

Western Snowy Plover Nesting at Bolsa Chica, Orange County, California 2016



by Peter Knapp* and Rachel Woodfield**

February 2017

* California Department of Fish & Wildlife

** Merkel & Associates, Inc.

TABLE OF CONTENTS

Executive Summary	1
Introduction.....	2
Background.....	2
Bolsa Chica Study Area.....	4
Study Methods	7
Protection from Predators	8
Results and Discussion	9
Numbers of Breeding Male and Female Snowy Plovers.....	9
Nest Site Selection and Distribution	10
Eggs, Chicks, and Fledgling Production.....	13
Egg Salvage and Chick/Adult Rescues.....	16
Brood Tracking.....	17
Observations of Banded Adults	17
Predation	18
Management Recommendations/Action Items	18
References.....	21

LIST OF FIGURES

Figure 1. Vicinity Map.....	3
Figure 2. Distribution of Western Snowy Plover Nests in 2016 at Bolsa Chica	5
Figure 3. 2016 Western Snowy Plover Active Nest Chronology.	13
Figure 4. Western Snowy Plover Fledge Rate (Fledglings/Male) 2012-2016 at Bolsa Chica.....	15
Figure 5. Number of Chick Deaths by Time since Hatching 2013-2016 at Bolsa Chica.	16

LIST OF TABLES

Table 1. Males and Females based on Estimated Minimum Number of Adult Method, Nests, and Fledgling Production per Male 2012-2016.....	9
Table 2. Males, Females, and Adults based on Breeding Window Survey 1997-2016.....	10
Table 3. 2016 Nests, Nest Fates, Chicks, and Fledglings by Location.....	12
Table 4. Nests, Eggs, Chicks, and Fledgling Production 1997-2016.....	14
Table 5: Number of Broods 2010-2016 at Bolsa Chica and Raised at the Wetlands and Wildlife Care Center.	15

APPENDICES

- Appendix 1. Western snowy plover eggs laid, chicks hatched, and fledged at Bolsa Chica, 2016
 Appendix 2. Distribution of western snowy plover nests at Bolsa Chica for 1997 through 2016

EXECUTIVE SUMMARY

In 2016, California Department of Fish & Wildlife (CDFW) staff and volunteers continued the annual monitoring and management of western snowy plovers at Bolsa Chica Ecological Reserve. Surveys were conducted daily from mid-February to mid-September. Observers documented the location of any new nests, installed welded-wire mini-exlosures (ME) over each nest to protect it from predators, monitored the nests each day, and later followed each brood until fledging. In addition, a range-wide Winter Window Survey and a range-wide Breeding Season Window Survey were conducted. Calculations were also made to estimate the minimum number of adults present at Bolsa Chica during the breeding season.

In 2016, the first snowy plover nest was established on March 7 and the last brood fledged on September 11. There were a total of 99 nests, producing 275 eggs, of which 246 hatched chicks, with 145 fledglings produced. There was an overall fledge rate (fledglings/male) of 2.50 for 2016, which when considered with the consistently high fledge rates of the preceding years, indicates the plover population is increasing at Bolsa Chica. The continued use of ME resulted in low rates of egg predation.

The range-wide Winter Window Survey conducted in January to estimate the winter population size found 44 adults. The range-wide, Breeding Season Window Survey conducted in May resulted in a count of 89 adult snowy plovers at Bolsa Chica. The minimum number of adults was determined to be 96.

The 2016 snowy plover monitoring observed the highest number of females, males, adults, nests, and fledglings that have been recorded at Bolsa Chica in the last 20 years of monitoring. This was the third consecutive year that Bolsa Chica met the management goal of 70 adults in the breeding season, as identified in the U.S. Fish and Wildlife Service (USFWS) Recovery Plan for the Pacific Coast Population of the Western Snowy Plover.

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.

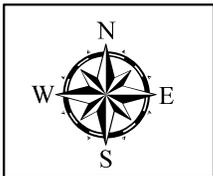
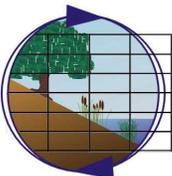
In 1997, the Bolsa Chica lowlands were acquired into public ownership. This marked the beginning of a multi-agency effort to design, evaluate, and implement a plan for restoring the fish and wildlife habitats. These habitats had been cut off from the ocean for a century and have been an operating oil 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 2016 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



Adult with two large chicks under its wings.

Both sexes incubate the eggs for an average of 27 days. Snowy plovers will renest 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 adults 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).



Figure 2. Western Snowy Plover Nest Locations at Bolsa Chica Lowlands, 2016

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, 12, 13, 14, 19, and 22 from the Full Tidal Basin in the late fall in order to provide habitat for the wintering waterfowl and to control encroachment of reed growth in Cell 11. This is now common practice.

The FFTB lies between the Seasonal Ponds and the MTB and consists 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 MTB occupies the northeastern section of Bolsa Chica and is divided into west, central, and east basins. Muted tidal influence was introduced to the west MTB in March 2008, and later to the central and east basins in March and May 2011, respectively. Due to continued tidal muting in the Full Tidal Basin in 2016, the eastern MTB remained non-tidal. Inlet maintenance dredging in late 2015 allowed for modest muted tidal exchange in the central MTB during the nesting season. The west MTB continues to have highly muted tidal exchange for most of the year. In recent years, the MTBs have been largely inundated, composed of pickleweed, open water, and mudflat, and until 2014 were rarely used by western snowy plover for nesting. In 2016, nesting occurred in Cells 41, 42, 45, 46, and 47 of the MTBs. The MTBs also provided foraging habitat for juvenile least terns and plover chicks from NS2.

NTI and STI are well established, man-made islands surrounded by the muted tidal waters of Inner Bolsa Bay. The surfaces of the islands are dredge spoils 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 extending from the West Levee Road east toward the Full Tidal Basin. The shoreline of the nest site is under 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 has been highly vegetated the past three years and has required extensive vegetation control. The vegetative growth was primarily the native perennial beach sand-verbena (*Abronia umbellata* var. *umbellata*), the native California everlasting (*Gnaphalium californicum*), 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 2016 was undertaken by California CDFW staff member, Peter Knapp, with assistance from Ross Griswold, a CDFW volunteer, and Gary Keller (CDFW). 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.

During each survey for western snowy plovers, observers documented the location of any new nests. NS1, NS2, NS3, and STI were sectioned by markers, which formed a grid of squares that were 20 meters on a side, for consistent methodology across the four sites. Data recorded outside of these four sites was done by cell number or road name. Each plover nest located during survey efforts was mapped for ease of relocation on subsequent visits and a numbered ME was placed on the nest.

It was usually possible to follow the movements and determine the fate of chicks of each brood on all sites 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.

Calculations were made to estimate the minimum number of adults present at Bolsa Chica during the breeding season. This was calculated by taking the 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. This was performed each day of the breeding season. This method of estimating adults, referred to in this document as the Estimated Minimum Number of Adults method, is more accurate than the range-wide surveys described below, and has been performed since 2012 at Bolsa Chica.

A range-wide Winter Window Survey was conducted at Bolsa Chica on January 18, 2016 to estimate the number of adults present, in accordance with the guidelines set out in the Snowy Plover Recovery Plan (U.S. Fish and Wildlife Service 2007). A range-wide Breeding Season Window Survey was conducted during the week of May 15, 2016 to estimate the number of adults, also in accordance with the Snowy Plover Recovery Plan. While these methods of estimating the number of adults present are

known to considerably underestimate the true number, the surveys are still conducted and presented because they are called for in the Recovery Plan.

The collected data on nest distribution were plotted on a map, nesting summary statistics assembled, and the overall fledge rate determined as fledglings per male. In the past, this report has also presented the metric of fledglings per nest. This will be discontinued as fledglings per male is the metric used in the Recovery Plan and better expresses the reproductive success of the breeding population.

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 hatched. The MEs are 28 inches in width on all four sides and top, and 16 inches in height. These dimensions have proven effective in deterring predation by corvids, gulls, and coyotes (*Canis latrans*). MEs were used on all nests in 2016 except nests 61 and 77, as well as those nests found only as a brood.

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 2016, predator management was undertaken by Wally Ross of CDFW.

Beginning in the winter of 2014-2015, existing cut-off power poles approximately five feet in height were cut off to ground level by CDFW staff to eliminate potential perches for raptors. In the winter of 2015-2016, this effort continued and will be completed in the winter of 2016-2017.

The resident oil lease holder, CRC, placed NIXALITE on oil wells and other structures that CDFW staff determined to be detrimental to plover breeding success. NIXALITE is a strip of porcupine-like plastic spikes installed to prevent predator perching. The installation successfully deterred predator perching in 2016.

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 2016, the first snowy plover nest was established on March 7 in gravel on the 80 Road. The last brood fledged on September 11. There were a total of 99 nests producing 145 fledglings for the season (Table 1). The 2016 snowy plover monitoring observed the highest number of females, males, adults, nests, and fledglings that have been recorded at Bolsa Chica in the last 20 years of monitoring. The following sections discuss the details of the nesting season.

NUMBERS OF BREEDING MALE AND FEMALE SNOWY PLOVERS

The daily estimated minimum number of adults present at Bolsa Chica from May 16 through July 11 ranged between 71 and 96. Therefore, the minimum number of adults is reported as 96 (Table 1). The average of the daily surveys was 85 adults. This was the third consecutive year that Bolsa Chica met the management goal of 70 adults in the breeding season, as identified in the Snowy Plover Recovery Plan. This method of estimating the number of adults has consistently provided a higher count than the Breeding Season Window Survey. We believe the minimum number of adult methodology is the more effective method for determining the size of the breeding population. Because this method has only been employed since 2012, only five years of data are presented in Table 1. This method will now be continued annually.

Table 1. Males and Females based on Estimated Minimum Number of Adult Method, Nests, and Fledgling Production per Male 2012-2016.

Year	Females	Males	Total Adults	Total Nests	Fledglings	FI/Male
2016	38	58	96	99	145	2.50
2015	31	45	76	92	129	2.87
2014	31	48	79	82	113	2.35
2013	26	28	54	66	37	1.32
2012	28	35	63	68	77	2.20

The range-wide Winter Window Survey conducted in January to estimate the winter population size found 44 adults. The range-wide, Breeding Season Window Survey conducted in May resulted in a count of 89 adult snowy plovers at Bolsa Chica (Table 2). The Breeding Season Window Survey counts are known underestimates and are presented in Table 2 only for consistency with the Recovery Plan.

Table 2. Males, Females, and Adults based on Breeding Window Survey 1997-2016.

Year	Females	Males	Total Adults
2016	29	60	89
2015	25	37	62
2014	20 (2 unk)	40	62
2013	22	31	53
2012	26	31	57
2011	20 (1 unk)	28	49
2010	22	23	45
2009	25	22	47
2008	22	28	50
2007	18	12	30
2006	27	35	62
2005	25	41	66
2004	25	20	45
2003	15	16	31
2002	19	20	39
2001	19	18	37
2000	15	16	31
1999	12	11	32
1998	11	16	27
1997	14	20	34

unk = unknown

NEST SITE SELECTION AND DISTRIBUTION

Figure 2 presents the distribution of snowy plover nests in 2016. In prior years, this report has used the term “Successful Nest” on Figure 2, to indicate which nests successfully fledged at least one chick. We will no longer use that term, because the eventually fledging or failure to fledge is less related to the location of the nest and more to conditions and events in the areas the parents take the brood to forage. Figure 2 now indicates only if the nest hatched, or if it failed due to predation, abandonment, or sterility. Monitoring in 2017 will document plover habitat use and availability, as called for in the Recovery Plan, to better understand the factors that lead to successful fledging.

In 2016, fifteen nests had identical nest placement as nests in either the previous year or earlier in 2016. Six sites were used in the same year twice. One of the sites in Cell 41 had an ME left in place from 2015 and was utilized twice in 2016 (Nests 18 and 58). This was the first instance where a plover established a nest under an existing ME. A second similar instance (Nests 39 and 94) occurred in Cell 10. In both instances, the birds were unbanded.

In 2016, snowy plovers utilized all available nest sites typically used at Bolsa Chica (Figure 2). The Seasonal Ponds had 46% of all nests and a record number of nests since recording began in 1997.

They also produced 50% of the total fledglings. Cell 10 hatched 14 nests with 38 chicks and 31 fledglings, or 21% of all fledglings.

The man-made nest sites (NS1, NS2, and NS3) had two fewer nests in 2016 than in 2015, but produced 12 more fledglings (33) than 2015 (21). Cell 47 in the MTB was used for the first time. Dry conditions again in 2016 may have contributed to the increased usage of the MTB.

In 2016, the three substrates utilized for nests were rock gravel: 6 nests, salt panne: 67 nests, sand: 20 nests, and small stones: 6 nests. Live or dead vegetation was an integral element of 31 of the nests.

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, with both nesting on STI, NS1, NS2, and NS3 in 2016.

Table 3 presents the nesting information by location for 2016. The table also reports the number of fledglings by cell, though it should be noted that the fledglings may or may not have hatched from nests in that same cell. The broods frequently move from cells that were suitable for nesting into cells that provide suitable foraging space.

Table 3. 2016 Nests, Nest Fates, Chicks, and Fledglings by Location.

Location	Total Nests	Nests Failed no eggs hatched	Nests Hatched (# of chicks)	Fledglings
Seasonal Ponds	46	4	42 (111)	73
<i>Cell 2</i>	<i>1</i>	<i>0</i>	<i>1 (3)</i>	<i>3</i>
<i>Cell 9</i>	<i>12</i>	<i>1</i>	<i>11 (30)</i>	<i>15*</i>
<i>Cell 10</i>	<i>15</i>	<i>1</i>	<i>14 (36)</i>	<i>31</i>
<i>Cell 11</i>	<i>13</i>	<i>2</i>	<i>11 (28)</i>	<i>17</i>
<i>East Levee Road</i>	<i>1</i>	<i>0</i>	<i>1 (3)</i>	<i>3</i>
<i>Cell 12</i>	<i>3</i>	<i>0</i>	<i>3 (8)</i>	<i>1</i>
<i>Cell 22</i>	<i>1</i>	<i>0</i>	<i>1 (3)</i>	<i>3</i>
Nest Site 1	7	1	6 (18)	12*
Nest Site 2	3	1	2 (4)	3
Nest Site 3	9	0	9 (25)	18
Future Full Tidal Basin	12	0	12 (34)	14
<i>Cell 14</i>	<i>6</i>	<i>0</i>	<i>6 (16)</i>	<i>6</i>
<i>Cell 30</i>	<i>4</i>	<i>0</i>	<i>4 (12)</i>	<i>6</i>
<i>Cell 34</i>	<i>1</i>	<i>0</i>	<i>1 (3)</i>	<i>2</i>
<i>Sand Blast Road</i>	<i>1</i>	<i>0</i>	<i>1 (3)</i>	<i>0</i>
South Tern Island	2	1	1 (2)	1
Muted Tidal Basin	20	1	19(52)	24
<i>Cell 41</i>	<i>5</i>	<i>0</i>	<i>5 (12)</i>	<i>5</i>
<i>Cell 42</i>	<i>2</i>	<i>0</i>	<i>2 (5)</i>	<i>2</i>
<i>Cell 45</i>	<i>6</i>	<i>0</i>	<i>6 (17)</i>	<i>12</i>
<i>Cell 46</i>	<i>2</i>	<i>1</i>	<i>1 (3)</i>	<i>1</i>
<i>Cell 47</i>	<i>1</i>	<i>0</i>	<i>1 (3)</i>	<i>3</i>
<i>80 Road</i>	<i>4</i>	<i>0</i>	<i>4 (12)</i>	<i>1</i>
Total	99	8	91 (246)	145*

* 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 2016. Appendix 2 provides information on historical nest distribution.

NESTING CHRONOLOGY

In 2016, the first plover nest was initiated on March 7. The last nest hatched on August 17. There was an active nest and/or brood for a total of 188 days of the 2016 breeding season at Bolsa Chica. Nest chronology in 2016 is compared to the average of the prior eighteen years at Bolsa Chica in Figure 3.

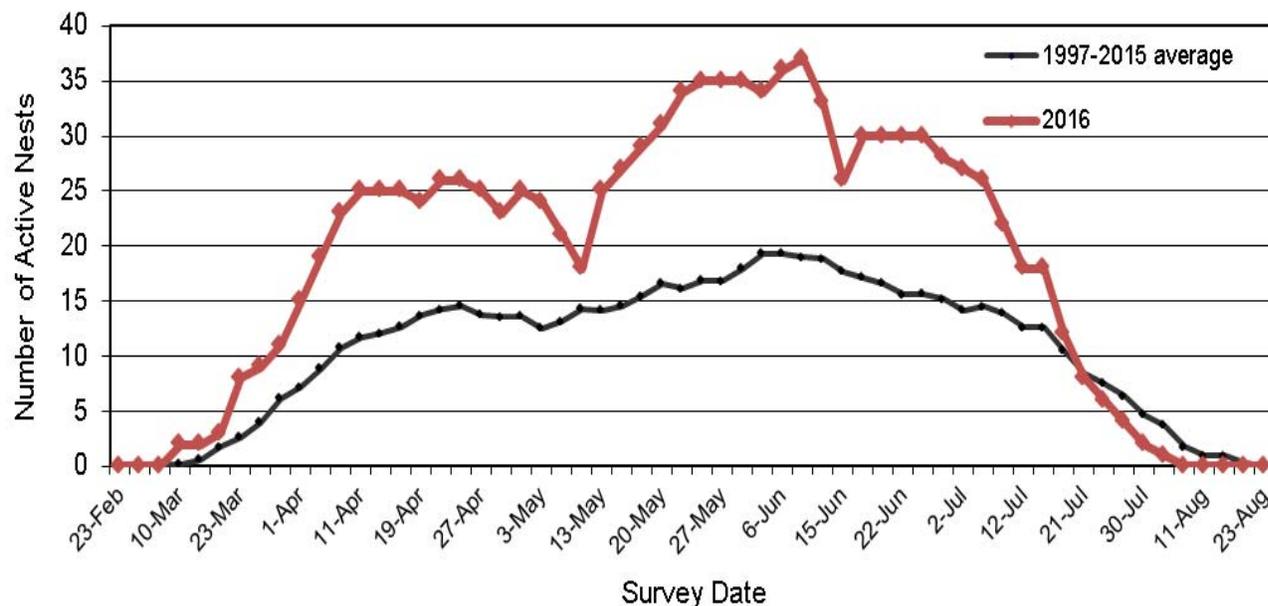


Figure 3. 2016 Western Snowy Plover Active Nest Chronology Compared to 1997 through 2015 Average at Bolsa Chica.

EGGS, CHICKS, AND FLEDGLING PRODUCTION

A total of 275 snowy plover eggs were produced in 2016, with 246 hatching: 242 in the wild and four at the Wetlands and Wildlife Care Center (WWCC) in Huntington Beach. There were 20 two-egg clutches and 78 three-egg clutches. Of the 29 eggs that did not hatch, five were predated and 24 failed to hatch. Twenty-three of the 24 eggs that failed to hatch were examined. Ten were found to have embryos of varying size and 13 were non-viable (yolk only).

A total of nine eggs were salvaged and given to the WWCC for incubation. Four of the nine hatched, were raised at the WWCC, and released at Bolsa Chica after fledging.

Of the 99 nests, 10 were found as broods only and the nest was not specifically located, but was assigned to the cell where the brood was initially found. The broods were found as two- or three-chick broods and were located throughout Bolsa Chica. Of the remaining 89 nests, nine were considered Failed: two were predated, and seven were abandoned pre-term. The 99 nests were judged to be complete clutches with the exception of Nest 62, which was abandoned with only one egg.

Table 4 presents the number of nests, eggs, chicks, and fledglings produced at Bolsa Chica over the past twenty years of monitoring.

Table 4. Nests, Eggs, Chicks, and Fledgling Production 1997-2016.

Year	Nests	Eggs	Chicks	Fledglings
2016	99	275	246	145
2015	92	244	208	129
2014	82	231	211	113
2013	66	185	140	37
2012	68	193	161	77
2011	73	207	164	62
2010	64	184	164	63
2009	70	201	184	42-70*
2008	67	193	174	57-109*
2007	50	143	130	25
2006	71	198	166	64
2005	51	153	115	75
2004	65	191	149	79
2003	32	92	76	44
2002	50	132	75	27
2001	55	156	63	57
2000	39	103	57	42
1999	38	102	71	23
1998	34	94	55	25
1997	30	79	44	ND

ND = not determined

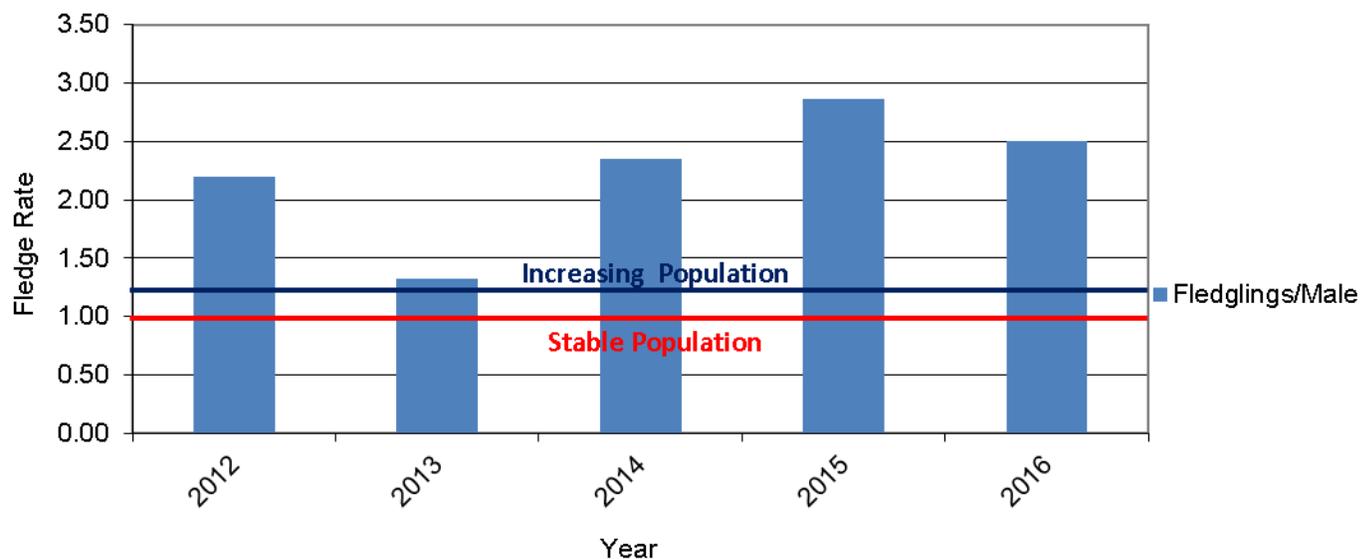
* minimum/maximum number of fledglings

Table 5 presents the total number of broods (one to three chicks each), then breaks them down into those that remained in the wild and fledged at least one chick, those that were raised at the WWCC (all of which fledged at least one chick each year), and those that remained in the wild but failed to fledge at least one chick. These data are available going back to 2010.

Table 5: Number of Broods 2010-2016 at Bolsa Chica and Raised at the Wetlands and Wildlife Care Center.

Year	Total Broods	Wild Broods that Fledged at Least 1 Chick	WWCC Raised Broods (All Fledged at Least 1 Chick)	Wild Broods that Failed to Fledge at Least 1 Chick
2016	91	68	3	20
2015	81	55	7	19
2014	76	55	4	17
2013	50	25	2	23
2012	60	39	0	21
2011	62	28	2	32
2010	58	31	5	22

A total of 145 fledglings, produced from 58 breeding males, results in an overall fledge rate (fledglings/male) of 2.50 for 2016 (Table 1). The Population Viability Analysis for Pacific Coast Western Snowy Plover in Appendix D of the Recovery Plan used a model that suggests that productivity (fledge rate) of at least 1.0 fledglings per breeding male per year should result in a stable population. It goes on to report that productivity of 1.2 or more fledglings per breeding male should increase the population sites at a “moderate pace”. Figure 4 presents the overall fledge rate (fledglings per breeding male), based on the Estimated Minimum Number of Adults since 2012. It shows a fledge rate reflective of an increasing population every year.

**Figure 4. Western Snowy Plover Fledge Rate (Fledglings/Male) 2012-2016 at Bolsa Chica.**

Of the 101 chicks that hatched but did not fledge, 11 died within the first day of hatching, 17 died within the first two days, and 56 died within the first week of hatching (Figure 5).

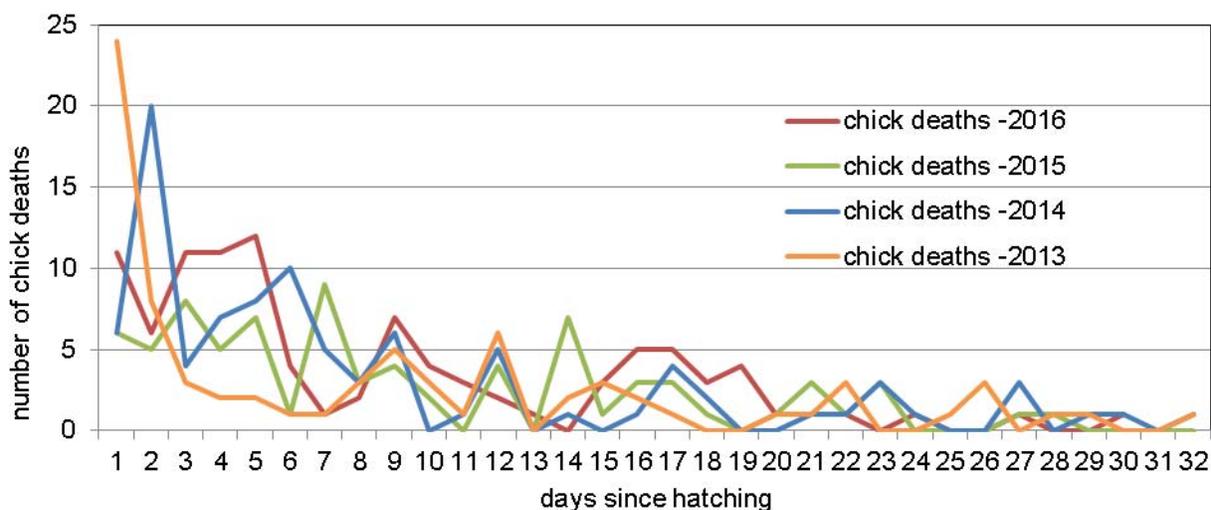


Figure 5. Number of Chick Deaths by Time since Hatching 2013-2016 at Bolsa Chica.

During 2016, no nests were incubated for an abnormal length of time. Abnormal incubation time spans have been observed at Bolsa Chica in each prior year beginning in 2009 through 2015.

All nest details are provided in Appendix 1.

EGG SALVAGE AND CHICK/ADULT RESCUES

A total of nine eggs from four nests were salvaged and taken to the WWCC for incubation. Four of these eggs hatched, the chicks raised at the WWCC until fledging, and then released at Bolsa Chica. Five of the eggs failed to hatch, with one broken in transit to the WWCC. The nine eggs came from Nest 56 (3), Nest 60 (33), Nest 62 (1), and Nest 85 (2).

Three chicks were rescued and taken to the WWCC for care. A chick from Nest 3 was found covered in ants and unable to stand, but did not survive. A chick from nest 80 was found alone without an adult after hatching and taken to the WWCC; it perished within 24 hours. Examination indicated an abnormally small heart. A chick from Nest 93 hatched 48 hours after its siblings had hatched and had left the vicinity of the nest. The WWCC raised that chick until fledging, and then it was released at Bolsa Chica.

An adult banded male (YSA:OO) was taken to the WWCC after capture when it was evident that the bands on its left leg had slipped down over the foot. The toes could not be extended inhibiting the bird from using the left leg. The problem bands were removed, the bird was rehabilitated, and subsequently released at Bolsa Chica. The released bird is now identified as S:OO.

To aid in the release of the fledglings, a small structure was built to shelter 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 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.

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 2016 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 from NS3 relocated within days of hatching to the Seasonal Ponds to forage. 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 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. Broods from NS2 often left the site to forage in Cell 45 and movement within the MTB was common. It is believed that NS2 will only support two or three broods at a time. This ability to disburse from the nest site to an adjacent cell probably contributed to fledgling success.

OBSERVATIONS OF BANDED ADULTS

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

A male, YS:WB (formerly WN:WB) raised at WWCC and released at Bolsa Chica in 2013, nested successfully at Bolsa Chica in 2014, 2015, and again successfully in 2016 (Nest 50), fledging three chicks.

A male, YS:WR (formerly YN:WR) raised at WWCC and released at Bolsa Chica in 2010, nested successfully at Bolsa Chica in 2016 (Nest 71), fledging three chicks. Although this male was observed at Bolsa Chica yearly from 2011-2015, it was not identified to a nest.

A male YSA:OO banded as an adult in December 2013 in Mexico nested successfully at Bolsa Chica in 2014, 2015, and again in 2016. This year prior to nesting, it suffered a left leg injury, was captured, and taken to the WWCC where it was rehabilitated and released to Bolsa Chica, as described above. It nested successfully (Nest 46) and fledged one chick.

A female, GA:OY, returned to Bolsa Chica in 2016, after successfully nesting in 2015, again producing two successful nests (Nests 10 and 43), fledging five chicks. This female was banded in 2014 at Oceano Dunes.

A male with a USFWS band only successfully nested in 2016 at Bolsa Chica (Nest 53), fledging two chicks. The origin of the bird is unknown.

A male, OY:GG, was present at Bolsa Chica from mid-May until late June, but was not specifically identified with a nest. Timing might indicate Nest 29.

A male, YS:BB (formerly YN:BB), raised at the WWCC and released at Bolsa Chica in 2015, returned in 2016 for two weeks, but was unsuccessful in finding a mate.

Other banded plovers were sighted in 2016 but did not nest at Bolsa Chica. The following combinations were recorded: GK:YY, BO:GG, AO:RO.

PREDATION

Several methods were utilized to deter predation of nests, chicks, and even adults. The use of the ME over all active nests contributes to the low rate of egg predation at Bolsa Chica. Other methods have met with more limited success including aversion nests and fencing around several of the nest sites (NS1 and NS3). Aversion nests were not used in 2016.

Two adults were found dead in 2016, both from unknown causes and without obvious trauma (Cells 10 and 45).

Two nests were depredated in 2016. The first was on NS1, protected by an ME, was believed to have been predated by rats. The second was in Cell 10, unprotected by an ME, by an unknown predator.

Two MEs were attacked by coyote, without success. Both nests hatched three eggs each.



Mini-enclosures attacked unsuccessfully by coyotes.

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 on nearly 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. Recent years of drought, including 2016, have resulted in drier conditions in the Seasonal Ponds, suitable for early nesting. In wet years, 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 improvements have been made to facilitate 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) in 2010 so that excess storm water can be pumped out to the Full Tidal Basin.

Although culvert repairs and the Freeman Creek pump have improved the drainage of water from the Seasonal Ponds after inundation, they are not enough to drain key cells enough for optimal plover nesting and brood rearing. The additional removal of water must be done with a portable pump, which requires a pit be present for the pump intake to be placed in. It is recommended that pits be dug to facilitate the removal of ponded water in key cells in fall of 2017. Priority cells are Cells 9, 10, 11, and 14.

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 calls for the introduction of salt water into the Seasonal Ponds beginning immediately after the close of the breeding season. This has been done annually in September. This has been effecting in stopping the spread of freshwater. It is recommended that this practice continue annually.

2. Enhance potential nesting areas

Beginning in 2014, several locations within the Seasonal Ponds were enhanced at the start of the breeding season 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 believed that this enhancement may have encouraged repeat use of nest sites within the same year and in the following years. It is not possible to know if the sites are being used repeatedly by the same individuals because most of the plovers are not banded. The recommendation is to continue the enhancement of these areas each year and expand the method to other areas as deemed appropriate by the substrate present.



Shell fragments spread to encourage nesting.

3. Continued monitoring

One of the key factors in the increasing success of nesting western snowy plovers at Bolsa Chica appears to be the intense monitoring and management employed to protect and track the nesting birds. It is recommended that monitoring continue annually with the same intensity in order to maintain the progress the plovers have made at Bolsa Chica, as the species attempts recovery range-wide.

Monitoring in 2017 will document plover habitat use and availability, as called for in the Recovery Plan: Paragraph 4.4.1 "*Identify western snowy plover brood habitat and map brood home ranges...*

Brood movements should be mapped and distances quantified to identify how large an area must be protected for broods".

4. Increase protection of nests and chicks in the Seasonal Ponds

The ME 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 also provide some protection to the mobile chicks after they have hatched. A great deal of effort has gone into protecting these young birds through actions 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 had been left in the Seasonal Ponds over the years and they were commonly used by raptors to view the salt panne within the cells. During the winter of 2014-2015, twenty-two of the cut-off power poles were cut down to ground level. In the winter of 2015-2016, additional poles were cut down and the remaining poles will be eliminated in winter of 2016-2017.

REFERENCES

- Federal Register. 1993. Endangered and threatened wildlife and plants; determination of threatened status of the Pacific Coast population of the western snowy plover. Federal Register 58: 12864-12874.
- Merkel & Associates. 2011. Bolsa Chica Lowlands Water Management Plan: Seasonal Ponds and Freeman Creek Water Management Unit. Prepared for California State Lands Commission. July 6, 2011(Revised August 10, 2013). 13 pp.
- Page, G. W., J. S. Warriner, J.C. Warriner, and P.W. Patton 1995. Snowy Plover (*Charadrius alexandrinus*) in The Birds of North America (A. Poole and F. Gill, eds.) No. 154. Acad. Nat. Sci. Philadelphia.
- U.S. Fish and Wildlife Service. 2007. Recovery Plan for the Pacific Coast Population of the Western Snowy Plover (*Charadrius alexandrinus nivosus*). In 2 volumes. Sacramento, California. xiv + 751 pages.

Appendix 1. Snowy plover eggs laid, chicks hatched, and fledged at Bolsa Chica, 2016

Nest #	Cell #	Date Found	Date Ended	Eggs	Nest Fate	Chicks	Fledglings	Bands	Substrate	Comments
1	80 RD	03/07/16	04/10/16	3	H	3	0		GRAVEL	chicks disappeared
2	NS3	03/18/16	04/12/16	3	H	3	3		SAND/UNDER BEACH PRIMROSE	
3	CELL 9	03/22/16	04/26/16	3	H	3	1		SALT PANNE	1 chick to WWCC; died from ant bites
4	CELL 9	03/24/16	04/26/16	2	A	0	0		SALT PANNE/VEG.	used last year sand, shells added
5	NS1	03/24/16	04/03/16	3	P	0	0		SAND/VEG	probable rats
6	CELL 14	03/26/16	04/18/16	3	H	3	0		SALT PANNE	
7	CELL 45	03/27/16	04/21/16	3	H	3	0		SALT PANNE/MOUND	
8	NS3	03/29/16	04/26/16	3	H	3	3		SAND	
9	CELL 9	03/31/16	04/29/16	2	H	3	1		SALT PANNE/SAND	
10	CELL 10	03/31/16	05/04/16	3	H	3	3	female/ GA:OY	SALT PANNE	
11	CELL 11	04/01/16	05/04/16	3	H	2	2		SML STONES	
12	80 RD	04/02/16	05/04/16	3	H	3	0		GRAVEL	
13	NS3	04/02/16	05/01/16	3	H	3	3		SAND	
14	CELL 22	04/05/16	05/06/16	3	H	3	3		SALT PANNE/SHELLED AREA	
15	NS1	04/05/16	05/03/16	3	H	3	1		SAND	
16	80 RD	04/06/16	05/08/16	3	H	3	1		GRAVEL	
17	CELL 14	04/09/16	05/06/16	3	H	2	2		SALT PANNE	
18	CELL 41	04/10/16	05/09/16	3	H	3	0		SALT PANNE	
19	CELL 45	04/10/16	05/13/16	3	H	3	2		SALT PANNE	
20	Sand Blast Rd	04/10/16	05/06/16	3	H	3	0		SAND/ASPHALT	2 DC in ME; S.B. = SAND BLAST
21	CELL 10	04/12/16	05/14/16	3	H	2	2		SALT PANNE/SHELLS/SAND ADDED	
22	CELL 46	04/12/16	05/07/16	3	A	0	0		SALT PANNE/DEAD	

Nest #	Cell #	Date Found	Date Ended	Eggs	Nest Fate	Chicks	Fledglings	Bands	Substrate	Comments
									VEG	
23	CELL 11	04/13/16	05/10/16	3	H	2	1		SML STONES	
24	CELL 11	04/15/16	04/28/16	3	H	2	0		SALT PANNE/VEG.	
25	STI	04/18/16	05/10/16	3	A	0	0		SAND/DIRT	
26	CELL 47	04/22/16	05/24/16	3	H	3	3		SALT PANNE	
27	NS1	04/22/16	04/24/16	3	H	3	2		SAND	
28	CELL 34	04/23/16	04/30/16	3	H	3	2		SALT PANNE	
29	CELL 10	04/25/16	05/18/16	3	H	3	2		SALT PANNE/DEAD VEG	
30	CELL 10	04/28/16	05/31/16	3	H	3	3		SALT PANNE/DEAD VEG	(veg=Pickleweed)
31	NS2	04/29/16	05/23/16	3	H	3	2		SAND/VEG	
32	NS3	05/04/16	05/11/16	3	H	3	2		SAND/BEACH PRIMROSE	
33	CELL 11	05/05/16	06/02/16	3	H	3	3		SALT PANNE	
34	NS1	05/06/16	05/22/16	3	H	3	2		SAND	
35	CELL 10	05/08/16	06/06/16	3	H	3	3		SALT PANNE	
36	NS1	05/10/16	06/02/16	3	H	3	1		SAND	
37	NS2	05/12/16	06/02/16	3	A	0	0		SAND	
38	E. LEVEE RD	05/15/16	06/08/16	3	H	3	3		GRAVEL	
39	CELL 10	05/15/16	06/12/16	2	H	3	3		SALT PANNE	
40	80 RD	05/15/16	06/10/16	3	H	3	0		GRAVEL	
41	CELL 30	05/16/16	06/11/16	3	H	3	3		SALT PANNE	
42	CELL 14	05/17/16	06/17/16	3	H	3	0		SALT PANNE	
43	NS3	05/19/16	06/12/16	3	H	3	2	female/ GA:OY	SAND	
44	CELL 10	05/19/16	06/14/16	3	H	3	3		SALT PANNE	
45	NS2	05/19/16	06/11/16	2	2A/1H	1	1		SAND	
46	CELL 10	05/19/16	06/19/16	3	2A/1H	1	1	male/ S:OO	SALT PANNE/VEG	female no toes on right leg

Nest #	Cell #	Date Found	Date Ended	Eggs	Nest Fate	Chicks	Fledglings	Bands	Substrate	Comments
47	CELL 11	05/20/16	06/14/16	3	H	3	2		SALT PANNE	
48	CELL 10	05/20/16	06/13/16	3	H	2	2		SALT PANNE	
49	CELL 9	05/20/16	06/14/16	2	H	3	2		SALT PANNE	
50	CELL 45	05/21/16	06/16/16	3	H	3	3	male/ YS:WB	SALT PANNE	
51	CELL 10	05/21/16	06/12/16	2	H	3	3		SALT PANNE	
52	CELL 2	05/21/16	06/12/16	2	H	3	3		GRAVEL	
53	CELL 14	05/22/16	06/17/16	2	H	3	2		SALT PANNE	
54	CELL 14	05/22/16	06/19/16	3	H	3	2		SALT PANNE	
55	NS3	05/23/16	06/16/16	3	1A/2H	2	0		SAND	
56	NS1	05/24/16	06/14/16	3	H	3	3		SAND/SALT PANNE	3 eggs to WWCC; 3 chicks banded by B. Peterson; fledglings released 8 Aug 2016
57	CELL 10	05/25/16	06/22/16	3	H	3	2		SALT PANNE	same as #21
58	CELL 41	05/25/16	06/23/16	3	H	3	2		SALT PANNE	same as #18
59	CELL 11	05/26/16	06/26/16	3	2H/1A	2	2		SALT PANNE	
60	CELL 11	05/26/16	06/12/16	3	A	0	0		SALT PANNE	Flooded, 3 eggs to WWCC
61	CELL 9	05/27/16	06/23/16	3	H	2	1		SALT PANNE	
62	CELL 11	05/25/16	05/29/16	3	A	0	0		SALT PANNE	1 egg to WWCC 5/29
63	NS1	05/29/16	06/28/16	3	H	3	3		SAND/HARD PACK	
64	CELL 14	05/29/16	05/29/16	3	H	2	0		SALT PANNE	found as a brood
65	CELL 9	05/29/16	06/26/16	3	H	3	3		SALT PANNE	
66	NS3	06/02/16	06/21/16	3	H	3	2		SAND	
67	CELL 9	06/02/16	06/02/16	3	H	2	1		SALT PANNE	found as a brood
68	CELL 12	06/04/16	06/13/16	3	H	3	1		SALT PANNE	
69	CELL 9	06/05/16	07/06/16	3	H	3	1		SALT PANNE	same as site nest #4
70	CELL 11	06/07/16	07/08/16	3	H	2	0		SALT PANNE	
71	NS3	06/08/16	07/08/16	3	H	3	3	male/ YS:WR	SAND	
72	CELL 11	06/11/16	07/09/16	3	H	3	2		SMALL STONES	
73	CELL 11	06/14/16	07/10/16	3	H	3	3		SMALL STONES	
74	CELL 9	06/17/16	07/10/16	2	H	3	2		SALT PANNE	

Western Snowy Plover Nesting at Bolsa Chica, 2016

Nest #	Cell #	Date Found	Date Ended	Eggs	Nest Fate	Chicks	Fledglings	Bands	Substrate	Comments
75	CELL 11	06/17/16	07/12/16	3	H	3	2		SMALL STONES	
76	CELL 41	06/18/16	06/18/16	2	H	3	1		SALT PANNE	found as brood
77	CELL 10	06/19/16	07/05/16	3	P	0	0		SALT PANNE	unknown
78	CELL 11	06/20/16	07/19/16	3	H	3	0		SALT PANNE	
79	STI	06/21/16	07/18/16	3	H	2	1		SALT PANNE	
80	CELL 9	06/23/16	07/18/16	3	H	3	0		SALT PANNE	SAME SITE AS NEST #9
81	CELL 10	06/23/16	07/22/16	3	H	3	1		SALT PANNE	
82	CELL 41	06/26/16	07/24/16	3	H	2	1		SALT PANNE	
83	CELL 30	06/30/16	06/30/16	3	H	3	3		SALT PANNE	FOUND AS A BROOD
84	CELL 45	06/30/16	06/30/16	3	H	3	2		SALT PANNE	FOUND AS A BROOD
85	CELL 10	06/30/16	07/29/16	3	1H/2A	2	1		SALT PANNE	1 hatched in the wild and 2 abandoned and taken to WWCC: 1H/1NV; thus, 2H/2A/1A-NV. WWCC chick released at BCER, 1-Sep-16.
86	CELL 45	07/01/16	07/18/16	3	H	3	3		SALT PANNE	
87	CELL 45	07/01/16	07/18/16	3	2H/1A	2	2		SALT PANNE	
88	CELL 46	07/01/16	07/19/16	3	H	3	1		SALT PANNE	
89	NS3	07/02/16	07/26/16	2	H	2	0		SAND	
90	CELL 12	07/02/16	07/30/16	1	H	3	0		SALT PANNE	
91	CELL 30	07/03/16	07/03/16	3	H	3	0		SALT PANNE	FOUND AS A BROOD
92	CELL 12	07/03/16	07/10/16	2	H	2	0		SALT PANNE	
93	70 RD	07/08/16	07/18/16	3	H	3	1			small stones. 1 chick to WWCC, released at BCER as a fledgling on 1-Sep-16.
94	CELL 10	07/09/16	08/07/16	3	H	2	2		SALT PANNE	same as sit #39
95	CELL 42	07/19/16	07/19/16	2	H	3	2		SALT PANNE	FOUND AS A BROOD
96	CELL 9	07/18/16	07/18/16	3	H	2	2		SALT PANNE	FOUND AS A BROOD
97	CELL 41	07/19/16	08/02/16	3	1H/1A	1	1		SALT PANNE	
98	CELL 30	07/22/16	07/22/16	3	H	3	0		SALT PANNE	FOUND AS A BROOD
99	CELL 42	07/27/16	07/27/16	3	H	2	0		SALT PANNE	FOUND AS A BROOD
2016 Season Totals				275 eggs		246 chicks	145 fledglings			

UNK= unknown, P = predated; A = abandoned; H = hatched, F = flooded, NV = not viable, WWCC = Wetlands and Wildlife Care Center .

Appendix 2. Distribution of Western Snowy Plover Nests at Bolsa Chica for 1997 through 2016.

Number of nests by area at Bolsa Chica

Year	Total # Nests	Cells eliminated during restoration	Seasonal Ponds	FFTB	MTB	NTI	NS1	NS2	NS3	STI	Other
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
2015	92		41	8	17	1	9	8	5	3	
2016	99		46	12	20		7	3	9	2	

Number of nests by cell at Bolsa Chica

Year	Cell 2	Cell 9	Cell 10	Cell 11	Cell 12	Cell 13	Cell 14	Cell 19	Cell 21	Cell 22	Cell 25	Cell 30	Cell 31	Cell 32	Cell 33	Cell 34	Cell 36	Cell 40	Cell 41	Cell 42	Cell 45	Cell 46	Cell 47	80 Rd.
1997			4	7			1			2														
1998		2	7	6			1			1														
1999			6	5			1	5		4														
2000		2	6	12	1		1			1							3							
2001	1	8	11	9				5																
2002	1	2	1	10		3	3			10							1							
2003		6	1		2			1																
2004		5	12	13	2	1	1	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			1
2015	1	8	15	10	5	2	4		2									2	2	3	5	1		5
2016	1	12	15	13	3		6			1									5	2	6	2	1	4