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BREEDING BIOLOGY OF THE EGYPTIAN PLOVER PLUVIANUS AEGYPTIUS

by Thomas R. Howell

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The following is a summary of a study which will appear in full in the University of California Publications in Zoology series, probably in the latter part of 1979. This preview is offered now, in view of the great interest to those concerned with African ornithology which the Egyptian Plover has long evinced.

The Egyptian Plover Pluvianus aegyptius (Glareolidae; Cursoriinae), breeds only in tropical Africa along rivers where sandbars are exposed by low water during the dry season. This species is most noteworthy on account of two unusual behaviour patterns often attributed to it: picking food particles from the jaws and teeth of basking crocodiles; and burying its eggs in the sand and leaving them to be incubated by solar heat. The first pattern, accounts of which date back to Herodotus, is still not documented incontrovertibly and I never saw it take place. The second pattern is more complex than is stated and was a principal subject of my study.

I studied a population of Egyptian Plovers at Gambela, along the Baro River, Ilubabor Province, southwestern Ethiopia, from 24 January to 6 April, 1977. The species is strikingly patterned and the sexes are indistinguishable in colour, vocalizations, and size; adults weigh about 78 g during the nesting period. Most birds were paired and territorial at the time of my arrival. Both sexes defended a territory on a sandbar island by threat displays and fighting, and they attempted to drive off all other Egyptian Plovers and all potential competitors and predators. Courtship activity and precopulatory displays are simple and minimal. The nest is a scrape in the sand-gravel substrate, and both sexes make many preliminary scrapes before one is finally chosen. The usual clutch at Gambela was 2 or 3 eggs (one single-egg clutch); the mean egg weight is 9.5 g. From the first, eggs are covered with sand (by use of the bill, not the feet) to a usual depth of 2–3 mm above their upper surface. The parents in turn sit on the nest most of the day and may sometimes bring the egg surface in contact with the incubation patch by scraping away sand with the feet while sitting. Whenever an adult leaves the nest it quickly throws sand over the site with the bill. At night the eggs are about two-thirds uncovered and continuously incubated. During the six hottest hours of the day, each adult frequently soaks its ventral feathers in the river and then returns to settle on the buried eggs, thus keeping them surrounded by wet sand. The soaking is a stereotyped activity and is done only after the first egg is laid and when ambient temperatures are high.

The incubation period is about 30 days, and chicks hatch from eggs under the sand. Chicks are highly precocial and leave the nest permanently by the end of the day of hatching. Some food is brought by the parents, which also expose food for the chicks by stone-turning and other foraging methods. At any approach of danger, chicks crouch down and are completely covered with sand by a parent in the same manner that eggs are covered. Buried chicks are also wetted with soaked ventral feathers. Chicks remain immobile if excavated and gently handled but will suddenly flee if extensively manipulated. Even juveniles up to three weeks of age may be covered with sand by a parent. By the age of about four weeks, juveniles have acquired contour feathers with the adult colour pattern but still do not fly. I estimated the age of first flight as about 35 days.

I measured the incubation temperature (T_E) using a fresh egg implanted with a thermocouple as a replacement for one of a pair's own eggs, and simultaneously recorded relevant ambient temperatures. On a typical day, the parents attend the buried eggs only occasionally during the first three hours after sunrise (0700 hrs). A balanced combination of body heat, solar heat, and heat retained by the sand keeps T_E within appropriate limits. The birds often poke the bill in the sand around the eggs, possibly testing the temperature. By about 1000-1030 hrs, air temperature in the shade approaches 40° and continues rising to peaks of 45-46° (over 50° in sun). For about the next six hours the adults cool the eggs by wetting them every few minutes with soaked ventral feathers (water temperature 27°). As shaded air temperatures and sub-surface dry sand temperatures often exceed 45°, mere shading of the buried eggs would not be enough. By about 1600 hrs solar heat begins to decline and the birds become less attentive and cease soaking. T_E sometimes briefly reached 42°, but all undamaged, non-implanted eggs in monitored nests hatched. I estimated mean incubation temperature over 24 hours as 37.5°.

Birds' eggs are heaviest at the time of laying and lose weight at a relatively constant rate throughout the incubation period. The decline in weight is the result of loss of water vapour through the microscopic pores in the eggshell. The rate of water vapour loss is determined primarily by the porosity of the shell and the difference in water vapour pressure inside and outside the shell, which is in turn influenced by incubation temperature and the humidity of the immediate surroundings of the egg. The latter point was of particular interest as the eggs are usually covered by soaking wet sand for about 6 hours out of each 24. I found that the daily rate of weight loss (= water vapour loss) was much lower than predicted on the basis of the size of the egg, but that the porosity of the eggshell was not reduced. I therefore hypothesize that the soaking of the eggs greatly reduces their daily water loss and thus permits a long incubation period without causing excessive dehydration. I further hypothesize that the long incubation period (presumably genetically determined) is adaptively advantageous by allowing enough time for pre-hatching maturation to produce a highly precocial chick, as is necessary for survival on an open sandbar island. I propose that concealment was the initial adaptive advantage to egg-burying, and that the combination of burying and wetting enables the Egyptian Plover to nest in a habitat where the eggs would otherwise be lethally overheated.

The species' conspicuous pattern makes concealment of the incubating adults impossible, but covering-wetting of the eggs makes it possible for the adults to leave the nest safely while distracting or attacking any approaching predators or competitors. The display of striking plumage patterns is often effective in repelling adversaries without a fight. The success of Pluvianus aegyptius - the only species of courser to colonize the fluviatile habitat - is attributable to its methods of incubation and chick care, which are unique among birds.

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