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RING-BILLED GULLS DISPLAY SEXUALLY TOWARD OFFSPRING AND MATES DURING POST-HATCHING

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While studying Ring-billed Gulls (*Larus delawarensis*) during post-hatching on Mugg's Island, Toronto, Ontario, Canada, I observed adult gulls with offspring performing pre-copulatory and copulatory behavior toward both their young and their mates. Kinkel and Southern (1978) documented three cases of adult female Ring-billed Gulls sexually "molesting" pre-fledging young. Here, I present data on adult-adult and adult-chick sexual interactions, examine associated ecological and behavioral parameters, and discuss the possible proximate causes and functions of these interactions.

METHODS

Description of the site, location of the observation blind and the study plots, and methods for collection of data are briefly reviewed here and given in detail elsewhere (Fetterolf 1979, 1981, 1983). A blind adjacent to three study plots (7 × 14 m) was located near the geographic center of the oval-shaped colony of about 6000 nesting pairs. During the incubation period in all years (1976–1978), nests were labeled with numbered tongue depressors placed near nest rims and nest locations were mapped. The onset of hatching in each nest was determined during visits (to all plots in 1976 and one plot in 1977) or from the blind (for one plot in 1977 and all plots in 1978). From the blind in each year I determined the number of young that fledged (reached 35 days of age).

Ecological parameters.—After the gulls left the site in August, my assistant and I measured five nest-site characteristics (see Fetterolf 1981, 1983). The birds nested in clumps (see Vermeer 1970) and each plot had one or two clumps of nesting birds. I therefore designated birds with no nearby neighbors in one of the major compass quadrants as edge nesters and others as center nesters. Nearby nests are defined as those located within 3 m of a study nest, without intervening nests—that is, there can be only one nearest neighbor along any single line radiating from a single nest. I recorded territory size for nesting pairs in 1976 and 1978 by mapping the location of agonistic encounters between neighbors for each of two subsequent observation days. I quantified the hatching synchrony of each pair with its nearby neighbors by averaging the absolute values of the differences between the hatching date of the first egg of the subject pair and each of its neighbors.

Behavioral parameters.—From the blind, I collected data on adult-adult agonistic behavior, adult attacks on neighboring chicks, intraspecific kleptoparasitism, food provisioning of young, food-begging by chicks, food-begging by adults, and sexual behavior by adults between 15:30 and dark (about 21:00) every second evening. At about 04:30 the morning after spending the night in the blind, I sampled behavior for approximately 5 h. I recorded adult-adult agonistic behavior during 1-min random samples (Fetterolf 1981). All other behaviors mentioned above were noted whenever I saw them and were standardized by dividing by the number of hours of observation for each pair.

Adults and chicks stole food from neighbors infrequently during 1976 and frequently during the last 2 years of the study (see also Elston et al. 1978). I recorded the identity of

the thief and victim whenever possible. I quantified the frequency of robbing by the pair and from the pair. In 1977 and 1978, I counted each feeding by parents and noted the type and amount of food. In 1978, I also estimated the size of food items (about 75% fish) and computed the amount of biomass fed to each brood using regression equations of body weight vs body length for each fish species (J. R. Foster, pers. comm.).

Chicks beg for food by "head-tossing" and by uttering a high-pitched vocalization similar to the adult "head-tossing call" (see below) (Moynihan [1955] for the Black-headed Gull [*L. ridibundus*] and Hailman [1967] for the Laughing Gull [*L. atricilla*]). Whenever chicks in a brood begged for more than 4 min, I counted it as a protracted begging bout. Sometimes adults head-tossed, uttered the associated call, and "robbed" food from their brood while the mate provisioned young. I counted each incident as mate food-begging.

During courtship, sexual displays usually occur in the following order: head-tossing, "copulation call," mounting, and copulation (Moynihan 1958, Southern 1974, Fetterolf 1979). Head-tossing can be performed by both sexes and is characterized by a series of rapid skyward bobs of the bill accompanied by the head-tossing call. The copulation call is typically a male courtship behavior which precedes mounting and can be described as a rapid *ka ka ka* (Southern 1974). Mounting occurs when one individual hops onto the other's back, and copulation ensues when the mounted bird lowers its tail to make cloacal contact. Occasionally, a thwarted mounting or copulation is followed by "tail waggling" (Moynihan [1955] for Black-headed Gull).

Determination of gender.—For each nesting pair, I assigned a gender to each gull using sexual behavior observed during pre-egg-laying, body size (Ryder 1978), head shape (male has less rounded head), and bill length and depth (Ryder 1978). I tested my ability to subjectively determine the sex of Ring-billed Gulls in 1980 and 1981 at the Eastern Headland in Toronto. Colleagues and I trapped 201 gulls in a drop trap (Mills and Ryder 1979) and sexed them using bill measurements (Ryder 1978). Prior to handling the birds, I guessed the gender of each bird from a distance using binoculars. I correctly sexed 97.5% of the birds.

Data analysis.—In 1976, because I concentrated on other research, my records of sexual behavior are probably incomplete. For the first half of 1976, I incorrectly assumed that males were displaying sexually toward chicks. I therefore excluded all 1976 data from the analyses of ecological and behavioral parameters associated with sexual behavior and only report the actor's gender in 1977 and 1978.

I divided the data for adult-adult and adult-chick sexual behavior into two groups: (1) pairs in which at least one individual exhibited sexual behavior (hereafter sexual pairs); and (2) pairs in which no sexual behavior was observed (hereafter non-sexual pairs). Sample sizes were small for sexual pairs in each year (Tables 1, 2) and there were no significant differences ($P < 0.05$) in variance between years (F test). I therefore combined the data and analyzed them with two-tailed t-tests. Whenever an F test indicated a significant difference in variance between sexual and non-sexual pairs for any ecological or behavioral parameter, I used a t-test and calculated a reduced number of degrees of freedom (Dixon and Massey 1969).

RESULTS

Adult-adult sexual behavior.—Fifteen of the 421 (3.6%) pairs that reared young throughout the study (Table 1) engaged in sexual behavior during the post-hatch period. One pair engaged in sexual behavior on three occasions, one pair on two occasions, and 11 pairs exhibited such behavior only once. In all instances of adult-adult sexual behavior, females initiated

TABLE 1
ADULT-ADULT SEXUAL BEHAVIOR FOR RING-BILLED GULLS DURING POST-HATCHING 1976–1978

Year	No. pairs observed	No. incidents		No. pairs involved
		Morning	Evening	
1976	139	3	1	4
1977	156	6	4	7
1978	126	3	2	4
Total	421	12	7	15

head-tossing while the mate provisioned chicks. The age of the oldest chick in each brood ranged from 3–30 days ($\bar{x}$ = 18.84, SD = 8.86, N = 19) when each incident occurred. Males copulation-called while females head-tossed. Males mounted females and performed copulatory tail-lowering during 15 (78.9%) of 19 incidents. Females often ran out from under the male or tried to force him to dismount by pecking violently at his breast. Following copulation, females continued head-tossing and on two occasions were fed by the male. Females were never observed performing copulation call or mounting toward mates but on three occasions they "food-begged" by pecking at the base of the male's bill (Moynihan 1958).

No ecological parameters were significantly different for pairs that engaged in adult-adult sexual behavior and those that did not. Pairs that engaged in sexual behavior performed mate food-begging ($\bar{x}$ = 0.035 per h, SD = 0.031) significantly more often than pairs not involved in sexual activity ($\bar{x}$ = 0.006, SD = 0.011, t = 7.79, df = 10, $P < 0.001$). Ninety one of 156 (58.3%) incidents of mate food-begging in 1977 and 1978 involved females (χ^2 = 4.33, df = 1, $P < 0.05$).

Adult sexual behavior toward chicks.—From 1976–1978, 38 of 842 (4.5%) adults performed copulation call, mounting, tail waggling or copulation toward chicks (Table 2). Based on the number of hours of observation (53% in the morning), more incidents were observed in the evening than the morning (χ^2 = 4.75, df = 1, $P < 0.05$). In 1977 and 1978, 55 of 58 (94.8%) instances of sexual behavior involved adult females as actors (χ^2 = 39.10, df = 1, $P < 0.001$) even though males were on the territory during 46% of all 1-min random samples.

Adults directed sexual displays at their own offspring on 64 (91.4%) of the 3-year total of 70 incidents. Thirty six (51.4%) of these incidents led to copulation with the chick; the remainder included copulation call and often attempted mounting or tail waggling (Table 2). Ten individuals

TABLE 2
ADULT SEXUAL BEHAVIOR OF RING-BILLED GULLS TOWARD CHICKS 1976–1978

Year	No. incidents		Actor's sex		No. adults involved	Behavior			
	Morning	Evening	Male	Female		Copulation call only	Copulation call, mounting attempt	Copulation call, tail waggling	Copulation
1976	4	8	—	—	6	1	1	1	9
1977	16	24	2	38	17	7	6	13	14
1978	8	10	1	17	15	4	1	0	13
Total	28	42	3	55	38	12	8	14	36

displayed toward chicks on two or more occasions and one female behaved sexually toward its offspring 11 times. Sexual displays were performed toward chicks ranging in age from 9–44 days ($\bar{x}$ = 21.1, SD = 7.63, N = 70). Chicks were begging from the adult before and during all but eight cases of sexual behavior. When begging, chicks circled around and close to the displaying adult, much as a female head-tosses to her mate during the pre-egg-laying period. Chicks sometimes avoided mounting by circling more rapidly. When mounted, chicks sat down giving a distress vocalization until the adult dismounted. Occasionally the chick then began to beg again. On eight occasions chicks were sitting and silent when adults displayed sexually toward them. In six of these eight cases, the adults involved displayed sexually toward unguarded neighboring chicks rather than their own offspring.

Only one ecological parameter, the number of nearby neighbors, was significantly related to sexual behavior toward chicks. Pairs that displayed sexually toward chicks had more nearby neighbors than pairs that did not (t = 3.13, df = 280, $P < 0.001$) (Table 3). The former also had significantly more observed chick feedings (t = 3.49, df = 35, $P < 0.001$), more frequent protracted chick begging (t = 3.26, df = 33, $P < 0.01$) and more frequent mate food-begging (t = 2.70, df = 280, $P < 0.01$) than the latter. Unlike mate food-begging and adult-adult sexual behavior, sexual displays toward chicks were not associated with provisioning of young. Food-robbing from neighbors was also more common for sexual pairs than for non-sexual pairs (t = 3.25, df = 32, $P < 0.01$).

DISCUSSION

Apparently, begging for food by a mate or chick sometimes elicited a sexual rather than a feeding response from the accompanying adult. Play-

TABLE 3

VARIABLES WHICH DIFFERED ($P < 0.01$) BETWEEN SEXUAL (N = 31 PAIRS) AND NON-SEXUAL PAIRS (N = 251) FOR COMBINED 1977 AND 1978 DATA

Type of pair	No. nearby neighbors	No. feedings observed/h	Protracted chick begging/h	Mate begs food	Attempted thefts by pair/h
Sexual behavior toward chicks	4.74 ±1.26[a]	0.072 ±0.055	0.0038 ±0.0067	0.013 ±0.015	0.019 ±0.039
No sexual behavior toward chicks	4.06 ±1.14	0.044 ±0.040	0.0012 ±0.0039	0.006 ±0.013	0.007 ±0.015

[a] SD.

backs of the adult head-tossing call during pre-egg-laying demonstrate that this vocalization stimulates sexual behavior in males and females (Fetterolf and Dunham, unpubl.). Pairs that engaged in adult-chick sexual behavior had more nearby neighbors. Perhaps more neighboring chicks provided more auditory stimulation which promoted sexual behavior.

The associations among sexual behavior, begging by mates for food during provisioning of young, and begging by chicks when feeding was not imminent, supports the interpretation that food stress promoted sexual behavior. Male gulls that engaged in sexual display toward mates were paired with females that begged more often when food was offered to chicks and these pairs attempted to rob food from neighbors more than gulls that did not display sexually. Female gulls that displayed sexually toward chicks begged food more often during provisioning of young and reared chicks that begged for more protracted periods when feeding was not imminent. Begging by mates often preceded robbing of food from the brood; robbing is probably a sign of food stress (Elston et al. 1978, Brockmann and Barnard 1979). Glaucous-winged Gull (*L. glaucescens*) chicks increased their begging when deprived of food for long periods suggesting that chick begging is an indicator of food stress (Henderson 1975). Sexual behavior toward chicks occurred more frequently during my evening sampling periods when young were more likely to be food-stressed. Chick provisioning is most frequent in early morning and late evening (Kirkham and Morris 1979) and chicks are not fed very often for periods of 8–10 h during the day. Most of my evening sampling sessions preceded late evening provisioning whereas most morning samples followed feeding.

More frequent chick feedings by pairs which displayed sexually toward chicks seems to contradict the food stress interpretation. However, males

often do most of the foraging, sometimes leaving females on the territory for periods extending over two or more male foraging trips (Fetterolf, unpubl.). These long periods of female presence on the territory often preceded mate food-begging which was more frequent for females than males. Females also performed nearly all sexual behavior toward chicks. Thus, the data are compatible with the hypothesis that food-stressed female gulls elicited sexual behavior from mates and performed sexual behavior toward chicks.

As Kinkel and Southern (1978) commented, it is especially interesting that females performed sexual behaviors indistinguishable from those of courting males. Hunt and Hunt (1977) reported that three female Western Gulls (*L. occidentalis*), in pairs consisting of two females, performed male behaviors such as copulation (see also Wingfield et al. 1982). Female-female pairs occur in Ring-billed Gulls (Ryder and Somppi 1979, Conover et al. 1979), although it has not been reported whether females perform male sexual behavior in these pairs.

It is possible that sexual behavior toward chicks is nonadaptive or maladaptive even though chicks did not appear to be harmed by mounting. However, such behavior in fact may be adaptive because it allows parents to control the behavior of their offspring while minimizing the chances of harming them. Persistent begging by chicks was characteristic of all behavioral sequences leading up to sexual displays by adults and seemed to 'agitate' the parent. The parent had three possible responses: (1) it could endure the harassment; (2) it could leave the territory; or (3) it could try to stop the chick's begging. Prolonged chases around the territory could be energetically costly for both parent and young. Parental absence from the territory exposes the offspring to attacks by neighbors (Fetterolf 1983). If a parent pecks at its own chick to silence it, the parent risks chasing its offspring from the territory and thus subjecting it to attacks by other gulls (Fetterolf 1983). Display of the orange mouth lining during copulation call probably functions as a threat during adult courtship (Fetterolf 1979). This display, sometimes in combination with mounting, may thus provide a low-risk means for female parents to control the behavior of their offspring.

SUMMARY

From 1976–1978, I quantified the sexual behavior of adult male and female Ring-billed Gulls (*Larus delawarensis*) rearing chicks. Male Ring-billed Gulls occasionally displayed sexually to their mates and rarely exhibited such behavior toward their chicks. However, females frequently performed sexual behavior toward their offspring which was indistinguishable from the sexual behavior of courting males. Males exhibited sexual behavior toward their mates when females begged for food during feedings of offspring. Persistent

begging by chicks when feeding was not imminent apparently stimulated females to perform male-like behavior toward them. Females that engaged in sexual behavior with mates or chicks may have been food-stressed.

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