

**Western Snowy Plover Nesting  
at Bolsa Chica, Orange County, California  
2010**



Photo by Peter Knapp

by Peter Knapp\* and Bonnie Peterson\*\*

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## INTRODUCTION

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

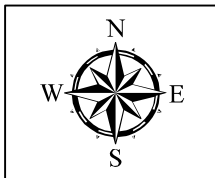
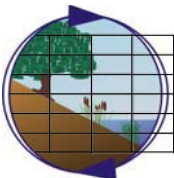
In 1997, the Bolsa Chica lowlands were acquired into public ownership. This marked the beginning of a multi-agency effort to design, evaluate, and implement a plan for restoring the fish and wildlife habitats. These habitats had been cut off from the ocean for a century and have been an operating oil field for over 50 years. Construction of the restoration project began in Fall 2004 and was completed in August 2006.

By the 2006 breeding season, 3 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 in 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 purpose of this investigation is to continue to improve the level of knowledge about the western snowy plover (*Charadrius alexandrinus 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 aid or assist in documenting achievement levels in meeting 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 report addresses the 2010 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.



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

**Figure 1**

The recognized breeding season of the western snowy plover normally extends from March 1 through September 15; however, the first nest in 2009 occurred on February 23 and in 2010 the first nest was on March 5. In both years courting behavior began in 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.

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

Double brooding and polyandry are typical. Snowy plover females may leave very young chicks 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, Tucker and Powell 1999). 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**

The study area includes several snowy plover nesting areas within Bolsa Chica. These nesting areas include: Seasonal Ponds (Cells 2 through 13), Future Full Tidal Basin (Cells 14 through 40 and Cell 63), Muted Tidal Basin (Cells 41 through 50 and Cell 66), North Tern Island (NTI), South Tern Island (STI), Nest Site 1 (NS1), Nest Site 2 (NS2), Nest Site 3 (NS3), Levee Roads of the Full Tidal Basin and, in 2010, the sandbar at the ocean Tidal Inlet (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, Inner Bolsa Bay to the west of West Levee Road with the exception of NTI and STI (Figure 2).

The Seasonal Ponds, Future Full Tidal Basin, and Muted Tidal Basin are demarcated into subareas (cells) by the network of slightly elevated roads constructed decades ago for access to the oil wells. These cells were numbered and form the basis for observer navigation, nest mapping, and data recording. Each cell is unique in configuration and area. The approximate areas of some key cells are: Cell 10 (17 acres) and Cell 11 (54 acres). The Seasonal Ponds are predominantly salt panne and the most dominant plant species is pickleweed (*Sarcocornia pacifica*). Portions of the ponds are seasonally inundated with fresh to brackish water that become highly saline as evaporation concentrates the remaining water in diminishing pools over the salt panne.



Figure 2. Distribution of Western Snowy Plover Nests in 2010 at Bolsa Chica

The Future Full Tidal Basin occurs between the Seasonal Ponds and the Muted Tidal Basin and includes Freeman Creek. These zones are very similar to the Seasonal Ponds and consist mainly of salt panne and pickleweed, although there are some areas that retain water year-round. The Muted Tidal Basin occupies the northeastern section of Bolsa Chica. These zones generally contain less salt panne, with broad expanses of pickleweed and are generally considered unsuitable for western snowy plover nesting.

Zones 49, 50, 66, and a portion of 48 were exposed to muted tidal influence starting in March 2008. The other zones of the Muted Tidal Basins were inundated by tidal overflow and rainwater for much of the spring and summer, but were not open directly to the Full Tidal Basin. Areas inundated by water during most of the breeding season (Cells 30 and 38) are unsuitable for nesting but the margins were regularly checked for nesting plovers. Large portions of Cells 11, 12, 13, and 22 were inundated in 2010 and were not available for snowy plover nesting.

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

NS1 is a large linear nesting area between Inner Bolsa Bay and the Full Tidal Basin that was built during the creation of the Full Tidal Basin. The surface is dredge spoil that forms a flat surface that extends from the West Levee Rd. toward the basin. The shoreline of the nest site is now under full tidal influence. In 2009, vegetation covered much of the site, including beach evening primrose (*Camissonia cheiranthifolia*), beach sand verbena (*Abronia umbellata* var. *umbellate*), saltgrass (*Distichlis spicata*), alkali heath (*Frankenia salina*), pickleweed, coastal deerweed (*Lotus scoparius*), five-hook bassia (*Bassia hyssoifolia*), hottentot-fig (*Carpobrotus edulis*), crystalline iceplant (*Mesembryanthemum crystallinum*), and slender-leaved iceplant (*Mesembryanthemum nodiflorum*). Efforts were made during the winter and spring to remove much of the iceplant but it still persisted in large patches throughout the site during the 2010-nesting season. The northeastern shoreline generally lacks vegetation or debris that is normally found in a tidal area, though pickleweed is now spreading on this shoreline.

NS2 and NS3 are also newly created sites that are within Cell 42 and Cell 14, respectively. NS3 is within the Seasonal Ponds and NS2 is located in the Muted Tidal Basin. These sites were built up with fill and covered with sand. Winds have blown much of the sand from the surface of NS3, and rainfall has eroded NS2. In 2009, vegetation on both sites increased and continues to increase. On NS2 this occurred naturally. On NS3 seeded sand from the Huntington State Beach tern site was spread early in the 2009-breeding season and select plants were transplanted to NS3 from NS1. Cloth windbreaks were also added to retain the sand on the site and dunes have started to form. Chicks on NS2 hatched and foraged on the site through fledging. Chicks on NS3 tend to leave the site immediately after hatching to seek forage in the surrounding cells.

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**

Peter Knapp (the primary surveyor) assisted by Wally Ross, Gary Keller and Kelly O'Reilly (each of California Department of Fish & Game (CDFG)), and Bonnie Peterson and Antonette Gutierrez (Merkel & Associates) surveyed for nesting western snowy plovers a minimum of twice a week, but most often on a daily basis. Surveying begins as soon as there is evidence that the snowy plover is preparing to nest. Normally surveys would begin in mid to late March; however, in 2009 and 2010 regular surveys commenced in late January when scrapes were observed on NS1. Data collected during this study included the gender of the incubating adult, length of incubation (days), number of eggs in the clutch, condition of the nest (e.g. signs of disturbance), and the fate of each nest (hatched, predated, or abandoned). Observations were also recorded of western snowy plover distribution throughout the study area, not just those birds associated with nests.

The large majority of suitable western snowy plover nesting habitat in the Seasonal Ponds was visible from the road network. Usually between 7 am and noon, the observer(s) would slowly drive in a motor vehicle 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. In this manner, it was possible to discover most nests within a few days of eggs having been laid. Most of the time, a nest was evident when an adult was incubating. Other times the adult was foraging or preening near the nest and soon returned to it. The observer would occasionally exit the vehicle in order to inspect an area not visible from the road or to verify the presence of eggs or chicks in a nest. Close examination of nests was usually conducted only once or twice per nest.

STI was surveyed by vehicle from the West Levee Road and on foot as part of concurrent least tern surveys. NTI is used primarily by nesting elegant terns and black skimmers and was surveyed from the West Levee Road.

NS1, NS2, and NS3 are sectioned by markers which form the basis for data recording. NS1 is sectioned south to north from A through CC. NS1 was surveyed by vehicle, in the same manner as the Seasonal Ponds, either from the West Levee Road or the eastern slope of NS1. Due to nesting patterns of least terns, black skimmers, and other terns, vehicle surveys were limited after mid-May. NS1 was also surveyed on foot as part of least tern surveys. NS2 was surveyed by vehicle from the East Levee Road weekly using a spotting scope and irregularly on foot. NS3 was surveyed by vehicle from the west end of the site. All nests were marked with numbered tongue depressors and mapped for ease of relocation on subsequent visits.

On all sites other than NS1, it was usually possible to follow the movements and determine the fate of chicks of each brood since there was dispersion over space and time sufficient to differentiate between broods. In a few cases banded adults identified specific broods. Broods were observed between 2 and 7 days per week. 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. Due to high nesting activity on NS1 following broods along such a long narrow reach was difficult. Effort was still made to determine the number of fledglings but it was often difficult to locate the brood or assign them to a specific nest.

A Range-wide, Breeding Season Window Survey was conducted at Bolsa Chica in May 2010. The survey was conducted in the same manner as in previous years and in accordance with the guidelines set out in the Snowy Plover Recovery Plan (U.S. Fish and Wildlife Service. 2007).

## **PROTECTION FROM PREDATORS**

Once a nest was discovered, a welded wire mini-exclosure (ME) was anchored in place over the top of the nest and left in place until the eggs in the nest hatched. The MEs are 28 inches in width on all four sides and 16 inches in height. These dimensions have proven effective in deterring predation by corvids, gulls, and coyotes (*Canis latrans*). The use of the ME contributes greatly to the low egg predation at Bolsa Chica. Aversion nests have also been used in past years to deter coyote and corvid nest predation; however, this method was not used in 2010.

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 2010, predator management was undertaken by Wally Ross.

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



## RESULTS AND DISCUSSION

In 2010, the first snowy plover nest was established on NS1 on March 5. There were a total of 64 nests producing 63 fledglings (Table 1).

### NUMBERS OF MALE AND FEMALE SNOWY PLOVERS

During May 2010, a Range-wide, Breeding Season Window Survey was conducted. The total number of snowy plovers present at Bolsa Chica was 45 adults: 22 female and 23 male (Table 1). The management goal of the Snowy Plover Recovery Plan for Bolsa Chica is 70 adults.

**Table 1. Males, Females, Nests and Fledgling Production 1997-2010**

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

Fl = fledglings, nd = not determined

\* based on minimum/maximum numbers of fledglings

### NEST DISTRIBUTION AND CHRONOLOGIES

The snowy plover utilized all available nest sites at Bolsa Chica in 2010; however, the distribution of nests indicates that NS1, NS3, and the Seasonal Ponds were the preferred plover nest sites. NS1 had 41% of all nests, NS3 had 23%, and the Seasonal Ponds had 17% of all nests (Figure 2, Table 2). NS2 was also utilized by nesting snowy plovers this year with a fairly high success rate. This nest site was used last year for the first time since 2006. After an absence of plover nests for 10 years at least one and probably two plover pairs nested on NTI, in 2008. These nests were abandoned due to conflict between plovers and elegant terns. In 2009 and 2010, one nest was initiated, but again due to conflict with elegant terns, adults abandoned the nests. Nests were established for the first time on the East Levee Road and at the Full Tidal Basin inlet. Appendix 1 provides the cell location, start and end dates, nest fates, and eggs and chicks produced for each nest. Appendix 2 provides information on historical nest distribution.

**Table 2. 2010 Nest, Nest Fate, and Reproductive Success Distribution by Cell**

Location	Total Nests	Nests Failed	Nests Hatched (# chicks)	Fledglings
<b>Nest Site 1</b>	<b>26</b>	<b>2</b>	<b>24(67)</b>	<b>16*</b>
<b>Seasonal Ponds:</b>	<b>11</b>	<b>1</b>	<b>10 (29)</b>	<b>12</b>
Cell 9	2	0	2 (5)	2
Cell 10	5	0	5 (15)	8
Cell 11	3	1	2 (6)	0
Cell 12	1	0	1 (3)	2
<b>Future Full Tidal Basin:</b>	<b>4</b>	<b>1</b>	<b>3 (7)</b>	<b>6</b>
Cell 14	3	1	2 (4)	3
Cell 22	1	0	1 (3)	3*
<b>Full Tidal Basin Inlet</b>	<b>1</b>	<b>0</b>	<b>1 (3)</b>	<b>3</b>
<b>East Levee Rd.</b>	<b>1</b>	<b>0</b>	<b>1 (3)</b>	<b>2</b>
<b>Nest Site 2</b>	<b>4</b>	<b>0</b>	<b>4 (12)</b>	<b>7</b>
<b>Nest Site 3</b>	<b>14</b>	<b>1</b>	<b>13 (37)</b>	<b>15</b>
<b>North Tern Island</b>	<b>1</b>	<b>1</b>	<b>0 (0)</b>	<b>0</b>
<b>South Tern Island</b>	<b>2</b>	<b>0</b>	<b>2 (6)</b>	<b>2</b>
<b>Total</b>	<b>64</b>	<b>6</b>	<b>58 (164)</b>	<b>63</b>

\* includes birds raised at Wetlands and Wildlife Care Center.

The Seasonal Pond cells, in addition to the nest sites, are also the primary feeding areas for hatched plovers other than those from STI, NS1, and NS2. More than one cell may be used by a brood and often a brood will travel to another cell within one or two days of hatching. As an example, although there were only two nests that hatched in Cell 11 in 2010, at least six broods not hatched from Cell 11 used this cell for foraging.

The State and Federal Endangered California least tern also nests at Bolsa Chica. In 2006, they nested on STI and on the newly created NS1 and have continued this nesting pattern through 2010. In 2010 the least terns also nested on NS2, NS3, and NTI. Snowy plover egg laying typically begins several months before the least tern begins its egg laying. This has been the case at Bolsa Chica. The two species tolerate the co-location of their nests.

Black skimmers, royal tern, California least tern, Caspian tern, American avocet (*Recurvirostra americana*), black-necked stilt (*Himantopus himantopus*), killdeer (*Charadrius vociferus*), gadwall (*Anas strepera*), and horned lark (*Eremophila alpestris*) all nested on NS1 in 2010. Due to the use of the ME, the tight colonial style of nesting of the terns and black skimmers had only minimal effect on nesting snowy plovers. However, it is suspected that their presence on NS1 had an effect on the overall reproductive success of the snowy plover once the nests hatched and the chicks left the protection of the ME. In late May and early June a family of coyotes began preying on the eggs and newly hatched chicks of the terns and skimmers on NS1, clearing the entire site of these species. It is unknown what this mass predation event had on snowy plover chicks.

In 2010, the first plover nest was initiated March 5. Snowy plover nesting rose to a peak in late May and early June, slightly earlier than the average (Figure 3). The last known nests hatched at the end of July (Figure 4), although a brood of an adult and one chick was found on August 14 in Cell 14.

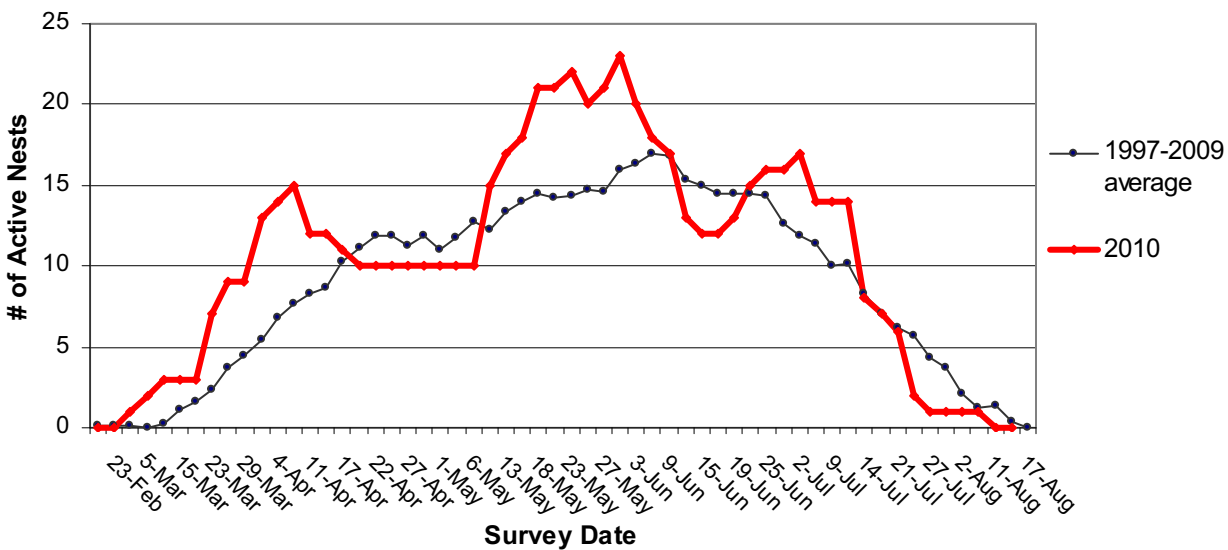
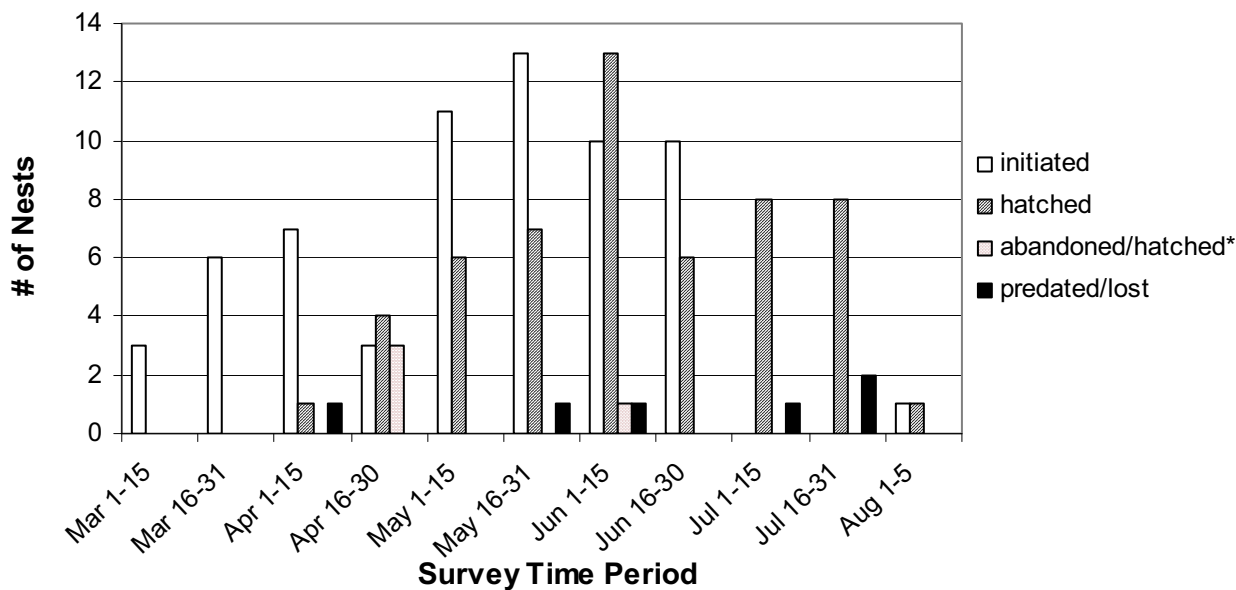


Figure 3. 1997-2010 Bolsa Chica Active Nest Chronology



\*nests collected and hatched at the Wetlands and Wildlife Care Center

Figure 4. Biweekly Western Snowy Plover Nest Initiation, Hatching, & Loss at Bolsa Chica in 2010

### FLEDGLING PRODUCTION, EGGS, AND CHICKS

Of the 64 nests at Bolsa Chica in 2010, 37 nests produced a total of 63 fledglings. This includes 5 nests (13 individuals) that were raised at the Wetlands and Wildlife and Care Center (WWCC) in Huntington Beach. The overall fledge rate was 0.98 fledglings/nest. The number of nests on NS1 has decreased from a high of 37 nests in 2008 to 26 nests in 2010. Reproductive success on NS1 is also decreasing. In 2010 the fledge rate was 0.62 (fledge/nest) and if rescued eggs and chicks that would have failed due to adult abandonment are excluded the fledge rate drops to 0.23 fledglings/nest. The Seasonal Ponds and NS3 have similar fledge rates at 1.09 and 1.07 respectively. NS2, which has only had one nest prior to 2009, had 4 nests this year with a fledge rate of 1.75.

All 64 nests in 2010 were judged to be complete clutches with the exception of Nest 45 in Cell 14, which was depredated, and Nest 63 in Cell 11, which was abandoned with just one egg. Nest 64 was not located as a nest but as a single chick with an adult. Only two completed clutches were 2-egg clutches, while 59 were 3-egg clutches (Appendix 1). Eight nests were abandoned, one nest was depredated, and one nest had sterile eggs.

The cause of the abandonment of Nests 8, 13, and 14, and the abandonment of chicks from Nests 2, all from NS1, during the time frame of April 16 and April 23 is undocumented but is believed to be the depredation of adult plovers. The female from Nest 2 was banded YNRR and she was not seen again after the hatching of her chicks. Nest 5 on NS1 hatched on April 30 producing 3 chicks but the banded female WWYY was not seen again. In prior years she had produced clutches at Bolsa Chica. These observations are consistent with the results of a paper on the piping plover (*Charadrius melodus*) that demonstrate that nest abandonment is most likely due to the loss of attending adults (Roche et al. 2010)

Nest 23 on NTI was abandoned due to elegant tern harassment of adult plovers attempting to reach their nest to incubate eggs. Nest 37 is believed to have been abandoned after tracks around the ME indicated that a pair of raccoons circled the enclosure. There was no evidence of adult depredation. Nest 7, 40, and 63 were abandoned for unknown reasons.



Photo by Paige

Photo of banded chicks at the Wetlands and Wildlife Care Center

Nest 25 contained sterile eggs. The female incubated 3 eggs for 83 days until the eggs were collected and determined sterile. This is the second instance of abnormal incubation periods on NS3. In 2009, Nest 27 was incubated for 81 days. Also in 2009 Nest 46 on NS1 was incubated from June 3 to August 30, 88 days and was found to have sterile eggs.

The eggs from Nests 8, 13, 14 and 37 were collected after determination that abandonment had occurred and

were given to the WWCC for possible salvage (Table 3). Eleven of the twelve eggs hatched at the care center and were raised to fledging, banded, and subsequently released in Cell 13 of the Seasonal Pond area of Bolsa Chica. In addition, two abandoned chicks from Nest 2 on NS1 were taken to the WWCC for salvage. They were raised, fledged, banded, and subsequently released in the Seasonal Ponds at Bolsa Chica (Table 3). To aid in the release of the fledglings a temporary shelter or halfway house was built to provide shelter to the young birds while they familiarized themselves to their surroundings. This shelter consisted of a framed wire cage that was opened at both ends (see photo). It was placed over a small amount of pickleweed to offer the young fledglings some cover while inside the shelter.

A total of 184 snowy plover eggs were produced at Bolsa Chica in 2010, with 25 eggs abandoned, predated or failed to hatch, the remaining eggs produced 164 chicks. Of these 164 total chicks produced in 2010, 63 survived to fledge (Table 2, Figure 5). Fifty-nine nests (92% of all nests) survived to hatch.

In 2010, eight eggs were considered non-viable and did not hatch including the three eggs from Nest 25. No laboratory analysis was made of these eggs; however, the eggs from Nest 25 appeared to be unfertilized based on contents. In this study, when one or more eggs of a clutch hatch, several days are allowed to pass before any egg(s) that may have been abandoned are removed. No apparently abandoned eggs have been seen to hatch.

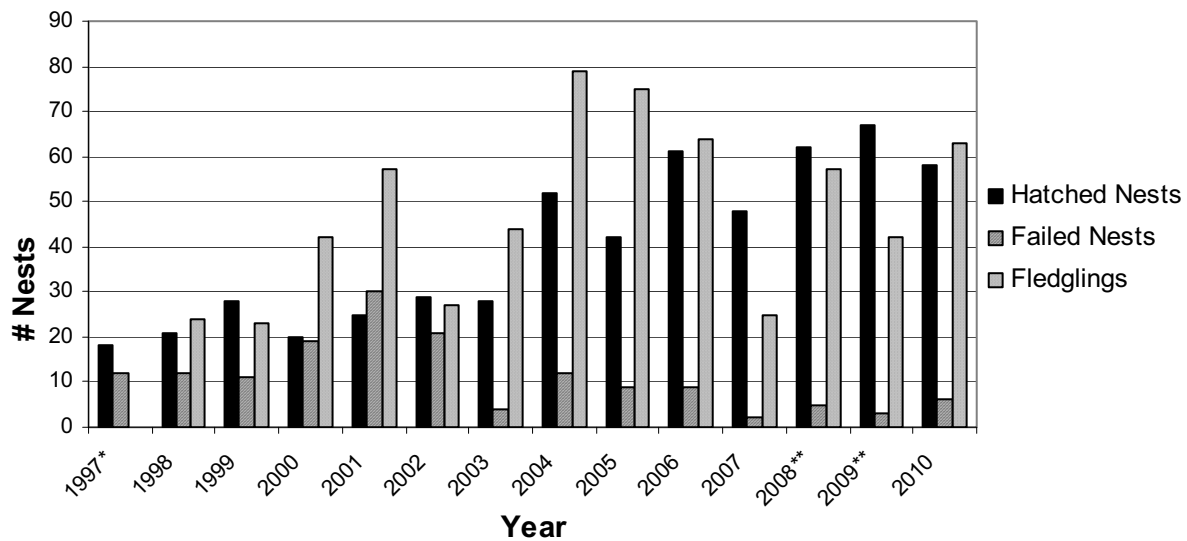


Photo by Cheryl Egger

Halfway House designed by Peter Knapp for the release of fledglings raised at the Wetlands and Wildlife Care Center.

**Table 3. Western Snowy Plovers Banded at the Wetlands and Wildlife Care Center in 2010.**

Band Combination	Nest #	Arrived As	Date Banded	Date Released	Last Observed	Comment
YNWG	2	chick	5/19/2010	5/19/2010	5/19/2010	
YNGR	2	chick	5/19/2010	5/19/2010	5/19/2010	
YNYB	8	egg	5/19/2010	5/19/2010	9/22/2010	
YNYG	8	egg	5/19/2010	5/19/2010	10/18/2010	Lost tape on Service band
YNRB	8	egg	5/19/2010	5/19/2010	6/13/2010	
YNRG	13	egg	5/19/2010	5/19/2010	6/25/2010	
YNGG	13	egg	5/19/2010	5/19/2010	6/21/2010	
YNGW	14	egg	5/19/2010	5/19/2010	6/25/2010	
YNWY	14	egg	5/19/2010	5/19/2010	7/05/2010	
YNWR	14	egg	5/19/2010	5/19/2010	6/25/2010	
YNGY	37	egg	6/24/2010	7/24/2010	7/24/2010	
BBYN	37	egg	6/24/2010	7/24/2010	7/24/2010	
BYYN	37	egg	6/24/2010	7/24/2010	10/29/2010	Last seen at Balboa Beach
	63	egg				Did not hatch



\* no fledgling data available

\*\* based on the minimum number of fledglings

**Figure 5. Comparison of Number of Western Snowy Plover Hatched Nests, Failed Nests, and Fledglings 1997-2010 at Bolsa Chica**

Two birds, YNYW and YNY (probable loss of second band on right leg), that were raised at WWCC in 2009 were observed during the 2010 breeding season and potentially nested at Bolsa Chica. This would represent a 22% return rate of fledglings to breed in the following year. The return of fledglings at Bolsa Chica is comparable to those in San Diego County from 1994-1998 (Powell et al. 1998) that ranged from 10% to 22%.

### BROOD TRACKING

Due to the chronological and geographic spacing of each brood, it is often possible to locate and identify individual broods over the period before they fledge. As generally seen in prior years, in 2010 each brood tended to stay together and the males prevented overlap or co-mingling with other broods. There were confrontations between the males if the broods wandered too close together or tried to take advantage of the same resources.

Broods hatched from NS3 relocated within days to other locations to seek food. Snowy plovers readily used the roads of Bolsa Chica to cover distances of 1/3 to 3/4 mile. In the Seasonal Ponds, broods would move about or change cells but could generally be identified. Broods on NS1 were not tracked on a regular basis to avoid possible disturbance of other nesting birds on the site (least and Caspian terns, and black skimmers).

### OBSERVATIONS OF BANDED ADULTS

A male, identified by banding color code (WNGY) has nested at Bolsa Chica every year since 2004. This male was banded at Guadalupe Dunes near Pismo Beach in 2003. He has wintered at both Surfside, Orange County and Bolsa Chica State Beach for the past four years. In 2010 he lost the WN bands on the left leg. He was seen on NS1 with a brood of 3 chicks on May 10 but has not been seen since.

A female (WWYY) banded as an adult at the South Spit, Humboldt Bay in 2006, had one clutch, Nest 5 on NS1, but disappeared after the clutch hatched on April 30.

Two females (SKM) banded at Camp Pendleton (year unknown), bred at least once each at Bolsa Chica in 2010. A male (SKM) also from Camp Pendleton nested a least once at Bolsa Chica in 2009 and 2010.

Banded birds that may have bred at Bolsa Chica were as follows: SKG, YNYW, and YNY (probable loss of second band on right leg). Other banded bird sightings not breeding at Bolsa Chica were as follows: RARW on April 9, YOWR on April 18, ARWA and RGRA on July 25.

A female SYK was seen in May. The U.S. Fish & Wildlife Service (Service) band had slipped onto the foot so that the toes could not open (see photo). She did not nest at Bolsa Chica.



SYK observed at Bolsa Chica with Service band over foot

A list of birds banded at Bolsa Chica can be found in Appendix 3.

### PREDATION

In 2010, only one nest was depredated, Nest 45 from Cell 14. The low rate of nest loss and high degree of chick production was attributable the deployment of ME's to deter corvid and coyote predation. Predators removed from Bolsa Chica are summarized in Table 4. The information was obtained from the annual predator management report (Ross 2010).

Chicks from Nest 47 on NS3 were taken upon hatching by common raven (*Corvus corax*). Tracks were seen all around the ME. Two chicks from Nest 3 on NS1 were also taken by raven. An American kestrel (*Falco sparverius*) was present on NS1 early in the breeding season and was seen carrying at least one least tern chick. It was present for at least 3 weeks.

Red-tailed hawks (*Buteo jamaicensis*) were regularly present at Bolsa Chica, but no hawk nests were known to be present in 2010. Red-tailed hawks were present continuously on the power poles opposite STI. Although there was no documented take of snowy plover chicks by red-tailed hawk, one took at least one least tern chick from STI from this perch in 2008. These red-tailed hawks were resistant to repeated attempts to trap them and remained present during the entire breeding season.

**Table 4. Bolsa Chica Predator Removal Summary (1999-2010)**

Potential Predator	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999
Gull-billed Tern	-	-	-									
American Crow	5	6	12	10	-	15	99	118	52	80	91	10
America Kestrel	2	5	4	4	6	13	19	5	12	13	15	11
Loggerhead Shrike	1	-	-	-	4	1	10	5	3	6	2	5
Common Raven	5	5	-	4	2	1	2	4	5	6	3	2
Cooper's Hawk	1	-	1	-	-	8	-	-	-	-	-	-
Peregrine Falcon	-	-	-	1	-	-	-	-	-	-	-	-
Red-tailed Hawk	-	1	1	-	-	-	-	-	-	-	-	-
Gulls	-	-	1	7	-	1	-	-	-	-	-	-
Skunk	-	-	-	-	-	-	2	1	-	-	-	-
Virginia Opossum	-	1	-	-	-	-	-	-	-	-	-	-
Ground Squirrel	unkn *	4	3	unkn *	unkn *	unkn *	unkn *	unkn *	-	-	-	-
Brown Rat	-	1	-	-	-	-	-	-	-	-	-	-

\* bait stations used; therefore the number removed is unknown (unkn).

One gull-billed tern (*Gelochelidon nilotica*) was present for a short time (observed April 7 and 17) and is not believed to have been a predator in 2010. Chick loss to black skimmers is believed to have occurred on NS1. Both an adult peregrine falcon (*Falco peregrinus*) and a merlin (*Falco columbarius*) were observed at Bolsa Chica at the beginning of the season but appeared to have migrated away from the area without incident. A juvenile peregrine falcon appeared at Bolsa Chica at the end of the breeding season. It is not known if there were any snowy plover predation events. Black-crowned night heron (*Nycticorax nycticorax*) and Cooper's hawk (*Accipiter cooperii*) were present during all or part of the breeding season but were not suspected predators in 2010.

A family of coyotes was responsible for the predation of all eggs and chicks of the nesting species on NS1 including; black skimmer, California least tern, Caspian tern, elegant tern, and gadwall during the last week in May and early June. It is assumed that this devastating predation event included some snowy plover chicks, although snowy plover nests would have been protected by the ME.

As noted earlier, there were several highly probable instances of predation of adult snowy plovers while they were tending nests or young chicks. These nests were recorded as abandoned; however, the banded adults were not observed after the incidents. It is unknown what predator was involved with these predation events.



## **MANAGEMENT RECOMMENDATIONS**

The 2010 western snowy plover breeding season continued the high nest survival rates experienced since the 2002 breeding season. The high nest survival rates are attributable the use of MEs. The fledgling rate (Table 1), however, was moderate, with 50 fledglings in the wild and 13 in captivity for a total of 0.98 fledglings per nest. Therefore, management recommendations focus on maintaining existing management actions that have worked in the past as well as taking additional steps focused on improving fledgling success. The endangered California least tern, which nests in the same locations as the western snowy plover, needs to be considered in all management efforts.

Many of these 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, providing protection from both predation and trampling; 2) deploying MEs on every snowy plover nest to prevent egg loss due to predation and trampling; 3) utilizing drift fences to create dunes and maintain the sand on NS3; and 4) continuing with the “eyes on the colony” volunteer effort at NS1 that was initiated in 2010. These management efforts have been effective in the enhancement of nest sites and improving reproductive success of the snowy plover and should continue. It is also recommended that monitoring continue with the same intensity that has occurred in the past in order to maintain this quality of management within the nest sites.

In 2010, some of the management recommendations from prior years were in progress and need to continue until the outstanding issues are resolved. These issues include: overcrowding and low reproductive success on NS1, limited use of NS2 and NS3, the need to increase predator control actions, and the need for weed management on NS1. These management issues are discussed in detail below.

Improving water management at the Seasonal Ponds has been an issue for several years; however, a number of solutions have been implemented to improve the flow of water out of these cells to make them available for snowy plover nesting and foraging. These include repair of culverts between cells and installation of a permanent pump in Freeman Creek (to which the ponds drain), so that excess stormwater can be pumped out to the Full Tidal Basin if excessive shoaling in the basin prevents drainage by gravity. It is unknown at this point whether these management efforts will be sufficient.

### **1. Develop methods to manage overcrowding and improve reproductive success on NS1.**

Overcrowding on NS1 was not an issue in 2010 due to large scale predation of eggs and nestlings utilizing the nest site. However, attempts were made by ten species to nest on NS1 including American avocet, California least tern, black skimmer, royal tern, Caspian tern, black-necked stilt, killdeer, horned lark, gadwall, as well as the western snowy plover. The problem of overcrowding is unresolved, although a number of options have been discussed. One of these options included encouraging the terns and skimmers to return to NTI, where they nested exclusively until 2007. Large tern decoys are already deployed on the island; however, black skimmer decoys should also be purchased and deployed. There are limitations to the number of birds that can be supported on NTI when considering the large number of terns and the small size of the island. Opportunities should also be sought to increase the size of NTI. Sand from the dredging efforts in the Full Tidal Basin should be used to expand this island and make room for the increase in nesting activity. Sand from the dredging effort should also be used to enhance STI. After a peak of nine nests in 2003 the number of plover nests has declined to only two in 2010. This would also enhance STI for the least tern.

The fledgling rate on NS1 is well below average at 0.62 fledglings per nest and if you remove the fledglings that were raised at WWCC this number drops to 0.23 fledglings per nest. Although predation could have been the cause this year (discussed in recommendation #3), reproductive success has been low for several years. This trend should be monitored for potential reasons for this loss of chicks. Two methods of monitoring should be considered including: 1) additional observation time for the portion of NS1 that is not observable by the “eyes on the colony” volunteer effort and, 2) the banding of chicks on NS1. The banding of chicks on NS1 could offer insight into the causes of low fledging and supply management data for the following:

- Determining reproductive success by nest and/or adults
- Determining loss of adults and chicks during nesting season
- Determining the rate of return and dispersal
- Determining where winter sites are for potential winter site management

## 2. Increase usage and reproductive success on NS2 and NS3.

In 2010, both NS2 and NS3 were utilized by both snowy plover and California least tern. The reproductive success for the snowy plover was 1.75 fledglings per nest on NS2 and 1.07 fledglings per nest at NS3. The least terns had very low reproductive success (0 fledglings from 31 nests on NS2 and 1-4 fledglings from 19 nests on NS3). This was primarily due to predation.

The increased nesting by plovers can be partially attributed to the absence of Seasonal Pond nesting habitat and the creation of dunes on NS3 (see photo). The dunes provided structure at the site and allowing native dune plants to take root. This was done by staking in fabric fencing and allowing the sand to build up against the fencing. Weed control efforts have also been effective on these two sites. Increased predator control as discussed in the next management recommendation need to be activated to encourage plovers and terns to continue use of these nest sites.



Photo by Peter Knapp  
Sand dunes formed against fabric fencing on NS3.

## 3. Deter predators on the Seasonal Ponds and Nest Sites

This year the Seasonal Ponds and Nest Sites were all hard hit by predators. This had a smaller effect on the snowy plover due to the use of the ME but was devastating to the terns and skimmers on NS1 and NS3. A family of coyotes began foraging on the tern eggs and chicks just prior to the hatching of the first wave of California least terns. A small group of common ravens were also actively foraging on least tern and snowy plover chicks in the Seasonal Ponds.

Egg aversion techniques have been developed that deter both coyotes and corvids from consuming eggs. Egg aversion is a learned association between a food item and illness. This technique requires that ill tasting or slightly toxic eggs be placed on the nest site in an attempt to emulate the California least tern or western snowy plover nests. When the eggs are consumed by the predator, a learned association is formed that deters the predator from seeking this same food type. This aversion is long

lasting but may need to be reaffirmed in the event that new predators are being introduced onto the site. Often one event is all that is required; however, in a situation like Bolsa Chica where a large number of good tasting eggs were consumed, a number of tastings may be required before successful aversion is obtained. This method has been used on the project site before with great success but was discontinued. We recommend that egg aversion techniques be resumed in the same manner as in the past.

Another useful tool is to try to deter the predator, in this case the coyote, from entering the nest site. This would be possible on NS1 where a single levee road surrounded by water is used to access the nest site. A gate with fencing on the levee road, which extends into the water to below the low tide mark, would be highly recommended for the West Levee Road south of NS1.

#### **4. Improve weed control and/or eradication on all man-made nest sites.**

For several years now, all man-made nest sites have been prepared for nesting by removing non-native plant cover with herbicides and by hand. This has been necessary in order to keep the area clear of unwanted vegetation and encourage nesting by the terns and plovers. On NS1, this effort has been massive and has not been able to produce the desired result. There are several alternatives that should be considered.

On some man-made nest sites, at other locations, annual grading or scraping has been used. This removes all vegetation just prior to the nesting of the California least tern. With no rainfall this eliminates weeds until the next rainy season. This method is required annually and encourages long-term weed growth by disturbing the soil. Grading must be completed prior to the nesting of all birds on NS1. The western snowy plover nests two months earlier than the California least tern (early May) and during the past two years has commenced nesting even earlier: February 23 in 2009 and March 5 in 2010. This timing is still within the rainy season in southern California and therefore the rain has the potential to germinate a new seed bank that would normally stay dormant until the fall. Scraping the site may be preferable to grading because of less ground disturbance which may discourage germination after only a few light rainfalls.

Another method that has been successful at the Seal Beach Naval Weapons Station is the use of saltwater irrigation. This method was established following a study that incorporated four different non-native vegetation control methods and a control site (Agri Chemical & Supply 2006). The saltwater irrigation treatment was the most effective in terms of controlling non-native plants and providing a suitable nesting area. This method involves pumping salt water into an irrigation system once a year for about six hours or until the ground is saturated. This is repeated the next day. Saltwater irrigation is very effective at killing annual herbaceous plants and not as effective on iceplant and other invasives that can tolerate high salt content.

It is recommended that a combination of salt water irrigation and the application of herbicide or hand weeding on the more salt tolerant species would be the most feasible method for controlling weeds on all man-made nest sites at Bolsa Chica.

#### **5. Improve water management in the Seasonal Ponds**

A number of cells or large portions of cells within the Seasonal Ponds were not available for nesting due to seasonal inundation. This has been the case since 2008. These ponds frequently flood during

the winter but dry out prior to the snowy plover nesting season. Since 2008, water was not able to drain into Freeman Creek due to elevated levels in the creek and the closed condition of the storm water release flap gates. A large portion of Cell 11, in particular, has been highly used for snowy plover nesting in the past years but is now largely unavailable. This flooding caused the snowy plover to expand into potentially less suitable cells in order to locate suitable, dry nesting areas. Pumping of selected cells has occurred in 2008, 2009 and 2010 to lower the water level at the pond margins. A Water Management Plan has been drafted that includes provisions to seasonally reduce water levels in the Seasonal Ponds to provide additional plover nesting and foraging habitat as a management element. This will enhance efforts by improving habitat to accommodate the western snowy plover goal of 70 breeding adults in accordance with the goals of the Western Snowy Plover Recovery Plan.

Nesting in the Seasonal Ponds has decreased over the last 5 years, probably due to the creation of NS1; therefore, increasing the number of cells available in the Seasonal Ponds would also provide increased potential for nesting opportunities. Based on changing conditions in the Full Tidal Basin and Muted Tidal Basin, it is likely that similar pond basin flooding will continue to occur in future years.

Ongoing and adaptive management actions are essential to improving western snowy plover reproductive success at Bolsa Chica, which provides the best nesting option for snowy plovers within a 60-mile radius.

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**Appendix 1. Snowy plover eggs laid, chicks hatched, and fledged at Bolsa Chica, 2010**

<u>Nest #</u>	<u>Cell #</u>	<u>date found</u>	<u>date ended</u>	<u>eggs</u>	<u>nest fate</u>	<u>chicks</u>	<u>fledglings</u>
1	NS1 F1	3-05	4-16	3	<b>H</b>	3	0
2	NS1 Y2	3-10	4-16	3	<b>H</b>	2*	2
3	NS1 AA2	3-12	4-15	3	<b>H</b>	3	1
4	NS1 R1	3-24	5-01	3	<b>H</b>	3	0
5	NS1 N1	3-25	4-30	3	<b>H</b>	3	0
6	NS3 6A	3-26	5-03	3	<b>2H1A</b>	2	2
7	NS1 Y1	3-18	4-17	3	<b>A</b>	0	0
8	NS1 A1	3-27	4-23	3	<b>A/H</b>	3	3
9	NS1 T1	3-27	5-04	3	<b>H</b>	3	0
10	NS1 I1	4-02	4-30	3	<b>H</b>	3	0
11	NS1 E1	4-03	5-08	3	<b>H</b>	3	0
12	NS3 B3	4-04	5-08	3	<b>H</b>	3	1
13	NS1 Y2	4-04	4-17	3	<b>A/H</b>	2	2
14	NS1 V1	4-07	4-21	3	<b>A/H</b>	3	3
15	STI	4-09	5-07	3	<b>H</b>	3	1
16	CELL 10	4-15	5-20	3	<b>H</b>	3	3
17	NS1 J2	4-18	5-25	3	<b>2H1A</b>	2	0
18	EAST LEVEE	4-30	5-24	3	<b>H</b>	3	2
19	NS3 2	4-30	6-05	3	<b>H</b>	3	0
20	NS3	5-03	5-20	3	<b>H</b>	3	1
21	NS3	5-04	5-31	3	<b>H</b>	3	1
22	STI	5-06	6-04	3	<b>H</b>	3	1
23	NTI	5-07	5-26	3	<b>A</b>	0	0
24	NS1 P1	5-07	6-08	3	<b>H</b>	3	0
25	NS3 4B	5-07	7-29	3	<b>S</b>	0	0
26	CELL 12	5-12	6-08	3	<b>H</b>	3	2
27	NS1 Z2	5-13	6-08	3	<b>2H/1A</b>	2	1
28	NS1 Z2	5-13	5-23	3	<b>H</b>	3	1
29	CELL 10	5-13	6-12	3	<b>H</b>	3	2
30	NS2	5-13	6-09	3	<b>H</b>	3	3
31	CELL 11	5-16	6-12	3	<b>H</b>	3	0
32	NS3	5-18	6-13	3	<b>H</b>	3	2
33	NS1 S2	5-19	6-08	3	<b>PH</b>	3	0
34	NS1 V3	5-19	6-15	3	<b>PH</b>	3	0
35	NS1 R2	5-15	5-25	3	<b>2H/1A</b>	2	0



<u>Nest #</u>	<u>Cell #</u>	<u>date found</u>	<u>date ended</u>	<u>eggs</u>	<u>nest fate</u>	<u>chicks</u>	<u>fledglings</u>
36	NS3 2B	5-20	6-15	3	H	3	1
37	CELL 22	5-22	6-04	3	A/H	3	3
38	NS2	5-22	6-18	3	H	3	2
39	NS1 G1	5-24	6-13	3	H	3	0
40	NS1 L2	5-25	7-07	3	A	0	0
41	NS2	5-26	6-18	3	H	3	1
42	NS1 M1	5-25	6-12	3	H	3	0
43	NS3	5-28	6-26	3	H	3	1
44	CELL 10	6-01	6-25	3	H	3	2
45	CELL 14	6-02	6-03	2	P	0	0
46	NS3 3	6-04	6-30	3	H	3	2
47	NS3 6D	6-09	7-05	3	H	3	0
48	NS3	6-09	7-07	3	H	3	2
49	NS1 M1	6-01	7-05	3	H	3	0
50	NS3 4A/5A	6-13	7-14	3	H	3	1
51	NS3 2/2A	6-16	7-16	2	H	2	1
53	CELL 9	6-18	7-15	3	H	3	0
54	CELL 14	6-18	7-15	3	H	3	2
55	CELL 9	6-20	7-20	2	H	2	2
56	NS1 F1	6-24	7-16	3	H	3	0
57	NS1 C1	6-24	7-15	3	H	3	1
58	CELL 10	6-27	7-24	3	H	3	0
59	CELL 10	6-27	7-24	3	H	3	1
60	NS1 H1	6-28	7-25	3	H	3	0
61	CELL 11	7-01	7-21	3	H	3	0
62	NS1 N1	7-05	7-31	3	H	3	3
63	CELL 11	7-08	7-24	1	A	0	0
64	CELL 14	8-14	8-14	1+	H	1	1
65	FTB INLET	6-26	6-26	3	H	3	3
<b>2010 Season Totals</b>				<b>184 eggs</b>	<b>54H, 4A, 4A/H, 1S, 1P 64 Nests</b>	<b>164 chicks</b>	<b>63 fledglings</b>

P = predated; A = abandoned; H = hatched, PH = probably hatch, A/H = abandoned eggs that were salvaged and hatched at Wetlands and Wildlife Care Center, S = sterile eggs,

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

\*chicks were abandoned but salvaged and sent to the Wetlands and Wildlife Care Center and subsequently released after fledging.

**Appendix 2. Distribution of Western Snowy Plover Nests at Bolsa Chica for 1997 through 2010.**

**Distribution of nests throughout 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

**Distribution of Nests within Cells**

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

**Appendix 3. Western Snowy Plovers Banded at the Wetlands and Wildlife Care Center.**

<b>Band Combination</b>	<b>Nest #</b>	<b>Arrived As</b>	<b>Date Banded</b>	<b>Date Released</b>	<b>Last Observed</b>	<b>Comment</b>
YNRW	11	chick	5/20/2009	6/19/2009	7/17/2009	
YNY Y	11	chick	5/20/2009	6/19/2009	7/13/2009	
YNWB	11	chick	5/20/2009	6/19/2009	6/19/2009	
YNBW	18	egg	5/20/2009	6/19/2009	6/19/2009	
YNBB	18	egg	5/20/2009	6/19/2009	7/28/2009	
YNR Y	18	egg	5/20/2009	--	--	euthanized
YNBG	47	egg	7/17/2009	8/8/2009	8/25/2009	
YNBR	47	egg	7/17/2009	8/8/2009	10/15/2009	
YNBY	47	egg	7/17/2009	--	--	predated
YNGB	48	egg	7/17/2009	8/8/2009	8/25/2009	
YNYW	48	egg	7/17/2009	8/8/2009	10/28/2010	
--	48	egg	--	--	--	did not hatch
YNBY		injured juvenile	9/21/2009	9/21/2009	9/21/2009	
YNR R		sick	9/30/2009	9/30/2009	4/16/2010	Nested on Nest 2 in 2010, assumed depredated
YNWG	2	chick	5/19/2010	5/19/2010	5/19/2010	
YNGR	2	chick	5/19/2010	5/19/2010	5/19/2010	
YNYB	8	egg	5/19/2010	5/19/2010	9/22/2010	
YNYG	8	egg	5/19/2010	5/19/2010	10/18/2010	Lost tape on Service band
YNRB	8	egg	5/19/2010	5/19/2010	6/13/2010	
YNRG	13	egg	5/19/2010	5/19/2010	6/25/2010	
YNGG	13	egg	5/19/2010	5/19/2010	6/21/2010	
YNGW	14	egg	5/19/2010	5/19/2010	6/25/2010	
YNWY	14	egg	5/19/2010	5/19/2010	7/05/2010	
YNWR	14	egg	5/19/2010	5/19/2010	6/25/2010	
YNGY	37	egg	6/24/2010	7/24/2010	7/24/2010	
BBYN	37	egg	6/24/2010	7/24/2010	7/24/2010	
BYYN	37	egg	6/24/2010	7/24/2010	10/29/2010	Last seen at Balboa Beach
	63	egg				Did not hatch