

BRIEF REPORT

Factors Affecting Aggression in a Captive Flock of Chilean Flamingos (*Phoenicopterus chilensis*)

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The influence of pair bond status, age and sex on aggression rates in a flock of 84 captive Chilean flamingos at Zoo Atlanta was examined. Analysis showed no difference between aggression rates of male and female flamingos, but adult flamingos had higher rates of aggression than juveniles. There were also significant differences in aggression depending on pair bond status (single, same-sex pair, male–female pair or group). Bonded birds were significantly more aggressive than single birds, which is consistent with the concept that unpaired birds are not breeding and do not need to protect pair bonds or eggs. Birds in typical pair bonds (male–female) and atypical pair bonds (same-sex pairs or groups) exhibited similar rates of aggression. These results contribute to the existing body of research on aggression in captive flamingos. Zoo Biol 30:59–64, 2011. © 2010 Wiley-Liss, Inc.

Keywords: flamingo; aggression; age differences; sex differences; same-sex pair bond

INTRODUCTION

There are between three and five million flamingos in the world [Conway, 2000]. Four of the six species of flamingos, Lesser, Andean, Chilean, and Puna flamingos, have declining populations because of egg harvesting and habitat

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degradation and are classified as “near threatened” [IUCN, 2009]. Flamingos live in colonies that can number more than 20,000 individuals [Bucher et al., 2000]. Studying flamingos in the wild can be difficult because their movements are unpredictable, colonies are difficult to approach, and identifying individual birds is nearly impossible in the extremely large flocks [King, 2000]. In fact, many elements of flamingo ecology, behavior, and biology remain unknown [Bildstein et al., 2000; King, 2000]. For these reasons, researchers have begun to see the value in studying the smaller, captive populations found in zoos [King, 2008].

Because of the limited breeding success in captive flamingo populations [King, 2006], researchers are especially interested in flamingo behavior during breeding season. Flamingos may begin to breed whenever conditions are favorable [Studer-Thiersch, 2000], and the breeding season therefore can vary from location to location and from year to year. During breeding season, flamingos form pair bonds and engage in aggressive acts to preserve these pair bonds, maintain territories, or protect offspring [Bildstein et al., 1993]. This aggression may result in the destruction of eggs or increased risk of predation on eggs [King, 2006] and hinder captive breeding efforts.

The majority of pair bonds form between one male and one female bird, but up to a third of a captive population can consist of same-sex pairs, trios and quartets [Shannon, 2000; King, 2006]. Birds living in these atypical groups often engage in breeding behaviors. Male–male pairs typically take over an existing nest and egg, and groups with multiple females often destroy the subordinate female’s egg and incubate the dominant female’s egg [Shannon, 2000]. Atypical groupings may form to allow a bird to successfully compete for resources it would not be able to obtain as a single, to provide the benefit of teamwork in chick rearing, and to increase physical size and number to increase success during aggressive encounters [King, 2006].

In the typical male–female pair, the partners share the workload for nest-building, incubation of eggs, defense of the nest and other parental behaviors such as chick-feeding [Cézilly et al., 1994; King, 2000]. Schmitz and Baldassarre [1992] found that pairs in a colony of wild American flamingos (*Phoenicopterus ruber ruber*) often initiated aggressive acts together. However, during nonbreeding times, it has been found that male flamingos initiate more aggressive acts than female flamingos [Schmitz and Baldassarre, 1992]. It is not clear whether male and female flamingos differ in aggressive behavior during the breeding season.

The research on aggression and age in flamingos is also mixed. One study found that during feeding, juvenile American flamingos were more likely to be engaged in aggressive encounters than adults [Bildstein et al., 1991]. However, Schmitz and Baldassarre [1992] found no difference in the number of aggressive acts initiated by adult and juvenile American flamingos at their field site. However, both these studies were conducted during nonbreeding times.

The aim of this study was to investigate the influence of pair bond status, sex and age on aggression rates in a captive population of Chilean flamingos (*Phoenicopterus chilensis*). Because pair bonds and offspring must be protected, often through aggressive acts, we predicted that rates of aggression will be higher in birds that have bonded with one or more birds when compared with those living singly. We were also interested in whether males or females initiated more aggressive acts, and whether juveniles or adults were more aggressive during the breeding season.

METHOD

Subjects

Data were collected on Chilean flamingos at Zoo Atlanta in Atlanta, GA. The captive flock used in our study consisted of 65 adults (37 males and 28 females) and 19 juveniles (6 males and 13 females). Birds were individually identifiable by numbered leg bands, which were used to determine age and sex based on zoo records.

Data Collection

Data were collected by four trained observers at the flamingo exhibit between May and July 2007, the beginning of the breeding season at Zoo Atlanta (Ballance, personal communication). Inter-observer agreement between each observer and an experienced observer was at or above 95%. Observations were balanced between morning and afternoon. Each bird was observed four times per week for 1 min focal scans. To determine pair bond status, “partner” was scored for any bird that was in close proximity to the focal bird (within 1 wingspan), and walked with the focal bird, guarded the nest with the focal bird or helped the focal bird in an agonistic encounter [Studer-Thiersch, 1975]. This study focused on direct contact aggressive interactions, which were recorded whenever a bird extended its neck and pecked at another bird [Stevens et al., 1992].

Data Analysis

Differences in aggression rates among male, female, adult and juvenile birds were analyzed using a two (sex) by two (age) analysis of variance (ANOVA), with α set at 0.05. Differences in aggression according to pair-status (single, male–female pair, same-sex pair or group) were tested using a one-way ANOVA ($\alpha = 0.05$). A planned contrast was run to determine whether birds with a social bond had significantly higher rates of aggression than single birds. In addition, Tukey’s HSD post-hoc comparisons were conducted to determine whether a significant difference in aggression was seen between birds with different variations of social bonding (male–female pairs, same-sex pairs or groups). Analyses were conducted using SPSS version 13.0.

RESULTS

Overall, rates of aggression differed based on the age and sex of the bird ($F(3,80) = 4.10$, $P = 0.009$). Adult birds had significantly higher rates of aggression ($M = 0.22$, $SD = 0.17$) than juvenile birds ($M = 0.08$, $SD = 0.08$), $F(1,80) = 9.49$, $P = 0.003$. There was no main effect of sex on aggression rates, nor was there a significant age by sex interaction (see Fig. 1).

During this study, 36% of the birds were in male–female pairs, 14% were in same-sex pairs, 15% lived in groups and 35% of the flock lived singly (see Table 1). Five of the six same-sex pairs were male–male (see Table 1).

Overall, there were significant differences in aggression rates across pair bond status ($F(3,80) = 3.35$, $P = 0.02$) (see Fig. 2). Socially bonded birds (those in pairs or groups) had significantly higher rates of aggression ($M = 0.22$, $SD = 0.17$) than single birds ($M = 0.12$, $SD = 0.12$), $t(80) = 2.95$, $P = 0.004$. There were no significant differences in aggression rates between the socially bonded groups (see Fig. 2).

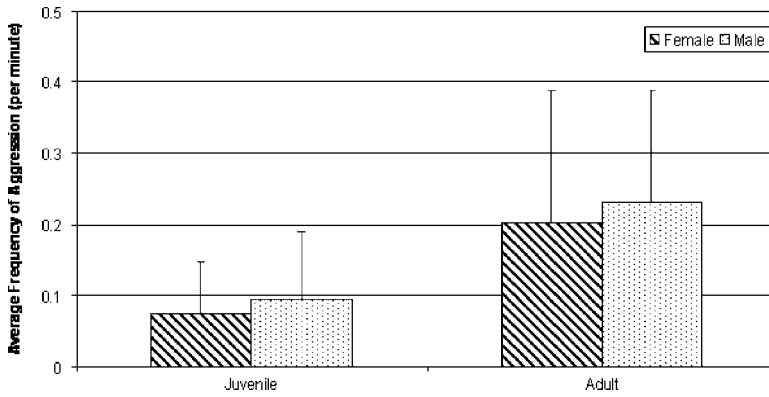


Fig. 1. Aggression rates by sex and age.

TABLE 1. Number of birds classified as single, typical pair (male–female), same-sex pair or atypical group

Pair bond Status	Description	Number of birds
Single	Adult Female	5
	Adult Male	5
	Juvenile Female	13
	Juvenile Male	6
Typical pair	Male–Female	30 (15 pairs)
Same-sex pair	Male–Male	10 (5 pairs)
	Female–Female	2 (1 pair)
Group	2 Female/1 Male	6 (2 groups)
	2 Males/1 Female	3 (1 group)
	3 Males/1 Female	4 (1 group)

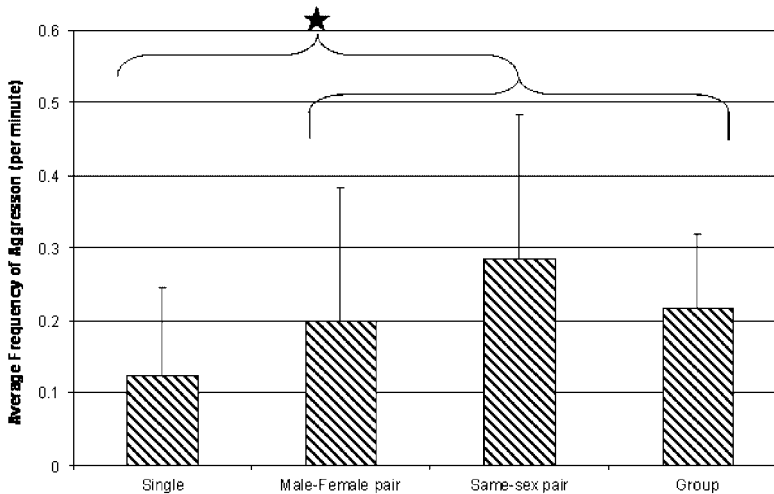


Fig. 2. Aggression rates by pair bond status. *Bonded birds were significantly more aggressive than single birds.

DISCUSSION

We found no sex differences in aggression in our flock of flamingos. This finding is consistent with the Schmitz and Baldassarre [1992] finding that male and female American flamingos exhibit equal rates of aggression. These results suggest that Chilean flamingos may jointly initiate aggression during the breeding season to preserve their social bonds, defend their territories or protect their offspring. Previous research on age-related aggression has been limited to nonbreeding times of year and the results have been mixed. This study found that adult birds initiate significantly more aggressive acts than juvenile birds. A future study should be implemented to collect aggression data during other times of the year to determine whether this age-difference is limited to the breeding season.

Twenty-nine percent of birds in this flock were recorded to live in atypical groups: same-sex pairs, trios or quartets. Atypical pairings may result from skewed sex ratios in the flock, although support for this hypothesis is mixed [Shannon, 2000; King, 2006]. The population in this study was male-biased and the majority of same-sex pairs were male–male. However, a female–female pair was recorded and there were a number of males and females unpaired.

Male–female pairs, same-sex pairs and groups exhibited similar rates of aggression. However, these bonded birds were significantly more aggressive than single birds. Our observations indicated that the same-sex pairs and birds with multiple partners in our flock engaged in nesting behaviors (data not shown). These results suggest that typically and atypically bonded birds may aggressively protect nest mounds, pair bonds and offspring, and that these reproductive pressures are absent in single birds, resulting in lower rates of aggression.

Same-sex pairs can be both disruptive and destructive during breeding season [King, 2006]. Trios can also cause problems for incubating birds. For captive colonies with low reproductive success, any egg loss can be detrimental. Same-sex pairs have been found to take over nests from male–female pairs and incubate eggs, which prevented further disruption of the colony [King, 2006]. Providing atypical pairs or groups with dummy or infertile eggs may therefore decrease aggression rates; however, additional research is necessary to determine the effectiveness of this practice in flamingos.

Our results contribute significantly to our understanding of flamingo aggression, and may have practical implications for reducing aggression and improving reproductive success in captive Chilean flamingos.

CONCLUSIONS

1. Male and female flamingos exhibit similar rates of aggression during breeding season.
2. Adults initiate significantly more aggressive acts than juveniles during the breeding season.
3. During the breeding season, flamingos bonded with one or more bird (male–female, same-sex or group) are significantly more aggressive than birds living singly.

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