

Full Length Research Paper

A preliminary investigation into nesting and nest predation of the critically endangered, gharial (*Gavialis gangeticus*) at Boksar in Corbett Tiger Reserve, Uttarakhand, India

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The gharial, *Gavialis gangeticus*, is an endemic crocodylian of the north Indian subcontinent and is also found in the Corbett Tiger Reserve. Surveys in Corbett National Park in 1974 recorded only five gharial whereas current estimates are 42 adults inclusive of 10 adult males and 59 individuals of smaller size classes. This study confirms that the expanded population in the Kalagarh Reservoir is breeding, although nests appear to be subject to significant predation, thought to be by *Varanus bengalensis*. Varanids are serious predators on crocodylian eggs in a number of countries. In this case, it is unclear whether such high predation levels are natural situations that apply when they live in a free-flowing river environment, or whether it is a derived state linked to the lake-type environment in which they now reside.

Key words: Gharial, *Gavialis gangeticus*, Corbett Tiger Reserve, Corbett National Park, Boksar, nest predation.

INTRODUCTION

The gharial, *Gavialis gangeticus*, is an endemic, river dwelling crocodylian of the North Indian subcontinent, whose wild populations have been depleted throughout much of its former range (Ross and Magnusson, 1990). The western-most historic occurrence of the Gharial was the Indus River in present day Pakistan and the eastern-most (albeit from only two records in the scientific literature) was the Irrawaddy River in present day Myanmar.

Today three widely separated breeding populations re-

main in India (Chambal River, Girwa River and the Kalagarh Reservoir/Ramganga River in Corbett Tiger Reserve) and one in Nepal (Rapti/Narayani River). The wild population was subject to an intensive conservation action program in the 1970's supported by United Nations Development Programme (UNDP)/Food and Agriculture Organization (FAO), which included 'head-starting', establishing protected areas, partial mitigation of anthropogenic pressures and physical enforcement of wildlife laws. In 1975, a breeding conservation project for gharial (and other crocodylians) was initiated with the Government of Orissa at the Nandankanan Zoological Park (Acharyo et al., 1996). The wild population recovered significantly, which was hailed a success.

By the mid 2000's, the wild population was once again recognized as being in serious decline with the global adult population at no more than 200 individuals. In 2007, the International Union for Conservation of Nature (IUCN)

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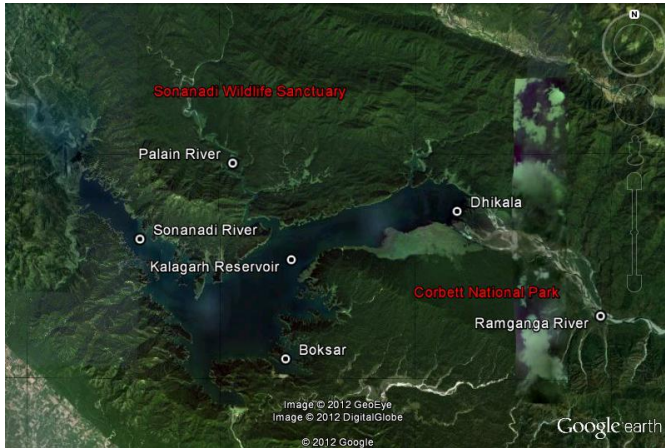


Figure 1. Point locations in CTR surveyed for Gharial.



Figure 2. Gharial nest predated by *Varanus bengalensis* in Boksar in 2011.



Figure 3. Gharial nest predated by *Varanus bengalensis* in Boksar in 2008.

red listing for gharials was upgraded from “Endangered” to “Critically Endangered” (IUCN, 2012).

The Corbett Tiger Reserve (Figure 1) is one of the habitats where recruitment from released stock resulted in an increase in the adult population after the construction of the Kalagarh Dam (Basu, 1995). Surveys of the Ramganga River in Corbett National Park in 1974 recorded only five gharial and there was no evidence of any breeding, either in the form of nests or hatchlings (Whitaker, 1979). Boksar, the best known gharial habitat in the park was being inundated at the time due to the filling of the then new Kalagarh Dam (Whitaker, 1979).

Gharial nesting was documented in Boksar in Corbett NP and the Palain River in the Sonanadi Wildlife Sanctuary of Corbett Tiger Reserve during extensive surveys in 2008. Nesting was also found in 2011 preliminary nesting surveys in Boksar in Corbett National Park. The 2008 surveys were the first record of gharials breeding in the area (Chowfin 2011).

Surveys of Boksar 2011 also reconfirmed gharial nesting in the area during which only Corbett National Park was surveyed. Sonanadi Wildlife Sanctuary was not surveyed as the surveys were preliminary in nature. However, predation of gharial nests in Boksar (Figures 2 and 3) was observed on both occasions with the common Monitor Lizard, *Varanus bengalensis*, being identified as the predator based on visual confirmation and spoor. The findings are of special significance as it confirms that Gharial nesting in Boksar is recent in nature.

MATERIALS AND METHODS

Nesting surveys in CTR were conducted by six forest staff in groups of two or three in boats or on foot in 2008 (Chowfin 2010, 2011). The areas covered in the survey included the Ramganga River near Dhikala, the reservoir at Boksar, Gaujeda, the Palain and Sonanadi Rivers in 2008 and Boksar (Figure 4), Dhikala and the Ramganga River in 2011. Surveys were conducted from late March to late April which is the most frequently reported nesting period for the species in most parts of its range (Whitaker and Basu, 1981).

During 2008, nesting sites were identified by searching the river and reservoir banks for any signs of nesting activity and/or nests and eggshell remnants during daylight hours. Signs of nesting activity included body prints in open, sunny, sandy areas; entry and exit trails to and from the water's edge; attempted digging of egg chambers (“probe” holes) and eggshell remnants (Figure 5) towards the end of the nesting season.

A global positioning system (GPS) location was recorded at all possible nesting sites during the first survey of the season. These sites were then revisited later in the nesting season to confirm actual nesting. (Chowfin, 2011)

RESULTS

At Boksar (CNP) during the nesting surveys in 2008, a clutch of at least 36 eggs was found: 11 eggs were intact and banded to the distal poles, six egg shells were predated, with the tracks indicating *Varanus*, 14 eggs were intact but with broken eggshells and five additional



Figure 4. Gharial nesting habitat in Boksar (CNP).



Figure 6. Predated Gharial egg from a nest in Boksar in 2008.



Figure 5. Egg shell remnants of one of the predated gharial nests in Boksar.



Figure 7. Predated Gharial egg from a nest in Boksar in 2011.

eggs with broken eggshells were infected with a black fungus like growth. Twelve eggs were fertile.

The fertile eggs, with opaque banding reaching the distal poles, were clearly in an advanced stage of development. Eggshell remnants were found at five more discrete locations in the Boksar area, indicating the presence of at least five more nests (which had been completely predated).

Surveys at Boksar 2011 again confirmed the presence of gharial nesting with an intact clutch of at least 48 eggs found in the same general location as one found in 2008. In this clutch, 45 eggs were fertile and in an advanced stage of development with banding reaching the distal poles. However, many of the fertile eggs had damaged egg shells or had been predated (Figures 6 and 7). Based on observed spoor at the nest site, *V. bengalensis* was identified as the predator.

DISCUSSION

Gharials in Boksar, although originally in a free-flowing river ecosystem, seem to have successfully adapted to the lake-like environment created by the Kalagarh Dam in 1974. Breeding is clearly occurring, although predation rates seem very high, with *V. bengalensis* the likely predator. They may be constraining the recovery of the species.

These results, although preliminary, indicate that the Corbett Tiger Reserve could contain a significant breeding population of gharials, which are highly depleted throughout their range. Additionally, it is the only known population of the species to be living in a lake-like environment, as opposed to a free-flowing river system. This suggests that nesting surveys and monitoring of nesting sites in Boksar and other areas in CTR should be

undertaken more regularly, perhaps annually, and more intensely, to gain a better understanding of the productivity of the population of adult female gharials living in the area. Surveys at the time of hatching may give a better indication of the number of nests laid but not predated.

The loss of eggs to predators appears to be very significant, which could be a natural occurrence (Webb et al., 1983), or a derived one linked to the lake environment. Either way, it suggests that if the conservation goal is to increase the resident population of gharials, then a nest protection program increasing the numbers of hatchlings recruited to the wild could be warranted. Corbett Tiger Reserve may prove to be a suitable study site for examining gharial nesting in more depth, including nest site attributes and basic clutch and female characteristics.

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