

**Western Snowy Plover Nesting
at Bolsa Chica, Orange County, California
2017**



Photo by P. Knapp

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EXECUTIVE SUMMARY

In 2017, 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 2017, the first snowy plover nest was established on March 12 and the last brood fledged on September 5. There was a total of 127 nests, producing 361 eggs, of which 340 hatched chicks, with 152 fledglings produced. There was an overall fledge rate (fledglings/male) of 2.41 for 2017. This continues the high fledge rates of recent years, indicating an increase in the plover population at Bolsa Chica. The continued use of MEs resulted in low rates of egg predation.

The most utilized region of Bolsa Chica for snowy plover nesting was the Seasonal Ponds, with 43% of all nests. Within the ponds, Cell 10 was the most successful site, producing 21% of all fledglings.

The range-wide Winter Window Survey conducted in January to estimate the winter population size found 73 adults. The range-wide, Breeding Season Window Survey conducted in May resulted in a count of 106 adult snowy plovers at Bolsa Chica. The calculated minimum number of adults was determined to be 114.

The 2017 snowy plover monitoring observed the highest number of females, males, adults, nests, and fledglings that have been recorded at Bolsa Chica in the last 21 years of monitoring. This was the fourth 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.

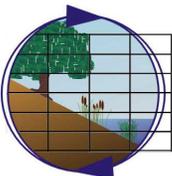
In 1997, the Bolsa Chica lowlands were acquired into public ownership. This marked the beginning of a multi-agency effort to design, evaluate, and implement a plan for restoring the fish and wildlife habitats. These habitats had been cut off from the ocean for a century and have been an operating oil 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 long-term effect of the restoration project and identify any 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 2017 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



Copulating snowy plovers.

Photo P. Knapp

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).

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

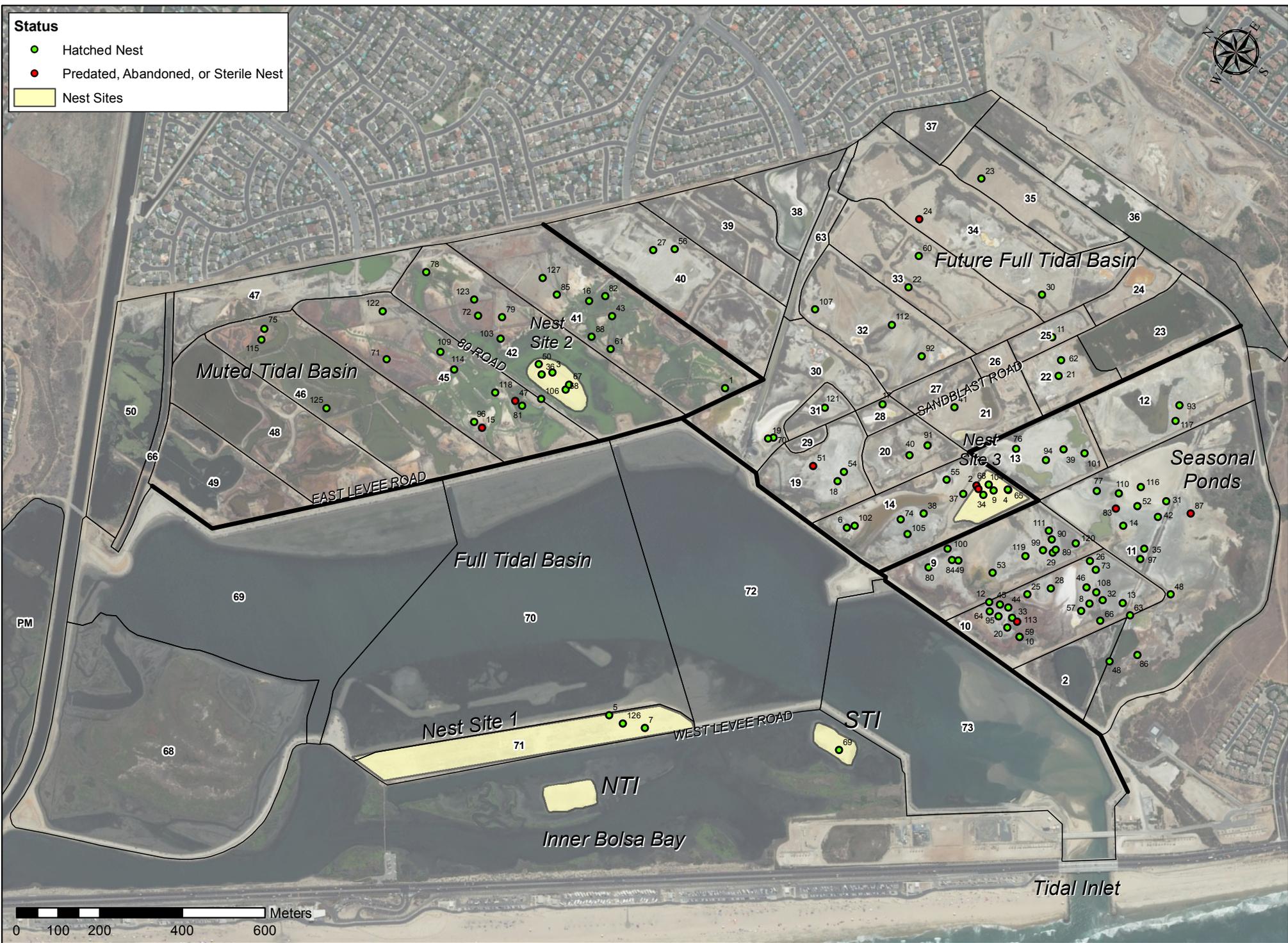


Figure 2. Western Snowy Plover Nest Locations at Bolsa Chica Lowlands, 2017

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 some pickleweed, although there is one cell that retains water year-round (Cells 30). Although the FFTB is mostly suboptimal for nesting, this year, with an increased plover population, 29 nests were initiated in the FFTB. The previous high was 19 in 2002.

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 2017, the central and eastern MTBs remained non-tidal. The west MTB continued 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 2017, nesting occurred in Cells 41, 42, 45, and 46 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 2017 was undertaken by California CDFW staff member, Peter Knapp, with assistance from Ross Griswold, a CDFW volunteer. 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 21, 2017 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 21, 2017 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 has been 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 2017 except nests 47 and 115, 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 2017, 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 2017-2018.

For the second year, 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 discourage avian predator perching. In 2017, predators did perch on wells with NIXALITE on a limited basis. Further research on deterrence of avian predator perching should be conducted.

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 2017, the first snowy plover nest was established on March 12 in salt panne on well pad 71E in Cell 41. The last brood fledged on September 5. There was a total of 127 nests producing 152 fledglings for the season (Table 1). The 2017 snowy plover monitoring observed the highest number of females, males, adults, nests, and fledglings that have been recorded at Bolsa Chica in the last 21 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 April 17 through July 8 ranged between 70 and 114. Therefore, the minimum number of adults is reported as 114 (Table 1). The average of the daily surveys was 93 adults. This was the fourth 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 six 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 2012-2017.

Year	Females	Males	Total Adults	Total Nests	Fledglings	Fl/Male
2017	51	63	114	127	152	2.41
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 73 adults. The range-wide, Breeding Season Window Survey conducted in May resulted in a count of 106 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 1997-2017.

Year	Females	Males	Total Adults
2017	46	60	106
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 2017. 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. To better understand the factors that lead to successful fledging, monitoring in 2017 documented plover selection of habitat and foraging sites for raising chicks in relation to their fledging success.

In 2017, snowy plovers utilized all available nest sites typically used at Bolsa Chica (Figure 2). The Seasonal Ponds had 43% of all nests and a record number of nests since recording began in 1997. They also produced 45% of the total fledglings. Cell 10 was the most successful site, with 20 nests hatching 58 chicks with 32 fledglings, or 21% of all fledglings. The FFTB substantially increased nests, going from 12 in 2016 to 29 in 2017. These nests hatched 82 chicks, with 32 fledglings.

The man-made nest sites (NS1, NS2, and NS3) had three fewer nests and 12 fewer fledglings in 2017 than in 2016. NS1 continued the observed decline in nest attempts, from a high of 37 nests in 2008 to only 3 in 2017 (Appendix 2). The cause may be increased vegetation, presence of additional predators (gulls), or other unknown factors.

Use of the MTBs continued to increase, recording a record number of nests (26), chicks (69), and fledglings (30).

In 2017, the four substrates utilized for nests were salt panne (94 nests), sand (10), dried algae (8), and gravel (6). Vegetation was an integral element of 10 salt panne 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 2017.

Table 3 presents the nesting information by location for 2017. 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. 2017 Nests, Nest Fates, Chicks, and Fledglings by Location.

Location	Total Nests	Nests Failed no eggs hatched	Nests Hatched (# of chicks)	Fledglings
Seasonal Ponds	55	3	52 (145)	68
<i>Cell 9</i>	<i>12</i>		<i>12 (34)</i>	<i>20</i>
<i>Cell 10</i>	<i>21</i>	<i>1</i>	<i>20 (58)</i>	<i>32</i>
<i>Cell 11</i>	<i>16</i>	<i>2</i>	<i>14 (37)</i>	<i>15*</i>
<i>Cell 12</i>	<i>2</i>		<i>2 (4)</i>	<i>1</i>
<i>Cell 22</i>	<i>4</i>		<i>4 (12)</i>	<i>0</i>
Nest Site 1	3		3 (8)	4
Nest Site 2	5		5 (13)	8
Nest Site 3	8	1	7 (20)	12
South Tern Island	1		1 (3)	1
Future Full Tidal Basin	29		29 (82)	32
<i>Cell 14</i>	<i>6</i>		<i>6 (17)</i>	<i>8</i>
<i>Cell 19</i>	<i>3</i>		<i>3 (7)</i>	<i>3</i>
<i>Cell 20</i>	<i>3</i>		<i>3 (9)</i>	<i>0</i>
<i>Cell 21</i>	<i>1</i>		<i>1 (3)</i>	<i>0</i>
<i>Cell 22</i>	<i>2</i>		<i>2 (6)</i>	<i>2</i>
<i>Cell 25</i>	<i>1</i>		<i>1 (3)</i>	<i>1</i>
<i>Cell 30</i>	<i>12</i>		<i>2 (4)</i>	<i>0</i>
<i>Cell 31</i>	<i>31</i>		<i>1 (3)</i>	<i>3</i>
<i>Cell 32</i>	<i>23</i>		<i>3 (9)</i>	<i>6</i>
<i>Cell 33</i>	<i>22</i>		<i>2 (6)</i>	<i>1</i>
<i>Cell 34</i>	<i>12</i>		<i>2 (6)</i>	<i>5*</i>
<i>Cell 35</i>	<i>21</i>		<i>1 (3)</i>	<i>0</i>
<i>Cell 40</i>	<i>2</i>		<i>2 (6)</i>	<i>3</i>
Muted Tidal Basin	26	1	25 (69)	30
<i>Cell 41</i>	<i>8</i>		<i>8 (23)</i>	<i>8</i>
<i>Cell 42</i>	<i>5</i>		<i>5 (15)</i>	<i>10</i>
<i>Cell 45</i>	<i>9</i>	<i>1</i>	<i>8 (22)</i>	<i>7</i>
<i>Cell 46</i>	<i>3</i>		<i>3 (8)</i>	<i>5</i>
<i>80 Road</i>	<i>1</i>		<i>1 (1)</i>	<i>0</i>
Total	127	5	122 (340)	152*

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

An interesting observation made during the nesting season, and not seen before, was a male plover in Cell 40 that was guarding (standing over) one American avocet egg. It was in a scrape and after five days the observer destroyed the egg so that the male could pursue nesting. The bird was not banded and therefore his it is unknown whether he subsequently nested successfully.

Appendix 1 provides the cell location, start and end dates, nest fates, and eggs and chicks produced for each nest in 2017. Appendix 2 provides information on historical nest distribution.

NESTING CHRONOLOGY

In 2017, the first plover nest was initiated on March 12. The last nest hatched on August 3. There was an active nest and/or brood for a total of 174 days of the 2017 breeding season at Bolsa Chica. Nest chronology in 2017 is compared to the average of the prior nineteen years at Bolsa Chica in Figure 3 and to the average of the prior three years, during with the recovery goal of breeding adults was met.

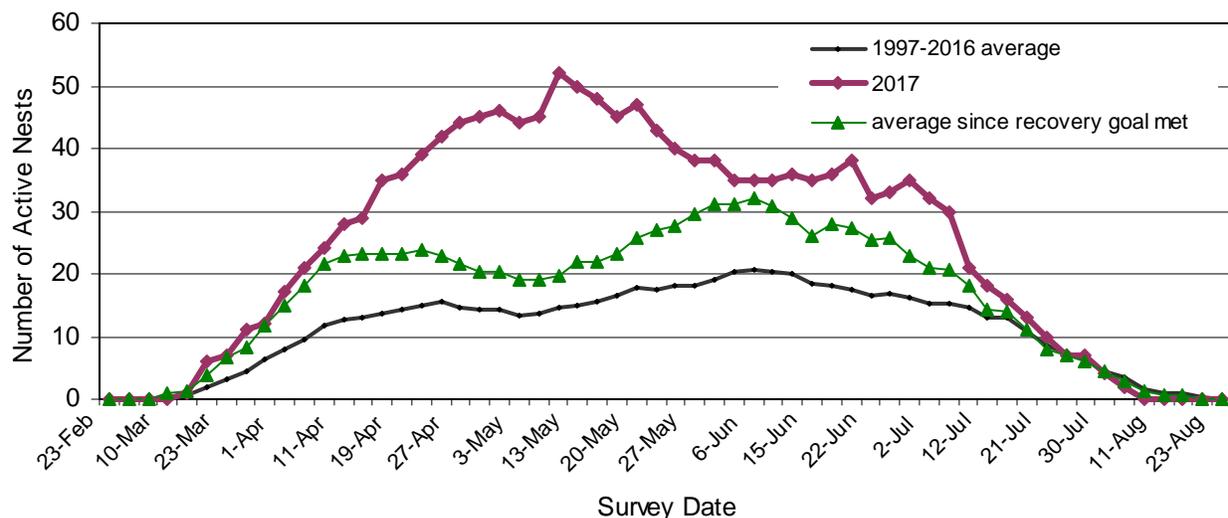


Figure 3. 2017 Western Snowy Plover Active Nest Chronology Compared to 1997 through 2016 Average at Bolsa Chica.

EGGS, CHICKS, AND FLEDGLING PRODUCTION

A total of 361 snowy plover eggs were produced in 2017, with 340 hatching: 328 in the wild and 12 at the Wetlands and Wildlife Care Center (WWCC) in Huntington Beach. There were 3 one-egg clutches, 14 two-egg clutches and 107 three-egg clutches. Three nests were abandoned with only one egg, one of which was caused by flooding and the other two caused by unknown factors. Of the 21 eggs that did not hatch, one was damaged in the nest, four were predated and 16 failed to hatch. Ten of the 16 eggs that failed to hatch were examined. All ten were found to be non-viable (yolk only).

A total of 15 eggs were salvaged and given to the WWCC for incubation. Twelve hatched, were raised at the WWCC, and released at Bolsa Chica after fledging. Two chicks were abandoned in Cell 11, given to the WWCC, were raised there and released at Bolsa Chica after fledging.

Of the 127 nests, 9 were found as broods only and the nests not specifically located, but was assigned to the cell where the brood was initially located. Of the remaining 118 nests, two were predated and three failed (no eggs hatched).

Nests 7 and 9, each with 3 eggs, were covered by blowing sand on March 31. The eggs in the scrapes were uncovered from the sand by Peter Knapp the following day and replaced into a hand made scrape in the sand. Thereafter they were incubated normally by the adults, and hatched on schedule.

Table 4 presents the number of nests, eggs, chicks, and fledglings produced at Bolsa Chica over the past 21 years of monitoring.

Table 4. Nests, Eggs, Hatch Success, and Fledgling Production 1997-2017.

Year	Nests	Eggs	Hatched	Failed to Hatch	Fledglings
2017	127	361	340	21	152
2016	99	275	246	29	145
2015	92	244	208	35	129
2014	82	231	211	20	113
2013	66	185	140	45	37
2012	68	193	161	32	77
2011	73	207	164	43	62
2010	64	184	164	20	63
2009	70	201	184	16	42-70*
2008	67	193	174	19	57-109*
2007	50	143	130	13	25
2006	71	198	166	32	64
2005	51	153	115	28	75
2004	65	191	149	42	79
2003	32	92	76	16	44
2002	50	132	75	57	27
2001	55	156	63	93	57
2000	39	103	57	46	42
1999	38	102	71	31	23
1998	34	94	55	39	25
1997	30	79	44	35	ND

ND = not determined

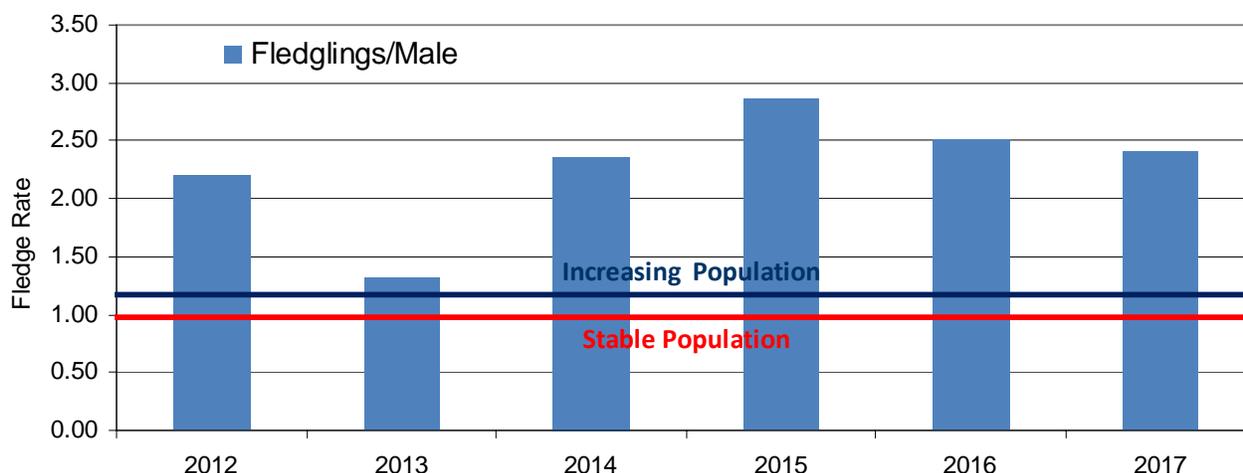
* minimum/maximum number of fledglings

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 2010-2017 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
2017	122	74	5	43
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 152 fledglings, produced from 63 breeding males, results in an overall fledge rate (fledglings/male) of 2.41 for 2017 (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) 2012-2017 at Bolsa Chica.**

A total of 188 chicks failed to fledge. Of these, 30 died within the first day of hatching, 51 died within the first two days, and 103 within the first week (Figure 5).

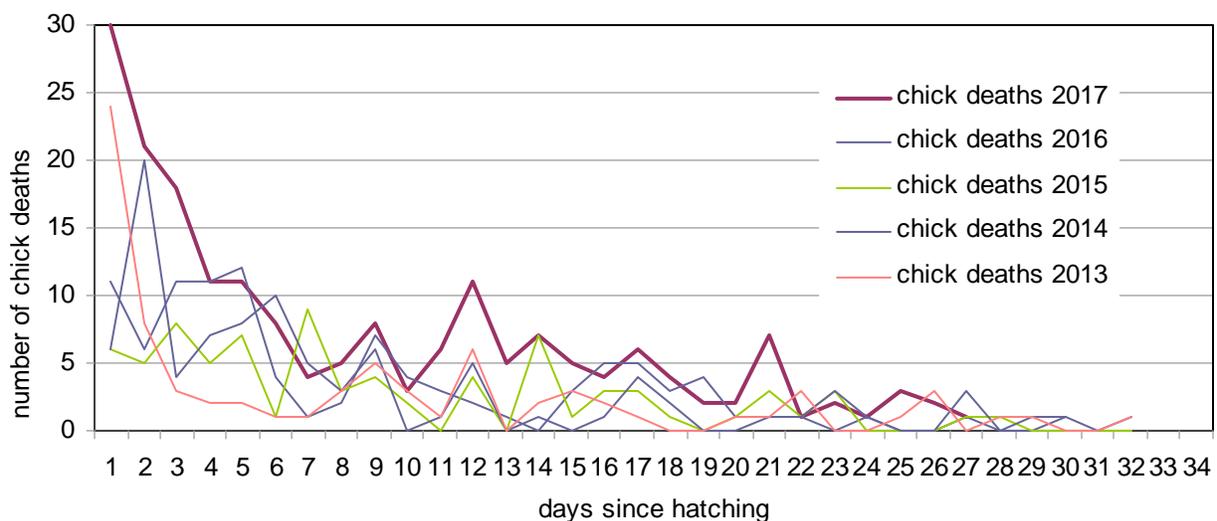


Figure 5. Number of Chick Deaths by Time since Hatching 2013-2017 at Bolsa Chica.

Nest 24 in Cell 34 was found on April 14, with one egg and incubation of three eggs was initiated on or before April 18. On a number of occasions in the following weeks there was no bird incubating when monitored. On May 21 the eggs were turned up to determine if the eggs were being incubated over night. On the morning of May 22, it was determined by Peter Knapp that the nest was not being attended and the three eggs were salvaged and taken to the WWCC. On May 31 all three eggs hatched at the Care center, where they were raised until fledging and then released at Bolsa Chica. This was the second time that a fertile nest from Bolsa Chica hatched after more than forty days of incubation.

From 2009 until 2015 instances of prolonged incubation of one or more nest each year occurred at Bolsa Chica, but in each of these instances the eggs were infertile.

All nest details are provided in Appendix 1.

EGG SALVAGE AND CHICK/ADULT RESCUES

A total of 15 eggs from seven nests were salvaged and taken to the WWCC for incubation. Twelve of these eggs hatched, the chicks raised at the WWCC until fledging, banded, and then released at Bolsa Chica. Three of the eggs failed to hatch. The fifteen eggs came from Nest 15 (3), Nest 24 (3), Nest 51 (3), and Nest 68 (3), and one each from Nests 83, 87, and 97.

Two chicks were rescued and taken to the WWCC for care. Both had been abandoned in Cell 11 and were being attacked by a male plover with its brood. No adult was observed for two days with the two chicks. The WWCC raised the chicks until fledging and then both were released at Bolsa Chica. In past years a shelter was used during the release of WWCC fledglings, but this practice was discontinued in 2017.

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 2017 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.



Snowy plover fledgling. Photo P. Knapp

Tracking in 2017 included study of brood movement between nest site locations, foraging locations, and fledgling location. Fourth-four broods fledged from the same cell as the nest location. Thirty fledged from a cell other than the nest site. Thirty-one failed to fledge within the nest site cell, and 12 failed to fledge after moving to another cell. Five broods fledged from the WWCC. Movement within a cell can be considerable. As noted above, approximate areas of some key cells are Cell 10 (17 acres) and Cell 11 (54 acres).

OBSERVATIONS OF BANDED ADULTS

A limited number of banded plovers were observed breeding in 2017 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, 2016. In 2017 the male had a nest that was abandoned with three eggs, which were salvaged and taken to the WWCC where they hatched, were raised to fledging, and released at Bolsa Chica. The male was seen only once more after abandonment of the nest.

A male, ys:wr (formerly yn:wr) raised at WWCC and released at Bolsa Chica in 2010, nested twice successfully at Bolsa Chica in 2017, fledging three chicks. It nested successfully at Bolsa Chica in 2016 and was seen there from 2011-2015, but not identified with specific nests.

A male, s:oo (formerly ysa:oo), banded as an adult in December 2013 in Mexico, nested successfully at Bolsa Chica from 2014 to 2017. In 2016 it suffered a left leg injury, was captured, and taken to the WWCC where it was rehabilitated and re-released to Bolsa Chica, and nested successfully.

A male, rr:kk, unidentified from any known site, nested successfully in 2016 and 2017 at Bolsa Chica, fledging two chicks in 2017.

A female, bb:ay, banded in 2014 or 2016 at Oceano Dunes, nested once successfully at Bolsa Chica in 2017 with three eggs and three chicks, one of which fledged.

One or two females banded s:x nested twice at Bolsa Chica in 2017, fledging four birds. The band numbers on the S were too small to read, so identity of one or two birds is unknown.

A female, sb:oy, banded in 2016 at Coronado, nested at Bolsa Chica with three eggs and two chicks, neither of which fledged.

A female, ga:oy, had three clutches in 2017, hatching nine chicks, four of which fledged. This female has nested at Bolsa Chica the past three years. In 2015 and 2016 she had two clutches of three eggs each, six chicks, of which 5 fledged each year. She was banded in 2014 at Oceano Dunes. During the past two winters she has been seen at Malibu Lagoon.

A female, sb:bw, banded in 2016 at Camp Pendleton, nested at Bolsa Chica in 2017 producing a clutch of three3 eggs, that hatched three chicks, only one of which fledged.

A female, pg:rb, banded in 2016 at Oceano Dunes, had two clutches of three eggs each in 2017. One clutch hatched three chicks, which all fledged. The second clutch hatched only one chick, and it did not fledge.

An unusual visitor at Bolsa Chica on August 22, 2017 in migration was a snowy plover banded bwb:w in 2016 at South Tenmile, Coos City, Oregon.

Other banded birds seen at Bolsa Chica for varying lengths of time during the breeding season included the following band combinations; ga:vb, bk:rw, bp:rr, ob:gw, bb:gy, gg:pr, vg:wy, and ob:bg.

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 2017, but will be instituted again in 2018 due to the presence of a new group of coyotes from a litter of seven that survived.

One adult plover was found dead in a road at the intersection of cells 9, 11, 13 and 14 early in the 2017 season, but no trauma was detected on the bird.

Two unprotected nests were predated in 2017, from unknown predators.

Documented chick losses were from an American kestrel, red-tailed hawk, and coyote.

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



Mini-exlosures attacked unsuccessfully by coyotes.

An observation of interest was that Nest 30, in Cell 34, was located approximately 15 meters from a den of seven coyote pups. The pups roamed the area and the female plover was always noted attending the nest. Coyote tracks were found around the ME, but no attempts to predate the nest were observed. The three eggs hatched and the male and female led the chicks away from the area of the coyote den and eventually all three chicks fledged out of Cell 9.

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, through 2016, resulted in drier conditions in the Seasonal Ponds, suitable for early nesting. The drought had ended by 2017, but the greater inundation did not impact plover nesting. However it is still important to have a flexible management process for balancing the amount of water in the Seasonal Ponds to make them available for snowy plover nesting and foraging.

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 months. 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.

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 included commencement of identifying brood movements, 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*".

In the next breeding season, linear distances will be calculated as part of the monitoring.

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. The loss of 188 chicks in 2017 indicates that consideration must be given to changes in predator management or development of other means to deter predators and protect the plover chicks.

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- 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, 2017.

Nest #	Date Found	Date Ended	Location	# Eggs	Nest Fate	# Chicks	# Fledged	Bands	Comments
1	12-Mar-17	15-Apr-17	CELL 41	3	H	3	0		
2	17-Mar-17	12-Apr-17	NS3	3	A	0	0		
3	19-Mar-17	18-Apr-17	NS2	3	2H/1A	2	0		
4	20-Mar-17	24-Apr-17	NS3	3	H	3	1		
5	22-Mar-17	23-Apr-17	NS1	3	H	3	2		
6	25-Mar-17	27-Apr-17	CELL 14	3	H	3	0		
7	26-Mar-17	28-Apr-17	NS1	3	H	3	1		
8	28-Mar-17	25-Apr-17	CELL 10	3	H	3	0		
9	30-Mar-17	21-Apr-17	NS3	3	H	3	2	ga:oy (female)	
10	30-Mar-17	28-Apr-17	CELL 10	2	H	2	0		
11	3-Apr-17	4-May-17	CELL 25	3	H	3	1		
12	4-Apr-17	3-May-17	CELL 10	3	H	3	1		
13	4-Apr-17	3-May-17	CELL 10	3	H	3	0		
14	5-Apr-17	3-May-17	CELL 11	3	H	3	0		
15	5-Apr-17	6-May-17	CELL 45	3	3A/3H	3	3	ys:wb (male) (BCER-2013)	3 eggs to OCWWCC; hatched then banded and released at BC
16	5-Apr-17	5-May-17	CELL 41	3	H	3	1		
17	6-Apr-17	3-May-17	CELL 20	3	H	3	0		
18	9-Apr-17	11-May-17	CELL 19	3	H	3	1		
19	9-Apr-17	6-May-17	CELL 30	3	2H/1D	2	0		egg was damaged
20	9-Apr-17	12-May-17	CELL 10	3	H	3	3		
21	10-Apr-17	6-May-17	CELL 22	3	H	3	2		
22	10-Apr-17	29-Apr-17	CELL 33	3	H	3	1		
23	14-Apr-17	13-May-17	CELL 35	3	H	3	0		
24	14-Apr-17	22-May-17	CELL 34	3	3A/3H	3	3		Possible coyote; 3 eggs to WWCC; 3H & banded; released 7/6
25	14-Apr-17	16-May-17	CELL 10	3	H	3	3	s:oo (male)	
26	15-Apr-17	14-May-17	CELL 10	3	H	3	0		
27	15-Apr-17	14-May-17	CELL 40	3	H	3	0		
28	15-Apr-17	18-May-17	CELL 10	3	H	3	3		
29	16-Apr-17	18-May-17	CELL 9	3	H	3	0		
30	17-Apr-17	18-May-17	CELL 34	3	H	3	2		
31	18-Apr-17	14-May-17	CELL 11	3	H	3	1		
32	19-Apr-17	20-May-17	CELL 10	2	H	2	2		
33	20-Apr-17	19-May-17	CELL 10	3	H	3	0		
34	21-Apr-17	19-May-17	NS3	3	H	3	2	ys:wr (male, BCER-2010)	
35	21-Apr-17	21-May-17	CELL 11	3	2H/1A	2	0		

Western Snowy Plover Nesting at Bolsa Chica, 2017

Nest #	Date Found	Date Ended	Location	# Eggs	Nest Fate	# Chicks	# Fledged	Bands	Comments
36	21-Apr-17	19-May-17	NS2	3	H	3	0		
37	21-Apr-17	28-Apr-17	NS3	3	2H/1A	2	1		
38	23-Apr-17	24-May-17	CELL 14	2	H	2	1		
39	23-Apr-17	26-May-17	CELL 13	3	H	3	0		
40	25-Apr-17	26-May-17	CELL 20	3	H	3	0		
41	25-Apr-17	29-Apr-17	CELL 21	3	H	3	0		
42	25-Apr-17	26-May-17	CELL 11	3	H	3	3		
43	26-Apr-17	24-May-17	CELL 41	3	H	3	1		
44	27-Apr-17	28-May-17	CELL 10	3	H	3	2	rr:kk (male)	
45	27-Apr-17	30-May-17	CELL 10	3	H	3	2		
46	28-Apr-17	26-May-17	CELL 10	3	H	3	2		
47	28-Apr-17	10-May-17	CELL 45	2	P	0	0		No ME on nest
48	1-May-17	1-Jun-17	CELL 11	3	2H/1A	2	2		
49	1-May-17	1-Jun-17	CELL 9	3	H	3	2		
50	1-May-17	1-Jun-17	NS2	2	H	2	0		
51	4-May-17	22-May-17	CELL 19	3	3A/2H/1NV	2	2		3 eggs to WWCC; 2H/1NV, 2 banded & released.
52	4-May-17	28-May-17	CELL 11	3	H	3	0		
53	4-May-17	29-May-17	CELL 9	3	H	3	0	ga:oy (female)	
54	4-May-17	6-Jun-17	CELL 19	2	H	2	0		
55	9-May-17	6-Jun-17	CELL 14	3	H	3	0		
56	9-May-17	6-Jun-17	CELL 40	3	H	3	3		
57	9-May-17	6-Jun-17	CELL 10	3	H	3	2		
58	10-May-17	4-Jun-17	NS2	3	H	3	3	pg:rb (female)	
59	10-May-17	6-Jun-17	CELL 10	3	H	3	0		
60	10-May-17	9-Jun-17	CELL 33	3	H	3	0		
61	10-May-17	9-Jun-17	CELL 41	3	H	3	2		
62	10-May-17	9-Jun-17	CELL 22	3	H	3	0		
63	12-May-17	6-Jun-17	CELL 11	3	H	3	2		
64	16-May-17	11-Jun-17	CELL 10	3	H	3	2		
65	17-May-17	13-Jun-17	NS3	3	H	3	1		same scrape as #4
66	17-May-17	11-Jun-17	CELL 10	3	H	3	2		
67	18-May-17	1-Jun-17	NS2	3	H	3	2		
68	20-May-17	16-Jun-17	NS3	3	3A/3H	3	3		3 eggs to WWCC; 3H; 3 banded & released
69	23-May-17	22-Jun-17	STI	3	H	3	1		
70	25-May-17	15-Jun-17	CELL 30	3	2H/1A	2	0		
71	25-May-17	17-Jun-17	CELL 45	3	H	3	0		
72	25-May-17	25-May-17	CELL 42	3	H	3	3		
73	26-May-17	10-Jun-17	CELL 10	3	H	3	3		
74	26-May-17	26-May-17	CELL 14	3	H	3	3		

Western Snowy Plover Nesting at Bolsa Chica, 2017

Nest #	Date Found	Date Ended	Location	# Eggs	Nest Fate	# Chicks	# Fledged	Bands	Comments
75	27-May-17	22-Jun-17	CELL 46	3	H	3	0		
76	28-May-17	22-Jun-17	CELL 13	3	H	3	0		
77	28-May-17	22-Jun-17	CELL 11	3	H	3	0		
78	28-May-17	11-Jun-17	CELL 42	3	H	3	1		
79	28-May-17	13-Jun-17	CELL 42	3	H	3	1		
80	29-May-17	28-Jun-17	CELL 9	3	H	3	3		
81	29-May-17	29-Jun-17	CELL 45	3	H	3	1		
82	30-May-17	3-Jun-17	CELL 41	3	H	3	2		
83	31-May-17	5-Jun-17	CELL 11	1	A	0	0		1 egg to WWCC; it failed to hatch
84	31-May-17	30-Jun-17	CELL 9	3	H	3	3	s:x (female)	
85	31-May-17	31-May-17	CELL 41	3	H	3	0		
86	2-Jun-17	30-Jun-17	CELL 11	3	H	3	1		
87	3-Jun-17	5-Jun-17	CELL 11	1	F	0	0		1 egg to WWCC; it failed to hatch
88	5-Jun-17	1-Jul-17	CELL 41	3	2H/1A	2	1		
89	5-Jun-17	7-Jul-17	CELL 9	3	H	3	3		
90	5-Jun-17	2-Jul-17	CELL 9	3	H	3	1	So:bw (female)	coyote took 2 chicks
91	6-Jun-17	22-Jun-17	CELL 20	3	H	3	0		
92	6-Jun-17	8-Jul-17	CELL 32	3	H	3	3		
93	6-Jun-17	4-Jul-17	CELL 12	2	H	2	0		
94	7-Jun-17	5-Jul-17	CELL 13	3	H	3	0		
95	7-Jun-17	7-Jul-17	CELL 10	3	H	3	3		
96	11-Jun-17	10-Jul-17	CELL 45	3	2H/1A	2	0	Sb:oy (female)	
97	11-Jun-17	20-Jun-17	CELL 11	1	1A/1H	1	1		egg to WWCC; hatched, banded, and released
98	11-Jun-17	7-Jul-17	CELL 11	3	H	3	3		
99	11-Jun-17	8-Jul-17	CELL 9	3	H	3	2		
100	12-Jun-17	13-Jul-17	CELL 9	3	H	3	2		
101	14-Jun-17	8-Jul-17	CELL 13	3	H	3	0		
102	14-Jun-17	10-Jul-17	CELL 14	3	H	3	3		
103	15-Jun-17	15-Jul-17	CELL 42	3	H	3	3		
104	8-Jun-17	7-Jul-17	NS3	3	H	3	2	ga:oy (female)	
105	16-Jun-17	16-Jul-17	CELL 14	3	H	3	1	s:x (female)	
106	18-Jun-17	19-Jul-17	80 RD	3	1H/2A	1	0	pg:rb (female)	
107	19-Jun-17	14-Jul-17	CELL 32	3	H	3	2		
108	21-Jun-17	22-Jul-17	CELL 10	3	H	3	2		
109	21-Jun-17	21-Jun-17	CELL 45	3	H	3	0		
110	23-Jun-17	19-Jul-17	CELL 11	3	H	3	0		
111	23-Jun-17	19-Jul-17	CELL 9	3	H	3	1	ys:wr (male, BCER-2010)	
112	24-Jun-17	7-Jul-17	CELL 32	3	H	3	1	bb:ay (female)	
113	28-Jun-17	2-Jul-17	CELL 10	2	P	0	0		no ME

Western Snowy Plover Nesting at Bolsa Chica, 2017

Nest #	Date Found	Date Ended	Location	# Eggs	Nest Fate	# Chicks	# Fledged	Bands	Comments
114	28-Jun-17	24-Jul-17	CELL 45	3	H	3	0		
115	28-Jun-17	12-Jul-17	CELL 46	3	H	3	3		no ME
116	28-Jun-17	28-Jul-17	CELL 11	2	H	2	1		
117	28-Jun-17	29-Jul-17	CELL 12	2	H	2	1		
118	30-Jun-17	30-Jun-17	CELL 45	3	H	3	1		
119	4-Jul-17	2-Aug-17	CELL 9	2	H	2	1		
120	5-Jul-17	2-Aug-17	CELL 9	2	H	2	2		2 chicks taken to WWCC, banded, released.
121	6-Jul-17	13-Jul-17	CELL 31	3	H	3	3		
122	7-Jul-17	18-Jul-17	CELL 45	3	2H/1A	2	2		
123	8-Jul-17	8-Jul-17	CELL 42	3	H	3	2		
124	10-Jul-17	29-Jul-17	CELL 11	3	H	3	1		
125	15-Jul-17	3-Aug-17	CELL 46	2	H	2	2		
126	22-Jul-17	22-Jul-17	NS1	2	H	2	1		Found as brood so true clutch size unknown
127	5-Aug-17	5-Aug-17	CELL 41	3	H	3	1		
TOTALS				361		340	152		

Appendix 2. Distribution of Western Snowy Plover Nests at Bolsa Chica for 1997 through 2017.

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	
2017	127		55	29	26		3	5	8	1	

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 35	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
2017		12	21	16	2	4	6	3	1	2	1	2	1	3	2	2	1	0	2	8	5	9	3	0	1