

YOM-TOV, Y. 1976. Recognition of eggs and young by the Carrion Crow (*Corvus corone*). *Behaviour* 59: 247–251.

ZINK, R. M., S. ROHWER, A. V. ANDREEV, AND D. L.

DITTMAN. 1995. Trans-beringia comparisons of mitochondrial DNA differentiation in birds. *Condor* 97:639–649.

The Condor 102:438–440
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AN UNUSUAL TYPE OF SIBLING AGGRESSION IN BLACK-CROWNED NIGHT HERONS¹

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Abstract. Sibling aggression varies with brood size, nestling age disparities, and food characteristics. We observed feeding and fighting within two broods of Black-crowned Night Herons (*Nycticorax nycticorax*) in Minnesota. In one nest, on two different days, a senior chick swallowed the head of its smallest sibling, immobilizing it until it seemed near death. Occasional fights also occurred in this nest only. Senior chicks in both nests gained more food than juniors. We discuss possible functions of head-swallows, including how this behavior, as well as fighting and other factors, may have enhanced the feeding advantage of seniors.

Key words: *Black-crowned Night Heron, head swallows, Nycticorax nycticorax, prey size, sibling aggression, sibling competition.*

Sibling aggression varies considerably among the handful of ardeid species that have been studied, from frequently fatal (siblicidal) to virtually no fights (Mock and Parker 1997). Proximate and ultimate influences on fighting in these species include brood size, disparities in sizes/ages of siblings, food scarcity, and prey size (Mock and Parker 1997). This latter, prey-size, hypothesis (Mock 1985) predicts that nestlings should fight when fed items small enough to be economically defensible, but not when fed larger items.

We report an unusual and potentially injurious form of sibling aggression in one brood of Black-crowned Night Herons (*Nycticorax nycticorax*). In two broods, we also investigated feeding frequency, quantity and size of prey, and whether seniors gained a feeding advantage over their junior siblings.

METHODS

Our observations took place on Egret Island Scientific and Natural Area, in Pelican Lake, near Ashby, Grant County, Minnesota, on 8 days between 6–23 June 1998, during a larger study of sibling aggression in

Great Egrets (*Ardea alba*). A mix of Great Egrets, Double Crested Cormorants (*Phalacrocorax auritus*), Great Blue Herons (*A. herodias*), and Black-crowned Night Herons nested in stands of mostly boxelder (*Acer negundo*), which were separated by meadows. Night herons nested from approximately 2.5–5 m high in the trees.

We erected a 2.5-m tall blind within 12 m of two night heron nests, which we observed with binoculars and a spotting scope. We observed nest 1 when chicks were ages 6, 11–15, and 18 days, for a total of 81 hr. We observed nest 2 for 76 hr when chicks were ages 12–16, 19, and 24. On 3 days, we observed both nests continuously from about 05:00 to 22:00, breaking this period into approximately 8 hr shifts by changing observers at 14:00. On other days, we observed for only one 4–8 hr shift. Both nests contained four chicks initially, but in nest 1 a Red-tailed Hawk (*Buteo jamaicensis*) killed the C-chick when the brood was about 14.5 days old and the D-chick had disappeared when the brood was 18 days old.

We classified chicks as seniors (“Srs”) and juniors (“Jrs”) by plumage development and easily distinguishable size differences. Often we could further distinguish the youngest (D-chick) from the other (“C”) Jr. Brood age was the age of the oldest (“A”) chick. For nest 1, we estimated the A-chick’s hatching date as the day before we saw the first feed (Palmer 1962), 4 days after last seeing eggs only. We estimated A’s age in nest 2 as 1 day older than in nest 1 by comparing plumage and motor-skills of the A-chicks.

Each “feed” consisted of a parent regurgitating a series of discrete boluses, no two of which were more than 10 min apart (Mock 1985). We estimated bolus lengths as percentages, to the nearest 10%, of the parents’ bill length from tip to eye. We standardized bolus lengths against a scale drawing of boluses relative to adult head dimensions (Ploger and Mock 1986). We used study skins at the University of Minnesota’s Bell Museum to determine the bill length of seven adult Black-crowned Night Herons from Minnesota. Bill length averaged 9.6 ± 2.6 cm from tip to eye. We thus

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converted bolus lengths to cm by estimating that each 10% of the parent's bill was 1 cm long. Shares of a bolus that were gained by each chick were determined by the proportion (in tenths) of the bolus that each chick received (Mock 1985). The total cm each chick received was calculated by multiplying its share by the bolus length.

We recorded the percentage of direct, defensible, versus indirect, indefensible boluses (Mock 1985). Parents regurgitated indirect boluses onto the nest floor, whereas direct boluses never touched the floor because chicks pulled them directly from the parent's bill. We also calculated the percentage of boluses actually monopolized by being completely consumed by only one chick. Occasional food thefts also occurred when one chick pulled food from another chick's bill.

We classified as aggressive, cases of chicks swallowing another's head or fighting. A fight consisted of a series of blows delivered until no more blows were exchanged for at least 10 sec. Blows involved one chick striking another forcefully with its beak or tightly grasping another's bill while shoving the head back one or more times (Mock and Parker 1997). A head-swallow was when one chick swallowed another's head and neck to the point of wing-attachment and held the victim like this for at least 10 sec.

The nestlings also engaged in mildly aggressive interactions, which we did not call fights. Chicks sometimes faced each other while stretching their necks maximally, as is common in Great Egrets just prior to a fight (Mock and Parker 1997). Chicks frequently grasped each other's bills gently in a series of brief scissor grips until one or both sank down. We suspect that such "scissoring" was one form of what Noble et al. (1938) called "billing," although they also used this term for some behaviors that we might have classified as fights.

Statview 4.51 (Roth et al. 1995) was used for calculating descriptive statistics. Means are reported \pm SD.

RESULTS

In nest 1, three fights occurred, and on two occasions, a Sr chick swallowed the head of the D-chick. No fights or head-swallows occurred in nest 2. The fighting rate for nest 1 alone was 0.86 fights day⁻¹, or 0.14 fights day⁻¹ sibling-dyad⁻¹, in the 3.5 days when the nest had four chicks. All aggressive interactions occurred during feeds. The first head-swallow occurred when the A-chick was 11 days old. Seven minutes after the start of a feed, after 3.5 of 5 boluses were eaten by Srs, the observer noticed a Sr swallowing the head of the D-chick. The D-chick tried to escape while its head was still in the Sr's throat. The Sr then shook D until it was motionless. D's head finally came out, slimy and wet, 2.25 min after the head-swallow was first noticed, 2.9 min after the Sr was standing over the D-chick and may have been swallowing its head. After this head-swallow, the parent brooded the chicks. The second head-swallow occurred when the A-chick was 13 days old. After the only bolus of the feed fell to the floor, a Sr swallowed the D-chick's head for about 3 min. After its release, the D-chick squawked

loudly. The chicks then pecked at the fish on the floor, which was eventually reswallowed by the parent.

The parents at nest 1 fed their chicks slightly smaller boluses than at nest 2 (7 ± 3 cm vs. 8 ± 4 cm, respectively), but delivered more boluses per feed (3.9 ± 2.0 vs. 1.7 ± 0.8 , respectively). These boluses averaged about 70% of the parent's bill-length. Chicks in nest 1 received fewer feeds day⁻¹ (2.3 ± 0.58) than in nest 2 (8.0 ± 2.6), when observed all day, while both broods had four chicks. Nest 1 parents fed 37% of their boluses directly to their chicks, whereas at nest 2, 59% of boluses were delivered directly. The percentage of direct boluses delivered per day was highly variable, ranging from 0–86% when chicks were 6–19 days old. The transition from indirect to direct feeds, when chicks received between 20–80% of boluses directly, was already occurring when chicks were 6 days old (at the start of this study) and continued through age 19 days. Chicks older than 19 days received all boluses directly.

The Srs in both nests received more food per feed than did their Jrs. In nest 1, Srs received 4 ± 5 cm whereas Jrs received 3 ± 7 cm chick⁻¹ feed⁻¹. In nest 2, Srs received 5 ± 5 cm chick⁻¹ versus 3 ± 4 cm chick⁻¹ for Jrs. The Srs in nest 1 monopolized 34% of the boluses and Jrs monopolized 11%. In Nest 2, Srs monopolized 49% of the boluses and Jrs monopolized 17%. Only one of 47 boluses was stolen in nest 1. Of the 72 boluses delivered to nest 2, Srs stole 2 from the D-chick and attempted to steal a third one from that chick.

DISCUSSION

Head-swallows have not been reported in the literature for either night herons or other ardeids in which sibling aggression has been studied extensively. Cattle Egrets (*Bubulcus ibis*) occasionally show this behavior (B. Ploger, pers. observ.), but these observations remain unpublished. One possible reason why head-swallows have not been observed in well-studied Great Blue Herons and Great Egrets is that the size differences between Srs and Jrs might not exceed a certain threshold in these larger ardeids. Another possibility is that the proportionally longer bills of these large ardeids may make performing head-swallows more difficult and risky than in the shorter-billed Cattle Egrets and Black-crowned Night Herons.

Head-swallows may serve a variety of functions. Head-swallows resemble cannibalism, which has been reported occasionally in this species (Gross 1923, Beckett 1964; J. Tims, pers. comm.). Black-crowned Night Heron nestlings preying on nestling White Ibis (*Eudocimus albus*) sometimes swallow them only to the point of wing attachment, and successfully digest the front half of their victims before regurgitating the remains (Beckett 1964). Head-swallows may also cause non-cannibalistic siblicide by suffocating the victim. After both head-swallows that we observed, the D-chick victim appeared limp and nearly dead when it was released. Although head-swallows might occasionally result in the immediate death of the victim, a more common result might be to reduce its participation in competition for food, at least temporarily.

In our night herons, Srs in both nests averaged about

one-third more food per chick than did Jrs. Srs gained this feeding advantage without fighting in nest 2, and with only 0.1 fights day⁻¹ dyad⁻¹ in nest 1. Although no data were provided, Noble et al. (1938) reported a similar pattern in which the oldest, largest chicks gained more fish than smaller nest-mates, a skew that they felt was maintained by "billing." A combination of superior motor skills in scramble competition, mild aggression such as scissoring, and occasional fights and head-swallows may all have contributed to the feeding advantage of Srs in our study.

Sibling aggression in Black-crowned Night Herons may vary among populations, possibly depending on food abundance or prey size. Such a relationship occurs in Great Blue Herons. In this species, fighting was frequent and intense in a population that fed their nestlings small prey, but in another that fed large prey, fighting rates were low (Mock et al. 1987) and similar to those that we found among nestling night herons. As in Great Blue Herons, diet and presumably prey size varies widely among different populations of Black-crowned Night Herons worldwide (Voisin 1991). Within these populations, prey sizes and intake rates vary with time of day, season, and hunting technique (Voisin 1991). In the two Black-crowned Night Heron nests that we observed, the feeding patterns that tended to differ most included the number of feeds per day, the percentage of direct feeds and percentage of boluses monopolized by seniors. Black-crowned Night Herons may be an excellent species to further explore the relationship between prey size, food amounts, and sibling aggression.

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LITERATURE CITED

- BECKETT, T. A., III. 1964. Black-crowned Night Heron feeding behavior. *Chat* 28:93-94.
- GROSS, A. O. 1923. The Black-crowned Night Heron (*Nycticorax nycticorax naevis*) of sandy neck. *Auk* 40:1-30.
- MOCK, D. W. 1985. Siblicidal brood reduction: the prey-size hypothesis. *Am. Nat.* 125:327-343.
- MOCK, D. W., T. C. LAMEY, C. F. WILLIAMS, AND A. PELLETIER. 1987. Flexibility in the development of heron sibling aggression: an intraspecific test of the prey-size hypothesis. *Anim. Behav.* 35:1386-1393.
- MOCK, D. W., AND G. A. PARKER. 1997. The evolution of sibling rivalry. Oxford Univ. Press, Oxford.
- NOBLE, G. K., M. WURM, AND A. SCHMIDT. 1938. Social behavior of the Black-crowned Night Heron. *Auk* 55:7-40.
- PALMER, R. S. 1962. Handbook of North American birds. Vol. I. Yale Univ. Press, New Haven, CT.
- PLOGER, B. J., AND D. W. MOCK. 1986. Role of sibling aggression in food distribution to nestling Cattle Egrets (*Bubulcus ibis*). *Auk* 103:768-776.
- ROTH, J., K. HAYCOCK, J. GAGNON, C. SOPER, AND J. CALDAROLA. 1995. Statview. Version 4.51. Abacus Concepts, Inc., Berkeley, CA.
- VOISIN, C. 1991. The herons of Europe. T. & A. D. Poyser, London.