Point Blue Report

Population size and reproductive success of California Gulls at Mono Lake, California

Annual Report

December 2016

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Conservation science for a healthy planet

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Acknowledgements

We are grateful to the **Mono Lake Committee** for providing financial and logistical support for this project in 2016. We are extremely thankful to **Lighthawk**, and pilot Geoff Pope, for donating flight time to conduct aerial photography as an alternative method for counting gull nests on Mono Lake. We also wish to thank the Mono Market, and Tamara Sasaki and Dan Shaw of the Mono Lake Tufa State Natural Reserve.

We greatly appreciated the help of volunteers and others who assisted with field work – without dedicated people like you, the long-term effort would not have been possible. Volunteers & participants for the 2016 season were: Charlotte Cumberworth, Nancy Devon, Nathan Ernster, Sara Matthews, Connor Mullinix, Matt Rice, and Tina Weedman. Many thanks also to Jora Fogg and Phil Capitolo for their assistance.

Suggested Citation

Nelson, K.N.; 2016. Population Size and Reproductive success of California Gulls at Mono Lake, California. Point Blue Conservation Science, Petaluma, CA.

This is Point Blue Contribution No. 2108.

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Cover photo: California Gull and its chick in Little Tahiti West Plot. This gull with coded red band 070 was banded as a chick in the Little Tahiti West plot in 2010, and returned to this plot to breed in 2015 & 2016. Photo by Kristie Nelson

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EXECUTIVE SUMMARY

We conducted our 34th year of monitoring the California Gull (*Larus californicus*) breeding population on Mono Lake in 2016. The surface elevation of Mono Lake continued to drop in 2016 as a result of California's 5th consecutive year of severe drought. For the first time since 1996 coyotes (*Canis latrans*) were detected on Negit Island and at least one of the gull nesting islets, and areas of the Negit islet colony that contained nests in May were devoid of chicks by July.

Relatively few gulls successfully nested at Mono Lake in 2016. Our estimate of 32,564 breeding California Gulls (based on 16,282 nests counted in May) was the lowest ever recorded in the history of this project, and well below the long-term average of 46,395 ± 1324 for the period 1983–2015 (n =33 years). Ninety percent of Mono Lake's gulls nested on the Negit Islets and 10% nested on the Paoha Islets. Negit Island contained no nests this year, likely due to presence of coyotes.

Average reproductive success in the sample plots was 0.57 ± 0.08 chicks fledged per nest, which is significantly below the 1983-2015 average of 0.91 ± 0.06. Based on plot data, we estimated 9,345 ± 773 chicks fledged from Mono Lake in 2016. However, in July we noted significant nesting failure had occurred in areas outside the sample plots, thus colony-wide productivity was likely considerably lower.

One-hundred and ninety-seven chicks were banded in July. Of these, 159 received an orange cohort color band on the left leg opposite the federal band on the right leg, 19 received a coded, auxiliary marked red color band, and 19 chicks received no color band. Weight at banding was significantly greater for those that survived to fledging than for those that did not. Post-banding mortality for banded chicks was 11%, which is below the 2005-2015 average of 15%.

INTRODUCTION

Mono Lake in eastern California is a large hypersaline lake of great ecological importance. Its large seasonal populations of endemic brine shrimp (*Artemia monica*) and alkali flies (*Ephydra hians)* provide important food resources for a large numbers of birds. Mono Lake supports one of the largest breeding colonies of California Gulls in the world (Winkler 1996).

In 1983, Point Blue Conservation Science (founded as Point Reyes Bird Observatory) began standardized monitoring of the population size and reproductive success of California Gulls at Mono Lake. The goal of the project is to use gulls as an indicator to help guide long-term management of the lake ecosystem. Specifically we aim to track the long-term reproductive success and population size of the gulls through changing lake conditions and identify the ecological factors influencing fluctuations in these metrics. This study represents one of the longest term ongoing studies of birds in North America. It is a powerful tool for assessing the conditions at Mono Lake and can be an invaluable tool in understanding how wildlife populations respond to ecological change that manifests over longer periods (e.g. climate change).

In 2016, we conducted the 34th consecutive year monitoring the population size and reproductive success of California Gulls (*Larus californicus*) at Mono Lake. We continued to collect information on nest numbers, banded young gulls, and surveyed for mortality. In recent years we have also added additional objectives to better understand gull movements, including fall and winter distribution and breeding colony fidelity through a color banding program. In this report we provide a detailed summary of the 2016 results with reference to historical conditions. We also discuss the impacts of the historic drought, low lake levels, and coyote (*Canis latrans*) activity on the gull colony.

Study Area

Mono Lake, California, USA, is located at 38.0° N 119.0° W in the Great Basin of eastern California at an altitude of 1945 m. The lake has a surface area of approximately 160 km2, a mean depth of about 20 m, and a maximum depth of about 46 m. As a terminal lake with no outlet, it is high in dissolved chlorides, carbonates, and sulfates, and has a pH of approximately 10.

Gulls nest on a series of islands located within an approximately 14-km² area in the north-central portion of the lake. At various times the gulls have nested on Negit (103 ha) and Paoha (810 ha) islands, and on two groups of smaller islets referred to as the Negit and Paoha islets, which range in size from 0.3–5.3 ha (Wrege et al. 2006).

Fig. 1. Locations of islands and islets within Mono Lake. Note when this photograph was taken the surface elevation of Mono Lake was >1 m above that measured during the 2016 gull breeding season.

Fig. 2. View of the nesting islets within the Negit Islet complex. Note when this photograph was taken the surface elevation of Mono Lake was > 1 m above that measured during the 2016 gull breeding season.

METHODS

Nest Counts

In 2016, we continued using our standardized methods for counting gull nests for most islets. From May 26 - 29 2016, we walked through the nesting islets in sweep-lines to count nests. Each sweep line consisted of 3 to 5 personnel depending on islet size and nest density. Every nest (defined by containing at least 1 egg) was counted with a tally meter and marked with a small dab of water-soluble paint to avoid duplicate counts. For some small islets with low densities, incubating adults were counted from a small motor boat.

Aerial Surveys

Aerial surveys of the gull colony were conducted in 2015 and 2016. This year, two nesting islets (Browne and Little Norway) were counted solely using aerial photography. On 21 May, 2016, the entire nesting colony was photographed from the open window of a Cessna 180 flying at an altitude of approximately 2165 m (7100') using a fixed 200mm and/or an 18 – 200mm zoom lens. Incubating gulls were counted from photographs using the image tagging software program ITAG version 0.7.0.1. Because the aerial photographs did not typically capture every nest due to topography, vegetation cover, bird posture, etc., a correction factor was applied based on islet-by-islet comparisons of aerial vs. ground count results using 2015 data.

Fig. 3. The Paoha Islet complex. Note when this photograph was taken the surface elevation of Mono Lake was > 1 m above that measured during the 2016 gull breeding season.

Clutch Size, Banding, and Reproductive Success

We sampled 9 fenced plots on 3 islets to estimate clutch size and reproductive success in 2016. 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 two smaller rounded fenced plots approximately 100 -120 m^2 are located on Coyote Islet of the Paoha Islet complex. 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.

From 6 - 8 July 2016, we banded all chicks within plots located on Twain and Coyote Islets. Due to a medical situation, banding on the Tahiti Islet plots was canceled. Chicks received a U.S. Fish and Wildlife Service band as well a color band – either a single orange cohort-style color band (applied to the left leg) or a red coded band engraved with a field-readable alpha-numeric code unique to each banded individual.

Additionally, a new chick counting technique was tested. With a hand-held tally meter, field workers stood on the plot edge and counted the number of chicks observed within that plot 2 or 3 consecutive times. Totals were averaged, and compared with the actual chick count obtained from banding. During banding, chicks were weighed using hand-held Pesola scales.

To estimate the number of chicks in the Tahiti plots, two observers counted the number of chicks observed in each plot using the tally meter method described above on July 11. Because tally meter counts tended to under-estimate the number of chicks, particularly in plots with high visual obstructions and a large proportion of small, downy chicks, a "correction factor" was added to Tahiti plot chick counts using the average difference between tally meter and banding results from Twain plots with similar conditions.

From 7 - 9 September 2016, we searched the islets in which chicks were banded (Twain and Coyote) to determine the number of banded chicks that died before fledging. The post-banding mortality rate for Twain Islet was applied to Tahiti Islet plots.

We estimated the fledging rate for each plot, and, applied this average fledging rate to the entire population to estimate the total number of gulls successfully fledged from Mono Lake in 2016. We calculated the fledging rate for each plot **(fplot)** as:

$$fplot = (Cb - Cd) / Np$$

where **Cb** is the number of chicks banded (or counted) in that plot in July, **Cd** is the number of chicks from that plot found dead in September, and **Np** 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. Overall chick production is estimated by multiplying the average reproductive success by the total number of nests. On islets which were abandoned or where large proportions of chicks were missing in July, we estimated chick production by multiplying the estimated surviving number of chicks observed in July by the post-banding survival rate, which was 0.89 in 2016. Variables associated with chick mortality were analyzed 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. 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. For more information on the life cycle of this endemic tick, see Schwan et al. (1992).

Diet Samples

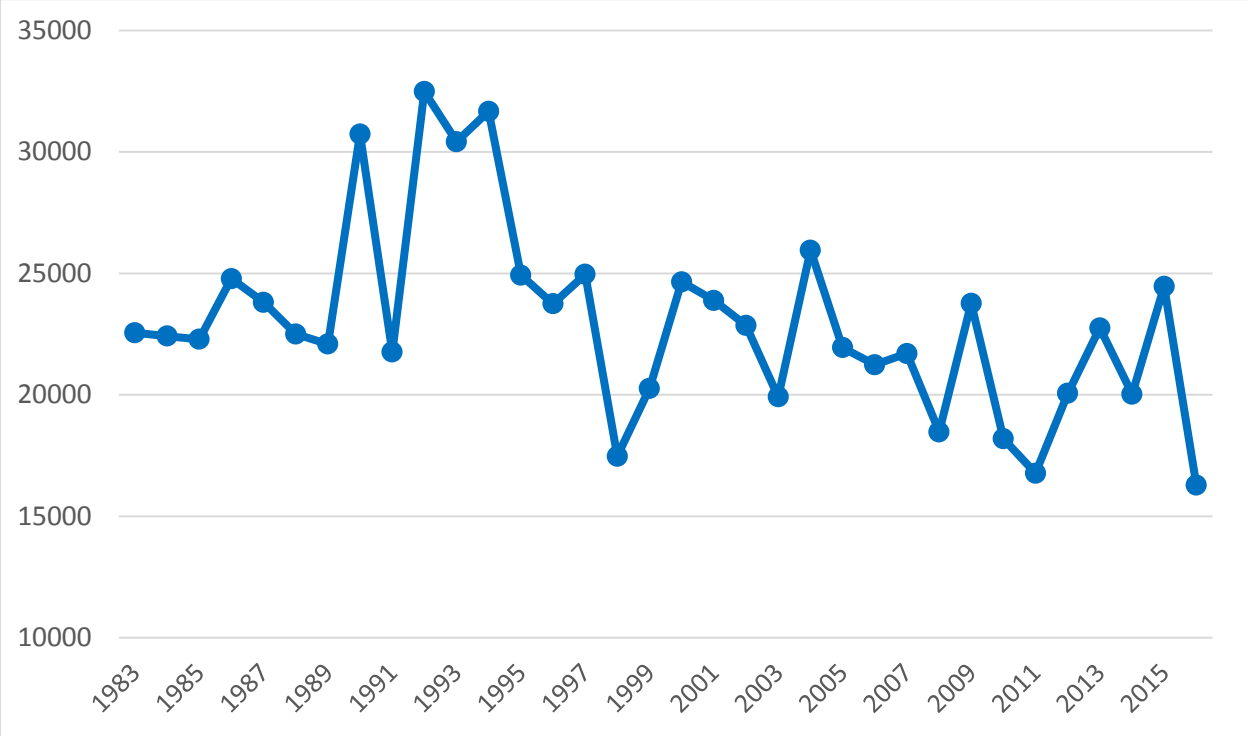
Diet samples were taken from chicks that spontaneously regurgitated during banding. For each bolus of regurgitation, the percent volume of each prey item was estimated.

RESULTS

Number of Nests and Breeding Adults

In 2016, we counted a lake-wide total of 16,282 California Gull nests, yielding a population of 32,564 nesting adults, which is the lowest ever recorded over the course of this study (Fig. 4, Appendix 1). This total is significantly below the long-term mean population size of 46,395 ± 1324 for the period 1983-2015 (n = 33 years), and well below the mean population over the past 10 years, which is 41,487 ± 793. The average decline in the number of nests in 2016 relative to 2015 numbers was 19% for all islets combined. For the 4 major nesting islets which account for 89% of the total population, the average relative decline in 2016 compared to 2015 was 33%. On Java islet, this relative decline was most pronounced at 86%.

Figure 4. Number of California Gull nests at Mono Lake, 1983 - 2016



Ninety percent of the gulls nested on the Negit Islets, and 10% nested on the Paoha Islets (Figures 1, 2 and 3, Appendix 1). No nests were found on Negit Island, and coyote scat and tracks were widespread there. Of the individual islets, Twain was the most populous, holding 7,760, or 48%, of the lake-wide total number of nests. Little Tahiti and Pancake islets were the next most populous islets, containing 3,039 and 2,497 nests; representing 19% and 15% of the nesting population respectively.

Clutch Size

In 2016, the lake-wide average clutch size was below average at 1.78 ± 0.04 eggs/nest (range = 1-3 eggs, n = 537 nests). Overall, 38% of the nests contained one egg, 56% had two, and 6% had three. The average clutch size for Mono Lake since 2002 (n = 14 years) is 1.9 ± 0.04 eggs/nest.

Table 1. Summary of Nest Counts and Chick Banding results from all plots in 2016. Values marked with asterisks represent estimated metrics.

Plot	# nests in May	Avg. chicks/nest in July	# chicks in July (# found dead)	Average chick mass (grams)	Total chicks successfully fledged/nest
Cornell	114	0.48*	55 (6)*	n/a	0.43*
L. Tahiti East	45	0.62*	28 (3)*	n/a	0.56*
L. Tahiti West	79	0.90*	71 (8)*	n/a	0.80*
Twain North	55	0.49	17 (4)	432 g	0.37
Twain South	82	0.48	31 (0)	530 g	0.48
Twain West	89	1.07	65 (7)	517 g	0.95
Twain New	71	0.94	48 (4)	523 g	0.86
Negit Islet totals/averages:	**450**	**0.71 ± .09**	**315 (32)**	**512 ± 11 g**	**0.63 ± .09**
Coyote Cove	37	0.62	23 (4)	385 g	0.51
Coyote Hilltop	50	0.26	13 (3)	575 g	0.20
Paoha Islet Totals:	**87**	**0.44 ± 0.5**	**36 (7)**	**452 ± 27 g**	**0.36 ± .16**
Lakewide totals/averages	**537**	**0.65 ± .09**	**351 (39)**	**501 ± 10 g**	**0.57 ± .08**

***** = estimated values

Reproductive Success

The Negit Islet plots averaged 64.3 ± 10 nests per plot, with an average nesting density of 0.28 ± 0.03 nests/m² and fledged an average of 0.64 ± 0.09 chicks per nest. The Paoha Islet plots averaged 43.5 ± 6.5 nests per plot and averaged 0.36 ± 0.16 chicks fledged per nest. Combined, the 9 plots averaged 0.57 ± .08 fledged chicks per nest (Table 1), which is below the long-term average of 0.91 ± 0.06 chicks fledged per nest.

Based on the total of 16,282 California Gull nests counted in late May, and an average of 0.57 ± 0.08 chicks fledged per nest in the sample plots, an estimated 9,345 ± 773 chicks

fledged at Mono Lake in 2016. This is significantly lower than the 1983-2015 average of 21,803 ± 1885 (n = 33 years) chicks produced annually. This long term average is calculated for the Negit Islets only from 1983-2002, and Negit and Paoha Islets combined since 2002.

During field work in July we noted large areas of the Negit Islet colony, including entire islets, were devoid (or nearly so) of chicks. Because this mortality did not appear to affect the plots, our estimated chick production obtained from plot data is probably too high. Based on our observations, actual colony-wide chick production was likely lower than the above estimate by about 2,670 or more chicks (Table 2). The re-evaluated colony-wide estimated chick production is approximately 6,673 (9,345 minus 2,672).

Table 2. Summary of observed chick numbers and estimated numbers of successfully fledged chicks on Negit Islets in July.

ISLET	# Nests in May	estimated # chicks fledged/islet based on plot data (# nests X 0.57)	# Chicks counted in July, or estimated percent chick loss	Re-evaluated chick production (# surviving chicks X 0.89)	Estimated chick loss
Pancake	2352	1341	chick numbers appeared normal	1341 (no added mortality)	0
Java	60	34	2 chicks (no adults)	0	- 34
Twain	7,760	4423	estimated 35% chick loss	2559	- 1864
Tie	170	97	27 chicks	24	- 73
Little Tahiti	2923	1666	estimated 10% chick loss	1335	- 331
Spot	144	82	1 chick (no adults)	0	- 82
Steamboat	675	385	122 chicks	109	- 276
Hat	21	12	0 chicks	0	- 12
Estimated chick production of islets surveyed in July		**8040**	**Re-evaluated chick production of islets surveyed in July**	**5368**	**- 2672**

Mass at Banding

The average mass of the 195 chicks banded and weighed in July was 501 ± 10g, which is similar to the long-term average (calculated since 2002) of 504 ± 7g. Mass of chicks that survived to fledging (514 ± 10g; $n = 174$) was significantly greater than the average mass for chicks that did not survive to fledging (395 ± 30g; $n = 21$) ($X^2 = 14.31$, $df = 1$, $p = 0.0002$). This pattern has been consistent all years in which chicks were weighed.

Notable this year was not only the relatively high number of young chicks categorized during banding as "downy" (meaning still completely covered in natal down), but that they seemed remarkably heavy for their small size. Thirty-three "downy" chicks were banded in 2016 (17% of the total), and their average weight was 261 ± 16g, and ranged from 65g to a remarkable 440g downy chick. Although downy chick weights have not previously been calculated separately, they are typically around 100 – 200g. This year, 12 "downy"- aged individuals weighed over 300g, which is unusual.

Diet

Twenty-four diet samples were examined from chicks that spontaneously regurgitated during banding. Brine shrimp accounted for 84% of the observed diet, alkali fly larvae accounted for 8%, and 5% was garbage. The remaining 3% consisted of an unidentified red goo observed in 4 samples. During nest count, multiple adults spontaneously regurgitated boluses of brine shrimp when they flushed off their nests; something we associate with well-fed individuals.

Tick Infestation

Tick infestation of gull chicks continued to be low and localized in 2016. Only 8 chicks of the 197 chicks examined had ticks, representing 3%. All of the 8 chicks with ticks had very few.

Post-banding Mortality Rate

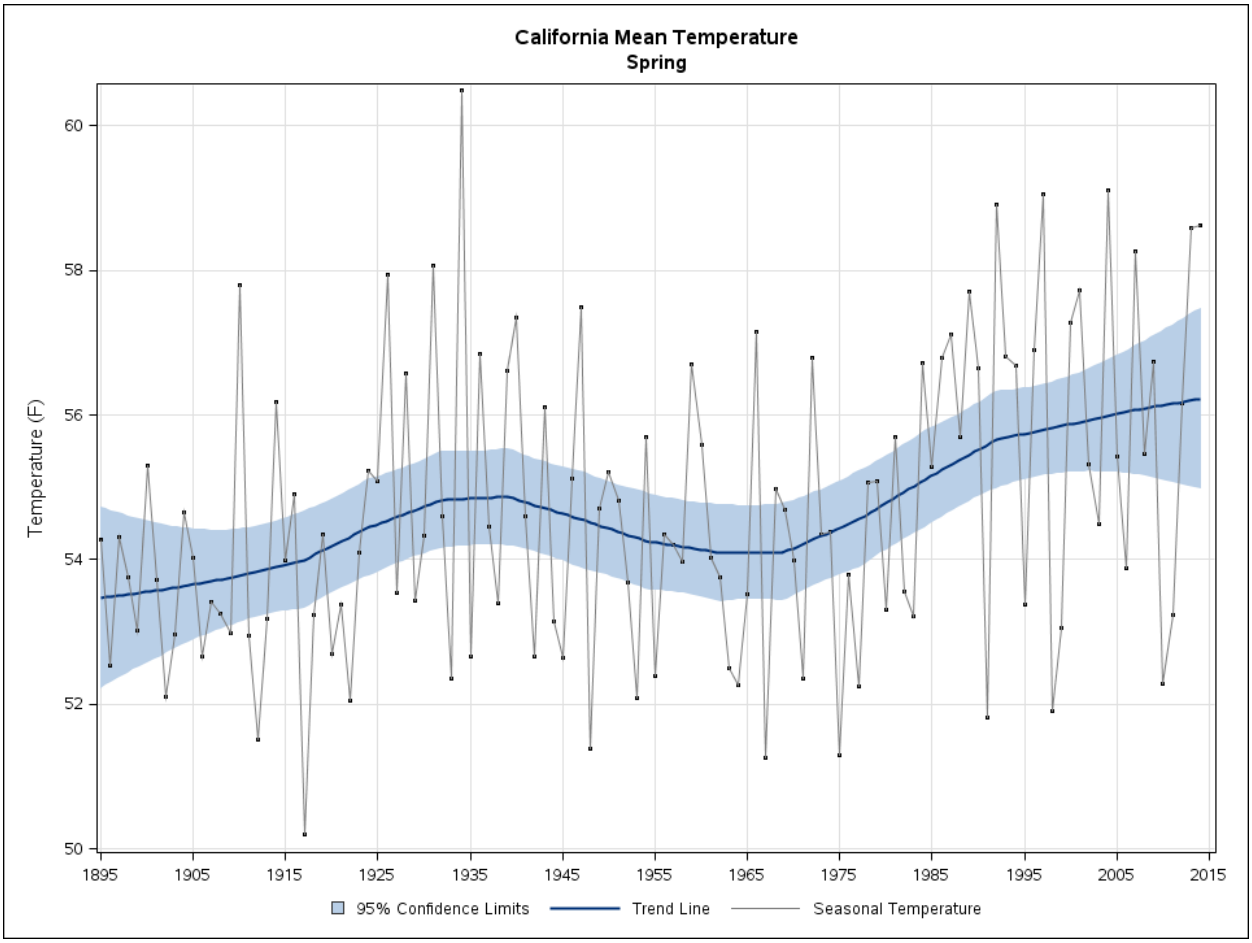
During the mortality count in early September, 22 dead, banded chicks were recovered from the islets on which they were banded, representing an average of 11%. This is somewhat lower than the average recorded over the past 10 years, which is 15% ± 2%.

DISCUSSION

Population Size

For reasons unknown, the population size of California Gulls at Mono Lake has been in decline ($R^2 = 0.234$; Point Blue, unpubl. data; Fig. 4), and this year continued that trend. Using data from 1987 – 2003, Wrege et al. (2006) found 4 variables that explained over 80% of the variability in the Mono Lake gull population, particularly brine shrimp densities around the time of egg-laying, springtime temperatures, and recruitment. However, the relationship between the population size and these variables appears to be changing. Brine shrimp have been trending significantly towards an earlier peak in abundance - closer to the gull egg-laying period - since approximately 2004 (Jellison and Rose 2012, LADWP 2015), yet the gull population has been in decline relative to the long-term mean since that time. Springtime temperatures in California and the Mono Lake region have been trending warmer (e.g., Fig. 5), and recruitment (measured by average reproductive success at Mono Lake 4 years previously) which was significantly and positively correlated with population size from 1987 – 2003, has since correlated slightly *negatively* with population size.

Fig. 5. Mean springtime temperatures for California. Chart & data courtesy of NOAA, https://www.ncdc.noaa.gov/temp-and-precip/state-temps/



Predator activity may have contributed to the reduced population size in 2016. During nest count in May, we noted large numbers of empty nests, particularly on southern and western sections of Twain Islet. Our field crew collectively estimated between 10% - 25% of the nests in parts of Twain were empty. We noted this to a lesser extent on Little Tahiti, estimating ~5% of nests were empty. Empty nests indicate eggs were consumed by a predator, or by neighboring gulls, and/or that the eggs had not yet been laid. The 13 newly hatched chicks and pipping eggs observed in May suggests nesting was not protracted this year. In May 2014 an adult Bald Eagle (*Haliaeetus leucocephalus*) was

observed walking through Twain Islet consuming eggs (Nelson and Greiner 2014). However, that had not observed before or since. Neighboring gulls can be highly cannibalistic on eggs, particularly during disturbances when gulls are flushed off their nests. Coyote depredation may also explain the empty nests, particularly on Twain. However the pattern observed on Little Tahiti appears inconsistent with coyote predation (relatively few, somewhat spread-out affected nests).

Coyote presence on Negit Island and islet(s) likely affected the number of nesting gulls as well as the number of chicks they produced. The lack of nests on Negit Island, a first since 2012, was likely due to coyotes residing there. Coyote scat was also found on Java Islet in July, confirming coyote(s) had swum there, probably from Negit Island. The isolated and extreme nature of the relative population decline on Java from 2015 (when 439 nests were counted) to 2016 (only 60 nests), suggests coyotes may have raided Java during the 2015 nesting season, resulting in partial abandonment by gulls in 2016.

Emigration or reduced recruitment (young birds not returning to breed at Mono Lake when sexually mature) could contribute to a population decline at Mono Lake. Yet evidence in support of this hypothesis is limited. The San Francisco Bay colony, which grew rapidly in the 2000's to surpass Mono Lake's gull population, experienced an 11% population decline this year relative to 2015 numbers (M. Tarjan, San Francisco Bay Bird Obs. pers. comm.). That decline would not be expected if it received an uptick of emigrants or recruits from Mono Lake this year. Also, we observed 10 adult gulls color-banded as chicks at Mono Lake during field surveys, the highest number yet seen in a season. This suggests a decent rate of natal philopatry. However, two color banded sub-adult gulls from Mono Lake observed in and near the San Francisco Bay colony during the breeding season in 2014 (Nelson and Greiner 2014) suggests some California gulls hatched at Mono Lake could begin nesting in other colonies.

Reproductive Success

The average of 0.57 chicks fledged per nest in 2016 was the 7th lowest recorded since 1983, and below the 1983-2015 average of 0.91 ± 0.06 chicks fledged per nest. Conditions this year, particularly that spring-time temperatures were warm, and the lake was not highly meromictic or stratified, have typically been correlated with higher chick productivity (Nelson et al. 2014).

Breeding conditions may have been poor early in the season (locally and/or on wintering areas), but later improved. The low population size, below average clutch size, and large proportion of young, downy chicks in July suggest early season conditions were less than ideal. Higher proportions of young, downy chicks are associated with late nest initiation (usually following cold springs and poor breeding conditions), and/or re-nesting attempts after a failed clutch. The above-average numbers of newly hatched chicks in May suggests overall nest initiation was not delayed, so perhaps many pairs re-nested after losing their first clutch. However, that the young downy chicks banded in July were unusually heavy for their size and that post-banding mortality rate was below average suggest conditions later in the season improved.

A poorly understood condition referred to as "wing-droop" may have contributed to chick mortality in 2016. "Wing-droop" may be associated with a tick-borne virus, and was described by Shuford et al. (1984) as chicks holding their wings down at their sides and jerking them sporadically. It was considered epidemic in 1981, and observed in 15 out of 1,051 chicks in 1987 (Strauss 1987). In 2016, at least 9 such chicks were noted, including 4 or 5 on Steamboat Islet and 4 in the Cornell Plot. In the past 10 or more years this condition has not been observed, although small numbers of chicks with a slight droop in one wing are seen regularly (K. Nelson, pers. obs.).

Coyotes on Negit Island and Negit Islets

For the first time since 1996, we found evidence of coyotes on Negit Island, where scats and tracks were widespread. The extent of damage coyote(s) caused the nesting gulls is uncertain. In July, several smaller nesting islets were completely abandoned, with few or no chicks, which is highly unusual. This abandonment included Java Islet, which contained 60 nests in May but only two chicks (with no attending adults) in July. A search of Java in July revealed coyote scat, confirming their presence there and the likely cause for the lack of chicks. Nearby Spot and Hat islets were also abandoned in July, and Twain and Steamboat had very few chicks. Large areas of Twain, particularly around the shoreline, appeared completely devoid of chicks, although territorial adults were present. Two probable coyote scats were found on Twain islet in September. Given the significance that finding would be, and the potential confusion with Great-horned Owl (*Bubo virginianus*) pellet material, these samples will be sent to a laboratory for genetic confirmation. Patches of Little Tahiti Islet were also lacking chicks, but to a lesser extent than Twain.

This represents the third time in which coyotes have accessed Negit Island and islets over the course of this study. The lake level was also higher this year than in any past known initial invasions. Coyotes first accessed Negit Island in 1979 via the landbridge that formed, and they apparently remained, or continued to access Negit, through 1984 as the lake rose to nearly 1945 m (6380.5'). In 1982 Twain and Java islets became connected to the mainland and were abandoned by gulls following coyote activity. By 1983 Twain and Java became water-bound islets again and hosted 13% of the breeding gull population, although nesting was initiated later and at lower densities than the other Negit islets (Shuford et al. 1984). In 1984, coyotes were still present on Negit Island, although they did not appear to affect nesting gulls (none nested on Negit), and coyotes were considered "stranded" on Negit (Shuford 1985). Then in 1989, the lake

declined to 1943.5 m (6376.5′) and coyotes were again detected on Negit Island, and on Pancake (Dierks 1990). Coyotes continued to be detected on Negit Island and some nesting islets annually through 1996. In August 1996 coyote scat was found on Twain, indicating a coyote had made a substantial swim there, although no known chick mortality occurred (Shuford et al. 1996).

Fig. 6. Possible coyote tracks on Coyote Islet of the Paoha Islet complex. No evidence of coyote predation was seen on this islet in 2016, although coyotes reside on Pahoa Island, and adjacent Piglet Islet was raided by coyotes in 2013.

Coyote(s) may currently be residing on Negit, as fresh canid tracks were present in early November 2016. Three baited trail cameras were placed on Negit Island in July and removed in early November. Although no coyotes were detected, cottontail rabbits (*Sylvilagus sp.*) and abundant mice (*Peromyscus sp.*) were detected on the cameras. Fresh water is absent on Negit, however research suggests coyotes can survive for significant periods of time without it. Golightly and Ohmart (1984) measured water economy in coyotes and kit foxes (*Vulpes macrotis*). Kit foxes can apparently survive indefinitely without access to drinking water by meeting their water needs through metabolic

processes. Coyotes probably cannot survive without water indefinitely, though access to cool temperatures in summer and ample prey supplies (from which water is metabolized) can allow them to subsist without water for substantial amounts of time.

Shivik and Crabtree (1992) studied coyotes near the Mono Lake gull colony, including Negit Island. They found 6 - 8 individual coyotes visited Negit Island during their 10 month field season when the lake was approximately 1943.0 m (6374.5') in surface elevation. During April to July, a territorial pair (or three) apparently "held" Negit Island, and visitation rates from non-resident coyotes declined or was absent. Shivik and Crabtree did not think the lack of water would greatly affect coyotes' ability to reside on Negit, at least during the majority of the year.

At Mono Lake, when coyotes have gained access to the Negit Island and islets, they have persisted for multiple years. Gulls respond by abandoning nesting islets impacted by coyotes. Thus it is crucial to eliminate coyote access to gull nesting areas to avoid future colony abandonment. An electric fence will be erected on the Negit landbridge in early spring 2017, and monitored throughout the gull breeding season.

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Appendix 1. Nest number by islet, 2007 - 2016

Negit Islets	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Twain	10138	8891	11449	8219	8704	9396	9567	9144	12263	7760
L. Tahiti	3102	2477	2770	2429	2049	3366	3995	3899	4258	2923
L Norway	172	137	119	114	171	390	493	384	505	284 [c]
Steamboat	631	590	580	509	579	871	1175	1076	1010	675
Java	648	482	433	367	432	325	234	216	439	60
Spot	9	49	87	122	151	39	95	162	184	144
Tie	0	9	37	55	58	30	56	65	181	170
Krakatoa	119	24	5	2	0	12	9	12	84	38
Hat	10	3	3	0	7	24	30	29	25	21
La Paz	0	0	0	0	0	0	0	4	7	16
Saddle	1	0	1	0	0	0	0	0	0	0
Midget	0	0	0	0	0	0	0	0	0	0
L.Tahiti Minor	[a]	[a]	152	151	162	253	282	255	202	116
Pancake	1602	1623	2293	1894	1741	1972	2450	1903	3159	2497
Negit Islets Total	**16432**	**14285**	**17929**	**13862**	**14054**	**16678**	**18386**	**17149**	**22317**	**14704**
Paoha Islets										
Coyote	3094	1989	2591	1711	929	1393	2093	2618	2042	1432
Browne	118	99	135	116	50	60	75	110	87	146 [c]
Piglet	1269	1001	1314	997	599	344	148	38 [b]	0	0
Paoha Islets Total:	**4481**	**3089**	**4040**	**2824**	**1578**	**1797**	**2316**	**2766**	**2129**	**1578**
Negit Island:	63	0	0	0	0	7	8	28	16	0
Old Marina	723	1089	1775	1496	1133	1541	1665	9 [b]	0	0
O.M. So.	0	9	22	4	9	36	380	70 [b]	0	0
Lakewide Total	**21699**	**18472**	**23766**	**18186**	**16774**	**20059**	**22755**	**20022**	**24462**	**16282**
Nesting Adults	**43398**	**36944**	**47532**	**36372**	**33548**	**40118**	**45510**	**40044**	**48924**	**32564**

a. Nest numbers for Little Tahiti Minor were previously included within the Little Tahiti Total
b. Number of nests known to be depredated or abandoned on Old Marina South; likely an underestimate.
c. Nest numbers obtained through aerial surveys and photographs