STATUS PROFILE - 8

Crocodile Conservation in Maharashtra : Problems and Prospects

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IN MAHARASHTRA, THE RIVER systems of the Godawari and Krishna (both originating in the Sahyadri ranges) and the Tapi (emerging from the Satpura hills along the northern boundary of the state), along with their tributaries, harbored the Indian 'mugger' crocodiles (*Crocodylus palustris*) in reasonably adequate numbers till the mid-1960's. Presence of mugger crocodiles in the rivers of central India including Godawari and Tapi tributaries as well as in forest pools has also been reported by Dunbar Brander. No reports, however, are available regarding the presence of saltwater crocodiles *Crocodylus porosus* in the coastal areas of Maharashtra.

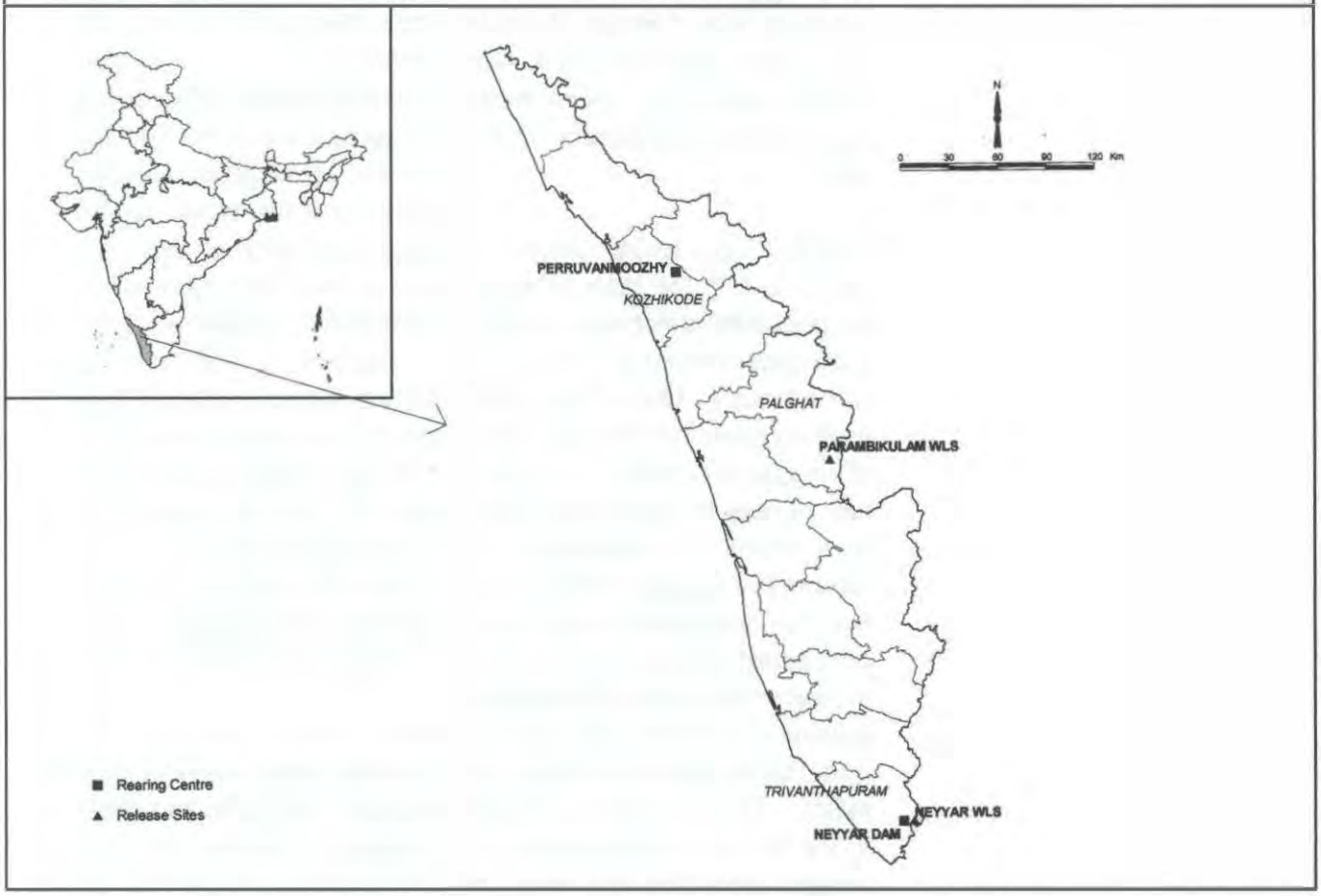
Recent record of crocodiles

The author has observed crocodiles in the coastal areas of Vashiti river near Chiplun in Ratnagiri district as also in ponds in Goregaon vandre in Mumbai prior to 1960. During 1956-57, crocodiles were observed in the Dahisar river, which flows through Krishnagiri Upwan, located, adjacent to the present Sanjay Gandhi National Park, Mumbai. There have been a number of reports on the presence of mugger in Krishna river near Sangli till 1996. Inquiries with the field staff have confirmed presence of crocodiles in rivers Wainganga, Pranahita, Godawari and Indrawati in Bhandara, Gadchiroli and Chandrapur districts till the late sixties but thereafter there have hardly been any reports, perhaps due to severe depletion of their population as a result of the crocodile-fisheries conflicts. Hunting for skin, but more importantly, habitat destruction have nearly wiped out crocodiles from the major known habitats in Maharashtra.

Inclusion of the mugger crocodile in Schedule I of Wildlife (Protection) Act, 1972 was a little late in protecting this species outside the protected areas. The network of protected areas in Maharashtra did not cover any wetland or marine eco-system till late 1980's. The creation of Jaikwadi, Nandur-Madhmeshwar, Koyana and Bor sanctuaries in 1985-86, which encompass large reservoirs, has also not really helped in conservation of crocodilian fauna because of administrative problems.

Pawi, which is outside Sanjay

Figure 6 - Crocodiles in Kerala



for mugger crocodiles (*Crocodylus palustris*) – one at Neyyar dam (Trivandrum district) and another at Peruvannamoozhy (Calicut district) in 1977. During the period, the status survey revealed that the estuarine crocodiles were locally extinct in Kerala and the mugger were discontinuously distributed in low numbers in the waterbodies, especially of Neyyar reservior and Parambikulam reservoirs and in Kabani river near Waynnad. The population of the mugger crocodile then was less than 60 in the wild in the state. At the time, muggers were then exhibited in the Trivandrum Zoological Park and Trichoor Zoo without any facilities or attempts for captive breeding.

With a batch of 12 yearlings from the Madras Crocodile Bank and three specimens collected from nearby places, the captive rearing programme for mugger crocodiles started in the Neyyar Crocodile Centre. The centre with adequate infrastructural facilities continued to rear the mugger crocodiles. Currently, there is a surplus population of 192 mugger crocodiles of different age, size categories at this centre. There are also five large sized muggers in Peruvannammozhy. Due to paucity of funds, and means for other economical assistance, a low priority is given to the captive rearing and management including captive breeding programmes of mugger in the state.

Crocodile release and monitoring

The mugger crocodiles were thrice released into Neyyar Wildlife Sanctuary and Parambikulam Wildlife sanctuary where there there is a viable population in the state.

Periodic crocodilian census is carried out in the state to assess the population dynamics of mugger crocodiles in the state. The census carried out in 1991, 1994, 1997 have revealed that the population of mugger crocodiles in the wild has increased considerably and now there is a population of around 250 muggers in the various age, sex categories in the two protected areas in the state. However, the status of this reptile outside the protected areas is quite bleak and the threat still exists. There is also sufficient scope for the reintroduction of mugger crocodiles into many of the natural habitats still available, after observing the guidelines of release of a super predator.

Man-crocodile conflicts

The crocodile attacks on man and his domestic stock and the injuries inflicted on human beings have raised much hue and cry. There have been references to the subject in the Legislative Assembly of the state. Many features on crocodiles-man conflict had also appeared in the media.

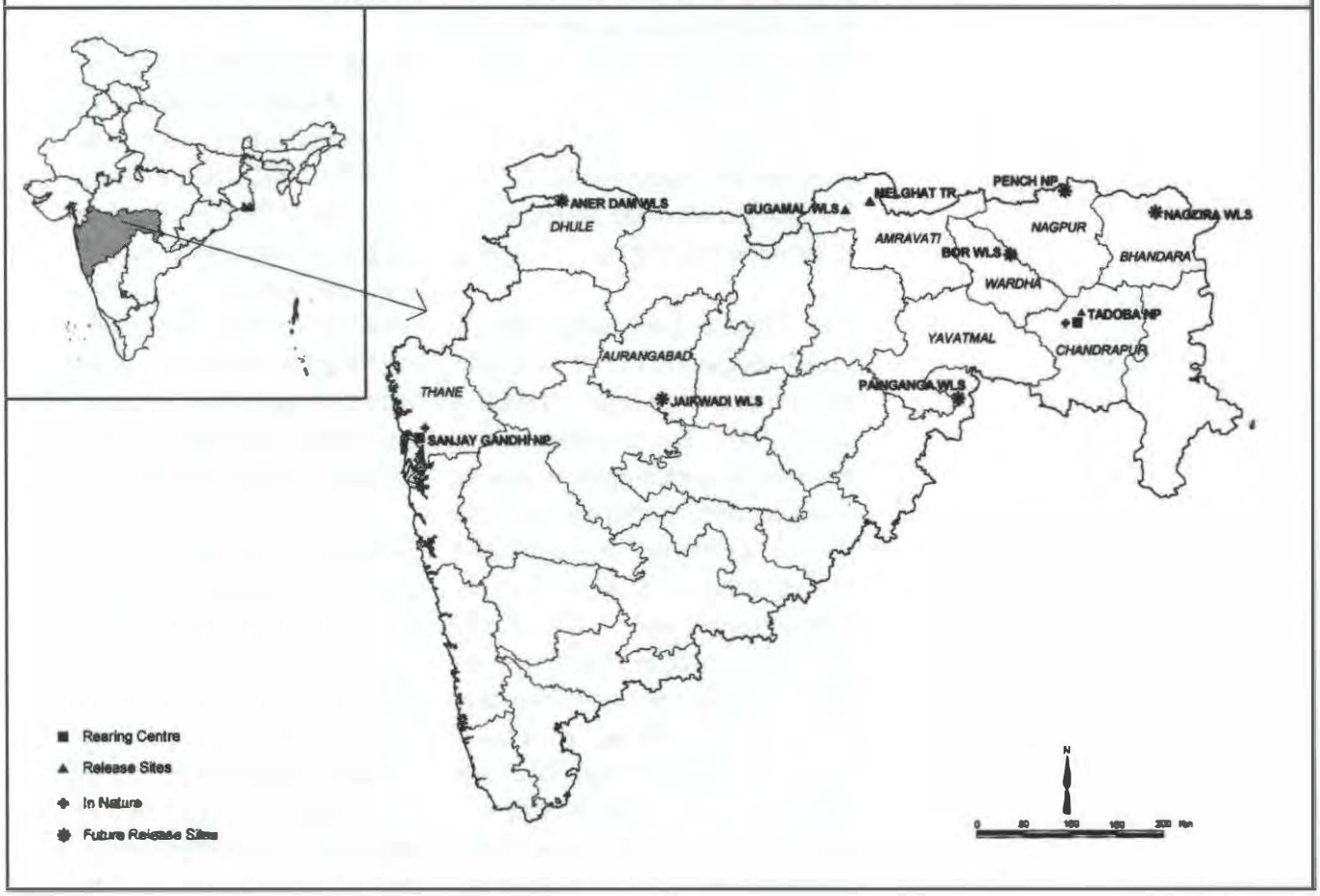
The largescale release of the mugger crocodiles into Neyyar reservoir, a part of the Neyyar Wildlife Sanctuary, where the water is shared by man and the wild animals has created some conflicts. Most of the people who become victims of the crocodile attack belong to the localities like Mayam, Amboori, Thumbichikkadavu, Karimankulam, Puravimala, etc. In the Trivandrum district, where predominantly the tribals and the poor non-tribals reside, one woman lost her one arm in crocodile attack when she had come to the reservoir forwater at sunset. She was paid compensation and also a job in the crocodile rearing centre. Another man and woman lost one finger each in crocodile attack. The domestic animals and, in one case, a wild baby elephant were also attacked by the mugger crocodiles in Neyyar Wildlife Sanctuary.

However, an analysis of the crocodile attacks reveals that the cases are negligible and could be averted by meaningful education and extension programmes on the ecology and the behaviour of the super predator. The Kerala Forest Department has started an education and extension programmes on wildlife, especially on crocodiles in the local areas around Neyyar Wildlife Sanctuary and the situation has now improved considerably. People have now started to appreciate the biological necessities of the mugger crocodiles.

The future

However, the abrupt winding up of the Indian Crocodile Conservation Project and its activities including the central government assistance after the first phase of programme, has created problems for successful

Figure 7 - Crocodiles in Maharashtra



Gandhi National Park, has a viable population of mugger, but this lake is under threat of pollution as also heavy human interference. Vihar and Tulsi lakes, within Sanjay Gandhi National Park, which are least disturbed, provide some chance for habitat protection and amelioration in the interest of crocodiles. These and the Tadoba lake in Tadoba National Park in Chandrapur district have been the only crocodile habitats in the state, which have received statutory protection. But, even in these areas, there have been no managerial inputs with specific emphasis on crocodile habitat improvement.

Crocodile conservation efforts

Tadoba Crocodile Rearing Centre

As a part of Government of India-FAO-UNDP sponsored Crocodile Conservation project, training was imparted to field staff in crocodile conservation and management, and two crocodile breeding centres were established. The first centre was established in Tadoba National Park in 1977, with 21 hatchlings of marsh crocodiles, brought from the Gir Sanctuary, Gujarat (Rajkondawar 1988). The centre includes a hatchery, a breeding pool, 16 pools for sub-adults and four pools for adult crocodiles; these pools are connected with a well-designed water supply and drainage system. Hatchlings were raised a large

successfully at the centre and subsequently gradually transferred from the hatchling pools to sub-adult pools, and then a limited number was shifted to the breeding pool. This process provided an opportunity for the field staff to develop an expertise in handling and rearing crocodiles.

The Tadoba Lake supported a small population of mugger crocodiles, which was breeding successfully. But considering the low survival percentage in nature, it was decided to adopt a "rear and release" technique, as postulated in the project (Choudhury & Choudhury 1986). Crocodile eggs were collected from the wild from Tadoba Lake, and the first batch of 12 hatchlings were born in 1979. In April 1980, fifty eggs were collected in a similar manner and the project authorities were successful in raising 29 hatchlings. This process continued till 1985.

Captive breeding at the centre added 82 hatchlings in 1986 and this was a major landmark in crocodile conservation efforts. In 1987 and 1988, the second and third batches comprising 70 and 53 hatchlings respectively, emerged from the eggs laid by the crocodiles in the breeding pool at the Tadoba crocodile rearing centre.

Sanjay Gandhi National Park Centre

The second crocodile breeding centre was established in Krishnagiri Upvan, Sanjay Gandhi National Park division in 1981, but it was not so successful and it is necessary to investigate the reasons for its failure. Non-provision of sandy banks may possibly be one of the reasons.

The first two batches of hatchlings from artificially incubated eggs of wild origin, which were collected in 1979-1980, were ready for release in 1984. The first batch of eight hatchlings were supplied to Jijamata Upvan, Mumbai in February 1984, and then four hatchlings, with an average size of over 1m length, were released into the Tadoba lake for the first time, denoting a major achievement.

Till March 1992, one hundred and twentysix muggers were seeded out from this centre and this includes supplies to, and reintroductions in Erai and other waterbodies located close to Tadoba National Park, Tadoba and Pench lakes located within the respective protected areas, and also in forest pools of Melghat Tiger Reserve (Khawarey 1995). Release continued and 74 crocodiles were released in Tadoba lake and Erai dam sites only, as there were no other alternatives. The centre was then closed.

Reintroduction of crocodiles in and around Tadoba National Park

As reported above, out of more than 200 hatchlings successfully reared, a majority had to be released within and around Tadoba National Park only, because of administrative compulsions. Tadoba Lake is about 120 hectares only and though fish fingerlings are being released into the lake to improve fish stocking, sustainability of such

a large number of crocodiles on fishes is debatable.

A review of predation by crocodiles on wild herbivores indicates that crocodile is slowly emerging as a serious competitor to carnivores at the apex of the food chain in Tadoba National Park, *i.e.*, tiger, panther and wild dogs. Crocodiles they are predating on wild boar, chital and sambars, and observations during the summer indicate that, crocodiles in Tadoba lake alone, are catching at least one animal almost every week.

With an average body-weight of 50kg, over a hundred crocodiles in and around Tadoba Lake mean over 5000kg of animal body-weight. Considering weekly food requirement to be 2% of the body-weight, about 100kg meat will be needed for their survival. If sufficient food is not available, intense competition for food will possibly result in migration and/or infighting for survival. A serious thinking is, therefore, necessary on limiting the number of crocodiles released in the protected area. As natural breeding of mugger is now taking place, even with low survival rates, there would be additions. Crocodile number thus need be kept in check. Picking up eggs regularly from Tadoba Lake banks for artificial hatching for translocation would be in order.

Reintroduction of crocodile in Melghat Tiger Reserve

Melghat Tiger Reserve encompasses the catchments of Khandu, Khapra, Sipna, Gadga and Dolar rivers which are tributaries of river Tapi, in the Melghat and Chikhaldara Talukas of Amravati district. The project areas merely touch the river Tapi near Rangubeli, but the project itself does not include river Tapi. Literature review as also local enquiry reveal that the river Tapi used to harbour crocodiles (Dunbar Brander, 1971) but because of habitat destruction and excessive fishing, there are no crocodiles anymore within the areas encompassed by the Project Tiger Melghat itself. Because of possible human-crocodile conflict, the crocodiles could not be released directly into the river Tapi or its tributaries outside the tiger reserve. Those portions of the tributaries, which have perennial waterpools, within the tiger reserve, however, offered a fair chance for their re-introduction.

In 1990-91, it was thought essential to include mugger alongwith the tiger, under the umbrella of Project Tiger. A critical survey of the perennial waterpools and potentials of pisci fauna therein indicated a fair chance of survival for mugger. Introduction of mugger directly into the river Tapi was ruled out on administrative grounds as it would be difficult to monitor their movements at subsequent stages. Crocodiles were re-introduced in a systematic manner in March 1990 and February 1991 in Siddu Kund in Gadga river near Dhakna and Hathikund in the Dolar river in the Gugamal National Park.

The first and second batches of

crocodiles released were of 1986 origin. The first batch included 2 males and 5 females and had an average size and weight of 1.3m and 10.5kg respectively. Introductions in 1991 comprised 3 males and 5 females, with an average length and weight of 1.4m and 13kg respectively.

The released have been monitored till today (1999). It has been seen that crocodiles have survived in Siddu Kund though there have been substantial movements up and down the river. Breeding was also noticed and few hatchlings seen in the Siddu Kund subsequently. The reintroductions, therefore, can be termed a success.

The introductions in Hathikund have stabilized, but there has been considerable movement downstream. At least one or two animals are seen in the lake and recently the Deputy Director, Project Tiger, observed a full-grown crocodile in the Dolar riverbed about 3km down stream of Hathikund. Because of protection provided by the project to the habitat, muggers will have a fair chance to survive here, still we have to watch for their survival as time passes. As the animals grow, they may find it difficult to sustain themselves in the limited permanent pools and may migrate downstream; and would mean re-stocking of river Tapi, with fully grown and well adapted animals in a subtle manner and without generating ill will.

Potential for future crocodile reintroduction

There are a number of potential sites for reintroduction in rivers Krishna, Tapi, Wainganga, Pranhita, Indravati and Godawari. However, there have been no takers of hatchlings for release back to nature. A fear of backlash on account of releases, has been and still is a serious deterrent to reintroduction even in the protected areas. All the major river systems are under heavy human use; fishermen consider crocodile introduction to be a serious threat to their interests.

With the expansion of protected areas network in recent past, and inclusion of large reservoirs therein, the chances for reintroduction of mugger have increased, e.g. Koyana, Chandoli, Dnyanganga, Katepurna, Jaikwadi, Bor, Aner dam Sanctuaries, Pench National Park, etc. If we are able to convince the authorities incharge of hydel and irrigation projects and the fishermen's lobby that crocodiles are not a serious menace to their interests, the large potential for crocodile conservation can be harnessed. In *Figure 1*, places of re-introduction have also been tentatively indicated.

Saltwater crocodile has not been reported from Maharashtra. However, the areas which have been identified for mangrove conservation, could possibly provide sites for *ex-situ* conservation of this important crocodilian species. Potential sites for conserving mangroves and it is

proposed to launch serious efforts for conservation of these sites & possibly, there could be scope for 'ex-situ' conservation of *Crocodylus porosus* in one of these areas, if required.

Discussions and recommendations

Based on the foregoing information, it is surmised that crocodiles can be bred easily by collecting eggs and hatching them artificially under controlled conditions. Under protection, the hatchlings have better survival rates and the entire process of raising hatchlings is relatively simple. Since the food requirements of crocodiles are limited, rearing of hatchlings and sub-adults is easy. The adaptive and ectothermic nature of crocodiles enables them to adjust themselves easily even to difficult conditions.

The juvenile size of about 1m in length appears to be most suitable for release, as the chances of survival then are excellent in suitable habitat, where food and shelter is available. As in the case of Melghat, reintroduced crocodiles survived easily even in small water rivers. Individual crocodiles may occupy small pools which can sustain them while other individuals may migrate to occupy suitable habitats elsewhere. For this, they may cover even long distances of 5-10km downstream.

Serious impediments to *in-situ* crocodile conservation in Maharashtra are non-availability of suitable habitats free from human interference and general opposition to reintroduction because of the prejudiced mindset of the people.

The role of crocodiles in the aquatic eco-system has not been properly understood and therefore, erroneous views that long-term conservation of crocodiles,

It is, therefore, necessary to carry out a detailed survey of existing nesting and the potential sites need to be identified for according strict protection during nesting and hatching period. For reintroduction, it is necessary to identify new sites suitable for reintroduction and educate local inhabitants so as to remove their misapprehensions and gain their support. It is also essential to evolve measures which will harmonise the interests of crocodile conservation with harvesting of aquatic resources by fishermen.

Taking into account the ground realities, *in-situ* conservation through protection to the existing habitat is a difficult proposition. Waterbodies within protected area would be the only viable proposition. However, such sites are limited. As artificial breeding of crocodiles is relatively easy, bold approach of allowing crocodile farming as a viable economic proposition in the private sector, be examined seriously.

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