area of the upper mandible below the nostrils. This area remains yellow in museum specimens as much as a century old, clearly contrasting with the dull black of the remainder of the bill. In young Black-billed Cuckoos, the lower mandible varies from the black of the upper mandible to blue-gray in color. In those examples whose lower mandibles were blue-gray in life, the color fades to white in museum specimens. In the Meridian bird, the lower mandible is yellowish brown, contrasting much less with the upper mandible than in Yellow-billed Cuckoos, and darker than any museum specimen examined of the latter species. It is thus intermediate between the yellow lower mandible of Yellow-billed Cuckoos and the black (rather than blue-gray) extreme of lower mandible color in young Black-billed Cuckoos.

The measurements presented by Ridgway (U.S. Natl. Mus. Bull. 50, Pt. 7, 1916) indicate that adult Black-billed Cuckoos have, on the average, shorter wings and bills but longer tails than adult Yellow-billed Cuckoos. The sexes are alike in size. First-year specimens measured for this study (as mentioned, nine of each species) confirm all except the tail differences; there was no significant difference in tail lengths between the two series, and the Yellow-billed Cuckoo series included both the longest- and shortest-tailed specimens. The measurements (mm) were as follows: flattened wing—Black-billed Cuckoos 128.5–141 (134.5), Yellow-billed Cuckoos, 140–152.5 (145.0), hybrid 142; tail—Black-billed Cuckoos, 134–150 (142.8), Yellow-billed Cuckoos 132–161 (143.9), hybrid 136; bill from anterior end of nostril—Black-billed Cuckoo 15–19.5 (17.1), Yellow-billed Cuckoos 18–20 (18.7), hybrid 17.5. The hybrid thus has a wing length like that of a large Black-billed Cuckoo or small Yellow-billed Cuckoo, a tail length within the range of both species, and a bill length like an average Black-billed Cuckoo or a very small Yellow-billed Cuckoo. In all other characters (color, pattern), the Meridian specimen is essentially intermediate between the two species, although more like the Yellow-billed Cuckoo in tail, wing and bill color and more like the Black-billed Cuckoo in underparts color.

Hybridization is apparently rare in the family Cuculidae. None has been reported prior to my describing a hybrid Philippine Coucal (*Centropus viridis*) × Lesser Coucal (*C. bengalensis*) (Parkes, Living Bird 4:94–95, 1965). I know of no other record of hybridization between the Yellow-billed and Black-billed cuckoos, which are widely sympatric in North America. Each of these species of *Coccyzus* is known occasionally to lay eggs in the nest of the other (several references given by Bent 1940:56). It is tempting to speculate that one of the parents of the Meridian bird hatched from such a misplaced egg and was thus imprinted on the wrong species.—KENNETH C. PARKES, *Carnegie Museum of Natural History, Pittsburgh, Pennsylvania 15213.* *Accepted 15 Feb. 1984.*

Wilson Bull., 96(2), 1984, pp. 296–301

Clutch-size and nest placement in the Brown-headed Nuthatch.—Brown-headed Nuthatches (*Sitta pusilla*) occupy southeastern pine forests from eastern Texas to Florida, north to Arkansas and the southern tip of Delaware; an insular race occurs on Grand Bahama Island (A.O.U. Checklist 1983). Data on their nesting biology are scattered except for that collected by Norris (Univ. Calif. Publ. Zool. 56:119–300, 1958). Information on clutch-size, nest placement, and other aspects of nesting biology throughout the species' range is available on oology cards and in the literature. Collation and study of data from these sources has allowed me to quantitatively examine some facets of Brown-headed Nuthatch breeding biology.

Methods.—I requested oology data from various museums and used a total of 372 cards. In addition, I conducted a literature search for nesting records (N = 35), received Cornell Nest Record Card Program (NRCP) data (N = 22), and solicited information from indi-

viduals. Most nests were only visited once, and I treated all data having complete egg sets accordingly. The date of clutch initiation was determined by a procedure similar to that of Anderson and Hickey (Wilson Bull. 82:14–28, 1970). (For data in the literature and from the NRCP, I followed the method of Myres, Bird Study 2:2–24, 1955.) The egg sets were arranged into five groups depending on estimates of the length of time they had been incubated. The estimated date of clutch initiation was equal to the date the egg set was collected minus clutch-size plus 1 day; additional days were then subtracted from these dates according to the collector's estimation of incubation time elapsed: fresh = 2, slight = 4, advanced = 10, unknown = 7 (half of incubation period). If the number of days of incubation had been estimated and stated explicitly, I used that number. This fifth group then overlaps groups one through four. Clutch-size, estimated by nestling sets, was significantly lower than estimates of clutch-size by egg sets ($t = 3.57$, N = 369/20, $P < 0.01$), and thus, nestling set data were not used.

Average clutch-size was calculated from clutches containing no fewer than three eggs. Smaller clutches were assumed to be incomplete and were not used in the analysis; this involved fewer than 15 nest records. This assumption is supported by accounts in Bent (U.S. Natl. Mus. Bull. 195, 1948), Norris (1958) and others.

Results.—An analysis of variance was performed comparing the five incubation-stage groups with respect to both the date of clutch initiation and clutch-size. I found no significant differences among any of the five incubation groups with respect to either the date of clutch initiation or clutch-size. Accordingly, I pooled data on date of clutch initiation and clutch-size from all incubation groups.

The majority of nest records are from coastal regions of Florida, Georgia, North Carolina, and South Carolina. The mean egg date for all states in the range of the Brown-headed Nuthatch is 9 April ± 19 days (SD) (median = 7 April), as suggested in the literature (Howell, Florida Bird Life, Coward-McCann, New York, New York, 1932; Burleigh, Birds of Georgia, Univ. Georgia Press, Athens, Georgia, 1958; Norris 1958; Oberholser, The Bird Life of Texas, Vol. II, Univ. Texas Press, Austin, Texas, 1974; Haney, Migrant 52:77–86, 1981; and others). The egg-laying period spanned approximately 2 months within each state and 90% of all clutches were laid before 5 May. The onset of breeding began rapidly around 10 March and the distribution of egg dates was slightly skewed to the right. There are six records of renesting attempts and two records of second broods. Several late records extended into mid-July (Coffey, Chat 7:77, 1943; six eggs, incubation fresh, Chatham County, Georgia, 20 July 1925, collected by T. D. Perry). There are no significant differences with respect to mean egg date among Florida, Georgia, and South Carolina; in those states, mean egg date ranged from 4–6 April ± 17–20 days (SD). The mean egg date in North Carolina was 23 April ± 16 days (SD), which is significantly different from the other three states (ANOVA, $F = 13.22$, $P < 0.005$). I also tested for differences in mean egg date among latitudes (range = 27–38°N), when egg dates are grouped according to 1°-latitudinal increments. I found no significant differences in mean egg date of any one latitude in pairwise comparisons with all other latitudes, i.e., no single latitudinal group stood alone, apart from all the others, though there are several homogeneous subsets (ANOVA, $F = 10.56$, $P < 0.005$; Student-Newman-Keuls test).

The mean clutch-size for all states is 5.10 ± 0.91 (SD) (N = 369). Clutch-size ranged from three to seven and I included one record of a clutch of nine (Arnow, Auk 24:447, 1907). The modal clutch-size throughout the brownhead's range is five (146 nests, 39.6%) and the next most frequent is six (115 nests, 31.2%), except in Florida where the first and second most common clutch-sizes are four and five. There is a significant positive correlation between clutch-size and latitude ($r = 0.29$, $P < 0.005$) and a significant negative correlation between clutch-size and date of clutch initiation ($r = -0.18$, $P < 0.005$). Compared to all

TABLE 1
CLUTCH-SIZE OF THE BROWN-HEADED NUTHATCH

State	N	$\bar{x} \pm$ SD
Florida	80	4.50 ± 0.80[a]
Georgia	96	5.17 ± 0.90
South Carolina	90	5.38 ± 0.76
North Carolina	61	5.11 ± 0.90
All other states (N = 9)	42	5.43 ± 1.00

[a] Homogeneous subsets, Student-Newman-Keuls test.

other states, only Florida had a significantly smaller mean clutch-size (ANOVA, $F = 14.23$, $P < 0.005$; Student-Newman-Keuls test; Table 1) and this is also true when adjusted for date of clutch initiation. When clutch-size data from Florida were removed, there was no significant correlation of clutch-size with latitude ($r = 0.01$, $P > 0.05$). I also tested for differences in mean clutch-size among latitudes, when latitudes were grouped according to 1°-latitudinal increments. I found no significant differences in mean clutch-size of any one latitude in pairwise comparisons with all other latitudes, i.e., no single latitudinal group stood alone, apart from all the others, though there are several homogeneous subsets (ANOVA, $F = 7.44$, $P < 0.005$; Student-Newman-Keuls test).

The incubation period for Brown-headed Nuthatches, as measured from the last egg laid to the last egg hatched, is given as 14 days (Grimes, Florida Nat. 6:8–13, 1932; Bent 1948; Beers, Chat 16:78–80, 1952; Quay, Chat 19:87–88, 1955; Norris 1958). The mean nestling period is about 18.5 days (Bent 1948, Norris 1958). Nestling periods of 18–19 days (Norris 1958; Norwood, Chat 23:82, 1959), 19 days (Draper—observer, Guilford County, North Carolina, 1973, from NRCP), 19–20 days (Norwood, Chat 20:73–74, 1956), 20 days (Beers 1952, Norris 1958), and 23 days (Norwood, Chat 19:19–20, 1955) have also been recorded. These longer nestling periods involved pairs breeding later than usual, renesting attempts, or second broods after successful fledging of a first clutch.

Double-brooding by Brown-headed Nuthatches has been documented by Norwood (1956, 1959) and claimed by Becket (*in* Sprunt and Chamberlain, revised by Burton, South Carolina Bird Life, Univ. South Carolina Press, Columbia, South Carolina, 1970). Nicholson stated (on oology slip with egg sets) that brownheads may rear two broods in Flagler County, Florida, as did Baynard (Auk 30:240–247, 1913) for Alachua County, Florida. Possible double-broodedness was recorded in Atlanta, Georgia (Eyles and Giles, Auk 52:462, 1935) and in North Carolina (comment on oology slip with egg sets collected by T. A. Southwick).

Nest-sites were grouped into 12 categories (Table 2). Nests were found in various conifers including longleaf (*Pinus palustris*), slash (*P. elliottii*), loblolly (*P. taeda*), pond (*P. serotina*), shortleaf (*P. echinata*), sand (*P. clausa*) and Virginia (*P. virginiana*) pines, baldcypress (*Taxodium distichum*), and Atlantic white-cedar (*Chamaecyparis thyoides*). Hardwood trees containing nests included willow (*Salix* spp.), poplar (*Populus* spp.), pecan (*Carya illinoensis*), oaks (*Quercus* spp.), sycamore (*Platanus occidentalis*), sweetgum (*Liquidambar styraciflua*) (most frequent hardwood used), pear and apple (*Pyrus* spp.), peach (*Prunus persica*), prickly-ash (*Xanthoxylum* spp.), holly (*Ilex* spp.), black tupelo (*Nyasa sylvatica*), dogwood (*Cornus* spp.), ashes (*Fraxinus* spp.), and *Catalpa* spp. The modal cavity height for all nest-site categories was 1.2 m (17.4%). The median cavity height was 1.5 m. The cavity height distribution was strongly skewed toward higher cavity heights (mean height

TABLE 2
NEST-SITE LOCATION AND CAVITY HEIGHT (M)

Nest-site	N	$\bar{x} \pm$ SD
Pine trunk	22	3.78 ± 2.65
Stump	144	1.86 ± 1.34
Limb	1	9.15 —
Deciduous trunk	7	3.69 ± 2.14
Stump	21	2.17 ± 1.04
Limb	1	3.05 —
Nest box	15	1.80 ± 0.34
Post	39	1.25 ± 0.55
Pole	4	4.82 ± 1.01
Tree unidentified	6	3.75 ± 2.29
Stump unidentified	45	1.86 ± 1.25
Other nest-sites	4	4.27 ± 1.20
Total	309	2.09 ± 1.59

of 2.1 m ± 1.6 SD). Ninety percent of all cavity heights recorded were below 3.66 m. The lowest nests recorded included one at 15 cm (Wayne, Birds of South Carolina, Contrib. Charleston Mus. No. 1, 1910), one at 30 cm (Sprunt, in litt.), and five at 45 cm in fence posts and pine stumps. Wayne (1910) recorded a cavity at 27.5 m. Nest-sites in pine stumps, deciduous stumps, unidentified stumps, posts, and nest boxes, with nesting cavities located at mean heights of less than 3 m, are most frequently used. All other nest-sites, with cavities at mean heights of greater than 3 m, were infrequently used, except for pine trunks (Table 2). These results on nest placement agree with the literature (Bent 1948, Norris 1958, and others).

Secondary cavities are rarely used. There were some records of nests in nest boxes (N = 20; see also Table 2) and natural cavities (N = 24). There are also single records of brownhead nests in an old Downy Woodpecker (*Picoides pubescens*) hole in a limb of a yellow pine (St. Marys County, Maryland) and in an abandoned woodpecker hole in a cypress fence post (Orange County, Florida).

Unusual nest-sites used by Brown-headed Nuthatches have been recorded. A cavity was dug in the side of a 7.5-cm plank leaning against a tree in open pine woods at Savannah, Georgia (Burleigh 1958). Fire scar depressions in old pines have been used and naturally occurring cavities under bark have been used without excavation (at least 12 records). A hole 0.6 m above the ground in a railroad crosstie (Hopkins, The Birdlife of Ben Hill County, Georgia, Occ. Publ. No. 5, Georgia Ornithol. Soc., 1975), a cavity in a decayed pole of a timber boom in a bayou, holes in wooden pilings, wooden street sign posts, and other natural cavities of pine and fence posts have also been used. Brownheads frequently select nest-sites in clearcuts, along roadsides, in windbreaks, over ponds, and in fields. Burleigh (1958) found a nest in a fence post in a field 460 m from the nearest woods.

Brownheads may start several excavations before finishing the eventual nest cavity (Bent 1948, Norris 1958, many egg collectors in litt.). Since they usually excavate their own nest, partially rotted wood is a prerequisite. The sapwood is excavated from between the bark and heartwood, and the cavity often follows the outline of impenetrable heartwood (May,

Bird-Lore 27:383–386, 1925; Norris 1958). Cracks and crevices in the nest cavities are plugged up with bark shreds (Nicholson, in litt.; several other records). Pine stumps and posts, particularly those with bark attached, are favored (Table 2). Cedar, especially unshaven cedar posts with bark attached, are also among preferred nest-sites for brownheads.

Cavities are usually long, narrow, and irregular in size and shape. The largest natural cavity size recorded was 10.2 × 10.2 × 20.3 cm. Most nest boxes had larger dimensions. The largest was 14.0 × 12.7 × 20.3 cm. Cavity depth was measured from the bottom of the cavity entrance to the bottom of the cavity (N = 69). Values ranged from 7.6–40.6 cm with most of the total ranging from 12.7–25.4 cm, with modes of 15.2 and 20.3 cm. This agrees with the literature (Wayne 1910, Bent 1948, Burleigh 1958, Norris 1958, and others). The cavity entrance is often jagged, sometimes circular, with most diameters ranging from 2.5–3.8 cm (N = 34). Only five entrances were greater than 3.8 cm in diameter, from 3.8–5.1 cm. These latter measurements agree with values of the diameter of the cavity entrance provided by Norris (1958).

Eastern Bluebirds (*Sialia sialis*) are the Brown-headed Nuthatch's most frequent competitors for cavities (Barefield, Raven 14:34–37, 1943; Bent 1948; Hearne, Chat 13:78, 1949; Oliver, Oriole 17:17, 1952; Houck and Oliver, Auk 71:330–331, 1954; Norris 1958; several other records, in litt.). Brownheads may also be aggressive toward woodpeckers during excavation, nest-building, and incubation (Beers 1952; Norris 1958; several other records, in litt.). Woodpeckers occasionally destroy nuthatch eggs and young. Interspecific competition at nest-sites between brownheads and other species have been recorded, as have interspecific coexistence with other species, including bluebirds and woodpeckers (Coffey 1943, Norwood 1956, Norris 1958, Haney 1981). The majority of cavity interactions between brownheads and bluebirds or other species were at atypical nest-sites (high cavity heights, deciduous trees, tree limbs, nest boxes) and less preferred habitat (suburbia).

Discussion.—The fact that mean date of clutch initiation and mean clutch-size were not significantly different when the five incubation-stage groups were compared suggests that oologists are usually able to judge correctly the incubation stage of any nest. Thus, oologists' methods of estimating the incubation stage are not believed to seriously bias determination of the date of clutch initiation or clutch-size. I did not explicitly compare oology data to more recent data collected from the Cornell NRCP, the literature, and several individuals, because of the small sample sizes of the latter sources. Several other nest record studies have pooled the latter sources with oology data without indicating or suggesting the existence of significant differences between the different sources (Von Haartman, pp. 611–619 *in* Proc. 13th Inter. Ornithol. Congr., Oxford, England, 1963; pp. 155–164 *in* Proc. 14th Inter. Ornithol. Congr., Canberra, Australia, 1967).

Collation and study of data from the sources cited herein have clarified our knowledge of Brown-headed Nuthatch breeding biology with respect to date of clutch initiation, clutch-size, incubation period, double-broodedness, nest-sites, use of secondary cavities, cavity size and characteristics, and cavity competitors. In general, there is agreement between oology data and the literature on these facets of Brown-headed Nuthatch breeding biology. This is not surprising, for accounts in the literature are based, to a varying degree, on data from oologists. Lack of clearer differences among states of 1°-latitudinal increments with respect to mean date of clutch initiation or clutch-size may occur because of small sample-sizes or may be due to biases: uneven observer coverage with respect to time of year and locality, for example. Nevertheless, quantification of these parameters has improved our knowledge of them.

One important result, undocumented in the literature, is the significantly lower clutch-size in Florida compared to other states in the brownheads' range (Table 1). The significance of this is unknown. Lower mean clutch-size in Florida compared to other southeastern states or larger geographical areas has also been documented for Red-tailed Hawks (*Buteo jamai-*

censis) (Henny and Wight, Fish & Wildl. Serv., Wildl. Resear. Rept. 2:229–250, 1972), Eastern Bluebird (Peakall, Living Bird 9:239–255, 1970), and several other passerines (Crowell and Rothstein, Ibis 123:42–50, 1981). The significant decline in clutch-size with date of clutch initiation for Brown-headed Nuthatches conforms with the usual pattern observed in passerines (Lack, Ecological Adaptations for Breeding in Birds, London, England, 1968).

Acknowledgments.—I thank the following institutions for sending me oological data: Adams State College, Alamosa, Colorado; American Museum of Natural History; University of Arkansas; California Academy of Sciences; Carnegie Museum; Charleston Museum; Chicago Academy of Sciences; Clemson University; Cleveland Museum of Natural History; Cornell University; Cornell Laboratory of Ornithology; Delaware Museum of Natural History; Field Museum of Natural History; Florida State Museum; Florida State University; Illinois State Museum; University of Massachusetts; University of Miami, Florida; University of Michigan; Mississippi Museum of Natural Science, Jackson; Museum of Comparative Zoology, Harvard University; Museum of Science, Boston; Museum of Vertebrate Zoology, University of California, Berkeley; Montshire Museum of Science, New Hampshire; National Museum of Natural History, Smithsonian Institution; Ohio State University, Columbus; Peabody Museum, Yale University; Reading Public Museum, Pennsylvania; Royal Ontario Museum, Toronto; San Bernardino County Museum; University of South Florida; Strecker Museum, Baylor University; Tall Timbers Research Station, Florida; Washington State University; Western Foundation of Vertebrate Zoology, Los Angeles; William Penn Memorial Museum, Harrisburg; University of Wisconsin, Zoological Museum, Madison. I also thank the following individuals for sending data: J. H. Carter, III, D. M. Forsythe, and M. M. Hopkins, Jr. My study was partially supported by the Department of Biological Sciences, Mississippi State University, Mississippi, and by the Department of Biological Sciences, Clemson University, South Carolina. I thank F. C. James and H. Ross and the editorial staff of *The Wilson Bulletin* for constructive criticisms.—DOUGLAS B. MCNAIR, *Dept. Zoology, Clemson Univ., Clemson, South Carolina 29631.* *Accepted 27 Jan. 1984.*

Wilson Bull., 96(2), 1984, p. 301

A record of ground nesting by the Hermit Warbler.—On 15 May 1979, a single Hermit Warbler (*Dendroica occidentalis*) ground nest was discovered 1.6 km west of Castella, Shasta Co., California. The nest, which contained five eggs, was located under the litter in a pocket formed by basal branching of a hazelnut (*Corylus cornuta*). Overstory vegetation consisted of Douglas-fir (*Pseudotsuga menziesii*) topped by California black oak (*Quercus kelloggii*).

An adult female was sitting on the nest at time of discovery and allowed one of us (CRM) to approach <1 m before she flew. She did not move far. Soon, a male bird flew in with a green caterpillar which he offered to his mate. The female, apparently preoccupied with the presence of the observer near her nest, declined the meal, and the male ate the caterpillar. A visit to the nest 2 days later revealed two newly hatched chicks and three eggs. No further visits were made to the nest.

We are unaware of any other records documenting ground nesting in the species, and our literature search included the North American Nest Record Program at Cornell's Laboratory of Ornithology. Cogswell (pp. 144–146 *in* The Warblers of America, Griscom and Sprunt, eds., The Devin-Adair Company, New York, New York, 1957) reported the nest is nearly always located in conifers, saddled on horizontal branches at moderate heights (6.1–12.2 m) but varying from 0.6–15.2 m.

We thank Chandler Robbins and Daniel Leedy for comments on this note.—CHARLES R. MUNSON AND LOWELL W. ADAMS, *National Institute for Urban Wildlife, 10921 Trotting Ridge Way, Columbia, Maryland 21044.* *Accepted 1 Dec. 1983.*