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Population Size and Reproductive Success of California Gulls at Mono Lake, California, in 2005

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Abstract

In 2005, nest counts estimated 43,882 adult California Gulls (*Larus californicus*) were nesting at Mono Lake in late May. This total was the fifth lowest in 23 years of monitoring, and was well below the 1983-2004 average of 48,740 ± 1650. Roughly 75% of the gulls nested on the Negit Islets, 23% on the Paoha Islets, and 1% on Negit Island. Twain Islet remained the most populous, holding 44% of the lakewide total, followed by Coyote A Islet with 14% and Pancake and Little Tahiti each with 11%. Following complete failure because of predation in 2004, Old Marina Islet had only a single nest in 2005. The number of nests on the Negit Island declined by 51% compared to 2004, reversing the trend of a steady increase in the island's nesting population since it was recolonized in 1999. The proportion of the lakewide total of nests on the Paoha Islets was the 6th highest and on Negit Islets was the 6th lowest recorded in the 23 years of this study. The number of nests continued to decline sharply on Little Norway Islet, most likely in response to extreme tick parasitism rates. Although the number of breeding gulls was below the long-term average in 2005, the lakewide reproductive success of 1.00 ± 0.03 chicks fledged per nest was slightly above the1983-2004 average of 0.97 ± 0.08. Still, reproductive success in 2005 was the lowest for Mono Lake since 1999. An estimated 21,941 ± 790 chicks fledged from the Mono Lake islands in 2005. For the 656 chicks banded in early July, weight at banding was significantly greater for those that survived to fledging than for those that did not. Also, overall mortality of banded chicks did not differ significantly between chicks with and without infestations of the endemic bird tick *Argas monolakensis*.

INTRODUCTION

The long-term monitoring of population size and reproductive success of California Gulls (*Larus californicus*) nesting at Mono Lake, California, by PRBO Conservation Science was continued between May and August, 2005. During this period, spanning most of egg laying through the fledging of young, we obtained three standardized measures of reproductive success of gulls nesting on the lake's islands. The objectives of this ongoing study are to measure the year-to-year variation in population size and reproductive success as they relate to changing lake levels and conditions.

The effects of recent changes in the Mono Lake ecosystem are of special interest to biologists (Patten et al. 1987, Botkin et al. 1988) and to public agencies charged with protecting the lake's valuable natural and scenic resources (Jones and Stokes 1993). Because court-mandated protection of the Mono Lake ecosystem will allow the lake's surface elevation to rise to 1948.3 m (6392.1 ft) (SCWRCB 1994), there is a continuing need to monitor the lake's resources, including nesting gulls, to document their responses to changing conditions.

STUDY AREA AND METHODS

The study area of Mono Lake has previously been described (Shuford et al. 1984, Shuford 1985), but because conditions that could potentially affect nesting gulls have changed considerably over time, some aspects of the study area are reviewed here. We focused on the three main areas at Mono Lake that support nesting gulls: Negit Island, the Negit Islets, and the Paoha Islets. We also surveyed Old Marina Island, near the west shore of the lake, which has been used by nesting gulls since 2002. Historically, Negit Island supported the majority of the lake's gulls until it was abandoned in 1979 following predation by coyotes which were able to gain access to Negit via a landbridge formed by the lowered water level. Negit was recolonized in 1985, and through 1993 it supported up to 13% of the lakewide total until it was abandoned again in 1994. In 1999 it was recolonized a second time, and between 1999 and 2004 its population grew steadily. The adjacent Negit Islets have supported the majority of the lake's nesting gulls since the first abandonment of Negit Island. Since 1985, the Negit Islets have supported 71% to 91% of the total, the Paoha Islets 9% to 29%.

Lake Level and Meromixis

Since 1941, the lake had dropped almost 45 vertical feet and nearly doubled in salinity because of diversions of its inflowing streams. Wet winters in the early and mid-1980s caused a temporary reversal of this downward trend. Then the winters of 1986-87 through 1993-94 averaged very dry, and the lake fell to a surface elevation of 1943.0 m (6374.5 ft) by May 1992. Very wet winters returned in 1994-95 through 1997-98, and, reinforced

by reduced diversions of water from the inflowing streams, the lake level rose to 1946.2 m (6385.1 ft) in July 1999. With another dry period from 1999 to 2004, the lake consistently dropped each year to a low of 1945.1 m (6381.7 ft) in May 2004. In 2005, the lake level was at 1945.1 m (6381.6 ft) in May, then, following the large spring runoff from the third wettest winter in the Mono Basin, rose to 1945.4 m (6382.6 ft) in August (data from Los Angeles Dept. Water and Power, available at www.monolake.org/live/lakelevel/monthly.htm).

From 1983-1988, Mono Lake experienced persistent salinity stratification (meromixis), which lowered the lake's primary productivity (Jellison and Melack 1993). In the first year of this meromictic episode, primary productivity (measured as grams of carbon per cubic meter) dropped by two thirds. It remained low until 1986, then began to rise, and reached its highest level in the winter of 1988-89 following the breakdown of meromictic conditions (Jellison et al. 1998). In 1996 the lake entered another period of meromixis, which initially was predicted to last for up to several decades (Jellison et al.1998). However, it almost completely broke down during the winter of 2002-03, after only seven years, virtually eliminating the chemocline – the depth defining the threshold between the monolimnion (deeper saltier waters) and mixolimnion (fresher surface waters) – at a depth of 31 m. Both episodes of meromixis ended in response to drought, though continuing high water diversions also helped quickly end the first episode. Following the near breakdown of meromixis in 2003, primary productivity rose to the highest recorded level at Mono Lake, which was almost twice that following the breakdown in 1989, and may even represent the highest level of primary productivity to be recorded in the limnological literature (R. Jellison pers. comm.).

Nest Counts

We counted nests on Negit Island, the Negit Islets, and the Paoha Islets from 21-25 May, and on Old Marina Islet on 27 May. Field workers walked through all the colonies tallying each nest 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. We kept separate subtotals for nests within seven 10 x 20 m fenced

plots on three of the Negit Islets (four plots on Twain, two on Little Tahiti, one on Little Norway) and four fenced plots of various sizes (described in Jehl 2001) on two of the Paoha Islets (two on Coyote A, two on Piglet Islet). We used these detailed counts to estimate average clutch size and reproductive success, excluding data from the Little Norway plot for reasons discussed below.

Chick Counts and Reproductive Success

From 2-6 July, we banded all chicks (except one that was too young to band on Coyote A) within 10 fenced plots on the Negit and Paoha islets. From 19-22 August, we searched the nesting islands to determine the number of banded nestlings that died before fledging. With the data from the nest, chick, and mortality counts, we estimated the fledging rate for each plot and, using the average fledging rate for the entire population, the total number of gulls successfully fledged from Mono Lake in 2005. 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 August, 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 Negit Islet fenced plots. Clutch size was calculated similarly; however **fi** is the number of eggs per nest for each plot.

We analyzed results using a nonparametric test (Wilcoxon/Kruskal-Wallis) in Intercooled Stata 8.0 (Stata Corp. 2003), and calculated the distances between Gaines Island and Negit Island and the Negit Islets from a map showing the 2004 lake level (Tom Harrison Maps 2003).

Because of an isolated, extreme decline in nest numbers and fledging success limited to Little Norway, data from this plot have been excluded since 2003 to give a more reasonable lakewide estimate of reproductive success. In 2005 Little Norway held only 126 nests (0.57% of the Mono Lake total), and 2005 was the first year no chicks survived to the date of banding in the Little Norway plot. The standard method for calculating the fledging rate for the entire population averages the fledging rate from each plot. Under that scenario, the Little Norway plot, if used, would account for 9% (1 of 11 plots) of the sample used to estimate reproductive success for the entire population. One reason for using data from multiple plots to estimate fledging success is to account for variation among different islands or breeding areas. In this case, however, using plot data from Little Norway would unduly bias calculations of lakewide nesting success downward, since no other Mono Lake subpopulation has shown a similar consistent and major decline. Low productivity on Little Norway is thought to be due to acute parasitism by the endemic Mono Lake bird tick *Argas monolakensis* (see Hite et al. 2005).

All estimates in this report are presented plus or minus one standard error.

Tick Infestations

Because of its potential effect on gull reproductive success, during banding we recorded the presence and abundance of the bird tick *Argas monolakensis* for all 665 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.

Ticks take 2-5 years to reach adulthood, and they feed on California Gulls, their only known natural host, during all life stages (larval, 2-5 nymph stages, and adult). Because larvae require 5-8 days to feed and all post-larval stages feed only at night and for only 9-62 minutes (Schwan et al. 1992), all the ticks on gull chicks during banding were larvae. We therefore can not sample the relative parasitism by nymphs or adults on any of the chicks or assess the relative fitness costs to the chicks from these other life stages. Ticks may affect chick fitness directly by feeding on their blood, or indirectly by transmitting a

virus (Mono Lake virus). Although the fitness costs of the virus are unknown, it was found in 2.2%-8.8% of ticks tested, and neutralizing antibodies to the virus were found in 37% of chicks tested (Schwan et al. 1992). Schwan et al. (1992) also collected up to 1200 larvae per bird from chicks that had died of unknown causes, illustrating the extent to which *A. monolakensis* could affect chick health.

Chick Mass at Banding

We used hand-held Pesola scales to weigh 656 of the 665 chicks that were banded.

RESULTS AND DISCUSSION

Number of Nests and Breeding Adults

In 2005, late May nest counts recorded a lakewide total of 21,941 California Gull nests for an estimate of 43,882 nesting adults. Of the total, 75% were nesting on the Negit Islets, 23% on the Paoha Islets, and 1% on Negit Island (Appendix 1). Twain Islet held 44% of the total, followed by Coyote A with 14% and Pancake and Little Tahiti each with 11%. Collectively, the remaining 14 islands/islets inhabited by gulls in 2005 held only 19% of the total. The number of nests on the Paoha Islets as a proportion of the lakewide total was the 6th highest since 1983, and 8% above the 22-year average of 4734 ± 462. The proportion of nests on the Negit Islets was the 6th lowest since 1983, and 13% below the 22-year average of 19,045 ± 540. For unknown reasons, the number of nests on Negit Island dropped sharply by 51% from 2004, breaking the trend of a steady increase since it was recolonized in 1999. In 2004, al 511 nests on Old Marina were lost to predation, most likely from a coyote (*Canis latrans)*. In 2005 that islet was virtually abandoned as only a single nest was counted. On Little Norway numbers of nests have declined steadily from a recent high of 887 in 2000 to reach an all-time low of 126 in 2005 (Appendix 1).

Clutch Size

In 2005, average clutch size at Mono Lake was 1.99 ± 0.03 eggs/nest (range = 1-3 eggs, *n* = 529 nests) within the 10 fenced plots, exclusive of Little Norway. Nineteen percent of

the nests contained one egg, 63% had two, and 17% had three. Winkler (1983) reported the average clutch size at Mono Lake is approximately 1.8 eggs/nest, which is similar to the average of 1.89 and 1.83 in 2002 and 2003, respectively, but much lower than the average of 2.35 in 2004 (Hite et al. 2005).

Phenology

We found only one nest containing chicks and at least four others with pipped eggs out of the 21,941 nests counted from 21-26 May 2005. That there were few nests with eggs or newly hatched chicks in early July indicates overall nest initiation and subsequent hatching was probably not protracted. We did not observe any unfledged chicks during mortality counts from 19-22 August.

Fledging Rates in the Fenced Plots

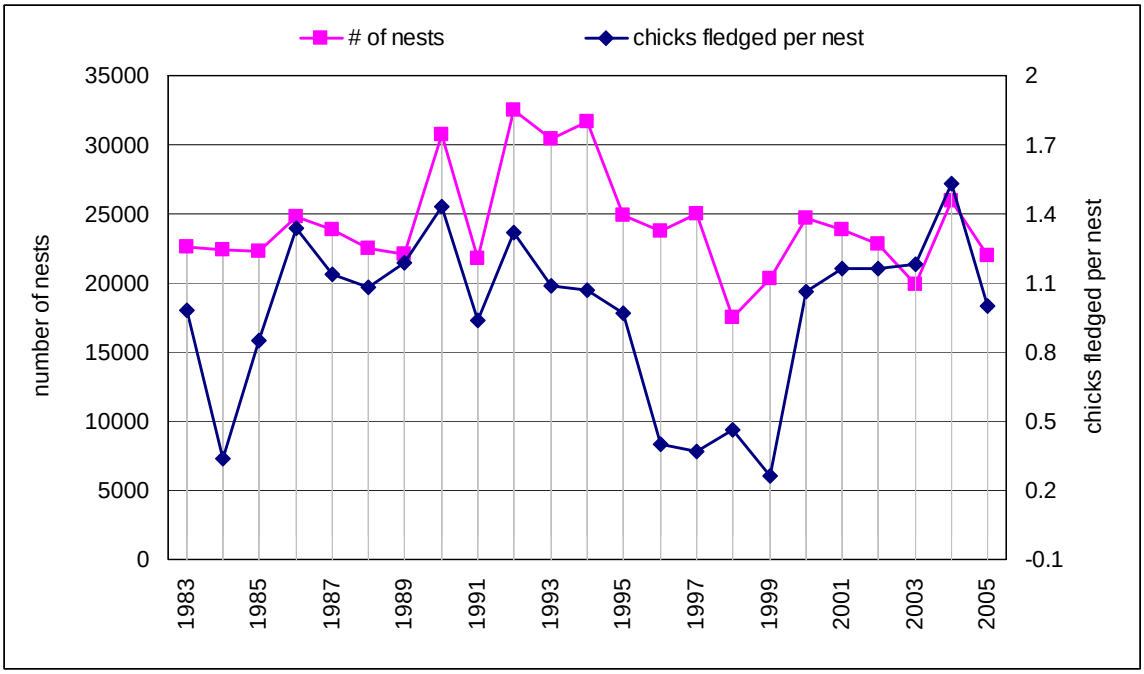
The six fenced plots on the Negit Islets, exclusive of Little Norway, held an average of 62.3 ± 8.1 nests and fledged an average of 1.00 ± 0.05 chicks per nest (Table 1). The four fenced plots on the Paoha Islets held an average of 38.0 ± 0.05 nests and also fledged an average of 1.00 ± 0.05 chicks per nest. Combined, the 10 plots held an average of 52.5 ± 6.6 nests and fledged an average of 1.00 ± 0.03 chicks per nest. The latter is very close to the 1983-2004 average of 0.97 ± 0.08 chicks fledged per nest. Over this period, the number of nests and chicks fledged per nest generally have tended to increase or decrease together from year to year, with the greatest deviations between the two in the mid-1980s and late 1990s (Fig. 1). This suggests that the overall conditions that affect egg laying and fledging success are generally related within a given year.

Table 1. Summary of Nest Counts, Chick Banding, and Mortality Counts on the Negit and Paoha Islets in 2005.

Site	Nests per Plot 21 – 25 May	Chicks per Nest 2 – 6 July	Chicks Banded (chicks found dead)	Chicks Fledged/Nest
Little Norway *(LN)*	3	0.00	0 (0)	0.00
Little Tahiti East *(LTE)*	37	1.22	45 (10)	0.95
Little Tahiti West *(LTW)*	75	1.20	91 (9)	1.09
Twain North *(TwNor)*	62	1.40	87 (19)	1.10
Twain South *(TwS)*	89	1.21	108 (24)	0.94
Twain West *(TwW)*	69	1.50	102 (24)	1.14
Twain New *(TwNew)*	42	1.02	43 (9)	0.81
Negit Islet Totals: [a]				
Totals =	**374**	**-**	**476(94)**	**-**
Average =	**62.3**	**1.26**	**-**	**1.00**
SD =	**19.8**	**0.17**	**-**	**0.12**
SE =	**8.1**	**0.07**	**-**	**0.05**
Coyote A Cove *(CC)*	47	0.98	46 (6)	0.85
Coyote A Hilltop *(CH)*	52	1.40	73 (14)	1.12
Paoha Islet East *(PE)*	22	1.36	30 (7)	1.05
Paoha Islet West *(PW)*	31	0.63	40 (9)	1.00
Paoha Islet Totals:				
Totals =	**152**	**-**	**189 (37)**	**-**
Average =	**38.0**	**1.25**	**-**	**1.00**
SD =	**13.9**	**0.19**	**-**	**0.11**
SE =	**6.96**	**0.09**	**-**	**0.06**
Mono Lake Totals:				
Totals =	**526**	**-**	**665 (131)**	**-**
Average =	**52.6**	**1.26**	**-**	**1.00**
SD =	**21.01**	**0.16**	**-**	**0.11**
SE =	**6.65**	**0.05**	**-**	**0.03**

[a] Calculated excluding data from LN plot for reasons discussed in the Methods.

Figure 1. Number of nests and chicks fledged per nest at Mono Lake, 1983 to 2005.



Overall Reproductive Success

Based on the total of 21,941 California Gull nests on Mono Lake and an average of 1.00 ± 0.03 chicks fledged per nest, an estimated 21,941 ± 790 chicks fledged at Mono Lake in 2005.

Tick Infestation

The presence and relative abundance of larval ticks found on gull chicks varied among plots. Of the 665 chicks banded, 92.2% had a tick score of 0. 7.2% had a score of 1, and 0.06% had a tick score of 2 (2 each from TwNew, LTE, see Table 1 for plot abbreviations); no chicks had a tick score of 3. Within five plots (LTW, CC, TwNor, PW, PE) no ticks were detected, thus all the chicks had a tick score of 0. For the five plots in which ticks were detected (CH, LTE, TwNew, TwS, TwW), 86% of the chicks had a tick score of 0, 13% had score of 1, and 1% had a score of 2. Since at least 2003, the Little Norway plot has had the highest infestation rates (>80% of chicks with some ticks) and highest average tick scores. In 2003 and 2004, 100% of the chicks on Little Norway had a tick score of either 2 or 3 (Hite et al. 2005). Because no chicks on Little Norway survived to the stage at which we typically band them and check for ticks in early July, it was not

possible to assess tick levels on that islet in 2005. Given the high tick infestation levels on that islet in prior years, though, it is possible that many chicks in 2005 succumbed to the effect of ticks or were abandoned by adults prior to banding. Although 38 of the 45 chicks banded on the Little Tahiti East plot had ticks, only 2 of the 38 had a tick score >1. Mortality of banded chicks did not differ significantly between chicks with and without infestations of ticks (X^2= 0.043, df = 1, p > 0.01).

Mass at Banding

The average mass of the 656 chicks banded in 2005 was 512 ± 4 g. The average mass for chicks that survived to fledging (532 ± 4 g) was significantly higher than the average mass for chicks that did not survive to fledging (429 ± 10 g, X^2= 93.2, df = 1, p =0.0001). This pattern has been consistent through all years in which chicks were weighed (1998, 2002 - 2005).

Gull Predators

Few potential gull predators were detected in 2005. Avian predators seen or heard regularly throughout the season were the Black-crowned Night-Heron (*Nycticorax nycticorax*), Great-Horned Owl (*Bubo virginianus*), and Common Raven *(Corvus corax*). Ospreys (*Pandion haliaetus*), unlikely but potential predators (one was observed taking on a gull egg in 2003, Hite et al. 2004), were detected regularly, and several pairs were nesting in various areas around the shore of Mono Lake.

Coyotes have represented a major threat to the Mono Lake gull population during periods of lowered lake levels. Coyotes gained access to Negit Island in the late 1970s via a landbridge that formed when the lake receded to a level of approximately 1943.1 m (6375.0 ft). At that time, the majority of the lake's gulls nested on Negit Island, which was abandoned in 1979, apparently in response to coyote predation. Periodically between 1989 to 1996 coyotes and coyote sign (tracks, scat) were detected on a few of the Negit Islets (Java, Pancake, Twain) and on Negit Island (Shuford 1992, Shuford et al. 1996). During this period spring and summer lake levels varied between 1942.9 m (6374.4 ft) in June 1992 to 1944.6 m (6380.1 ft) in August 1996 (data from Los Angeles Dept. Water

and Power, available at www.monolake.org/live/lakelevel/monthly.htm). In August 2003, a single coyote was observed on Gaines Island, when the lake level was approximately 1945.3m (6382.1 ft, Hite et al. 2005). In 2005, the channel between Gaines Island and Negit Island was approximately 0.4 km in width. The three Negit Islets closest to Gaines Island - Pancake (0.70 km), Java (0.77km), and Twain (0.90km) – were visited by coyotes during periods of low lake levels in the 1990s. These islets, respectively, accounted for 11%, 3%, and 44% of the lake's breeding population in 2005. If the lake continues to decline as it did from 1999 to 2004, it would become increasingly feasible for coyotes to cross the channel from Gaines Island to Negit Island or one of the closest Negit Islets.

Other Species Nesting on Mono Lake Islets

In addition to California Gulls, three other avian species of waterbird were detected nesting on the Mono Lake islets in 2005. The Black-crowned Night-Heron (*Nycticorax nycticorax*) population continued to increase. Seventy-six night-heron nests, 15 of which contained chicks, were counted in late May. Of these, 57 of these were on Twain Islet and 19 on Little Tahiti. A single Canada Goose (*Branta canadensis*) nest containing three eggs was detected on Java in late May. This species nests infrequently on the Mono Lake islets. Three Caspian Tern (*Sterna caspia*) nests were counted on the sandy spit on the northwest shore of Twain Islet.

OVERVIEW

Multiple factors contribute to the year-to-year variation in numbers of breeding gulls at Mono Lake. Wrege et al. (2006) found that four variables accounted for >80% of the variation in the number of breeding gulls at Mono Lake between 1987 and 2003. Two factors reflecting immediate local conditions - the density of brine shrimp (*Artemia monica*) at about the time of egg-laying and the mean temperature in the month before egg laying began – had the greatest direct effect on the numbers of breeding gulls. Less important were the potential number of four-year-old gulls returning to the lake to breed for the first time (reflecting in reproductive success 4 years earlier) and winter coastal conditions associated with the Pacific Decadal Oscillation. Yet regional climate patterns

may indirectly influence gull numbers as yearly snow pack and spring runoff affect brine shrimp numbers through changes in limnological conditions.

During the tenure of this long-term monitoring program, low reproduction by gulls has been associated with the early years of each of two meromictic periods. During these episodes, the primary productivity of Mono Lake has been reduced, and brine shrimp phenology has been delayed (Jellison and Melack 1999). Effects of meromixis on alkali flies (*Ephydra hians*), another major prey item of gulls, are unclear, but these flies may benefit (in body size and population size) from the lower relative salinity of the surface waters (D. Herbst pers. comm.). Long-legged flies (*Hydrophorus plumbeus*), a third major prey item, have a lower salinity tolerance than do alkali flies. Though Herbst and Bradley (1988) found that the larvae of *H. plumbeus* can survive at high salinities that would kill alkali fly larvae, they noted that other life stages may not be as salt tolerant, which would in turn reduce the species' overall salt tolerance. *H. plumbeus* have been recorded in large numbers only during the first (D. Herbst pers comm.) and second (Hite et al. 2004) episodes of meromixis, which suggests that meromixis may enhance *H. plumbeus* abundance by reducing surface salinity to levels lower than those found during monomictic (fully mixed) years at the same lake level.

During the previous period of meromixis from 1983 through 1988 (Jellison and Melack 1993), gull productivity on the Negit Islets was low in 1983 and 1984, increased in 1985, and increased further to above average levels from 1986 through 1988 (PRBO unpubl. data) as meromixis weakened with the falling lake levels (R. Jellison pers. comm.). These events suggest that over the course of the prior period of meromixis, invertebrate food supplies increased or the gulls otherwise adapted to the meromictic conditions. The four years of poor reproduction from 1996 to 1999 followed by relatively high success from 2000 to 2004, mirrors the pattern in the previous meromictic event. As meromixis weakened, some of its typical effects were at least partially absent: adult shrimp were available in the water column three to four weeks earlier than in preceding years, and shrimp population density increased rapidly during the gulls' early chick hatching period (R. Jellison pers. comm., P. Wrege unpubl. data).

Although it warrants concern, the long-term effect of meromixis on gull productivity at Mono Lake is uncertain. Meromixis will, however, occur with increasing regularity compared to pre-diversion rates if the lake is managed, as planned, at the lower than natural level of 1948.3 m (6392 ft) above sea level as mandated by the State (SCWRCB 1994; decision 1631). All else being equal, the lake will become meromictic if its surface elevation rises 0.8 m in one year (R. Jellison pers. comm.), and such a rise will occur with relatively lower volumes of runoff when the lake is at or below target level compared to its pre-diversion level because of the lake's relatively higher salinity and lower volume.

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Appendix 1. Nest counts on Negit Island and the Negit and Paoha islets from 1983 to 2004. Data from the Paoha Islets in all years but 2002 to 2004 from J. R. Jehl, Jr. (in litt.).

Negit Islets	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 Rocks	2	3	4	3	4	6	5	4
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
Negit Islets Total:	**14557**	**18872**	**19040**	**20444**	**19098**	**17631**	**16641**	**22765**
Paoha Islets								
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[b]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Paoha Islets Total:	**8001**	**3546**	**3153**	**3694**	**3208**	**2833**	**2682**	**5145**
Negit Island	--	--	92	636	1502	2037	2765	2827
Mono Lake Grand Total	**22558**	**22418**	**22285**	**24778**	**23808**	**22501**	**22088**	**30737**
Nesting Adults:	**45116**	**44836**	**44570**	**49556**	**47616**	**45002**	**44176**	**61474**

[a] Data published elsewhere by J. R. Jehl, Jr.

b 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. 2004b) it was changed to "Piglet Islet" to avoid confusion with Paoha Island.

Appendix 1. Continued.

Negit Islets	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 Rocks	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
Negit Islets Total:	**16530**	**23200**	**21912**	**23488**	**17596**	**19416**	**19429**	**14779**
Paoha Islets								
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[b]	[a]	[a]	[a]	[a]	[a]	[a]	[a]	[a]
Paoha Islets Total:	**4442**	**9284**	**8498**	**8182**	**7331**	**4334**	**5708**	**2678**
Negit Isl.	788	4	12	0	9	0	0	0[c]
Mono Lake Grand Total	**21760**	**32488**	**30422**	**31670**	**24927**	**23750**	**24957**	**17466**
Nesting Adults:	**43520**	**64976**	**60844**	**63340**	**49854**	**47500**	**49914**	**34932**

c 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

Negit Islets	1999	2000	2001	2002	2003	2004	2005
Twain	10728	11856	11773	10772	9288	11480	9582
L. Tahiti	5108	5076	4309	3831	2632	3303	2511
L. Norway	732	887	665	357	249	213	126
Steamboat	381	477	570	621	575	635	621
Java	149	480	611	706	718	915	779
Spot	27	29	36	42	70	98	127
Tie	5	16	23	24	38	49	50
Krakatoa	76	120	141	129	113	181	184
Hat	43	29	23	9	7	9	3
La Paz	0	0	0	0	0	1	2
Geographic	0	0	0	0	0	0	0
Muir	0	0	0	0	0	0	0
Saddle	2	1	1	0	0	0	0
Midget	3	2	0	0	0	1	1
Siren	0	0	0	0	0	0	0
Comma	0	0	0	0	0	0	0
Castle Rocks	3	1	1	1	0	0	0
Pancake	1136	2098	2145	2085	1847	2837	2530
Java Rocks	0	0	0	0	0	0	0
No name	0	0	0	0	0	0	0
Negit Islets Total:	**18393**	**21072**	**20298**	**18577**	**15537**	**19722**	**16516**
Paoha Islets							
Coyote A	[a]	[a]	2237	2612	2480	3244	3174
Coyote B	[a]	[a]	22	26	34	55	63
Browne	[a]	[a]	279	261	224	283	253
Piglet Islet[b]	[a]	[a]	776	991	1010	1552	1649
Paoha Islets Total:	**1858**	**3478**	**3314**	**3890**	**3748**	**5134**	**5139**
Negit Island:	14	100	271	391	452	587	285
Old Marina Islet:	0	0	0	[d]	178[e]	511	1
Mono Lake Grand Total	**20265**	**24650**	**23883**	**22858**	**19915**	**25954**	**21941**
Nesting Adults:	40530	49300	47766	45716	39830	51908	43882

d Number of nests on Old Marina Islet in 2002 (and years before) is uncertain. Nesting activity was not discovered until 5 July, 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.

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