

Incubating Eggs of the Gharial (*Gavialis gangeticus*) for Conservation Purposes

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CROCODYLIAN management programmes within India were initiated in the 1970's, when numbers of all three species found on the sub-continent (*Crocodylus palustris*, *C. porosus* and *Gavialis gangeticus*) were declining, and the threat of extinction in the not too distant future seemed real (see Whitaker Chapter 7). The short-term aim of these programmes was to reverse the trend of declining numbers and avoid extinction, and in the longer term, to re-establish viable populations that could be used in a responsible manner to generate foreign exchange (Bustard 1974). The programmes with all three species involve the collection of eggs from the wild, their artificial incubation, and subsequent raising of young for release back into the wild. The involvement of local people in the programmes occurs at all levels (Singh Chapter 23).

With the gharial (*G. gangeticus*) (Fig. 1), few data on the timing of reproduction, nesting, egg characteristics, incubation procedures, hatchlings and post-hatching requirements were available when the management programme for that species was initiated (Subba Rao 1977). Even today there is still much to learn, but the basic pattern of reproduction is known and eggs are now collected and incubated successfully, and the young are being raised and released in accordance with the programme's aims. This chapter briefly summarizes information on gharial reproduction as it relates to the management programmes for them. Results come mainly from the gharial conservation project at Tikerpara (21°N, 85°E), Dhenkanal District, Orissa.

NESTING AND EGG COLLECTION

Gharials are polygamous, and mating takes place in the water in January-February. Adult gharials are about ten years of age. The eggs are laid in March-April, in a hole-type nest excavated in sandy substrates 10-15 metres from the water's edge. Depending upon the size and age of the female, clutch size

varies from 18-97 eggs. The eggs are hard-shelled, 'milky' white in colour and are elliptical with both ends being more or less blunt (Fig. 2). They range from 117-121 g; mean egg length is 69 mm and mean egg width 46 mm. Incubation typically takes 10-11 weeks, and thus hatching occurs in June-July, before the monsoon season. Many nests are collected for artificial incubation, and nesting sites are regularly patrolled during the egg-laying season with the help of fishermen and tribal people.

When a nest is found, the eggs are collected during the cooler part of the day and packed in damp nest material in well-ventilated wooden boxes. The orientation of each egg in the nest is marked and maintained in the boxes.

Incubation is carried out in specially constructed hatcheries enclosed by wire mesh. The eggs are positioned in three layers (22, 10 and 8 eggs from the bottom to the top in a typical nest) within a hole excavated in a cubic metre of slightly moistened sand (about 7% water content by weight). This is held in place by side walls made of half bricks, to promote aeration and evaporative cooling (as in an earthenware water pot). Temperature is measured with a thermometer within a thin bamboo rod inserted into the level of the eggs, and is maintained at $30 \pm 0.5^\circ\text{C}$ by sprinkling the sand with 6 to 8 litres of water every day during the summer.

During incubation under the above conditions egg size increases up to the 8th week of incubation (Fig. 3), after which it remains stable. The swelling causes the outer shell to crack and flake off, particularly in the later stages of incubation.

HATCHING

Details on the hatching of 71 eggs from two clutches were recorded in 1975. The eggs were collected soon after laying and incubated at 30°C .

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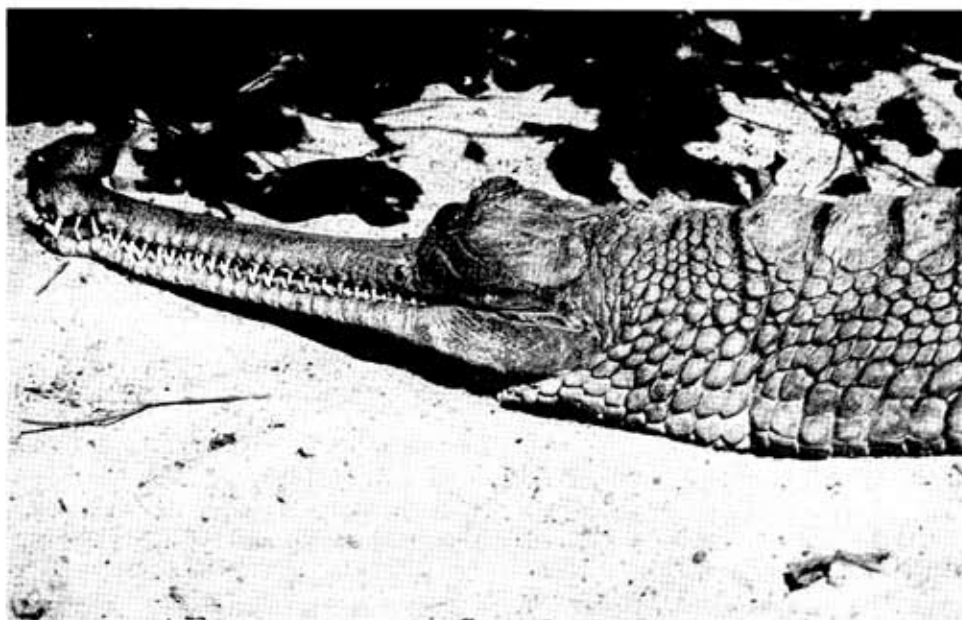


Fig. 1. An adult male gharial *Gavialis gangeticus* (2.7 m total length), with the pot-like "ghari" at the tip of its snout.

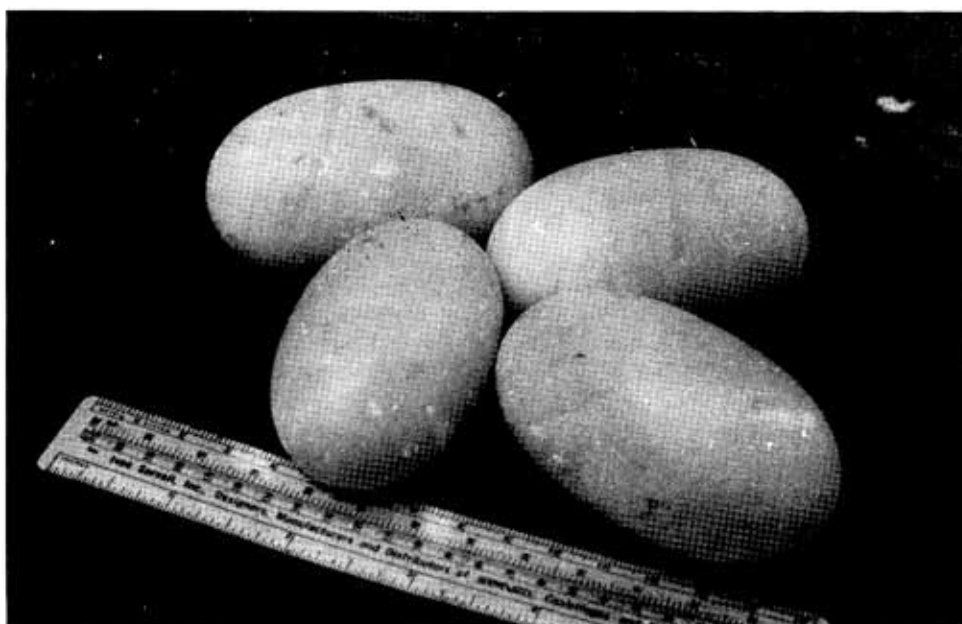


Fig. 2. Freshly laid *Gavialis gangeticus* eggs.

The time interval between the hatching of the first and last egg was 72 hours and a typical hatching sequence is as follows:

Time	Observation
0810	Intermittent jerks of the complete egg.
0815	Egg shell pipped.
0819.45	About 10 mm of snout protruding through slit in shell membrane.
0827.30	Snout moving back and forward in slit; allantoic fluid seeping from slit.
0828.30	About 28 mm of snout protruding; more allantoic fluid seeping out.
0829.15	Complete head and neck emerged.

0830.40	Most of body protruding.
0830.45	Hatchling completely emerged with umbilicus still attached to the allantois within the egg.

Hatchling gharials are very active after leaving the egg. The umbilicus dries and separates within 3-6 hours, and if they hatch prematurely, with the residual yolk still external, it may be internalized after hatching. Mean size of some hatchlings measured at the time of hatching ranged from 30-36 cm total length, 15-17 cm snout-vent length and 60-89 g.

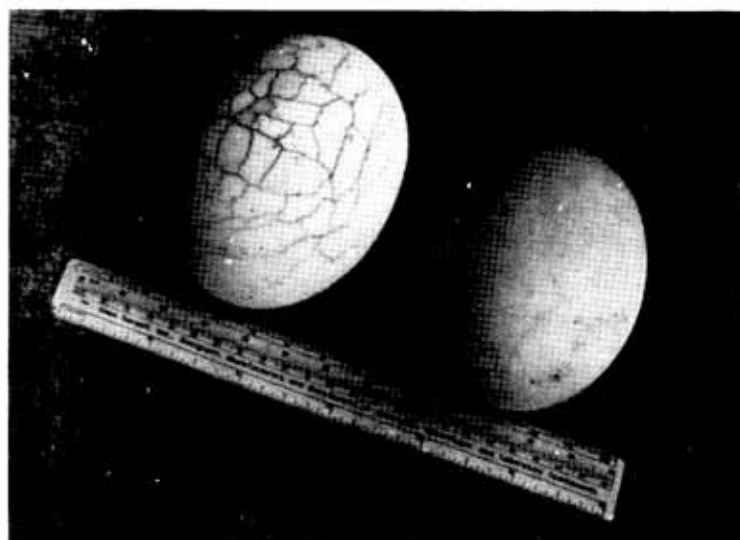


Fig. 3. Eggs of *Gavialis gangeticus* showing the extent of swelling and cracking at the time of hatching (left) relative to early in incubation (right).

POST-HATCHING CARE

Hatchlings are kept for the first year in groups of 10-12 per pool. The pools are $2.13 \times 2.28 \times 0.3$ m deep, and are surrounded by clean river sand with shade from willows (*Salix* sp.). The hatchlings bask in the morning and evening, typically stay in a group, and never fight with each other (in contrast to *C. palustris* which are notorious for fighting). About 250-350 scaleless live fish, 2.5-3.5 cm long, are released into the pool daily as food. Initially, hatchlings seem clumsy at catching their prey, but once mastered, tadpoles are offered on alternate days. Hatchlings can readily perish if conditions are unsuitable and/or insufficient food is provided at this time.

The 'second year pools' are $4.6 \times 4.6 \times 1.0$ m deep, and are surrounded by a strip of sand about 1 m wide and 15 cm deep. Gharials about 1 m long are reared in these pools for about another year, before release into the gazetted sanctuaries.

DISCUSSION

By 1984, at least 34 rearing centres and 34 protected areas were in operation within India. The National Chambal Gharial Sanctuary, which is the

largest sanctuary in India (12,568 km²) holds the largest gharial population in the country (about 1160 animals); at least 53 resident adults and 907 animals restocked through the management programme.

The success of the gharial management programme to date has been directly related to the success with which eggs could be located, collected, incubated and the young raised until they could be released.

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