

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

**Breeding Biology of the California Least Tern
at Venice Beach, Marina Del Rey, California
in the 2009 Breeding Season**

**by
Thomas Ryan and Stacey Vigallon**

Report

To

State of California
Department of Fish and Game
Office of Spill Prevention and Response
1700 K Street, Suite 250
Sacramento, California 95814

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ABSTRACT

In 2009, California least terns (*Sternula antillarum browni*) arrived at the Venice Beach Colony on April 20 and departed after July 10. We estimate 295 breeding pairs were present at the site in 2009. Courtship activities began on April 20 and the first nest was found on May 11. All nests were predated between May 11 and June 18, when the last active nest was observed. By July 10, the colony was abandoned. We estimate a total of 295 nests and 585 eggs; these figures were derived using an estimated mean clutch size of 1.98 eggs per nest. We estimate no chicks hatched or fledged due to predation by American crows (*Corvus brachyrhynchos*). In 2009, American crows were the primary predators on eggs; peregrine falcons (*Falco peregrinus*) were the primary predators on adult least terns. In 2009, we estimate American crows removed approximately 585 eggs (100%), an increase from 12% in 2007; 20.6% in 2006; and 61.6% in 2008. Most predation occurred before June 18. A pilot study documented 47 American crows present on the Marina del Rey Peninsula on July 30. It appears that there were also very low number of anchovies present in April and May. The terns were laying relatively few eggs each day and there were few birds observed loafing at or adjacent to the colony during the day, supporting the possibility of food scarcity. Fewer terns were present to defend the colony from crows. Therefore, while the proximate cause of colony failure was egg predation by crows, the ultimate cause may have been low food resources. Colony disturbance by helicopters was a regular occurrence in 2009 and the occasional flushing of the colony likely increased opportunities for local predators.

INTRODUCTION

The California least tern (*Sternula antillarum browni*) (least tern) is one of three least tern subspecies breeding in North America. It nests from April through August along the coast from the San Francisco Bay in California to lower Baja California. This subspecies presumably winters in southern Mexico, Central America, or northern South America, although their wintering range remains unknown (Ryan and Kluza 1999, Keane 2001).

Least terns historically nested in several small, scattered aggregations on sandy beaches and salt flats along the California and Baja California coast, although the progressive loss throughout the last century of undisturbed sandy beaches resulted in a severe reduction in both nesting sites and numbers of nesting pairs (Chambers 1908). By the 1940's, least terns were gone from most beaches of Orange and Los Angeles counties and were considered sparse elsewhere in the state (Grinnell and Miller 1944).

Least terns have nested near Venice Beach since 1894 (Western Foundation of Vertebrate Zoology records). Nesting in the area from that time through 1976 was poorly documented. In 1977, three pairs of least terns nested on the sand at Venice Beach north of the Ballona Creek mouth (Atwood et al. 1977). Beach managers placed emergency fencing around the area to protect the nests and it has remained in the same general location since. This fence has allowed the colony to continue nesting with minimal disturbance (Comrack 2001). Since 1977, Venice Beach has supported up to 16.6 percent of the statewide pairs of breeding least terns and over 30 percent of statewide fledglings (Table 1). However, during the past ten years, the percentage of statewide pairs contributed by the Venice Beach colony has declined from a maximum of 12.4 percent in 1994 to 0.4 percent in 2004. Additionally, the proportion of fledglings produced at the Venice Beach colony declined from 12.4 percent in 1994 to 6.9 percent in 2003, with no productivity in 2003, 2004, and 2005 (Table 1). From 1999 to 2005, this site had failed to fledge young four of seven years. American crows (*Corvus brachyrhynchos*) likely caused these desertions in 1999, 2002, 2004, and 2005 (L. Comrack pers. comm.). Since 2005, efforts by project biologists and California Department of Fish and Game (CDFG) staff to recover this colony have included increasing the colony size, replacing the enclosure fence, earlier and aggressive predator control, vegetation management, and volunteer monitoring.

Following recommendations made by biologists and CDFG, the size of the nesting area was enlarged in March 2006 from 4.2 acres to 7.7 acres (3.3 hectares) and a new fence was installed. The fence has thin mesh wire (chick fencing) around the bottom to prevent chicks from wandering out of the site and an angled top to keep people and other mammals from climbing into the site. However, the chick fence on the north and west sides has become covered in sand since its installation, so each season a temporary 2-foot high fabric fence is prepared to be installed inside the enclosure approximately 10 feet from the new chain link fence to prevent chicks from escaping from the colony. However, in 2009, no chicks hatched and the fence was not installed.

The project team modified predator control efforts to better target egg-depredating crows, including beginning efforts earlier in the season. A volunteer colony monitor program began in 2005 (Ryan 2005). Volunteers provide timely reports of disturbance and predation events and

assist biologists in monitoring tern populations. In 2007, Los Angeles (LA) Audubon coordinated volunteer efforts.

Since 2006, the project team has studied the placement and success of nests in relation to habitat conditions and location within the colony. We have used measures of nest placement, hatching success, and predation rates to make recommendations for long-term habitat management and restoration at the site. We will summarize these efforts in a separate report (Ryan et al. 2010).

Overall, the goals of this report are to:

- Document the timing of the nesting cycle.
- Provide estimates of productivity at the colony.
- Document predation and other causes of mortality.
- Provide results of studies examining how the implementation of previous recommendations has affected the productivity of the colony.
- Provide further recommendations based on these results and on observations made during the 2009 nesting season to improve productivity at the colony.

METHODS

Colony Preparation

The project team first re-marked the existing grid system using a Trimble GEO-XT GPS unit, then surveyed the site for special status plant species on March 18 (Figure 1). We marked areas with sensitive plant species and they were not disturbed during the vegetation clearing. Next, assisted by crews from the Los Angeles County Department of Beaches and Harbors (LACBH), local volunteers, CDFG and U.S. Fish and Wildlife Service, we conducted site maintenance on March 18, 22, and 28. This included removing as much sea rocket (*Cakile maritime*) as possible and modifying 20 x 20 m grids as part of the vegetation study (Ryan and Vigallon 2008a). In total, eight grids were cleared of existing vegetation; eleven others were already less than 5 percent vegetated; six grids were reduced to less than 30 percent vegetation cover: and four others were already less than 30 percent vegetated. We followed recommendations made in Ryan (2008a) to avoid removing too much vegetation from the dunes to prevent destabilizing them. In addition, we placed bundles of native vegetation in the boundary areas to help induce dune growth. In addition, LACBH crews used heavy equipment and hand crews to remove the sand from the chick fence on March 18-23. This included some sand movement within 10 m of the fence on the inside of the enclosure due to heavy sand build-up.

Colony Monitoring

The project team conducted site visits from April 20 to July 11 to observe and monitor nesting activities. Once the adult least terns arrived, we recorded observations of nest building, courtship, and anti-predator behavior. Nest monitoring consisted of walking through the colony, visually searching the sand surface for nests with eggs. When a nest was encountered, we marked it using a wooden tongue depressor with a letter indicating date and a number indicating

order of detection. We then recorded the contents and mapped the nest using a Trimble GEO-XT GPS unit. We counted all predated eggs at the site.

After completing each survey, biologists downloaded nest locations using Trimble Pathfinder. GIS specialists then used the shape-files generated to map each nest and its alphanumeric identifier on an aerial photograph, with the grid system super-imposed. GIS specialists generated field maps each week to aid biologists in locating active nests on their next visit. The project team visited and noted the condition of each nest during each visit. We considered eggs predated if they disappeared within three weeks of detection, were visibly predated, or were missing and other signs of predation (such as American crow tracks) were observed. We considered eggs “did not hatch” if they remained in the nest more than 28 days. We considered eggs “presumed hatched” if they remained in the nest a minimum of three weeks, but no more than 28 days, or if they were located at nests that showed signs of hatching such as a pipped eggshell or tracks from chicks. We considered eggs “confirmed hatched” when chicks were observed at the nest or small chicks were observed within 1 m of the nest. For purposes of analysis, presumed and confirmed hatched are combined into “total hatched.” We included unknown-outcome nests in nest counts, eggs produced, and mean clutch size calculations, but not in measures of productivity.

In 2009, we observed heavy predation resulting in the removal of all eggs in all nests. We counted the number of predated eggs away from nests and used volunteer observations to estimate the number of eggs removed from the colony. Both the predated eggs and weekly estimates were used in producing the estimates of the total number of eggs, nests, and total pairs in 2009 as we did in 2008. Our calculation for total nests was achieved by dividing the total number of eggs estimated through the counts of predated eggs and estimates based on volunteer observations and dividing them by the overall mean clutch size (1.98 eggs per nest) (Massey and Atwood 1981).

No chick counts were conducted, as no eggs hatched.

Volunteer Monitoring

Following the recommendations made in previous annual reports (Ryan and Taylor 2004, Ryan 2005, Ryan 2006), the project team recruited volunteer observers from the local community and Audubon Chapters. LA Audubon biologist S. Vigallon coordinated volunteer recruitment, site maintenance, and monitoring efforts in 2009. The team held volunteer training sessions on April 2, 22, 23, and May 1, 2009. The project team discussed methods, purpose, and least tern identification.

Each volunteer observed the colony for a one-hour period at the same time once per week. They reported their observations via e-mail or phone to Audubon biologist Stacey Vigallon. Ms. Vigallon conveyed urgent reports immediately to Mr. Ryan and summarized each week’s observations in a brief report to Mr. Ryan. Volunteers monitored the colony from April 15 to July 13. There were an average of eight visits per week by the twenty volunteers, totaling approximately 130 hours spent observing the colony. Once abandonment of the colony had been confirmed, volunteers spent an additional 16 hours monitoring the crow population at and adjacent to the colony from July 14 to July 30 (see Appendix A for full description).

Additionally, volunteers spent approximately 236 hours conducting pre-season site maintenance. Volunteers from Dorsey High School, Leo Politi Elementary School, Los Angeles Valley College, and Santa Monica College accounted for approximately 170 of these hours. Post-season site maintenance occurred on September 19, 2009, with 99 volunteers working in the colony for a period of two to three hours (266 hours total). We documented that volunteers spent over 640 hours assisting with the Venice Beach colony in 2009.

Population Parameters

The project team estimated the total number of breeding pairs by subtracting an estimate of re-nesting pairs from the total number of nests.

Banding

No banding was conducted in 2009 as no chicks hatched.

Predation and Disturbance Monitoring

The project team monitored predation through personal observations during the colony monitoring, trap checks, and by reports from the team of volunteer observers. We estimated predation rates adding the number of eggs, adults, and chicks reported killed and removed from the colony by the volunteers to the number of eggs, chicks, and adults found dead at the colony. We also estimated egg predation as part of the monitoring of individual nests (described above). In addition, volunteers reported all helicopters flying below 500 feet directly over the colony enclosure as well as any other human-related disturbance they observed.

Predator Management

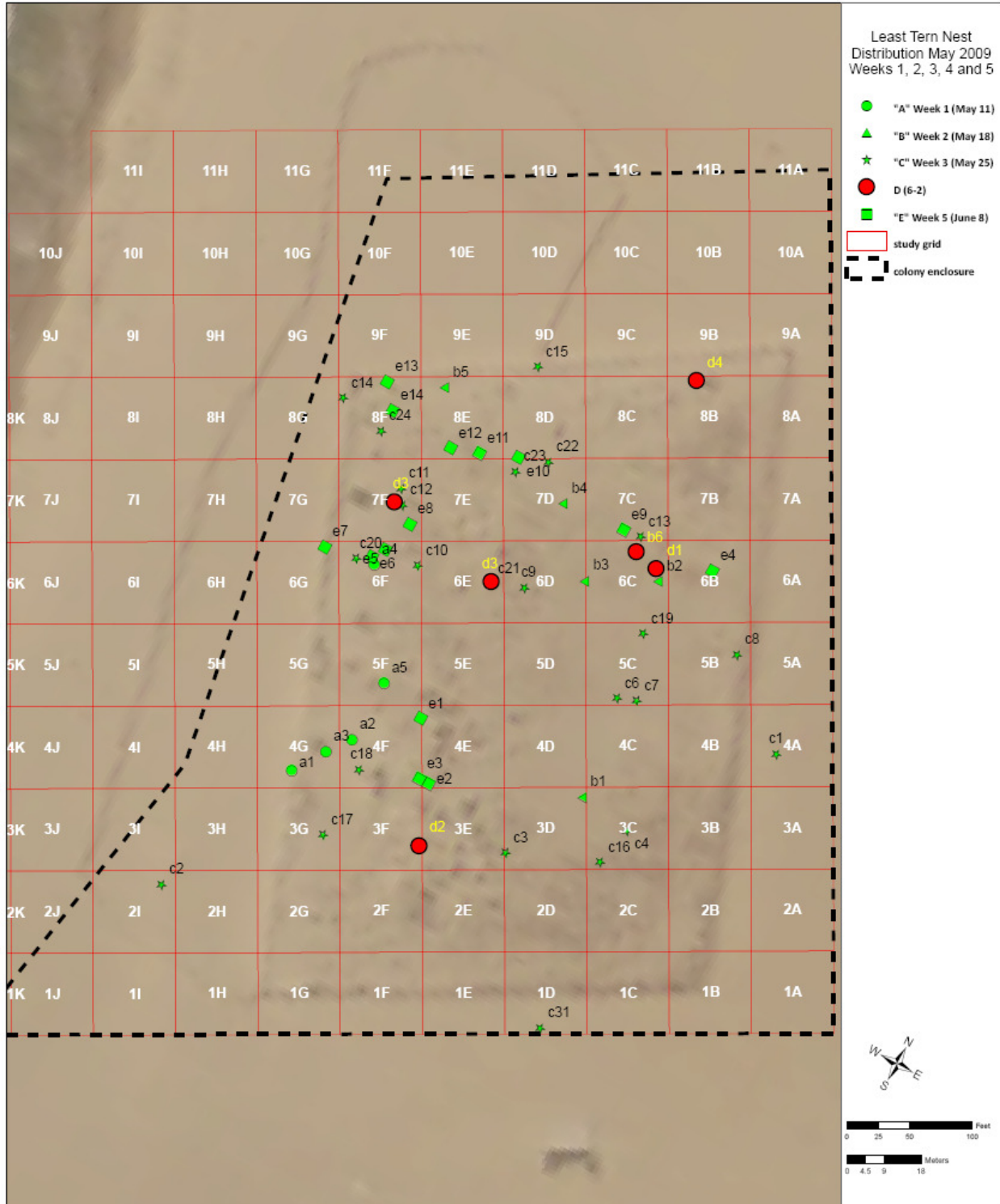
The project team conducted predator management activities to attempt to minimize predation by American crow in 2009. This effort included placing carcasses of dead crows at the colony and using egg-baited traps to capture crows. Between 9 and 16 traps were deployed between March 17 and 27, March 31 and April 6, April 14 and 20, and May 11 and July 1 (76 trapping days). Traps were baited with hard-boiled quail eggs, which superficially resemble the size, texture, and color of least tern eggs. The bait was changed weekly and the traps were monitored daily. Captured crows were removed and their carcasses placed on the colony.

Table 1. Summary of least tern nesting and productivity at the Venice Beach nesting site, 1977 to 2009 (Ryan and Taylor 2004, Ryan 2005).

Year	Number of Pairs ^a	Percent of Statewide Pairs ^b	Number of Nests	Number of Fledglings	Fledglings Per Pair	Percent of Statewide Fledglings ^b
1976	Nesting site not active					
1977	35	4.1%	N/A	30	0.86	5.7%
1978	68	8.2%	N/A	75	1.1	17.9%
1979	88	8.8%	N/A	140	1.68	20.1%
1980	158	13.5%	N/A	240	1.52	31.2%
1981	150	15.4%	N/A	195	1.3	23.4%
1982	170	16.6%	N/A	60	0.35	11.7%
1983	145	12.1%	N/A	140	0.97	15.7%
1984	83	8.6%	N/A	94	1.13	18.1%
1985	96	9.4%	N/A	113	1.18	17.3%
1986	104	10.8%	N/A	113	1.09	12.8%
1987	109	11.7%	N/A	82	0.75	13.0%
1988	165	13.2%	N/A	192	1.16	17.0%
1989	137	11.0%	N/A	134	0.98	17.5%
1990	206	12.1%	N/A	279	1.35	17.3%
1991	198	10.8%	N/A	200	1.01	11.2%
1992	229	10.9%	275	245	1.07	17.4%
1993	246	10.6%	219	288	0.85	14.2%
1994	345	12.4%	345	224	0.65	12.4%
1995	310	11.9%	354	44	0.14	4.1%
1996	271	8.0%	361	92	0.33	4.6%
1997	375	9.4%	400	263	0.7	8.2%
1998	383	9.2%	387	200	0.52	7.3%
1999	43	1.2%	50	0	0	0.0%
2000	274	5.9%	308	150	0.55	3.9%
2001	295	6.9%	348	388	0.91	8.5%
2002	2	0.1%	2	0	0	0.0%
2003	348	5.1%	371	181	0.52	6.9%
2004	24	0.4%	24	0	0	0.0%
2005	105	1.5%	90	0	0	0.0%
2006	276	3.9%	384	266	0.97	7.3 - 10.3%
2007	453	6.5 - 6.7%	546	413	0.91	15.6 - 18.0%
2008	468	6.1 - 6.7%	928	296	0.63	11.5 - 13.1%
2009	295	4.0 - 4.1%	344	0	0	0%

- ^a Values are number of least tern nests minus estimated number of re-nesting pairs.
- ^b Percent of statewide total of nesting pairs and fledglings, derived from means of ranges presented in annual reports prepared for the California Department of Fish and Game (see Marschalek 2008). The Venice Beach site is one of approximately 38 sites statewide.

N/A – not available



RESULTS and DISCUSSION

Population Estimate

Least terns arrived at the Venice Beach Colony on April 20: two days earlier than their arrival in 2007 and 2008. We estimate 295 breeding pairs were present in 2009 (Table 1). Their numbers continued to increase through April and May, with peak numbers of individuals present in late May. The colony began to fail and numbers declined sharply beginning approximately June 13-17 (Table 2). Team biologists estimated about 700 individuals attended the colony in at its peak in late May (Table 2). Least terns were present until at least July 10.

Table 2. Summary of least tern population estimates in 2007–2009.

Month	Volunteer Population Estimate Peak (Average)			Biologists' Population Estimate			Number of Nests Present		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
April	65 (45.4)	85 (22.5)	150 (23.6)	200	157	40	0	0	0
May	273 (86.6)	300 (74.7)	356 (105.2)	400	268	350	159	30	71
June	350 (221.4)	300 (176.2)	300 (70.2)	900	500	250	410	252	257
July	325 (205.7)	300 (177.4)	30 (6.9)	600	700	8	261	375	16
August	140 (79.0)	316 (93.2)	0	250	300	0	25	25	0

Nesting Activity

Nest Timing

Courtship activities began immediately upon arrival on April 20. These included fish exchanges and courtship flights between adults. Egg laying began on May 11, but colony terns faced heavy predation by American crows. This predation resulted in low numbers of active nests at any one time (see Nesting Activity below). Between May 11 and June 21, typically a time when the numbers of nests are continuously increasing, the total numbers of nests present remained between 2-16 nests and corresponding counts of adults by the volunteers remained at approximately 300 individuals. This was a very similar pattern to 2008 when 2-30 eggs were found during a similar period of 100% predation between May 13 and June 16 (Ryan and Vigallon 2008b). Meanwhile, the project biologists found 328 predated eggs (an average of 41.0/week) and we estimate, based on volunteer observations, that the crows removed 183 eggs from the colony before July 11. As has been observed in previous years, when there are fewer than 150 nests, the terns appear to be unable to defend the colony against crow predation. Between June 13 and 17 the colony began to fail and many terns departed, but a group of between 5 and 25 remained at the site, mostly roosting in front and flying above the colony until July 10.

Productivity

Based on observation of 328 predated eggs counted by the colony monitors, 74 one-egg nests observed predated, and an estimate of 183 eggs removed from the colony, we estimate that 585 eggs were produced by the terns in 2009. No eggs remained for more than one week, no chicks hatched, and no young fledged in 2009.

Table 3. Least tern breeding statistics for Venice Beach, 2004-2009.

Statistic	2009	2008	2007	2006	2005	2004
Total Nests	295	928	546	384	90	24
Estimated Re-nesting least terns	0	460	97	108	0	Unk.
Total Estimated Nesting Pairs ^a	295 ^b	468	453	276	105	24
Total Eggs	585	1236	775	597	177^b	26
Mean Clutch Size (<i>mean eggs per nest</i>)	1.77 ^b	1.33	1.42	1.55	1.07 ^b	1.08
Number of Eggs Hatched	0	476	571	382	0	0
Hatching Success (<i>eggs hatched of total eggs</i>)	0%	38.5%	73.7%	64.0%	0	0
Eggs lost to Predators	585	720	110	123	177 ^b	26
Percent of Total Eggs Lost to Predators	100%	58.3%	14.2%	20.6%	100%	100%
Eggs abandoned and/or infertile	0	35	89	60	0	0
Percent of Total Eggs Abandoned/Infertile	0%	2.8%	11.5%	13.3%	0	0
Known Mortality (<i>dead chicks and fledglings</i>)	0	134	131	57	0	n/a
Percent Mortality (<i>of total chicks hatched</i>)	0%	21.2	16.9%	14.9%	0	n/a
First Fledgling count	0	124	121	23	0	0
Second Fledgling count	0	183	182	120	0	n/a
Third Fledgling count	0	17	111	85	0	n/a
Total Fledglings counted^c	0	296	414	266	0	0
Fledglings per Nest	0	0.32	0.76	0.69	0	0
Fledglings per Hatched Egg (<i>chick survival</i>)	0	0.62	0.73	0.70	0	n/a
Fledglings per Pair	0	0.63	0.91	0.96	0	0

^a The estimated number of pairs is the total number of nests, minus the estimated number of nests initiated by re-nesting pairs (from the same or other sites). This is impossible to determine accurately without uniquely banded birds and varies from site to site and year to year. However, based upon expected re-nesting after the loss of eggs and young to predation, abandonment, and natural mortality, the estimated number of re-nesting least tern pairs at Venice Beach in 2007 is 97.

The number of pairs is used to derive a statewide population estimate. Although less accurate than the number of nests, it is generally a better indicator of population status, as nest numbers will be high during years of high nest predation followed by re-nesting.

^b In 2005 and 2009, both the number of eggs and estimated numbers of nests were derived from observation of predation events. This provided us with a measure of the number of eggs removed from the colony by crows. This was then divided by the mean clutch size (1.98) provided by Massey and Atwood (1981) to estimate the number of nests. The mean clutch size presented here is the summary of observed nests.

^c See Methods section of text.

Predation and Human Disturbance

Predation

In 2009, as in the past, American crows were the primary predator of least tern eggs at the Venice Beach colony. In 2009, volunteer observers noted 28 least tern eggs removed from the colony by American crows. When extrapolated for volunteer effort and removals per hour, we estimate 183 eggs were removed from the colony. The project team found an additional 328 predated eggs within the colony. Nest surveys by the project team found a similar number of 74 nests predated based on nest outcomes. We estimate that American crows predated 585 eggs (100%) from 295 nests. Our observations indicate that crows consumed approximately 64% of eggs depredated at the colony and removed approximately 36% of the eggs they depredated (vs. 56% consumed and 44% removed in 2008 [Ryan and Vigallon 2008b]). We may have underestimated the eggs being removed because our volunteer who lived in front of the colony moved this year. He typically contributed an additional 50 hours of observation and crows departing the colony often flew directly above his house.

In 2006 and 2007, trapping of American crows occurred between March and May and prior to nesting. CDFG personnel trapped and removed four American crows from the local population in both years; these were among the least terns' most successful nesting years to-date. After each trapping effort, volunteer observers noted a decline in crow activity (Table 4) and a reduction in the number of eggs taken. In 2008, crow trapping was suspended from March 12 to April 4, when use of a modified version of the traps was authorized. Trapping began on May 15, when four traps were placed on the colony, fewer than used in 2007 (6 traps) but the same number used in 2005. Six additional traps were added on June 21. Four crows were trapped and removed between May 15 and July 21. Prior to trapping, no nests were successful, but after the second crow was caught in mid-June few nests were depredated. In 2008, several crow family groups were observed in the colony with young observing the adults predate eggs before the trapping was complete. The project team suspected that there might be a larger than usual number of egg-aware crows in 2009. Early season surveys indicated that this was true; as many as 14 American crows were foraging and perching near the colony in March-April 2009.

In 2009, crow trapping began in March and continued through July with 10 crows trapped and removed from within the colony over 76 trapping days. This is more than double the previous efforts. Despite this effort, crows remained the primary predator at the colony and consumed all eggs produced.

The fish populations appeared to be healthy in March and April, with large numbers of pelicans, cormorants, grebes, and terns foraging immediately offshore. This may have been aided by strong winds in late March helping with local upwelling. However, it should be noted that the local anchovy populations appeared to be very low in May and June (W.L. Ross pers. comm.). The terns' behaviors supported this assertion in that few birds were observed loafing at the colony and the nest deposition rate was very low with 2-16 eggs being laid each day. With few adults loafing and few adults attending nests, there was little defense when crows entered the colony. Years where fewer than 100 nests were detected tended to have high rates of crow predation and colony failure. In 2009, we did not reach more than 16 nests (~32 adults)

defending the colony in any one day, and although the immediate cause of failure was the predation of eggs by crows, the ultimate cause was likely a lack of food which caused the adults to lay eggs more slowly and spend longer away from the colony searching for food.

Volunteer observers noted the crow activity at the colony was lower than in 2008, but higher than 2006 and 2007 in April and May. In June it was similar than or greater to 2008 as well. It dropped off in July, but by then the colony had been abandoned.

Table 4. American crow activity near and within the least tern colony in 2006 to 2009.

	Average Obs.				Flying Over/hr.				Landing/hr.				Eggs Removed/hr.			
	2006	2007	2008	2009	2006	2007	2008	2009	2006	2007	2008	2009	2006	2007	2008	2009
Apr	3.8	1.3	5.9	4.9	4	1.1	4.8	2.7	1.6	0.5	2.8	1.8	0	0	0	0
May	3.6	2.6	4.3	3.9	3.4	1.5	5.1	2.6	1.6	1.6	3.5	1.5	0.1*	0.4	0.2	0.2
Jun	3	1.5	4.7	5.7	1.4	0.6	2.9	3.6	0.5	0.5	1.7	1.7	0	0.1	0.4	0.3
Jul	1	1.1	4.8	3.1	0.9	1.3	1	0.3	0	2.1	0.1	0.3	0	0.3	0	0
Aug	3	3	7	ns	0.6	2.3	3	ns	0.4	2.5		ns	0	0.3	0	ns

*John Trefts reported 18 eggs removed by American crows over a 4-hour period on May 30, 2006 apart from the regular volunteer effort.

An adult peregrine falcon was observed killing an adult tern on May 27. It departed with the adult in its talons over the Ballona Channel. Another adult peregrine falcon made a pass on adults at the colony on June 25, but did not capture any adults. A raccoon (*Procyon lotor*) entered the colony through a small gap in the fence, but did not appear to predate any nests. Four common ravens were observed on June 27, but they did not enter the colony. Other potential predators detected include gulls, domestic dogs (*Canis familiaris*), domestic cats (*Felis catus*), and rats (*Rattus* sp.). The project team detected rodent tracks within the colony, as large numbers of rats occur in the adjacent breakwater.

Human Disturbance

Historically, the most frequently reported human disturbance events have involved helicopter flyovers and Fourth of July fireworks. As in previous years, helicopters continued to fly low over the colony in 2009 (Table 5). There were several incidents where the least terns flushed in response to helicopters. The most frequently reported helicopters were from local police agencies. By far the most common type of private helicopter observed was the Robinson Helicopter R44 Raven model. The colony was mostly abandoned by July 4 and the numbers of birds remaining at the colony did not change following the fireworks display. In 2009, the volunteers noted that an LAPD SUV drove through and flushed the flock sitting on the beach in front of the colony on several occasions.

Table 4. Log of helicopters observed flying below 500 feet over the colony. Others were observed; these only include reports with identifying features or tail numbers.

Date & Time	ID/Tail Number	Photo	Notes
April 28, 2009 2:35 pm	N453J		Red with 1 white stripe
April 28, 2009 2:38 pm	N230LA		LAPD Dark blue, black colors, 2:38pm
May 1, 2009	LA Sheriff		seemed close to the edge of the eastern part of the enclosure
May 2, 2009 9:06 am	LA Sheriff		flew overhead within 500 ft
May 6, 2009	N144PE		red and yellow
May 7, 2009 16:03	N96XBC		white
May 12, 2009	LAPD		LAPD blue & gray
May 14, 2009 9:14 am	N225 LA		LAPD, initially steered clear of west edge of enclosure, but turned east and headed back over.
June 23, 2009	#N3027		1 White w/ blue stripe

In 2009 we expanded on the human-use data we asked volunteers to collect in order to gather more information on general beach use, such recreation and the presence of vehicles. Volunteers collected this data simultaneously with their observations of terns and predators while walking the perimeter of the colony enclosure. Thus, human-use data represented here pertains only to the section of beach adjacent to the enclosure, and not to Venice Beach as a whole. Not all volunteers provided consistent data on human use, but some general trends can be noted during the 15 consecutive weeks of volunteer monitoring. While it is not surprising that people were observed engaging in some form of recreation (walking, jogging, sports, and sitting) during all 15 weeks, it is disconcerting to note that off-leash dogs were also observed at least once each week for all 15 weeks. In addition, volunteers reported the presence of vehicles at least once a week for 14 weeks of the 15-week monitoring period.

Band Reports and Banding

Band Reports

No banded adults were found dead at the colony site in 2009

Banding

No banding was conducted in 2009 because no chicks hatched.

Recommendations

We suggest the following recommendations based on observations made at the colony between 2004 and 2009. We suggest that implementation of these recommendations along with

recommendations generated from Ryan and Vigallon (2008c) will help maintain and increase the number of nesting adults and their productivity at the Venice Beach least tern colony.

- 1) Continue aggressive predator control activities in March-April before the nesting season. Methods initiated in 2006 and modified in 2007 have proven effective. Non-lethal harassment proved ineffective in 2008, and should only be used to complement lethal techniques. We recommend setting a schedule for these activities and coordinating with CDFG predator management staff on dates before the nesting season. We recommend that techniques that are more aggressive be used every 1-2 weeks to specifically target and reduce the number of egg-predating crows in the vicinity before the least terns arrive in April. These measures should include:
 - a. Continue experimentation with deterrent and aversion techniques for corvids. These may include crow calls, decoys, and lasers.
 - b. Continue placing crow carcasses within the colony in late March. This measure, along with measure (a), will discourage any crows new to the area from going within the colony before the least terns return to the vicinity.
 - c. Methods targeted at removing egg predating crows should be implemented in early March and continue until volunteers note a decrease in crow activity. Past methods have proven successful and we recommend that they be implemented again, although experimentation with new methods is advantageous as well because of the crow's intelligence. New techniques may include multiple noose traps and mist nets.
 - d. We should deploy at least 10 traps beginning in early March; these traps should then be used whenever volunteers detect high levels of crow activity.
 - e. We should then employ adaptive management techniques to adjust our techniques and level of aggressiveness based on the monitoring reports.
- 2) Continue vegetation clearing on plots within the colony according to the *Preliminary Site Management Plan for the Venice Beach Least Tern Colony, Marina Del Rey, California* before April 1 (Ryan and Vigallon 2008c).
- 3) Continue the volunteer monitoring program with a goal of having at least one monitor checking the colony daily. Provide an updated volunteer training session prior to April 1. Expand volunteer monitoring of the area in front of the colony between July 10 and August 15 and provide more detailed descriptions and photographs of human-related disturbance events.
- 4) Request that police and sheriff personnel enforce existing dog regulations west of the colony between July 10 and August 15 (dates to be modified based on first hatching dates).
- 5) Request that vehicle use by all agencies using the beach be minimized west of the colony between July 10 and August 15 (dates to be modified based on first hatching dates).
- 6) Have a CDFG or USFWS warden present during and after Fourth of July festivities near the colony.

- 7) Have the USFWS contact pilots observed flying low over the colony and have them issue a general letter to pilots and local airports on or around April 1, requesting they fly over the water when flying near the Marina del Rey harbor entrance. We should consider working with the FAA on additional airspace restrictions to limit aircraft to flying above 1,000 ft. within ½ mile of the colony between April 1 and August 15, and placing the colony on air-charts with a notation.
- 8) Placing at least two interpretive signs near the colony as specified by the Coastal Commission permit.
- 9) Continue to partner with Dorsey High School, Leo Politi Elementary School, Los Angeles Valley College, Santa Monica College, Toyota, and other local community groups and organizations on colony clean-up days.
- 10) Use volunteers to continue the public education campaign.
- 11) Lead public tours through the colony site on weekends during the off-season (October – February) to explore the unique dune system.
- 12) Ensure local garbage receptacles have functional lids within ¼ mile of the enclosure.
- 13) Begin a public awareness campaign to discourage people from feeding local crows, including covering garbage and covering pet food or keeping it inside.
- 14) Members of the local community have requested that a viewing platform or other structure be erected in a manner that will not interfere with the least terns so that the local community can view the nesting cycle within the fence.
- 15) Continue to use a sand-colored (burlap) chick fence, installed within 2 weeks of the initiation date of the first nest that survives to two weeks.
- 16) Investigate complaints from neighbors that the dunes are growing in height and blocking their view. Look for ways to document this, and consider this in the habitat management plan.

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Appendix A. Marina del Rey American Crow Pilot Study

Introduction

American crows are the primary predator of least tern eggs at the Venice Beach Colony and likely caused desertions of the colony in 1999, 2002, 2004, and 2005 (L. Comrack pers. comm.). Since 2005, efforts by project biologists and California Department of Fish and Game staff to recover this colony have included aggressive predator control. In 2009 despite the highly localized predator control conducted at the colony, crows were again the primary predator of eggs, and we estimate that crows predated 585 eggs (100%) from 295 nests. In an effort to gain a better understanding of this abundant, highly intelligent predator, we monitored crows at both the colony and the adjacent residential area.

Methods

As in previous years of monitoring, we asked volunteers in 2009 to provide us with counts of crows present at the colony. After the terns abandoned the colony this year, four volunteers continued to provide us with their observations of colony use by crows for two additional weeks (ending July 23).

To obtain data on local crow population size and distribution in the residential area adjacent to the Venice Beach Colony, we recruited and trained six volunteers to conduct a survey of the area on July 30, 2009. Surveyors met at 10:30 am to be briefed on survey protocol. The survey was completed between 10:40 and 11:35. The overall survey route traversed the beach and residential area between the Venice Pier/Washington Blvd to the north and Ballona Channel to the south, and incorporated four survey transects (1) Venice Beach, (2) Pacific Avenue, (3) Via Dolce, and (4) Via Marina, all of which are west of the marina. Routes were 1.1 to 1.2 miles in length. The four transects were surveyed simultaneously, with one or more observers on each transect starting at Ballona Channel and ending at Washington Blvd. Crow locations and observation times were documented in a single pass, and observers noted whether crows were flying or perched, and if flying, the direction they were headed. Survey location data was plotted using GoogleEarth maps (Figure 3) and crow numbers tallied and compared for each route.

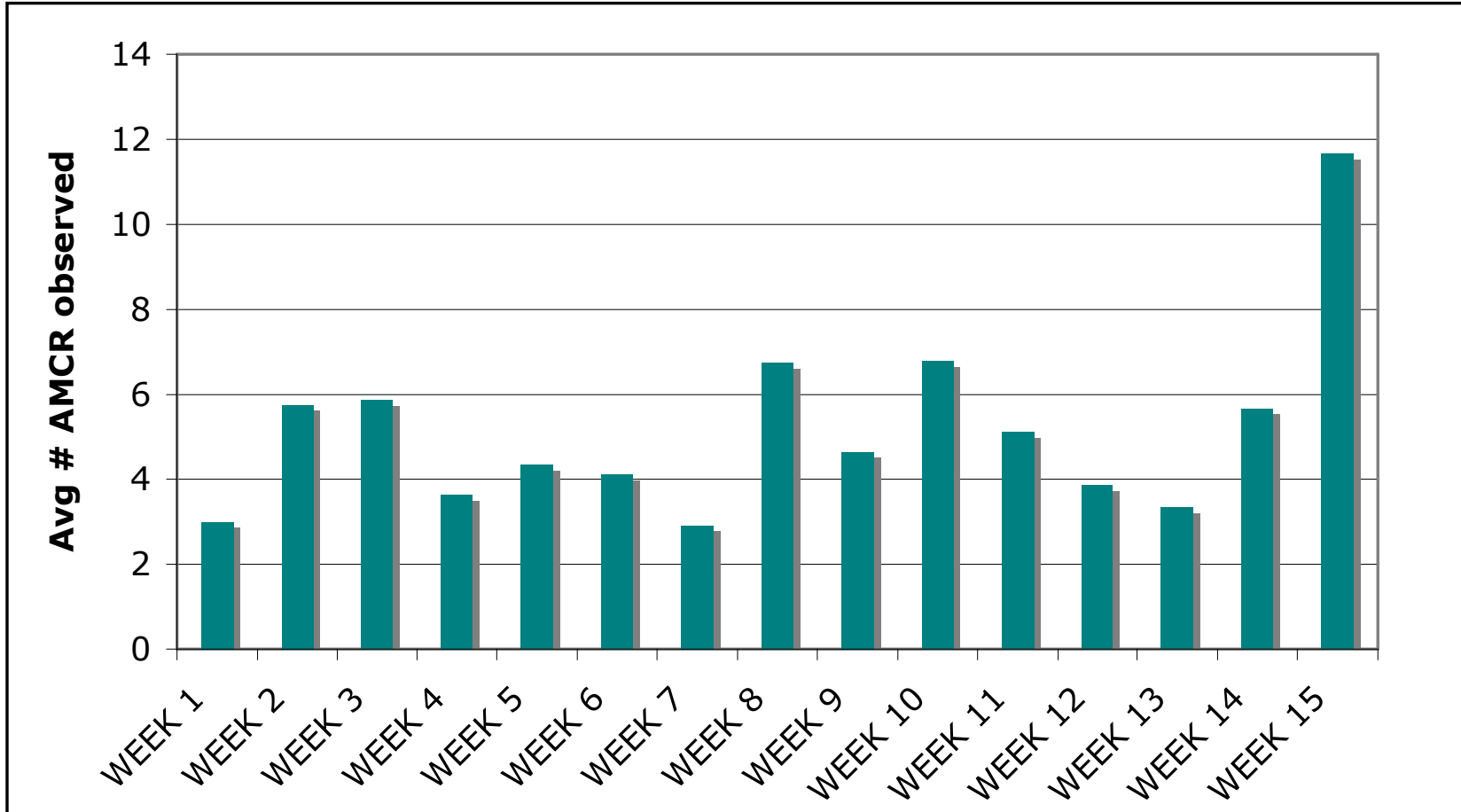
Results/Discussion

Crows demonstrated continual use of the colony throughout the breeding season in 2009 (Figure 1) in keeping with their behavior from previous years (Figure 2), though our data indicates that the average crow numbers observed at the colony have increased in the past two field seasons. More research is needed to determine if this represents an increase in the local crow population or is the result of a behavioral response by local crows. During the 2009 breeding season, the greatest number of crows reported at the colony during a single monitoring session (38) occurred while terns were still present (4 June, Week 8). However, the second greatest number of crows observed (30) occurred after the terns had abandoned the colony (July 22, Week 15).

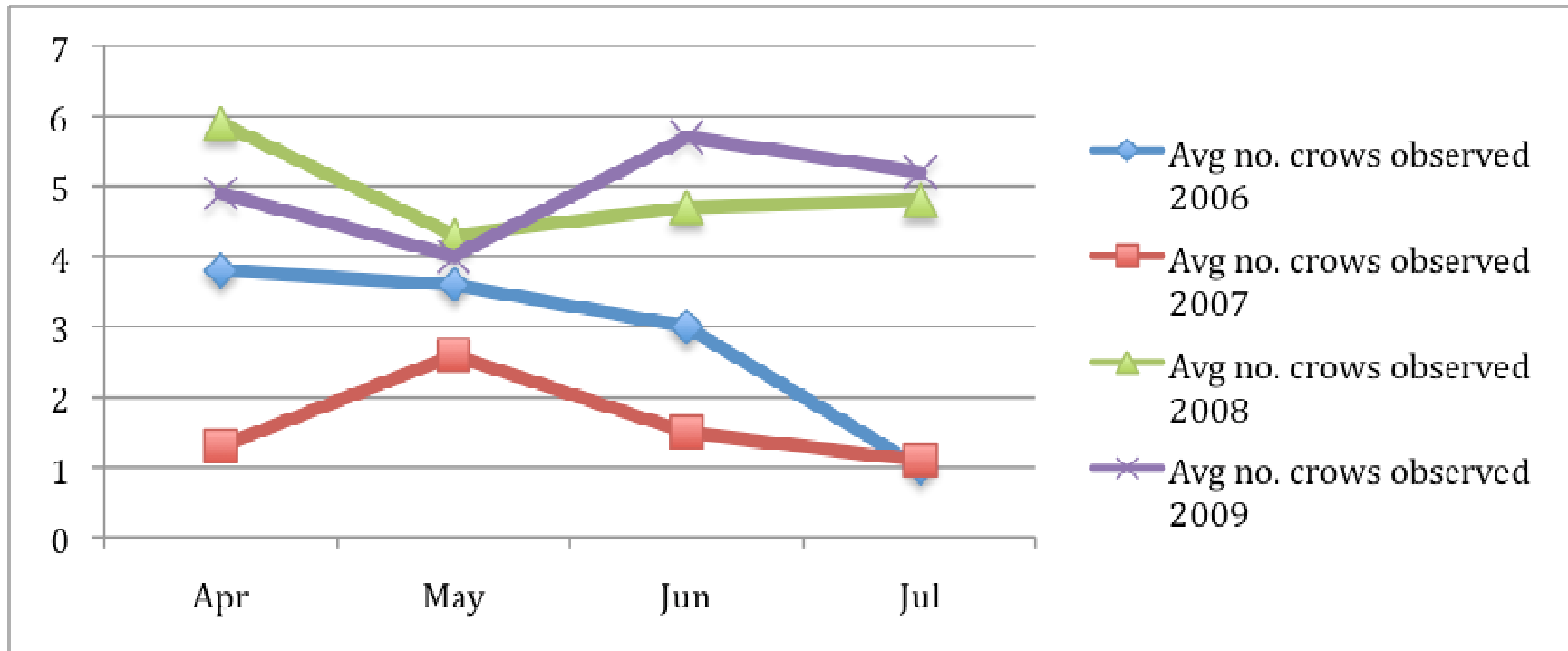
The July 30 residential area survey yielded a total count of 47 crows, with five as the largest number of crows in a single group. Ten crows were observed along the Venice Beach route, five along Pacific Ave, 16 along Via Dolce, and 16 along Via Marina. A map of these observations shows crows distributed evenly throughout the survey area at midmorning (Figure 3).

We view this initial July 30 survey as a small pilot study to determine the feasibility of having volunteers conduct simultaneous surveys for crows. Volunteers were successful in completing the survey within the space of 1.5 hours, leading us to believe that continued surveys would be efficient to coordinate. Because crows are conspicuous and easy to identify, these surveys may be an excellent opportunity to engage novice birders such as middle school, high school, and college-level students in meaningful biological monitoring. In order to address temporal and seasonal use of this area by crows, we recommend conducting monthly surveys following the above protocol, stratifying surveys by early morning, midday, and early evening during both the wintering and breeding seasons. An understanding of crows' spatial use patterns of the residential areas adjacent to the colony may prove an essential tool in managing predation at the colony. Continued surveys could help pinpoint human-created food sources, nest sites, and roost sites of this predator. We recommend that these surveys continue every other month during the non-breeding season (September, November, January, March) and be conducted biweekly during the breeding season (April – July). Appendix Figure 1. Average number of American crows observed per week at the Venice Least Tern Colony during nesting season (April 16 to July 23, 2009). The exceptionally high average for Week 15 was due to small observation sample size.

Appendix Figure 1. The average number of American crows observed at the Venice Beach Least Tern Colony by week during the nesting season (April 15 to August 7)



Appendix Figure 2. Average number of American crows observed per month during the 2006-2009 breeding seasons at the Venice colony. Overall numbers of crows observed have increased in the past two field seasons.



Appendix Figure 3. American crow locations observed during a simultaneous survey of four routes adjacent to the Venice Beach Tern Colony on July 30, 2009. Yellow markers indicate locations where volunteers observed crows either flying or perched. The four routes covered the beach and residential area west of the marina between Ballona Channel and Washington Blvd (Venice Pier).

