



**Population Size and Reproductive Success of California Gulls  
at Mono Lake, California in 2008**



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## Summary

An estimated 36,944 adult California Gulls (*Larus californicus*) nested at Mono Lake in 2008. This total was the second lowest in 26 years of monitoring, and was below the 1983-2007 ( $n=26$  years) average of  $47653 \pm 1527$  SE. In 2008, 77% nested on the Negit Islets, 17% on the Paoha Islets, and 6% on Old Marina Islet. Twain Islet remained the most populous, holding 48% of the lake-wide total, followed by Little Tahiti Islet with 13%, and Coyote A Islet with 11% of the nesting population. No nests were found on Negit Island in 2008, a first since 1997. Lake-wide reproductive success of  $0.851 \pm 0.12$  SE chicks fledged per nest was below the 1983-2007 average of  $0.98 \pm 0.07$  SE ( $n=26$  years). An estimated  $15,722 \pm 1458$  SE chicks fledged from the Mono Lake islands in 2008. For the 503 chicks banded and weighed in early July, weight at banding was significantly greater for those that survived to fledging than for those that did not. Excluding two plots for reasons discussed below, overall mortality of banded chicks did not differ significantly between chicks with and without infestations of the endemic bird tick *Argas monolakensis*.

## INTRODUCTION

We continued long-term monitoring of population size and reproductive success of California Gulls (*Larus californicus*) at Mono Lake, California in 2008. Our objectives are to measure year-to-year variation in population size and reproductive success as they relate to changing lake levels and other environmental conditions.

In 2014, the State Water Board will assess Mono Lake's progress toward the targeted managed lake level of 1948.3 m ([www.monolake.org/restoration/status.htm](http://www.monolake.org/restoration/status.htm)). This study provides an important benchmark of the lake's ecological condition that may be crucial at that time.

## STUDY AREA

The study area has previously been described in detail (see Wrege et al. 2006, Shuford et al. 1984, Shuford 1985, and [www.monolake.org/naturalhistory](http://www.monolake.org/naturalhistory)). Locations of nesting islands and islets shown in Figures 1 and 2.



Figure 1. Map of study area showing the Negit and Paoha islets.

### **Lake Level**

The lake level was approximately 1945.6 m (6383.1 ft.) in May 2008, a decline of 0.5 m from May of 2007. Lake level data from Los Angeles Dept. Water and Power are available at [www.monolake.org/live/lakelevel/yearly.htm](http://www.monolake.org/live/lakelevel/yearly.htm).



Figure 2. West shore of Mono Lake showing Old Marina and Old Marina South islands

## **METHODS**

### **Nest Counts**

In 2008, we counted nests on Negit Island, the Negit Islets, and the Paoha Islets from 26-29 May. Field workers walked through all the colonies counting each nest with a tally meter and marking them with a small dab of water-soluble paint to avoid duplicate counts. For some small, steep-sided islets, incubating adults were counted from a small motor boat.

### **Clutch Size, Chick Banding, and Reproductive Success**

We sampled 9 fenced plots on 4 islets to estimate clutch size and reproductive success. Seven plots measuring 10 x 20 m are located on the Negit Islets (four on Twain, one on Little Tahiti) and four fenced plots of various but smaller sizes (Jehl 2001) on the Paoha Islets (two on Coyote A, two on Piglet Islet).

We estimated clutch size by averaging the number of eggs per nest for all nests counted in late May within the 9 plots. From 6-8 July 2008, we banded all chicks within the 9 fenced plots. From 12-13 September 2008, we searched the plots' islets to determine the number of banded nestlings that died before fledging. We estimated the fledging rate for each plot in which data was collected, and, using the average fledging rate for the entire

population, the total number of gulls successfully fledged from Mono Lake in 2008. We calculated the fledging rate for each plot ( $f_{plot}$ ) as:

$$f_{plot} = (C_b - C_d) / N_p$$

where  $C_b$  is the number of chicks banded in that plot in July,  $C_d$  is the number of chicks from that plot found dead in September, and  $N_p$  is the number of nests counted in that plot in May. We calculated the total number of gulls successfully fledged ( $F$ ) from Mono Lake as:

$$F = (N/P) \sum_{i=1}^P f_i$$

where  $N$  is the total number of nests on Mono Lake,  $P$  is the number of plots, and  $f_i$  is the number of young fledged per nest in each of the Negit Islet fenced plots.

Increased chick mortality is associated with high levels of tick infestation (Hite et al. 2004). Since 2003, data from the Little Norway plot has been excluded in estimating average clutch size and reproductive success for the lake-wide population due to a large tick outbreak localized on Little Norway that apparently led to extreme chick mortality there (Hite et al. 2004). In 2008, we excluded data from the Little Tahiti East plot as well due to an exceptionally low fledge rate. Little Tahiti East has consistently had high levels of tick infestation, nearly as high as those experienced on Little Norway in recent years (Hite et al. 2004, 2005, Nelson et al. 2006a, 2006b, 2007).

We analyzed results using a nonparametric test (Wilcoxon/Kruskal-Wallis) with Stata 8.0 (Stata Corp. 2003).

### **Tick Infestations**

Because of its potential effect on gull reproductive success, we recorded the presence and abundance of the bird tick *Argas monolakensis* for all 504 chicks banded. Each bird received a score of 0-3 based on the approximate proportion of the fleshy part of the legs covered by tick larvae: 0 no ticks; 1, up to one third covered; 2, up to two-thirds covered; and 3, more than two-thirds covered. For more information on the life cycle of this endemic tick, see Schwan et al.(1992) and Nelson et al. (2006b).

## **Chick Mass at Banding**

We used hand-held Pesola scales to weigh the chicks that were banded.

## **RESULTS AND DISCUSSION**

### **Number of Nests and Breeding Adults**

In 2008, we recorded a lake-wide total of 18,472 California Gull nests and estimated a population of 36,944 nesting adults. The number of nests and breeding adults in 2008 was 22% below the long-term average (mean =  $47,653 \pm 1527$  SE,  $n=26$  years,) and 15% lower in 2008 than in 2007. Of the total, 77% nested on the Negit Islets, 17% on the Paoha Islets, 6% on Old Marina Islet, and no nests were found on Negit Island, the historic location of the colony (Figures 1, 2). Considering the island/islets individually, Twain Islet held 48% of the total, followed by Little Tahiti with 13%, Coyote A with 11% and Pancake with 9%. The remaining islets inhabited by gulls in 2008 collectively held 19% of the total (Appendix 1).

### **Nesting Occupation Changes among Islands and Islets**

The number of nests on the Paoha Islets declined 31% in 2008 relative to the number there in 2007. The relative decline in the number of nests on the Negit Islets was 13%. The nesting population on Old Marina Island, located near the western shoreline (Figure 2) continued to grow in 2008. One-thousand and eighty-nine nests were tallied in 2008; a 66% rise relative to the number there in 2007. The number of nests on Old Marina has increased greatly each year since 2006, although in 2005 it was virtually abandoned after the island was raided by predator(s) in 2004. Characteristics of adult carcasses and eggshell fragments recovered suggested coyote (*Canis latrans*) predation. Additionally, 9 active nests were discovered on a small islet just south of Old Marina in 2008, this islet was newly named Old Marina South (Figure 2).

**Negit Island:** No nests were found on Negit Island in 2008, following a sharp decline of about 50% observed annually from 2004-2007 (Appendix 1).

## **Phenology**

Over 81 nests, or about 0.5%, contained newly hatched chicks out of the total of nests counted during 26-29 May 2008. During chick banding, 29 nests with eggs or chicks too young to band were encountered, primarily within the Paoha Islet plots. No unfledged chicks were detected during mortality count 12-14 September 2008.

## **Clutch Size**

In 2008, average clutch size at Mono Lake was  $1.90 \pm 0.27$  eggs/nest (range = 1-3 eggs,  $n = 523$  nests). Twenty-four percent of the nests contained one egg, 63% had two, and 13% had three. Winkler (1983) reported the average clutch size at Mono Lake in 1983 was approximately 1.8 eggs/nest, which is similar to the averages which have been calculated since 2002 (Hite et al. 2003, 2004, Nelson et al. 2006a, 2006b, 2007), with the exception of 2004, when the average clutch size was 2.35 (Hite et al. 2005).

## **Fledging Rates and Overall Reproductive Success**

The five fenced plots on the Negit Islets held an average of  $73.4 \pm 10.4$  nests and fledged an average of  $0.91 \pm 0.13$  chicks per nest in 2008. The four fenced plots on the Paoha Islets held an average of  $39.0 \pm 2.3$  nests and had an average fledge rate of  $0.77 \pm 0.14$  chicks per nest (Table 1). Combined, the 9 plots held an average of  $58 \pm 8.2$  nests and fledged an average of  $0.851 \pm 0.12$  chicks per nest. This rate was significantly below the 1983-2007 average of  $0.98 \pm 0.07$  SE ( $n=26$  years) chicks fledged per nest, although only by a slight margin ( $p=.04$ ,  $t=1.81$ ). Reproductive success has fluctuated greatly over the tenure of this study and has been as low as 0.26 chicks fledged per nest (Nelson et al 2006b).

Based on the total of 18,472 California Gull nests on Mono Lake and an average of  $0.851 \pm 0.12$  chicks fledged per nest; an estimated  $15,723 \pm 1458$  chicks fledged at Mono Lake in 2008.

**Table 1.** Summary of Nest Counts, Chick Banding, and Mortality Counts on the Negit and Paoha Islets in 2008.

<b>Site</b>	<b>Nests per Plot</b>	<b>Chicks per Plot</b>	<b>Number banded (# dead)</b>	<b>fledged/nest</b>
Little Norway	7	n/a	n/a	n/a
Little Tahiti East	29	0.034	1 (0)	0.034
Little Tahiti West	72	1.33	96 (10)	1.19
Twain North	61	0.47	27 (0)	0.44
Twain South	103	0.96	99 (7)	0.89
Twain West	88	1.12	99 (10)	1.01
Twain New	43	1.09	47 (3)	1.02
<b>Negit Islet Totals:<sup>a</sup></b>				
<b>Totals =</b>	<b>367</b>	<b>-</b>	<b>368 (30)</b>	<b>-</b>
<b>Average =</b>	<b>73.40</b>	<b>0.994</b>	<b>-</b>	<b>0.91</b>
<b>SE =</b>	<b>10.41</b>	<b>0.14</b>		<b>0.13</b>
Coyote Cove	44	0.93	41 (4)	0.84
Coyote Hilltop	38	0.84	31 (2)	0.76
Piglet East	33	0.48	16 (3)	0.39
Piglet West	41	1.17	48 (3)	1.09
<b>Paoha Islet Totals:</b>				
<b>Totals =</b>	<b>156</b>	<b>-</b>	<b>136(12)</b>	<b>-</b>
<b>Average =</b>	<b>39.0</b>	<b>0.855</b>	<b>-</b>	<b>0.77</b>
<b>SE =</b>	<b>0.14</b>	<b>0.14</b>		<b>0.14</b>
<b>Mono Lake Totals:</b>				
<b>Totals<sup>a</sup> =</b>	<b>523</b>	<b>-</b>	<b>-</b>	<b>-</b>
<b>Average<sup>a</sup> =</b>	<b>58.11</b>	<b>0.932</b>	<b>504 (42)</b>	<b>0.848</b>
<b>SE<sup>a</sup> =</b>	<b>8.2</b>	<b>0.10</b>	<b>-</b>	<b>0.12</b>

<sup>a</sup> Exclude data from Little Norway and Little Tahiti East, for reasons discussed in the Methods

**Results from Little Tahiti East:** Only 0.034 chicks fledged per nest on the Little Tahiti East plot in 2008, which is extremely low (the average for this plot is  $0.89 \pm .07$  SE, PRBO unpubl. data). The 2008 fledge rate on Little Tahiti East is much lower than those encountered on the other plots, which varied between 0.39-1.19 (Table 1). Little Tahiti East has experienced a high degree of tick infestation among its chicks in previous years, and the infestation rate has been increasing. From 2001-2003, the percentage of chicks with ticks increased annually and was 72%, 75%, and 80%, respectively (Hite et al. 2004). From 2004-2007 the percentage was higher, and varied between 80-98% (Hite et al. 2004, 2005; Nelson et al 2006a, 2006b, 2007). Over the tenure of this study, Little Norway and Little Tahiti East plots have been the only plots to have tick scores regularly >1 (Hite et al. 2004, 2005, Nelson et al 2006a, 2006b, 2007).



### **Mass at Banding**

The average mass of the 503 chicks banded in 2008 was  $537 \pm 5$ g. The average mass for chicks that survived to fledging ( $544 \pm 5$ g) was significantly higher than the average mass for chicks that did not survive to fledging ( $468 \pm 21$ g,  $X^2 = 13.8$ ,  $df = 1$ ,  $p = 0.0002$ ). This pattern has been consistent through all years in which chicks were weighed (Hite et al. 2004, 2005, Nelson et al. 2006a, 2006b, 2007).

### **Tick Infestation**

Ninety-two percent of the chicks had a tick score of 0, and 7.9% had a tick score of 1. That only 1 chick was found on Little Tahiti East, and Little Norway was not visited may explain why so few ticks were detected this year, as these two plots have generally been the only ones to record tick scores  $>1$  (Hite et al. 2004). Ticks were detected on 2 (4%) chicks in Piglet West - this plot has been tick-free in previous years (Hite et al. 2004, Nelson et al 2006a, 2006b, 2007). Plots with high levels of tick infestation have generally had low levels of fledging success (Hite et al. 2004).

<b>Plot</b>	<b># chicks</b>	<b># with ticks</b>	<b>% w/ ticks</b>	<b>fledged/nest</b>
<b>Little Tahiti East</b>	<b>1</b>	<b>1</b>	<b>100</b>	<b>0.034</b>
<b>Little Tahiti West</b>	<b>96</b>	<b>2</b>	<b>2</b>	<b>1.19</b>
<b>Twain North</b>	<b>27</b>	<b>0</b>	<b>0</b>	<b>0.44</b>
<b>Twain South</b>	<b>99</b>	<b>1</b>	<b>1</b>	<b>0.89</b>
<b>Twain West</b>	<b>99</b>	<b>8</b>	<b>8</b>	<b>1.01</b>
<b>Twain New</b>	<b>47</b>	<b>23</b>	<b>47</b>	<b>1.02</b>
<b>Coyote Hilltop</b>	<b>31</b>	<b>3</b>	<b>10</b>	<b>0.76</b>
<b>Coyote Cove</b>	<b>41</b>	<b>0</b>	<b>0</b>	<b>0.84</b>
<b>Pigelet East</b>	<b>16</b>	<b>0</b>	<b>0</b>	<b>0.39</b>
<b>Piglet West</b>	<b>48</b>	<b>2</b>	<b>4</b>	<b>1.09</b>

Table 2. Tick infestation by plot

### **Band Recoveries**

Three dead California Gulls banded in previous years were recovered on the Negit islets in 2008. Two recently dead adults were found during the nest count in late May. One was banded at Mono Lake as a chick in 2003, another was banded as a chick at Mono Lake in 1990, indicating it was 18 years old when it died. The maximum recorded life span for a California Gull is over 24 years (D. Humple, pers. comm.). Finally, a young bird recovered during the mortality census in September had been banded as a chick in 2007, indicating it had returned to the nesting colony during late summer or fall at one year of age.

### **Other Species Nesting on Mono Lake Islets**

In addition to California Gulls, other species found nesting on the Mono Lake islets in 2008 were the Black-crowned Night-Heron and Osprey. Sixty-eight Black-crowned Night Heron nests were tallied in late May – 38 on Twain, 29 on Little Tahiti and 1 on Steamboat. Six pairs of Osprey (*Pandion haliaetus*) nested at Mono Lake (J. Pence, pers. comm.). All but 1 were located on tufa towers near the shoreline. The remaining Osprey pair nested on the Negit islet of Saddle, a small islet Southeast of Twain (Fig. 1), where two chicks were seen in the nest during September mortality count. This pair had attempted nesting there for the previous 2 years. No Caspian Tern (*Sterna caspia*) nests were found on the Mono Lake islets in 2008. This species nested nearly annually on the Mono Lake islets from at least the mid-1970's (Jehl 1986) through 2006 (Nelson et al. 2006b). Due primarily to frequent predation by California Gulls, the Mono Lake population has never flourished, and has fluctuated greatly (Jehl 1986, Nelson et al. 2006b).

### **California Gulls Increasing in the San Francisco Bay**

Historically, the Mono Lake nesting population of California Gulls has been the largest in California, and the second largest for the species (Shuford and Ryan 2000). However, this may be changing. Beginning in 1980, small numbers of nesting California Gulls were detected in the San Francisco Bay region (Shuford and Ryan 2000, SFBBO, unpubl. data), becoming the first coastal breeding population for the species (Howell and Dunn

2007). This population grew quickly, and by 2008 estimates of the number of gulls in the combined San Francisco Bay Area colonies surpassed the estimated population for Mono Lake (SFBBBO unpubl. data, Figure 3).

The exponentially expanding California Gull population in the San Francisco Bay region has led to significant predation rates on local nesting birds (Ackerman et al. 2006) which before 1980 were unexposed to significant California Gull predation. In the South San Francisco Bay, California Gulls were found to have depredated at least 61% of American Avocet (*Recurvirostra americana*) and 23% of Black-necked Stilt (*Himantopus mexicanus*) chicks, and a large number of eggs as well (Ackerman et al. 2006).

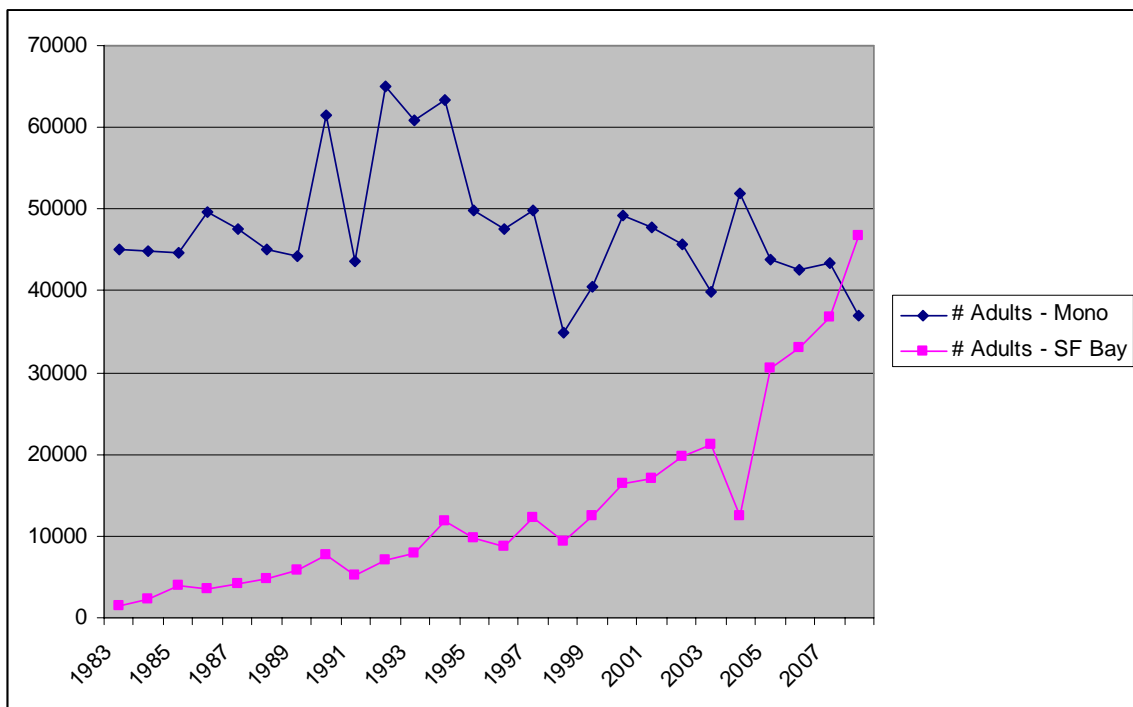


Figure 3. Estimates of breeding adult gulls for Mono Lake and the San Francisco Bay region, 1983-2008

\* 2004 SF Bay population estimate was conducted differently, and was likely a conservative count

The pioneering date of 1980 for a new colony in the San Francisco Bay region is of interest because it may suggest an influx from the Mono Lake population. In 1979, due to the lowered lake level from water diversions, a land-bridge formed from the mainland to Negit Island, and coyotes gained access to and decimated the Mono Lake nesting colony on Negit Island (Winkler and Shuford 1986). In 1980, Mono Lake's California Gulls responded by abandoning Negit Island almost entirely and moving their breeding grounds

to the multiple smaller islets which were still surrounded by water (Winkler and Shuford 1986). It is conceivable that some gulls remained closer to their wintering grounds (coastal California) to breed in 1980 in response to the coyote predation and the abandonment of Negit Island.

There are other suggestive ties between the San Francisco Bay population's increase and the Mono Lake decrease. Wrege et al. (2006) found that four variables accounted for >80% of the variation in the number of breeding gulls at Mono Lake. One of these variables was the potential number of four-year-old gulls returning to Mono Lake to breed for the first time, which depends on reproductive success 4 years earlier. The 2004 breeding season at Mono Lake was very successful for all population parameters measured – clutch size, chick weight, and most important for the 2008 population size, reproductive success which was 1.53 chicks fledged/nest - significantly above the then average of  $0.942 \pm .08$  SE ( $p < 0.00001$ ) (Hite et al. 2005). Yet the 2008 Mono Lake population showed no indication of this expected increase. On the contrary, the nesting population in 2008 was the second lowest recorded in 26 years of monitoring.

Three-hundred and sixteen California Gulls banded at Mono Lake have been recovered from 1983 to 2008 at locations from Washington State south to northern Mexico and east to Nevada (PRBO unpubl. data). Of those, 14 were adults recovered during the breeding season (April-July) from locations away from the Mono Lake region. Of these, all but 3 were from locations not known to be near breeding colonies. One was recovered April 26, 1999 near Stillwater, NV, a region where California Gulls are considered “opportunistic nesters” (Chisholm and Neel 2002) as both stable and opportunistic breeding colonies are present. Late April is the typical egg-laying period for the Mono Lake population, and it seems likely this individual, if breeding, was a member of one of the colonies in that region. The remaining two were found during the height of the breeding season near the San Francisco Bay area. The first was banded at Mono Lake as a chick in 1986 and was recovered May 23, 2007 at Moffett Field, CA. Moffett Field is located on the San Francisco bay shoreline and has contained a breeding colony of California Gulls since 1994 (Ackerman et al. 2006). Given the date and location of the band recovery, it is likely this individual joined the Moffett breeding colony. Another gull banded at Mono Lake as a chick in 2000 was recovered July 18, 2007 at Half Moon

Bay, CA. Half Moon Bay is about 32 km from the nearest breeding colony - a conceivable distance from its nest for an individual to forage. However, if this gull was in fact nesting locally is unknown.

The San Francisco Bay area population has been growing exponentially (Figure 3, Ackerman et al. 2006), so presumably breeding conditions there are favorable. The population increase may be closely related to the use of landfills and other anthropogenic food sources, as there are 3 large landfills within short flight distances of the main San Francisco Bay breeding colonies (Ackerman et al. 2006). Large numbers of California Gulls have been tallied in recent years foraging at San Francisco Bay area landfills in spring, peaking at almost 9,000/day among 4 landfills in April (Ackerman et al. 2006). In spring, the crucial egg-laying period which is typically late April for Mono Lake gulls, foraging opportunities are limited in the Mono Basin (Wrege et al. 2006), but are abundant in the San Francisco Bay area at landfills. This could provide an incentive for Mono gulls wintering in the San Francisco Bay area to remain there to breed.

As Mono Lake rises towards the 1948.3 m target level, much of the currently used nesting area will be submerged. Islets such as Pancake, Paoha Islet complex, and all other islet area below 1948.3 m will become unavailable to nesting gulls. If Mono Lake California Gulls have contributed to the San Francisco Bay area population, it is possible more Mono gulls may nest there. However, California Gulls are essentially a Great Basin nesting species (Howell and Dunn 2006), and breeding on the Pacific coast is atypical. Conditions at Mono Lake are can be harsh and unpredictable, but can also be exceptional for gulls in years when the lake brims with shrimp, alkali flies and larvae. The highest level of primary productivity to be recorded in the limnological literature may have occurred at Mono Lake (R. Jellison pers. comm.), demonstrating how productive its ecosystem can be when conditions are favorable. How Mono Lake's gull population will respond to the forecasted loss of islet space due to a rising lake level and other lake conditions, or temptations to breed elsewhere, remains to be seen.

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**Appendix 1** Nest counts on Negit Island and the Negit and Paoha islets from 1983 to 2008. Data from the Paoha Islets in all years but 2002 to 2008 from J. R. Jehl, Jr.

<b>Negit Islets</b>	1983	1984	1985	1986	1987	1988	1989	1990
Twain	3808	7372	9309	11985	12422	11057	10573	15045
L. Tahiti	5260	7051	6572	5763	4261	3692	2983	4218
L. Norway	2218	1956	1407	810	360	254	269	432
Steamboat	997	1016	721	722	467	359	314	704
Java	143	396	195	400	439	458	543	789
Spot	505	358	296	311	248	247	231	309
Tie	511	231	196	150	84	87	95	167
Krakatoa	319	272	178	173	185	197	174	283
Hat	146	109	73	56	14	18	10	19
La Paz	105	58	43	30	22	21	23	46
Geographic	140	0	0	0	0	0	2	4
Muir	170	0	0	0	0	1	10	61
Saddle	175	46	41	29	14	13	10	18
Midget	5	3	3	4	4	2	3	3
Siren	51	0	1	0	0	0	1	7
Comma	2	1	1	1	0	0	0	0
Castle	2	3	4	3	4	6	5	4
Rocks								
Pancake	0	0	0	7	570	1216	1395	651
Java Rocks	0	0	0	0	4	3	0	4
No name	0	0	0	0	0	0	0	1
<b><i>Negit islet Total:</i></b>	<b>14557</b>	<b>18872</b>	<b>19040</b>	<b>20444</b>	<b>19098</b>	<b>17631</b>	<b>16641</b>	<b>22765</b>
<b>Paoha Islets</b>								
Coyote A	a	a	a	a	a	a	a	a
Coyote B	a	a	a	a	a	a	a	a
Browne	a	a	a	a	a	a	a	a
Piglet Islet <sup>b</sup>	a	a	a	a	a	a	a	a
<b><i>Paoha Islets Total:</i></b>	<b>8001</b>	<b>3546</b>	<b>3153</b>	<b>3694</b>	<b>3208</b>	<b>2833</b>	<b>2682</b>	<b>5145</b>
<b>Negit Island</b>	--	--	92	636	1502	2037	2765	2827
<b><i>Lakewide Total</i></b>	<b>22558</b>	<b>22418</b>	<b>22285</b>	<b>24778</b>	<b>23808</b>	<b>22501</b>	<b>22088</b>	<b>30737</b>
<b><i>Nesting Adults:</i></b>	<b>45116</b>	<b>44836</b>	<b>44570</b>	<b>49556</b>	<b>47616</b>	<b>45002</b>	<b>44176</b>	<b>61474</b>

<sup>a</sup> Data published elsewhere by J. R. Jehl, Jr.

<sup>b</sup> Numbers of nests intermittently attributed to Piglet Islet are from a piece of land adjacent to the other Paoha Islets, which in past years of lower water levels has been partially or completely connected to the Paoha mainland via a landbridge. Formally known as "Paoha Islet" (Jehl 2001, Hite et al. 2004) it was changed to "Piglet Islet" to avoid confusion with Paoha Island.

**Appendix 1** Continued.

<b>Negit Islets</b>	1991	1992	1993	1994	1995	1996	1997	1998
Twain	10883	15896	15431	15792	11035	12690	13140	9488
L. Tahiti	3205	3810	3616	4505	4021	4570	4092	3846
L. Norway	355	473	428	533	493	766	794	606
Steamboat	671	862	958	1217	981	459	505	405
Java	586	1040	399	199	4	70	41	65
Spot	311	335	356	449	422	399	341	191
Tie	160	220	210	320	264	267	194	81
Krakatoa	181	209	146	175	116	57	33	16
Hat	10	21	21	14	19	41	58	47
La Paz	49	70	77	57	55	44	30	17
Geographic	10	68	84	69	51	0	0	0
Muir	84	139	131	116	87	4	0	0
Saddle	8	14	10	11	21	31	13	1
Midget	2	2	3	2	2	2	3	0
Siren	7	19	20	14	16	10	0	0
Comma	1	1	1	0	0	1	0	0
Castle R.	5	5	3	3	3	4	4	3
Pancake	0	0	0	0	0	0	1	13
Java Rocks	2	13	15	9	5	1	0	0
No name	0	3	3	3	1	0	0	0
<i>Negit Islet</i>								
<b>Total</b>	<b>16530</b>	<b>23200</b>	<b>21912</b>	<b>23488</b>	<b>17596</b>	<b>19416</b>	<b>19429</b>	<b>14779</b>
<b>Paoha Islets</b>								
Coyote A	a	a	a	a	a	a	a	a
Coyote B	a	a	a	a	a	a	a	a
Browne	a	a	a	a	a	a	a	a
Piglet Islet <sup>b</sup>	a	a	a	a	a	a	a	a
<i>Paoha Islets</i>								
<b>Total:</b>	<b>4442</b>	<b>9284</b>	<b>8498</b>	<b>8182</b>	<b>7331</b>	<b>4334</b>	<b>5708</b>	<b>2687</b>
<b>Negit Island:</b>	788	4	12	0	0	0	0	0 <sup>c</sup>
<b>Old Marina</b>	0	0	0	0	0	0	0	0
<i>Lakewide</i>								
<b>Total:</b>	<b>21760</b>	<b>32488</b>	<b>30422</b>	<b>31670</b>	<b>24927</b>	<b>23750</b>	<b>24957</b>	<b>17466</b>
<i>Nesting Adults</i>								
<b>Adults</b>	<b>43520</b>	<b>64976</b>	<b>60844</b>	<b>63340</b>	<b>49854</b>	<b>47500</b>	<b>49914</b>	<b>34932</b>

<sup>c</sup> No nesting gulls were seen on Negit Island in late May 1998, but a nearshore boat survey on 8 July found five adults apparently incubating, and one pre-fledged chick (J. R. Jehl, Jr. pers. comm.).

**Appendix 1.**

Continued

<b>Negit Islets</b>	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Twain	10728	11856	11773	10772	9288	11480	9582	9900	10138	8891
L. Tahiti	5108	5076	4309	3831	2632	3303	2511	2700	3102	2477
L. Norway	732	887	665	357	249	213	126	165	172	137
Steamboat	381	477	570	621	575	635	621	583	631	590
Java	149	480	611	706	718	915	779	710	648	482
Spot	27	29	36	42	70	98	127	75	9	49
Tie	5	16	23	24	38	49	50	33	0	9
Krakatoa	76	120	141	129	113	181	184	131	119	24
Hat	43	29	23	9	7	9	3	5	10	3
La Paz	0	0	0	0	0	1	2	0	0	0
Saddle	2	1	1	0	0	0	0	1	1	0
Midget	3	2	0	0	0	1	1	0	0	0
Siren	0	0	0	0	0	0	0	0	0	0
Comma	0	0	0	0	0	0	0	0	0	0
Castle Rocks	3	1	1	1	0	0	0	0	0	0
Pancake	1136	2098	2145	2085	1847	2837	2530	2059	1602	1623
Java Rocks	0	0	0	0	0	0	0	0	0	0
No name	0	0	0	0	0	0	0	0	0	0
<b><i>Negit Islets Total</i></b>	<b>18393</b>	<b>21072</b>	<b>20298</b>	<b>18577</b>	<b>15537</b>	<b>19722</b>	<b>16516</b>	<b>16362</b>	<b>16432</b>	<b>14285</b>
<b>Paoha Islets</b>										
Coyote A	<sup>a</sup>	<sup>a</sup>	2237	2612	2480	3244	3174	3181	3094	1989
Coyote B	<sup>a</sup>	<sup>a</sup>	22	26	34	55	63	40	0	0
Browne	<sup>a</sup>	<sup>a</sup>	279	261	224	283	253	225	118	99
Piglet <sup>b</sup>	<sup>a</sup>	<sup>a</sup>	776	991	1010	1552	1649	1218	1269	1001
<b><i>Paoha Islet Total:</i></b>	<b>1858</b>	<b>3478</b>	<b>3314</b>	<b>3890</b>	<b>3748</b>	<b>5134</b>	<b>5139</b>	<b>4664</b>	<b>4481</b>	<b>3089</b>
<b>Negit Island:</b>	14	100	271	391	452	587	285	120	63	0
<b>Old Marina</b>	0	0	0	<sup>d</sup>	178 <sup>e</sup>	511	1	94	723	1089
<b>Old Marina So.</b>									0	9
<b><i>Mono Lake Total:</i></b>	<b>20265</b>	<b>24650</b>	<b>23883</b>	<b>22858</b>	<b>19915</b>	<b>25954</b>	<b>21941</b>	<b>21240</b>	<b>21699</b>	<b>18472</b>
<b><i>Nesting Adults</i></b>	<b>40530</b>	<b>49300</b>	<b>47766</b>	<b>45716</b>	<b>39830</b>	<b>51908</b>	<b>43882</b>	<b>42480</b>	<b>43398</b>	<b>36944</b>

<sup>d</sup> Number of nests on Old Marina Islet in 2002 (and years before) is uncertain. Nesting activity was not discovered until 5 July 2002, making a standardized nest count impossible; pre-fledged chicks were observed with a spotting scope from shore, but nests were concentrated on an area obscured from view from shoreline. A minimum of five pairs of gulls initiated nests but this is likely an underestimate.

<sup>e</sup> Nests were not counted with water soluble paint which typically serve as a counting aid, and counters believe 178 they recorded is an underestimate.