

Acknowledgments.—I should like to thank the members of the joint Ecuadorean-British expedition for their help, particularly the caving team who made entry to the cave possible. I also thank the Los Tayos Expedition 1976 Trust for their logistic and financial support and A. Hutson and Dr. C. de Vries for assistance with field observations. I am also indebted to Dr. H. E. Moore for identifying some of the palms.—BARBARA K. SNOW, *Old Forge, Wingrave, Nr. Aylesbury, Bucks., England. Accepted 14 Aug. 1978.*

Wilson Bull., 91(3), 1979, pp. 461–463

Observations on the nesting biology of the Great Cormorant in Ethiopia.—The breeding biology of the Great Cormorant (*Phalacrocorax carbo*) is fairly well known for northern temperate populations (Cramp and Simmons, *Birds of the Western Palearctic* Vol. I, Oxford University Press, Oxford, 1977; Palmer, *Handbook of North American Birds* Vol. I, Yale University Press, New Haven, 1962) but not for African populations (Olver and Kuyper, *Ostrich* 49:25–30, 1978; Urban and Jefford, *Emu* 74 [Suppl.]: 294, 1975). This paper, one in a series on the breeding biology of large water birds nesting in the Rift Valley of Ethiopia, presents observations on breeding plumage, pair formation, nest building, incubation, and behavior, care and predators of nestlings of *P. c. lucidus*.

Study area and methods.—Observations were made at Lake Shala (7° 30' N, 38° 30' E; 330 km²; max. depth 266 m; pH 10.0) and Lake Abiata (7° 35' N, 38° 35' E; 196 km²; max. depth 14 m; pH 10.3) (Urban, *Ibis* 116:263–277, 1974). Throughout the period of observation from 1964–1974, the Great Cormorant nested at Shala on trees on islands, although in 1969–1974 they also nested at Abiata in trees surrounded by water due to a substantial rise in the lake's level. Observations, made usually once a month on weekends, totalled 240 h in 87 visits to Shala and 110 h in 56 visits to Abiata. The birds were observed from at least 20 m away in a boat or on the ground. No blind was used nor were any nestlings or adults banded or marked. Classification of *carbo* used in this paper is from Urban and Jefford (*Bull. Br. Ornithol. Club* 94:104–107, 1974); names of colors are from Palmer (op. cit.); and names of displays are from van Tets (*Ornithol. Monogr.* 2, 1965).

Breeding plumage.—The lores—orange in male and scarlet, scarlet-orange, or orange in the female early in the nesting cycle—turn orange-yellow in both sexes once incubation begins. The breeding plumage is otherwise essentially the same in both adult sexes: the cheeks, throat, and upper breast are white while the rest of the body is black glossed with olive. The lower breast and abdomen are speckled white and black in immatures (2- to 3-year-olds ?) and white in 1-year-olds. An oval white patch is often present (adults only ?) on either side of the rump in both sexes, not only in males as stated by Olver and Kuyper (op. cit.). The gular pouch, olive to dark olive early in the breeding season, becomes olive to buffy yellow in late stages of incubation. The iris is emerald.

Pair formation.—Nesting activity commences when a few to several hundred cormorants appear at the islands at Shala or on the partly submerged trees at Abiata. Occasionally 300 or more individuals swim in a group close to the islands of Shala for several h before moving onto them. Pair formation at Shala and Abiata appears to be much like pair formation in *carbo* populations in northern temperate regions as described by Cramp and Simmons (op. cit.). Thus, males establish nest-sites and advertise on them by wing-waving; they are silent when doing so. Based on 30 observations, the males waved the wings 1.8 times per sec and 11 times in a sequence before stopping. European and North American

carbo males do so 1.3–1.7 times per sec and 8–25 times before stopping (van Tets, op. cit.). When approached by a female, a male shifts from wing waving to gaping and produces a loud *a/rrooo* or *a/a/a/rrooo*. The female responds by placing the head and bill half-way back to the tail, not all the way back to it as the male does, and by producing a soft *hrrr*. Both also point, allopreen, and entwine the necks. If the female remains at the nest, the male will collect nesting material which he gives her upon his return.

Early in the nesting cycle, both sexes produce 1 to 2 “growls” before departing the nest. Later in the nesting season both sexes are silent when leaving the nest. When returning to the nest-site early in the nesting season, the female produces a soft *hhhhhhhhhh* while the male makes a loud *kro/kro/kro/kroo/kroa/kraa*. Later in the nesting season, both only produce a *kro/kro/kro/kro* similar to but not so loud as that produced earlier by the male. These changes in vocalizations have also been observed by Kortlandt (Arch. Neerl. Zool. 4:403–422, 1940; and pers. comm.) in Dutch *carbo* populations.

No distinctive pre- or post-copulatory displays occur. At copulation the female flattens her body with bill pointed forward; and the male may nibble the back of her neck. Three timed copulations (success ?) lasted 1, 2, and 7 sec.

No display platforms, as Kortlandt (loc. cit.) described, were observed at the Shala and Abiata colonies. Occasionally 1- to 2-year-old individuals wing-waved, gaped, or pointed on tree stumps or branches projecting out of the water at Abiata.

Nest building.—Once pair formation is established, the pair builds the nest with the male typically collecting the material, and the female constructing the nest. At Shala the males collected nest material mainly from the islands; at Abiata they collected the material from trees and other partly-submerged vegetation close to the colony. Males regularly took material from unguarded or abandoned nests. Nests varied from touching each other to being several m apart and from 0.5–5 m above the water level at Abiata or the ground at Shala. Most nests contained unidentified sticks, 0.5–1.5 × 10–40 cm in size, interspaced with grass (*Sporobolus* sp.) and unidentified feathers. Most were lined with the grass and feathers, although occasionally a nest consisted of only grass and feathers. Several unoccupied nests at Abiata contained innumerable unidentified small mites, each about 0.5 mm long. The dimensions of 25 nests measured at Abiata were: outside rim 47 × 50 cm–33 × 35 cm (av. 39.5 × 39.4 cm), inside rim 28 × 30 cm–21 × 21 cm (av. 24.0 × 23.6 cm), depth central depression 1.0–6.5 cm (av. 3.9 cm), and thickness from top to bottom 13–27 cm (av. 20.3 cm). Occasionally other nests at Abiata were 1 m thick from top to bottom.

Incubation.—Clutch-size, based on 96 nests, averaged 2.24 eggs. Since siblings from the same nests were usually the same size, incubation probably begins when the clutch is complete. However, on occasion one of a brood was smaller in size, indicating that incubation also starts before the clutch is complete. Incubation, done by both parents, lasted about 28–29 days. During the first few days of incubation, the parent (sex ?) sitting on the nest angles the tail about 45° above the horizontal axis; the significance of this behavior, which appears not to have been reported previously, was not determined.

Behavior of young.—Nestlings, from time of hatching to about 2-weeks of age, appear to be active only when the parents feed them. When the nestling is about 4-weeks-old, it is active, jabbing at neighbors or siblings, but it normally does not leave the nest. Sometimes during the heat of the day, the 4-week-old nestling hangs the head and neck over the shady side of the nest. When it is about 5–6 weeks old, the nestling flaps the wings during wind and rain storms and occasionally flies a few meters. At this age, it moves sticks in the nest and gapes much like an adult female does. When the nestling is about 8-weeks-old, it flies nearly as well as the adult although it takes about twice as long as the adult to rise from the surface of the water.

Care of young.—Both parents usually are at the nest at time of hatching. At least 1 parent is at the nest from time of hatching until the nestling is about 1–2 weeks old. Thereafter, the parents come and go until, when the nestling is about 6-weeks old, a parent is at the nest only at feeding time. Both parents, nevertheless, appear to care for the young birds until they are about 8-weeks-old; no adult was seen carrying for any older young.

The very small young cormorants seem to be fed at regular intervals throughout the day, and each feeding sequence may last 45 min. Nestlings 3-weeks-old and older seem to be fed once every 24 h, most often 1 to 2 h before sunset but not uncommonly shortly after sunrise and at mid-day. Normally, feeding of young 3-weeks-old and older does not last long. Thus, 42 feeds by 6-weeks-old young ranged between 3.8 and 17.8 sec (av. 8.8 sec). However, the young bird may be fed at frequent intervals (one 3-week-old fed 7 times within $\frac{1}{2}$ h with each feeding lasting about 10 sec) or the parent may remain with the young bird for several hours before feeding it (1 adult arrived at the nest but waited $2\frac{1}{2}$ h before feeding a 4-week-old who begged during most of the period; another adult remained with a 4-week-old bird from 09:00–17:45, feeding it once at 15:30). During the warm mid-day temperatures, the parents fetch and give the nestlings water; this behavior will be described elsewhere.

The young birds remain close to the nest-site apparently awaiting the return of the adults. The nestling appears to recognize its parents; the adults seem to recognize and feed only their young. The young bird may fly or swim after an adult (its parent?) when begging for food. When returning to the nest, the adult normally lands close to it. If the nestling is some distance from the nest, the parent does not appear to seek it out and eventually leaves the area without feeding it.

Parents seem to feed the most active and strongest siblings. A young bird, hatched later than its siblings, normally expires before reaching 2- to 3-weeks of age, due apparently to starvation or to accidentally being pushed out of the nest by its larger siblings. Young birds falling out of the nest in this manner and jumping out to avoid predators appear to be major causes of mortality at the colonies.

Predators.—Predators at the Shala and Abiata colonies include Marabous (*Leptoptilos crumeniferus*) taking eggs, nestlings and young cormorants nearly ready to fly; African Fish Eagles (*Haliaeetus vocifer*) who take eggs and nestlings to at least 3-weeks-old; and Black Kites (*Milvus migrans*) and Fan-tailed Ravens (*Corvus rhipidurus*) taking eggs and newly-hatched young. Egyptian Vultures (*Neophron percnopterus*) are uncommon at the colonies. Tawny Eagles (*Aquila rapax*), Marsh Harriers (*Circus aeruginosus*), Peregrine Falcons (*Falco peregrinus*), and other unidentified falcons were seen around the colonies but were not seen feeding on cormorant eggs or nestlings.

Acknowledgments.—Financial assistance for this study was provided by African Wildlife Leadership Foundation, National Geographic Society, Addis Ababa University, University of Miami (Maytag Chair for Ornithology), and Ethiopian Wildlife Conservation Organization. The special assistance of I. L. Gibson, T. G. Jefford, and L. L. Urban is acknowledged with much appreciation.—EMIL K. URBAN, *Dept. of Biology, Augusta College, Augusta, Georgia 30904. Accepted 14 Aug. 1978.*

Wilson Bull., 91(3), 1979, pp. 463–464

American Woodcock hatched in Alabama killed in Michigan.—Since the winter of 1973–74 researchers at Auburn University have located numerous nests and broods of American Woodcock (*Philohela minor*) in Alabama between January and April. When