

NOTES ON EGG-LAYING, INCUBATION, AND NESTLING PERIODS AND OF FOOD BROUGHT TO THE NEST BY FOUR SPECIES OF CAVITY-NESTING BIRDS

BILL E. DUYCK¹ & DOUGLAS B. McNAIR²

Since 1986, Duyck has studied and photographed cavity-nesting birds in the open woodland of his suburban yard at 628 m elevation near Bear Creek Road, Asheville, Buncombe County, North Carolina. He has documented the egg-laying, incubation, and nestling periods for 1–2 pairs each of four species. He usually first visits the nest around 0800 h; additional visits may be made later in the day. Estimates of the incubation period (measured from the time the last egg is laid to the time the last egg hatches) assume eggs are laid in early morning prior to the first visit of the day. Estimates of the nestling period must be more flexible, because hatching and fledging occur throughout the day. Fortunately, Duyck often was at the nest when those events occurred. He photographed food brought to the female by the male during the egg-laying and incubation periods, as well as food brought to the nestlings by both sexes during the nestling period. Details on nest box construction for each species are available from Duyck or from a video developed by the Cornell Laboratory of Ornithology.

Eastern Screech-Owl

One pair of red-phase Eastern Screech-Owls (*Otus asio*) nested in a man-made poplar (*Populus* sp.) cavity in 1986 and 1988. The cavity entrance is 4.1 m above ground.

In 1988, eggs were laid on 15 and 16 April. On 13 May, both eggs hatched synchronously. On 12 June, both young fledged and were photographed.

This female Eastern Screech-Owl laid her small clutch of two eggs at an interval of approximately one day, not 2–3 days (Sherman, 1911; Harrison, 1975). The incubation period was approximately 27 days. Fledging of the two young was also virtually synchronous; the nestling period was 30 days.

In both 1986 and 1988, the male screech-owl brought birds to the female inside the cavity during all three stages of the breeding cycle. Among other species, we have identified Eastern Meadowlark (*Sturnella magna*), Common Grackle (*Quiscalus quiscula*), American Goldfinch (*Carduelis tristis*), and a wren as prey.

In 1988, at least during the latter half of the nestling period, the pair took a variety of animals, many of which they probably obtained from several creeks 201–402 m from the nest site. Especially interesting prey were the Two-lined Salamander (*Eurycea bislineata*) (Figure 1) and an unidentified salamander (*Desmognathus* sp.). Also brought to the nest were many crayfish (see Craighead and Craighead, 1956), several freshwater shrimp, a bat, a moth, a beetle, and a spider.

Eastern Screech-Owls are opportunistic foragers, and birds may compose a large portion of their diet (Allen, 1924; Bent, 1938; and others). Salamanders are rarely, though regularly, captured as prey in some areas, including North Carolina (Stewart, 1969). Our pair of screech-owls favored foraging along



Figure 1. The male Eastern Screech-Owl brought a Two-lined Salamander to the nestlings (female absent) inside the nest cavity. Photo by B. Duyck.

streams, and we suspect salamanders may be more frequent prey than heretofore known in the southern Appalachian Mountains, the world center of salamander species diversity and abundance.

Red-bellied Woodpecker

In 1989, a pair of Red-bellied Woodpeckers (*Melanerpes carolinus*) nested in a section of a Black Locust (*Robinia pseudo-acacia*) mounted on a pole. On 17 May, the female laid the first egg and the clutch of four was completed on

20 May. The first egg hatched on the morning of 31 May. By the afternoon, another egg had hatched. By the morning of 1 June, a third egg had hatched. The remaining egg did not hatch. The incubation period for this pair of Red-bellied Woodpeckers was 12 days, or as much as one day less. In May 1990, the incubation period recorded was also 12 days.

The nestling period in 1989 could not be determined because the three nestlings died on 21 June of hematophagous mite parasitism (Figure 2). For the



Figure 2. By 19 June, the three nestling Red-bellied Woodpeckers were dying as a result of hematophagous mite parasitism, despite frequent food provisioning by the adults. Photo by B. Duyck.

3–4 days prior to death, the young had been listless, despite frequent food provisioning by the adults. The mite infestation was apparent on 4 June, four days after hatching. Hippoboscid flies were also seen on the adults. In 1990, the

young starved before fledging because screech-owls evicted the parents from the cavity.

The only specific foods we could identify between the adults' mandibles were many earwigs, bark beetles, caterpillars, and moths. Of 19 documented trips to the nest to feed the nestlings in 1989, the male made 18.

Northern Flicker

In 1989, a pair of Northern Flickers (*Colaptes auratus*) nested in the same poplar cavity used by breeding Eastern Screech-Owls in 1988. The female flicker completed laying an uninterrupted sequence of 8 eggs in early May (including one runt egg; color photo not reproduced here). The incubation period for this first clutch was 11 days. Soon after hatching, the nestlings were eaten by an unknown predator.

The female flicker laid the first egg of the second clutch in the early morning on 20 May, and she laid one egg a day until 23 May when the fourth egg was laid. She then skipped a day and laid a fifth egg in the early morning of 25 May. Five eggs were still in the nest on 27 May. On 28 May, a sixth egg was in the nest, though on 29 May, one of the eggs was missing. At this point, egg-laying in this nest was complete. On 6 June, three of the nestlings hatched in the morning and one more young was breaking out of the egg; the fifth egg did not hatch. Between the evening of 7 June and the morning of 9 June, the four nestlings starved to death, because the parents failed to return to the nest.

Northern Flickers normally lay one egg each day until the clutch is complete (Harrison, 1975; Jackson, 1977). It is highly unusual for interruption of egg-laying to occur twice in one clutch (we assume the two eggs laid after 23 May were laid by the same breeding female). Back-dating from hatching of the young on 6 June to 23 May at the conclusion of uninterrupted egg-laying gives an incubation period of 14 days + 3 h., within the reported range of 11-14 days (Jackson, 1977). If the two other eggs of this indeterminate egg-laying species had been laid without interruption, the incubation period would have been about 12 days. If incubation commences with the laying of the penultimate egg, which in our case was laid on 25 May, then the incubation period would still have been about 12 days, rather than the unacceptably short 9-day period between laying of the last egg on 28 May and hatching on 6 June.

We are uncertain what caused the female to interrupt laying of the second clutch twice in late May. We have no evidence that a second female laid eggs in the poplar cavity. Northern Flickers and Eastern Screech-Owls alternated nesting in this cavity for four years, from 1986 to 1989. Duyck has observed both flickers and screech-owls prospecting for a nest-site at the entrance from 1986 to 1988 while the other species was inside the cavity during the egg-laying or the incubation stage of the breeding cycle. On the evening of 28 May 1989, he heard a commotion at the nest cavity, and soon thereafter saw a screech-owl in the backyard. An egg was missing on the morning of 29 May; it may have been damaged during the commotion and removed by a flicker. We do not believe a flicker removed an undamaged egg in response to nest disturbance (Baker, 1975), because the pair remained to breed and no more eggs disappeared. We believe, though without certain evidence, that the screech-owls may have killed one or both nesting flickers, or otherwise forced the pair to abandon the nest between the evening of 7 June and the morning of 9 June.

Screech-owls prey on flickers at the nest (Landin, 1978) and are known to displace species as large as Pileated Woodpeckers (*Dryocopus pileatus*) from their nest cavity (Connor, 1973). In addition, screech-owls interfered with nesting Red-bellied Woodpeckers and White-breasted Nuthatches in 1990 causing adults of both species to abandon nesting attempts during the nestling stage. We suspect that disturbance by screech-owls during egg-laying stressed the female flicker, causing her to interrupt egg-laying twice because the owls were contesting the flickers for occupation of this nest-site.

White-breasted Nuthatch

A pair of White-breasted Nuthatches (*Sitta carolinensis*) nested inside an aged 46.5 cm-long section of a cherry (*Prunus serotina*) snag in 1989. The bottom of the sectioned piece is 1 m above ground. The cavity entrance is 4.4 cm. The longest length inside the cavity is 30 cm. The inside diameter is 11.5 cm.

On 7 April 1989, the pair of nuthatches evicted a pair of Carolina Chickadees (*Parus carolinensis*) from this nest-site, removed their moss from the cavity, and caulked it outside on the nest box. The nuthatches relined the cavity with their own nest material of straw, pieces of bark, plant stems, plant down, and masses of fur. Earlier that morning, the pair had examined at least two other cavities in the yard, but rejected them. Both sexes engaged in nest-building; in addition, the male fed the female while she was building. Only the male had black head feathers. The pair continued nest-building until a few days after the first egg was laid.

The first egg was laid on the morning of 12 April. Three eggs were in the nest on the morning of 14 April. One egg was accidentally destroyed, which may have caused the female to interrupt egg-laying for one day, as the fourth egg was not laid until the morning of 16 April. The clutch was completed on the morning of 18 April, when the sixth egg was laid (five eggs now in the nest). Three eggs hatched during the morning of 3 May. The fourth egg hatched between 1200 h on 3 May and 0800 h on 4 May. The fifth egg did not hatch. The estimated incubation period was 15 days + 11 h (or 15 days, if measured to the time the first three young hatched).

In 1990, a pair of White-breasted Nuthatches nested inside another cherry snag, with a cavity entrance hole of 3.3 cm diameter. Seven eggs were laid during the first nesting attempt in mid-March but the incubation period was not determined. The first egg of the re-nesting attempt was laid on the morning of 14 April and the clutch of 6 was completed on 19 April. On 3 May, the eggs were still unhatched. On 4 May, all 6 eggs had hatched and the adults were feeding young. The estimated incubation period was 15 days.

Both estimates of the incubation period for the White-breasted Nuthatch are considerably longer than the questionable 12 days given by Allen (1929) and quoted in Tyler (1948a). Allen also stated that both sexes incubate. Butts (in Tyler, 1948a) stated the male White-breasted Nuthatch does not incubate. Although Sheppard and Klimkiewicz (1976; and pers. comm.) said "nuthatch males do incubate but do not develop a full edematous brood patch," they were unable to provide a reference for their statement. Duyck did not see the male White-breasted Nuthatch incubate (or brood) at Asheville, N. C., nor are we aware of a source with published data that states males may incubate in any of the three other nuthatch species in North America. We believe incubation by

male White-breasted Nuthatches needs to be confirmed, as well as the incubation period of 12 days, because we are skeptical that Allen's account is accurate. Perhaps Allen mistakenly attributed defensive behavior at the nest by the male White-breasted Nuthatch for incubation (see Hailman and Woolfenden, 1985).

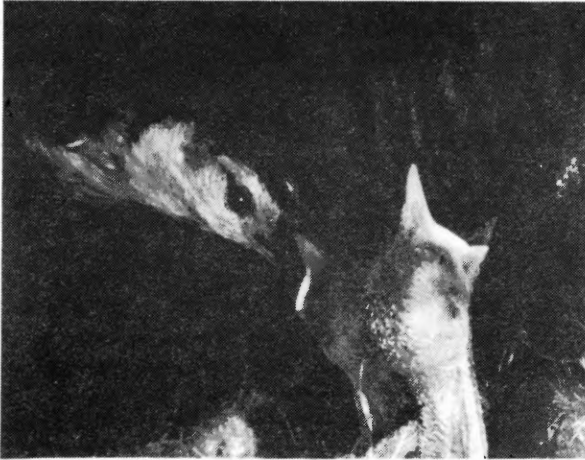


Figure 3. On 13 May, the eyes of the nestling White-breasted Nuthatches were half-open. Compare the eye of the nestling on the right with the eye of the adult nuthatch. Photo by B. Duyck.



Figure 4. On 17 May, the nestlings began preening while many body contour, wing, and tail feathers were still in the pin stage. Photo by B. Duyck.

On the day the nestlings hatched in 1989, the female brooded the young and fed them, chiefly with food provided by the male. Nestlings were pho-

tographed inside the nest cavity on the day of hatching and next on 9 May (day 7). Photographs were taken daily from 9 May to the completion of the nestling period (the nest and slides prepared from the photographs have been archived at the Laboratory of Ornithology, Cornell University).

On 9 May, the nestlings' eyes were closed. On 13 May, their eyes were half-open (Figure 3). On 16 May, the nestlings began exercising their wings. On 17 May, they frequently exercised their wings; they also began preening their feathers, though many body contour, wing, and tail feathers were still in the pin stage (Figure 4). For the first time, the female did not remain overnight in the nest to brood the young on 17 May, nor did she do so again during the nesting cycle. On 22 May, the nestlings still exercised their wings and preened their feathers. Some down feathers were still attached to the tip of the shaft of emerging feathers, especially in the region of the head and neck (Figure 5). On day 20, all young walked around inside the nest cavity for the first time. On 23 and 24 May, both adults were still feeding the young (3 males; 1 female) and carrying the fecal sacs away. At 1010 h on 25 May, the adults were still engaged in the same behavior. At 1440 h, one nestling finally fledged. At 1450 h, the last nestling fledged, and the adults busily fed the young outside the nest. Thirty-two days later, the adults were still feeding suet and sunflower seeds to at least three of the fledglings.

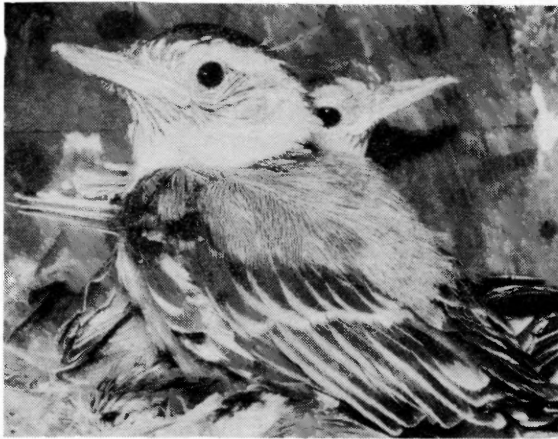


Figure 5. On 22 May, the nestlings began walking around inside the nest. Some down feathers were still attached to the tip of the shaft of emerging feathers, in the region of the head and neck. Photo by B. Duyck.

If calculated from the time the last egg hatched, the nestling period for this brood of White-breasted Nuthatches is 21 days \pm 11 h. If calculated from the time the first three eggs hatched, the nestling period is 22 days + 7 h.. We are unaware of any source with published data that documents the nestling period of the White-breasted Nuthatch. Typical nestling periods for the Red-breasted (*S. canadensis*), Pygmy (*S. pygmaea*), and Brown-headed (*S. pusilla*) nuthatches range from 18–21 days (Tyler, 1948a, 1948b; Harrison, 1978; McNair,

1984), though estimates for the Red-breasted Nuthatch are claimed to be as low as 14 days (Tyler, 1948b). However, we believe Tyler's low estimate needs to be confirmed.

Our brief description of the gross morphological and behavioral development of the four young White-breasted Nuthatches cannot be compared with other sources because none are adequate. Therefore, we are uncertain that either of our calculations of the nestling period is long for the White-breasted Nuthatch. Based on our data, we believe the female discontinued brooding the young after day 14 (after the midpoint of the nestling period), because the young had attained thermogenic homeothermy (Dunn, 1975; O'Connor, 1984).

During the nestling stage of the breeding cycle in 1989, both sexes fed the young (30 documented trips; M = 18, F = 12). Up until day 11, the male primarily brought food to the nest. After day 14, both sexes fed the young about equally. Food items brought to the nest during the 30 trips were winged insects (n = 8), caterpillars (n = 5), grubs (n = 4), moths (n = 3), a spider (n = 1), and unidentified prey (n = 9).

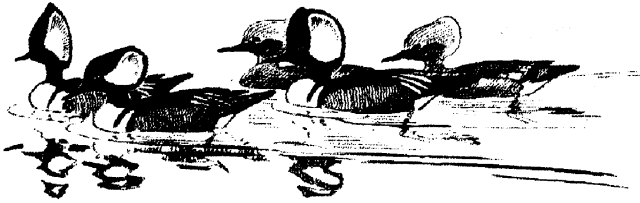
Acknowledgments: We thank all who assisted us with preparation of our paper. R. C. Bruce confirmed identification of the Two-lined Salamander. R. N. Conner, L. Kilham, C. A. Long, E. F. Potter, J. R. Walters, and an anonymous individual reviewed the manuscript. We also thank the Laboratory of Ornithology, Cornell University, for archiving the 1989 nest of the White-breasted Nuthatch, the senior author's slides of breeding behavior at that nest, and for producing a video on cavity-nesting birds that breed in the senior author's yard.

LITERATURE CITED

- Allen, A. A. 1924. A contribution to the life history and economic status of the Screech Owl (*Otus asio*). Auk 41:1-16.
- _____. 1929. Nuthatch. Bird-Lore 31:423-432.
- Baker, J. N. 1975. Egg-carrying by a Common Flicker. Auk 92:614-615.
- Bent, A. C. 1938. Life histories of North American birds of prey. Pt. 2. Bull. U.S. Natl. Mus. No. 170.
- Conner, R. N. 1973. Screech Owl displaces nesting Pileated Woodpeckers. Bird-Banding 44:316.
- Craighead, J. J., and F. C. Craighead. 1956. Hawks, owls, and wildlife. Harrisburg, Penn., and Wildl. Manage. Inst., Washington, D. C.
- Dunn, E. H. 1975. The timing of endothermy in the development of altricial birds. Condor 77:288-293.
- Hailman, J. P., and G. E. Woolfenden. 1985. Nest-defense of the Florida Scrub Jay and the problem of "incubation" by male passerines. Wilson Bull. 97:370-372.
- Harrison, C. 1978. A field guide to the nests, eggs and nestlings of North American birds. Collins, London.
- Harrison, H. H. 1975. A field guide to birds' nests. Houghton Mifflin Company, Boston.
- Jackson, J. A. 1977. How to determine the status of a woodpecker nest. Living Bird 15:205-221.

- Landin, M. C. 1978. Screech Owl predation on a Common Flicker nest. *Wilson Bull.* 90:652.
- McNair, D. B. 1984. Clutch-size and nest placement in the Brown-headed Nuthatch. *Wilson Bull.* 96:296-301.
- O'Connor, R. J. 1984. *The growth and development of birds.* John Wiley and Sons Ltd.
- Sheppard, J. M., and M. K. Klimkiewicz. 1976. An update to Wood's Bird-Bander's guide. *North American Bird-Bander* 1:25-27.
- Sherman, A. R. 1911. Nest life of the Screech Owl. *Auk* 28:155-168.
- Stewart, P. 1969. Prey in two Screech Owl nests. *Auk* 86:141.
- Tyler, W. M. 1948a. White-breasted Nuthatch. Pp. 1-12 in Bent, A. C., *Life Histories of North American nuthatches, wrens, thrashers, and their allies.* Bull. U. S. Natl. Mus. No. 195.
- _____, 1948b. Red-breasted Nuthatch. Pp. 22-35 in Bent, A. C., *Life Histories of North American nuthatches, wrens, thrashers, and their allies.* Bull. U. S. Natl. Mus. No. 195.

¹ 53 Merion Drive, Asheville, NC 28806. ² 303 Robinson Street, Rockingham, NC 28379.



Association of Field Ornithologists

Interested in the study of birds? You might enjoy membership in the Association of Field Ornithologists (AFO). They offer a terrific quarterly *Journal* that includes articles on field research techniques and on the life history, ecology, behavior, migration, and zoogeography of birds. The journal includes Spanish abstracts, reviews of scientific articles published in other journals, and an annual supplement, *Resident Bird Counts*. Members also receive a bimonthly *Ornithological Newsletter* with job opportunities (paid and unpaid) and other scientific bird news, a chance to attend the annual meeting, discounts on mist nests, and more. Send \$21 (\$15 for students, \$45 for institutions) to AFO, c/o Allen Press, Inc., P.O. Box 1897, Lawrence KS 66044, or ask for our brochure (same address).