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Egg Manipulation By The American Alligator

It is now certain that several, and by extension probably all, crocodylians characteristically open their nests at hatching time (Cott, 1961; Alvarez del Toro, 1969; Pooley, 1977; Herzog, 1975; Statton and Dixon, 1977), and Pooley and Gans (1976) have discussed the life history and evolutionary correlates of such nest opening behavior. For several species in which this activity has been documented, nest opening also involves the adult picking up eggs or young using its mouth (Alvarez del Toro, 1969; Hadley, 1969; Pooley, 1977; Tryon, 1980). Despite the considerable amount of research conducted on the American alligator (*Alligator mississippiensis*), oral manipulation of eggs to aid in hatching has not been described for the species. In this note, we document that process and discuss the fate of non-viable eggs.

Observations were made September, 1978 in the Everglades of southern Florida. As in most conclusive studies of crocodylian parental behavior, experimental manipulations were performed but in a way that simulated natural conditions. Eggs were removed from a nest threatened by flooding and incubated artificially. At the time of hatching, the eggs were returned to the nest, and a tape recording of juvenile vocalizations was used to attract an adult alligator to the nest site. Although this alligator was not tagged, it was the same size as the habitual nest guardian and so was probably the parent. Egg manipulations were documented by 35 mm-still and 16 mm-motion picture photography.

Egg opening behavior began with the adult picking up an egg in its teeth by rotating its head to the side (Fig. 1a). The alligator gently propelled the egg backwards onto its tongue and rolled it between its tongue and palate (Fig. 1b), which apparently aided in hatching. After the egg hatched, lateral head movements swished water through its mouth clearing shell debris. Young were picked up in a similar fashion and carried in the gular pouch in front of the tongue. These egg opening and hatching handling behaviors were similar to those recorded for other crocodylians (Alvarez del Toro, 1969; Pooley, 1977).

The fate of infertile or dead eggs during crocodylian nest opening has not received much attention. Although a few dead eggs will sometimes be left in an alligator nest, more typically all eggs are removed. Some crocodylians have been reported to discard already hatched shells or rotten eggs (Alvarez del Toro, 1969; Hunt, 1975). Pooley (1977) found in an experiment that a *Crocodylus niloticus* swallowed hatched eggs shells and infertile or rotten eggs that were given to it. Based on this observation, Dietz and Hines (1980) hypothesized that the alligator might also eat its eggs. Our observations confirm this. The alligator rolled rotten eggs on its tongue and when they cracked swallowed them immediately. We could tell the eggs were rotten because they were unbanded and because an opaque fluid was emitted when they cracked. This observation suggests discrimination in the behavioral response that the adult exhibited toward the eggs. The alligator recognized viable eggs and assisted them in hatching but ate spoiled eggs, the decision between release or consumption presumably being accomplished by touch or taste.

Egg eating has several ramifications. The possibility that egg eating has occurred means that an investigator cannot determine nest production by using data derived from the number of unhatched eggs found to remain in a nest after hatching (Graham, 1968). Egg manipulation behavior, like that of nest defense (Kushlan and Kushlan, 1980), appears to be complex and involves crucial points at which the alligator makes decisions as to which of two behaviors is most appropriate. Egg eating allows an adult to recoup the energy and nutrients of nonviable eggs, which otherwise would be lost. It also may decrease the likelihood of attracting predators to hatchlings that stay near the nest.

Unlike the Nile crocodile (Pooley and Gans, 1976), young alligators can emerge from the nest without parental assistance (pers. obs.). Thus the existence of nest opening in alligators might be more than just a way to affect release of the young. An important point is that egg manipulation to assist in hatching allows the alligator to synchronize the emergence of its hatchlings. Forming pods after hatching may offer considerable advantage to young alligators by facilitating parental care (Kushlan, 1973). If so, it would be important for young to hatch together rather than independently straggling out of the nest over a period of days. Alligator nests in the Everglades can be threatened by flooding late in incubation (Kushlan and Kushlan, 1981). Egg hatching might allow alligators to hatch out their young to prevent flooding, and there is some suggestion that this can occur (Kushlan and Kushlan, 1981). It may also be of advantage to a hatchling to have access to the protection of a pod of siblings, even if this required its being hatched out somewhat prematurely. Hatching synchrony, brought about by egg manipulation, may increase the reproductive fitness of adult alligators.

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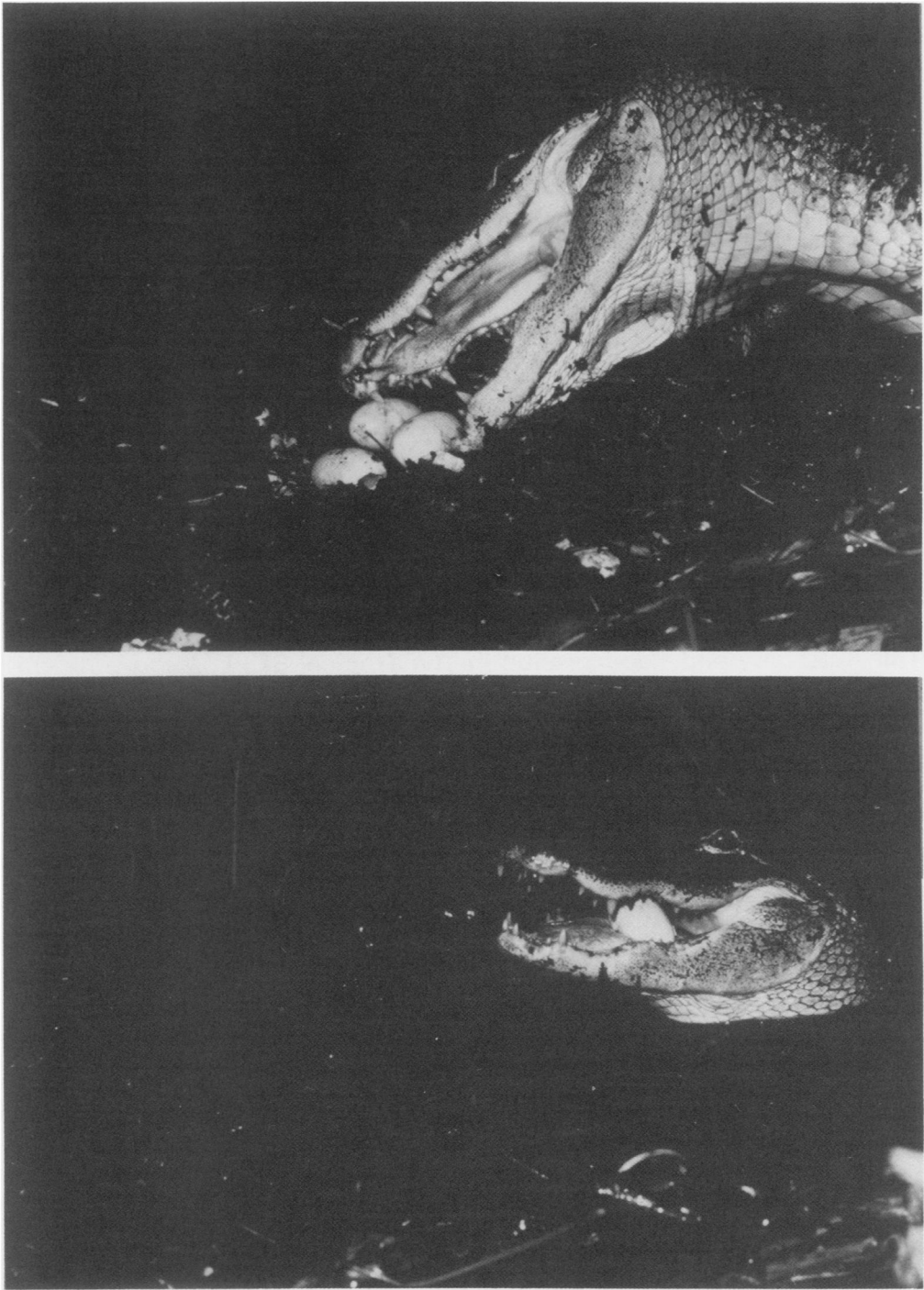


FIGURE 1. Alligator egg manipulation behavior. Top A: alligator picking up eggs with its mouth. Bottom B: alligator assisting egg in hatching.

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Tail Autotomy and Regeneration in The Tropical Skink, *Mabuya heathi*

Recent interest in tail autotomy adaptations of lizards and salamanders has greatly increased our understanding of these phenomena (Ballinger et al., ms.; Congdon et al., 1974; Jaksic and Fuentes, 1980; Maiorana, 1977; Schall and Pianka, 1980; Schoener, 1979; Schoener and Schoener, 1980; Vitt et al., 1977). Like other aspects of the biology of organisms, ability to lose tails, tail regeneration rates, energy content of tails, and morphology of tails are subject to natural selection. Understanding adaptations for autotomy and regeneration necessitates evaluation of ecological and physiological data.

In this paper, I present data on autotomy and regeneration in the tropical Brazilian skink, *Mabuya heathi* and relate the results to aspects of the ecology of this skink.

Samples of *Mabuya heathi* were collected over a 12 month period near Exu, Pernambuco, in northeastern Brazil (7°25' S latitude and 40°10' W longitude). Each lizard was measured (snout-vent length, original tail, and regenerated portion, if any) to the nearest mm, and weighed (.1g) shortly after capture. In some instances, entire tails of lizards which had not experienced autotomy were removed at the base to obtain weights of the whole tail.

Seven adult males and five adult females of *Mabuya* were collected for determination of regeneration rates in the lab. Each individual was maintained in a 1,000 cm³ plastic terrarium, given water in a small dish, and fed ad libitum a diet of various insects (primarily acridid grasshoppers). Lab temperature averaged between 25-30 C and some heat and light was provided with 100 watt bulbs positioned 1 m above the terraria. The thermal regime approximated that of the natural habitat of *Mabuya heathi*. These conditions were also similar to those used in experiments with *Eumeces* by Vitt et al. (1977). After a 2-day acclimation period, tails were removed from the experimental animals by pinching the tail at the base.

At weekly intervals, experimental animals were measured, and weighed. Experiments were terminated after 10 weeks, when regeneration rates approached an asymptote.