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Adult Yellow-crowned Night-herons Face in Opposite Directions at the Nest

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ABSTRACT.—Vigilance is especially important in colonial socially monogamous birds during the nesting season as nest materials, offspring, and mates are vulnerable to theft, depredation, and extra-pair copulations, respectively. We found that when both members of a mated pair of Yellow-crowned Night-herons (*Nyctanassa violacea*) were at the nest they faced in opposite directions in 73% of observations, which was significantly more often than would be expected by chance ($P < 0.0001$, $\chi^2_1 = 33.3$). This behavior may improve vigilance against intruders from all directions. When an extra-pair conspecific was present at the nest of a mated pair, members of the pair were significantly more likely to orient in the same direction towards the conspecific rather than face opposite directions. In 95% of all cases in which an extra-pair conspecific was present, at least one member of the mated pair faced it, indicating that extra-pair conspecifics are perceived as threats by nesting pairs. *Received 8 August 2006. Accepted 17 January 2007.*

Birds often benefit from colonial nesting. One of the most important advantages is shared threat surveillance in which predator detection by one member of the colony alerts other members of a potential threat (Lazarus 1979, Lima 1995, Roberts 1996). Another important benefit of living in a colony is predator dilution (Turner and Pitcher 1986, Inman and Krebs 1987). The overall level of predation may increase when bird density increases, but the probability that any particular individual will become prey decreases. These benefits can cause selection to favor colonial nesting.

Nesting in a colony also exposes birds to increased competition for limited resources. In many species, individuals expend both time and energy fighting over mates, territories, nesting materials, and food. These behaviors are exacerbated by the close proximity of other individuals in colonies (Caraco et al. 1980). Thus, natural selection on individuals may favor smaller or less dense colonies.

Most species in the family Ardeidae breed in dense colonies. However, Yellow-crowned Night-herons (*Nyctanassa violacea*) often nest individually or in dispersed colonies (Watts 1989). We have observed Yellow-crowned Night-herons breeding in small clusters of nests present at regular intervals throughout an area of about 3 ha. These dispersed colonies may be a result of opposing selection pressures, such as the risk of predation and cost of competition. It is likely both threat surveillance and predator dilution occur in dispersed colonies, but protection against predators of nestlings may be reduced with decreased colony size and density. Thus, one might expect natural selection to favor increased vigilance by mated pairs in dispersed colonies.

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We collected data on vigilance behavior in mated pairs of Yellow-crowned Night-herons during the breeding season. We addressed the following questions: (1) do members of a nesting pair face in the same or opposite directions at the nest, and (2) does the presence of extra-pair conspecifics influence this orientation?

METHODS

We observed vigilance in a dispersed colony of Yellow-crowned Night-herons in a 3-ha area at the northeast end of the Rice University campus in Houston, Texas (29° 43′ 07.18″ N, 95° 23′ 45.15″ W). The habitat consisted mainly of live oaks (*Quercus virginiana*) (88%) with a small number of loblolly pine (*Pinus taeda*) (5.1%), water oak (*Q. nigra*) (3.6%), willow oak (*Q. phellos*) (1.4%), post oak (*Q. stellata*) (1.2%), yaupon (*Ilex vomitoria*) (0.3%), and Shumard oak (*Q. shumardii*) (0.3%). The herons were observed nesting only in live oaks.

We observed 86 nests on the first day of our study (1 Apr 2005). By the end of our study (20 Apr 2005) we had observed the establishment of 20 more nests for a total of 106 nests. The colony was composed of clusters of 5–10 nests spaced 5–10 m apart. Each cluster of nests was distributed over 5–6 trees with overlapping canopies, and distances between clusters of 15–30 m. During this 20-day period, in which the herons engaged in nest-building, egg laying, and incubation, we surveyed the population once between 0900 and 1100 hrs and once between 1200 and 1400 hrs CST during each observation day. It took 30–60 min to survey the entire site.

We used binoculars to locate pairs of herons either in or near their nests and recorded data only when both adults were present in their nest or on a branch within 1 m of their nest. We recorded the orientation for each pair as opposite or same to describe the directions the mated pair faced when near the nest. We classified herons as having the same orientation if they faced $<90°$ apart or in opposite orientation if they faced $\geq 90°$ to a maximum of 180°. We also noted if an extra-pair conspecific was present within an estimated 5 m of the pair's nest and if either or both members of the pair were facing directly towards it or within $\pm 10°$. We used the statistical package JMP 5.1 for data analysis and considered differences to be significant only if $P < 0.01$ to compensate for a small amount of pseudoreplication (157 observations of 106 nests).

RESULTS

Mated pairs of Yellow-crowned Night-herons faced in opposite directions in 73% of the time (114 of 157 observations, $P < 0.0001$, $\chi^2_1 = 33.3$), and extra-pair conspecifics were present within 5 m of the pair's nest 28% of the time (44 of 157 observations). Fifty-three percent (23 of 43 observations) of same-oriented pairs had an extra-pair conspecific present whereas only 18% (21 of 114 observations) of opposite-oriented pairs had an extra-pair conspecific present. A two-way contingency analysis revealed that extra-pair conspecifics were significantly ($P < 0.0001$, $\chi^2_1 = 19.68$) more common near nests with same-oriented pairs compared to nests with opposite-oriented pairs.

At least one of the resident adults faced the extra pair bird in 42 of 44 observations ($P < 0.0001$, $\chi^2_1 = 44.73$). When both members of the mated pairs faced in the same direction and an extra-pair conspecific was present, they faced towards the conspecific in 96% of the observations (22 of 23 pairs, $P < 0.0001$, $\chi^2_1 = 23.66$). When members of the mated pair were facing in opposite directions, one member of the pair faced the extra-pair bird in 95% of the observations (20 of 21 pairs, $P < 0.0001$, $\chi^2_1 = 21.07$).

DISCUSSION

Yellow-crowned Night-herons are monogamous and nest singly or in dispersed colonies in tall trees (Watts 1995). When both pair members are present, facing in opposite direction provides a collective wider field of view. We found that nesting Yellow-crowned Night-herons faced in opposite directions significantly more often than would be expected by chance and when extra-pair conspecifics were present, pairs more commonly oriented in the same direction towards the conspecifics.

This high frequency of opposite orientation could have developed as a result of predation. Possible predators of eggs and chicks include American Crows (*Corvus brachyrhynchos*), common raccoons (*Procyon lotor*), Virginia opossums (*Didelphis virginiana*), domestic cats

(*Felis catus*), and dogs (*Canis lupus familiaris*) (Watts 1995). We observed only American Crows in the immediate vicinity of the colony, although dogs, cats, and opossums are also present in the area. American Crows elicited alarm calls that alerted other Yellow-crowned Night-herons and caused the crows to leave the area. Facing in opposite directions may facilitate crow detection.

Orientation of mated pairs could result from factors unrelated to vigilance. For example, the size and shape of each heron's body may make it easier for pairs to share a nest when facing in opposite directions. In addition, opposite orientation could be used to keep bills, the primary weapon of ardeids, away from potential mates. We consider these possibilities to be unlikely. For example, opposite orientation was observed even when a member of the pair was on a branch within 1 m of the nest. In those cases, spatial constraints and the possibility of injury would no longer limit orientation.

The colony structure of Yellow-crowned Night-herons may increase vigilance against conspecifics that could steal nesting material, participate in extra-pair copulations, kill chicks, or otherwise diminish a pairs' reproductive success. Early in the nesting season, we often observed conspecifics removing twigs from each other's nests when the occupants were not present, as has been observed by others (Nice 1929, Darden 1962, Bagley and Grau 1979). Theft of nesting material may explain the observed vigilance against conspecifics.

Vigilance of Yellow-crowned Night-herons may result from the threat of extra-pair copulation. Members of a pair in many socially monogamous bird species opportunistically copulate with extra-pair individuals (Jennions and Petrie 2000, Griffith et al. 2002). Darden (1962) described a Yellow-crowned Night-heron courtship triad in which a female performed courtship behavior with two males, then mated with one, and eventually pair-bonded with the other.

Another explanation for vigilance against extra-pair herons is depredation of chicks. Juvenile Black-crowned Night-herons (*Nycticorax nycticorax*), a closely related species, have been observed depredating chicks and adults have been observed eating Cattle Egret (*Bubulcus ibis*) chicks (Riehl 2006; D. W. Mock, pers. comm.). Yellow-crowned Night-herons may do the same.

We believe the high frequency of opposite direction orientation by Yellow-crowned Night-herons probably functions in nest vigilance.

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