

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

**California Least Tern Breeding Survey
2018-19 Season Final Report**

by
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February 8, 2024

Wildlife Diversity Program, 2024-1

California Least Tern Productivity Survey 2018 and 2019 Season¹

by

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ABSTRACT

Monitoring to document breeding success of California least terns (*Sternula antillarum browni*) continued in 2018 and 2019 with observers at 60 nesting sites throughout California providing data. In 2018, nest initiation peaked in mid-May, chick hatching in early-mid June, and fledgling observations in early-mid July. An estimated 3,741-4,502 California least tern breeding pairs established 4,729 nests and produced 841-1,125 fledglings at 50 documented sites across California. The fledgling to breeding pair ratio was 0.19 to 0.30. Statewide, 7,927 eggs were reported, with a statewide clutch size of 1.68. In 2019 a total of 59 sites were surveyed and nest initiation peaked in early to mid-May and the start of chick hatching peaked in early June. The date of first fledgling observation peaked in late June. An estimated 3,169-4,037 California least tern breeding pairs established 4,485 nests and produced 734-958 fledglings. The fledgling to breeding pair ratio was 0.18 to 0.30. Individual egg fates and clutch sizes were not recorded in 2019 as part of the statewide data collection effort.

In California, numbers of nesting least terns were not uniformly distributed across all sites. In 2018, 4 sites had 62% of the minimum count of breeding pairs, including Batiquitos Lagoon, Huntington Beach, Naval Base Coronado, and Alameda Point (Batiquitos and Coronado include their respective subsites). The same sites produced 45% of the state's minimum fledgling count. In 2019, the same 4 sites accounted for 60% of the minimum count of breeding pairs, and 42% of the minimum fledgling count. Overall, these values indicate decreased productivity compared to the last decade of reports on California least tern productivity.

¹ Sin, H., C. Clatterbuck, and K. Rice. California least tern breeding survey, 2018-19 season. California Department of Fish and Wildlife, Wildlife Branch, Nongame Wildlife Program Report, 2024-01-22. Sacramento, CA. 23 pp + Appendices.

Least terns were observed in the state of Hawai'i on the island of Hawai'i at Kohana'iki on the leeward side of the island, with the nesting season starting in April 2018 and 2019. Monitors reported three nests in 2018 with two nests that hatched and produced a total of six fledglings. In 2019, three nests produced eight fledglings at Kohana'iki. Least terns were also found to nest on the island of O'ahu in 2019 for the first time, at the James Campbell National Wildlife Refuge with two nests and one suspected fledgling (Harmon et al. 2021). Finally, in Baja California, Mexico, 286 pairs were reported in 2018 and 428 pairs reported in 2019, spanning the region from Ensenada to La Paz.

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 1985). Least terns have been documented to nest on Midway Atoll (1989) and on the island of Hawai'i (Szczyt et al. 2014). Two other subspecies, Interior (*S. a. athalassos*) and Eastern (*S. a. antillarum*), are recognized in the United States (American Ornithologists' Union: AOU 1957); however, there is little genetic variation among the subspecies which questions the validity of this division (Draheim et al. 2010). 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 migrate to the nesting areas by 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, or the second wave, may be established by renesters from the first wave, or late-arriving first time breeders (Massey and Atwood 1981). Renesting is often a result of stochastic events, like predation and human disturbance, that cause them to renest back on site or abandon the site to disperse to closer colonies.

The age of first breeding is typically 3 years; however, breeding by 2-year-old California least terns has been documented (Massey and Atwood 1981). California least terns establish nesting colonies on sandy soils with little vegetation along the ocean, lagoons, and bays, where they forage by plunge-diving for small fish (e.g., anchovy, *Engraulis* sp., and silversides, *Antherinopsidae*). Their nests are shallow depressions lined with shells or other debris (Massey 1974, Cogswell 1977). Given that vegetative cover in active least tern colonies is generally less than 20% (Gochfeld 1983, Carreker 1985), removal of non-native vegetation and select native vegetation is recommended to maintain open nesting areas with some dense vegetation that can be used by chicks to hide from predators (Ryan et al. 2010). On average, there are two eggs per nest that are incubated by both parents for approximately three weeks. Upon hatching, the semi-precocial young are tended by both parents, become mobile within three days, and can fly by 28 days (USFWS 1985). California least terns are a long-lived species and banded birds have been recovered after 24 years (Patton 2011, unpubl. report).

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 (USFWS 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 (Bradd Bridges 2015, pers. comm., 9 Jan.).

Monitoring efforts

Craig (1971) conducted the initial surveys of breeding colonies in 1969 and 1970, focusing on site characteristics, including historical use and threats to each colony. In 1973, the first annual breeding survey was conducted (Bender 1974a), which changed the focus of the monitoring effort from an earlier descriptive emphasis to quantifying breeding numbers and nesting success for each breeding colony. Factors determining breeding success, such as predation and egg and chick abandonment, were recorded starting in 1975 (Massey 1975). From 1976 to 1978, research and new management techniques were initiated to develop a better understanding of least tern biology and to increase breeding success. These techniques included banding to study local movements (Jurek 1977), use of chick shelters (Jurek 1977), identifying key feeding areas (Atwood et al. 1977), and extensive use of decoys (Atwood et al. 1979). The first documented records of fledglings appeared in the 1977 annual survey report

(Atwood et al. 1977). Massey (1989a) later conducted an analysis of fledgling survey techniques to determine a method that minimized sampling problems associated with the tendency of young to leave the nesting area within approximately three weeks of hatching. Based on that analysis, she recommended that an evening count of fledglings be done every three weeks, starting approximately eight to nine weeks after the first egg is laid, or three weeks after the first fledgling is observed.

Since 1971, the frequency of nest monitoring at breeding colonies increased from one to three visits per year to more than one visit per week. However, wide variation exists among sites and years. The observed statewide population increase of least terns in the 1970s and 1980s has been attributed to increased sampling and associated personnel effort rather than an actual increase in the number of California least terns (Atwood et al. 1977, USFWS 1980, Massey 1988). Additionally, USDA APHIS Wildlife Services (formerly Animal Damage Control) commenced predator management activities to benefit least terns in the 1980's. Their involvement resulted from monitors identifying predation of chicks as the main factor of poor breeding success rather than reduced habitat and pair disturbance (Collins 1984). Obst and Johnston (1992) recommended that datasheets and fledgling counts be standardized across the state. This was accomplished in 1993 when all site monitors were provided with the same datasheets and instructions (Caffrey 1994, 1995). 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 (Lewison and Deutschman 2014). Based on their analyses, they recommended:

- Adopting the new data collection and reporting protocol deployed by CDFW in 2013;
- Less emphasis on number of eggs per nest;
- Greater emphasis on fledgling monitoring using the improved chick classification method;
- Improving 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 2018 and 2019 breeding seasons in California.

METHODS

Monitors for each site that planned least tern monitoring activities for 2018 and 2019 were provided instructions and spreadsheets to report final breeding data used for the annual report. The spreadsheet format was revised in 2013 and again in 2019, 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 from 2013 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. In 2019, monitors discontinued reporting the fate of individual eggs and instead focused on reporting overall nest fates, fledgling estimations, and observed mortalities. This change was based on the Lewison and Deutschman (2014) California least tern long-term data analysis report that demonstrated that egg level data (i.e., clutch size) has not significantly changed from 1990 -2013. These changes in the reported data were discussed during the 2018 California least tern Technical Advisory Group meeting and were intended to minimize the amount of time spent in the colony and to focus monitoring efforts on those data that are used in the calculation of breeding pairs and the assessment of productivity.

Site information

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.

Chronology and productivity monitoring

For each day breeding colonies were monitored in 2018, 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).

In 2019, similar survey data was collected, including date, number of monitors, hours in the colony or blind, adults, fledges, chicks, and each predator species observed. However, the status of each egg was not tracked over the course of the season and monitors only reported the final overall fate of the nest using the following codes: H (Hatch), PH (Probable Hatch), F (Failed), U (Unknown). In addition, any observed mortalities were recorded and linked to individual nests where possible.

Data analysis

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 were 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 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 reneesters prior to 15 June

pairs second wave = #nests 15 June or after - estimated reneesters 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 in 2018 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. However, in 2019 productivity was measured by counting the number of nests and the number of fledglings produced. Dates of first chick and fledgling were also typically recorded in both years. These data will not be available for Type 2 or 3 sites simply because monitors cannot easily observe eggs and nests from a distance. Nest counts were used to estimate numbers of breeding pairs using the methods described above for comparison to recovery plan targets.

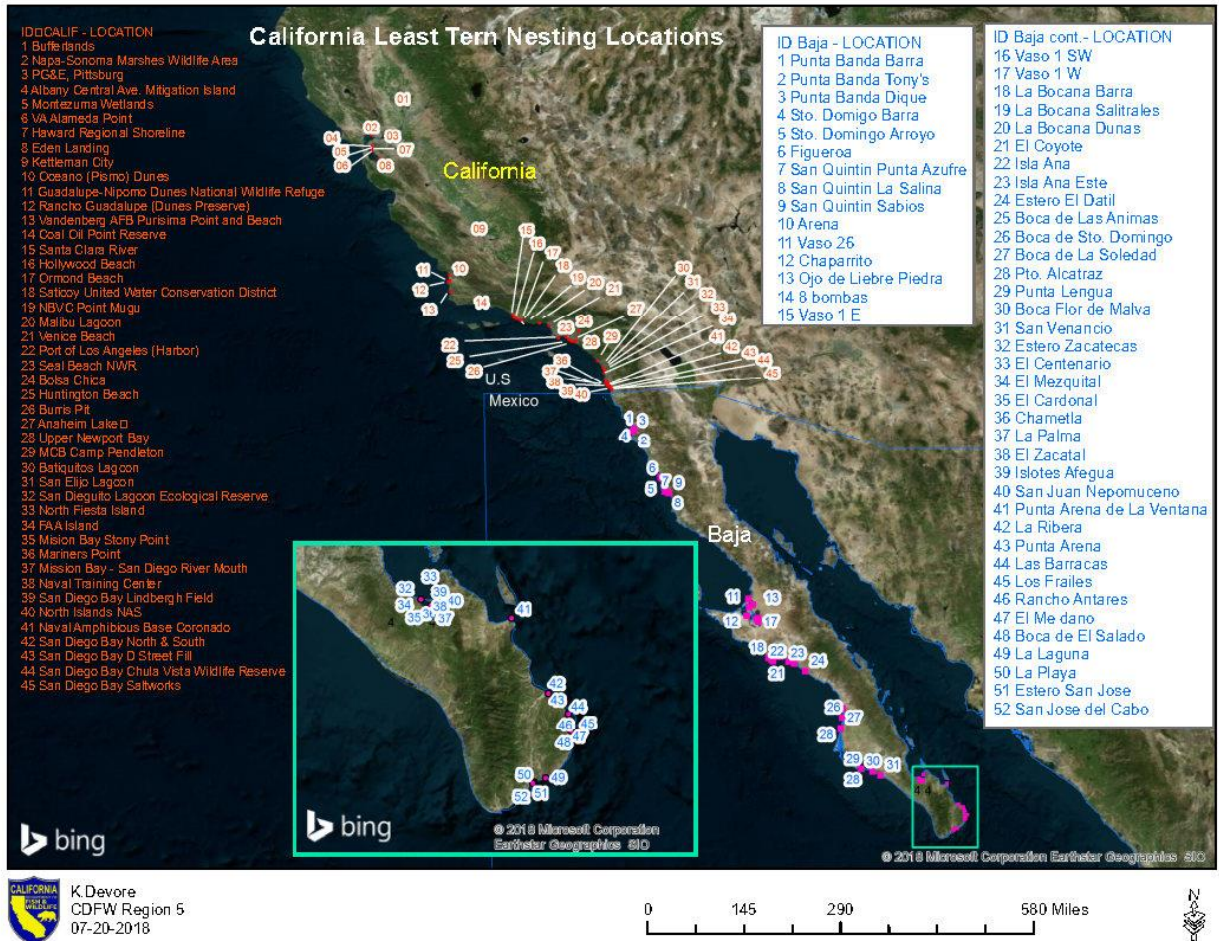
Three sites, San Elijo, Hollywood Beach, and Saticoy, did not record a nest in 2018 or 2019 and no nests were detected at Malibu Lagoon in 2019 after six nests were found in 2018. Statewide mean clutch size was calculated in 2018 by using data from sites that reported clutch sizes of every nest detected (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. Clutch sizes and individual egg fates were not collected as part of the 2019 statewide effort. 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.

RESULTS AND DISCUSSION

Monitoring

California least terns were monitored at 53 breeding sites, including subsites, in 2018, and 59 breeding sites 2019. Of the 59 sites in 2019, 10 were in the San Francisco Bay area, 3 in San Luis Obispo and Santa Barbara counties, 8 in Ventura county, 13 in Los Angeles and Orange counties, and 25 in San Diego county (Figure 1). In both years, the majority of sites were Type 1 sites that were surveyed at least once a week.

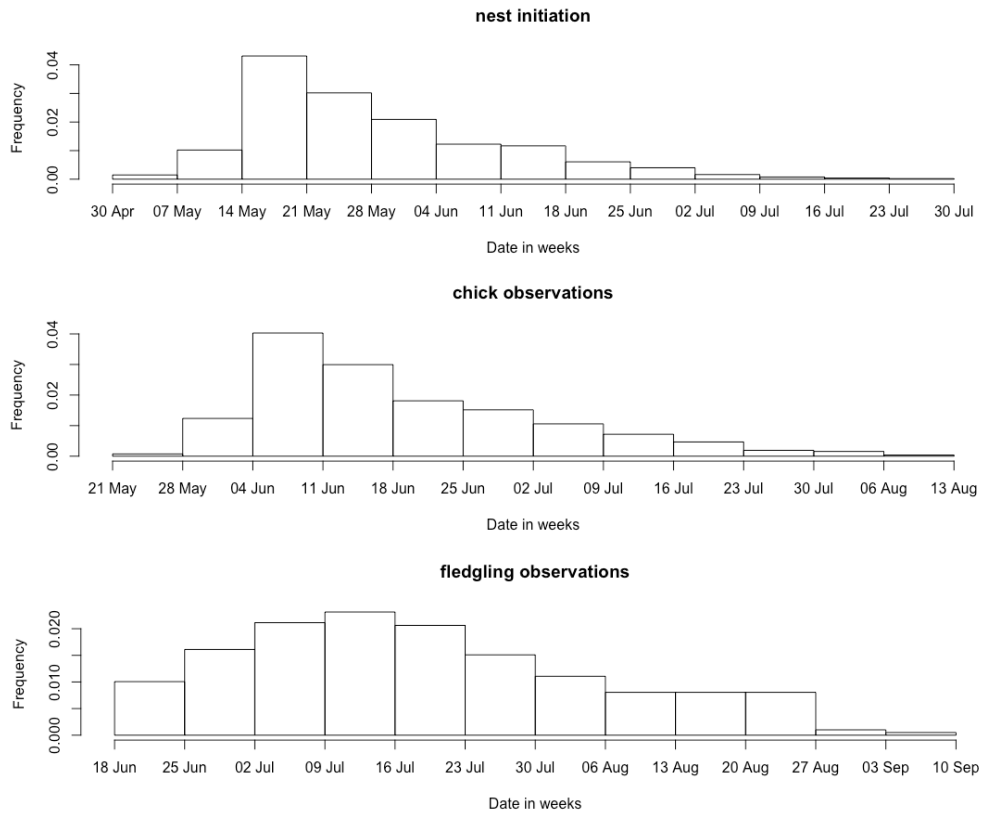
Figure 1: California least tern nesting sites in California and Baja California.



2018 Chronology

The 2018 California least tern nesting season lasted almost 5 months. Least terns were first sighted at Huntington Beach and Camp Pendleton on 11 April. The first egg was surveyed on 1 May at Naval Base Coronado - NABON, the first chicks on 25 May at Naval Base Coronado – NABON and DBN, and the first fledglings on 16 June at Huntington Beach and Naval Base Coronado - NABON. The last eggs were observed 24 July at Alameda Point & McGrath State Beach, the last observed chick on 10 August at Alameda Point, and the last observed fledgling on 1 September at McGrath State Beach. Nest initiation peaked at the 14-21 of May, the highest number of chicks observed in 4-18 June, and fledgling observations by site peaked over 2-23 July 9 (Figure 2). The beginning of nest initiation varied widely by site, from 1 May to 13 June (McGrath State Beach). Additionally, 14 of 50 active sites, including subsites, reported a 2nd wave of nesting.

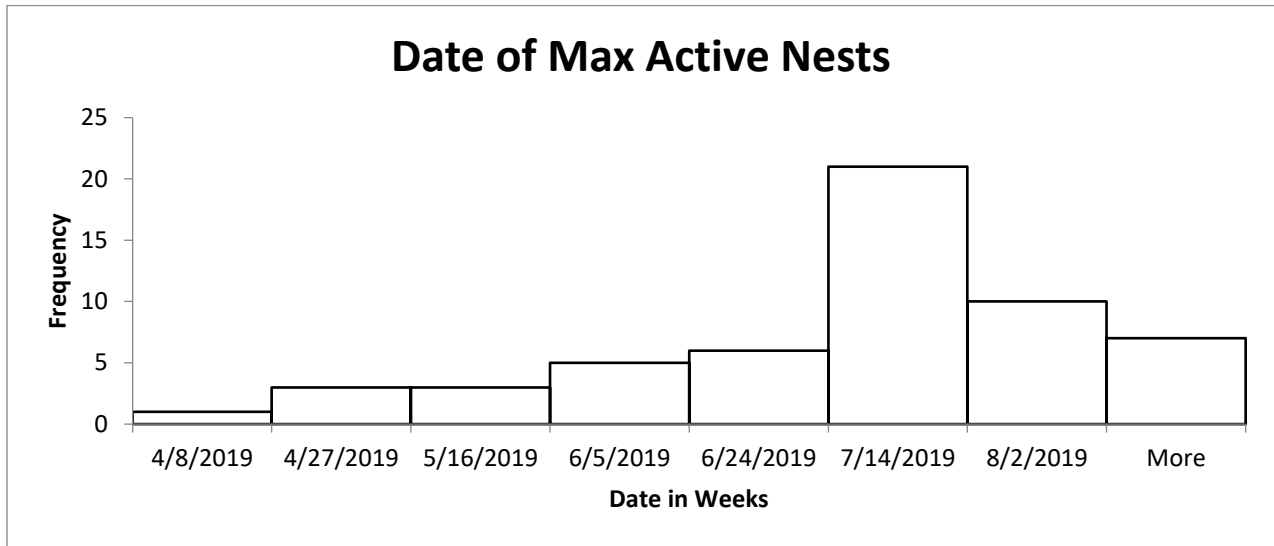
Figure 2: Breeding chronology for California least terns in 2018. Note difference in x-axis dates among histograms.



2019 Chronology

In 2019, least terns were first sighted at Huntington Beach on 4 April. The first nest was surveyed on 1 May at D Street Fill and the first chicks were detected on 28 May at Batiquitos Lagoon Ecological Reserve (W2) and Bolsa Chica Ecological Reserve (NS1-North). The first fledglings were observed on 17 June at Marine Corps Base Camp Pendleton (Blue Beach) and the last observed hatches occurred on 15 August at Mariner's Point. Nest initiation peaked on the 2-9 of May and the highest number of active nests were observed 24 June through 14 July (Figure 3). Finally, the beginning of nest initiation varied widely by site, from 1 May to 6 July (Ormond Beach).

Figure 3: Date of max active nests for California least terns in 2019.



2018 Productivity

In 2018, an estimated 3,741-4,502 California least tern breeding pairs established 4,729 nests, laid 7,927 eggs, and produced 841-1,125 fledglings at 50 documented sites. The statewide mean clutch size was 1.68, but mean clutch size among sites ranged from 1.17 (Mission Bay/FAA Island) to 2.12 (Montezuma/12A). The statewide fledgling-to-breeding pair ratio was 0.19 to 0.30, though the ratio varied among sites (Table 1). Excluding the 10 sites that documented nesting but did not produce fledglings (and thus had a ratio of 0), the site with the lowest fledgling-to-breeding pair ratio was Eden Landing (0.01-0.03), and the highest fledgling-to-breeding pair ratio was Oceano Dunes (1.13-1.30).

Table 1 – California least tern productivity in 2018. Pair estimates are based on productivity methods I, II, and III.

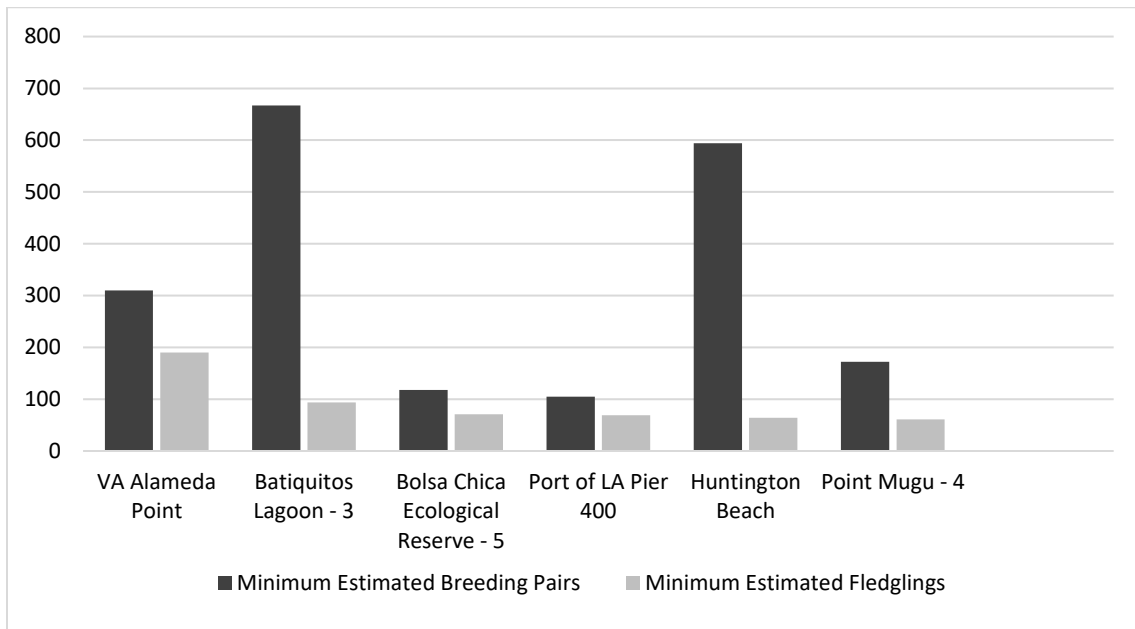
Site - # of Subsites (if applicable)	Minimum Estimated Breeding Pairs	Maximum Estimated Breeding Pairs	Number of Nests	Minimum Estimated Fledglings	Maximum Estimated Fledglings	Minimum Estimated Fledge-to-Breeding Pair Ratio	Maximum Estimated Fledge to Breeding Pair Ratio
Napa-Sonoma Marsh Wildlife Area - 2	2	27	28	0	0	0	0
Montezuma Wetlands – 3	13	16	18	0	0	0	0
Alameda Point	310	348	375	190	300	0.55	0.97
Hayward Regional Shoreline	20	26	32	11	11	0.42	0.55

Eden Landing Ecological Reserve	95	105	141	1	3	0.01	0.03
Oceano Dunes SVRA	27	31	35	35	35	1.13	1.3
Vandenberg AFB	49	69	83	35	35	0.51	0.71
Santa Clara River/McGrath State Beach	14	23	24	6	8	0.26	0.57
Hollywood Beach	0	0	0	0	0	0	0
Ormond Beach	67	84	84	44	44	0.52	0.66
Point Mugu - 4	172	271	291	61	72	0.23	0.42
Saticoy United Water Conservation District	0	0	0	0	0	0	0
Malibu Lagoon	3	4	6	0	0	0	0
LA Harbor	105	117	133	69	69	0.59	0.66
Venice Beach/Marina Del Rey	2	4	5	0	0	0	0
Seal Beach NWR – Anaheim Bay	114	117	117	42	42	0.36	0.37
Bolsa Chica Ecological Reserve - 5	118	130	133	71	71	0.55	0.6
Burriss Sand Pit/Burriss Basin	14	14	16	6	6	0.43	0.43
Upper Newport Bay Ecological Reserve	18	19	22	1	1	0.05	0.06
Huntington Beach	594	644	688	64	171	0.1	0.29
MCB Camp Pendleton -4	43	321	334	4	4	0.01	0.09
Batiquitos Lagoon Ecological Reserve - 3	667	674	684	94	99	0.14	0.15
San Elijo Lagoon Ecological Reserve	0	0	0	0	0	0	0
Mission Bay - FAA Island	0	12	12	0	0	0	
Mission Bay - Mariner's Point	138	177	178	30	50	0.17	0.36
Mission Bay - North Fiesta Island	0	1	1	0	0	0	0
Mission Bay - Stony Point	10	10	11	0	0	0	0
Lindbergh Field/Former Naval Training Center	14	19	19	13	14	0.68	1
Naval Base Coronado - 4	744	815	827	29	46	0.04	0.06
US Navy – NI-MAT	12	15	16	1	1	0.07	0.08
D Street Fill/Sweetwater Marsh NWR	95	108	109	12	15	0.11	0.16
Chula Vista Wildlife Reserve	76	82	83	6	10	0.07	0.13
South San Diego Bay Unit, SDNWR/Saltworks	27	32	33	1	1	0.03	0.04
Tijuana Estuary NERR- 2	178	187	191	15	17	0.08	0.1
TOTALS	3,741	4,502	4,729	841	1,125	0.19	0.30

As in past years, a limited number of sites drove the observed productivity values. The majority of the minimum count of breeding pairs (62%), nests (54%), and eggs (55%), were found at 4 of 50 total breeding sites: Batiquitos Lagoon, Huntington Beach, Naval Base Coronado, and Alameda Point (Batiquitos and Coronado include their respective subsites). These 4 sites also produced 45 percent of the statewide fledgling count. Among the 6 sites (including subsites) that produced the highest number of fledglings, the minimum number of breeding pairs appears decoupled from fledgling production (Figure 4).

Fledgling production also varied among regions, with each approximately 10-25% of the state's minimum fledgling production. Although the majority of least tern pairs nested in San Diego county (2,004 vs. 1,737 minimum pairs, or 54%), only 24% of the minimum fledgling total came from San Diego county. Meanwhile, VA Alameda Point was responsible for 23% of the state's total minimum fledgling production and drove fledgling production in the San Francisco Bay Area.

Figure 4: Minimum breeding pairs (dark gray bars) and minimum fledgling count (light gray bars) of California least tern breeding sites with the highest minimum fledgling count.



2019 Productivity

In 2019, an estimated 3,169-4,037 California least tern breeding pairs established 4,485 nests and produced 734-958 fledglings at 59 monitored sites (Table 2). The statewide fledgling-to-breeding pair ratio was 0.18 to 0.30, similar to 2018; though total fledglings and nesting attempts were down, suggesting a continuing decline in productivity as compared to the 7 years preceding the reporting period. Excluding sites that did not produce fledglings (and thus had a ratio of 0), the site with the lowest fledgling-to-breeding pair ratio was Salt Works (0.03-0.04), and the highest fledgling-to-breeding pair ratio was Oceano Dunes (1.15-1.23).

Observed nesting and breeding pair values continued to be driven by Batiquitos Lagoon, Huntington Beach, Naval Base Coronado, and Alameda Point in 2019. These sites accounted for 60% of the minimum breeding pairs and 52% of the

nests statewide; however, they only produced 42% of the statewide minimum fledge count due to low success at Batiquitos and Naval Base Coronado (minimum fledge-to-breeding pair ratios of 0.04 and 0.03 respectively). Conversely, the five sites located in the San Francisco Bay area (Eden Landing, Hayward Regional Shoreline, Montezuma Wetlands, Napa-Sonoma Wildlife Area, and VA Alameda Point) accounted for only 12% of both total nests and minimum breeding pairs statewide but produced 32% of the documented fledglings demonstrating the continuation of varied fledgling production among regions as was observed and described for 2018.

Table 2 – California least tern productivity in 2019. Pair estimates are based on productivity methods I, II, and III.

Site - # of Subsites (if applicable)	Minimum Estimated Breeding Pairs	Maximum Estimated Breeding Pairs	Number of Nests	Minimum Estimated Fledglings	Maximum Estimated Fledglings	Minimum Estimated Fledge-to-Breeding Pair Ratio	Maximum Estimated Fledge to Breeding Pair Ratio
Napa-Sonoma Marsh Wildlife Area – 2	2	3	3	0	0	0	0
Montezuma Wetlands – 3	9	12	15	2	3	0.17	0.33
Alameda Point	240	334	345	182	273	0.54	1.14
Hayward Regional Shoreline	44	54	56	44	50	0.81	1.14
Eden Landing Ecological Reserve – 3	71	120	121	10	13	0.08	0.18
Oceano Dunes SVRA	31	33	34	38	38	1.15	1.23
Rancho Guadalupe Dunes Preserve	13	17	17	4	8	0.24	0.62
Vandenberg AFB	43	45	47	21	21	0.47	0.49
Hollywood Beach	0	0	0	0	0	0	0
Ormond Beach – 2	80	86	92	18	18	0.21	0.22
Point Mugu – 4	234	281	315	64	120	0.23	0.51
Saticoy United Water Conservation District	0	0	0	0	0	0	0
Malibu Lagoon	0	0	0	0	0	0	0
LA Harbor	161	184	199	97	97	0.53	0.6
Venice Beach/Marina Del Rey	0	6	6	0	0	0	0
NAVWPNSTA Seal Beach	1	2	2	0	2	0	2
Seal Beach NWR – Anaheim Bay	0	54	54	0	0	0	0
Bolsa Chica Ecological Reserve – 5	90	98	134	44	47	0.45	0.52
Burriss Sand Pit/Burriss Basin	14	17	17	2	2	0.12	0.14
Upper Newport Bay Ecological Reserve	20	20	20	4	4	0.2	0.2
Huntington Beach	452	503	531	81	110	0.16	0.24
MCB Camp Pendleton – 3	62	397	418	15	15	0.04	0.24
Batiquitos Lagoon Ecological Reserve – 3	481	522	548	22	31	0.04	0.06
San Elijo Lagoon Ecological Reserve – 2	0	0	0	0	0	0	0

Mission Bay - FAA Island	11	37	39	1	2	0.03	0.18
Mission Bay - Mariner's Point	123	146	159	36	39	0.25	0.32
Mission Bay - North Fiesta Island	1	2	2	0	0	0	0
Mission Bay - Stony Point	0	1	1	0	0	0	0
Lindbergh Field/Former Naval Training Center	13	17	19	6	6	0.35	0.46
Naval Base Coronado - 4	717	741	928	21	34	0.03	0.05
US Navy - NI-ALT	0	0	0	0	0	0	0
US Navy - NI-MAT	2	2	2	1	1	0.5	0.5
US Navy - NIA18	1	2	2	0	0	0	0
D Street Fill/Sweetwater Marsh NWR	77	86	104	12	12	0.14	0.16
Chula Vista Wildlife Reserve	51	53	66	2	4	0.04	0.08
South San Diego Bay Unit, SDNWR/Saltworks	28	32	39	1	1	0.03	0.04
Tijuana Estuary NERR - 2	97	130	150	6	7	0.05	0.07
TOTALS	3,169	4,037	4,485	734	958	0.18	0.30

Statewide, the minimum number of breeding pairs and fledglings are the lowest recorded since 1995 and 2012 (Figure 5), respectively (Caffrey 1997, Frost 2013). The minimum fledgling to breeding pair ratio is also low compared to past reports and dropped below 0.2 for the first time since 2012. Together, these values indicate that California least tern productivity was lower than in the 7 years preceding the reporting period and suggests a continued decline in numbers since 2009.

Figure 4: Minimum breeding pairs (open diamonds) and minimum fledgling count (solid squares) of California least terns from 1969 through 2019.

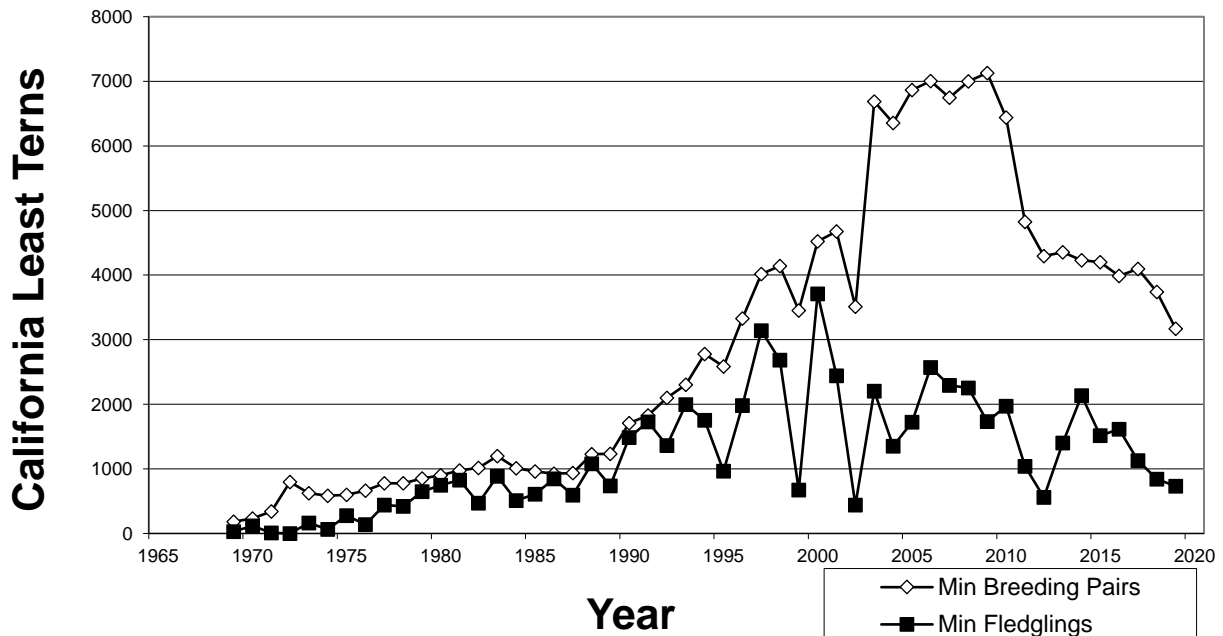
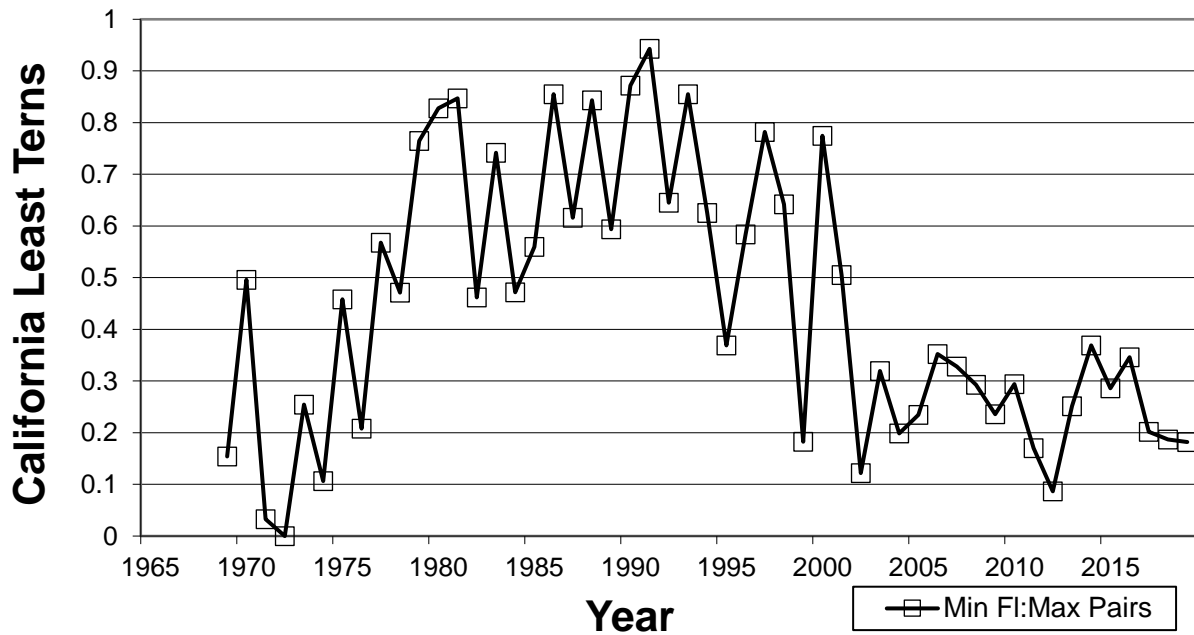


Figure 5: Minimum California least tern fledge-to-breeding pair ratio from 1969 to 2019.



Baja California

CDFW obtained data on nesting activity by California least terns in Baja California for 2018 and 2019. While this data is included in this report for the purposes of documentation and to ensure a comprehensive representation of the breeding range of the species, detailed information on methodologies and metrics beyond breeding pair estimation are outside of the scope of this report and should be acquired from other sources.

Historical least tern data exists for up to 57 total sites, indicating that least terns use multiple sites in Baja California to breed. In 2018 and 2019, documented nesting ranged from Ensenada to La Paz and partners reported an estimated 286 breeding pairs in 2018 and 428 breeding pairs in 2019. The majority of nesting sites were surveyed only once during the breeding season, leading to high variability in pair estimations between years and sites and highlighting the need for additional funding for management and monitoring of the species throughout its range in Baja California.

Conclusion

California least tern breeding success was monitored in 2018 and 2019 to track where this endangered species is relative to population recovery. Biologists recorded a minimum of 3,741 breeding pairs in 2018 and 3,169 breeding pairs in 2019, the lowest count since 1995. Additionally, the minimum statewide fledgling-to-breeding pair ratios for 2018 and 2019 (0.19 and 0.18 respectively) were lower than previous reports, indicating depressed reproductive success during the reporting period. Since 1977, this ratio has been less than 0.50 for only 23 years (including the last 18 years). Although some of the recovery criteria outlined in the 1985 Recovery Plan have been met (e.g., the minimum breeding pairs), other key metrics, such as the fledgling-to-breeding pair ratio, remain variable. While there have been over 1,200 minimum breeding pairs every year since 1988, none of these years had a statewide fledgling to pair ratio of at least 1.0 (from 1988-2016, the average minimum fledgling-to-breeding pair ratio was 0.43). In 2018 and 2019, none of the regions met a minimum fledgling-to-breeding pair ratio of 1.0 and the reduction from recent years highlights a continuing trend of decline in the species throughout the state.

Acknowledgments

I thankfully acknowledge co-authors Corey Clatterbuck, who provided a new statistical analysis, and Kyle Rice, who assisted with manuscript review and preparation, and appendices preparation. A thank you to Dr. Rebecca Lewison with San Diego State University for providing graduate work guidance for the statistical analysis. Thank you to Stéphane Vernhet, Natasha Rodriguez, and Camilla Estes for their assistance with editing the data reporting spreadsheets to ensure quality assurance and summarizing the mortality data. And all the site monitors, predator control crews and managers who contributed to the 2018-19 management and monitoring effort to recover the California least tern. We are also grateful to Eduardo Palacios and other Mexican monitors for the inclusion of data from Mexico and a mahalo to Scott Waddington, Patricia Baird, and the staff at Kohana'iki for the inclusion of data from the Island of Hawai'i.

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Appendix 1A – 2018 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Grid System	Vegetation Management	Predator Management	Other Site Prep	Entity
Napa Sonoma Marsh Wildlife Area - Green Island Unit	4	No	1	Yes/Paint Pen	Yes/5 Ceramic Roof tile, 12 Drift wood pieces washed up, 5 other debris pieces	No	No	3	3	None	CDFW
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	4	No	1	Yes/Paint Pen	No	No	No	6	3	None	CDFW
Montezuma Wetlands - 12A	4	No	3	Yes	7 wood A-frame, 5 full-round roof tiles and 6 half-round roof tiles	Yes/9	No	3	3	none	
Montezuma Wetlands - 12B	4	No	3	Yes	No	No	No	6	3	none	
Montezuma Wetlands - 3/4C	4	No	3	Yes	6 A-frame wood, 3 full-round roof tiles and 5 half-round roof tiles	Yes/3	No	3	3	none	

Appendix 1A – 2018 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Grid System	Vegetation Management	Predator Management	Other Site Prep	Entity
Alameda Point	1	No	3	Yes/each nest marker is a 3-inch metal washer placed upright into plaster of paris base; all painted white; nest number written on both sides of washer with black paint pen.	Yes/ approx. 1030 roof tiles and wooden A-frames (combined) and several thousand oyster shells distributed evenly throughout colony.	No	Yes/ 9.7 acres comprised of 99 grids (each grid is 20m x 20m)	4	1 & 2	grading of sand substrate; replacing plastic chick fencing annually; resetting grid, shelters and oyster shells on sand after sand grading; reinforcing low ends of fence to prevent sand from draining out after rains.	FWS staff, volunteers and VA contractors
Hayward Regional Shoreline	4	Yes	1	Yes	Yes/26	Yes/12	Yes/10 m grid cells	2 & 3	2	See Notes 1	See Notes 2
Eden Landing Ecological Reserve	4	No	3	No	No	No	No	5	1		
Oceano Dunes SVRA	1 (34 nests), 3 (1 nest)	Yes	3	Yes/most nests typically marked 30-40 ft. east and west with color-coded bamboo stick	No/cut branches and driftwood are distributed in nesting area	No	No	5; least tern breeding site open to off-road vehicle use October to February and this prevents or removes most vegetation.	1 and 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)

Appendix 1A – 2018 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Grid System	Vegetation Management	Predator Management	Other Site Prep	Entity
Vandenberg AFB - Purisima Point	1	Yes	3	Yes/tongue depressor	Yes/36 V-shaped wooden, 35 teepee snow-fence style, 24 white PVC pipe cut in half	No	No	7	2	Electric Fence Maintenance	Mantech
Santa Clara River/McGrath State Beach	3	Yes	1	Yes	No	No	No	7	3	None	NA
Hollywood Beach	1	Yes	1	Yes	No	No	No	7	3		
Ormond Beach	3	Yes	1	Yes/naturally occurring driftwood, numbered	No	No	No	6/7	3		
Point Mugu - Holiday Beach	4	Yes	3	Yes/tongue depressors	Yes/25 shelters	No	No	7	1, 2	NO	
Point Mugu - Holiday Salt Panne	4	Yes	3	Yes/tongue depressors	No	No	No	7	1, 2	NO	
Point Mugu - Eastern Arm	4	Yes	3	Yes/tongue depressors	No	No	No	7	1, 2	NO	
Point Mugu - Ormond Beach East	4	Yes	3	Yes/tongue depressors	Yes/50 shelters	No	No	7	1, 2	NO	
Saticoy United Water Conservation District	3/4	No	3		No	No	No	4/5/6	3	N/A	N/A
Malibu Lagoon	3	Yes	1	No	No	No	No	2	3		State Parks

Appendix 1A – 2018 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Grid System	Vegetation Management	Predator Management	Other Site Prep	Entity
Venice Beach/Marina Del Rey	1	Yes	1	No	No	No	Yes	2	3		Los Angeles Audubon Greenhouse
LA Harbor – Pier 400	1	No	3	Yes/"popsicle" sticks marked with nest number	Yes/40	No	Yes	4	2		Quality Sprayers Inc.
Seal Beach NWR - Anaheim Bay	1	Yes	1	Yes	Yes	No	Yes	4	3	Herbicide Ranger Pro used. Windscreen in chainlink fence repaired. New battery for solar panels for electric fence.	Rick Nye, Manager, SBNWR
Bolsa Chica Ecological Reserve – Nest Site 1 North	2	Yes	1	Yes/tongue depressor	40	Yes/12	Yes/20 mX20m	4	2		
Bolsa Chica Ecological Reserve – Nest Site 1 South	2	No	1	Yes/tongue depressor	8	No	Yes/20 mX20m	4	2		
Bolsa Chica Ecological Reserve – Nest Site 2	4	No	1	Yes/tongue depressor	12	No	Yes/20 mX20m	4	2		

Appendix 1A – 2018 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Grid System	Vegetation Management	Predator Management	Other Site Prep	Entity
Bolsa Chica Ecological Reserve – Nest Site 3	1	No	1	Yes/tongue depressor	20	No	Yes/20 mX20m	4	2		
Bolsa Chica Ecological Reserve – South Tern Island	4	No	1	Yes/tongue depressor or numbered shells	20	No	Yes/20 mX20m	4	2		
Huntington Beach	1, 2	Yes	1	Yes/tongue depressors	Yes/40	No	Yes/25m	4	1		CA State Parks
Burriss Sand Pit/Burriss Basin	4	No	1	Yes/Rock painted white	Yes/Dozen but Not used	No	No	2	3		
Upper Newport Bay Ecological Reserve	4	Yes	1	Yes	Yes/	No	Yes/	2,3	1		
MCB Camp Pendleton – Red Beach	4	No	1	Yes/green paint stick	No	No	No	6	2		
MCB Camp Pendleton – White Beach	3	Yes	1	Yes/green paint stick	No	Yes/74	Yes/30X30	4	2		
MCB Camp Pendleton – Blue Beach	2	Yes	1	Yes/green or brown paint stick	No	No	Yes/30X30	4	2		
MCB Camp Pendleton – Salt Flats	3	Yes	1	Yes/green paint stick	No	No	Yes/30X30	6	2		
Batiquitos Lagoon Ecological Reserve - E1	1	Yes	1	Yes/tongue depressor	Yes / roofing tiles	No	Yes	4	1		

Appendix 1A – 2018 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Grid System	Vegetation Management	Predator Management	Other Site Prep	Entity
Batiquitos Lagoon Ecological Reserve - W1	1	Yes	1	Yes/tongue depressor	Yes / roofing tiles	No	Yes	4	1		
Batiquitos Lagoon Ecological Reserve - W2	1	Yes	1	Yes/tongue depressor	Yes / roofing tiles	No	Yes	4	1		
San Elijo Lagoon Ecological Reserve	3	Yes	3	Yes/tongue depressor (if nesting)	No	No	No	6	3	On-going construction and restoration activity throughout the lagoon	
Mission Bay - FAA Island	1 (island)	Yes	1	Yes	Yes	Yes	Yes/10 m	2,3	3		
Mission Bay - Mariner's Point	1	Yes	1	Yes/tongue depressor	Yes/50	Yes/23	Yes/128 000 sq meters/ squares 400 sq meters	2	1	set up grid system, decoys, chick shelters, chick fence repairs, erosion damage repair	San Diego Audubon Society volunteers/ City of San Diego Park and Recreation Dept
Mission Bay - North Fiesta Island	1	Yes	1	Yes/Tongue Depressor	Yes	Yes	Yes	1,2,3,4	1		
Mission Bay - Stony Point	1	Yes	1	Yes	Yes	Yes	Yes	1	1	gopher removal	City of SD

Appendix 1A – 2018 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Grid System	Vegetation Management	Predator Management	Other Site Prep	Entity
Lindbergh Field/Former Naval Training Center	2	Yes	1	Yes/nest number spray-painted on substrate 1m to S	No	No	Yes/30m	4	1 mammals & corvids/2 raptors		site prep by SDCRAA staff & ZSSD contractors; monitoring by ZSSD contractors; pred control by USDA WS
Naval Base Coronado - NABON	4	No	1	Yes/green tongue depressor	No	No	Yes/30m x variable	7	1/2		
Naval Base Coronado - NABOS	3	Yes	1	Yes/green tongue depressor	No	No	Yes/30m x variable	2	1/2		
Naval Base Coronado – Delta Beach North	1	Yes	1	Yes/3 inch high PVC ring, painted green/sand colors	Yes/100 to 200	No	Yes/30m x 30m	4	1/2		
Naval Base Coronado – Delta Beach South	1	Yes	1	Yes/3 inch high PVC ring, painted green/sand colors	Yes/100 to 200	No	Yes/30m x 30m	4	1/2		
US Navy - NI-MAT	1	Yes	1	No/gps only	No	No	Yes/30m x 30m	4	1/2		

Appendix 1A – 2018 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Grid System	Vegetation Management	Predator Management	Other Site Prep	Entity
D Street Fill/ Sweetwater Marsh NWR	3	Yes	1	Yes/tongue depressor	Yes/roofing tiles/174	Yes/60	Yes/30 m	4	1 mammals & corvids/2 raptors	herbicide invasive plant sp., mechanically scrape & manually weed to reduce vegetation, prune potential raptor perches	site prep by USFWS, SD Port staff & contractors; monitoring by Port contractor; pred control by USDA WS
Chula Vista Wildlife Reserve	3	Yes	1	Yes/tongue depressors	Yes/44/roofing tile	Yes/60	Yes/30 m	4	1 mammals & corvids/2 raptors	herbicide treatment and mechanical scraping on portions of the site, manual weeding	site prep by ZSSD contractor; pred control by USDA WS
South San Diego Bay Unit, SDNWR/Saltworks	3	No	1	Yes/tongue depressor	Yes/10/roofing tile	No	No	6	1 mammal/2 avian		monitoring by NWR contractors, predator control by USDA WS
Tijuana Estuary NERR - Tijuana North	3	Yes	1	Yes/tongue depressors	Yes/41	No	Yes/30 m	7	1 mammals & corvids/2 raptors		pred control by USDA WS
Tijuana Estuary NERR – Tijuana South	3	Yes	1	Yes/tongue depressors	Yes/49	No	Yes/30 m	7	1 mammals & corvids/2 raptors		pred control by USDA WS

Appendix 1A – 2018 Site Preparation

Appendix 1A Legend:

Note: Information imported directly from "Site Info" tab of 2018 reporting spreadsheet. Blank cells indicate that no data was provided, or information is unknown.

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.

Site Type: 1 - Sites where monitors walk within the colony, mark nests, and count nest contents; 2 - Sites where terns are observed primarily from outside the colony; 3 - Sites where monitors primarily observed from outside but entered the colony for sampling more frequently than once per month or more than 5 times during the season when active nests or chicks were present.

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

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

Appendix 1B – 2019 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Vegetation Management	Predator Management	Other Site Prep
Napa Sonoma Marsh Wildlife Area - Green Island Unit	4	No	1	Yes	Yes – Roof tiles, woody debris	No	2/3	3	
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	4	No	1	Yes	Yes – Roof tiles, woody debris	No	2/3	3	
Montezuma Wetlands - 12A	4	No	3	Yes	No	Yes	4	4	Veg management included both weed whacking and spraying with Polaris (pre-emergent) and Aquamaster (post-emergent).
Montezuma Wetlands - 14A	3	No	3	Yes	No	No	7	4	14A was an unexpected new nesting site in an area with active cattle grazing. We had cattle removed and then fencing was installed on two sides to keep cattle out - fencing would not exclude other local predators. No other prep or management - it had been an active construction site the previous winter, so terns used bare areas for nesting. Vegetation management was not needed this year.

Appendix 1B – 2019 Site Preparation

Site Name	Fence Type	Interpretive Signs a Site	Site Type	Nest Marking	Chick Shelters	Decoys	Vegetation Management	Predator Management	Other Site Prep
Montezuma Wetlands - 3/4C	4	No	3	Yes	No	Yes	3	4	Veg management included only spraying with Polaris and Aquamaster
Alameda Point	1	No	1	Yes	Yes – Roof tiles and wooden A-frames	No	4	3	grading of sand substrate; replacing plastic chick fencing annually; resetting grid, shelters and oyster shells on sand after sand grading; reinforcing low ends of fence to prevent sand from draining out after rains.
Hayward Regional Shoreline	4	Yes	1	Yes	Yes – Roof tiles	Yes	4	3	
Eden Landing Ecological Reserve - E12	4	No	1	No	No	No	7	3	
Eden Landing Ecological Reserve - E14	4	No	1	Yes	Yes – Roof tiles	No	5	3	Pond flooded during winter to prevent vegetative growth
Eden Landing Ecological Reserve - E6A									
Oceano Dunes SVRA	1	Yes	3	Yes, most nests typically marked 40-45 ft. east and west with color-coded bamboo stick	No	No	5; least tern breeding site open to off-road vehicle use October to February and this prevents or removes vegetation.	3	Limited amounts of driftwood and woodchips were put out for nest and chick cover.

Appendix 1B – 2019 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Vegetation Management	Predator Management	Other Site Prep
Rancho Guadalupe Dunes Preserve	3	Yes	3	No	No	No	7	4	None
Vandenberg AFB - Purisima Point	1	Yes	3	Yes	Yes – V-shaped wooden, teepee style wooden, white PVC pipe cut in half	No	7	2	
Hollywood Beach	1	Yes	3	Yes	No	No	7	4	Add natural cover such as driftwood, palm leaves
Ormond Beach - North	1	Yes	1	Yes	No	No	6	4	
Ormond Beach - South	1	Yes	1	Yes	No	No	6	4	
Point Mugu - Eastern Arm	4	Yes	3	Yes	No	No	7	3	
Point Mugu - Holiday Beach	4	Yes	3	Yes	Yes – Roof tiles	No	7	3	
Point Mugu - Holiday Salt Panne	4	Yes	3	Yes	No	No	7	3	
Point Mugu - Ormond Beach East	4	Yes	3	Yes	Yes – Roof tiles	No	7	3	
Saticoy United Water Conservation District	3/4	No	3	No	No	No	4/5/6	4	
Malibu Lagoon	3	Yes	1	No	No	No	6	4	
Venice Beach/Marina Del Rey	1	Yes	1	Yes	Yes – Roof tiles	Yes	2	4	Predator aversion
LA Harbor – Pier 400	2	Yes	1	Yes	Yes – Roof tiles	Yes	1/3	3	fenced to riprap only
NAVWPNSTA Seal Beach W8	4	No	1	No	No	No	7	4	
Seal Beach NWR - Anaheim Bay	1	Yes	1	Yes	Yes – Roof tiles	Yes	4	3	
Bolsa Chica Ecological Reserve - Nest Site 1 North	2	Yes	1	Yes	Yes – Roof tiles	Yes	2/3	4	
Bolsa Chica Ecological Reserve – Nest Site 1 South	2	No	1	Yes	Yes – Roof tiles	No	2/3	4	

Appendix 1B – 2019 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Vegetation Management	Predator Management	Other Site Prep
Bolsa Chica Ecological Reserve – Nest Site 2	4	No	1	Yes	Yes – Roof tiles	No	2/3	4	
Bolsa Chica Ecological Reserve – Nest Site 3	4	No	1	Yes	Yes – Roof tiles	No	2/3	4	
Bolsa Chica Ecological Reserve – South Tern Island	1	No	1	Yes	Yes – Roof tiles	No	2/3	4	
Huntington Beach	2	Yes	1	Yes	Yes – Roof tiles	No	1	1	
Burriss Sand Pit/Burriss Basin	4	No	1	Yes	Yes – Roof tiles	No	2	4	
Upper Newport Bay Ecological Reserve	4	Yes	2	No	Yes – Roof tiles	Yes	4	4	
MCB Camp Pendleton - Blue Beach	3	Yes	1	Yes	No	No	4	2	
MCB Camp Pendleton - Salt Flats	3	No	1	Yes	No	No	7	2	
MCB Camp Pendleton - White Beach	3	Yes	1	Yes	No	Yes	4	2	
Batiquitos Lagoon Ecological Reserve - E1	1	Yes	1	Yes	Yes – Roof tiles	No	2	2	
Batiquitos Lagoon Ecological Reserve - W1	1	Yes	1	Yes	Yes – Roof tiles	No	2	2	
Batiquitos Lagoon Ecological Reserve - W2	1	Yes	1	Yes	Yes – Roof tiles	No	2	2	Productivity plots. Nests were monitored in these plots for the entire season, the outside of the plots monitored 6 weeks in May/June

Appendix 1B – 2019 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Vegetation Management	Predator Management	Other Site Prep
San Elijo Lagoon Ecological Reserve - Cardiff SB and West Basin	3	Yes	3	Yes	No	No	7	4	As part of the on-going large-scale lagoon restoration project Wildlife Innovations was available for predator management if nesting occurred
San Elijo Lagoon Ecological Reserve – East Basin Saltpanne	3	Yes	3	Yes	No	No	7	4	As part of the on-going large-scale lagoon restoration project Wildlife Innovations was available for predator management if nesting occurred
Mission Bay - FAA Island	1	Yes	1	Yes	Yes – Roof tiles	Yes	2/3	2	Site prep by Audubon
Mission Bay - Mariner's Point	1	Yes	1	Yes	Yes – Roof tiles	Yes	2/3	2	Site prep by Audubon
Mission Bay - North Fiesta Island	1	Yes	1	Yes	Yes – Roof tiles	Yes	2/3	1	
Mission Bay - Stony Point	1	Yes	1	Yes	Yes – Roof tiles	Yes	2/3	1	
Lindbergh Field/Former Naval Training Center	2	Yes	1	Yes	No	No	4	3	
Naval Base Coronado – Delta Beach North	1	No	1	Yes	Yes – Wooden A-frame	No	4	3	
Naval Base Coronado – Delta Beach South	1	Yes	1	Yes	Yes – Wooden A-frame	No	4	3	Sand supplementation on a 60m x 90m area
Naval Base Coronado - NABON	4	No	1	Yes	No	No	7	3	
Naval Base Coronado - NABOS	3	Yes	1	Yes	No	No	7	3	

Appendix 1B – 2019 Site Preparation

Site Name	Fence Type	Interpretive Signs at Site	Site Type	Nest Marking	Chick Shelters	Decoys	Vegetation Management	Predator Management	Other Site Prep
US Navy - NI-ALT	1	No	1	Yes	No	Yes	4	3	
US Navy - NI-MAT	1	Yes	1	No	Yes – Wooden A- frame	No	4	3	
US Navy – NIA18	4	No	3	Yes	No	No	7	4	
D Street Fill/ Sweetwater Marsh NWR	3	Yes	1	Yes	Yes – Roof tiles	Yes	4	3	
Chula Vista Wildlife Reserve	3	Yes	1	Yes	Yes – Roof tiles	Yes	4	3	
South San Diego Bay Unit, SDNWR/Saltworks	3	Yes	1	Yes	Yes – Roof tiles	No	7	3	
Tijuana Estuary NERR - Tijuana North	3	Yes	1	Yes	No	No	7	3	
Tijuana Estuary NERR – Tijuana South	3	Yes	1	Yes	No	No	7	3	

Appendix 1B Legend:

Note: Information imported directly from "Site Info" tab of 2019 reporting spreadsheet. Blank cells indicate that no data was provided, or information is unknown.

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.

Site Type: 1 - Sites where monitors walk within the colony, mark nests, and count nest contents; 2 - Sites where terns are observed primarily from outside the colony; 3 - Sites where monitors primarily observed from outside, but entered the colony for sampling more frequently than once per month or more than 5 times during the season when active nests or chicks were present.

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

Predator management: 1 - Proactive predator removal; 2 - Reactive predator removal; 3 - Combination of 1 and 2; 4 - None.

Appendix 2A – 2018 Pair Estimation (Method I)

Site Name	Date of First Nest Found	Date of Last Nest Found	Total Nests in First Wave (Prior to June 15)	Total Nests in Second Wave (June 15 or After)	Total Nests	Total Pairs
Napa Sonoma Marsh Wildlife Area - Green Island Unit	2018-05-29	2018-06-04	7	0	7	7
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	2018-05-31	2018-06-15	19	2	21	20
Montezuma Wetlands - 12A	2018-06-03	2018-06-19	7	1	8	7
Montezuma Wetlands - 12B	2018-07-09	2018-07-09	0	4	4	2
Montezuma Wetlands - 3/4C	2018-05-27	2018-06-23	3	3	6	4
Alameda Point	2018-05-18	2018-07-24	246	129	375	310
Hayward Regional Shoreline	2018-05-14	2018-07-02	20	12	32	26
Eden Landing Ecological Reserve	2018-05-14	2018-07-18	50	91	141	95
Oceano Dunes SVRA	2018-05-28	2018-06-29	20	15	35	27
Vandenberg AFB - Purisima Point	2018-05-29	2018-07-13	55	28	83	69
Santa Clara River/McGrath State Beach	2018-06-13	2018-07-24	4	20	24	14
Hollywood Beach	NA	NA	0	0	0	0
Ormond Beach	2018-05-30	2018-07-12	51	33	84	67
Point Mugu - Eastern Arm	2018-05-30	2018-06-05	3	0	3	3
Point Mugu - Holiday Beach	2018-05-14	2018-07-03	38	20	58	48
Point Mugu - Holiday Salt Panne	2018-05-17	2018-06-18	9	3	12	10
Point Mugu - Ormond Beach East	2018-05-17	2018-07-19	178	40	218	198
Saticoy United Water Conservation District	NA	NA	0	0	0	0
Malibu Lagoon	2018-05-17	2018-07-11	3	3	6	4
Venice Beach/Marina Del Rey	2018-05-31	2018-07-05	4	1	5	4
LA Harbor – Pier 400	2018-05-12	2018-07-07	101	32	133	117
Seal Beach NWR - Anaheim Bay	2018-05-16	2018-07-01	114	3	117	115
Bolsa Chica Ecological Reserve – Nest Site 1 North	2018-05-15	2018-07-10	41	13	54	47
Bolsa Chica Ecological Reserve – Nest Site 1 South	2018-05-22	2018-06-12	12	0	12	12
Bolsa Chica Ecological Reserve – Nest Site 2	2018-05-15	2018-06-12	47	0	47	47
Bolsa Chica Ecological Reserve – Nest Site 3	2018-05-22	2018-05-29	7	0	7	7
Bolsa Chica Ecological Reserve – South Tern Island	2018-05-15	2018-06-26	12	1	13	12
Huntington Beach	2018-05-04	2018-07-17	572	116	688	630
Burriss Sand Pit/Burriss Basin	2018-05-29	2018-07-03	13	3	16	14
Upper Newport Bay Ecological Reserve	2018-05-18	2018-07-06	15	7	22	18
MCB Camp Pendleton – Blue Beach	2018-05-09	2018-06-22	256	22	278	267
MCB Camp Pendleton – Red Beach	2018-05-29	2018-05-29	1	0	1	1

Appendix 2A – 2018 Pair Estimation (Method I)

Site Name	Date of First Nest Found	Date of Last Nest Found	Total Nests in First Wave (Prior to June 15)	Total Nests in Second Wave (June 15 or After)	Total Nests	Total Pairs
MCB Camp Pendleton – Salt Flats	2018-05-22	2018-06-01	3	1	4	3
MCB Camp Pendleton – White Beach	2018-05-15	2018-06-16	50	1	51	50
Batiquitos Lagoon Ecological Reserve - E1	2018-05-15	2018-06-19	67	2	69	68
Batiquitos Lagoon Ecological Reserve - W1	2018-05-15	2018-06-19	64	1	65	64
Batiquitos Lagoon Ecological Reserve - W2	2018-05-10	2018-06-26	534	16	550	542
San Elijo Lagoon Ecological Reserve	NA	NA	0	0	0	0
Mission Bay - FAA Island	2018-05-02	2018-05-18	12	0	12	12
Mission Bay - Mariner's Point	2018-05-04	2018-06-20	177	1	178	177
Mission Bay - North Fiesta Island	2018-05-28	2018-05-28	1	0	1	1
Mission Bay - Stony Point	2018-05-21	2018-06-23	10	1	11	10
Lindbergh Field/Former Naval Training Center	2018-05-08	2018-05-22	19	0	19	19
Naval Base Coronado – Delta Beach North	2018-05-04	2018-06-26	114	3	117	115
Naval Base Coronado – Delta Beach South	2018-05-07	2018-06-28	133	2	135	134
Naval Base Coronado - NABON	2018-05-01	2018-07-06	278	10	288	283
Naval Base Coronado - NABOS	2018-05-03	2018-06-28	280	7	287	283
US Navy - NI-MAT	2018-05-15	2018-06-15	15	1	16	15
D Street Fill/ Sweetwater Marsh NWR	2018-05-08	2018-06-19	107	2	109	108
Chula Vista Wildlife Reserve	2018-05-12	2018-06-19	81	2	83	82
South San Diego Bay Unit, SDNWR/Saltworks	2018-05-09	2018-06-27	31	2	33	32
Tijuana Estuary NERR - Tijuana North	2018-05-10	2018-06-14	117	3	120	118
Tijuana Estuary NERR – Tijuana South	2018-05-17	2018-06-28	67	4	71	69

Appendix 2A Legend:

NA: Indicates no terns were detected at the subsite during the breeding season.

Appendix 2B – 2019 Pair Estimation (Method I)

Site Name	Date of First Nest Found	Date of Last Nest Found	Total Nests in First Wave (Prior to June 15)	Total Nests in Second Wave (June 15 or After)	Total Nests	Total Pairs
Napa Sonoma Marsh Wildlife Area - Green Island Unit	2019-05-20	2019-06-08	1	2	3	2
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	NA	NA	0	0	0	0
Montezuma Wetlands - 12A	2019-06-02	2019-06-15	2	0	2	2
Montezuma Wetlands - 14A	2019-06-14	2019-07-31	1	9	10	5
Montezuma Wetlands - 3/4C	2019-05-23	2019-07-01	2	1	3	2
Alameda Point	2019-06-04	2019-07-16	136	209	345	240
Hayward Regional Shoreline	2019-05-13	2019-07-12	32	24	56	44
Eden Landing Ecological Reserve - E12	2019-06-03	2019-07-15	3	17	20	11
Eden Landing Ecological Reserve - E14	2019-06-03	2019-07-22	19	82	101	60
Eden Landing Ecological Reserve - E6A	NA	NA	0	0	0	0
Oceano Dunes SVRA	2019-05-23	2019-06-30	28	6	34	31
Rancho Guadalupe Dunes Preserve	2019-06-04	2019-07-30	10	7	17	13
Vandenberg AFB - Purisima Point	2019-05-31	2019-07-09	41	6	47	44
Hollywood Beach	NA	NA	0	0	0	0
Ormond Beach - North	2019-05-21	2019-07-10	70	21	91	80
Ormond Beach - South	2019-07-06	2019-07-06	0	1	1	0
Point Mugu - Eastern Arm	NA	NA	0	0	0	0
Point Mugu - Holiday Beach	2019-05-20	2019-07-08	40	23	63	51
Point Mugu - Holiday Salt Panne	2019-06-13	2019-07-01	1	5	6	3
Point Mugu - Ormond Beach East	2019-05-20	2019-07-17	114	132	246	180
Saticoy United Water Conservation District	NA	NA	0	0	0	0
Malibu Lagoon	NA	NA	0	0	0	0
Venice Beach/Marina Del Rey	2019-05-08	2019-05-20	6	0	6	6
LA Harbor – Pier 400	2019-05-08	2019-07-17	124	75	199	161
NAVWPNSTA Seal Beach W8	2019-06-15	2019-06-26	0	2	2	1
Seal Beach NWR - Anaheim Bay	2019-05-15	2019-06-05	54	0	54	54
Bolsa Chica Ecological Reserve - Nest Site 1 North	2019-05-07	2019-07-09	7	26	33	20
Bolsa Chica Ecological Reserve – Nest Site 1 South	2019-06-04	2019-06-11	4	4	8	6
Bolsa Chica Ecological Reserve – Nest Site 2	2019-05-21	2019-07-02	20	54	74	47
Bolsa Chica Ecological Reserve – Nest Site 3	NA	NA	0	0	0	0
Bolsa Chica Ecological Reserve – South Tern Island	2019-05-14	2019-06-13	15	4	19	17
Huntington Beach	2019-05-07	2019-07-09	476	55	531	503

Appendix 2B – 2019 Pair Estimation (Method I)

Site Name	Date of First Nest Found*	Date of Last Nest Found*	Total Nests in First Wave (Prior to June 15)	Total Nests in Second Wave (June 15 or After)	Total Nests	Total Pairs
Burriss Sand Pit/Burriss Basin	2019-05-22	2019-07-09	12	5	17	14
Upper Newport Bay Ecological Reserve	2019-05-14	2019-06-14	20	0	20	20
MCB Camp Pendleton - Blue Beach	2019-05-02	2019-07-22	351	40	391	371
MCB Camp Pendleton - Salt Flats	2019-05-22	2019-05-22	2	0	2	2
MCB Camp Pendleton - White Beach	2019-05-07	2019-06-06	24	1	25	24
Batiquitos Lagoon Ecological Reserve - E1	2019-05-09	2019-06-20	69	2	71	70
Batiquitos Lagoon Ecological Reserve - W1	2019-05-08	2019-06-19	40	2	42	41
Batiquitos Lagoon Ecological Reserve - W2	2019-05-08	2019-06-26	387	48	435	411
San Elijo Lagoon Ecological Reserve - Cardiff SB and West Basin	NA	NA	0	0	0	0
San Elijo Lagoon Ecological Reserve – East Basin Saltpanne	NA	NA	0	0	0	0
Mission Bay - FAA Island	2019-05-09	2019-07-12	35	4	39	37
Mission Bay - Mariner's Point	2019-05-04	2019-08-02	133	26	159	146
Mission Bay - North Fiesta Island	2019-06-10	2019-07-01	1	1	2	1
Mission Bay - Stony Point	2019-05-09	2019-05-09	1	0	1	1
Lindbergh Field/Former Naval Training Center	2019-05-09	2019-07-03	15	4	19	17
Naval Base Coronado – Delta Beach North	2019-05-03	2019-07-16	80	47	127	103
Naval Base Coronado – Delta Beach South	2019-05-06	2019-07-16	77	52	129	103
Naval Base Coronado - NABON	2019-05-03	2019-07-22	255	145	400	327
Naval Base Coronado - NABOS	2019-05-02	2019-07-11	146	126	272	209
US Navy - NI-ALT	NA	NA	0	0	0	0
US Navy - NI-MAT	2019-06-11	2019-06-10	2	0	2	2
US Navy - NIA18	2019-06-07	2019-06-17	1	1	2	1
D Street Fill/ Sweetwater Marsh NWR	2019-05-01	2019-07-06	50	54	104	77
Chula Vista Wildlife Reserve	2019-05-07	2019-07-06	36	30	66	51
South San Diego Bay Unit, SDNWR/Saltworks	2019-05-09	2019-07-03	18	21	39	28
Tijuana Estuary NERR - Tijuana North	2019-05-09	2019-07-18	10	30	40	25
Tijuana Estuary NERR – Tijuana South	2019-05-15	2019-07-11	34	76	110	72

Appendix 2B Legend:

NA: Indicates no terns were detected at the subsite during the breeding season.

Appendix 3A – 2018 Pair Estimation (Method II)

Site Name	Number of Nests	Number of Unsuccessful Nests + Brood Loss Prior to June 20	Date of Second Wave (if reported)	Total Pairs
Napa Sonoma Marsh Wildlife Area - Green Island Unit	7	7		0
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	21	19		2
Montezuma Wetlands - 12A	8	1		7
Montezuma Wetlands - 12B	4	0		4
Montezuma Wetlands - 3/4C	6	1	19-Jun-18	5
Alameda Point	375	27	16-Jun-18	348
Hayward Regional Shoreline	32	6	15-Jun-18	26
Eden Landing Ecological Reserve	141	36		105
Oceano Dunes SVRA	35	4		31
Vandenberg AFB - Purisima Point	83	34	25-Jun-18	49
Santa Clara River/McGrath State Beach	24	1		23
Hollywood Beach	0	0		0
Ormond Beach	84	0		84
Point Mugu – Eastern Arm	3	3		0
Point Mugu – Holiday Beach	58	19	11-Jun-18	39
Point Mugu – Holiday Salt Panne	12	5	11-Jun-18	7
Point Mugu – Ormond Beach East	218	92	11-Jun-18	126
Saticoy United Water Conservation District	0	0		0
Malibu Lagoon	6	3	28-Jun-18	3
Venice Beach/Marina Del Rey	5	3		2
LA Harbor – Pier 400	133	28		105
Seal Beach NWR – Anaheim Bay	117	0	15-Jun-18	117
Bolsa Chica Ecological Reserve – Nest Site 1 North	54	2		52
Bolsa Chica Ecological Reserve – Nest Site 1 South	12	3		9
Bolsa Chica Ecological Reserve – Nest Site 2	47	4		43
Bolsa Chica Ecological Reserve – Nest Site 3	7	0		7
Bolsa Chica Ecological Reserve – South Tern Island	13	1		12
Huntington Beach	688	94	12-Jun-18	594
Burris Sand Pit/Burris Basin	16	2		14
Upper Newport Bay Ecological Reserve	22	3		19
MCB Camp Pendleton – Blue Beach	278	243		35

Appendix 3A – 2018 Pair Estimation (Method II)

Site Name	Number of Nests	Number of Unsuccessful Nests + Brood Loss Prior to June 20	Date of Second Wave (if reported)	Total Pairs
MCB Camp Pendleton – Red Beach	1	1		0
MCB Camp Pendleton – Salt Flats	4	3		1
MCB Camp Pendleton – White Beach	51	44		7
Batiquitos Lagoon Ecological Reserve - E1	69	2		67
Batiquitos Lagoon Ecological Reserve - W1	65	6		59
Batiquitos Lagoon Ecological Reserve - W2	550	9		541
San Elijo Lagoon Ecological Reserve	0	0		0
Mission Bay - FAA Island	12	12		0
Mission Bay - Mariner's Point	178	14		164
Mission Bay - North Fiesta Island	1	1		0
Mission Bay - Stony Point	11	1	6-Jun-18	10
Lindbergh Field/Former Naval Training Center	19	5		14
Naval Base Coronado – Delta Beach North	117	11		106
Naval Base Coronado – Delta Beach South	135	8		127
Naval Base Coronado - NABON	288	44		244
Naval Base Coronado - NABOS	287	20		267
US Navy - NI-MAT	16	4		12
D Street Fill/ Sweetwater Marsh NWR	109	14	19-Jun-18	95
Chula Vista Wildlife Reserve	83	7		76
South San Diego Bay Unit, SDNWR/Saltworks	33	6		27
Tijuana Estuary NERR - Tijuana North	120	8	21-Jun-18	112
Tijuana Estuary NERR – Tijuana South	71	2	21-Jun-18	69

Appendix 3A Legend:

Blank Cells: Date of second wave was not reported.

Appendix 3B – 2019 Pair Estimation (Method II)

Site Name	Number of Nests	Number of Unsuccessful Nests + Brood Loss Prior to June 20	Total Pairs
Napa Sonoma Marsh Wildlife Area - Green Island Unit	3	1	2
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	0	0	0
Montezuma Wetlands - 12A	2	2	0
Montezuma Wetlands - 14A	10	0	10
Montezuma Wetlands - 3/4C	3	1	2
Alameda Point	345	11	334
Hayward Regional Shoreline	56	2	54
Eden Landing Ecological Reserve - E12	20	0	20
Eden Landing Ecological Reserve - E14	101	1	100
Eden Landing Ecological Reserve - E6A	0	0	0
Oceano Dunes SVRA	34	1	33
Rancho Guadalupe Dunes Preserve	17	0	17
Vandenberg AFB - Purisima Point	47	2	45
Hollywood Beach	0	0	0
Ormond Beach - North	91	6	85
Ormond Beach - South	1	0	1
Point Mugu - Eastern Arm	0	0	0
Point Mugu - Holiday Beach	63	27	36
Point Mugu - Holiday Salt Panne	6	0	6
Point Mugu - Ormond Beach East	246	7	239
Saticoy United Water Conservation District	0	0	0
Malibu Lagoon	0	0	0
Venice Beach/Marina Del Rey	6	6	0
LA Harbor – Pier 400	199	15	184
NAVWPNSTA Seal Beach W8	2	0	2
Seal Beach NWR - Anaheim Bay	54	54	0
Bolsa Chica Ecological Reserve - Nest Site 1 North	33	4	29
Bolsa Chica Ecological Reserve – Nest Site 1 South	8	0	8
Bolsa Chica Ecological Reserve – Nest Site 2	74	15	59
Bolsa Chica Ecological Reserve – Nest Site 3	0	0	0
Bolsa Chica Ecological Reserve – South Tern Island	19	17	2

Appendix 3B – 2019 Pair Estimation (Method II)

Site Name	Number of Nests	Number of Unsuccessful Nests + Brood Loss Prior to June 20	Total Pairs
Huntington Beach	531	79	452
Burris Sand Pit/Burris Basin	17	0	17
Upper Newport Bay Ecological Reserve	20	0	20
MCB Camp Pendleton - Blue Beach	391	329	62
MCB Camp Pendleton - Salt Flats	2	2	0
MCB Camp Pendleton - White Beach	25	25	0
Batiquitos Lagoon Ecological Reserve - E1	71	24	47
Batiquitos Lagoon Ecological Reserve - W1	42	21	21
Batiquitos Lagoon Ecological Reserve - W2	435	22	413
San Elijo Lagoon Ecological Reserve - Cardiff SB and West Basin	0	0	0
San Elijo Lagoon Ecological Reserve – East Basin Saltpanne	0	0	0
Mission Bay - FAA Island	39	28	11
Mission Bay - Mariner's Point	159	36	123
Mission Bay - North Fiesta Island	2	0	2
Mission Bay - Stony Point	1	1	0
Lindbergh Field/Former Naval Training Center	19	6	13
Naval Base Coronado – Delta Beach North	127	26	101
Naval Base Coronado – Delta Beach South	129	33	96
Naval Base Coronado - NABON	400	96	304
Naval Base Coronado - NABOS	272	57	215
US Navy - NI-ALT	0	0	0
US Navy - NI-MAT	2	0	2
US Navy - NIA18	2	0	2
D Street Fill/ Sweetwater Marsh NWR	104	18	86
Chula Vista Wildlife Reserve	66	13	53
South San Diego Bay Unit, SDNWR/Saltworks	39	7	32
Tijuana Estuary NERR - Tijuana North	40	3	37
Tijuana Estuary NERR – Tijuana South	110	17	93

Appendix 3B Legend:

The 2019 data spreadsheet did not include date of second wave. June 20th used for all Method II total pair calculations.

Appendix 4A – 2018 Pair Estimation (Method III)

Site Name	Total First Wave Nests (Prior to June 15)	Estimated First Wave Renesters	Total First Wave Pairs	Total Second Wave Nests (June 15 or Later)	Estimated Second Wave Renesters	Total Second Wave Pairs	Total Pairs
Napa Sonoma Marsh Wildlife Area - Green Island Unit	7			0			
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	19			2			
Montezuma Wetlands - 12A	7	1	6	1	0	1	7
Montezuma Wetlands - 12B	0			4			
Montezuma Wetlands - 3/4C	3	1	2	3	1	2	4
Alameda Point	246	26	220	129	35	94	314
Hayward Regional Shoreline	20	0	20	12	12	0	20
Eden Landing Ecological Reserve	50			91			
Oceano Dunes SVRA	20			15			
Vandenberg AFB - Purisima Point	55	19	36	28	0	28	64
Santa Clara River/McGrath State Beach	4			20			
Hollywood Beach	0			0			
Ormond Beach	51			33			
Point Mugu - Eastern Arm	3			0			
Point Mugu - Holiday Beach	38	0	38	20	3	17	55
Point Mugu - Holiday Salt Panne	9			3			
Point Mugu - Ormond Beach East	178	0	178	40	15	25	203
Saticoy United Water Conservation District	0			0			
Malibu Lagoon	3			3			
Venice Beach/Marina Del Rey	4			1			
LA Harbor – Pier 400	97			36			
Seal Beach NWR - Anaheim Bay	114	3	111	3	0	3	114
Bolsa Chica Ecological Reserve – Nest Site 1 North	41			13			
Bolsa Chica Ecological Reserve – Nest Site 1 South	12			0			
Bolsa Chica Ecological Reserve – Nest Site 2	47			0			

Appendix 4A – 2018 Pair Estimation (Method III)

Site Name	Total First Wave Nests (Prior to June 15)	Estimated First Wave Renesters	Total First Wave Pairs	Total Second Wave Nests (June 15 or Later)	Estimated Second Wave Renesters	Total Second Wave Pairs	Total Pairs
Bolsa Chica Ecological Reserve – Nest Site 3	7			0			
Bolsa Chica Ecological Reserve – South Tern Island	12			1			
Huntington Beach	572	33	539	116	11	105	644
Burriss Sand Pit/Burriss Basin	13	2	11	3	0	3	14
Upper Newport Bay Ecological Reserve	15			7			
MCB Camp Pendleton – Blue Beach	256			22			
MCB Camp Pendleton – Red Beach	1			0			
MCB Camp Pendleton – Salt Flats	3			1			
MCB Camp Pendleton – White Beach	50			1			
Batiquitos Lagoon Ecological Reserve - E1	67			2			
Batiquitos Lagoon Ecological Reserve - W1	64			1			
Batiquitos Lagoon Ecological Reserve - W2	534			16			
San Elijo Lagoon Ecological Reserve	0			0			
Mission Bay - FAA Island	12	6	6	0	0	0	6
Mission Bay - Mariner's Point	177	40	137	1	0	1	138
Mission Bay - North Fiesta Island	1	1	0	0	0	0	0
Mission Bay - Stony Point	10	1	9	1	0	1	10
Lindbergh Field/Former Naval Training Center	19	3	16	0	0	0	16
Naval Base Coronado – Delta Beach North	114			3			
Naval Base Coronado – Delta Beach South	133			2			
Naval Base Coronado - NABON	278			10			
Naval Base Coronado - NABOS	280			7			
US Navy - NI-MAT	15			1			

Appendix 4A – 2018 Pair Estimation (Method III)

Site Name	Total First Wave Nests (Prior to June 15)	Estimated First Wave Renesters	Total First Wave Pairs	Total Second Wave Nests (June 15 or Later)	Estimated Second Wave Renesters	Total Second Wave Pairs	Total Pairs
D Street Fill/ Sweetwater Marsh NWR	107	7	100	2	2	0	100
Chula Vista Wildlife Reserve	81	1	80	2	1	1	81
South San Diego Bay Unit, SDNWR/Saltworks	31	0	31	2	2	0	31
Tijuana Estuary NERR - Tijuana North	117	0	117	3	3	0	117
Tijuana Estuary NERR – Tijuana South	67	1	66	4	4	0	66

Appendix 4A Legend:

Method III pairs only calculated for sites that provided renester data. If no renester data was provided, the cell(s) was left blank.

Appendix 4B – 2019 Pair Estimation (Method III)

Site Name	Total First Wave Nests (Prior to June 15)	Estimated First Wave Renesters	Total First Wave Pairs	Total Second Wave Nests (June 15 or Later)	Estimated Second Wave Renesters	Total Second Wave Pairs	Total Pairs
Napa Sonoma Marsh Wildlife Area - Green Island Unit	1	0	1	2	0	2	3
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	0			0			
Montezuma Wetlands - 12A	2			0			
Montezuma Wetlands - 14A	1			9			
Montezuma Wetlands - 3/4C	2			1			
Alameda Point	136			209			
Hayward Regional Shoreline	32			24			
Eden Landing Ecological Reserve - E12	3			17			
Eden Landing Ecological Reserve - E14	19			82			
Eden Landing Ecological Reserve - E6A	0			0			
Oceano Dunes SVRA	28			6			
Rancho Guadalupe Dunes Preserve	10	0	10	7	0	7	17
Vandenberg AFB - Purisima Point	41	0	41	6	4	2	43
Hollywood Beach	0			0			
Ormond Beach - North	70			21			
Ormond Beach - South	0			1			
Point Mugu - Eastern Arm	0			0			
Point Mugu - Holiday Beach	40			23			
Point Mugu - Holiday Salt Panne	1			5			
Point Mugu - Ormond Beach East	114			132			
Saticoy United Water Conservation District	0			0			
Malibu Lagoon	0			0			
Venice Beach/Marina Del Rey	6	0	6	0	0	0	6
LA Harbor – Pier 400	124	0	124	75	38	37	161
NAVWPNSTA Seal Beach W8	0			2			
Seal Beach NWR - Anaheim Bay	54			0			
Bolsa Chica Ecological Reserve - Nest Site 1 North	7			26			
Bolsa Chica Ecological Reserve – Nest Site 1 South	4			4			

Appendix 4B – 2019 Pair Estimation (Method III)

Site Name	Total First Wave Nests (Prior to June 15)	Estimated First Wave Renesters	Total First Wave Pairs	Total Second Wave Nests (June 15 or Later)	Estimated Second Wave Renesters	Total Second Wave Pairs	Total Pairs
Bolsa Chica Ecological Reserve – Nest Site 2	20			54			
Bolsa Chica Ecological Reserve – Nest Site 3	0			0			
Bolsa Chica Ecological Reserve – South Tern Island	15			4			
Huntington Beach	476			55			
Burris Sand Pit/Burris Basin	12	0	12	5	3	2	14
Upper Newport Bay Ecological Reserve	20			0			
MCB Camp Pendleton - Blue Beach	351			40			
MCB Camp Pendleton - Salt Flats	2			0			
MCB Camp Pendleton - White Beach	24			1			
Batiquitos Lagoon Ecological Reserve - E1	69			2			
Batiquitos Lagoon Ecological Reserve - W1	40			2			
Batiquitos Lagoon Ecological Reserve - W2	387			48			
San Elijo Lagoon Ecological Reserve - Cardiff SB and West Basin	0			0			
San Elijo Lagoon Ecological Reserve – East Basin Saltpanne	0			0			
Mission Bay - FAA Island	35	6	29	4	5	0	29
Mission Bay - Mariner's Point	133			26			
Mission Bay - North Fiesta Island	1			1			
Mission Bay - Stony Point	1			0			
Lindbergh Field/Former Naval Training Center	15			4			
Naval Base Coronado – Delta Beach North	80			47			
Naval Base Coronado – Delta Beach South	77			52			
Naval Base Coronado - NABON	255			145			
Naval Base Coronado - NABOS	146			126			
US Navy - NI-ALT	0			0			
US Navy - NI-MAT	2			0			
US Navy - NIA18	1			1			
D Street Fill/ Sweetwater Marsh NWR	50			54			
Chula Vista Wildlife Reserve	36			30			

Appendix 4B – 2019 Pair Estimation (Method III)

Site Name	Total First Wave Nests (Prior to June 15)	Estimated First Wave Renesters	Total First Wave Pairs	Total Second Wave Nests (June 15 or Later)	Estimated Second Wave Renesters	Total Second Wave Pairs	Total Pairs
South San Diego Bay Unit, SDNWR/Saltworks	18			21			
Tijuana Estuary NERR - Tijuana North	10			30			
Tijuana Estuary NERR – Tijuana South	34			76			

Appendix 4B Legend:

Method III pairs only calculated for sites that provided renester data. If no renester data was provided, the cell(s) was left blank.

Appendix 5A – 2018 Productivity and Chronology

Site Name	Date Terns First Observed ¹	Date Terns Last Observed ¹	Date of First Hatch ²	Date of Last Hatch ²	Max Number of Active Nests ¹	Max Active Nest Date ¹	Date of First Fledgling ¹	Fledgling Estimate Method ¹	Total Fledglings ¹
Napa Sonoma Marsh Wildlife Area - Green Island Unit	08-May-18	09-Jul-18	NA	NA	13	1-Jun-18	NA	NA	0
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	3-May-18	11-Jul-18	NA	NA	31	8-Jun-18	NA	NA	0
Montezuma Wetlands - 12A	19-May-18	14-Jul-18	23-Jun-18	6-Jul-18	7	19-Jun-18	NA	NA	0
Montezuma Wetlands - 12B	19-May-18	14-Jul-18	14-Jul-18	14-Jul-18	3	9-Jul-18	NA	NA	0
Montezuma Wetlands – 3/4C	19-May-18	6-Jul-18	23-Jun-18	23-Jun-18	4	23-Jun-18	NA	NA	0
Alameda Point	18-Apr-18	27-Aug-18	5-Jun-18	6-Aug-18	210	20-Jun-18	21-Jun-18	other	190-300
Hayward Regional Shoreline	17-Apr-18	28-Jul-18	1-Jun-18	8-Jun-18	18		25-Jun-18	3WD	11-11
Eden Landing Ecological Reserve	23-Apr-18	13-Aug-18	9-Jul-18	6-Aug-18	45	4-Jun-18	2-Jul-18	other	1-3
Oceano Dunes SVRA	2-May-18	27-Aug-18	16-Jun-18	2-Aug-18	18	30-Jun-18	10-Jul-18	R	35-35
Vandenberg AFB - Purisima Point	9-May-18	24-Aug-18	21-Jun-18	30-Jul-18	54	13-Jun-18	12-Jul-18	3WD	35-35
Santa Clara River/McGrath State Beach	23-Mar-18	1-Sep-18	11-Jul-18	14-Aug-18	11	27-Jun-18	1-Aug-18	3WD	6-8
Hollywood Beach	8-May-18	4-Sep-18	NA	NA	0	NA	NA	NA	0
Ormond Beach	18-May-18	20-Jul-18	18-Jun-18	17-Jul-18	74		3-Jul-18	3WD	44-44
Point Mugu - Eastern Arm			NA	NA	2	5-Jun-18	NA	NA	0
Point Mugu - Holiday Beach	26-Apr-18		11-Jun-18	26-Jul-18	23	27-Jun-18	2-Jul-18	other	16-19
Point Mugu - Holiday Salt Panne	26-Apr-18		2-Jul-18	18-Jul-18	7	11-Jun-18	NA	other	NA
Point Mugu - Ormond Beach East	26-Apr-18		14-Jun-18	2-Aug-18	96	14-Jun-18	6-Jul-18	other	45-53
Saticoy United Water Conservation District	NA	NA	NA	NA	0	NA	NA	NA	0
Malibu Lagoon	26-Apr-18	10-Aug-18	NA	NA	3	17-May-18	NA	NA	0
Venice Beach/Marina Del Rey	17-Apr-18	21-Jul-18	NA	NA	2	7-Jul-18	NA	NA	0

Appendix 5A – 2018 Productivity and Chronology

Site Name	Date Terns First Observed	Date Terns Last Observed	Date of First Hatch	Date of Last Hatch	Max Number of Active Nests	Max Active Nest Date	Date of First Fledgling	Fledgling Estimate Method	Total Fledglings
LA Harbor – Pier 400	18-Apr-18	2-Aug-18	6-Jun-18	18-Jul-18	71		25-Jun-18	other	69
Seal Beach NWR - Anaheim Bay	26-Apr-18	2-Aug-18	3-Jun-18	11-Jul-18	93		24-Jun-18	other	42-42
Bolsa Chica Ecological Reserve – Nest Site 1 North			5-Jun-18	17-Jul-18				3WD	
Bolsa Chica Ecological Reserve – Nest Site 1 South			5-Jun-18	12-Jun-18				3WD	
Bolsa Chica Ecological Reserve – Nest Site 2			5-Jun-18	26-Jun-18				3WD	
Bolsa Chica Ecological Reserve – Nest Site 3			5-Jun-18	19-Jun-18				3WD	
Bolsa Chica Ecological Reserve – South Tern Island			5-Jun-18	3-Jul-18				3WD	
Huntington Beach	11-Apr-18	6-Aug-18	29-May-18	17-Jul-18	444		19-Jun-18	other	64-171
Burriss Sand Pit/Burriss Basin	8-May-18	31-Jul-18	26-Jun-18	10-Jul-18	12	19-Jun-18	17-Jul-18	other	6-6
Upper Newport Bay Ecological Reserve	11-May-18	27-Jul-18	8-Jun-18	6-Jul-18	7		4-Jul-18	3WD	1-1
MCB Camp Pendleton – Blue Beach	11-Apr-18	30-Jul-18	8-Jun-18	25-Jun-18	66	21-May-18	2-Jul-18	R	4-4
MCB Camp Pendleton – Red Beach	10-May-18	31-May-18	NA	NA	1	29-May-18	NA	NA	0
MCB Camp Pendleton – Salt Flats	26-Apr-18	19-Jul-18	NA	NA	2	1-Jun-18	NA	NA	0
MCB Camp Pendleton – White Beach	24-Apr-18	17-Jul-18	9-Jun-18	21-Jun-18	37	2-Jun-18	NA	NA	0
Batiquitos Lagoon Ecological Reserve - E1	24-Apr-18	19-Jul-18	5-Jun-18	26-Jun-18	59	1-Jun-18	26-Jun-18	other	16-16
Batiquitos Lagoon Ecological Reserve - W1	24-Apr-18	17-Jul-18	5-Jun-18	26-Jun-18	56	8-Jun-18	3-Jul-18	other	8-8
Batiquitos Lagoon Ecological Reserve - W2	24-Apr-18	24-Jul-18	5-Jun-18	3-Jul-18	295	5-Jun-18	26-Jun-18	other	70-75

Appendix 5A – 2018 Productivity and Chronology

Site Name	Date Terns First Observed	Date Terns Last Observed	Date of First Hatch	Date of Last Hatch	Max Number of Active Nests	Max Active Nest Date	Date of First Fledgling	Fledgling Estimate Method	Total Fledglings
San Elijo Lagoon Ecological Reserve	14-May-18	31-Jul-18	NA	NA	0	NA	NA	NA	0
Mission Bay - FAA Island	23-Apr-18	21-Jun-18	NA	NA	4	14-May-18	NA	NA	0
Mission Bay - Mariner's Point	16-Apr-18	26-Jul-18	28-May-18	25-Jun-18	130		20-Jun-18		30-50
Mission Bay - North Fiesta Island	25-Apr-18	19-Jun-18	NA	NA	1		NA	NA	0
Mission Bay - Stony Point	27-Apr-18	23-Jun-18	12-Jun-18	19-Jun-18	8	7-Jun-18	NA	NA	0
Lindbergh Field/Former Naval Training Center	19-Apr-18	19-Jul-18	29-May-18	12-Jun-18	16	22-May-18	22-Jun-18	other	13-14
Naval Base Coronado – Delta Beach North	27-Apr-18	17-Aug-18	25-May-18	19-Jun-18	61	28-May-18	22-Jun-18	3WD	4-4
Naval Base Coronado – Delta Beach South	19-Apr-18	23-Jul-18	28-May-18	27-Jun-18	69	28-May-18	21-Jun-18	3WD	6-11
Naval Base Coronado - NABON	20-Apr-18	21-Aug-18	25-May-18	29-Jun-18	220	31-May-18	19-Jun-18	3WD	15-24
Naval Base Coronado - NABOS	19-Apr-18	20-Aug-18	28-May-18	25-Jun-18	126	29-May-18	25-Jun-18	3WD	4-7
US Navy - NI-MAT	27-Apr-18	3-Jul-18	5-Jun-18	19-Jun-18	12	1-Jun-18	26-Jun-18	3WD	1-1
D Street Fill/ Sweetwater Marsh NWR	17-Apr-18	23-Jul-18	29-May-18	26-Jun-18	94	29-May-18	22-Jun-18	other	12-15
Chula Vista Wildlife Reserve	28-Mar-18	23-Jul-18	2-Jun-18	22-Jun-18	77		26-Jun-18	other	6-10
South San Diego Bay Unit, SDNWR/Saltworks	18-Apr-18	8-Sep-18	6-Jun-18	20-Jun-18	29	30-May-18	27-Jun-18	other	1-1
Tijuana Estuary NERR - Tijuana North	26-Apr-18	27-Aug-18	31-May-18	12-Jul-18	105	31-May-18	21-Jun-18	other	6-7
Tijuana Estuary NERR – Tijuana South	26-Apr-18	27-Aug-18	7-Jun-18	28-Jun-18	63	31-May-18	21-Jun-18	other	9-10

Appendix 5A – 2018 Productivity and Chronology

Appendix 5A Legend:

¹Data imported from the "Summary Table" tab of 2018 reporting spreadsheet.

²Data imported from the "Season Chronology" tab of the 2018 reporting spreadsheet.

Blank cells: indicate that no data was provided.

Fledgling Estimate Method: 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.

NA: Column not applicable.

Appendix 5B – 2019 Productivity and Chronology

Site Name	Date Terns First Observed	Date Terns Last Observed	Date of First Hatch	Date of Last Hatch	Max Number of Active Nests	Max Active Nest Date	Date of First Fledgling	Fledgling Estimate Method	Total Fledglings
Napa Sonoma Marsh Wildlife Area - Green Island Unit	2019-05-13	2019-07-17	NA	NA	2	2019-07-02	NA	3WD	0
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	2019-05-01	2019-07-24	NA	NA	0	NA	NA	3WD	0
Montezuma Wetlands - 12A	2019-05-04	2019-07-12	NA	NA	2	2019-06-05	NA	NA	0
Montezuma Wetlands - 14A	2019-06-14	2019-08-06	2019-06-30	2019-07-20	10	2019-07-17	2019-07-30	Other	2-3
Montezuma Wetlands – 3/4C	2019-05-04	2019-07-12	2019-07-07	2019-07-07	3	2019-06-25	NA	NA	0
Alameda Point	2019-04-17	2019-08-29	2019-06-28	2019-08-06	345	2019-07-16	2019-07-19	3WD	182-273
Hayward Regional Shoreline	2019-04-18	2019-07-29	2019-06-02	2019-07-01	56	2019-07-12	2019-06-27	3WD	44-50
Eden Landing Ecological Reserve - E12	2019-06-03	2019-08-07	2019-06-24	2019-07-15	20	2019-07-01	2019-07-15	3WD	5-5
Eden Landing Ecological Reserve - E14	2019-04-29	2019-08-12	2019-07-01	2019-08-05	101	2019-07-22	2019-07-08	3WD	5-8
Eden Landing Ecological Reserve - E6A	2019-08-05	2019-08-05	NA	NA	0	NA	NA	NA	0
Oceano Dunes SVRA	2019-05-04	2019-08-25	2019-06-14	2019-07-17	34	2019-06-30	2019-07-05	R	38-38
Rancho Guadalupe Dunes Preserve	2019-05-08	2019-08-19	2019-06-24	2019-07-31	14	2019-06-19	2019-07-19	Other	4-8
Vandenberg AFB - Purisima Point	2019-05-09	2019-09-04	2019-06-21	2019-07-23	47	2019-07-09	2019-07-17	3WD/Other	21-21
Hollywood Beach	2019-05-09	2019-08-24	NA	NA	0	NA	NA	NA	0
Ormond Beach - North	2019-04-30	2019-08-19	2019-06-18	2019-07-23	91	2019-08-08	2019-07-10	3WD	18-18
Ormond Beach - South	2019-07-03	2019-07-29	2019-07-24	2019-07-24	1	2019-07-06	NA	3WD	0
Point Mugu - Eastern Arm	NA	NA	NA	NA	0	NA	NA	NA	0

Appendix 5B – 2019 Productivity and Chronology

Site Name	Date Terns First Observed	Date Terns Last Observed	Date of First Hatch	Date of Last Hatch	Max Number of Active Nests	Max Active Nest Date	Date of First Fledgling	Fledgling Estimate Method	Total Fledglings
Point Mugu - Holiday Beach	2019-04-25	2019-09-06	2019-06-24	2019-07-29	63	2019-08-22	2019-07-30	Other	25-45
Point Mugu - Holiday Salt Panne	2019-04-25	NA	NA	NA	6	2019-07-01	NA	NA	0
Point Mugu - Ormond Beach East	2019-04-25	2019-08-26	2019-06-16	2019-07-30	246	2019-08-06	2019-07-18	Other	39-75
Saticoy United Water Conservation District	NA	NA	NA	NA	0	NA	NA	NA	0
Malibu Lagoon	2019-04-25	2019-09-14	NA	NA	0	NA	NA	3WD	0
Venice Beach/Marina Del Rey	2019-05-01	2019-06-10	NA	NA	2	2019-05-08	NA	3WD	0
LA Harbor – Pier 400	2019-04-24	2019-08-08	2019-06-01	2019-07-31	199	2019-07-17	2019-06-26	3WD/other	97-97
NAVWPNSTA Seal Beach W8	2019-04-22	2019-07-04	2019-07-02	2019-07-02	2	2019-06-26	2019-07-06	Other	0-2
Seal Beach NWR - Anaheim Bay	2019-04-17	2019-07-28	NA	NA	54	2019-06-05	NA	NA	0
Bolsa Chica Ecological Reserve - Nest Site 1 North	2019-04-22	2019-08-03	2019-05-28	2019-07-09	33	2019-05-14	2019-06-18	3WD	44-44
Bolsa Chica Ecological Reserve – Nest Site 1 South	2019-04-22	2019-06-06	2019-06-04	2019-06-18	8	2019-06-04	NA	NA	0
Bolsa Chica Ecological Reserve – Nest Site 2	2019-04-24	2019-06-25	2019-06-04	2019-07-16	74	2019-06-25	2019-06-25	Other	0-3
Bolsa Chica Ecological Reserve – Nest Site 3	NA	NA	NA	NA	0	NA	NA	NA	0
Bolsa Chica Ecological Reserve – South Tern Island	2019-05-14	2019-08-07	NA	NA	19	2019-07-30	NA	NA	0

Appendix 5B – 2019 Productivity and Chronology

Site Name	Date Terns First Observed	Date Terns Last Observed	Date of First Hatch	Date of Last Hatch	Max Number of Active Nests	Max Active Nest Date	Date of First Fledgling	Fledgling Estimate Method	Total Fledglings
Huntington Beach	2019-04-04	2019-08-10	2019-05-31	2019-07-23	531	2019-08-06	2019-06-21	Other - maximum number of fledglings observed in a 2 week (for maximum) or 3 week (for minimum) period.	81-110
Burris Sand Pit/Burris Basin	2019-05-07	2019-07-23	2019-06-25	2019-07-16	17	2019-07-09	2019-07-16	Other - High count day used	2-2
Upper Newport Bay Ecological Reserve	2019-05-10	2019-07-19	2019-06-14	2019-06-26	20	2019-06-14	2019-06-28	3WD	4-4
MCB Camp Pendleton - Blue Beach	2019-04-15	2019-08-22	2019-05-29	2019-08-01	391	2019-07-22	2019-06-17	R	15-15
MCB Camp Pendleton - Salt Flats	2019-05-06	2019-05-31	NA	NA	2	2019-05-22	NA	NA	0
MCB Camp Pendleton - White Beach	2019-04-23	2019-07-30	NA	NA	25	2019-08-20	NA	NA	0
Batiquitos Lagoon Ecological Reserve - E1	2019-04-24	2019-07-09	2019-05-30	2019-06-13	71	2019-06-20	2019-06-20	Other	10-12
Batiquitos Lagoon Ecological Reserve - W1	2019-04-24	2019-07-16	2019-06-12	2019-06-12	42	2019-06-19	2019-06-26	Other	2-3
Batiquitos Lagoon Ecological Reserve - W2	2019-04-12	2019-07-16	2019-05-28	2019-06-05	435	2019-06-26	2019-06-19	Other	10-16
San Elijo Lagoon Ecological Reserve - Cardiff SB and West Basin	2019-05-06	2019-05-30	NA	NA	0	NA	NA	NA	0
San Elijo Lagoon Ecological Reserve – East Basin Saltpanne	2019-06-10	2019-06-10	NA	NA	0	NA	NA	NA	0

Appendix 5B – 2019 Productivity and Chronology

Site Name	Date Terns First Observed	Date Terns Last Observed	Date of First Hatch	Date of Last Hatch	Max Number of Active Nests	Max Active Nest Date	Date of First Fledgling	Fledgling Estimate Method	Total Fledglings
Mission Bay - FAA Island	2019-04-25	2019-08-12	2019-06-14	2019-07-26	39	2019-07-12	2019-07-01	3WD	1-2
Mission Bay - Mariner's Point	2019-04-20	2019-08-17	2019-06-03	2019-08-15	159	2019-08-02	2019-06-24	3WD	36-39
Mission Bay - North Fiesta Island	2019-04-25	2019-07-01	2019-07-01	2019-07-01	2	2019-07-01	NA	3WD	0
Mission Bay - Stony Point	2019-05-09	2019-05-18	NA	NA	1	2019-05-09	NA	3WD	0
Lindbergh Field/Former Naval Training Center	2019-04-17	2019-08-15	2019-06-07	2019-07-16	19	2019-07-03	2019-06-29	R	6-6
Naval Base Coronado – Delta Beach North	2019-04-16	2019-08-16	2019-05-29	2019-07-23	127	2019-07-16	2019-07-05	3WD	6-9
Naval Base Coronado – Delta Beach South	2019-04-16	2019-08-16	2019-05-29	2019-07-23	129	2019-07-22	2019-07-03	3WD	4-4
Naval Base Coronado - NABON	2019-04-16	2019-08-08	2019-05-30	2019-07-25	400	2019-08-06	2019-07-02	3WD	7-15
Naval Base Coronado - NABOS	2019-04-18	2019-08-12	2019-05-30	2019-07-29	272	2019-07-11	2019-07-03	3WD	4-6
US Navy - NI-ALT	2019-05-14	2019-05-14	NA	NA	0	NA	NA	NA	0
US Navy - NI-MAT	2019-06-04	2019-07-30	2019-07-02	2019-07-02	2	2019-06-18	2019-07-23	3WD	1-1
US Navy - NIA18	2019-05-07	2019-07-30	2019-06-25	2019-07-09	2	2019-06-11	2019-07-19	3WD	0
D Street Fill/ Sweetwater Marsh NWR	2019-04-10	2019-08-17	2019-06-01	2019-07-20	104	2019-07-13	2019-06-25	R/3WD	12-12
Chula Vista Wildlife Reserve	2019-04-10	2019-07-22	2019-06-04	2019-07-20	66	2019-07-06	2019-06-25	R	2-4
South San Diego Bay Unit, SDNWR/Saltworks	2019-04-10	2019-08-07	2019-06-05	2019-07-10	39	2019-07-03	2019-07-10	R/3WD	1-1
Tijuana Estuary NERR - Tijuana North	2019-04-24	2019-08-22	2019-07-01	2019-08-01	40	2019-07-18	2019-07-11	R/3WD	4-5
Tijuana Estuary NERR – Tijuana South	2019-04-18	2019-08-08	2019-07-02	2019-07-25	110	2019-07-11	2019-08-01	R/3WD	2-2

Appendix 5B – 2019 Productivity and Chronology

Appendix 5B Legend:

Fledgling Estimate Method: 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.

NA: Column not applicable.

Appendix 6A – 2018 Clutch Size and Hatch Success

Site Name	Nest Total	Egg Total	Average Clutch Size	Total Hatched	Hatch Rate	1 Egg Clutch	2 Egg Clutch	3 Egg Clutch
Napa Sonoma Marsh Wildlife Area - Green Island Unit	7	9	1.29	0	NA	5	2	0
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	21	35	1.67	0	NA	9	10	2
Montezuma Wetlands - 12A	8	17	2.12	14	0.82	0	7	1
Montezuma Wetlands - 12B	4	8	2	1	0.12	0	4	0
Montezuma Wetlands – 3/4C	6	10	2	2	0.2	0	5	0
Alameda Point	375	595	1.59	445	0.75	156	218	1
Hayward Regional Shoreline	32	50	1.56	26	0.52	16	14	2
Eden Landing Ecological Reserve	141	183	1.43	16	0.09	73	55	0
Oceano Dunes SVRA	35	54	1.54	42	0.78	16	19	0
Vandenberg AFB - Purisima Point	83	148	1.78	57	0.39	18	65	0
Santa Clara River/McGrath State Beach	24	39	1.62	22	0.56	9	15	0
Hollywood Beach	0	0	0	0	0	0	0	0
Ormond Beach	84	158	1.88	117	0.74	10	74	0
Point Mugu - Eastern Arm	3	5	1.67	0	NA	1	2	0
Point Mugu - Holiday Beach	58	89	1.56	40	0.45	25	32	0
Point Mugu - Holiday Salt Panne	12	18	1.5	10	0.56	6	6	0
Point Mugu - Ormond Beach East	218	360	1.68	148	0.41	68	146	0
Saticoy United Water Conservation District	0	0	0	0	0	0	0	0
Malibu Lagoon	6	9	1.5	0	NA	3	3	0
Venice Beach/Marina Del Rey	5	6	1.2	0	NA	4	1	0
LA Harbor – Pier 400	133	230	1.73	149	0.65	36	97	0
Seal Beach NWR - Anaheim Bay	117	209	1.79	172	0.82	26	90	1
Bolsa Chica Ecological Reserve – Nest Site 1 North	54	98	1.81	65	0.66	10	44	0

Appendix 6A – 2018 Clutch Size and Hatch Success

Site Name	Nest Total	Egg Total	Average Clutch Size	Total Hatched	Hatch Rate	1 Egg Clutch	2 Egg Clutch	3 Egg Clutch
Bolsa Chica Ecological Reserve – Nest Site 1 South	12	20	1.67	10	0.5	4	8	0
Bolsa Chica Ecological Reserve – Nest Site 2	47	83	1.77	53	0.64	11	36	0
Bolsa Chica Ecological Reserve – Nest Site 3	7	14	2	4	0.29	0	7	0
Bolsa Chica Ecological Reserve – South Tern Island	13	24	1.85	18	0.75	2	11	0
Huntington Beach	688	1185	1.72	869	0.73	192	495	1
Burris Sand Pit/Burris Basin	16	28	1.75	22	0.79	4	12	0
Upper Newport Bay Ecological Reserve	22	38	1.73	22	0.58	6	16	0
MCB Camp Pendleton – Blue Beach	278	424	1.53	12	0.03	132	146	0
MCB Camp Pendleton – Red Beach	1	2	2	0	NA	0	1	0
MCB Camp Pendleton – Salt Flats	4	7	1.75	0	NA	1	3	0
MCB Camp Pendleton – White Beach	51	84	1.65	8	0.1	18	33	0
Batiquitos Lagoon Ecological Reserve - E1	69	127	1.84	106	0.83	11	58	0
Batiquitos Lagoon Ecological Reserve - W1	65	116	1.78	94	0.81	14	51	0
Batiquitos Lagoon Ecological Reserve - W2	550	931	1.69	479	0.51	170	379	1
San Elijo Lagoon Ecological Reserve	0	0	0	0	0	0	0	0
Mission Bay - FAA Island	12	14	1.17	0	NA	10	2	0
Mission Bay - Mariner's Point	178	311	1.75	241	0.77	45	133	0
Mission Bay - North Fiesta Island	1	2	2	0	NA	0	1	0
Mission Bay - Stony Point	11	19	1.73	15	0.79	3	8	0
Lindbergh Field/Former Naval Training Center	19	34	1.79	22	0.65	4	15	0

Appendix 6A – 2018 Clutch Size and Hatch Success

Site Name	Nest Total	Egg Total	Average Clutch Size	Total Hatched	Hatch Rate	1 Egg Clutch	2 Egg Clutch	3 Egg Clutch
Naval Base Coronado – Delta Beach North	117	194	1.66	96	0.49	40	77	0
Naval Base Coronado – Delta Beach South	135	222	1.64	100	0.45	48	87	0
Naval Base Coronado - NABON	288	496	1.72	391	0.79	80	208	0
Naval Base Coronado - NABOS	287	464	1.62	204	0.44	110	177	0
US Navy - NI-MAT	16	27	1.69	12	0.44	5	11	0
D Street Fill/ Sweetwater Marsh NWR	109	198	1.82	155	0.78	21	87	1
Chula Vista Wildlife Reserve	83	144	1.73	101	0.7	23	59	1
South San Diego Bay Unit, SDNWR/Saltworks	33	53	1.61	28	0.53	13	20	0
Tijuana Estuary NERR - Tijuana North	120	209	1.74	112	0.54	31	89	0
Tijuana Estuary NERR – Tijuana South	71	127	1.79	86	0.68	15	56	0

Appendix 6A Legend:

NA: Column not applicable.

Appendix 7A – 2018 Egg Mortality

Site Name	Total Eggs	Total Eggs Lost	Damaged (Includes Human Caused)	Flooded	Abandoned Pre-term	Abandoned Post-term/Non-viable	Died Hatching	Predation (Number, Obs. Type, Species)
Napa Sonoma Marsh Wildlife Area - Green Island Unit	9	7	0	0	0	0	0	7S Unknown
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	35	35	0	0	0	0	0	32D LOCA, 3S Unknown
Montezuma Wetlands - 12A	17	2	0	0	0	0	0	2P Unknown
Montezuma Wetlands - 12B	8	2	0	0	2	0	0	0
Montezuma Wetlands – 3/4C	10	7	0	0	1	0	0	2D 4S Unknown
Alameda Point	595	150	0	0	58	84	1	2S BUOW, 2S CORA, 3 Unknown
Hayward Regional Shoreline	50	24	0	0	0	0	0	6D 4S Gull, 12P Rat, 2P Unknown
Eden Landing Ecological Reserve	183	132	0	0	0	1	0	2D 47S 82P VUVU
Oceano Dunes SVRA	54	11	0	0	7	3	1	0
Vandenberg AFB - Purisima Point	147	91	0	0	4	2	0	85D CALA
Santa Clara River/McGrath State Beach	39	15	1	1	1	0	0	8P CALA, 4P Unknown
Hollywood Beach	0	0	0	0	0	0	0	0
Ormond Beach	158	35	0	0	11	9	0	15P Unknown
Point Mugu - Eastern Arm	5	5	0	0	0	0	0	3D CORA, 2S DIVI
Point Mugu - Holiday Beach	89	47	0	5	15	12	0	3D CORA, 8 Unknown, 3P Unknown Mammal, 1P WHIM
Point Mugu - Holiday Salt Panne	18	8	0	0	2	1	0	5 Unknown
Point Mugu - Ormond Beach East	360	184	0	1	33	7	0	13D CALA, 73D CORA, 4D DIVI, 31 Unknown, 22 Unknown Avian
Saticoy United Water Conservation District	0	0	0	0	0	0	0	0
Malibu Lagoon	9	9	0	6	1	0	0	2 Unknown

Appendix 7A – 2018 Egg Mortality

Site Name	Total Eggs	Total Eggs Lost	Damaged (Includes Human Caused)	Flooded	Abandoned Pre-term	Abandoned Post-term/Non-viable	Died Hatching	Predation (Number, Obs. Type, Species)
Venice Beach/Marina Del Rey	6	6	0	0	0	0	0	6D AMCR
LA Harbor – Pier 400	230	81	4	0	54	0	0	19D 4S ELTE
Seal Beach NWR - Anaheim Bay	209	22	0	0	1	20	1	0
Bolsa Chica Ecological Reserve – Nest Site 1 North	98	30	0	0	14	13	0	3D CORA
Bolsa Chica Ecological Reserve – Nest Site 1 South	20	10	0	0	3	4	0	3P Corvid
Bolsa Chica Ecological Reserve – Nest Site 2	83	23	0	0	12	6	2	1D Ant, 2S Corvid
Bolsa Chica Ecological Reserve – Nest Site 3	14	0	0	0	0	0	0	0
Bolsa Chica Ecological Reserve – South Tern Island	24	3	0	0	0	0	0	3P Corvid
Huntington Beach	1185	312	4	0	90	212	2	4S AMCR
Burris Sand Pit/Burris Basin	28	5	0	0	0	0	0	5P Unknown
Upper Newport Bay Ecological Reserve	38	12	6	0	3	3	0	0
MCB Camp Pendleton – Blue Beach	424	410	0	13	26	3	0	90D 71S 3P CALA, 1D 1S Canid, 28D 17S 1P CORA, 14D 3S 1P NOHA, 2D 14S 8P Rodent, 1S 17P Unknown, 5D 29S 57P Unknown Avian, 5S Unknown Mammal
MCB Camp Pendleton – Red Beach	2	2	0	0	0	0	0	2S CORA
MCB Camp Pendleton – Salt Flats	7	7	0	0	0	0	0	1S CALA, 6P Unknown

Appendix 7A – 2018 Egg Mortality

Site Name	Total Eggs	Total Eggs Lost	Damaged (Includes Human Caused)	Flooded	Abandoned Pre-term	Abandoned Post-term/Non-viable	Died Hatching	Predation (Number, Obs. Type, Species)
MCB Camp Pendleton – White Beach	84	76	0	12	0	0	0	5D 34S 4P CALA, 2D 5S CORA, 1S 1P Corvid, 3P Unknown, 6S 3P Unknown Avian
Batiquitos Lagoon Ecological Reserve - E1	127	21	0	0	15	0	1	1D BAOW, 4P PRLO
Batiquitos Lagoon Ecological Reserve - W1	116	23	1	0	20	0	0	2D CALA
Batiquitos Lagoon Ecological Reserve - W2	931	140	0	0	133	3	3	1D Unknown Avian
San Elijo Lagoon Ecological Reserve	0	0	0	0	0	0	0	0
Mission Bay - FAA Island	14	14	0	0	6	0	0	1P AMCR, 1D 2P CORA, 4S WEGU
Mission Bay - Mariner's Point	311	70	0	0	50	0	0	18 Unknown, 2S WEGU
Mission Bay - North Fiesta Island	2	2	0	0	0	0	0	2P Snake
Mission Bay - Stony Point	19	4	0	0	1	0	0	1P AMCR, 2S GBHE
Lindbergh Field/Former Naval Training Center	34	10	0	0	7	1	0	2S Corvid
Naval Base Coronado – Delta Beach North	194	29	0	0	19	9	1	0
Naval Base Coronado – Delta Beach South	222	42	0	0	17	18	5	2P Unknown Mammal
Naval Base Coronado - NABON	496	102	33	0	39	15	2	7D CORA, 5P Unknown, 1P Unknown Avian
Naval Base Coronado - NABOS	464	102	0	0	78	22	2	0
US Navy - NI-MAT	27	15	0	0	7	2	0	2D 4S AMCR

Appendix 7A – 2018 Egg Mortality

Site Name	Total Eggs	Total Eggs Lost	Damaged (Includes Human Caused)	Flooded	Abandoned Pre-term	Abandoned Post-term/Non-viable	Died Hatching	Predation (Number, Obs. Type, Species)
D Street Fill/ Sweetwater Marsh NWR	198	39	0	0	14	8	4	4D CALA, 3S CORA, 3S NOHA, 3P Unknown
Chula Vista Wildlife Reserve	144	41	0	0	28	5	2	2D Ant, 4 Unknown
South San Diego Bay Unit, SDNWR/Saltworks	53	14	0	0	11	0	0	3S BLSK
Tijuana Estuary NERR - Tijuana North	209	70	0	6	48	8	0	2S BCNH, 3S GBTE, 3S Unknown
Tijuana Estuary NERR – Tijuana South	127	28	2	0	20	4	0	2S CALA

Appendix 7A Legend:

Died Hatching: Observations were recorded as either chicks or eggs depending on site. For this report, all died hatching events are included as eggs.

Abandoned Pre-Term: Observations include those eggs that were documented as buried.

Predator Species Codes:

American crow (AMCR), American kestrel (AMKE), Ant, Barn owl (BAOW), Black skimmer (BLSK), Black-bellied plover (BBPL), Black-crowned night-heron (BCNH), Black-tailed jackrabbit (LECA), Bobcat (LYRU), Brown pelican (BRPE), California ground squirrel (OTBE), California gull (CAGU), Canid, Caspian tern (CATE), Common raven (CORA), Cooper's hawk (COHA), Corvid, Coyote (CALA), Domestic cat (FECA), Domestic dog (CAFA), European starling (EUST), Glaucous-winged gull (GWGU), Gopher snake (PICA), Gray fox (URCI), Great blue heron (GBHE), Great egret (GREG), Great horned owl (GHOW), Great-tailed grackle (GTGR), Gull-billed tern (GBTE), Gull, Horned lark (HOLA), Least tern (LETE), Loggerhead shrike (LOSH), Long-billed curlew (LBCU), Merlin (MERL), Mice, Northern harrier (NOHA), Northern mockingbird (NOMO), Opossum (DIVI), Osprey (OSPR), Owl, Parasitic Jaeger (PAJA), Peregrine falcon (PEFA), Raccoon (PRLO), Rat, Red fox (VUVU), Red-tailed hawk (RTHA), Red-winged blackbird (RWBL), Ring-billed gull (RBGU), River otter (LOCA), Rodent, Short-eared owl (SEOW), Snake, Snapping turtle (CHSE), Southern Pacific rattlesnake (CROR), Striped skunk (MEME), Unknown, Unknown Avian, Unknown Mammal, Unknown raptor, Western gull (WEGU), Western meadowlark (WEME), White-tailed kite (WTKI).

Observation type: Describes certainty level for each predator species that is associated with a predation event. In other words what evidence suggests a predation was committed by the predator species in question.

P=possible (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).

S=suspected (when loss of terns directly corresponded to the presence of a predator).

D=documented (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).

Appendix 7B – 2019 Egg Mortality

Site Name	Total Eggs Lost	Damaged (Includes Human Caused)	Flooded	Abandoned Pre-term	Abandoned Post-term/Non-viable	Died Hatching	Predation (Number, Obs. Type, Species)
Napa Sonoma Marsh Wildlife Area - Green Island Unit	5	0	0	0	0	0	5S Unknown
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	0	0	0	0	0	0	0
Montezuma Wetlands - 12A	4	0	0	0	0	0	2P Unknown, 2P Unknown Avian
Montezuma Wetlands - 14A	9	0	0	2	2	0	4P Unknown, 1P Unknown Avian
Montezuma Wetlands - 3/4C	4	0	0	2	0	0	2P Unknown
Alameda Point	117	0	0	56	49	8	4P Unknown Avian
Hayward Regional Shoreline	25	8	0	9	0	0	8D Gull
Eden Landing Ecological Reserve - E12	9	0	0	0	0	0	4P CAGU, 5S CAGU
Eden Landing Ecological Reserve - E14	57	0	0	1	0	0	7D 44S 2P MEME, 3P CORA
Eden Landing Ecological Reserve - E6A	0	0	0	0	0	0	0
Oceano Dunes SVRA	3	0	0	3	0	0	0
Rancho Guadalupe Dunes Preserve	2	0	0	0	0	0	2S CALA
Vandenberg AFB - Purisima Point	17	1	0	11	0	0	5D Gull
Hollywood Beach	0	0	0	0	0	0	0
Ormond Beach - North	112	7	0	1	12	0	61D CALA, 11D CORA, 16D OTBE, 4P HOLA
Ormond Beach - South	0	0	0	0	0	0	0
Point Mugu - Eastern Arm	0	0	0	0	0	0	0
Point Mugu - Holiday Beach	49	0	2	12	2	0	1D CALA, 3D CORA, 29D DIVI
Point Mugu - Holiday Salt Panne	10	0	0	0	1	0	4D 3P CALA, 2 Unknown

Appendix 7B – 2019 Egg Mortality

Site Name	Total Eggs Lost	Damaged (Includes Human Caused)	Flooded	Abandoned Pre-term	Abandoned Post-term/Non-viable	Died Hatching	Predation (Number, Obs. Type, Species)
Point Mugu - Ormond Beach East	132	0	6	30	16	0	50D CALA, 1D CORA, 29 Unknown
Saticoy United Water Conservation District	0	0	0	0	0	0	0
Malibu Lagoon	0	0	0	0	0	0	0
Venice Beach/Marina Del Rey	7	0	0	2	0	0	3D 2S CORA
LA Harbor – Pier 400	85	20	0	42	9	0	9D CORA, 5 Unknown
NAVWPNSTA Seal Beach W8	2	0	2	0	0	0	0
Seal Beach NWR - Anaheim Bay	75	0	0	0	0	0	75P Corvid
Bolsa Chica Ecological Reserve - Nest Site 1 North	18	0	0	12	2	0	2S 1P Corvid, 1S Gull
Bolsa Chica Ecological Reserve – Nest Site 1 South	1	0	0	1	0	0	0
Bolsa Chica Ecological Reserve – Nest Site 2	64	0	0	51	5	0	8P AMCR
Bolsa Chica Ecological Reserve – Nest Site 3	0	0	0	0	0	0	0
Bolsa Chica Ecological Reserve – South Tern Island	34	0	0	0	0	0	1P CAGO, 33 Unknown
Huntington Beach	185	4	0	84	96	0	1P AMCR
Burris Sand Pit/Burris Basin	10	0	0	0	2	0	8P CAGO
Upper Newport Bay Ecological Reserve	0	0	0	0	0	0	0

Appendix 7B – 2019 Egg Mortality

Site Name	Total Eggs Lost	Damaged (Includes Human Caused)	Flooded	Abandoned Pre-term	Abandoned Post-term/Non-viable	Died Hatching	Predation (Number, Obs. Type, Species)
MCB Camp Pendleton - Blue Beach	485	2	31	84	130	3	83D 2S CALA, 27D 1S CORA, 1D Corvid, 36D NOHA, 4D 24S 4P Unknown Avian, 38P Unknown, 9S 2P Unknown Mammal, 1S Gull, 2S Raptor, 1S WEGU
MCB Camp Pendleton - Salt Flats	2	0	0	1	0	0	1S Unknown Avian
MCB Camp Pendleton - White Beach	42	0	3	4	0	0	4D CORA, 15D Corvid, 16P Unknown
Batiquitos Lagoon Ecological Reserve - E1	55	0	0	31	21	0	3P Unknown
Batiquitos Lagoon Ecological Reserve - W1	49	1	0	34	10	0	2S GHOW, 2S Unknown
Batiquitos Lagoon Ecological Reserve - W2	259	0	0	16	24	1	2P Unknown
San Elijo Lagoon Ecological Reserve - Cardiff SB and West Basin	0	0	0	0	0	0	0
San Elijo Lagoon Ecological Reserve – East Basin Saltpanne	0	0	0	0	0	0	0
Mission Bay - FAA Island	45	0	0	4	0	0	5P 36 GBHE/Gull/Corvid
Mission Bay - Mariner's Point	97	2	0	73	5	3	14P Rat
Mission Bay - North Fiesta Island	2	0	0	0	0	0	2P Snake
Mission Bay - Stony Point	1	0	0	0	0	0	1P Unknown
Lindbergh Field/Former Naval Training Center	13	0	0	4	2	0	4S AMCR, 3 Unknown

Appendix 7B – 2019 Egg Mortality

Site Name	Total Eggs Lost	Damaged (Includes Human Caused)	Flooded	Abandoned Pre-term	Abandoned Post-term/Non-viable	Died Hatching	Predation (Number, Obs. Type, Species)
Naval Base Coronado – Delta Beach North	62	2	0	32	19	1	2D 2P Unknown, 2D Unknown Avian, 2S LBCU
Naval Base Coronado – Delta Beach South	83	4	0	46	30	1	2P Unknown
Naval Base Coronado - NABON	225	7	0	55	30	1	50D 2S AMCR, 12D DIVI, 5D NOHA, 1D RUTU, 18D 30S 5P Unknown, 4D 3S Unknown Avian, 2S BCNH
Naval Base Coronado - NABOS	135	0	0	100	31	2	1D Unknown, 1S AMCR
US Navy - NI-ALT	0	0	0	0	0	0	0
US Navy - NI-MAT	0	0	0	0	0	0	0
US Navy - NIA18	0	0	0	0	0	0	0
D Street Fill/ Sweetwater Marsh NWR	58	0	0	49	5	0	2P Unknown Avian, 2S NOHA
Chula Vista Wildlife Reserve	44	2	0	41	0	0	1P Unknown
South San Diego Bay Unit, SDNWR/Saltworks	28	6	0	16	1	0	5DGull
Tijuana Estuary NERR - Tijuana North	35	0	3	13	0	0	8D BBPL, 1D Corvid, 1D Gull, 9D Rat
Tijuana Estuary NERR – Tijuana South	113	0	5	51	0	0	4D AMCR, 52D CALA, 1D Corvid

Appendix 7B – 2019 Egg Mortality

Appendix 7B Legend:

Died Hatching: Observations were recorded as either chicks or eggs depending on site. For this report, all died hatching events are included as eggs.

Abandoned Pre-Term: Observations include those eggs that were documented as buried.

Predator Species Codes:

American crow (AMCR), American kestrel (AMKE), Ant, Barn owl (BAOW), Black skimmer (BLSK), Black-bellied plover (BBPL), Black-crowned night-heron (BCNH), Black-tailed jackrabbit (LECA), Bobcat (LYRU), Brown pelican (BRPE), California ground squirrel (OTBE), California gull (CAGU), Canid, Caspian tern (CATE), Common raven (CORA), Cooper's hawk (COHA), Corvid, Coyote (CALA), Domestic cat (FECA), Domestic dog (CAFA), European starling (EUST), Glaucous-winged gull (GWGU), Gopher snake (PICA), Gray fox (URCI), Great blue heron (GBHE), Great egret (GREG), Great horned owl (GHOW), Great-tailed grackle (GTGR), Gull-billed tern (GBTE), Gull, Horned lark (HOLA), Least tern (LETE), Loggerhead shrike (LOSH), Long-billed curlew (LBCU), Merlin (MERL), Mice, Northern harrier (NOHA), Northern mockingbird (NOMO), Opossum (DIVI), Osprey (OSPR), Owl, Parasitic Jaeger (PAJA), Peregrine falcon (PEFA), Raccoon (PRLO), Rat, Red fox (VUVU), Red-tailed hawk (RTHA), Red-winged blackbird (RWBL), Ring-billed gull (RBGU), River otter (LOCA), Rodent, Short-eared owl (SEOW), Ruddy Turnstone (RUTU), Snake, Snapping turtle (CHSE), Southern Pacific rattlesnake (CROR), Striped skunk (MEME), Unknown, Unknown Avian, Unknown Mammal, Unknown raptor, Western gull (WEGU), Western meadowlark (WEME), White-tailed kite (WTKI).

Observation type: Describes certainty level for each predator species that is associated with a predation event. In other words what evidence suggests a predation was committed by the predator species in question.

P=possible (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).

S=suspected (when loss of terns directly corresponded to the presence of a predator).

D=documented (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).

Appendix 8A – 2018 Bird Mortality

Site Name	Chick Depredation Total (Number, Obs. Type, Species)	Chick Total Mortality	Fledgling Depredation Total (Number, Obs. Type, Species)	Fledgling Total Mortality	Total Fledglings	Adult Depredation Total (Number, Obs. Type, Species)	Adult Total Mortality	Total Minimum Estimated Breeding Pairs
Napa Sonoma Marsh Wildlife Area - Green Island Unit	0	0	0	0	0	0	0	0
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	0	0	0	0	0	0	0	2
Montezuma Wetlands – 12A	0	0	0	0	0	0	0	7
Montezuma Wetlands - 12B	0	0	0	0	0	0	0	2
Montezuma Wetlands – 3/4C	0	0	0	0	0	0	0	4
Alameda Point	12D 8S BUOW, 1D PEFA	107	8S BUOW, 2D 9S PEFA	23	190-300	3D BUOW, 13D 1P PEFA	17	310
Hayward Regional Shoreline	0	0	0	0	11-11	0	0	20
Eden Landing Ecological Reserve	0	0	0	0	1-3	0	0	95
Oceano Dunes SVRA	0	0	1S Unknown Avian	1	35-35	0	0	27
Vandenberg AFB - Purisima Point	0	5	1P GHOW	1	35-35	0	0	49
Santa Clara River/McGrath State Beach	0	0	0	0	6-8	0	0	14
Hollywood Beach	0	0	0	0	0	0	0	0
Ormond Beach	1P Unknown	3	0	0	44-44	0	0	67
Point Mugu – Eastern Arm	0	0	0	0	0	0	0	0
Point Mugu - Holiday Beach	0	0	0	0	16-19	0	0	39
Point Mugu - Holiday Salt Panne	0	0	0	0	0	0	0	7
Point Mugu - Ormond Beach East	0	1	0	0	45-53	2D PEFA	3	126
Saticoy United Water Conservation District	0	0	0	0	0	0	0	0
Malibu Lagoon	0	0	0	0	0	0	0	3
Venice Beach/Marina Del Rey	0	0	0	0	0	3D AMCR	3	2
LA Harbor – Pier 400	4D 5 ELTE, 4 PEFA, 10 AMKE	30	3 PEFA	3	69	2 AMKE, 1 PEFA	3	105
Seal Beach NWR - Anaheim Bay	0	31	0	0	42-42	0	0	114

Appendix 8A – 2018 Bird Mortality

Site Name	Chick Depredation Total (Number, Obs. Type, Species)	Chick Total Mortality	Fledgling Depredation Total (Number, Obs. Type, Species)	Fledgling Total Mortality	Total Fledglings	Adult Depredation Total (Number, Obs. Type, Species)	Adult Total Mortality	Total Minimum Estimated Breeding Pairs
Bolsa Chica Ecological Reserve – Nest Site 1 North	1D PEFA	9	0	0		0	0	47
Bolsa Chica Ecological Reserve – Nest Site 1 South	0	0	0	0		0	0	9
Bolsa Chica Ecological Reserve – Nest Site 2	2D ANT	5	0	0		0	0	43
Bolsa Chica Ecological Reserve – Nest Site 3	0	0	0	0		0	0	7
Bolsa Chica Ecological Reserve – South Tern Island	2D ANT	2	0	0		0	0	12
Huntington Beach	7D AMKE, 2P Unknown Avian	150	0	11	64-171	4D AMKE, 1D PEFA, 9P Unknown avian,	19	594
Burriss Sand Pit/Burriss Basin	0	0	0	0	6-6	0	0	14
Upper Newport Bay Ecological Reserve	0	1	0	0	1-1	0	0	18
MCB Camp Pendleton – Red Beach	0	0	0	0	0	0	0	0
MCB Camp Pendleton – White Beach	0	2	0	0	0	1D Unknown Avian	1	7
MCB Camp Pendleton – Blue Beach	0	2	0	0	4-4	2D 3S Unknown Avian, 1P Unknown	6	35
MCB Camp Pendleton – Salt Flats	0	0	0	0	0	1D Unknown Avian	1	1
Batiquitos Lagoon Ecological Reserve - E1	2D RTHA	25	0	1	16-16	1D 1S 1P BAOW	3	67
Batiquitos Lagoon Ecological Reserve - W1	0	40	1D BAOW	1	8-8	3D PEFA, 1S COHA	4	59

Appendix 8A – 2018 Bird Mortality

Site Name	Chick Depredation Total (Number, Obs. Type, Species)	Chick Total Mortality	Fledgling Depredation Total (Number, Obs. Type, Species)	Fledgling Total Mortality	Total Fledglings	Adult Depredation Total (Number, Obs. Type, Species)	Adult Total Mortality	Total Minimum Estimated Breeding Pairs
Batiquitos Lagoon Ecological Reserve - W2	13D GHOW, 3D GBHE, 5D BAOW, 2D GREG	578	2D Unknown Raptor	9	70-75	1D 16P GHOW, 6D PEFA, 2P BAOW, 1D CALA, 1P Unknown Avian	29	541
San Elijo Lagoon Ecological Reserve	0	0	0	0	0	0	0	0
Mission Bay - FAA Island	0	0	0	0	0	1S PEFA	1	0
Mission Bay - Mariner's Point	2S Owl, 1S PEFA	70	1S Owl, 5S PEFA	7	30-50	7S Owl, 4S PEFA, 1 Unknown	12	138
Mission Bay - North Fiesta Island	0	0	0	0	0	0	0	0
Mission Bay - Stony Point	0	0	0	0	0	1P Unknown Raptor	1	10
Lindbergh Field/Former Naval Training Center	1D COHA	6	0	0	13-14	1S Unknown Avian	1	14
Naval Base Coronado - NABON	1D AMCR, 1D COHA	166	1D AMCR, 1D Unknown Raptor	3	15-24	1D COHA	2	244
Naval Base Coronado - NABOS	1D Unknown Raptor, 1S Unknown Avian, 1D BAOW, 1D FECA, 1D Unknown	165	0	0	4-7	10D FECA, 1D BAOW, 2D PEFA	15	267
Naval Base Coronado – Delta Beach North	2D GBHE	41	0	0	4-4	0	0	106

Appendix 8A – 2018 Bird Mortality

Site Name	Chick Depredation Total (Number, Obs. Type, Species)	Chick Total Mortality	Fledgling Depredation Total (Number, Obs. Type, Species)	Fledgling Total Mortality	Total Fledglings	Adult Depredation Total (Number, Obs. Type, Species)	Adult Total Mortality	Total Minimum Estimated Breeding Pairs
Naval Base Coronado – Delta Beach South	1D Unknown Avian, 2D Unknown Raptor, 1D GBTE, 1D NOHA	65	1D Unknown Raptor	1	6-11	1D Unknown Raptor, 7D FECA, 1D Unknown	9	127
US Navy - NI-MAT	0	0	0	0	1-1	0	0	12
D Street Fill/ Sweetwater Marsh NWR	1D 1P NOHA, 1D Unknown, 1S GBTE	50	1P Unknown, 2D 1S NOHA	4	12-15	1P Unknown	1	95
Chula Vista Wildlife Reserve	1P Unknown Raptor	29	0	0	6-10	1D BAOW, 1S PEFA	2	76
South San Diego Bay Unit, SDNWR/Saltworks	0	4	0	0	1-1	0	0	27
Tijuana Estuary NERR - Tijuana North	1S Unknown, 1D GBTE	22	0	0	6-7	1S Unknown, 1S PEFA	4	112
Tijuana Estuary NERR – Tijuana South	1D NOHA	18	0	0	9-10	1S Unknown	1	66

Appendix 8A – 2018 Bird Mortality

Appendix 8A Legend:

Total Mortality: For each class (chick, fledgling, adult) total mortality includes both predation and non-depredation (e.g., natural causes, unknown) mortalities.

Predator Species Codes:

American crow (AMCR), American kestrel (AMKE), Ant, Barn owl (BAOW), Black skimmer (BLSK), Black-bellied plover (BBPL), Black-crowned night-heron (BCNH), Black-tailed jackrabbit (LECA), Bobcat (LYRU), Brown pelican (BRPE), California ground squirrel (OTBE), California gull (CAGU), Canid, Caspian tern (CATE), Common raven (CORA), Cooper's hawk (COHA), Corvid, Coyote (CALA), Domestic cat (FECA), Domestic dog (CAFA), European starling (EUST), Glaucous-winged gull (GWGU), Gopher snake (PICA), Gray fox (URCI), Great blue heron (GBHE), Great egret (GREG), Great horned owl (GHOW), Great-tailed grackle (GTGR), Gull-billed tern (GBTE), Gull, Horned lark (HOLA), Least tern (LETE), Loggerhead shrike (LOSH), Long-billed curlew (LBCU), Merlin (MERL), Mice, Northern harrier (NOHA), Northern mockingbird (NOMO), Opossum (DIVI), Osprey (OSPR), Owl, Parasitic Jaeger (PAJA), Peregrine falcon (PEFA), Raccoon (PRLO), Rat, Red fox (VUVU), Red-tailed hawk (RTHA), Red-winged blackbird (RWBL), Ring-billed gull (RBGU), River otter (LOCA), Rodent, Short-eared owl (SEOW), Snake, Snapping turtle (CHSE), Southern Pacific rattlesnake (CROR), Striped skunk (MEME), Unknown, Unknown Avian, Unknown Mammal, Unknown Raptor, Western gull (WEGU), Western meadowlark (WEME), White-tailed kite (WTKI), Elegant tern (ELTE).

Observation type: Describes certainty level for each predator species that is associated with a predation event. In other words what evidence suggests a predation was committed by the predator species in question.

P=possible (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).

S=suspected (when loss of terns directly corresponded to the presence of a predator).

D=documented (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).

Total Adults: (Minimum breeding pairs from Table 1): Minimum breeding pairs are derived by selecting minimum breeding pair estimates from Method I, II, and III.

Blank cells indicate that no data was provided.

Appendix 8B – 2019 Bird Mortality

Site Name	Chick Depredation Total (Number, Obs. Type, Species)	Chick Total Mortality	Fledgling Depredation Total (Number, Obs. Type, Species)	Fledgling Total Mortality	Total Fledglings	Adult Depredation Total (Number, Obs. Type, Species)	Adult Total Mortality	Total Minimum Estimated Breeding Pairs
Napa Sonoma Marsh Wildlife Area - Green Island Unit	0	0	0	0	0	0	6	2
Napa Sonoma Marsh Wildlife Area - Pond 7/7A	0	0	0	0	0	5S Unknown	5	0
Montezuma Wetlands – 12A	0	0	0	0	0	0	0	0
Montezuma Wetlands – 14A	0	1	0	0	2-3	0	0	5
Montezuma Wetlands – 3/4C	0	0	0	0	0	0	0	2
Alameda Point	1D RTHA	142	1S AMKE, 2S PEFA, 2S RTHA, 2P PEFA, 1P RTHA	9	182-273	6D PEFA, 4S PEFA, 1S RTHA, 1P PEFA	12	240
Hayward Regional Shoreline	0	0	0	0	44-50	0	0	44
Eden Landing Ecological Reserve - E12	0	0	0	0	5-5	0	0	11
Eden Landing Ecological Reserve - E14	3D NOHA	3	0	0	5-8	0	0	60
Eden Landing Ecological Reserve - E6A	0	0	0	0	0	0	0	0
Oceano Dunes SVRA	0	0	1D NOHA	3	38-38	0	0	31
Rancho Guadalupe Dunes Preserve	0	0	0	0	4-8	0	0	13
Vandenberg AFB - Purisima Point	0	15	2D GHOW, 1D PEFA	3	21-21	1D PEFA	1	43
Hollywood Beach	0	0	0	0	0	0	0	0
Ormond Beach - North	1D WEGU	1	0	0	18-18	0	0	80
Ormond Beach - South	0	0	0	0	0	0	0	0
Point Mugu - Eastern Arm	0	0	0	0	0	0	0	0
Point Mugu - Holiday Beach	0	0	0	0	25-45	0	0	36
Point Mugu - Holiday Salt Panne	0	1	0	0	0	1P Unknown avian	1	3

Appendix 8B – 2019 Bird Mortality

Site Name	Chick Depredation Total (Number, Obs. Type, Species)	Chick Total Mortality	Fledgling Depredation Total (Number, Obs. Type, Species)	Fledgling Total Mortality	Total Fledglings	Adult Depredation Total (Number, Obs. Type, Species)	Adult Total Mortality	Total Minimum Estimated Breeding Pairs
Point Mugu - Ormond Beach East	0	3	0	1	39-75	2P Unknown avian	2	180
Saticoy United Water Conservation District	0	0	0	0	0	0	0	0
Malibu Lagoon	0	0	0	0	0	0	0	0
Venice Beach/Marina Del Rey	0	0	0	0	0	0	0	0
LA Harbor – Pier 400	1D PEFA	29	4D PEFA	4	97-97	4D PEFA	4	161
NAVWPNSTA Seal Beach W8	0	0	0	0	0-2	0	0	1
Seal Beach NWR - Anaheim Bay	0	0	0	0	0	0	0	0
Bolsa Chica Ecological Reserve - Nest Site 1 North	0	2	0	0	44-44	0	0	20
Bolsa Chica Ecological Reserve – Nest Site 1 South	0	0	0	0	0	0	0	6
Bolsa Chica Ecological Reserve – Nest Site 2	0	0	0	0	0-3	0	0	47
Bolsa Chica Ecological Reserve – Nest Site 3	0	0	0	0	0	0	0	0
Bolsa Chica Ecological Reserve – South Tern Island	0	0	0	0	0	0	0	2
Huntington Beach	0	309	0	3	81-110	4D PEFA, 1D Unknown avian	9	452
Burriss Sand Pit/Burriss Basin	0	3	0	0	2-2	0	1	14
Upper Newport Bay Ecological Reserve	0	0	0	0	4-4	0	0	20
MCB Camp Pendleton - Blue Beach	2D AMKE, 1P AMKE	43	1D Unknown raptor	1	15-15	2D PEFA, 3D Unknown raptor, 1S Unknown raptor	6	62
MCB Camp Pendleton - Salt Flats	0	0	1D Unknown raptor	1	0	1D PEFA	1	0

Appendix 8B – 2019 Bird Mortality

Site Name	Chick Depredation Total (Number, Obs. Type, Species)	Chick Total Mortality	Fledgling Depredation Total (Number, Obs. Type, Species)	Fledgling Total Mortality	Total Fledglings	Adult Depredation Total (Number, Obs. Type, Species)	Adult Total Mortality	Total Minimum Estimated Breeding Pairs
MCB Camp Pendleton - White Beach	0	0	0	0	0	0	0	0
Batiquitos Lagoon Ecological Reserve - E1	0	9	0	1	10-12	1S CALA	3	47
Batiquitos Lagoon Ecological Reserve - W1	0	9	0	0	2-3	0	0	21
Batiquitos Lagoon Ecological Reserve - W2	0	190	0	0	10-16	1S GHOW, 3P GHOW	5	411
San Elijo Lagoon Ecological Reserve - Cardiff SB and West Basin	0	0	0	0	0	0	0	0
San Elijo Lagoon Ecological Reserve – East Basin Saltpanne	0	0	0	0	0	0	0	0
Mission Bay - FAA Island	2P ANT	4	0	0	1-2	0	0	11
Mission Bay - Mariner's Point	17P ANT	65	1S PEFA	2	36-39	4D PEFA, 1S PEFA	5	123
Mission Bay - North Fiesta Island	0	0	0	0	0	0	0	1
Mission Bay - Stony Point	0	0	0	0	0	0	0	0
Lindbergh Field/Former Naval Training Center	1D AMKE, 1D Ant	2	0	0	6-6	0	3	13
Naval Base Coronado – Delta Beach North	0	38	1D BAOW, 1S PEFA	2	6-9	0	1	101
Naval Base Coronado – Delta Beach South	0	38	1D PEFA, 1S BAOW	3	4-4	1D Unknown raptor	1	96
Naval Base Coronado - NABON	2D GBTE, 1D WEGU, 1S Unknown, 1P Unknown avian	55	2D PEFA	5	7-15	2D PEFA	2	304
Naval Base Coronado - NABOS	2D GBTE	68	0	0	4-6	1P PEFA	1	209
US Navy - NI-ALT	0	0	0	0	0	0	0	0
US Navy - NI-MAT	0	0	0	0	1-1	0	0	2
US Navy - NIA18	0	2	0	0	0	0	0	1

Appendix 8B – 2019 Bird Mortality

Site Name	Chick Depredation Total (Number, Obs. Type, Species)	Chick Total Mortality	Fledgling Depredation Total (Number, Obs. Type, Species)	Fledgling Total Mortality	Total Fledglings	Adult Depredation Total (Number, Obs. Type, Species)	Adult Total Mortality	Total Minimum Estimated Breeding Pairs
D Street Fill/ Sweetwater Marsh NWR	1D ant	17	1S PEFA	1	12-12	1P PEFA, 1P Unknown avian	2	77
Chula Vista Wildlife Reserve	0	4	0	0	2-4	3D Owl, 1S Unknown avian	4	51
South San Diego Bay Unit, SDNWR/Saltworks	0	2	1S PEFA	1	1-1	1P Unknown avian	1	28
Tijuana Estuary NERR - Tijuana North	0	5	0	1	4-5	1S Unknown avian	1	25
Tijuana Estuary NERR – Tijuana South	0	1	2D PEFA	2	2-2	1P Unknown	1	72

Appendix 8B Legend:

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Predator Species Codes:

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Observation type: Describes certainty level for each predator species that is associated with a predation event. In other words what evidence suggests a predation was committed by the predator species in question.

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Total Adults: (Minimum breeding pairs from Table 1): Minimum breeding pairs are derived by selecting minimum breeding pair estimates from Method I, II, and III.