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FEMALE-FEMALE PAIRING IN RING-BILLED GULLS

JOHN P. RYDER AND PATRICIA LYNN SOMPPI
Department of Biology, Lakehead University, Thunder Bay, Ontario, Canada P7B 5E1

ABSTRACT.—Female-female pairs of Ring-billed Gulls (*Larus delawarensis*) were recorded attending supernormal clutches (5–8 eggs) on Granite Island, northern Lake Superior in 1978. Female-female pairs complete their clutches usually before the peak of egg-laying in the colony. Supernormal clutches completed after the peak are thought to result from egg-dumping by several unpaired females. Compared to normal 3-egg clutches, laid early in the season, the average hatching success of supernormal clutches was lower (8–20% vs 80-90%) and over 50% of the embryos showed depressed growth and development. Although the phenomenon of homosexual pairing is likely not recent in Ring-billed Gulls, as compared to the situation in Western Gulls, the adaptive significance of such pairs is currently unknown. *Received 5 July 1978, accepted 8 October 1978.*

RECENTLY Hunt and Hunt (1977) reported the occurrence of female-female pairs of Western Gulls (*Larus occidentalis*) on Santa Barbara Island, California. These authors showed that females that remained together annually nearly always attended large (supernormal) clutches containing four to six eggs each. Their paper provided evidence for the first known case of homosexual pairing in a population of wild birds.

In our studies of Ring-billed Gulls (*L. delawarensis*) on Granite Island, Black Bay, northern Lake Superior, we have noted clutches larger than the normal three eggs each year since 1971. Recently Ryder (1975) and Somppi (1978) reported, respectively, 11 of 118 (9.4%) clutches in 1973 and 49 of 405 (12.1%) clutches in 1977 each with 5–8 eggs. Vermeer (1970) and Somppi (1978) did not consider 4-egg Ring-billed Gull clutches to be supernormal, as did Hunt and Hunt (1977) for Western Gulls, but suggested five eggs or more per nest might represent accidental laying in a nest by more than one female.

Stimulated by the report of the association between supernormal clutches and female-female pairs in Western Gulls, along with our annual observations of such clutches on Granite Island, we initiated a preliminary study to determine the sex of the attendants at these nests and the fertility and success of the eggs.

METHODS

Granite Island (48°43′N, 88°29′W) and its Ring-billed Gull colony are described by Ryder (1976) and Somppi (1978). In 1978 we were unable to visit Granite Island until 17 May because of ice conditions in Black Bay. By this time egg-laying was well underway. On 17 May we counted all clutches containing between five and eight eggs. We consider nests that contained more than eight eggs to be dump nests in which two or more unpaired females laid eggs (Chamberlin 1977). We marked each supernormal clutch by placing a numbered wooden block beside the nest. On 2 June, after the peak of egg-laying, we

TABLE 1. Clutch size and hatching success of Ring-billed Gull supernormal clutches, Granite Island, 1978.

	Number of eggs per nest								
	0	1	2	3	4	5	6	7	8
Number of nests									
17 May[a]						19	16	1	1
16 June	4	3	7	5	7	1			
Number of eggs hatched									
Minimum[b]			5	7	3	2			
Maximum			7	9	10	2			

[a] The 37 supernormal clutches found on 17 May were reduced through egg loss to the sizes observed on 16 June. The sample size of 27 nests on 16 June differs from the 37 on 17 May because we collected 10 clutches before any of the eggs hatched.

[b] Minimum hatching success does not include 11 live embryos in 27 nests remaining on 16 June. Maximum success assumes the 11 embryos would have hatched under normal circumstances.

searched the colony again and recorded additional supernormal clutches. We checked each of the original supernormal clutches found on 17 May weekly, and recorded the number and condition of the eggs. Between 3–10 June we attempted to catch the attendants at these nests with a drop-trap described by Mills and Ryder (1979). Each gull caught was sexed by bill measurements (Ryder 1978) and a sample collected to confirm the sex by gonadal inspection. After a mated pair was collected, we opened their eggs to determine fertility and embryonic development (Ryder and Somppi 1977). We replaced these eggs with others from non-study nests to determine whether there were more than two attendants at the supernormal clutches (cf. polygyny, Shugart and Southern 1977). The length, maximum breadth, and volume (Ryder 1975) of 73 eggs in 14 supernormal clutches were recorded to determine if they were smaller than those laid by females of heterosexual pairs (Hunt and Hunt 1977: 1467). We opened all eggs from supernormal clutches that did not hatch and noted the condition of the contents.

Hatching success is defined here as the percentage of eggs laid that hatch.

RESULTS

On 17 May we counted 37 supernormal Ring-billed Gull clutches with an average clutch size of 5.6 ± 0.7 (SD) eggs. By 16 June the average clutch size in 27 of these nests was 2.4 ± 1.5 (Table 1) from egg loss. In view of this change in clutch size, tabulation of supernormal clutches must be completed early in the nesting season. In our case, 96.3% of the supernormal clutches decreased to four eggs or less (Table 1). Consequently, later in the nesting season these clutches cannot be distinguished from normal 2-egg and 3-egg clutches. The total number of Ring-billed Gull nests on Granite Island in 1978 was 1,911 (D. Boersma and K. Quinney pers. comm.) giving a supernormal clutch frequency of 1.9%.

Thirty-four additional supernormal clutches found on 2 June 1978 were considered to be the result of dump nesting and as such are not used in our analyses. It is known that most larids lay eggs at intervals of about 2 days (Hunt and Hunt 1977). Data collected in 1977 (Somppi in prep.) show that the intervals between successive eggs in 34 supernormal clutches completed before or at the peak of egg-laying were too short to be the result of laying by single females in 52.9% (18/34) of the nests. However, none of 18 supernormal clutches that were completed after the peak of egg-laying in 1977 received more than one egg per day or on successive days. Additionally, early supernormal clutches were completed in a shorter time [7.9 ± 1.7 (SD) days] than later ones (18.6 ± 6.8 days) in 1977.

We live-trapped 32 Ring-billed Gulls from the original 37 supernormal clutches. Of the 32 gulls caught and sexed, 31 were females in adult plumage. Five of the 37 nests were attended by female-female pairs, as determined by gonadal inspection.

TABLE 2. Fate of eggs from 37 Ring-billed Gull supernormal clutches, Granite Island, 1978.

Number of eggs laid	206
Number of eggs hatched	17 (8.2)[a]
Number of live embryos collected	26 (12.6)
Dead embryos	22 (10.7)
Infertile eggs	33 (16.0)
Addled eggs	29 (14.1)
Disappeared eggs	51 (24.8)
Eaten eggs	23 (11.2)
Buried eggs	5 (2.4)

[a] Numbers in parentheses are percentages of eggs laid.

The sex of the 10 females from these nests was correctly identified, before necropsy, by the measurement technique in Ryder (1978). All the replacement eggs in the above five nests were either cold or eaten the day after collection. This indicates there are likely only two attendants at supernormal clutches. The attendants collected from one supernormal clutch proved to be a male and a female. An additional six mated pairs were trapped and sexed as females by measurements. One female member of a pair was collected. Her mate was captured and sexed as a female by measurements. Six attendants from six other supernormal clutches from which only one member of the pair was captured were sexed as females by measurement. Concurrent live-trapping at 68 2-egg and 3-egg clutches completed before the peak of egg-laying produced 33 males and 35 females by measurement (D. Boersma and K. Quinney, pers. comm.). These results indicate strongly that clutches of normal size in this species are attended primarily by male-female pairs.

The average length, breadth and volume of 73 eggs from 14 supernormal clutches were 59.9 ± 2.6 (SD) mm, 42.0 ± 1.0 mm, and 51.6 ± 3.6 cc, respectively. These do not differ significantly ($P > 0.05$) from data in Ryder (1975:539) for 3-egg clutches attended by adult-plumaged, presumably heterosexual, pairs.

The fate of supernormal clutch eggs is presented in Table 2. The percentage of eggs containing dead embryos or that were infertile (no development) is high compared to the 7.6% (50 of 657 eggs) found by Somppi (in prep.) in 3-egg clutches in 1977. Since we do not know how many of the 74 eggs that disappeared or were eaten were infertile or contained dead embryos, these infertility and embryo mortality data are minimal.

Fourteen of the 26 live embryos collected from eggs of known minimum age (the clutches were completed by the time of our initial visit to the island on 17 May) were at least 3 days behind in their growth and development characteristics relative to embryos of equivalent minimum age from 3-egg clutches (Table 3). This may have been caused by eggs in supernormal clutches receiving less heat during incubation than eggs in 3-egg clutches. Suboptimal heating during incubation in Ring-billed Gulls increases the incubation period and presumably retards development (Hunter et al. 1976).

The category of eggs that hatched in Table 2 excludes 26 live embryos in the eggs we opened. If these embryos are included, assuming with some reservation that the 26 eggs would have hatched under non-disturbed conditions, maximum hatching success in the 37 supernormal clutches would be 20.9% (43/206). Both the minimum hatching success in Table 2 and the value calculated above to include live embryos are very much below those reported for this species by Dexheimer and Southern (1974), Ryder (1975), Baird (1976), and Somppi (1978).

TABLE 3. Difference in growth and development of 26 live Ring-billed Gull embryos from supernormal clutches relative to equivalent age embryos from 3-egg clutches.

Minimum age of eggs (days)[a]	Minimum age of embryos (days)[b]	Extent of growth and development retardation (days)
22	10–12	10
	16–18 (3 embryos)	4
24	16–18	6
	19–21 (3 embryos)	3
	22–24 (6 embryos)	0
25	22–24 (3 embryos)	1
	25	0
26	14–16 (2 embryos)	10
	16–18	8
	19–21	5
	22–24	2
27	22–24 (2 embryos)	3
	25 +	0

[a] The age of eggs is minimal because all 26 supernormal clutches were complete when found on 17 May 1978.
[b] Aged according to criteria in Ryder and Somppi (1977).

Data in Table 1 indicate that eggs remaining in supernormal clutches that are reduced to 2-egg or 3-egg clutches experience the highest hatching success, even though the values are below the 80–90% reported by Somppi (1978: 31) for clutches of less than five eggs started early in the season.

DISCUSSION

The results of this initial study confirm that female-female pairs exist among nesting Ring-billed Gulls on Granite Island. The phenomenon is very likely not of recent origin in Ring-billed Gulls. If such pairs are usually associated with supernormal clutches, then mated females may have existed at least for three decades, as Moffitt (1942) reported 5-egg Ring-billed Gull clutches on 14 May 1941 in California.

At present we cannot advance a causal or functional explanation for female-female pairings. They may simply be a response to disturbance of the gulls during research activities. Merilees (1974) intimated such human disturbance may have caused Ring-billed Gull supernormal clutches in British Columbia. However, no relationship was reported between human disturbance and large clutches in Glaucous-winged Gulls (*L. glaucescens*) (Gillett et al. 1975), Western Gulls (Robert and Ralph 1975), or Herring Gulls (*L. argentatus*) (Hunt 1972). Further, all the supernormal clutches considered in this report were completed before we started our studies in 1978. Normally no one visits Granite Island, and in 1978 we were on the island the day after ice had moved out of Black Bay. Therefore, it is highly likely that the 37 supernormal clutches forming the basis of this report were laid under normal colony conditions. In view of the above, we consider these clutches to be a natural occurrence in Ring-billed Gulls. Whether or not female-female pairs of Ring-billed Gulls stay together for more than one year or whether they attend only large clutches is currently unknown. The origin of female-female pairs and their adaptive significance have yet to be determined. These topics form, among others, the bases of our continuing studies of Ring-billed Gulls.

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