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

California Least Tern Breeding Survey

2015 Season

by
Nancy Frost

Nongame Wildlife Program, 2016-01

Final Report

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ABSTRACT

Monitoring to document breeding success of California least terns (*Sternula antillarum browni*) continued in 2015, with observers at 41 nesting sites providing data. An estimated 4202-5295 California least tern breeding pairs established 5504 nests and produced 1514-1887 fledglings at 49 documented locations across California. The fledgling to breeding pair ratio was 0.29 to 0.45. Statewide, 9654 eggs were reported, with a Statewide clutch size of 1.7 eggs (St Dev = 0.26) 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, Huntington, Point Mugu, and Alameda Point each had over 300 minimum breeding pairs, which represented 64% of the state total, and produced the most fledglings, contributing 60% of the state's production (Table 1). Sites with greater than 35 fledglings each (the five aforementioned sites plus Mariner's Point, Hayward, Batiquitos, Bolsa Chica, and Oceano Dunes) contributed 86% of the state's production.

The 2015 statewide non-predation chick mortality rate was 18%, similar to that in 2014 (20%). With the exceptions of Camp Pendleton and Naval Base Coronado, the larger nesting colonies experienced non-predation chick mortality rates less than the average, similar to that documented in 2014. The predators known to be responsible for the greatest number of depredated least terns in 2015 were coyotes (*Canis latrans*), common ravens (*Corvus corax*), corvid species, raptor species, peregrine falcons (*Falco peregrinus*), and American crows (*Corvus brachyrhynchos*). The monitoring effort of 2015 is scheduled to continue in 2016.

[1] Frost, N. 2015. California least tern breeding survey, 2015 season. California Department of Fish and Wildlife, Wildlife Branch, Nongame Wildlife Program Report, 2016-01. Sacramento, CA. 24 pp + Appendices.

INTRODUCTION

Species Taxonomy and Life History

The California least tern (*Sternula antillarum browni*) is a 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). Least terns have been documented to nest on Midway Atoll (1989) and on the island of Hawaii (Szczys et al. 2014). 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 (formerly *Sterna*) based on the work of Bridge et al. (2005).

California least terns winter along the west coast of Central and South America (Massey 1977). Winter sightings have been reported from western Mexico, Guatemala, Gulf of Panama, Ecuador, Peru, Chile, and Hawaii (Tom Ryan 2014, pers. comm., 17 Jan.). They migrate to the nesting areas by mid- to late- April and are generally present through September (Massey 1974, Cogswell 1977, Patton 2002). California least terns often have two waves of nesting during this time period (Massey and Atwood 1981). Late-season nests may be established by renesters from the first wave or late-arriving first time breeders (Massey and Atwood 1981). The age of first breeding is typically 3 years; however, breeding by 2 year-old California least terns has been documented (Massey and Atwood 1981). California least terns establish nesting colonies on sandy soils with little vegetation along the ocean, lagoons, and bays, where they forage by plunge-diving for small fish (e.g., anchovy, *Engraulis* sp., and silversides, *Antherinopsidae*). Their nests are shallow depressions lined with shells or other debris (Massey 1974, Cogswell 1977). Given that vegetative cover in active least tern colonies is generally less than 20% (Gockfeld 1983, Carreker 1985), removal of non-native vegetation and select native vegetation is recommended to maintain open nesting areas with some dense vegetation that can be used by chicks to hide from predators (Ryan et al. 2010). On average, there are two eggs per nest that are incubated by both parents for approximately three weeks. Upon hatching, the semi-precocial young are tended by both parents, become mobile within three days, and can fly by 28 days (U.S. Fish and Wildlife Service 1985). California least terns are a long-lived species and banded birds have been recovered after 24 years (Brian Foster 2013, pers. comm., 13 July).

Listing Status

The California least tern 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. The Revised California Least Tern Recovery Plan (U.S. Fish and Wildlife Service 1985) identifies the recovery of the species as follows:

> "The annual breeding population in California must increase to at least 1200 pairs distributed in at least 20 secure coastal management areas throughout their 1982 breeding range before delisting can be considered. Each of the 20 secure management areas must have a minimum of 20 breeding pairs with a 5-year mean reproductive rate of at least 1.0 young fledged/per breeding pair. Of these 20 secure management areas San Francisco Bay, Mission Bay and San Diego Bay must have a minimum of 4, 6 and 6 secure

colonies, respectively. If 1,200 breeding pairs in California occur in 15 secure management areas with a 3-year mean reproduction rate of 1.0, the California least tern may be considered for threatened status. When additional information is available on the extent of nesting in Baja California, the Mexican colonies may be considered in the recovery goal for both threatened status and delisting."

However, the U.S. Fish and Wildlife Service has recognized that the Recovery Plan needs to be updated and anticipates doing so in the next few years (Bradd Bridges 2015, pers. comm., 9 Jan.).

Monitoring Efforts

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 leave the nesting area within approximately three weeks of hatching. Based on that analysis, she recommended that an evening count of fledglings be done every three weeks, starting approximately eight to nine weeks after the first egg is laid, or three weeks after the first fledgling is observed.

Since 1971, the frequency of nest 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 APHIS 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 chicks 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 pairs renesting on a site (Caffrey 1998). These equations have been used since the 1998 nesting season (Keane 2000). For over a decade, monitors have continued to provide comparable California least tern breeding success data, which has been compiled into annual summary reports.

In 2014, the Institute for Ecological Monitoring and Management (IEMM) completed an analysis of the long-term California least tern dataset to: (1) identify population trends and drivers of

those trends; and (2) evaluate current monitoring and management practices. Based on their analyses, they recommended:

- Adopting the new data collection and reporting protocol deployed by CDFW in 2013 (Appendix A);
- Decreasing emphasis on number of eggs per nest;
- Increased emphasis on fledgling monitoring using the improved chick classification method;
- Improved vital rate monitoring through a well-designed and coordinated recapture effort;
- Exploring new methods of colony monitoring like video or pellet and isotope analyses; and
- Rebalancing the effort directed to data collection and analysis to include more frequent comprehensive analyses.

The new data collection and reporting protocols were utilized by monitors during the 2015 breeding season in California.

METHODS

Monitors for each site that had least tern nesting in 2014 or who planned monitoring activities for 2015 were provided the instructions and spreadsheet to report final breeding data used for the annual report (Appendix A). The spreadsheet format was revised in 2013, but 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 revised spreadsheet included 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 revised Mortality worksheet combined the data fields that had to be entered separately in the previous Mortality, Non-nest Mortality, and Predation worksheets.

Site Information

Site Preparation

Prior to the arrival of California least terns on the nesting grounds, land managers conducted a variety of site preparation activities, which varied by site based on need, staffing, and available funding. 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. Following established conservation and monitoring methods for least terns and other similar species, monitors reported 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 with 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 (e.g., glyphosate or fusilade use; (4) combination of 1, 2 or 3; (5) vegetation removed by other means (e.g., spraying with salt water, soil solarization); (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 (pre-nesting season) 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); DH (died hatching); H (hatched and no longer present); PH (probable hatch); A (abandoned pre-term); NV (abandoned post-term/non-viable); P (predated); B (buried by wind); D (damaged); T (human take); F (flooded); U (unknown); and INC (actively-incubated nest, contents unknown).

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. For Method I, 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.

Total Pairs (#nests prior to 15 June + [(#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.

Total Pairs (total nests - (#unsuccessful nests prior 20 June + #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.

pairs first wave (#nests prior to 15 June - estimated renesters prior to 15 June)

pairs second wave (#nests 15 June or after - estimated renesters 15 June or after)

Total Pairs (pairs first wave + 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.

Statewide mean clutch size was 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); T (human take); F (flooded); B (buried by wind); DS (disease suspected); U (unknown); DH (died hatching); A (abandoned pre-term); or NV (abandoned post-term/non-viable). 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, two 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 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 wire or twine to a chain link fence completely enclosing the site. While over half of the sites used chick shelters, less than half of the sites used decoys. Site specific and complete site preparation data are in Appendix B-1.

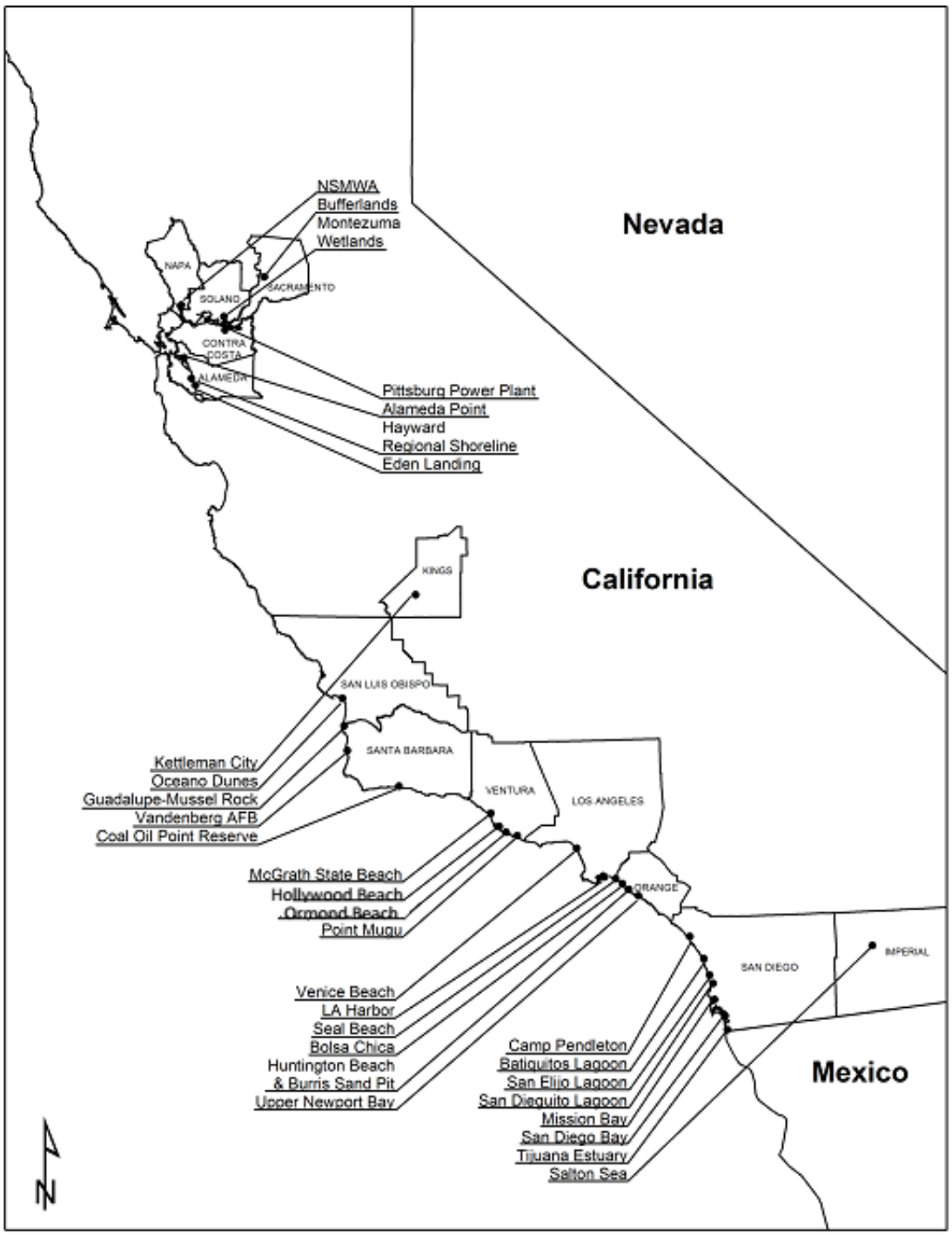

Figure 1. California sites monitored for California least tern nesting in 2015.

Monitoring

The majority of subcolonies monitored in 2015 were Type 1 sites (44) and monitored at least one or two times per week. A grid system to assist in locating nests was used at most sites and nest marking was used at nearly all of the sites. Site-specific monitoring data are in Appendix B-2.

Productivity

At least partial data were received and analyzed for all monitored least tern nesting areas in California for 2015. An estimated 4202-5295 California least tern breeding pairs established 5504 nests and produced 1514-1887 fledglings at 49 documented locations, including sub-sites (Table 1, Figure 2, Appendix B-3). The fledgling to breeding pair ratio was 0.29 to 0.45, lower than that in 2014 (0.37 to 0.68 fledglings per pair). For a few sites (Seal Beach, Huntington, Lindbergh Field, Tijuana Estuary), the maximum number of concurrently active nests was higher than the minimum number of pairs based on the three pair estimation methods (Appendix B-4). Based on the results of the three pair estimation methods (that have been used consistently over the past 10+ years) and the maximum number of concurrently active nests, the minimum number of pairs for 2015 would be 4229.

Statewide, 9654 eggs were reported, with a Statewide clutch size of 1.7 eggs (St Dev = 0.26). Average clutch size ranged from a high of 1.9 in the San Francisco Bay area and central coast area and a low of 1.6 in the Los Angeles and Orange county area (Appendix B-4). Four-egg clutches were observed in 2015 at Camp Pendleton (n=1) and Batiquitos (n=1). The date of peak nesting activity varied by region (Figure 3). Furthermore, a second wave of nesting was more apparent in some regions than others.

The 2015 California least tern nesting season lasted five months. The first recorded least terns at a nesting site were observed on 13 April at Hayward, and the last observed on 4 September at Bufferlands. The first nest was detected on 25 April (Camp Pendleton), the first chick on 20 May (Camp Pendleton), and first fledgling on 11 June (Mariner's Point). There were two locations used in 2014 (Ormond Beach and Salton Sea) for which there was no evidence of least tern nesting in 2015. Conversely, least terns nested at two locations, Bufferlands and Pittsburg Power Plant, that were not used in 2014. Site-specific and complete productivity data are located in Appendix B-3 (breeding pair estimation) and B-4 (productivity).

The 4202 minimum number of breeding pairs in 2015 represented the lowest count since 2002 (Figure 2). The minimum number of fledglings in 2015 was 1514, which was much lower than that in 2014 (2136) but similar to that in 2013 (1404; Frost 2014). The majority of breeding pairs nested in San Diego County (2492 pairs, 59%) and the fewest in the central coast area: San Luis Obispo, Santa Barbara, and Kings counties combined (70 pairs, 2%) (Table 1, Appendix B-3). The fledgling-to-pair ratio ranged from a low of 0.24 in Los Angeles/Orange Counties to a high of 1.4 in the central coast area. The colony with the highest ratio was Vandenberg with 1.32 fledglings per pair (Table 1). The only other colonies statewide that had a ratio greater than one were Oceano Dunes (1.30) and Hayward (1.29).

A few sites constituted the majority of breeding activity for the state in 2015, which is a trend consistently observed in the past (Frost 2015). Camp Pendleton, Naval Base Coronado, Huntington, Point Mugu, and Alameda Point each had over 300 minimum breeding pairs, which represented 64% of the state total, and produced the most fledglings, contributing 60% of the state's production (Table 1). Sites with greater than 35 fledglings each (the five aforementioned sites plus Mariner's Point, Hayward, Batiquitos, Bolsa Chica, and Oceano Dunes) contributed 86% of the state's production. Except for the San Francisco Bay area, there is a linear relationship between the number of breeding pairs and fledglings in each region across time (from 2004-2015; Appendix B-4).

Table 1. California least tern colony productivity in 2015 (pair estimates using Methods I, II, and III*).

2015 Results	Estimated Number of Breeding Pairs		Number of Nests	Estimated Number of Fledglings		Fledglings per Pair Ratio	
Site	Minimum	Maximum		Minimum	Maximum	Minimum	Maximum
Sacramento Area							
Bufferlands	1	1	1	1	1	1.00	1.00
San Francisco Bay Area							
Napa Sonoma Marsh Wildlife Area - Totals	63	71	79	24	24	0.34	0.38
Montezuma Wetlands - Totals	12	14	16	0	0	0.00	0.00
Pittsburg Power Plant	2	3	3	0	0	0.00	0.00
Alameda Point	320.5	335	351	330	536	0.99	1.67
Hayward Regional Shoreline	66.5	70	71	90	105	1.29	1.58
Eden Landing	0	0	0	0	0	0	0
Kings County							
Kettleman City Evaporation Ponds	0	0	0	0	0	0	0
San Luis Obispo/Santa Barbara Counties							
Oceano Dunes SVRA	50	53	54	69	69	1.30	1.38
Rancho Guadalupe Dunes	0	0	0	0	0	0	0
Vandenberg AFB	20	22	22	29	29	1.32	1.45
Coal Oil Point Reserve	0	0	0	0	0	0	0
Ventura County							
Ormond Beach	0	0	0	0	0	0	0
Hollywood Beach	15	23	24	0	0	0.00	0.00
Santa Clara River/McGrath State Beach	45	69	72	27	27	0.39	0.60
Pt Mugu - Totals	323	441	473	116	150	0.26	0.46
Saticoy United Water Conservation District	0	0	0	0	0	0	0
Los Angeles/Orange Counties							
Venice Beach	8	8	8	0	0	0.00	0.00
LA Harbor	103	109	109	0	0	0.00	0.00
Seal Beach NWR - Anaheim Bay	50	94.5	106	7	7	0.07	0.14
Bolsa Chica Ecological Reserve - Totals	184	192	204	51	53	0.27	0.29
Huntington State Beach	411	506.5	524	125	125	0.25	0.30
Burris Sand Pit/Burris Basin	18	22	23	3	3	0.14	0.17
Upper Newport Bay Ecological Reserve	18.5	21	22	1	1	0.05	0.05
San Diego County							
MCB Camp Pendleton - Totals	917.5	1358	1384	170	171	0.13	0.19
Batiquitos Lagoon Ecological Reserve - Totals	296	413	415	90	143	0.22	0.48
San Elijo Lagoon Ecological Reserve	0	0	0	0	0	0	0
San Dieguito Lagoon Ecological Reserve	0	0	0	0	0	0	0
Fairbanks Ranch	0	0	0	0	0	0	0
Mission Bay							
FAA Island	16	19	20	9	12	0.47	0.75
North Fiesta Island	17	23	24	1	2	0.04	0.12
Mariner's Point	164.5	177.5	181	100	130	0.56	0.79
Stony Point	1	1	1	0	0	0.00	0.00
San Diego River Mouth	0	0	0	0	0	0	0
San Diego Bay							
Lindbergh Field/Former Naval Training Center	8	18	18	8	9	0.44	1.13
NIMAT	23	27.5	32	3	3	0.11	0.13
NI 18	1	1	1	0	0	0.00	0.00
Naval Base Coronado- Totals	707	778.5	826	167	173	0.21	0.24
D Street Fill/Sweetwater Marsh NWR	104.5	119.5	123	21	34	0.18	0.33
Chula Vista Wildlife Reserve	68.5	77.5	79	33	37	0.43	0.54
South San Diego Bay Unit, SDNWR-Saltworks	24	26.5	29	9	10	0.34	0.42
Tijuana Estuary NERR - Totals	143.5	198.5	208	30	32	0.15	0.22
Imperial County							
Salton Sea	0	1	1	0	1	0.00	1.00
Totals	4202	5295	5504	1514	1887	0.00	0.00

*Not all sites were able to provide data to calculate Methods III (see Appendix B-3 for details).

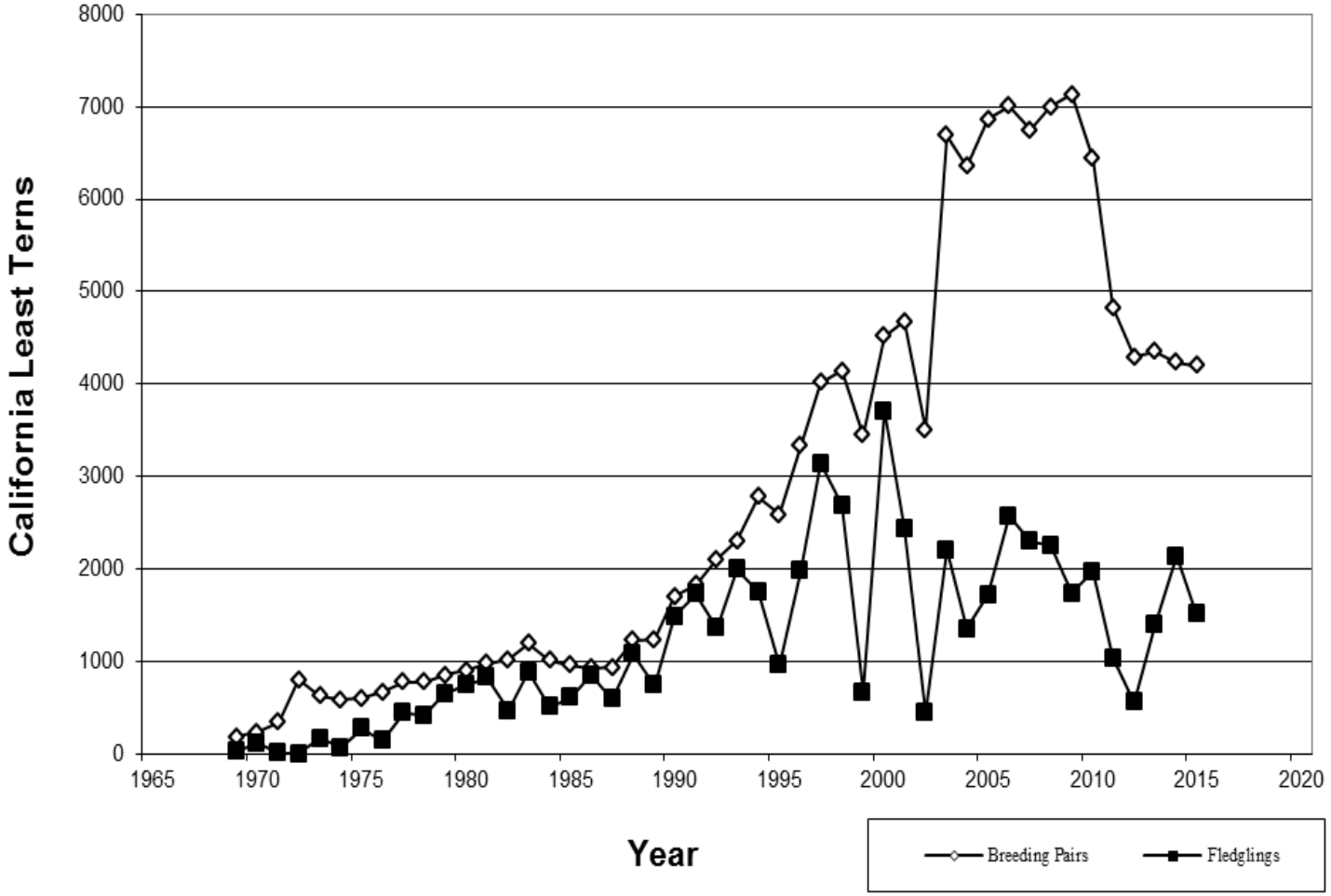

Figure 2. Minimum number of documented California least tern breeding pairs and fledglings in California during annual surveys, 1969-2015 (data from: Craig 1971; Bender 1974a, 1974b; Massey 1975, 1988, 1989b; Atwood *et al*. 1977; Jurek 1977; Atwood *et al*. 1979; Collins 1984, 1986, 1987; Gustafson 1986; Johnston and Obst 1992; Obst and Johnston 1992; Caffrey 1993, 1994, 1995b, 1997, 1998; Keane 1998, 2000, 2001; Patton 2002, 2004 unpublished table; Marschalek 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012; Frost 2013, 2014, 2015).

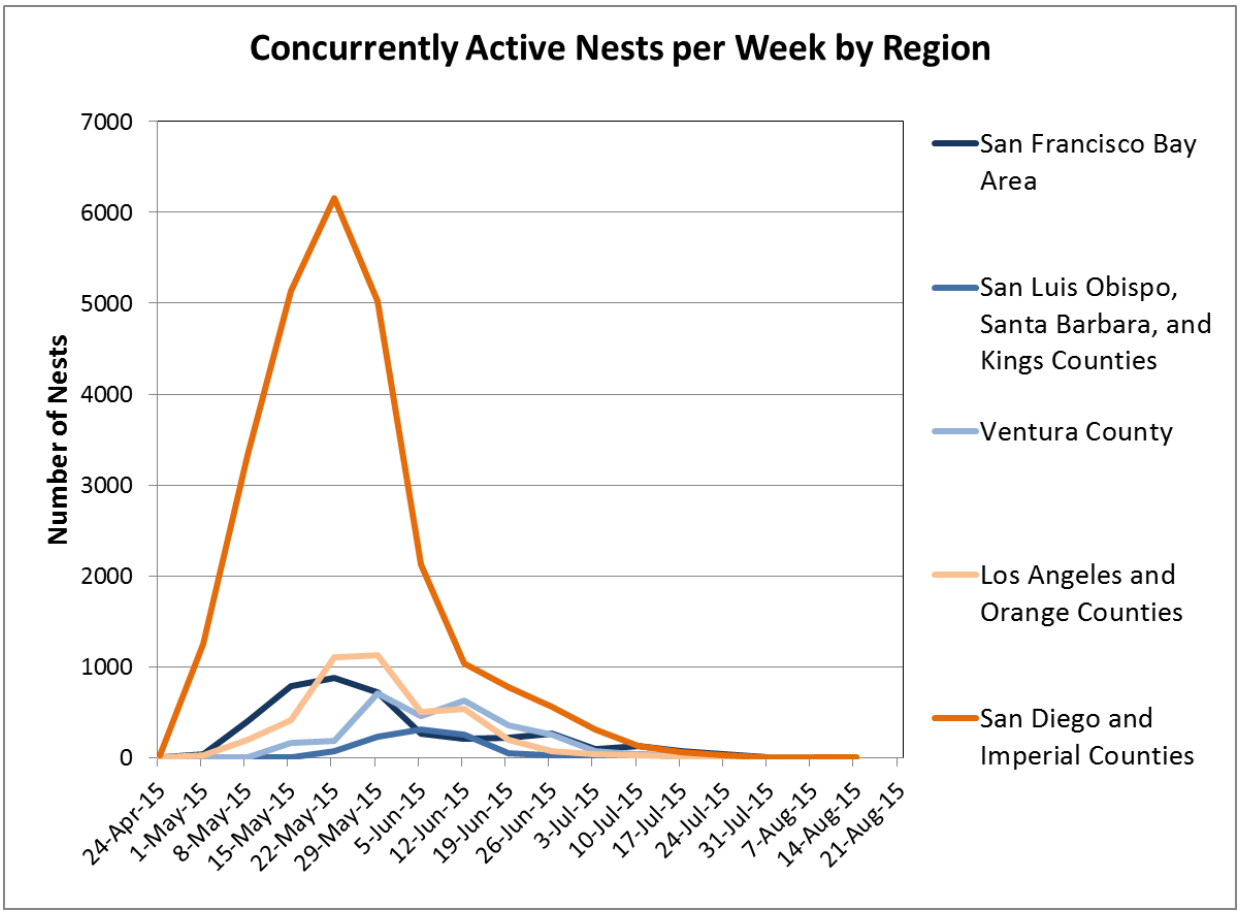

Figure 3. Maximum concurrently active nests by region.

Mortality and Predation

In 2015, the statewide non-predation chick mortality rate was 18%, similar to that in 2014 (20%; Frost 2014). As was the case in 2014, the majority of the larger nesting colonies experienced non-predation chick mortality rates less than the statewide average (Huntington: 13%; Point Mugu: 3%; and Alameda Point 2%). Total non-predation chick deaths at these sites represent 9% of the total statewide count, which is much less than the number of chicks hatched at these sites compared to the statewide total (23%). Conversely, two of the larger nesting colonies experienced non-predation chick mortality rates greater than the statewide average. Camp Pendleton had a 31% non-predation chick mortality rate and Naval Base Coronado had a 24% non-predation chick mortality rate. These two sites represented 69% of the total reported non-predation chick deaths and 44% of the total chicks hatched.

Least tern mortality due to non-predation factors was greater than mortality due to predation in 2015. Of non-predation egg mortality events, the highest cause of failure (41%) was attributed to abandonment prior to the expected hatching date leading to the loss of 797 eggs. Abandonment post-term (non-viable, failed to hatch eggs) was estimated to constitute 31% of non-predation mortality (597 eggs). Predation was reported as the cause of loss of 894 eggs, 115 chicks, 103 fledglings, and 65 adults (Table 4). In 2014, more eggs (1072) and a similar number of chicks (104), fledglings (87), and adults (77) were documented as depredated (Frost 2015).

Out of the total nests that were lost range-wide in 2015, 35% were abandoned pre-term, 14% were nonviable, and 32% were lost to depredation.

Non-predation mortality rates and cause of nest failure varied by region (Figures 4 and 5). Chick mortality accounted for most of the non-predation mortality in San Diego County while fledgling mortality constituted the majority of the non-predation mortality in Los Angeles and Orange counties. Predation attributed to the highest percent of nest failure in Ventura County, while abandonment pre-term caused the highest percent of nest failure in San Diego County. Non-viable and abandoned eggs accounted for the highest percent of nest failure in the San Francisco Bay area and nonviable eggs and unknown causes caused the highest percent of nest failure in the Central Coast area. Nest failure in Los Angeles and Orange counties was due primarily to predation and damaged eggs.

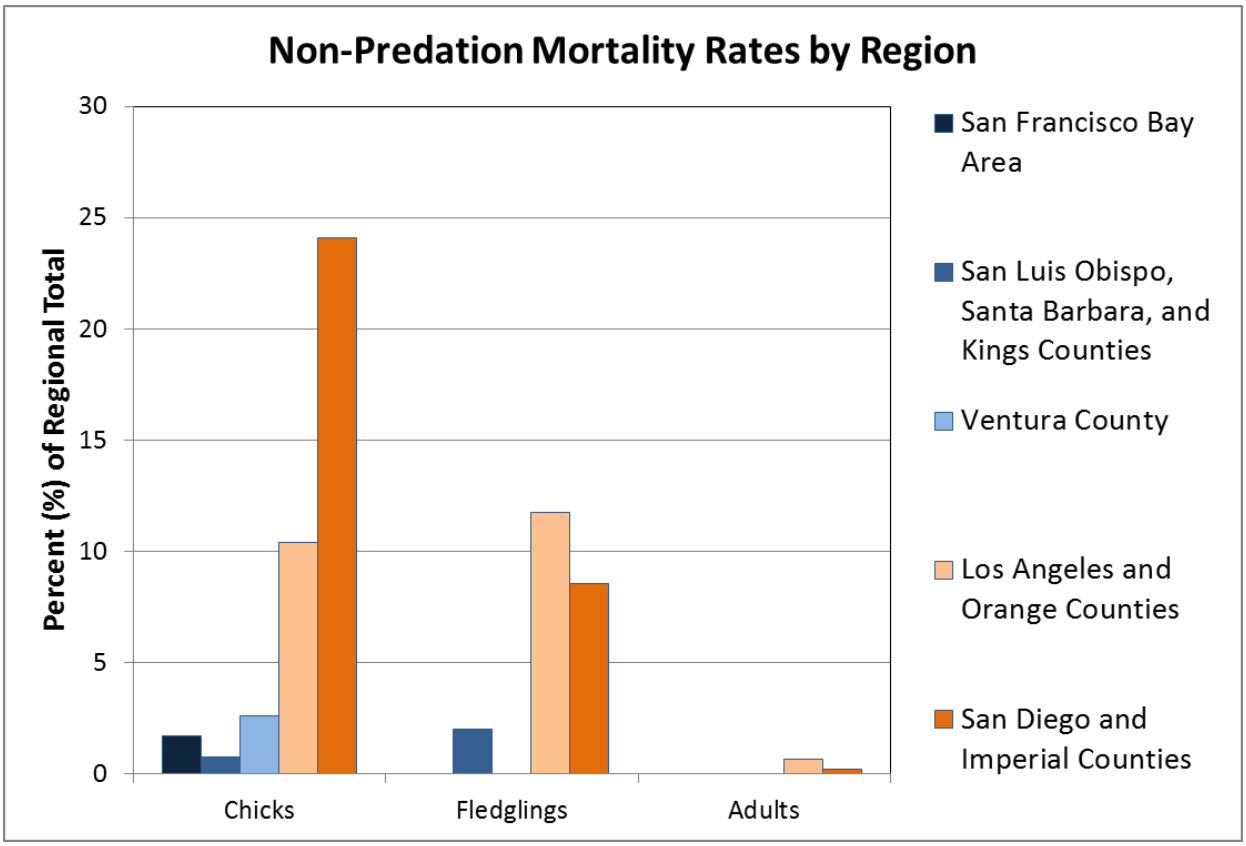

Figure 4. Non-predation chick, fledgling, and adult mortality rates by region in 2015.

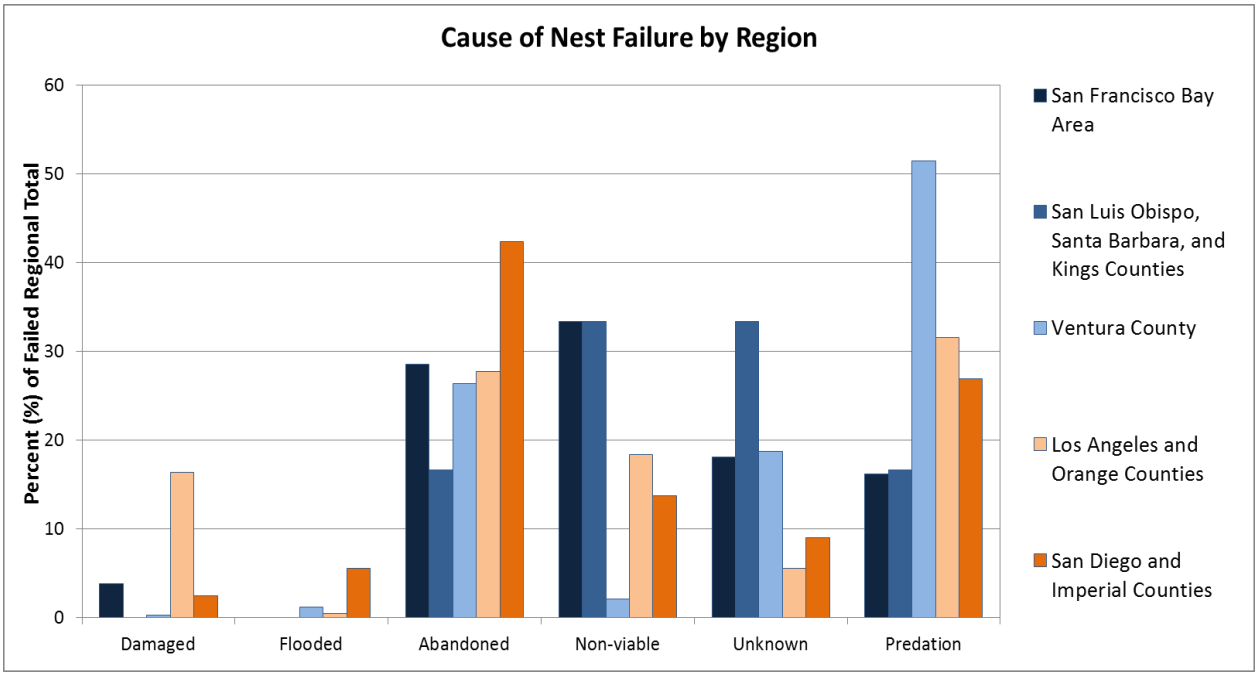

Figure 5. Cause of nest failure by region in 2015.

Table 4. 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	894**	115	103	65	1177
Non-predation	1611	1212	79	21	2923

*An additional 349 eggs were lost to unknown causes.
**Includes data from Chronology worksheet.

It can be very difficult to accurately determine the predator species involved in tern predation events, which are not typically observed and from which little or no evidence may remain. Level of certainty regarding a predation event may be reflected by reporting it as either suspected or documented, 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).

Twenty species as well as 6 other taxa (e.g., corvid, unknown, and unknown avian species) were reported as possible, suspected, or documented predators of least terns (Appendix B-6). Based on the number of sub-colonies reporting each predator species, the most commonly reported predator species were peregrine falcons (*Falco peregrinus*, 16), unknown species (16), common ravens (*Corvus corax*, 12), unknown avian species (8), corvids (7), great blue herons (*Ardea herodias*, 7), coyotes (*Canis latrans*, 6), and American crows (*Corvus brachyrhynchos*, 6). The remaining predator species were reported from four or fewer sub-colonies. As in past years, most reported predators were avian species.

A total of 927 least tern individuals (including eggs) were reported as taken by a documented or suspected predator species, of which only six were depredated by unknown species (Appendix B-6). Of those least terns lost to suspected or documented predator species, coyotes, common ravens, corvid species, raptor species, peregrine falcons, and American crows depredated the most least terns. 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 gull-billed terns tended to be higher (Marschalek 2010). The foraging area of gull-billed terns has expanded since 2007; however the number of least terns suspected or documented to be depredated by gull-billed terns has decreased over the last several years with 813 individuals depredated in 2009, 222 in 2010, 149 in 2011, 87 in 2012, 2 in 2013 (when the gull-billed tern acanthocephalan die-off may have contributed to reduced depredation), 7 in 2014, and 14 in 2015 (including bands from 7 chicks hatched at Coronado, that were found in gull-billed tern pellets at the Saltworks colony; Jeanette Boylan 2015, pers. comm. 14 September).

Predator species varied in importance among each least tern age class. Coyotes, common ravens, corvid species, American crows, and raptor species had the largest depredation rate of eggs, while great blue herons, peregrine falcons, raptor species, red-tailed hawks, American kestrels, and Cooper's hawks depredated the most chicks. Peregrine falcons, raptor species, barn owls, great horned owls, and great blue herons, depredated the most fledglings, and peregrine falcons, raptor species, great horned owls, owl species, and barn owls depredated the most adults (Appendix B-6).

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

California least tern breeding success was monitored in 2015 to track where this endangered species is relative to population recovery. While some of the recovery criteria (e.g., minimum number of breeding pairs) have been met, there are concerns regarding the increased level of threats to the species in the last few years (Bradd Bridges 2015, pers. comm., 9 Jan.) and other key metrics, such as the fledgling to pair ratio, which remain variable. The majority of breeding pairs nested at Camp Pendleton, Naval Base Coronado, Huntington, Point Mugu, and Alameda Point, and the majority of fledglings produced were from these colonies. Biologists recorded a minimum of 4202 breeding pairs, the lowest count since 2002, and the minimum fledgling to maximum breeding pair ratio (0.29) was lower than during the previous year. Since 1977, this ratio has been less than 0.50 for only 16 years (including the last 14 years).

As was the case in 2014, California least tern population growth in 2015 was hindered by relatively low productivity as well as direct limiting factors (1177 individuals lost to predation) and indirect limiting factors (2923 individuals lost to non-predation causes including abandonment post-term, which contributed to half of the non-predation egg mortality).

Non-predation chick mortality in 2015 was similar to that documented in 2014, with most of the larger nesting colonies (Huntington, Point Mugu, and Alameda Point) experiencing non-predation chick mortality rates less than the average. In addition to avian predators, which were responsible for the highest predation rates over the last several years, coyotes contributed to the highest predation rates documented in 2015.

A lack of sufficient foraging resources is widely thought to be a significant factor limiting California least tern population growth and warrants additional study. Continued site preparation (including maintenance of fencing and vegetative cover), predator management, and California least tern breeding success monitoring will be key to identifying adaptive management strategies that will contribute towards the recovery of this species.

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Appendix A

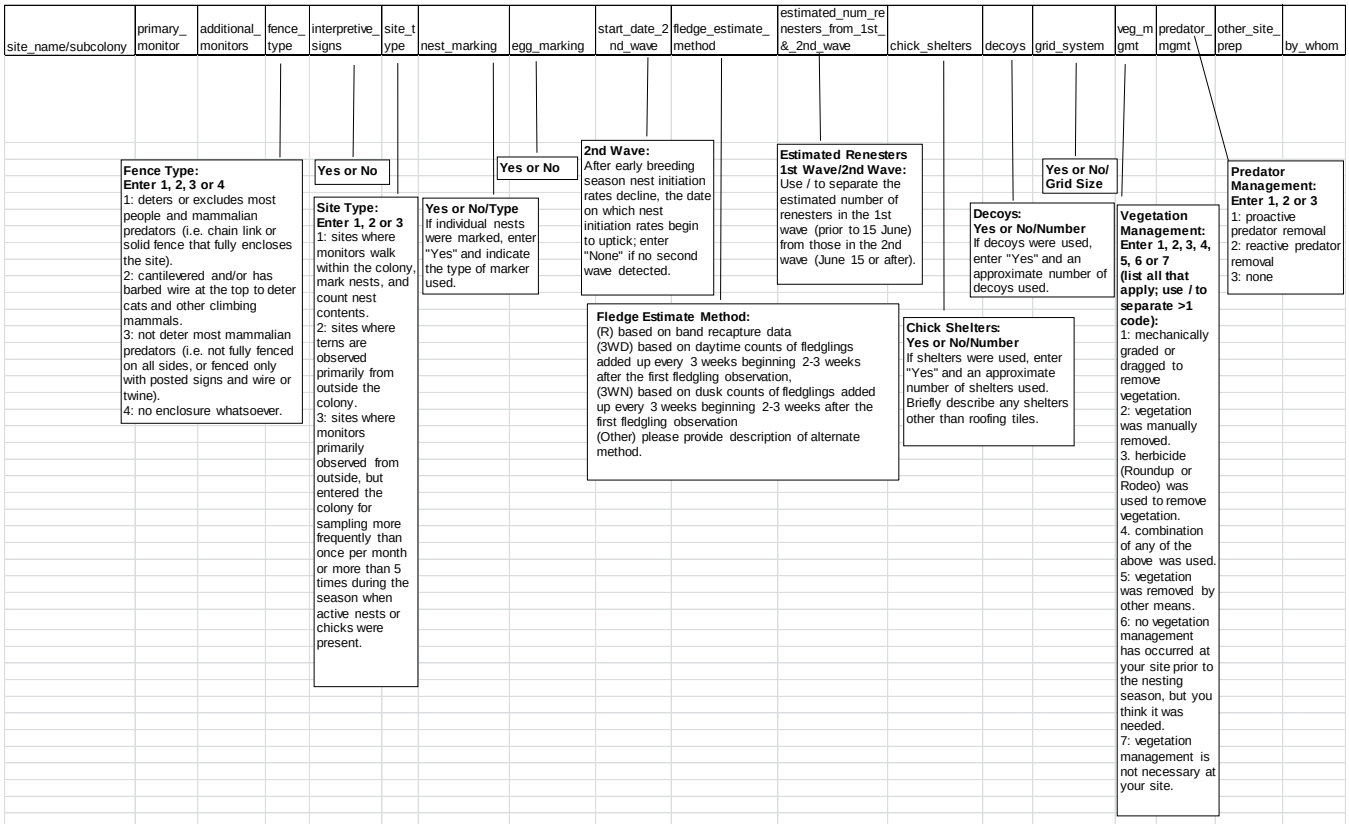
Data Sheets

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-15
•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 not required to complete the Notes worksheet and Summary Table worksheet.
•Use consistent colony or subcolony names in each worksheet.
•Avoid entering blank spaces before or after codes entered in the spreadsheet.
•Be sure to use 0 (zero), not O (letter) in numbers.

Site Information:



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				
	Nest_07				
	Nest_08				
	Nest_09				
	Nest_10				
	Nest_11				

Comments: If local nest numbers (e.g., NBN-001, NBN-002…) are used, enter them in the comments column.

Nest_num: Submit nest numbers in sequential order (e.g., Nest_01, Nest_02…) based on date for each subcolony.

Season Chronology: Enter data for the actual date you conducted the survey (include days when least terns weren't seen). Complete new worksheet for each subcolony.

date	site_name/subcolony	num_monitors	num_hrs_in_colony(C)/blind(B)	num_adults	num_fledges	num_chicks_off_nest	num_observed_predators	nest_01	nest_02	nest_03	nest_04	nest_05	nest_06	nest_07

Number of Adults: Enter counts of adults when seen.

Chick and Fledge Codes
C=chick-downy
CF=chick-feathered
PF=pre-fledge
FY=fledge-young
FO=fledge-old

For "num_chicks_off_nest" only count chicks for which nest affiliation cannot be determined.

For "num_fledges" do not count pulses of fledglings passing through.

Predator Species Codes (use / to separate >1 code & use numbers to indicate how many individuals of each species; 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

Egg Codes (use / to separate >1 code & use numbers to indicate how many at nest with that code, i.e., two eggs in nest is coded 2E, or one egg & one hatch in nest is coded 1E/1H; use codes to account for each egg on each visit, unless nest is missed on visit):
E=egg
C=chick-downy
DC=dead chick
DH=died hatching
H=hatched and no longer present
PH=probable hatch
A=abandoned pre-term
NV=abandoned post-term/non-viable
P=predated
B=buried by wind (applies to nests that were active on the visit prior to being found buried)
D=damaged
T=human take
F=flooded
U=unknown
INC=actively-incubated nest, contents unknown

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

Nest Number:
•Be sure all DC=dead chick (including those not associated with a nest) are entered in Mortality so we have complete information on the number of nests and broods that fail.
•For DC found at nest, enter nest number in nest_num column; for DC found on site but not associated with a nest, enter U in nest_num column. This will facilitate counting and cross checking Chronology and Mortality data, which is necessary to ensure accurate results from pair estimation method II.

Mortality Codes:
P=predated
D=damaged
T=human take
F=flooded
B=buried by wind (applies to nests that were active on the visit prior to being found buried)
DS=disease suspected
U=unknown
DH=died hatching
A=abandoned pre-term
NV=abandoned post-term/non-viable

Notes:
•Use code T=human take to distinguish from code D=damaged (non-human take e.g., elegant tern trampling).
•Cross check Mortality data with nest Chronology data to make sure P, DC, D, F, DS, U, and B, as well as A and NV (see below), are recorded the same in both datasets. For instance, if nests are recorded as P in nest Chronology but there is no information in Mortality, we can only record that as an unknown predator.
•If a nest is determined to be inactive (A or NV) and then predated, indicate A or NV in the mortality_cause column. This will allow accurate determination of individual predator species impact.

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)

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).

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

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

Predator Species Codes (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)

Disposition codes:
H=harass
U=unsuccessful capture attempt
E=escaped
T=transferred
C=captively-held
R=relocated
K=killed
D=found dead

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

Birds_Banded_This_Year							Resightings_of_Birds_Banded_in_Current_or_Previous_Years						
site_name/subcolony	band_num	color_comb_l-r	nest_num	date	age	died_during_season	band_num	color_comb_l-r	site_name/subcolony	date	age	status	comments

Enter nest number, if banded at nest.

Yes or No

Status Codes:
D=dead
TR=trapped/released
O=other

Summary Table (completion not required)

	Colony Name
Date terns first observed	
Date terns last seen	
Date of first nest	
Date last nest found	
Date last nest established	
Date of first hatch	
Date of last hatch	
Date of first fledgling	
Estimated number of pairs	
Total number of nests	
Total number of eggs	
Clutch size:	
1 egg	
2 egg	
3 egg	
4 egg	
unknown (min. 1 egg)	
Average clutch size	
No. of nests hatching young	
Total number of eggs hatched	
Estimated number of fledglings	
Number of chicks banded	
Number of adults banded	
Uncertain outcome	
Nests	
Eggs	
Documented Mortality	
Preyed upon	
Nests	
Eggs*	
Chicks	
Fledglings	
Adults	
Human disturbance	
Nests	
Eggs	
Chicks	
Fledglings	
Adults	
Other causes	
Nests	
Abandoned (pre-term)	
Failed to hatch (incubated to term)	
Died hatching	
Damaged (eggshell thinning)	
Flooded	
Eggs	
Abandoned (pre-term)	
Failed to hatch (incubated to term)	
Died hatching	
Damaged (eggshell thinning)	
Flooded	
Chicks	
Fledglings	
Adults	

Summary Table:
Do not double count nest outcomes. If a nest has at least one hatch and the other egg(s) fails, it would be considered a successful nest and would not be counted as a nest with a failed outcome (i.e., A, FH or NV, DH, D, or F).

* not including previously abandoned eggs that were depredated/scavenged

General Data Sheet

Page 1

Date:			Site_name/Subcolony:					
Monitors:			start_time:			end_time:		
num_adults:						num_hrs_in_colony_vs_blind: colony(C): /blind(B):		
num_fledges:			For "num_fledges" do not count pulses of fledglings passing through.					
FY (total):	(tally)							
FO (total):	(tally)							
num_chicks_off_nest:			For "num_chicks_off_nest" only count chicks for which nest affiliation cannot be determined.					
C (total):	(tally)							
CF (total):	(tally)							
PF (total):	(tally)							
num_observed_predators:			Use / to separate >1 code & use numbers to indicate how many individuals of each species.					
Notes_comments:								
Chick/Fledge Codes: C=chick-downy, CF=chick-feathered, PF=pre-fledge, FY=fledge-young, FO=fledge-old.								

Date:				Site_name/Subcolony:					
Depredation and Mortalities:									
num_eggs	nest_num	num_chicks	num_fledge	num_adults	mortality___ _cause	predator___ _species	predator___ _type	predation__ _evidence	comments

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

Predator Type Codes: PP=possible predator, SP=suspected predator, DP=documented predator

Mortality codes: P=predated, D=damaged (non-human damage, ie: trampling by ELTE), T=human take, F=flooded, B=buried by wind, DS=disease suspected, U=unknown (can be used for DC found at nest with no obvious signs of trauma), DH=died hatching, A=abandoned pre-term, NV=abandoned post-term/non-viable

Nest Check Sheet

Date (enter date of each survey):										GPS	
Nest	Date Found	Grid	Prior Status*	Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Survey 6	utm_easting	utm_northing
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
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23											
24											
25											
26											
27											
28											
29											
30											
31											
32											
33											
34											
35											
Nest	Date Found	Grid	Prior Status*	Survey 1	Survey 2	Survey 3	Survey 4	Survey 5	Survey 6	utm_easting	utm_northing

Egg/Nest Codes (use / to separate >1 code & use numbers to indicate how many at nest with that code): E=egg, C=chick-downy, DC=dead chick, DH=died hatching, H=hatched and no longer present, PH=probable hatch, A=abandoned pre-term, NV=abandoned post-term/non-viable, P=predated, B=buried by wind, D=damaged, T=human take, F=flooded, U=unknown, INC=actively-incubated nest, contents unknown; *copy nest status entry from last survey and paste into Prior Status column when printing out new sheet to allow for understanding of nest contents while in field.

Master Band List

Version #1

Species Year Observer(s)

Band Prefix	Band No.	Date	Band Comb.	Wing	Weight	Cond.	Nest No.	Egg No.	Loc.	Grid	Age	NOTES
Band Prefix	Band No.	Date	Band Comb.	Wing	Weight	Cond.	Nest No.	Egg No.	Loc.	Grid	Age	NOTES

Version #2

Species **Year** **Observer(s)**

Band Prefix	Band No.	Date	Band Comb.	Wing	Weight	Cond.	Nest No.	Egg No.	Loc.	Age
Band Prefix	**Band No.**	**Date**	**Band Comb.**	**Wing**	**Weight**	**Cond.**	**Nest No.**	**Egg No.**	**Loc.**	**Age**

Appendix B

Site Specific Data

Appendix B-1: Site Preparation in 2015.

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; 7-None needed. Predator management: 1-Proactive predator removal; 2-Reactive predator removal; or 3-None. *Sites that do egg marking.

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Sacramento Area													
Bufferlands	Chris Conard	Steve Scott	3	No	2	No	No	No	No	6	3		
San Francisco Bay Area													
Napa Sonoma Marsh Wildlife Area/Green Island Unit	Karen Taylor	Erickson, Mellquist, Hlusak, Shelton, Allington (USGS)	4	No	1	Yes/paint pen	Yes/5 Ceramic Roof tiles, 12 drift wood pieces, washed up, 5 other debris pieces	No	No	6	3	No	CDFW
Napa Sonoma Marsh Wildlife Area/Pond 7/7A	Karen Taylor	Erickson, Mellquist, Taylor, Allington(USGS), Tzen (USGS), Barry, Cabral, Hollander (USGS)	4	No	1	Yes/paint pen	No	No	No	6	3	No	CDFW
Montezuma/ Site_1B	Anne Wallace	Susan Euing 1 day	4	No	2	Yes/4 nests that were active June 15	No	No	No		3		
Montezuma/ Site_3/4C	Anne Wallace	Susan Euing 1 day	4	No	2	Yes/5 nests active on June 15	No	No	No	Sprayed with Roundup and Polaris March 2015	3		
Pittsburg Power Plant	Claire Woolf	Jason Yakich	1	No	2	No	Yes/ approx. 40 roof tiles	No	No	4	3	No	

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Alameda Point	Susan Euing	Meredith Elliott, Eric Lynch	1	No	1	Yes/3-inch metal washer placed upright in plaster of paris base, all painted white with nest number applied with black paint marker to washer	Yes/ approx. 250 wooden A-frames, 600 terracotta half-cylinders & scattered oyster shells	No	Yes/9.7 acres comprised of 99 grids (each grid 20m X 20m)	4	1/2	Smooth out and/or add sand as needed; reinstall grid system and chick shelters/ shells; repair/ replace sections of chick fence	FWS and Vols.
Hayward Regional Shoreline	David Riensche, Mary Riensche, Sarah Riensche, Daniel Riensche, Nathan Riensche, Rebekah Riensche, and Sarah C. Gidre		4	Yes	1	Yes/5cm washers	Yes/26	Yes/24	Yes/10 m grid cells	2/3	1	See Notes	See Notes
Eden Landing	Cheryl Strong												
Kings/San Luis Obispo/Santa Barbara Counties													
Kettleman City Evaporation Ponds	Jeff Seay												

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Oceano Dunes State Vehicular Recreation Area	Doug George, Joanna Iwanicha, Amber Clark, Ryan Slack, Cheryl Lish, Amber Branske	Sarah Stratton, Nicky Petch-Bar, Sarah Robinson, Mattie Bishop, Josh Willems, Ryan Wardle, Rick Hernandez, Alex Velazquez, Caitrin Doles	1 (45 nest), 3 (9 nests)	Yes	3	Yes/most nests typically marked 30-40 ft. east and west with color-coded bamboo sticks	No; cut branches and driftwood are distributed in nesting area	No	No	5; least tern breeding site open to off-road vehicle use October to February and this prevents or removes most vegetation. Efforts are made to encourage some vegetation for chick cover.	1		
Rancho Guadalupe Dunes Preserve	Tom Applegate	Melissa Kelly	3	Yes									
Vandenberg AFB/Purisima Point	Robinette	Hargett, Howar, Miller, Rice	1	Yes	3	Yes/ tongue depres-sor	Yes/46 V-shaped wooden plus 24 teepee style	No	No	7	2	Electric Fence Maintenance	ManTech
Coal Oil Point Reserve	Jessica Nielsen	Cristina Sandoval											
Ventura County													
Santa Clara River/ McGrath State Beach	Alexis Frangis	Brooke Sheridan, Chelsea Fletcher	3	Yes	1	Yes/ Natural Driftwood	No	No	No	7	3	None	
Hollywood Beach	Debra Barringer	Danielle Glenn	3	Yes	1	Yes/ tongue depres-sor	No	No	No	7	3		
Ormond Beach	Cynthia Hartley	Debra Barringer	3	Yes	1	Yes/ tongue depres-sor	No	No	No	7	3		

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
NBVC Point Mugu/Holiday Beach	Francesca Ferrara	Martin Ruane, Josh More, Erica Hadley, Jack Velasquez, Colleen DelVecchio	4	Yes	1	Yes/ tongue depres-sors	Yes/25 shelters	No	No	7	1/2	No	
NBVC Point Mugu/Holiday Salt Panne	Francesca Ferrara	Martin Ruane, Josh More, Erica Hadley, Jack Velasquez, Colleen DelVecchio	4	Yes	1	Yes/ tongue depres-sors	No	No	No	7	1/2	No	
NBVC Point Mugu/Ormond Beach East	Francesca Ferrara	Martin Ruane, Josh More, Erica Hadley, Jack Velasquez, Colleen DelVecchio	4	Yes	1	Yes/ tongue depres-sors	Yes/50 shelters	No	No	7	1/2	No	
United Water Conservation District facilities in Saticoy, Ventura County, California	Jennifer Turner, Carie Wingert	James Rasico, Monica Jacinto, Ethan Ripperger, Jennifer Alvarado	3/4	No	3	N/A	No	No	No	4/5/6/7	3		
Los Angeles/Orange Counties													
Venice Beach	Thomas Ryan	Stacey Vigallon, Joyce RegalaNo/Carlos Jauregui, Emily Cobar, Peter Auger, George Dinius	1	Yes	1	No	Yes/8	Yes/15	Yes/ 20x20m	2	1		

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Port of Los Angeles Pier 400	Nathan Mudry	Santiago Lopez, Isaac DeRobles, Spencer Langdon, Wally Ross, Nick Liberato, Josh Tabor, Bob Schallman	2/3		1	Yes/ tongue depres-sors	Yes/52	Yes/12	Yes/100 ft	1/2/3/4	1/2	Sand redistributed over site	Site prep done by POLA environ-mental division
Seal Beach National Wildlife Refuge	John Konecny, Kirk Gilligan	Michelle Barton, Bob Schallman	1	Yes	1	Yes/ wooden tongue depres-sor	Yes/48	No	Yes/8x12	4	2		Kirk Gilligan/ USFWS
Bolsa Chica/Nest Site 1	Peter Knapp	Kelly O'Reilly, Gary Keller, Charlie Collins, Ross Griswold, Wally Ross	3	Yes	1	Yes/ numbered tongue depres-sor	Yes/48 roof tiles	No	Yes/20 m X 20m	4	1		CDFW
Bolsa Chica/Nest Site 2	Peter Knapp	Kelly O'Reilly, Ross Griswold, Claire Grozinger	4	No	1	Yes/ numbered tongue depres-sor	Yes/12 roof tiles	No	Yes/20 m X 20m	4	1		CDFW
Bolsa Chica/Nest Site 3	Peter Knapp	Kelly O'Reilly, Gary Keller, Ross Griswold, Wally Ross, Claire Grozinger	2	No	1	Yes/ numbered tongue depres-sor	Yes/20 roof tiles	No	Yes/20 m X 20m	4	1		CDFW
Bolsa Chica/South Tern Island	Peter Knapp	Kelly O'Reilly, Ross Griswold, Charlie Collins	4	No	1	Yes/ numbered tongue depres-sor	Yes/20 roof tiles	No	Yes/20 m X 20m	4	1		CDFW
Bolsa Chica/Seasonal Ponds	Peter Knapp	Ross Griswold	4	No	2	No	No		No		1		CDFW
Huntington Beach	Nicole Housel	Cyndi Kam, Lana Ngyuen, Christine Whitcraft	1	Yes	1	Yes/ tongue depres-sors	Yes	No	Yes/25 m	1	1		CA State Parks

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Burris Basin	David McMichael	Dick Zembal, Bonnie Johnson, AK, CC	4	No	1	Yes/ stones	Yes 15	No	Yes	2	3		
UNBER Tern Island	Taylor Van Berkum	Kathy Sheridan, Carla Navarro	4	Yes	3	Yes	Yes/65 shelters	No	Yes	4	3	n/a	DFW staff
San Diego County													
Marine Corps Base Camp Pendleton/RB	Travis Wooten	Rachel Smith, Amie Aguiar, Jennifer Hahn, Monica Stupaczuk, Anjanette Butler, Demetri Lafkas, Andrew Motto, Jeanette Boylan	4	No	1	Yes/white paint stick	No	No	No	7	3		
Marine Corps Base Camp Pendleton/ WBC/S	Travis Wooten	Rachel Smith, Amie Aguiar, Jennifer Hahn, Monica Stupaczuk, Anjanette Butler, Demetri Lafkas, Andrew Motto, Jeanette Boylan	3	Yes	1	Yes/white paint stick	No	No	Yes/ 30X30	1	1/2		

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Marine Corps Base Camp Pendleton/ BBN	Travis Wooten	Rachel Smith, Amie Aguiar, Jennifer Hahn, Monica Stupaczuk, Anjanette Butler, Demetri Lafkas, Andrew Motto, Jeanette Boylan	2	Yes	1	Yes/white paint stick	No	No	Yes/ 30X30	1/2	1/2		
Marine Corps Base Camp Pendleton/ BBS	Travis Wooten	Rachel Smith, Amie Aguiar, Jennifer Hahn, Monica Stupaczuk, Anjanette Butler, Demetri Lafkas, Andrew Motto, Jeanette Boylan	2	Yes	1	Yes/white paint stick	No	No	Yes/ 30X30	1/2	1/2		
Marine Corps Base Camp Pendleton/SF	Travis Wooten	Rachel Smith, Amie Aguiar, Jennifer Hahn, Monica Stupaczuk, Anjanette Butler, Demetri Lafkas, Andrew Motto, Jeanette Boylan	2	Yes	1	Yes/white paint stick	No	No	Yes	7	1/2		
Batiquitos Lagoon/W1	Joelle Fournier		1	Yes	1	Yes	Yes	No	Yes		1		
Batiquitos Lagoon/W2	Joelle Fournier		1	Yes	1	Yes	Yes	No	Yes		1		
Batiquitos Lagoon/E1	Joelle Fournier		1	Yes	1	Yes	Yes	No	Yes		1		
San Elijo Lagoon	Robert Patton		3	Yes			No	No	No	7	No		

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
San Dieguito Lagoon	Brian Foster		3	No	1		Yes/ several	Yes/40	Yes/30 m	1/3	1		
Fairbanks Ranch	Brian Foster												
Mission Bay													
FAA Island	Jennifer Jackson, Sandy Vissman		4 Island moat	Yes	1	Yes/ tongue depres-sor	Yes/ approx. 75 roof tiles and grid markers	Yes/3 sets of 20 = 60 total	10 m	4	1	Chick fence patching	Sandy Vissman, Jennifer Jackson
North Fiesta Island*	Ginger Johnson	None	1	Yes	1	Yes/ tongue depres-sor	Yes/80	Yes/51	Yes/ approx. 36400 square meters/ squares 400 square meters	4	1	Prepare grid/put out decoys and tiles	San Diego City Parks Dept/San Diego Audubon Society volun-teers
Mariners Point*	Ginger Johnson	Jennifer Jackson	1	Yes	1	Yes/ tongue depres-sor	Yes/50	Yes/41	Yes/ approx. 12800 square meters/ squares 400 square meters	4	1	Set up grid, put out decoys and tiles/hand clearing of vegetation	San Diego City Parks Dept/ San Diego Audubon Society volun-teers
Stony Point*	Ginger Johnson	None	1	Yes	1	Yes/ tongue depres-sor	Yes/50	Yes/40	Yes/12800 square meters/ squares 400 square meters	4	1	Vegetation study	San Diego Audubon Society
San Diego River Mouth	Ginger Johnson	None	1	No	1	No	No	No	No	7	3	Temporary chain link fence installed for nesting season	San Diego City Parks Dept

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
San Diego Bay													
Lindbergh Field	Robert Patton	Elizabeth Copper, Brian Foster, Lea Squires, Matt Sadowski, Kate GoodeNough, Monica Alfaro, Mayra Garcia, Thomas Myers, Rossy Mendez	2	Yes	1	Yes/nest number spray-painted on substrate 1m to S	No	No	Yes/30 m	4	1		Site prep by SDCRAA staff & ZSSD contract-ors; monitor-ing by ZSSD contract-ors; pred control by USDA WS
Naval_Base_ Coronado/ NIMAT	Katrina Murbock	Maggie Post, Julia Hoopes, Melissa Murillo, Stephanie McLaughlin, Christy Stanton, Kerry Ross, Monica Tydlaska, Jeanette Boylan	1	Yes	1	No/gps only	Yes/100 to 200	Yes/50	Yes/ 30mx30 m	1	1/2		
Naval_Base_ Coronado/ NIA18	Katrina Murbock	Maggie Post, Julia Hoopes, Melissa Murillo, Stephanie McLaughlin, Christy Stanton, Kerry Ross, Monica Tydlaska, Jeanette Boylan	4	No	1	Yes/blue cone with sandbag	No	No	No	7	3		

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Naval_Base_ Coronado/ DBN	Katrina Murbock	Maggie Post, Julia Hoopes, Melissa Murillo, Stephanie McLaughlin, Christy Stanton, Kerry Ross, Monica Tydlaska, Jeanette Boylan	1	Yes	1	Yes/3 inch high PVC ring, painted green/sand colors	Yes/100 to 200	No	Yes/ 30mx30 m	1	1/2		
Naval_Base_ Coronado/ DBS	Katrina Murbock	Maggie Post, Julia Hoopes, Melissa Murillo, Stephanie McLaughlin, Christy Stanton, Kerry Ross, Monica Tydlaska, Jeanette Boylan	1	Yes	1	Yes/3 inch high PVC ring, painted green/ sand colors	Yes/100 to 200	Yes/ 200 to 300	Yes/ 30mx30 m	1	1/2		
Naval_Base_ Coronado/ NABON	Katrina Murbock	Maggie Post, Julia Hoopes, Melissa Murillo, Stephanie McLaughlin, Christy Stanton, Kerry Ross, Monica Tydlaska, Jeanette Boylan	4	No	1	Yes/ green tongue depres-sor	No	No	Yes/ 30m x variable	2	1/2		

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Naval_Base_ Coronado/ NABOS	Katrina Murbock	Maggie Post, Julia Hoopes, Melissa Murillo, Stephanie McLaughlin, Christy Stanton, Kerry Ross, Monica Tydlaska, Jeanette Boylan	3	Yes	1	Yes/ green tongue depres-sor	No	No	Yes/ 30m x variable	2	1/2		
D Street Fill	Robert Patton	Jennifer Jackson, Brian Foster, Lea Squires, Matt Sadowski, Thomas Myers, Kate Goodenough	3	Yes	1	Yes/ tongue depres-sor	Yes/ roofing tiles/174	Yes/77	Yes/30 m	4	1		Site prep by USFWS NWR & SD Port staff & contract-ors; monitor-ing by Port contract-ors; pred control by USDA WS
Chula Vista Wildlife Refuge	Robert Patton	Matt Sadowski, Jennifer Jackson, Lea Squires, Brian Foster, Kate Goodenough	3	Yes	1	Yes/ tongue depres-sor	Yes/44/ roofing tile	Yes/60	Yes/30 m	4	1		Site prep by ZSSD contract-ors; pred control by USDA WS
Saltworks	Robert Patton	Matt Sadowski, Kate Goodenough, Lea Squires, Brian Collins, Elizabeth Copper	3	No	1	Yes/ tongue depres-sor	Yes/10/ roofing tile	No	No	6	1		Site prep by USFWS NWR staff, monitor-ing by NWR contract-ors, pred control by USDA WS

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Site Type	Nest Marking	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Tijuana Estuary NERR, Tijuana North (NTJ)	Robert Patton	Lea Squires, Matt Sadowski, Kate Goodenough, Brian Collins, Kurt Roblek	3	Yes	1	Yes/ tongue depres-sor	Yes/50	No	Yes/30 m	6	1		Monitor-ing by NWR contract-ors, predator control by USDA WS
Tijuana Estuary NERR, Tijuana South (STJ)	Robert Patton	Lea Squires, Matt Sadowski, Kate Goodenough, Brian Collins, Kurt Roblek	3	Yes	1	Yes/ tongue depres-sor	Yes/150	No	Yes/30 m	6	1		Monitor-ing by NWR contract-ors, predator control by USDA WS
Imperial County													
Salton Sea	Guy McCaskie	Kathy Molina											

Appendix B-2: Monitoring in 2015 (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	2015	Adults	Y/K, M/R	Yellow/Black, Mauve/Red
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
North Fiesta Island	2014-2015	Chicks	B/L	Blue/Lime
Mariner's Point	198?-2013, 2015	Chicks	B/G	Blue/Green
Mariner's Point	2014	Chicks	G/B	Green/Blue
Stony Point	2013-2014	Chicks	B/G	Blue/Green
Lindbergh Field	2008-2011	Adults	G/W	Green/White
Lindbergh Field	2012-2014	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, 2014	Chicks/Adults	R/Y	Red/Yellow
Delta Beach South	199?-2010, 2014	Chicks/Adults	K/W	Black/White
Naval Amphibious Base Ocean	199?-2010, 2014	Chicks/Adults	P/B	Dark Pink/Blue
D Street	2008, 2012, 2014	Chicks/Adults	M/W	Mauve/White
Chula Vista Wildlife Reserve	2008-2013	Adults	K/Y	Black/Yellow
Chula Vista Wildlife Reserve	2014	Chicks/Adults	A/K	Aqua/Black
Saltworks	2008-2014	Chicks/Adults	M/L	Mauve/Lime
Tijuana Estuary	2008-2014	Chicks/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).

Note: Least terns were banded only with Service bands at the following colonies in 2015: Pendleton, FAA Island, Stony Point, Naval Base Coronado, Lindbergh Field, D Street, Chula Vista Wildlife Reserve, Saltworks, and Tijuana Estuary.

Appendix B-3: Pair Estimation in 2015 (Method I).

Site name	Date terns first observed*	Date terns last observed	Date of first nest	Date of last nest initiation	Total number of monitoring visits	Total nests in first wave	Total nests in second wave	Total pairs	Total Nests
Sacramento Area									
Bufferlands	5-Jul-15	4-Sep-15	9-Jul-15	na	13	1	0	1	1
San Francisco Bay Area							0		
Napa Sonoma Marsh Wildlife Area – Totals						47	32	63	79
Green Island Unit	28-May-15	12-Aug-15	28-May-15	30-Jul-15	19	37	16	45	53
Pond 7/7A	27-Apr-15	3-Aug-15	26-May-15	2-Jul-15	18	10	16	18	26
Montezuma – Totals						8	8	12	16
Site 1	18-May-15	4-Aug-15	18-May-15	16-Jul-15	18	3	6	6	9
Site 3/4	18-May-15	4-Jul-15	18-May-15	22-Jun-15	11	5	2	6	7
Pittsburg Power Plant	3-Jun-15	28-Jul-15	11-Jun-15	13-Jul-15	17	1	2	2	3
Alameda Point	20-Apr-15	13-Aug-15	4-May-15	10-Jul-15	88	290	61	320.5	351
Hayward Regional Shoreline	13-Apr-15	14-Aug-15	5-May-15	6-Jul-15	24	62	9	66.5	71
San Luis Obispo/Santa Barbara Counties							0		
Oceano Dunes SVRA	28-Apr-15	17-Aug-15	18-May-15	12-Jul-15	112	46	8	50	54
Rancho Guadalupe Dunes Preserve	20-Jul-15	26-Jul-15	na	na	na		0	0	0
Vandenberg AFB-Purisima Pt.	5-May-15	21-Aug-15	22-May-15	8-Jul-15	93	18	4	20	22
Coal Oil Point Reserve	na						0	0	0
Ventura County							0		
Ormond Beach	12-May-15	27-Jul-15	na	na	34		0	0	0
Hollywood Beach	29-Apr-15	1-Aug-15	17-May-15	31-May-15	35	22	2	23	24
Santa Clara River/McGrath State Beach	15-May-15	1-Sep-15	3-Jun-15	5-Aug-15	25	18	54	45	72
Pt Mugu						409	64	441	473
Holiday Beach	27-Apr-15	19-Aug-15	14-May-15	27-Jun-15	67	229	49	253.5	278
Holiday Salt Panne	27-Apr-15	19-Aug-15	14-May-15	3-Jul-15	30	19	3	20.5	22
Eastern Arm						0	0	0	0
Ormond Beach East	27-Apr-15	19-Aug-15	14-May-15	15-Jun-15	24	161	12	167	173

Site name	Date terns first observed*	Date terns last observed	Date of first nest	Date of last nest initiation	Total number of monitoring visits	Total nests in first wave	Total nests in second wave	Total pairs	Total Nests
Saticoy United Water Conservation District	3-Jul-15	3-Jul-15	na	na	20		0	0	0
Los Angeles/Orange Counties							0		
Venice Beach/Marina del Rey	21-Apr-15	22-Jul-15	19-May-15	17-Jun-15	13	8	0	8	8
LA Harbor	12-May-15	20-Jun-15	12-May-15	13-Jun-15	12	109	0	109	109
Seal Beach NWR - Anaheim Bay	6-May-15	29-Jul-15	6-May-15	8-Jul-15	13	83	23	94.5	106
Bolsa Chica Ecological Reserve						180	24	192	204
Nest Site 1 (NS1)	8-May-15	26-May-15	8-May-15	12-May-15	6	3	0	3	3
Nest Site 2 (NS2)	7-May-15	7-Jul-15	7-May-15	30-Jun-15	10	111	16	119	127
Nest Site 3 (NS3)	7-May-15	2-Jul-15	7-May-15	2-Jul-15	10	3	1	3.5	4
South Tern Island (STI)	12-May-15	23-Jun-15	12-May-15	23-Jun-15	13	57	7	60.5	64
Seasonal Ponds	11-May-15	24-May-15	11-May-15	24-May-15	4	6	0	6	6
Huntington State Beach	29-Apr-15	2-Aug-15	12-May-15	23-Jun-15	17	489	35	506.5	524
Burris Sand Pit/Burris Basin	28-May-15	15-Jul-15	28-May-15	8-Jul-15	12	14	9	18.5	23
Upper Newport Bay Ecological Reserve	6-May-15	27-Jul-15	13-May-15	24-Jul-15	21	15	7	18.5	22
San Diego County							0		
MCB Camp Pendleton						34	1350	1358	1384
Red Beach	7-May-15	10-Aug-15	25-Jun-15	2-Jul-15	21	0	7	3.5	7
White Beach	21-Apr-15	4-Aug-15	2-May-15	2-Jul-15	47	34	6	37	40
Santa Margarita River - North Beach North	14-Apr-15	31-Aug-15	30-Apr-15	23-Jun-15	56			0	nests combined into North Beach South below
Santa Margarita River - North Beach South	13-Apr-15	31-Aug-15	25-Apr-15	26-Jun-15	58	1292	38	1311	1330
Santa Margarita River - Saltflats and Island	13-Apr-15	6-Aug-15	6-May-15	17-Jun-15	50	6	1	6.5	7
Batiquitos Lagoon Ecological Reserve						411	4	413	415
E1	4-Apr-15	14-Jul-15	5-May-15	16-Jun-15	21+	64	1	64.5	65
W1	24-Apr-15	30-Jun-15	1-May-15	2-Jun-15	19+	42	0	42	42
W2	17-Apr-15	14-Jul-15	1-May-15	23-Jun-15	24+	305	3	306.5	308

Site name	Date terns first observed*	Date terns last observed	Date of first nest	Date of last nest initiation	Total number of monitoring visits	Total nests in first wave	Total nests in second wave	Total pairs	Total Nests
San Elijo Lagoon Ecological Reserve	na						0	0	0
Fairbanks Ranch	na						0	0	0
San Dieguito Lagoon Ecological Reserve	na						0	0	0
Mission Bay							0		
FAA Island	17-Apr-15	7-Aug-15	9-May-15	24-Jun-15	47	12	8	16	20
North Fiesta Island	17-Apr-15	27-Jul-15	7-May-15	14-Jun-15	17	22	2	23	24
Mariner's Point	28-Apr-15	22-Jul-15	4-May-15	25-Jun-15	30	174	7	177.5	181
Stony Point	29-Apr-15	17-Jun-15	9-May-15	9-May-15	6	1	0	1	1
San Diego River Mouth	na				6		0	0	0
San Diego Bay							0		
Lindbergh Field & Former Naval Training Center	15-Apr-15	14-Jul-15	9-May-15	3-Jun-15	142	18	0	18	18
US Navy - NI MAT	28-Apr-15	21-Jul-15	9-May-15	16-Jul-15	55	23	9	27.5	32
US Navy - NI18	28-Apr-15	20-Jun-15	12-May-15	12-May-15	34	1	0	1	1
Naval Base Coronado - Totals						731	95	778.5	826
Delta Beach North	21-Apr-15	20-Aug-15	5-May-15	16-Jul-15	48	141	26	154	167
Delta Beach South	20-Apr-15	31-Jul-15	4-May-15	17-Jul-15	53	129	7	132.5	136
NAB Ocean	21-Apr-15	28-Aug-15	4-May-15	25-Jul-15	103	461	62	492	523
D Street Fill/Sweetwater Marsh NWR	17-Apr-15	25-Jul-15	5-May-15	3-Jul-15	47	116	7	119.5	123
Chula Vista Wildlife Reserve	20-Apr-15	18-Aug-15	10-May-15	30-Jun-15	53	76	3	77.5	79
South San Diego Bay Unit, SDNWR - Saltworks	15-Apr-15	5-Aug-15	13-May-15	19-Jun-15	33	24	5	26.5	29
Tijuana Estuary NERR						189	19	198.5	208
Tijuana North	16-Apr-15	18-Aug-15	7-May-15	9-Jul-15	26	70	5	72.5	75
Tijuana South	16-Apr-15	18-Aug-15	14-May-15	23-Jul-15	26	119	14	126	133
Imperial County							0		
Salton Sea	25-Apr-15	10-May-15	na	na			0	0	0

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.

Appendix B-3: Pair Estimation in 2015 (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 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**
Sacramento Area												
Bufferlands	1	0	0	1								
San Francisco Bay Area												
Napa Sonoma Marsh Wildlife Area - Totals	79	8	0	71								
NSMWA-Green Island Unit	53	0	0	53								
NSMWA-Pond 7/7A	26	8	0	18	18-Jun-15	5	2		21	2		
Montezuma Wetlands - Totals	16	2	0	14								
Site 1	9	1	0	8	15-Jun-15	3	1	2	6	0	6	8
Site 3/4	7	1	0	6	15-Jun-15	5	0	5	2	1	1	6
Pittsburg Power Plant	3	0	0	3	7-Jul-15	1		1	2		2	3
Alameda Point	351	18	2	331	17-Jun-15	290	16	274	61	0	61	335
Hayward Regional Shoreline	71	1	0	70	15-Jun-15	62	1	61	9	1	8	69
San Luis Obispo/Santa Barbara Counties												
Oceano Dunes SVRA	54	1	0	53	15-Jun-15	46	0	46	8	3	5	51
Rancho Guadalupe Dunes Preserve	0	0	0	0				0			0	0
Vandenberg AFB-Purisima Pt.	22	0	0	22	18-Jun-15	18		18	4		4	22
Coal Oil Point Reserve	0	0	0	0				0			0	0
Ventura County												
Ormond Beach	0	0	0	0				0			0	0
Hollywood Beach	24	19	0	5		22	9	13	2	0	2	15
Santa Clara River/McGrath State Beach	72	3	0	69	2-Jul-15	29	0	29	43	18	25	54
Pt Mugu- Totals	473	150	0	323				0			0	0
Holiday Beach	278	19	0	259				0			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**
Holiday Salt Panne	22	3	0	19				0			0	0
Eastern Arm	0	0	0	0				0			0	0
Ormond Beach East	173	128	0	45				0			0	0
Saticoy United Water Conservation District	0	0	0	0				0			0	0
Los Angeles/Orange Counties												
Venice Beach/Marina del Rey	8	8	0	0				0			0	0
LA Harbor- Pier 400	109	92	0	17	13-Jun-15	103	6	97	6	0	6	103
Seal Beach NWR - Anaheim Bay	106	25	0	81	10-Jun-15	79	30	49	27	26	1	50
Bolsa Chica Ecological Reserve -Totals	204	19	1	184				0			0	0
Nest Site 1 (NS1)	3	3	0	0				0			0	0
Nest Site 2 (NS2)	127	4	1	122				0			0	0
Nest Site 3 (NS3)	4	2	0	2		3	1	2	1	0	1	3
South Tern Island (STI)	64	4	0	60				0			0	0
Seasonal Ponds	6	6	0	0				0			0	0
Huntington State Beach	524	96	17	411	12-Jun-15	463	43	420	61	25	36	456
Burris Sand Pit/Burris Basin	23	1	0	22	21-Jun-15	15	0	15	8	5	3	18
Upper Newport Bay Ecological Reserve	22	1	0	21				0			0	0
San Diego County												
MCB Camp Pendleton - Totals	1384	274	192.5	917.5								
Red Beach	7	0	0	7								
White Beach	40	5	0	35								

	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**
Santa Margarita River - North Beach North	nests combined into North Beach South below		0									
Santa Margarita River - North Beach South	1330	265	192.5	872.5								
Santa Margarita River - Saltflats and Island	7	4	0	3								
Batiquitos Lagoon Ecological Reserve - Totals	415	52	67	296								
E1	65	11	7.5	46.5								
W1	42	6	6.5	29.5								
W2	308	35	53	220								
San Elijo Lagoon Ecological Reserve	0	0	0	0								
Fairbanks Ranch	0	0	0	0								
San Dieguito Lagoon Ecological Reserve	0	0	0	0								
Mission Bay												
FAA Island	20	1	0	19	15-Jun-15	12	2	10	8	1	7	17
North Fiesta Island	24	7	0	17	15-Jun-15	22	7	15	2	0	2	17
Mariner's Point	181	13	3.5	164.5	17-Jun-15	175	15	160	6	0	6	166
Stony Point	1	0	1	0				0			0	0
San Diego River Mouth	0	0	0	0				0			0	0
San Diego Bay												
Lindbergh Field & Former Naval Training Center	18	9	1	8		18	8	10	0	0	0	10
US Navy - NI MAT	32	9	0	23				0			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**
US Navy - NI18	1	1	0	0				0			0	0
Naval Base Coronado - Totals	826	49	70	707				0			0	0
Delta Beach North	167	6	13	148				0			0	0
Delta Beach South	136	12	13.5	110.5				0			0	0
NAB Ocean	523	31	43.5	448.5				0			0	0
D Street Fill/Sweetwater Marsh NWR	123	13	5.5	104.5	23-Jun-15	116	12	104	7	0	7	111
Chula Vista Wildlife Reserve	79	6	4.5	68.5		76	8	68	3	0	3	71
South San Diego Bay Unit, SDNWR - Saltworks	29	4	0	25		24	5	19	5	0	5	24
Tijuana Estuary NERR - Totals	208	62	2.5	143.5				0			0	0
Tijuana North	75	31	0	44		70	23	47	5	0	5	52
Tijuana South	133	31	2.5	99.5		119	19	100	14	0	14	114
Imperial County												
Salton Sea	0	0	0	0								

Appendix B-3 Legend:
*Total pairs not renesting calculated using nesting chronology and mortality databases.

Appendix B-4: Productivity in 2015.

Site name	Total nests	Total eggs	Average clutch size	No. of eggs hatched	Egg Hatching Rate	Date of first hatch	Date of last hatch	Max # active nests	Date of max active nests	Date of first fledgling	Fledgling estimate method	Total fledglings
Sacramento Area												
Bufferlands	1	2	2.00	2	1.00	31-Jul-15	3-Aug-15	1	9-Jul-15	17-Aug-15		1
San Francisco Bay Area												
Napa Sonoma Marsh Wildlife Area - Totals	79	147	1.86	111	0.76						3WD	
NSMWA-Green Island Unit	53	102	1.92	86	0.84	25-Jun-15	27-Jul-15	42	25-Jun-15	2-Jul-15		3
NSMWA-Pond 7/7A	26	45	1.73	25	0.56	2-Jul-15	31-Jul-15	16	2-Jul-15	16-Jul-15	3WD	21
Montezuma Wetlands - Totals*	16	32	2.00	15	0.47						Other	
Site 1	9	19	2.11	11	0.58	15-Jun-15	1-Aug-15	3	15-Jun-15	na		0
Site 3/4	7	13	1.86	4	0.31	12-Jun-15	15-Jun-15	15	15-Jun-15	na	Other	0
Pittsburg Power Plant	3	3	1.00	0	0.00	nr	nr	2	20-Jul-15	20-Jul-15		0
Alameda Point	351	679	1.93	560	0.82	29-May-15	24-Jul-15	255	26-May-15	12-Jun-15	2WD	280
Hayward Regional Shoreline	71	135	1.90	119	0.88	23-May-15	22-Jul-15	57	23-May-15	15-Jun-15	3WD	90-105
San Luis Obispo/Santa Barbara Counties												
Oceano Dunes SVRA	54	98	1.81	83	0.85	9-Jun-15	25-Jul-15	41*	8-Jun-15	24-Jun-15	Other, R	69
Rancho Guadalupe Dunes Preserve	0											0
Vandenberg AFB-Purisima Pt.	22	47	2.14	46	0.98			18	9-Jun-15		3WD	29
Coal Oil Point Reserve	0											
Ventura County												
Ormond Beach	0							0	28-May-15		n/a	0
Hollywood Beach	24	28	1.17	0	0.00			8	17-May-15		3WD	0
Santa Clara River/McGrath State Beach	72	136	1.89	68	0.50	24-Jun-15	22-Jul-15	34	8-Jul-15	15-Jul-15	3WD	27
Pt Mugu- Totals	473	806	1.70	352	0.44						Other	
Holiday Beach	278	488	1.76	292	0.60	8-Jun-15	17-Jul-15	182	10-Jun-15	1-Jul-15	Other	111-145
Holiday Salt Panne	22	39	1.77	26	0.67	8-Jun-15	24-Jul-15	18	8-Jun-15	na	Other	0

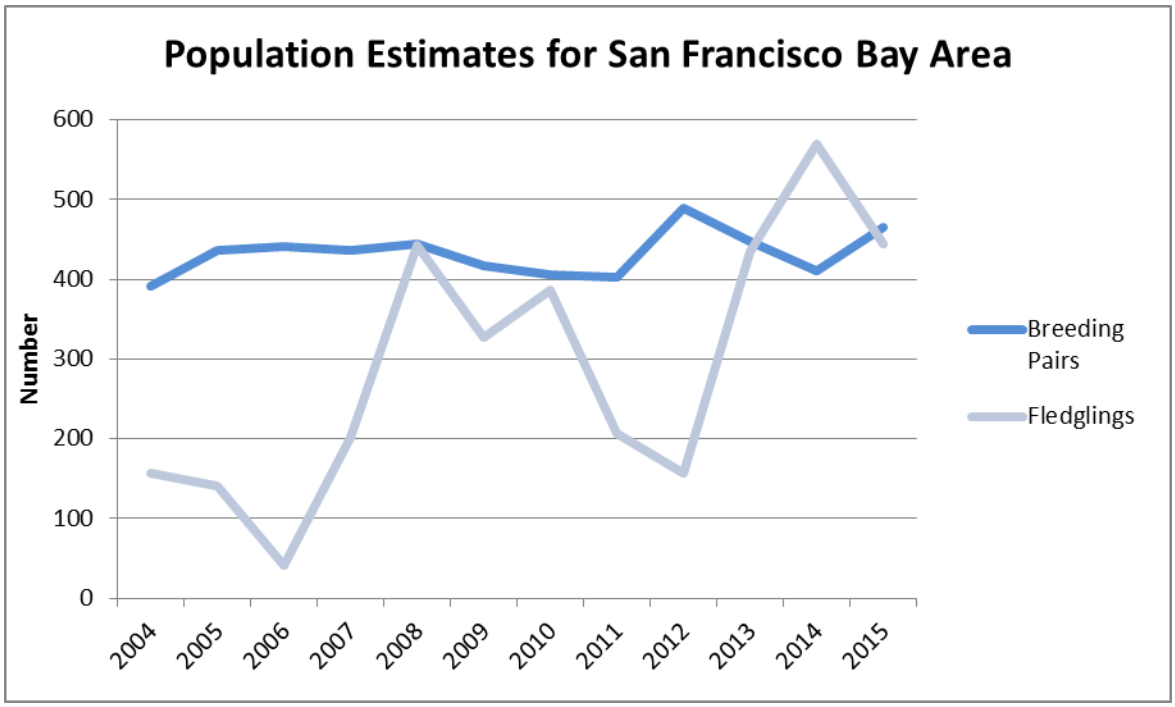
Site name	Total nests	Total eggs	Average clutch size	No. of eggs hatched	Egg Hatching Rate	Date of first hatch	Date of last hatch	Max # active nests	Date of max active nests	Date of first fledgling	Fledgling estimate method	Total fledglings
Eastern Arm	0											
Ormond Beach East	173	279	1.61	34	0.12	11-Jun-15	3-Jul-15	81	4-Jun-15	15-Jul-15	Other	5
Saticoy United Water Conservation District	0											0
Los Angeles/Orange Counties												
Venice Beach/Marina del Rey	8	8	1.00	0	0.00	na	na			na	R	0
LA Harbor- Pier 400	109	176	1.61	13	0.07	6-Jun-15	16-Jun-15	59	26-May-15	na	3WD	0
Seal Beach NWR - Anaheim Bay	106	171	1.61	63	0.37	10-Jun-15	22-Jul-15	64	17-Jun-15	1-Jul-15	R	7
Bolsa Chica Ecological Reserve -Totals	204	356	1.75	218	0.61						Other	51-53
Nest Site 1 (NS1)	3	5	1.67	0	0.00	na	na	2	12-May-15	na	Other	0
Nest Site 2 (NS2)	127	221	1.74	145	0.66	28-May-15	30-Jun-15	94	28-May-15	30-Jun-15	Other	44
Nest Site 3 (NS3)	4	6	1.50	0	0.00	na	na	3	10-Jun-15	na	Other	0
South Tern Island (STI)	64	112	1.75	73	0.65	27-May-15	30-Jun-15	40	2-Jun-15	16-Jun-15	Other	7
Seasonal Ponds	6	12	2.00	0	0.00	na	na	4	11-May-15	na	Other	0
Huntington State Beach	524	851	1.62	624	0.73	26-May-15	30-Jun-15	416	29-May-15	12-Jun-15	3WD	125
Burris Sand Pit/Burris Basin	23	44	1.91	14	0.32	17-Jun-15	15-Jul-15	14	10-Jun-15	nr	3WD	3
Upper Newport Bay Ecological Reserve	22	28	1.27	18	0.64			13	24-Jun-15			1
San Diego County												
MCB Camp Pendleton - Totals	1384	2369	1.71	1713	0.72						3WD, R	
Red Beach	7	10	1.43	4	0.40	7-Jul-15	16-Jul-15	7	2-Jul-15	25-Jul-15		2-3
White Beach	40	70	1.75	54	0.77	28-May-15	21-Jul-15	21	2-Jun-15	20-Jun-15	3WD	13
Santa Margarita River - North Beach North	nests combined into North Beach South below										3WD, R	8

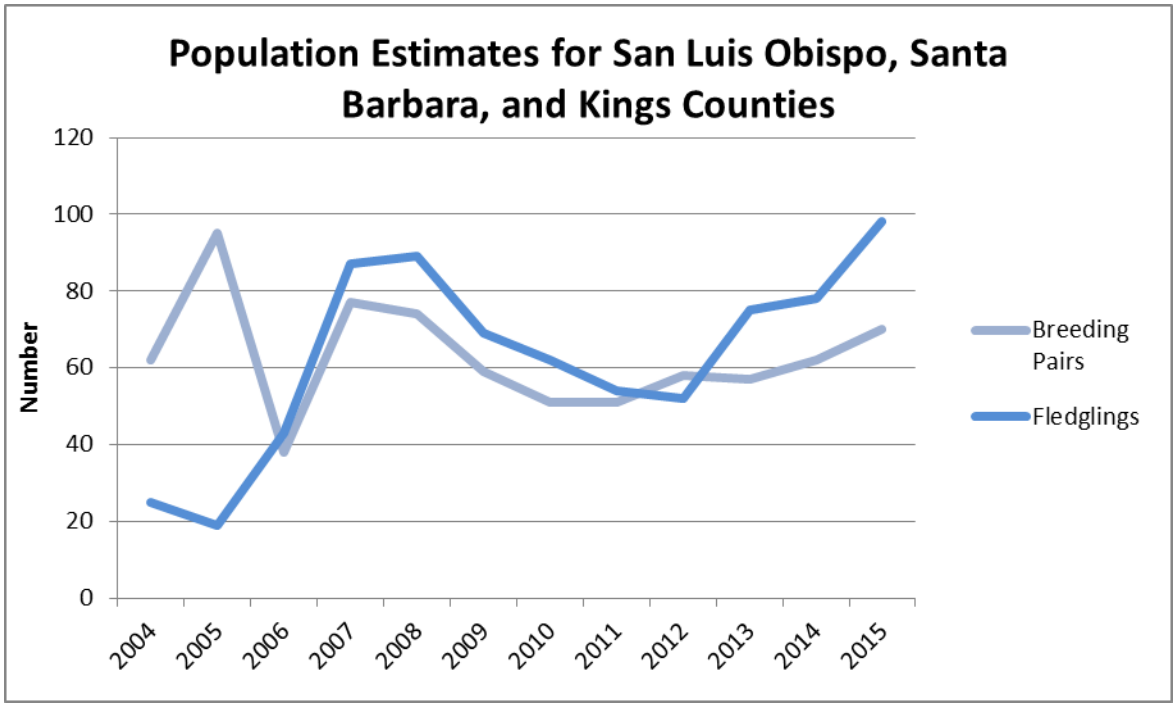
Site name	Total nests	Total eggs	Average clutch size	No. of eggs hatched	Egg Hatching Rate	Date of first hatch	Date of last hatch	Max # active nests	Date of max active nests	Date of first fledgling	Fledgling estimate method	Total fledglings
Santa Margarita River - North Beach South	1330	2278	1.71	1653	0.73	20-May-15	8-Jul-15	937	22-May-15	12-Jun-15	3WD, R	147
Santa Margarita River - Saltflats and Island	7	11	1.57	2	0.18	17-Jun-15	na	3	6-May & 17-Jun-15	nr	3WD	see NBS
Batiquitos Lagoon Ecological Reserve - Totals	415	749	1.80	623	0.83						3WD, other	90-143
E1	65	109	1.68	88	0.81	29-May-15	10-Jul-15	56	29-May-15	19-Jun-15	Other	
W1	42	75	1.79	64	0.85	26-May-15	19-Jun-15	36	22-May-15	12-Jun-15	Other	
W2	308	565	1.83	471	0.83	29-May-15	29-Jun-15	283	29-May-15	16-Jun-15	3WD, other	
San Elijo Lagoon Ecological Reserve	0											
Fairbanks Ranch	0											
San Dieguito Lagoon Ecological Reserve	0											
Mission Bay												
FAA Island	20	38	1.90	34	0.89	2-Jun-15	15-Jul-15	10	28-May & 8-Jun-15	24-Jun-15	3WD	9-12
North Fiesta Island	24	43	1.79	28	0.65	2-Jun-15	6-Jul-15	17	2-Jun-15	24-Jun-15		1-2
Mariner's Point	181	326	1.80	274	0.84	24-May-15	2-Jul-15	88	24-May-15	11-Jun-15	3WD	100-130
Stony Point	1	2	2.00	2	1.00	4-Jun-15	na	1	9-May-15	na	3WD	0
San Diego River Mouth	0											0
San Diego Bay												
Lindbergh Field & Former Naval Training Center	18	27	1.50	14	0.52	2-Jun-15	24-Jun-15	9	23-May-15	23-Jun-15	2WD, R	8-9
US Navy - NI MAT	32	51	1.59	25	0.49	2-Jun-15	25-Jun-15	14	26-May through 9-Jun-15	30-Jun-15	3WD	3
US Navy - NI18	1	2	2.00	0	0.00	na	na	1	12-May-15	na	3WD	0
Naval Base Coronado - Totals	826	1499	1.81	1287	0.86						3WD	
Delta Beach North	167	294	1.76	255	0.87	30-May-15	28-Jul-15	129	30-May-15	20-Jun-15	3WD	7-8
Delta Beach South	136	252	1.85	221	0.88	29-May-15	17-Jul-15	114	1-Jun-15	19-Jun-15	3WD	24-26
NAB Ocean	523	953	1.82	811	0.85	29-May-15	3-Aug-15	319	2-Jun-15	18-Jun-15	3WD	136-139

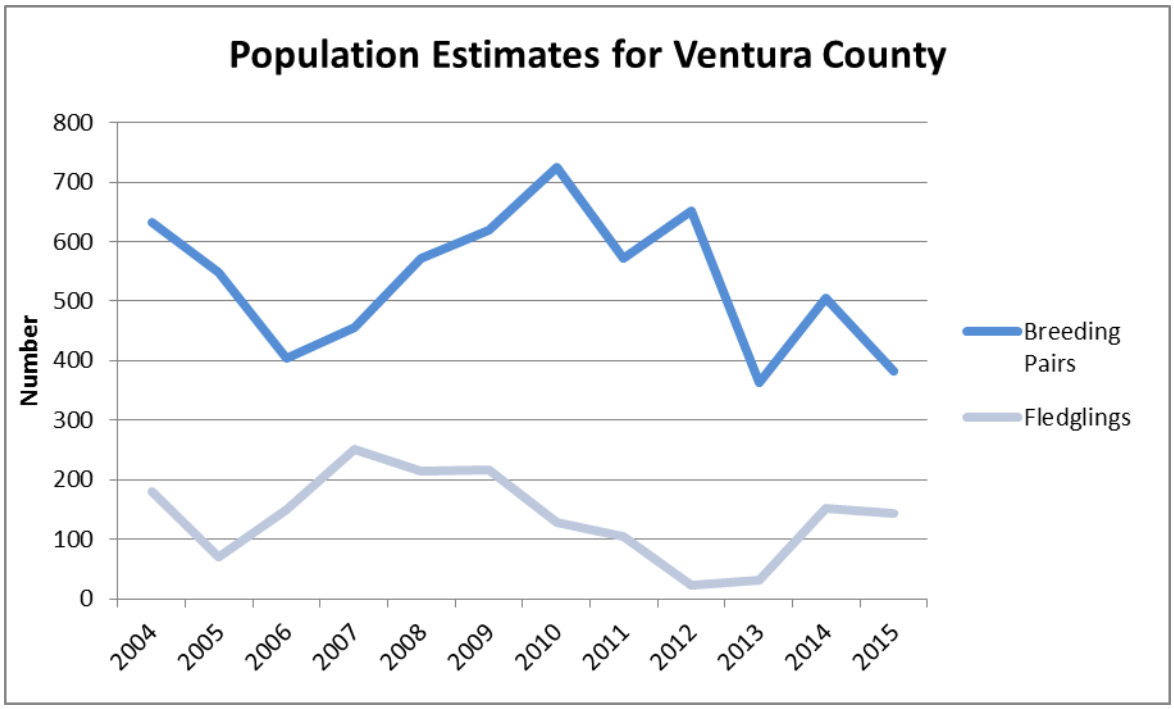
Site name	Total nests	Total eggs	Average clutch size	No. of eggs hatched	Egg Hatching Rate	Date of first hatch	Date of last hatch	Max # active nests	Date of max active nests	Date of first fledgling	Fledgling estimate method	Total fledglings
D Street Fill/Sweetwater Marsh NWR	123	224	1.82	184	0.82	2-Jun-15	10-Jul-15	108	2-Jun-15	23-Jun-15	2WD, R	21-34
Chula Vista Wildlife Reserve	79	146	1.85	127	0.87	2-Jun-15	6-Jul-15	64	26-May & 2-Jun-15	20-Jun-15	2WD, R	33-37
South San Diego Bay Unit, SDNWR - Saltworks	29	55	1.90	38	0.69	3-Jun-15	9-Jul-15	22	3-Jun-15	28-Jun-15	2WD, R	9-10
Tijuana Estuary NERR - Totals	208	375	1.80	164	0.44	4-Jun-15	9-Jul-15	150		25-Jun-15	2WD, R	
Tijuana North	75	127	1.69	45	0.35	28-May-15	23-Jul-15		28-May-15	25-Jun-15	2WD, R	6-7
Tijuana South	133	248	1.86	119	0.48	4-Jun-15	9-Jul-15		28-May-15	25-Jun-15	2WD, R	24-25
Imperial County												
Salton Sea	1	1	1.00	1								0-1

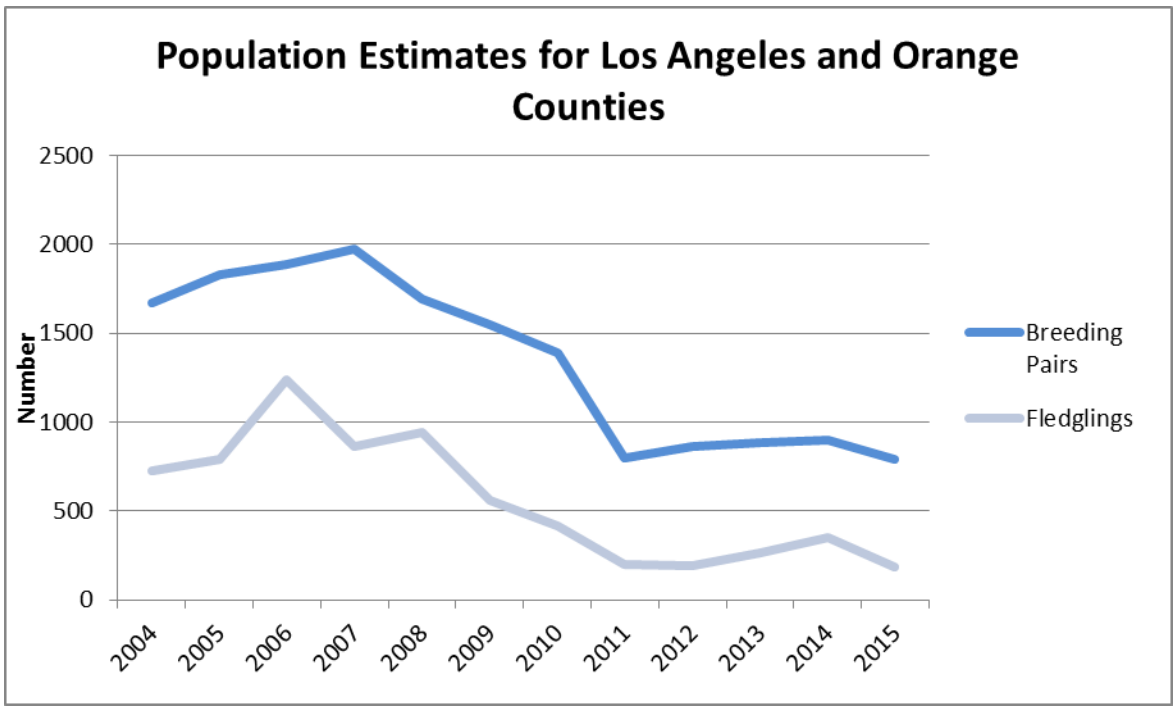
*Max active counts may be slightly low due to monitoring occurring mainly outside of colony.

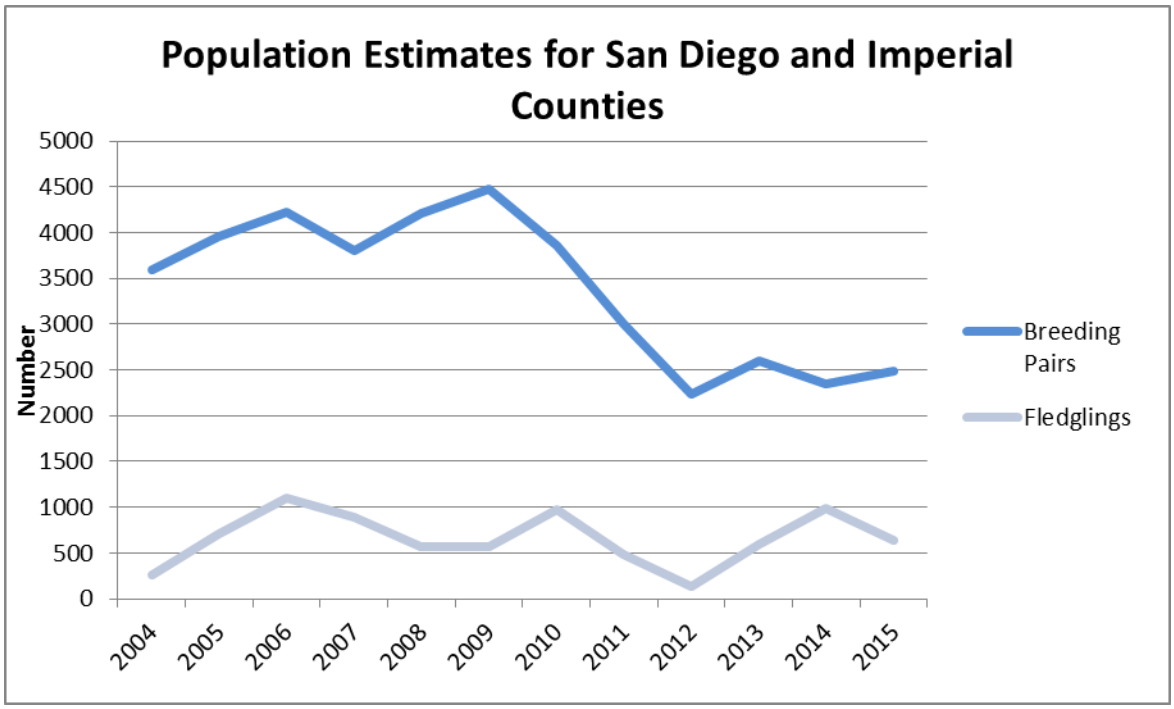
Appendix B-4: Productivity: minimum number of breeding pairs and fledglings per region from 2004-2015.






Population Estimates for Ventura County
800
700
600
500
400
300
200
100
0
Number
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Breeding Pairs
Fledglings


Population Estimates for Los Angeles and Orange Counties
2500
2000
1500
1000
500
0
Number
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Breeding Pairs
Fledglings


Population Estimates for San Diego and Imperial Counties
Number
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
Breeding Pairs
Fledglings

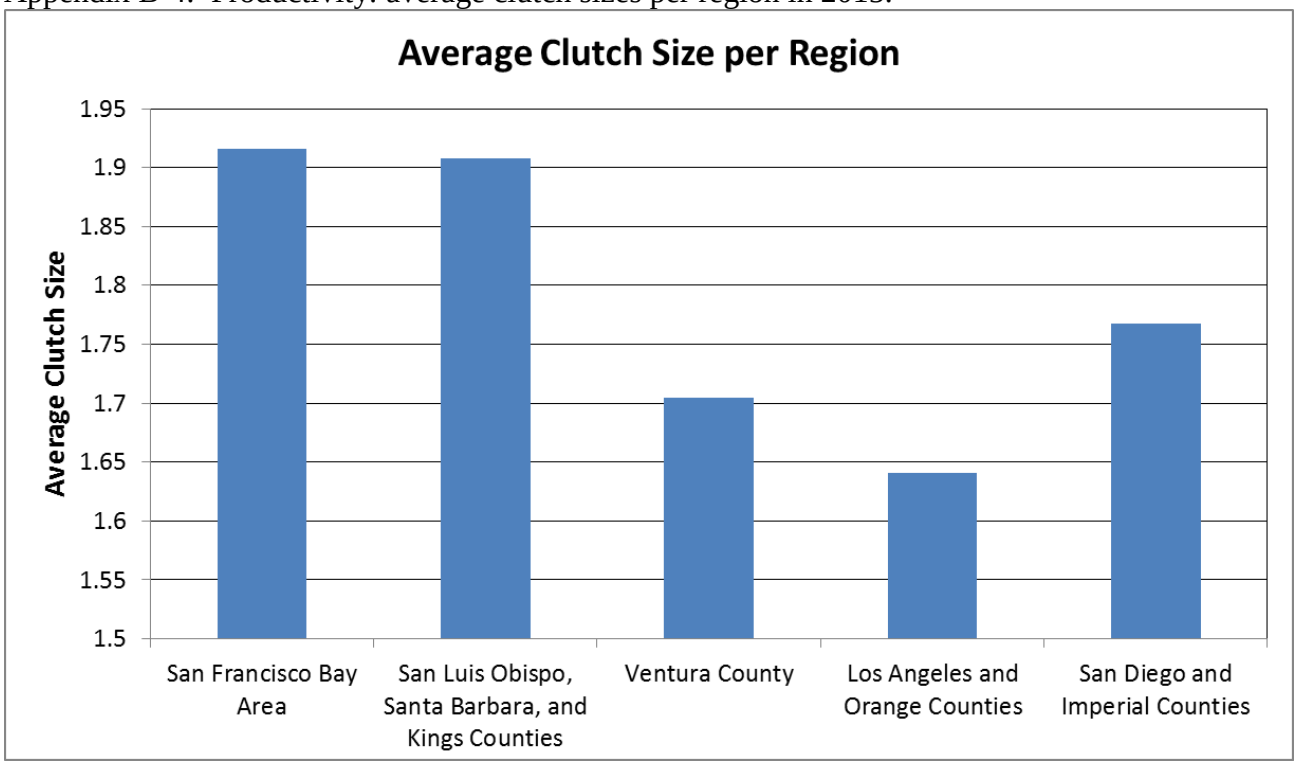
Appendix B-4: Productivity: clutch sizes in 2015.

			Number of nests			
Site name:	**Nest total**	**Egg total**	**1 egg clutch**	**2 egg clutch**	**3 egg clutch**	**4 egg clutch**
Sacramento Area						
Bufferlands*	1	2	0	1	0	0
San Francisco Bay Area						
Napa Sonoma Marsh Wildlife Area - Totals	79	151	19	48	12	0
NSMWA-Green Island Unit	53	102	10	37	6	0
NSMWA-Pond 7/7A	26	45	11	11	4	0
Montezuma Wetlands - Totals*	16	32	5	6	5	0
Site 1	9	19	2	4	3	0
Site 3/4	7	13	3	2	2	0
Pittsburg Power Plant*	3	3	3	0	0	0
Alameda Point	351	679	49	276	26	0
Hayward Regional Shoreline	71	135	12	54	5	0
San Luis Obispo/Santa Barbara Counties						
Oceano Dunes SVRA*	54	98	11	42	1	0
Rancho Guadalupe Dunes Preserve	0	0				
Vandenberg AFB-Purisima Pt.*	22	47	1	17	4	0
Coal Oil Point Reserve	0	0				
Ventura County						
Ormond Beach	0	0				
Hollywood Beach	24	28	20	4	0	0
Santa Clara River/McGrath State Beach	72	136	8	64	0	0
Pt Mugu- Totals	473	806	143	327	3	0
Holiday Beach*	278	488	69	208	1	0
Holiday Salt Panne	22	39	6	15	1	0
Eastern Arm	0	0				
Ormond Beach East	173	279	68	104	1	0
Saticoy United Water Conservation District	0	0				
Los Angeles/Orange Counties						
Venice Beach/Marina del Rey	8	8	8	0	0	0
LA Harbor- Pier 400	109	176	42	67	0	0
Seal Beach NWR - Anaheim Bay	106	171	41	65	0	0
Bolsa Chica Ecological Reserve -Totals	204	356	55	146	3	0
Nest Site 1 (NS1)	3	5	1	2	0	0
Nest Site 2 (NS2)	127	221	35	90	2	0
Nest Site 3 (NS3)	4	6	2	2	0	0
South Tern Island (STI)	64	112	17	46	1	0
Seasonal Ponds*	6	12	0	6	0	0
Huntington State Beach	524	851	198	325	1	0
Burris Sand Pit/Burris Basin	23	44	2	21	0	0
Upper Newport Bay Ecological Reserve*	22	28	16	6	0	0

			Number of nests			
Site name:	**Nest total**	**Egg total**	**1 egg clutch**	**2 egg clutch**	**3 egg clutch**	**4 egg clutch**
San Diego County						
MCB Camp Pendleton - Totals	1384	2371	404	974	5	1
Red Beach	7	10	4	3	0	0
White Beach	40	70	10	30	0	0
Santa Margarita River - North Beach North	nests combined into North Beach South below	0				
Santa Margarita River - North Beach South	1330	2278	387	939	3	1
Santa Margarita River - Saltflats and Island	7	11	3	4	0	0
Batiquitos Lagoon Ecological Reserve - Totals	415	749	87	323	4	1
E1	65	109	21	44	0	0
W1	42	75	9	33	0	0
W2	308	565	57	246	4	1
San Elijo Lagoon Ecological Reserve	0	0				
Fairbanks Ranch	0	0				
San Dieguito Lagoon Ecological Reserve	0	0				
Mission Bay						
FAA Island	20	38	3	16	1	0
North Fiesta Island	24	43	6	17	1	0
Mariner's Point	181	326	38	141	2	0
Stony Point	1	2	0	1	0	0
San Diego River Mouth	0	0				
San Diego Bay						
Lindbergh Field & Former Naval Training Center	18	27	9	9	0	0
US Navy - NI MAT	32	51	13	19	0	0
US Navy - NI18	1	2	0	1	0	0
Naval Base Coronado - Totals	826	1499	156	667	3	0
Delta Beach North	167	294	40	127	0	0
Delta Beach South	136	252	20	116	0	0
NAB Ocean	523	953	96	424	3	0
D Street Fill/Sweetwater Marsh NWR	123	224	22	101	0	0
Chula Vista Wildlife Reserve	79	146	13	65	1	0
South San Diego Bay Unit, SDNWR - Saltworks	29	55	4	24	1	0
Tijuana Estuary NERR - Totals	208	375	44	161	3	0
Tijuana North	75	127	23	52	0	0
Tijuana South	133	248	21	109	3	0
Imperial County						
Salton Sea*	1	1	1			

*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.

Appendix B-4: Productivity: average clutch sizes per region in 2015.



Appendix B-5: Non-Predation Mortality in 2015.

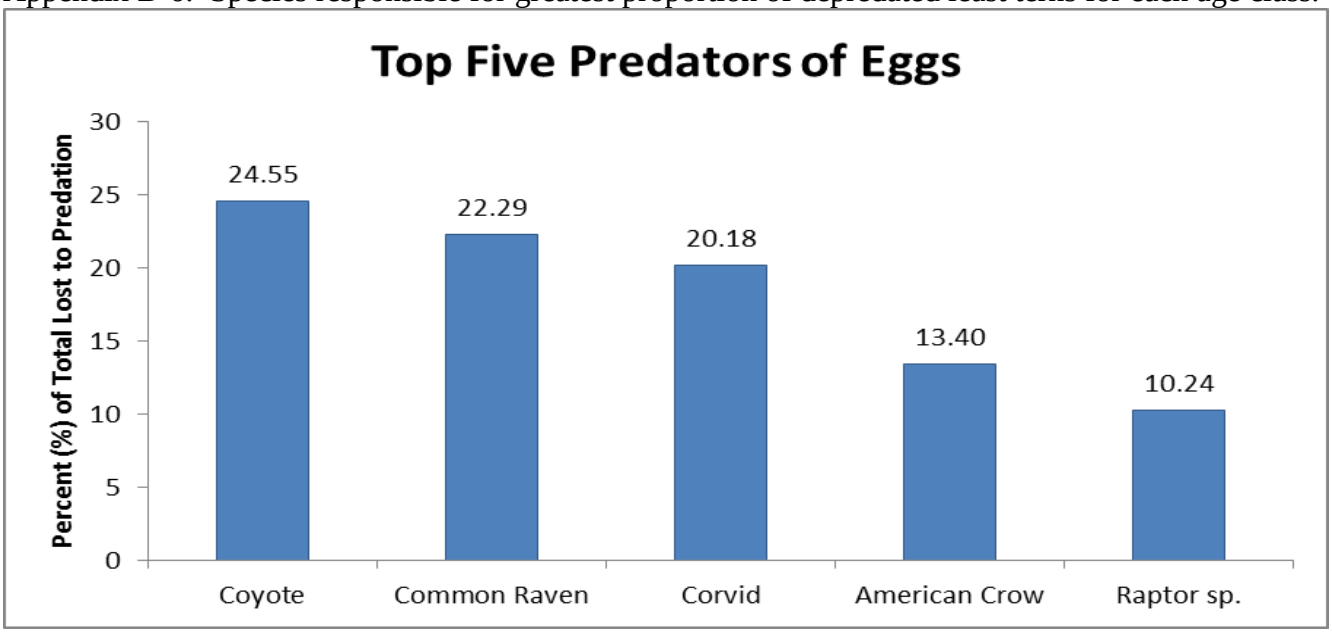
	No. of eggs					No. of nests					No. of dead			
Site name:	(human caused): damaged	lost to flooding:	abandoned pre-term (buried)	abandoned post-term/nonviable	outcome unknown:	(human caused): damaged	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	Comments on cause(s) of non-predation mortality:
Sacramento Area														
Bufferlands	0	0	0	0	0									
San Francisco Bay Area														
Napa Sonoma Marsh Wildlife Area - Totals	3	0	0	15	1	3	0	0	17	1	2	0	0	
Green Island Unit	1	0	0	13	1				6	1	2			
Pond 7/7A	2	0	0	2	0	3			11					
Montezuma - Totals	1	0	2	3	10	1	0	1	1	6	1	0	0	
Site 1	0	0	2	3	3			1	1	2				
Site 3/4	1	0	0	0	7	1				4	1			damaged nest was from TAKE event
Pittsburg Power Plant	0	0	0	0	3					3				
Alameda Point	0	0	28	52	29			24	17	9	11			includes 1DH chick
Hayward Regional Shoreline	0	0	9	6	0			5						
San Luis Obispo/Santa Barbara Counties														
Oceano Dunes SVRA	0	0	1	2	9			1	2	2		2		
Rancho Guadalupe Dunes Preserve														
Vandenberg AFB-Purisima Pt.	0	0	0	1	0						1			
Coal Oil Point Reserve														
Ventura County														
Ormond Beach	0	0	0	0	0									

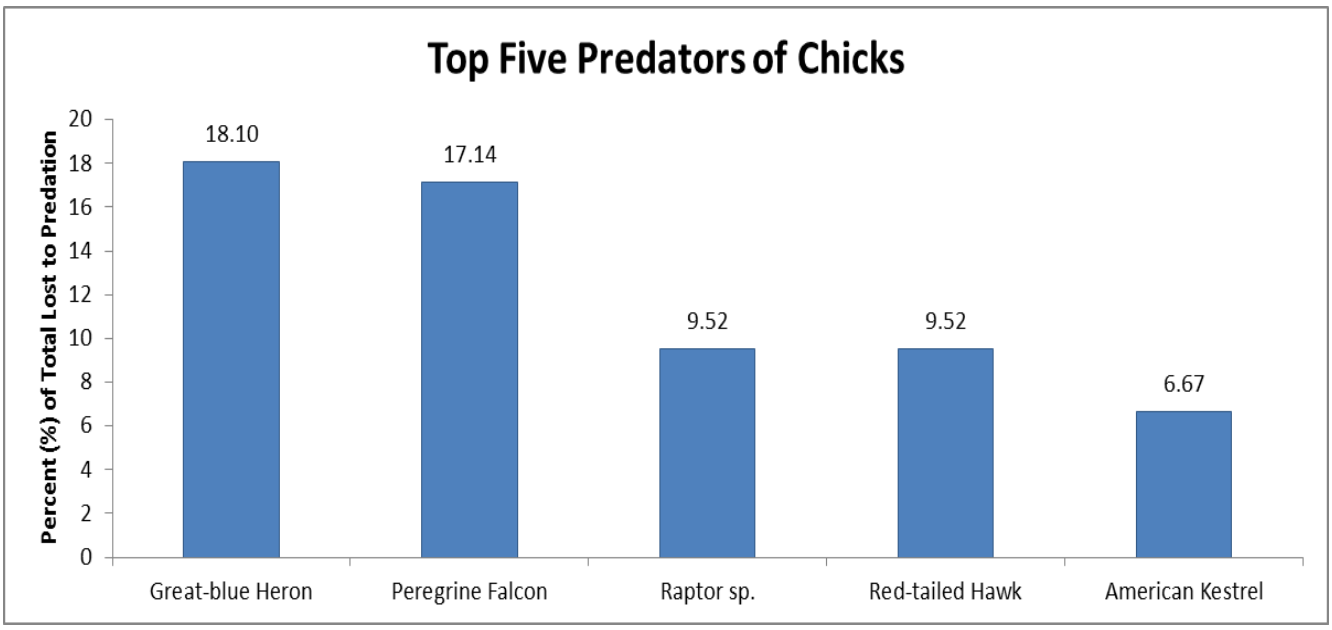
	No. of eggs					No. of nests					No. of dead			
Site name:	(human caused): damaged	lost to flooding:	abandoned pre-term (buried)	abandoned post-term/nonviable	outcome unknown:	(human caused): damaged	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	Comments on cause(s) of non-predation mortality:
Hollywood Beach	1	0	3	0	4	1		2		3				damaged nest was from TAKE event
Santa Clara River/McGrath State Beach	0	0	2	1	13			1		7				
Pt Mugu - Totals	0	7	124	30	87	0	4	87	7	54	11	0	0	
Holiday Beach	0	6	100	20	68		3	69	2	39	10			includes 1DH chick
Holiday Salt Panne	0	1	3	4	1		1	3	2	1				
Eastern Arm	0	0	0	0	0									
Ormond Beach East	0	0	21	6	18			15	3	14	1			
Saticoy united Water Conservation District														
Los Angeles/Orange Counties														
Venice Beach/Marina del Rey	0	0	0	0	0									
LA Harbor- Pier 400	114	0	16	0	0	68		9						damaged nests due to trampling by other larger nesting seabirds
Seal Beach NWR - Anaheim Bay	0	0	3	65	1			2	41	1				
Bolsa Chica Ecological Reserve -Totals	0	4	24	38	8	0	2	15	13	7	12	0	0	
Nest Site 1 (NS1)	0	0	0	0	0			1		2				
Nest Site 2 (NS2)	0	0	2	27	6			1	9	4	6			
Nest Site 3 (NS3)	0	0	0	0	0									
South Tern Island (STI)	0	4	22	11	2		2	13	4	1	6			
Seasonal Ponds	0	0	0	0	0									
Huntington State Beach	0	0	126	60	12			89	21	6	83	22	11	includes 2 sick/injured fledges and 1 sick/injured adult

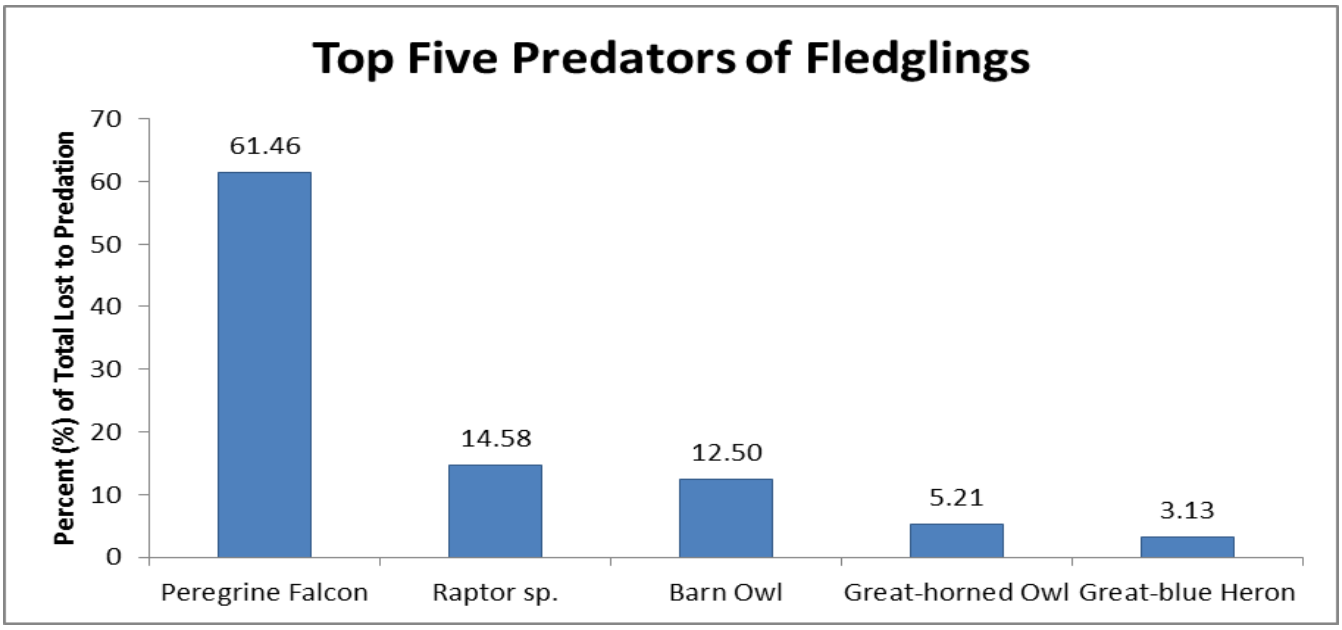
	No. of eggs					No. of nests					No. of dead			
Site name:	(human caused): damaged	lost to flooding:	abandoned pre-term (buried)	abandoned post-term/nonviable	outcome unknown:	(human caused): damaged	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	Comments on cause(s) of non-predation mortality:
Burris Sand Pit/Burris Basin	0	0	0	0	10					1				
Upper Newport Bay Ecological Reserve	0	0	0	2	8				1	8	4			
San Diego County														
MCB Camp Pendleton - Totals	2	57	152	181	25	1	44	117	74	12	525	17	5	
Red Beach	0	0	5	0	0			4			1	1	1	
White Beach	0	2	9	5	0		2	7	2		1			
Blue Beach - North & South Beach combined	2	52	137	176	25	1	40	106	72	12	523	16	4	includes 4DH chicks
Santa Margarita River - Saltflats and Island	0	3	1	0	0		2							
Batiquitos Lagoon Ecological Reserve - Totals	1	0	78	36	1	1	0	55	6	1	162	7	0	
E1	0	0	13	4	0			9	1		5			
W1	0	0	5	2	0			4			1			
W2	1	0	60	30	1	1		42	5	1	156	7		includes 1 chick that choked
San Elijo Lagoon Ecological Reserve														
Fairbanks Ranch														
San Dieguito Lagoon														
Mission Bay														
FAA Island	0	0	3	1	0			2			10			1 chick disease suspected
North Fiesta Island	0	0	5	0	0			3			2			
Mariner's Point	0	0	52	0	10			31			30	2	1	
Stony Point	0	0	0	0	0									

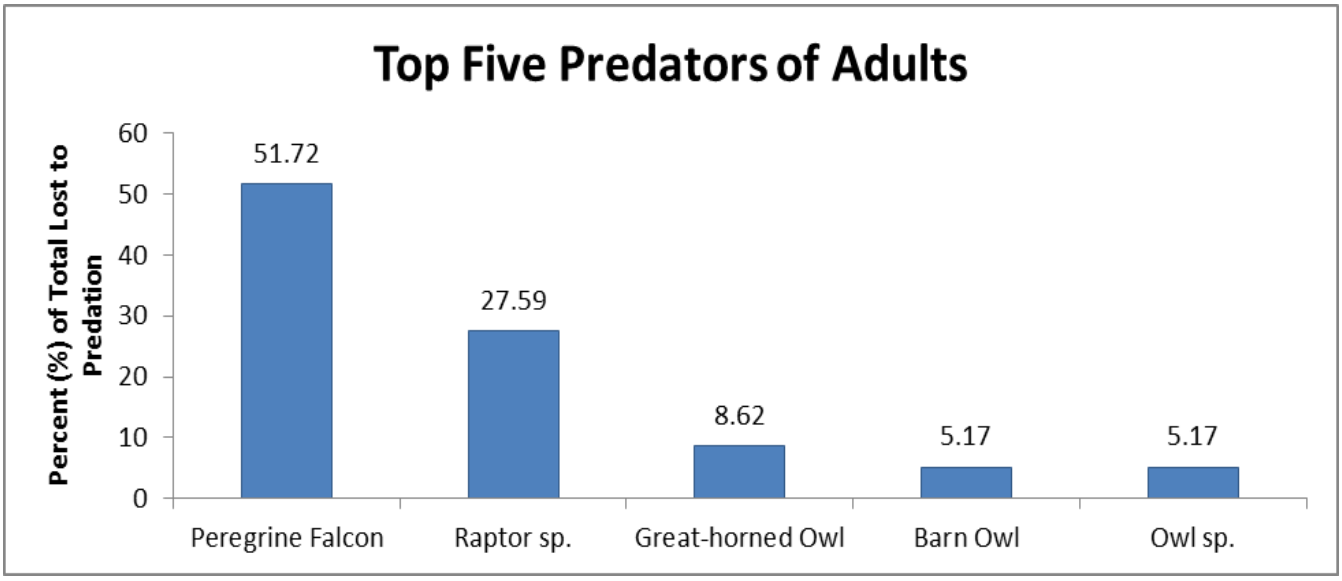
	No. of eggs					No. of nests					No. of dead			
Site name:	(human caused): damaged	lost to flooding:	abandoned pre-term (buried)	abandoned post-term/nonviable	outcome unknown:	(human caused): damaged	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	Comments on cause(s) of non-predation mortality:
San Diego River Mouth														
San Diego Bay														
Lindbergh Field & Former Naval Training Center	1	1	3	2	0	1	1	3	1			1		includes 1TAKE fledge
US Navy - NI MAT	0	0	11	5	0			9	2			1		
US Navy - NI18	0	0	2	0	0			1						
Naval Base Coronado - Totals	23	0	78	81	17	16	0	68	28	8	306	16	4	
Delta Beach North	2	0	18	15	1	1		17	8	2	43			includes 2DH chicks
Delta Beach South	1	0	12	11	4	1		10	4	1	54	2		
NAB Ocean	20	0	48	55	12	14		41	16	5	209	14	4	includes 13 TAKE nests recorded under damaged nests and 3DH chicks
D Street Fill/Sweetwater Marsh NWR	0	0	24	5	7			19		3	22	2		includes 1TAKE fledge
Chula Vista Wildlife Reserve	0	0	10	3	0			6			17	4		
South San Diego Bay Unit, SDNWR - Saltworks	0	0	2	3	4					3	6	2		includes 1DH chick
Tijuana Estuary NERR – Totals	2	0	39	5	87	1	0	28	0	46	7	3	0	
Tijuana North	0	0	13	1	33			12		16				
Tijuana South	2	0	26	4	54	1		16		30	7	3		includes 1 TAKE nest recorded under damaged nests and 1DH chick and 1TAKE fledge
Imperial County														
Salton Sea														

Appendix B-6: Species responsible for greatest proportion of depredated least terns for each age class.






Top Five Predators of Fledglings
Percent (%) of Total Lost to Predation
70
60
50
40
30
20
10
0
61.46
14.58
12.50
5.21
3.13
Peregrine Falcon
Raptor sp.
Barn Owl
Great-horned Owl
Great-blue Heron


Top Five Predators of Adults
Percent (%) of Total Lost to Predation
60
50
40
30
20
10
0
51.72
27.59
8.62
5.17
5.17
Peregrine Falcon
Raptor sp.
Great-horned Owl
Barn Owl
Owl sp.

Appendix B-6: Predation in 2015.

	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									0	0	0	0	0
San Francisco Bay Area													
Napa Sonoma Marsh Wildlife Area													
Green Island Unit									0	0	0	0	0
Pond 7/7A	OSPR, WEGU, UNKNOWN	UNKNOWN AVIAN	CORA	CORA 5D, UNKNOWN 3P, WEGU 2P, GULL 6S	CORA 4D, WEGU 2P, GULL 3S				16	9	0	0	0
Montezuma									0	0	0	0	0
Site 3/4									0	0	0	0	0
Site 1									0	0	0	0	0
Pittsburg Power Plant									0	0	0	0	0
Alameda Point	UNKNOWN AVIAN	CORVID, UNKNOWN AVIAN, PEFA, RAPTOR	PEFA	CORVID 2S, UNKNOWN AVIAN 1S, 6P	CORVID 2S, UNKNOWN AVIAN 1S, 4P		PEFA 3S, 2D, UNKNOWN AVIAN 1S, 2P, RAPTOR 1S	PEFA 2S, 2D	9	7		9	4
Hayward Regional Shoreline		CAGU, PEFA	CAGU, AMKE	CAGU 1D	CAGU 1D	AMKE 1D, CAGU 4D, 1S	PEFA 1S		1	1	6	1	0
Eden Landing	n/a												
San Luis Obispo/Santa Barbara Counties													
Oceano Dunes SVRA		PRLO	PRLO	PRLO 2D, 1S	PRLO 1D				3	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
Rancho Guadalupe Dunes Preserve	n/a												
Vandenberg AFB-Purisima Pt.									0	0	0	0	0
Coal Oil Point Reserve	n/a												
Ventura County													
Santa Clara River/McGrath State Beach	UNKNOWN		UNKNOWN MAMMAL, CALA, CORVID, DIVI	CALA 4D, CORVID 6D, DIVI 9D, UNKNOWN 34P, UNKNOWN MAMMAL 2D	CALA 2D, CORVID 4D, DIVI 5D, UNKNOWN 19P, UNKNOWN MAMMAL 1D				55	31	0	0	0
Hollywood Beach	UNKNOWN	AMCR, GBHE, GULL	AMCR	AMCR 6D, 8S, GBHE 2S, GULL 1S, UNKNOWN 3P	AMCR 5D, 7S, GBHE 2S, GULL 1S, UNKNOWN 3P				20	18	0	0	0
Ormond Beach	n/a												
Pt Mugu													
Holiday Beach	UNKNOWN		PEFA	UNKNOWN 1P	UNKNOWN 1P			PEFA 2D	1	1	0	0	2
Holiday Salt Panne	UNKNOWN			UNKNOWN 4P	UNKNOWN 2P				4	2	0	0	0
Ormond Beach East	UNKNOWN, UNKNOWN AVIAN		CALA, CORA	CALA 145D, CORA 31D, UNKNOWN 20P, UNKNOWN AVIAN 7P	CALA 84D, CORA 24D, UNKNOWN 12P, UNKNOWN AVIAN 4P				203	124	0	0	0
Saticoy United Water Conservation District	n/a												
Los Angeles/Orange Counties													
Venice Beach/Marina del Rey		AMCR	AMCR	AMCR 9D, 6S	AMCR 2D, 6S				15	8	0	0	0
LA Harbor- Pier 400			CORA	CORA 33D	CORA 26D				33	26	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**
Seal Beach NWR - Anaheim Bay		CORA, CORVID, UNKNOWN AVIAN	GHOW, PEFA	CORA 5S, CORVID 36S, UNKNOWN AVIAN 1S	CORA 2S, CORVID 24S, UNKNOWN AVIAN 1S	PEFA 1D	GHOW 4D	GHOW 1D	42	27	1	4	1
Bolsa Chica Ecological Reserve													
Nest Site 1 (NS1)	UNKNOWN	CORA		UNKNOWN 2P, CORA 3S	UNKNOWN 1P, CORA 2S				5	3	0	0	0
Nest Site 2 (NS2)	UNKNOWN		Ants, CORA, RTHA	UNKNOWN 2P, ANT 3D, CORA 35D	UNKNOWN 1P, CORA 1D, ANT 2D, CORA 25D	RTHA 2D, CORA 1D			40	29	3	0	0
Nest Site 3 (NS3)	UNKNOWN			UNKNOWN 6P	UNKNOWN 4P				6	4	0	0	0
South Tern Island (STI)									0	0	0	0	0
Seasonal Ponds	CALA, Unknown		CALA	UNKNOWN 2P, CALA 4P, 6D	UNKNOWN 1P, CALA 2P, 3D				12	6	0	0	0
Burris Sand Pit/Burris Basin	CALA			CALA 20P	CALA 13P				20	13	0	0	0
Huntington State Beach		AMCR, PEFA	PEFA, AMKE	AMCR 30S	AMCR 15S	PEFA 1S, AMKE 1D, PEFA 3D	PEFA 1D	PEFA 1S	30	15	5	1	1
Upper Newport Bay Ecological Reserve													
San Diego County													
MCB Camp Pendleton													
Santa Margarita River - BBN/BBS (combined chick, fledge, & adult predation)	UNKNOWN	PEFA, RAPTOR SP.	GBHE, PEFA, RAPTOR SP.			GBHE 3D, PEFA 1D, 4S, RAPTOR 3D, 5S, UNKNOWN 2P	GBHE 2D, PEFA 8D, 4S, RAPTOR 4D, 4S	GBHE 1D, PEFA 1D, 2S, RAPTOR 1D, 5S, UNKNOWN 1P	see below	see below	18	22	11

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
Santa Margarita River - BBN (formerly North Beach North)	CORVID	CORVID	CORVID, CORA	CORA 15D, CORVID 12D, 65S, 7P	CORA 10D, CORVID 6D, 44S, 5P				99	65	see above for BBN & BBS (which doesn't include 2 BBS chicks below)	see above	see above
Santa Margarita River - BBS (formerly North Beach South)	CORVID, GULL, UNKNOWN, UNKNOWN AVIAN	RAPTOR, AMCR, CORVID	AMCR, BLSK, CORA, GULL, UNKNOWN AVIAN	AMCR 16D, AMCR 4S, BLSK 1D, CORA 4D, CORVID 1P, 13S, GULL 5P, 1D, UNKNOWN 75P, UNKNOWN AVIAN 8P, 2D	AMCR 1D, 3S, BLSK 1D, CORA 3D, CORVID 7S, GULL 3D, 1P, UNKNOWN 39P, UNKNOWN AVIAN 1D, 5P	UNKNOWN 1P, RAPTOR 1S			130	64	2	see above	see above
Santa Margarita River - Saltflats and Island	UNKNOWN			UNKNOWN 5P	UNKNOWN 4P				5	4	0	0	0
White Beach		PEFA, RAPTOR	PEFA				PEFA 1S	PEFA 1S, 1D, RAPTOR 1S	0	0	0	1	3
Red Beach	CORVID	RAPTOR		CORVID 1P	CORVID 1P		RAPTOR 1S		1	1	0	1	0
Batiquitos Lagoon Ecological Reserve -													
E1	UNKNOWN AVIAN		RTHA	UNKNOWN AVIAN 4P	UNKNOWN AVIAN 2P	RTHA 6D	RTHA 1D		4	2	6	1	0
W1		CALA	CALA, COHA	CALA 4D	CALA 2D	COHA 7D, CALA 1D, 4S			4	2	12	0	0
W2		GREG	BAOW, BCNH, GBHE, OWL, PEFA, RTHA	GREG 1S	GREG 1S	BAOW 4D, GBHE 1D, RTHA 2D	BAOW 12D, BCNH 1D, PEFA 25D	OWL 2D, PEFA 4D	1	1	7	38	6

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
San Elijo Lagoon Ecological Reserve	n/a												
Fairbanks Ranch	n/a												
San Dieguito Lagoon	n/a												
Mission Bay													
FAA Island									0	0	0	0	0
North Fiesta Island		CORA		CORA 10S	CORA 5S				10	5	0	0	0
Mariner's Point			PEFA				PEFA 5D		0	0	0	5	0
Stony Point		PEFA				PEFA 2S		PEFA 1S	0	0	2	0	1
San Diego River Mouth	n/a												
San Diego Bay													
Lindbergh Field & Former Naval Training Center		Corvid, PEFA, CORA, WEGU, AMKE	ANT, CORA	CORA 2D, 2S, WEGU 1S	CORA 2D, 1S, WEGU 1S	CORVID 1S, AMKE 1S, ANT 1D, PEFA 1S		PEFA 1S	5	4	4	0	1
US Navy - NI MAT	AMCR			AMCR 10D	AMCR 7D				10	7	0	0	0
US Navy - NI18	UNKNOWN							UNKNOWN 1P	0	0	0	0	1
Naval Base Coronado													
Delta Beach North	RAPTOR		GBHE			GBHE 1D		RAPTOR 1D	0	0	1	0	1
Delta Beach South	RAPTOR, UNKNOWN, UNKNOWN MAMMAL		CORA, GHOW, PEFA, NOHA	CORA 1D, UNKNOWN 2P	CORA 1D, UNKNOWN 1P	GHOW 1D, NOHA 1D, RAPTOR 1P,UNKWOWN MAMMAL 1P	GHOW 1D, PEFA 1D	GHOW 2D, PEFA 2D, RAPTOR 1P	3	2	4	2	5
NAB Ocean	RAPTOR, LBCU		AMCR, BAOW, CORA, GBHE, GHOW, NOHA, PEFA	CORA 2D, LBCU 3P	CORA 2D, LBCU 2P	AMCR 1D, GBHE 1D, NOHA 4D, PEFA 2D, RAPTOR 3P	GBHE 1D, PEFA 3D, RAPTOR 3P	BAOW 2D, GHOW 2D, PEFA 4D, RAPTOR 3P	5	4	11	7	11

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
D Street Fill/Sweetwater Marsh NWR	ANT, GBTE, RAPTOR	BAOW, UNKNOWN	AMKE, PEFA	UNKNOWN 2S, GBTE 2P	UNKNOWN 1S, GBTE 1P	ANT 1P, RAPTOR 1P, AMKE 4D	RAPTOR 2P	BAOW 1S, PEFA 3D	4	2	6	2	4
Chula Vista Wildlife Reserve	raptor	ANT, GBTE, PEFA, RAPTOR, UNKNOWN	GBHE, PEFA	GBTE 1S, RAPTOR 1P, 4S	GBTE 1S, RAPTOR 1P, 2S	ANT 1S, UNKNOWN 1S, GBHE 13D	PEFA 1D, RAPTOR 2S	PEFA 1D, 1S, RAPTOR 5S	6	4	15	3	7
South San Diego Bay Unit, SDNWR - Saltworks		CALA, GULL, UNKNOWN, OWL		CALA 4S, GULL 1S, UNKNOWN 3S	CALA 2S, GULL 1S, UNKNOWN 1S			OWL 1D	8	4	0	0	1
Tijuana Estuary NERR													
Tijuana North		GULL, RAPTOR, UNKNOWN AVIAN	GBTE	GULL 1S, RAPTOR 24S, UNKNOWN AVIAN 17S	RAPTOR 13S, UNKNOWN AVIAN 10S	GBTE 1D	RAPTOR 1S	RAPTOR 3S	42	23	1	1	3
Tijuana South		RAPTOR, UNKNOWN AVIAN	GBHE, PEFA, NOHA	UNKNOWN AVIAN 2S, RAPTOR 40S	UNKNOWN AVIAN 1S, RAPTOR 22S	GBTE 5D, NOHA 2D, PEFA 3D, RAPTOR 1S	PEFA 4D, RAPTOR 1S	PEFA 1D, RAPTOR 1S	42	23	11	5	2
Imperial County													
Salton Sea									0	0	0	0	0

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

* Observations of predators on site recorded in nesting chronology data.

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

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

Predator Species 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), Great blue heron (GBHE), Great egret (GREG), Great horned owl (GHOW), Great-tailed grackle (GTGR), Gull-billed tern (GBTE), Gull, Horned lark (HOLA), Least tern (LETE), Loggerhead shrike (LOSH), Long-billed curlew (LBCU), Merlin (MERL), Mice, Northern harrier (NOHA), Opossum (DIVI), Osprey (OSPR), Owl, Peregrine falcon (PEFA), Raccoon (PRLO), Rat, Red fox (VUVU), Red-tailed hawk (RTHA), Red-winged blackbird (RWBL), Ring-billed gull (RBGU), River otter (LOCA), Rodent, Snake, Snapping turtle (CHSE), Southern Pacific rattlesnake (CROR), Striped skunk (MEME), Unknown, Unknown avian, Unknown mammal, Western gull (WEGU), Western meadowlark (WEME), White-tailed kite (WTKI)

Appendix B-7: Site-specific Summaries and Notes (excerpts taken from 2015 California least tern data reporting spreadsheets unless indicated otherwise).

Site name:	**Summary of breeding season at site:**
Sacramento Area	
Bufferlands	Per Chris Conard 9-28-15 email: After a complete absence in 2014, a pair a returned to the Sacramento Regional Wastewater Treatment Plant/Bufferlands. The first county record was in 2008 at this location and a pair nested from 2008-12 (fledging young in 2009-11). They were only seen for two days in 2013 and not at all in 2014. I first detected them this year on the late date of 5-Jul-2015 (http://ebird.org/ebird/view/checklist?subID=S24161164) and they fledged two young, though only one was seen after two days of flying, so the other was likely eaten by a predator or met some other untimely end. The terns were last seen on 4-Sept-2015, with one adult and one juv (http://ebird.org/ebird/view/checklist?subID=S24891277).
San Francisco Bay Area	
Montezuma	Predators named for each subcolony in previous worksheets are only those observed within 100 m of the colony. Additional predators seen on site during 2015 surveys include golden eagle, red-tailed hawk, mink (carcass found dead on a levee road), Swainson's hawk, common raven, great blue heron, turkey vulture, great horned owl, and black-crowned night-heron. A number of other avian and mammalian predators are known to occur there but were not seen during 2015 surveys.
Pittsburg Power Plant	This year, we had 3 LETE nests at the site. The first was first observed on June 11th, and was incubating during a site check on June 17th, but was not active during a site check on 6/22 and all following site checks. The case of nest failure/abandonment is not known, although we suspect some sort of predation event because nests by AMAV and BNST were also suspiciously absent during this check and did not re-appear in following checks, and ravens and otters had been spotted during the previous check on 6/17. Tern activity in the area was next documented on 6/30, and a tern was incubating during a check on 7/7. A third incubation for the season was first documented on 7/13. These second and third nests were considered the second wave for the site, and the June nest was considered the first wave, although June is generally late for the first wave of LETE breeding in California. These last two nests contained incubating LETE until the 7/20 site check, where LETE were observed in the area, but none were incubating or hanging around the nest locations. Neither of these last two nests hatched, and no cause of failure/abandonment could be identified. Our survey methods do not include nest checks, and any eggs in nests would have been impossible to see from our survey points, so we do not have any egg data. The last LETE for the season were seen during the 7/28 site check.

Hayward Regional Shoreline	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 180 tons of sand, salt, 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 4,462 volunteers who have contributed 21,200 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 $95,000 in grant funds and donations were secured for the Tern Island Project from the Regional Parks Foundation, U.S. Fish & Wildlife Service Coastal Program, Fremont Bank Foundation, Alameda Countywide Clean Water Community Stewardship Program, New United Motor Manufacturing, Orchard Supply Hardware and Johnston's & Drake's Bay Oyster Farms.
Kings County	
Kettleman City Evaporation Ponds	Per Jeff Seay 9-11-15 email: Just a quick note to confirm that there were no least terns observed in Kings County again this year. Unfortunately, the water situation at the site where they previously nested near Kettleman City has changed, so that there are no fish bearing canals or ditches near the old nest sites.
San Luis Obispo/Santa Barbara Counties	
Oceano Dunes SVRA	All least tern nests were inside a large seasonally fenced exclosure in the southern portion of the vehicle riding area including 46 within type 1 (deters or excludes most people and (some) mammalian predators) fencing and 8 within type 3 (symbolic) fencing. There were an estimated 44-49 breeding pairs, similar to the 47-48 breeding pairs in 2014, and slightly above the average of 40-43 pairs (range=23-66) from 2005-14. There were 54 known nesting attempts and 48 hatched, for a nest hatching rate of 89%. Of the six nests that failed, one was abandoned pre-term; one was abandoned post-term; one was abandoned, unknown if pre- or post-term; one depredated by raccoon; and two failed due to an unknown cause. Eighty-four chicks hatched and 69 were color-banded to individual. Sixty-nine of the 84 chicks (including 12 unbanded chicks) are known to have fledged (seen when 21 days old or older), for a chick fledging rate of 82% and 1.41-1.55 chicks fledged per pair. This compares to an average fledging rate of 78% (range=66-91%) during the previous nine years when most chicks were banded to individual. One fledgling (L:Y/G from LT9) was not seen from the day it was banded until it was found as a carcass on 21 July, and is included in the total number of fledglings. In 2015, 21.4% (12/56) of color-banded juveniles were documented remaining at ODSVRA for 21 days or longer post-fledging, with one juvenile staying at least 45 days past fledge date. Over the 11-year period 2005-15, 483 color-banded fledglings were tracked at ODSVRA with 33% remaining 21 days or longer.
Rancho Guadalupe Dunes Preserve	Per Melissa Kelly 9-18-15 email: RGDP had no nesting terns and no apparent attempts in 2015. We actually didn't see any until the week of 20-26 July when 6-7 adults and young showed up hunting the estuary for a week or so.

Vandenberg AFB-Purisima Pt.	We estimate the 2015 breeding population to be 22 pairs which is 27% smaller than the 21-year mean of 30.2 pairs. Hatching success in 2014 (96%) was the highest on record and higher than the 20-year mean of 62%. Fledging success (64%) was higher than the 20-year mean of 45%. Breeding success (1.32 fledglings per breeding pair) was tied for the highest year on record (see Figure 1) and 110% higher than the 21-year mean of 0.63 fledglings per breeding pair. 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 21-year mean. Since 2007, the colony has shown above average reproductive success for 7 of the 9 years. During this period, young-of-the-year rockfish have dominated the diet. To date, diet samples from 2015 have not been analyzed, but anecdotal evidence suggests that foraging conditions adjacent to the colony were good. Despite overall high annual reproductive success since 2007, the population size has decreased in recent years. The seven smallest annual population sizes on record have occurred within the last 12 years. The population has increased slightly since 2013. 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. When weather did not permit us to enter the colony, off-colony surveys were conducted.
Coal Oil Point Reserve	Per Jessica Nielsen 9-4-15 email: I am the new Conservation Specialist at UCSB's Coal Oil Point Reserve, working with Cristina Sandoval. Despite our ten decoys, we did not have any California Least Terns nesting here this year.
Ventura County	
Santa Clara River/McGrath State Beach	Estimated fledge numbers are conservative. Pulses of fledges from other sites (indicated by color banded birds) move through and intermix with fledges from the McGrath/SCR site. Fledge counts are based on conservative estimates to preclude fledges from other sites. Full summary and additional details will be included in the annual report narrative.
Hollywood Beach	The size of the suitable nesting beach available this year was approximately 1/4 the size it was the last two years following a major dredging event over the winter. As many as 60 CLTs were seen circling the beach at a time but only 24 nest attempts were made and several nests were located far from the primary group. Nest attendance was very low and few brooding birds were observed. Therefore, predation by the usually present crows was easy and CLTs moved on to another beach soon after losing eggs.
Ormond Beach	9-8-15 Cyndi Hartley email: We did not have any Ca least tern nests this year on Ormond. Despite courtship displays (nest scraping and exchanging fish) the site was abandoned. We have also had nests in this location is past years. However this year there was intense homeless encampment activity where the birds nest, including recently an unattended pit bull allowed to roam the beach that lives in one camp. Efforts are under way to address this problem with local law enforcement agencies and land owners, however it is uncertain how long it will take to make an effective change.

NBVC Point Mugu	California least tern nests on the Ormond East Beach colony experienced severe predation pressure from common ravens and coyotes early in the season. Ultimately 122 of 173 nests were predated, the majority between 21 May - 22 June 2015. This colony typically is the largest on the installation but was almost completely abandoned after the first wave of nests was predated. Prior to this season, the largest number of nests established on the Holiday Beach colony was 164 in 2013. A total of 278 were documented in 2015. The majority of the nests were initiated during the same early season timeframe as the predation occurring on the Ormond East colony. It is difficult to determine what proportion of adults initiated their first nests on Holiday Beach and what proportion were renesting after failure on Ormond East. The nests that ultimately hatched appeared to have fared very well. The nests were in a compact area that was comparatively easy to defend. Adults were regularly seen provisioning young with appropriate sized fish. There did not appear to be a resource shortage as observed in some recent breeding seasons. The Holiday Beach Salt Panne colony was viewable from the Holiday Beach colony monitoring location. Fledgling counts recorded for Holiday Beach also include any fledglings observed in the Holiday Beach Salt Panne. No California least tern nesting occurred on the Eastern Arm colony in 2015.
Saticoy United Water Conservation District	Two LETE were observed foraging onsite for approximately 15 minutes on one occasion during a survey. No LETE nests, fledglings, or terns exhibiting breeding/nesting behavior were observed.
Los Angeles/Orange Counties	
Bolsa Chica (Overall)	Overall, 204 nests were initiated on Bolsa Chica's colonies during 2015. The estimated number of breeding pairs was 194. Only 2 of 5 sites were productive (NS2 and STI) and productivity on those sites halted toward the end of the breeding season due to pressure from predators. The first chick hatched on 27 May. The first CLTE fledgling was recorded on 16 June. On 7 July, we conducted a fledgling survey between 10:45 hrs and 11:23hrs and counted a combined total of 53 fledglings: 5 on STI, 3 on NS1, 1 in Cell 41, 10 in Cell 42, 4 on the 80Rd, and 30 in Cell 45. Simultaneously, Cells 46, 47, 48, 49, 50 and a cove were also surveyed but no CLTE were observed in those areas. A total of 29 adults were also counted: 21 on STI, 1 flying over Cell 41 and 7 in Cell 42. On 16 July, P. Knapp counted 44 fledglings in Cell 45 and 7 on STI. We stopped seeing/hearing any CLTE by 31 July. Then on 21 August, P. Knapp saw two CLTE fledglings on NS1 and on 22 and 23 August, he saw 3 CLTE fledglings on NS1. Two juvenile CLTE were seen on the West Levee Rd. on 26 August. The CLTE observed during August may have been fledglings from other colonies up and down the coast. The estimated number of fledglings was 99.
Bolsa Chica South Tern Island (STI)	Of the 64 nests initiated on South Tern Island (STI) this season, 43 (67%) hatched at least 1 chick. There was one 3-egg clutch on STI and it produced 2 chicks. A total of 4 dead chicks were found within nests. Two nests flooded and one had an unknown fate. Nine nests (14%) had at least one non-viable (NV) egg. During mid-June, a GHOW was photographed by a nest cam on STI and its feathers were found as well. Subsequently, 13 nests were abandoned and we surmised that the adults stopped incubating these nests due to the presence of the GHOW. However, adults with chicks continued to attend to their young: this was confirmed by our field observations and by the nest cams. Survey counts suggest that at least 12 CLTE fledged from STI; the highest fledgling count on STI was 7 on 16 July 2015.
Bolsa Chica Nest Site 1 (NS1)	Only 3 nests were initiated on Nest Site 1, our largest nest site. These were depredated almost immediately and no other nests were ever found there.

Bolsa Chica Nest Site 2 (NS2)	Of the 127 nests initiated on Nest Site 2 (NS2), 86 (68%) hatched at least one chick and 20 nests (16%) had a least one NV egg. Only one nest was abandoned; 4 nests had an unknown fate; and, 28 (22%) nests were depredated by ravens. A total of six dead chicks were found within nests. This site had two 3-egg clutch nests, and each of them produced 3 chicks. On 30 June, 16 nests on this site had been depredated by ravens; tracks were all over the site and the eggs had been eaten. No downy chicks were seen during that survey and it was assumed that they had also taken by the ravens. Once CLTE were old enough to fly, they typically left NS2 and were provisioned within one of the adjacent wetland cells (Cell 42 and Cell 45). O'Reilly believes the number of fledglings was likely highest in these cells during the first week of July sometime around the July 4 Holiday. We conducted a fledgling survey on 7 July and counted 44 CLTE fledglings around NS2: n=10 in Cell 42; n = 30 in Cell 45; and, 4 on the road between these two wet cells. The last 9 nests initiated on the site could have been renesters (nest #s 119-127). It is likely the later nests were depredated prior to reaching full clutch size; and this helps to explain BCER's overall average clutch size of 1.74.
Bolsa Chica Nest Site 3 (NS3)	A total of 4 nests were initiated on Nest Site 3; however, Corvids were constantly hunting over the site. All 4 nests were lost, presumably to those Corvids. O'Reilly thinks the pair that laid nest #1 may have renested (nest #4).
Bolsa Chica Seasonal Ponds	A total of 6 nests were observed within the Seasonal Ponds but they were all depredated by coyotes.
Burris Basin	We know that our principal problem was with 2 coyotes accessing the island and wiping out the FOTEs in 2015 (leaving lots of sign) and lots of CLT eggs taken too; lots of potential predators around, particularly GBHEs nesting nearby but no predation observed directly and nothing in the colony when we were there. Total possible fledglings observed was 3 seen once.
Upper Newport Bay Ecological Reserve	Productive year compared with 2014. The nest site also had a high amount of black skimmer nests (approx. 30-40), chicks (13) and fledges (15). Found a large king snake on the island, was not removed.
San Diego County	
San Dieguito Lagoon	Per Brian Foster 10-2-15 email: Neither Fairbanks Ranch nor San Dieguito had nesting least terns. The terns visited San Dieguito for a few days and then left. We were having daily visits from the peregrines at the time.
Mission Bay	
FAA Island	I estimated FL numbers 3 ways then took the average: daytime counts every 2 weeks was 10 total, Banding data looking at recaps 9 total, banding data looking at # hatched - # dead =19 total, average 12.6 rounded down to 12. That was close to my gut feeling 10-12 which is good.
North Fiesta Island	Successful nesting with good hatching success, but most of the chicks were lost to suspected predator PEFA.
Mariner's Point	A successful nesting season with good hatching and fledging success and fairly low mortality.
Stony Point	One nest, 2 chicks hatched, both lost before fledging to SP PEFA.
San Diego River Mouth	No CLTEs were seen at the site this 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 storm drains. The Terminal Link Road construction project resulted in closure of the adjacent perimeter road and relocation of the perimeter fence to closer to the colony site along the southern edge of oval 03-S, construction of an electronic gate and guard shack, and installation of visual barrier fabric on the perimeter fence adjacent to the southwestern edge of the site. Although these were completed prior to the nesting season, construction activity continued on the opposite side of the fence and construction traffic passed along the edge of the site and through the gate throughout the season. Zoological Society of San Diego subcontract personnel established a 30 m grid system in the primary nesting oval (03-S) 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 15 April 2015. They were observed each visit after that through 14 July. There was an 82 percent reduction in nest numbers from 2014 to 2015 thought to be influenced by disturbance from construction activity, predators, and nest predation during the early formative period of colony establishment, as well as by possibly limited prey fish availability due to above average water temperatures, and by the long-term overall decline of the tern population in Southern California. At least 18 nests were initiated by nine to ten estimated pairs between 9 May and 3 June. The maximum number of concurrently active nests was nine from 21 May to 1 June, and six nests with three broods of chicks on 2 June. Up to eight nests possibly appeared to be renesting of pairs that had lost their initial clutches. At least 17 nests were established in the main nesting oval 03-S and one nest in oval 02-S. Fifteen chicks from eight nests hatched successfully. It is estimated that nine to 10 chicks reached fledgling age and eight to nine young survived to fledge from the site. Four nests with four eggs were abandoned pre-term, including one that had been washed out of its nest scrape by record rainfall. One egg was found abandoned with thin and only partially developed eggshell, and one two-egg clutch failed to hatch and was abandoned after prolonged incubation of 44 to 46 days. Five eggs from four nests were depredated, two to three by common ravens and one suspected by western gull. One chick was depredated by ants and three to four others are suspected to have been depredated, with raven, American kestrel, and peregrine falcon each seen leaving the site with prey suspected to be possible tern chicks. One fledgling was crushed by an aircraft on the taxiway but was suspected to have been flushed from the site by a peregrine falcon. Feathers of one adult were found beneath the beacon where a peregrine falcon had been perched. Nest abandonment and chick predation coincided with regular disturbance by peregrine falcon, as well as disturbance and possible predation by Cooper's hawk, gulls, common raven, and American crows. Other potential predators observed in the area included rats, great blue heron, black-crowned night-heron, and European starling.
D Street Fill/Sweetwater Marsh NWR	Through mid-March, U.S. Fish and Wildlife Service staff and contractors applied herbicide to invasive plant species and completed mechanical scraping of the site to reduce vegetation and enhance it for use by least terns and snowy plovers. Biological monitors under contract with the Port manually removed non-native invasive plants from the site, pruned back vegetation to reduce cover and potential raptor perches, 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, and is to be reported separately. Monitoring was conducted March through mid-August one to three days per week. Least terns were first observed at the D Street Fill on 17 April 2015. They were observed each visit after that through 25 July. At least 123 nests were initiated by 108 to 111 estimated pairs between 5 May and 7 July. The maximum number of concurrently active nests was 106 on

	29 May, and the maximum number of concurrently active nests and broods was 91 nests with 17 to 18 broods of chicks on 2 June. At least 12 nests were suspected to have resulted from renesting by pairs that lost earlier clutches. At least 184 chicks from 99 nests hatched successfully. It is estimated that 25 to 37 chicks reached fledgling age and 21 to 34 survived to fledge from the site. The outcome of four nests with seven eggs was uncertain, but lack of evidence of hatching or chick presence indicates probable depredation. At least two nests with two eggs were depredated, one by undetermined species and one suspected to have been taken by gull-billed terns. Nineteen nests with 24 eggs were abandoned pre-term, and five eggs failed to hatch and were abandoned after the other egg in each clutch hatched successfully. One fledgling and 29 chicks were found with no obvious cause of death. Two additional chicks were found dead being scavenged by ants, but whether ants contributed to their mortality could not be determined. One fledgling banded at D Street was later found hit by a vehicle at Border Field State Park. One adult was observed being taken by a peregrine falcon, another prey item observed being carried from the site by a peregrine was suspected to be a least tern adult, and piles of feathers of an additional adult and a fledgling suggested predation by peregrine. The depredated carcass of another adult was found following observation of a barn owl on-site. Two chicks were observed being taken by an American kestrel and remains of two more recovered upon necropsy. Two chick carcasses were found with trauma to the head and either kestrel or northern harrier were suspected to be responsible. 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 109 to 112 chicks coincided with documented depredation and/or daily disturbances to the colony by northern harrier, American kestrel, and peregrine falcon, and visits by gull-billed tern and barn owl. Other potential predator species observed in the area included great blue heron, great egret, black-crowned night-heron, Cooper's hawk, red-tailed hawk, gulls, common raven, American crow, European starling, western meadowlark, rats, California ground squirrel, coyote, feral cat, and striped skunk.
Chula Vista Wildlife Reserve	Prior to early April 2015 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 through August 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 20 April 2015, and on each visit through 4 August. One adult and fledgling were observed on 18 August. At least 79 nests were initiated by 65 to 71 estimated pairs between 10 May and 30 June 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 80 on 27 May, and maximum number of concurrently active nests was 65 on 31 May, and maximum number of concurrently active nests and broods was 55 nests and 10 broods on 5 June. At least 127 chicks from 70 nests hatched successfully. It is estimated that 40 to 44 chicks reached fledgling age and 33 to 37 young survived to fledge from the site this season. Four eggs from two nests were depredated and northern harrier suspected responsible, two eggs from one nest were depredated and gull-billed tern suspected responsible, two eggs from one nest and a previously abandoned egg from another nest were depredated but species responsible could not be determined. Seven nests were abandoned pre-term, and three were abandoned after the other egg in each clutch hatched successfully. One of the abandoned nests was found following record rainfall and may have been flooded prior to abandonment. Four fledglings and 16 chicks were found dead of undetermined causes. One chick was observed being depredated by a great blue heron, and the bands and remains of 12 additional chicks were recovered upon necropsy. One chick was apparently depredated by ants, and carcasses of others apparently previously deceased were scavenged. An owl pellet was found containing adult least tern feathers and bones. One adult and one fledgling were observed being taken by peregrine falcons, the remains of five to nine adults and one fledgling were suspected

	to have resulted from peregrine predation, those of two adults and one fledgling were suspected of being depredated by either owl or peregrine, and that of one large chick/fledgling depredated by undetermined species. 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 71 to 75 chicks coincided with repeated hunting of the site by peregrine falcons and great blue heron, and visits by northern harrier, American kestrel, and gull-billed tern. Other potential predator species observed in the area included great egret, osprey, red-tailed hawk, gulls, Caspian tern, common raven, American crow, coyote, gray fox, raccoon, striped skunk, feral cat, California ground squirrel, and rats.
South San Diego Bay NWR – Saltworks	Potential nesting sites of the endangered California least tern and western snowy plover were monitored one to three days per week late February to mid-October 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 15 April 2015. They were observed each visit after that through 5 August. At least 29 nests were initiated by 22 to 24 pairs between 13 May and 19 June in four concentrations or subcolonies. The maximum number of concurrently active nests was 21 with one brood on 3 June, and five nests appeared to be renesting by pairs that had lost earlier clutches. Twenty nests were established near the wooden bridge/sluice on the southeast edge of pond 25, east edges of pond 27, and west edge of pond 30; two nests were established on dike VII; one nest on mid-dike IV; and six nests were established on the fill in southeast pond 11. At least 38 chicks from 23 nests hatched successfully. One chick died while hatching. Three nests each had one egg fail to hatch after the other in the clutch hatched. Two nests were abandoned following predation of one of two eggs in each clutch, three nests with four eggs were depredated, and two additional previously abandoned eggs were depredated. Coyote tracks were found at two of the depredated nests and gull tracks at one of the scavenged abandoned nests. The fate of seven eggs from four nests was uncertain, but lack of evidence of hatching or chick presence indicates probable depredation. The majority of chicks were not seen beyond the first three days following hatching with predation the most likely limiting factor. Eleven to 12 are estimated to have reached fledging age and nine to 10 are estimated to have fledged from the site. Six chicks and two fledglings were found dead with no visible trauma. The remains of one adult was found depredated and large owl suspected. No other definitive evidence of chick depredation was found, but lack of observations, recaptures, fledglings, and attentive adults indicates that the other 20 to 21 chicks were likely preyed on. Their disappearance coincided with regular sightings of peregrine falcons and gull-billed terns, as well as kestrels, gulls, and coyote tracks. Other predator species observed in the area included northern harrier, red-tailed hawk, Cooper's hawk, gulls, barn owl, common raven, American crow, dog, cat, raccoon, striped skunk, California ground squirrel, and small rodents. Nesting by most tern species in South San Diego Bay was delayed this year and numbers remained lower than usual, likely related both to predator disturbance and to possibly decreased prey fish availability resulting from warmer than usual winter/spring sea surface temps. Elegant terns were an exception in that their numbers increased significantly after initial delays in nesting, but the increase appeared due to the warm-water-related collapse of fisheries in the Gulf of California and relocation of birds from the Mexican colonies to Southern California.
Tijuana Estuary	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, Kate Goodenough, and Brian Collins. Predator management was conducted by USDA Wildlife Services staff. California least terns were first observed at Tijuana Estuary on 16 April 2015. They were observed each visit after that through 18 August. At least 208 nests were initiated by 150 to 166 pairs between 7 May and 23 July. The maximum number of concurrently active nests and broods was 150 on 28 May. At least 42 nests were likely renests from clutches lost earlier. Nests were distributed in four 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 74 nests were established on upper beach immediately north of the rivermouth but south of the barrier dune, and one nest was established mid-beach between Seacoast Dr. and the south end of the barrier dune. At least four 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, 117 nests were established, and 12 nests were established north of the trail. At least 164 chicks hatched from 88 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, 30 to 32 young were estimated to have fledged from the site.
Tijuana Estuary North	At least 46 to 52 pairs established 75 nests with 127 eggs on the beach north of the Tijuana River this season, most being located just north of the rivermouth and south of the barrier dune, and one being located mid-beach west of the barrier dune. The maximum number of concurrently active nests was 45 plus one brood on 28 May. Twenty-three nests appeared to result from renesting. Forty-five chicks hatched from 25 nests. The maximum number of chicks observed on a single date was 18 and of fledglings was four. Seven to eight chicks reached fledging age and six to seven survived to fledge from the site. Thirteen nests with 13 eggs were abandoned pre-term, including one abandoned after the other egg in the clutch was depredated. One egg failed to hatch and was abandoned after the other egg in the clutch hatched successfully. The outcome of 18 nests with 33 eggs was undetermined but predation was suspected, including one nest where the outcome of one egg was uncertain but the other hatched, and one nest where the outcome of one egg was uncertain but the other was depredated. At least 22 nests with 35 eggs were depredated. These included three nests found depredated with eggshell damage indicative of northern harrier, and one with harrier or corvid tracks. This and presence of harrier and common raven on corresponding dates led to the suspicion of harrier responsible for depredation of at least 12 of the nests, and harrier or possibly raven for 10 nests. Seven additional depredated eggs were found away from nests but thought to have come from previously documented depredated nests or possibly nests of uncertain outcome; one had adjacent gull tracks but the others were suspected to have been depredated by harrier. Two additional eggs at previously abandoned nests were also depredated with harrier and gull-billed tern suspected responsible. The remains of three adults and one fledgling were found depredated and peregrine falcon suspected. One chick was observed being carried from south of the river by a gull-billed tern. Additional predation of up to 35 to 36 chicks was suspected by each of the above-mentioned species. Other potential predator species observed in the area were opossum, cat, dog, small rodents, California ground squirrel, great blue heron, black-crowned night-heron, red-tailed hawk, American kestrel, great horned owl, American crow, and western meadowlark.
Tijuana Estuary South	At least 104 to 114 pairs established 133 nests with 248 eggs on the beach south of the Tijuana River this season, most (117 nests) being located north of the beach parking lot near the international border but south of the horse trail, 12 nests north of the trail, and four just south of the rivermouth in the historic colony site. The maximum number of concurrently active nests was 104 on 28 May. Nineteen nests appeared to result from renesting. Sixty-three nests had 119 chicks hatch south of the trail; none hatched in the north trail nor south rivermouth areas. The maximum number of chicks observed on a single date was 44 to 50 and of fledglings was 22. Thirty-one to 32 chicks reached fledging age and 24 to 25 survived to fledge from the site. At the south rivermouth site, three nests with six eggs were depredated with possible harrier tracks at one and harrier suspected of being responsible for each. One nest with two eggs was destroyed by human activity, with footprints found at the nest and the eggs found broken several feet away. North of the trail, the outcome of one nest with two eggs was uncertain, but predation was likely since the other 11 nests with 21 eggs were depredated. One nest had possible burrowing owl and

	harrier tracks, two nests had possible harrier tracks, and harrier was suspected responsible for predation at each. South of the trail, 20 nests with 26 eggs were abandoned pre-term, including one abandoned after the other egg in the clutch was depredated and three abandoned after uncertain outcome of one egg in each clutch. Four eggs failed to hatch and were abandoned after the other egg in each clutch hatched successfully. The outcome of 29 nests with 52 eggs was undetermined but predation was suspected. At least eight nests with 15 eggs were depredated. Northern harrier was suspected as responsible for the depredation of each but one where possible burrowing owl or corvid tracks were detected. One chick died while hatching and three chicks and two fledglings were found dead with no visible trauma. One chick, two large chick/fledglings, and one fledgling that had been banded as a chick at the D Street Fill colony were found dead within vehicle tracks outside of the fenced nesting area. Monitors had previously noted that harrier and peregrine activity in the dunes and nesting area appeared to be causing adults and broods to shift to the wrackline and unfenced beach, and agencies had been alerted to caution staff about driving in the area. The remains of two adults, one large chick/fledgling, and one fledgling were found depredated and peregrine falcon suspected. In addition, peregrines were observed depredating three large chick/fledglings, three fledglings, and seen driving a fourth fledgling into the surf from which it was not seen to emerge. Two to five chicks were observed being depredated by harrier. Four chicks were observed being taken by gull-billed terns, and a fifth seen being carried was suspected to be least tern but possibly could have been a snowy plover chick. Additional predation of up to 92 to 95 chicks was suspected by each of the above-mentioned species. Other potential predator species observed in the area were ants, snakes, opossum, cat, dog, coyote, small rodents, ground squirrel, great blue heron, black-crowned night-heron, red-tailed hawk, Cooper's hawk, kestrel, gulls, barn owl, crow, and meadowlark.
Imperial County	
Salton Sea	Per Guy McCaskie 9-4-15 email: No more than one pair present [from 25 April through 10 May 2015] at the south end of the Salton Sea, and no concrete evidence of nesting, but an adult seen with a flying hatch-year bird on 16 August by Kathy Mihn Dunning.