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

California Least Tern Breeding Survey

2014 Season

by
Nancy Frost

Nongame Wildlife Program, 2015-01

Final Report

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ABSTRACT

Monitoring to document breeding success of California least terns (*Sternula antillarum browni*) continued in 2014, with observers at 41 nesting sites providing data. An estimated 4232-5786 California least tern breeding pairs established 6038 nests and produced 2136-2859 fledglings at 48 documented locations across California. The fledgling to breeding pair ratio was 0.37 to 0.68. Statewide, 10,827 eggs were reported, with a Site Mean clutch size of 1.7 eggs per nest (St Dev=0.29) and a Statewide clutch size of 1.8 eggs (St Dev = 0.45) 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 Beach, Point Mugu, and Batiquitos Lagoon represented 60% of the breeding pairs. Fledgling numbers were also unevenly distributed as the sites with at least 90 fledglings each (Camp Pendleton, Alameda, Batiquitos, Huntington Beach, Point Mugu, Naval Base Coronado, and Hayward), contributed 74% of the state's production, and the sites with greater than 35 fledglings each (including the seven aforementioned sites plus Bolsa Chica, Venice Beach, Mariner's Point, Napa Sonoma Marsh, and Oceano Dunes), contributed 90% of the state's production. The 2014 statewide non-predation chick mortality rate was 20%, similar to that in 2013 (22%). 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 2013. The predators known to be responsible for the greatest number of depredated least terns in 2014 were common ravens (*Corvus corax*), followed by American crows (*Corvus brachyrhynchos*), peregrine falcons (*Falco peregrinus*), coyotes (*Canis latrans*), gull species, western meadowlarks (*Sturnella neglecta*), unknown species, corvid species, raptor species, great horned owls (*Bubo virginianus*), northern harriers (*Circus cyaneus*), opossums (*Didelphis virginiana*), unknown avian species, and American kestrels (*Falco sparverius*). The monitoring effort of 2014 is scheduled to continue in 2015.

[1] Frost, N. 2015. California least tern breeding survey, 2014 season. California Department of Fish and Wildlife, Wildlife Branch, Nongame Wildlife Program Report, 2015-01. Sacramento, CA. 23 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). 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 nests established in 20-40% vegetative cover are most successful, 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 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;
- 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 2014 breeding season in California.

METHODS

Monitors for each site that had least tern nesting in 2013 or who planned monitoring activities for 2014 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). Sampling intensity was based on the total number of visits to a site and dates of first and last visits.

Pair Estimation

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

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

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

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

Mortality and Predation

Identifying causes of mortality was of particular importance since it has been identified as the main cause of low reproductive success for this species (Collins 1984). Therefore, mortality data was reported by date and included numbers of lost nests and individuals of each age class (egg, chick, fledgling, and adult). Causes of mortality were reported using one of the following mortality codes: P (predated); D (damaged); 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, three statistics are provided. The first ranks the species by the number of sub-colonies at which they were documented or thought to have depredated least terns. The second quantifies a predator rating for each species reported as a documented, suspected, or possible predator, calculated as follows:

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

The third quantifies mortality by calculating the proportion of total least tern eggs, chicks, fledglings, and adults depredated by specific predators. The number of eggs, rather than the number of nests, was used in calculations since they more accurately represent individual terns. For the few cases when the number of eggs was not reported, the number of nests was used as a conservative estimate of the number of eggs depredated. When a range of individuals depredated by a species was reported, the average was used. Past analysis with minimum, average, or maximum values resulted in only slight differences (Marschalek 2005). Only the numbers of terns lost to a suspected or documented predator (possible category excluded) were used in calculating the proportion of least terns lost to predators. Past data shows little difference between only documented predation and combining suspected and documented predation (Marschalek 2008).

Predator Control

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

RESULTS and DISCUSSION

Site Preparation

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

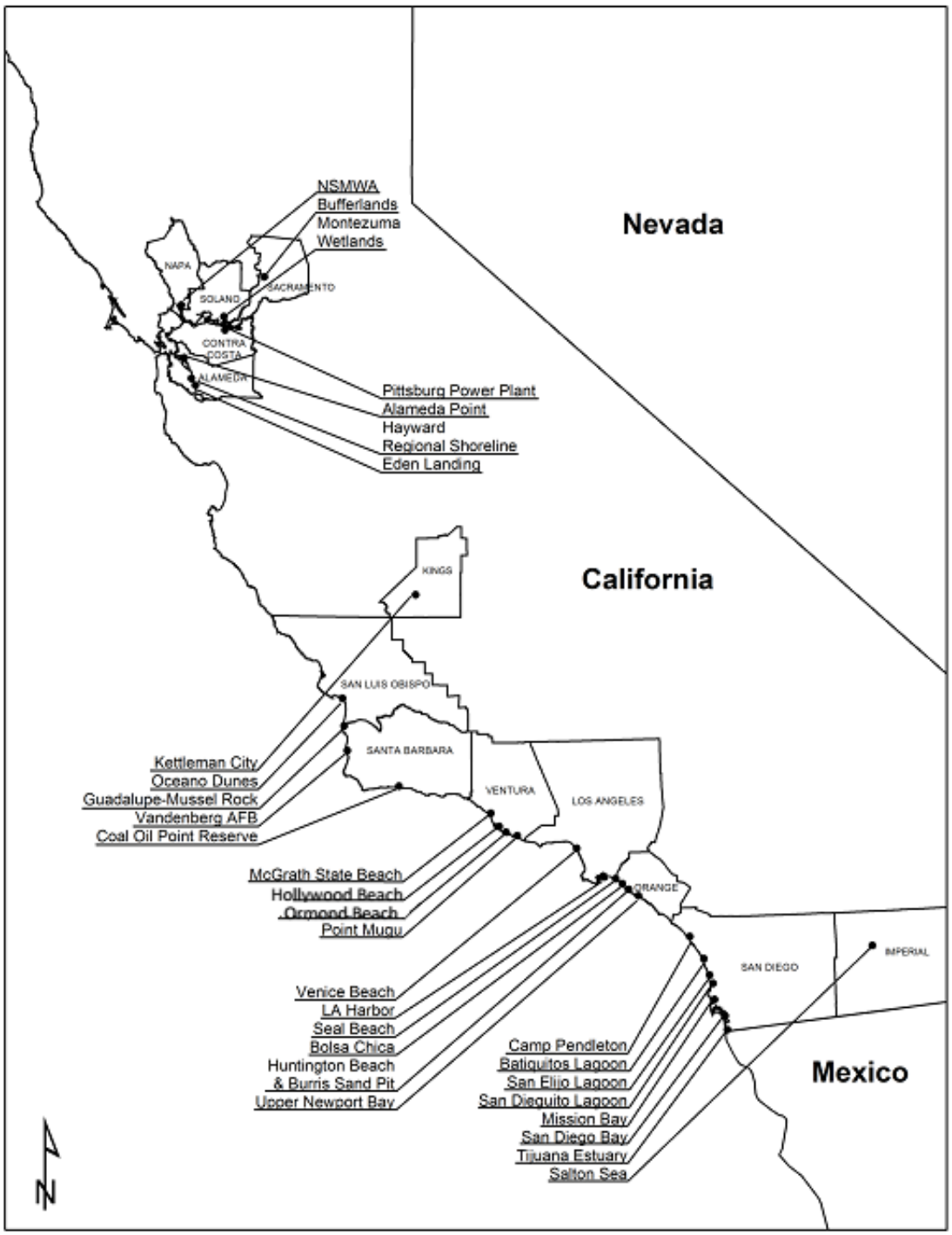

Figure 1. California sites monitored for California least tern nesting in 2014.

Monitoring

Twenty-seven of 41 sites monitored in 2014 were Type 1 sites, and the majority were monitored at least one or two times per week. A grid system to assist in locating nests was used at most sites and nest marking was used at nearly all of the sites. Site-specific and complete monitoring data are located in Appendix B-2.

Productivity

At least partial data were received and analyzed for all monitored least tern nesting areas in California for 2014. An estimated 4232-5786 California least tern breeding pairs established 6038 nests and produced 2136-2859 fledglings at 48 documented locations, including sub-sites (Table 1, Appendix B-3). The fledgling to breeding pair ratio was 0.37 to 0.68, greater than that in 2013 (0.25 to 0.38 fledglings per pair). Statewide, 10,827 eggs were reported, with a Site Mean clutch size of 1.7 eggs per nest (St Dev=0.29) and a Statewide clutch size of 1.8 eggs (St Dev = 0.45). No four-egg clutches were observed in 2014. Pair estimation and total nest calculations included eggs that were laid and likely abandoned shortly thereafter.

The 2014 California least tern nesting season lasted five months. The first recorded least terns at a nesting site were observed on 13 April at Alameda Point and the Salton Sea, and the last observed on 14 September at Hollywood Beach. The first nest was detected on 27 April (Salton Sea), the first chick on 20 May (Camp Pendleton), and first fledgling on 13 June (Batiquitos Lagoon).

There was one location used in 2013 (San Dieguito Lagoon: 3 nests) at which least terns did not nest in 2014. Conversely, they nested at two locations (North Fiesta Island: 13 nests; and NIMAT: 22 nests) not used in 2013. Site-specific and complete productivity data are located in Appendix B-3 (breeding pair estimation) and B-4 (productivity).

The 4232 minimum breeding pairs in 2014 was lower than the 4353 recorded in 2013 (Frost 2014) and 4293 recorded in 2012 (Frost 2013), which represented the lowest count recorded since 2002 (Figure 2) (Craig 1971; Bender 1974a, 1974b; Massey 1975, 1988, 1989b; Atwood et al. 1977; Jurek 1977; Atwood et al. 1979; Collins 1984, 1986, 1987; Gustafson 1986; Johnston and Obst 1992; Obst and Johnston 1992; Caffrey 1993, 1994, 1995b, 1997, 1998; Keane 1998, 2000, 2001; Patton 2002, 2004 unpubl. table; Marschalek 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012; Frost 2013, 2014). Conversely the minimum number of fledglings in 2014 (2136) was much higher than that in 2013 (1404) and nearly four times that in 2012 (557; the lowest count recorded since 2002) (Frost 2014, 2013). Higher fecundity in 2014 was most likely due to an overall decrease in chick mortality statewide, which can be caused by an increase in forage availability and quality, as well as a decrease in predator impact, among other factors.

The majority of breeding pairs nested in San Diego County (2349 pairs, 55.5%) and the fewest in the central coast area: San Luis Obispo, Santa Barbara, and Kings counties combined (62 pairs, 1.5%) (Table 2). The fledgling-to-pair ratio ranged from a low of 0.30 in Ventura County to a high of 1.39 in the San Francisco Bay area. The colony with the highest ratio was Hayward with 1.42 fledglings per pair.

Table 1. California least tern colony productivity in 2014 (pair estimates using Methods I, II, and III*).

2014-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	0	0	0	0	0	0.00	0.00
San Francisco Bay Area							
Napa Sonoma Marsh Wildlife Area - Totals	38	44	45	60	70	1.36	1.84
Montezuma Wetlands - Totals	15	16	16	1	1	0.06	0.07
Pittsburg Power Plant	0	0	0	0	0	0.00	0.00
Alameda Point	281	321	326	391	391	1.22	1.39
Hayward Regional Shoreline	77	83	85	118	128	1.42	1.66
Eden Landing	0	0	0	0	0	0.00	0.00
Kings County							
Kettleman City Evaporation Ponds	0	0	0	0	0	0.00	0.00
San Luis Obispo/Santa Barbara Counties							
Oceano Dunes SVRA	45	47	49	58	58	1.23	1.29
Rancho Guadalupe Dunes	0	0	0	0	0	0.00	0.00
Vandenberg AFB	17	20	21	20	20	1.00	1.18
Coal Oil Point Reserve	0	0	0	0	0	0.00	0.00
Ventura County							
Santa Clara River/McGrath State Beach	4	4	4	2	2	0.50	0.50
Hollywood Beach	77	87	120	23	29	0.26	0.38
Ormond Beach	18	21	22	0	0	0.00	0.00
Pt Mugu - Totals	407	440	465	127	127	0.29	0.31
Saticoy United Water Conservation District	0	0	0	0	0	0.00	0.00
Los Angeles/Orange Counties							
Venice Beach	47	66	81	75	100	1.14	2.13
LA Harbor	110	112	126	16	112	0.14	1.02
Seal Beach NWR - Anaheim Bay	115	130	154	4	4	0.03	0.03
Bolsa Chica Ecological Reserve - Totals	205	292	301	80	219	0.27	1.07
Huntington State Beach	407	499	516	168	348	0.34	0.86
Burris Sand Pit/Burris Basin	16	18	18	10	10	0.56	0.63
Upper Newport Bay Ecological Reserve	1	2	2	0	0	0.00	0.00
San Diego County							
MCB Camp Pendleton - Totals	858	1311	1337	420	532	0.32	0.62
Batiquitos Lagoon Ecological Reserve - Totals	311	476	478	232	269	0.49	0.86
San Elijo Lagoon Ecological Reserve	0	0	0	0	0	0.00	0.00
San Dieguito Lagoon Ecological Reserve	0	0	0	0	0	0.00	0.00
Fairbanks Ranch	0	0	0	0	0	0.00	0.00
Mission Bay							
FAA Island	4	8	8	2	2	0.25	0.50
North Fiesta Island	10	11	13	7	9	0.64	0.90
Mariner's Point	91	112	119	60	70	0.54	0.77
Stony Point	1	2	2	1	1	0.50	1.00
San Diego River Mouth	0	0	0	0	0	0.00	0.00
San Diego Bay							
Lindbergh Field/Former Naval Training Center	67	99	100	34	46	0.34	0.69
NIMAT	22	23	24	1	4	0.04	0.18
NI 18	20	29	33	4	6	0.14	0.30
Naval Base Coronado- Totals	556	1014	1039	125	187	0.12	0.34
D Street Fill/Sweetwater Marsh NWR	100	143	148	30	35	0.21	0.35
Chula Vista Wildlife Reserve	59	86	87	23	27	0.27	0.46
South San Diego Bay Unit, SDNWR-Saltworks	22	32	35	10	11	0.31	0.50
Tijuana Estuary NERR - Totals	229	235	261	34	40	0.14	0.17
Imperial County							
Salton Sea	2	3	3	0	1	0.00	0.50
Totals:	**4232**	**5786**	**6038**	**2136**	**2859**	**0.37**	**0.68**

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

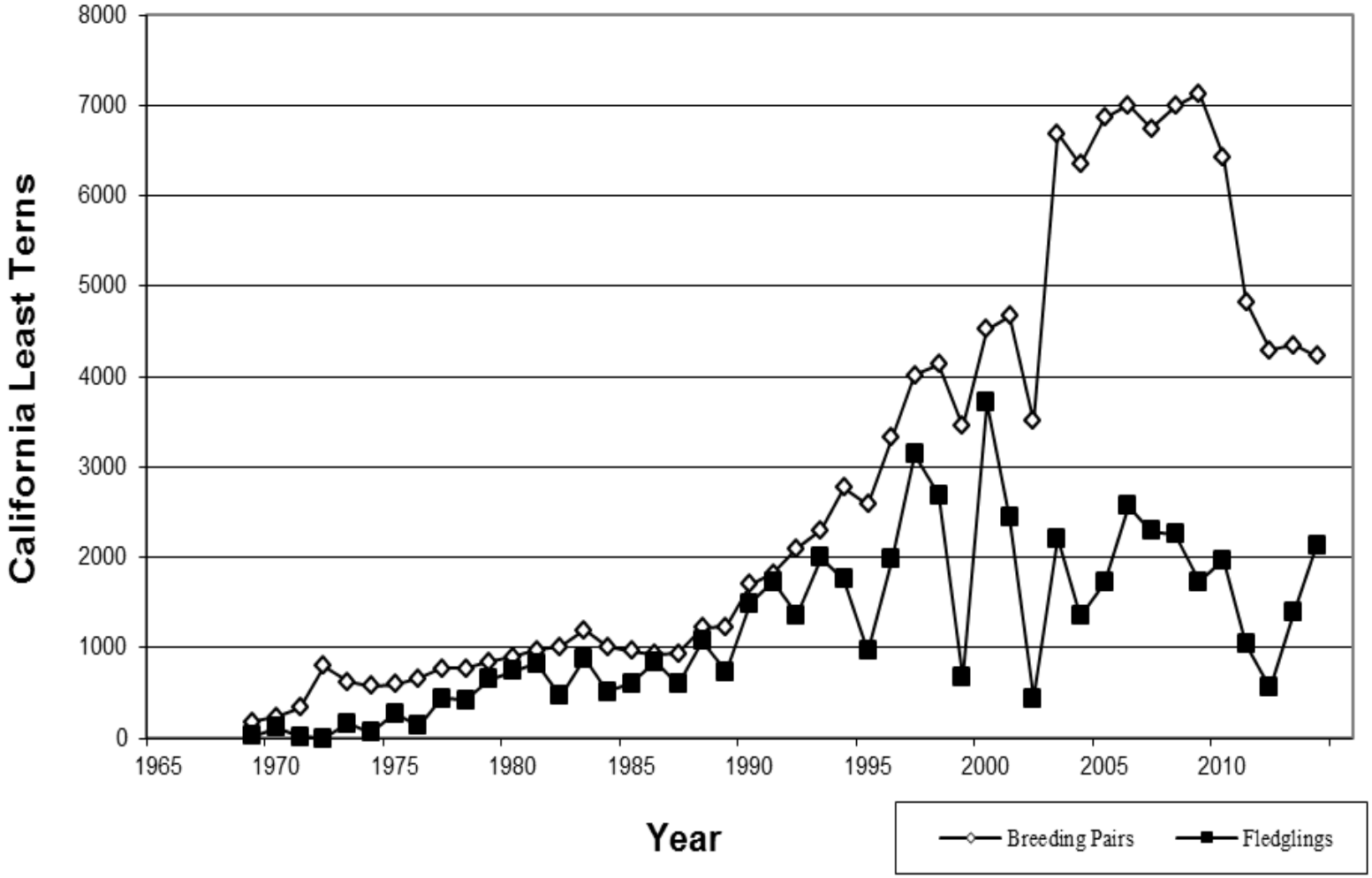

Figure 2. Minimum number of documented California least tern breeding pairs and fledglings in California during annual surveys, 1969-2014 (data from: Craig 1971; Bender 1974a, 1974b; Massey 1975, 1988, 1989b; Atwood *et al*. 1977; Jurek 1977; Atwood *et al*. 1979; Collins 1984, 1986, 1987; Gustafson 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).

Table 2. Regional productivity comparison, 2014.

Region	Breeding Pairs*	Proportion of Total	Fledglings*	Proportion of Total	Fledgling:Pair**
San Francisco Bay Area (with Bufferlands)	411	0.097	570	0.267	1.387
San Luis Obispo/Santa Barbara/Kings Counties	62	0.015	78	0.037	1.258
Ventura County	506	0.120	152	0.071	0.300
Los Angeles/Orange Counties	901	0.213	353	0.165	0.392
San Diego/Imperial Counties	2352	0.556	983	0.460	0.418
Total	4232	1.000	2136	1.000	0.505

*Breeding pairs and fledglings represent the minimum number recorded if a site reported a range of abundance.
**This is not the minimum fledgling-to-breeding pair ratio, which is calculated using the maximum number of pairs.

The number of breeding pairs generally corresponds more closely to the number of nests, eggs, and chicks than the number of fledglings (Table 3). As was the case in 2013, Camp Pendleton, Naval Base Coronado, Huntington, Point Mugu, and Batiquitos had the highest number of breeding pairs, nests, eggs, and chicks in the state in 2014. With the exception of Alameda Point and Hayward, the sites with the most fledglings produced were those with the highest number of breeding pairs. Napa Sonoma Marsh, Alameda Point, Hayward, Oceano Dunes, Vandenberg, and Venice Beach had a minimum fledgling-to-pair ratio $\geq$1.0 (Table 1). A few sites constituted the majority of breeding activity for the state in 2014, which is a trend consistently observed in the past (Frost 2014). Camp Pendleton, Naval Base Coronado, Batiquitos Lagoon, Point Mugu, and Huntington State Beach had over 300 minimum breeding pairs, which represented 60% of the state total. Eggs and nests tend to show a linear relationship with number of breeding pairs. Fledgling numbers were also unevenly distributed. The sites with at least 90 fledglings each (Camp Pendleton, Alameda, Batiquitos, Huntington Beach, Point Mugu, Naval Base Coronado (125), and Hayward [118]), contributed 74% of the state's production, and the sites with greater than 35 fledglings each (the seven aforementioned sites plus Bolsa Chica [80], Venice Beach [75], Mariner's Point [60], Napa Sonoma Marsh [60], and Oceano Dunes [58]), contributed 90% of the state's production.

Table 3. Top five nesting sites with highest observed number of minimum breeding pairs, nests, eggs, chicks and minimum fledglings (actual number observed in parentheses).

Breeding Pairs	Nests	Eggs	Chicks	Fledglings
Camp Pendleton (858)	Camp Pendleton (1337)	Camp Pendleton (2529)	Camp Pendleton (2084)	Camp Pendleton (420)
Naval Base Coronado (556)	Naval Base Coronado (1039)	Naval Base Coronado (1790)	Naval Base Coronado (1196)	Alameda Point (391)
Huntington Beach (407)	Huntington Beach (516)	Batiquitos Lagoon (906)	Batiquitos Lagoon (775)	Batiquitos Lagoon (232)
Point Mugu (407)	Batiquitos Lagoon (478)	Huntington Beach (849)	Huntington Beach (681)	Huntington Beach (168)
Batiquitos Lagoon (311)	Point Mugu (465)	Point Mugu (806)	Point Mugu (550)	Point Mugu (127)

Mortality and Predation

In 2014, the statewide non-predation chick mortality rate was 20%, similar to that in 2013 (22%; Frost 2014) (Table 4). As was the case in 2013, the majority of the larger nesting colonies experienced non-predation chick mortality rates less than the statewide average (Batiquitos Lagoon: 17.1%; Huntington Beach: 4.8%; and Point Mugu: 1.2%). However, total non-predation chick deaths at these sites represent 23.0% of the total statewide count, which is proportional to the number of chicks hatched at these sites compared to the statewide total (25.2%).

Conversely, two of the larger nesting colonies experienced non-predation chick mortality rates greater than the statewide average. Camp Pendleton had a 36.5% non-predation chick mortality rate and Naval Base Coronado had a 27% non-predation chick mortality rate. These two sites represented 63.5% of the total reported non-predation chick deaths and 41.1% of the total chicks hatched.

Least tern mortality due to non-predation factors was greater than mortality due to predation in 2014. Of non-predation egg mortality events, the highest cause of failure (49.2%) was attributed to abandonment post-term (non-viable, failed to hatch eggs) leading to the loss of 736 eggs. Abandonment prior to the expected hatching date was estimated to constitute 44.6% of non-predation mortality. Predation was reported as the cause of loss of 1072 eggs, 104 chicks, 87 fledglings, and 77 adults (Table 4). In 2013, nearly twice as many fledglings (143) and a similar number of eggs (915), chicks (95), and adults (106) were documented as depredated (Frost 2014).

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	1072**	104	87	77	1340
Non-predation	1497	1585	181	16	3279

*An additional 315 eggs were lost to unknown causes.
**Includes data from Chronology worksheet.

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

Twenty-five species as well as 7 other taxa (e.g., avian spp., ant spp.) were reported as possible, suspected, or documented predators of least terns (Table 5). Based on the number of sub-colonies reporting each predator species, the most commonly reported predator species were

unknown species, peregrine falcons (*Falco peregrinus*), unknown avian predators, coyotes (*Canis latrans*), raptor species, common ravens (*Corvus corax*), American crows (*Corvus brachyrhynchos*), and great horned owls (*Bubo virginianus*). As in past years, most known predators were avian species. Similarly, the species with the highest predator rating ($\geq$100) included common ravens, unknown species, American crows, coyotes, peregrine falcons, gull spp., western meadowlarks (*Sturnella neglecta*), and unknown avian species (Appendix B-6).

Table 5. Species documented, suspected, or possibly thought to have depredated least terns.

Number of Sub-Colonies Reporting Each Species	Predator Species
24	Unknown spp.
20	Peregrine falcon
9	Unknown avian spp.
8	Coyote, Unknown raptor spp.
7	Common raven
6	American crow, Great horned owl
5	Ant spp., Corvid spp.
4	American kestrel, Gull-billed tern, Northern harrier
3	Barn owl, Cooper's hawk, Opossum, Gull spp., Western gull, Unknown mammal spp.
2	Black-bellied plover, Black skimmer, Long-billed curlew, Raccoon, Red-tailed hawk
1	California gull, Domestic cat, Horned lark, Killdeer, Least tern, Trapdoor spider, Turkey vulture, Western meadowlark, Ring-billed gull

A total of 1027 least tern individuals (including eggs) were reported as taken by a documented or suspected predator species, 3.2% (33) of which were depredated by unknown species (Appendix B-6). Of those least terns lost to suspected or documented predator species, common ravens, American crows, peregrine falcons, coyotes, gull species, western meadowlarks, unknown species, corvid species, raptor species, great horned owls, northern harriers (*Circus cyaneus*), opossums, unknown avian species, and American kestrels (*Falco sparverius*) depredated the most least terns (Table 6). All other species not listed in Table 6 each represented less than 1% of the depredation. Nests were excluded from this analysis since the number of eggs better represents the loss of individuals. Abandonment was also excluded from depredation data but can be driven by a predator. Site-specific and complete mortality data are located in Appendix B-5 (non-predation) and B-6 (predation).

Historically, predation due to American crows, gull-billed terns, common ravens, and coyotes tended to be higher (Marschalek 2010). The foraging area of gull-billed terns 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, and 7 in 2014. The 2013 gull-billed tern die-off may have contributed to the reduction in least tern depredations.

Table 6. Species responsible for greatest proportion of known depredated least tern eggs, chicks, fledglings, or adults.

Species	Proportion of Least Tern Individuals Depredated by Documented and Suspected Predators	Number of Least Terns Depredated
Common raven	0.3155	324
American crow	0.1110	114
Peregrine falcon	0.1100	113
Coyote	0.1003	103
Gull spp.	0.0594	61
Western Meadowlark	0.0536	55
Unknown spp.	0.0341	35
Corvid spp.	0.0321	33
Raptor spp.	0.0312	32
Great horned owl	0.0243	25
Northern harrier	0.0224	23
Opossum	0.0185	19
Unknown avian spp.	0.0136	14
American kestrel	0.0117	12

Predator species varied in importance among each least tern age class. Common ravens, American crows, coyotes, gull species, and western meadowlarks had the largest depredation rate of eggs, while peregrine falcons, northern harriers, American kestrels, great horned owls, Cooper's hawks, and trapdoor spiders depredated the most chicks. Peregrine falcons, great horned owls, raptor species, domestic cats, and barn owls depredated the most fledglings, and peregrine falcons, raptor species, great horned owls, unknown avian species, northern harriers, and unknown species depredated the most adults (Table 7).

Table 7. The five species responsible for greatest proportion of depredated least terns for each age class.

Eggs	**# Depredated**	323	114	103	61	55
	Predator	Common raven	American crow	Coyote	Gull spp.	Western Meadowlark
	Proportion	0.4094	0.1445	0.1305	0.0773	0.0697
Chicks	**# Depredated**	23	16	12	7	6
	Predator	Peregrine falcon	Northern harrier	American kestrel	Great horned owl	Cooper's hawk, Trapdoor spider
	Proportion	0.2447	0.1702	0.1277	0.0745	0.0638
Fledges	**# Depredated**	54	10	7	4	2
	Predator	Peregrine falcon	Great horned owl	Raptor spp.	Domestic cat	Barn owl
	Proportion	0.6923	0.1282	0.0897	0.0513	0.0256
Adults	**# Depredated**	35	12	6	4	3
	Predator	Peregrine falcon	Raptor spp.	Great horned owl	Unknown avian spp.	Northern harrier, Unknown spp.
	Proportion	0.5224	0.1791	0.0896	0.0597	0.0448

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 2014 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 in southern California at Camp Pendleton, Naval Base Coronado, Huntington Beach, Point Mugu, and Batiquitos Lagoon, and the majority of fledglings produced were from these colonies as well as two northern California colonies, Alameda and Hayward. Although biologists only recorded a minimum of 4232 breeding pairs, the lowest count since 2002, the minimum fledgling to maximum breeding pair ratio (0.37) was greater than during the previous two years. Nonetheless, since 1977, this ratio has been less than 0.50 for only 15 years (including the last 13 years) and is still considered low.

As was the case in 2013, California least tern population growth in 2014 was hindered by relatively low productivity as well as direct limiting factors (1340 individuals lost to predation) and indirect limiting factors (3279 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 2014 was similar to that documented in 2013, with most of the larger nesting colonies (Batiquitos Lagoon, Huntington Beach, Point Mugu) 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 and opossums also contributed to the highest predation rates documented in 2014.

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 20-40% 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

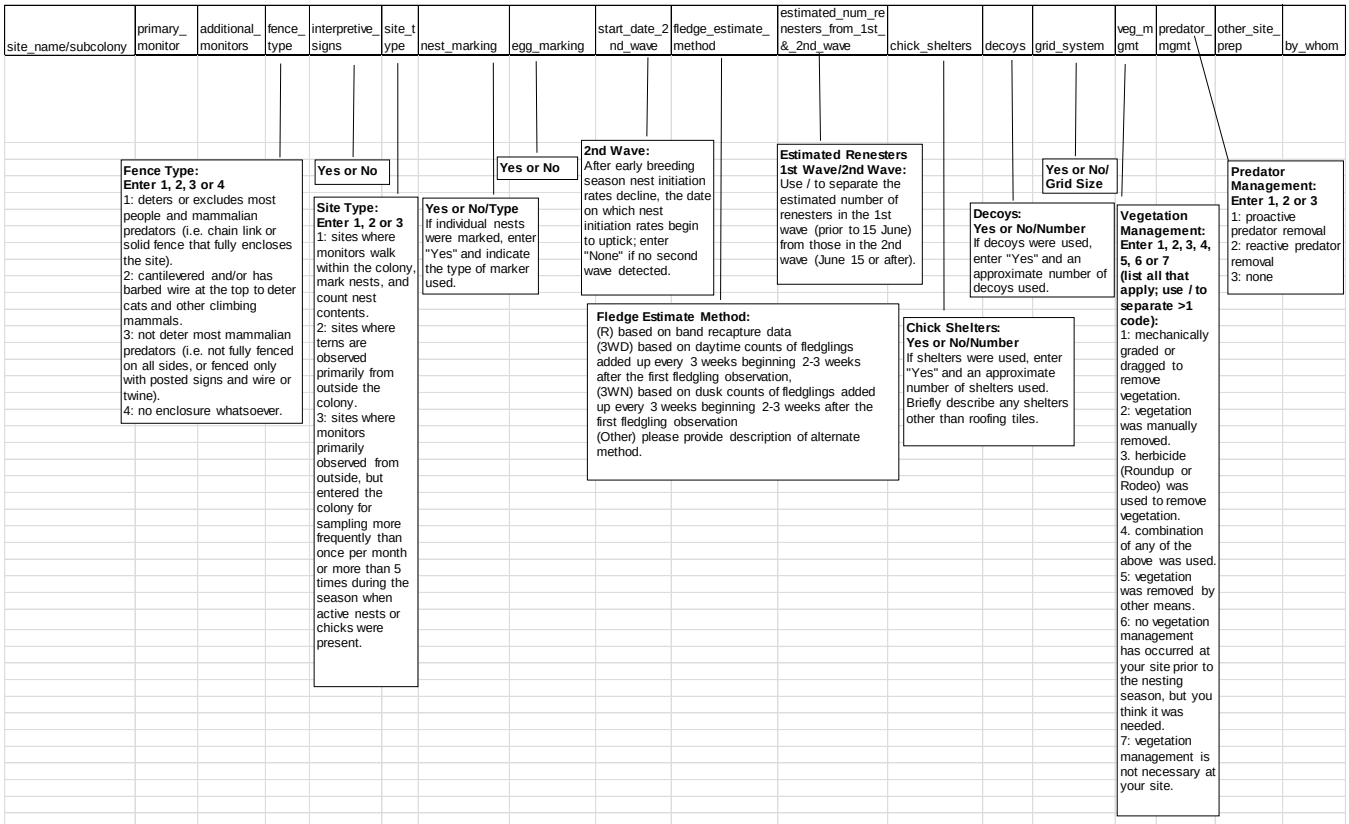
Data Sheets

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-14
•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

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

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

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

Predators Observed (Time, Species, Location, Activity):

Ants Y / N   Grid Location(s):

Documented Predation/Mortality:

Human Disturbance/Take:

Comment:

Band Prefix	Band Number	Comb. L - R	Age	Wing	Weight	Cond.	Nest No.	Egg #	Grid	Comment	Recap. (Y/N)
		-									
		-									
		-									
		-									
		-									
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		-									
		-									
		-									
Band Prefix	Band Number	Comb. L - R	Age	Wing	Weight	Cond.	Nest No.	Egg #	Grid	Comment	Recap. (Y/N)

Predators Observed (Time, Species, Location, Activity):

Ants Y / N **Grid Location(s):**

Documented Predation/Mortality:

Human Disturbance/Take:

Comment:

Band Prefix	Band Number	Comb. L - R	Age	Wing	Weight	Cond.	Nest No.	Egg #	Grid	Comment	Recap. (Y/N)
		-									
		-									
		-									
		-									
		-									
		-									

Master Nest List Form

Least Tern Master Nest List				Location:					
Date of 1st Nest:				1st Chick:			1st Fledge:		
Nest No.	Grid No.	Egg No.	Date Found	Hatch Date	Other Outcome	Date	Band Number	Move Y/N	Comments
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
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40									
41									

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

Multi-visit Form

Species:								LOCATION			
Date 1				Date 2				Date 3			Date 4
Observers:				Observers:				Observers:			Observers:
Date 5				Date 6				Date 7			Date 8
Observers:				Observers:				Observers:			Observers:
Date 9				Date 10				Date 11			
Observers:				Observers:				Observers:			

Nest	Found	Grid	Prior	Date 1	Date 2	Date 3	Date 4	Date 5	Date 6	Date 7	Band Number
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
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32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
Nest	Found	Grid	Prior	Date 1	Date 2	Date 3	Date 4	Date 5	Date 6	Date 7	Band Number

Appendix B

Site Specific Data

Appendix B-1: Site Preparation in 2014.

Legend

Fence Type: 1-Fully enclosed site deterring most predators; 2-Fully enclosed site, cantilevered to deter climbing predators; 3-Incomplete, deterring few predators; 4-No fence/exclosure.
Vegetation Management: 1-Mechanical removal; 2-Manual removal; 3-Herbicide; 4-Combination of 1, 2, or 3; 5-Other means; 6-Needed, but not conducted in 2013; 7-None needed.
Predator management: 1-Proactive predator removal; 2-Reactive predator removal; or 3-None.

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Sacramento Area											
Bufferlands	Chris Conard										
San Francisco Bay Area											
Napa Sonoma Marsh Wildlife Area/Green Island Unit	Karen Taylor		4	No	Yes, 29 ceramic roof tiles, 30 wooden structures secured with re-bar	No	No	2 (South Island), 6 (Main Island, East Island)	3		CDFW
Napa Sonoma Marsh Wildlife Area/Pond 7/7A	Karen Taylor	Pruitt, Hlusak, Cabrall, Curry, Barry, Hollander	4	No	No	No	No	6	3		CDFW
Montezuma/Site 3/4	Anne Wallace		4	No	No	No	No		3		
Montezuma/Site 6/7	Anne Wallace		4	No	No	No	No		3		
Pittsburg Power Plant	Dana Riggs	Jason Yakich	1	Yes	Yes, 50	No	Yes	4	Yes	Clear out spider webs from shelters	WRA
Alameda Point	Susan Euing	Meredith Elliott, Emily Mathews	1	No	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 Volunteers

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Hayward Regional Shoreline	David Riensche, Mary Riensche, Sarah Riensche, Daniel Riensche, Nathan Riensche, Rebekah Riensche, Nicole A. Beadle and Sarah C. Gidre	Patrick Alvarez, Maggie Clark, Norman Chu, Rachel Crosby, Hannah Crosby, Kala Crosby, Arthur Garibaldi, Carin High, Howard High, Sam High, Richard Kaufmann, Anne Krysiak, Marty Marrow, John Mena, Brian Pinomaki, Steve Wiley, and David Wiley	4	Yes	Yes, 26	Yes, 24	Yes, 10m 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										
Oceano Dunes State Vehicular Recreation Area	Doug George, Joanna Iwanicha, Amber Clark, Cheryl Lish, Ryan Slack, Amber Branske	Natalie Rathjen-Gonzales, Michael Maples, Alison Fox, Jessica Spickler, Sarah Stratton, Liz Maxwell, Brittany Miller, Anna Butler, Laura Chain	1 (31 nests), 3 (14 nests)	Yes	Yes, 26 plywood, A-shape shelters (6 in high by 12 in long by 11 in wide)	No	No	5, least tern breeding site open to off-road vehicle use October to February and this prevents or removes vegetation. Efforts are made to encourage some vegetation for chick cover.	1, 2	Limited amounts of driftwood and woodchips were put out for nest and chick cover.	California Department of Parks and Recreation (Oceano Dunes State Vehicular Recreation Area)

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Rancho Guadalupe Dunes Preserve	Tom Applegate	Melissa Kelly	3	Yes							
Vandenberg AFB/Purisima Point	Robinette	Barcinas, Hargett, Howar, Miller	1	Yes	Yes, 46 V-shaped wooden plus 24 teepee style	No	No	6	2	Electric Fence Maintenance	ManTech
Coal Oil Point Reserve	April Price	Cristina Sandoval									
Ventura County											
Santa Clara River/McGrath State Beach	Alexis Frangis	Jennifer Gold, Anjanette Butler, Karl Krause	3	Yes	No	No	No	7	3		
Hollywood Beach	Debra Barringer	Danielle Glenn	3	Yes	No	No	No	7	3		
Ormond Beach	Debra Barringer	Chris Kahler	1	Yes	No	No	No	7	3		
NBVC Point Mugu/Holiday Beach	Francesca Ferrara	Martin Ruane, Shannon Murphy, Josh More, Colton Wise, Jack Velasquez	4	Yes	Yes, 25 shelters	No	No	7	1		
NBVC Point Mugu/Holiday Salt Panne	Francesca Ferrara	Martin Ruane, Shannon Murphy, Josh More, Colton Wise, Jack Velasquez	4	Yes	No	No	No	7	1		
NBVC Point Mugu/Eastern Arm	Francesca Ferrara	Martin Ruane, Shannon Murphy, Josh More, Colton Wise, Jack Velasquez	4	Yes	No	No	No	7	1		
NBVC Point Mugu/Ormond Beach East	Francesca Ferrara	Martin Ruane, Shannon Murphy, Josh More, Colton Wise, Jack Velasquez, Valerie Vartanian	4	Yes	Yes, 50 shelters	No	No	7	1		

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
United Water Conservation District facilities in Saticoy, Ventura County, California	Nancy Fox-Fernandez, Jennifer Turner	Jennifer Alvarado, Travis Marella	3, 4	No	No	No	No	4, 5, 6, 7	3		
Los Angeles/Orange Counties											
Venice Beach	Thomas Ryan	Stacey Vigallon, Joyce Regalano, Vanessa Velasco, Peter Auger, Laurel Jones, Charles Collins	1	Yes	Yes	Yes	Yes, 20x20m	2	1		
Port of Los Angeles Pier 400	Nathan Mudry	Santiago Lopez, Isaac DeRobles, Spencer Langdon, Wally Ross, Nick Liberato	2, 3		Yes, 52	No	Yes, 100ft	1, 2, 3, 4	1 ,2		Site prep done by POLA environmental division
Seal Beach National Wildlife Refuge	Matthew Teutimez, Santiago Lopez	Kirk Gilligan, Bob Schallmann, John Fitch, Charles Collins	1	Yes	Yes, roofing tiles	Yes	Yes, 11 columns (A to K) and 11 rows (1 to 11)	4	2	Sand relocation at site, electric fence maintenance, removal of visquene plastic underneath sand and salt	USFWS
Bolsa Chica/Nest Site 1	Peter Knapp	Kelly O'Reilly, Gary Keller, Charlie Collins, Ross Griswold	3	Yes	Yes, 48 roof tiles	No	Yes, 20m X 20m	4	3		
Bolsa Chica/Nest Site 2	Peter Knapp	Kelly O'Reilly, Ross Griswold	4	No	Yes, 12 roof tiles	No	Yes, 20x20m	4	1		
Bolsa Chica/Nest Site 3	Peter Knapp	Kelly O'Reilly, Gary Keller, Ross Griswold	2	No	Yes, 20 roof tiles	No	Yes, 20m X 20m	4	1	Beach sand added prior to season	Contractor

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Bolsa Chica/South Tern Island	Peter Knapp	Kelly O'Reilly, Ross Griswold, Charlie Collins	4	No	Yes, 20 roof tiles	No	Yes, 20x20m	4	1		
Bolsa Chica/Seasonal Ponds	Peter Knapp	Ross Griswold	4	No	No	No	No	7	1		
Huntington Beach	Nicole Housel	Cyndie Kam, Talula Barbee, Bonnie Johnson, Cameron Macbeth, Melody Aimar, Maricela Paramo	1	Yes	Yes, 12	No	Yes, 25x25m	1	1		CA State Parks
Burris Basin	David McMichael	Dick Zembal, Bonnie Johnson	3	Yes	Yes, cut plastic pipe sections	Yes, 12	Yes	4	3	Sand bag erosion control	All
UNBER Tern Island	Carla Navarro	Taylor Van Berkum, Kathy Sheridan	4	Yes	Yes, 65 shelters	None	Yes, 20x20m	2, 3	3		
San Diego County											
Marine Corps Base Camp Pendleton/Red Beach	Rachael Herman, Katrina Murbock	MC, CM, JEB	4	No	No	No	No	6	3		
Marine Corps Base Camp Pendleton/WBC	Rachael Herman, Katrina Murbock	MC, CM, JEB	3	Yes	No	No	Yes, 30x30m	4	1		
Marine Corps Base Camp Pendleton/BBN	Rachael Herman, Katrina Murbock	MC, CM, JEB	2	Yes	No	No	Yes, 30x30m	4	1		
Marine Corps Base Camp Pendleton/BBS	Rachael Herman, Katrina Murbock	MC, CM, JEB	2	Yes	No	No	Yes, 30x30m	4	1		
Marine Corps Base Camp Pendleton/SF	Rachael Herman, Katrina Murbock	MC, CM, JEB	2	Yes	No	No	No	7	1		

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Batiquitos Lagoon/W1	Warren Wong		1	No							
Batiquitos Lagoon/W2	Warren Wong		1	No							
Batiquitos Lagoon/E1	Warren Wong		1	No							
Batiquitos Lagoon/E1	Warren Wong		1	No							
Batiquitos Lagoon/E3	Warren Wong		4	No							
San Elijo Lagoon	Robert Patton		3	Yes	No	No	No	7	No		
San Dieguito Lagoon	Brian Foster		3	No	Yes, several	Yes, 40	Yes, 30m	1, 3	1		
Fairbanks Ranch	Brian Foster										
Mission Bay											
FAA Island	Jennifer Jackson		4	Yes	Yes, 20-25	Yes, 50	Yes, 10m	2, 3, 4	1		
North Fiesta Island	Ginger Johnson		1	Yes	Yes, 80	Yes, 80	Yes, approx. 36400 square meters, 400 square meters	4	1	Prepare grid/ install chick fence	San Diego City Parks Dept, San Diego Audubon Society volunteers
Mariners Point	Ginger Johnson		1	Yes	Yes, 50	Yes, 18	Yes, approx. 36400 square meters, 400 square meters	4	1	Grid and chick fence work	San Diego City Parks Dept, San Diego Audubon Society volunteers
Stony Point	Ginger Johnson		1	Yes	Yes, 50	Yes, 60	Yes, approx. 36400 square meters, 400 square meters	4	1	Prepare grid/install chick fence	San Diego City Parks Dept, San Diego Audubon Society volunteers
San Diego River Mouth	Ginger Johnson		1	Yes	No	No	No	7	3	Temporary fence and berm to control flooding under fence	City of San Diego Parks Dept
San Diego Bay											
Lindbergh Field	Robert Patton	Elizabeth Copper, Brian Foster, Lea Squires, Matt Sadowski	2	Yes	No	No	Yes, 30 m	4	1		Site prep by SDCRAA staff & ZSSD contractors; monitoring by ZSSD contractors; pred control by USDA WS

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Naval Base Coronado/NIMAT	Emily Rice	SC, RS, MP, KR, CS, JTB	1	Yes	Yes, ~100-200	Yes, 50	Yes, 30x30m	1	1/2		
Naval Base Coronado/NIA18	Emily Rice	SC, RS, MP, KR, CS, JTB	4	No	No	No	Yes, 30x30m	6	3		
Naval Base Coronado/DBN	Emily Rice	SC, RS, MP, KR, CS, JTB	1	Yes	Yes, ~100-200	Yes, 200	Yes, 30x30m	1	1, 2		
Naval Base Coronado/DBS	Emily Rice	SC, RS, MP, KR, CS, JTB	1	Yes	Yes, ~100-200	Yes, 200	Yes, 30x30m	1	1, 2		
Naval Base Coronado/NABON-G1	Emily Rice	SC, RS, MP, KR, CS, JTB	4	No	No	No	Yes, 30x30m	7	1, 2		
Naval Base Coronado/NABON-G2	Emily Rice	SC, RS, MP, KR, CS, JTB	4	No	No	No	Yes, 30x30m	7	1, 2		
Naval Base Coronado/NABON-R1	Emily Rice	SC, RS, MP, KR, CS, JTB	4	No	No	No	Yes, 30x30m	7	1, 2		
Naval Base Coronado/NABON-R2	Emily Rice	SC, RS, MP, KR, CS, JTB	4	No	No	No	Yes, 30x30m	7	1, 2		
Naval Base Coronado/NABON-Y2	Emily Rice	SC, RS, MP, KR, CS, JTB	4	No	No	No	Yes, 30x30m	7	1, 2		
Naval Base Coronado/NABOS-B1	Emily Rice	SC, RS, MP, KR, CS, JTB	3	Yes	No	No	Yes, 30x30m	2	1, 2		
Naval Base Coronado/NABOS-B2	Emily Rice	SC, RS, MP, KR, CS, JTB	3	Yes	No	No	Yes, 30x30m	2	1, 2		
Naval Base Coronado/NABOS-O1	Emily Rice	SC, RS, MP, KR, CS, JTB	3	Yes	No	No	Yes, 30x30m	2	1, 2		
Naval Base Coronado/NABOS-O2	Emily Rice	SC, RS, MP, KR, CS, JTB	3	Yes	No	No	Yes, 30x30m	2	1, 2		
Naval Base Coronado/ALT SITE	Emily Rice	SC, RS, MP, KR, CS, JTB	1	No	No	Yes, 50	Yes, 30x30m	1	1, 2		
D Street Fill	Robert Patton	Jennifer Price-Jackson, Brian Foster, Lea Squires, Matt Sadowski	3	Yes	Yes, 174	Yes, 55	Yes, 30m	4	1		Site prep by USFWS NWR & SD Port staff & contractors; monitoring by Port contractors; pred control by USDA WS
Chula Vista Wildlife Refuge	Robert Patton	Matt Sadowski, Jennifer Jackson, Lea Squires, Brian Foster, Kate Goodenough	3	Yes	Yes, 44	Yes, 80	Yes, 30m	4	1		Site prep by ZSSD contractors; pred control by USDA WS

Site name	Name of primary monitor	Names of other monitors	Fence type	Interpretive signs at site	Chick shelters	Decoys	Grid system	Vegetation management	Predator management	Other site preparation	By whom
Saltworks	Robert Patton	Matt Sadowski, Kate Goodenough, Lea Squires, Brian Collins, Elizabeth Copper	3	No	Yes, 10	No	No	3	1		Site prep by USFWS NWR staff, monitoring by NWR contractors, pred control by USDA WS
Tijuana Estuary/North	Robert Patton	Matt Sadowski, Lea Squires, Brian Collins	3	Yes	Yes, 42	No	Yes, 30m	6	1		Site prep by USFWS NWR staff & contractors & USDA WS, monitoring by NWR contractors, pred control by USDA WS
Tijuana Estuary/South	Robert Patton	Matt Sadowski, Lea Squires, Brian Collins	3	Yes	Y, 150	No	Yes, 30m	6	1		Site prep by USFWS NWR staff & contractors & USDA WS, monitoring by NWR/CDPR contractors, pred control by USDA WS
Imperial County											
Salton Sea	Guy McCaskie	Kathy Molina									

Appendix B-2: Monitoring in 2014.

Site name	Site type	Date of first monitoring visit	Date of last monitoring visit	Total number of monitoring visits	Nest marking	Egg marking	Banding	If color-banding, what color(s) were used
Sacramento Area								
Bufferlands		n/a	n/a		n/a			
San Francisco Bay Area								
Napa Sonoma Marsh Wildlife Area -								
Green Island Unit	1	10-Apr-14	24-Jun-14	7	n/a			
Pond 7/7A	1	23-Apr-14	14-Aug-14	28	Yes, paint pen on saltpan.	No	No	
Montezuma -								
Site 3/4	2	22-Apr-14	28-Aug-14	24	No	No	No	
Site 1	2	27-Apr-14	1-Aug-14	17	No	No	No	
Pittsburg Power Plant	2	22-Apr-14	23-Jul-14	8	No	No	No	
Alameda Point	1	13-Apr-14	12-Aug-14	79	Yes, 3 inch white washers with black paint.	No	No	
Hayward Regional Shoreline	1	6-May-14	31-Jul-14	87	Yes, 5cm washers.	No	No	
San Luis Obispo/Santa Barbara Counties								
Oceano Dunes SVRA	3	16-May-14	20-Aug-14	97	Yes, usually naturally occurring materials present on the site.	No	Yes, chick	Size 1A blank aluminum band is covered with white over blue vinyl tape (to make a bicolored band) on right leg for all chicks. FWS band placed on left leg and tape in 1 to 2 colors placed on this band to create combos unique to each bird.
Rancho Guadalupe Dunes Preserve	2	29-Mar-14	7-Aug-14	60	n/a			
Vandenberg AFB-Purisima Pt.	3	15-Apr-14	29-Jul-14	73	Yes, numbered tongue depressors placed 1m from nest.	No	No	
Coal Oil Point Reserve		n/a	n/a		n/a			
Ventura County								
Santa Clara River/McGrath State Beach	1	1-May-14	17-Sep-14	21	Yes, natural driftwood.	No	No	
Hollywood Beach	1	16-Mar-14	14-Sep-14	28	Yes, tongue depressors.	No	No	
Ormond Beach	1	14-Mar-14	20-Aug-14	23	Yes, tongue depressors.	No	No	

Site name	Site type	Date of first monitoring visit	Date of last monitoring visit	Total number of monitoring visits	Nest marking	Egg marking	Banding	If color-banding, what color(s) were used
Pt Mugu -								
Holiday Beach	1	22-May-14	28-Jul-14	22	Yes, tongue depressors.	No	No	
Holiday Salt Panne	1	22-May-14	10-Jul-14	13	Yes, tongue depressors.	No	No	
Eastern Arm	1	27-May-14	17-Jun-14	6	Yes, tongue depressors.	No	No	
Ormond Beach East	1	19-May-14	29-Jul-14	44	Yes, tongue depressors.	No	No	
Saticoy United Water Conservation District	3	21-Apr-14	2-Sep-14	20	n/a	No	No	
Los Angeles/Orange Counties								
Venice Beach/Marina del Rey	1	15-Apr-14	1-Sep-14	18	No	No	No	
Port of Los Angeles - Pier 400	1	20-May-14	25-Jul-14	16	Yes, tongue depressors.	No	No	
Seal Beach NWR - Anaheim Bay	1	7-May-14	13-Aug-14	15	Yes, tongue depressors.	No	Yes, chick	
Bolsa Chica Ecological Reserve -								
Nest Site 1 (NS1)	1	6-May-14	17-Jun-14	9	Yes, tongue depressors.	No	No	
Nest Site 2 (NS2)	1	8-May-14	8-Jul-14	11	Yes, tongue depressors.	No	No	
Nest Site 3 (NS3)	1	8-May-14	3-Jul-14	10	Yes, tongue depressors.	No	No	
Seasonal Ponds	2	7-May-14	17-Jun-14	4	No	No	No	
South Tern Island (STI)	1	13-May-14	20-Jul-14	15	Yes, tongue depressors.	No	No	
Huntington State Beach	1	9-May-14	1-Aug-14	21	Yes, tongue depressors.	No	No	
Burris Sand Pit/Burris Basin	1	29-May-14	7-Aug-14	12	Yes, numbered rocks.	No	No	
Upper Newport Bay Ecological Reserve	3	8-May-14	9-Jul-14	16	No	No	No	
San Diego County								
MCB Camp Pendleton -								
Red Beach	1	5-May-14	11-Sep-14	18	Yes	No	No	
White Beach	1	2-May-14	11-Sep-14	49	Yes	No	No	
Santa Margarita River - North Beach North	1	2-May-14	11-Sep-14	51	Yes	No	Yes, chick	
Santa Margarita River - North Beach South	1	29-Apr-14	11-Sep-14	54	Yes	No	Yes, chick	
Santa Margarita River - Saltflats and Island	1	3-May-14	11-Sep-14	52	Yes	No	No	
Batiquitos Lagoon Ecological Reserve								
E1	1	28-Mar-14	22-Jul-14	30	Yes, tongue depressors.	No	Yes, chick	USGS band only
E3	2	n/a	n/a		n/a	No	No	
W1	1	28-Mar-14	8-Jul-14	26	Yes, tongue depressors.	No	Yes, chick	USGS band only
W2	1	28-Mar-14	1-Aug-14	40	Yes, tongue depressors.	No	Yes, chick	USGS band only
San Elijo Lagoon Ecological Reserve	1	n/a	n/a		n/a	No	No	
San Dieguito Lagoon	1	15-Mar-14	1-Aug-14		n/a	No	No	
Fairbanks Ranch		n/a	n/a		n/a			

Site name	Site type	Date of first monitoring visit	Date of last monitoring visit	Total number of monitoring visits	Nest marking	Egg marking	Banding	If color-banding, what color(s) were used
Mission Bay								
FAA Island	1	23-Apr-04	14-Jul-14	31	Yes	No	Yes, chick	
North Fiesta Island	1	25-Apr-14	11-Aug-14	21	Yes, tongue depressors.	Yes	Yes, chick	B/L either under FWS band on left leg, or on right leg.
Mariner's Point	1	24-Apr-14	24-Aug-14	28	Yes, tongue depressors.	Yes	Yes, chick	FWS band on left leg, G/B on right
Stony Point	1	3-May-14	22-Jul-14	10	Yes, tongue depressors.	Yes	Yes, chick	
San Diego River Mouth	1	28-Apr-14	19-Apr-14	4	n/a			
San Diego Bay								
Lindbergh Field & Former Naval Training Center	1	13-Apr-14	29-Jul-14	68	Yes, spray paint on substrate and sharpie on small rock.	No	Yes, chick and adult	Adult with K/F over FWS band on right and B on left leg; and another with FWS band on right leg and K/F on left.
US Navy - NI MAT	1				Yes, green popsicle stick	No	No	
US Navy - NI18	1				Yes, blue cone with sandbag	No	Yes, chick	
Naval Base Coronado -								
Delta Beach North	1	29-Apr-14	4-Sep-14	52	Yes, 3 in. PVC rounds painted to match substrate.	No	Yes, chick	
Delta Beach South	1	29-Apr-14	4-Sep-14	52	Yes, 3 in. PVC rounds painted to match substrate.	No	Yes, chick	
NAB Ocean	1	28-Apr-14	12-Sep-14	61	Yes, green popsicle stick	No	Yes, chick	
Alternate Site	1	28-Apr-14	26-Aug-14	38	Yes, green popsicle stick	No	Yes, chick	
D Street Fill/Sweetwater Marsh NWR	1	6-Apr-14	28-Aug-14	60	Yes, tongue depressors.	No	Yes, chick and adult	Adults with M/W on left, B over FWS band on right.
Chula Vista Wildlife Reserve	1	5-Apr-15	19-Aug-14	61	Yes, tongue depressors.	No	Yes, chick and adult	Adult with B on left and A/K over FWS band on right.
South San Diego Bay Unit, SDNWR-Saltworks	1	5-Apr-14	19-Aug-14	39	Yes, tongue depressors.	No	Yes, chick	
Tijuana Estuary NERR -								
Tijuana North	1	3-Apr-14	18-Sep-14	28	Yes, tongue depressors.	No	Yes, chick	
Tijuana South	1	3-Apr-14	25-Sep-14	27	Yes, tongue depressors.	No	Yes, chick	
Imperial County								
Salton Sea		13-Apr-14	13-Aug-14	12				

Appendix B-2: Monitoring in 2014 (continued). Color combinations of current and past California least tern banding studies conducted at breeding areas in California.

Site	Year	Age	Abbreviation	Color*
Oceano Dunes SVRA		Chicks	G/Y, Y/G, W/B	Green/Yellow, Yellow/Green, Various (Left): White/Blue (Right)
Seal Beach			Y/K	Yellow/Black
Camp Pendleton	?-2009	Chicks	K/M	Black/Mauve
Batiquitos	198?-2011	Chicks, Adults	R/W	Red/White
San Dieguito	2013	1 Adult	K/F	Black/Fuchsia
North Fiesta Island	2014	Chicks	B/L	Blue/Lime
Mariner's Point	198?-2013	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).

Appendix B-3: Pair Estimation in 2014 (Method I).

Site name	Date terns first observed*	Date terns last observed	Date of first nest	Date of last nest initiation	Total nests in first wave	Total nests in second wave	Total pairs	Total nests
Sacramento Area								
Bufferlands	n/a		n/a					0
San Francisco Bay Area								
Napa Sonoma Marsh Wildlife Area – Totals	23-Apr-14	14-Aug-14	22-May-14	07-Aug-14	31	14	38	45
Green Island Unit	24-May-14	n/a	n/a					0
Pond 7/7A	23-Apr-14	14-Aug-14	22-May-14	07-Aug-14	31	14	38	45
Montezuma – Totals	22-May-14	28-Aug-14	22-May-14	07-Jul-14	14	2	15	16
Site 1	27-May-14	19-Jun-14	27-May-14	12-Jun-14	4	0	4	4
Site 3/4	22-May-14	28-Aug-14	22-May-14	07-Jul-14	10	2	11	12
Pittsburg Power Plant	22-Apr-14	01-May-14	n/a					0
Alameda Point	13-Apr-14	04-Aug-14	07-May-14	15-Jul-14	317	9	321	326
Hayward Regional Shoreline	nr	31-Jul-14	06-May-14	14-Jul-14	70	15	77	85**
San Luis Obispo/Santa Barbara Counties								
Oceano Dunes SVRA	nr	nr	20-May-14	06-Jul-14	46	3	47	49
Rancho Guadalupe Dunes Preserve	n/a		n/a					0
Vandenberg AFB-Purisima Pt.	06-May-14	24-Jul-14	27-May-14	17-Jun-14	20	1	20	21
Coal Oil Point Reserve	n/a		n/a					0
Ventura County								
Ormond Beach	23-May-14	27-Jun-14	30-May-14	27-Jun-14	15	7	18	22
Hollywood Beach	02-May-14	14-Sep-14	26-May-14	01-Aug-14	53	67	86	120
Santa Clara River/McGrath State Beach	08-May-14	04-Sep-14	03-Jul-14	10-Jul-14	4	0	4	4
Pt Mugu - Totals	nr	nr	19-May-14	17-Jul-14	415	50	440	465
Holiday Beach	nr	nr	22-May-14	17-Jul-14	35	30	50	65
Holiday Salt Panne	nr	nr	22-May-14	16-Jun-14	9	1	9	10
Eastern Arm	nr	nr	24-May-14	09-Jun-14	25	0	25	25
Ormond Beach East	nr	nr	19-May-14	04-Jul-14	346	19	355	365
Saticoy united Water Conservation District	n/a		n/a					0
Los Angeles/Orange Counties								
Venice Beach/Marina del Rey	30-Apr-14	14-Jul-14	15-May-14	30-Jul-14	14	67	47	81
LA Harbor	20-May-14	25-Jul-14	20-May-14	12-Jul-14	98	28	112	126
Seal Beach NWR - Anaheim Bay	07-May-14	13-Jul-14	07-May-14	23-Jul-14	107	47	130	154
Bolsa Chica Ecological Reserve -Totals	07-May-14	nr	07-May-14	24-Jun-14	284	17	292	301
Nest Site 1 (NS1)	13-May-14	nr	13-May-14	03-Jun-14	120	0	120	120
Nest Site 2 (NS2)	08-May-14	nr	08-May-14	26-Jun-14	97	7	100	104
Nest Site 3 (NS3)	15-May-14	nr	15-May-14	26-Jun-14	31	4	33	35
South Tern Island (STI)	13-May-14	nr	13-May-14	24-Jun-14	35	5	37	40
Seasonal Ponds	07-May-14	nr	07-May-14	17-Jun-14	1	1	1	2
Huntington State Beach	09-May-14	01-Aug-14	09-May-14	08-Jul-14	482	34	499	516
Burris Sand Pit/Burris Basin	29-May-14	07-Aug-14	29-May-14	26-Jun-14	15	3	16	18

Site name	Date terns first observed*	Date terns last observed	Date of first nest	Date of last nest initiation	Total nests in first wave	Total nests in second wave	Total pairs	Total nests
Upper Newport Bay Ecological Reserve	08-May-14	11-Jun-14	12-May-14	14-May-14	2	0	2	2
San Diego County								
MCB Camp Pendleton - Totals	29-Apr-14	22-Aug-14	29-Apr-14	26-Jul-14	1286	51	1311	1337
Red Beach	25-Jun-14	02-Jul-14	n/a					0
White Beach	02-May-14	01-Aug-14	21-May-14	23-Jul-14	10	6	13	16
Santa Margarita River - North Beach North	02-May-14	08-Aug-14	05-May-14	06-Jun-14	166	4	168	170
Santa Margarita River - North Beach South	29-Apr-14	22-Aug-14	29-Apr-14	26-Jul-14	1086	41	1106	1127
Santa Margarita River - Saltflats and Island	03-May-14	29-Jul-14	03-May-14	12-Jun-14	24	0	24	24
Batiquitos Lagoon Ecological Reserve - Totals	15-Apr-14	01-Aug-14	07-May-14	24-Jun-14	474	4	476	478
E1	18-Apr-14	08-Jul-14	07-May-14	24-Jun-14	70	1	70	71
W1	25-Apr-14	08-Jul-14	07-May-14	06-Jun-14	36	0	36	36
W2	15-Apr-14	01-Aug-14	07-May-14	24-Jun-14	368	3	369	371
San Elijo Lagoon Ecological Reserve	n/a		n/a					0
Fairbanks Ranch	n/a		n/a					0
San Dieguito Lagoon Ecological Reserve	15-Apr-14	19-Apr-14	n/a					0
Mission Bay								
FAA Island	23-Apr-14	14-Jul-14	12-May-14	23-May-14	8	0	8	8
North Fiesta Island	14-May-14	05-Aug-14	14-May-14	25-Jun-14	9	4	11	13
Mariner's Point	24-Apr-14	11-Aug-14	08-May-14	03-Jul-14	106	13	112	119
Stony Point	22-May-14	14-Jul-14	27-May-14	03-Jun-14	2	0	2	2
San Diego River Mouth	n/a		n/a					0
San Diego Bay								
Lindbergh Field & Former Naval Training Center	15-Apr-14	23-Jul-14	06-May-14	31-May-14	99	1	99	100
US Navy - NI MAT	10-May-14	03-Jul-14	15-May-14	28-Jun-14	22	2	23	24
US Navy - NI18	02-May-14	22-Jul-14	10-May-14	12-Jul-14	26	7	29	33
Naval Base Coronado - Totals	28-Apr-14	08-Aug-14	01-May-14	09-Jul-14	989	50	1014	1039
Delta Beach North	29-Apr-14	07-Aug-14	01-May-14	01-Jul-14	216	8	220	224
Delta Beach South	29-Apr-14	07-Aug-14	01-May-14	01-Jul-14	162	8	166	170
NAB Ocean	28-Apr-14	08-Aug-14	02-May-14	09-Jul-14	611	34	626	645
D Street Fill/Sweetwater Marsh NWR	15-Apr-14	12-Aug-14	06-May-14	08-Jul-14	139	9	143	148
Chula Vista Wildlife Reserve	15-Apr-14	12-Aug-14	10-May-14	20-Jun-14	86	1	86	87
South San Diego Bay Unit, SDNWR - Saltworks	19-Apr-14	04-Aug-14	14-May-14	09-Jul-14	30	5	32	35
Tijuana Estuary NERR – Totals	17-Apr-14	09-Sep-14	08-May-14	17-Jul-14	197	64	229	261
Tijuana North	17-Apr-14	09-Sep-14	08-May-14	11-Jul-14	71	8	75	79
Tijuana South	17-Apr-14	09-Sep-14	08-May-14	17-Jul-14	126	56	154	182
Imperial County								
Salton Sea	13-Apr-14	13-Aug-14	27-Apr-14	10-May-14	2	1	2	3

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 2014 (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	0											
San Francisco Bay Area												
Napa Sonoma Marsh Wildlife Area - Totals	45	1		44	08-Jul-14							
NSMWA-Green Island Unit	0											
NSMWA-Pond 7/7A	45	1		44								
Montezuma Wetlands - Totals	16			16								
Site 1	4			4								
Site 3/4	12			12								
Pittsburg Power Plant	0											
Alameda Point	326	33	12.5	281								
Hayward Regional Shoreline	85	4	1.5	81	16-Jun-14	70	2	68	15	0	15	83
San Luis Obispo/Santa Barbara Counties												
Oceano Dunes SVRA	49	1	3.5	45	15-Jun-14	47	1	46	2	1	1	47
Rancho Guadalupe Dunes Preserve	0											
Vandenberg AFB-Purisima Pt.	21	4		17	none	21	4	17				17
Coal Oil Point Reserve	0											
Ventura County												
Ormond Beach	22	1		21								
Hollywood Beach	120	32	1	87	04-Jul-14	58	0	58	62	43	19	77
Santa Clara River/McGrath State Beach	4			4								
Pt Mugu- Totals	465	71	11.5	408								
Holiday Beach	65	5	0.5	60								
Holiday Salt Panne	10			10								
Eastern Arm	25	25		25**								
Ormond Beach East	365	42	11	312								
Saticoy United Water Conservation District	0											
Los Angeles/Orange Counties												
Venice Beach/Marina del Rey	81	15	1	65	29-Jun-14	15	15	0	66	0	66	66
LA Harbor- Pier 400	126	14	2	110	22-Jun-14	101	14	87	25	0	25	112
Seal Beach NWR - Anaheim Bay	154	38	1.5	115								
Bolsa Chica Ecological Reserve -Totals	301	95	2.5	205								
Nest Site 1 (NS1)	120	83	1.5	37								
Nest Site 2 (NS2)	104	4		100								
Nest Site 3 (NS3)	35	1	1	33								
South Tern Island (STI)	40	7		33	17-Jun-14	35	5	30	5	0	5	35
Seasonal Ponds	2			2								

	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**
Huntington State Beach	516	67	41.5	407	none	516	23	493				493
Burris Sand Pit/Burris Basin	18			18	19-Jun-14	15	2	13	3	0	3	18
Upper Newport Bay Ecological Reserve	2	1		1								
San Diego County												
MCB Camp Pendleton - Totals	1337	166	313	858								
Red Beach	0											
White Beach	16	3	2	11								
Santa Margarita River - North Beach North	170	17	33	120								
Santa Margarita River - North Beach South	1127	134	277	716								
Santa Margarita River - Saltflats and Island	24	12	1	11								
Batiquitos Lagoon Ecological Reserve - Totals	478	21	33	325								
E1	71	6	12	53								
W1	36	2	9.5	25								
W2	371	27	111.5	233								
San Elijo Lagoon Ecological Reserve	0											
Fairbanks Ranch	0											
San Dieguito Lagoon Ecological Reserve	0											
Mission Bay												
FAA Island	8	4		4								
North Fiesta Island	13	2		11	15-Jun-14	9	3	6	4	0	4	10
Mariner's Point	119	9	7.5	103	19-Jun-14	107	22	85	12	0	12	97
Stony Point	2	1		1								
San Diego River Mouth	0											
San Diego Bay												
Lindbergh Field & Former Naval Training Center	100	19	14.5	67	none	100	6	94				94
US Navy - NI MAT	24	22	2	22								
US Navy - NI18	33	23	10	20								
Naval Base Coronado - Totals	1039	259	226.5	556								
Delta Beach North	224	87	36.5	102								
Delta Beach South	170	24	34	112								
NAB Ocean	645	148	156	342								
D Street Fill/Sweetwater Marsh NWR	148	14	34	100	19-Jun-14	139	14	125	9	0	9	134
Chula Vista Wildlife Reserve	87	9	19	59	none	87	3	84				84
South San Diego Bay Unit, SDNWR - Saltworks	35	12	1.5	22	14-Jun-14	29	6	23	6	0	6	29
Tijuana Estuary NERR - Totals	261	17	10	235								
Tijuana North	79	7	0.5	72	20-Jun-14	71	10	61	8	0	8	69
Tijuana South	182	10	9.5	163	19-Jun-14	108	21	87	74	0	74	161

	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**
Imperial County												
Salton Sea	3			3								

Appendix B-3 Legend: nr=not reported

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

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

Appendix B-4: Productivity in 2014.

Site name	Total nests	Total eggs	No. of eggs hatched	Hatching Success	Date of first chick	Date of last hatch	Max # active nests	Date of max active nests	Date of first fledgling	Fledgling estimate method	Total fledglings
Sacramento Area											
Bufferlands	0										
San Francisco Bay Area											
Napa Sonoma Marsh Wildlife Area - Totals	45	111	77	0.69	12-Jun-14	14-Aug-14				3WD	60-70
NSMWA-Green Island Unit	0										
NSMWA-Pond 7/7A	45	111	77	0.69	12-Jun-14	14-Aug-14	29	12-Jun-14		3WD	60-70
Montezuma Wetlands - Totals	16	19*	5	0.71	30-Jun-14	25-Jul-14			nr	Other	1
Site 1	4	5	0	0.00	n/a						
Site 3/4	12	14	5	1.00	30-Jun-14	25-Jul-14	9	27-May-14	nr	Other	1
Pittsburg Power Plant	0										
Alameda Point	326	659	545	0.83	27-May-14	15-Jul-14	294	27-May-14	16-Jun-14	2WD	391
Hayward Regional Shoreline	85	168*	151	0.90	27-May-14	25-Jul-14	60	27-May-14	nr	3WD	118-128
San Luis Obispo/Santa Barbara Counties											
Oceano Dunes SVRA	49	93	76	0.83	12-Jun-14	16-Jul-14	44	12-Jun-14	02-Jul-14	Other, R	58
Rancho Guadalupe Dunes Preserve	0										
Vandenberg AFB-Purisima Pt.	21	41	31	0.76	13-Jun-14	09-Jul-14	17	03to06-Jun-14	07-Jul-14	3WD	20
Coal Oil Point Reserve	0										
Ventura County											
Ormond Beach	22	38	8	0.21	27-Jun-14	09-Jul-14	14	13-Jun-14		n/a	0
Hollywood Beach	120	179	88	0.49	03-Jun-14	11-Jul-14	53	24-Jul-14	10-Jul-14	3WD	23-29
Santa Clara River/McGrath State Beach	4	7	3	0.43	24-Jul-14	31-Jul-14	2	10to17-Jul-14	07-Aug-14	3WD	2
Pt Mugu- Totals	465	806	550	0.68	09-Jun-14	21-Jul-14			03-Jul-14	Other	127
Holiday Beach	65	111	61	0.55	16-Jun-14	21-Jul-14	37	16-Jun-14	08-Jul-14	Other	
Holiday Salt Panne	10	17	10	0.59	16-Jun-14	23-Jun-14	10	16-Jun-14		Other	
Eastern Arm	25	46	0	0.00	n/a		20	05-Jun-14			
Ormond Beach East	365	632	479	0.76	09-Jun-14	08-Jul-14	301**	09-Jun-14	03-Jul-14	Other	
Saticoy United Water Conservation District	0										
Los Angeles/Orange Counties											
Venice Beach/Marina del Rey	81	126	89	0.71	30-Jul-14	06-Aug-14	55	14-Jul-14	nr	R	75-100
LA Harbor- Pier 400	126	207	145	0.70	07-Jun-14	22-Jul-14	82	12-Jun-14	01-Jul-14	3WD	16-112
Seal Beach NWR - Anaheim Bay	154	240	122	0.51	18-Jun-14	06-Aug-14	97	25-May-14	02-Jul-14	R	4
Bolsa Chica Ecological Reserve -Totals	301	542	252	0.46	30-May-14	12-Jul-14			17-Jun-14	Other	80-219
Nest Site 1 (NS1)	120	214	21	0.10	03-Jun-14	13-Jun-14	82	27-May-14		Other	
Nest Site 2 (NS2)	104	191	150	0.79	05-Jun-14	03-Jul-14	83	29-May-14	17-Jun-14	Other	

Site name	Total nests	Total eggs	No. of eggs hatched	Hatching Success	Date of first chick	Date of last hatch	Max # active nests	Date of max active nests	Date of first fledgling	Fledgling estimate method	Total fledglings
Nest Site 3 (NS3)	35	62	44	0.71	05-Jun-14	19-Jun-14	27	12-Jun-14		Other	
South Tern Island (STI)	40	72	34	0.47	01-Jun-14	12-Jul-14	29	27-May-14	01-Jul-14	Other	
Seasonal Ponds	2	3	3	1.00	30-May-14	17-Jun-14	1	07to30-May-14		Other	
Huntington State Beach	516	849	681	0.80	03-Jun-14	11-Jul-14	414	03-Jun-14	20-Jun-14	3WD	168-348
Burris Sand Pit/Burris Basin	18	37	34	0.92	19-Jun-14	17-Jul-14	16	19-Jun-14	03-Jul-14	3WD	10
Upper Newport Bay Ecological Reserve	2	2	0	0.00	n/a		1	16-May-14			0
San Diego County											
MCB Camp Pendleton - Totals	1337	2529	2084	0.82	20-May-14	29-Jul-14			14-Jun-14	3WD, R	420-532
Red Beach	0										
White Beach	16	27	18	0.67	04-Jun-14	25-Jul-14	7	04-Jun-14	20-Jun-14	3WD	
Santa Margarita River - North Beach North	170	330	282	0.85	26-May-14	14-Jul-14	142	23-May-14	16-Jun-14	3WD, R	
Santa Margarita River - North Beach South	1127	2135	1769	0.83	20-May-14	29-Jul-14	906	22-May-14	14-Jun-14	3WD, R	
Santa Margarita River - Saltflats and Island	24	37	15	0.41	31-May-14	14-Jun-14	13	29-May-14	21-Jun-14	3WD	
Batiquitos Lagoon Ecological Reserve - Totals	478	906	775	0.86	23-May-14	03-Jul-14			13-Jun-14	3WD, other	232-269
E1	71	140	116	0.83	27-May-14	17-Jun-14	66	30-May-14	20-Jun-14	Other	
W1	36	70	61	0.87	23-May-14	24-Jun-14	33	30-May-14	13-Jun-14	Other	
W2	371	696	598	0.86	30-May-14	03-Jul-14	341	30-May-14	17-Jun-14	3WD, other	
San Elijo Lagoon Ecological Reserve	0										
Fairbanks Ranch	0										
San Dieguito Lagoon Ecological Reserve	0										
Mission Bay											
FAA Island	8	14	5	0.36	04-Jun-14	13-Jun-14	7	23-May-14	25-Jun-14	3WD	2
North Fiesta Island	13	24	19	0.79	11-Jun-14	21-Jul-14	9	11-Jun-14	25-Jun-14		7-9
Mariner's Point	119	216	159	0.74	01-Jun-14	24-Jun-14	93	01-Jun-14	19-Jun-14	3WD	60-70
Stony Point	2	4	2	0.50	17-Jun-14	n/a	2	03-Jun-14	14-Jul-14	3WD	1
San Diego River Mouth	0										
San Diego Bay											
Lindbergh Field & Former Naval Training Center	100	180	116	0.64	29-May-14	24-Jun-14	86	27-May-14	17-Jun-14	2WD, R	34-46
US Navy - NI MAT	24	41	27	0.66	03-Jun-14	03-Jul-14	15	10-Jun-14	21-Jun-14	3WD	1-4
US Navy - NI18	33	58	26	0.45	03-Jun-14	12-Jul-14	19	03to07-Jun-14	28-Jun-14	3WD	4-6
Naval Base Coronado - Totals	1039	1790	1196	0.67	22-May-14	18-Jul-14			14-Jun-14	3WD	125-187
Delta Beach North	224	387	199	0.51	22-May-14	15-Jul-14	146	20-May-14	21-Jun-14	3WD	
Delta Beach South	170	292	226	0.77	22-May-14	01-Jul-14	132	24-May-14	14-Jun-14	3WD	
NAB Ocean	645	1111	771	0.69	26-May-14	18-Jul-14	442	28-May-14	20-Jun-14	3WD	
D Street Fill/Sweetwater Marsh NWR	148	260	224	0.86	30-May-14	12-Jul-14	123	27-May-14	17-Jun-14	2WD, R	30-35

Site name	Total nests	Total eggs	No. of eggs hatched	Hatching Success	Date of first chick	Date of last hatch	Max # active nests	Date of max active nests	Date of first fledgling	Fledgling estimate method	Total fledglings
Chula Vista Wildlife Reserve	87	166	142	0.86	31-May-14	28-Jun-14	80	31-May-14	20-Jun-14	2WD, R	23-27
South San Diego Bay Unit, SDNWR - Saltworks	35	61	33	0.54	04-Jun-14	05-Aug-14	20	31-May to 02-Jun-14	25-Jun-14	2WD, R	10-11
Tijuana Estuary NERR - Totals	261	451	311	0.69	29-May-14	07-Aug-14			26-Jun-14	2WD, R	34-40
Tijuana North	79	146	101	0.69	05-Jun-14	31-Jul-14	70	05-Jun-14	03-Jul-14	2WD, R	
Tijuana South	182	305	210	0.69	29-May-14	07-Aug-14	116	05-Jun-14	26-Jun-14	2WD, R	
Imperial County											
Salton Sea	3	3*	1	1.00	unknown	unknown	2	20-May-14	13-Aug-14		0-1

*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.
**Estimate is low due to incomplete nesting records.

Appendix B-4: Productivity, clutch sizes in 2014.

			Number of nests			
Site name:	**Nest total**	**Egg total**	**1 egg clutch**	**2 egg clutch**	**3 egg clutch**	**4 egg clutch**
Sacramento Area						
Bufferlands	0					
San Francisco Bay Area						
Napa Sonoma Marsh Wildlife Area - Totals	45	111				
NSMWA-Green Island Unit	0					
NSMWA-Pond 7/7A	45	111		24	21	
Montezuma Wetlands - Totals	16	19*	unknown	unknown	unknown	unknown
Site 1	4	5*	unknown	unknown	unknown	unknown
Site 3/4	12	14*	unknown	unknown	unknown	unknown
Pittsburg Power Plant	0					
Alameda Point	326	659	39	241	46	
Hayward Regional Shoreline	85	168*	unknown	unknown	unknown	unknown
San Luis Obispo/Santa Barbara Counties						
Oceano Dunes SVRA	49	92	8	38	3	
Rancho Guadalupe Dunes Preserve	0					
Vandenberg AFB-Purisima Pt.	21	41	4	14	3	
Coal Oil Point Reserve	0					
Venture County						
Ormond Beach	22	38	6	16		
Hollywood Beach	120	179	61	59		
Santa Clara River/McGrath State Beach	4	7	1	3		
Pt Mugu- Totals	465	806	129	331	5	
Holiday Beach	65	111	22	40	3	
Holiday Salt Panne	10	17	3	7		
Eastern Arm	25	46	4	21		
Ormond Beach East	365	632	100	263	2	
Saticoy United Water Conservation District	0					
Los Angeles/Orange Counties						
Venice Beach/Marina del Rey	81	126	36	45		
LA Harbor- Pier 400	126	207	46	79	1	
Seal Beach NWR - Anaheim Bay	154	240	68	86		
Bolsa Chica Ecological Reserve -Totals	301	542	63	235	3	
Nest Site 1 (NS1)	120	214	27	92	1	
Nest Site 2 (NS2)	104	191	19	83	2	
Nest Site 3 (NS3)	35	62	8	27		
South Tern Island (STI)	40	72	8	32		
Seasonal Ponds	2	3	1	1		
Huntington State Beach	516	849	184	331	1	
Burris Sand Pit/Burris Basin	18	37	1	15	2	
Upper Newport Bay Ecological Reserve	2	1	2			
San Diego County						
MCB Camp Pendleton - Totals	1337	2529	161	1160	16	
Red Beach	0					
White Beach	16	27	5	11		
Santa Margarita River - North Beach North	170	330	12	156	2	
Santa Margarita River - North Beach South	1127	2135	133	980	14	
Santa Margarita River - Saltflats and Island	24	37	11	13		
Batiquitos Lagoon Ecological Reserve - Totals	478	906	55	418	5	
E1	71	140	4	65	2	
W1	36	70	2	34		
W2	371	696	49	319	3	
San Elijo Lagoon Ecological Reserve	0					

			Number of nests			
Site name:	**Nest total**	**Egg total**	**1 egg clutch**	**2 egg clutch**	**3 egg clutch**	**4 egg clutch**
Fairbanks Ranch	0					
San Dieguito Lagoon Ecological Reserve	0					
Mission Bay						
FAA Island	8	14	2	6		
North Fiesta Island	13	24	2	11		
Mariner's Point	119	216	24	93	2	
Stony Point	2	4		2		
San Diego River Mouth	0					
San Diego Bay						
Lindbergh Field & Former Naval Training Center	100	180	20	80		
US Navy - NI MAT	24	41	7	17		
US Navy - NI18	33	58	10	21	2	
Naval Base Coronado - Totals	1039	1790	290	747	2	
Delta Beach North	224	387	61	163		
Delta Beach South	170	292	48	122		
NAB Ocean	645	1111	181	462	2	
D Street Fill/Sweetwater Marsh NWR	148	260	36	112		
Chula Vista Wildlife Reserve	87	166	8	79		
South San Diego Bay Unit, SDNWR - Saltworks	35	61	9	26		
Tijuana Estuary NERR - Totals	261	451	71	190		
Tijuana North	79	146	12	67		
Tijuana South	182	305	59	123		
Imperial County						
Salton Sea	3	3*	3			

*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-5: Non-Predation Mortality in 2014.

	No. of eggs					No. of nests					No. of dead			
Site name:	damaged (human caused):	lost to flooding:	abandoned pre-term (buried)	abandoned post-term/nonviable	outcome unknown:	damaged (human caused):	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	Comments on cause(s) of non-predation mortality:
Sacramento Area														
Bufferlands														
San Francisco Bay Area														
Napa Sonoma Marsh Wildlife Area - Totals	9		2	17				2	4		4		1	
Green Island Unit														
Pond 7/7A	9		2	17				2	4		4		1	3 of 4 chicks died hatching
Montezuma - Totals					14					13				
Site 1					5					4				
Site 3/4					9					9				
Pittsburg Power Plant														
Alameda Point	1		43	40	18	1		32	7		13			6 of 13 chicks died hatching
Hayward Regional Shoreline			7					2			1			
San Luis Obispo/Santa Barbara Counties														
Oceano Dunes SVRA			2	4	10			1	2	4		6	1	Is possible a handful of fledges and adult may have been killed by crashing into site fence.
Rancho Guadalupe Dunes Preserve														
Vandenberg AFB-Purisima Pt.				2					1					
Coal Oil Point Reserve														
Ventura County														
Santa Clara River/McGrath State Beach			1	1				1						
Hollywood Beach	2 (2)		2	15	24	1		2	8	14	5			1 chick died hatching
Ormond Beach			1	10	13			1	6	6	1			
Pt Mugu - Totals		2	119	55	2		2	80	23	1	19	3	1	
Holiday Beach		1	33	2			1	23	1		1	1		1 chick died hatching
Holiday Salt Panne			1	6				1	4					
Eastern Arm		1					1							
Ormond Beach East			85	47	2			56	18	1	18	2	1	2 chicks died hatching
Saticoy united Water Conservation District														

	No. of eggs					No. of nests					No. of dead			
Site name:	damaged (human caused):	lost to flooding:	abandoned pre-term (buried)	abandoned post-term/nonviable	outcome unknown:	damaged (human caused):	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	Comments on cause(s) of non-predation mortality:
Los Angeles/Orange Counties														
Venice Beach/Marina del Rey											2			
LA Harbor- Pier 400	19		19	21		14		11	12		12			
Seal Beach NWR - Anaheim Bay			56	7	1			40						
Bolsa Chica Ecological Reserve -Totals			3	46	75			2	16	39	15			
Nest Site 1 (NS1)			2		48			1		26				
Nest Site 2 (NS2)			1	27	11			1	7	4	8			1 chick died hatching
Nest Site 3 (NS3)				4	5				2	3	4			
South Tern Island (STI)				15	11				7	6	3			
Seasonal Ponds														
Burris Sand Pit/Burris Basin			3											
Huntington State Beach			54	87	3			44	34		76	26	2	1 chick died hatching
Upper Newport Bay Ecological Reserve					1					1				
San Diego County														
MCB Camp Pendleton - Totals	2	26	27	148	28	2	15	18	48	12	576	102	5	
Red Beach														
White Beach			1	2				1			3	1		
Santa Margarita River - North Beach North		5	6	21			3	4	5		66	5	2	Includes 1 chick that died hatching, and 1 fledge that died by take.
Santa Margarita River - North Beach South	1	21	18	125	28	1	12	11	43	12	507	96	3	Includes 6 chicks that died hatching, as well as 5 chicks and 4 fledges that died by choking on fish.
Santa Margarita River - Saltflats and Island	1		2			1		2			2			
Batiquitos Lagoon Ecological Reserve - Totals	3	0	64 (10)	31	23			36	15	12	271	17		
E1			13 (6)	2	3			7	2	1	26	1		
W1			7 (2)					4			19	1		
W2	1		44 (2)	29	20	1		25	13	11	226	15		
San Elijo Lagoon Ecological Reserve														

	No. of eggs					No. of nests					No. of dead			
Site name:	damaged (human caused):	lost to flooding:	abandoned pre-term (buried)	abandoned post-term/nonviable	outcome unknown:	damaged (human caused):	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	Comments on cause(s) of non-predation mortality:
Fairbanks Ranch														
San Dieguito Lagoon														
Mission Bay														
FAA Island			5	1				3						
North Fiesta Island			3					2			5			
Mariner's Point			54					32			13	2		
Stony Point	2					1					1			
San Diego River Mouth														
San Diego Bay														
Lindbergh Field & Former Naval Training Center			24	18	14			16	7	6	21	2		1 chick died hatching, 1 fledge hit by vehicle
US Navy - NI MAT			7	7				5	2		4			1 chick died hatching
US Navy - NI18	3 (4)		3	15	4	3		1	7	3	4	1		1 chick and 1 fledge died by take
Naval Base Coronado - Totals	6		82	181	23	1		68	70	11	428	13	6	
Delta Beach North			13	29	19			11	13	9	64	5	1	
Delta Beach South			16	32		1		13	9		66	3		1 chick died hatching and 1 chick died by choking on fish.
NAB Ocean	1 (5)		53	120	4			44	48	2	298	5	5	1 chick died by hatching, 2 chicks and 1 fledge died by choking on fish, 5 chicks died by take
D Street Fill/Sweetwater Marsh NWR			23	8	2			16	2	2	65	7		
Chula Vista Wildlife Reserve			12	3	2			7		1	35	2		
South San Diego Bay Unit, SDNWR - Saltworks			8	1	5			6		2	5			3 chicks died hatching
Tijuana Estuary NERR – Totals	3	10	34	18	51	2	6	27	2	24	7			
Tijuana North		2	1	4	25		1	1	1	12	1			
Tijuana South	(4)	8	33	14	26	2	5	26	1	12	6			1 chick died by take
Imperial County														
Salton Sea					2					2				

Appendix B-6: Predation in 2014 (table does not include predator species documented at sites with no least tern nesting or predation).

Predator Species	Predator Category*			Predator Rating**
	Documented	Suspected	Possible	
Common raven	269	55		917
Unknown spp.	1	24	244	295
American crow	58	56		286
Coyote	71	32		277
Peregrine falcon	72	23		262
Gull spp.	10	51		132
Western meadowlark		55		110
Unknown avian spp.	5	47		109
Corvid spp.	14	19	6	86
Raptor spp.	10	24	5	83
Great horned owl	22	3		72
Northern harrier	22	1	2	70
Opossum	18	1		56
American kestrel	10	2		34
Black skimmer	4		13	25
Cooper's hawk	7	1		23
Gull-billed tern	4	3	1	19
Trapdoor spider	6			18
Ant spp.	4		4	16
California gull	4	2		16
Barn owl	3	3		15
Domestic cat	4			12
Long-billed curlew	2	1		8
Unknown mammal spp.		1	6	8
Western gull	2		1	7
Black-bellied plover		2	2	6
Raccoon		3		6
Red-tailed hawk	2			6
Horned lark		2		4
Killdeer	1			3
Least tern	1			3
Turkey vulture	1			3
Ring-billed gull	1			3

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

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

Appendix B-6: Predation in 2014 (continued).

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
Sacramento Area													
Bufferlands													
San Francisco Bay Area													
Napa Sonoma Marsh Wildlife Area -													
Green Island Unit	n/a												
Pond 7/7A		unknown		unknown 6	unknown 3				6	3	0	0	0
Montezuma -													
Site 3/4	GREG, GBHE, NOHA, LBCU, RTHA, CORA*								0	0	0	0	0
Site 1	NOHA, RTHA, Skunk, RWBL, GREG, GBHE*								0	0	0	0	0
Pittsburg Power Plant	n/a												
Alameda Point	WEGU, unknown, unknown avian	AMKE, PEFA	PEFA, CORA	CORA 27, unknown 2, unknown avian 11	CORA 3, unknown avian 4	AMKE 2, PEFA 6, unknown avian 1, WEGU 1	PEFA 15	PEFA 4	40	7	10	15	4
Hayward Regional Shoreline	unknown	CAGU, PEFA	CAGU, killdeer, unknown	CAGU 4, killdeer 1, unknown 5	CAGU 3, killdeer 1, unknown 2	CAGU 2	PEFA 1		10	6	2	1	0
Eden Landing	n/a												
San Luis Obispo/Santa Barbara Counties													
Oceano Dunes SVRA			PEFA				PEFA 2		0	0	0	2	0
Rancho Guadalupe Dunes Preserve													
Vandenberg AFB-Purisima Pt.			CALA	CALA 8	CALA 4				8	4	0	0	0
Coal Oil Point Reserve	n/a												

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
Ventura County													
Santa Clara River/McGrath State Beach	mammal			mammal 2	mammal 1				2	1	0	0	0
Hollywood Beach	corvid, unknown	AMCR	corvid	AMCR 30, corvid 12, unknown 6	AMCR 23, corvid 7, unknown 4				48	34	0	0	0
Ormond Beach	unknown			unknown 6	unknown 4				6	4	0	0	0
Pt Mugu -													
Holiday Beach		DIVI	CALA, DIVI, unknown avian	CALA 4, DIVI 10	CALA 2, DIVI 5			unknown avian 1	14	7	0	0	1
Holiday Salt Panne			unknown avian					unknown avian 1	0	0	0	0	1
Eastern Arm			CALA	CALA 45	CALA 24				45	24	0	0	0
Ormond Beach East	unknown, unknown avian	PRLO	AMKE, DIVI, LETE, PEFA, TUVU, unknown avian	unknown 6, PRLO 2, unknown avian 6, DIVI 5	unknown 4, PRLO 1, unknown avian 4, DIVI 3	AMKE 4, LETE 1, PEFA 2,TUVU 1	PEFA 1	PEFA 1, unknown avian 1	19	12	8	1	2
Saticoy United Water Conservation District	n/a												
Los Angeles/Orange Counties													
Venice Beach/Marina del Rey			AMCR	AMCR 37	AMCR 29				37	29	0	0	0
LA Harbor- Pier 400	unknown		ant, FECA	Ant 1, unknown 2	unknown 2		FECA 4		3	2		4	0
Seal Beach NWR - Anaheim Bay	raptor, unknown	BAOW,CORA, GHOW		CORA 47, unknown 6	CORA 39, unknown 5	BAOW 1, CORA 1, GHOW 2		BAOW 1, GHOW 1, raptor 1, unknown 1	53	44	4	0	4
Bolsa Chica Ecological Reserve -													
Nest Site 1 (NS1)	BLSK, unknown	CALA, gull, unknown		BLSK 13, CALA 20, gull 50,	BLSK 8, CALA 11, gull 30, unknown 32				143	81	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
				unknown 60									
Nest Site 2 (NS2)	unknown, ants	PRLO		unknown1, PRLO 1	unknown 1, ants 1, PRLO 1	ants 2			2	3	2	0	0
Nest Site 3 (NS3)	unknown	CORA		Unknown 2, CORA 7	Unknown 1, CORA 5				9	6	0	0	0
South Tern Island (STI)		CALA		CALA 12	CALA 7				12	7	0	0	0
Burris Sand Pit/Burris Basin	None reported								0	0	0	0	0
Huntington State Beach	GBTE	AMCR	PEFA	AMCR 24	AMCR 17	GBTE 1, PEFA 1	PEFA 2	PEFA 1	24	17	2	2	1
Upper Newport Bay Ecological Reserve		AMCR		AMCR 2	AMCR 1				2	1	0	0	0
San Diego County													
MCB Camp Pendleton -													
Red Beach	n/a												
White Beach	Unknown		Corvid, Coyote, GHOW, PEFA, Raptor	Corvid 1, Coyote 5, Unknown 3	Corvid 1, Coyote 3	GHOW 1		PEFA 2, Raptor 1	9	4	1	0	3
Santa Margarita River - North Beach North	Unknown, Raptor	Raptor	Coyote, Opossum, PEFA	Coyote 2, Opossum 4, Raptor 2, Unknown 8	Coyote 1, Opossum 2, Raptor 1, Unknown 4	PEFA 1, Raptor 1	PEFA 1, Raptor 1	PEFA 1, Raptor 1	16	8	2	2	2
Santa Margarita River - North Beach South	Unknown, Unknown Mammal	Unknown Avian, BBPL, HOLA, LBCU, Raptor, WEME	AMCR, Corvid, GHOW, Gull, NOHA, PEFA, Raptor	AMCR 17, Unknown Avian 8, BBPL 2, Corvid 7, Gull 2, HOLA 2,	AMCR 10, Unknown Avian 4, BBPL 1, Corvid 4, Gull 1, HOLA 1, LBCU 1, Raptor 1, Unknown 36, Unknown	NOHA 3, PEFA 1, Raptor 4, Unknwon Mammal 1	GHOW 1, PEFA 4, Raptor 4, Unknown 1	PEFA 2, Raptor 2	172	89	9	10	4

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
				LBCU 1, Raptor 2, Unknown 73, Unknown Mammal 3, WEME 55	Mammal 1, WEME 29								
Santa Margarita River - Saltflats and Island	Unknown	Raptor	Coyote	Coyote 7, Unknwon 14	Coyote 5, Unknown 7		Raptor 1		21	12	0	1	0
Batiquitos Lagoon Ecological Reserve -													
E1			RTHA, PEFA			RTHA 1	PEFA 1	PEFA 1	0	0	1	1	1
W1			PEFA			PEFA 1			0	0	1	0	0
W2			WEGU, RBGU, PEFA	RBGU 2	RBGU 1	PEFA 3	PEFA 13, WEGU 1	PEFA 2	2	1	3	14	1
San Elijo Lagoon Ecological Reserve	n/a												
Fairbanks Ranch	n/a												
San Dieguito Lagoon	n/a												
Mission Bay													
FAA Island	ant	unknown avian	PEFA	ant 2, unknown Avian 1	ant 1, unknown avian 1			PEFA 1	3	2	0	0	1
North Fiesta Island	Unknown		Ant	Unknown 1	Unknown 1	Ant 2		Unknown 1	2	1	2		1
Mariner's Point	Unknown	Unknown, PEFA		Unknown 3	Unknown 2			PEFA 2	3	2	0	0	2
Stony Point		Unknown				Unknown 1			0	0	1	0	0
San Diego River Mouth	n/a												
San Diego Bay													
Lindbergh Field & Former Naval Training Center		Corvid, PEFA	Ants, COHA, PEFA	Ants 1, Corvid 7	Ants 1, Corvid 4	COHA 4, PEFA 5	PEFA 4	PEFA 2	8	5	9	4	2
US Navy - NI MAT	None reported								0	0	0	0	0
US Navy - NI18	Unknown, WEGU			Unknown 2,	Unknown 1,	Unknown 1			3	2	1	0	0

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
				WEGU 1	WEGU 1								
Naval Base Coronado -													
Delta Beach North	Avian, Raptor, Unknown	COHA, Raptor	CORA, GHOW, Raptor	CORA 115, GHOW 2, Unknown 11	CORA 66, GHOW 1, Unknown 6	Avian 1, COHA 1, Raptor 1	Avian 1, GHOW 4	Avian 4, GHOW 2, Raptor 3	128	74	3	5	9
Delta Beach South	Avian, Unknown		COHA, CORA, GHOW, PEFA	CORA 16, Unknown 1	CORA 11	COHA 1, GHOW 1, PEFA 2	GHOW 1	Avian 2, COHA 2, GHOW 1, PRFA 5	17	11	4	1	10
NAB Ocean	Avian, Unknown		AMCR, Avian, BNOW, CORA, GHOW, LBCU, NOHA, PEFA, Trapdoor Spider	CORA 110, NOHA 2, Unknown 37, AMCR 4, Avian 1, LBCU 2	CORA 74, NOHA 1, Unknown 28, AMCR 3, Avian 2, LBCU 1	Avian 3, BNOW 1, GHOW 3, NOHA 2, Trapdoor Spider 6	Avian 7, BNOW 2, GHOW 4	Avian 2, GHOW 2, NOHA 3, PEFA 4	156	109	15	13	11
D Street Fill/Sweetwater Marsh NWR	NOHA, Unknown	NOHA, PEFA, Raptor	AMKE, NOHA, PEFA, RTHA	NOHA 3, PEFA 1,Unknown 1	NOHA 2	NOHA 1, AMKE 3	Raptor 1	Raptor 6, PEFA 2, RTHA 1, Unknown 1	5	2	4	1	10
Chula Vista Wildlife Reserve	Raptor, Unknown	PEFA, Raptor	GBTE, PEFA	Raptor 5, Unknown 2	Raptor 3, Unknown 1	GBTE 1, Unknown 2	PEFA 9	PEFA 3, Raptor 2, Unknown 1	7	4	3	9	6
South San Diego Bay Unit, SDNWR - Saltworks		BAOW, Unknown mammal, Gull, PEFA	BLSK, GBTE, Gull, PEFA	Unknown mammal 1, Gull 9, BLSK 4	Unknown mammal 1, Gull 5, BLSK 2	BAOW 1, GBTE 1	PEFA 1	PEFA 1	14	8	2	1	1
Tijuana Estuary NERR -													
Tijuana North		Corvid	CORA, NOHA	CORA 1, Corvid 12	CORA 1, corvid 5S	NOHA 1			13	6	1	0	0
Tijuana South	BBPL, Unknown	GBTE, PEFA	AMKE, GBTE, NOHA	BBPL 2, NOHA	BBPL 2, NOHA 1, Unknown	AMKE 3, GBTE		PEFA 1	10	7	15	0	1

	Predators			Number of Depredations					Total Number Documented				
Site name	Possible*	Suspected	Documented	Eggs**	Nests	Chicks	Fledglings	Adults	Eggs**	Nests***	Chicks	Fledglings	Adults
				1, Unknown 5, GBTE 2	3, GBTE 1	2, NOHA 9, PEFA 1							
Imperial County													
Salton Sea	CALA, PRLO, GBTE*								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.

Appendix B-7: Site-specific Summaries and Notes (excerpts taken from 2014 California least tern data reporting spreadsheets unless indicated otherwise).

Site name:	**Summary of breeding season at site:**
Sacramento Area	
Bufferlands	Per Chris Conard 12-10-14 email: Sadly, I never saw a Least Tern in the vicinity this year. Last year four showed up, but did not stick around. So, after five years of nesting, only one pair each year, there's been no nesting in 2013 and 2014. I hope they return, though it may have been ephemeral. The 2008 nesting was also the first time the species had ever been recorded in Sacramento County.
San Francisco Bay Area	
NSMWA	Wildlife Area Pond 7/7A: No predator control or banding occurred at site. One adult found dead. No apparent cause determined. Not associated with any specific nest. Found on 7-14-14 approximately at 3pm. Location 557154 4227546 Green Island Unit: No nests found.
Montezuma	Per Anne Wallace 2-3-15 report to FWS: Nesting least terns (*Sterna antillarum browni*) were present in two small colonies at the project site in 2014. Monitoring continued roughly twice a week between May 22 and August 28, with visits ranging from 3 to 8 days apart, but mostly 3 to 4 days apart. Two subcolonies were initially established by the terns, but one subcolony, a new one for the site, was abandoned early. The only successful nests hatched at the other subcolony site, one that has been used several times in the past.
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 4,332 volunteers who have contributed 18,082 hours in support of this stewardship effort (cumulative numbers). A very important component of this stewardship project involves the financial support from the community. More than $85,000 in grant funds and donations were secured for the Tern Island Project from the Regional Parks Foundation, U.S. Fish & Wildlife Service Coastal Program, 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 12-10-14 email: There were no least terns at any of the areas I monitor this past nesting season. And as far as I know, none were seen anywhere in the south valley by bird watchers either. The canals the least terns used to feed in when they were nesting at Westlake Farms south evaporation basin in Kings County have been dry the last couple of years due to the drought and other factors. With no foraging habitat, my guess is they move on, if they even still come at all. Last nest was in 2010 and last sighting was in June 2011 (2 adults only seen on one day).

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. There was a minimum of 47 breeding pairs, similar to the 48 breeding pairs in 2013, and above the average of 40 pairs (range=20-55) from 2002-13. There were 49 known nesting attempts. Of the 46 nests with known location and fate, 42 hatched, for a nest hatching rate of 91.3%. Of the four nests that failed, one was abandoned pre-term (prior to the expected hatch date); one was abandoned post-term; one was abandoned, unknown if pre- or post-term; and one failed due to an unknown cause. Seventy-six chicks hatched and 50 were color-banded to individual. Fifty-eight of the 76 chicks (including 16 unbanded chicks) are known to have fledged (seen when 21 days old or older), for a chick fledging rate of 76.3% and 1.23 chicks fledged per pair. Predation was documented for a minimum of two terns (juveniles or adults). The maximum number of juveniles produced that may have survived to leave the site was 52 (six either known dead or last seen with nonsurvivable severe injury).
Rancho Guadalupe Dunes Preserve	Per Melissa Kelly 2-20-15 report to FWS: Snowy plovers were monitored between March 29 and August 7, 2014. Sixty field surveys were conducted. Sixty-eight snowy plover nests and no least tern nests were discovered. Least terns were not seen nor heard on the Preserve or in the Santa Maria River this year.
Vandenberg AFB-Purisima Pt.	We estimate the 2014 breeding population to be 17 pairs which is 44% smaller than the 20-year mean of 30.6 pairs. Hatching success in 2014 (73%) was higher than the 19-year mean of 59% and fledging success (67%) was higher than the 20-year mean of 45%. Breeding success (1.18 fledglings per breeding pair) was the fourth highest year on record (see Figure 1) and 98% higher than the 20-year mean of 0.60 fledglings per breeding pair. The highest year on record was 1.32 fledglings per breeding pair in 2001. The Purisima Point least tern colony continues to be characterized by years of anomalously high and low reproductive success, with very few years consistent with the 20-year mean. Since 2007, the colony has shown above average reproductive success for 6 of the 8 years. During this period, young-of-the-year rockfish have dominated the diet. To date diet samples from 2014 have not been analyzed, but anecdotal evidence suggests that foraging conditions adjacent to the colony were good. Additionally, the terns began foraging in the Santa Ynez River estuary toward the end of the breeding season and brought fledglings to the estuary for approximately 4 weeks after dispersing from the colony. 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 11 years. 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 peices 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 April Price 12-10-14 email: There was no CLT nesting at COPR in 2014.

Ventura County	
Ormond Beach	The reasons for nest and egg abandonment and low tern numbers are unknown. Very few predators were observed at this site and the incidence of human disturbance observed was low. There is the possibility that people were walking through the primary nesting area either early in the morning or at night, as footprints were noted. Another nesting area that was completely fenced had unusually early dry out of the wetlands that may have contributed too no tern visitation/nesting there.
Hollywood Beach	We saw the second year of unusually high breeding attempts and success at this beach. We found that symbolic fences with educational signs were a big help in keeping the many visitors a reasonable distance from nesting birds, which reduced disturbance and increased nesting success. We also saw some fairly regular human intrusion into fences that included an ATV and a bicycle in the breeding area. Early to mid-June, we had 4 AMCR show up that walked the colony depredating eggs, ignoring LETE mobbing and human harassment. Fortunately, this ended after a couple weeks and LETE likely renested successfully. We continue to have concern that the sand moving occurs in the summer adjacent to the nesting area. Winter of 2014, the bi-annual harbor dredging resumed, which affects the area of the nesting colony, and the size of the flat nesting beach next year may be as much as halved.
NBVC Point Mugu	California least terns had a successful season at NBVC in 2014. A total of 465 nests were established and over 65% hatched. This is the first time the hatch rate was over 50% since 2009. The previous two years, 2012-2013 were particularly bad, with no documented fledglings produced in 2013. Colony failure appeared to be due primarily to high winds, flooding, and lack of food resources. This year there were no extreme wind or flooding events; there also appeared to be ample food. During the chick feeding phase, the vast majority of adults flying by were observed carrying fish. SITE INFO WORKSHEET NOTE: Fledgling Estimate Method Standard protocol suggests beginning counts 2-3 weeks after the first fledglings are observed and holding subsequent surveys at 2-3 week intervals. However, the LETE at NBVC tend to nest several weeks later than other sites and in a single wave. The vast majority of individuals depart less than a month after the first fledglings are observed. Since the season is very compressed at NBVC, spacing the surveys so far apart would provide an underestimate of productivity. Fledgling surveys were conducted 2x/week for the month of July, and overall fledglings were determined by using totals from surveys held a minimum of 8 days apart. Fledglings were categorized as young fledglings (FY) and older fledglings (FO); older fledgling were only added into the overall total during the first survey. A minimum of 8 days allowed most of the FY to transition to FO before the next subsequent survey, minimizing the chances of double counting individual juveniles while at the same time maximizing the ability to obtain a more accurate index of overall productivity.
Saticoy United Water Conservation District	No LETE were observed during any survey period. No LETE nests, fledglings, or terns exhibiting breeding/nesting behavior were observed.

Los Angeles/Orange Counties	
Seal Beach NWR - NASA Island	Per Jon Rishi 9-19-14 report: The California least tern (*Sternula antillarum browni*), listed as endangered by both the federal and California endangered species acts, nested in 2014 on NASA Island in Anaheim Bay on Seal Beach National Wildlife Refuge, Seal Beach, Orange County, California. This report discusses the methods and results of monitoring at the California least tern (CLTE) nesting area at NASA Island in 2014 by the U.S. Fish and Wildlife Service. A total of 154 CLTE nests were initiated in 2014. The first nest was observed 5 May and the last new nest was initiated 23 July. Mean clutch size was 1.58 eggs per nest with a total of 228 eggs laid. Hatchling success was 51.0% (62 eggs were lost to predators and 57 were abandoned or infertile). Documented predation by Common Raven (*Corvus corax*) and/or American Crow (*Corvus brachyrhynchos*), as well as predation by Great Horned Owl (*Bubo virginianus*) and Barn Owl (*Tyto alba*), with suspected predation by Peregrine Falcon (*Falco peregrinus*), combined with natural mortality, resulted in a chick survival of 0.03 fledglings per hatched egg, and a minimum fledgling estimate of 4 birds, or 0.03 fledglings per pair.
Bolsa Chica South Tern Island (STI)	Nests were recorded between 13 May and 24 June; and hatched between 30 May and 13 July. An estimated 22 to 33 chicks fledged from the site. One dead chick was found on the site and the feathers of an adult were found on the site. Coyote and gull tracks were found on the site. This was the only Bolsa Chica site that appeared to have a second wave of nesters--the last five nests found on 17 June.
Bolsa Chica Nest Site 1 (NS1)	Nests were initiated between 6 May and 10 June. The first hatch was recorded on 3 June and the last hatch on 10 June. Although 6 to 14 nests hatched, no fledglings were seen on Nest Site 1 due to high predation by coyotes and gulls and nest trampling by BLSK.
Bolsa Chica Nest Site 2 (NS2)	Nests were initiated 8 May to 26 June. The first hatch was recorded on 5 June and the last hatch on 3 July. This was the most successful site; producing 42 to 140 fledglings. Ants killed 8 chicks found dead in their nests and an additional dead chick was found on the site for a total of 9 dead chicks. By early July, most of the chicks had left NS2 and were being provisioned in the surrounding vegetation within Cells 42 and 45 (NS2 is located within Cell 42). As evidenced by tracks, non-viable eggs that remained on the site were depredated by gulls and a pair of raccoons.
Bolsa Chica Nest Site 3 (NS3)	Nests were initiated between 15 May and 26 June and hatched between 5 June and 19 June. Throughout this period, ravens were seen on the site and their tracks were found near nests; 2 eggs in a nest were pecked. Ambulatory chicks were led off NS3 into Cell 9 by their parents. The parents provisioned chicks in Cell 9 until the chicks fledged. One dead chick was found on NS3. An estimated 13 to 43 chicks fledged from Nest Site 3.
Bolsa Chica Cell 9 (C9)	For the first year on record, least terns nested within Cell 9, located adjacent to Nest Site 3 in Cell 13. On 7 May, a western snowy plover monitor discovered a 1-egg least tern nest. On 19 May, he observed 2 eggs in the nest and on 30 May, 2 chicks. On 17 June, the plover monitored observed an additional and younger least tern chick within Cell 9 and subsequently observed each of the 2 broods being provisioned by adult least tern. Due to ample vegetative cover and no evidence of predation, it was assumed that all 3 chicks fledged.
Upper Newport Bay Ecological Reserve	Two females were observed incubating nests between 5/12/14-5/14/14. On 5/16/14, one incubated nest was one. Only one incubating female was observed. On 5/19/14, the second incubating female was gone. No obvious signs of predations but American Crows are suspected. They were observed frequently during every subsequent remote observation visit. This is the first year since 2010 that we have seen crows frequent the island.

San Diego County	
San Elijo Lagoon	Potential foraging, roosting, and nesting sites of the endangered California least tern and threatened western snowy plover at San Elijo Lagoon Ecological Reserve and Cardiff State Beach were checked up to weekly through 2014, with Matt Sadowski and Lea Squires conducting surveys along the beach under contract with California Department of Parks and Recreation through Avian Research Associates, Robert Patton and Maryanne Bache monitoring potential nesting areas within the lagoon, and coordinating with Jayne Lesley, Steve Brad, and other volunteers along public access trails and beach to conduct monthly bird counts. Least terns were observed in limited numbers again this year. Two observed foraging along the beach on 12 May; five along the beach and four in the southeastern east basin on 9 June; one offshore on 23 June; and four along the beach on 14 July. No nests were documented this season and no on-ground tern or plover activity observed on saltpanne east of the east basin dike or in other potential nesting areas. Human footprints, dog tracks, coyote and raccoon tracks were observed in the area, as were raptors and corvids.
San Dieguito Lagoon	Per Avian Research Associates January 2015 report: Least Tern nesting was not detected this season at the lagoon. California Least Terns were observed at San Dieguito from as early as 15 April (three individuals) with 15 seen on 17 April and three observed on the 18th and two seen on 19 April. No terns were observed after 19 April. No nesting attempts were documented. One adult tern was found depredated (found dry and decomposed on 14 August, it could easily have been depredated in April) and the presence of Northern Harriers nesting within sight of the nesting areas NS11 and NS12 may have contributed to the lack of Least Tern nesting this season.
Mission Bay	
FAA Island	Lack of nesting and renesting due to continued predator disturbances from PEFA visiting the site frequently. Egg abandonment although minimal also attributed to PEFA harassment. Gull roosting apparent on the site by early July indicated by tracks and molting feathers throughout. This may have also contributed to lack of renesting and egg mortality and/or abandonment.
San Diego River Mouth	No Least Terns were observed at this site during the nesting season.
San Diego Bay	
San Diego County Regional Airport Authority and San Diego Unified Port District Sites	Potential nesting sites of the endangered California least tern were prepared prior to mid-April at Lindbergh Field - San Diego International Airport, D Street Fill, and Chula Vista Wildlife Reserve, and monitored from late February through August, 2014, by Robert Patton, Matt Sadowski, Jennifer Jackson, Lea Squires, Brian Foster, and Elizabeth Copper. Mayra Garcia and staff of SDIA Environmental Affairs assisted at Lindbergh Field, and Brian Collins of Sweetwater Marsh NWR also monitored at D Street Fill. Least terns were observed from 15 April through 12 August 2014 at and adjacent to properties and facilities of the San Diego Unified Port District. At the three Port District and San Diego County Regional Airport Authority sites, 335 nests were established from 6 May to 21 July. At least 85 to 109 young are estimated to have fledged from the sites, with productivity limited primarily by predation. Other limiting factors included nest abandonment, most likely related to disturbances from predators, and by unexplained mortality suspected possibly to be related to locally reduced prey availability. Snowy plovers were observed foraging adjacent to the D Street Fill pre-season from January through mid-March, and post-season in October. A maximum number of 74 plovers were recorded foraging on the tidal flats, but there were no sightings near potential nesting habitat. Snowy plovers were recorded only twice at CVWR this season with one roosting in late May and one in mid-August.

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. Ocean Blue also capped with coarse sand the site of the previous Ryan taxiway that had separated the two halves of oval 03-S. 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 2014. They were observed each visit after that through 23 July. At least 100 nests were initiated by 90 to 99 estimated pairs between 6 May and 17 June. The maximum number of concurrently active nests was 89 on 27 May, and 89 nests with one brood of chicks on 29 May. At least 95 nests were established in the main nesting oval 03-S, three nests in oval 02-S, and two nests in oval 04-S. At least 113 chicks from 65 nests hatched successfully. It is estimated that 34 to 46 chicks reached fledgling age and 30 to 41 young survived to fledge from the site. Eight eggs from seven nests were depredated, one by ants the others suspected by corvids, with common ravens scavenging 36 additional previously abandoned eggs. The outcome of ten nests with 14 eggs was uncertain, but lack of evidence of hatching or chick presence indicates probable depredation. Seventeen nests with 24 eggs were abandoned pre-term, and four single-egg and three two-egg clutches failed to hatch and were abandoned after prolonged incubation of 36 to 47 days. One egg each at eight nests failed to hatch and was abandoned after the other egg in its clutch hatched successfully. One fledgling and 18 chicks were found with no obvious cause of death. One fledgling was crushed by a vehicle on the adjacent perimeter road. One adult was observed being taken from the site by peregrine falcon, one was taken to Project Wildlife where it subsequently died of injuries suspected to have been caused by peregrine falcon, and a peregrine was observed taking an adult or large chick from the site. Two fledglings, a large chick/fledgling, and four chicks were observed being depredated by peregrine falcons. One to two additional chicks were suspected of being depredated by peregrines when a peregrine was seen leaving the site with small prey and when one was flushed from a nest where chicks had been previously but could not be found afterward. Piles of feathers of one to two other fledglings indicated additional peregrine predation. Four chicks were seen taken by Cooper's hawk. Nest abandonment and chick mortality coincided with regular disturbance and documented predation by Cooper's hawk and peregrine falcon, as well as disturbance and possible predation by gulls, common raven, and American crows. Although no other definitive evidence of chick depredation was found, the lack of observations, recaptures, fledglings, and attentive adults indicates that up to 38 to 50 more chicks were likely preyed on. Other potential predators observed in the area included opossum, rats, California ground squirrel, great blue heron, black-crowned night-heron, red-tailed hawk, and European starling.
D Street Fill/Sweetwater Marsh NWR	Through late February, U.S. Fish and Wildlife Service staff applied herbicide to invasive plant species; and in mid- to late March, 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 late February through August one to three days per week. Least terns were first observed at the D Street Fill on 15 April 2014. They were observed each visit after that through 12 August. At least 148 nests were initiated by 125 to 129 estimated pairs between 6 May and 21 July. The maximum number

	of concurrently active nests was 121 on 23 May, and the maximum number of concurrently active nests and broods was 120 nests with five broods of chicks on 27 May. At least 224 chicks from 126 nests hatched successfully. It is estimated that 36 to 42 chicks reached fledgling age and 28 to 36 survived to fledge from the site. The outcome of two nests with two eggs was uncertain, but lack of evidence of hatching or chick presence indicates probable depredation. At least three northern harriers were observed consistently within the colony coinciding with depredation of two nests with two eggs. One egg was damaged when the adult was depredated on the nest apparently by peregrine falcon. Sixteen nests with 23 eggs were abandoned pre-term, one single-egg nest and one two-egg nest were abandoned following prolonged incubation, and five eggs failed to hatch and were abandoned after the other egg in each clutch hatched successfully. Seven fledglings and 59 chicks were found with no obvious cause of death. One additional chick was found dead being scavenged by ants, but whether ants contributed to its mortality could not be determined. The bones and feathers of two large chick/fledglings were found but it could not be determined whether they had been depredated or not. One adult was observed being taken by a red-tailed hawk, another by a peregrine falcon, and piles of feathers of four to seven additional adults suggested predation by peregrines. Tracks at the bill, forehead, and feathers of a depredated adult indicated predation by a large owl, and feathers possibly from a second adult suggested predation by either a large owl or peregrine. One chick was observed being taken by a northern harrier and a second was suspected when a harrier with small unidentified prey was seen from a distance leaving the nesting area. Three chicks were observed being taken by an American kestrel. One fledgling carcass was found with trauma to the head and either kestrel or peregrine falcon 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 114 to 122 chicks coincided with documented depredation and daily disturbances to the colony by northern harrier, American kestrel, and peregrine falcon, and visits by Cooper's hawk, red-tailed hawk, and barn owl. Other potential predator species observed in the area included great blue heron, great egret, black-crowned night-heron, gulls, gull-billed tern, great horned owl, common raven, American crow, European starling, western meadowlark, opossum, rats, California ground squirrel, coyote, feral cat, striped skunk, raccoon, and gopher snake.
Chula Vista Wildlife Reserve	Prior to early April 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 15 April 2014, and on each visit through 25 July. One fledgling was observed on 12 August. At least 87 nests were initiated by 80 to 86 estimated pairs between 10 May and 20 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 and broods was 80 on 31 May including 77 nests and three broods. At least 142 chicks from 75 nests hatched successfully. It is estimated that 23 to 36 chicks reached fledgling age and 23 to 27 young survived to fledge from the site this season. The outcome of one nest with two eggs was uncertain, but lack of evidence of hatching or chick presence indicates probable depredation. Two eggs from one nest were depredated along with the adult by a barn owl. Four eggs from three other nests were depredated but species responsible could not be determined. Nine nests were abandoned pre-term, and three were abandoned after the other egg in each clutch hatched successfully. One previously abandoned egg was depredated/scavenged but species responsible could not be determined.

	Two fledglings, one large chick/fledgling, and 34 chicks were found dead of undetermined causes. One adult was depredated at the nest by barn owl, one by either barn owl or peregrine falcon, one was observed depredated by peregrine, and feather piles from three others indicated additional peregrine predation. The band of one depredated chick from CVWR was recovered in a regurgitated pellet in the gull-billed tern colony at South San Diego Bay saltworks. One chick was found depredated with trauma to its back but species responsible could not be determined. Two fledglings were observed being depredated by a peregrine falcon, and remains of seven others indicated predation by peregrines. No other definitive evidence of chick depredation was found, but lack of observations, recaptures, fledglings, and attentive adults indicates that others were likely preyed on. The disappearance of up to 67 to 71 chicks coincided with repeated hunting of the site by peregrine falcons, and visits by northern harrier, American kestrel, and gull-billed tern. Other potential predator species observed in the area included great blue heron, great egret, osprey, Cooper's hawk, red-tailed hawk, gulls, Caspian tern, common raven, coyote, striped skunk, feral cat, California ground squirrel, and rats. Snowy plovers were recorded only twice at CVWR this season with one roosting during high tide on 27 May and one on 12 August. Gull-billed terns nested for the third time at CVWR, establishing seven nests on the northwest dike; and elegant terns nested for the second time with five nests on the southwest jetty. Forster's terns established at least 315 nests, the majority of which were on the southwest jetty, with smaller sub-colonies on the northwest and northwest central dikes. Black skimmers nested for the second time at CVWR this season with 23 nests established on the northwest and northwest central dikes. Osprey successfully fledged young from the nest platform adjacent to the east dike again this season, and a second pair began nest construction on the north end of the southwest jetty.
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 March through September by Robert Patton, Matt Sadowski, Lea Squires, Kate Goodenough, and Brian Collins. Predator management was conducted by USDA Wildlife Services staff. Least terns were first observed at the saltworks on 19 April 2014, although they had been seen at adjacent Chula Vista Wildlife Reserve on 15 April. They were observed each visit after that through 9 August. At least 35 nests were initiated by 18 to 30 pairs between 14 May and 9 July in four concentrations or subcolonies. The maximum number of concurrently active nests was 18 on 28 May. Eighteen 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; five nests on mid-dike IV; and 10 nests were established on the new fill in southeast pond 11. At least six nests appeared to be renests based on loss of clutches to predation or abandonment followed by initiation of new nests. At least 31 chicks from 18 nests hatched successfully. Six nests with eight eggs were abandoned and one egg failed to hatch after the other in the clutch hatched. Chicks in two eggs died while hatching. Fourteen eggs from eight nests were depredated, including four nests with eight eggs found depredated with gull tracks, one with nearby coyote tracks, one with cat or fox tracks, and two were destroyed by black skimmers as their colony expanded. The fate of five eggs from three 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. Ten to 11 are estimated to have fledged from the site. Three chicks were found dead with no visible trauma. The remains of one adult and one fledgling were found depredated and peregrine suspected, and one large chick/fledgling was depredated by either peregrine or owl. One chick was observed being taken by a gull-billed tern. No other definitive evidence of chick depredation was found, but lack of observations, recaptures, fledglings, and attentive adults indicates that the other 14 to 15 chicks were likely preyed on. Their disappearance coincided with regular sightings of harriers, peregrine falcons, and gull-billed terns, as well

	as kestrels and coyote tracks. Other predator species observed in the area included red-tailed hawk, Cooper's hawk, gulls, barn owl, raven, crow, ground squirrel, and small rodents.
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, and Brian Collins. Predator management was conducted by USDA Wildlife Services staff. California least terns were first observed at Tijuana Estuary on 17 April 2014. They were observed each visit after that through 9 September. At least 261 nests were initiated by 181 to 229 pairs between 8 May and 24 July. The maximum number of concurrently active nests was 181 on 29 May. At least 31 nests were likely renests from clutches lost earlier. Nests were distributed in four concentrations or subcolonies. The river mouth shifted significantly to the south again this season, opening up potential nesting habitat north of the river mouth but eliminating what had been the largest potential nesting area and historic least tern colony site south of the river mouth. At least 79 nests were established on upper beach immediately north of the river mouth but south of the barrier dune. At least 19 nests were located in upper beach and dune areas south of the river mouth in what remained of the historic south river mouth site. Between the beach parking lot and equestrian access trail at Border Field State Park, 139 nests were established, and 24 nests were established north of the trail. At least 311 chicks hatched from 187 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, 34 to 40 young were estimated to have fledged from the site. Twenty-six nests with 32 eggs were abandoned pre-term, 15 eggs failed to hatch and were abandoned after the other egg in each clutch hatched successfully, and two nests failed to hatch after prolonged incubation. Ten eggs in six nests were flooded by extreme high tides or lost when banks collapsed from beach erosion. The outcome of 29 nests with 51 eggs was undetermined but predation was suspected. At least 17 nests with 26 eggs were depredated. These included two nests found depredated with harrier tracks, one nest with raven tracks, and three with corvid tracks. Additional eggs at previously abandoned nests were also depredated by coyote, harrier, and black-bellied plover. Three eggs from two nests were destroyed by human activity and one chick was found crushed in vehicle tracks. Five chicks were found dead with no visible trauma. The remains of one adult and one large chick/fledgling were found depredated and peregrine falcon suspected. Ten chicks were observed being depredated by harrier, three by kestrel, and two by gull-billed tern. Additional predation of up to 249 to 255 chicks was suspected by each of the above-mentioned species. Other potential predator species observed in the area were ants, snakes, opossum, raccoon, 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 12-12-14 email: Two pairs laid eggs in May, but the nests failed. Adults remained in the area into August, and the presence of an adult with a recently fledged young (young being fed by the adult) suggested a successful second nesting nearby.