

**Population Size and Reproductive Success of California Gulls  
at Mono Lake, California in 2001,  
With Emphasis on the Negit Islets**

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**Abstract**

In 2001, nest counts estimated about 47,766 adult California Gulls (*Larus californicus*) were nesting at Mono Lake in late May. About 85% of Mono Lake's breeding gulls were on the Negit Islets, 14% on the Paoha Islets complex, and just over 1% on Negit Island. Twain Islet remained the most populous nesting island, holding 49% of Mono Lake's breeding gulls, followed by Little Tahiti Islet with 18%. The two colony locations on Negit Island continued to expand this breeding season, with the larger site more than doubling in size. The fledging rate on the Negit Islets was 1.16 chicks per nest, the fourth highest rate in 19 years of monitoring. An estimated 27,935 young fledged from all the lake's nesting islands in 2001, nearly a six-fold increase over the estimate from 1999. An early and warm spring accelerated the population growth of the two most important prey species, brine shrimp (*Artemia monica*) and alkali flies (*Ephydra hians*). In addition 2001 was an outbreak year for the cicada *Okanagana cruentifera*, which was exploited heavily by breeding gulls. However, it remains unclear whether these characteristics of the prey populations directly affected chick production. During a prior six-year period of meromixis in the 1980s, gull nesting success was low the first two years but increased thereafter. During the current period of meromixis, which began in 1996, gull reproduction was extremely low for four years, followed by two years in which it was above average. This trend suggests a recovery similar to that in the 1980's and is consistent with observations that the chemocline is eroding more rapidly than initially projected.

## **Introduction**

The long-term study of California Gull (*Larus californicus*) population density and reproductive success at Mono Lake, California, under the direction of David Shuford of the Point Reyes Bird Observatory, was continued between May and August 2001. During this period, spanning most of egg laying through the fledging of young, three standardized measures of reproduction were obtained on gulls nesting on the Negit Islets. The foraging ecology of nesting adults was again a parallel focus, continuing the observational study initiated in 2000 (Wrege et. al. 2001). Here we summarize the results obtained from the nest counts and chick banding surveys.

The objectives of this ongoing study are to measure year-to-year variation in population size and reproductive success and to determine their relationship to changing lake levels. This report focuses on the Negit Islets, which currently support most of the lake's nesting gulls, and on Negit Island, which supported the majority until the gulls abandoned it in 1979.

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 a recent decision that protects the Mono Lake ecosystem will allow the lake's surface elevation to rise to 6392 feet (SCWRCB 1994), there is a continuing need to monitor the lake's resources, including nesting gulls, to document their responses to the changing conditions.

## **Study Area And Methods**

The study area at Mono Lake has previously been described in Shuford (1985) and Shuford et al. (1984, 1985), though conditions that potentially could affect nesting gulls have changed considerably over time. Since 1941, the lake has 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 the downward trend. The winters of 1986-87 through 1993-94 averaged very dry, and the lake level fell to a surface elevation of 6374.5 feet by May 1992. Very wet winters returned in 1994-95, 1996-97, and 1997-98 and, reinforced by reduced diversion of water from the watershed, the lake level rose to 6384 feet in 1999 (P. Kavounas in litt.), and 2000. The lake level in 2001 was 0.7 feet lower than in 2000.

Additionally, for the six-year period 1983 to 1988, Mono Lake experienced chemical stratification (meromixis), which lowered the lake's productivity (Jellison and Melack 1993). Since 1996 the lake has entered another episode of meromixis, which initially was predicted to last for up to several decades (Jellison et al. 1998). Deeper than expected mixing in the fall of 1999, along with mild and early springs in 2000 and 2001, contributed to an early abundance of brine shrimp (*Artemia monica*) in both of the latter years (R. Jellison, pers. com.; Wrege et.al, 2001).

Over the years, small numbers of gulls have intermittently initiated nesting on a peninsula of Paoha Island (immediately adjacent to the Paoha Islets), which is either partially or completely (e.g., 1999-2001) isolated as a small islet by the rising lake (J. R. Jehl, Jr. in litt.). The Paoha Islets and this peninsula/islet are referred to below as the Paoha Islets complex.

**Nest Counts:** Nests on the Negit Islets and Negit Island were counted from 24 to 27 May. Field workers walked through all the colonies tallying each nest and marking them with a dab of paint to avoid duplicate counts. For some small, steep-sided islets incubating/brooding adults were counted from a small motorboat to estimate the number of nests present. Nest totals for the Negit Islets and Negit Island were added to those for the Paoha Islets complex provided by Joseph R. Jehl, Jr., and the number of adult gulls breeding at Mono Lake was estimated as twice the total number of nests at the lake. Separate subtotals were compiled for nests within eight 10 X 20 m fenced plots on three islets (five on Twain, two on Little Tahiti, and one on Little Norway) that were monitored to determine chick production. Within plots, counts included the number of eggs in each nest.

**Chick Counts and Reproductive Success:** From 1-4 July, we banded chicks within the eight fenced plots on the Negit Islets. Combined with a follow-up count of all banded nestlings that died before fledging (conducted 11-13 August), we estimate the total number of gulls successfully fledged from the Negit Islets in 2001. The number fledged (**F**) is calculated as:

$$(N/8) \sum_{i=1}^8 f_i$$

where  $N$  is the total number of nests on the Negit Islets and  $f_i$  is the number of young fledged per nest in the eight Negit Islet fenced plots. An estimate of the number of young fledged on the

Paoha Islets complex, based also on fenced plots (J. R. Jehl, Jr. pers. com.), was added to the corresponding number for the Negit Islets to provide an estimate of the total number of young produced at Mono Lake in 2001.

## **Results and Discussion**

**Phenology:** In 2001, chicks occupied 0.3% of nests checked 24-27 May, indicating that nest initiation began about the same time as in most other years of study. There were relatively few nests with eggs and newly hatched chicks during the chick-banding period (1-4 July), indicating that nest initiation was more synchronized than in either of the last two years.

**Number of Breeding Adults:** In 2001, late May nest counts estimated that 40,596 gulls were nesting on the Negit Islets, 6,628 on the Paoha Islets complex (J.R. Jehl Jr., pers. com.), and 542 on Negit Island for a lakewide total of 47,766 nesting adults (Table 1). About 85% of the nesting gulls occupied the Negit Islets, 14% the Paoha Islets complex, with slightly more than 1% on Negit Island. Twain Islet alone held 49% of the lake-wide breeding population followed by Little Tahiti with 18%. Overall the number of nesting pairs on Mono Lake in 2001 was slightly lower than in the previous year (767 fewer nests). Nesting density decreased on the Little Tahiti and Little Norway islets, and on the Paoha Islet complex. However, nearly all other islets gained slightly in numbers of nests, and the main colony site on Negit Island more than doubled in size (Table 1). No evidence of coyotes or any other canid was seen on Negit Island in numerous surveys of the shore and interior.

**Table 1.** Nest counts on the Negit Islets and totals for Mono Lake – 1990 to 2001.

Negit Islets	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Twain	15045	10883	15896	15431	15792	11035	12690	13140	9488	10728	11856	11773
L. Tahiti	4218	3205	3810	3616	4505	4021	4570	4092	3846	5108	5076	4309
L. Norway	432	355	473	428	533	493	766	794	606	732	887	665
Steamboat	704	671	862	958	1217	981	459	505	405	381	477	570
Java	789	586	1040	399	199	4	70	41	65	149	480	611
Spot	309	311	335	356	449	422	399	341	191	27	29	36
Tie	167	160	220	210	320	264	267	194	81	5	16	23
Krakatoa	283	181	209	146	175	116	57	33	16	76	120	141
Hat	19	10	21	21	14	19	41	58	47	43	29	23
La Paz	46	49	70	77	57	55	44	30	17	0	0	0
Geographic	4	10	68	84	69	51	0	0	0	0	-	-
Muir	61	84	139	131	116	87	4	0	0	0	-	-
Saddle	18	8	14	10	11	21	31	13	1	2	1	1
Midget	3	2	2	3	2	2	2	3	0	3	2	0
Siren	7	7	19	20	14	16	10	0	0	0	-	-
Comma	0	1	1	1	0	0	1	0	0	0	-	-
Castle Rocks	4	5	5	3	3	3	4	4	3	3	1	1
Pancake	651	0	0	0	0	0	0	1	13	1136	2098	2145
Java Rocks	4	2	13	15	9	5	1	0	0	0	0	0
No name	1	0	3	3	3	1	0	0	0	0	-	-
<b>Totals</b>												
<b>Negit Islets:</b>	22765	16530	23200	21912	23488	17596	19416	19249	14779	18393	21072	<b>20298</b>
<b>Totals</b>												
<b>Paoha Islets:</b>	5145	4442	9284	8498	8182	7331	4334	5708	2687	1858	3478	<b>3314</b>
Negit Island:	2827	788	4	12	0	0	0	0	0 <sup>a</sup>	14	100	<b>271</b>
<b>Totals</b>												
<b>Mono Lake:</b>	30737	21760	32488	30422	31670	24927	23750	24957	17466	20265	24650	<b>23883</b>
<b>Nesting</b>	61474	43520	64976	60844	63340	49854	47500	49914	34932	40530	49300	<b>47766</b>
<b>Adults:</b>												

**Fledging Rate in the Fenced Plots:** The fledging rate from fenced plots in 2001 averaged 1.16 chicks per nest (Table 2), the fourth highest rate recorded in the last 19 years (PRBO unpubl. data). For comparison, the long-term average (1983 to 2000) for the Negit Islets is 0.89 (SD = 0.39) chicks per nest.

Table 2. Summary of Nest Counts and Chick Banding on the Negit Islets, 2001.

Site	Total Nests	Chicks per Nest <sup>1</sup>	Chicks Banded (died)		Fledged per Nest
Little Norway	71	<b>1.24</b>	88	(3)	<b>1.20</b>
Little Tahiti West	111	<b>1.23</b>	136	(3)	<b>1.20</b>
Little Tahiti East	69	<b>.86</b>	59	(3)	<b>0.81</b>
Twain North	78	<b>1.58</b>	123	(7)	<b>1.49</b>
Twain South	135	<b>1.18</b>	160	(6)	<b>1.14</b>
Twain Northeast	123	<b>1.38</b>	170	(7)	<b>1.33</b>
Twain West	111	<b>1.33</b>	148	(6)	<b>1.28</b>
Twain New	70	<b>0.91</b>	64	(4)	<b>0.86</b>
<b>Totals / Means:</b>	768	Mean=1.21	948	(39)	Mean=1.16

<sup>1</sup> based on number of chicks banded in each plot, 1-4 July.

**Reproductive Success:** Using the estimate of fledging success from the fenced plots (Table 2), and the total count of nests (Table 1), at least 23,860 chicks fledged from the Negit Islets and Negit Island; about 4075 fledged from the Paoha Islets (J.R. Jehl Jr., pers. com.). This gives an estimate of 27,935 young California Gulls fledging from Mono Lake in 2001. In spite of slightly smaller numbers of nesting adults compared to 2000, the higher nesting success resulted in an increased number of chicks fledging from the lake in 2001.

**Overview:** The reasons for year-to-year variation in the number of adult gulls breeding at Mono Lake and their nesting success remain imperfectly known. During the tenure of this long-term monitoring program, low reproduction has been associated with each period of meromixis (1983-1988, 1996-1999). During these meromictic episodes, the productivity of Mono Lake has been reduced and brine shrimp phenology has been delayed (Jellison and Melack 1999). In both 2000 and 2001, some of the typical effects of meromixis 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 early chick hatching period (R. Jellison, pers. com.; Wrege unpubl. data). In 2001, dense populations of adult cicadas may have accelerated chick growth and contributed to higher reproductive success (Wrege et al. 2001).

Although it warrants concern, the long-term effect of meromixis on gull productivity at Mono Lake is uncertain. 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 falling lake levels (R. Jellison pers. com.). 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. Although Jellison et al. (1998) initially predicted the current episode of meromixis would last for up to several decades, preliminary analysis of additional data suggests that it will not last as long as previously thought (R. Jellison pers. com.). The relatively high reproductive success in 2000 and 2001, following four years of poor reproduction, suggest a pattern similar to the previous meromictic event.

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