

## NESTING HABITS OF THE BLACK-BILLED CUCKOO<sup>1</sup>

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**D**URING the summers of 1939 and 1941, I carried on studies on the nesting habits of the Black-billed Cuckoo (*Coccyzus erythrophthalmus*) at the University of Michigan Biological Station in Cheboygan County, Michigan. I kept six nests under daily observation, two from the laying of the first egg, and four from the last few days of incubation, through the nestling stage. I supplemented information obtained from these nests with data from five additional nests of the Black-bill and from two nests of the Yellow-billed Cuckoo (*Coccyzus americanus*), which has similar habits (Barrows, 1912: 338; Bent, 1940: 54).

To note details of nestling activities and kinds of food brought into the nesting area by the adults, observations totalling 94 hours were made from canvas blinds three to five feet from the nests; depending upon the nest height, these blinds were placed on the ground or on a tower. A 4x field glass was used. Additional observations, particularly on general habits, were made without a blind.

The information presented in this paper is based, except when otherwise indicated, upon data obtained from the six nests under observation. Table 1 is a summation of these data.

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### NESTS AND NEST BUILDING

The Black-billed Cuckoo generally nests in low trees or bushes (Chapman, 1937: 331), but nest-sites in the Biological Station area varied. The vegetation chosen for nests ranged from clumps of beech saplings (*Fagus grandifolia*) to coniferous trees (*P. strobus* and *Tsuga canadensis*) and tall deciduous trees (*Acer saccharum* and *Populus sp.*), and sites varied in elevation from 19 inches to 20 feet, with an average elevation of 5.9 feet.

The nests were always well concealed by overhanging branches and leaf-clusters. Made of small twigs loosely interwoven, and lined with leaf scraps, pine needles, catkin remains, or empty cocoons, they were comparatively frail platforms, with uniform  $\frac{3}{4}$ -inch inside depth and 3- to  $3\frac{1}{2}$ -inch inside diameter. Apparently the material was gathered largely in the vicinity of the nest, both bulk and lining materials being chosen from those readily available. Two nests, No. 3 and No. 5, were selected for detailed examination of nesting material. The bulk of nest No. 3 gave a total of 65 twigs, 10 varying from 9 to 14 inches in length,

<sup>1</sup>Contribution from the University of Michigan Biological Station.

TABLE 1  
SIX NESTS OF THE BLACK-BILLED CUCKOO

	Nest 1	Nest 2	Nest 3	Nest 4	Nest 5	Nest 6
Date found:	July 5, 1939	July 22, 1939	July 2, 1941	July 7, 1941	July 16, 1941	July 18, 1941
Habitat:	Wooded area	Open 2nd-growth aspen area	Open wooded area	Hilltop with aspen, beech, and bracken cover	Edge of low woodland thicket	Roadside bordered by aspen, maple, and occasional pines
Nest site:	Lower branch of white pine, 3 ft. from trunk	Angle of lower branch of small aspen	Small beech tree where two main branches crossed	Three-way fork of a sapling in a beech clump	Near top of hemlock, 1½ in. from trunk	Near tip of main branch of sugar-maple, 4-5 in. from trunk
Elevation of nest:	19. in.	19.5 in.	5.5 ft.	2 ft.	5 ft.	70 ft.
Bulk of nest:	Twigs of wild cherry and maple and bracken leaf-stems	Twigs of maple, wild cherry, and aspen	Twigs of beech, bracken stem, and leaf-stalks	Twigs of beech and aspen	Twigs of arborvitae, aspen, & osier, with dead maple- and aspen-leaves between	Aspen and maple twigs
Lining of nest:	Pine-needles and scraps of dead aspen leaves	Bracken leaf-scrap, moth cocoons, and lichen fragments	Scraps of dead beech & bracken leaves, pine-needles	Bracken leaves, leaf-stalks and aspen - leaf scraps	Small pieces of arborvitae, scraps of maple leaves, pistillate willow-catskins, and pine-needles	Bracken, aspen-leaf scraps, pine-needles
Inside diameter:	3.25 in.	3.5 in.	3.75 in.	3.5 in.	3 in.	3.5 in.
Outside diam.:	5.5 in.	6.0 in.	6.5 in.	6.5 in.	7 in.	6.5 in.
Inside depth:	0.75 in.	0.75 in.	0.75 in.	0.75 in.	0.75 in.	0.75 in.
Outside depth:	1.5 in.	4.0 in.	3.0 in.	2.75 in.	3 in.	3 in.
Contents when found:	4 eggs	3 eggs	1 egg	1 egg	2 eggs	3 eggs

30 from 6 to 9 inches, and 25 from 3 to 6 inches. Nest No. 5 gave a total of 76 twigs of more uniform length, 40 varying from 5 to 12 inches, and 36 from 3 to 5 inches. The lining of the first nest was a small handful of dry leaf scraps, and of the second, a considerable mat of dead leaves, pieces of arbor vitae, willow catkins, and pine-needles.

I was not able to make observations during the nest-building period, but there is evidence that nest-building is prolonged into the incubation period. Three times at nest No. 6, an adult brought pine needles as lining material when coming to replace its mate on the nest. Twice the material was carefully worked into the nest.

#### COURTSHIP FEEDING

During my observations at nest No. 1 on July 12, 1939, the eighth day of incubation, one of the adults (presumably the female) was on a branch above the nest when the other (presumably the male) came into the nest area with a green larva in his bill. Within a few minutes he swallowed the larva and several times gave a loud call. Immediately the female began flirting her wide-spread tail, while making a low mewling sound. This display went on intermittently for fifteen minutes before she flew to the top branch of a nearby aspen. The male remained silent and motionless.

Again, two days later, one of the adults (presumably the male) came into the nest area with a larva in his bill and took the usual guarding position above the nest on a branch of a near-by tree. The female left the nest and alighted on a branch just below. In a few minutes the male hopped down to the same branch, ran down it toward the female and mounted her. However, copulation did not take place. The male immediately flew away with the larva still in his bill, and the female remained motionless. After eight minutes the male returned with another larva and alighted on the same branch with the female, but this time as he ran toward her she flew away. In a short while the male ate the larva he had brought, then remained on the branch ten minutes before moving out of sight. This behavior, though merely inceptive, can presumably be taken as illustrating courtship feeding (Lack, 1940).

#### EGG LAYING, INCUBATION, AND HATCHING

The Black-billed Cuckoos laid from 2 to 4 eggs, with an average of 3 eggs per nest. The eggs were oval in shape and dull greenish blue in color, and some had a marbled appearance after three or four days' incubation.

The egg-laying interval was variable. The nests were checked daily at approximately 9 A.M. Each new egg was marked and recorded. Nest No. 3, when discovered July 2, contained one egg. A second egg was

laid July 3 and a third July 6. Nest No. 4 contained one egg when found July 7. A second was laid July 8 and a third July 10.

Several authors (e.g. Barrows, 1912: 340; Bent, 1940: 56, 73; and Herrick, 1910: 229-232) state that not infrequently Black-billed and Yellow-billed Cuckoos lay their eggs in each other's nests as well as in the nests of other birds. During my observations I noted only one case of parasitism, finding a Black-bill's egg in a Yellow-bill's nest with two young and two eggs of the Yellow-bill. It was readily distinguished from the other eggs by its deeper color and smaller size.

Incubation began after the laying of the first egg, but was three to four days shorter than the 14-day period given by Burns (1915: 283). In nest No. 3 one egg, laid and marked the morning of July 6, hatched the morning of July 16. In nest No. 4, the egg laid July 8 hatched July 19. The shortest period of sitting was 15 minutes, the longest 115 minutes, with an average period of 90 minutes. The shortest interval the eggs were left uncovered was 5 minutes, the longest 56 minutes, with an average interval of 28 minutes. The eggs were incubated 68 per cent of the time (calculated on the basis of 15 hours' observation, exclusive of the 4-hour period of unusual activity described later).

The sexes were not distinguishable, but I was able to corroborate the statement by Herrick (1910: 195) that both sexes take part in incubating the eggs. Several times a second adult came into the nest area, gave a low call, and took the place of the incubating bird as soon as the latter left the nest. In 17 hours of observation during the incubation period, I observed the second adult take over this duty three times.

During both incubation and brooding, the adult sat very quietly, turning the head from time to time, and moving the eyes more or less continuously. Contrary to the observation made by Herrick (1910: 197), the adults varied their position on the nest, but four birds seemed to have a favorite position, which they assumed more often than others. The birds had also a favorite path to the nest, but it was not invariably used.

Ordinarily the cuckoo remained close on its nest and was not readily flushed during the last few days of incubation. A striking exception to this was noted during an observation period the day before the first egg was hatched. Nest No. 6, containing 3 eggs, was about ten yards from the main road into the Station area. Three times the bird was frightened from the nest—by a low-flying airplane overhead, by a passing group of children, and by a passing truck. With each disturbance the bird flew to a favorite high branch above the nest, which it used as lookout, and then returned to the nest by flying down to the nest branch, and running along it, stopping cautiously and deliberately on the smaller branches on the way. The adult appeared continuously uneasy throughout the four hours of the morning-observation.

As far as I observed, egg-laying and hatching took place during the early morning hours, except in one case, when the younger nestling in nest No. 5 appeared about 3 P.M., July 18. This very exceptional case of afternoon hatching gave me the opportunity to watch hatching procedure. The adult left the nest upon my approach at 2:55 P.M., exposing one nestling and the second egg, whose shell was cracked and slightly parted around its lesser circumference, showing the young bird moving about inside. Within the next five minutes, half of the shell fell away. The young nestling began emitting low cries, and emerged from the remaining half-shell *entirely dry*. The adult, meanwhile, remained on a branch of an adjacent tree and called softly at irregular intervals.

The egg shells were usually disregarded by most of the adults, though they were sometimes pushed about in the nest with the bill. That they were not consistently removed was proved by the fact that many shell scraps were found in the bottom of the nests. However, at nest No. 6, an adult ate the larger pieces of shell. About four hours after the young hatched and after they were fed, the adult stepped over the nest, but before taking the brooding position reached into the nest and devoured what appeared to be small shell scraps. After a short period of brooding, the adult again reached into the nest and brought out the entire smaller half of the shell. It was too large to be taken into the mouth whole, so that it was necessary to crack the shell first between the mandibles. In about two minutes' time the bird had swallowed the entire half.

#### NESTLING STAGE

The newly hatched Black-billed Cuckoo nestling has a coal-black skin, whose feather tracts are made conspicuous by wiry gray "hairs"—the feather tubes of a vestigial down that never unfolds (Herrick, 1910: 198). The feet and bill are a steel-blue, the commissure very slightly lighter in color. By the third day the down-feather tubes are pushed out on the tips of the juvenal contour-feather tubes, and remain attached to these for four or five days. The feather tubes on the anterior portion of the ventral tract at first develop more slowly than the others, being barely visible until the fourth day, but in their later development they practically parallel those on the dorsal area. By the sixth day the juvenal contour-feather tubes, ranging in length from 17 mm. to 21 mm., give the young nestling the appearance of a porcupine, but on the seventh day the ends of these tubes begin to burst, and the nestling for the first time has a somewhat fluffy plumage. According to Herrick (1910: 206) the opening of the feather tubes (except those on the head and neck, which require longer) is completed in about 12 hours.

The day-old nestlings weighed from 7.5 grams to 9 grams, giving an average for 7 nestlings of 8.5 grams. Weight increased quite uniformly during the first four days, the average daily gain of 9 nestlings

being 4.7 grams; but the increase was more gradual during the remainder of nestling life, the average daily gain of 9 nestlings being 2.8 grams. The average weight of the 9 nestlings on the last day of nest life was 28.5 grams.

#### FEEDING, CALL NOTES, BROODING OF YOUNG

Feeding began  $1\frac{1}{2}$  to 2 hours after hatching. The food consisted almost entirely of insects, 90 per cent of which were in the larval form. The remaining 10 per cent was made up of grasshoppers, small moths, mayflies, and robber flies, with an occasional spider. The larvae of the rosy maple moth (*Anisota rubicunda*) were extremely abundant in the Station area. This abundance probably explains why 81 per cent of the larvae fed to the young cuckoos were of this variety. Herrick (1910: 212) found that smooth larvae made up 44 per cent of the total food of Black-billed Cuckoos, hairy caterpillars 5 per cent, adult lepidoptera 5 per cent, and grasshoppers 27 per cent.

Feeding was done by both sexes. The adult approached the nest by running along the nest branch, and the resulting vibrations excited the food-response in the young: open mouth, stretched neck and flapping wings, accompanied by a sound like the buzzing of bees. As mentioned by Herrick (1910: 214), whenever this food-response was not given by the time the adult stepped on the nest edge, the parent immediately gave a peculiar low mewing sound, and this invariably excited a vigorous response.

The wide-open mouth of the begging young bird displayed a very conspicuous group of snow-white disks of variable size symmetrically arranged on the bright red palate. (Herrick, 1910: 201). Some observers (e.g. Herrick, 1935: 99; Roberts, 1932: 593) believe these disks to be sucking pads used by the young to hold the adult's bill while feeding. However, in 75 feedings, I noticed close contact between the maxilla of the nestling and the bill of the parent only three times. Since the lower or inner edges of the larger disks were decidedly rough, the disks may be an aid in grasping the live food. Another possible function of these disks may be as a food target, since they greatly increase the conspicuousness of the palate.

The food was always carried to the young crosswise in the bill. Occasionally the adult crushed the food before bringing it into the nest area, but more often not until after alighting on the nest edge. Usually the food was thrust far down in the throat. When necessary, additional thrusts were given to hasten the swallowing response. With the younger nestlings the larva was put into the open mouth, then a motionless position was held by both adult and young for many seconds—often for as long as two or three minutes—before swallowing occurred. Herrick (1910: 218) records an instance in which five minutes were required to awaken the swallowing reflex. If the first attempt failed, the larva

was withdrawn, further crushed, and put again into the throat. Occasionally this procedure had to be gone through a third time. With the older nestlings swallowing took place either immediately, or within a few seconds after the food was inserted into their mouths.

Food was generally brought by the adult when coming to take its turn on the nest, the other adult leaving the nest and not returning for a considerable period. A notable exception occurred about 10:30 A.M., July 24, 1941, at nest No. 6, which contained two nestlings. The brooding adult left the nest as the relief adult came up the nest-limb with a grasshopper nymph in its bill, which it fed to the day-old nestling and then ran down the nest limb out of sight. In less than three minutes it was back again with a larva about one inch long and correspondingly thick, which it fed to the same nestling. Just as the larva was inserted into the open mouth, the mate returned and alighted on the nest edge, carrying a well-developed larva of the rosy maple moth. The first adult withdrew the unswallowed larva just fed the nestling, and both parents gave the low food-call. Response was instantaneous, and both adults now tried to feed the younger bird. The first adult succeeded in replacing the same larva, and the mate turned about and placed the larva it was carrying in the wide-open mouth of the older nestling. The swallowing response of both nestlings was retarded because of the size of the larvae, the older one swallowing first. The second adult took the fecal sac and flew away again, leaving the other to assume brooding duties.

Feeding intervals varied considerably. At nest No. 1, containing three young (3-, 5-, 6-day age) intervals ranged from 1.5 minutes to 80 minutes; the average was 18.5 minutes during a 4-hour observation made in the morning. At nest No. 6, with two young (2-day, 3-day age), the feeding intervals varied from 3 minutes to 65 minutes over a five-hour morning-period, and averaged 25 minutes. Herrick (1910: 222) cites two extreme observations. For a 53-hour period at two nests containing six young (ages varying from one to six days), the feeding rate was once every 25 minutes. For an entire day at a nest containing three young (4-, 5-, 6-day), the feeding rate was once every 4 minutes. Herrick explained this high rate by lack of fear, abundant food, favorable weather, and no other young, already fledged, to divert the attentions of the parents.

After feedings on the first five days, fecal sacs were voided and were picked up by the adult. They were either swallowed immediately or carried away. During a four-hour period at nest No. 1 (containing 3 young), when 27 feedings took place, the fecal sacs were carried away after 17 feedings and swallowed after the other 10. On seven occasions after swallowing the sac, the adult settled on the nest, and on the three other occasions it again fed the nestlings several times. It thus appears that at this stage of nest life the manner of fecal disposal is determined

by the adult's next activity: if the bird is disposed to brood or feed again, it swallows the sacs; if not, it carries them away. Herrick (1910: 220) stated that the disposition of the fecal sacs was dependent upon various circumstances in which must be included the hunger of the old bird at the moment.

From the age of 5 days the nestlings backed to the edge of the nest before voiding the fecal sacs. Occasionally the sacs fell to the ground, but more often they fell on the edge of the nest and were picked up by the adult and either swallowed or carried away.

An unusually strong grasping-reflex appeared during the first five hours out of the shell, allowing the bird to cling to the nest. At one-day-old a very rapid opening and closing of the toes was noticed. On succeeding days the toes were opened and closed with greater force.

I noted a very slight shivering of the wings during the food response in all 14 nestlings at one-day-old. This movement became more forceful in the 2-day young. Four 3-day nestlings (nests Nos. 1, 2, and 4) were seen to stretch one wing after the other, sidewise, during prolonged absences of the adult. Grasping at this age was so well-developed that, unless I took great care when removing the young for weighing, the nest was pulled apart. Ten nestlings at 4 days (nests Nos. 1, 2, 3, and 4) stretched the wing on each side downward while extending the corresponding leg. This was done regularly during an adult's absence of an hour and fifteen minutes at nest No. 2, the leg-wing stretching occurring on the average every 8 or 10 minutes, with a maximum interval of 16 minutes.

I saw no evidence of the preening instinct which Herrick (1910: 205) says becomes very active on the sixth day. During the last two days of nestling life (6 and 7 days), with a very few quill tips on dorsal and ventral tracts opened, the young cuckoos were quick to pick at ants or flies on themselves. At no time could this action be mistaken for the combing action as described by Herrick (1910: 205).

During the first two days of nestling life the sound accompanying the feeding response had been similar to the buzzing of a bee. This buzzing gradually gave way to a "bark," a low grating call that took on true cuckoo characteristics about the sixth or seventh day. At the five-day age fear manifested itself in loud, explosive calls, and the young became especially reluctant to be taken from the nest for weighing. Either just before or at the time of removal they voided a brown, sticky excretion, whereas after feeding they invariably voided white fecal sacs.

Accompanying the changes in the grasping-reflex and wing-movements, and in the call of the nestlings, was the development of sight and hearing. The eyes began to open at two days and were wide open for short periods by the third day. At four days the nestling followed moving objects with its eyes, and at five days turned its head from side to



side in an attempt to see moving objects in the nest area. At one day of age the rustling of leaves excited the food response, which indicated an already keen sense of hearing. At five days the breaking of a twig several feet from the nest caused the nestling to turn its head in that direction. Both sight and hearing were well-developed by the six-day age.

At my approach to the nest during brooding the behavior of the adult very closely paralleled that described by Herrick (1910: 197). At first, the adult moved its head to keep me within view, but as I came nearer the nest (within 4 or 5 feet), the head began to rise and continued until the bill pointed to the zenith. Rapid movements of the eyelids and fast breathing movements were very noticeable.

Even though the adult cuckoo was normally a shy, retiring bird it became quite courageous and bold in defending its young. Early in the period of incubation, when flushed from the nest by my approach to within five feet of the nest, the adult flew very quietly to a nearby branch and watched. Toward the end of the incubation period (8 to 9 days) the adult did not leave the nest so readily, but remained motionless until I was within two or three feet of the nest. When it did leave, it was with a mewing sound and perhaps open bill. At the time of hatching, the adult was more reluctant to leave and more vigorous in its calls; it stayed closer to the nest than before—within two or three feet—while uttering kuk-kuks of protest. It continued to behave in this manner for the first three or four days of nestling life. Later, whenever the young emitted the raspy bark commonly made by them when disturbed, the adult became strikingly bold, and a number of times flew directly at my face with wide-open mouth, spread tail, and drooping wings, sometimes clapping the bill loudly. Each attack was usually short, and it quickly decreased in intensity, the adult finally perching on a nearby branch and quietly looking on.

Observations on the attendance of the adult were made for 10-hour periods at 2-day and 5-day ages of nestlings. In each case the data were obtained during ten hours' observation, during which the weather was clear and the temperature mild (78° F and 81° F). The periods of attendance were longest during the middle of the day. The shortest periods were in late afternoon, when feeding activity increased. For the 2-day nestling the maximum attendance period was 120 minutes, the minimum 45 minutes, giving an average of 87.5 minutes. For the 5-day nestling the maximum attendance period was 105 minutes, the minimum 10 minutes, giving an average of 43.3 minutes.

Weather conditions had an evident bearing upon brooding. During the entire life of the nestlings in nest No. 4, the weather was windy and cool (65° F: five-day average); brooding was maintained quite steadily through the first five days. The average length of the brooding period (based on 19 hours of observation) was 80 minutes, and the young

were brooded 54 per cent of the time. In contrast with this, at nest No. 6, when the temperature was quite high (93° F: three day average) with just an occasional breeze, the young were brooded only 26 per cent of the time. The average brooding period (based on 11 hours of observation) was 20 minutes, and the parent would often shade the young from the sun for an equivalent period.

During the approach and duration of a storm, brooding at nest No. 1 was maintained for a two-hour period. The adult apparently sensed the storm's approach, for although the second bird called from a nearby branch, the brooding one did not leave. Three times during the hour preceding the storm the adult used its bill and body in an attempt to push the nestlings deeper into the nest. As the storm broke, the bird noticeably lowered its body, at the same time spreading the wings over the nest edge and lowering the tail. With each additional down-pour the body was pulled more tightly to the nest, tail lowered further, and bill pointed higher. For 45 minutes following the storm the only change the brooding bird made in her position was to lower her head. Herrick (1910: 225) watched a nesting adult during a 1½-hour rain. He noted that it left as soon as the rain was about over. He also noted that the bird raised her body two or three times during the rain to examine the young, whereas the one I observed did not raise the body until shortly before leaving the nest even though it was evident that the nestlings were decidedly restless.

#### NESTING SUCCESS

During the summer of 1939, when I kept two nests under daily observation, both were brought to successful completion except for a single egg, which did not hatch; but during 1941 only one out of the four nests was entirely successful. In one nest (No. 3), two out of three eggs hatched, the second four days after the first. The younger nestling was found dead at two days of age, hanging on the outer edge of the nest, from which it had probably been crowded. In another nest (No. 4), one of the three eggs was pushed out of the nest and, although I returned it before many hours had passed, it was again missing the next morning with no evidence of it on the ground under the nest. The younger of the two nestlings (three days of age) was also gone the following morning. In a third nest (No. 6), where brooding was in progress during a period of high temperatures (93°-99°), a 15-minute exposure to direct sunlight for purposes of photography killed the two nestlings. (The adults stayed near the nest for several hours afterwards, but deserted before the next day.)

Of the 18 eggs laid in the two seasons, 14 (87.4 per cent) hatched. Ten of the young (71 per cent) left the nest, giving a total for surviving young of 55 per cent from the six nests.

NEST LEAVING

Herrick (1910: 199) says the cuckoo nestling, in proportion to its size, is probably the strongest and most enterprising altricial young on the North American continent. This, in part, explains the shortness of its nest life. Of the ten nestlings known to leave the nest, two left at the age of six days, and eight at seven days.

My single observation of a young bird leaving the nest was made during the summer of 1939 and occurred after I weighed the birds the evening of the seventh day. When I was returning one young to the nest, I noted that the one previously weighed had climbed out on the supporting branch, where it stood erect with upward pointed bill, suggesting the pose characteristic of a bittern. I loosened its grasp with difficulty and put it back into the nest. It immediately ran out again to the end of the nest-branch but, in its haste to escape, lost its balance and, while hanging by its toes, gave loud calls that brought the parent, in a spectacular display of courage, from its watching perch on a nearby tree. The young lost its hold, fell, and, still giving its calls, ran with amazing speed through the bracken (*Pteris*) for several yards before being caught. It was returned to the nest but remained quiet only a short while before repeating the attempt to escape, performing several climbing-feats with skill and speed. Once again the nestling was returned to the nest, but when I left the nest area it was standing in a climbing position on the supporting bracken stem and nest edge. The adult cuckoo, perched just a couple of branches above, was giving a low coaxing call.

SUMMARY

In northern Michigan the Black-billed Cuckoo was found to nest usually in woodlands but occasionally in more open areas. A total of six nests were observed during the summers of 1939 and 1941.

Nest elevation varied from 19 inches to 20 feet, the average being 5.9 feet.

Possible cases of courtship feeding were observed.

The egg-laying interval varied from one to three days. Both sexes took part in incubating the eggs, one adult apparently assuming the greater responsibility. The incubation period, determined in two cases by marking the eggs, was found to be 10 and 11 days respectively.

Insect larvae made up 90 per cent of the food brought to the nestlings; the remaining 10 per cent consisted of miscellaneous insects.

The Black-billed Cuckoo nestling is exceptionally precocious. The most outstanding reactions displayed upon hatching or shortly thereafter are its grasping-reflex, call-notes, and enthusiastic food-responses.

Observations showed the average attendance-period of the parents to decrease somewhat less than 50 per cent between the 2-day-old and

5-day-old stages of nestling life. During cool windy weather, length of attendance-periods increased.

The young left the nest at the age of 6 or 7 days, with the juvenal-feather tubes just beginning to open.

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GENERAL ZOOLOGY. By Tracy I. Storer. McGraw-Hill Book Co., N.Y. 1943: 6 x 9 in., xii + 798 pp., illus. \$3.75.

Ornithologists who want to gain a better understanding of birds in relation to the rest of the animal world will do well to study this admirable new zoology text by the California ornithologist, Tracy Storer. His 37 page chapter on birds is a remarkably clear and concise summary of the whole field of ornithology. Other chapters especially helpful to students of birds are those on ecology, distribution, and organic evolution.

We believe that many ornithologists will return to their special bird problems with renewed enthusiasm and vision after a study of this volume.—J. Van Tyne.