

**State of California
The Resources Agency
Department of Fish and Game
Wildlife Branch**

California Least Tern Breeding Survey

2008 Season

**by
Daniel A. Marschalek**

Final Report

To

State of California
Department of Fish and Game
South Coast Region
4949 Viewridge Avenue
San Diego, CA 92123

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Daniel A. Marschalek
California Department of Fish and Game
South Coast Region
4949 Viewridge Avenue
San Diego, CA 92123
dmarschal@dfg.ca.gov

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Daniel A. Marschalek
California Department of Fish and Game
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4949 Viewridge Avenue
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ABSTRACT

Monitoring to document breeding success of California least terns (*Sternula antillarum browni*) continued in 2008, with observers at 36 nesting sites providing data. An estimated 6998-7698 California least tern breeding pairs established 8223-8226 nests and produced 2254-2573 fledglings at 47 documented locations. The fledgling to breeding pair ratio was 0.29-0.37. Statewide, 13,847 eggs were reported, with a Site Mean clutch size of 1.77 eggs per nest (St Dev = 0.124) and the statewide clutch size of 1.75 eggs (St Dev = 0.452) for Type 1 sites (clutch sizes for each nesting site are provided for 2004-2008). Numbers of nesting least terns were not uniformly distributed across all sites. Camp Pendleton, Naval Base Coronado, Batiquitos Lagoon, Los Angeles Harbor, and Venice Beach represented 64% of the breeding pairs while Alameda Point, Venice Beach, Huntington Beach and Los Angeles Harbor produced 50% of the fledglings. The 2008 chick mortality rate of 14% represented the first increase since 2004 but the actual rate was less than those of 2004 (32%) and 2005 (28%). Camp Pendleton, Venice Beach, LA Harbor, Seal Beach, and Batiquitos Lagoon Ecological Reserve represented 87% of the total reported chick deaths, but only 45% of the total chicks. The main predator of least terns in 2008 was the American crow (*Corvus brachyrhynchos*), resulting from depredation of 760 eggs at Venice Beach. Gull-billed tern (*Gelochelidon nilotica*), common raven (*Corvus corax*), and coyote (*Canis latrans*) predation each comprised 8-10% of all predation. Common ravens, peregrine falcons (*Falco peregrinus*), American crows, gulls (*Larus* sp.), great blue herons (*Ardea herodias*) and American kestrels (*Falco sparverius*) were reported from the most sites. The monitoring effort of 2008 is scheduled to continue in 2009.

¹ Marschalek, D.A. 2009. California least tern breeding survey, 2008 season. California Department of Fish and Game, Wildlife Branch, Nongame Wildlife Program Report, 2009-02. Sacramento, CA. 23 pp. + app.

INTRODUCTION

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

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

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

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

accomplished in 1993 when all site monitors were provided with the same datasheets and instructions (Caffrey 1994, 1995a). In an attempt to provide a more accurate statewide (rather than site specific) method of estimating the number of breeding pairs, calculations consider the number of reneesting pairs a site may produce rather than the number of reneesting pairs actually at the site (Caffrey 1998). These equations have been used to some extent since the 1998 nesting season (Keane 2000). Over the last decade, monitors continued to provide comparable data of California least tern breeding success and these data were compiled into annual summary reports. These latest monitoring efforts were continued for the 2008 breeding season in California.

METHODS

Monitors for each site that had least tern nesting in 2007 or who planned monitoring activities for 2008 were provided datasheets prior to the arrival of adult terns (Appendix A). These forms were similar to those used since the 1998 nesting season to continue standardized data collection for the entire state. Forms and instructions to report final breeding data were provided at the same time so monitors could collect and prepare data requested for the annual report. General updates from each site were compiled about every two weeks throughout the breeding season and distributed to California Department of Fish and Game (CDFG) and U.S. Fish and Wildlife Service (USFWS) representatives so that any potential problems could be dealt with quickly.

Site Preparation

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

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

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

Monitoring

Sampling Type and Intensity

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 whether nests were marked (generally with a tongue depressor or wooden stake), eggs marked (numbering the shell), or birds banded. When color-banding studies were conducted, the band color was requested.

Sampling intensity was reported as the total number of visits to a site and dates of first and last visits. Optional data included monthly averages of visits per week, number of hours per visit (total, within colony and within colony in blind) and number of monitors per visit.

Pair Estimation

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

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

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

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

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

Method III is much more subjective, relying on the monitor to estimate of the number of renesting pairs in the first and second wave. This calculation subtracts the estimated number of renesting pairs for each wave from the total nests during each wave. The totals for waves one

and two are then added to estimate the total number of breeding pairs. Adult banding can reduce the subjectivity of Method III by allowing the monitor to observe renesting pairs.

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

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

Total Pairs = pairs first wave + pairs second wave

Productivity

Productivity was measured by counting the number of nests, eggs, eggs hatched, hatching success and total fledglings at each site. Dates of first chick and fledgling were also typically recorded. These data will not be available for Type 2 or 3 sites simply because monitors cannot easily observe eggs and nests from a distance. “Window surveys” of active nests, fledglings, and adults were conducted at two-week intervals throughout the breeding season for statewide comparison.

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

Accurate fledgling counts are problematic as fledglings quickly move from their nesting areas (Massey 1989a). At least four specific techniques may be used and are reported as an abbreviation: (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, and (other) description of alternate method.

Mortality and Predation

Identifying causes of mortality was of particular importance since it has been identified as the main cause of low reproductive success for this species (Collins 1984). Numbers of lost nests and individuals of each age class (egg, chick, fledgling, and adult) were recorded. Causes of mortality were further separated into either non-predation events or predation. Non-predation causes of death included abandonment, flooding, and human damage.

Predators were characterized as either “potential,” “possible,” “suspected,” and/or “documented.” *Potential* predators were classified as species known to feed on least terns and observed on or near the site without the loss of terns. If predation of terns occurred and a potential predator was known to be on or near the site through direct observation or other signs

(track, scat, etc.), the animal was considered a *possible* predator. A *suspected* predator was reported when loss of least terns directly corresponded to the presence of a predator. These three predator classifications rely on the expertise of the monitors. *Documented* predators required a direct observation of a predator killing a least tern or substantial evidence to indicate responsibility. This evidence could be characteristic feeding patterns or tracks leading to a carcass or shell remains.

To quantify the impact of each predator species on the reproductive success and survivorship of least terns, two statistics are provided. The first ranks the species by the number of sub-colonies they were documented as predators. The second quantifies mortality by calculating the proportion of total least tern eggs, chicks, fledglings, and adults depredated by specific predators. The number of eggs, rather than the number of nests, was used in calculations since they more accurately represent individual terns. For the few cases when the number of eggs was not reported, the number of nests was used as a conservative estimate of the number of eggs depredated. When a range of individuals depredated by a species was reported, the average was used. Past analysis with minimum, average, or maximum values resulted in only slight differences (Marschalek 2005). Only the numbers of terns lost to a suspected or documented predator (possible category excluded) were used in calculating the proportion of least terns lost to predators. Past data shows little difference between (1) only documented predation and (2) combining suspected and documented predation (Marschalek 2008).

Both preventive and reactive predator management techniques were used to reduce the loss of least terns. Select predators were often removed from the site or adjacent areas just prior to the terns arriving in the spring. When predation was documented, the predator was removed using appropriate capture techniques. Sensitive and protected species were either trapped and released at off-site locations or were left on site and monitored.

RESULTS and DISCUSSION

Site Preparation

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

Monitoring

Twenty-seven of 36 sites monitored in 2008 were Type I sites, the majority monitored at least one or two times per week. A grid system to assist in locating nests was not used at every site but almost every monitor marked nests in some fashion. Site-specific and complete monitoring data are located in Appendix B-2.

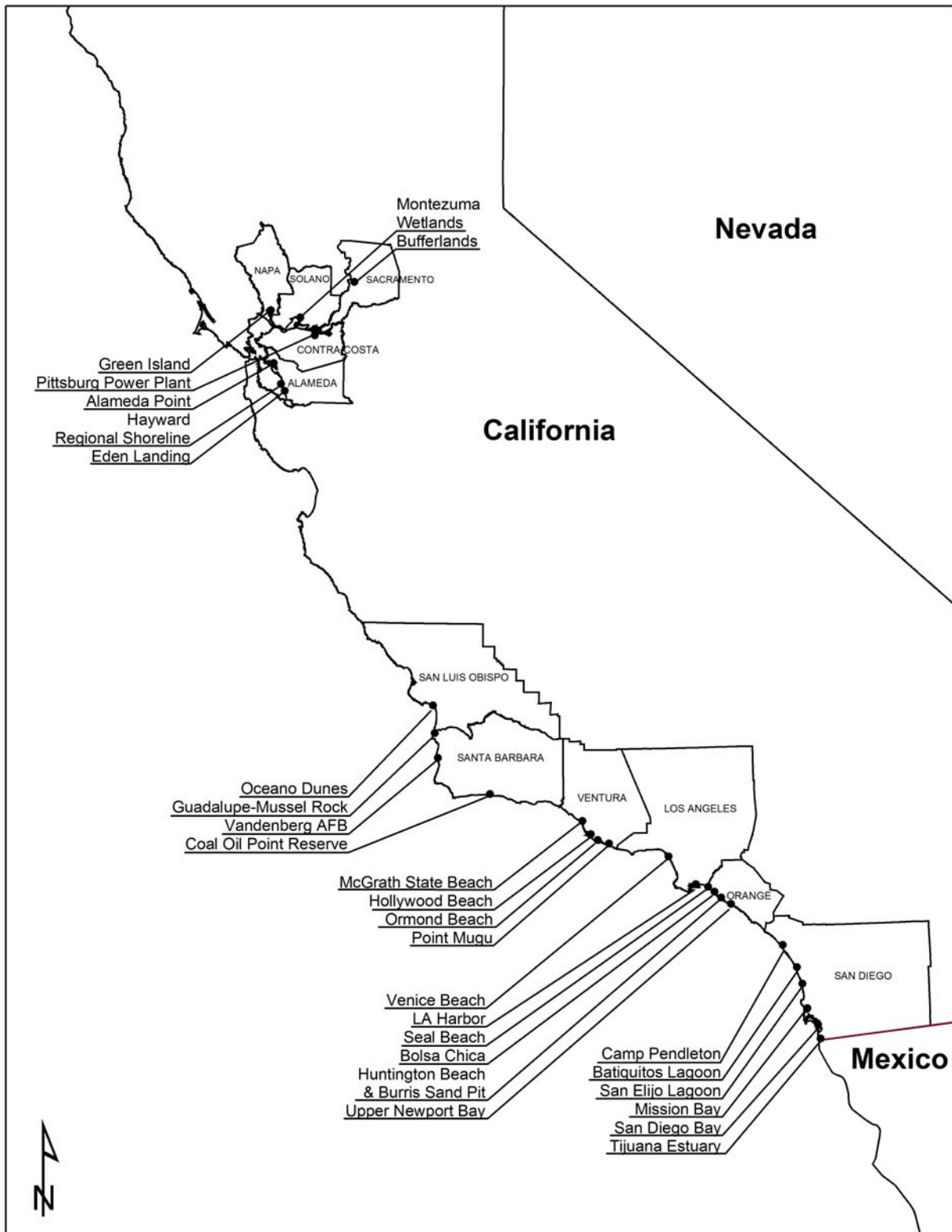


Figure 1. California sites monitored for California least tern nesting in 2008. Some listed areas include multiple sites, sites with nesting at more than one location, or both.

Productivity

At least partial data were received and analyzed for all monitored least tern nesting areas in California for 2008. An estimated 6998-7698 California least tern breeding pairs established 8223-8226 nests and produced 2254-2573 fledglings at 47 documented locations (Table 2). The fledgling to breeding pair ratio was 0.29 to 0.37 fledglings per pair. Statewide, 13,847 eggs were reported, with a Site Mean clutch size of 1.77 eggs per nest (St Dev = 0.124) and a Statewide clutch size of 1.75 eggs (St Dev = 0.452). Appendix B-4 contains site specific clutch size data for years 2004-2007 in addition to data for 2008.

The 2008 California least tern nesting season lasted approximately five months. The first recorded least tern at a nesting site was on 9 April at Chula Vista Wildlife Reserve and the last observed on 18 September at Tijuana Estuary. The first nest was detected on 4 May at Bolsa Chica Ecological Reserve, the first chick at NAB Ocean on 28 May, and first fledgling at Delta Beach North on 18 June. Least terns did not nest at three sites used in 2007 (Guadalupe-Mussel Rock, FAA Island and Stony Point), however, they nested at one location not used last year (Bufferlands). The three locations used in 2007 and not in 2008 had 74 nests total. Site-specific and complete productivity data are located in Appendix B-3 (breeding pair estimation) and B-4 (productivity).

The 6998 recorded minimum breeding pairs in 2008 was about 4% higher than the 6744 total in 2007 (Marschalek 2008). This represents the second highest count recorded for California, just below the 7006 total from 2006 (Figure 2) (Craig 1971; Bender 1974a, 1974b; Massey 1975, 1988, 1989b; Atwood et al. 1977; Jurek 1977; Atwood et al. 1979; Collins 1984, 1986, 1987; Gustafson 1986; Johnston and Obst 1992; Obst and Johnston 1992; Caffrey 1993, 1994, 1995b, 1997, 1998; Keane 1998, 2000, 2001; Patton 2002, 2004 unpubl. Table; Marschalek 2005, 2006, 2007, 2008).

Due to concerns regarding late nesting, any technique monitors determined to be most representative of the actual number of breeding pairs was used as the estimate. Late nest initiation will often result in an underestimation when calculating the number of breeding pairs using any of the three traditional estimates. For consistency, the traditional estimates are provided in the appendices. Fledgling numbers were nearly identical (1.7% lower) to the 2007 count (Marschalek 2008), representing an average number over the last decade and the seventh highest total recorded.

The majority of breeding pairs nested in San Diego County (4240 pairs, 60.4%) and the fewest in San Luis Obispo and Santa Barbara Counties (74 pairs, 1.1%) (Table 3). Breeding pairs were not a predictor for fledgling numbers, however. The fledgling-to-pair ratio ranged from a low of 0.134 in San Diego County to a high of 1.203 in San Luis Obispo and Santa Barbara Counties.

Table 2. California least tern productivity in 2008.

2008 Site	Estimated Number of Breeding Pairs		Number of Nests	Estimated Number of Fledglings		Fledgling per Pair Ratio	
	Minimum	Maximum		Minimum	Maximum	Minimum	Maximum
Sacramento Area							
Bufferlands	1	1	1	0	0	0.00	0.00
San Francisco Bay Area							
Green Island/Napa Plant	16	18	16 to 18	1	2	0.06	0.13
Montezuma Wetlands	35	35	35	11	18	0.31	0.51
Pittsburg Power Plant	10	10	1	0	0	0.00	0.00
Alameda Point	323	324	336	357	507	1.10	1.57
Hayward Regional Shoreline	57	62	62	73	73	1.18	1.28
Eden Landing	2	2	2	0	0	0.00	0.00
San Luis Obispo/Santa Barbara Counties							
Oceano Dunes SVRA	55	55	56	70	70	1.27	1.27
Guadalupe-Mussel Rock	0	0	0	0	0	0.00	0.00
Vandenberg AFB	18	18	18	19	19	1.06	1.06
Coal Oil Point Reserve	1	1	1	0	0	0.00	0.00
Ventura County							
Santa Clara River/McGrath State Beach	89	97	97	77	77	0.79	0.87
Hollywood Beach	24	24	24	28	28	1.17	1.17
Ormond Beach	79	81	81	30	30	0.37	0.38
Pt Mugu- Totals	380	456	506	79	79	0.17	0.21
Ormond Beach East	277	337	362	59	59	0.18	0.21
Holiday Beach	52	66	74	12	12	0.18	0.23
Holiday Beach Salt Panne	13	16	17	4	4	0.25	0.31
Eastern Arm	35	41	53	4	4	0.10	0.11
Los Angeles/Orange Counties							
Venice Beach	460	698	928	296	296	0.42	0.64
LA Harbor	486	515	529	210	210	0.41	0.43
Seal Beach NWR - Anahiem Bay	166	200	206	44	44	0.22	0.27
Bolsa Chica Ecological Reserve	211	217	242	100	150	0.46	0.71
Huntington State Beach	344	411	454	267	267	0.65	0.78
Burris Sand Pit/Burris Basin	4	4	10	2	2	0.50	0.50
Upper Newport Bay Ecological Reserve	22	26	25	20	20	0.77	0.91
San Diego County							
MCB Camp Pendleton- Totals	1604	1604	1665	107	139	0.07	0.09
Red Beach	5	5	5	0	0	0.00	0.00
White Beach	114	114	119	2	3	0.02	0.03
Cockleburrr Beach	1	1	1	0	0	0.00	0.00
Santa Margarita River - North Beach North	432	432	458	17	17	0.04	0.04
Santa Margarita River - North Beach South	987	987	1012	85	116	0.09	0.12
Santa Margarita River - Saltflats	44	44	48	3	3	0.07	0.07
Santa Margarita River - Saltflats Island	21	21	22	0	0	0.00	0.00
Batiquitos Lagoon Ecological Reserve- Totals	598	598	610	123	176	0.21	0.29
W1	35	35	35	24	32	0.69	0.91
W2	397	397	404	73	98	0.18	0.25
E1	165	165	170	25	45	0.15	0.27
E2	0	0	0	0	0	0.00	0.00
E3	1	1	1	1	1	1.00	1.00
San Elijo Lagoon Ecological Reserve	0	0	0	0	0	0.00	0.00
Mission Bay							
FAA Island	0	0	0	0	0	0.00	0.00
North Fiesta Island	10	10	10	0	0	0.00	0.00
Mariner's Point	12	13	14	0	0	0.00	0.00
Stony Point	0	1	0-1	0	0	0.00	0.00
San Diego River Mouth	1	1	1	0	0	0.00	0.00
San Diego Bay							
Lindbergh Field & Former Naval Training Center	122	124	139	115	128	0.93	1.05
USN- Totals	1451	1671	1671	155	155	0.09	0.11
NI MAT	104	146	146	25	25	0.17	0.24
Delta Beach North	272	295	295	30	30	0.10	0.11
Delta Beach South	163	174	174	35	35	0.20	0.21
NAB Ocean	912	1056	1056	65	65	0.06	0.07
D Street Fill/Sweetwater Marsh NWR	133	135	148	17	24	0.13	0.18
Chula Vista Wildlife Reserve	28	28	33	2	2	0.07	0.07
South San Diego Bay Unit, SDNWR - Saltworks	79	80	102	6	6	0.08	0.08
Tijuana Estuary NERR	177	178	201	45	51	0.25	0.29
Totals:	6998	7698	8223-8226	2254	2573	0.29	0.37

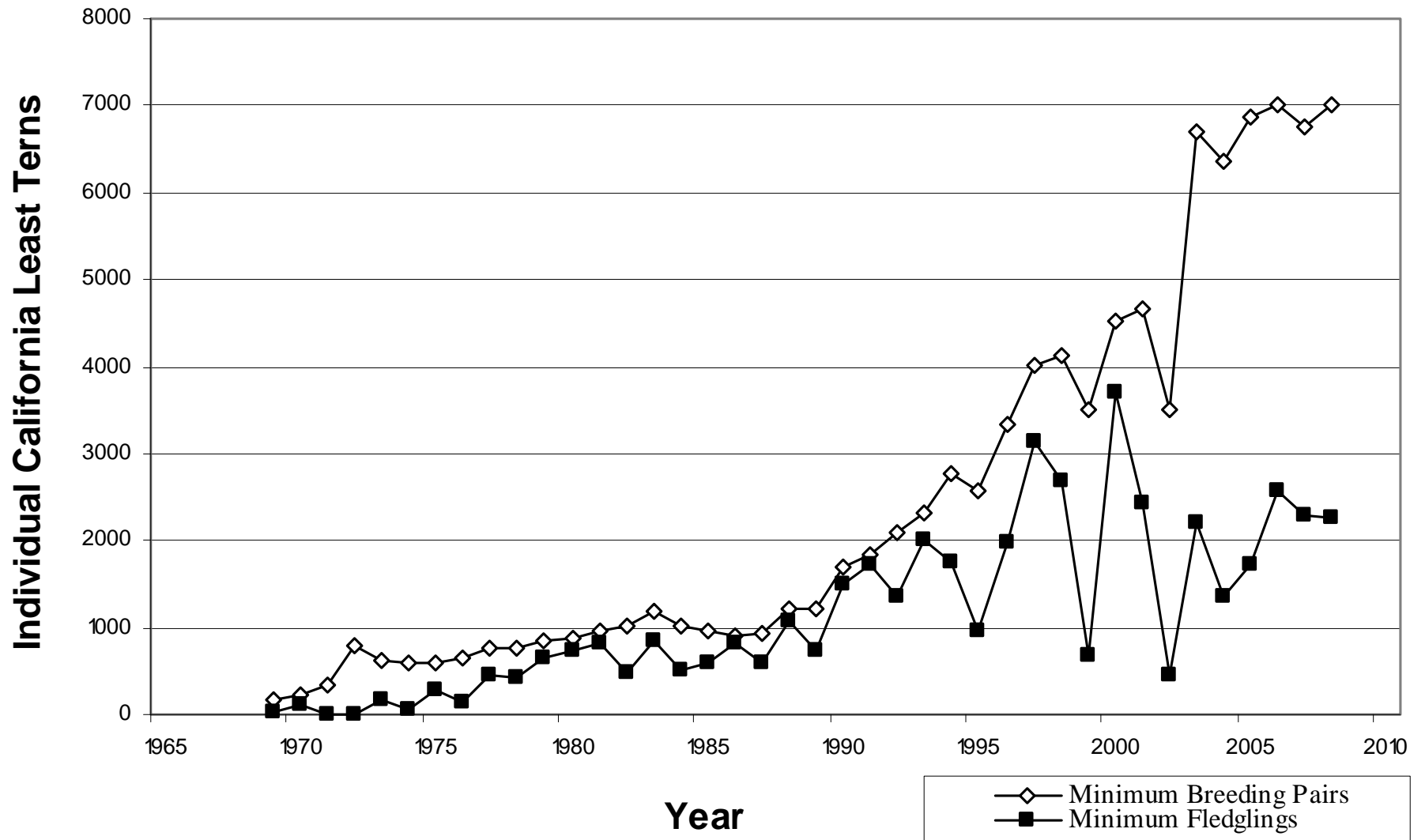


Figure 2. Number of documented California least tern breeding pairs and fledglings in California during annual surveys, 1969-2008. (Data from: Craig 1971; Bender 1974a, 1974b; Massey 1975, 1988, 1989b; Atwood *et al.* 1977; Jurek 1977; Atwood *et al.* 1979; Collins 1984, 1986, 1987; Gustafson 1986; Johnston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

Table 3. Regional productivity comparison, 2008.

Region	Breeding Pairs**	Proportion of Total	Fledglings**	Proportion of Total	Fledgling:Pair*
San Francisco Bay Area (w/Bufferlands)	444	0.063	442	0.196	0.995
San Luis Obispo/Santa Barbara Counties	74	0.011	89	0.039	1.203
Ventura County	572	0.082	214	0.095	0.374
Los Angeles/Orange County	1693	0.242	939	0.417	0.555
San Diego County	4215	0.602	570	0.253	0.135
Total	6998	1.000	2254	1.000	0.322

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

** Breeding pair and fledgling numbers represent the minimum number recorded if a site reported a range of abundance.

As in the past, the number of breeding pairs generally corresponds more closely to the number of nests, eggs, and chicks than the number of fledglings (Table 4). Camp Pendleton, Naval Base Coronado, Batiquitos Lagoon Ecological Reserve, and Venice Beach had the highest number of breeding pairs, nests, eggs, and chicks in the state in 2008. There was more variation in the rankings than previous years. The five sites with the most fledglings produced differed due to different survival rates at each site. Hayward (1.18), Hollywood Beach (1.17), Alameda Point (1.10) and Vandenburg AFB (1.06) are the only four sites that had a minimum fledgling-to-pair ratio greater than one.

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

Breeding Pairs	Nests	Eggs	Chicks	Fledglings
Camp Pendleton (1604)	Camp Pendleton (1665)	Camp Pendleton (2907)	Camp Pendleton (2188)	Alameda Point (357)
Naval Base Coronado (1335)	Naval Base Coronado (1524)	Naval Base Coronado (2643)	Naval Base Coronado (2137)	Venice Beach (296)
Batiquitos (598)	Venice Beach (928)	Venice Beach (1236)	Batiquitos (924)	Huntington Beach (267)
LA Harbor (486)	Batiquitos (610)	Batiquitos (1086)	Alameda Point (543)	LA Harbor (210)
Venice Beach (460)	LA Harbor (529)	Pt. Mugu & LA Harbor (891 each)	Venice Beach (476)	Naval Base Coronado (130)

A few sites constituted the majority of breeding activity for the state in 2008, which is a trend observed in the past (Caffrey 1994, 1995b, 1997, 1998; Marschalek 2005, 2006, 2007, 2008). Five sites (Camp Pendleton, Naval Base Coronado, Batiquitos Lagoon Ecological

Reserve, Los Angeles Harbor, and Venice Beach) had over 400 minimum breeding pairs, which represented 64% of the state total. Eggs and nests tend to show a linear relationship with number of breeding pairs, resulting in an uneven distribution of eggs and nests as well. Fledgling numbers were also unevenly distributed as the four sites with over 200 fledglings each (Alameda Point, Venice Beach, Huntington Beach, and LA Harbor) contributed 50% of the state's production, similar to 52% in 2007 although two of the four sites are different.

Mortality and Predation

The 2008 chick mortality rate of 14% represented the first increase since 2004 but the actual rate was less than those of 2004 (32%) and 2005 (28%) (Marschalek 2005, 2006, 2007, 2008) (Table 5). The larger nesting colonies continued to experience rates greater than the average. At Camp Pendleton, Venice Beach, LA Harbor, Seal Beach, and Batiquitos Lagoon Ecological Reserve 31, 27, 26, 20, and 18% of chicks were found dead, respectively. These five sites represented 87% of the total reported chick deaths, but only 45% of the total chicks hatched in California. Least tern mortality due to non-predation factors was greater than mortality due to predation in 2008.

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

	Eggs	Nests	Chicks	Fledglings	Adults
Non-predation	2348	1400	1329	314	31
Predation	1686-1693	1100-1107	308-443+	73-100	28

Abandonment prior to the expected hatching date was the second highest death rate from non-predation events, leading to the loss of 1088 eggs (46%). Abandonment post-term or failure to hatch is often difficult to distinguish from pre-term abandonment and contributed a slightly lower rate (27%) to the non-predation mortality.

It was very difficult to accurately determine the predator species involved in a tern predation event. These events were not typically observed and often little or no evidence remained at the site. The uncertainty of the exact predator species responsible for a depredation event often resulted in reporting a range of least terns lost to a particular species rather than an exact number. Uncertainty is also reflected in a predation event reported as either suspected or documented in some cases, based on the evidence available and the conservative nature of the biologist. For this reason, the proportion of least terns lost to each predator species includes two different calculations: (1) only documented species, and (2) suspected and documented species.

Forty-five species were reported as possible, suspected, or documented predators of least terns (Table 6). The most commonly documented predators were common ravens (*Corvus corax*), peregrine falcons (*Falco peregrinus*), American crows (*Corvus brachyrhynchos*), gulls

(*Larus* sp.), great blue herons (*Ardea herodias*), and American kestrels (*Falco sparverius*). As in past years, most reported predators were avian species.

Table 6. Reported species documented or thought to have depredated least terns. Number of sub-colonies each species was reported from in parenthesis.

Species	Species	Species
Great blue heron (20)	Peregrine falcon (22)	Black-tailed jackrabbit (3)
Great egret (4)	Black-bellied plover (1)	Opossum (11)
Black-crowned night heron (11)	Barn owl (9)	River otter (1)
California gull (2)	Great-horned owl (6)	Raccoon (8)
Western gull (5)	Burrowing owl (3)	Skunk (6)
Gulls (21)	Owls (10)	Gray fox (3)
Caspian tern (4)	Rock pigeon (1)	Red fox (2)
Elegant tern (1)	American crow (22)	Coyote (14)
Gull-billed tern (11)	Common raven (25)	Domestic dog (8)
Black skimmer (3)	Corvids (3)	Domestic cat (10)
Northern harrier (14)	Loggerhead shrike (2)	California ground squirrel (8)
White-tailed kite (4)	European starling (3)	Rats (6)
Cooper's hawk (7)	Western meadowlark (4)	Rodents (8)
Red-tailed hawk (14)	Red-winged blackbird (1)	Unknown mammal (2)
Golden eagle (1)	Brewer's blackbird (1)	Snakes (4)
Osprey (5)	Unknown avian (13)	Ants (9)
Crested caracara (1)	Long-tailed weasel (3)	Unknown (10)
American kestrel (20)		

Predation led to the loss of 1686-1693 eggs, 308-443 chicks, 73-100 fledglings, and 28 adults (Table 5). The number of depredated eggs was about two times greater in 2008 than 2007, but 760 eggs (45%) were solely from Venice Beach. It is believed that most of the Venice Beach terns re-nested, ultimately producing 296 fledglings. In past years, a predation event(s) of this magnitude would typically result in complete reproductive failure from that particular site. Monitors reported about half the number of chicks, equal number of fledglings, and three-quarters the number of adults depredated in 2008 compared to 2007. A total of 2034 least tern individuals (including eggs) were reported with a documented or suspected predator species.

Most depredated least terns were lost to American crows (802 total individuals, 38%) in 2008 (Table 7). Excluding the large predation event at Venice Beach, American crow predation would have been lower than in past years (3% in 2008 compared to 7% or higher in 2004-2007) (Marschalek 2008). Gull-billed terns, common ravens, and coyotes represented 8-10% of the depredation, with all other species responsible for less than 5% of depredated least terns. The “unknown predators” category is different than reported in 2007. The 2007 category included only those least terns that were actually reported as depredated by “unknown predators,” while the 2008 category represents the difference between the total number reported depredated minus the number associated with suspected or documented predator species. Nests were excluded from this analysis since the number of eggs better represents the loss of individuals. Abandonment was also excluded from depredation data but can be driven by a predator. Site-specific and complete mortality data are located in Appendix B-5 (non-predation) and B-6 (predation).

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

Species	Proportion of Least Tern Individuals Depredated (Documented and Suspected Predators)*
American crow	0.3776
Gull-billed tern	0.1031
Common raven	0.0833
Coyote	0.0791
Peregrine Falcon	0.0485
American kestrel	0.0414
Unknown	0.0414
Burrowing owl	0.0381
Black skimmer	0.0254
Unknown avian	0.0217
Northern harrier	0.0202

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

Predation data reported by the site monitors appears to be the most detailed since 2004 or earlier. As in 2007, most predation was a result of only a couple species in 2008. American crows, gull-billed terns, common ravens, and coyotes comprised about 64% of the predator mortality. The expanded foraging area of gull-billed terns observed in 2007 (Marschalek 2008) was again observed in 2008, with similar predation rates. Predator species varied in importance among each least tern age class. American crows had the largest depredation rate of eggs, while gull-billed terns, avian species, and peregrine falcons depredated the most chicks, fledglings, and adults, respectively (Table 8). In addition, fledgling and adult predation was almost exclusively restricted to avian predators.

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

Eggs		Chicks		Fledglings		Adults	
Predator	Proportion*	Predator	Proportion*	Predator	Proportion*	Predator	Proportion*
American crow (795)	0.5318	Gull-billed tern (148)	0.2716	Unknown avian (15)	0.2542	Peregrine Falcon (13)	0.3250
Coyote (160)	0.1070	American kestrel (87)	0.1596	Unknown (13)	0.2203	Unknown avian (12)	0.3000
Common raven (153)	0.1023	Peregrine falcon (84)	0.1541	Great blue heron (8)	0.1356	Owl species (9)	0.2250
Gull-billed tern (71)	0.0475	Burrowing owl (81)	0.1486	Peregrine falcon (6)	0.1017	Unknown (2)	0.0500
Unknown (63)	0.0421	Great blue heron (27)	0.0495	Owl species (5)	0.0847	Four different species (1)	0.0250

*This value represents the proportion of least terns within the particular age class depredated by the particular predator species.

Summary by Site

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

Sacramento Area

Bufferlands

One pair established a nest on a gravel road situated between two treatment ponds associated with the Sacramento Regional Wastewater Treatment Plant. This appears to be the first recorded nesting of least terns in Sacramento County. When the nest was detected, the road was closed; however the pair was unsuccessful in producing fledglings.

San Francisco Bay Area

Green Island (Napa Plant)

This was the second year least tern nesting was documented at Green Island. In 2008, 16-18 pairs established 16-18 nests and produced 1-2 fledglings. This represents the first confirmation of successful nesting at this site.

Montezuma Wetlands

This was the third year least tern nesting was documented at Montezuma Wetlands, with 35 pairs establishing 35 nests and producing 11-18 fledglings. Red foxes were reported near the site.

Pittsburg Power Plant

Ten least tern pairs were present early in the year, although only one nest was observed. These terns left the site and the nest was unsuccessful.

Alameda Point

At the Alameda Point site, 323-324 breeding pairs established 336 nests and produced 357-507 fledglings. The number of pairs and nests were lower in 2008 than 2007, but fledgling production was about double the 2007 total. Nesting started about a week later than 2007. Many predator species were observed at the nesting site, resulting in the removal of barn owls, common ravens, American crows, skunks and feral cats removed from refuge area.

Hayward Regional Shoreline

Hayward Regional Shoreline experienced the fourth consecutive year of least tern nesting activity and the third production of fledglings. In 2008, 57-62 breeding pairs established 62 nests and produced 73 fledglings. This represents the highest total of pairs, nests and fledglings for this site, as well as one of the state's highest fledgling per breeding pair ratio again.

Predation was low, but the few events resulted from aerial predators (California gull, American crow and Peregrine falcon). Volunteers contributed to this reduced predation rate by deterring predator species in the area or reporting these to Wildlife Services. There was the first western snowy plover nest at this site in 2008 as well. This site has been constructed with a combination of volunteer efforts and support from a variety of grant funds and donations (Riensch 2007).

Eden Landing

This was the second year that least terns nested at Eden Landing, with two pairs established two nests. Both nests were unsuccessful due to suspected predation by California gulls.

San Luis Obispo/Santa Barbara Counties

Oceano Dunes SVRA

The Oceano Dunes State Vehicular Recreational Area (SVRA) site had 55 breeding pairs, 56 nests, and produced 70 fledglings. These numbers are similar to 2007, which represented a doubling in reproductive success from 2006. All nesting occurred within the large seasonally fenced area provided for nesting least terns and snowy plovers. Least terns continue to use the site as a night roost.

Guadalupe-Mussel Rock

There was no least tern nesting at Guadalupe-Mussel Rock in 2008. Only one pair has attempted nesting in the last three years.

Vandenberg AFB

At Vandenberg AFB, 18 breeding pairs established 18 nests and produced 19 fledglings. Pair and nest counts are identical to those in 2007, but three more fledglings were produced. Two-egg clutches were more common in 2008 than 2007 when about half of the nests were only one-egg clutches.

Coal Oil Point Reserve

For the second consecutive year, least tern nesting was unsuccessful at Coal Oil Point Reserve due to predation by skunks. A predator control program is now in place and 2009 plans include attracting least tern nesting using audio devices.

Ventura County

Santa Clara River/McGrath State Beach

The Santa Clara River site had 89-97 breeding pairs establish 97 nests and produce 77 fledglings. This represents the highest recorded number of pairs, nests and fledglings from this site.

Hollywood Beach

At Hollywood Beach, 24 breeding pairs established 24 nests and produced 28 fledglings. This is only the fourth year of least tern nesting at this site.

Ormond Beach

At Ormond Beach, 79-81 breeding pairs established 81 nests and produced 30 fledglings.

NAS Point Mugu

Point Mugu had a total of 380-456 breeding pairs, 506 nests, and 79 fledglings. As in the last two years, Ormond Beach East had the highest number of pairs, nests and fledglings of the sub-colonies. Coyote predation was the main reason for documented mortality, although 148 eggs had unknown outcomes.

Los Angeles/Orange Counties

Venice Beach

Venice Beach had 460-698 breeding pairs, 928 nests, and 296 fledglings. Predation due to American crows was extremely high and resulted in 100% failure of the first nesting attempt. In total, 760 eggs from 553 nests were depredated by crows. A second nesting wave was able to produce the second most fledglings of any site in 2008.

Los Angeles Harbor

The Los Angeles Harbor site had 486-515 breeding pairs, 529 nests, and 210 fledglings. Despite fewer pairs and nests, more fledglings were produced compared to 2007. Burrowing owls, American kestrel, and peregrine falcons are suspected to be responsible for depredation of 150 least tern chicks. Predator presence may have also led to some nest abandonment. When chicks were present, it was noted that prey may have been limited, another possible reason for abandonment.

Seal Beach NWR

At Seal Beach NWR, 166-200 breeding pairs established 206 nests and produced 44 fledglings. Great blue heron predation may have led to high levels of mortality, but exact totals are unknown due to a weekly survey schedule.

Bolsa Chica Ecological Reserve

At Bolsa Chica Ecological Reserve, 211-217 breeding pairs established 242 nests and produced 100-150 fledglings. This represents the second highest breeding pair count ever recorded from this site, and the highest since 1990.

Huntington State Beach

At Huntington State Beach, 344-411 breeding pairs established 454 nests and produced 267 fledglings.

Burris Sand Pit (Burris Basin)

At Burris Sand Pit, four breeding pairs established at least 10 nests and produced two fledglings. The four pairs resulted from the maximum number observed at any one time. Predation was likely high, resulting in the low reproduction success. Burris Basin is another name being used for this location.

Upper Newport Bay Ecological Reserve

At Upper Newport Bay Ecological Reserve, 22-26 breeding pairs established at least 25 nests and produced 20 fledglings. This was a Type 2 site so specific reproductive data are not available.

San Diego County

MCB Camp Pendleton

At Camp Pendleton, a total of 1604 breeding pairs established 1665 nests and produced 107-139 fledglings, the highest number of breeding pairs and nests of any site within the state for 2008. As in the last three years, the Santa Margarita River North Beach sites (North and South) had the majority of the least tern nesting and production, representing 88% of the pairs and 95% of the fledglings at Camp Pendleton.

Batiquitos Lagoon Ecological Reserve

At Batiquitos Lagoon Ecological Reserve, 598 breeding pairs established 610 nests and produced 123-176 fledglings. Documented predation was relatively low.

San Elijo Lagoon Ecological Reserve

There was no nesting activity at San Elijo Lagoon Ecological Reserve in 2008. Currently, a restoration project is underway that may provide additional least tern nesting habitat in the future.

Mission Bay - FAA Island

There were no nests at FAA Island in 2008. Scrapes were present earlier in the season so the terns expressed some interest in nesting.

- North Fiesta Island

The North Fiesta Island site had 10 breeding pairs establish at least 10 nests. All nesting attempts failed due to predation by snakes, gulls, American crows or common ravens.

- Mariner's Point

At Mariner's Point, 12-13 breeding pairs established 14 nests. All nesting attempts failed due to predation by gulls, American crows, common ravens or rats.

- Stony Point

No nesting was detected at Stony Point in 2008, but a suspected least tern egg was observed being carried away by an American crow.

- San Diego River Mouth (S)

The San Diego River Mouth (S) site had one breeding pair establish one nest. The nest was depredated by an American crow or common raven.

San Diego Bay

- Lindbergh Field

At Lindbergh Field, 122 breeding pairs established 139 nests and produced 115-128 fledglings, including a four-egg clutch nest. Pair and nest numbers are nearly identical to those of 2007; however fledgling production was about four times greater.

- NAS North Island

At North Island, 139 breeding pairs established 146 nests and produced 25 fledglings.

-Naval Base Coronado

Naval Base Coronado had 1347-1525 breeding pairs, 1525 nests, and 130 fledglings, with most of the production at the Naval Amphibious Base Ocean sub-colony. South Delta Beach had the fewest numbers of the three sub-colonies for the third consecutive year.

- D Street Fill/Sweetwater Marsh NWR

At D Street, 135 breeding pairs established 148 nests and produced 17-24 fledglings.

- Chula Vista Wildlife Reserve

Chula Vista NWR had 28 breeding pairs establish 33 nests and produced two fledglings. Evidence of nest abandonment and documented predation were minimal.

- South San Diego Bay Unit, SDNWR - Saltworks

At Saltworks NWR, 79 breeding pairs established 102 nests and produced six fledglings. Predation and non-predation mortality were at similar levels.

Tijuana Estuary NERR

At Tijuana Estuary, 177 breeding pairs established 201 nests and produced 45-50 fledglings. Flooding resulted in the loss of 27 eggs, while 36 eggs were abandoned and 62 lost to predation.

Biologists recorded the second highest total of California least tern breeding pairs in 2008. After an increase in the breeding population through the 1990s, it appears the population is stabilizing around 6900 breeding pairs based on counts of 2005-2008. Chick mortality continues to be a factor at specific sites, possibly a result of limited or inappropriate food sources. Many of the same predator species, such as American crows and coyotes, continued to be an issue in 2008. However, it appears that predation by “protected” species or species of special concern, such as gull-billed terns and burrowing owls, is increasing and will be an important topic that will have to be addressed.

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Appendix A

Data Sheets

General Data Sheet

Page 1

Location:				Date:		Job:		Observer(s):			
Time start:				Time stop:				On site:			
Est/Measured	Time:		Temp:	Wind Spd/Dir:		Cloud cvr (%):		Precip. (Y/N):		Tide: H L In Out	
ADULTS	Total:			NESTS	Total:			New:			
CHICKS	Observed:			Est max:		New Chicks:		Fledglings Obs:		Est max:	
Mortality (Y/N):	Adult:		Fledgling:		Chick:		Egg:		Nest:		
Predation (Y/N):	Adult:		Fledgling:		Chick:		Egg:		Nest:		
Take (Y/N):	Adult:		Fledgling:		Chick:		Egg:		Nest:		
Col Live (Y/N):	Adult:		Fledgling:		Chick:		Egg:		Other:		
Col Dead (Y/N):	Adult:		Fledgling:		Chick:		Egg:		Fish:		Other:
Nest No.	Grid No.	New/ Incub.	Status	Nest No.	Grid No.	New/ Incub.	Status	Nest No.	Grid No.	New/ Incub.	Status
1				31				61			
2				32				62			
3				33				63			
4				34				64			
5				35				65			
6				36				66			
7				37				67			
8				38				68			
9				39				69			
10				40				70			
11				41				71			
12				42				72			
13				43				73			
14				44				74			
15				45				75			
16				46				76			
17				47				77			
18				48				78			
19				49				79			
20				50				80			
21				51				81			
22				52				82			
23				53				83			
24				54				84			
25				55				85			
26				56				86			
27				57				87			
28				58				88			
29				59				89			
30				60				90			

Egg/Nest Codes: E=egg, CH=chick, NC=New Chick, H=hatched and no longer present, PH=probable hatch, FH=failed to hatch, A=abandoned
 P=Preyed on, DAM=damaged, F=flooded, B=buried, Col=collected, M=moved, Unk=unkown. Circle Nest Number if new or if status has changed.

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

Ants Y / N Grid Location(s):

Documented Predation/Mortality:

Human Disturbance/Take:

Comment:

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

Multi-visit Form

Species:				LOCATION							
Date 1		Date 2		Date 3			Date 4				
Observers:		Observers:		Observers:			Observers:				
Date 5		Date 6		Date 7			Date 8				
Observers:		Observers:		Observers:			Observers:				
Date 9		Date 10		Date 11							
Observers:		Observers:		Observers:							
Nest	Found	Grid	Prior	Date 1	Date 2	Date 3	Date 4	Date 5	Date 6	Date 7	Band Number
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
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31											
32											
33											
34											
35											
36											
37											
38											
39											
40											
41											
Nest	Found	Grid	Prior	Date 1	Date 2	Date 3	Date 4	Date 5	Date 6	Date 7	Band Number

Appendix B
Site Specific Data

Appendix B-1: Site Preparation (continued).

Site name:	Sub-colony names (if any):	Name of primary monitor:	Names of other monitors:	Fence type:	Interpretive signs at site:	Chick shelters:	Decoys:	Grid system:	Vegetation management:	Other site preparation:	By whom:
San Diego County											
MCB Camp Pendleton- Totals											
Red Beach		Brian Foster									
White Beach		Brian Foster									
Cockleburrr Beach		Brian Foster									
Santa Margarita River - North Beach North		Brian Foster									
Santa Margarita River - North Beach South		Brian Foster									
Santa Margarita River - Saltflats		Brian Foster									
Santa Margarita River - Saltflats Island		Brian Foster									
Batiqitos Lagoon Ecological Reserve- Totals											
W1	BAT-W1	S. Wolf	L. Squires, A. Copper, L. Hofsteen	3	Yes	Yes	No	Yes	Yes		
W2	BAT-W2	S. Wolf	L. Squires, A. Copper, L. Hofsteen	3	Yes	Yes	No	Yes	Yes		
E1	BAT-E1	S. Wolf	L. Squires, A. Copper, L. Hofsteen	3	Yes	Yes	No	Yes	Yes		
E2	BAT-E2	S. Wolf	L. Squires, A. Copper, L. Hofsteen	3	Yes	Yes	No	Yes	Yes		
E3	BAT-E3	S. Wolf	L. Squires, A. Copper, L. Hofsteen	4	Yes	Yes	No	Yes	Yes		
San Elijo Lagoon Ecological Reserve		R. Patton	M. Bache, S. Welker	3	Yes	No	No	No	6	Flood control dike gate valve	County of SD Parks Dept
Mission Bay											
FAA Island											
North Fiesta Island		Ginger Johnson		1	Yes	Yes- 50	Yes- 35	Yes	4	Improved grid and installed chick fence	San Diego City Parks Dept
Mariner's Point		Ginger Johnson		1	Yes	Yes- 30	No	Yes	4	Repairs of chick fence	San Diego Audubon Society, San Diego City Parks Dept
Stony Point		Ginger Johnson		1	Yes	Yes	No	Yes	4	Improved grid, new chain link fence, chick shelters provided	San Diego City Parks Dept
San Diego River Mouth		Ginger Johnson		1	Yes	No	No	No	7	Temporary plastic fence with chick fence at bottom	San Diego City Parks Dept

Appendix B-1: Site Preparation (continued).

Site name:	Sub-colony names (if any):	Name of primary monitor:	Names of other monitors:	Fence type:	Interpretive signs at site:	Chick shelters:	Decoys:	Grid system:	Vegetation management:	Other site preparation:	By whom:
San Diego Bay											
Lindbergh Field & Former Naval Training Center		R. Patton	E. Copper, B. Foster, J. Barth, M. Garcia	3	Yes	No	No	Yes	4		
USN- Totals											
NI MAT		E. Copper	Dennis Parker, Mark Billings, Laura Hoffsteen	1	Yes	Yes- 200 wood tent shelters	Yes- 60	Yes	4		Ernie Clemm
Delta Beach North			Marit Evans-Layng, Mark Billings, Lea Squires, Matt Sadowski, Laura Hofsteen	1	No	Yes- 200 wood tent shelters	Yes- 60	Yes	1		Ernie Clemm
Delta Beach South			Marit Evans-Layng, Mark Billings, Lea Squires, Matt Sadowski, Laura Hofsteen	1	Yes	Yes- 200 wood tent shelters	Yes- 80	Yes	1		Ernie Clemm
NAB Ocean	yellow2/red, green, blue, orange		Tom Myers, Mark Billings, Matt Sadowski, Joe Barth, Laura Hofsteen,	3, 4	Yes	No	No	Yes	7		
D Street Fill/Sweetwater Marsh NWR		R. Patton	B. Collins, J. Jackson, J. Barth	3	Yes	Yes- 180	Yes- 100	Yes	4		
Chula Vista Wildlife Reserve		R. Patton	J. Jackson, J. Barth	3	Yes	Yes- 40	Yes- 100	Yes	4		
South San Diego Bay Unit, SDNWR - Saltworks		R. Patton	B. Collins	3	No	Yes- 20	No	No	7		
Tijuana Estuary NERR		R. Patton	B. Collins, J.Barth,R.Burg,P.Roulard	3	Yes	Yes- 100	No	Yes	7		

Legend

Fence Type:

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

Vegetation Management

- 1- Mechanical Removal
- 2- Manual Removal
- 3- Herbicide
- 4- Combination of 1, 2 or 3
- 5- Other Means
- 6- Needed, but not conducted in 2008
- 7- None Needed

Appendix B-2: Monitoring.

Site name:	Site type:	Date of first monitoring visit:	Date of last monitoring visit:	Total number of monitoring visits:	Nest marking:	Egg marking:	Banding:	If color-banding, what color(s) were used:
Sacramento Area								
Bufferlands								
San Francisco Bay Area								
Green Island								
Montezuma Wetlands	2	6-May-08	29-Jul-08	13	No	No	No	N/A
Pittsburg Power Plant	2	22-Apr-08	25-Jun-08	7	N/A	N/A	N/A	N/A
Alameda Point	3	28-Apr-08	11-Aug-08	80	Yes	No	No	N/A
Hayward Regional Shoreline	3	25-Apr-08	17-Aug-08	232	Yes	No	No	N/A
Eden Landing								
San Luis Obispo/Santa Barbara Counties								
				Site received some degree of monitoring on a daily basis.	Yes- with naturally occurring materials present	No	Yes- chicks	Green over yellow on left, right with USFWS band and tape for unique combo.
Oceano Dunes SVRA	1	1-Mar-08	30-Sep-08			No		
Guadalupe-Mussel Rock		5-Mar-08	12-Sep-08	64	No	No	No	N/A
Vandenberg AFB	3	15-Apr-08	7-Sep-08	105	Yes	No	No	N/A
Coal Oil Point Reserve								
Ventura County								
Santa Clara River/McGrath State Beach	1	29-May-08	10-Sep-08	20	Yes	No	No	
Ormond Beach	1	30-Apr-08	3-Sep-08	18	Yes	No	No	
Hollywood Beach	1	20-May-08	31-Aug-08	16	Yes	No	No	
Pt Mugu- Totals	1 and 3	5-May-08	26-Aug-08	25	Yes	No	No	
Ormond Beach East	1	5-May-08	7-Aug-08	23	Yes	No	No	
Holiday Beach	1	5-May-08	11-Aug-08	17	Yes	No	No	
Holiday Beach Salt Panne	1	5-May-08	28-Jul-08	23	Yes	No	No	
Eastern Arm	3	5-May-08	26-Aug-08	25	Yes	No	No	
Los Angeles/Orange Counties								
Venice Beach	1	22-Apr-08	3-Sep-08	25	Yes	No	Yes- chicks	N/A
LA Harbor	1	29-Apr-08	18-Aug-08	50	Yes	No	No	N/A
Seal Beach NWR - Anahiem Bay	1	8-May-08	21-Jul-08	14	Yes	no	Yes- chicks	Black/yellow split plastic on left leg, FWS on right
Bolsa Chica Ecological Reserve	1	15-May-08	26-Jun-08	21	Yes	no	No	N/A
Huntington State Beach	1	16-May-08	5-Aug-08	22	Yes	No	No	N/A
Burris Sand Pit/Burris Basin	2				No	No	No	N/A
Upper Newport Bay Ecological Reserve	2							

Appendix B-2: Monitoring (continued).

Site name:	Site type:	Date of first monitoring visit:	Date of last monitoring visit:	Total number of monitoring visits:	Nest marking:	Egg marking:	Banding:	If color-banding, what color(s) were used:
San Diego County								
MCB Camp Pendleton- Totals	1						Yes	black/mauve
Red Beach	1						Yes	N/A
White Beach	1						Yes	black/mauve
Cockleburrr Beach	1						Yes	N/A
Santa Margarita River - North Beach North	1						Yes	black/mauve
Santa Margarita River - North Beach South	1						Yes	black/mauve
Santa Margarita River - Saltflats	1						Yes	black/mauve
Santa Margarita River - Saltflats Island	1						Yes	black/mauve
Batiquitos Lagoon Ecological Reserve- Totals	1						Yes	black/mauve
W1	1	3-Jan-08	30-Sep-08		Yes		Yes	white/red
W2	1	3-Jan-08	30-Sep-08		Yes		Yes	red/white
E1	1	10-Jan-08	30-Sep-08		Yes		Yes	red/white
E2	1	14-Jan-08	25-Sep-08		Yes		Yes	red/white
E3	1	19-Feb-08	25-Sep-08		Yes		Yes	red/white
San Elijo Lagoon Ecological Reserve	3	14-Apr-08	8-Sep-08	30	Yes	No	Yes- chicks	N/A
Mission Bay								
FAA Island	1							
North Fiesta Island	1	23-Apr-08	5-Aug-08	17	Yes	Yes	No	N/A
Mariner's Point	1	17-Apr-08	5-Aug-08	22	Yes	Yes	No	N/A
Stony Point	1	25-Apr-08	5-Aug-08	16	No	No	No	N/A
San Diego River Mouth	1	16-Apr-08	6-Aug-08	18	Yes	Yes	No	N/A

Appendix B-2: Monitoring (continued).

Site name:	Site type:	Date of first monitoring visit:	Date of last monitoring visit:	Total number of monitoring visits:	Nest marking:	Egg marking:	Banding:	If color-banding, what color(s) were used:
San Diego Bay								
Lindbergh Field & Former Naval Training Center	1	3-Apr-08	2-Sep-08	57	Yes	No	Yes- chicks and adults	adult: W/G
USN- Totals	1	4-Jan-08	31-Dec-08		Yes	Yes	Yes- chicks and adults	
NI MAT	1	26-Mar-08	27-Aug-08	112	Yes	Yes	Yes- chicks and adults	S-O/A chicks; A-A/OS or A/OS-A adults
Delta Beach North	1	4-Jan-08	31-Dec-08	133	Yes	Yes	Yes- chicks and adults	S-R/Y chicks; A-Y/RS or Y/RS-A adults
Delta Beach South	1	4-Jan-08	31-Dec-08	146	Yes	Yes	Yes- chicks and adults	S-W/K chicks; W/KS-A, K/WS-A, X-W/KS adults
NAB Ocean	1	4-Jan-08	31-Dec-08	169	Yes	Yes	Yes- chicks and adults	S-B/F chicks; A-F/BS or F/BS-A adults
D Street Fill/Sweetwater Marsh NWR	1	1-Apr-08	5-Sep-08	52	Yes	No	Yes- chicks and adults	adult: W/M
Chula Vista Wildlife Reserve	1	1-Apr-08	29-Aug-08	59	Yes	No	Yes- chicks and adults	adult: Y/K
South San Diego Bay Unit, SDNWR - Saltworks	1	1-Apr-08	30-Sep-08	33	Yes	No	Yes- chicks and adults	adult: L/M
Tijuana Estuary NERR	1	2-Apr-08	30-Sep-08	44	Yes	No	Yes- chicks and adults	adult: G/R

Appendix B-2: Monitoring (continued).

Color combinations of current and past California least tern banding studies conducted at breeding areas in California.

Site Name	Color Combination	Abbreviation
Oceano Dunes SVRA	Green/Yellow, Yellow/Green	G/Y, Y/G
MCB Camp Pendleton	Mauve (Violet)/Black	M/K
Batiquitos Lagoon Ecological Reserve	Red/White	R/W
Mariner's Point	Blue/Green	B/G
NIMAT	Aqua (light blue)/Orange	A/O
NI 1-1	Black/Aqua (Light Blue)	K/A
Naval Amphibious Base Ocean	Blue/Pink, Red/Blue	B/P, R/B
Delta Beach North	Yellow/Red	Y/R
Delta Beach South	White/Black	W/K
2005 Captive*	Anodized Red	-
2004 Captive*	Anodized Red	-
2003 Captive*	Anodized Green	-
2002 Captive*	Anodized Blue	-

* "Captive" refers to rehabilitated birds (Project Wildlife) released to the wild (no releases in 2006-2008)

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

Site name:	Date terns first observed:	Date terns last observed:	Date of first nest:	Date of last nest initiation:	Total nests prior to 15 June:	Total nests 15 June & later:	Total pairs:
Sacramento Area							
Bufferlands							
San Francisco Bay Area							
Green Island							
Montezuma Wetlands	6-May-08	29-Jul-08	3-Jun-08	Unknown	Unknown	Unknown	35 (high count on weekly visits)
Pittsburg Power Plant	22-May-08	25-Jun-08					
Alameda Point	25-Apr-08	8-Aug-08	14-May-08	11-Jul-08	310	26	323
Hayward Regional Shoreline	25-Apr-08	17-Aug-08	15-May-08	17-Jul-08	51	11	56.5
Eden Landing							
San Luis Obispo/Santa Barbara Counties							
Oceano Dunes SVRA	10-May-08	22-Aug-08	3-Jun-08	27-Jun-08	23	33	39.5
Guadalupe-Mussel Rock	19-May-08	8-Jun-08	N/A	N/A	0	0	0
Vandenberg AFB	12-May-08	15-Aug-08	17-Jun-08	22-Jul-08	18	0	18
Coal Oil Point Reserve							
Ventura County							
Santa Clara River/McGrath State Beach	29-May-08	2-Sep-08	3-Jun-08	10-Jul-08	97		97
Ormond Beach	7-May-08	27-Aug-08	24-May-08	13-Jul-08	81		81
Hollywood Beach	26-May-08	24-Aug-08	26-May-08	20-Jul-08	24		24
Pt Mugu- Totals	5-May-08	27-Aug-08	19-May-08	14-Jul-08	406	100	456
Ormond Beach East		4-Aug-08	23-May-08	1-Jul-08	58	16	66
Holiday Beach		27-Aug-08	23-May-08	3-Jul-08	9	8	13
Holiday Beach Salt Panne		4-Aug-08	22-May-08	14-Jul-08	28	25	40.5
Eastern Arm		4-Aug-08	19-May-08	9-Jul-08	311	51	336.5
Los Angeles/Orange Counties							
Venice Beach	22-Apr-08	27-Aug-08	13-May-08	23-Jul-08	468	460	698
LA Harbor	29-Apr-08	15-Aug-08	19-May-08	9-Jul-08	500	29	514.5
Seal Beach NWR - Anahiem Bay	21-Apr-08	unknown	8-May-08	30-Jun-08	193	13	199.5
Bolsa Chica Ecological Reserve	14-Apr-08	19-Aug-08	4-May-08	2-Jul-08	191	51	216.5
Huntington State Beach	2-May-08	5-Aug-08	16-May-08	27-Jun-08	367	87	411
Burris Sand Pit/Burris Basin			29-May-08				4
Upper Newport Bay Ecological Reserve							

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

Site name:	Date terns first observed:	Date terns last observed:	Date of first nest:	Date of last nest initiation:	Total nests prior to 15 June:	Total nests 15 June & later:	Total pairs:
San Diego County							
MCB Camp Pendleton- Totals	22-Apr-08	30-Aug-08	10-May-08	17-Jul-08			1604
Red Beach	29-Apr-08	8-Jul-08	15-May-08	31-May-08			5
White Beach	29-Apr-08	14-Aug-08	13-May-08	26-Jun-08			114
Cocklebur Beach	19-Jun-08	12-Aug-08	19-Jun-08	19-Jun-08			1
Santa Margarita River - North Beach North	29-Apr-08	12-Aug-08	11-May-08	10-Jul-08			432
Santa Margarita River - North Beach South	22-Apr-08	30-Aug-08	10-May-08	17-Jul-08			987
Santa Margarita River - Saltflats	29-Apr-08	27-Jul-08	17-May-08	1-Jul-08			44
Santa Margarita River - Saltflats Island	29-Apr-08	27-Jul-08	17-May-08	24-Jun-08			21
Batiquitos Lagoon Ecological Reserve- Totals	23-Apr-08	26-Aug-08	13-May-08	24-May-08			593
W1	26-Apr-08	14-Aug-08	15-May-08	12-Jun-08	34	1	34.5
W2	24-Apr-08	26-Aug-08	13-May-08	21-Jun-08	385	19	394.5
E1	23-Apr-08	14-Aug-08	13-May-08	24-Jun-08	156	14	163
E2	24-Apr-08	12-Jul-08	N/A	N/A	0	0	0
E3	24-Apr-08	12-Jul-08	24-May-08	24-May-08	1	0	1
San Elijo Lagoon Ecological Reserve	26-Apr-08	11-Aug-08	N/A	N/A	0	0	0
Mission Bay							
FAA Island					0	0	0
North Fiesta Island	13-May-08	12-Jun-08	21-May-08	21-May-08	10	0	10
Mariner's Point	3-May-08	16-Jul-08	14-May-08	20-Jun-08	11	3	12.5
Stony Point	7-May-08	7-Jun-08					0
San Diego River Mouth	20-May-08	16-Jul-08	9-Jun-08	9-Jun-08	1	0	1
San Diego Bay							
Lindbergh Field & Former Naval Training Center	22-Apr-08	15-Aug-08	16-May-08	18-Jul-08			122-124
USN- Totals	14-Apr-08	29-Aug-08	5-May-08	1-Aug-08	1305	366	1488
NI MAT	25-Apr-08	3-Aug-08	7-May-08	23-Jun-08	134	12	140
Delta Beach North	22-Apr-08	12-Aug-08	5-May-08	4-Jul-08	250	45	272.5
Delta Beach South	22-Apr-08	27-Aug-08	10-May-08	7-Jul-08	153	21	163.5
NAB Ocean	14-Apr-08	29-Aug-08	5-May-08	1-Aug-08	768	288	912
D Street Fill/Sweetwater Marsh NWR	22-Apr-08	13-Aug-08	10-May-08	16-Jul-08			133-135
Chula Vista Wildlife Reserve	9-Apr-08	29-Aug-08	16-May-08	8-Jul-08			28
South San Diego Bay Unit, SDNWR - Saltworks	26-Apr-08	17-Sep-08	14-May-08	23-Jul-08			79-80
Tijuana Estuary NERR	26-Apr-08	18-Sep-08	15-May-08	19-Jul-08			177-178

Appendix B-4: Productivity (continued).

Site name:	Total nests:	Total eggs:	No. of eggs hatched:	Hatching Success:	Date of first chick:	Date of last hatch:	Date of first fledgling:	Fledgling estimate method:	Total fledglings:
San Diego County									
MCB Camp Pendleton- Totals	1665	2907	2188	0.7527	31-May-08	17-Jul-08			107-139
Red Beach	5	8	0	0	N/A	N/A			0
White Beach	119	209	146	0.6986	5-Jun-08	29-Jun-08			2-3
Cocklebur Beach	1	2	0	0	N/A	N/A			0
Santa Margarita River - North Beach North	458	773	565	0.7309	1-Jun-08	15-Jul-08			17
Santa Margarita River - North Beach South	1012	1796	1391	0.7745	31-May-08	17-Jul-08			85-116
Santa Margarita River - Saltflats	48	82	55	0.6707	8-Jun-08	15-Jul-08			3
Santa Margarita River - Saltflats Island	22	37	31	0.8378	5-Jun-08	15-Jul-08			0
Batiquitos Lagoon Ecological Reserve- Totals	610	1086	924	0.8508	3-Jun-08	14-Jun-08	8-Jul-08		123-176
W1	35	64	54	0.8438	5-Jun-08	3-Jul-08	26-Jun-08	recap	24-32
W2	404	706	594	0.8414	3-Jun-08	15-Jul-08	24-Jun-08	recap	73-98
E1	170	314	274	0.8726	5-Jun-08	15-Jul-08	26-Jun-08	2W obs	25-45
E2	0	0	0	0	N/A	N/A	N/A	N/A	0
E3	1	2	2	1	14-Jun-08	14-Jun-08	8-Jul-08	2W obs	1
San Elijo Lagoon Ecological Reserve	0	0	0	N/A	N/A	N/A	N/A	N/A	0
Mission Bay									
FAA Island	0	0	0	N/A	N/A	N/A	N/A	N/A	0
North Fiesta Island	10	18	0	0	N/A	N/A	N/A	N/A	0
Mariner's Point	14	17	0	0	N/A	N/A	N/A	N/A	0
Stony Point	0	0	0	N/A	N/A	N/A	N/A	N/A	0
San Diego River Mouth	1	1	0	0	N/A	N/A	N/A	N/A	0
San Diego Bay									
Lindbergh Field & Former Naval Training Center	139	238	193	0.8109	6-Jun-08	21-Jul-08	30-Jun-08	R, 2WD	115-128
USN- Totals	1670	2890	2286	0.7910	28-May-08	14-Jul-08	18-Jun-08	Combination of survey and fledgling data	155
NI MAT	146	247	149	0.6032	3-Jun-08	14-Jul-08	24-Jun-08	Combination of survey and fledgling data	25
Delta Beach North	295	519	407	0.7842	30-May-08	25-Jul-08	18-Jun-08	Combination of survey and fledgling data	30
Delta Beach South	174	308	276	0.8961	31-May-08	25-Jul-08	23-Jun-08	Combination of survey and fledgling data	35
NAB Ocean	1055	1816	1454	0.8007	28-May-08	28-Jul-08	24-Jun-08	Combination of survey and fledgling data	65
D Street Fill/Sweetwater Marsh NWR	148	262	223	0.8511	3-Jun-08	22-Jul-08	24-Jun-08	R, 2WD	17-24
Chula Vista Wildlife Reserve	33	60	32	0.5333	6-Jun-08	26-Jul-08	15-Aug-08	R, 2WD	2
South San Diego Bay Unit, SDNWR - Saltworks	102	191	81	0.4241	7-Jun-08	30-Jul-08	25-Jun-08	R, 2WD	6
Tijuana Estuary NERR	201	371	191	0.5148	5-Jun-08	10-Jul-08	26-Jun-08	R, 2WD	45-51

Appendix B-4: Productivity, clutch sizes 2008.

Site name:	Nest total	Egg total	Number of nests			
			1 egg clutch	2 egg clutch	3 egg clutch	4 egg clutch
Sacramento Area						
Bufferlands	1	1	1	0	0	0
San Francisco Bay Area						
Green Island	16-18					
Montezuma Wetlands	35+					
Pittsburg Power Plant	1					
Alameda Point	336	633	43	289	4	0
Hayward Regional Shoreline	62	114	10	51	1	0
Eden Landing	2	2				
San Luis Obispo/Santa Barbara Counties						
Oceano Dunes SVRA	56	115				
Guadalupe-Mussel Rock						
Vandenberg AFB	18	35	1	17	0	0
Coal Oil Point Reserve	1	2				
Ventura County						
Santa Clara River/McGrath State Beach	97	158	38	57	2	0
Ormond Beach	81	153	10	70	1	0
Hollywood Beach	24	46	5	16	3	0
Pt Mugu- Totals	492	891	101	371	16	0
Ormond Beach East	73	140	9	61	3	0
Holiday Beach	17	31	4	12	1	0
Holiday Beach Salt Panne	53	100	12	35	6	0
Eastern Arm	345	620	76	263	6	0
Los Angeles/Orange Counties						
Venice Beach	928	1276				
LA Harbor	529	891	167	362	0	0
Seal Beach NWR - Anahiem Bay	206	359	56	147	3	0
Bolsa Chica Ecological Reserve	242	434	55	182	5	0
Huntington State Beach	454	739	170	283	1	0
Burris Sand Pit/Burris Basin						
Upper Newport Bay Ecological Reserve						
San Diego County						
MCB Camp Pendleton- Totals	1665	2907	431	1226	9	0
Red Beach	5	8	2	3	0	0
White Beach	119	209	29	90	1	0
Cockleburr Beach	1	2	0	1	0	0
Santa Margarita River - North Beach North	458	773	144	313	1	0
Santa Margarita River - North Beach South	1012	1796	235	770	7	0
Santa Margarita River - Saltflats	48	82	14	34	0	0
Santa Margarita River - Saltflats Island	22	37	7	15	0	0
Batiquitos Lagoon Ecological Reserve- Totals	610	1086	143	460	7	0
W1	35	64	6	29	0	0
W2	404	706	106	296	2	0
E1	170	314	31	134	5	0
E2	0	0	0	0	0	0
E3	1	2	0	1	0	0
San Elijo Lagoon Ecological Reserve	0	0	0	0	0	0

Appendix B-4: Productivity, clutch sizes 2008 (continued)

Site name:	Nest total	Egg total	Number of nests			
			1 egg clutch	2 egg clutch	3 egg clutch	4 egg clutch
Mission Bay						
FAA Island	0	0	0	0	0	0
North Fiesta Island	10	18	2	8	0	0
Mariner's Point	14	17	11	3	0	0
Stony Point	0	0	0	0	0	0
San Diego River Mouth	1	1	1	0	0	0
San Diego Bay						
Lindbergh Field & Former Naval Training Center	139	238	43	94	1	1
USN (Total)	1671	2891	454	1212	4	0
NI MAT	146	247	45	101	0	0
Delta Beach North	295	519	73	220	2	0
Delta Beach South	174	308	40	134	0	0
NAB Ocean	1056	1817	296	757	2	0
D Street Fill/Sweetwater Marsh NWR	148	262	34	114	0	0
Chula Vista Wildlife Reserve	33	60	7	25	1	0
South San Diego Bay Unit, SDNWR - Saltworks	102	191	15	86	0	0
Tijuana Estuary NERR	201	371	34	164	3	0

Appendix B-4: Productivity, clutch sizes 2007.

Site name:	Nest total	Egg total	Number of nests			
			1 egg clutch	2 egg clutch	3 egg clutch	4 egg clutch
San Francisco Bay Area						
Pittsburg Power Plant						
Alameda Point	394	678	114	276	4	0
Hayward Regional Shoreline	35	67	5	30	0	0
San Luis Obispo/Santa Barbara Counties						
Oceano Dunes SVRA						
Rancho Guadalupe Dunes Preserve						
Vandenberg AFB- Purisima Pt	18	29	7	11	0	0
Coal Oil Point						
Ventura County						
Santa Clara River/McGrath State Beach						
Ormond Beach	52	92	13	38	1	0
Hollywood Beach	1	2		1		
NBVC Pt. Mugu (Total)	431	743	117	309	5	0
Ormond East	351	596	101	247	3	0
Holiday Beach	65	124	9	54	2	0
Holiday Beach Salt Panne	6	9	3	3	0	0
Eastern Arm	9	14	4	5	0	0
Los Angeles/Orange Counties						
Venice Beach	546	775	319	225	2	0
LA HARBOR Pier 400						
Seal Beach NWR/Anaheim Bay	166	292	42	122	3	0
Bolsa Chica Ecological Reserve	266	392	60	166	0	0
Huntington State Beach	485	772	198	287	0	0
Burris Sand Pit						
Upper Newport Bay ER						
San Diego County						
Camp Pendleton (Total)						
Red Beach	14	24	4	10	0	0
White Beach	117	194	40	77	0	0
Santa Margarita River - North Beach North	288	420	156	132	0	0
Santa Margarita River - North Beach South	984	1416	554	428	2	0
Santa Margarita River - Saltflats	85	125	45	40	0	0
Santa Margarita River - Saltflats Island	42	56	28	14	0	0
Batiquitos Lagoon Ecological Reserve (Total)						
W1	40	62	18	22	0	0
W2	379	600	158	221	0	0
E1	170	269	71	99	0	0
E2	0	0	0	0	0	0
E3	5	8	2	3	0	0
San Elijo Lagoon Ecological Reserve						

Appendix B-4: Productivity, clutch sizes 2007 (continued).

Site name:	Nest total	Egg total	Number of nests			
			1 egg clutch	2 egg clutch	3 egg clutch	4 egg clutch
Mission Bay						
FAA	28	48	9	18	1	0
North Fiesta Island	39	64	16	22	0	1
Mariner's Point	105	180	30	75	0	0
Stony Point	45	78	12	33	0	0
San Diego River Mouth	30	54	7	22	1	0
San Diego Bay						
Lindbergh Field & Former Naval Training Center	135	238	33	101	1	0
USN (Total)	1285	2205	365	920	0	0
NI MAT	123	200	46	77	0	0
Delta Beach North	224	393	55	169	0	0
Delta Beach South	156	264	48	108	0	0
NAB Ocean	782	1348	216	566	0	0
D Street Fill/Sweetwater Marsh NWR	130	214	47	82	1	0
Chula Vista Wildlife Reserve	46	81	11	35	0	0
South San Diego Bay Unit, SDNWR - Saltworks	97	166	28	69	0	0
Tijuana Estuary NERR	291	511	72	218	1	0

Appendix B-4: Productivity, clutch sizes 2006.

Site name:	Nest total	Egg total	Number of nests		
			1 egg clutch	2 egg clutch	3 egg clutch
San Francisco Bay Area					
Pittsburg Power Plant					
Alameda Point	441	754	132	305	4
Hayward Regional Shoreline	15	13 +	unknown	unknown	unknown
San Luis Obispo/Santa Barbara Counties					
Oceano Dunes SVRA					
Guadalupe-Mussel Rock					
Vandenberg AFB (Total)					
Purissima Point	2	4	0	2	0
Beach 2	0	0	0	0	0
Ventura County					
Santa Clara River/McGrath State Beach					
Ormond Beach	53	100	10	41	2
NAWS Pt Mugu (Total)	469	838	100	363	6
Ormond East	194	686	90	295	4
Holiday Beach	21	87	4	40	1
Eastern Arm	16	64	6	28	1
Los Angeles/Orange Counties					
Venice Beach, Marina del Rey, California	384	597	172	211	1
LA HARBOR Pier 400					
Seal Beach NWR/Anaheim Bay	186	298	77	106	3
Bolsa Chica Ecological Reserve	222	363	83	137	2
Huntington State Beach					
Upper Newport Bay ER	36	61	11	25	0
San Diego County					
Camp Pendleton (Total)					
Red Beach	27	43	11	16	0
White Beach	147	246	50	95	2
Santa Margarita River - North Beach North	301	455	147	154	0
Santa Margarita River - North Beach South	951	1499	403	548	0
Santa Margarita River - Saltflats	66	113	19	47	0
Santa Margarita River - Saltflats Island	48	79	17	31	0
Batiquitos Lagoon Ecological Reserve (Total)					
W1	36	59	13	23	0
W2	409	669	149	260	0
E1	160	262	58	102	0
E2	0	0	0	0	0
E3	22	35	9	13	0
San Elijo Lagoon Ecological Reserve					

Appendix B-4: Productivity, clutch sizes 2006 (continued)

Site name:	Nest total	Egg total	Number of nests		
			1 egg clutch	2 egg clutch	3 egg clutch
Mission Bay					
FAA	104	145	63	41	0
North Fiesta Island	30	52	8	22	0
Mariner's Point	120	169	72	47	1
Stony Point	136	236	36	100	0
San Diego River Mouth	14	17	11	3	0
San Diego Bay					
Lindbergh Field & Former Naval Training Center					
USN (Total)					
NI MAT	180	272	88	92	0
Delta Beach North	223	327	120	102	1
Delta Beach South	155	242	68	87	0
NAB Ocean	1047	1632	462	585	0
D Street Fill/Sweetwater Marsh NWR					
Chula Vista Wildlife Reserve					
South San Diego Bay Unit, SDNWR - Saltworks	82	138	26	56	0
Tijuana Estuary NERR	371	606	136	235	0

Appendix B-4: Productivity, clutch sizes 2005

Site name:	Nest total	Egg total	Number of nests		
			1 egg clutch	2 egg clutch	3 egg clutch
San Francisco Bay Area					
Pittsburg Power Plant					
Alameda Point	550	913	192	353	5
Hayward Regional Shoreline	8				
San Luis Obispo/Santa Barbara Counties					
Oceano Dunes SVRA					
Guadalupe-Mussel Rock					
Vandenberg AFB					
Purisima Pt	74	14	30	0	
Beach 2	0	0	0	0	
Ventura County					
Santa Clara River/McGrath State Beach	9	17	1	8	0
Ormond Beach	27	46	8	19	0
Pt Mugu- Totals	608	1105	100	480	15
Eastern Arm	24	45	5	17	2
Holiday Beach	108	202	20	82	6
Ormond Beach East	476	858	75	381	7
Los Angeles/Orange Counties					
Venice Beach					
LA Harbor - Pier 400					
Seal Beach NWR - Anahiem Bay	142	259	34	108	3
Bolsa Chica Ecological Reserve	135	243	36	97	2
Huntington State Beach	339	554	124	215	0
Upper Newport Bay Ecological Reserve	28	57	16	12	0
San Diego County					
MCB Camp Pendleton	1664	2683	648	1240	5
Red Beach	3	4	2	1	0
White Beach	136	226	46	89	1
Santa Margarita River - North Beach N	375	610	140	464	2
Santa Margarita River - North Beach S	1034	1658	412	618	2
Santa Margarita River - Saltflats	59	95	24	35	0
Santa Margarita River - Saltflats Island	57	90	24	33	0
Batiquitos Lagoon Ecological Reserve	595	944	253	335	7
W1	46	71	22	23	1
W2	354	583	149	211	4
E1	157	249	68	86	3
E2	0	0	0	0	0
E3	30	47	14	15	1
San Elijo Lagoon Ecological Reserve	1	2	0	1	0

Appendix B-4: Productivity, clutch sizes 2005 (continued)

Site name:	Nest total	Egg total	Number of nests		
			1 egg clutch	2 egg clutch	3 egg clutch
Mission Bay					
FAA Island					
North Fiesta Island					
Mariner's Point	281	483	79	202	0
San Diego River Mouth	118	198	38	80	0
San Diego Bay					
Lindbergh Field & Former Naval Training Center	157	278	39	115	3
USN (Total)	1269	2073	461	808	1
NI MAT	134	229	39	95	0
Delta Beach North	351	578	125	226	1
Delta Beach South	215	338	89	126	0
NAB Ocean	569	928	208	361	0
D Street Fill/Sweetwater Marsh NWR	101	161	42	58	1
Chula Vista Wildlife Reserve	57	101	13	44	0
South San Diego Bay Unit, SDNWR - Saltworks	34	60	8	26	0
Tijuana Estuary NERR	458	803	119	333	6

Appendix B-4: Productivity, clutch sizes 2004

Site name:	Nest total	Egg total	Number of nests			
			1 egg clutch	2 egg clutch	3 egg clutch	4 egg clutch
San Francisco Bay Area						
Pittsburg Power Plant	15	24 min	0	9 min	0	0
Albany Central Ave. Mitigation Island	0	0	0	0	0	0
Alameda Point	440	755	148	281	10	1
San Luis Obispo/Santa Barbara Counties						
Oceano Dunes SVRA						
Guadalupe-Mussel Rock	8	18	0	4	3	0
Vandenberg AFB	1	1	1	0	0	0
Purisima Pt	1	1	1	0	0	0
Beach 2	0	0	0	0	0	0
Coal Oil Point Reserve						
Ventura County						
Santa Clara River/McGrath State Beach	83	143	20	60	1	0
Hollywood Beach	48	82	18	32		0
Ormond Beach	29	43	12	14	1	0
Pt Mugu- Totals	617	1048	190	420	6	0
Holiday Beach	12	23	1	11	0	0
Ormond Beach East	453	755	149	303	0	0
Nesting Islands	25	49	3	20	2	0
Eastern Arm	127	221	37	86	4	0
Los Angeles/Orange Counties						
Venice Beach	17	19	16	0	1	0
LA Harbor - Pier 400	1071	1748	396	673	2	0
Seal Beach NWR - Anahiem Bay	206	335	79	125	2	0
Bolsa Chica Ecological Reserve	229	334	124	105	0	0
Huntington State Beach	323	444	202	121	0	0
Upper Newport Bay Ecological Reserve						
San Diego County						
MCB Camp Pendleton	1430	2558	312	1087	5	0
Red Beach	1	2	0	1	0	0
White Beach	102	175	29	73	0	0
Santa Margarita River - North Beach N	450	797	103	344	2	0
Santa Margarita River - North Beach S	801	1444	167	634	3	0
Santa Margarita River - Saltflats	39	101	8	31	0	0
Santa Margarita River - Saltflats Island	37	69	5	32	0	0
Batiquitos Lagoon Ecological Reserve	592	1032	160	424	8	0
San Elijo Lagoon Ecological Reserve						

Appendix B-4: Productivity, clutch sizes 2004 (continued)

Site name:	Nest total	Egg total	Number of nests			
			1 egg clutch	2 egg clutch	3 egg clutch	4 egg clutch
Mission Bay						
FAA Island	315	423	208	212	1	0
North Fiesta Island	17	20	14	3	0	0
Mariner's Point	299	455	145	152	2	0
Dog Beach	42	58	32	26	0	0
San Diego Bay						
Lindbergh Field & Former Naval Training Center	76	126	27	48	1	0
USN (Total)	1207	1861	555	650	2	0
NI MAT	172	283	61	111	0	0
Delta Beach North	263	410	117	145	1	0
Delta Beach South	195	289	101	94	0	0
NAB Ocean	577	879	276	300	1	0
D Street Fill/Sweetwater Marsh NWR	111	163	59	52	0	0
Chula Vista Wildlife Reserve	66	103	30	35	1	0
South San Diego Bay Unit, SDNWR - Saltworks	49	78	20	29	0	0
Silver Strand State Beach	1	2	0	1	0	0
Tijuana Estuary NERR	520	804	236	284	0	0

Appendix B-5: Non Predation Mortality.

Site name:	No. of eggs					No. of nests					No. of dead			Comments on cause(s) of non-predation mortality:
	human damaged:	lost to flooding:	abandoned pre-term	abandoned post-term/nonviable	outcome unknown:	human damaged	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	
Sacramento Area														
Bufferlands														
San Francisco Bay Area														
Green Island														
Montezuma Wetlands														With weekly visits, there was no way to know the fate of any nest.
Pittsburg Power Plant														
Alameda Point			17	37	21	0	0	12	30	17	22	0	0	Unknown.
Hayward Regional Shoreline	0	0	0	15	0	0	0	0	5	0	3	0	0	
Eden Landing														
San Luis Obispo/Santa Barbara Counties														
Oceano Dunes SVRA	0	0	6	3	0	0	0	3	2	0	7	1	1	One juvenile, seven chicks, and one adult found on-site dead from unknown causes. Necropsy of a large chick (20 days old) showed atrophy of pectoral muscles and showed the presence of Aeromonas sp. bacteria in the liver and lungs. Necropsy of a second chick (8 days old) also showed Aeromonas sp. bacteria in the liver and lungs. Both necropsies are inconclusive on cause of death. (One additional juvenile was seen to drown off-site at a artificial lake 3.2 miles away from breeding area. This lake is used by adult and juvenile ODSVRA terns (bands seen) and it is highly likely this was an ODSVRA juvenile.)
Guadalupe-Mussel Rock	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Vandenberg AFB	0	0	2	0	0	0	0	1	0	0	4	4	0	Likely food shortage at end of breeding season.
Coal Oil Point Reserve														
Ventura County														
Santa Clara River/McGrath State Beach	1		4		6	1		4		4	2			
Ormond Beach	2		8		9	1		5		5	2			
Hollywood Beach	1			2		1			1					
Pt Mugu- Totals	0	93	55	9	148	0	47	33	9	77	0	0	0	
Ormond Beach East	0	25	7	3	10	0	13	4	3	6	0	0	0	
Holiday Beach	0	15	0	0	2	0	7	0	0	2	0	0	0	
Holiday Beach Salt Panne	0	53	1	1	2	0	27	1	1	1	0	0	0	
Eastern Arm	0	0	47	5	134	0	0	28	5	68	4	1	0	

Appendix B-5: Non Predation Mortality (continued).

Site name:	No. of eggs					No. of nests					No. of dead			Comments on cause(s) of non-predation mortality:
	human damaged:	lost to flooding:	abandoned pre-term	abandoned post-term/nonviable	outcome unknown:	human damaged	lost to flooding	abandoned pre-term	abandoned post-term/nonviable	outcome unknown	chicks	fledglings	adults	
Mission Bay														
FAA Island	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
North Fiesta Island	0	0	0	0	0	0	0	0	0	0	0	0	0	
Mariner's Point	0	0	0	0	0	0	0	0	0	0	0	0	0	
Stony Point	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
San Diego River Mouth	0	0	0	0	0	0	0	0	0	0	0	0	0	
San Diego Bay														
Lindbergh Field & Former Naval Training Center	0	0	9	20	0	0	0	8	16	0	19	5	0	
USN- Totals	27	8	183	124	104	17	3	148	51	46	51	8	3	
NI MAT	0	0	24	22	1	0	0	17	20	0	5	0	0	Predator caused abandonment.
Delta Beach North	0	4	36	34	24	0	2	28	18	13	12	2	0	Human disturbance and predator caused abandonment.
Delta Beach South	0	0	11	10	6	0	0	11	4	3	8	0	1	Human disturbance and predator caused abandonment.
NAB Ocean	27	4	112	58	73	17	1	92	9	30	26	6	2	Human disturbance and predator caused abandonment.
D Street Fill/Sweetwater Marsh NWR	0	0	20	9	0	0	0	16	6	0	12	0	0	
Chula Vista Wildlife Reserve	0	0	0	4	0	0	0	0	4	0	0	0	0	
South San Diego Bay Unit, SDNWR - Saltworks	0	0	23	8	0	0	0	15	6	0	0	0	0	
Tijuana Estuary NERR	1	27	25	11	0	1	14	21	10	0	3	2	1	

Appendix B-6: Predation.

Predator Species	Predation		
	Possible	Suspected	Documented
ants (spp.)	X	X	X
snakes (spp.)	X		
great blue heron	X		X
great egret	X		
black-crowned night heron	X		X
California gull			X
western gull		X	X
gulls (spp.)	X	X	X
Caspian tern	X		
elegant tern			X
gull-billed tern	X	X	X
black skimmer	X	X	X
northern harrier	X	X	X
white-tailed kite	X		
Cooper's hawk	X	X	X
red-tailed hawk	X	X	X
golden eagle	X		
osprey	X		
crested caracara	X		
American kestrel	X	X	X
peregrine falcon	X	X	X
black-bellied plover	X		
barn owl	X	X	X
great-horned owl	X	X	X
burrowing owl	X		X
owls (spp.)	X	X	X
rock pigeon	X		
American crow	X	X	X
common raven	X	X	X
corvids			X
loggerhead shrike	X		X
European starling	X		X
western meadowlark	X		
red-winged blackbird	X		
Brewer's blackbird	X		
unknown avian spp.		X	X
unknown mammal spp.	X		
opossum	X		X
river otter	X		
long-tailed weasel	X		X
black-tailed jackrabbit	X		
California ground squirrel	X	X	X
rats (spp.)	X	X	
rodents	X	X	X
domestic dog	X		
coyote	X	X	X
gray fox	X		
red fox	X		
raccoon	X		
striped skunk	X		X
domestic cat	X	X	

Appendix B-6: Predation (continued).

Site name	Predation			Number of					Total number documented				
	Possible	Suspected	Documented	Eggs	Nests	Chicks	Fledglings	Adults	Eggs	Nests	Chicks	Fledglings	Adults
Sacramento Area													
Bufferlands													
San Francisco Bay Area													
Green Island									0	0	0	0	0
Montezuma Wetlands	GTBH, gull, CATE, NOHA, RTHA, GOEA, AMKE, BUOW, AMCR, WEME, RWBL, otter, btj rabbit, rfox, rac, cat								0	0	0	0	0
Pittsburg Power Plant	GTBH, GREG, AMKE, NOHA, mammal								0	0	0	0	0
Alameda Point	gull, BAOW	NOHA, RTHA, AMKE, PEFA, BAOW, owl	ant, NOHA, RTHA, PEFA, BAOW, AMCR, CORA, LOSH, avian	ant 1D, corvid 5S, avian 6S		ant 1D, NOHA 1D, RTHA 1D, avian 1D	NOHA 1D, avian 11S	PEFA 1S, BAOW 1S, LOSH 1D, avian 6D	12		4	12	9
Hayward Regional Shoreline	NOHA, RTHA, CORA, rfox, rac, cat		CAGU, PEFA, AMCR	CAGU 2D, AMCR 2D	CAGU 2D, AMCR 2D	CAGU 3D	PEFA 1D		4	4	4	1	0
Eden Landing		CAGU		CAGU 2S	CAGU 2S				2	2	0	0	0

Appendix B-6: Predation (continued).

Site name	Predation			Number of					Total number documented					
	Possible	Suspected	Documented	Eggs	Nests	Chicks	Fledglings	Adults	Eggs	Nests	Chicks	Fledglings	Adults	
San Luis Obispo/Santa Barbara Counties														
	GTBH, gull, NOHA, RTHA, AMKE, PEFA, GHOW, owl, AMCR, CORA, BRBL, op, dog, coyote, rac, skunk		gull	gull 1D	gull 1D	GTBH 0- 22P, gull 0- 22P, NOHA 0-22P, RTHA 0- 22P, AMKE 0-22P, PEFA 0- 22P, GHOW 0-22P, owl 0- 22P, AMCR 0-22P, CORA 0- 22P, BRBL 0-22P, op 0- 22P, dog 0- 22P, coyote 0-22P, rac 0- 22P, skunk 0-22P				1	1	0	0	0
Oceano Dunes SVRA									0	0	0	0	0	
Guadalupe-Mussel Rock														
Vandenberg AFB			GHOW				GHOW 1D	GHOW 1D	0	0	0	1	1	
Coal Oil Point Reserve			skunk	skunk 2D	skunk 1D				2	1	0	0	0	

Appendix B-6: Predation (continued).

Site name	Predation			Number of					Total number documented				
	Possible	Suspected	Documented	Eggs	Nests	Chicks	Fledglings	Adults	Eggs	Nests	Chicks	Fledglings	Adults
Ventura County													
Santa Clara River/McGrath State Beach	GTBH, WTKI, RTHA, PEFA, CORA		AMCR, op, gs, coyote	AMCR 2D, op 1D, gs 3D, coyote 3D					9		0	0	0
Ormond Beach			op, rodent, coyote	op 2D, rodent 1D, coyote 1D	op 1D, rodent 1D, coyote 1D				4	3	0	0	0
Hollywood Beach	mammal		AMCR, avian	AMCR 3D	AMCR 2D			avian 1D	14	11	2	1	2
Pt Mugu- Totals	snake, GTBH, BCNH, gull, WTKI, NOHA, RTHA, AMKE, PEFA, BAOW, GHOW, owl, AMCR, LOSH, WEME, avian, rats, dog, It weasel, cat	gs, rodents, coyote	CORA, op, rodents, coyote	CORA 2D, op 4D, rodent 33D, coyote 136D	CORA 1D, op 2D, rodent 20D, coyote 77D	coyote 8D			229	131	8	0	0
Ormond Beach East	gull		op, rodent, coyote	op 4D, rodent 20D, coyote 101D	op 2D, rodent 12D, coyote 59D	coyote 8D			151	88	8	0	0
Holiday Beach			CORA, rodent, coyote	CORA 2D, rodent 13D, coyote 8D	CORA 1D, rodent 8D, coyote 4D				46	26	0	0	0
Holiday Beach Salt Panne													
Eastern Arm			coyote	coyote 27D	coyote 14D				32	17	0	0	0

Appendix B-6: Predation (continued).

Site name	Predation			Number of					Total number documented				
	Possible	Suspected	Documented	Eggs	Nests	Chicks	Fledglings	Adults	Eggs	Nests	Chicks	Fledglings	Adults
Los Angeles/Orange Counties													
Venice Beach	GTBH, BCNH, AMKE		gull, PEFA, AMCR	AMCR 760D	AMCR 553D			gull 1D, PEFA 3D	760	553	0	1	3
LA Harbor	rats, cat	CORA	gull, AMKE, PEFA, BUOW, CORA	gull 1D, CORA 32D	gull 1D, CORA 28D	AMKE 1D 0-150S, PEFA 8D 0-150S, BUOW 6D 0-150	PEFA 3D		33	29	15-150	3-30	0
Seal Beach NWR - Anaheim Bay	BCNH, AMCR, CORA	NOHA, PEFA	GTBH, PEFA, GHOW	GTBH ?	GTBH ?	GTBH 20+D, NOHA 10S, GHOW 4D			?	?	34+	0	0
Bolsa Chica Ecological Reserve	GTBH, BCNH, gull, CATE, GBTE, BLSK, WTKI, RTHA, AMKE, PEFA, AMCR, CORA, gs, coyote, rac	BLSK, RTHA	ant, BLSK, RTHA	BLSK 34D	BLSK 19D	ant 2D, RTHA 1D			34	19	3	0	0
Huntington State Beach	BCNH, gull, CATE, GBTE, OSPR, COHA, AMKE, PEFA, ROPI, AMCR, CORA, gs, dog		AMKE, AMCR	AMCR 1D		AMKE 6D, AMCR 1D	AMCR 1D		100	71	7	1	0
Burris Sand Pit/Buris Basin	GTBH, GREG, WEGU, COHA, AMKE, PEFA	RTHA							0-7	0-7	0	0	0
Upper Newport Bay Ecological Reserve									0	0	0	0	0

Appendix B-6: Predation (continued).

Site name	Predation			Number of					Total number documented				
	Possible	Suspected	Documented	Eggs	Nests	Chicks	Fledglings	Adults	Eggs	Nests	Chicks	Fledglings	Adults
San Diego County													
MCB Camp Pendleton- Totals									169	133	32	22	2
Red Beach				AMCR 4D, CORA 2D	AMCR 3D, CORA 1D				6	4	0	0	0
White Beach				BAOW 4D, CORA 25D, It weasel 3D, coyote 4D, unknown 1D	BAOW 2D, CORA 17D, It weasel 2D, coyote 2D, unknown 1D	CORA 8D, owl 4D, op 4D	CORA 1D, owl 3D	owl 5D, avian 1D	37	24	4	0	0
Cocklebur Beach									0	0	0	0	0
Santa Margarita River - North Beach North				BLSK 3D, CORA 21D, gull 3D, op 2D, unknown 8D	BLSK 2D, CORA 15D, gull 3D, op 1D, unknown 7D	CORA 15D, BCNH 2D, WEGU 1D,owl 5D, unknown 4D	NOHA 1D	owl 2D	37	28	19	14	1
Santa Margarita River - North Beach South				BCNH 1D, BLSK 17D, corvid 1D, ELTE 1D, gull 3D, avian 7D, skunk 9D, unknown 38D		BCNH 1D, GBTE 1D, WEGU 3D, RTHA 1D, owl 2D, unknown 2D	PEFA 1D, owl 2D, It weasel 2D, gs 1D, unknown 2D	owl 1D, unknown 1D	80	69	9	8	1
Santa Margarita River - Saltflats				avian 1D, skunk 6D, unknown 1D					8	7	0	0	0
Santa Margarita River - Saltflats Island				unknown 1D					1	1	0	0	0

Appendix B-6: Predation (continued).

Site name	Predation			Number of					Total number documented				
	Possible	Suspected	Documented	Eggs	Nests	Chicks	Fledglings	Adults	Eggs	Nests	Chicks	Fledglings	Adults
San Diego County													
Batiquitos Lagoon Ecological Reserve-Totals				gull 11S, AMCR 2D, CORA 2D, avian 1 D	AMCR 1D, CORA 1D, avian 2D	GTBH 7D, WEGU 2D, COHA 3D, owl 2S, avian 1D, unknown 2D	GTBH 8D, avian 3D, unknown 8D	owl 1S, avian 2D	6	4	16	20	2
W1		owl	GTBH, COHA, AMCR, avian	AMCR 2D, avian 1D	AMCR 1D, avian 1D	COHA 2D, owl 1S, avian 1D	GTBH 1D, avian 1D		3	2	3	2	0
W2		WEGU, gull, owl, avian, unknown	GTBH, WEGU, COHA	gull 11S		GTBH 7D, COHA 1D, WEGU 2D	GTBH 7D, avian 1D, unknown 1D	owl 1S, avian 2D	0	0	10	9	2
E1		COHA, owl	COHA, GHOW, CORA, avian, unknown	CORA 2D, avian 1D	CORA 1D, avian 1D	COHA 1S 1D, owl 1S, unknown 2D	GHOW 1D, avian 1D, unknown 7D		3	2	3	9	0
E2									0	0	0	0	0
E3	rac								0	0	0	0	0
San Elijo Lagoon Ecological Reserve	snake, RTHA, AMKE, AMCR, CORA, op, dog, coyote, rac								0	0	0	0	0

Appendix B-6: Predation (continued).

Site name	Predation			Number of					Total number documented				
	Possible	Suspected	Documented	Eggs	Nests	Chicks	Fledglings	Adults	Eggs	Nests	Chicks	Fledglings	Adults
Mission Bay													
FAA Island									0	0	0	0	0
North Fiesta Island	snake, gull	AMCR, CORA		snake 0-18P, gull 0-18P, AMCR 0-18S, CORA 0-18S	snake 0-10P, gull 0-10P, AMCR 0-10S, CORA 0-10S				18	10	0	0	0
Mariner's Point		gull, AMCR, CORA, rat		gull 0-17D, AMCR 0-17D, CORA 0-17D, rat 0-17D	gull 0-14D, AMCR 0-14D, CORA 0-14D, rat 0-14D				17	14	0	0	0
Stony Point	AMCR			AMCR 1P	AMCR 1P				0	0	0	0	0
San Diego River Mouth		AMCR, CORA		AMCR 0-1S, CORA 0-1S	AMCR 0-1S, CORA 0-1S				1	1	0	0	0

Appendix B-6: Predation (continued).

Site name	Predation			Number of					Total number documented				
	Possible	Suspected	Documented	Eggs	Nests	Chicks	Fledglings	Adults	Eggs	Nests	Chicks	Fledglings	Adults
San Diego Bay													
Lindbergh Field & Former Naval Training Center	ant, GTBH, BCNH, gull, COHA, AMKE, PEFA, BAOW, AMCR, CORA, EUST, rat, rodent, gfox, rac, cat	AMKE, PEFA, CORA	gull, PEFA, CORA, EUST	gull 1D, CORA 9D 2S	gull 1D, CORA 7D 2S	ant 1D, AMKE S, PEFA 1D, CORA S	PEFA 1D	PEFA 2D	14	11	2	1	2
USN- Totals									155	67	159	9	7
NI MAT	GTBH, gull, RTHA, BAOW, GHOW, BUOW, btj rabbit, rat, rodent, cat	AMKE	ant, PEFA, AMCR, CORA	AMCR 2D, CORA 38D, corvid 5D, unknown 2D		AMCR 2D, avian 1D, unkown 2D	AMCR 3D, avian 1D	PEFA 2D, avian 1D	47	28	5	4	2
Delta Beach North	GTBH, gull, RTHA, BAOW, CORA, dog, coyote	ant, AMKE	GBTE, NOHA, PEFA	GBTE 9S or D		NOHA 1S or D, GBTE 36S or D	AMKE 1S or D, unknown 3S or D	PEFA 2D, avian 1D, unknown 1D	9	4	37	4	4
Delta Beach South	ant, GTBH, gull, CORA, dog	NOHA	GBTE, AMKE, PEFA	CORA 2S or D, GBTE 4S or D, unknown 3S or D		GBTE 22S or D	avian 1S or D	PEFA 1S or D	9	4	22	1	1
NAB Ocean	GTBH, dog, coyote	AMKE, PEFA, CORA	GBTE, op	GBTE 58S or D, op 23S or D, unknown 9S or D		GBTE 95S or D			90	31	95	0	0

Appendix B-6: Predation (continued).

Site name	Predation			Number of					Total number documented				
	Possible	Suspected	Documented	Eggs	Nests	Chicks	Fledglings	Adults	Eggs	Nests	Chicks	Fledglings	Adults
San Diego Bay													
D Street Fill/Sweetwater Marsh NWR	ant, snakes, GTBH, GREG, BCNH, gull, OSPR, NOHA, COHA, RTHA, AMKE, PEFA, BAOW, AMCR, CORA, EUST, WEME, op, gs	ant, GBTE, NOHA, COHA, AMKE, PEFA, BAOW, gs, cat	GBTE, AMKE	GBTE S, avian D	GBTE S, avian D	ant S, GBTE 5D S, NOHA S, AMKE 5D S			2	2	11	0	0
Chula Vista Wildlife Reserve	ant, GTBH, GREG, BCNH, gull, CATE, GBTE, OSPR, NOHA, AMKE, PEFA, BAOW, CORA, gs, rat, gfox, skunk, cat	GBTE, NOHA, PEFA, rat	GBTE	GBTE S, NOHA S, rat S	GBTE S, NOHA S, rat S	GBTE 2D S, NOHA S, PEFA S, rat S	PEFA S		6	4	2	1	0
South San Diego Bay Unit, SDNWR - Saltworks	GTBH, gull, GBTE, OSPR, NOHA, RTHA, AMKE, PEFA, AMCR, CORA, op, rodent, coyote, rac, skunk, cat	gull, GBTE, NOHA, PEFA, coyote	gull, GBTE, coyote	gull 7D S, GBTE S, coyote 16D S	gull 6D S, GBTE S, coyote 9D S	gull S, GBTE 7D S, NOHA S, PEFA S, coyote S			32	19	7	0	0
Tijuana Estuary NERR	ant, snakes, GTBH, BCNH, gull, GBTE, OSPR, WTKI, NOHA, RTHA, CRCA, AMKE, PEFA, BBPL, owl, AMCR, CORA, WEME, op, btj rabbit, gs, rodent, dog, coyote, gfox, cat	GBTE, NOHA, AMKE	GBTE, NOHA	GBTE S, NOHA 29D S, rodent S	GBTE S, NOHA 17D S, rodent S	GBTE 2D S, NOHA S, AMKE S			62	10	2	0	0

Appendix B-6: Predation (continued).

Legend:	P: Possible	S: Suspected	D: Documented	
GTBH: Great blue heron		WTKI: White-tailed kite	GHOW: Great-horned owl	avian: Unknown avian species
GREG: Great Egret		COHA: Cooper's hawk	BUOW: Burrowing owl	op: Opossum
BCNH: Black-crowned night-heron		RTHA: Red-tailed hawk	ROPI: Rock pigeon	btj rabbit: Black-tailed jackrabbit
CAGU: California gull		GOEA: Golden eagle	AMCR: American crow	gs: California ground squirrel
WEGU: Western gull		OSPR: Osprey	CORA: Common raven	lt weasel: long-tailed weasel
CATE: Caspian tern		CRCA: Created caracara	LOSH: Loggerhead shrike	gfox: Gray fox
ELTE: Elegant tern		AMKE: American kestrel	EUST: European starling	rac: Raccoon
GBTE: Gull-billed tern		PEFA: Peregrine falcon	WEME: Western meadowlark	mammal: Unknown mammal species
BLSK: Black Skimmer		BBPL: Black-bellied plover	RWBL: Red-winged blackbird	
NOHA: Northern harrier		BAOW: Barn owl	BRBL: Brewer's blackbird	