

were remarkably small for a bird as large as the Channel-billed Toucan. The holes measure $2\frac{1}{2} \times 2\frac{1}{2}$ and $2\frac{1}{16} \times 2\frac{1}{4}$ inches, respectively, and the adult birds literally had to "wriggle" in and out with a type of lateral pivoting movement, their bodies totally filling the nest hole. Nest A was accessible by means of a short ladder, while nest B could be examined from ground level; the interiors and contents were examined by means of a small light and mirror. The visibility at nest B was better than at nest A.

Both nest holes were approximately 12–18 inches deep and both had a basal "lining" of seeds, mainly of one type measuring 1.0×1.5 cm, though a few other larger and smaller seeds were present. Skutch (loc. cit.) has pointed out that a similar phenomenon is known for other species in the family, and that the seeds do not constitute a true nest lining fabricated by the parent birds, but are merely due to regurgitation when the parents are sitting.

Clutch sizes were four and three respectively (cf. Herklot's value of two, loc. cit.), the eggs being ovate and white with some dark fleck markings. Nest B was located, complete with three eggs, on 26 April, and at least two eggs hatched between 1 and 10 May. The chicks were (presumably) predated between 10 and 15 May and the nest unused again during the remainder of the season. The interior of nest A was first successfully examined on 1 April, and found to contain four eggs; the nesting birds had first been heard calling in the nest vicinity on 16 March, and one was flushed from the nest on 20 March. Three of the eggs hatched between 1 and 8 April. One chick may have died and been removed by the parents between 5 and 10 May, and only two fledged. Fledging was apparently asynchronous, one chick leaving on 21 May and the other the following day. Thus the minimal duration of the nesting period was 44–45 days, the maximal, 50–51 days. The first value corresponds almost exactly with that given by Chenery (loc. cit.) for a nest whose interior was not examined, the nestling period being judged from the adult birds' behavior.

A few other aspects of nesting behavior are worth mentioning. At one nest the egg shell remains were found approximately 100 ft from the nest shortly after

hatching. The young were completely featherless when hatched and development was slow; the eyes of the chicks opened in the second to third week after hatching and the first feather tracts emerged through the skin approximately three weeks post-hatching. The characteristic blue hue of the facial skin and the yellow throat feathers were apparent only 6–12 days prior to fledging. Both parents fed the young in the nest, sometimes coming simultaneously, sometimes separately. On synchronized visits first one and then the other parent would feed the chicks, completely entering the nest hole to do so, unlike the pair cited by Chenery (loc. cit.). Nest depth may be the critical factor determining whether or not the parents actually enter the nest to feed the young. The approach of a parent bird to the nest elicited vocalizations in the young audible to the observer at a distance of 35 yards. The few nest watches carried out indicated that there were distinct feeding bouts when both adult birds fed the young intensively for 30 min or so, gathering food near the nest site, while at other times adults visited the nest at widely spaced intervals. Although Channel-billed Toucans generally feed high in trees, the pair at nest A often descended to the forest floor to pick up fallen fruits and nuts to carry to the nestlings. During the early stages of nesting the same pair exhibited what appeared to be mobbing behavior towards a 6-ft long tree boa (*Boa enydris*) on the ground 20 ft from the tree in which the birds were nesting. Since this species of snake readily climbs trees, it may well be a potential predator of *R. vitellinus* eggs and young.

The main significance of the findings reported here is that they confirm the four previous records for the species in Trinidad in suggesting a main March–June breeding season, while indicating that clutch size and nest height are more variable than previously suspected. From the available information it seems that the major breeding season for the species coincides with that of the majority of Trinidad landbirds (Snow and Snow, *Zoologica* 49:1, 1964).

The observations were made while I was holding grant no. AF-AFOSR 1254-67 from the U.S. Air Force Office of Scientific Research.

Accepted for publication 25 September 1968.

INGESTION OF STONES BY GOATSUCKERS (CAPRIMULGIDAE)

MARION ANNE JENKINSON

AND

ROBERT M. MENGEL

Museum of Natural History
The University of Kansas
Lawrence, Kansas 66044

Many birds regularly ingest small stones or grit, apparently to help grind their food. This seems primarily to be a practice of granivorous and herbivorous birds (Famer 1960:433; Meinertzhagen 1964). Although there are in the literature a few scattered reports (see below) of stone-eating by caprimulgids, which are almost strictly insectivorous, most of these reports state or imply that this is a novel occurrence among these birds. We here present evidence to the contrary, indicating that the practice of stone-eating is widespread in the family Caprimulgidae and that it occurs regularly in at least some species. The birds probably use these stones to help grind the heavy,

chitinous bodies of beetles (Coleoptera) which form a large part of their diets.

Unless otherwise stated, the specimens mentioned below are in the University of Kansas alcoholic collection or are ones for which skins are in the U.S. National Museum and for which carcasses have been sent to the University of Kansas. In most cases the stomach contents have been saved.

Caprimulgus carolinensis. In the springs of 1963–67, we made extensive observations of numerous Chuck-will's-widows, chiefly in an area of about one square mile near Lecompton, Douglas County, Kansas. As is well known, Chuck-will's-widows regularly sit on gravel roads at night, and we could often easily watch them there, without disturbing them, by using 7×35 binoculars and the light of a nearly full moon, sometimes supplemented by the light of a sealed-beam flashlight covered with several layers of red cellophane. On many such occasions we saw a bird pick up a small stone in the tip of its bill, raise its head, tilting it noticeably upwards, and swallow. For example, our notes for 12 May 1965 read: "Clear, still night, 72° F, moon two days short of full. At 23:00

two chucks in the road about six or eight inches apart allowed approach within 25 feet with the car. Carefully studied through binoculars under excellent conditions with a red light. At least four times the female elegantly shoveled up a pebble, tossing her head upwards and visibly gulping each time. After this the birds flushed and flew away."

Also, stones have been found in the stomachs of Chuck-will's-widows. Of three adults taken in the above-mentioned area in 1963, one had one stone (measuring 8×5 mm) in its stomach, and one had six stones ($9 \times 5-3 \times 2$ mm). Sievert A. Rohwer (pers. comm.) found four pebbles ($11 \times 8-7 \times 7$ mm) in a bird he took in Edwards County, Kansas, on 10 May 1968. Rohwer also tells us that he has noticed rather large amounts of sand in the stomachs of several Chuck-will's-widows he collected on an island at the mouth of Tampa Bay, Pinellas County, Florida, an area where stones are in very short supply. Additionally, we have in hand a specimen taken by M. G. Vaiden (collector's number 2898, housed in the University of Mississippi), the label of which reads: "2 beetles; rock in stomach."

We know of no published records of stone-eating by Chuck-will's-widows, but Sprunt (in Bent 1940: 154) expressed surprise that a bivalve was among the food items found in one bird's stomach. We suspect that, rather than representing a food item, this mollusc had been taken as grit.

Caprimulgus vociferus. We have examined only one stomach of a Whip-poor-will, taken in Kansas, and found no stones. However, Jones (1933), writing of Virginia, stated: "almost every night . . . [Whip-poor-wills] from time to time alight on the bare spots near the foundations of the house, where they creep about over the red clay, and apparently pick up grit." Jones found no insects on the ground in these spots.

Caprimulgus europaeus. We found no stones in the two specimens of the European Nightjar we had available. Marples (1939), however, found 16 stones, the largest of which was 10×8 mm, in a bird found dead in England. Remmert (1953) also found a number of stones (the largest being 8×5 mm) in the stomach of one of this species and suggested, as do we, that these were taken in for the purpose of food processing.

Caprimulgus ridgwayi. Of three stomachs of Ridgway's Whip-poor-will, one contained a 6×5 mm stone. Otherwise that stomach was empty.

Phalaenoptilus nuttallii. Of four stomachs we examined of the Poor-will, one, which was otherwise essentially empty, contained five stones, $7 \times 5-3 \times 2$ mm, and several small fragments apparently from one of these stones. Rohwer (pers. comm.) examined the stomachs of two Poor-wills taken in Colorado and found no stones. Without special comment, Brauner (1953:69) mentioned that on many occasions a captive Poor-will swallowed small bits of gravel from the soil filling the bottom of its cage.

Nyctidromus albicollis. One young Pauraque (remiges and rectrices still one-fourth to one-third sheathed) taken on 21 July 1962 near Pisté, Yucatán, had four stones in its stomach, the two largest being 7×5 and 4×2 mm. The food in this bird's stomach was thoroughly digested, nothing being identifiable.

We examined the stomach contents of 46 fully-grown Pauraques, from many localities in Central and South America, and found no stones. In about one-third of these stomachs, however, we found from one to three hard, triangular-to-round, undigested heads (about $4 \times 5-8 \times 6$ mm) of beetles, with digestion

being otherwise well advanced; in one case a beetle's head was the only item present. We think that these heads may substitute for stones. According to Meinhertzhagen (1964), diving ducks similarly use the hard outer coverings of the molluscs and crustaceans they eat to serve as grit.

In any event, these data suggest that a comparison of the food and feeding habits of young and fully-grown Pauraques might be interesting. There is also the question of whether our young bird obtained its own stones or was given them by a parent.

Chordeiles acutipennis. Of 10 stomachs of the Texas Nighthawk examined, one had three stones, $5 \times 4-4 \times 3$ mm.

Chordeiles pusillus. Only one specimen of the Least Nighthawk was available, a bird taken 21 March 1967 near Maripa, Bolívar, Venezuela. This bird had one stone (8×5 mm) in its otherwise empty stomach.

Podager nacunda. A Venezuelan specimen of a Nacunda Nighthawk examined had three stones ($12 \times 8-4 \times 3$ mm) in its stomach; four birds taken in Brazil had no stones.

Other species examined, the stomach contents of which included no stones, were as follows (number of specimens in parentheses): *Caprimulgus rufus* (1), *C. nigrescens* (2), *C. parvulus* (5), *C. maculicaudus* (1), *Lurocalis semitorquatus* (2), and *Chordeiles minor* (10).

In summary, 9 of the 15 species here considered have been shown to ingest stones. These species represent both of the caprimulgid subfamilies, Chordeilinae and Caprimulginae. We think it very likely that at least some of the other species take grit, but our generally small samples failed to demonstrate this. This may not be true, however, of *Chordeiles minor* or adult *Nyctidromus albicollis*, for which we examined 10 and 46 specimens, respectively, finding no stones.

In several instances the stones (or heads of beetles which may substitute for stones) were the only items present. This indicates that these birds retain grit in their stomachs, as apparently do most birds.

We wish to thank various persons at the University of Kansas: P. S. Humphrey made available to us many specimens from Brazil; J. K. Jones, Jr., and J. D. Smith have been especially diligent in collecting various South and Central American caprimulgids for our continuing work on these birds; S. A. Rohwer permitted us to use some of his data; and G. D. Schnell rendered various assistance.

LITERATURE CITED

- BENT, A. C. 1940. Life histories of North American cuckoos, goatsuckers, hummingbirds and their allies. U. S. Natl. Mus., Bull. 176.
- BRAUNER, J. 1953. Observations on the behavior of a captive Poor-will. Condor 55:68-74.
- FARNER, D. S. 1960. Digestion and the digestive system. p. 411-467. In A. J. Marshall [ed.] Biology and comparative physiology of birds. Academic Press, New York.
- JONES, G. W. 1933. An apparently unnoticed trait of Whip-poor-will. Auk 50:436-437.
- MARPLES, G. 1939. Stones in gizzard of Nightjar. Brit. Birds 33:81-82.
- MEINHERTZHAGEN, R. 1964. Article "Grit." p. 341-342. In A. L. Thomson [ed.] A new dictionary of birds. McGraw-Hill, New York.
- REMMERT, H. 1953. Kieselsteine im Magen einer Nachtschwalbe (*Caprimulgus europaeus*). Ornithol. Mitteil. 5:231-232.

Accepted for publication 19 December 1968.