

Humans sharing space with *Crocodylus porosus* in Bhitarkanika Wildlife Sanctuary: conflicts and options

G. V. Gopi and Bivash Pandav

The saltwater crocodile (SWC), *Crocodylus porosus* is perhaps the largest living reptile in the world¹. *C. porosus* has the widest range of any extant crocodylian. This is due to its ability to traverse long distances in the open sea which helped this species to inhabit almost the whole of tropical coastal Asia, besides many inland², including India, Indonesia, Malaysia, the Philippines, Papua New Guinea and Australia^{3,4}. SWCs are extinct from Seychelles and Mauritius. In India, they are currently restricted to Bhitarkanika, Sunderbans and the Andaman Islands. Considering the declining numbers of this species, the Government of India enforced a protective legislation through the Indian Wildlife (Protection) Act, 1972, to conserve them along with two other crocodylians, the gharial (*Gavialis gangeticus*) and mugger crocodile (*Crocodylus palustris*). Under the Government of India/FAO/UNDP Crocodile Breeding and Management Project, coordinated by FAO expert H. R. Bustard, captive breeding of SWCs was initiated by the Forest Department of Orissa in 1975 at Dangmal, the Bhitarkanika Wildlife Sanctuary (BWLS).

The estimated population of crocodiles during 1976 in Bhitarkanika was 96. In the rear and release (captive breeding) programme of SWCs in the BWLS, eggs were collected from the wild, and hatchlings were reared in captivity and released in the wild when they attained 1.2 m in total length. A total of 1400 captive-bred crocodiles were released from 1977 to 1993. Surveys in 1994 indicated the survival of at least 580 SWCs in the BWLS, showing a recovery of this species⁵. This augmented the population of the crocodylian in the wild. Determining the exact sex ratio of the crocodiles precisely during the annual census carried out by visual estimation methods from a distance is difficult. However, annual nest census carried out across the sanctuary provides clear data on the breeding females. According to the 2007 census, a total of 54 nests were recorded, while it was only 5–7 in 1976, indicating ten-fold increase in the breeding females.

With increase in the SWC population, conflicts with humans and livestock also have been on the rise. The BWLS encompasses an area of 675 km². However, the habitat of SWCs is largely confined to the 30 km² aquatic area. The average encounter rate of SWCs (barring hatchlings) in the BWLS was 0.87 individuals^{6,7} prior to the release of the 1976–77 census; but the 2007 census indicates 5.0 individuals/km.

The human–SWC conflicts have risen over the years, with increase in the populations of both. The SWC holds the reputation of attacking humans throughout its distribution range³. However, instances of attack on men have been exaggerated^{8,9}. There have been 72 instances of attack on humans from 1975–76 to 2006–2007 (32 years). Among these, 30 human casualties and 36 injuries were reported between 1994–95 and 2006–07. However, only six conflicts were reported prior to 1994. There may be two reasons for this. First, many would have gone unrecorded. Secondly, the crocodile population then was lower than the current population; hence there would have been lesser conflict. Most of the attacks were reportedly made by male crocodiles. Male crocodiles are generally larger and more aggressive than the female crocodiles and hence may require a larger territory. This might be the reason for more male crocodile conflicts. Crocodile attacks on humans particularly took place during the monsoon season due to high tidal upsurge, when the crocodiles stray into the village ponds outside the BWLS. Also, certain attacks were reported when there was human intrusion into the crocodile habitats⁶. The reported number of crocodile attacks on livestock from August 1975 to March 2005 was 62, which involved cows, buffaloes, calves, bullocks and goats. Again all attacks/deaths reported were by large male crocodiles (>16 ft). All the attacks happened during the high tide, which may be conducive for the crocodiles to attack animals grazing on the riverbank.

The attack on both humans and livestock happened under one of the following scenarios:

1. Entry into the BWLS by wading, swimming in the crocodile-infested waterbodies.
2. At locations where mangrove cover is poor. These are areas where it is easy for humans and livestock to walk compared to the pneumatophore-rich mangrove areas. (People normally operate in these areas to reach the river/creek for fishing and other activities, and livestock prefer to feed on grass which grows in the river beds, where mangrove cover is degraded and poor.)
3. Grazing of livestock in the river banks.
4. Straying of crocodiles into the village ponds.

Today, after 32 years of protection, the SWCs have established their population in the BWLS. The rear and release programme has been a great success in terms of boosting crocodile population from 96 to 2000. However, this increase in population in a limited area (30 km²) has caused crocodile–human conflicts. The captive breeding programme is still underway at Dangmal, though in a self-effacing scale of about 100 eggs annually. Well-designed scientific research to evaluate the current restocking and identification of additional release sites needs to be carried out soon. Studies should also focus to assess the carrying capacity of the BWLS for crocodiles. Certain crocodiles that regularly attack humans and livestock should be captured and placed in captivity. Since the records show that cattle graze in the river banks where mangrove cover has been degraded, these areas may be planted with mangroves for at least a few hundred metres along the river and creeks in the sanctuary. Efforts should also be made to translocate excess crocodiles to the Mahanadi delta, where SWCs were distributed. Habitat suitability assessment should be done prior to this. Also certain stretches of rivers highly prone to conflict should be fenced by the Forest Department. This may bring down conflict levels.

The SWCs were able to recuperate because of habitat protection and efficient

management, and their population may swell in future. SWCs are potentially dangerous animals and this reality cannot be ignored. The SWCs currently in the BWLS are neither rare nor is their population in decline. Hence the management problems posed by this species would be critical. Formulation and implementation of realistic long-term conservation programmes that are biologically feasible and acceptable to the people inhabiting around the BWLS are required. Conservation and management of SWCs should involve the following: (1) Public safety – by reducing the number of SWCs; this could be done by culling. The possibility of commercial use of this species with stringent monitoring mechanism should be explored. (2) Public relation – by making local people become aware of the value of the crocodiles. (3) Conservation – by relocating them elsewhere, i.e. in the river systems of the Mahanadi and Devi after proper assessment.

Literature on the SWCs in India is scanty, despite work on this species for

over 30 years. All the information that we have now pertains only to population status and conflict. Major issues on which their future holds have not been touched upon. The time has come to reassess our conservation approach for SWC management in the BWLS. Robust scientific research should be carried out to determine the carrying capacity of the BWLS, and dispersal range of juvenile and adult crocodiles, assess and suggest suitable relocation areas, make behavioural studies of breeding crocodiles, and evaluate sustainable utilization options as a conservation tool quantifying limits and possible solutions. This would foster better coexistence between the SWCs and the inhabitants around the BWLS.

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G. V. Gopi is in the Wildlife Institute of India, Post Box No. 18, Chandrabani, Dehradun 248 001, India; Bivash Pandav is in the WWF-International, P.O. Box # 7660, Baluwatar, Kathmandu, Nepal.*
*e-mail: gopigv@wii.gov.in

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Contact: Prof. C. V. Raman
Director
International Seminar on Marine Sediments
Department of Geology
Andhra University
Visakhapatnam 530 003, India
Tel: 91-0891-2844709 (O)
Mobile: 98858 96620
E-mail: cvraman8@yahoo.co.in

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