



Activity of the  
California Least Tern (*Sternula antillarum browni*)  
at Huntington State Beach  
Orange County, California

Prepared by the  
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## INTRODUCTION

The California Least Tern (*Sternula antillarum brownii*; hereafter Least Tern), a State and Federally listed endangered species, is a migratory, water-associated bird which returns to coastal California from Central America to breed between April and September. Adults are gray with white under-parts, black cap and lore with a white forehead, black-tipped wings, and a yellow beak with dark tip. Young birds are brownish-gray with a scaly appearance, black head lacking the white triangle on the forehead and a dark beak. California Least Terns are approximately 10 inches in length with a 30-inch wingspan. This once abundant, colonial nesting species inhabits seacoasts, beaches, estuaries, lagoons, lakes, and rivers and prefers to nest on bare or sparsely vegetated sand, soil, or pebbles. Least Tern nesting is characterized by two “waves” (Massey and Atwood 1981). The first wave is typically comprised of experienced breeders while the second wave is predominately second-year birds breeding for the first time. This second wave of nest initiations usually occurs in mid-June. Pairs that lose their first clutch and re-nest may also contribute to the group of second wave nesters. The nest of the Least Tern is a simple shallow scrape in the sand, sometimes lined with shells, pebbles, bits of wood, or plant material, and may contain one to three eggs. Both parents incubate the nest which hatches in approximately 21-23 days (Massey 1974). Adults forage for fish in near-shore waters, estuaries, lagoons, bays, and river mouths (Atwood and Kelly 1984). Fledging, or the ability to fly, for Least Terns usually occurs within three weeks of hatching. Early in their decline, Least Terns were collected to adorn women’s hats. Today, habitat destruction is the biggest threat to this species as nesting habitat is prized for recreation and residential development. A second major threat is predation by animals such as birds of prey, coyotes, foxes, and domesticated or feral cats and dogs. El Niño weather patterns can also affect Least Tern populations by causing a northern shift in fish populations following cold water currents, resulting in a shortage of food for adult terns and their young.

In Los Angeles and Orange Counties, there are seven Least Tern nesting areas that have been utilized since 1986: Venice Beach, Los Angeles Harbor, Seal Beach National Wildlife Refuge, Bolsa Chica Ecological Reserve, Upper Newport Bay Ecological Reserve, Burris Basin, and Huntington State Beach. In 2015, a minimum of 792.5 breeding pairs were reported for these colonies (Frost 2015). A minimum of eight pairs were documented at Venice Beach, 103 at Los Angeles Harbor, 50 at Seal Beach National Wildlife Reserve (NWR), 184 at Bolsa Chica Ecological Reserve, 18.5 at Upper Newport Ecological Reserve, 18 at Burris Basin, and 411 at Huntington State Beach. The nesting area at Huntington State Beach (Figure 1) has been utilized by Least Terns for decades and has been an extremely important contributor to the recovery of the species.

The Huntington State Beach tern colony was designated a preserve in 1975 with 2.5 acres (Huntington State Beach General Development Plan, 1976). Over the years several changes were made, including increases in acreage and improvements to the fencing. In 1984 and 1985, the Huntington State Beach California Least Tern Natural Preserve consisted of about 6.4 acres (26,000 m<sup>2</sup>) protected by chain-link and temporary sand fencing. This area was expanded to 7.5 acres (30,437 m<sup>2</sup>) in 1986 and completely surrounded with a five to seven foot

high chain link fence. In 1989, the fence was replaced with one designed to preclude entry by predators including the non-native red fox (*Vulpes vulpes*), which had plagued the colony in preceding years. A cantilevered barrier was placed at the top, creating a net height of about eight feet which would prevent climbing or bounding over by mammalian predators. A strip of plastic aviary netting was partially buried along the entire base of the fence to keep chicks inside the fenced area and to prevent predators from burrowing under the fence.

In 1990, the alignment of some sections of the fence was modified to slightly enlarge the colony by about 1.1 acres which created an enclosed area of approximately 8.6 acres (34,872 m<sup>2</sup>). In the winter of 2012-2013, the sand fence around the south side of the colony was replaced with the chain-link fencing used around the rest of the colony. Plastic netting was partially buried along the base of this fence to keep chicks inside. The sand fence was moved about 20 feet outside of this fencing to prevent sand from drifting on the permanent fence and burying the plastic netting.

The Huntington State Beach colony was raked to clear vegetation in most years until 1985 (Pavelka and Stadtlander 1993). Since 1985, raking has occurred sporadically. The nesting area typically supports a widely spaced and low-stature population of beach primrose (*Camissoniopsis cheiranthifolia*), and some sparse beach morning-glory (*Calystegia soldanella*), sea rocket (*Cakile edentula*), and beach sand verbena (*Abronia umbellata*). The vegetation is now strategically cleared to maintain about 25% bare sand and varying levels of vegetative cover. The vegetation is removed in a grid pattern so that strip is raked every four years, allowing for various amounts of vegetative cover.

Prior to the 1991 breeding season, the Army Corps of Engineers attempted to prepare a newly constructed five-acre nesting island within its wetland restoration project in Newport Slough. However, as a result of poor execution and contractor oversight, the site was not rendered suitable for Least Tern nesting until 1992. Least Terns did not use Newport Slough initially, and it fell into disrepair. The Santa Ana Watershed Association (SAWA) prepared the island for potential occupation by removing vegetation during the winter of 2008-2009, but nesting has not yet been documented on the site.

The U.S. Fish and Wildlife Service (FWS) previously studied and reported on Least Tern nesting activity at the Huntington State Beach colony from 1986 through 1988 while the California Department of Fish and Wildlife (CDFW) monitored the colony in 1989 and 1990. The FWS began monitoring the Huntington State Beach colony and the newly created Newport Slough colony again in 1991 and continued through 1993. In 2008, SAWA and Orange County Water District began nest monitoring at Huntington State Beach and incidentally checking for nesting behavior at Newport Slough. The work reported herein discusses the results of Least Tern monitoring efforts in 2016.

This work was done under permit TE 839480-5. No California Least Terns were injured during this activity.

## **METHODS**

### *Site Preparation*

Prior to the 2016 breeding season, a limited amount of vegetation was raked in the colony. Grid markers were re-marked and roof tiles were cleaned out to offer additional shelter for chicks. Fencing surrounding the colony was mended and non-native vegetation was removed.

### *Monitoring*

In 2016, the Huntington State Beach colony was monitored twice per week from mid-May until late July for a total of 21 visits. Visits to the colony typically lasted about two to four hours for a total of 163 observer field hours. Three observers monitored inside the colony throughout most of the breeding season. Each observer covered about one-third of the colony, with two observers working inside the main colony and the third observer working in the adjacent fenced yard. During each visit, all active nests were visually examined at close range to determine the number and condition of the eggs or chicks. Chicks and fledglings were counted into several age classes according to a request by CDFW.

All of the nest observations were made within the fenced colony from portable cotton blinds originally designed and built by Richard Zembal and family. The use of blinds at this colony causes very little disturbance to nesting terns; any disturbance to the terns was localized and very brief. As new nests were discovered, they were identified by placing two numbered tongue depressors into the sand approximately one foot from each nest on the ocean and up-coast sides. The location of each nest was marked on a colony map using a grid system. Each grid square was marked on the ground with a labeled PVC pipe in the north-west corner of the square. State Park volunteers monitored the colony from outside the fence throughout the day during nesting season and notified the preserve manager in order to protect the colony upon sightings of potential predators, maintenance issues with the preserve, and any other pertinent information. When not in use, the blinds were secured with a tarp and stones in an unused portion of the colony at the gate entrance away from nesting terns.

For each nest, clutch size and hatching success was determined. In addition, the number of breeding pairs and total fledglings produced were estimated for the colony. In cases of nest or chick predation, efforts were made to determine the predatory species involved and assess the impact to the overall colony. Data were compiled and analyzed per CDFW protocol. Abandoned eggs were buried outside the colony at the end of the season.

### *Pair and Fledgling Number Calculations*

A range of the number of breeding pairs in the colony was determined using CDFW reporting protocol. The estimated number of total fledglings was determined by counting

fledglings at each visit and using the “window surveys” described in CDFW protocol. These window surveys occur approximately every three weeks. It is assumed that fledglings left the colony after three weeks and that each three week period contained new fledglings.

## **RESULTS and DISCUSSION**

In 2016, California Least Terns were first observed in the area of the Huntington State Beach colony on April 24. The first nests were located on May 10, the first chicks observed on May 27, and the first fledglings were observed on June 21. The last nest was located on July 22 and the last Least Terns were observed on July 28. A total of 348 nests were initiated, and produced a total of 365 documented chicks. The majority of nests occurred inside the main colony. No Western Snowy Plovers (*Charadrius nivosus nivosus*) were documented nesting on this site in 2016.

An estimated 292 to 337 Least Tern pairs initiated 348 nests at Huntington State Beach. The chronology of active nests is shown in Figure 2 and nest locations within the colony are shown in Figures 3 and 4. There was no discernible second wave this year, indicating poor recruitment of new breeders. Terns typically start to breed in their second year. Fledgling production in 2014 was 168 to 348, for a fledgling to pair ratio of 0.35 to 0.79. When examining this production, the extremely low second wave nesting attempt this season is somewhat unexpected. With an estimated fledgling to pair ratio of 0.70 required to maintain a breeding population, there should have been a detectable second wave in the 2016 breeding season. At the end of June, a biologist’s car was broken into and the tern equipment was among the items stolen. The data had been backed up to May 31, leaving the data from June 1 to June 20 missing. However, summaries for each visit had been backed up throughout the season, providing the total number of nests, new nests, depredations, chick numbers, and mortalities. Those nests which hatched during the period of missing data were marked as “probable hatch” during data analysis due to the loss of data records. Out of 348 nesting attempts, 266 (76%) were successful (Table 1), defined by at least one egg hatching, or probable hatch, defined as at least one egg having hatched without observation of a chick and no signs of depredation. Of the 266 successful attempts, 76% (421/556) of eggs hatched or were probable hatches. Of the 82 unsuccessful nests, 62 (76%) were abandoned pre-term, 18 (22%) were incubated to term but failed to hatch, and two (2%) had unknown outcomes. Surprisingly, there were no nest depredations this year. However, biologists did report scavenged unhatched eggs later in the season.

The number of nesting attempts (348) in 2016 is one of the lowest since SAWA began monitoring this colony in 2008, with 2013 having the least with 347 nesting attempts. On a statewide level there has been a downward trend, with individual colonies experiencing variations and fluctuations in total nesting attempts. The Huntington State Beach colony has experienced great fluctuation over the last nine years, with a high of 712 nest initiations in 2011, and a low of 347 initiations in 2013. The average number of nesting attempts has been 482 over these years, with a median of 454. Nesting success was 76% in 2016 and has ranged from 59% in 2011 to 85% in 2012. Hatching success in 2016 was 76%, which is higher than the

average of 73% over the last nine years. The average clutch size in 2016 was 1.61 and has ranged from 1.27 in 2013 to 1.96 in 2010. Although there was no prominent second wave, the average clutch size of the second wave, defined by CDFW as nests initiated after June 21, 2016, was 1.38. The second wave clutch sizes have ranged between 1.25 in 2015 to 1.86 in 2010.

Pre-term abandonment continues to be the highest cause of nest mortality. In 2016, 78% of nests failed due to this cause. In 2010, 88% of nests failed due to pre-term abandonment, the highest in the last nine years; the lowest failure rate was 44% in 2014. Depredation is the second highest cause of nest failure; however, no depredations occurred in 2016, the lowest depredation rate in the last nine years. In 2011, 49% of nests failed due to depredation, the highest since monitoring of the colony began. Twenty-two percent of the nests that were incubated to term failed to hatch; Failure to hatch rates were at a low in 2011 when 3% failed and at a high in 2014 when 38% failed. Although no nest depredations occurred, predators did take chicks and adult terns. An American Kestrel (*Falco sparverius*) was documented taking two chicks. A pair of kestrels was observed in the vicinity of the colony throughout the season, especially after chicks began to hatch. A pair of Peregrine Falcons (*Falco peregrinus*) was also observed in the vicinity of the colony. One falcon was documented taking an adult tern early in the season, and another adult tern was suspected to have been killed by a falcon. The female peregrine was trapped and removed from the area by a permitted individual. Several subsequent attempts to trap problematic peregrines and kestrels proved unsuccessful. Other potential predators observed in the area included the American Crow (*Corvus brachyrhynchos*), Common Raven (*Corvus corax*), Osprey (*Pandion haliaetus*), Red-tailed Hawk (*Buteo jamaicensis*), Great Blue Heron (*Ardea herodias*), European Starling (*Sturnus vulgaris*), and gulls (*Larus* spp.). Adult terns were observed mobbing and chasing away predators from the colony.

An estimated 292 to 337 breeding pairs produced an estimated 100 to 123 fledglings (Table 2), yielding a fledgling per pair ratio of 0.30 to 0.42. Although higher than the 2015 ratio of 0.25 to 0.30, this is still lower than the 0.70 ratio estimated to be necessary to maintain a breeding population (Fancher 1992). If other breeding colonies experience a similar fledgling productivity, the statewide population will be unable to maintain itself and will continue to decline. Future breeding seasons will need to show increased productivity for this species to survive.

## **INCIDENTAL OBSERVATIONS**

In previous years, adult and fledgling Least Terns were observed loafing and preening just outside the colony fence along the beach strand and Santa Ana River mouth. In 2016, high surf coupled with shifting currents has eroded away much of this beach, and has threatened to undermine portions of the fence surrounding the preserve. This erosion has decreased the area terns are able to use for loafing and for juveniles to learn how to fish. The erosion under the preserve's fencing may impact nesting area in future seasons. However, dredging efforts of the Santa Ana River are taking place in winter 2016-2017 and should return much of the sand to the

front of the preserve. A rise in the number of dogs has been observed along the beach, despite the State Beach being closed to dogs. The presence of dogs appears to be a disturbance to the terns, causing the birds nesting closest to the beach to be more likely to flush from nests. Dogs have also been observed within the Santa Ana River and on the Newport Beach side of the river and are using the path adjacent to the downcoast side of the preserve to access these areas. No terns were observed loafing or feeding in the Santa Ana River this year during the monitoring effort, which is a change from previous years. As in previous years, helicopters flying over the colony caused the terns to flush. Throughout the season, banded Least Terns were observed around and nesting in the colony. Biologists monitoring the colony recorded a total of 48 banded birds on nests, but most of the band numbers could not be read for reporting.

During the nesting season, several Killdeer (*Charadrius vociferous*) nested within the main fenced colony, and produced chicks throughout the season. Mourning Doves (*Zenaida macroura*) and House Finches (*Haemorhous mexicanus*) were seen foraging throughout the colony. Other species documented in and around the colony included Elegant Tern (*Thalasseus elegans*), Forster's Tern (*Sterna forsteri*), Caspian Tern (*Hydroprogne caspia*), Western Gull (*Larus occidentalis*), California Gull (*Larus californicus*), Ring-billed Gull (*Larus delawarensis*), Heermann's Gull (*Larus heermanni*), Bonaparte's Gull (*Chroicocephalus philadelphia*), Marbled Godwit (*Limosa fedoa*), Willet (*Tringa semipalmata*), Sanderling (*Calidris alba*), Black-bellied Plover (*Pluvialis squatarola*), Semipalmated Plover (*Charadrius semipalmatus*), Long-billed Dowitcher (*Limnodromus scolopaceus*), Long-billed Curlew (*Numenius americanus*), Black Turnstone (*Arenaria melanocephala*), Green Heron (*Butorides virescens*), Western Sandpiper (*Calidris mauri*), Black Skimmer (*Rynchops niger*), Brown Pelican (*Pelecanus occidentalis*), Rock Pigeon (*Columba livia*), Double-crested Cormorant (*Phalacrocorax auritus*), Say's Phoebe (*Sayornis saya*), Barn Swallow (*Hirundo rustica*), and Snowy Egret (*Egretta thula*). Most of the species are unlikely to depredate Least Terns, but other tern species have been observed competing with the Least Terns for fish in previous seasons. A juvenile Western Snowy Plover was observed foraging on the beach late in the season. Volunteers also observed a sea lion in the shallow surf early in the season.

## **SUMMARY**

Fledgling productivity and success varies from year to year, depending on factors such as depredation during the season, food availability, and seasonal fluctuations in weather, sea, and climate conditions. When SAWA began monitoring in 2008, a high rate of depredation of eggs by crows early in the season led to low hatching success. Despite the depredations, fledgling recruitment was considered favorable (estimated 267 fledglings). For undetermined reasons, fledgling production was low in 2009, but favorable in 2010 (estimated 132 and 298 fledglings, respectively). Since 2010, fledgling production has fallen. Between 2011 and 2013, an estimated 107, 90, and 100 fledglings were produced. Domoic acid, which is toxic to birds, was a suspected cause for the low productivity in 2011, while food shortages in 2012 and 2013 are suspected for low productivity in those years. Since 2013, there have been few detectable second wave nesting attempts. This is consistent with the low fledgling production since 2011. In 2016, hatching success was fair (76%) and chick mortality was low, with only 89 documented

chick deaths (421 eggs hatched or probable hatched). The low chick mortality is attributed to high fish availability. A low estimate of 100 to 123 fledglings produced in 2016 follows the trend since 2011, excluding 2014. This low production will likely see a low second wave nesting effort in 2018. Consistent with the lower value in the range of productivity (0.35 to 0.79 fledglings per pair )seen in 2014, there was a very low second wave nesting attempt this season.

Preventing significant predation by falcons and crows requires constant vigilance at the Huntington State Beach colony. Both species are relatively abundant in the urbanized coastal areas of southern California, relatively unpredictable in the timing of their appearance at Least Tern nesting areas, and are capable of precluding initial nesting and negatively affecting Least Tern reproductive success at a particular site. Efforts this year documented a very low incidence of depredations. No nests were depredated while only two chicks and one adult were documented to have been taken by predators. The full impacts of the falcons were unknown, because most depredations were probably not observed. When examining Least Tern nest failure at this site over the last nine years, pre-term abandonment appears to be the primary cause of nest failure (Figure 5). Predator presence may play a role in early abandonment, but other factors, notably food availability, are certainly important as well.

Managing disturbances that can significantly reduce the productivity of a major tern colony is imperative to the survival and recovery of this species. Recruitment of new individuals is crucial to sustaining the breeding population, and it can be set back several years or completely by major stochastic events. While cyclical weather patterns such as El Niño and La Niña events cannot be prevented, measures can be taken to reduce the effects of such events on reproductive output. Maintaining as many nesting sites as possible throughout the state will not only aid in increasing the population as a whole, but will also reduce the risk of any one stochastic event wiping out a large portion of the tern population. This strategy is important locally as well. In certain years, terns have moved en masse from one site with major issues to another and bred successfully. Improved management of the Newport Slough site to keep it suitable for Least Tern nesting, along with maintaining the Huntington State Beach colony site and other local options, should be considered critical to the recovery of the species.

## **ACKNOWLEDGMENTS**

SAWA gratefully acknowledges the staff of the California Department of Parks and Recreation prepared the site. Appreciation is extended to Lana Nguyen for her oversight of the Huntington State Beach nesting site, and providing predation data from the volunteer monitors. Special thanks are given to Cheryl Egger for her coordination efforts and the California State Park volunteers for observing the colony and reporting disturbances and providing predator data. Appreciation is also extended to Wally Ross for quick action in response to reports of predators in the colony. We thank the Orange County Water District for providing funding for SAWA participation in the monitoring of the Huntington State Beach site since 2008.



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Photo credit: Nicole Housel

Figure 1. Location of Huntington State Beach California Least Tern breeding colony.



Figure 2. California Least Tern nesting chronology by week at the Huntington State Beach colony, 2016.

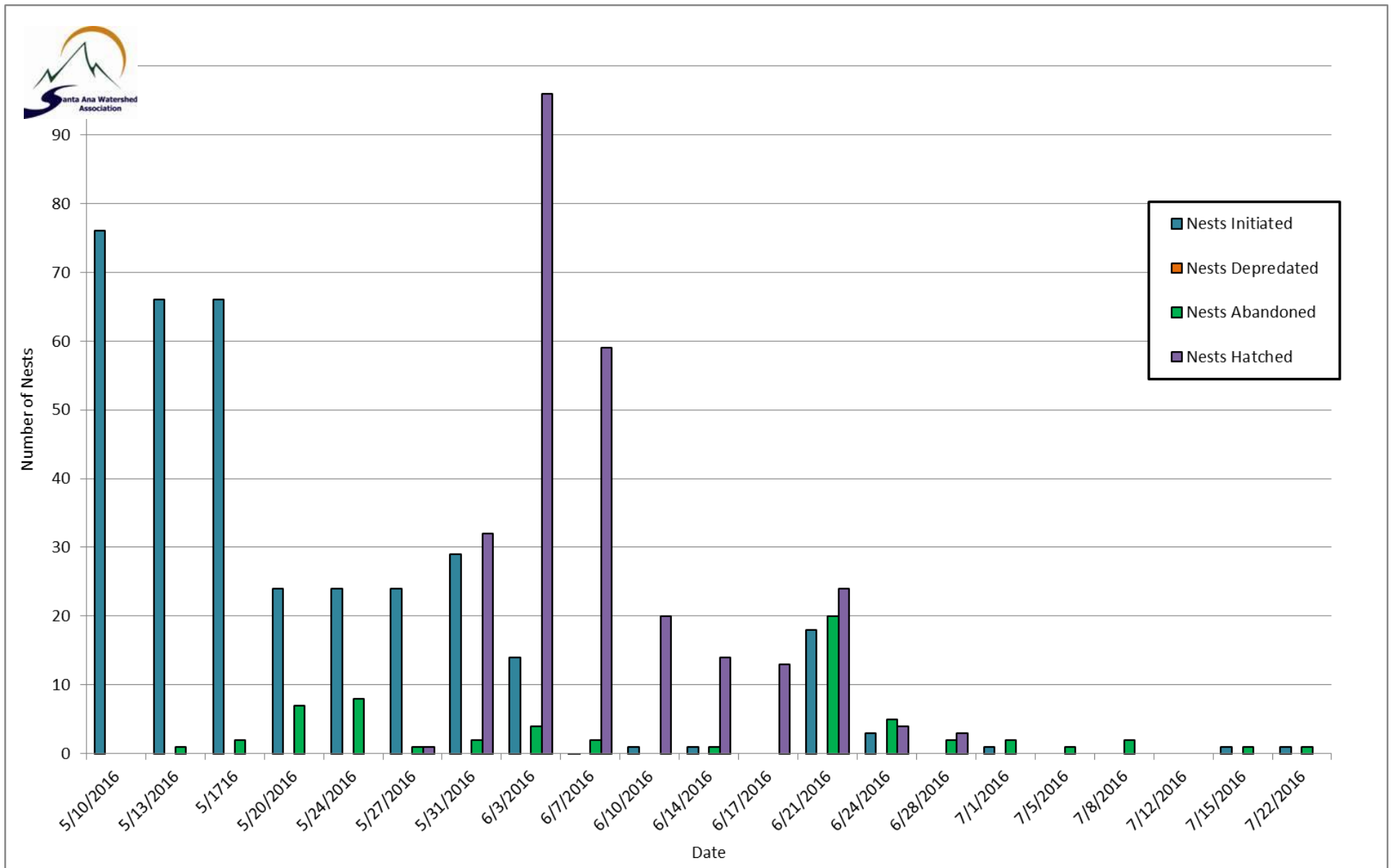


Figure 3. California Least Tern nest distribution inside the main colony at the Huntington State Beach site, 2016.

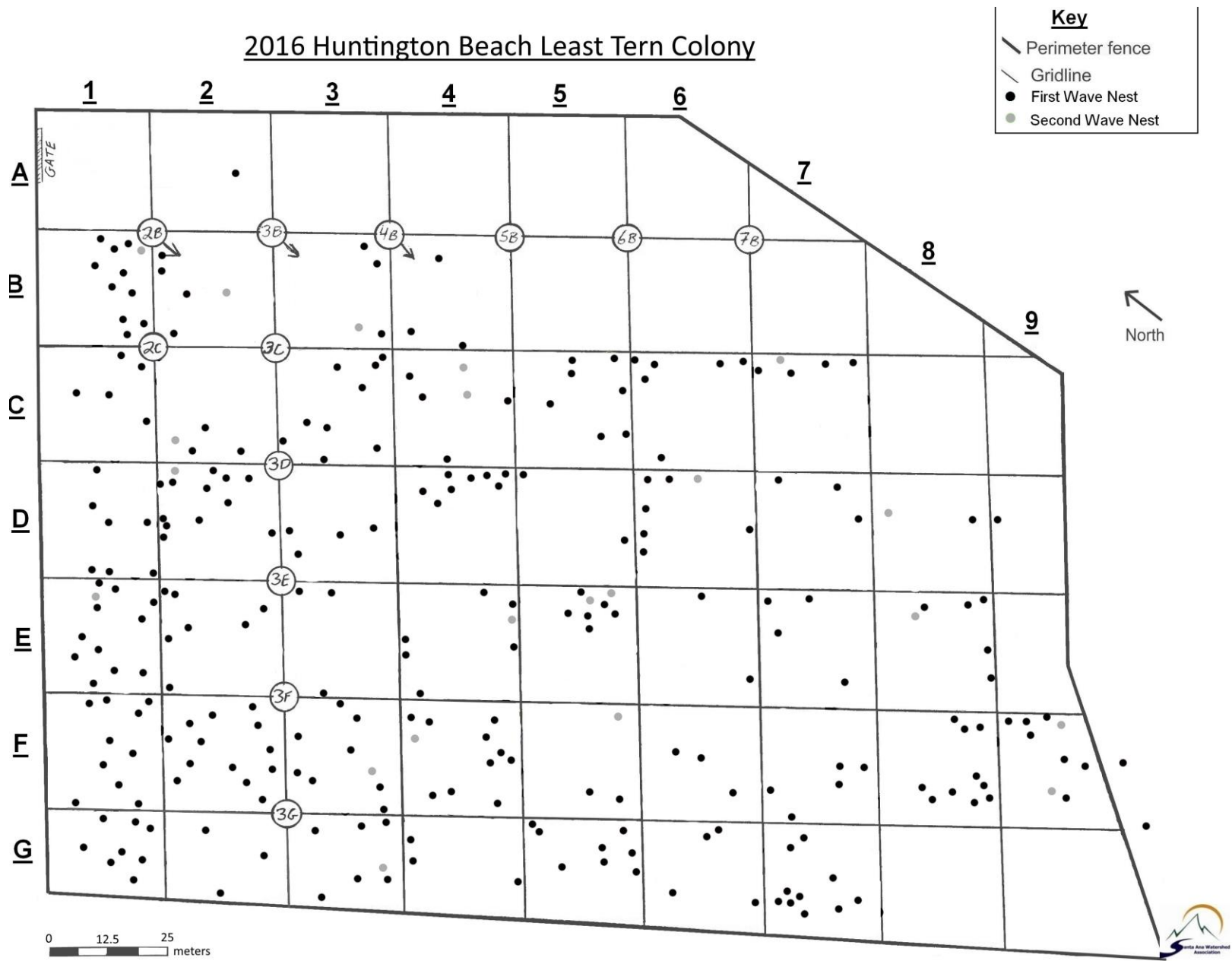


Figure 4. California Least Tern nest distribution within the fenced yard at the Huntington State Beach site, 2016.

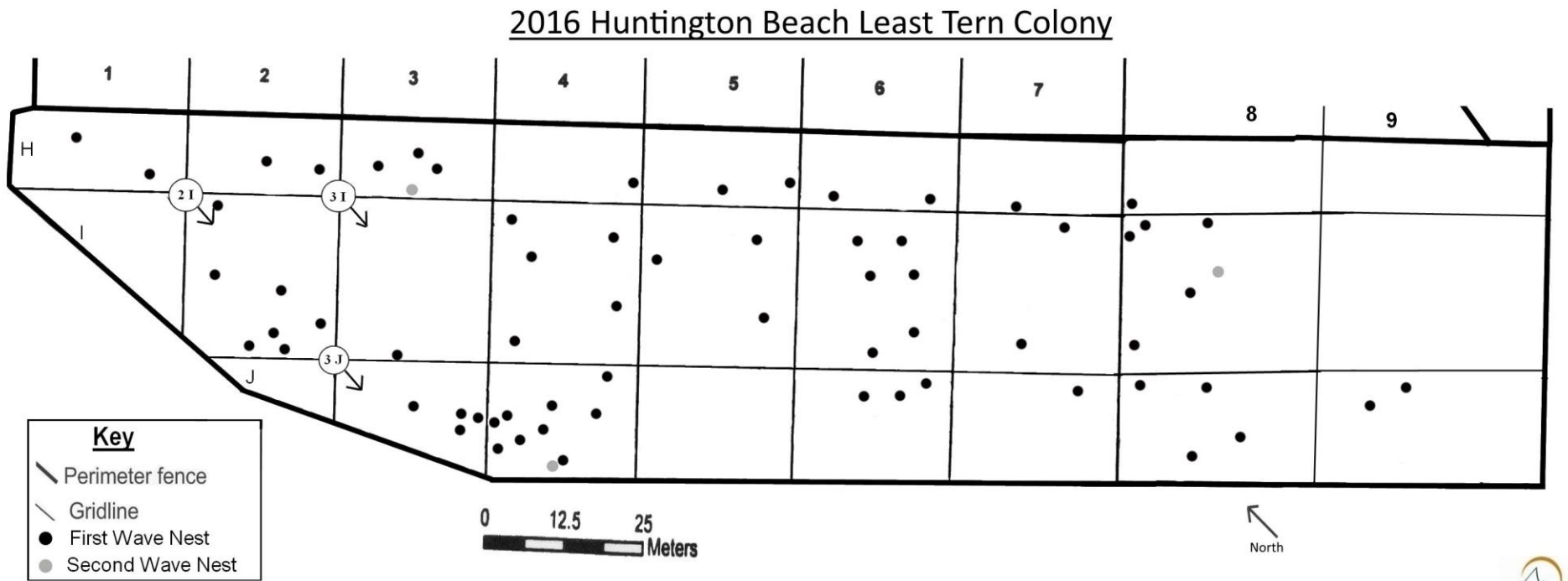


Figure 5. A nine-year comparison of California Least Tern nest failure at the Huntington State Beach Park colony.

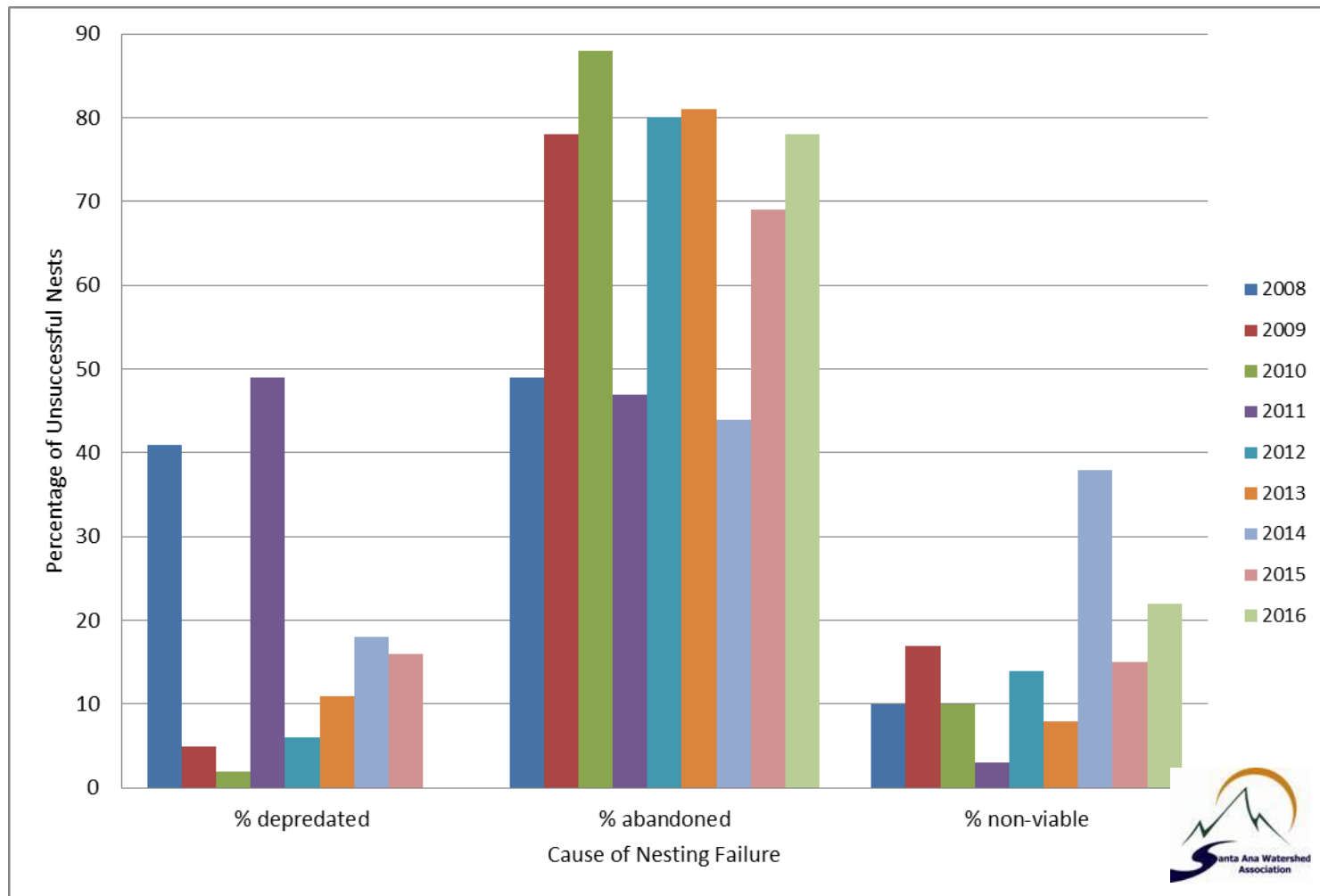


Table 1. California Least Tern clutch size data from Huntington State Beach, 2008-2016.

Year	Time Period	Percent of Total Nests				Mean Clutch SD	Total Nests	Overall Hatching Success (%)
		1-egg	2-egg	3-egg	4-egg			
2008	1 <sup>st</sup> wave	36.3	63.4	0.3	0.0	1.64 ± .49	366	62
	2 <sup>nd</sup> wave	42.0	58.0	0.0	0.0	1.58 ± .50	88	
2009	1 <sup>st</sup> wave	22.0	77.5	0.5	0.0	1.78 ± 0.38	391	76
	2 <sup>nd</sup> wave	58.1	41.9	0.0	0.0	1.42 ± 0.50	43	
2010	1 <sup>st</sup> wave	6.6	90.4	3.0	0.0	1.96 ± 0.31	363	81
	2 <sup>nd</sup> wave	14.3	85.7	0.0	0.0	1.86 ± 0.35	70	
2011	1 <sup>st</sup> wave	30.5	69.1	0.3	0.1	1.70 ± 0.47	701	59
	2 <sup>nd</sup> wave	54.5	45.5	0.0	0.0	1.45 ± 0.52	11	
2012	1 <sup>st</sup> wave	24.6	75.2	0.2	0.0	1.76 ± 0.43	525	85
	2 <sup>nd</sup> wave	41.2	58.8	0.0	0.0	1.59 ± 0.51	17	
2013	1 <sup>st</sup> wave	72.6	27.4	0.0	0.0	1.27 ± 0.45	347	69
	No discernible second wave							
2014	1 <sup>st</sup> wave	33.0	66.7	0.2	0.0	1.67 ± 0.47	516	80
	2 <sup>nd</sup> wave	69.7	30.3	0.0	0.0	1.30 ± 0.47	33	
2015	1 <sup>st</sup> wave	35.2	64.6	0.2	0.0	1.65 ± 0.48	489	73
	2 <sup>nd</sup> wave	77.1	22.9	0.0	0.0	1.25 ± 0.44	35	
2016	1 <sup>st</sup> wave	39.6	60.1	0.0	0.3	1.61 ± 0.51	326	76
	2 <sup>nd</sup> wave	59.1	40.9	0.0	0.0	1.41 ± 0.50	22	

Table 2. California Least Tern reproductive success at Huntington State Beach, 2008-2016.

Year	Pairs	Fledglings	Fledglings per Pair	Total Pairs Statewide
2008	344 to 411	267 <sup>a</sup>	0.65 to 0.78	7067 to 7513
2009	379 to 413	132	0.002 to 0.348	7130 to 7352+
2010	398 to 405	298	0.74 to 0.75	6437 to 6699+
2011	518 to 707	107	0.15 to 0.21	4931 to 6153
2012	422 to 534	90	0.17 to 0.21	4595 to 6155
2013	311 to 347	100	0.29 to 0.32	4352.5 to 5560.5
2014	439 to 479	168 to 348	0.35 to 0.79	4232 to 5786
2015	422 to 506	125	0.25 to 0.30	4202 to 5295
2016	292 to 337	100 to 123	0.30 to 0.42	TBA

<sup>a</sup>moderate egg predation by crows