

Breeding of False Gharial (*Tomistoma schlegelii*) at Zoo Negara, Malaysia

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Introduction

The False Gharial (*Tomistoma schlegelii*) is a large fresh water crocodilian species. It lives in dense secluded areas of the rainforest fringes, mainly near slow moving rivers, swamps and lakes (Steel. R, 1989). With its long snout and cutting edge teeth, its diet primarily comprises fish, but small mammals may be consumed when the opportunity arises. This secretive animal spends most of its time submerged in water with just the nostrils and eyes visible. They also can be found in wallows or mud-holes.

This once widespread species currently can be found only in Peninsular Malaysia, West Borneo, Java and Sumatra (Ross. C.A. and Magnusson. W.E.). With habitat destruction being the main contributor to their disappearance, it is believed that there are fewer than 2500 individuals left in the wild. The species is listed on Appendix 1 (Endangered) of the Convention of International Trade of Endangered Species (CITES) (Steel. R, 1989). In addition to this they are listed on Schedule 1 of the Wildlife Protection Act 1972, thereby afforded totally protected status within Peninsular Malaysia by the Department of Wildlife and National Parks (DWNP). Little is known of the biology of this species in the wild, and so captive breeding represents a great challenge.

Animals and Behaviour

Zoo Negara currently houses three adult males and one adult female. Three individuals were purchased from Singapore in 1989. Two additional animals were purchased the following year, one from the Singapore and the other from a local dealer. One female died in 2002 after a tree fell in the exhibit following a heavy storm.

All three males are between 360 to 390 centimeters (cm) in length with bodyweights between 190 – 210 kilograms (kg). The lone female is 327 cm long and weighs 93 kg. All four have always been kept together with no social problems noted at any time. In particular there has been no evidence of any aggressive behaviour amongst the males. The double crest scutes of the tail of each animal have been cut to allow easy identification at a distance.

In addition to the False Gharial, the exhibit is also home to three Southeast Asian Soft-shelled Turtles (*Amyda cartilagineus*). A number of wild White-breasted Water-hens (*Amaurornis phoenicurus*) and both Clouded and Water Monitor lizards (*Varanus bengalensis* and *Varanus salvator*) are also found intermittently within the exhibit.

Housing and Environment

The False Gharial exhibit is approximately 1078 m² with almost two thirds being a cement-based pool which stretches from one side of the area to the other. There is one main open viewing area along the front of the pool with a three foot wide planted area at the top which acts as a barrier between the animals and public. This area is planted with fairly thick vegetation. Keeper access is from a raised walkway to one side of the exhibit allowing staff to enter from the land area at the back.

The substrate is a mixture of peat and sand which has been well planted with shrubs and tall trees. There is also a mud hole big enough for all four False Gharials to wallow in at any one time. This mud wallow was previously a cement-based treatment pond which allowed animals to be isolated when necessary. This was later converted to address the behavioural needs of the species. Additional basking areas, in which the animals are exposed to direct sunlight, can be found around the edges of the pool. However, it must be noted that basking has rarely been observed in these animals.

The pool is relatively straight along the front, whilst the back of the pool (at the rear of the exhibit) is irregular in shape providing visual barriers which possibly lessen the likelihood of social or behavioural conflict among the animals. The shallow end of the pool is only 30 cm deep with a gradual slope down to 90 cm at the deepest point. The pool is filled with natural river water flowing through the zoo. During the day, the water flows at a slow constant rate allowing a gradual rate of daily water exchange. There are no filters used for the pool. The pool is cleaned out every two weeks or sooner if needed.

Diets and Feeding

The main diet of the False Gharial is fish. Individual animals are fed two to three kg of fish three times per week. In addition to this, they are also fed chicken, white rats, guinea pigs and lean meat (beef) once every seven to fourteen days depending on availability. No vitamin and mineral supplements are added to the diet.

Courtship and Mating

Courtship coincides with periods of rainfall (November to February and from April to June). The animals were noticeably more active during this period and the female was often seen with the largest male. The two other males positioned themselves at different inlets of the pool. However no mating was observed and it appears likely that this took place at night.

Nest Construction and Laying

Nest building started at the end of May just after the heavy rains. The nest mound was constructed just behind an area of thick undergrowth, directly under a tall Oil palm tree (*Elaeis quineensis*), approximately six metres from the water's edge. The female cleared 150 to 200 cm of undergrowth surrounding the nest site and that cleared vegetation was used by her for nest construction. Other substrates used included peat, twigs, small broken branches, oil palm seeds, parts of the palm leaf and frond and dried Banana (*Musa sapientum*) leaves found by her in the exhibit. Additional Guinea (*Panicum maximum*) and Napier (*Pennisetum purpureum*) grass blades were placed close to the nest to use as extra nesting material if required. Two weeks following the initial construction additional vegetation was collected by the female and used to increase the height of the nest, suggesting that egg laying took place around this time. The nest and eggs were not examined during this whole process for fear of disturbance.

Nest and Eggs

The nest mound was approximately 45 to 50 cm high, with a diameter of 90 to 110 cm. Examination of the nest revealed that the eggs were positioned just above ground level; each was marked and numbered. A total of 19 eggs were found, of which

only 11 were fertile. Three eggs were randomly selected for further examination and their measurements are listed below (Table 1). These eggs were candled; revealing that each was fertile. A plywood screen was held between the female and the nest throughout the collection of data. Although the female remained at the edge of the pool closest to the nest, no aggression was observed.

Table 1.

Egg No.	Weight (gm)	Length (cm)	Width (cm)
1	150	9.3	5.5
2	155	9.0	5.5
3	145	9.4	5.5

Note: Egg dimensions were obtained two weeks after approximate date of laying.

Random measurements of the nest temperature at egg level revealed a fluctuation between 26°C and 32°C, with lower temperatures recorded following heavy rainfall. All the eggs were left in the nest for natural incubation which allowed for data collection. During the second month of incubation, one egg was removed and opened revealing a healthy, well formed embryo. Unfortunately, this died after two days despite being placed in an incubator.

Hatchlings

In September 2003, after approximately 90 to 100 days of incubation, the hatchlings emerged from the nest. Much of the nest substrate and vegetation around the nest site had been cleared suggesting that the female had assisted with the uncovering of the nest. Seven of the eggs hatched. Four hatchlings survived and are currently thriving; two of these were found in the water whilst all others were located on the land. Each of those that died was badly bitten by ants and termites found within the exhibit. We did not observe any attempt by the female to aid the hatchlings into the water. No aggression was displayed towards the keepers when the hatchlings were collected, but the female remained close by. Later examination of the nest showed that of the eggs which did not hatch, eight were infertile and a further three eggs each contained fully formed embryos. The hatchlings were removed to prevent any danger of predation from the adults, the Southeast Asian Soft-shelled Turtles and Monitor lizard species resident within the exhibit.

Discussion

The breeding of *Tomistoma schlegelii* at Zoo Negara marks the first captive breeding in Peninsular Malaysia. Few False Gharials are currently held in captivity in the Peninsular and this fact, coupled with the lack of recent data available on the size of the wild population means that captive breeding could play a vital role in the recovery of the species.

Although the False Gharial has laid at Zoo Negara once in 1998, no nest building took place and the clutch was laid in the water. In an effort to understand the reasons for our first successful breeding of this species, we compared the ways in which these animals had been kept in the past with our current husbandry practices. It is possible that

one or a combination of some or all of these changes have contributed to this first success.

During the last 13 to 15 years, Zoo Negara displayed five animals with a sex ratio of three males and two females, no signs of courtship or aggression have been seen in the past although based on size, all of the animals were sexually mature. Courtship was first noticed early in the year 2003 by which time the sex ratio was three males to only one female following the death of the other female in 2002. It is possible that females kept in close proximity may suppress the breeding of one other. In addition, it must be noted that although Zoo Negara keeps males of almost equal size, there has been no aggression causing displacement of territory within the pool and the exhibit. All three males are able to congregate at the deepest loop of the pool and the wallow at the same time.

The concept of the exhibit was altered after 2002 when changes were made to the maintenance routine in an attempt to better meet the needs of the animals housed within. Before this, the exhibit was always kept trimmed and devoid of ground cover to allow a clear view of the animals for the public. Changes included an increase in the planting with extra vegetation and wild shrubs being planted. In addition to this, a decision was made to cease the trimming of plants and undergrowth, providing a much more secluded area and a more varied choice of substrate for nest construction. We believe that the female was probably more comfortable building the nest in this less disturbed and more secluded area.

In addition to these changes, the diet was altered after 2002. Prior to this, the animals were fed only on fish. We believe that the variety of whole diet feeds provided to the animals, also contributed to the subsequent breeding success. It is possible that a more varied diet allowed the animals to acquire the essential nutrients for fertility, egg development and laying.

This first captive breeding success in the Peninsular has been a great encouragement for further propagation of *Tomistoma schlegelii*. In view of this, we hope to get a greater understanding of the species not only in captivity but more importantly in the wild. The future of this beautiful crocodilian species may well depend on this.

References

1. Charles A. Ross and William Ernest Magnusson. Living Crocodilians, Crocodiles and Alligators. Facts On File, Weldon Owen Pty Limited, United States.
2. Rodney Steel, 1989. Crocodiles. Christopher Helm Ltd.