SURVIVAL STATUS AND ECOLOGY OF *CROCODYLUS PALUSTRIS* LESSON IN BHOR SHAHIDAN CROCODILE SANCTUARY, HARYANA INDIA

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ABSTRACT

Crocodiles are biologically complex reptiles despite their prehistoric look. The mugger crocodile (Crocodylus palustris) which is widely distributed throughout Asia, is studied here for the basking, mating behaviour and its survival status of in Bhor Shahidan crocodile sanctuary and breeding centre.

Key words: Mugger, basking, mating, population and behavior

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INTRODUCTION

Crocodylus palustris is classified as Vulnerable A1a, C2a by the IUCN Red List 2007 and Appendix I of CITES. The word crocodile is derived from Greek word *krokodilos*, *kroke*, means "pebbles" and *drilos*, means "worm". They are very fast over short distances, even when out of water, with extremely powerful jaws capable of biting down with immense force. Their diet varies depending on age. Juveniles eat insects, crustaceans and small fish and adults primarily eat reptiles, amphibians, fish, birds, and small mammals, such as monkeys (Gupta & Bhardwaj, 1993; Britton, 1995). Mugger crocodiles are a hole nesting species. As with other hole nesters, egg laying takes place during the annual dry season. Females become sexually mature at a length of approximately 1.8–2m, and lay 25–30 eggs (Whitaker & Whitaker, 1989). Nests are located in a wide variety of habitats, and females have even been known to nest at the opening of, or inside, the burrow. In captivity, some mugger crocodiles are known to lay two clutches in a single year (Whitaker & Whitaker, 1984), but this has not been observed in the wild. Incubation is relatively short, typically lasting 55–75 days. Incubation temperature determines the sex in the mugger crocodile. Exclusively females are produced at constant temperatures of 28.0 through 31°C. At 32.5°C, only males are produced. Both sexes are produced in varying proportions at 31.5, 32.0, and 33.0°C (Whitaker, 1987).

In the 1960s, their population was extremely low, due to wild hunting for trade. Habitat degradation through damming and channeling of river systems for irrigation is another cause of population decline. The conservation efforts for the revival of the species were initiated in 1976 under the crocodile conservation project. Simultaneously, the Madras crocodile bank trust was set up as a major captive breeding, research and education centre for conservation of all the three Indian crocodilian species (Bustard, 1980).

Bhor Shahidan crocodile sanctuary is loomed in village Bhor Shahidan. It is believed that about 1960, 2-3 muggers came here in the flood, residing in the village pond. At that time the pond had a very ideal environment for crocodiles in the form of water body, terrestrial platform, and marshy plant growth inside water, a huge earth mound for egg laying, etc. The pond was situated in 3 acres area at that time. After sometime population increased through breeding which became a problem for villagers. They started attacking human as well as pets. Then the administration became alert and declared the crocodile breeding centre under crocodile conservation project. It was declared a wildlife sanctuary in 1982 under Wildlife Protection Act, 1972 by the Government of Haryana, with a total area of 8 acres.

MATERIALS AND METHODS

Study area: The crocodile sanctuary is situated on Kurukshetra-Pehowa Road in Bhor Shahidan village at a distance of 13 km west of Kurukshetra University campus. It is a small sanctuary spread over an area of 8 acres. This is one of natural heritage for crocodile breeding in the State. It lies at 29° 57' 39.3" N latitude and 76° 41' 56.3"E longitude.

Topography: The main topographical features are: (i) circular water body and (ii) mound of settled soil. The water body is approximately 1.25 m deep in the center, artificially fed by a feeder originating from Bhakra-Saraswati Canal. This water level is maintained throughout the year. The mound is circular in shape, 243.60 m in circumference and 5 m in height. The soil is settled and has grassy patches. The circular canal is interrupted at one place by a longitudinal stretch of earth which provides a passage to approach the mound. The various tunnels scattered round the mound are significant features of the sanctuary and have been dug by the crocodiles (Fig. 1).

Flora and Fauna: The aquatic flora consists of *Nelumbium speciosum*, *Ipomoea*, *Pistia* and *Eichhornia* species. The submerged weeds are *Valisneria*, *Hydrilla*, *Chara* and *Potamogeton*. The nektonic fauna comprises of fishes, mainly *Labeo rohita* and *Channa punctatus*. Birds like the weaver bird (*Ploceus philippinus*) and cattle egret (*Bubulcus ibis*) nest on the nearby trees.

Climate: The altitude of the study area is around 230 m MASL. The maximum temperature recorded during June was 46^0 C and minimum in winter (December-January) was 4^0 C. The mean annual rainfall is 1200 mm. The relative humidity ranges from 100 % during monsoon to 14 % in summer.

Methods: This sanctuary is very little known. Keeping this in view, systematic surveys were initiated to study the ecology and survival status of *Crocodylus palustris*. Survey was carried out from 2011-12 at different seasons. Basking is the only reliable method used for crocodile observation in the sanctuary. Juveniles were observed almost at dusk and nocturnal. Tapetum of crocodile's eyes enables us to observe in night. The reflection of small crocodiles is pinkish in colour and dark red in large crocodiles. The whole study was based on the intensive direct observation with the aid of 10x50 power Olympus UV binocular. Field identifications were carried out with the help of various field guides Gupta & Sri Hari (1989); Gupta & Bhardwaj (1996).

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Not to scale

Fig.1 Map of Bhor Shahidan Crocodile Sanctuary, Haryana

RESULTS AND DISCUSSION

Individuals recorded during the surveys were varies from 2-17 numbers. In winter we usually observed sun basking, showing the incidence of paring and mating. We are unable to count the total population of crocodile, but according to the sanctuary staff estimation there is a total of 25 crocodiles. Basking with open mouths in pairs is the peculiar feature during winter. These pairs usually consist of individuals who are the same size because crocodiles are cannibalistic, and large crocodiles will eat smaller ones. In contrast, plovers wander freely among the basking creatures, picking leeches and parasites from their skins. The basking site chosen by the crocodiles of the sanctuary is unique as it provides them the safest undisturbed site, with maximum solar radiation and minimum wind currents. The site is a sort of platform situated in the sanctuary. Basking behavior generally attracts the tourist and people in the sanctuary. Thus the numbers of tourist are maximum in the winter season. The basking pattern observed during the study is of three types: individual basking, group basking and

basking during mating season. Present study revealed the breeding behavior *in vivo*. It is evident that breeding season is between December to May. The pair formation takes place during basking from October, as the autumn goes on. At that time they bask in groups of four to seven. As the winter approaches and progresses the number of crocodile in each group increases and later on they segregate into smaller groups, *i.e*. pair of male and female. This paring activity was noted for last three months from December onward up to March. They show intimacy by various actions. Before mating male starts circling the female, keeping his tail upward and snout of the male is always directed toward the female. The incident of nesting and egg lying was observed by the formation of tunnel in the mound centrally situated of sanctuary and favor the earlier studied of Gupta & Bhardwaj, 1995.

25 crocodiles in all present in the sanctuary and population is constant for last three years. Every year two or three female lays egg, around 20-40, but unable to hatch. The main threats to the survival of the mugger are consumption of their egg by human beings, carnivores, predation of its hatching by birds like herons and natural calamities like the flood and desiccation. Every year two or three young ones are seen but they are unable to adapt themselves. In January and February 2008 four muggers lost their lives and reasons are unknown even after the post-mortem reports. According to the Veterinary Doctors and senior researcher, the main reason of the failure of hatching is the biomagnifications of pesticides and insecticides used in the nearby agriculture field. The Wildlife Department of Haryana has done the tremendous efforts in enhancing the scientific establishment of the habitat for Indian muggers. Studies conducted during the same period also indicate that the constantly changing man-made or altered habitats are inadequate to sustain larger and viable populations. Some of the major factors that have had an affect on mugger populations include the decrease in depth and increase in water spread area by floods. The reduction in water levels and drying up of streams during the summer months have taken their toll, causing fish populations to die out and dispersal of mugger crocodiles to unfavorable habitats, in most cases human habitation, where their survival is at risk and re-migration is next to impossible(Davidar, 1983; Andrews & Arumugam, 1992) . Other problems affecting altered habitats is the fishing and agricultural activities around these areas, including the frequent use of fertilizers and pesticides by local settlers, aggravated by the ever-increasing human habitation in these areas. Present study supports the Whitaker & Whitaker 1989 that muggers are being threatened by rapid agricultural development. As many as 32 zoological parks and almost all crocodile rearing centre are now breeding

mugger in captivity. However, today, many of the zoological parks do not want to breed the species any more due to lack of holding space and inadequate facilities.

Despite the enormous pressures encountered, particularly from habitat loss and human encroachment, conservation efforts for the survival of *C. palustris* in Tamil Nadu have been notably successful. Surveys and assessments carried out in 1991 and 1992 indicate that *C. palustris* populations are stable only within protected areas (Satheesh, 1992). A drastic decline in mugger populations was observed in areas prone to severe human pressures, mainly due to habitat modification and destruction. Reduction and degradation of crocodile nesting habitat and poaching of eggs, has affected populations. Dispersal and migration of sub-adult and juvenile size-class animals into human habitation where their chances of survival is further reduced, poses another problem. Therefore, it is an urgent need to implement the crocodile management plans and initiation of a sound environmental education programme for people living in and around crocodile habitats for conservation of the species.

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