Population Size and Reproductive Success of California Gulls at Mono Lake, California in 2013

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Summary

An estimated 45,510 adult California Gulls (*Larus californicus*) nested at Mono Lake in 2013. This total is similar to the long-term average of 46,552 ± 1440 for the period 1983–2012 (*n* =30 years). Eighty-one percent of Mono Lake's gulls nested on the Negit Islets, 10% on the Paoha Islets, and 9% on the Old Marina islets. On Piglet Islet (formally known as Paoha Islet), the number of nests tallied in May was the lowest recorded, and for the second consecutive year, all nests on that islet were predated. Lake-wide reproductive success of 0.72 ± 0.05 chicks fledged per nest was below the 1983-2012 average of 0.91 ± 0.07. An estimated 16,288 ± 879 chicks fledged from Mono Lake islets in 2013. For the 648 chicks banded and weighed in July, weight at banding was significantly greater for those that survived to fledging than for those that did not. Post-banding mortality was 18%, which is above the long-term average of 10% ± 1%. Three-hundred and twenty-three chicks were banded with coded red color bands, 322 received a pale blue color band on the left leg and a federal USFWS band on the right leg, the remaining 3, all recently hatched, received no color band.

INTRODUCTION

We continued long-term monitoring of population size and reproductive success of California Gulls (*Larus californicus*) at Mono Lake, California, in 2013. 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. Through color banding, we aim to better understand gull movements, fall and winter distribution, and investigate whether or how often individual gulls breed in different colonies in different years. This study provides an important long-term data set that is a useful measurement of Mono Lakes' ecological condition.

STUDY AREA AND CLIMATE CONDITIONS

The study area has previously been described in detail (see Wrege et al. 2006). Locations of the Mono Lake nesting islets are shown in Figures 1, 2 and 3.

Fig. 1. Location of gull nesting islets within Mono Lake.

The winter of 2012-2013 was relatively dry for the Mono Basin. Snowpack levels measured at Gem pass were 70% of average as of April 1 2013, marking the second consecutive dry winter in the Mono Basin. Mono Lake dropped 0.6 m (1.9') from May 2012 to May 2013. According to data compiled from a Lee Vining weather station present since 1988, the summer of 2013 was relatively warm and wet. Average temperatures for June were the warmest on record, and the .05 m (2 inches) of rain that fell in July was the most recorded locally since 2002 (Greg Reis, Mono Lake Committee). By July 2013, despite the slight increase due to rain, the lake level dropped to 1945.1 m (6381.7') - the lowest recorded during the gull breeding season since 2004 (data courtesy of Los Angeles Dept. of Water and Power website). In both 2004 and 2013 Coyote (*Canis latrans*) predation occurred on nesting islands due to reduced water channels protecting the islets.

METHODS

Nest Counts

Between May 24 - 28, 2013 field workers walked through colony islets in sweep-lines to count nests. Each sweep line consisted of 4 to 6 personnel depending on islet size and

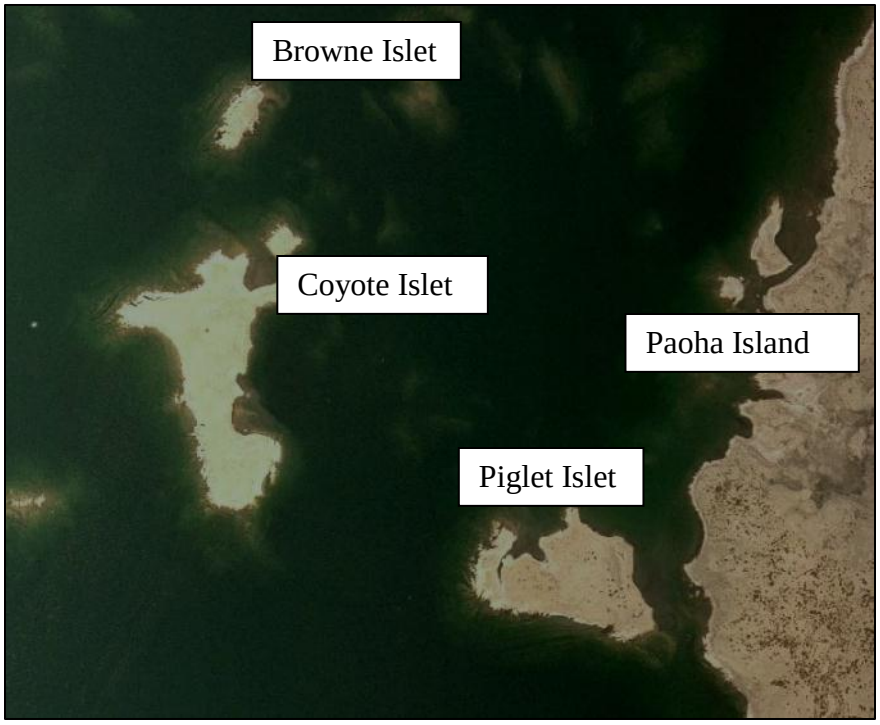
nest density. Every nest was counted with a tally meter and marked with a small dab of water-soluble paint to avoid duplicate counts. For some small islets, incubating adults were counted from a small motor boat.

Fig. 2.View of individual islets within the Negit Islet complex.

Clutch Size, Banding, and Reproductive Success

We sampled 9 fenced plots on 3 islets to estimate clutch size and sampled 8 plots on 3 islets to estimate reproductive success. Six fenced plots measuring 10 x 20 m are located on the Negit Islets (four on Twain, two on Little Tahiti), another plot approximately 20 x 20 m is located on Little Tahiti, and four fenced plots of various but smaller sizes are located on the Paoha Islets (two on Coyote A, two on Piglet Islet). Average clutch size was estimated by counting the number of eggs per nest for all nests within the 9 plots during nest count in late May.

Fig.3. View of Paoha Islet complex



Reproductive success, or average fledging rate, was calculated from surveys recoding the number of nests on each plot in late May, the counts and banding of chicks in July, and the recovery of banded chicks that died on the island in which they were banded. From 7-11 July 2013, we banded all chicks within the plots with a silver U.S. Fish and Wildlife Service (USFWS) band as well a color band – either a single pale blue color band (applied to the right leg of smaller, less vigorous chicks) or a red coded band engraved with a field-readable numeric code unique to each banded individual. During banding, chicks were weighed using hand-held Pesola scales.

From 6 - 8 September 2013, we searched the islets in which chicks were banded to determine the number of banded chicks 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 2013. We calculated the fledging rate for each plot **(f_{plot})** as:

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

where $\mathbf{C_b}$ is the number of chicks banded in that plot in July, $\mathbf{C_d}$ is the number of chicks from that plot found dead in September, and $\mathbf{N_p}$ 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 **fi** is the number of young fledged per nest in each of the fenced plots.

In 2013, data from two small plots on Piglet Islet were excluded from reproductive success estimates due to Coyote predation which occurred in spring and caused complete nesting failure on Piglet Islet and its plots. Predation was not noted on other plots. Due to the isolation of the event, the 2 Piglet Islet plots were not deemed representative for the overall population and thus removed from the sample. Additionally, one plot on Coyote Islet (Coyote Hilltop) was not used for reproductive success estimation due to a large hole in the fence which allowed chicks to freely move in or out of the plot. This plot was included in clutch size estimations.

We analyzed variables associated with chick mortality using a nonparametric test (Wilcoxon/Kruskal-Wallis) with Stata 10.0 (Stata Corp. 2003). Results are presented with plus or minus one standard error.

Tick Infestations

Because of the potential effect on gull reproductive success, we recorded the presence and abundance of the bird tick *Argas monolakensis* for all banded chicks. We also checked for the presence of "mites" (apparently tick nymphs). Each bird received a tick score of 0-3 based on the approximate proportion of the fleshy part of the leg (tibia) 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. "Mites" were recorded as either present or absent based on examination of the tibia. For more information on the life cycle of this endemic tick, see Schwan et al. (1992) and Nelson et al. (2006).

RESULTS AND DISCUSSION

Number of Nests and Breeding Adults

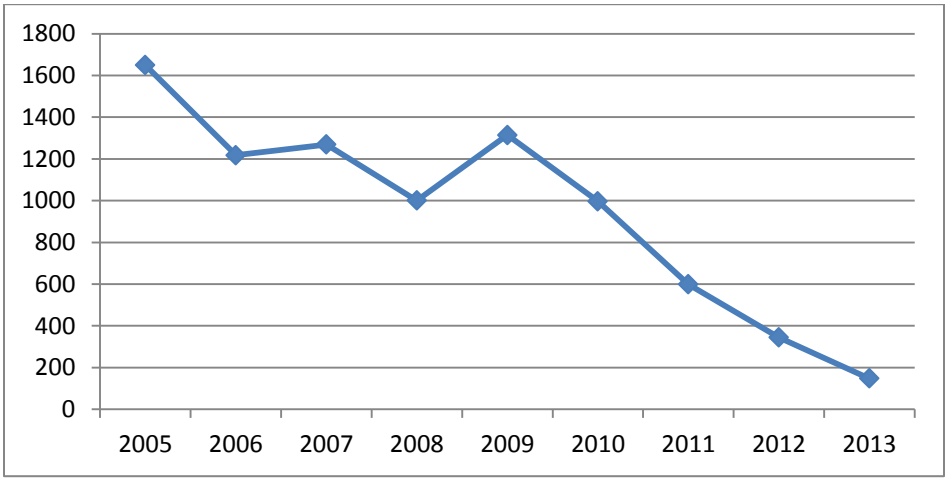
In 2013, we counted a lake-wide total of 22,755 California Gull nests, yielding a population of 45,510 nesting adults. This is similar to the long-term mean population size of 46,552 ± 1440 for the period 1983-2012 (n = 30 years).

Eighty-one percent of the gulls nested on the Negit Islets, 10% nested on the Paoha Islets and 9% nested on Old Marina and Old Marina South islets (Figures 1, 2 and 3, Appendix 1). Eight nests were counted on Negit Island, only the second time nests have been found there since 2007 (Appendix 1). The number of nests on the Paoha Islets continued their trend of relatively low nest numbers; a decline which began around 2005 (see Nelson and Greiner 2012). Nest numbers on Piglet Islet particularly plummeted in 2013. The nest predation this islet has suffered for two successive years may cause decreased nesting or abandonment in future years.

Of the individual islets, Twain was the most populous, holding 9,567, or 42%, of the lake-wide total number of nests. Little Tahiti and Pancake A islets contained 3,995 and 2,446 nests; representing 18% and 11% of the entire nesting population respectively (Appendix 1).

Noteworthy changes in nest numbers relative to recent years were noted in several nesting areas in 2013. On the Negit Islets, nest numbers increased considerably relative to the past 10 or more years on Little Tahiti, Steamboat, and Little Norway (Appendix 1). Piglet Islet plummeted in population size - only 148 nests were counted in May. This number is less than half of the previous record low count which was tallied in 2012. Old Marina South, however, experienced considerable population growth (Appendix 1); nesting was only first detected there in 2008. Nearby Old Marina Islet experienced a similar population increase (though greater and more prolonged) in the early 2000's. Like Old Marina Islet, which became attached to the mainland in fall 2013 due to reduced lake levels, Old Marina South is close to the mainland shore and susceptible to mammal predation.

Fig. 4. Number of nests counted on Piglet Islet, 2005 – 2013



Phenology

Six nests containing small chicks were detected during the May 24 - 28 2013 nest count and 6 additional nests contained pipping eggs. This is approximately average, or slightly above the typical number counted this time of year, and indicates the onset of hatching was not protracted.

Clutch Size

In 2013, the lakewide average clutch size was similar to years past at 1.8 ± 0.03 eggs/nest (range = 1-3 eggs, *n* = 796 nests). Overall, 31% of the nests contained one egg, 59% had two, and 9% had three. The average clutch size for Mono Lake since 2002 (*n* = 11 years) is 1.9 ± 0.05 eggs/nest.

Overall Reproductive Success

The Negit Islet plots averaged 98 ± 12 nests and averaged 0.71 ± 0.06 fledged chicks per nest. The two plots on Coyote Islet of the Paoha Islet complex averaged 54 ± 8 nests and Coyote Cove (the only Paoha Islet plot used for reproductive success measurements in 2013) fledged 0.80 chicks per nest. Combined, the 8 plots used to estimate lakewide reproductive success averaged 0.72 ± .05 fledged chicks per nest (Table 1), which is below the long-term average of 0.91 ± 0.07 chicks fledged per nest.

Based on the total of 22,755 California Gull nests on Mono Lake and an average of 0.72 ± 0.05 chicks fledged per nest, an estimated 16,336 ± 870 chicks fledged at Mono Lake in 2013. This is below the 1983-2012 average of 20,909 ± 2036 (n = 30 years). The long term average is calculated for the Negit Islets only from 1983-2002, and Negit and Paoha Islets combined since 2002.

Mass at Banding

The average mass of all chicks banded in July 2013 was 504 ± 4g , consistent with the long-term average (calculated since 2002) of 500 ± 8g. Mass of chicks that survived to fledging (519 ± 4g; n = 527) was significantly greater than the average mass for chicks that did not survive to fledging (437 ± 10g; n = 117) (X^2 = 60.0, df = 1, p = 0.0001). This pattern has been consistent all years in which chicks were weighed.

Table 1. Summary of Nest Counts, Chick Banding, and Mortality Counts from all plots in 2013.

Plot	Total nests in May	Avg. Clutch Size	Chicks/nest in July	# Chicks Banded (# found dead)	Total chicks successfully fledged/nest
Cornell	162	1.8	0.75	122 (12)	0.68
Little Tahiti East	79	1.8	0.87	69 (12)	0.72
Little Tahiti West	111	1.8	1.20	132 (26)	0.96
Twain North	67	1.9	0.54	36 (6)	0.45
Twain South	93	1.6	0.78	73 (13)	0.65
Twain West	99	1.7	1.13	112 (30)	0.83
Twain New	77	1.7	0.82	63 (12)	0.66
Negit Islet Totals/averages:	**688**	**1.8**	**0.87 ± .08**	**607 (111)**	**0.72 ± .06**
Coyote Cove	46	1.9	0.91	42 (5)	0.80
Coyote Hilltop	62	1.9	n/a	--	--
Piglet East	0	0	0	0	0
Piglet West	10	1.9	0	0	0
Paoha Islet Totals: *** calculated w/ C.Cove only**	**118**	**1.9**	**0.91***	**42 (5)***	**0.80***
Lakewide Totals *** calculated w/o Piglet Islet plots**	**806**	**1.8***	**0.875 ± .07***	**648 (116)**	**0.72 ± .05 ***

Note: Piglet Islet was raided by a Coyote and all nests were destroyed; thus these plots were removed from sample

Tick Infestation

Ticks were found on only 10 chicks of the 648 examined, approximately 1% of the total, and those with ticks had very few. The presence of "mites", small orange ectoparasites we now believe to be larval ticks, were slightly more widespread. One-hundred and five chicks (16%) had "mites" present on the tibia. Though not experienced in recent years, plots with high levels of tick infestation have had low levels of fledging success (Hite et al. 2004).

Post-banding Mortality Rate

During our mortality count in early September, 118 dead, banded chicks were recovered from the islets on which they were banded. This post-banding, pre-fledging mortality rate represents 18% of the total number banded, which is well above the long term (1984 – 2012) average of .10 ± .01. Heat stress, particularly consecutive days of above average high temperatures, appear to cause increased mortality of gull chicks and juveniles at Mono Lake (Shuford et al. 1985, Chappel et al. 1984, Winkler 1983, Jehl and Jehl 1982), and the summer of 2013 was unusually warm. The number of days in June and July with temperatures over 90 degrees F. was far above average (G. Reis, http://www.monolake.org/today/2013/08/08/another-record-breaking-summer-for-hot-weather/).

Coyote Predation in 2013

Two nesting islets were raided by Coyotes in 2013, a result of relatively low lake levels reducing the protective water channel width of nearshore islets. Piglet Islet, which also suffered predation in 2012, was raided by a Coyote in spring 2013. Prints were observed and photographed on 24 May 2013. On that date, 148 active nests were still present on Piglet Islet, but by our next visit in early July the islet was abandoned – no nests or adults were present. No chick carcasses were observed, suggesting predation of remaining nests happened before any young hatched.

In 2012, an unknown predator also caused complete failure of the nesting population of Piglet Islet. At the time, the predator responsible for Piglet Islet predation event in 2012 was assumed to be a Great-horned Owl (*Bubo virginianus*), as Great-horned Owls had

previously been documented locally whipping out populations on Paoha islets (Jehl 1983, Jehl and Chase 1987) and we did not observe any sign (scat or prints) of Coyote. However, the many predated chick carcasses examined and collected in 2012 were not consistent with typical owl kills -- all had heads attached, and the authors considered Coyotes, but had no direct evidence to identify the predator, yet it is possible a/the coyote also accessed Piglet Islet in 2012. Individual Coyotes that learn to cross water channels to Mono Lake nesting islets can pose a considerable long-term threat if water channels remain crossable. Coyote(s) continually raided gulls nests on certain Mono Lake islets from 1989 – 1996, crossing up to 200 m of Mono Lake water channel (Dierks 1990).

Old Marina Islet was also raided by a Coyote and responsible for the demise of many chicks, and apparently, adults as well. On the evening of July 31, 2013 Mono Lake volunteer Susan Weddel observed a Coyote cross a small water channel separating Old Marina Islet (Fig. 1) from the mainland. It was observed making two trips onto the islet creating a huge chaos, and observed killing many chicks. Many additional chicks were "force fledged" as they dispersed into the water to escape from the Coyote. On Aug. 2, KNN observed several unflighted live chicks or juveniles plus a dead chick along the mainland shoreline adjacent to Old Marina; of these 3 were obviously injured. Only about 5 chicks or flighted juveniles remained on the islet (one of which was obviously injured), and all adults had abandoned. Four dead adults were visible with binoculars, though much of the islet surface was obstructed from view. Although this event occurred toward the end of the breeding season, it was apparent many nests and chicks were affected.

Fig. 5. Twain West Plot on 20 Sept. 2013 showing *Bassia* growth to its north (*Chyrsothamnus* in foreground)

Bassia Encroachment on the Negit Islets

Bassia hyssopifolia, native to the Old World, has likely been present on Mono Lake's islands and islets for many years. Until last year when large areas of the Cornell Plot became newly covered, we took little notice of it. It is a bushy annual that can grow a meter or more tall, and live vegetation as well as woody stems from previous year(s) seem to be increasingly abundant in some areas of the Negit Islets and plots to a degree that could be displacing nesting gulls. We are increasingly concerned about the negative impact that encroachment of this non-native could have on nesting gulls, as appears to favor the relatively flat, open terrain where gulls nest in the greatest densities, and appears to be increasing (Nelson and Greiner 2012).

Other Species Nesting on Mono Lake Islets

In addition to the California Gull, other species found nesting on the Mono Lake islets in 2013 were the Black-crowned Night-Heron (*Nycticorax nycticorax*), Osprey *(Pandion haliaetus*), and Violet-green Swallow (*Tachycineta thalassina*). Black-crowned Night-heron nests were not thoroughly counted on the Mono Lake islets this year but were present on Twain and Little Tahiti Islets only. Three Caspian Terns (*Sterna caspia*) were observed on Coyote Islet (where they have nested in recent years) on May 24 although nesting was not evident, and the absence of any terns in July suggested failed or lack of breeding. Violet-green swallows are abundant breeders in rock crevices on Negit Island and some of the Negit Islets.

Detections and Recoveries of Banded Mono Lake California Gulls in 2012 & 2013

There were 27 detections or recoveries of banded Mono Lake gulls reported in late 2012 and 2013 (Table 2); all but one from California. Seven USFWS band numbers of breeding adults were read by field workers with binoculars during Mono Lake chick banding within the plots; all had been banded as chicks at Mono Lake. Four of these 7 were nesting in the plot they had been banded in, suggesting strong natal philopatry.

Fig. 6. Color-banded Mono Lake gulls detected away from breeding grounds in 2013. Left: a juvenile at Southeast Farallon Island, San Francisco County 04 Sept. with Western Gull (*L. occidentalis*) behind (ph. J. Tietz). Right: a second-year bird at the Yolo Bypass Wildlife Area Yolo County 19 Aug. (ph. S. Hampton)

Field observations of color-banded Mono Lake gulls generated 15 reports ranging from Lincoln County, Oregon in the north to San Luis Obispo County, California, in the south. The later was a red banded juvenile observed August 7; the earliest coastal record of a color-banded Mono Lake juvenile thus far. Of the color-band observations, over 25% (7) were from Southeast Farallon Island, located 48 km (30 mi.) off San Francisco during fall migration. In 2009, up to 16 color-banded juveniles from Mono Lake (about 3% of the successfully fledged, banded chicks that year) were observed on SE Farallon during a 2 week period (Nelson and Greiner 2009), suggesting this may be an important region utilized by migrant Mono Lake gulls some years. Two 3-year olds identified by their red coded color bands were observed within the Mono Lake colony and may have been nesting or prospecting. Most California Gulls do not breed until their 4th year, but some (typically males) will breed in their third year (Winkler 1996).

Table 2. Band recoveries and sightings of Mono Lake California Gulls since the 2012 annual report. BBL represents reports sent to the National Bird Banding Lab in Laurel, MD.

No.	Date Detected	Location	Year banded	Reporter	Condition	Remarks
1	03 Dec. 2012	near Vernalis, San Joaquin Co.	2012	L. Hazelett	Injured	BBL
2	13 Feb. 2013	near Tracy, San Joaquin Co.	2012	G. Maraoka	Dead	BBL
3	26 May 2013	Mono Lake, Tahiti Islet	2010	K. Nelson	Live	Red band within colony; possibly breeding. Apparent female by bill size
4	08 July 2013	Twain West Plot	2005	Z. Michelson	Live	Nesting in plot; band # read w/binoculars. Banded as chick in Twain West plot
5	08 July 2013	Twain West Plot	2007	N. Livingston	Live	Same as above.
6	08 July 2013	Twain West Plot	2004	N. Livingston	Live	Same as above
7	08 July 2013	Twain West Plot	2007	N. Livingston	Live	Same as above except banded as chick in Twain New plot.
8	08 July 2013	Twain West Plot	2007	N. Livingston	Live	Same as above except banded as chick in Twain South plot.
9	08 July 2013	Twain West Plot	2007 or 2008	N. Livingston	Live	last band # digit not read; banded at Mono Lake
10	08 July 2013	Twain North Plot	2004	Z. Michelson	Live	Nesting in plot; band # read w/binoculars. Banded as chick in Twain North plot
11	09 July 2013	Cornell Plot	2010	R. Price	Live	Red Band 104. Possibly breeding within colony
12	05 Aug. 2013	South Beach, Lincoln Co. Oregon	2011	J. Garrett	Live	Red band observed with spotting scope
13	07 Aug. 2013	near Pismo Beach, SLO CO.	2013	J. Iwanicha	Live	Red band 744
14	12 Aug. 2013	San Jose, Santa Clara Co.	2012	A. Kinney	Injured	BBL
15	14 Aug. 2013	Crowley Lake, Mono Co.	2013	S. Brad	Live	Blue color band
16	19 Aug. 2013	Yolo Bypass Wildlife Area	2012	S. Hampton	Live	Red band 267
17	20 Aug. 2013	SE Farallon Island, SF Co.	2013	J. Tietz	Live	Red Band 712
18	20 Aug. 2013	near Topaz Lake, Mono Co.	2013	P. Fenwick	Dead	BBL
19	24 Aug. 2013	near Vernalis, San Juaquin Co.	2013	unk	Dead	Killed by falcon for dump abatement program
20	26 Aug. 2013	Navy Beach, Mono Lake	2013	K. Nelson	Live	Blue color band
21	03 Sept. 2013	SE Farallon Island, SF Co.	2013	J. Tietz	Live	Blue color band

22	04 Sept. 2013	SE Farallon Island, SF Co.	2013	J. Tietz	Live	Red band 780
23	08 Sept. 2013	SE Farallon Island, SF Co.	2013	D. Maxwell	Live	Blue color band
24	21 Sep. 2013	SE Farallon Island, SF Co.	2013	K. Nelson	Live	Red band 823
25	22 Sep. 2013	SE Farallon Island, SF Co.	2013	D. Maxwell	Live	Red band 692
26	30 Sep 2013	SE Farallon Island, SF Co.	2013	K. Nelson	Live	Red band number not read
27	01 Oct. 2013	Stinson Beach, Marin Co.	2012	N. Livingston	Live	Red band 291

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Appendix 1. Nest number by islet, 2004 - 2013

Negit Islets	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Twain	11480	9582	9900	10138	8891	11449	8219	8704	9396	9567
L. Tahiti	3303	2511	2700	3102	2477	2770	2429	2049	3366	3995
L. Norway	213	126	165	172	137	119	114	171	390	493
Steamboat	635	621	583	631	590	580	509	579	871	1175
Java	915	779	710	648	482	433	367	432	325	234
Spot	98	127	75	9	49	87	122	151	39	95
Tie	49	50	33	0	9	37	55	58	30	56
Krakatoa	181	184	131	119	24	5	2	0	12	9
Hat	9	3	5	10	3	3	0	7	24	30
La Paz	1	2	0	0	0	0	0	0	0	0
Saddle	0	0	1	1	0	1	0	0	0	0
Midget	1	1	0	0	0	0	0	0	0	0
Little Tahiti Minor	[a]	[a]	[a]	[a]	[a]	152	151	162	253	282
Pancake	2837	2530	2059	1602	1623	2293	1894	1741	1972	2450
Negit Islets Total	**19722**	**16516**	**16362**	**16432**	**14285**	**17929**	**13862**	**14054**	**16678**	**18386**
Paoha Islets										
Coyote A	3244	3174	3181	3094	1989	2591	1711	929	1393	2093
Coyote B	55	63	40	0	0	0	0	0	0	0
Browne	283	253	225	118	99	135	116	50	60	75
Piglet	1552	1649	1218	1269	1001	1314	997	599	344	148
Paoha Islets Total:	**5134**	**5139**	**4664**	**4481**	**3089**	**4040**	**2824**	**1578**	**1797**	**2316**
Negit Island:	587	285	120	63	0	0	0	0	7	8
Old Marina	511	1	94	723	1089	1775	1496	1133	1541	1665
Old Marina So.	0	0	0	0	9	22	4	9	36	380
Lakewide Total	**25954**	**21941**	**21240**	**21699**	**18472**	**23766**	**18186**	**16774**	**20059**	**22755**
Nesting Adults	**51908**	**43882**	**42480**	**43398**	**36944**	**47532**	**36372**	**33548**	**40118**	**45510**

a. Nest numbers for Little Tahiti Minor were previously included within the Little Tahiti Total