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Population Size and Reproductive Success of California Gulls at Mono Lake, California, in 2006

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Abstract

In 2006, nest counts estimated 42,480 adult California Gulls (*Larus californicus*) were nesting at Mono Lake in late May. This total was the fourth lowest in 24 years of monitoring, and was well below the 1983-2005 average of 48,528 ± 1590. Roughly 77% of the gulls nested on the Negit Islets, 22% on the Paoha Islets, and only 0.6% on Negit Island. Twain Islet remained the most populous, holding 47% of the lakewide total, followed by Coyote A Islet with 15%, Little Tahiti with 13%, and Pancake Islet with 10%. Old Marina Islet, up from only a single nest in 2005, contained 94 nests in 2006. The number of nests on Negit Island continued to decline sharply for a second year in a row with an 80% decrease from the number of nests there in 2004; the period spanning 1999-2004, Negit Island experienced a rapid increase in nesting occupation. Lakewide reproductive success of 1.05 ± 0.07 chicks fledged per nest was slightly above the1983-2005 average of 0.97 ± 0.08. An estimated 22,369 ± 1668 chicks fledged from the Mono Lake islands in 2006. For the 584 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, 2006. 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). 2006 witnessed an even greater increase in lake level with a substantial rise of 1.9 m during the breeding season alone. In May of 2006 the lake level was 1945.6m (6383.2 ft) and peaked at 1946.2 m (6385.1 ft) by August. The August 2006 lake level exactly tied the peak level last recorded in July 1999, and before that, the lake level had not been that high since approximately 1971 (data from Los Angeles Dept. Water and Power, available at www.monolake.org/live/lakelevel/yearly.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 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

In 2006, we counted nests on Negit Island, the Negit Islets, and the Paoha Islets from 23-27 May, and on Old Marina Islet on 30 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 1-4 July 2006, we banded all chicks within 9 of the 10 fenced plots on the Negit and Paoha islets. No chicks were banded in one plot on a Paoha islet due to a deteriorated fence wall which resulted in chicks freely being able to enter/exit the plot. From 17-19 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 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 2006. 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 August, 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 **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) with 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).

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 584 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 the chicks that were banded.

RESULTS AND DISCUSSION

Number of Nests and Breeding Adults

In 2006, late May nest counts recorded a lakewide total of 21,240 California Gull nests for an estimate of 42,480 nesting adults. Of the total, 77% were nesting on the Negit Islets, 22% on the Paoha Islets, and only 0.6% on Negit Island (Appendix 1). Twain Islet

held 47% of the total, followed by Coyote A with 15%, Little Tahiti with 13%, and Pancake with 10%. Collectively, the remaining 14 island/islets inhabited by gulls in 2006 held only 16% of the total.

The number of nests on the Paoha Islets as a proportion of the lakewide total was the 8th highest since 1983, yet the number of nests there was nearly 10% below the 22-year average of 4752 ± 442. Both as a proportion of the lakewide total and quantitative average, the number of nests on the Negit islets was average. For unknown reasons, the number of nests on Negit Island dropped sharply by 42% from 2005, and over 80% relative to the number that nested there in 2004, which was the first year to experience a drop in nesting occupation since Negit Island was recolonized in 1999. Little Norway experienced a precipitous decline in the number of nests from 2000 in which there were 887 nests to 2005, in which there were 126 nests. 2006, however, experienced a small population increase on Little Norway with 165 nests counted.

In 2004, all 511 nests, chicks and some adults on Old Marina Islet 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. In 2006 the number of nests on Old Marina Islet climbed to 94. The approximate 0.86 m difference in the lakelevel during the breeding season in 2006 compared to when the islet was predated in 2004 likely hinders accessibility of the islet to terrestrial predators. Yet as demonstrated by coyotes gaining access by swimming to such locations as Twain Islet and Negit Island in the early 1990's, predation is still a risk factor for that population due to its close proximity to the mainland.

Due to the increase in lake level, many of the islets, particularly the small, "flat" ones, lost significant volume during the course of the breeding season in 2006 (KN, pers. obs). The flattest islets with little topographic rise such as Pancake, Spot, Tie, Browne, and Pancake, had reduced nesting occupancy compared with 2005, up to 41% (Appendix 1). The majority of the lake level rise experienced in 2006 occurred after nest count was completed which likely decreased the number of nests on many of the islets further. Calculating nest loss is impossible with the current data, but must be proportionally

greater for small, “flat” islets which were visibly greatly reduced in size during the course of the 2006 season.

Clutch Size

In 2006, average clutch size at Mono Lake was 2.04 ± 0.03 eggs/nest (range = 1-3 eggs, *n* = 505 nests) within the 10 fenced plots. Fifteen percent of the nests contained one egg, 66% had two, and 19% 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 average of 1.89, 1.83, and 1.99 and in 2002, 2003, and 2005, respectively, but lower than the average of 2.35 in 2004 (Hite et al. 2005).

Phenology

Thirteen nests contained chicks out of the 21,240 nests counted during May 23-27 2006. 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 17-19 August.

Fledging Rates in the Fenced Plots

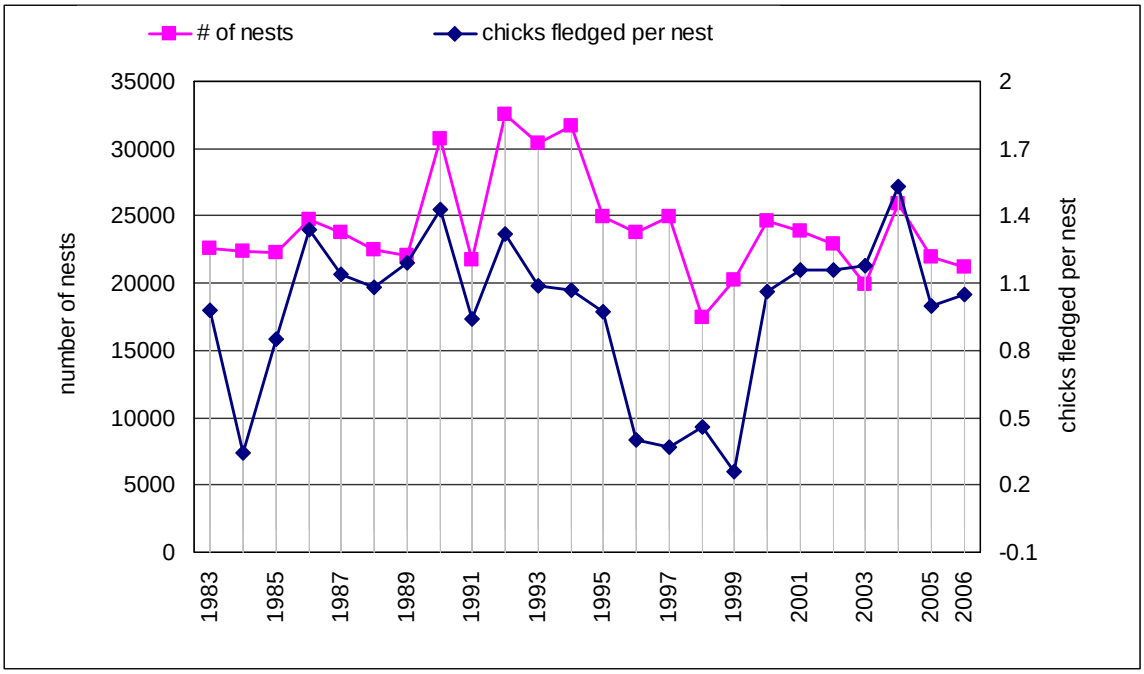
The six fenced plots on the Negit Islets held an average of 61.7 ± 7.0 nests and fledged an average of 1.07 ± 0.16 chicks per nest (Table 1). The four fenced plots on the Paoha Islets held an average of 30.7 ± 6.4 nests and the three Paoha Islet plots in which fledging data were obtained had an average fledge rate of 1.01 ± 0.09 chicks per nest. Combined, the 10 plots held an average of 50.5 ± 6.5 nests and fledged an average of 1.05 ± 0.07 chicks per nest. The latter is close to and above the 1983-2005 average of 0.97 ± 0.07 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 2006.

Site	Nests per Plot 23 – 27 May	Chicks per Nest 1 – 4 July	Chicks Banded (chicks found dead)	Chicks Fledged/Nest
Little Norway *(LN)*	12	0.08	1 (0)	0.08
Little Tahiti East *(LTE)*	40	1.00	40 (10)	0.75
Little Tahiti West *(LTW)*	62	1.56	97 (11)	1.39
Twain North *(TwNor)*	62	1.16	72 (6)	1.06
Twain South *(TwS)*	89	1.33	118 (8)	1.24
Twain West *(TwW)*	69	1.17	81 (12)	1.00
Twain New *(TwNew)*	48	1.89	57 (8)	1.02
Negit Islet Totals: [a]				
Totals =	**370**	**-**	**465**	**-**
Average =	**61.7**	**1.24**	**-**	**1.08**
SD =		**0.19**	**-**	**0.22**
SE =	**6.97**	**0.08**	**-**	**0.09**
Coyote A Cove *(CC)*	43	n/a	n/a	n/a
Coyote A Hilltop *(CH)*	46	1.50	69 (8)	1.33
Paoha Islet East *(PE)*	19	0.89	17 (1)	0.84
Paoha Islet West *(PW)*	27	1.22	33 (10)	0.85
Paoha Islet Totals:				
Totals =	**135**	**-**	**119**	**-**
Average =	**30.7**	**1.20**	**-**	**1.01**
SD =		**0.30**	**-**	**0.28**
SE =	**6.45**	**0.17**	**-**	**0.16**
Mono Lake Totals:				
Totals =	**505**	**-**		**-**
Average =	**50.5**	**1.23**	**-**	**1.05**
SD =	**20.62**	**0.21**	**-**	**0.22**
SE =	**6.52**	**0.071**	**-**	**0.074**

[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 2006.



Overall Reproductive Success

Based on the total of 21,240 California Gull nests on Mono Lake and an average of 1.05 ± 0.03 chicks fledged per nest; an estimated 22,369 ± 1668 chicks fledged at Mono Lake in 2006.

Tick Infestation

The presence and relative abundance of larval ticks found on gull chicks varied among plots. Of the chicks banded, 87.5% had a tick score of 0. Of those that had ticks, 85% had a tick score of 1, 11% had a tick score of 2, and 4% had a tick score of 3. Within 3 plots (TwNor, PW, PE) no ticks were detected, thus all the chicks had a tick score of 0. No ticks were detected in these plots in 2005 as well. Six of the seven remaining plots (including Little Norway, which was not used in calculating productivity) in which ticks were detected - CH, TwNew, TwS, TwW, LTW, LN - all the chicks had a tick score of 1. The Little Tahiti East (LTE) plot contained the only detections of tick scores greater than one. Within this plot, only one chick (representing 2.5% of the total) had a tick score of 0.

Seventy percent of the chicks on LTE had a tick score of 1, 20% a score of 2, and 7.5% had a score of 3. This plot has had similar rates of tick detection in the past (Hite et al. 2005, Hite et al. 2004).

The Little Norway plot experienced extreme rates of tick infestation, and a significant drop in nesting occupation. Since at least 2003 until no surviving chicks were detected in 2005, Little Norway plot had 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). Nesting numbers on Little Norway dropped from an all-time high of 887 in 2000 to an all-time low of 126 in 2005, which has been thought to be due to the extreme rates of tick parasitism there (Hite et al. 2004).

Mass at Banding

The average mass of the 584 chicks banded in 2006 was 504 ± 4 g. The average mass for chicks that survived to fledging (519 ± 4 g) was significantly higher than the average mass for chicks that did not survive to fledging (398 ± 11 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 - 2006).

Gull Predators

Few potential gull predators were detected in 2006. Avian predators seen or heard regularly throughout the season were the Black-crowned Night-Heron (*Nycticorax nycticorax*), Great-Horned Owl (*Bubo virginianus*), Bald Eagle (*Haliaeetus* leucocephalus), 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, and an unsuccessful nesting attempt was made on the Negit islet La Paz.

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 10%, 3%, and 47% of the lake's breeding population in 2006. If the lake were to decline as it has during certain periods, such as the most recent steady decline that occurred 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.

In 2006, Mono Lake levels were among the highest experienced by the lake in the last 35 years. Threat of terrestrial predators, primarily coyotes, is greatly reduced by the increase in size of the water channel between the mainland and the nesting 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 2006. The Black-crowned Night-Heron population continued to increase. Ninety-one night-heron nests were counted in late May. Of these, 55 of these were on Twain Islet, 33 were on Little Tahiti, 2 were on Steamboat and 1 on Java. Two Canada Goose (*Branta canadensis*) nests containing eggs were detected on Java and Steamboat in late May. This species nests infrequently on the Mono Lake islets. Three Caspian Tern (*Sterna caspia*) nests were estimated to be 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 yet still significant 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 could, 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 could become meromictic if its surface elevation rises 0.8 m in one year (R. Jellison pers. comm.), and such a rise may 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. The significant gain in lakelevel experienced during 2006 likely caused the water stratification observed on the lake - demonstrated by shrimp concentrations generally seen several inches below the surface during the breeding season, and relatively large amounts of surface ice in the winter (KN, pers. obs.).

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Appendix 1. Nest counts on Negit Island and the Negit and Paoha islets from 1983 to 2006. Data from the Paoha Islets in all years but 2002 to 2006 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 Nesting Adults:	**21760** **43520**	**32488** **64976**	**30422** **60844**	**31670** **63340**	**24927** **49854**	**23750** **47500**	**24957** **49914**	**17466** **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	2006
Twain	10728	11856	11773	10772	9288	11480	9582	9900
L. Tahiti	5108	5076	4309	3831	2632	3303	2511	2700
L. Norway	732	887	665	357	249	213	126	165
Steamboat	381	477	570	621	575	635	621	583
Java	149	480	611	706	718	915	779	710
Spot	27	29	36	42	70	98	127	75
Tie	5	16	23	24	38	49	50	33
Krakatoa	76	120	141	129	113	181	184	131
Hat	43	29	23	9	7	9	3	5
La Paz	0	0	0	0	0	1	2	0
Geographic	0	0	0	0	0	0	0	0
Muir	0	0	0	0	0	0	0	0
Saddle	2	1	1	0	0	0	0	1
Midget	3	2	0	0	0	1	1	0
Siren	0	0	0	0	0	0	0	0
Comma	0	0	0	0	0	0	0	0
Castle Rocks	3	1	1	1	0	0	0	0
Pancake	1136	2098	2145	2085	1847	2837	2530	2059
Java Rocks	0	0	0	0	0	0	0	0
No name	0	0	0	0	0	0	0	0
Negit Islets Total	**18393**	**21072**	**20298**	**18577**	**15537**	**19722**	**16516**	**16362**
Paoha Islets								
Coyote A	[a]	[a]	2237	2612	2480	3244	3174	3181
Coyote B	[a]	[a]	22	26	34	55	63	40
Browne	[a]	[a]	279	261	224	283	253	225
Piglet [b]	[a]	[a]	776	991	1010	1552	1649	1218
Paoha Islet Total:	**1858**	**3478**	**3314**	**3890**	**3748**	**5134**	**5139**	**4664**
Negit Island:	14	100	271	391	452	587	285	120
Old Marina	0	0	0	[d]	178[e]	511	1	94
Mono Lake Total:	**20265**	**24650**	**23883**	**22858**	**19915**	**25954**	**21941**	**21240**
Nesting Adults	**40530**	**49300**	**47766**	**45716**	**39830**	**51908**	**43882**	**42480**

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.