

16. COLLECTION AND HATCHING OF MARSH CROCODILE (*C. PALUSTRIS*) EGGS

The Madras Snake Park collected mugger eggs in Tamil Nadu for the second season this year. During April and May seven nesting sites were visited, and four wild nests were transported to the hatching area in the Park. The areas visited were: (1) Vakkaramari Waterworks, Chidambaram; (2) Elathur, Coleroon River; (3) Kilikuddi Tank, Grand Anicut; (4) Amaravathi Dam, Chinnar and Munnar Rivers; (5) Bhavanisagar, Bhavani and Moyar Rivers; (6) Hogenakal Falls, Stanley Reservoir, Cauvery River; and (7) Sathanur Dam, Ponnaiyar River.

1) Vakkaramari Waterworks:- 19-iv-75

Area: Forty acre waterworks with two large tanks, feed canal and pumping station. A 30 feet bund divides the tanks. Sparse vegetation.

Number of mugger: 15 adults and sub-adults:

Nests found: Nest 1 was on the centre bund, $1\frac{1}{2}$ metres from the waters' edge. The eggs had been laid the night before (fresh mucous on top egg, scattered fresh earth from digging). The eggs were 8 cms below soil surface under an acacia bush.

A one metre square chicken wire mesh was pegged down on the nest to keep out predators. During the operation a $2\frac{1}{2}$ metre adult crocodile, possibly the female, kept close by on the water surface.

Nest 2 was located on the south side of the canal. The eggs had been dug up and eaten by predators, the common ones there being mongooses, jackals, monitors, civets.

Subsequently, the Superintending Engineer for the Waterworks wrote us a very interesting letter; that on 2-v-75 at 9-30 a.m. the staff saw a nesting mugger dig a nest hole on the centre

bund and lay 22-28 eggs, after which she turned round and started eating them. This has been reported to happen in captive conditions (Ahmedabad Zoo, 1975), but in wild crocodiles this behaviour is difficult to explain.

2) Elathur, Coleroon (branch of Cauvery River):- 20-iv-75

Area: A sharp double bend in the Coleroon 12 miles from its entry into the Bay of Bengal has formed a deep channel, where crocodiles were once plentiful. There are several bathing ghats on the south bank of the river.

No. of mugger: Approximately 5.

Nests found: None.

3) Kilikudi Pond, Grand Anicut:- 20-iv-75

Area: Two acre pond, ten miles from Trichy. Declared a Crocodile Preserve in 1972.

No. of mugger: 16.

Nests found: Nest 3 was located on the north bank of the pond, 1 metre above and 2 metres from the water line. 20 cm under, the fine clay soil was moist enough to compress into a ball. The nest had 16 eggs, out of which 6 were cracked and 2 rotten. They had been laid around 12-iv-75.

The eggs were transferred to a box and Mr. Rao flew with them to Madras. The cracked eggs failed to develop in the hatchery and were attacked by ants. Four others also turned rotten and on 20-vi-75 only six hatched. One hatchling, which was very weak with a dry skin, died a month later.

4) Amaravathi Dam (Thennar,, Kuthirayan and Chinnar Streams):- 22-iv-75

Area: 5 sq km reservoir within the Anaimalai Wildlife Sanctuary. Being a drought year the maximum depth was 15 feet.

No. of mugger: Largest single population noted in Tamil Nadu. In one night count 22

animals were observed, and 14 adults in the day time.

Nests found: On a walk around the entire circumference of the reservoir a total of 11 empty nests were seen (nests 4-14). The eggs had been fairly recently removed by humans. Local tribals said that cow herders, stick and dead fish collectors etc. do not hesitate to take the eggs from a fresh mugger nest. These are either sold to the local hotel or eaten at home. All these eggs had been laid during the first two weeks of April. An estimated 350 hatchlings were thus lost to human predation in Amaravathi alone this year.

Remarks: A point of interest about Amaravathi is the fish catch in relation to the number of crocodiles. Having the largest number of mugger in any one habitat in the State, this reservoir also has one of the largest fish catches in India; sometimes one man may catch as much as 350 kg a day, the main fish being *Tilapia peter mozambique*. This situation directly contradicts the popular belief that crocodiles are detrimental to the fish industry. In fact, recent studies in many parts of the world prove the importance and value of crocodilians to Fisheries.

5) Bhavanisagar, Bhavani and Moyar Rivers:- 25-iv-75

Area: Large reservoir, present depth 63 feet.

No. of mugger: About 10. 5 were seen by us.

Nests found: No nests located. Much human activity on all shores; fishing, planting, construction etc.

a) Moyar River

Area: Moyar River joins Bhavanisagar Dam. Broad stream, thick elephant jungle.

No. of mugger: Not known; very scanty population.

Nests found: None; but local Irulas reported regular nesting sites by a few crocodiles.

b) Kedarhalli Stream

Area: Minor tributary of the Moyar which flows down from the Kotagiri Hills through deep narrow chasms. Near Masipatti where the Nilgiri foot-hills start to level out, the stream forms fairly large pools at bends and below falls. There is no road.

No. of mugger: At least 6 breeding size mugger live in pools along the stream. In the 4 km stretch where we camped, we saw 4 adults.

Nests found: Nest 15 was found on the south side of a small pond, 30 feet away from water and 6 feet above water level. The sand was damp $\frac{1}{2}$ metre below the surface. There was no shade nearby, and the nest received direct sunlight from 9 to 4. The eggs had hatched 3 days before and we found the (17) hatchlings in the pond under a huge overhanging rock 50 metres from the nest. The parent had carried hatched and semi-hatched young to the pond. Shells and 2 freshly dead young lay under the boulder. Some of the young had swollen stomachs (unabsorbed yolk) and three had curled tails (over-heating of nest site). Two had raw umbilical scars.

Nest 16 was located near a pool 1 km upstream from here, 40 metres long and 10 metres wide. The average depth was $1\frac{1}{2}$ metres. There was thick mud at the bottom and a large number of fish were dying from clogged gills due to recent rains stirring up the mud. Two adult mugger live in this pool.

15 metres from the pools' edge we saw a slight mound in the bushes, smooth from the passage of a mugger, and wet. Tapping it, we heard soft croaking grunts. In the evening we dug the covering of 25 cms of earth. There were 18 eggs, 11 of which hatched during the next 12 hours. Several were discoloured. The next day these were taken by train to Madras.

Another 3 km upstream, near a slightly

larger pool, we saw nests 17 and 18. The eggs had hatched but there was no sign of the young.

6) Hogenekal Cauvery River:- 1-v-75

Area: The Cauvery flows swiftly over a rocky bed with several large, deep pools. This Melgiri area has scrub and deciduous forest, elephant habitat.

No. of mugger: Unknown, a few scattered pairs.

Nests found: Nest 19 was located on a sand bank about 3 metres from the river. The young had hatched about April 21st and on information from local people 23 young were collected.

7) Sathanur, Ponnaiyar River:- 3-v-75

Area: Approximately 10 sq mile reservoir, surrounded by dry scrub.

No. of mugger: 10-12 adults.

Nests found: Seven empty nest holes were found (nests 20-26). The eggs had been taken by Irulas and other local people.

Captive breeding at Madras Snake Park

Our 7 feet, 16 year old female laid 22 eggs on 8th March. On 6th May these were transferred to the hatchery. 17 were good eggs, 1 punctured, and four rotten. 15 babies hatched on 24th May. Of these, one was blind in one eye.

Conservation of the mugger: Tamil Nadu has representative examples of the two types of mugger habitat which could contribute to conservation: reservoirs, which could be used for artificial breeding and management (collection of eggs, rearing etc.), and those, like Kedarhalli, which could be excellent wild crocodile preserves in primeval habitat, provided efficient protective measures were taken.

Local tribals would provide ideal staff personnel for crocodile breeding projects, as they have considerable experience and knowledge of nesting habits of mugger through collection

of eggs for consumption, besides having a natural aptitude and liking for work involved with wildlife.

Natural hatching of mugger eggs:

After mating, (in India usually between January and March, though timings may change in severe drought conditions, geographically or in captive animals), the female mugger is ready to lay her eggs after about 2 months. Up to five or six trial nests are made, presumably to check suitability of soil temperature, humidity, consistency etc. The final nest has an average depth of 50-60 cms and the average diameter is about 35 cm. Soil above the nest has been found to be between 5 cm and 22.5 cm. The female digs with her hind feet, only sometimes using her front feet. Occasionally she inserts her snout into the hole; this may be checking for fungus, ants, and other undesirable elements. After laying, (anywhere from 16 to 40 eggs, depending on the size and age of the animal) she covers the nest with the fine loose earth she has dug out and packs it with her body. Under normal conditions she visits the nest every night, or lies near or on the site for 24 hours. On every occasion that we found a wild nest, the tracks of the female were clearly visible from the night before. On some of her nightly visits she dampens the nest, either carrying water in her mouth or perhaps by cloacal evacuation (noted by Reuben David, Ahmedabad Zoo). When, 45-47 days later, the babies start their grunting chorus, she gently digs down to the eggs. The hatched and sometimes semi-hatched babies are carried to the water in her mouth.

The protective instinct of crocodiles is very strong. Both males and females react very strongly to the nasal distress cry of the young. Experiments on this with captive and wild specimens have sometimes had rather fright-

ening results, with 3 or 4 large mugger leaving the water and charging open-mouthed at the (human) imitator of the cry.

Artificial incubation and hatching:

Two methods can be adopted. (a) By far the best one is to cover the nest with mesh and have someone keeping constant watch on it.

Hatching success is likely to be far greater this way, as errors in transferring, transporting and duplicating nest site conditions are eliminated. (b) The other method is to transfer the eggs to hatching boxes and transport these to the hatchery. This transfer should be done either within 24 hours after laying or after 20 days. We use wooden boxes $2' \times 2' \times 2'$. These should be filled with one layer of earth from the nest site, the eggs placed in it, and re-covered with earth.

The method of transferring the eggs to the boxes is of the utmost importance, and should be done very carefully and slowly. As it is removed from the nest, the top of each egg should be marked with a felt pen, and placed in exactly the same position in the box. If it is turned even slightly, the delicate blood vessels may break and the egg will probably not hatch. The eggs should be tightly packed in a mixture of earth, leaves and grass. The best mode of transport to the hatchery is by train, if the distance is great.

Conditions in hatchery: The hatchery boxes should be placed in an enclosed area. Air and soil temperatures should be taken at the nest site and duplicated inside the hatchery. Careful temperature and humidity checks should be kept. If possible, cracked eggs should be kept in a separate box, as these attract ants.

Efforts should be made to eliminate these and other insects.

Hatching: When the babies are ready to hatch, they start making barely audible grunting sounds. 24 hours after the first sounds are heard, at a cool time of day, the earth covering the hatchlings should be dug up. Those still in shells should be allowed to hatch by themselves.

Hatchling enclosure: It is essential to provide an enclosure safe from predators, with clean water, thick vegetation for hiding, and plenty of food.

Food: Young crocodiles eat voraciously from the second or third day. Insects (beetles, termites, dragon-flies, grass-hoppers), small frogs and fish are taken during the first couple of months, up to the first year. A light bulb hung over the pond is a cheap and easy way of seasonally providing some insects. It is important to remember that if there are too many animals put in for food, e.g. frogs, the feeding rate will go down, so also if there are too few. A balance has to be worked out in each case after careful observation. If these basic requirements are provided, hatchlings can grow at an incredible rate. A few of the one year old hatchlings we have are already a metre long.

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criticisms. As always, special thanks to our Irula friends, whose knowledge of natural history puts—or should not put—us all to shame.

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17. EXTENSION OF THE RANGE OF DISTRIBUTION OF A MICROHYLID FROG [*UPERODON SYSTOMA* (SCHNEIDER)]

The microhylid frog, *Uperodon systoma* (Schneider) (the Marbled Baloon Frog) has so far been recorded from Agra and Allahabad (Uttar Pradesh), Tamil Nadu, S. Kerala and Karnataka (Peninsular India) and Sri Lanka (Thurston 1888; Boulenger 1890; Ferguson 1904; Nieden 1926; Parker 1934; Mahendra 1939; Daniel 1963). Recently, six examples (5♂♂, 1♀) of *Uperodon systoma* (Schneider) were collected from Siwalik hills near Badshahibag (District Saharanpur, Uttar Pradesh) nearly 5 km east of the point where river Yamuna cuts through the Siwalik hills.

The occurrence in the Siwalik hills extends the range of distribution of the species northwards.

A burrowing form, it is found buried under the superficial layer of soil below bushes and stones and is ordinarily not seen because of its nocturnal habits. During breeding season, it visits water holes for laying the spawn. In

Siwaliks, it breeds in standing pools of water during the month of July when the pools are filled with rain water.

The species could have a much wider distribution than so far attributed to it has been appropriately pointed out by Daniel (1963). Further thorough surveys might extend its range still further. This record is the first from Siwalik hills and it is likely that the species might also exist in some pockets in the foothills of the Himalayas although Waltner (1974) has not recorded it in the Himalayas.

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