

**Western Snowy Plover Nesting  
at Bolsa Chica, Orange County, California  
2014**



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## 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 MTB 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 2014 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 (FFTB), Cells 14 through 40 and Cell 63), Muted Tidal Basin (MTB, 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, FFTB, and MTB 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 becomes 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. This is now common practice.

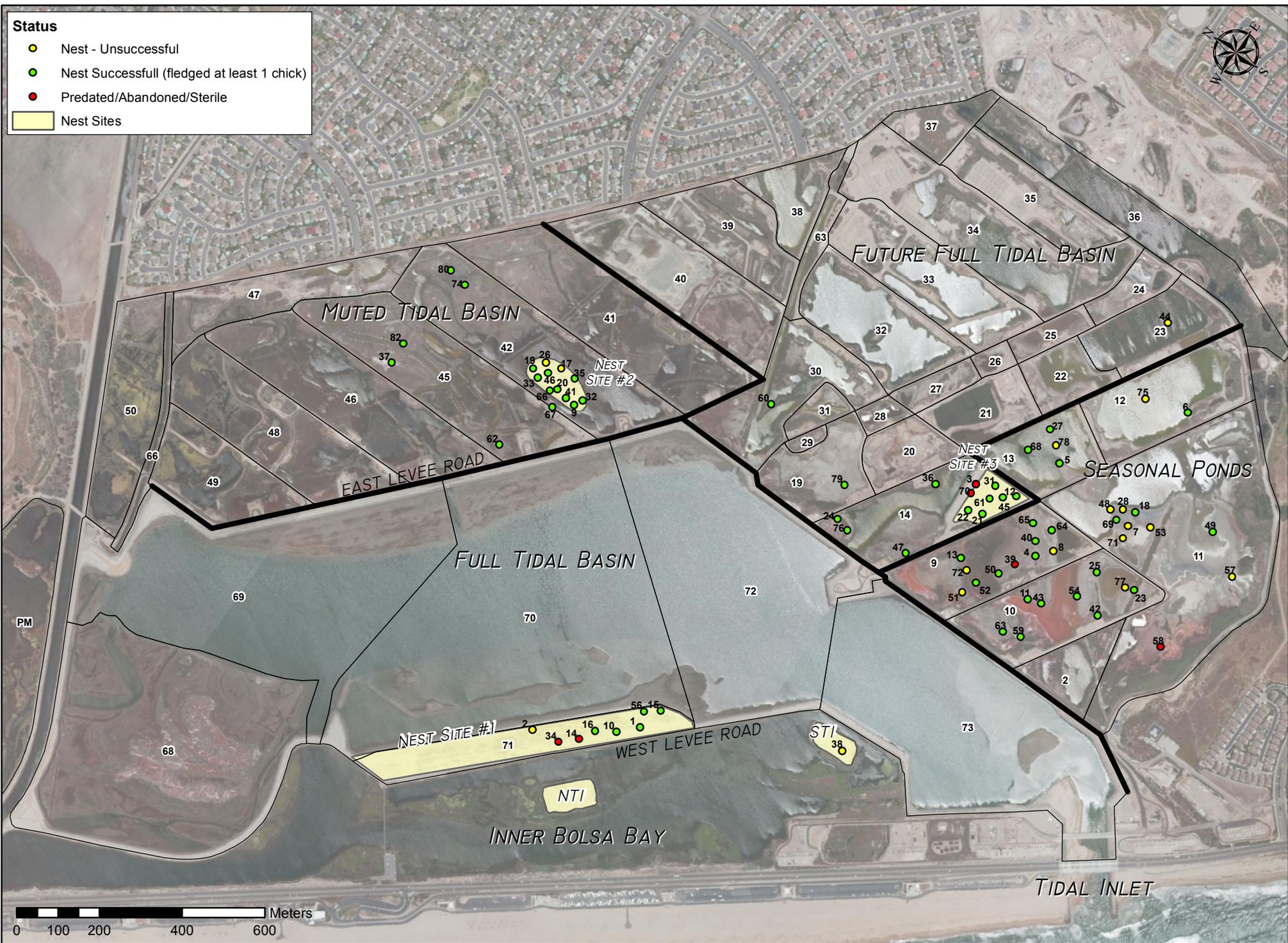


Figure 2. Western Snowy Plover 2014 Nesting Sites

The FFTB lies between the Seasonal Ponds and the MTB 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.



Photo by P. Knapp

**Cell 45, in the MTB, had increased snowy plover nesting and foraging in 2014 possibly due to drought conditions.**

possibly due to dry conditions making these cells more suitable for nesting. The MTB also provided foraging habitat for juvenile least terns and plover chicks from NS2.

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 is also used by plovers. 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 and suaeda (*Suaeda* sp.) 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. The site is 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 MTB and NS3 is within the FFTB. 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(s) by swimming across surrounding water and foraging in adjacent cells or in the Seasonal Pond cells. Chicks on NS3 tend to leave the site immediately after hatching to seek

forage in the surrounding Seasonal Pond cells. NS3 has a 6-foot high chain link fence surrounding the entire nesting site.

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 2014 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 continued until mid-September. 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 also 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.



*Mini-exclosure placed over active snowy plover nest with nest number attached to the exclosure.*

During each survey for western snowy plover, observers documented the location of any new nests. NS1, NS2, NS3, and STI were sectioned by markers, which formed the basis for data recording. Each nest site has 20-square meter grids for consistent methodology across the four sites. NS1 is significantly larger than the other two nest sites; therefore, NS1 was sectioned north to south from 1 through 36. Each snowy plover nest located during survey efforts was mapped for ease of relocation on subsequent visits and a numbered mini-exclosure (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 2014 to estimate the number of adults. 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). Calculations were also made to estimate the minimum number of adults present at Bolsa Chica. This was based on calculating the highest number of nests (calculated as 2 adults) during the nesting season and combining that with the number of broods (calculated as 1 adult) present at the same time.

### **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*). Aversion nests, used to deter coyote and corvid nest predation, were used on NS1 early in the 2014 breeding season with no follow-up treatments.

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 2014, 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 platform for viewing chick movement.

### **RESULTS AND DISCUSSION**

In 2014, the first snowy plover nest was established on March 10 on NS1. There were a total of 82 nests producing 113 fledglings for the season (Table 1).

#### **NUMBERS OF MALE AND FEMALE SNOWY PLOVERS**

During May 2014, a Range-wide, Breeding Season Window Survey was conducted. The total number of snowy plovers present at Bolsa Chica was 62 adults: 20 females, 40 males, and 2 unknown (Table 1).

Calculations were also made to estimate the minimum number of adults present at Bolsa Chica using a different method. This was done by calculating the highest number of nests (calculated as 2 adults) during the nesting season and combining that with the number of broods (calculated as 1 adult) present at the same time. With this information an estimate was made daily from May 28 to June 12 of the minimum number of adults present at Bolsa Chica. The resulting estimates ranged from 70 to 79 adult snowy plovers, with 79 calculated on multiple days.

**Table 1. Males and Females based on Window Survey, Nests and Fledgling Production 1997-2014.**

Year	Females	Males	Total Adults	Total Nests	Fledglings	Total FI/Nest	FI/Male
2014	20 (2unk)	40	62	82	113	1.38	2.83
2013	22	31	53	66	37	0.56	1.19
2012	26	31	57	68	77	1.13	2.48
2011	20 (1unk)	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

FI = fledglings, unk = unknown, nd = not determined

\* based on minimum/maximum numbers of fledglings

Estimating the minimum number of adults during the nesting season (Table 2) appears to be an effective method for determination of the breeding population. At Bolsa Chica a higher count resulted from estimating the minimum number of adults than from the Breeding Season Window Survey. The management goal of the Snowy Plover Recovery Plan for Bolsa Chica is 70 adults. This would be the first year that this management goal has been surpassed.

**Table 2: Estimated Minimum Number of Adults, Nests and Fledgling Production 2012-2014.**

Year	Females	Males	Total Adults	Total Nests	Fledglings	Total FI/Nest	FI/Male
2014	31	48	79	82	113	1.38	2.35
2013	26	28	54	66	37	0.56	1.22
2012	28	35	63	68	77	1.13	2.20

## NEST DISTRIBUTION AND CHRONOLOGIES

Snowy plovers utilized all available nest sites at Bolsa Chica in 2014 except NTI (Figure 2). Seasonal Ponds had 46% of all nests and a record number of nests since recordings began in 1997. The highest increase was in Cell 9. NS2 had 15% of all nests in 2014, which was above average but equal to the number of nests found in 2011. However, this year the fledge rate was much higher at this site.

Table 3 presents the nesting information by location for 2014. NS1 had only 11% of all nests (9 nests), continuing the plover usage decline at NS1 since its high of 37 nests in 2008. The FFTB and NS3 each had 10% of all nests. Cell 45, immediately adjacent to NS2 in the MTB, was also used for nesting, as it was in 2009, 2011, and 2012. Cell 42, also in the MTB, was used for the first time in 2014 and had 2 successful nests.

**Table 3. 2014 Nest, Nest Fate, and Reproductive Success Distribution by Cell**

Location	Total Nests	Nests Failed	Nests Hatched (# chicks)	Fledglings
<b>Seasonal Ponds</b>	<b>38</b>	<b>2</b>	<b>36 (97)</b>	<b>45</b>
Cell 9	12	1	11 (30)	14
Cell 10	9	0	9 (24)	14
Cell 11	11	1	10 (27)	10
Cell 12	2	0	2 (5)	2
Cell 13	4	0	4 (11)	5
<b>Nest Site 1</b>	<b>9</b>	<b>2</b>	<b>7 (21)</b>	<b>11</b>
<b>Nest Site 2</b>	<b>12</b>	<b>0</b>	<b>12 (35)</b>	<b>19</b>
<b>Nest Site 3</b>	<b>8</b>	<b>2</b>	<b>6 (17)</b>	<b>14</b>
<b>Future Full Tidal Basin</b>	<b>8</b>	<b>0</b>	<b>8 (20)</b>	<b>12</b>
Cell 14	5	0	5 (11)	7
Cell 19	1	0	1 (3)	3
Cell 22	1	0	1 (3)	0
Cell 30	1	0	1 (3)	2
<b>South Tern Island</b>	<b>1</b>	<b>0</b>	<b>1 (3)</b>	<b>0</b>
<b>Muted Tidal Basin</b>	<b>5</b>	<b>0</b>	<b>5 (15)</b>	<b>11</b>
Cell 42	2	0	2 (6)	5
Cell 45	3	0	3 (9)	6
<b>80 Road</b>	<b>1</b>	<b>0</b>	<b>1 (3)</b>	<b>1</b>
<b>Total</b>	<b>82</b>	<b>6</b>	<b>76 (211)</b>	<b>113*</b>

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

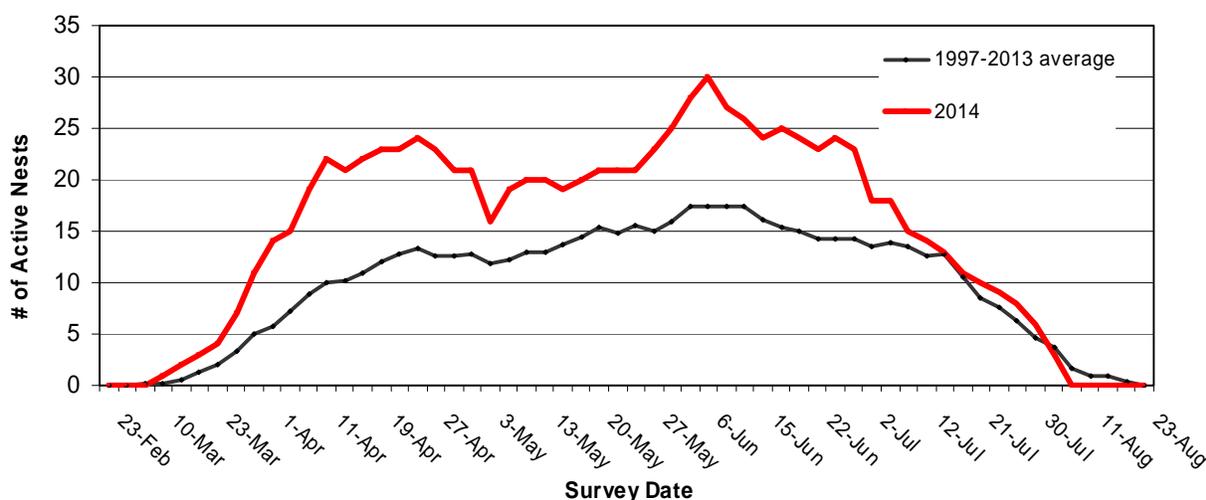
Appendix 1 provides the cell location, start and end dates, nest fates, and eggs and chicks produced for each nest in 2014. Appendix 2 provides information on historical nest distribution.

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. The two species tolerate the co-location of their nests. This was apparent in 2014 when they both nested on STI, NS1, NS2, and NS3.



*California least tern and western snowy plover chicks utilizing the same area.*

In 2014, the first plover nest was initiated March 10, somewhat earlier than average. The number of snowy plover nests rose quickly to 28 nests by April 13 (Figure 3). The last known nests hatched on August 5. Seventy-six (93%) nests survived to hatch. There was an active nest and/or a prefledge brood for a total of 190 days of the 2014 breeding season at Bolsa Chica.



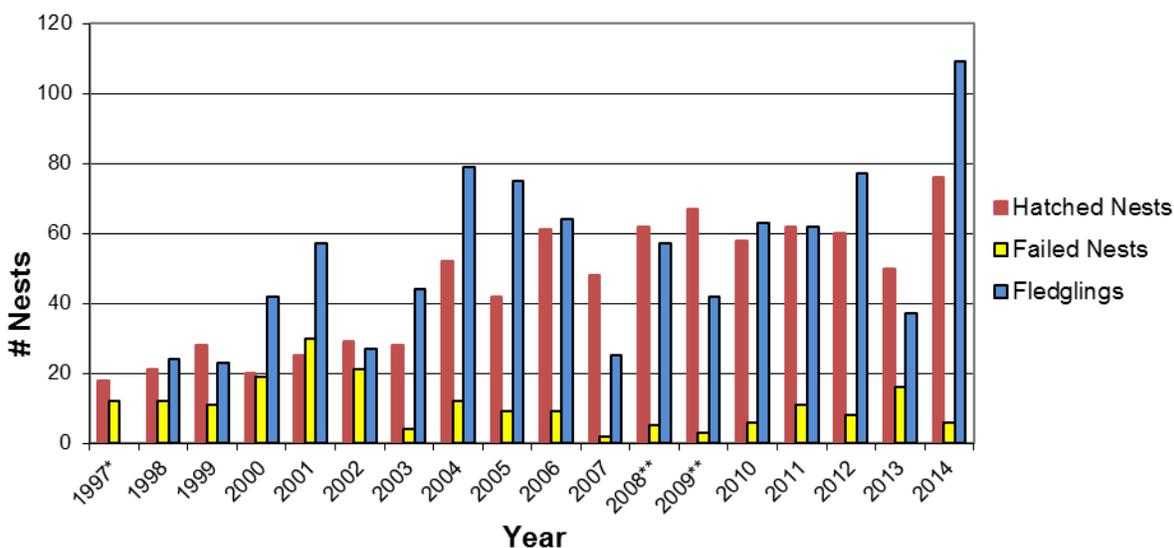
**Figure 3. 1997-2014 Bolsa Chica Active Nest Chronology.**

### NEST SITE SELECTION

In 2014, Nests 5, 6, 7 and 43 had identical nest placement as nests in the previous year (Figure 2). These locations were primarily in the Seasonal Ponds where the salt panne substrate seldom changes. Prior to the start of the breeding season, these and other locations were enhanced by Peter Knapp through the dispersal of large-grained sand and shells within a two-foot radius of the previous nest site. This enhancement may have encouraged nest site selection.

### EGGS, CHICKS, AND FLEDGLING PRODUCTION

A total of 231 snowy plover eggs were produced at Bolsa Chica in 2014, with 20 eggs abandoned, predated, or failed to hatch. The remaining eggs produced 211 chicks. Of these 211 total chicks, 113 survived to fledge (Table 3, Figure 4, Appendix 1).

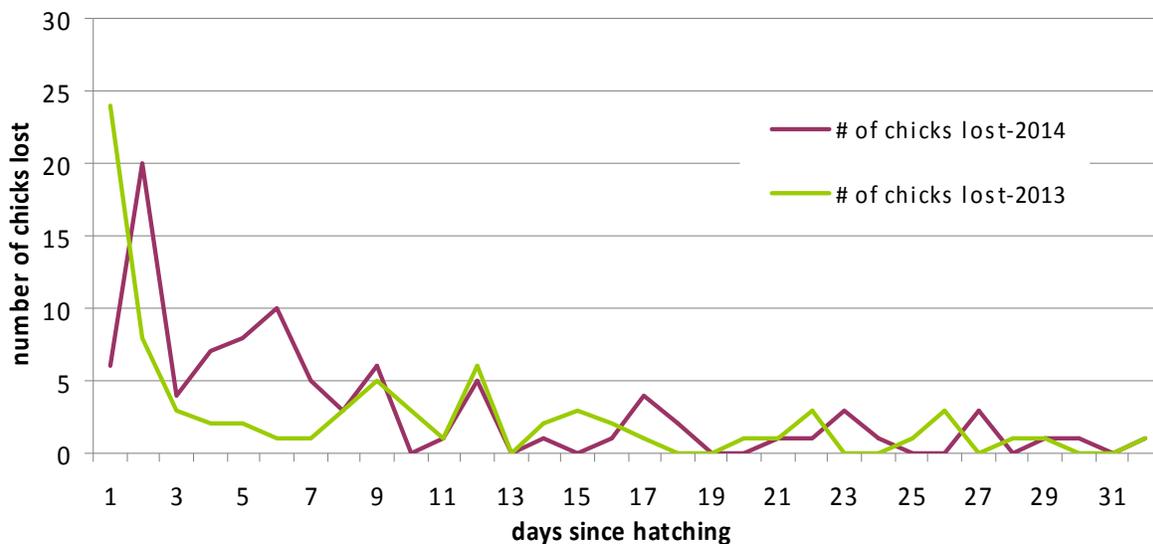


\* no fledgling data available

\*\* based on the minimum number of fledglings

**Figure 4. Number of Western Snowy Plover Hatched Nests, Failed Nests, and Fledglings 1997-2014 at Bolsa Chica.**

As the age of the chick increased, so did chick survival (Figure 5). Of the chicks hatched, 6 died within the first day of hatching, 26 died within the first two days, and 60 died within the first week of hatching (Figure 5). Among the chicks that perished 27% died within the first two days, and 63% died within the first week of hatching.



**Figure 5. Chick Survival by Day in 2013 and 2014 at Bolsa Chica.**

Two chicks were taken to the Wetlands and Wildlife Care Center (WWCC) after they were observed to be separated from the adults and ill. Neither chick survived.

Of the 82 nests in 2014, five were found as broods only and the nest was not specifically located. The broods were found as two or three chick broods and were located throughout Bolsa Chica. The remaining 77 nests were judged to be complete with the exception of Nest 71 which was abandoned and the one egg taken to WWCC. Nine completed clutches were 2-egg clutches and the remaining 66 were 3-egg clutches. Nest 36 and 71 only had one egg each. The nest details are provided in Appendix 1.

Ten nests (12%) did not hatch eggs (27 eggs). Five nests with 12 eggs total were salvaged and given to WWCC for incubation. Three of those eggs did not hatch and were subsequently sent to Western Foundation of Vertebrate Zoology (WFVZ) (Table 4). The other nine eggs hatched and the chicks released at Bolsa Chica after fledging.

To aid in the release of the fledglings, a temporary shelter 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 measured 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 observations suggest it improves the survival of these hand-reared fledglings after release.

Two nests (Nests 3 and 70) with a total of six eggs were incubated for an abnormal length of time and were most likely infertile. This abnormal incubation time span has been seen at Bolsa Chica in prior years: 2013 (2 eggs), 2012 (1), 2011 (2), 2010 (1) and 2009 (2). Nest 14, with three eggs, was lost to blowing sand. Nest 58 was predated by an unknown avian predator prior to placement of an ME. Nest 34 on NS1 and Nest 64 in Cell 9 were both abandoned due to incursions by ants. The ants did not allow the adults to incubate the eggs; the eggs were therefore taken to WWCC. The eggs from Nest 34 did not hatch but the two eggs from Nest 64 fledged two chicks. Nest 39, with three eggs, was abandoned due to unknown causes. Only one nest (Nest 58) was predated in 2014. It was located in Cell 11.

Nine unhatched eggs were salvaged and given to the WFVZ for analysis of sterility. The results of the analysis are presented in Table 4.

**Table 4. Results of Analysis by the Western Foundation of Vertebrate Zoology (WFVZ) of Abandoned or Sterile Snowy Plover Eggs.**

<b>Nest #</b>	<b>Clutch size</b>	<b>Eggs abandoned (collected)</b>	<b>Notes</b>	<b>Results from WFVZ</b>
14	3	3	Nest lost to wind-blown sand	Large Embryo
34	3	3	Nest abandoned by ants	Infertile
39	3	3	Nest abandoned	Small Embryo

Eighteen nests (22%) hatched a total of 52 eggs that did not fledge. The assumed predominant cause of chick loss was predation, primarily by American kestrel (*Falco sparverius*). Thirty-seven (61%) of the unsuccessful chicks were from the Seasonal Ponds area, a third of which were hatched in Cell 11.

Of the 82 nests at Bolsa Chica in 2014, a total of 113 fledglings were produced. The overall fledge rate (fledglings/nest) was 1.38 (Table 1). MTB, NS3, NS2, and the FFTB were the most successful nesting areas with fledge rates of 2.20, 1.75, 1.58, and 1.50, respectively. The Seasonal Ponds, which had almost half of the snowy plover nests had a fledge rate of 1.18. Previously, the Seasonal Ponds were 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 fledge rate at NS3 marked a sharp increase from 0.75 in 2013 and 0.67 in 2012. Broods from nests on NS3 left the site and foraged in the Seasonal Ponds.



*Nests on NS1 and in Cell 9 overrun by ants.*

Considering other metrics, there was a fledglings/male rate of 2.83 based on the window survey and 2.38 based on the revised minimum number of males (Table 2).

### **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 2014 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 to each other or tried to take advantage of the same resources. This was apparent on NS2.

Broods hatched from NS3 relocated within days to 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 would 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 NS2 to Cell 19 while other broods from NS2 left the nest site to forage in Cell 45. This ability to disperse from the nest site to an adjacent cell probably contributed to fledging success.



Photo by P. Knapp

*Two pre-fledge chicks resting in the Seasonal Ponds.*

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

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

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 also attempted to nest at Bolsa Chica in 2011, 2012, and 2013, but a nest was never located. This bird was banded as a fledgling at Bolsa Chica after being raised at WWCC in 2010.

Another captive reared bird, male YNWB released at Bolsa Chica on June 4 2013, had a nest on Cell 45 (Nest 62) in 2014. This nest had three fledglings.

Captive reared male YNYR, released at Bolsa Chica in 2008, had a nest in Cell 13 (Nest 27) in 2014 and fledged one chick.

Two wintering birds not seen during the breeding season but seen regularly off season were VG:AY and BO:GG. VG:AY was last seen at Bolsa Chica on April 2, 2014 and returned July 19, 2014. BO:GG was last seen on February 26, 2014 and returned on August 10, 2014. VG:AY was banded as a chick in 2013 at Vandenberg Air Force Base BO:GG was banded as a chick at Salinas National Wildlife Refuge in 2012.

A male with an unidentifiable color combination, but sufficient to identify it as a bird banded as an adult in Mexico in December 2014, fledged 2 chicks from an unidentified nest.

#### **PREDATION**

Several methods were utilized to avoid predation of nests, chicks, and even adults. The use of the ME over all active nests contributes greatly to the low egg predation at Bolsa Chica. Other methods have met with limited success including aversion nests and fencing around several of the nest sites

(NS1 and NS3). In 2014, aversion nests were placed on NS1 after the least tern nesting season had begun and were not very effective in deterring nest predation.

In 2014 only one nest (Nest 58) was predated. It was unprotected by an ME in Cell 11 and most likely the eggs were taken by an avian predator as no tracks were observed.

An American kestrel took 2 chicks from Nest 82 in Cell 45. Coyote took 2 chicks from Nest 67 (on the 80 Road). An owl is believed to have taken 2 chicks from Nest 8 in Cell 9. All other losses are undocumented.

## **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; and 3) continuing weed management on all manmade nest sites through manual removal of non-native plants and the use of herbicide. These management efforts have been effective in the enhancement of nest sites and improving reproductive success of the snowy plover and should continue. Additional management recommendations are provided below. 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.

### **1. 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 in winter and spring 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.

Since at least 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 of freshwater marsh is recommended.

## 2. Enhance potential nesting areas

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 areas. It is thought that this enhancement may have encouraged nest site selection. The recommendation is to continue the enhancement of these areas each year and expand the method to other areas.

## 3. Determine the individual(s) responsible for sterile eggs production

There have been one or two nests per year for at least four years that have been incubated for extended periods of time. For several years these eggs had been collected and sent to the WFVZ for 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, the adults associated with the nest should be trapped and banded. This will identify adults that may suffer from infertility. From a management perspective there is little that can be done to prevent an infertile bird from nesting but we could encourage this individual to remain on the nest rather than have multiple nests. However, by banding the individuals involved it would aid us in determining if this is more than one adult. If more than one adult is involved we may want to try to determine the source of the problem. In 2014, the two nests affected (Nest 3 and 70), were not sent to WFVZ for analysis, but were assumed to be infertile.

## 4. Continued monitoring

It is also recommended that monitoring continue annually with the same intensity that has occurred in the past in order to maintain this quality of management within the nest sites.

## 5. Increase protection of nests and chicks in the Seasonal Ponds

The mini-exclosure has been used successfully for many years to protect snowy plover nests from predators. Although this was a major step forward it is still critical to provide some protection to the mobile chicks after they have hatched. A great deal of effort has gone into protecting these young birds such as active predator control and exclusion fencing. These and other methods have had varying success but management of this species requires development of additional ideas to protect the plover chicks.

A large number of inoperative power poles have been left in the Seasonal Ponds over the years and they are commonly used by raptors to view the salt panne within the Season Pond area. During the winter of 2014-2015, managers at Bolsa Chica plan to eliminate these perches by either extraction or by cutting them down to ground level.



Photo by B. Peterson

*Peregrine Falcon perched on a cut off power pole in the Seasonal Ponds.*

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**Appendix 1. Snowy plover eggs laid, chicks hatched, and fledged at Bolsa Chica, 2014**

<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>
1	NS1 33A	3/10/2014	4/13/2014	3	H	3	2	
2	NS1 15C	3/14/2014	4/14/2014	3	H	3	0	
3	NS3 C1	3/18/2014	5/3/2014	3	A	0	0	Collected 3 eggs
4	CELL 9	3/22/2014	4/20/2014	3	H	3	2	
5	CELL 13	3/24/2014	4/25/2014	3	H	3	3	
6	CELL 12	3/27/2014	4/29/2014	2	H	2	2	
7	CELL 11	3/27/2014	5/1/2014	3	H	3	0	
8	CELL 9	3/27/2014	4/24/2014	2	H	2	0	
9	NS2 A1	3/28/2014	4/27/2014	3	H	3	2	
10	NS1 28A	4/1/2014	5/3/2014	3	H	3	1	
11	CELL 10	4/6/2014	5/8/2014	3	H	3	2	
12	NS3 B4	4/8/2014	5/3/2014	3	H	3	3	
13	CELL 9	4/8/2014	5/6/2014	3	H	3	3	
14	NS1 22A	4/8/2014	5/3/2014	3	A	0	0	Covered by sand - collected 3 eggs and sent to WFVZ
15	NS1 34B	4/10/2014	5/13/2014	3	H	3	3	
16	NS1 25B	4/13/2014	5/13/2014	3	H	3	2	
17	NS2 E2	4/13/2014	5/11/2014	3	H	3	0	
18	CELL 11	4/15/2014	5/11/2014	3	H	3	2	
19	NS2 F1	4/17/2014	5/2/2014	3	H	3	2	
20	NS2 D1	4/17/2014	5/18/2014	3	H	3	2	
21	NS3 E3	4/18/2014	5/14/2014	3	H	3	3	
22	NS3 E2	4/18/2014	4/26/2014	3	H	3	1	
23	CELL 10	4/23/2014	5/25/2014	3	H	3	3	
24	CELL 14	4/25/2014	5/28/2014	2	H	2	2	
25	CELL 10	5/4/2014	5/29/2014	3	H	3	2	
26	NS2 G2	5/4/2014	6/1/2014	3	H	3	0	
27	CELL 13	5/7/2014	5/27/2014	2	H	2	1	Male = YNYR
28	CELL 11	5/7/2014	6/8/2014	3	H	3	0	
29	NS1	4/29/2014	4/29/2014	3	H	3	0	Nest not found

Western Snowy Plover Nesting at Bolsa Chica, 2014

<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>
30	CELL 11	5/2/2014	5/2/2014	3	H	3	2	Nest not found
31	NS2 C2/3	5/8/2014	5/23/2014	2	H	2	2	
32	NS2 A2	5/8/2014	6/7/2014	3	H	3	2	
33	NS2 G1	5/8/2014	6/7/2014	3	H	3	1	
34	NS1 18A	5/13/2014	5/15/2014	3	A	0	0	Ants - collected 3eggs for WWCC and then sent to WFVZ
35	NS2 D2	5/13/2014	6/5/2014	3	H	3	1	
36	CELL 14	5/14/2014	6/13/2014	1	H	1	1	
37	CELL 45	5/16/2014	6/16/2014	3	H	3	2	Nest not found
38	STI	5/16/2014	6/13/2014	3	H	3	0	
39	CELL 9	5/17/2014	6/13/2014	3	A	0	0	Collected 3 eggs and sent to WFVZ
40	CELL 9	5/17/2014	6/11/2014	3	H	3	1	
41	NS2 B1	5/15/2014	5/25/2014	3	H	3	2	
42	CELL 10	5/20/2014	6/12/2014	3	H	3	1	
43	CELL 10	5/20/2014	6/16/2014	3	H	3	2	
44	CELL 22	5/19/2014	6/18/2014	3	H	3	0	
45	NS3 D1	5/29/2014	6/28/2014	3	H	3	3	Collected 3eggs for WWCC
46	NS2 F2	5/29/2014	6/25/2014	3	H	3	3	
47	CELL 14	5/30/2014	6/24/2014	3	H	3	2	
48	CELL 11	5/30/2014	6/26/2014	3	H	3	0	
49	CELL 11	5/30/2014	6/21/2014	3	H	3	2	
50	CELL 9	6/1/2014	6/29/2014	3	H	3	1	
51	CELL 9	6/1/2014	6/29/2014	3	H	3	0	
52	CELL 9	6/04/014	7/2/2014	3	H	3	1	
53	CELL 11	6/6/2014	7/3/2014	3	H	3	0	
54	CELL 10	6/6/2014	6/26/2014	2	H	2	1	
55	CELL 9	6/7/2014	6/7/2014	3	H	3	2	Nest not found
56	NS1 B33	6/7/2014	6/19/2014	3	H	3	3	
57	CELL 11	6/8/2014	7/1/2014	2	H	2	0	
58	CELL 11	6/8/2014	6/13/2014	3	P	0	0	
59	CELL 10	6/8/2014	7/5/2014	2	1H1A	1	1	

Western Snowy Plover Nesting at Bolsa Chica, 2014

<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>
60	CELL 30	6/9/2014	6/26/2014	3	H	3	2	
61	NS3	6/12/2014	7/9/2014	3	H	3	2	
62	CELL 45	6/11/2014	7/1/2014	3	H	3	3	Male= YSWB
63	CELL 10	6/15/2014	7/15/2014	3	H	3	2	
64	CELL 9	6/19/2014	6/30/2019	2	H	2	2	Ants collected 2eggs for WWCC
65	CELL 9	6/19/2014	6/19/2014	3	2H1A	2	2	collected 1 egg
66	NS2	6/20/2014	7/11/2014	3	H	3	2	
67	80 ROAD	6/22/2014	7/18/2014	3	H	3	1	
68	CELL 13	6/24/2013	7/19/2014	3	H	3	1	
69	CELL 11	6/25/2014	7/14/2014	3	H	3	3	collected 3eggs for WWCC
70	NS3 C1	6/17/2014	8/4/2014	3	S	0	0	collected
71	CELL 11	6/27/2001	7/8/2014	1	H	1	1	collected 1egg for WWCC
72	CELL 9	6/28/2014	7/28/2014	3	H	3	0	
73	NS2	7/2/2014	7/2/2014	2	H	2	2	Nest not found
74	CELL 42	7/5/2014	7/6/2014	3	H	3	3	
75	CELL 12	7/5/2014	7/28/2014	3	H	3	0	
76	CELL 14	7/7/2014	8/3/2014	3	H	3	1	
77	CELL 10	7/8/2014	8/2/2014	3	H	3	0	
78	CELL 13	7/11/2014	8/1/2014	3	H	3	0	
79	CELL 19	7/12/2014	8/5/2014	3	H	3	3	
80	CELL 42	7/12/2014	7/31/2014	3	H	3	2	
81	CELL 14	7/24/2014	7/24/2014	2	H	2	1	Nest not found
82	CELL 45	7/26/2014	7/26/2014	3	H	3	1	Nest not found
<b>2014 Season Totals</b>				<b>231 eggs</b>	<b>76H, 4A, 1S, 1P Nests</b>	<b>211 chicks</b>	<b>113 fledglings</b>	

P = predated; A = abandoned; H = hatched, S = sterile eggs, WfVZ= Western Foundation of Vertebrate Zoology; WWCC = Wetlands and Wildlife Care Center  
**Note:** In the Nest Fate column, **2H1A** means the nest hatched but only two eggs produced chicks, one egg was abandoned.

**Appendix 2. Distribution of Western Snowy Plover Nests at Bolsa Chica for 1997 through 2014.**

**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
2014	82		38	8	5		9	13	7	1	1

**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 42</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
2014		12	9	11	2	4	5			1	1		1							2	3