NEST GUARDING BEHAVIOR BY MALE GRAY CATBIRDS

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IN the study of the breeding biology of passerine birds, the relationship between the activity of the female and the activity of the male during incubation has received little attention in the literature. The male Gray Catbird (*Dumetella carolinensis*), which does not incubate, does spend a considerable amount of time near the nest and thus provides an ideal species in which to study the behavioral relationships of the male and female during incubation.

The Gray Catbird is relatively abundant and is one of the most widely distributed mimids of North America. Although a common nesting bird of the eastern United States and southern Canada, few studies on the breeding biology of the Gray Catbird are available in the literature (Grabrielson 1913, Bent 1948, Zimmerman 1963, Graber et al. 1970, Darley et al. 1971).

Skutch (1953) suggested that nonincubating male birds may coordinate their movements with those of incubating females in two forms: (1) standing guard over the nest during the female's recesses and (2) accompanying the female on her recesses. Standing guard (or "nest guarding") has been reported for the Gray Catbird previously (Whittle 1923, Davis 1942, Skutch 1953, Zimmerman 1963). However none of these reports contained the necessary quantitative data to distinguish nest guarding from random movements in the nesting territory or from an unusual territorial configuration.

Nest guarding by males or at least coming to the nest vicinity when the female is absent has been reported for many passerine species. Following is a report of the results of field investigations of the nest guarding behavior of the male Gray Catbird, evidence for the coordination of male and female activities during incubation, and speculation on the significance of this behavior.

METHODS

I studied Gray Catbirds in northeastern Franklin County, Ohio from March 1971 until August 1972. The 33.2-ha study area was located 1.6 km east of New Albany, Ohio, south of the intersection of state route 161 and Blacklick Creek.

Four nests were studied intensively for a total of 252 h. Daily observations were made from a portable blind placed 6 m from the nest. Observation periods of 4½ h were defined at 0500–0930, 0930–1400, and 1400–1830, all Eastern Standard Time. During the nesting cycle observations were made in each period approximately the same number of times. Observations of nest guarding behavior began as soon as an

TABLE 1
NEST GUARDING DISTANCES FOR MALE GRAY CATBIRDS

Year–nest	Number of observations	Mean guarding distance (m) ± SD	Minimum guarding distance (m)	Minimum singing distance (m)
1971-A	53	2.22 ± 1.36	0.3	1.5
1971-B	35	1.42 ± 1.03	Nest rim	2.0
1972-C	79	2.16 ± 0.87	0.3	0.3
1972-D	88	1.90 ± 0.97	Nest rim	0.5
Totals	255	1.98 ± 1.07		

appropriate nest was found and were terminated when the nest was destroyed by predators, female brooding time was less than 50% of a 4½-h observation period, or observations were begun at other nests.

Davis (1942) and Zimmerman (1963) indicated that male Gray Catbirds guard within a few feet and 2.4 m from the nest, respectively. With these distances in mind, and taking into account the infinite possibilities of vegetational configuration around a nest, I defined a distance of 5 m from the nest as the nest guarding area. Red flags placed approximately 5 m in radius from the nest and in sight of the blind delineated the guarding area.

Nest guarding as defined here occurred when the male spent a significantly greater amount of time within the 5-m ring while the female was absent than he did when she was present. If the male entered the 5-m ring while the female was absent from the nest, he was said to be guarding the nest.

The time, duration, and type of the male's vocalizations were recorded and compared to the behavior of the female. As soon as possible after observation of a nest had begun, an attempt was made to capture and color band at least one member of each pair. At the four nests one member of each of three pairs was banded, and the male of the fourth pair was readily identifiable by missing rectrices. At these four nests the sex of the individuals of each pair was inferred from behavior. Only one member of each pair incubated (presumably the female) and only one member of each pair sang the advertising song (presumably the male).

RESULTS

During the periods when the females were off the nest in the egg-laying and the incubation stages the males, while inside the 5-m ring, typically preened, sang, or gave wing-flips. Wing-flipping behavior has been described previously for the Gray Catbird by Zimmerman (1963). In any guarding session, the male often performed all three of these behavior patterns. The males sometimes visited the nest, but usually remained on nearby perches. During the nestling stage the males also foraged for food inside the ring and frequently fed the nestlings. The average distance from the nest to the perches used by the males while inside the 5-m ring is shown in Table 1. For 255 distance observations the mean nest guarding distance was 1.98 m. Male singing during nest

TABLE 2
SUMMARY OF NEST GUARDING BEHAVIOR OF MALE GRAY CATBIRDS

Nest	Duration of observations in nesting cycle	Hours of observation	Percent time in ring per period	
			♀ on nest	♀ off nest
1971-A	Incubation day 2, nestling day 2	58.5	3.24	46.84
1971-B	Incubation day 1, incubation day 10[1]	45.0	4.07	43.06
1972-C	Egg day 2, nestling day 2	72.0	5.50	75.50
1972-D	Incubation day 2, nestling day 6	76.5	5.33	60.81
Totals and Means		252.0	4.67 ± 4.04[2]	58.60 ± 23.09[2]

[1] Destroyed by predators.
[2] Mean ± SD.

guarding sessions was usually soft. The male at nest 1972-C sang on one occasion 0.3 m from the nest.

The percentage of time the male of each pair of Gray Catbirds spent inside the 5-m ring is given in Table 2. In each of the 56 observation periods the percentage of time the males spent inside the ring when the females were absent was greater than while the females were present. The hypothesis that the males spent percentagewise more time in the ring when the female was absent than when present was tested using a one-tailed *t*-test of the differences in the two percentages. The average difference, 53.93%, was significantly greater than zero ($P < 0.01$).

In order to test for possible differences among the observation periods in the percentage of time the males spent inside the ring under the two conditions (female on the nest, female off the nest) an angular transformation (Sokal and Rohlf 1969) of the corresponding percentages was performed. A one-way analysis of variance of the transformed data indicated that the average percentage of time the males spent inside the ring when the females were on the nests did not differ significantly among the three daily observation periods ($P > 0.05$). Likewise a one-way analysis of variance of the transformed data indicated that the average percentage of time the males spent nest guarding did not differ significantly among the three observation periods ($P > 0.05$). The combination of the time the females spent incubating plus the time the males spent nest guarding resulted in the presence of at least one adult in the 5-m ring 87.1% of the observed time.

The average length of the guarded inattentive periods was significantly

longer than the average length of the nonguarded inattentive periods ($P < 0.01$, Student's t-test). While the males were present inside the 5-m ring, the mean length of 403 female inattentive periods was 8.99 ± 5.27 (SD) min. While the males were absent from the 5-m ring, the mean length of 86 female inattentive periods was 6.19 ± 4.26 (SD) min.

The behavior of the males was found to affect the attentive behavior of the females. An attentive period was said to be terminated by the male if he was present or if he vocalized immediately preceding (within 1 min) the female's leaving the nest. Only complete attentive periods (beginning and ending within the 4½-h observation periods) were included. The mean length of the nonmale-terminated attentive periods was significantly longer than those terminated by the male ($P < 0.05$, Student's t-test). The average length of 176 nonmale-terminated attentive periods was 20.76 ± 11.63 (SD) min while the average length of 317 male-terminated attentive periods was 18.75 ± 10.06 (SD) min.

A summary of the aggressive encounters at the watched nests is given in Table 3. These encounters were noted with 25 other avian species and with one mammal. The most numerous encounters were between one or both members of a nesting pair and other Gray Catbirds.

During observations at the four nests 507 female nest departures were counted (including attentive periods that began prior to the beginning of my observations). The known behavior of the males that occurred within 1 min prior to the females' departure included vocalizations or the presence of the males near or in the ring wing-flipping. These activities or signals occurred prior to 64% of the females' departures. Of those signaled departures from the nest 67% occurred after a male vocalization. The most common vocalization was a song (77%) whereas call notes occurred in 23% of the instances.

Upon leaving the nest the female often gave call notes whether or not the male was present. If the male was present in the ring the female frequently flew to the male who often fed her. Shortly thereafter the female left the nest vicinity. The male often gave soft songs upon the female's return to the nest.

Discussion

Smith (1966) reported a coordinated system of cycles that involved alternate periods of incubation and foraging by the female Eastern Kingbird (*Tyrannus tyrannus*) and alternate periods of guarding and foraging by the male. His data for the Eastern Kingbird show that the two cycles are coordinated via the adjustment of the female's cycle by the coming of the male to guard the nest. The failure of the male kingbird to appear resulted in the female staying near the nest during her recess.

TABLE 3
LIST OF SPECIES INVOLVED IN AGGRESSIVE ENCOUNTERS WITH MALE GRAY CATBIRDS

Species	No. of Encounters
Downy Woodpecker (*Dendrocopos pubescens*)	3
Blue Jay (*Cyanocitta cristata*)	2
Carolina Chickadee (*Parus carolinensis*)	1
Tufted Titmouse (*P. bicolor*)	1
White-breasted Nuthatch (*Sitta carolinensis*)	1
House Wren (*Troglodytes aedon*)	2
Carolina Wren (*Thryothorus ludovicianus*)	1
Gray Catbird (*Dumetella carolinensis*)	24
Brown Thrasher (*Toxostoma rufum*)	4
Swainson's Thrush (*Catharus ustulatus*)[1]	2
Cedar Waxwing (*Bombycilla cedrorum*)	2
Red-eyed Vireo (*Vireo olivaceus*)	2
Yellow Warbler (*Dendroica petechia*)	6
Black-throated Blue Warbler (*D. caerulescens*)[1]	1
Chestnut-sided Warbler (*D. pensylvanica*)[1]	1
Ovenbird (*Seiurus aurocapillus*)[1]	1
Mourning Warbler (*Oporornis philadelphia*)[1]	1
Canada Warbler (*Wilsonia canadensis*)[1]	2
American Redstart (*Setophaga ruticilla*)[1]	2
House Sparrow (*Passer domesticus*)	13
Brown-headed Cowbird (*Molothrus ater*)	2
Cardinal (*Cardinalis cardinalis*)	20
Indigo Bunting (*Passerina cyanea*)	2
American Goldfinch (*Spinus tristis*)	1
Field Sparrow (*Spizella pusilla*)	2
Song Sparrow (*Melospiza melodia*)	6
Unidentified (avian)	6
Eastern chipmunk (*Tamias striatus*)	1
Total	112

[1] Occur only as migrants in study area.

The evidence presented here indicates a similar coordinated system in the Gray Catbird. The relatively long attentive periods that were not terminated by the males imply a reluctance on the part of the females to leave the nest unattended. Similarly the relatively short inattentive periods of the females while the males were absent from the ring imply a reluctance of the females to stay away from an unattended nest. Zimmerman (1963) suggested that the female Gray Catbird's recesses were longer when the male was near the nest than when he was not present. Verbeek (1970) and Smith (1966) noted similar phenomena in the Water Pipit (*Anthus spinoletta*) and the Eastern Kingbird, respectively.

Coordination between the male and the female in any such system necessarily involves communication. Numerous authors have mentioned vocal or behavioral communication between a male and an incubating

female (Nice 1937, Pitelka 1940, Nice and Thomas 1948, Putnam 1949, Kendeigh 1952, Brackbill 1958, Cox 1960, Zimmerman 1963, Prescott 1964, Smith 1966, Verbeek 1970). The data presented here add further to this list, as 64% of the females' departures from the nest were preceded by auditory or visual signals from the males.

The coordination between the male and the female may be further enhanced by the behavior and vocalization of both individuals in addition to the male's signals immediately preceding the female's departure from the nest. The male's frequent singing while guarding may allow the female to monitor the male's location while she is foraging. Upon the female's return to the nest, typically the male sang softly and gave wing-flips, which may give her further information on his location.

Vocalization by the female may also aid in adjusting the two cycles. On occasion the females gave call notes from the nest while the males were singing or just as the females left the nest. Such behavior would inform the male of the female's location.

The nature of the nesting habitat of the Gray Catbird further focuses on the importance of auditory and visual signals. The Gray Catbird typically nests in lowland thickets or shrubs (Graber et al. 1970). The use of song and wing-flipping to effect communication between the nesting pair appears to be highly adaptive for a species that nests in dense vegetation. Andrew (1961) noted that warblers that nest in thick cover utilize song and exaggerated tail flicks as a means of maintaining contact between a pair. Similarly, Zusi (1969) contends that the trembling of wings characteristic of the Trembler (*Cinclocerthia ruficauda*) makes the birds conspicuous and appears to function as a social signal.

Smith (1966) cautioned that nest guarding may not be taking place simply because a bird perches near the nest without any other apparent functional reason for being there. He states that guarding implies chasing or attempting to chase all potential predators from the vicinity of the nest. The aggressive encounters given in Table 3 include a large number of interspecific contacts including such known egg predators as the Blue Jay (*Cyanocitta cristata*), House Wren (*Troglodytes aedon*), the eastern chipmunk, and the brood parasite, the Brown-headed Cowbird (*Molothrus ater*). Zimmerman (1963) reported male Gray Catbirds attacking the House Wren, the Brown-headed Cowbird (plus six other avian species), and a blue racer (*Coluber constrictor*). Because of the number of interspecific contacts and because the Gray Catbird chases known predators from the vicinity of the nest, guarding appears to be the function of the male Gray Catbird's aggressive behavior while near the nest.

Nest guarding behavior, a form of territoriality, may have evolved in response to potential competitors, i.e. Cardinals (*Cardinalis cardinalis*),

Song Sparrows (*Melospiza melodia*), and conspecifics; but I suggest that nest guarding may have also evolved as a response to predation. The continuous presence of one adult near the nest implies an adaptive mechanism for protecting the nest from predators. Putnam (1949) thought the high nest success (76%) of Cedar Waxwings (*Bombycilla cedrorum*) was partially due to the constant attendance of one or both adults at the nest. For 49 nests in this study the nest success of the Gray Catbird was 69% (at least one nestling fledged). Other workers have found similarly high nesting success in the Gray Catbird—Kendeigh (1942) 70%, Berger (1951) 62%, and Zimmerman (1963) 61%.

The coordinated nest guarding system of the Gray Catbird may also account in part for the low incidence of Brown-headed Cowbird parasitism on Gray Catbirds reported by Friedmann (1963) and Rothstein (1971). Owing to the difficulties of locating observable nests early in the nesting cycle the onset of nest guarding behavior was not determined. However, nest guarding was observed in progress at two nests on days eggs were laid. At one of these nests a Gray Catbird chased a female Brown-headed Cowbird from the ring. No data are available on the time of the initial daily nest guarding bout for either of these two nests. Typically during the incubation and nestling stages nest guarding began with the female's first nest departure. If daily nest guarding during the egg-laying stage begins with the female's initial nest departure then nest guarding would further deter cowbird parasitism, as cowbirds usually lay their eggs early in the morning (Hann 1941). Although the Brown-headed Cowbird was a common breeding bird in the study area, only one Gray Catbird nest was found with a cowbird egg. The nest was deserted after all the eggs were punctured.

Friedmann (1963) and Rothstein (1971, 1974) report that cowbird eggs are removed from the nest by Gray Catbirds. Ejection, therefore, may account for the relatively low incidence of cowbird parasitism in this species. I predict that few cowbird eggs are laid, owing to the continuous presence of one of the adults. Similarly Ricklefs (1969) suggested that increased tenacity to the nest during the egg-laying stage may be one adaptive strategy against the brood parasite. Nest guarding as reported herein may be another strategy that reduces the brood parasite's impact on the host.

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SUMMARY

The nest guarding behavior of male Gray Catbirds was studied during two breeding seasons. The males spent a significantly greater amount of time near the nest when the females were absent from the nest than when the females were present. Females were found to spend more time away from the nest when the males were guarding than when the males were not guarding. Likewise, the attentive periods of the females terminated by a male signal were found to be significantly shorter than those periods not terminated by a male. Coordination between the male and the incubating female was affected primarily by vocalizations. The almost continuous presence of an adult near the nest may be a factor in preventing nest predation and may play a significant role in deterring Brown-headed Cowbird parasitism of Gray Catbird nests.

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