Climate Change as new challenge for conservation of Crocodiles

Lala A. K. Singh*

Global changes in temperature predicted during the 21st century are likely to affect the crocodilian fauna sooner than we anticipate. It may perhaps give a fresh challenge to success achieved in conservation of Indian crocodiles since 1974.

Crocodile Conservation is a Trend Setter

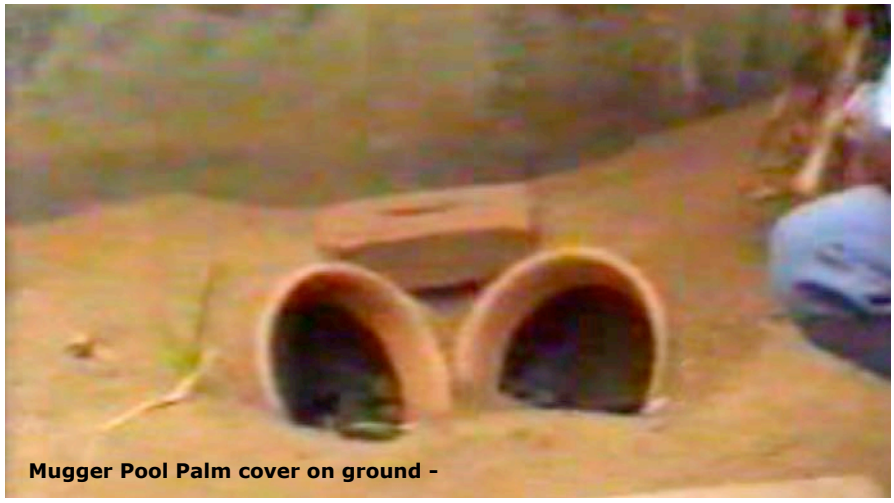
By 1974 the Gharial (*Gavialis gangeticus*) was facing imminent extinction, the Estuarine Crocodiles (*Crocodylus porosus*) in India were left in just three pockets with heavy pressure on their mangrove habitat, and the Mugger Crocodile (*Crocodylus palustris*) was depleting faster than it could reproduce.

All the three Indian Crocodilians got a new lease of life because of the country-wide conservation programmes implemented with international collaboration during 1974-1982. The Crocodile Conservation Project of Government of India is considered as one of the most successful projects of the UNDP and FAO of the United Nations. The states which participated in the programme are Odisha, Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Kerala, Bihar, Gujarat, West Bengal, Madhya Pradesh and Rajasthan.

In many respects the crocodile conservation programme is a forerunner in conservation of wetland fauna and flora, and the trend setter for research and training in wildlife. Populations of all the three species have got secured in captivity. A vast array of technical knowledge have got built up on Indian crocodilians for captive rearing, breeding, possible farming and management of crocodilians with other ecological associates in wetland habitats. At least 38 wetlands were identified as crocodile sanctuaries. The recognition given to marine turtle resource of Odisha coast was incidental to activities in Bhitarkanika, but over the years it has developed into a full fledged Turtle Conservation Project. The freshwater turtles and avian fauna which share the wetland habitats with crocodiles were identified, protected and studied for their conservation and scientific value. Training curriculums for Wildlife and Sanctuary Management with thrust on wetlands were developed and implemented for the first time with international collaborations at the erstwhile Central Crocodile Breeding and Management

Mugger hatchery - Tikarpada

Mugger Pool Palm cover on ground - 1



Mugger Pool Palm cover on ground -

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Training Institute, Hyderabad. This training nucleus with international experience and infrastructure joined with the Wildlife Division of the Forest Research Institute at Dehra Dun and founded the Wildlife Institute of India, currently a premier institution in the region.

To be specific about Odisha, the first three wildlife sanctuaries of the state were declared with intentions for conservation of crocodiles. Bhitarkanika Sanctuary (1975) stands as the best example in the country for conservation of the estuarine crocodile. The Satkosia Gorge Sanctuary (1976) was primarily meant for conservation of Gharial, and it developed as a site encompassing management of forest and wetland under the umbrella of Project Tiger. Another progarmme focused its attention in rebuilding population of Mugger Crocodile in Similipal forests from where several perennial rivers like the Salandi (Hadgarh Sanctuary, 1977) have taken origin. With so much to the credit of crocodile conservation programme, it is now feared that the impending changes in climate may adversely affect wetlands where crocodiles inhabit. Climate change will interfere normal crocodile behaviour as this group of animals do not have a system to physiologically regulate or maintain their body temperature as do birds or mammals.

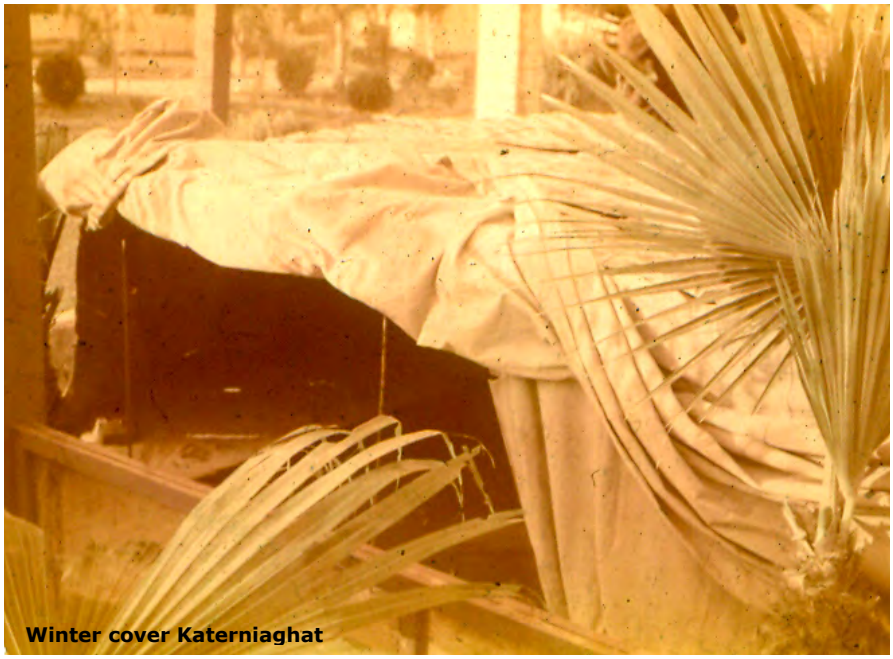
Temperature Controls Crocodilian Behaviour

Change in climate and rise in temperature affect the behaviour and survival of crocodiles. When the ambient temperature goes below 15^0C mugger crocodiles in Ramatirtha on the outskirt of Similipal go off-feed and become dormant. In nature crocodiles adopt means to prevent loss of heat by remaining in a warmer surrounding like warm deep water.

As ectothermic animals the Crocodiles rely largely on external heat such as sunlight energy to achieve a full working temperature. Normally they bask in the early morning and afternoon, and avoid scorching sun during mid-day. Basking in the sun is necessary to regain body temperature that is lost during cool hours of the night or for getting ready for stay in cool water. During basking a crocodile may keep its mouth open as a mean of thermoregulation. Additionally, it may keep its limb or tip of the tail dipped in water. This act like a 'temperature sink' and allow longer hours of exposure to sunlight that help in getting rid of algae and ecto-parasites from skin-folds. Scorching sun would prevent a crocodile from getting other

Mugger Pool Palm cover on ground - 3

Mugger Pot used as winter retreat



Winter cover Katerniaghat

advantages of a long-duration basking and it would have to keep moving between water and the basking site.

At the onset of winter, mugger crocodiles start digging tunnels or repair and use the tunnel of the previous year. They spend most of the winter in it until basking in sun appears beneficial. In places like Similipal, sighting of Mugger is rare until middle of February.

At Tikarpada gharial pools, during winter the roof used to be kept covered with transparent polythene-- that allows sunlight during the winter, and retains heat inside for the night, as the sides are covered with straw-polythene-straw boards.

Winter screen gharial pool, Tikarpada

Impact of Climate Change

Prolonged or a dry summer would destabilize the nest temperature and there will be skewed sex ratio in young crocodiles, as the sex of crocodiles is dependent on the temperature at which eggs are incubated in the nest. Incubation temperature below 30^0C produces more of females and above it more of males.

Crocodiles do not incubate their eggs. They leave it to the nest temperature that is largely stabilized by the nest-material, its humidity and ambient temperature. Increase in temperature and drying up of freshwater bodies will reduce breeding success. Higher nest temperature leading to desiccation of eggs will produce young with a large number of congenital deformities.

With respect to impact of climate change on crocodilian survival various aspects have not been quantified but the impacts can be summarized as logical conclusions from decades of studies and understanding of related ecology and behaviour of the crocodilians.

During summer when a marshy habitat dries up, Mugger crocodiles can walk on land for five to seven kilometers. With fast disappearance of marshes and small wetlands suitable for supporting Crocodiles, Muggers are getting confined to rivers and reservoirs. When they have to share the habitat with Gharial the latter is a loser, as evident in Satkosia Gorge of River Mahanadi in Odisha. The original Gharial Sanctuary appears like a Mugger Sanctuary.

It is argued in general that climate change may lead to change in salinity of oceans and the estuaries. This would affect the mangrove forests and associated biodiversity which support the Estuarine Crocodile for its nesting integrity of their wetland habitats have always been under various threats resulting from anthropogenic activities. Additional range of threats seems to be linked with imminent climatic changes. At present most of the probable impacts of climate change on flora and fauna appear hypothetical or fictional, and carry educational messages, but climate has a heavy impact on some group of animals like crocodilians.

Note on Environment Enrichment for Better Thermoregulation by Crocodiles in Captivity.

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This short article is about environmental enrichments we have practiced in captivity so that crocodiles, particularly the hatchlings and small juveniles are able to better adjust to the changing temperature in their rearing pools. Deep water and access to basking are two prime clues for providing better scope for thermoregulation by crocs in captivity. But to prevent mortality due to cold nights certain enrichments are done in captivity.

The arrangements include:
(a) sun-shade mosaic effect by planting creepers and other small plants,
(b) artificial tunnel for mugger hatchlings;
(c) large palm-leaves left on ground so that the hatchling mugger congregate underneath;
(d) maintain full water in pools, etc.

In Tikarpada we used to cover up the entire roof and sides of the rearing pen with specially designed boards having a layer of polythene between straw bound on bamboo frames. These 'winter covers' are installed before sunset and taken out after about an hour of sunrise. These were natural and better ways for thermoregulation than providing electric heaters with reflectors to raise the ambient temperature.

Sometimes I had to shift a sick gharial or mugger hatchling to the warmer temperature in my bedroom at Tikarpada. For captive rearing a few crocs these were alright and the approaches can be improved in captivity under any other conditions. But drastic and large climatic changes in natural habitat towards hot or cold may create a challenge for crocodilians. The behavioural adaptations evolved over centuries or learnt through years may not be adequate to overcome the impact of greater disaster anticipated because of climate change.

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