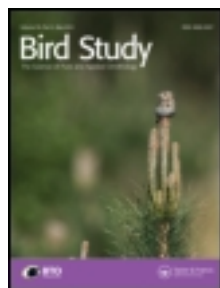


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Do young Ring-billed Gulls *Larus delawarensis* participate in territorial defence?

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The participation of Ring-billed Gulls and their young in ejecting intruders was compared by observing 13 families in the periphery of a colony in southern Quebec. The frequency of assaults suffered by chicks increased as they got older and the frequency of their jabs, charges and attacks against others also increased with age. Actual fights were less frequent than other agonistic patterns. Chicks showed less aggressive behaviour than adults against all classes of intruders. The agonistic behaviour of chicks was principally directed toward non-neighbouring young, whereas parents generally displayed toward other adults.

The participation of older young in territorial activities has been reported anecdotally,^{1,2} but with no detailed analysis of the exact part that they play. This paper reports on the chasing away of intruders by young Ring-billed Gulls *Larus delawarensis*, the relationship between the frequency of their aggressive responses and their age, and the type of intruder against which their agonistic behaviour is principally displayed.

STUDY AREA AND METHODS

Agonistic behaviour of Ring-billed Gulls and their young was studied by observing pairs breeding on the edge of the colony of Ile de la Couvée.^{3,4} The island is located close to the Saint Lawrence Seaway, south of Montreal, Quebec (45°28'30"N, 73°30'30"W). During this study in 1980, 14 730 pairs were breeding.⁵ Our study area contained 13 pairs with chicks, hatched between 13 May and 9 June. Four other pairs in the area abandoned their nests before hatching.

Observations for 223 hr during the post-hatch period were made from 12 May to 13 July from a hide installed before egg-laying began. It was easy to recognize each parent individually by different combinations of

natural marks on their plumage and bill and the colour of their eyes (brown or yellow). According to W.E. Southern (pers. comm.), brown eyes are found only in Ring-billed Gulls less than 3 years old. In fact, our sample was probably typical of birds nesting on the edge of the colony, with a high proportion of birds breeding for the first time and nesting late.^{4,6}

Young were distinguished by colour rings affixed when they were 1–2 days old. Observations of these juveniles were conducted from hatching to fledgling (i.e., just being able to fly), and even later in the case of a few birds which returned to their natal territories after they were fledged.⁴

Defended territories were measured by mapping boundaries where agonistic interactions occurred. We recorded the frequency with which each individual engaged in agonistic behaviour. All behaviour patterns were operationally defined, to remain as consistent as possible with those described by Butler & Janes-Butler.⁷ The following behaviours were analysed in this study:

Jab. Corresponds to gaping jab or jabbing.^{8,9,10} a pecking movement, generally with bill widely open, directed at an opponent, but without actual contact.

Charge. As described by Hand:¹¹ the de-

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fender rushes towards the intruder but does not make contact; the wings are generally extended; the bill may or may not be open.

Attack. As described by Hand¹¹ but differing from Stout.¹⁰ at the end of a charge, the defender strikes, pulls on, bites, or otherwise contacts the intruder.

Fight. Prolonged bout of mutual attack as defined by Butler & Janes-Butler.⁷

The level of an agonistic behaviour was determined by its final stage. Thus, a series of acts that ended with an attack were classified as an 'attack' even if the sequence started with a jab. By 'neighbour' we mean any individual sharing a territory boundary with a given pair or bird; an 'intruder' is any individual (neighbour or non-neighbour) trespassing on the territory of a given pair or bird; 'aggression' is any kind of agonistic interaction (charge, attack, fight, etc.) displayed or suffered by an individual.

Three-way analysis of variance and paired comparison *t*-tests were used to assess differences in the mean frequency scores of agonistic acts according to the age of challengers and intruders, and the status of intruders (neighbour or not). Pearson correlation coefficients were used to measure the relationship between the age of chicks and the frequency of aggressions they suffered from or displayed towards others.

RESULTS

Territories increased markedly and progressively in size after hatching,⁴ the means for the 13 territories (means of 13 means) being:

- before hatching $1.46 \pm 0.91 \text{ m}^2$;
- after hatching $3.81 \pm 2.78 \text{ m}^2$;
- mean difference $2.35 \pm 2.54 \text{ m}^2$.

Chicks began receiving aggression, both from other chicks and adults, when 4 d old. The combined frequency of all types of aggression suffered by chicks was correlated with age (Fig. 1). Chicks were first seen challenging other gulls when 12–26 d old, although some of them may have started assailing others earlier but at a time when the observer was away. The frequency of their jabs, charges and attacks against others also increased with age (Fig. 2). The same was true for the combined frequency of all types of aggression displayed by chicks (Fig. 1). Fights were less frequent

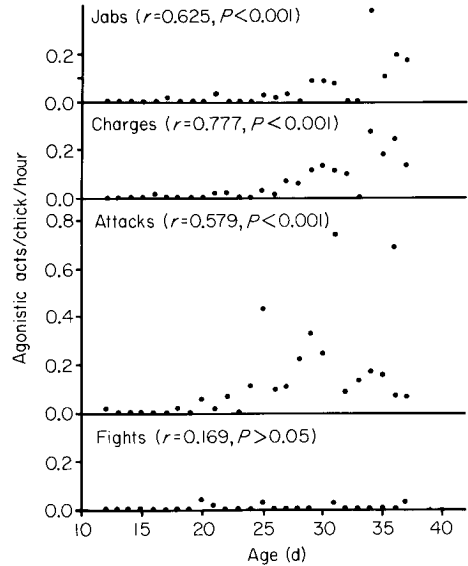


Figure 1. Relationship between the mean combined frequency of all aggressions suffered and displayed by young Ring-billed Gulls and their age. A mean of 5.8 chicks was observed at each stage.

than other types of agonistic behaviour, and a relationship between their frequency and the age of chicks was not conspicuous (Fig. 2).

The statistics of the $2 \times 2 \times 2$ analysis of variance showed the role of the age of the challenger, the age of the intruder and the status (neighbour or non-neighbour) of the intruder as factors affecting the distribution of agonistic acts. The main effects were that of the challenger's age ($F = 45.067$, d.f. = 1, 96, $P < 0.0001$) and the intruder's age ($F = 11.351$, d.f. = 1, 96, $P < 0.005$). Adults challenged and were assailed more often than young (Fig. 3). The interactions between the factors, however, provided the most important and interesting information. In fact, the interaction of challenger's age and intruder's age ($F = 13.415$, d.f. = 1, 96, $P < 0.001$) and that of intruder's age and status ($F = 8.725$, d.f. = 1, 96, $P < 0.005$) were highly significant. Furthermore, the second order interaction (challenger's age \times intruder's age \times intruder's status) was also significant ($F = 6.627$, d.f. = 1, 96, $P < 0.05$). Thus, the mean frequency of agonistic acts of adults and chicks varied differently in respect to the age of the intruders, and assaults against the two age

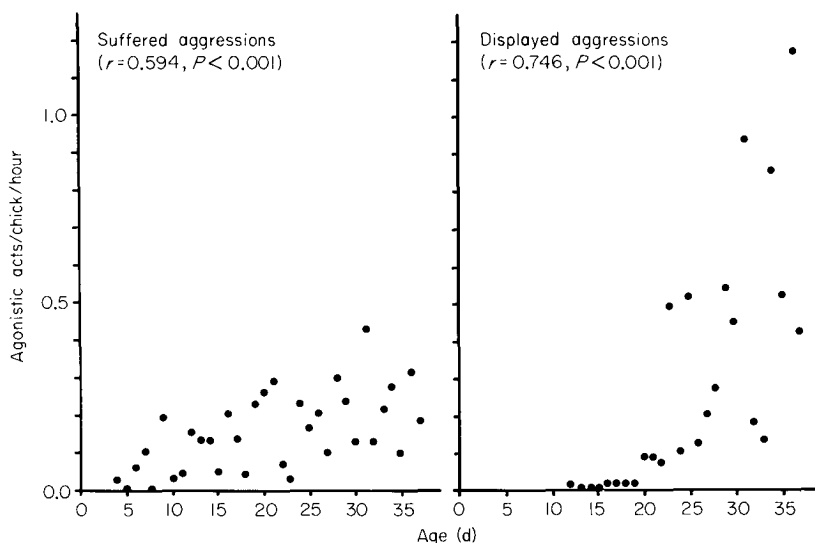


Figure 2. Relationship between the mean frequency of aggressive acts displayed by young Ring-billed Gulls and their age. A mean of 5.8 chicks was observed at each stage.

classes of intruders varied according to their status (Fig. 3). Finally, adults and chicks challenged differently the two age classes of neighbours and non-neighbours.

Several paired comparison *t*-tests also showed differences in the type of intruder challenged by chicks and adults (Fig. 3, Table 1). Adults assailed neighbouring adults

more frequently than non-neighbouring adults, but were aggressive against neighbouring chicks less often than against any other type of intruder. When confronted with non-neighbours, adults made no distinction between adults and chicks. In contrast, chicks principally challenged non-neighbouring young. Thus, adults and young behaved similarly

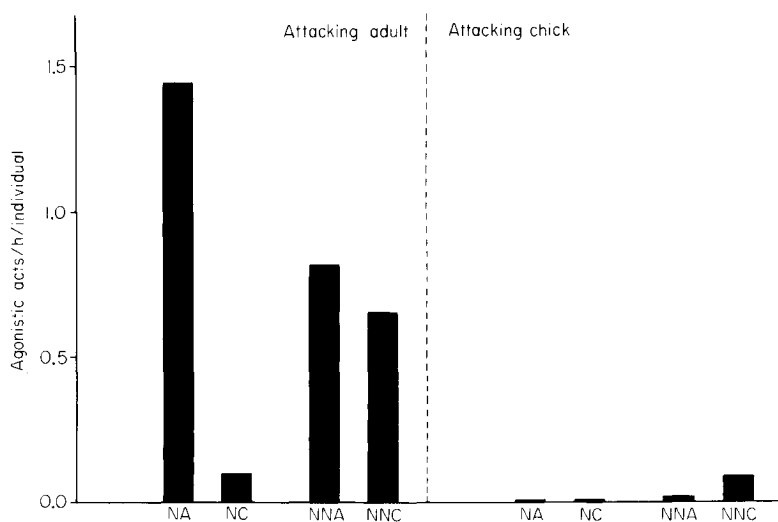


Figure 3. Mean total frequency of agonistic acts displayed by adult and young Ring-billed Gulls against neighbouring adults (NA), non-neighbouring adults (NNA), neighbouring chicks (NC) and non-neighbouring chicks (NNC).

Table 1. Results of paired sample *t*-statistics comparing 1×1 each type of intruder as a function of the mean frequency with which it was assailed by adult and young Ring-billed Gulls

	Comparison of			
	NA & NC	NA & NNA	NC & NNC	NNC & NNA*
Challenging adult				
<i>t</i>	-4.636	2.742	2.971	-0.631
<i>n</i> **	13	13	13	13
<i>P</i>	< 0.001	< 0.01	< 0.006	ns***
	NA > NC	NA > NNA	NNC > NC	—
Challenging chick				
<i>t</i>	-1.720	-0.135	-2.024	-1.881
<i>n</i>	13	13	13	13
<i>P</i>	n.s.	n.s.	< 0.03	< 0.04
			NNC > NC	NNC > NNA

*NA = neighbouring adult, NC = neighbouring chick, NNA = non-neighbouring adult, NNC = non-neighbouring chick.

**Number of pairs and their chicks.

***n.s. = not significant.

towards chicks: they assailed non-neighbours more frequently than neighbours. Chicks challenged neighbouring adults and chicks infrequently, but equally. When confronted with adults, they also challenged both categories infrequently, but again with equal frequency.

DISCUSSION

Our results confirm earlier reports,^{1,2} and Southern's observations (pers. comm.), that chicks may attack and drive away adult gulls much larger than themselves, but show that chicks principally challenge non-neighbouring young. Although gull chicks may attack other gulls much larger than themselves, one might expect unfledged young not to be strong enough to chase away adult intruders. However, they may exhibit behavioural patterns that are effective in intimidating younger gulls, or young of the same age, that are potential food-stealers. The fact that even baby birds are relatively secure, fierce and invincible on their own territory and timid in neighbouring territories has been seen in many species.^{1,12,13,14}

Intraspecific food-stealing has been reported in Ring-billed and other gulls.^{15,16,17,18} Initially,

only adults are involved in food-stealing attempts, but, once they are over 3 weeks old, chicks play an increasing role in piracy.^{15,18} Around 25 June, 15–20-d old young, still too young to fly, began to assemble in groups (crèches) of an average of 10 individuals on the fringe of the area where the nests were located, particularly near the study area; these young often tried to steal food from the regurgitations on nearby breeding territories.⁴ Harassment from pirates, both chicks and adults, forces parents to invest more time in agonistic interactions and to hesitate to regurgitate, alternating between regurgitating food and reswallowing it.^{15,18} Such behaviour by parents was frequently observed on Ile de la Couvée.¹⁹ Being more and more hungry, young become more excited, move more often and over longer distances (even crossing neighbouring territories to non-contiguous ones), and, as potential competitors for regurgitated food, are exposed to aggression from other gulls, adults and young.^{4,20}

Non-neighbours, as food-stealers, are likely to be more assailed than neighbours; far from their hatching territories, non-neighbouring chicks are frightened and display a strong tendency to escape. They are thus forced to return via a series of trespassed territories.

Perhaps this is the reason why non-neighbouring chicks are so much more frequently challenged by both defending chicks and defending adults.

Older chicks receive large food items,^{21,19} which may be also more attractive to pirates. The risk of their meals being stolen may thus increase with age. The greater nutritional need of older offspring, along with the rise of aggressive encounters, occasions additional cost to the parents. However, parents should not provide more parental investment than is beneficial for their own interests,²² so they might not be expected to spend extra time defending their territory against intruders. If this view is correct, one would expect the young to participate as early as possible in territorial defence.

However, do our observations show that chicks really do participate in territorial defence? In fact, the extremely low rates of agonistic behaviour noted for chicks compared with adults probably reflects how much defence by adults is needed to maintain a territory and indicates that the chicks make only little biologically meaningful contribution to territorial defence. Concerning Black-headed Gull *Larus ridibundus* chicks that drove adult gulls away from their nests, Kirkman¹ wrote: 'It is difficult to believe that the behaviour of these chicks is territorial . . .'. Rather, chicks may be defending personal space around themselves, food that is actually available, or a space within which food can in the future safely be delivered; or chick behaviour may be a kind of aggressive 'play' or practice for the aggression or fighting skills that they will need to acquire food or territories later in life.

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