

California Gull Predator Management and Reproductive Success of Endangered California Least Terns in the San Francisco Bay, California

Abstract:

Gull predation is known to be an important source of egg and chick mortality for many waterbirds and can have severe impacts on recovery efforts for special status species. From 2005 to 2011, the nesting success was monitored at a newly established California least tern (*Sterna antillarum brownii*) colony at Hayward Regional Shoreline in San Francisco Bay, detecting effects of implementing a California gull (*Larus californicus*) predator control program. No gull management was undertaken prior to 2007. We evaluated the effectiveness of gull management and removal, by monitoring tern hatching and fledgling success annually. California gulls were the most abundant aerial predator (97%). We recorded 3,769 predatory gull-tern interactions and presumptive take of 26 tern eggs and 23 chicks. Although gull predatory behavior did not change statistically, gull management efforts resulted in significantly



The California least tern (*Sterna antillarum brownii*) is a migratory species, nesting along the West Coast of North America from Baja California north to the San Francisco Bay. This bird is an endangered species. Photo by Juan Benjumea, EBRPD Wildlife Volunteer.

improved tern breeding success (as number of nests, eggs, chicks, and fledglings increased). From 2007 to 2011, this colony produced a total of 242 successful nests and 291 fledglings, an average nesting density of 196 nests per ha, and an average of 1.07 fledglings per breeding pair. We discuss difficulties of lethal control of predators, and suggest the importance of human presence for reducing gull predation at the site.

Introduction

Studies show that gull (*Larus*) predation limits the breeding success of terns and other colonial waterbirds. Small and declining seabird colonies may be particularly susceptible to gull predation due to compromised group defense.

The numbers of California gulls appear to be increasing throughout their range. California gull populations have increased over the past two decades in the South San Francisco Bay, to more than 40,000 breeding birds.

Results

Since the first California least tern census in 2005, the numbers of nesting pairs have steadily increased. California gulls over the past five years have been the most abundant aerial predator eliciting 97% of the California least tern distraction displays (Figure 1).

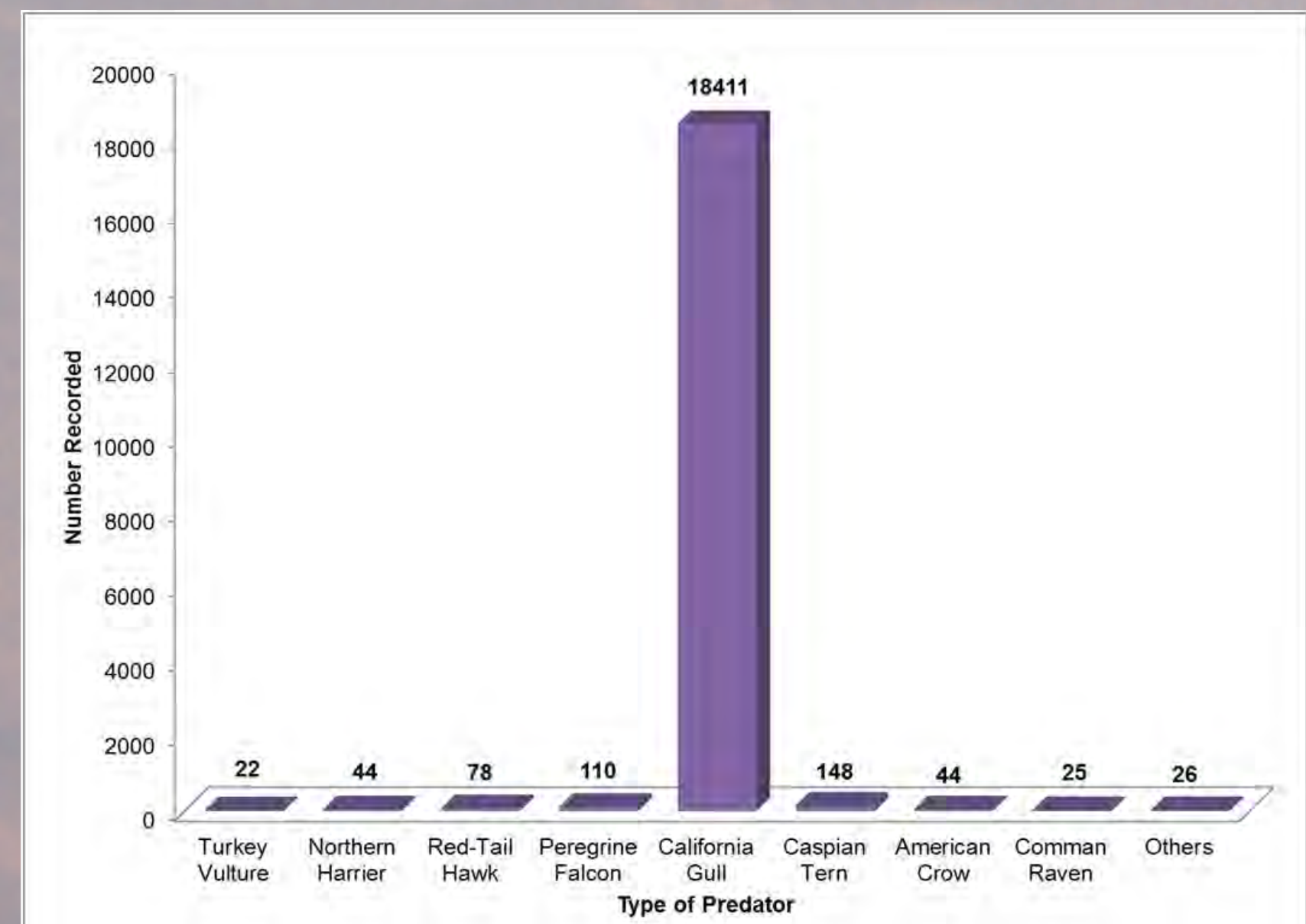


Figure 1. Aerial predators at the Hayward Shoreline California Least Tern Colony from 2007 to 2011 (eliciting a tern distraction display). The California gull is the most abundant aerial predator (97%).

● Out of 2,042 observational session hours of nesting California least terns, altogether, 18,074 gull-flyovers were recorded involving 3,769 predatory gulls (Table 1).

● Relative to the number of hunting gulls, few gulls exhibiting hunting behavior were removed. In all years combined a total of 100 California gulls were removed (2.6%) out of a total of 3769 hunting gull encounters (Table 1).

Years	2007	2008	2009	2010	2011	Totals
Total Number of Gulls	391	806	2,549	8,913	5,414	18,074
TCM observation session hours	260	403	637	457	285	2,042
# of Gulls/hour	1.5	2.	4.	19.5	19.	9.2*
Number of non-hunting Gulls	275	563	1,413	7,224	4,815	14,290
% non-hunting Gull behavior	74	70	55	80	89	79*
Number of hunting gulls	101	243	1,136	1,689	600	3,769
% hunting Gulls	26	30	45	20	11	21*
“Take” of Tern eggs	2	4	20	0	0	26
“Take” of Tern chicks	1	4	8	2	2	17
Number of “hunting gulls” lethally removed	15	14	28	30	13	100

Table 1. Gull - Tern Interactions at the Hayward Shoreline California least tern colony from 2007 to 2011. While not statistically significant, the proportion of California gulls observed exhibiting hunting behaviors apparently declined after 2009. * Average value for all five years.

● After the implementation of the California gull predator management program in 2007 a total of 242 successful nests resulted with the proportion of successful nests averaging 0.78 (Table 2).

Years	Nests	Eggs	Chicks	Number of depredated eggs	Number of depredated chicks	Successful nests	% successful nests
2005	8	n/a	0	n/a	n/a	0	0
2006	15	13	13	n/a	9	7	0.46
Totals	23	13	13	n/a	9	7	0.30
Summary without predator control 2005 - 2006							
2007	35	67	55	2	1	32	0.91
2008	62	114	95	4	1	53	0.85
2009	80	160	113	20	8	57	0.71
2010	53	100	91	0	2	49	0.92
2011	77	130	85	0	2	51	0.66
Totals	307	571	439	26	14	242	0.78
Summary with predator control 2007 - 2011							
TOTALS	330	584	452	26	23	249	0.75

Table 2. California least tern egg and chick fate at the Hayward Shoreline colony without and with gull predator management from 2005 to 2011. The breeding success variables (nests, eggs, chicks) show a statistically significant increase after the implementation of gull predator management in 2007 (Mann-Whitney U-test, $p \leq 0.05$; Unpaired t-test, $p < 0.01$).



An adult California least tern (*Sterna antillarum brownii*) providing for its fledgling. The Hayward colony's productivity averages one fledgling per pair with gull predator management. Photo by Juan Benjumea, EBRPD Wildlife Volunteer.

● The site has produced a total of 295 fledglings with the productivity ranging (fledglings per pair) from 0-0.26 without predator control (2005-2006; 4 fledglings) to 0.42 - 1.4 with predator control (2007 -2011; 291 fledglings) (Table 3).

Year	Nests	Pairs	#Eggs	Mean hatching success	Chicks	Fledglings	Mean fledglings per pair ratio
2005	8	8	0	0	0	0	0
2006	15	15	13	n/a	13	4	0.26
Totals	23	23	13	n/a	13	4	0.17
Summary without predator control 2005 - 2006							
2007	35	35	67	0.82	55	49	1.4
2008	62	59	114	0.83	95	73	1.23
2009	80	70	160	0.71	113	65	0.93
2010	53	53	100	0.91	91	75	1.41
2011	77	73	130	0.65	85	29	0.42
Totals	307	290	571	0.76	439	291	1.00
Summary with predator control 2007 - 2011							
TOTALS	330	313	584	0.76	452	295	0.80

Table 3. California least tern fledglings per pair ratio for the Hayward Shoreline colony with and without gull predator management from 2005 to 2011. The mean fledgling per pair ratio shows a statistically significant increase after the implementation of gull predator management. (Mann-Whitney U-test, $p \leq 0.05$; Unpaired t-test, $p < 0.01$).

● The implementation of gull predator management has proven successful at reducing and preventing predation at the Hayward tern colony and has resulted in statistically significant improved breeding success variables (Figure 2, and Table 2).

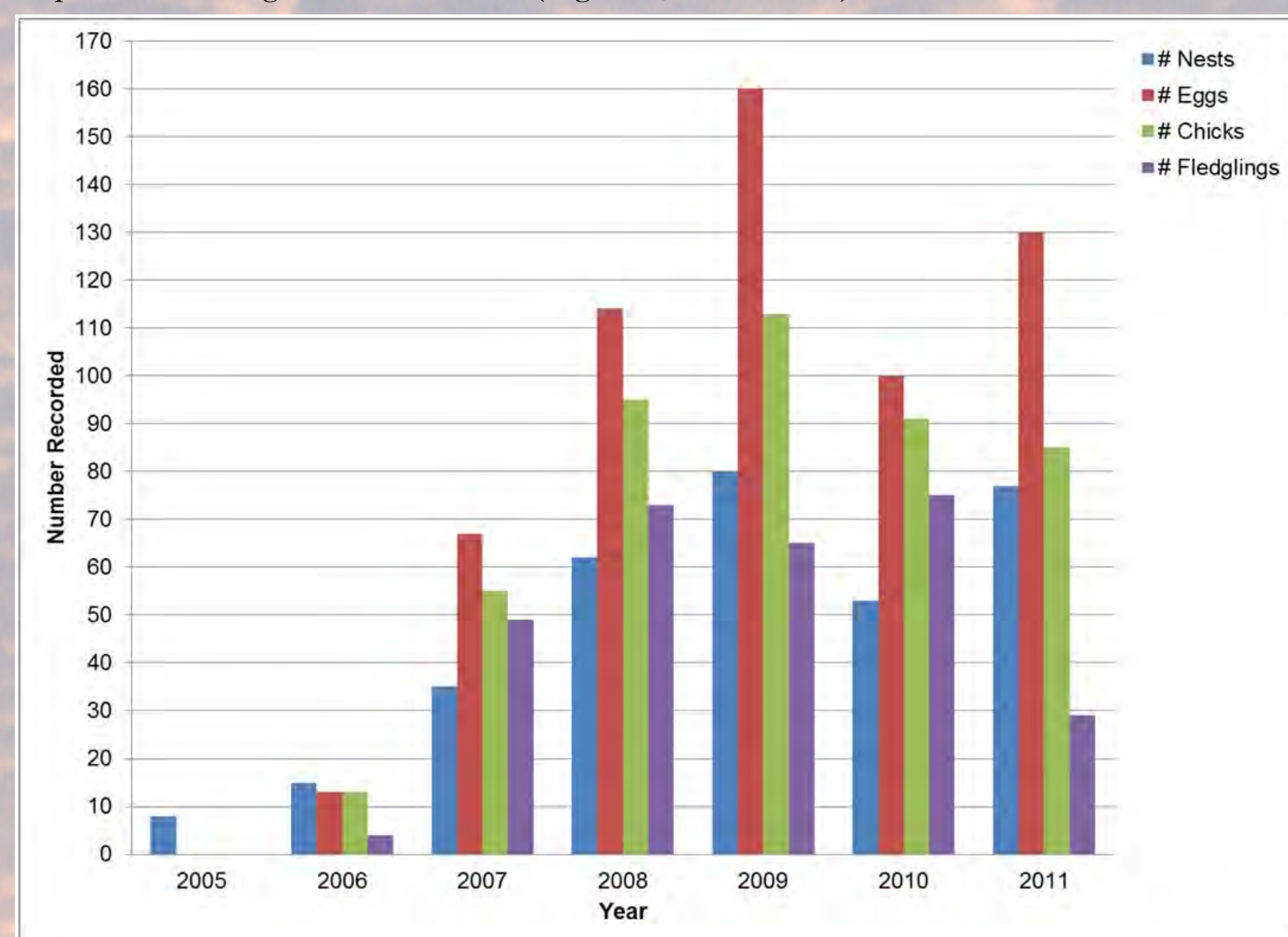


Figure 2. California least tern Breeding Success from 2005 to 2011 at the Hayward Shoreline colony. The breeding success variables listed below show a significant increase after the implementation of gull predator management in 2007 (ANOVA for all factors, $p < 0.05$; Mann-Whitney U-test, $p \leq 0.05$; Unpaired t-test, $p < 0.01$).

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● The Hayward colony's nesting density ranges from 33-333 nests per ha (13-133 per ac) and showed a statistically significant increase in the number of nesting pairs and nest densities after the implementation of predator management (Figure 3).

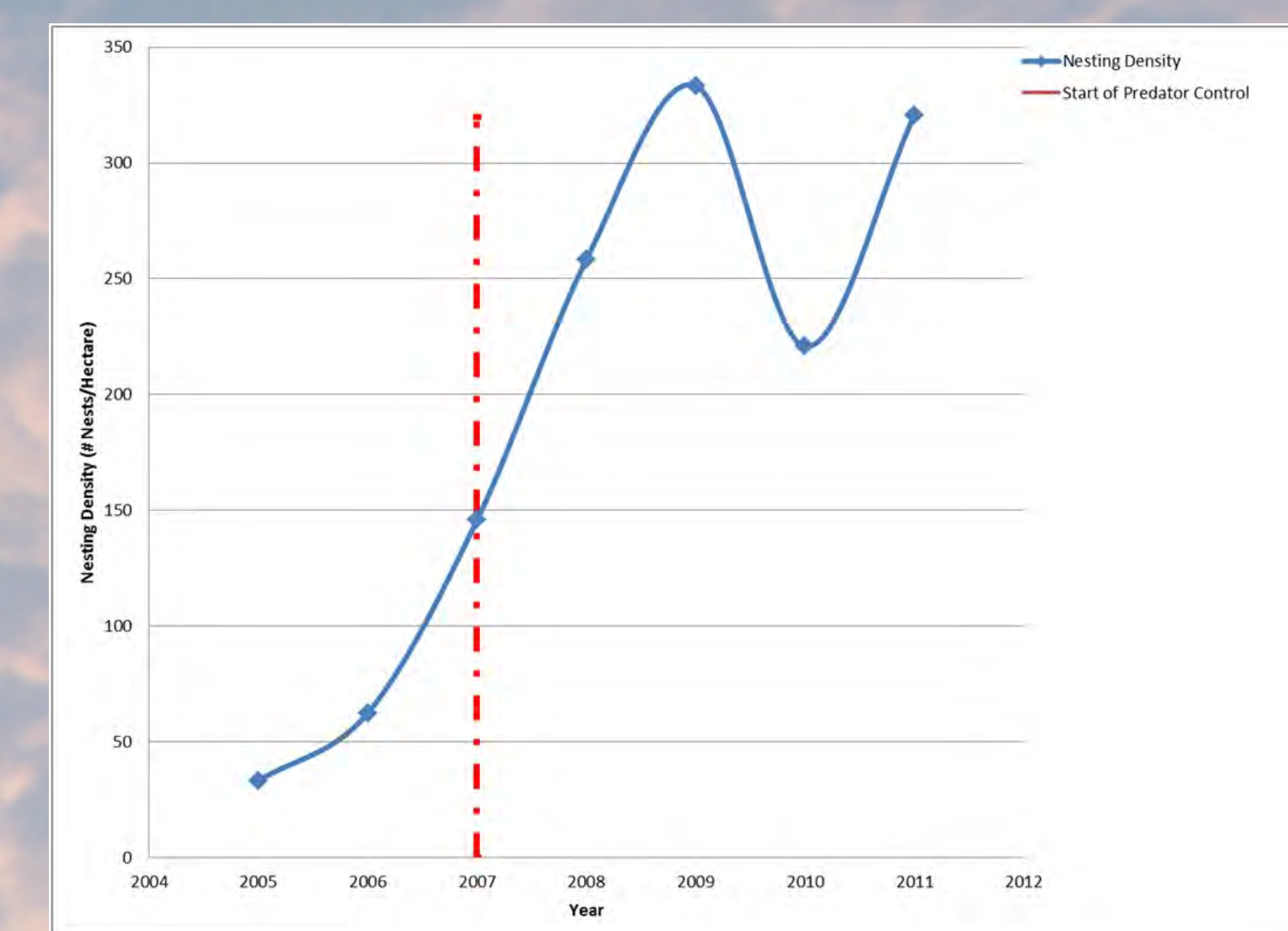


Figure 3. California least tern Nesting Density at the Hayward Shoreline colony with and without gull predator management from 2005 to 2011. The nesting density showed a statistically significant increase after the implementation of gull predator management. (Mann-Whitney U-test, $p \leq 0.05$; Unpaired t-test, $p < 0.01$).

Management Implications

Nest predation is a major detriment to the reproductive success of declining special status species that are also vulnerable to many other environmental threats. We recommend that California least tern restoration efforts be accompanied with close monitoring of potential avian predators that enables early detection and the possible prevention of tern egg and chick depredation. Localized California gull predator management may be insufficient as the sole management tool for the protection of nesting endangered species and needs to be considered as merely one of many components. We suggest that gull management practices intended to increase tern reproductive success, should emphasize gull harassment (hazing with horns and pyrotechnics, morbid decoys, conspicuous human monitors, gull displacement activities) combined with limited lethal techniques (shooting) to strengthen the effectiveness of the non-lethal alternatives. We conclude that an integral component of our study to improve California least tern conservation at Hayward into the foreseeable future must include on-going monitoring program, trained volunteers, and predator management efforts as performed by USDA Wildlife Services and staff.



A California least tern (*Sterna antillarum brownii*) nest with one-day old chick and hatching egg. California gulls were documented depredating a total of 4% of tern eggs and 5% of the chicks at the site (Table 2). Photo by David Riensch, EBRPD Certified Wildlife Biologist®