

**State of California
Natural Resources Agency
Department of Fish and Wildlife
Wildlife Branch**

**California Least Tern Breeding Survey
2013 Season**

**by
Nancy Frost**

Final Report

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ABSTRACT

Monitoring to document breeding success of California least terns (*Sternula antillarum browni*) continued in 2013, with observers at 41 nesting sites providing data. An estimated 4353-5561 California least tern breeding pairs established 5894 nests and produced 1399-1634 fledglings at 56 documented locations. The fledgling to breeding pair ratio was 0.25 to 0.38. Statewide, 9,366 eggs were reported, with a Site Mean clutch size of 1.6 eggs per nest (St Dev=0.16) and a Statewide clutch size of 1.6 eggs (St Dev = 0.04) for Type 1 sites where monitors walk within the colony. Numbers of nesting least terns were not uniformly distributed across all sites. Camp Pendleton, Naval Base Coronado, Batiquitos Lagoon, and Huntington State Beach represented over half of the breeding pairs. Fledgling numbers were also unevenly distributed as the six sites with at least 90 fledglings each (Alameda Point, Naval Base Coronado, Camp Pendleton, Hayward Regional Shoreline, Batiquitos Lagoon, and Huntington State Beach), contributed 67% of the state's production, and the sites with greater than 35 fledglings each (including the six aforementioned sites plus Seal Beach, Tijuana Estuary, and Oceano Dunes), contributed 82% of the state's production. The 2013 statewide non-predation chick mortality rate was 22%, much less than that in 2012 (49%) and a reverse in the upward trend observed in the previous five years. With the exceptions of Batiquitos Lagoon and Camp Pendleton, the larger nesting colonies experienced non-predation chick mortality rates less than the average, similar to that documented in 2012. The predators known to be responsible for the greatest number of depredated least terns in 2013 were common ravens (*Corvus corax*), peregrine falcons (*Falco peregrinus*), unknown gull spp., domestic cats (*Felis catus*), American crows (*Corvus brachyrhynchos*), American kestrels (*Falco sparverius*), coyotes (*Canis latrans*), great horned owls (*Bubo virginianus*), northern harriers (*Circus cyaneus*), unknown avian spp., unknown spp., Cooper's hawks (*Accipiter cooperii*), and red-tailed hawks (*Buteo jamaicensis*). The monitoring effort of 2013 is scheduled to continue in 2014.

¹ Frost, N. 2014. California least tern breeding survey, 2013 season. California Department of Fish and Wildlife, Wildlife Branch, Nongame Wildlife Program Report, 2014-06. Sacramento, CA. 20 pp + Appendices.

INTRODUCTION

The California least tern (*Sternula antillarum browni*) is the subspecies of least terns nesting along the west coast of North America, from Baja California, Mexico, north to the San Francisco Bay area (USFWS 1980). Two other subspecies, Interior (*S. a. athalassos*) and Eastern (*S. a. antillarum*), are recognized in the United States (American Ornithologists' Union: AOU 1957); however, there is little genetic variation among the subspecies which questions the validity of this division (Whittier et al. 2006). A taxonomic change by the AOU (Banks et al. 2006) resurrected the genus *Sternula* for the least tern based on the work of Bridge et al. (2005).

California least terns establish nesting colonies on sandy soils with little vegetation along the ocean, lagoons, and bays. Their nests are shallow depressions lined with shells or other debris (Massey 1974, Cogswell 1977). Least terns are generally present at nesting areas between mid-April and late September (Massey 1974, Cogswell 1977, Patton 2002), often with two waves of nesting during this time period (Massey and Atwood 1981). This species was listed as endangered by the U.S. Secretary of the Interior in 1970 (USFWS 1973) and the California Fish and Game Commission in 1971 (CDFG 1976) due to a population decline resulting from loss of habitat (Craig 1971, Cogswell 1977). The endangered status prompted wildlife agencies to initiate monitoring efforts to estimate the breeding population size of least terns in California.

Craig (1971) conducted the initial surveys of breeding colonies in 1969 and 1970, focusing on site characteristics, including historical use and threats to each colony. In 1973, the first annual breeding survey was conducted (Bender 1974a), which changed the focus of the monitoring effort from an earlier descriptive emphasis to quantifying breeding numbers and nesting success for each breeding colony. Factors determining breeding success, such as predation and egg and chick abandonment, were recorded starting in 1975 (Massey 1975). From 1976 to 1978, research and new management techniques were initiated to develop a better understanding of least tern biology and to increase breeding success. These techniques included banding to study local movements (Jurek 1977), use of chick shelters (Jurek 1977), identifying key feeding areas (Atwood et al. 1977), and extensive use of decoys (Atwood et al. 1979). The first documented records of fledglings appeared in the 1977 annual survey report (Atwood et al. 1977). Massey (1989a) later conducted an analysis of fledgling survey techniques to determine a method that minimized sampling problems associated with the tendency of young to quickly leave the nesting area. Based on that analysis, she recommended that evening fledgling counts be taken every three weeks, starting approximately 8-9 weeks after the first egg is laid.

Since 1971, the frequency of monitoring at breeding colonies increased from one to three visits per year to more than one visit per week. However, wide variation exists among sites and years. The observed statewide population increase of least terns in the 1970s and 1980s has been attributed to increased sampling and associated personnel effort rather than an actual increase in the number of California least terns (Atwood et al. 1977, USFWS 1980, Massey 1988). Additionally, USDA Wildlife Services (formerly Animal Damage Control) commenced predator management activities to benefit least terns in the 1980's. Their involvement resulted from monitors identifying predation of pre-flying young as the main factor of poor breeding success rather than reduced habitat and pair disturbance (Collins 1984). Obst and Johnston (1992) recommended that datasheets and fledgling counts be standardized across the state. This was

accomplished in 1993 when all site monitors were provided with the same datasheets and instructions (Caffrey 1994, 1995a). In an attempt to provide a more accurate statewide (rather than site specific) method of estimating the number of breeding pairs, calculations consider the number of renesting pairs a site may produce rather than the number of renesting pairs actually at the site (Caffrey 1998). These equations have been used to some extent since the 1998 nesting season (Keane 2000). Over the last decade, monitors continued to provide comparable data of California least tern breeding success and these data were compiled into annual summary reports. These latest monitoring efforts were continued for the 2013 breeding season in California.

METHODS

Monitors for each site that had least tern nesting in 2012 or who planned monitoring activities for 2013 were provided the instructions and spreadsheet to report final breeding data used for the annual report (Appendix A). While the spreadsheet format was revised, the data fields remained similar to those used since the 1998 nesting season in order to continue standardized data collection for the entire state. The 2013 spreadsheet was revised to include more detailed information in the Season Chronology worksheet, which was used to calculate values that previously had to be entered separately in the Monitoring, Pair Estimation, Productivity, and Chronology worksheets. Likewise, the 2013 Mortality worksheet combined the data fields that had to be entered separately in the previous Mortality, Non-nest Mortality, and Predation worksheets. Below is a comparison of the worksheets in the 2012 and 2013 spreadsheets:

2012 Spreadsheet	2013 Spreadsheet
General Instructions	General Instructions
Site Preparation	Site Information
-	Nest Information (grid # & UTM, if available)
Monitoring	-
Pair Estimation	-
Productivity	-
Chronology	Season Chronology
Mortality	Mortality
Non-nest Mortality	-
Predation	-
-	Predator Control
Banding	Banding
Notes	Notes

Site Information

Site Preparation

Information about each nesting site was requested to determine the level of protection provided to the birds. If a site had more than one discrete cluster of nests, the monitor had the option of reporting information for each sub-colony or the site as a whole. Use of shelters to protect chicks from predators and weather, decoys to attract adults, presence of interpretive signs to explain restricted access, and a grid system to assist in locating nests required a yes/no response. However, fence type, vegetation management, and predator management were more variable. In an attempt to standardize and simplify these three variables, categories were created which were easily reported as a number.

Fence type was reported as one of four categories: (1) the fence deterred or excluded most people and mammalian predators (i.e. chain link or solid fence that fully encloses the site); (2) cantilevered and/or barbed wire at the top deterred cats and other climbing mammals; (3) the fence would not deter most mammalian predators (i.e. not fully fenced on all sides; or fenced only with posted signs and wire or twine), or (4) no enclosure.

Vegetation management was reported as one of seven categories: (1) mechanically graded or dragged to remove vegetation; (2) manually removed; (3) herbicide (Roundup or Rodeo) use; (4) combination of 1, 2 or 3; (5) vegetation removed by other means; (6) no vegetation management occurred prior to the nesting season, but was needed in the opinion of the monitor; or (7) vegetation management was not necessary.

Predator management was reported as one of three categories: (1) proactive predator removal; (2) reactive predator removal; or (3) none.

Sampling Type

Each site was categorized as Type 1, 2, or 3 based on the level of sampling intensity employed. At a Type 1 site, monitors entered the colony to mark nests and record the number of eggs; a Type 2 nesting site was monitored from outside the colony. A Type 3 site was monitored primarily from outside the colony, but sampling within the colony occurred more frequently than once per month or more than 5 times during the season when nests are active or chicks are present. Type 1 sites yield more data, such as clutch size, hatching success, and evidence of predation. This type of monitoring allows more quantitative comparisons to be made among sites and years. Type 2 monitoring, however, minimizes disturbance to the nesting colony, possibly offering better conditions for behavior studies (Keane 1998, 2000, 2001).

Information regarding other monitoring techniques was requested as well. This included nest marking (generally with a tongue depressor or wooden stake), egg marking (numbering the shell), bird banding, and fledgling estimate method. When birds were banded or resighted, band number and color, nest number, date, and bird age and status (i.e., trapped and released, found dead, or other) was requested. Fledgling estimate method was reported as one of four categories: (R) based on band recapture data; (3WD) based on daytime counts of fledglings added up every 3 weeks beginning 2-3 weeks after the first fledgling observation; (3WN) based on dusk counts of fledglings added up every 3 weeks beginning 2-3 weeks after the first fledgling observation; or (Other) based on alternate method. Nest information including nest number, grid code, and UTM coordinates were requested.

Monitoring Breeding Season Chronology

For each day breeding colonies were monitored, the following was reported: date; number of monitors, hours in the colony or blind, adults, fledges, chicks off nest, and each predator species observed; and status of each nest using the following egg codes (e.g., two eggs in nest was coded 2E, or one egg and one hatch in nest was coded 1E/1H): E (egg); C (chick); DC (dead chick); H (hatched and no longer present); PH (probable hatch); A (abandoned pre-term); NV (abandoned

post-term/non-viable); P (predated); D (damaged); F (flooded); and U (unknown). Sampling intensity was based on the total number of visits to a site and dates of first and last visits.

Pair Estimation

Three different calculations (Methods I, II, III) were used to determine the total number of breeding pairs at any one site. Adjustments to the total number of nests was required to estimate breeding pair totals due to pairs renesting after a failed attempt and young adults nesting later in the year (Massey and Atwood 1981).

Method I assumes the total number of breeding pairs renesting is equal to half of the number of nests in the second wave, with the second wave defined as all nests initiated after 14 June (unless otherwise specified by the site monitor). If there is a time period with an obvious lull in nest initiation, dates of nest initiation dictate the start of the second wave. Total breeding pairs of a site is calculated by adding the number of nests of the first wave (prior to 15 June) to half of the nests in the second wave.

$$\text{Total Pairs} (\# \text{nests prior to 15 June} + [(\# \text{nests 15 June or after}) / 2])$$

Method II calculates the total number of breeding pairs by subtracting the total number of nests and broods lost prior to 20 June from the total number of nests. This method assumes that renesting will not occur from a nest or brood lost after 20 June and the number of nests and broods lost before this date are equal to the number of pairs renesting at that same site.

$$\text{Total Pairs} (\text{total nests} - (\# \text{unsuccessful nests prior 20 June} + \# \text{broods lost prior 20 June}))$$

Method III is much more subjective, relying on the monitor to estimate of the number of renesting pairs in the first and second wave. This calculation subtracts the estimated number of renesting pairs for each wave from the total nests during each wave. The totals for waves one and two are then added to estimate the total number of breeding pairs. Adult banding can reduce the subjectivity of Method III by allowing the monitor to observe renesting pairs.

$$\text{pairs first wave} (\# \text{nests prior to 15 June} - \text{estimated renesters prior to 15 June})$$

$$\text{pairs second wave} (\# \text{nests 15 June or after} - \text{estimated renesters 15 June or after})$$

$$\text{Total Pairs} (\text{pairs first wave} + \text{pairs second wave})$$

Pair estimation and total nest calculations included eggs that were laid and likely abandoned shortly thereafter, as the eggs were not observed to be incubated or attended by an adult.

Productivity

Productivity was measured by counting the number of nests, eggs, and eggs hatched, hatching success (ratio of eggs hatched to total eggs), and total fledglings at each site. Dates of first chick and fledgling were also typically recorded. These data will not be available for Type 2 or 3 sites simply because monitors cannot easily observe eggs and nests from a distance.

The mean clutch size was calculated by dividing the total number of eggs by the total number of nests for each site, then averaging site values (Site Mean clutch size). To reduce the influence of sites with only a couple nests of small or large clutch size, only the sites totaling more than 50 eggs are included. Sites were treated as independent samples in this calculation. Clutch size was also calculated by using data from sites that reported clutch sizes of every nest detected (Statewide clutch size). In those cases, each nest was treated as an independent sample. Only Type 1 sites were used for clutch size calculations because the data from Type 2 and 3 sites was not reliable.

Accurate fledgling counts are problematic as fledglings quickly move from their nesting areas (Massey 1989a). As defined above, at least four specific techniques may be used. Reported fledgling counts are based on the total number of fledglings produced at each site, including those that were later found dead.

Mortality and Predation

Identifying causes of mortality was of particular importance since it has been identified as the main cause of low reproductive success for this species (Collins 1984). Therefore, mortality data was reported by date and included numbers of lost nests and individuals of each age class (egg, chick, fledgling, and adult). Causes of mortality were reported using one of the following mortality codes: P (predated); D (damaged); F (flooded); DS (disease suspected); or U (unknown). If the mortality cause was believed to be predation, predator species, type, and evidence were reported. Predator types were characterized as either “possible,” “suspected,” or “documented.” If predation of terns occurred and a potential predator was known to be on or near the site through direct observation or other signs (track, scat, etc.), the animal was considered a *possible* predator. A *suspected* predator was reported when loss of least terns directly corresponded to the presence of a predator. These three predator classifications rely on the expertise of the monitors. *Documented* predators required a direct observation of a predator killing a least tern or substantial evidence to indicate responsibility. This evidence could be characteristic feeding patterns or tracks leading to a carcass or shell remains. Evidence of predation was reported using one of the following codes: O (observed predation); V (visual of predator on site); S (predator sign); and/or C (least tern carcass).

To quantify the impact of each predator species on the reproductive success and survivorship of least terns, three statistics are provided. The first ranks the species by the number of sub-colonies at which they were documented or thought to have depredated least terns. The second quantifies a predator rating for each species reported as a documented, suspected, or possible predator, calculated as follows:

$$\text{Predator Rating} = (\# \text{Documented} \times 3) + (\# \text{Suspected} \times 2) + (\# \text{Possible} \times 1)$$

The third quantifies mortality by calculating the proportion of total least tern eggs, chicks, fledglings, and adults depredated by specific predators. The number of eggs, rather than the number of nests, was used in calculations since they more accurately represent individual terns. For the few cases when the number of eggs was not reported, the number of nests was used as a conservative estimate of the number of eggs depredated. When a range of individuals

depredated by a species was reported, the average was used. Past analysis with minimum, average, or maximum values resulted in only slight differences (Marschalek 2005). Only the numbers of terns lost to a suspected or documented predator (possible category excluded) were used in calculating the proportion of least terns lost to predators. Past data shows little difference between only documented predation and combining suspected and documented predation (Marschalek 2008).

Predator Control

Both preventive and reactive predator management techniques were used to reduce the loss of least terns. Select predators were often removed from the site or adjacent areas just prior to the terns arriving in the spring. When predation was documented, the predator was removed using appropriate capture techniques. Sensitive and protected species were either trapped and released at off-site locations or were left on site and monitored. Number, sex, age, and disposition of each predator species, date, and control method and effort (e.g., hours on colony, trap hours, or trap nights) were requested. Predator disposition was reported using one of the following codes: H (harass); U (unsuccessful capture attempt); E (escaped); T (transferred); C (captively-held); R (relocated); K (killed); and D (found dead).

RESULTS and DISCUSSION

Site Preparation

Managers at most sites (Figure 1) implemented a variety of techniques to control vegetation, generally using mechanical and chemical methods together. The majority of nesting sites were fenced. Fences were extremely variable, ranging from no fence to a chain link fence completely enclosing the site. While over half of the sites used chick shelters, less than a third used decoys. Site specific and complete site preparation data are provided in Appendix B-1.

Monitoring

Twenty-seven of 41 sites monitored in 2013 were Type I sites, and the majority were monitored at least one or two times per week. A grid system to assist in locating nests was used at 21 sites and nest marking was used at 27 sites. Site-specific and complete monitoring data are located in Appendix B-2.

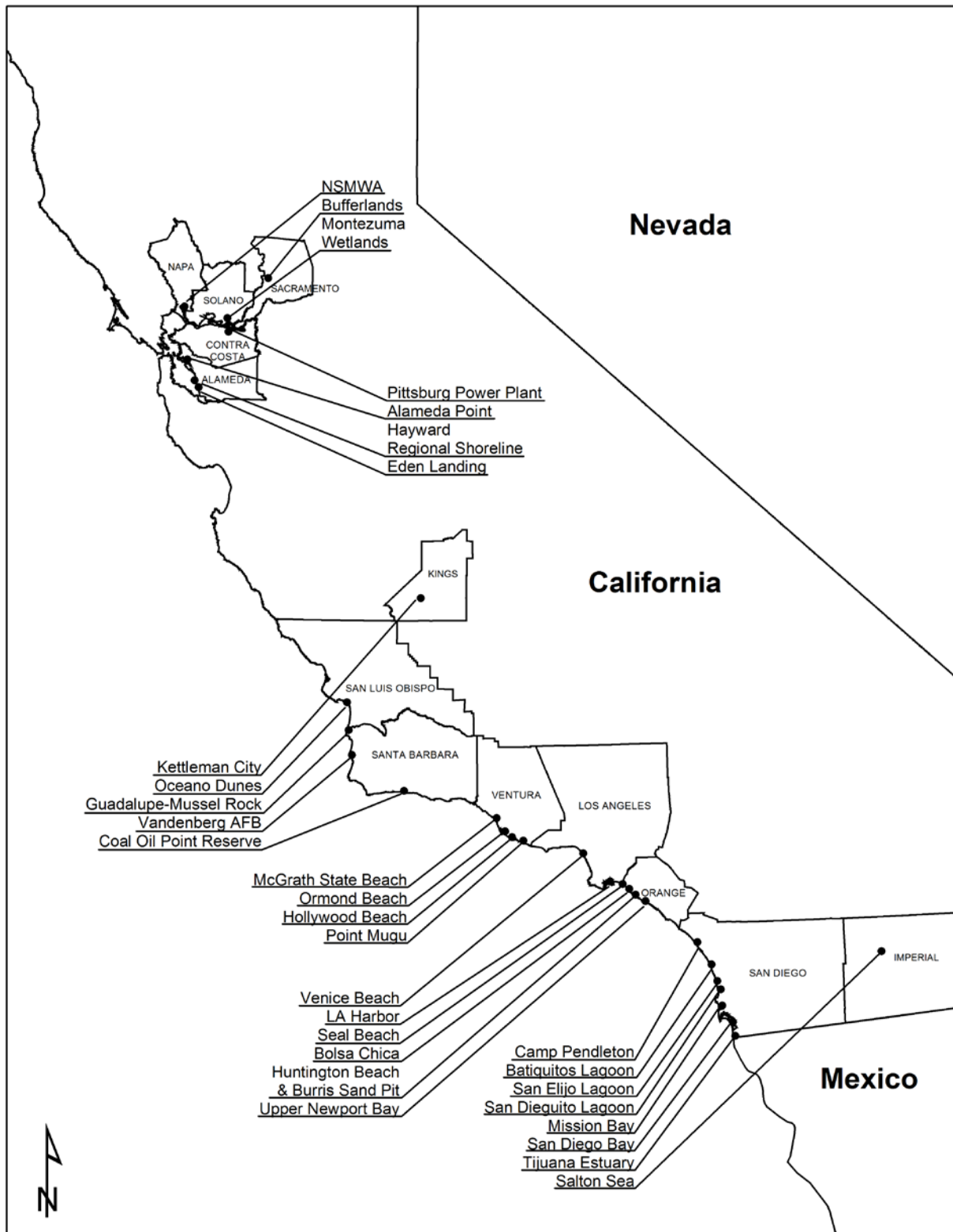


Figure 1. California sites monitored for California least tern nesting in 2013. Some listed areas include multiple sites, sites with nesting at more than one location, or both.

Productivity

At least partial data were received and analyzed for all monitored least tern nesting areas in California for 2013. An estimated 4353-5561 California least tern breeding pairs established 5894 nests and produced 1399-1634 fledglings at 56 documented locations, including sub-sites (Table 1, Table 2, Appendix B-3). The fledgling to breeding pair ratio was 0.25 to 0.38, greater than that in 2012 (0.09 to 0.15 fledglings per pair). Statewide, 9,366 eggs were reported, with a Site Mean clutch size of 1.6 eggs per nest (St Dev=0.16) and a Statewide clutch size of 1.6 eggs (St Dev = 0.04). Pair estimation and total nest calculations included eggs that were laid and likely abandoned shortly thereafter, as the eggs were not observed to be incubated or attended by an adult.

The 2013 California least tern nesting season lasted four and a half months. The first recorded least terns at a nesting site were observed on 13 April at Chula Vista Wildlife Reserve, and the last observed on 31 August at Burris Basin. The first nest was detected on 30 April, the first chick on 24 May, and first fledgling on 18 June – all were at Batiquitos Lagoon (W2).

There were five locations used in 2012 (Bufferlands: 2 nests; Pittsburg Power Plant: 3 nests; North Fiesta Island: 1 nest; San Diego River Mouth: 12 nests; NIMAT: 10 nests) at which least terns did not nest in 2013. Conversely, they nested at two locations (San Dieguito Lagoon: 3 nests; Salton Sea: 2 nests) not used in 2012. Although no nests were documented at Rancho Guadalupe Dunes in 2013 (the area used by terns was not entered by the monitor to eliminate potential disturbance), one pair was observed daily from 25 May - 8 June in flight with fish over the previously used nesting area, on the ground, and copulating. Site-specific and complete productivity data are located in Appendix B-3 (breeding pair estimation) and B-4 (productivity).

The 4353 recorded minimum breeding pairs in 2013 was slightly higher than the 4293 recorded in 2012 (Frost 2013), which represented the lowest count recorded since 2002 (Figure 2) (Craig 1971; Bender 1974a, 1974b; Massey 1975, 1988, 1989b; Atwood et al. 1977; Jurek 1977; Atwood et al. 1979; Collins 1984, 1986, 1987; Gustafson 1986; Johnston and Obst 1992; Obst and Johnston 1992; Caffrey 1993, 1994, 1995b, 1997, 1998; Keane 1998, 2000, 2001; Patton 2002, 2004 unpubl. Table; Marschalek 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012). Likewise, the minimum number of fledglings in 2013 (1404) was more than twice that in 2012 (557; the lowest count recorded since 2002) (Frost 2013).

The majority of breeding pairs nested in San Diego County (2604 pairs, 59.8%) and the fewest in the central coast area; San Luis Obispo, Santa Barbara, and Kings counties combined (57 pairs, 1.3%) (Table 3). The fledgling-to-pair ratio ranged from a low of 0.09 in Ventura County to a high of 1.3 in San Luis Obispo, Santa Barbara, and King Counties. The colony with the highest ratio was Hayward with 1.46 fledglings per pair.

Table 1. California least tern colony productivity in 2013.

2013-Final Results	Estimated Number of Breeding Pairs*		Number of Nests	Estimated Number of Fledglings		Fledgling per Pair Ratio	
Site	Minimum	Maximum		Minimum	Maximum	Minimum	Maximum
Sacramento Area							
Bufferlands	0	0	0	0	0	0.00	0.00
San Francisco Bay Area							
Napa Sonoma Marsh Wildlife Area - Totals	61	77	80	11	20	0.14	0.33
Montezuma Wetlands	25	25	29	3	4	0.12	0.16
Pittsburg Power Plant	0	0	0	0	0	0.00	0.00
Alameda Point	280.5	282	292	302	302	1.07	1.08
Hayward Regional Shoreline	80	81	85	118	122	1.46	1.53
Eden Landing	0	0	0	0	0	0.00	0.00
Kings County							
Kettleman City Evaporation Ponds	0	0	0	0	0	0.00	0.00
San Luis Obispo/Santa Barbara Counties							
Oceano Dunes SVRA	43	54	57	56	56	1.04	1.30
Rancho Guadalupe Dunes	0	1	0	0	0	0.00	0.00
Vandenberg AFB	14	15	15	19	19	1.27	1.36
Coal Oil Point Reserve	0	0	0	0	0	0.00	0.00
Ventura County							
Santa Clara River/McGrath State Beach	37	37	37	0	0	0.00	0.00
Ormond Beach	6	7	7	0	0	0.00	0.00
Hollywood Beach	117	209	209	31	31	0.15	0.26
Pt Mugu - Totals	203	337	346	0	0	0.00	0.00
Saticoy United Water Conservation District	0	0	0	0	0	0.00	0.00
Los Angeles/Orange Counties							
Venice Beach	12	15	15	0	0	0.00	0.00
LA Harbor	237	239	254	31	147	0.13	0.62
Seal Beach NWR - Anaheim Bay	149	161	164	89	89	0.55	0.60
Bolsa Chica Ecological Reserve - Totals	137	153	157	35	67	0.23	0.49
Huntington State Beach	303	331	347	100	100	0.30	0.33
Burris Sand Pit/Burris Basin	17	23	23	1	4	0.04	0.24
Upper Newport Bay Ecological Reserve	27	31	32	8	8	0.26	0.30
San Diego County							
MCB Camp Pendleton - Totals	785.5	1191	1243	150	150	0.13	0.19
Batiquitos Lagoon Ecological Reserve - Totals	442.5	549	558	117	163	0.21	0.37
San Elijo Lagoon Ecological Reserve	0	0	0	0	0	0.00	0.00
San Dieguito Lagoon Ecological Reserve	3	3	3	0	0	0.00	0.00
Fairbanks Ranch	0	0	0	0	0	0.00	0.00
Mission Bay							
FAA Island	98	145	156	7	7	0.05	0.07
North Fiesta Island	0	0	0	0	0	0.00	0.00
Mariner's Point	17	34	37	0	0	0.00	0.00
Stony Point	32.5	36	41	3	3	0.08	0.09
San Diego River Mouth	0	0	0	0	0	0.00	0.00
San Diego Bay							
Lindbergh Field/Formal Naval Training Center	91	106	114	34	34	0.32	0.37
NIMAT	0	0	0	0	0	0.00	0.00
NI 18	7	20	7	12	12	0.60	1.71
Naval Base Coronado- Totals	713.5	912	1034	156	156	0.17	0.22
D Street Fill/Sweetwater Marsh NWR	113	128.5	144	23	32	0.18	0.28
Chula Vista Wildlife Reserve	66	73	79	32	39	0.44	0.59
South San Diego Bay Unit, SDNWR-Saltworks	27	38	45	2	2	0.05	0.07
Tijuana Estuary NERR	206	245	282	57	65	0.23	0.32
Imperial County							
Salton Sea	2	2	2	2	2	1.00	1.00
Totals:	4352.5	5560.5	5894	1399	1634	0.25	0.38

*Pair estimates based on Methods I, II, and III.

Table 2. California least tern sub-colony productivity in 2013.

Colony	Sub-colony	Breeding Pairs*		Nests	Fledglings		Fledgling per Pair Ratio	
		Min	Max		Min	Max	Min	Max
Napa Sonoma Marsh Wildlife Area	Green Island Unit	0	0	0	0	0	0.00	0.00
	Huichica Unit (Pond 7/7A)	61	77	80	11	20	0.14	0.33
Montezuma Wetlands	Site 3/4	12	12	15	1	2	0.08	0.17
	Site 6/7	13	13	14	2	2	0.15	0.15
Point Mugu	Eastern Arm	4	4	5	0	0	0.00	0.00
	Holiday Beach	114	161	164	0	0	0.00	0.00
	Holiday Beach Salt Panne	9	11	11	0	0	0.00	0.00
	Ormond Beach East	76	161	166	0	0	0.00	0.00
Saticoy United Water Conservation District	Ferro Basin	0	0	0	0	0	0.00	0.00
	Freeman Diversion	0	0	0	0	0	0.00	0.00
	Noble/Rose Basins	0	0	0	0	0	0.00	0.00
	Santa Clara River	2	2	0	0	0	0.00	0.00
	Spreading Grounds	0	0	0	0	0	0.00	0.00
Bolsa Chica Ecological Reserve	Nest Site 1	20	20	20	0	0	0.00	0.00
	Nest Site 2	44	50	50	34	66	0.68	1.50
	Nest Site 3	3	3	3	0	0	0.00	0.00
	South Tern Island	70	80	84	1	1	0.01	0.01
Camp Pendleton	Santa Margarita River-Saltflats	13	26	29	0	0	0.00	0.00
	Santa Margarita River-South Beach	633.5	883	908	127	127	0.14	0.20
	Santa Margarita River-North Beach	76	178	183	12	12	0.07	0.16
	White Beach	57	84	100	9	9	0.11	0.16
	Red Beach	6	20	23	2	2	0.10	0.33
	Delta Beach	0	0	0	0	0	0.00	0.00
Batiquitos Lagoon Ecological Reserve	E1	43	47	49	8	28	0.17	0.65
	E2	0	0	0	0	0	0.00	0.00
	E3	13	14	14	0	0	0.00	0.00
	W1	33	37	37	10	27	0.27	0.82
	W2	353.5	451	458	99	108	0.22	0.31
San Dieguito Lagoon Ecological Reserve	NS11	1	1	1	0	0	0.00	0.00
	NS12	2	2	2	0	0	0.00	0.00
	NS13	0	0	0	0	0	0.00	0.00
	NS14	0	0	0	0	0	0.00	0.00
Naval Base Coronado	Delta Beach North	144.5	185	208	16	16	0.09	0.11
	Delta Beach South	126	158	174	28	28	0.18	0.22
	NAB Ocean	443	569	652	112	112	0.20	0.25
Tijuana Estuary	North	74	83	94	17	17	0.20	0.23
	South/North of Trail	2	2	3	2	2	1.00	1.00
	South/South of Trail	119	142	155	36	44	0.25	0.37
	South/South of Rivermouth	20	27	30	2	2	0.07	0.10

*Sub-colony pair estimates based on Methods I and II; see Appendix B-3 for colony pair estimates based on Method III.

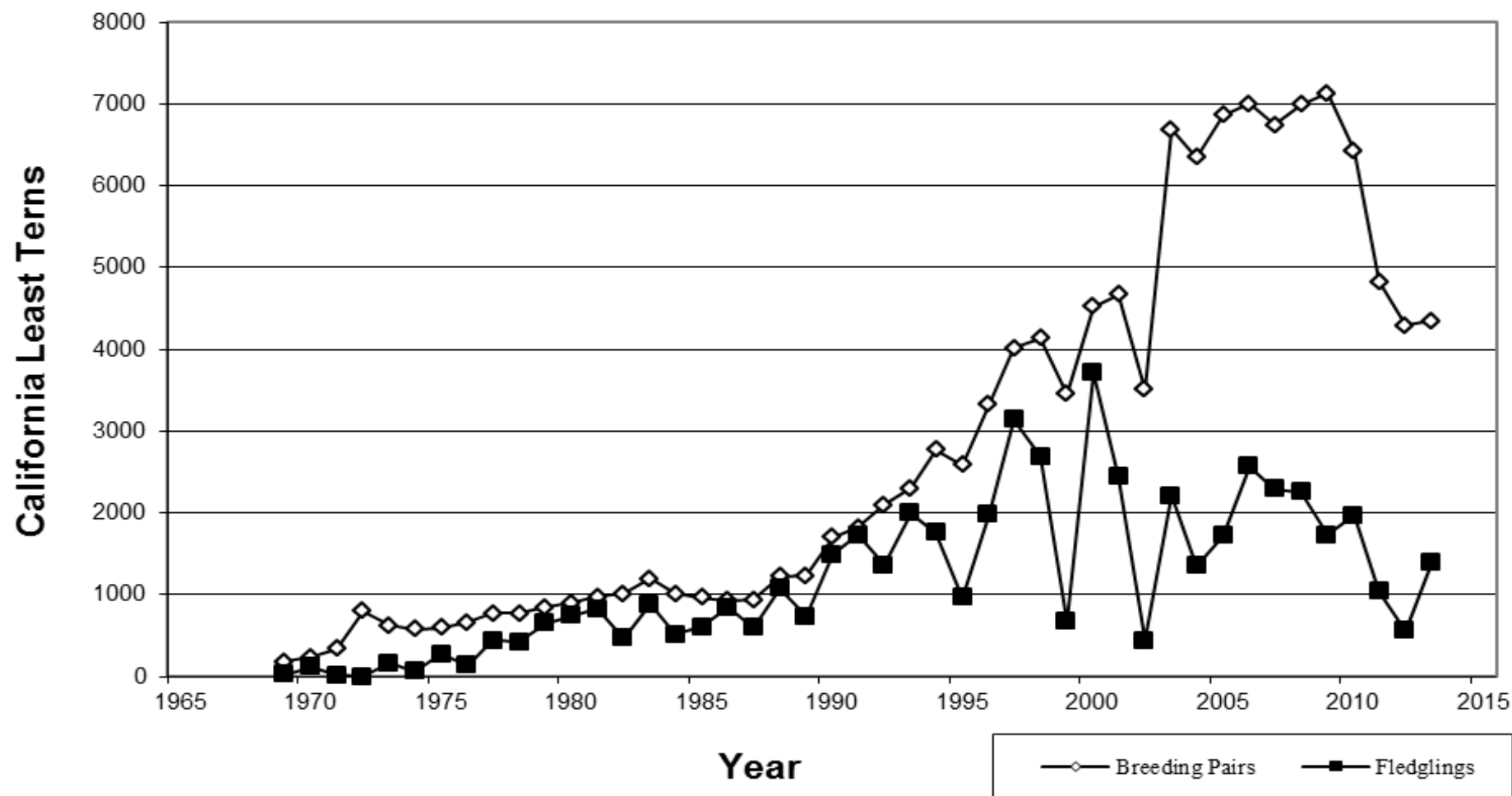


Figure 2. Minimum number of documented California least tern breeding pairs and fledglings in California during annual surveys, 1969-2013. (Data from: Craig 1971; Bender 1974a, 1974b; Massey 1975, 1988, 1989b; Atwood *et al.* 1977; Jurek 1977; Atwood *et al.* 1979; Collins 1984, 1986, 1987; Gustafson 1986; Johnston and Obst 1992; Obst and Johnston 1992; Caffrey 1993, 1994, 1995b, 1997, 1998; Keane 1998, 2000, 2001; Patton 2002, 2004 unpubl. Table; Marschalek 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012; Frost 2013).

Table 3. Regional productivity comparison, 2013.

Region	Breeding Pairs*	Proportion of Total	Fledglings*	Proportion of Total	Fledgling:Pair**
San Francisco Bay Area (w/Bufferlands)	447	0.103	434	0.310	0.972
San Luis Obispo/Santa Barbara/King Counties	57	0.013	75	0.054	1.316
Ventura County	363	0.083	31	0.022	0.085
Los Angeles/Orange Counties	882	0.203	264	0.189	0.299
San Diego/Imperial Counties	2604	0.598	595	0.425	0.228
Total	4353	1.000	1399	1.000	

*Breeding pairs and fledglings represent the minimum number recorded if a site reported a range of abundance.

**This is not the minimum fledgling-to-breeding pair ratio since the maximum number of pairs is not used.

The number of breeding pairs generally corresponds more closely to the number of nests, eggs, and chicks than the number of fledglings (Table 4). As was the case in 2012, Camp Pendleton, Naval Base Coronado, Batiquitos, Huntington, and Point Mugu had the highest number of breeding pairs, nests, eggs, and chicks in the state in 2013. With the exception of Naval Base Coronado, Camp Pendleton, and Batiquitos, the sites with the most fledglings produced (Alameda Point and Hayward) differed from those with the highest number of breeding pairs due to different survival rates at each site. Alameda Point, Hayward, and Vandenberg had a minimum fledgling-to-pair ratio greater than one (Table 1). A few sites constituted the majority of breeding activity for the state in 2013, which is a trend consistently observed in the past (Frost 2013). Camp Pendleton, Naval Base Coronado, Batiquitos, and Huntington had over 300 minimum breeding pairs, which represented nearly half of the state total. Eggs and nests tend to show a linear relationship with number of breeding pairs. One four-egg clutch was observed in 2013 at each of the following sites: FAA Island, Seal Beach, and Lindbergh Field. Fledgling numbers were also unevenly distributed. The six sites with at least 90 fledglings each (Alameda, Naval Base Coronado, Camp Pendleton, Hayward, Batiquitos, and Huntington), contributed 67% of the state's production, and the sites with greater than 35 fledglings each (the six aforementioned sites plus Seal Beach, Tijuana Estuary, and Oceano Dunes), contributed 82% of the state's production.

Table 4. Top five nesting sites with highest observed number of minimum breeding pairs, nests, eggs, chicks and minimum fledglings (actual number observed in parentheses).

Breeding Pairs	Nests	Eggs	Chicks	Fledglings
Camp Pendleton (785.5)	Camp Pendleton (1243)	Camp Pendleton (2064)	Camp Pendleton (1185)	Alameda Point (302)
Naval Base Coronado (713.5)	Naval Base Coronado (1034)	Naval Base Coronado (1599)	Naval Base Coronado (1022)	Naval Base Coronado (156)
Batiquitos Lagoon (442.5)	Batiquitos Lagoon (558)	Batiquitos Lagoon (937)	Batiquitos Lagoon (720)	Camp Pendleton (150)
Huntington Beach (303)	Huntington Beach (347)	Alameda Point (556)	Alameda Point (474)	Hayward (118)
Point Mugu (203)	Point Mugu (346)	Point Mugu (487)	Huntington Beach (304)	Batiquitos Lagoon (117)

Mortality and Predation

In 2013, the statewide non-predation chick mortality rate was 22%, much less than that in 2012 (49%) but similar to that documented in the previous two years (20% in 2011, 18% in 2010; Marschalek 2011, 2012; Frost 2013) (Table 5). Similar to 2012, the majority of the larger nesting colonies experienced non-predation chick mortality rates less than the statewide average (Naval Base Coronado: 20.7%; Alameda Point: 10.1%; and Huntington Beach: 5.9%). These three sites represented 32.4% of the total chicks hatched, but only 22.8% of the total reported non-predation chick deaths. The exceptions were Batiquitos Lagoon with a 40.8% non-predation chick mortality rate and Camp Pendleton with a 24.6% non-predation chick mortality rate. Conversely, these two sites represented 34.3% of the total chicks hatched but 48.2% of the total reported non-predation chick deaths.

Least tern mortality due to non-predation factors was greater than mortality due to predation in 2013. Of non-predation egg mortality events, the highest death rate (66%) was attributed to abandonment prior to the expected hatching date, leading to the loss of 1574 eggs. While often difficult to distinguish from pre-term abandonment, abandonment post-term (non-viable, failed to hatch eggs) was estimated to constitute 21% of non-predation mortality. Predation was reported as the cause of loss of 915 eggs, 95 chicks, 143 fledglings, and 106 adults (Table 5). In 2012, many more (647-655) chicks but fewer (32) fledglings were documented as depredated (Frost 2013).

Table 5. Cause of mortality of least terns with associated counts for each life stage (data taken from Mortality worksheet unless otherwise indicated). Complete and site specific mortality data is located in Appendix B-5 (non-predation) and B-6 (predation).

	Eggs*	Chicks	Fledglings	Adults	Total
Predation	915**	95	143	106	1259
Non-predation	2374	1214	62	10	3660

*An additional 400 eggs were lost to unknown causes.

**Includes data from Chronology worksheet.

It was very difficult to accurately determine the predator species involved in a tern predation event. These events were not typically observed and often little or no evidence remained at the site. The uncertainty of the exact predator species responsible for a depredation event often resulted in reporting a range of least terns lost to a particular species rather than an exact number. Uncertainty is also reflected in a predation event reported as either suspected or documented in some cases, based on the evidence available and the conservative nature of the biologist. For this reason, the proportion of least terns lost to each predator species includes both suspected and documented species. Previous calculations show similar trends when using only documented predator species (Marschalek 2008).

Nineteen species as well as 11 other taxa (e.g., avian spp., ant spp.) were reported as possible, suspected, or documented predators of least terns (Table 6). Based on the number of sub-colonies reporting each predator species, the most commonly reported predator species were unknown species, peregrine falcons (*Falco peregrinus*), unknown avian predators, coyotes (*Canis latrans*), corvid species including common ravens (*Corvus corax*) and American crows

(*Corvus brachyrhynchos*), American kestrels (*Falco sparverius*), great horned owls (*Bubo virginianus*), and northern harriers (*Circus cyaneus*). As in past years, most known predators were avian species. Similarly, the species with the highest predator rating (≥ 100) included unknown species, coyotes, unknown avian species, and peregrine falcons (Appendix B-6).

Table 6. Species documented, suspected, or possibly thought to have depredated least terns.

Number of Sub-Colonies Reporting Each Predator Species	Predator Species
24	Unknown spp.
18	Peregrine falcon
17	Unknown avian spp.
11	Coyote
10	Common raven, Corvid spp.
9	American crow
8	American kestrel, Great horned owl
7	Northern harrier
5	Cooper's hawk, Unknown mammal spp.
4	Unknown raptor spp., Striped skunk
3	Gull-billed tern, Gull spp., Red-tailed hawk, Opossum
2	European starling, Domestic cat, Mouse spp.
1	Great blue heron, Western gull, Barn owl, Loggerhead shrike, Long-billed curlew, Rodent spp., Canid spp., Snake spp., Ant spp.

A total of 321 least tern individuals (including eggs) were reported as taken by a documented or suspected predator species, 2.8% of which were depredated by unknown species (Appendix B-6). Of those least terns lost to suspected or documented predator species, common ravens, peregrine falcons, unknown gull spp., domestic cats (*Felis catus*), American crows, American kestrels, coyotes, great horned owls, northern harriers, unknown avian spp., unknown spp., Cooper's hawks (*Accipiter cooperii*), red-tailed hawks (*Buteo jamaicensis*), striped skunks (*Mephitis mephitis*), unknown raptor spp., European starlings (*Sturnus vulgaris*), and unknown snake spp. depredated the most least terns (Table 7). All other species not listed in Table 7 each represented less than 1% of the depredation. Nests were excluded from this analysis since the number of eggs better represents the loss of individuals. Abandonment was also excluded from depredation data but can be driven by a predator. Site-specific and complete mortality data are located in Appendix B-5 (non-predation) and B-6 (predation).

Historically, predation due to American crows, gull-billed terns, common ravens, and coyotes tended to be higher (Marschalek 2010). The foraging area of gull-billed terns appears to be expanding since 2007; however the number of least terns suspected or documented to be depredated by gull-billed terns has decreased over the last three years with 813 individuals depredated in 2009, 222 in 2010, 149 in 2011, 87 in 2012, and two in 2013. However, there was a gull-billed tern die-off in 2013 that may have contributed to the reduction in California least tern depredations.

Table 7. Species responsible for greatest proportion of known depredated least tern eggs, chicks, fledglings, or adults.

Species	Proportion of Least Tern Individuals Depredated by Documented and Suspected Predators* (# Least Terns Depredated in Parentheses)
Common raven	0.2617 (84)
Peregrine falcon	0.1542 (49.5)
Gull spp.	0.0903 (29)
Domestic cat	0.0654 (21)
American crow	0.0623 (20)
American kestrel	0.0545 (17.5)
Coyote, Great horned owl	0.0436 (14)
Northern harrier, Unknown avian spp.	0.0312 (10)
Unknown spp.	0.0280 (9)
Cooper's hawk	0.0249 (8)
Red-tailed hawk	0.0218 (7)
Striped skunk	0.0187 (6)
Raptor spp.	0.0156 (5)
European starling, Snake spp.	0.0125 (4)

*Based on average of the range reported for least terns depredated by each species.

Predator species varied in importance among each least tern age class. Common ravens, gull spp., and American crows had the largest depredation rate of eggs, while American kestrels, peregrine falcons, northern harriers, and unknown species depredated the most chicks. Peregrine falcons and domestic cats depredated the most fledglings, and great-horned owls, peregrine falcons, and raptor spp. depredated the most adults (Table 8).

Table 8. The five species responsible for greatest proportion of depredated least terns for each age class.

Eggs	# Depredated	84	29	20	14	7
	Predator	Common raven	Gull spp.	American crow	Coyote	Unknown avian spp.
	Proportion	0.4800	0.1657	0.1143	0.0800	0.0400
Chicks	# Depredated	14.5	10	7	5	2
	Predator	American kestrel	Peregrine falcon	Northern harrier, Unknown spp.	Cooper's hawk	Great blue heron, Gull-billed tern
	Proportion	0.2736	0.1887	0.1321	0.0943	0.0377
Fledges	# Depredated	30.5	21	6	3	2
	Predator	Peregrine falcon	Domestic cat	Red-tailed hawk	American kestrel	Unknown avian spp.
	Proportion	0.4621	0.3182	0.0909	0.0455	0.0303
Adults	# Depredated	11	9	3	2	1
	Predator	Great-horned owl	Peregrine falcon	Raptor spp.	Cooper's hawk, Unknown spp.	Unknown avian spp.
	Proportion	0.3929	0.3214	0.1071	0.0714	0.0357

Summary by Site

Management and monitoring of least terns requires a site-by-site perspective. This can be dictated by the biology or geography of the area or the specific nesting area, or by human-related issues. Appendix B-7 includes detailed site-specific information that is of particular importance for management, but is not meant to be all inclusive. Site-specific reports produced by the site biologist may be referred to if additional details are desired.

Conclusion

In 2013, biologists recorded a minimum number of breeding pairs that was slightly higher than that recorded in 2012, which represented the lowest count recorded since 2002. Notably, the fledgling to breeding pair ratio was more than two times higher in 2013 than in 2012. Despite this increase, the 2013 fledgling to breeding pair ratio is still considered low. Since 1977, this ratio has been less than 0.50 for 14 years, which includes the last 12 years.

Chick mortality in 2013 was half that documented in 2012 but similar to that in the previous two years. In addition to avian predators, which were responsible for the highest predation rates over the last several years, coyotes and domestic cats also contributed to the highest predation rates documented in 2013.

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Appendix A

Data Sheets

Data Reporting Spreadsheet

General Instructions

- Start filling in data for your site on the row below the headings.
- If the instructions are in the way, you can move them by clicking on the box border or pointer line. The pointer line does not prevent you from typing in the cells it passes through.
- Use day-month-year format: 17-Apr-13
- If you report a range of values, use the word "to" not a hyphen to avoid Excel mistaking it for a date (1 to 3, NOT 1-3).
- Complete the Site Info, Nest Info, Season Chronology, Mortality, Predator Control, and Banding worksheets for each subcolony.
- The Predator Control worksheet may be provided to the colony's predator control staff for completion, or the site monitor may complete this worksheet using information gleaned from the end-of-season predator control report.
- It is optional to complete the Notes worksheet.

Site Information

[illegible]

Nest Information: Complete new worksheet for each subcolony. Enter "None" if no grid used or coordinates taken.

site_name/subcolony	nest_num	grid_code	utm_easting	utm_northing	comments
	Nest_01				
	Nest_02				
	Nest_03				
	Nest_04				
	Nest_05				
	Nest_06				
	etc.				

Season Chronology: Enter data for the actual date you conducted the survey. Complete new worksheet for each subcolony.

[illegible]

Mortality: Enter each individual predation event (or tally if many in one age class were taken by a single predator species during a single predation event).

site_name/subcolony	date	num_eggs	nest_num	num_chicks	num_fledges	num_adults	mortality_cause	predator_species	predator_type	predation_evidence	comments
							<div>Mortality Codes: P=predated D=damaged F=flooded DS=disease suspected U=unknown</div>	<div>Predator Species Codes (use if mortality due to predation; click in box & scroll down for more codes): American crow (AMCR) American kestrel (AMKE) Ant Barn owl (BAOW) Black skimmer (BLSK) Black-bellied plover (BBPL) Black-crowned night-heron (BCNH) Black-tailed jackrabbit (LECA) Bobcat (LYRU) California ground squirrel (OTBE) California gull (CAGU) Canid Caspian tern (CATE) Common raven (CORA) Cooper's hawk (COHA) Corvid Coyote (CALA) Domestic cat (FECA) Domestic dog (CAFA) European starling (EUST) Gopher snake (PICA) Gray fox (URCI)</div>	<div>Evidence of Predation Codes (use / to separate >1 code): O=observed predation V=visual of predator on site S=predator sign C=California Least Tern carcass</div> <div>Predator Type Codes: PP=possible predator (if predation of terns occurred and a potential predator was known to be on or near the site through direct observation or other signs such as tracks or scat). SP=suspected predator (when loss of terns directly corresponded to the presence of a predator). DP=documented predator (direct observation of a predator killing a tern or substantial evidence to indicate responsibility. This evidence could be characteristic feeding patterns or tracks leading to a carcass or shell remains).</div>		

Predator Control: Enter "None" if no predator control.

species	number	sex	age	date	site_name/subcolony	method	disposition	remarks	notes-hrs_on_colony/trap_hrs/trap_nights
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Predator Species Codes (click in box & scroll down for more codes):</p> <p>American crow (AMCR)</p> <p>American kestrel (AMKE)</p> <p>Ant</p> <p>Barn owl (BAOW)</p> <p>Black skimmer (BLSK)</p> <p>Black-bellied plover (BBPL)</p> <p>Black-crowned night-heron (BCNH)</p> </div> <div style="width: 45%;"> <p>Disposition codes:</p> <p>H=harass</p> <p>U=unsuccessful capture attempt</p> <p>E=escaped</p> <p>T=transferred</p> <p>C=captively-held</p> <p>R=relocated</p> <p>K=killed</p> <p>D=found dead</p> </div> </div>									

Banding: Enter "None" if no banding or resightings.

[illegible]

General Data Sheet

Page 1

Location:				Date:		Job:		Observer(s):			
Time start:				Time stop:				On site:			
Est/Measured	Time:		Temp:	Wind Spd/Dir:		Cloud cvr (%):		Precip. (Y/N):		Tide: H L In Out	
ADULTS	Total:			NESTS	Total:			New:			
CHICKS	Observed:			Est max:		New Chicks:		Fledglings Obs:		Est max:	
Mortality (Y/N):	Adult:		Fledgling:		Chick:		Egg:		Nest:		
Predation (Y/N):	Adult:		Fledgling:		Chick:		Egg:		Nest:		
Take (Y/N):	Adult:		Fledgling:		Chick:		Egg:		Nest:		
Col Live (Y/N):	Adult:		Fledgling:		Chick:		Egg:		Other:		
Col Dead (Y/N):	Adult:		Fledgling:		Chick:		Egg:		Fish:	Other:	

Nest No.	Grid No.	New/ Incub.	Status	Nest No.	Grid No.	New/ Incub.	Status	Nest No.	Grid No.	New/ Incub.	Status
1				31				61			
2				32				62			
3				33				63			
4				34				64			
5				35				65			
6				36				66			
7				37				67			
8				38				68			
9				39				69			
10				40				70			
11				41				71			
12				42				72			
13				43				73			
14				44				74			
15				45				75			
16				46				76			
17				47				77			
18				48				78			
19				49				79			
20				50				80			
21				51				81			
22				52				82			
23				53				83			
24				54				84			
25				55				85			
26				56				86			
27				57				87			
28				58				88			
29				59				89			
30				60				90			

Egg/Nest Codes: E=egg; C=chick; DC=dead chick; H=hatched and no longer present; PH=probable hatch; A=abandoned pre-term; NV=abandoned post-term/non-viable; P=predated; D=damaged; F=flooded; U=unknown. Circle Nest Number if new or if status has changed.

Predators Observed (Time, Species, Location, Activity):											
Ants Y / N Grid Location(s):											
Documented Predation/Mortality:											
Human Disturbance/Take:											
Comment:											
Band Prefix	Band Number	Comb. L - R	Age	Wing	Weight	Cond.	Nest No.	Egg #	Grid	Comment	Recap. (Y/N)
		-									
		-									
		-									
		-									
		-									
		-									
		-									
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		-									
Band Prefix	Band Number	Comb. L - R	Age	Wing	Weight	Cond.	Nest No.	Egg #	Grid	Comment	Recap. (Y/N)

[illegible]

Master Band List

Version #1

[illegible]

Version #2

[illegible]

Multi-visit Form

Species:				LOCATION											
Date 1				Date 2				Date 3				Date 4			
Observers:				Observers:				Observers:				Observers:			
Date 5				Date 6				Date 7				Date 8			
Observers:				Observers:				Observers:				Observers:			
Date 9				Date 10				Date 11							
Observers:				Observers:				Observers:							
Nest	Found	Grid	Prior	Date 1	Date 2	Date 3	Date 4	Date 5	Date 6	Date 7	Band Number				
1															
2															
3															
4															
5															
6															
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36															
37															
38															
39															
40															
41															
Nest	Found	Grid	Prior	Date 1	Date 2	Date 3	Date 4	Date 5	Date 6	Date 7	Band Number				

Appendix B
Site Specific Data

Appendix B-1: Site Preparation in 2013.

Legend

Fence Type: 1-Fully enclosed site deterring most predators; 2-Fully enclosed site, cantilevered to deter climbing predators; 3-Incomplete, deterring few predators; 4-No fence/exclosure.

Vegetation Management: 1-Mechanical removal; 2-Manual removal; 3-Herbicide; 4-Combination of 1, 2, or 3; 5-Other means; 6-Needed, but not conducted in 2013; 7-None needed.

Predator management: 1-Proactive predator removal; 2-Reactive predator removal; or 3-None.

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Sacramento Area											
Bufferlands	Chris Conard										
San Francisco Bay Area											
Napa Sonoma Marsh Wildlife Area -Green Island Unit	Karen Taylor	Pruitt	4	No	Yes/29 Ceramic roof tiles, 30 wooden structures secured with re-bar, 12 PVC pipe cut in half	No	No	2-(in core on South Island), 6-(Main Island and East Island)	3	No	CDFW
Napa Sonoma Marsh Wildlife Area -Pond 7/7A	Karen Taylor	Barnwell, Lovett, Smith	4	No	No	No	No	6	3	No	CDFW
Montezuma/Site 3/4	Anne Wallace		4	No	No	No	No	1,7	3	site was constructed/raised	
Montezuma/Site 6/7	Anne Wallace		4	No	No	No	No	7	3		
Pittsburg Power Plant	Dana Riggs	Jason Yakich	1	Yes	Yes/50	No	Yes	4	Yes	Clear out spider webs from shelters	WRA
Alameda Point	Susan Euing	Meredith Elliott, Aviva Fiske	1	No	Approx. 250 wooden A-frames, 70 terracotta cylinders, 500 terracotta half-cylinders, scattered oyster shells	No	Yes/20m X 20m	4	1 & 2	smooth out and/or add sand as needed; reinstall grid system and chick shelters/ shells; replace sections of chick fence	FWS
Hayward Regional Shoreline	David Riensche, Mary Riensche, Sarah Riensche, Daniel Riensche, Nathan Riensche, Rebekah Riensche, Sarah A. Lockett and Cody Newell	Patrick Alvarez, Jaclyn Caldwell, Maggie Clark, Norman Chu, Rachel Crosby, Kala Crosby, Lien-Thi DeLa Pena, Emily DeLa Pena, Joshua DeLa Pena, Ed DeLa Pena, Teresa DeLa Pena, Megan DeLa Pena, Arthur Garibaldi, Carin High, Howard High, Sam High, Richard K	4	Yes	Yes/26	Yes/24	Yes/10m grid cells	2&3	1	See Notes 1	See Notes 2
Eden Landing	Cheryl Strong										
Kings County											
Kettleman City Evaporation Ponds	Jeff Seay										

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
San Luis Obispo/Santa Barbara Counties											
Oceano Dunes SVRA	Doug George, Amber Clark, Dano Costello, Ryan Slack, Cheryl Lish, Joanna Iwanich	Michael Maples, Natalie Folsom, Natalie Rathjen-Gonzales, Alison Fox, Mae Cowgill, Jillian Cosgrove, Chelsea Rose, Elicia Hildebrand	1, 3 (49 nests were within type 1 fencing. 8 nests were on the shoreline, outside the main enclosure and had type 3 fencing).	Yes	Yes, 192, plywood: A-shape shelter (typically six inches high by 12 inches long by 11 inches wide), L-shape shelter (typically seven inches high by 19 inches long by 14 inches wide), or T-shape shelter (12 inches by 12 inches flat roof with a center support partially buried in sand).	No	No	5 Least tern breeding site open to off-road vehicle use October to February and this prevents or removes vegetation. Efforts are made to encourage some vegetation for chick cover.	1, 2 (depends on the predator species and circumstances)	Limited amounts of driftwood, woodchips, seed, and plants were put out for nest and chick cover.	California Department of Parks and Recreation (Oceano Dunes State Vehicular Recreation Area)
Rancho Guadalupe Dunes Preserve	Tom Applegate	Melissa Kelly	3	Yes							
Vandenberg AFB-Purissima Pt.	Robinette	Howard, Hargett, Barcinas	1	Yes	Yes/46 V-shaped wooden plus 24 teepee style (see Notes for map)	No	No	6	2	Electric Fence Maintenance	ManTech
Coal Oil Point Reserve	April Price	Cristina Sandoval									
Ventura County											
Santa Clara River/McGrath State Beach	Alexis Frangis	Jennifer Gold	3	Yes	No	No	No	3	3		
Ormond Beach	Nancy Fox-Fernandez	Jerry Hidalgo, Jennifer Alvarado,	3	Yes	N/A	No	No	7	3	None	
Hollywood Beach	D. Barringer, D. Glenn	A. Frangis	3	Yes	No	No	No	6	3		
Pt Mugu - Holiday Beach	Martin Ruane	Francesca Ferrara, Rebecca Kelley,	4	Yes	Yes/25 shelters	No	No	7	1	No	
Pt Mugu - Holiday Beach Salt Panne	Martin Ruane	Francesca Ferrara, Rebecca Kelley,	4	Yes	No	No	No	7	1	No	
Pt Mugu - Eastern Arm	Martin Ruane	Francesca Ferrara, Rebecca Kelley,	4	Yes	No	No	No	7	1	No	
Pt Mugu - Ormond Beach East	Martin Ruane	Francesca Ferrara, Rebecca Kelley,	4	Yes	Yes/50 shelters	No	No	7	1	No	
Saticoy United Water Conservation District/Spreading Grounds (SG)	Rincon Consultants, Inc.		4								
Saticoy United Water Conservation District/Freeman Diversion	Rincon Consultants, Inc.		4								
Saticoy United Water Conservation District/Santa Clara River (SCR)	Rincon Consultants, Inc.		4								
Saticoy United Water Conservation District/Ferro Basin	Rincon Consultants, Inc.		4								
Saticoy United Water Conservation District/Noble/Rose Basins	Rincon Consultants, Inc.		4								

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Los Angeles/Orange Counties											
Venice Beach/Marina del Rey	Thomas Ryan	Stacey Vigallon, Joyce Regalano, Jessica Sosa	1	Yes	Yes	Yes/25	Yes/20x20m	2	1		
LA Harbor- Pier 400	Nathan Mudry (EGIS, LLC)	Kathy Keane, Spencer Langdon, Santiago Lopez, Nick Liberato, Matt Teutimez, Wally Ross, Lori Anderson, Bob Schallmann	3	Yes	Yes/49	Yes/15	Yes/30m	4	1,2		Port of Los Angeles, Quality Sprayers
Seal Beach NWR - Anaheim Bay	Matthew Teutimez, Santiago Lopez	Kirk Gilligan, Bob Schallmann, John Fitch, Charles Collins	1	Yes	Yes/roofing tiles	Yes/17	Yes/11 columns (A to K) and 11 rows (1 to 11).	4	2	Sand relocation at site, Electric fence maintenance, removal of visquene plastic underneath sand and salt	USFWS
Bolsa Chica Ecological Reserve - Nest Site 1	Peter Knapp	O'Reilly, Keller, Griswold, Collins	3	Yes	Yes/roofing tiles; n=40	No	Yes/20X20m	4	1		CDFW
Bolsa Chica Ecological Reserve - Nest Site 2	Peter Knapp	O'Reilly, Griswold	4	No	Yes/roofing tiles; n=2	No	Yes/20X20m	4	1		CDFW
Bolsa Chica Ecological Reserve - Nest Site 3	Peter Knapp	O'Reilly, Keller, Griswold	2	No	Yes/roofing tiles; n=40	No	Yes/20X20m	4	1		CDFW
Bolsa Chica Ecological Reserve - South Tern Island	Peter Knapp	O'Reilly, Griswold, Collins	4	No	Yes/roofing tiles; n=55	No	Yes/20X20m	4	1		CDFW
Huntington State Beach	Nicole Housel	Cyndie Kam, Allyson Beckman, Jill Coumoutso, Talula Barbee, Melody Aimar, Bonnie Johnson, Giovanni Arechavaleta, Maricela Paramo	1	Yes	Yes, 64/roofing tiles	No	Yes	1	1		CA State Parks
Burris Sand Pit/Burris Basin	David McMichael										
Upper Newport Bay Ecological Reserve	Taylor Van Berkum	Kathy Sheridan, John Hartman, Carla Navarro	4	Yes	Yes/~30 roof tiles	No	Yes/20x20m	4	3		

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
San Diego County											
MCB Camp Pendleton - Red Beach	J. Fournier	K. Turner, E. Rice, J. Symons, M. Evans	4	Yes	No	No	No	7	3		
MCB Camp Pendleton - Delta Beach	J. Fournier										
MCB Camp Pendleton - White Beach	J. Fournier	K. Turner, E. Rice, J. Symons, M. Evans	3	Yes	No	No	Yes/30m	4	1		
MCB Camp Pendleton - Santa Margarita River - North Beach	J. Fournier	K. Turner, E. Rice, J. Symons, M. Evans	3	Yes	No	No	Yes/30m	4	1		
MCB Camp Pendleton - Santa Margarita River - South Beach	J. Fournier	K. Turner, E. Rice, J. Symons, M. Evans	3	Yes	No	No	Yes/30m	4	1		
MCB Camp Pendleton - Santa Margarita River - Saltflats	J. Fournier	K. Turner, E. Rice, J. Symons, M. Evans	4	No	No	No	Yes/30m	7	1		
Batiquitos Lagoon Ecological Reserve - W1	Warren Wong	Frost, Miner, Penafior, Hupf, Edwards Dillingham, Stewart, Llanas	1	No	Yes/~30 roofing tiles	No	Yes/20X20	4	1		CDFW
Batiquitos Lagoon Ecological Reserve - W2	Warren Wong	Frost, Miner, Penafior, Hupf, Edwards Dillingham, Stewart	1	No	Yes/~60 roofing tiles	No	Yes/20X20m	4	1		CDFW
Batiquitos Lagoon Ecological Reserve - E1	Warren Wong	Frost, Miner, Penafior, Hupf, Edwards Dillingham, Stewart, Llanas	1	No	Yes/~80 roofing tiles	No	Yes/20X20	4	1		CDFW
Batiquitos Lagoon Ecological Reserve - E2	Warren Wong										
Batiquitos Lagoon Ecological Reserve - E3	Warren Wong	Frost, Miner, Penafior, Hupf, Edwards Dillingham, Stewart, Llanas	4	No	Yes/~30 roofing tiles	No	No	4	3		CDFW
San Elijo Lagoon Ecological Reserve Fairbanks Ranch	Robert Patton Brian Foster		3	Yes	No	No	No	7	3		
San Dieguito Lagoon Ecological Reserve NS11	Brian Foster	Elizabeth Copper	3	No	Yes/several	Yes/40 per site	Yes/30m	1,3	1		
San Dieguito Lagoon Ecological Reserve NS12	Brian Foster	Elizabeth Copper	3	No	Yes/several	Yes/40 per site	Yes/30m	1,3	1		
San Dieguito Lagoon Ecological Reserve NS13	Brian Foster	Elizabeth Copper	1	No	Yes/several	No	Yes/30m	1,3	1		
San Dieguito Lagoon Ecological Reserve NS14	Brian Foster	Elizabeth Copper	1	No	Yes/several	No	Yes/30m	1,3	1		
Mission Bay											
FAA Island	FAA Island	Jennifer Jackson	4	Yes	Yes/12	Yes/40	Yes/10m	4	1		Audubon
North Fiesta Island	Ginger Johnson		1	Yes	Yes/60	Yes/60	Yes	4	1	Vegetation studies	San Diego Audubon Society
Mariner's Point	Ginger Johnson		1	Yes	Yes/50	Yes/40	Yes	4	1	vegetation studies, hand weeding	San Diego Audubon Society volunteers
Stony Point	Ginger Johnson		1	Yes	Yes/30 to 40	Yes/59	Yes	4	1	Vegetation studies	San Diego Audubon Society
San Diego River Mouth	Ginger Johnson		1	Yes	No	No	No	6	3	chick fence at base of fence around north part of site	San Diego City Parks Dept

Appendix B-2: Monitoring in 2013.

Site name	Site type	Date of first monitoring visit	Date of last monitoring visit	Total number of monitoring visits	Nest marking	Egg marking	Banding	If color-banding, what color(s) were used
Sacramento Area								
Bufferlands		28-Jun-13	29-Jun-13	2	n/a			
San Francisco Bay Area								
Napa Sonoma Marsh Wildlife Area -	1							
Green Island Unit	1	8-May-13	9-Jul-13	4	n/a			
Pond 7/7A	1	1-May-13	19-Aug-13	26	Yes, black paint pen.	No	No	
Montezuma -	2							
Site 3/4	2	24-May-13	19-Aug-13	21	No	No	No	
Site 6/7	2	24-May-13	15-Jul-13	15	No	No	No	
Pittsburg Power Plant	2	10-May-13	19-Jul-13	9	No	No	No	
Alameda Point	1	23-Apr-13	30-Aug-13	111	Yes, 3 inch white washers with black paint.	No	No	
Hayward Regional Shoreline	1	15-Apr-13	9-Aug-13	114	Yes, 5cm washers.	No	No	
San Luis Obispo/Santa Barbara Counties								
Oceano Dunes SVRA	3	28-May-13	30-Aug-13	95	Yes, usually naturally occurring materials present on the site.	No	Yes, chick	Size 1A blank aluminum band is covered with white over blue vinyl tape (to make a bicolored band) on right leg for all chicks. FWS band placed on left leg and tape in 1 to 2 colors placed on this band to create combos unique to each bird.
Rancho Guadalupe Dunes Preserve	2	25-May-13	8-Jun-13	15				
Vandenberg AFB-Purisima Pt.	3	15-Apr-13	9-Aug-13	80	Yes, numbered tongue depressors placed 1m from nest.	No	No	
Coal Oil Point Reserve								
Ventura County								
Santa Clara River/McGrath State Beach	1	9-May-13	15-Aug-13	16	Yes, natural driftwood or buried tongue depressor.	No	No	
Hollywood Beach	1	28-Apr-13	1-Sep-13	17	Yes, tongue depressors.	No	No	
Ormond Beach	1	1-Apr-13	14-Aug-13	21	Yes, tongue depressors.	No	No	
Pt Mugu -	1							

Site name	Site type	Date of first monitoring visit	Date of last monitoring visit	Total number of monitoring visits	Nest marking	Egg marking	Banding	If color-banding, what color(s) were used
Holiday Beach	1	13-May-13	22-Jul-13	18	Yes, tongue depressors.	No	No	
Holiday Salt Panne	1	23-May-13	27-Jun-13	11	Yes, tongue depressors.	No	No	
Eastern Arm	1	30-May-13	25-Jun-13	5	Yes, tongue depressors.	No	No	
Ormond Beach East	1	9-May-13	29-Jul-13	23	Yes, tongue depressors.	No	No	
Saticoy united Water Conservation District	2				No	No	No	
Los Angeles/Orange Counties								
Venice Beach/Marina del Rey	1	15-Apr-13	15-Jul-13	20	Yes, tongue depressors.	No	No	
LA Harbor- Pier 400	1	24-May-13	19-Jul-13	16	Yes, tongue depressors.	No	No	
Seal Beach NWR - Anaheim Bay	1	8-May-13	31-Jul-13	13	Yes, tongue depressors.	No	Yes, chick	
Bolsa Chica Ecological Reserve -	1							
Nest Site 1 (NS1)	1	21-May-13	6-Jun-13	7	Yes, tongue depressors.	No	No	
Nest Site 2 (NS2)	1	16-May-13	23-Jul-13	11	Yes, tongue depressors.	No	No	
Nest Site 3 (NS3)	1	23-May-13	13-Jun-13	4	Yes, tongue depressors.	No	No	
South Tern Island (STI)	1	14-May-13	9-Jul-13	9	Yes, tongue depressors.	No	No	
Burris Sand Pit/Burris Basin		22-Apr-13	31-Aug-13	14				
Huntington State Beach	1	10-May-13	15-Aug-13	56	Yes, tongue depressors.	No	No	
Upper Newport Bay Ecological Reserve	3	10-Apr-13	7-Aug-13	35	Yes, tongue depressors.	No	No	
San Diego County								
MCB Camp Pendleton -	1							
Red Beach	1	4-Mar-13	20-Aug-13	40	Yes, shim with black sharpie.	No	No	
White Beach	1	4-Mar-13	20-Aug-13	50	Yes, shim with black sharpie.	No	No	
Santa Margarita River - North Beach North	1	1-Mar-13	6-Sep-13	60	Yes, shim with black sharpie.	No	Yes, chick	
Santa Margarita River - North Beach South	1	1-Mar-13	6-Sep-13	60	Yes, shim with black sharpie.	No	Yes, chick	
Santa Margarita River - Saltflats and Island	1	5-Mar-13	23-Jul-13	48	Yes, shim with black sharpie.	No	No	
Batiquitos Lagoon Ecological Reserve	1, 3							
E1	1	30-Apr-13	6-Aug-13	28	Yes, tongue depressors.	No	No	
E3	3	30-Apr-13	6-Aug-13	28	Yes, tongue depressors.	No	No	
W1	1	30-Apr-13	6-Aug-13	28	Yes, tongue depressors.	No	No	
W2	1	30-Apr-13	6-Aug-13	28	Yes, tongue depressors.	No	No	
San Elijo Lagoon Ecological Reserve	1	30-Apr-13	6-Aug-13	28	No	No	No	
Fairbanks Ranch								
San Dieguito Lagoon	1	15-Mar-13	9-Jul-13	18	Yes, tongue depressors.	No	Yes, adult	

Site name	Site type	Date of first monitoring visit	Date of last monitoring visit	Total number of monitoring visits	Nest marking	Egg marking	Banding	If color-banding, what color(s) were used
Mission Bay								
FAA Island	1	29-Apr-13	9-Aug-13	35	Yes	No	Yes, chick	
North Fiesta Island	1	17-Apr-13	30-Jul-13	14	No	No	No	
Mariner's Point	1	16-Apr-13	15-Aug-13	25	Yes, tongue depressors.	Yes	Yes, chick	
Stony Point	1	20-Apr-13	15-Aug-13	28	Yes	Yes	Yes, chick	
San Diego River Mouth	1	21-Apr-13	1-Aug-13	16	No	No	No	
San Diego Bay								
Lindbergh Field & Former Naval Training Center	1	5-Apr-13	26-Aug-13	66	Yes, spray paint on substrate and sharpie on small rock.	No	Yes, chick and adult	Adult with F/K over FWS band on left and W on right leg.
US Navy - NI MAT	1	4-Mar-13	13-Sep-13	40	n/a			
US Navy - NI18	3	17-Jul-13	13-Sep-13	5	No	No	Yes, chick	
Naval Base Coronado -	1							
Delta Beach North	1	4-Mar-13	9-Sep-13	60	Yes, 3 in. PVC rounds painted to match substrate.	No	Yes, chick	
Delta Beach South	1	4-Mar-13	9-Sep-13	60	Yes, 3 in. PVC rounds painted to match substrate.	No	Yes, chick	
NAB Ocean	1	4-Mar-13	11-Sep-13	120	Yes, shim with black sharpie and tongue depressors.	No	Yes, chick	
D Street Fill/Sweetwater Marsh NWR	1	9-Apr-13	20-Aug-13	41	Yes, tongue depressors.	No	Yes, chick and adult	Adult with W on left, FWS band over W/M on right.
Chula Vista Wildlife Reserve	1	13-Apr-13	20-Aug-13	58	Yes, tongue depressors.	No	Yes, chick and adult	Adult Y/K or K/Y over FWS band on left, W on right. And W on left leg with FWS band on right. And F over FWS band on left with nothing on right leg.
South San Diego Bay Unit, SDNWR -	1							
Saltworks	1	9-Apr-13	28-Aug-13	26	Yes, tongue depressors.	No	Yes, chick	
SE Pond 11	1	5-Apr-13	20-Aug-13	24	Yes, tongue depressors.	No	Yes, chick	
Tijuana Estuary NERR	1							
Tijuana North	1	11-Apr-13	29-Aug-13	23	Yes, tongue depressors.	No	Yes, chick	
Tijuana South – North of trail	1	11-Apr-13	29-Aug-13	23	Yes, tongue depressors.	No	Yes, chick	
Tijuana South – South of river	1	11-Apr-13	29-Aug-13	23	Yes, tongue depressors.	No	Yes, chick	
Tijuana South – South of trail	1	11-Apr-13	29-Aug-13	23	Yes, tongue depressors.	No	Yes, chick	

Site name	Site type	Date of first monitoring visit	Date of last monitoring visit	Total number of monitoring visits	Nest marking	Egg marking	Banding	If color-banding, what color(s) were used
Imperial County								
Salton Sea		11-May-13	26-Jun-13	7				

Appendix B-2: Monitoring in 2013 (continued). Color combinations of current and past California least tern banding studies conducted at breeding areas in California.

Site	Year	Age	Abbreviation	Color*
Oceano Dunes SVRA		Chicks	G/Y, Y/G, W/B	Green/Yellow, Yellow/Green, Various (Left): White/Blue (Right)
Seal Beach			Y/K	Yellow/Black
Camp Pendleton	?-2009	Chicks	K/M	Black/Mauve
Batiquitos	198?-2011	Chicks, Adults	R/W	Red/White
San Dieguito	2013	1 Adult	K/F	Black/Fuchsia
Mariner's Point	198?-2013	Chicks	B/G	Blue/Green
Stony Point	2013	Chicks	B/G	Blue/Green
Lindbergh Field	2008-2011	Adults	G/W	Green/White
Lindbergh Field	2012,2013	Adults	K/F	Black/Fuchsia
North Island MAT	198?-2010	Chicks/Adults	O/A	Orange/Aqua
North Island Runway 11		Chicks	K/A	Black/Aqua
Delta Beach North	198?-2010	Chicks/Adults	R/Y	Red/Yellow
Delta Beach South	199?-2010	Chicks/Adults	K/W	Black/White
Naval Amphibious Base Ocean	199?-2010	Chicks/Adults	P/B	Dark Pink/Blue
D Street	2008, 2012	Adults	M/W	Mauve/White
Chula Vista Wildlife Reserve	2008, 2009, 2010, 2011, 2012, 2013	Adults	K/Y	Black/Yellow
Saltworks	2008, 2009, 2010, 2011, 2012	Adults	M/L	Mauve/Lime
Tijuana Estuary	2008, 2009, 2011, 2012	Adults	R/G	Red/Green
Project Wildlife (rehabilitated birds released to the wild)	2002			Anodized Blue
Project Wildlife (rehabilitated birds released to the wild)	2003			Anodized Green
Project Wildlife (rehabilitated birds released to the wild)	2004			Anodized Red
Project Wildlife (rehabilitated birds released to the wild)	2005			Anodized Red
Various	2000	Adults	G	Green
Various	2008	Adults	A	Light Blue
Various	2009	Adults	R	Red
Various	2010	Adults	K	Black
Various	2011	Adults	L	Lime Green
Various	2012	Adults	F	Fuchsia
Various	2013	Adults	W	White
Various	2014	Adults	B	Dark Blue

*With the exception of Oceano Dunes, Seal Beach, and Project Wildlife, all color band information provided by E. Copper (pers. comm. November 4, 2014).

Appendix B-3: Pair Estimation in 2013 (Method I).

Site name	Date terns first observed*	Date terns last observed	Date of first nest	Date of last nest initiation	Total nests in first wave	Total nests in second wave	Total pairs	Total nests
Sacramento Area								
Bufferlands	28-Jun-13	29-Jun-13	n/a					0
San Francisco Bay Area								
Napa Sonoma Marsh Wildlife Area – Totals	1-May-13	19-Aug-13	30-May-13	18-Jul-13	42	38		80
Green Island Unit	20-May-13	20-May-13	n/a					0
Pond 7/7A	1-May-13	19-Aug-13	30-May-13	18-Jul-13	42	38	61	80
Montezuma – Totals	5-May-13	19-Aug-13	27-May-13	8-Jul-13	22	7	25	29**
Site 3/4	27-May-13	19-Aug-13	27-May-13	8-Jul-13	9	6	12	15**
Site 6/7	5-May-13	8-Jul-13	24-May-13	1-Jul-13	13	1	13	14**
Pittsburg Power Plant	7-Jun-13	7-Jun-13	n/a					0
Alameda Point	23-Apr-13	24-Aug-13	14-May-13	16-Jul-13	272	20	282	292
Hayward Regional Shoreline	29-Apr-13	9-Aug-13	12-May-13	28-Jun-13	75	10	80	85**
San Luis Obispo/Santa Barbara Counties								
Oceano Dunes SVRA	nr	nr	31-May-13	15-Jul-13	31	26	43	57
Rancho Guadalupe Dunes Preserve	25-May-13	8-Jun-13	n/a				0-1***	0
Vandenberg AFB-Purisima Pt.	13-May-13	6-Aug-13	5-Jun-13	18-Jun-13	13	2	14	15
Coal Oil Point Reserve			n/a					0
Ventura County								
Ormond Beach	1-May-13	24-Jul-13	4-Jun-13	12-Jun-13	7	0	7	7
Hollywood Beach	28-Apr-13	24-Aug-13	27-Jun-13	2-Aug-13	26	183	117	209
Santa Clara River/McGrath State Beach	30-May-13	21-Jun-13	30-May-13	12-Jun-13	37	0	37	37
Pt Mugu - Totals	nr	nr	9-May-13	13-Jun-13	333	13	337	346
Holiday Beach	nr	nr	13-May-13	13-Jun-13	159	5	161	164
Holiday Salt Panne	nr	nr	23-May-13	6-Jun-13	11	0	11	11
Eastern Arm	nr	nr	30-May-13	19-Jun-13	4	1	4	5
Ormond Beach East	nr	nr	9-May-13	10-Jun-13	159	7	161	166
Saticoy united Water Conservation District	nr	nr	n/a					0
Los Angeles/Orange Counties								
Venice Beach/Marina del Rey	22-Apr-13	24-Jun-13	10-May-13	24-Jun-13	9	6	12	15
LA Harbor	30-May-13	19-Jul-13	24-May-13	9-Jul-13	220	34	237	254
Seal Beach NWR - Anaheim Bay	8-May-13	31-Jul-13	8-May-13	17-Jul-13	135	29	149	164
Bolsa Chica Ecological Reserve -Totals	nr	nr	14-May-13	9-Jul-13	125	32	147	157
Nest Site 1 (NS1)	nr	nr	21-May-13	4-Jun-13	20	0	20	20
Nest Site 2 (NS2)	nr	nr	16-May-13	9-Jul-13	38	12	44	50
Nest Site 3 (NS3)	nr	nr	30-May-13	7-Jun-13	3	0	3	3
South Tern Island (STI)	nr	nr	14-May-13	2-Jul-13	64	20	80	84
Huntington State Beach	17-May-13	14-Aug-13	24-May-13	2-Jul-13	314	33	331	347
Burris Sand Pit/Burris Basin	nr	31-Aug-13	5-Jun-13	29-Jul-13	13	10	18	23

Site name	Date terns first observed*	Date terns last observed	Date of first nest	Date of last nest initiation	Total nests in first wave	Total nests in second wave	Total pairs	Total nests
Upper Newport Bay Ecological Reserve					22	10	27	32
San Diego County								
MCB Camp Pendleton - Totals	12-Apr-13	1-Aug-13	4-May-13	18-Jul-13	1156	86	1107	1242
Red Beach	nr	nr	21-May-13	5-Jul-13	18	5	20	23
White Beach	22-Apr-13	19-Jul-13	10-May-13	10-Jul-13	68	32	84	100
Santa Margarita River - North Beach North	22-Apr-13	31-Jul-13	8-May-13	1-Jul-13	174	9	178	183
Santa Margarita River - North Beach South	12-Apr-13	1-Aug-13	4-May-13	18-Jul-13	872	35	883	907
Santa Margarita River - Saltflats and Island	19-Apr-13	6-Jul-13	9-May-13	25-Jun-13	24	5	26	29
Batiquitos Lagoon Ecological Reserve - Totals	30-Apr-13	30-Jul-13	30-Apr-13	29-Jun-13	542	16	549	558
E1	30-Apr-13	23-Jul-13	5-May-13	29-Jun-13	46	3	47	49
E2			n/a					0
E3	nr	nr	29-May-13	29-May-13	14	0	14	14
W1	30-Apr-13	30-Jul-13	3-May-13	18-Jun-13	37	0	37	37
W2	30-Apr-13	30-Jul-13	30-Apr-13	28-Jun-13	445	13	451	458
San Elijo Lagoon Ecological Reserve			n/a					0
Fairbanks Ranch			n/a					0
San Dieguito Lagoon Ecological Reserve - Totals	30-Apr-13	nr	12-May-13	26-May-13	3	0	3	3
NS11	30-Apr-13	nr	12-May-13	n/a	1	0	1	1
NS12			14-May-13	26-May-13	2	0	2	2
NS13			n/a					0
NS14			n/a					0
Mission Bay								
FAA Island	29-Apr-13	9-Aug-13	7-May-13	5-Jul-13	134	22	145	156
North Fiesta Island	10-May-13	5-Jun-13	n/a					0
Mariner's Point	27-Apr-13	8-Jul-13	8-May-13	2-Jul-13	32	5	34	37
Stony Point	1-May-13	9-Jul-13	1-May-13	26-Jun-13	32	9	36	41
San Diego River Mouth	None seen		n/a					0
San Diego Bay								
Lindbergh Field & Former Naval Training Center	22-Apr-13	19-Aug-13	13-May-13	6-Aug-13	99	15	106	114
US Navy - NI MAT	None seen		n/a					0
US Navy - NI18	17-Jul-13	nr	unknown	unknown	unknown		unknown	7**
Naval Base Coronado - Totals	19-Apr-13	28-Aug-13	1-May-13	31-Jul-13	800	234	912	1034
Delta Beach North	19-Apr-13	26-Jul-13	2-May-13	5-Jul-13	163	45	185	208
Delta Beach South	24-Apr-13	9-Aug-13	1-May-13	26-Jul-13	142	32	158	174
NAB Ocean	19-Apr-13	28-Aug-13	1-May-13	31-Jul-13	495	157	569	652
D Street Fill/Sweetwater Marsh NWR	16-Apr-13	7-May-13	13-Aug-13	23-Jul-13	108	36	126	144
Chula Vista Wildlife Reserve	13-Apr-13	10-Aug-13	14-May-13	2-Jul-13	60	19	69	79
South San Diego Bay Unit, SDNWR - Totals	15-May-13	26-Jul-13	15-May-13	10-Jul-13	31	14	38	45
Saltworks	15-May-13	26-Jul-13	15-May-13	10-Jul-13	28	12	34	40

Site name	Date terns first observed*	Date terns last observed	Date of first nest	Date of last nest initiation	Total nests in first wave	Total nests in second wave	Total pairs	Total nests
SE Pond 11	nr	nr	18-May-13	24-Jun-13	3	2	4	5
Tijuana Estuary NERR – Totals	9-May-13	15-Aug-13	9-May-13	25-Jul-13	209	73	245	282
Tijuana North	9-May-13	15-Aug-13	9-May-13	25-Jul-13	55	39	74	94
Tijuana South – North of trail	9-May-13	1-Aug-13	16-May-13	7-Jul-13	1	2	2	3
Tijuana South – South of river	16-May-13	15-Aug-13	16-May-13	7-Jul-13	24	6	27	30
Tijuana South – South of trail	9-May-13	15-Aug-13	9-May-13	11-Jul-13	129	26	142	155
Imperial County								
Salton Sea	11-May-13	26-Jun-13	11-May-13	18-May-13	2	0	2	2

Appendix B-3 Legend:

nr=not reported

*Some dates determined from initiation of first nest.

**Minimum numbers obtained from number of observed nesting individuals, assuming each nest had at least one egg, and/or number of chicks and fledglings seen on site.

***No nests were documented at Rancho Guadalupe, but one pair was observed daily from 25 May - 8 June in flight with fish over the previously used nesting area, on the ground, and copulating.

Appendix B-3: Pair Estimation in 2013 (Method II and III).

	Pair Estimation II				Pair Estimation III							
Site name:	Total nests:	Number of unsuccessful nests before 20 June:	Estimated broods lost before 20 June:	*Total pairs not reneesting:	Date of second wave start (if any):	Total first wave nests:	Estimated renesters first wave:	Total Pairs first wave:	Total nests 2nd wave:	Estimated renesters 2nd wave:	Total Pairs 2nd wave:	Total Pairs:
Sacramento Area												
Bufferlands	0											
San Francisco Bay Area												
Napa Sonoma Marsh Wildlife Area - Totals	80	3	0	77		nr						
NSMWA-Green Island Unit	0											
NSMWA-Pond 7/7A	80	3	0	77								
Montezuma Wetlands - Totals	29	unknown	unknown			nr						
Site 3/4	15											
Site 6/7	14											
Pittsburg Power Plant	0											
Alameda Point	292	0	11.5	280.5		nr						
Hayward Regional Shoreline	85	2	2	81	15-Jun-13	75	2	73	10	2	8	81
San Luis Obispo/Santa Barbara Counties												
Oceano Dunes SVRA	57	3		54	15-Jun-13	31	1	30	26	4	22	52
Rancho Guadalupe Dunes Preserve	0											
Vandenberg AFB-Purissima Pt.	15	0	0	15	15-Jun-13	13	0	13	2	0	2	15
Coal Oil Point Reserve	0											
Ventura County												
Ormond Beach	7	1	0	6		nr						
Hollywood Beach	209	0	0	209		nr						
Santa Clara River/McGrath State Beach	37	37	0	0**	15-Jun-13	37	0	37	0	0	0	37
Pt Mugu- Totals	346	143	0	203		nr						
Holiday Beach	164	50	0	114								
Holiday Salt Panne	11	2	0	9								
Eastern Arm	5	1	0	4								
Ormond Beach East	166	90	0	76								
Saticoy United Water Conservation District	0											
Los Angeles/Orange Counties												
Venice Beach/Marina del Rey	15	14	0	1**	15-Jun-13	15	0	15	0	0	0	15
LA Harbor- Pier 400	254	15	0	239	15-Jun-13	220	0	220	34	17	17	237
Seal Beach NWR - Anaheim Bay	164	2	1	161		nr						
Bolsa Chica Ecological Reserve - Totals	157	37	0	120		nr						
Nest Site 1 (NS1)	20	20	0	0**								

	Pair Estimation II				Pair Estimation III							
Site name:	Total nests:	Number of unsuccessful nests before 20 June:	Estimated broods lost before 20 June:	*Total pairs not renesting:	Date of second wave start (if any):	Total first wave nests:	Estimated renesters first wave:	Total Pairs first wave:	Total nests 2nd wave:	Estimated renesters 2nd wave:	Total Pairs 2nd wave:	Total Pairs:
Nest Site 2 (NS2)	50	0	0	50								
Nest Site 3 (NS3)	3	3	0	0**								
South Tern Island (STI)	84	14	0	70								
Huntington State Beach	347	34	3	310	15-Jun-13	314	16	298	33	28	5	303
Burris Sand Pit/Burris Basin	23	0	0	23	15-Jun-13	13	2	11	10	4	6	17
Upper Newport Bay Ecological Reserve	32	1	0	31		nr						
San Diego County												
MCB Camp Pendleton - Totals	1242	374	82.5	785.5		nr						
Red Beach	23	17	0	6								
White Beach	100	42	1	57								
Santa Margarita River - North Beach North	183	101	6	76								
Santa Margarita River - North Beach South	907	198	75.5	633.5								
Santa Margarita River - Saltflats and Island	29	16	0	13								
Batiquitos Lagoon Ecological Reserve - Totals	558	24	91.5	442.5		nr						
E1	49	3	3	43								
E2	0											
E3	14	1	0	13								
W1	37	2	2	33								
W2	458	18	86.5	353.5								
San Elijo Lagoon Ecological Reserve	0											
Fairbanks Ranch	0											
San Dieguito Lagoon Ecological Reserve	3	2	1	0**	15-Jun-13	3	0	3	0	0	0	3
NS11	1	0	1	0**								
NS12	2	2	0	0**								
NS13	0											
NS14	0											
Mission Bay												
FAA Island	156	34	24	98		134	1	133	22	21	1	134
North Fiesta Island	0											
Mariner's Point	37	20	0	17	15-Jun-13	32	3	29	5	0	5	34
Stony Point	41	1	1.5	32.5	15-Jun-13	32	5	27	9	0	9	36
San Diego River Mouth	0											

Site name:	Pair Estimation II				Pair Estimation III							
	Total nests:	Number of unsuccessful nests before 20 June:	Estimated broods lost before 20 June:	*Total pairs not renesting:	Date of second wave start (if any):	Total first wave nests:	Estimated renesters first wave:	Total Pairs first wave:	Total nests 2nd wave:	Estimated renesters 2nd wave:	Total Pairs 2nd wave:	Total Pairs:
San Diego Bay												
Lindbergh Field & Former Naval Training Center	114	9	2.5	102.5	15-Jun-13	99	23	76	15	0	15	91
US Navy - NI MAT	0											
US Navy - NI18	7	unknown	unknown			nr						
Naval Base Coronado - Totals	1034	252	68.5	713.5		nr						
Delta Beach North	208	49	14.5	144.5								
Delta Beach South	174	35	13	126								
NAB Ocean	652	168	41	443								
D Street Fill/Sweetwater Marsh NWR	144	8	7.5	128.5		108	31	77	36	0	36	113
Chula Vista Wildlife Reserve	79	5	1	73		60	13	47	19	0	19	66
South San Diego Bay Unit, SDNWR - Totals	45	11	2	32	15-Jun-13	31	18	13	14	0	14	27
Saltworks	40	11	2	27								
SE Pond 11	5	0	0	5								
Tijuana Estuary NERR - Totals	282	58	0	224	15-Jun-13	207	76	131	75	0	75	206
Tijuana North	94	11	0	83								
Tijuana South – North of trail	3	1	0	2								
Tijuana South – South of river	30	10	0	20								
Tijuana South – South of trail	155	36	0	119								
Imperial County												
Salton Sea	2	0	0	2		2	0	2	0	0	0	2

Appendix B-3 Legend:

nr=not reported

*Total pairs not renesting calculated using nesting chronology and mortality databases.

**Assumed that numbers of nests initiated prior to June 20 at sites with complete failure are an estimate of pairs.

Appendix B-4: Productivity in 2013.

Site name	Total nests	Total eggs	No. of eggs hatched	Hatching Success	Date of first chick	Date of last hatch	Max # active nests	Date of max active nests	Date of first fledgling	Fledgling estimate method	Total fledges
Sacramento Area											
Bufferlands	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
San Francisco Bay Area											
Napa Sonoma Marsh Wildlife Area - Totals	80	169	92	0.54	17-Jun-13	5-Aug-13	47	24-Jun-13	8-Jul-13	3WD	11-20
NSMWA-Green Island Unit	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NSMWA-Pond 7/7A	80	169	92	0.54	17-Jun-13	5-Aug-13	43	17-Jun-13 to 20-Jun-13	8-Jul-13	3WD	11-20
Montezuma Wetlands - Totals	29	37*	Unknown	Unknown	Unknown	Unknown	22	5-Jun-13	8-Jul-13	Other	3-4
Site 3/4	15	18*	Unknown	Unknown	20-Jun-13**	26-Jul-13**	16	5-Jun-13	15-Jul-13	Other	1-2
Site 6/7	14	19*	Unknown	Unknown	Unknown	Unknown	7	5-Jun-13	8-Jul-13	Other	2
Pittsburg Power Plant	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Alameda Point	292	556	474	0.85	27-May-13	8-Jul-13	247	30-May-13	20-Jun-13	2WD	302
Hayward Regional Shoreline	85	85*	Unknown	Unknown	24-May-13	19-Jul-13	65	7-Jun-13	20-Jun-13	3WD	118-122
San Luis Obispo/Santa Barbara Counties											
Oceano Dunes SVRA	57	107*	84	0.79	21-Jun-13	3-Aug-13	34	20-Jun-13		Other	56
Rancho Guadalupe Dunes Preserve	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Vandenberg AFB-Purisima Pt.	15	30	26	0.87	24-Jun-13	2-Jul-14	15	24-Jun-13	15-Jul-13	3WD	19
Coal Oil Point Reserve	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ventura County											
Ormond Beach	7	10	0	0.0	n/a	n/a	4	4-Jun-13 & 12-Jun-13	n/a	n/a	n/a
Hollywood Beach	209	312	246	0.79	27-Jun-13	11-Aug-13	165	4-Jul-13	18-Jul-13	3WD	31
Santa Clara River/McGrath State Beach	37	61	0	0.0	n/a	n/a	29	12-Jun-13	n/a	n/a	n/a
Pt Mugu- Totals	346	487	19	0.039	20-Jun-13	1-Jul-13	225	6-Jun-13	n/a	n/a	0
Holiday Beach	164	242	9	0.037	20-Jun-13	24-Jun-13	121	6-Jun-13	n/a	n/a	0
Holiday Salt Panne	11	16	3	0.19	24-Jun-13	24-Jun-13	11	6-Jun-14	n/a	n/a	0
Eastern Arm	5	8	0	0.0	n/a	n/a	4	4-Jun-13 & 19-Jun-13	n/a	n/a	n/a
Ormond Beach East	166	221	7	0.032	28-Jun-13	1-Jul-13	93	6-Jun-13	n/a	n/a	0
Saticoy United Water Conservation District	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Los Angeles/Orange Counties											
Venice Beach/Marina del Rey	15	15	0	0.0	n/a	n/a	5	9-Jun-13	n/a	n/a	n/a
LA Harbor- Pier 400	254	400	247	0.62	11-Jun-13	12-Jul-13	203	14-Jun-13	9-Jul-13	3WN	31-147
Seal Beach NWR - Anaheim Bay	164	258	202	0.78	5-Jun-13	17-Jul-13	131	12-Jun-13	31-Jul-13	R	89
Bolsa Chica Ecological Reserve -Totals	157	237	118	0.50	5-Jun-13	9-Jul-13				Other	35-67
Nest Site 1 (NS1)	20	29	0	0.0	n/a	n/a	14	21-May-13	n/a	n/a	n/a

Site name	Total nests	Total eggs	No. of eggs hatched	Hatching Success	Date of first chick	Date of last hatch	Max # active nests	Date of max active nests	Date of first fledgling	Fledgling estimate method	Total fledges
Nest Site 2 (NS2)	50	81	68	0.84	6-Jun-13	9-Jul-13	37	20-Jun-13		Other	34-66
Nest Site 3 (NS3)	3	3	0	0.0	n/a	n/a	3	7-Jun-13	n/a	n/a	n/a
South Tern Island (STI)	84	124	50	0.40	5-Jun-13	2-Jul-13	51	4-Jun-13		Other	1
Huntington State Beach	347	446	304	0.68	7-Jun-13	23-Jul-13	273	14-Jun-13	28-Jun-13	3WD	100
Burris Sand Pit/Burris Basin	23	43	9	0.21	19-Jun-13	10-Jul-13	14	19-Jun-13	29-Jul-13		1-4
Upper Newport Bay Ecological Reserve	32	55	5	0.091	9-May-13	10-Jul-13	17	5-Jun-13 & 10-Jun-13	27-Jun-13		8
San Diego County											
MCB Camp Pendleton - Totals	1242	2064	1185	0.57	25-May-13	13-Jul-13	751	30-May-13	19-Jun-13	3WD, R, other	150
Red Beach	23	36	2	0.056	10-Jun-13	10-Jun-13	12	10-Jun-13	5-Jul-13	other	2
White Beach	100	155	38	0.25	3-Jun-13	8-Jul-13	43	29-May-13	1-Jul-13	3WD, other	9
Santa Margarita River - North Beach North	183	293	109	0.37	3-Jun-13	5-Jul-13	92	29-May-13	24-Jun-13	3WD, R, other	12
Santa Margarita River - North Beach South	908	1534	1025	0.69	25-May-13	13-Jul-13	605	30-May-13	19-Jun-13	3WD, R, other	127
Santa Margarita River - Saltflats and Island	29	46	11	0.24	4-Jun-13	27-Jun-13	12	6-Jun-13	n/a	n/a	0
Batiquitos Lagoon Ecological Reserve - Totals	558	937	720	0.77	24-May-13	19-Jul-13	399	4-Jun-13	18-Jun-13	3WD, other	117-163
E1	49	81	54	0.67	31-May-13	2-Jul-13	37	31-May-13	25-Jul-13	Other	8-28
E2	0	0	0	0.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a
E3	14	27	0	0.0	n/a	n/a	13	29-May-13	n/a	n/a	n/a
W1	37	62	44	0.71	31-May-13	5-Jul-13	27	4-Jun-13	21-Jun-13	Other	10-27
W2	458	767	622	0.81	24-May-13	19-Jul-13	358	28-May-13	18-Jun-13	Other	99-108
San Elijo Lagoon Ecological Reserve	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Fairbanks Ranch	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
San Dieguito Lagoon Ecological Reserve	3	6	0	0.0	n/a	n/a	2	14-May-13		n/a	n/a
NS11	1	2	2	1.0	n/a	n/a	1	12-May-13 to 14-Jun-13		n/a	n/a
NS12	2	4	0	0.0	n/a	n/a	1	14-May		n/a	n/a
NS13	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NS14	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Mission Bay											
FAA Island	156	263	101	0.38	29-May-13	17-Jul-13	110	3-Jun-13	24-Jun-13	3WN	7
North Fiesta Island	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Mariner's Point	37	54	11	0.20	10-Jun-13	11-Jun-13	23	30-May-13 & 8-Jun-13	n/a	n/a	0
Stony Point	41	69	40	0.58	4-Jun-13	17-Jun-13	31	31-May-13 to 4-Jun-13	30-Jun-13	3WD	3
San Diego River Mouth	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
San Diego Bay											
Lindbergh Field & Former Naval Training Center	114	160	109	0.68	7-Jun-13	16-Jul-13	90	7-Jun-13	2-Jul-13	2WD, R	37

Site name	Total nests	Total eggs	No. of eggs hatched	Hatching Success	Date of first chick	Date of last hatch	Max # active nests	Date of max active nests	Date of first fledgling	Fledgling estimate method	Total fledges
US Navy - NI MAT	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
US Navy - NI18	7*	14*	unknown	unknown	unknown	unknown	unknown	unknown	unknown	other	12
Naval Base Coronado - Totals	1034	1599	1022	0.64	24-May-13	31-Jul-13	575	27-May-13	21-Jun-13	2WD, other	156
Delta Beach North	208	317	206	0.65	24-May-13	15-Jul-13	123	31-May-13	21-Jun-13	2WD, other	16
Delta Beach South	174	275	187	0.68	24-May-13	17-Jul-13	110	29-May-13	24-Jun-13	2WD, other	28
NAB Ocean	652	1007	629	0.62	25-May-13	31-Jul-13	351	28-May-13	21-Jun-13	2WD, other	112
D Street Fill/Sweetwater Marsh NWR	144	216	179	0.83	1-Jun-13	19-Jul-13	79	4-Jun-13	25-Jun-13	2WD, R	23-32
Chula Vista Wildlife Reserve	79	129	106	0.82	4-Jun-13	16-Jul-13	48	21-Jun-13	25-Jun-13	2WD, R	32-39
South San Diego Bay Unit, SDNWR - Totals	45	79	37	0.47	5-Jun-13	17-Jul-13	25	5-Jun-13		2WD, R	2
Saltworks	40	70	31	0.44	5-Jun-13	17-Jul-13	21	12-Jan-13	3-Jul-13	2WD, R	
SE Pond 11	5	9	6	0.67	7-Jun-13	10-Jul-13	3	30-May-13 & 24-Jun-13		2WD, R	
Tijuana Estuary NERR - Totals	282	358	217	0.61	6-Jun-13	18-Jul-13	131	20-Jun-13	27-Jun-13	2WD, R	57-65
Tijuana North	94	160*	69	0.43	6-Jun-13	18-Jul-13	48	27-Jun-13	27-Jun-13	2WD, R	17
Tijuana South – North of trail	3	6	3	0.50	18-Jul-13	18-Jul-13	2	7-Jul-13	25-Jul-13	2WD, R	2
Tijuana South – South of river	30	45	19	0.42	6-Jun-13	7-Jul-13	14	20-Jun-13 & 27-Jun-13	27-Jun-13	2WD, R	36-44
Tijuana South – South of trail	155	253*	126	0.5	6-Jun-13	18-Jul-13	86	13-Jun-13	27-Jun-13	2WD, R	2
Imperial County											
Salton Sea	2	4	4	1.0	30-May-13	30-May-13	2	18-May-13 to 21-Jun-13			2

*Minimum numbers obtained from number of observed nesting individuals, assuming each nest had at least one egg, and/or number of chicks and fledglings seen on site.

**Dates are approximate based on monitoring method 2.

Appendix B-4: Productivity, clutch sizes in 2013.

			Number of nests			
Site name:	Nest total	Egg total	1 egg clutch	2 egg clutch	3 egg clutch	4 egg clutch
Sacramento Area						
Bufferlands	0	n/a	n/a	n/a	n/a	n/a
San Francisco Bay Area						
Napa Sonoma Marsh Wildlife Area - Totals	80	169	11	21	3	0
NSMWA-Green Island Unit	0	n/a	n/a	n/a	n/a	n/a
NSMWA-Pond 7/7A	80	168	9	53	18	0
Montezuma Wetlands	29	38*	unknown	unknown	unknown	unknown
Site 3/4	15	19*	unknown	unknown	unknown	unknown
Site 6/7	14	19*	unknown	unknown	unknown	unknown
Pittsburg Power Plant	0	n/a	n/a	n/a	n/a	n/a
Alameda Point	292	556	33	254	5	0
Hayward Regional Shoreline	85	85*	unknown	unknown	unknown	unknown
San Luis Obispo/Santa Barbara Counties						
Oceano Dunes SVRA	57	104	11	36	7	0
Rancho Guadalupe Dunes Preserve	0	n/a	n/a	n/a	n/a	n/a
Vandenberg AFB-Purisima Pt.	15	30	1	13	1	0
Coal Oil Point Reserve	0	n/a	n/a	n/a	n/a	n/a
Venture County						
Ormond Beach	7	10	4	3	0	0
Hollywood Beach	209	312	106	103	0	0
Santa Clara River/McGrath State Beach	37	61	14	22	1	0
Pt Mugu- Totals	346	487	206	139	1	0
Holiday Beach	164	242	86	78	0	0
Holiday Salt Panne	11	16	6	5	0	0
Eastern Arm	5	8	2	3	0	0
Ormond Beach East	166	221	112	53	1	0
Saticoy United Water Conservation District	0					
Los Angeles/Orange Counties						
Venice Beach/Marina del Rey	15	15	15	0	0	0
LA Harbor- Pier 400	254	400	109	144	1	0
Seal Beach NWR - Anaheim Bay	164	258	74	87	2	1
Bolsa Chica Ecological Reserve -Totals	157	237	79	76	2	0
Nest Site 1 (NS1)	20	29	11	9	0	0
Nest Site 2 (NS2)	50	81	21	27	2	0
Nest Site 3 (NS3)	3	3	3	0	0	0
South Tern Island (STI)	84	124	44	40	0	0
Huntington State Beach	347	446	248	99	0	0
Burris Sand Pit/Burris Basin	23	43	5	16	2	0
Upper Newport Bay Ecological Reserve	32	55	11	19	2	0
San Diego County						
MCB Camp Pendleton - Totals	1242	2064	431	800	11	0
Red Beach	23	36	10	13	0	0
White Beach	100	155	46	53	1	0
Santa Margarita River - North Beach North	183	293	73	110	0	0
Santa Margarita River - North Beach South	907	1534	290	607	10	0
Santa Margarita River – Saltflats and Island	29	46	12	17	0	0
Batiquitos Lagoon Ecological Reserve - Totals	558	937	184	369	5	0
E1	49	81	18	30	1	0
E2	0	n/a	n/a	n/a	n/a	n/a
E3	14	27	3	9	2	0
W1	37	62	12	25	0	0
W2	458	767	151	305	0	0

			Number of nests			
Site name:	Nest total	Egg total	1 egg clutch	2 egg clutch	3 egg clutch	4 egg clutch
San Elijo Lagoon Ecological Reserve	0	n/a	n/a	n/a	n/a	n/a
Fairbanks Ranch	0	n/a	n/a	n/a	n/a	n/a
San Dieguito Lagoon Ecological Reserve	3	6	0	3	0	0
NS11	1	2	0	1	0	0
NS12	2	4	0	2	0	0
NS13	0	n/a	n/a	n/a	n/a	n/a
NS14	0	n/a	n/a	n/a	n/a	n/a
Mission Bay						
FAA Island	156	263	51	104	0	1
North Fiesta Island	0	n/a	n/a	n/a	n/a	n/a
Mariner's Point	37	54	20	17	0	0
Stony Point	41	69	13	28	0	0
San Diego River Mouth	0	n/a	n/a	n/a	n/a	n/a
San Diego Bay						
Lindbergh Field & Former Naval Training Center	114	160	70	43	0	1
US Navy - NI MAT	0	n/a	n/a	n/a	n/a	n/a
US Navy - NI18	7*	14*	unknown	unknown	unknown	unknown
Naval Base Coronado - Totals	1034	1599	471	561	2	0
Delta Beach North	208	317	100	107	1	0
Delta Beach South	174	275	73	101	0	0
NAB Ocean	652	1007	298	353	1	0
D Street Fill/Sweetwater Marsh NWR	144	216	72	72	0	0
Chula Vista Wildlife Reserve	79	129	29	50	0	0
South San Diego Bay Unit, SDNWR -	45	79	11	34	0	0
Saltworks	40	70	10	30	0	0
SE Pond 11	5	9	1	4	0	0
Tijuana Estuary NERR	282	358	99	180	1	0
Tijuana North	94	159	27	66	0	0
Tijuana South – North of trail	3	6	0	3	0	0
Tijuana South – South of river	30	45	15	15	0	0
Tijuana South – South of trail	155	252	57	96	1	0
Imperial County						
Salton Sea	2	4	0	2	0	0

*Minimum numbers obtained from number of observed nesting individuals, assuming each nest had at least one egg, and/or chicks and fledglings seen on site.

Appendix B-5: Non-Predation Mortality in 2013.

	No. of eggs					No. of nests					No. of dead			
Site name:	damaged (human caused)	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown:	damaged (human caused)	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	Comments on cause(s) of non-predation mortality:
Sacramento Area														
Bufferlands	n/a													
San Francisco Bay Area														
Napa Sonoma Marsh Wildlife Area - Totals	9	0	15	34	0	1	0	11	7	0	6	0	0	
Green Island Unit	n/a													
Pond 7/7A	5 (4)	0	15	34	0	1	0	11	7	0	6	0	0	Dead chicks found in nest bowls. Heat? Suspected cause of damage to eggs was poor shell quality and damage happening during egg rotation by adults.
Montezuma - Totals	0	0	0	0	2	0	0	0	0	0	1	2	0	
Site 3/4	0	0	0	0	2	0	0	0	0	0	0	0	0	
Site 6/7	0	0	0	0	0	0	0	0	0	0	1	2	0	No physical evidence of fledglings mortality but individuals were not seen again after noting they were still too young to leave cover.
Pittsburg Power Plant	n/a													
Alameda Point	0	0	0	0	79	0	0	0	0	30	48	8	0	
Hayward Regional Shoreline	0	0	0	0	1	0	0	0	0	0	0	0	0	
San Luis Obispo/Santa Barbara Counties														
Oceano Dunes SVRA	0	0	7	3	7	0	0	4	0	6	3	2	1	On 27 July, an unbanded one-year-old tern was seen dragging its left wing and unable to fly. The bird was taken to Pacific Wildlife Care in San Luis Obispo County the same day and received veterinary care until it died on 31 July. The carcass was sent for necropsy. One other fledge was also sent for necropsy after being found dead on July 29 after being last seen alive and appearing well at 33 days old on July 28.
Rancho Guadalupe Dunes Preserve	n/a													
Vandenberg AFB-Purisima Pt.	0	0	0	4	0	0	0	0	0	0	2	0	0	
Coal Oil Point Reserve	n/a													
Ventura County														
Santa Clara River/McGrath State Beach	0	0	2	0	0	0	0	2	0	0	0	0	0	
Hollywood Beach	3	0	1	39	23	2	0	0	27	14	24	0	0	All dead chicks found were recently hatched, no sign of cause.

	No. of eggs					No. of nests					No. of dead			Comments on cause(s) of non-predation mortality:
Site name:	damaged (human caused)	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown:	damaged (human caused)	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	
Ormond Beach	0	1	4	0	1	0	1	3	0	1	0	0	0	
Pt Mugu - Totals	0	54	247	49	13	0	44	168	34	9	0	0	0	
Holiday Beach	0	44	141	35	8	0	36	90	23	5	0	0	0	
Holiday Salt Panne	0	0	9	3	1	0	0	5	3	1	0	0	0	
Eastern Arm	0	6	2	0	0	0	4	1	0	0	0	0	0	
Ormond Beach East	0	4	95	11	4	0	4	72	8	3	0	0	0	
Saticoy united Water Conservation District	n/a													
Los Angeles/Orange Counties														
Venice Beach/Marina del Rey	0	0	0	0	0	0	0	0	0	0	0	0	0	
LA Harbor- Pier 400	22	0	92	2	37	16	0	61	1	15	107	0	0	Damaged eggs trampled by ELTE. Cause of chick mortalities lack of food or adult abandonment.
Seal Beach NWR - Anaheim Bay	0	0	0	46	2	0	0	0	28	0	8	0	0	
Bolsa Chica Ecological Reserve -Totals	1	0	64	0	4	1	0	37	0	1	0	0	0	
Nest Site 1 (NS1)	0	0	0	0	0	0	0	0	0	0	0	0	0	
Nest Site 2 (NS2)	0	0	11	0	1	0	0	4	0	0	0	0	0	
Nest Site 3 (NS3)	0	0	0	0	0	0	0	0	0	0	0	0	0	
South Tern Island (STI)	1	0	53	0	3	1	0	33	0	1	0	0	0	
Burris Sand Pit/Burris Basin	0	0	0	0	14	0	0	0	0	6	0	0	0	
Huntington State Beach	0	0	101	20	8	0	0	82	9	3	18	0	0	
Upper Newport Bay Ecological Reserve	0	0	0	2	46	0	0	0	1	26	2	0	0	Dead chicks found in nests.
San Diego County														
MCB Camp Pendleton - Totals	10	85	325	116	17	0	54	225	49	17	291	1	2	
Red Beach	0	0	3	0	1	0	0	2	0	1	0	1	0	
White Beach	1	7	52	15	1	0	5	38	8	2	4	0	0	
Santa Margarita River - North Beach North	1	20	46	18	4	0	14	31	11	4	12	0	2	
Santa Margarita River - North Beach South	8	56	219	80	10	0	34	151	28	10	275	0	0	Includes 2 died hatching chicks
Santa Margarita River - Saltflats and Island	0	2	5	3	1	0	1	3	2	0	0	0	0	
Batiquitos Lagoon Ecological Reserve - Totals	4	0	141	23	40	1(2)	0	85	10	21	296	8	1	
E1	0	0	22	1	4	0	0	9	1	2	12	1	0	

	No. of eggs					No. of nests					No. of dead			
Site name:	damaged (human caused)	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown:	damaged (human caused)	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	Comments on cause(s) of non-predation mortality:
E2	n/a													
E3	1	0	0	0	26	1	0	0	0	13	0	0	0	
W1	0	0	10	1	1	0	0	7	1	0	11	0	0	
W2	(3)	0	109	21	9	(2)	0	69	8	6	271	7	1	Disease suspected in death of adult, messy cloaca.
San Elijo Lagoon Ecological Reserve	n/a													
Fairbanks Ranch	n/a													
San Dieguito Lagoon - Totals	0	0	2	0	0	0	0	1	0	0	0	0	0	
NS11	0	0	0	0	0	0	0	0	0	0	0	0	0	
NS12	0	0	2	0	0	0	0	1	0	0	0	0	0	
NS13	n/a													
NS14	n/a													
Mission Bay														
FAA Island	0	0	126	1	32	0	0	67	0	20	53	0	1	Dead adult appeared emaciated, sent to Sea World for possible necropsy. Six dead chicks found ant infestation; uncertain if is cause of death, abandonment by adults suspected.
North Fiesta Island	n/a													
Mariner's Point	1	0	40	0	0	0	0	28	0	0	2	0	0	
Stony Point	0	0	24	0	1	0	0	15	0	0	5	0	0	
San Diego River Mouth	n/a													
San Diego Bay														
Lindbergh Field & Former Naval Training Center	1	0	10	31	4	1	0	8	15	4	12	3	2	
US Navy - NI MAT	n/a													
US Navy - NI18	0	0	2	0	n/a	0	0	2	0	n/a	0	0	0	
Naval Base Coronado - Totals	(48)	0	237	118	19	(16)	1	298	58	20	211	23	1	
Delta Beach North	0	0	44	26	5	0	0	58	13	10	41	2	0	
Delta Beach South	0	0	37	15	7	0	0	40	11	4	33	3	0	Includes 2 died hatching chicks
NAB Ocean	(48)	0	156	77	7	(16)	1	200	34	6	137	18	1	Includes 4 died hatching chicks
D Street Fill/Sweetwater Marsh NWR	0	0	30	3	3	0	0	22	0	1	57	10	0	One fledge found dead at Tijuana Estuary on July 18. Majority of dead chicks and fledges recorded as found on site with no visible trauma.
Chula Vista Wildlife Reserve	0	0	9	12	0	0	0	7	5	0	29	3	0	Breeding adult, 8031-05395, found dead late season at San Dieguito Lagoon. Longevity

	No. of eggs					No. of nests					No. of dead			
Site name:	damaged (human caused)	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown:	damaged (human caused)	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	Comments on cause(s) of non-predation mortality:
														record for the species at 24 years old. Mortality not included in total count for breeding season. Majority of dead chicks recorded as found on site with no visible trauma.
South San Diego Bay Unit, SDNWR - Totals	0	0	13	1	7	0	0	8	1	4	3	0	1	
Saltworks	0	0	11	0	7	0	0	8	0	4	3	0	1	
SE Pond 11	0	0	2	1	0	0	0	0	1	0	0	0	0	
Tijuana Estuary NERR	0	45	82	12	40	0	28	48	3	30	47	2	1	
Tijuana North	0	13	44	5	13	0	7	28	2	7	6	1	1	Majority of dead chicks recorded as found on site with no visible trauma.
Tijuana South – North of trail	0	0	2	1	0	0	0	1	0	0	0	0	0	
Tijuana South – South of river	0	13	6	0	1	0	8	4	0	1	0	0	0	
Tijuana South – South of trail	0	19	30	6	26	0	13	15	1	22	32	1	0	Majority of dead chicks recorded as found on site with no visible trauma.
Imperial County														
Salton Sea	0	0	0	0	0	0	0	0	0	0	0	0	0	

Appendix B-6: Predation in 2013.

Predator Species	Predator Category*			Predator Rating**
	Possible	Suspected	Documented	
Unknown Spp.	145	1	7	168
Coyote	81		9	108
Unknown Avian Spp.	86	2	6	108
Peregrine Falcon	18	5	26	106
Common Raven	50	2	15	99
American Crow	43	2	8	71
Northern Harrier	38	2	6	60
Great Horned Owl	29	1	9	58
Gull Spp.	8	20		48
American Kestrel	10	1	10	42
European Starling	34	2	1	41
Striped Skunk	28	3		34
Corvid Spp.	30			30
Cooper's Hawk			8	24
Raptor Spp.	7		5	22
Unknown Mammal Spp.	12			12
Opossum	4		2	10
Red-Tailed Hawk	2		2	8
Gull-Billed Tern	1		2	7
Great Blue Heron			2	6
Domestic Cat	1		1	4
Loggerhead Shrike			1	3
Snake Spp.			1	3
Ant Spp.		1		2
Mouse Spp.	2			2
Western Gull	1			1
Long-Billed Curlew	1			1
Barn Owl	1			1
Rodent Spp.	1			1
Canid Spp.	1			1

*Predator Category numbers represent the total number of instances each predator species was reported as a documented, suspected, or possible predator.

**Predator Rating = (#Documented x 3) + (#Suspected x 2) + (#Possible x 1)

Appendix B-6: Predation in 2013 (continued).

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
Sacramento Area													
Bufferlands													
San Francisco Bay Area													
Napa Sonoma Marsh Wildlife Area - Totals													
Green Island Unit	gull, CATE, OSPR, PEFA, CORA, HOLA												
Pond 7/7A	GREG, gull, CATE, FOTE, NOHA, RTHA, OSPR, PEFA, CORA			avian 1P, unknown 18P	avian 1P, unknown 7P				19	8	0	0	0
Montezuma - Totals													
Site 3/4	GREG, NOHA, CORA, canid												
Site 6/7	NOHA, RTHA, PEFA												
Pittsburg Power Plant													
Alameda Point	GBHE, WEGU, CAGU, gull TUVU, OSPR, NOHA, WTKI, RTHA, CAGO, GOEA, MERL, AMKE, PEFA, raptor, BNOW, GHOW, CORA, AMCR, LOSH	AMKE, PEFA, EUST	PEFA	EUST 2S, unknown 1D	EUST 2S, unknown 1D	AMKE 3P, GHOW 1P, unknown 1D	AMKE 7P 1S, PEFA 1S, GHOW 18P	PEFA 3D 1P, BNOW 1P, GHOW 1P, raptor 5P	3	0	5	27	11
Hayward Regional Shoreline	CAGU, NOHA, RTHA, AMKE, PEFA, rfox, rac		AMKE, PEFA			AMKE 7.5D	PEFA 4.5D	PEFA 1D	0	0	7.5	4.5	1
San Luis Obispo/Santa Barbara Counties													
Oceano Dunes SVRA	NOHA, WTKI, COHA, RTHA, OSPR, PEFA,		PEFA, coyote, op	coyote 2D, op 1D	coyote 1D, op 1D		PEFA 1D		3	2	0	1	0

Site name	Predators			Number of Depredations					Total Number Documented				
	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
	AMCR, LOSH, owl, coyote, dog, bobcat, op, rac, st skunk, PAJA												
Rancho Guadalupe Dunes Preserve													
	GBHE, WEGU, NOHA, WTKI, RTHA, MERL, AMKE, PEFA, LOSH, coyote, bobcat, pig, unk. owl												
Vandenberg AFB-Purisima Pt.								avian 1P	0	0	0	0	1
Coal Oil Point Reserve													
Ventura County													
	GBHE, RTHA, CORA, corvid, coyote, op, mammal, unknown			CORA 13P, corvid 1P, coyote 3P, op 7P, mammal 1P, unknown 32P	CORA 8P, corvid 1P, coyote 2P, CORA/DI VI 2P, op 4P, mammal, 1P, unknown 18P								
Santa Clara River/McGrath State Beach									57	35	0	0	0
Hollywood Beach	RTHA, PEFA		RTHA				RTHA 6D		0	0	0	6	0
	CORA, AMCR	corvid		corvid 2S, unknown 2D	corvid 1S, unknown 1D				4	2	0	0	0
Ormond Beach													
Pt Mugu - Totals													
	avian		LOSH	avian 4P, unknown 1P	avian 3P	LOSH 1D		avian 1P	5	3	1	0	1
Holiday Beach													
Holiday Salt Panne	avian							avian 1P	0	0	0	0	1
Eastern Arm													
Ormond Beach East	avian	NOHA	CORA, coyote, op, unknown	NOHA 1S, CORA 73D,	NOHA 1S, CORA 55D,			avian 1P	100	74	0	0	1

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
				coyote 1D, op 2D, unkno wn 23P	coyote 1D, op 1D, unknown 16D								
Saticoy united Water Conservation District													
Los Angeles/Orange Counties													
Venice Beach/Marina del Rey	CORA, AMCR		PEFA, AMCR	AMCR 15D	AMCR			PEFA 1D	15	15	0	0	1
LA Harbor- Pier 400	GBHE, BCNH, gull, PEFA, AMCR, cat		PEFA, cat				cat 21D	PEFA 1D	0	0	0	21	1
Seal Beach NWR - Anaheim Bay	WTKI, PEFA, GHOW, AMCR	PEFA, GHOW	GHOW	avian 10P	avian 9P	PEFA 2S, GHOW 1S	PEFA 1D 14S, GHOW 1D, avian 3P	GHOW 1D, avian 1P	8	3	3	19	2
Bolsa Chica Ecological Reserve -Totals													
Nest Site 1 (NS1)		gull		gull 29S	gull 20S				29	20	0	0	0
Nest Site 2 (NS2)	corvid			corvid 1P	corvid 1P				1	0	0	0	0
Nest Site 3 (NS3)	corvid			corvid 3P	corvid 3P				3	3	0	0	0
South Tern Island (STI)				unkno wn 17P	unknown 14P				17	13	0	0	0
Burris Sand Pit/Burris Basin				unkno wn 20P	unknown 13P				20	12	0	0	0
Huntington State Beach	AMKE, PEFA, AMCR	AMCR	PEFA, AMCR	AMCR 1D 11P, unkno wn 1P	AMCR 1D 11P		AMKE 2D, PEFA 2D, unknown 9D	unknown 6D	13	12	0	13	6
Upper Newport Bay Ecological Reserve	AMCR, gull			unkno wn 2P	unknown 1P				2	1			
San Diego County													
MCB Camp Pendleton													
Red Beach		coyote, st skunk	GHOW, corvid, avian, coyote, unknown	corvid 1D, avian 1D, coyote 21D 2S, st	corvid 1D, avian 1D, coyote 12D 2S, st skunk	corvid 1D, avian 1D, coyote 21D 2S, st skunk	corvid 1D, avian 1D, coyote 12D 2S, st skunk 1S, unknown 2D	GHOW 1D, avian 1D	30	19	0	0	2

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
				skunk 1S, unknown 4D	1S, unknown 2D	1S, unknown 4D							
White Beach	NOHA, RTHA, AMCR	GHOW, coyote	GHOW, CORA, corvid, mammal, coyote, st skunk, st unknown	GHOW 1D, CORA 8D, corvid 1D, mammal 1D, coyote 26D 2S, st skunk 1D, unknown 1D	GHOW 1D, CORA 5D, corvid 1D, mammal 1D, coyote 15D 1S, st skunk 1D, unknown 1D			GHOW 7D 1S, avian 2D	41	26	0	0	10
Santa Margarita River - North Beach North	AMKE, GHOW, AMCR, CORA	PEFA, corvid, mouse, st skunk	NOHA, corvid, avian, mammal, coyote, st skunk, st unknown	Corvid 2D 1S, avian 8D, mammal 14D, mouse 1S, coyote 6D 2S, st skunk 28D 9S, unknown 23D	Corvid 1D 1S, avian 5D, mammal 8D, mouse 1S, coyote 4D 1S, st skunk 16D 7S, unknown 14D	NOHA 2D, avian 4D, unknown 1D	avian 2D	PEFA 3S, avian 9D	95	58	7	2	12
Santa Margarita River - North Beach South	RTHA, CORA, LBCU	gull, AMKE, PEFA, GHOW, AMCR, EUST, mouse	gull, NOHA, AMKE, GHOW, AMCR, corvid, avian, mammal, canid, coyote, unknown	gull 3D 2S, AMCR 15D 1S, corvid 6D, EUST 51S, avian 11D, mammal 1D, mouse 1S,	gull 2D 1S, AMCR 10D 1S, corvid 4D, EUST 33S, avian 7D, mammal 1D, mouse 1S, canid 1D,	NOHA 18D, AMKE 1D 1S, avian 3D	NOHA 19D, avian 8D	NOHA 1S, PEFA 2S, GHOW 7D 10S, avian 10D	136	88	23	27	30

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
				canid 1D, coyote 17D, unkno wn 27D	coyote 9D, unknown 16d								
Santa Margarita River - Saltflats and Island	NOHA, RTHA, AMKE, PEFA	coyote	avian, coyote, unknown	avian 6D, coyote 11D 1S, unkno wn 6D	avian 3D, coyote 7D 1S, unknown 5D			avian 1D	24	16	0	0	1
Batiquitos Lagoon Ecological Reserve - Totals													
E1	GBHE, GREG, SNEG, RTHA, PEFA, corvid, mammal, ant		RTHA						0	0	1	0	0
E2													
E3													
W1	GBHE, GREG, RTHA, AMCR, st skunk, cat, ant		COHA	st skunk 6S	st skunk 3S	COHA 1D			6	3	1	0	0
W2	GBHE, GREG, SNEG, WEGU, BCNH, WTKI, COHA, PEFA, GHOW, AMCR, coyote, ant		GHOW	unkno wn 3P	unknown 1P			GHOW 6D	3	1	0	0	6
San Elijo Lagoon Ecological Reserve													
Fairbanks Ranch													
San Dieguito Lagoon - Totals													
NS11	RTHA, COHA, PEFA, coyote					unknow n 2S			0	0	2	0	0
NS12			CORA	CORA 2D	CORA 1D				2	1	0	0	0

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
NS13													
NS14													
Mission Bay													
FAA Island	GBHE, GREG, WEGU, RBGU, PEFA, AMCR		unknown	unkno wn 3P	unknown 2P				3	2	0	0	0
North Fiesta Island													
Mariner's Point	GBHE, GREG, OSPR, PEFA, CORA	CORA, avian		CORA 2S, avian 2S	CORA 2S, avian 2S				4	4	0	0	0
Stony Point	GBHE, AMKE, PEFA, CORA		PEFA, snake	snake 4D	snake 3D	PEFA 1D		PEFA 1D	4	3	1	0	1
San Diego River Mouth	AMCR												
San Diego Bay													
Lindbergh Field & Former Naval Training Center	GBHE, BCNH, WEGU, COHA, RTHA, OSPR, AMKE, PEFA, CORA, AMCR, rat	AMKE, raptor, ant	COHA, AMCR, PEFA, CORA, unknown	AMCR 1P 1S, CORA 6D	AMCR 1D 1S, CORA 5D	COHA 1D, AMKE 1P, PEFA 2D,rapt or 1P, ant 1S, unknow n 3D	PEFA 1P	PEFA 2D, raptor 1D, unknown 1D	8	5	9	1	4
US Navy - NI MAT													
US Navy - NI18			avian			avian 1D			0	0	0	1	0
Naval Base Coronado - Totals													
Delta Beach North	GBHE, RTHA, AMKE	AMCR	GBTE, COHA, PEFA, AMCR, CORA. Avian, cat, unknown	AMCR 14D 1S, CORA 10D, avian 4D, cat 2D, unkno wn 6D	AMCR 10D, CORA 6D, avian 1D, cat 1D, unknown 5D	GBHE 2D, GBTE 1D-2D, COHA 1D, PEFA 1D	COHA 1D, PEFA 1D	COHA 1D, GHOW 1D	47	23	5-6	2	2
Delta Beach South	GBHE	PEFA	NOHA, COHA, AMKE, PEFA, AMCR, CORA,	AMCR , 1D, CORA 14D, corvid 11D,	CORA 9D, corvid 7D, avian 1D,	NOHA 2D, AMKE 4D, PEFA 3D	PEFA 5D, avian 5D	COHA 1D, PEFA 1S	31	18	9	7	2

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
			avian, mammal, unknown	avian 3D, mammal 1D, unknown 1D	unknown 1D								
NAB Ocean	GBHE, AMKE, mammal	COHA, AMCR, CORA	WEGU, gull, GBTE, RTHA, PEFA, LBCU, GHOW, AMCR, CORA, corvid, avian, unknown	WEGU 2D, gull 7D, LBCU 1D, AMCR 17D 2S, CORA 27D 2S, corvid 13D, avian 3D, CORA, unknown 18D	WEGU 1D, gull 3D, LBCU 1D, AMCR 12D 1S, CORA 15D 2S, corvid 7D, avian 2D, unknown 12D	GBTE 1D, COHA 3D, RTHA 2D, PEFA 1D, avian 1D	avian 3D	PEFA 1D, GHOW 1S, avian 1D	92	54	8	3	3
D Street Fill/Sweetwater Marsh NWR	GBHE, GREG, GBTE, NOHA, COHA, AMKE, PEFA, owl, CORA, AMCR, LOSH, coyote, gs, rat, PICA		AMKE, NOHA, mammal	rodent 1D	rodent 1D	AMKE 1D, NOHA 1D, unknown 2D	PEFA 3P		1	1	4	3	0
Chula Vista Wildlife Reserve	GBHE, gull, NOHA, COHA, RTHA, OSPR, AMKE, PEFA, CORA, AMCR, EUST, st skunk	AMCR	AMKE, PEFA, unknown	AMCR 2S	AMCR 1S	AMKE 1D	PEFA 1D 1P	PEFA 3P, unknown 1D	2	1	1	2	4
South San Diego Bay Unit, SDNWR - Totals													
Saltworks	CAGU, GBTE, COHA,		unknown	coyote 17P, unk 4D	coyote 11P, unk 3D	coyote 4P			21	12	4	0	0

Site name	Predators			Number of Depredations					Total Number Documented				
	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
	AMKE, PEFA, CORA, AMCR, coyote												
SE Pond 11	NOHA								0	0	0	0	0
Tijuana Estuary NERR													
Tijuana North	GBHE, GBTE, NOHA, PEFA, owl, raptor, CORA	PEFA		NOHA 2P, unknown 15P	NOHA 1P, unknown 7P	PEFA 1S, raptor 1P	raptor 1P	raptor 1P	15	7	2	1	1
Tijuana South – North of trail	GBTE, NOHA, AMKE, CORA												
Tijuana South – South of river	GBTE, NOHA, PEFA, rattlesnake		PEFA, raptor, coyote	coyote 4D, unknown 2P	coyote 3D, unknown 2P	raptor 1D	PEFA 1D, raptor 1D	raptor 2D	6	5	1	2	2
Tijuana South – South of trail	gull, GBTE, NOHA, AMKE, PEFA, coyote, canid	NOHA	coyote	NOHA 2S 1P, coyote 7D 18P, unknown 17P	NOHA 1S, coyote 4D 11P, unknown 10P				45	26	0	0	0
Imperial County													
Salton Sea									0	0	0	0	0

Appendix B-6 Legend; P: Possible; S: Suspected; D: Documented

* Includes observations of predators on site recorded in nesting chronology data as well as mortality tab.

** Number of eggs determined from both nesting chronology data as well as mortality tab.

*** Only complete nests lost to depredation counted in summary.

Appendix B-7: Site-specific Summaries and Notes (excerpts taken from California least tern data reporting spreadsheets).

Site name:	Summary of breeding season at site:
Sacramento Area	
Bufferlands	6/28/2013 After just about giving up hope that they would be seen in 2013, I saw four Least Terns at the Sacramento Reg. Wastewater Treatment Plant (SRWTP--that which is buffered by the Bufferlands) between Sacramento and Elk Grove. This is the sixth consecutive year they have been at the site and the first time with more than two adults. One was flying with a fish and landed near last year's nest site. Later all four terns flew around the ponds more or less together. On 6/29, only one was seen with Ed Pandolfino and Dell Richards. It was in SSB 2 when we arrived, it flew around the ponds, then headed out, presumably to forage at Black Crown Lake. It briefly perched near the manhole cover on the road heading west from the middle road at the mid-point of SSB 2. No sign of a scrape that I could detect. We drove past the lake but did not find it again. No Least Terns have been seen at the site this year after 6/29.
San Francisco Bay Area	
NSMWA-Green Island Unit	After July 9, 2013 surveys were discontinued due to the absence of nesting LETE. In 2012, any nests at this location were abandoned due to the presence of PEFA on the islands, and it is thought that the LETE moved to Pond 7/7A for a chance at a successful nesting season in 2013.
NSMWA-Wildlife Area Pond 7/7A	On various surveys, 17 eggs were noted as missing from nests--3 of these eggs left egg yolk in the nest bowl but there were no egg shells present. Predation: 2 eggs were present near the nest with predator sign. In total we had 19 eggs that were depredated/unknown. 6 newly hatched chicks were found dead in or directly outside of the nest bowl, and the cause of death was unknown. 10 eggs were damaged by adults whether they were accidentally punctured during rotation or whether they were kicked out of the nest.
Montezuma	site info page: the 3/4C nesting site was raised and graded to keep it above flood elevation for proposed sediment deliveries; it was bladed/graded just prior to the nesting season to cut down on weeds, but it was still pretty weedy. Entire colony: nest info page: data were not collected on any individual nests; my fledgling count is based on chick age and on date seen, not on any other method. I know I saw four separate fledglings; only two lived long enough to leave the colony; I don't think there were more, but this again isn't based on a counting method
Pittsburg Power Plant	One pair of California least terns was observed engaged in courtship behavior at the site on June 7; no subsequent observations of this species occurred, and there is no indication that nesting took place. Other predators observed but not recorded on specific days: WTKI, AMCR, CORA, EUST, SNER, GBHE, GRER, RBGU, GULL SPP., CATE, LOSH, NOHA, WTKI, PEFA, EUST, RWBL, River otter, Mink. One Canada goose nest was observed at the margins of the Nesting Site in April; geese (adults and young) were present (loafing) there throughout the monitoring period. No stilts or avocet nests were observed in the Nesting Site. A pair of Caspian terns attended the site in May but was not observed subsequently. No evidence of predation was observed. River otters were observed on May 10 and August 21; American mink was found dead on May 10.

<p>Hayward Regional Shoreline</p>	<p>1: Annually (before and after terns arrive) maintain the site by mechanically removing vegetation and adding additional substrate (sand/oyster shell) to the site. Additional 100 meters of straw waddles were placed to help slow the wave erosion along the western side of the island. Starting in 2001, we moved 335,000 pounds of materials onto the island. People of all ages spread out 170 tons of sand, Saltworks, and oyster shells to encourage California least terns to nest on the island. Youths participating in service learning opportunities painted and installed decoys to attract terns to the island. Starting in the spring of 2005, a solar-recharged sound system was installed specifically for attracting California least terns. 2: David Riensche - East Bay Regional Park District Wildlife Biologist, and 4,100 volunteers who have contributed 16,800 hours in support of this stewardship effort (cumulative numbers). A very important component of this stewardship project involves the financial support from the community. More than \$85,000 in grant funds and donations were secured for the Tern Island Project from the Regional Parks Foundation, U.S. Fish & Wildlife Service Coastal Program, Alameda Countywide Clean Water Community Stewardship Program, New United Motor Manufacturing, Orchard Supply Hardware and Johnston's Oyster Farm. This year we had approximately 83 California Least Tern breeding pairs (a range of 81 to 85 which is based on pair estimate calculations I, II, & III) on Island #5 at the Hayward Regional Shoreline located along the eastern shore of San Francisco Bay. We had a total of 85 incubated nests of which 81 hatched producing a total of 155 chicks. Preliminary evidence suggests that of the 170 eggs laid at the site, a total of 120 fledglings were produced (a range of 118 to 122 is based on the difficulty quantifying the exact fledgling number). Terns were first seen on April 23, 2013 and last recorded at the Hayward Shoreline colony on August 5, 2013. In addition, we observed three Western snowy plover pairs on the site this breeding season, of which one nest was produced. Recommendations: Continue implementing new vegetation management technologies to address the rapid growth of invasive plants. Stinking chamomile/Mayweed (<i>Anthemis cotula</i>) has been the dominate cover plant on the island and has created a monoculture that drastically reduces nesting habitat on the island and presumably limits tern reproductive success. This unhealthy situation attracts nesting waterfowl, thus creating crowded conditions, and catches the attention of mammalian predators providing them with the opportunity to depredate a large number of waterfowl, shorebird and tern eggs and chicks overnight. Expand predator control measures provided by USDA/AFHIS/WS to focus on non-typical avian and mammalian predators as well as gulls. When funding becomes available the breeding area should be enclosed with a chain link fence to deter mammalian predators with an additional plastic ¼ inch mesh fence attached at the bottom of the fence to prevent chick mortality. The wind and wave erosion on the west side of the tern nesting site (Island #5) at the Hayward Regional Shoreline has created a steep bank and an avenue for chick mortality (drowning /hypothermia). When funding is available, efforts should be made to riprapp this side of the island, or implement new technologies to reduce the wind and wave erosion and the risk for chick mortality.</p>
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San Luis Obispo/Santa Barbara Counties

Oceano Dunes SVRA	At Oceano Dunes SVRA a minimum of 48 breeding pairs established 57 nests and produced 56 fledglings. The fledgling to pair ratio was 1.17. The number of breeding pairs is an increase from 41 pairs in 2012. Of the 52 nests with known fates, 86.5% hatched. This compares to an average clutch hatching rate of 80% (range=66-89%) during the period 2002-12. Beginning in 2006, almost all chicks have been given a unique color band combination allowing individuals to be recognized in the field. During the eight-year period 2006-13, 76.6% (386/504) of the chicks have been documented to fledge (seen at 21 days old or older). In 2013, 19.2% (10/52) of the color-banded juveniles were documented remaining at ODSVRA for 21 days or longer post-fledging. Over the nine-year period 2005-13, 385 color-banded fledglings were tracked at ODSVRA with 34.5% remaining 21 days or longer post-fledging.
Rancho Guadalupe Dunes Preserve	While no nests were documented at Rancho Guadalupe, one pair was observed daily from 25 May - 8 June in flight with fish over the previously used nesting area, on the ground, and copulating; however, the area used by terns was not entered by the monitor to eliminate potential disturbance. Predators observed included CORA, CALA, American kestrel (<i>Falco sparverius</i>), California gull (<i>Larus californicus</i>), Cooper's hawk (<i>Accipiter cooperii</i>), Great blue heron (<i>Ardea herodias</i>), great horned owl (<i>Bubo virginianus</i>), Heermann's gull (<i>Larus heermanni</i>), Merlin falcon (<i>Falco columbarius</i>), Northern harrier (<i>Circus cyaneus</i>), peregrine falcon (<i>Falco peregrines</i>), raccoon (<i>Procyon lotor</i>), red-tailed hawk (<i>Buteo jamaicensis</i>), ring-billed gull (<i>Larus delawarensis</i>), and western gull (<i>Larus occidentalis</i>).
Vandenberg AFB-Purisima Pt.	We estimate the 2013 breeding population to be 15 pairs which is 52% smaller than the 19-year mean. Hatching success in 2013 (83%) was higher than the 19-year mean of 59% and fledging success (76%) was higher than the 19-year mean of 43%. Breeding success (1.27 fledglings per breeding pair) was the second highest year on record (see Figure 1) and 127% higher than the 19-year mean of 0.56 fledglings per breeding pair. The highest year on record was 1.32 fledglings per breeding pair in 2001. The Purisima Point least tern colony continues to be characterized by years of anomalously high and low reproductive success, with very few years consistent with the 19-year mean. Since 2007, the colony has shown above average reproductive success for 5 of the 7 years. During this period, young-of-the-year rockfish have dominated the diet. To date diet samples from 2013 have not been analyzed, but anecdotal evidence suggests that foraging conditions adjacent to the colony were good. Additionally, the terns began foraging in the Santa Ynez River estuary toward the end of the breeding season and brought fledglings to the estuary for approximately 2 weeks after dispersing from the colony. Despite overall high annual reproductive success since 2007, the population size has decreased in recent years, with 2013 showing the smallest population on record for this site. Two styles of chick shelters were used. Beginning in 2001, we used a semi-permanent teepee design based on those reported in Jenks-Jay 1982, J. Field Ornithol. 53(1): 58-60. As these shelters degraded, they were replaced by smaller inverted v-shaped shelters made by attaching two pieces of 2x8 wood at a right angle. We monitored the site 5 days per week. Surveys were conducted from vantage points off the colony on three of the days (usually Monday, Wednesday, and Thursday). We used a 'B' to signify these surveys, though no blind was used as our vantage points were far enough away to not cause a disturbance. We entered the colony approximately twice a week depending on weather conditions. We were unable to enter the colony between 14 June and 24 June due to high winds. However, we were able to enter a more sheltered portion of the colony to check 3 nests on 21 June. When weather did not permit us to enter the colony, off-colony surveys were conducted.

Ventura County	
Ormond Beach	Note in incubation of nests - Nests observed being incubated upon discovery were 28, 33, and 34. 32, 35, 38, and 39 were never observed being incubated. Please note surveys were weekly, therefore these nests could have been incubated at some point, but this was never directly observed.
Hollywood Beach	On the afternoon of August 2, just hours after our survey, we had a local person collect 6 pre-fledges thinking they were injured, which were taken to a rehabilitator, driven to Santa Barbara, and then returned to the beach within 12 hours. We had no way to know if they reconnected with parents but we did not find any dead (or other) chicks in the next few days. We also had the local Harbor Patrol maintenance staff, that are usually very helpful in storing and providing nest exclosures and fencing, mistakenly exclose 2 least tern nests overnight. Monitors removed exclosure and watched that parents resume brooding to hatch all 3 eggs. We had some incidences of people entering nesting colony fence and decorating nests with sticks placed upright near eggs. Monitors removed as soon as discovered and brooding parents returned to hatch successfully.
NBVC Point Mugu	All of the NBVC Point Mugu subcolonies had a delayed nesting season. Although a handful of nests were found beginning on 9 May 2013, most of the nests were not initiated until the last week of May, when nests are typically at their peak. For the first time, the Ormond East and Holiday subcolonies had similar numbers of nests. In recent years, the Ormond East colony was responsible over 75% of the nests on base. In 2013, the Ormond East subcolony experienced predation pressure on nests and eggs, mainly by ravens. Meanwhile, the Holiday Beach subcolony had minimal predation. Beginning the week of 17 June 2013, there was a mass abandonment of nearly all the remaining nests on both colonies. Many of the nests were due to hatch within days; examination of the abandoned egg contents indicated that most showed development and were viable. Very few nests were initiated after the mass abandonment; only 12 of 346 nests were confirmed to have hatched during the season and it is unlikely that any fledglings were produced. Many of the least terns from NBVC Point Mugu may have renested locally at Hollywood Beach in Oxnard, the site, which has not hosted a colony in the past, had approximately 200 least tern nests in 2013.
Saticoy United Water Conservation District/ Spreading Grounds	Predators observed from April 23, 2013, through August 30, 2013: GBHE, GRER, SNEG, GRHE, BCNH, RTHA, CAGU, WEGU, CATE, RODO, LOSH, AMCR, CORA, HOLA, RWBL, CALA
Saticoy United Water Conservation District/ Freeman Diversion (FD)	Predators observed from April 23, 2013, through August 30, 2013: GBHE, GRER, SNEG, GRHE, BCNH, COHA, RTHA, CAGU, WEGU, GRRO, GHOW, LOSH, AMCR, CORA, RWBL, URCI, CALA
Saticoy United Water Conservation District/Santa Clara River (SCR)	On June 7, 2013, two separate copulation events were observed by two different pairs at SCR; however, no nests were documented at the Saticoy facilities. Predators observed from April 23, 2013, through August 30, 2013: GBHE, GRER, SNEG, GRHE, BCNH, LBHE, WFIB, COHA, RTHA, AMKE, PEFA, CAGU, WEGU, GRRO, LOSH, AMCR, CORA, EUST, RWBL, CALA
Saticoy United Water Conservation District/Ferro Basin (FB)	Predators observed from April 23, 2013, through August 30, 2013: COHA, RTHA, MAKE, PEFA, WEGU, GRRO, LOSH, CORA,
Saticoy United Water Conservation District/Noble/Rose Basins (NRB)	Predators observed from April 23, 2013, through August 30, 2013: RTHA, AMKE, WEGU, GRRO, AMCR, CORA,

Los Angeles/Orange Counties	
Seal Beach NWR - NASA Island	Sand in northwest 1/5 of site still crusty from experimental Saltworks treatment (layer of 4"-6" Saltworks under sand with visquene layer underneath Saltworks) in 2005. Visquene layer was removed in winter 2012/2013. Fledgling estimate from banding data = 89
Bolsa Chica South Tern Island (STI)	LETE were active on South Tern Island (STI) from early May until the first week of July, 2013. The first nest was initiated on 8 May and weekly monitoring visits to the island occurred between 14 May when 17 nests were found, and 9 July when the final 23 nests were determined to be either abandoned (n=11) or depredated (n=12). During the season, a total of 84 nests were initiated on STI. Monitors confirmed 25 nests hatched, producing 40 chicks. Seven nests were recorded as probable hatches (PH), hypothetically producing an additional 10 chicks for a grand total of 50 chicks for the site. Nearly 100% of these chicks were taken during the first week of life by either a male northern harrier or a red-tailed hawk. Furthermore, the pressure from these predators eventually led to the abandonment of numerous nests with eggs and those abandoned eggs were later scavenged by ravens. Over the season, 56% (n=37) of the nests on STI were abandoned, 13 nests with eggs were depredated, and the fate of two nests was recorded as unknown. Only one fledgling was observed on STI. In contrast, 15 fledglings were produced on STI last year, and that was with 33% fewer nests (n=56).
Bolsa Chica Nest Site 1 (NS1)	Weekly monitoring visits to Nest Site 1 (NS1) began 21 May and concluded on 6 June. During this brief period, only 20 nests were found with a total of 29 eggs. All nests were lost to depredation attributed to gulls, based on gull tracks over a large area of the site. The complete reproductive failure of LETS on NS1 was quite unexpected for two reasons: First, the site had been resurfaced with beach sand and was free of weeds and therefore in excellent condition for the birds. Second, high numbers of LETS had nested on this site in the past (176 nests in 2012). Apparently, LETS were driven off NS1 by flocks of gulls that used the site for loafing.
Bolsa Chica Nest Site 2 (NS2)	Weekly monitoring visits to Nest Site 2 (NS2) began 16 May and concluded on 23 July. During this period, 50 nests were found on the site and 23 nests were confirmed hatches that produced 37 live chicks. Twenty-two nests were recorded as probable hatches (PH), hypothetically producing an additional 32 chicks for a grand total of 69 chicks for the site. Only four dead chicks were found on the site during the monitoring period and only one egg was depredated: nest #49 found pecked on 9 July with a Corvid track near it. In addition to the low mortality observed, we consistently saw live chicks ("runners") on the site during repeated monitoring visits and we observed fledglings from this site during July and August. It is worth noting that NS2 is within sight of the CDFW office; thus, CDFW staff and volunteers would know if predators were near the site. Given all of these facts, we believe 33 fledglings from NS2 is a reasonable and conservative minimum estimate [37 confirmed live chicks minus 4 dead chicks]; especially since there were potentially more chicks hatched than we were able to confirm. The maximum fledgling estimate is 65. 2013 was the best year on record for NS2. Last year (2012), 46 LETS nests were initiated on this site; however, due to coyote predation, none of the 53 chicks produced survived to fledge.
Bolsa Chica Nest Site 3 (NS3)	Due to exceptionally low LETS activity on Nest Site 3 (NS3), this site was only monitored for three weeks: 30 May – 13 June. During that period, only three 1-egg nests were found. Due to Corvids, these nesting efforts were unsuccessful (all three eggs were taken). During 2012, a total of 27 LETS nests were initiated on NS3 but 100% of them were depredated by coyote and raven. Coyote predation was also problematic during 2011, so funding was sought to construct a fence around NS3. During the winter of

	2012, two non-profit organizations donated the funds needed to construct a fence around NS3 as well as increase fencing at NS1. Although we knew Corvids would continue to be a problem on NS3, we had hoped for higher LETE productivity on the site during 2013 since it is now protected from coyote and other mammals. Better control of Corvids is needed.
Upper Newport Bay Ecological Reserve	<p>Remote monitoring of Tern Island began on April 10th 2013. First observation of LETE was on April 25. First nest observed on May 29. Season total was 32 nests with a cumulative total of 54 eggs laid.</p> <p>There was a high degree of variability in terminology used by monitoring crew that created a couple of problems on our data sheets. First, nests with unknown outcomes were recorded as 'probable hatches' despite lack of evidence to support hatching. These were converted to 'unknowns' because evidence of hatching (e.g.-shell fragments, chick tracks, feces, etc.) was not recorded anywhere on the data sheet. Chicks were observed during remote monitoring which suggests that many of the 'unknowns' were actual hatches, but I chose to maintain a conservative approach in the chronology coding.</p> <p>Second, I noticed that chicks and fledges were not clearly distinguished in monitoring notes. Based on timing, I believe many of the chicks observed were actually fledglings. Again, I chose to maintain the chick counts as stated in the data sheets instead of trying to deduce how many of the observations recorded as 'chicks' were probably 'fledges'.</p> <p>These inconsistencies in terminology and age categories were corrected through staff training in early May 2014 to reduce sampling error during the current 2014 season.</p> <p>Other species on island: American avocets: 2 nests. Black skimmer: None. Canadian goose: 1 nest, 4 chicks fledged.</p>
San Diego County	
San Dieguito Lagoon	For the first time since 1992, LETE established nests in the San Dieguito Lagoon. Late in the season a Loggerhead Shrike (<i>Lanius ludovicianus</i>) was observed on NS11. Additional predators observed at: NS11 and NS12 (GBHE, GRER, NOHA, MAKE, THBO); NS13 & NS14 (BAOW, GRRO, WTKI, WEME); & NS14 (GHOW)
Mission Bay	
North Fiesta Island	Although a few CLTs (1-7) were seen at the site, with some landing at times, no nests were found.
Mariner's Point	Of 37 nests, 11 chicks hatched from 7 nests, none surviving to fledging. 41 abandoned eggs were collected.
Stony Point	Of 41 nests 39 chicks hatched from 23 nests, 3 surviving to fledging. 6 abandoned eggs were collected; 17 remaining abandoned eggs were taken by suspected predator CORA.
San Diego River Mouth	No CLTS were seen at the site during the season.
San Diego Bay	
Lindbergh Field	Prior to the terns' arrival, San Diego County Regional Airport Authority personnel applied herbicide, manually removed vegetation, and contractor Ocean Blue repaired plastic mesh chick barriers and covers over stormdrains. Zoological Society of San Diego subcontract personnel established a 30 m grid system in the two ovals used in recent years by terns for nesting, and assisted in repairs to chick barriers. Monitoring was conducted April through August one to three days per week. Additional monitoring

was conducted associated with adjacent construction activities. Predator management was conducted by personnel from USDA Wildlife Services. Least terns were first observed foraging over the bay and in flight over the southeast end of Lindbergh Field on 13 April 2013. They were observed each visit after that through 19 August. At least 114 nests were initiated by 90 to 95 estimated pairs between 13 May and 16 July. The maximum number of concurrently active nests was 90 on 7 June and 78 nests with 12 broods of chicks on 11 June. At least 90 nests were established in the main nesting oval 03-S east of the Ryan taxiway, 16 nests in oval 03-S west of the Ryan taxiway, five nests in oval 02-S, and three nests in oval 04-S. At least 109 chicks from 80 nests hatched successfully. It is estimated that 38 chicks reached fledgling age and 34 young survived to fledge from the site. Four eggs from four nests were observed being depredated by common ravens with additional eggs from two of those nests and from a fifth nest being removed and cached under rocks and vegetation. The cached eggs were recovered and returned to the nests, and although terns returned to incubate at two of the nests, each was later abandoned. An American crow was seen carrying away an egg from another nest. The outcome of three nests and eggs were uncertain, but lack of evidence of hatching or chick presence indicates probable depredation. Twenty-seven nests with 38 eggs were abandoned pre-term, and one single-egg clutch failed to hatch and was abandoned after prolonged incubation of 50 days. One egg each at two nests failed to hatch and was abandoned after the other egg in its clutch hatched successfully. One egg was found damaged with notably thin eggshell. Three fledglings and 13 chicks were found with no obvious cause of death. One fledgling was crushed by a vehicle on the adjacent perimeter road. Two adults were observed being taken from the site by peregrine falcons and the remains of four others, one fledgling, and one large chick/fledgling suggested peregrine predation. One chick was depredated by ants, one was seen taken by Cooper's hawk, two by peregrines, one was found depredated and American kestrel suspected responsible, and three others were found depredated by undetermined raptors. Nest abandonment and chick mortality coincided with regular disturbance and documented predation by Cooper's hawk, American kestrel, and peregrine falcon, as well as disturbance and possible predation by gulls, common raven, and American crows. Although no other definitive evidence of chick depredation was found, the lack of observations, recaptures, fledglings, and attentive adults indicates that up to 53 more chicks were likely preyed on. Other potential predators observed in the area included opossum, rats, California ground squirrel, great blue heron, black-crowned night-heron, red-tailed hawk, and European starling. Nests 106, 108-112 had uncertain clutch size and outcome due to their location adjacent to the runway and limited access for monitoring. As a result, they were monitored from a distance and nest status was based on whether adults were visibly incubating or not. In chronology if entered as 1E this indicates observed incubation of a minimum of 1 egg. Nest 113 was near other nests (109-112) but at such an angle from our vantage point that it was unclear from a distance when it was being incubated or not – we were not able to determine initiation date or cessation date other than that it overlapped with those nests possibly active 5/21 through 6/11. When we were able to access the area after the season, we were at least able to confirm its existence by its well-defined scrape in pea gravel & adjacent feces.

D Street Fill

Through late February, U.S. Fish and Wildlife Service staff applied herbicide to invasive plant species; and in early March, a contractor for USFWS completed mechanical scraping of the site to reduce vegetation and enhance it for use by least terns and snowy plovers. In early April, San Diego Unified Port District personnel completed additional mechanical scraping to reduce vegetation on the northwest slope mitigation area. Biological monitors under contract with the Port manually removed non-native invasive plants from the site, pruned back vegetation, surveyed the grid system, and placed decoys and ceramic tiles for chick shelters. Predator management was conducted by

personnel of US Department of Agriculture, Wildlife Services. Monitoring was conducted late February through mid-August one to three days per week. Least terns were first observed at the D Street Fill on 16 April 2013. They were observed each visit after that through 13 August. At least 144 nests were initiated by 96 to 113 estimated pairs between 7 May and 22 July. The maximum number of concurrently active nests was 79 with 16 broods of chicks on 4 June, and the maximum number of concurrently active nests and broods was 96 on 5 June. At least 174 chicks from 114 nests hatched successfully. It is estimated that 37 to 46 chicks reached fledgling age and 23 to 32 survived to fledge from the site. The outcome of five nests with seven eggs was uncertain, but lack of evidence of hatching or chick presence indicates probable depredation. One egg was found depredated with rodent tracks. At least three northern harriers were observed consistently within the colony coinciding with depredation of two previously abandoned eggs. Twenty-two nests with 27 eggs were abandoned pre-term, one single-egg nest was abandoned following prolonged incubation, and two eggs failed to hatch and were abandoned after the other egg in each clutch hatched successfully. Three chicks died while hatching. Eleven fledglings and 54 chicks were found with no obvious cause of death. Four additional chicks were found dead being scavenged by ants, but whether ants contributed to their mortality could not be determined. One chick was observed being taken by a northern harrier and a second was confirmed in necropsy. Two chicks were observed being taken by American kestrels. The remains of three fledglings indicated predation by peregrine falcon. No other definitive evidence of chick depredation was found, but lack of observations, recaptures, fledglings, and attentive adults indicates that others were likely preyed on. The disappearance of up to 66 to 75 chicks coincided with documented depredation and daily disturbances to the colony by northern harrier, American kestrel, and peregrine falcon, and visits by Cooper's hawk, red-tailed hawk, and barn owl. Other potential predator species observed in the area included great blue heron, great egret, black-crowned night-heron, gulls, gull-billed tern, common raven, American crow, European starling, western meadowlark, opossum, rats, California ground squirrel, feral cat, striped skunk, coyote, and gopher snake. The majority of chick mortality and nest abandonment occurred through June and July when mortality was reported at other colony sites and attributed to possible lack of prey fish availability, but also coincided with repeated hunting of the site by the aforementioned predators. There were no western snowy plovers documented at D Street Fill during the peak of nesting season from mid-April to mid-August, and no nests were established by snowy plovers this season. Up to 98 plovers were observed foraging on adjacent mudflats during ebbing or low tides prior to nesting season. Band combinations observed included origins in Oregon, Baja California, elsewhere in San Diego County, and captive-reared individuals from Project Wildlife.

Chula Vista Wildlife Reserve	<p>Prior to early April 2013 and the terns' arrival, Zoological Society of San Diego subcontract personnel coordinated herbicide application, mechanical scraping and dragging of the site, and weeded invasive non-native vegetation, surveyed the grid system, and placed ceramic tiles for chick shelters, decoys, and new signs. Monitoring was conducted from late February to early September one to three days per week. Predator management was conducted by USDA Wildlife Services staff. Least terns were first observed at Chula Vista Wildlife Reserve on 13 April 2013, and on each visit through 10 August. A migrant group of two adults and two fledglings was observed on 19 August. At least 79 nests were initiated by 58 to 66 estimated pairs between 13 May and 2 July with distribution throughout but concentrated in two clusters in the southwestern portion of the site and in the north-central site. The maximum number of concurrently active nests was 48 with seven broods of chicks on 21 June, but maximum number of concurrently active nests and broods was 58 on 18 June including 44 nests and 14 broods. At least 106 chicks from 66 nests hatched successfully. It is estimated that 37 to 44 chicks reached fledgling age and 32 to 39 young survived to fledge from the site this season. Two eggs from one nest were documented to have been depredated, with American crows suspected of being responsible. Ten nests were abandoned pre-term, six were abandoned after the other egg in each clutch hatched successfully, and two failed to hatch and were abandoned after prolonged incubation. One previously abandoned egg was depredated/scavenged but species responsible could not be determined. Three fledglings and 28 chicks were found dead of undetermined causes. It was unclear from the disarticulated remains of an additional chick whether it had been depredated or not. One chick was observed being depredated by an American kestrel, one fledgling observed depredated by a peregrine falcon, and remains of another fledgling and three adults indicated predation by peregrines. No other definitive evidence of chick depredation was found, but lack of observations, recaptures, fledglings, and attentive adults indicates that others were likely preyed on. The disappearance of up to 37 to 40 chicks coincided with repeated hunting of the site by American kestrels and peregrine falcons. Other potential predator species observed in the area included great blue heron, great egret, osprey, northern harrier, Cooper's hawk, red-tailed hawk, gulls, Caspian tern, gull-billed tern, common raven, coyote, striped skunk, feral cat, California ground squirrel, and rats. Snowy plovers were recorded only once at Chula Vista Wildlife Refuge this season with one roosting during high tide on 23 July. Forster's terns established at least 249 to 254 nests, the majority of which were on the southwest jetty, with smaller sub-colonies on the northwest and northwest central dikes. Black skimmers nested for the first time at Chula Vista Wildlife Refuge this season with two nests established, one each on the northwest and northwest central dikes.</p>
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SDNWR - Saltworks	<p>Potential nesting sites of the endangered California least tern and western snowy plover were monitored one to three days per week March through September by Robert Patton, Matt Sadowski, Lea Squires, Kate Goodenough, and Brian Collins. Predator management was conducted by USDA Wildlife Services staff. Least terns were first observed at the Saltworks on 21 April 2013, although they had been seen at adjacent Chula Vista Wildlife Reserve on 13 April. They were observed each visit after that through 7 August, then reported over the western ponds on 23 August. At least 45 nests were initiated by 25 to 31 pairs between 15 May and 10 July in five concentrations or subcolonies. The maximum number of concurrently active nests was 25 on 5 June. Eighteen nests were established near the wooden bridge/sluice on the southeast edge of pond 25, east edges of ponds 26 and 27, and west edge of pond 30; 14 nests were established on west dike IV, east dike VI, and north dike VII; eight nests on mid-dike IV; and five nests were established on the new fill in southeast pond 11. At least 14 nests appeared to be renests based on loss of clutches to predation or abandonment followed by initiation of new nests, frequently in close proximity or even within the same scrapes as recently depredated nests. At least 37 chicks from 20 nests hatched successfully. The majority of chicks were not seen beyond the first three days following hatching with predation the most likely limiting factor. Two to six are estimated to have fledged from the site. Three chicks were found dead with no visible trauma and one adult was found dead but with injury to thigh possibly inflicted by a predator. Eight nests with 13 eggs were abandoned and one single-egg nest failed to hatch after 45 days of incubation. At least 21 eggs from 13 nests (27 to 29 percent) were depredated, including 10 nests with 17 eggs found depredated with coyote tracks. The fate of seven eggs from four nests was uncertain, but lack of evidence of hatching or chick presence indicates probable depredation. The hatching of four chicks from two nests was indicated by length of incubation and by chick feces in the nest scrape, but coyote tracks were also present at the nests and the chicks were never seen by monitors. No other definitive evidence of chick depredation was found, but lack of observations, recaptures, fledglings, and attentive adults indicates that the other 28 to 32 chicks were likely preyed on. Their disappearance coincided with regular sightings of coyote tracks, harriers, and peregrine falcons, as well as kestrels. Other predator species observed in the area included Cooper's hawk, gulls, raven, crow, ground squirrel, and small rodents.</p>
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Tijuana Estuary NERR	<p>Potential nesting sites of the endangered California least tern and western snowy plover were monitored one to three days per week from mid-February to mid-October by Robert Patton, Matt Sadowski, Lea Squires, and Brian Collins. Predator management was conducted by USDA Wildlife Services staff. California least terns were first observed at Tijuana Estuary on 25 April 2013. They were observed each visit after that through 20 August. At least 279 nests were initiated by 139 to 203 pairs between 9 May and 11 July. The maximum number of concurrently active nests was 131 on 20 June with at least eight active broods also present. At least 76 nests were likely renests from clutches lost earlier. Nests were distributed in five concentrations or subcolonies. The rivermouth shifted significantly to the south again this season, opening up potential nesting habitat north of the rivermouth but eliminating what had been the largest potential nesting area and historic least tern colony site south of the rivermouth. At least 91 nests were established on upper beach immediately north of the rivermouth but south of the barrier dune, and one was established at the historic north site on the east side of the barrier dune between Seacoast Dr. and the rivermouth. At least 30 nests were located in upper beach and dune areas south of the rivermouth in what remained of the historic south rivermouth site. Between the beach parking lot and equestrian access trail at Border Field State Park, 154 nests were established, and three nests were established north of the trail. It is possible that additional nests were initiated but depredated before being found and counted by monitors. At least 216 chicks hatched from 130 nests, although evidence of hatching for many simply consisted of eggshell and/or tracks and feces. Most chicks were not seen beyond the first week following hatching with predation the primary limiting factor. This season at Tijuana Estuary, 61 young were estimated to have fledged from the site of at least 68 that survived to fledging age. Sixty-two nests with 86 eggs were abandoned pre-term, six eggs failed to hatch and were abandoned after the other egg in each clutch hatched successfully, and two chicks died while hatching. Forty-five eggs in 26 nests were flooded by extreme high tides. The outcome of 26 nests with 39 eggs was undetermined but predation was suspected. At least 14 percent of eggs were depredated, 40 nests with 66 eggs. These included 18 nests found depredated with coyote tracks, one nest each with canid tracks, cat tracks, raven tracks, and one with eggshell damage indicating harrier predation. Nine eggs at six previously abandoned nests were also depredated by coyote, raven, harrier, and black-bellied plover. At least five adults, nine fledglings, and three chicks were documented to have been depredated, including one observed being eaten by a peregrine falcon and remains of 12 found with tracks of peregrine or owl. Three fledglings and 42 chicks were found dead with no visible trauma, including one fledgling that had been banded at D Street Fill. Additional predation of up to 99 chicks was suspected by each of the above-mentioned species. Other potential predator species observed in the area were ants, snakes, small rodents, ground squirrel, great blue heron, black-crowned night-heron, kestrel, gulls, barn owl, crow, and meadowlark.</p>
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