

CROCODILE CONSERVATION OF SONE GHARIYAL SANCTUARY SIDHI (M.P.)

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ABSTRACT:-

The Sone Gharial Sanctuary has been a safe adobe for Gharial and mugger for past three decades. No extensive study has been done so far to establish proper population density and trends. The present study was carried out to find out the status of Gharial. Approximately 122 km. stretch in the Sanctuary was surveyed and data related to population of Gharial and Mugger, in relation to their habitat, profile of river, human interference and threats were collected. During the present study, a total of 24 Gharials comprising 08 adult females, 07 sub-adult, 09 juveniles were observed. Major stretch of the river was found sub-optimal for sustenance of viable population of Gharial since biotic pressure was observed to be too high in terms of sand mining, fishing, grazing, cattle wading, agriculture and other anthropogenic activities. Thus these animals were found confined in deep pools at scattered places. Recommendations suggested on the basis of the observations during the present survey includes need of extensive survey of the entire river stretch for habitat management, reduction in human interference and flow management.

KEYWORDS:- Crocodile conservation, human activity, Sone Gharial Sanctuary.

INTRODUCTION:-

The crocodiles are now on extinction in India, but the Govt. of India have proposed certain aquatic national sanctuaries to conserve them. Two species of crocodiles are available in M.P. state i.e. *Garialis gangeticus* (Gharial) and *crocodiles palustris* (Mugger), in Gangatic system as well as within protected aquatic ecosystems. The latter can be seen in perennial rivers, fresh water lakes, streams, reservoirs etc. The population of these species of crocodiles is very few throughout the state. The threatementation and hunting habit of human being habituated this destruction.

The measurement of conservation of crocodiles:-

The Madhya Pradesh state govt. have established certain riverine systems to conserve the population of crocodiles as followings-

1. National Chambal sanctuary.
2. Ken ghariyal sanctuary.
3. Sone ghariyal sanctuary.

The Sone Gharial Sanctuary (SGS) is one among only four known protected areas in India that supports a breeding population of the critically endangered gharial. But severely modified water flow conditions due to the Bansagar Dam (completed in 2006) have impacted gharial habitat, movement, reproduction and survival. Estimating the ecological flow requirements in the Son River is essential for gharial conservation and overall ecosystem health.

In this study only Sone river sanctuary have been selected for the study in which Muggar and Ghariyal both are present and conserved. Sone river sanctuary drives its name from the masculine river Son. The river has been originated from Amarkantak, but comes in picture from Son Bacharwar a marshy and watery place. The tributaries of Son River are Gopad, Banas and Johila. The River Banas confluences in to Son river are in Shikarganj in this sanctuary and known as Bhamersen gate at 24° 17'N and 81° 37'E. The Gopad confluences into Son river at Bardi Khairpur village located at 24° 33'N and 82° 23'E. The general drainage direction of river Son in North east. The Son Confluences into Ganga River near the Danapur Patna Bihar.

The sanctuary is extended over 209 K.ms. long and 200 meter of the width on both of the river banks of Son River. It is the second sanctuary established for the river banks for the conservation in Madhya Pradesh state. The sanctuary is established in the North-East zone of M.P. state by the gazette notification No 14-47-80-x-(2) Bhopal dated 23rd September 1981 under the provisions of section -18(1) of the wildlife (protection) Act 1972.

The Description of the Sone Ghariyal Crocodiles Sanctuary Sidhi (M.P.)-

According to the power delegated by section 18(1) of the wildlife (protection) Act. 1972 (No. 53 of 1972). The Madhya Pradesh state Govt. have declared the following area named as Son Ghariyal and Crocodile Sanctuary.

The above said sanctuary is located in Revenue dept. of Sidhi, Shahdol and Satna district with the effect of west Sidhi, North Shahdol and Rewa in during the tahsils of Deosar. Gopad Banas, Beohari and Amartpatan. The length of river is considered for sanctuary is for Sone 160.93 Km, Gopad 25.75 Km and Banas 22.53 Kms. The total length of the sanctuary is 209.21 Kms and 200 meters of river as average for the conservation of Ghariyal and Crocodile in sanctuary.

Sone Ghariyal Sanctuary is particularly famous for natural habitat of reptilian fauna species for crocodiles species. Where crocodilian species are flourish fit & adopt for such microclimatic condition, alteration of the structure for such habitat affect the overall growth of the population, food chains are shrinking and turning into the simpler structure. Complex ecosystem of the habitat turns into the simpler structure, ultimately influencing the whole structure and function of the aquatic ecosystem. The species skins and other part are very useful to various purposes. The increase in species population need for adoption of various management practices. The population establishment can made success full through adoption of continuous watching and keeping safe for young and old crocodiles.

THE OBJECTIVES OF THE STUDY:-

1. To Study the Habitat Condition of Gharial.
2. To assess the impact of Sand mining on Nesting of Gharial.
3. To suggest mitigation measures to minimize the negative impacts.
4. To identify the key habitats of Gharial, Mugger.
5. To assessment of threats to these critical habitats.
6. To suggest conservation strategies for each species.

Crocodile have some unique aspects of natural history ecological importance subsequently create great challenges for their conservation into the habitat (Olson et.al.2009). They are the largest predators in their habitat. Many reptiles are exploited for their valuable resources which supports the international trade worth over millions of dollar annually. They are greatly affected by habitat destruction land loss and the pollution of aquatic habitat. Loss of any species of ecosystem would mean un repairable loss of natural entities consequently leads to homeostasis in which ecosystem turn up into structural & functional upsetting

subsequently turn into simpler form consequently accelerating many fold chance for extinction of species from the habitat. (Anon, 1994f).The study would be helpful for managing & maintaining these type of ecosystem. Although wetland ecosystem are known to be very fertile ecosystem, if these system are properly managed. But most wet lands are not properly managed and judiciously unutilized. The aim of this study is to assess the ecological importance of this species for balancing the whole aquatic ecosystem of Son River. Crocodile's presence is always used as indices for good quality of water and water is precious of nature (Kailas, 1999). Our cellular structure & function is fully based on the good quality of water. The various work on Sone river has been done by Arceivala (1983).

The attempt has been made to assess the conservation of crocodiles through appearance on the sites on different period of intervals. Maximum No. of appearance recorded after 12 hours i.e. 35 on site S3 followed by 30 after 9 hours of intervals of time. Human and domestic animals interference played crucial role for disturbance of this species. This is quite obvious that this species probably prefer to live in natural habitat without any disturbance. Free activity of crocodilian fauna in the form of appearance is supposed to good indices of the fitness of the species in the aquatic ecosystem. The study clearly indicates for ban of all type of activities. Noise, mining activities & their product transportation severely affect the appearance of crocodile species on the sites. Unexpected noise through mining activities and noise through transportation & their pollution effect also severely damage the whole ecosystem of the region. Thus complexity of ecosystem is badly affected. The industrial related activities must be discouraged. If used that must be properly planned & assessed and based on the facts of the near permitted value for the survival of the species.

Components of study:

Species monitoring and stream gauging to understand species' responses to flow regimes in the Sone Ghariyal Sanctuary.

Development of a simple methodology to estimate ecological flows in the SGS with the objective of maintaining longitudinal connectivity and access to suitable breeding sites for gharials and skimmers.

Sone River: Based on previous reports of gharial (Sharma et al. 2011; MPFD 2013), we investigated 8 locations (see Fig. 1, Table 1) in the Sone river at Ghariyal Sanctuary from June 2015 to May 2016. Since daytime temperatures in summer exceed 40°C, crocodilian basking is largely restricted to the morning

Table 1: Details of field observations in the Sone Gharial Sanctuary.

Survey Zone	Area Covered (Date)	Distance	Water Depth (in Feet)	Gharial			Mugger			
				A	SA	J	A	SA	J	Y
I	Terideh, Bhavarsen Gujrer (05.12.2017)	9.8	15-25	0	0	0	1	1	0	0
II	Akori, Churhat Bridge, Birgawa, Bhelki, Kaurwaghat (06.12.2017)	16.47	10-15.	0	0	0	0	0	0	0
III	Gaughat, Jogdah, Kukrwa (07.12.2017)	28.3	35-40	7	6	9	5	4	2	1
IV	Lahurghat, Jhariaghat, Baghar, Kajardeh, Kherpur, Rajghat, Kuthulideh, Bichhi (08.12.2017)	18.25	12-18.	1	1	0	2	2	1	0
V	Khairhani, Harma, Kyontaly, Badram (Deora) (09.12.2017)	28.10	5-8.	0	0	0	0	0	0	0
VI	Parsuli, Kathbauglow, Naudhiya, Barhai (10.12.2017)	20.7	1-5.	0	0	0	0	0	0	0
	Total	121.62	8	7	9	8	7	3	1	Total

A = Adults ; SA = Sub Adult ; J = Juvenile ; Y = Yearling

HABITATS OF GHARIAL, MUGGER, SONE CROCODILE SANCTUARY, MADHYA PRADESH

Besides annual surveys, reptilians as well as mammals key habitats in Sone Ghariyal Sanctuary were surveyed many times during study period to ascertain the habitat types.

Habitats of Gharial:

Gharials are better adapted for an aquatic life. Their limbs are not strong enough to carry them on land. Unlike the sympatric mugger when most of the river water dried in summer, mugger migrates in marshy and deep water sites but Gharials cannot walk up to few km and died due to human threats. Therefore, Gharials are found only in perennial rivers with continuous or scattered deep pools. It is a general feeling that only the Himalayan-fed.

Rivers are perennial and therefore supported the Gharial population. However, the catchments areas of all Rivers in the peninsular region were once so thickly forested that for almost round the year a flow in the river was maintained.

Habitats of Muggers:

Commonly known as "Mugger", this species is not only found in freshwater lakes, ponds, and marshes, but it has adapted well to reservoirs, irrigation canals, man-made ponds, and even recently in coastal saltwater lagoons. Mugger crocodiles have the broadest snouts of all the crocodiles. The head is relatively flat on the top, with the eyes, ears, and nostrils all being on the same plane. This allows the crocodile to see, hear, and smell while almost completely submerged underwater. They are fair sized crocodiles, reaching maximum length of 16 ft. (5 mtrs.) and having an average length of 13 ft. (3.9 mtrs). The males are generally larger than the females. Mugger crocodiles have life spans of 40+ years. They are highly social and communicate with a wide variety of vocalizations. They will also socialize with other crocodilian species, especially the Gharial. They must use heat acquired from the environment to regulate body temperature. Colour is generally light tan in juveniles, with black cross banding on body and tail. Adults are generally grey to brown, with little banding remaining.

Mugger crocodiles are excellent swimmers, using their flat tail to propel them. Their feet are webbed, but are not used for swimming. The body is well protected by a tough, scaly skin. The neck has large scutes. Its jaw contains 66-68 pointed teeth. Mugger crocodiles have a very diverse appetite. The juveniles feed on invertebrates such as crustaceans and insects, and small vertebrates such as fish. Adults capture larger prey, such as fish, frogs, snakes, turtles, birds, and mammals such as squirrels, monkeys, deer and buffalo. Their social behavior includes communication, gregarious behavior, dominance interactions, and territorial activities. At the age six, both male and female have reached their sexual maturity. This species of crocodile is a hole nesting species. Approximately one month after the mating, the eggs are deposited by the female into the nesting hole she has formed. This takes place between February - April and 28 consist of an average 28 (10 - 48 range) eggs per clutch.

THREAT ASSESSMENT OF GHARIAL:

The Gharial (*Gavialis gangeticus*) is the last surviving species from a very ancient lineage of crocodylians going back to pre-dinosaur years over 100 million years ago. It grows to over 20 feet in length and adult males grow a large bulbous projection on the tip of the long snout called a 'ghara' which gives it its name. Once common in all major rivers in the northern area of the Indian subcontinent, this strict fish-eater is harmless to humans and now faces imminent extinction. This is the story of the tragic fate of the strangest crocodile on earth. In 1970, S. Biswas of the Zoological Survey of India, alarmed at reports of the decline of the Gharial in the rivers of North India, carried out the first scientific surveys of the species. His findings were grim; almost everywhere Gharial once occurred in abundance they were simply gone. In 1973/74, with help from the Bombay Natural History Society, World Wildlife Fund-India and the Madras Snake Park, Rom Whitaker and his colleagues Dhruvajyoti Basu, E. Mahadev and the Irula, V. Rajamani, carried out Gharial surveys in much of its known range in India as well as Nepal. It became apparent that the Gharial was on the brink of extinction with less than 200 left in the wild. By 1974, the estimated total population of wild Gharial in the world had declined from what is inferred to have been 5,000 to 10,000 or more in the 1940s and throughout its huge former range (spanning the rivers of the northern part of

the India subcontinent from the Indus in present-day Pakistan 3000 km. eastward across the Gangetic floodplain to the Irrawady in Myanmar) to less than 200, a decline of about 96%. The drastic decline in the Gharial population over the last 60 years (three generations for the Gharial) was due to over-hunting for skins and trophies, egg collection for consumption, killing for indigenous medicine, and drowning in fishing nets. In addition dams, barrages, irrigation canals, siltation, changes in river course, artificial embankments, sand-mining, riparian agriculture, domestic and feral livestock have combined to cause an extreme limitation to Gharial range due to this excessive, irreversible loss of riverine habitat. During the study following threats was assessed on the Gharial habitats in the Sone Ghariyal Sanctuary, Madhya Pradesh.

Sand mining

The Sone Ghariyal Sanctuary is a riverine Sanctuary. The Sone River is a perennial river. The prime habitat characteristic of the river is the long stretches of sand banks. The sand is formed due to corrosion of the rocks and it takes many years for the rocks to convert into sand. The sand is regularly washed down from upstream due to the fast flow of the river water. The availability of sand at one place is depending on the availability of sand on the upper stretches and the flow of the river water. It is a natural process and every time sand removed from one place is filled up after some time (years). Depending on the availability of the sand and the river course the steep sand banks and flat sand banks are formed at different places. Sand mining sites were observed at 9 sites (Churhat Bridge, Kaurwaghat, Gaughat, Jogdah, Lahurghat, Jhariaghat, Rajghat, Badram (Deora), Barhai) in the year 2015-16.

Sand Mining Gharial Sanctuary

Gharial nesting sites were observed at 7 sites (Churhat Bridge, Kaurwaghat, Gaughat, Jogdah, Lahurghat, Jhariaghat and Rajghat,) in the 2016 but only 6 sites were observed in the 2015-16 (Table – 1).

Due to sand mining nesting sites are disturbed and animals shifted to other sites for the nesting and basking. Gharial habitats are drastically changed to sand mining. Every year observed new one or two sites of mining sites. During the study period 2 new sites Sukhdhya ka Pura and Barsala was observed. Barsala is having a good

nesting and basking habitats. Comparative Gharial nests in the Son Ghariyal Sanctuary, Madhya Pradesh from 2015-16 are shown in the Table-1.

Sand mining activities were recorded in both the states, 7 sites were in Madhya Pradesh. Sand mining sites were plotted on map with the help of GPS. A total of 178 hect. area were observed totally disturbed due to sand mining and 124 tractors were observed during the current survey (February, 2016). Point scale intensity method was also adopted for the assessment of impacts; Scale was adopted on the basis of less than 10 tractors sand extraction per day is categories as I, less than 50 tractors per day as II and more than 50 tractors per day as III. Scale was based on the monthly monitoring of sand banks 7 sites (Churhat Bridge, Kaurwaghat, Gaughat, Jogdah, Lahurghat, Jhariaghat, Rajghat,).

The Department of Mining, Government of Madhya Pradesh was given 108 hect. area on lease for sand extraction at the Piparai (Rajghat) in the Sone Ghariyal Sanctuary. After the intimation of high court, legal sand mining area was stopped from 26 December 2006.

THREAT ASSESSMENT OF MUGGERS:-

The mugger or marsh crocodile lives in stagnant water, reservoir, lakes and river. As such their population in the Chambal River has never been comparable to that of Gharial and has always been much less as compared to the Gharial population. Muggers nesting were minutely observed in the study area (Table-1). There was only one nesting site i.e. in the study area earlier in 2015-16 which was also found lost in 2016 due to sand mining. Remaining sites in the study were found totally disturbed due to sand mining. Other human activities such as fishing, ferry agricultural/wood collection etc. which were also found indirectly effecting the habitats of Muggers. Population of muggers and threats were observed.

CONSERVATION STRATEGIES OF GHARIAL, MUGGER:-

Conservation Strategies for Gharial: Based on the finding of the recent study, following conservation strategies could be visualized:

1. Sand mining activities should be shifted from areas sensitive and vital for wildlife and biodiversity and be conducted in a regulated and restricted manner.
2. Requirement of interstate co-ordination committee at state level, divisional level and district level for the proper management of the Sanctuary.
3. Other thrusts to effect socio-economic upliftment of communities like Mallah, Dhimar, etc. that have been traditionally dependent on fishing for nutrition and economic benefits.
4. Illegal sand mining and fishing need to be curbed. But this requires sufficient forces and resources.
5. It is recommended that special emphasis should be given on protection of nesting islands, especially during the critical nesting period.
6. Presently there is a need to continue "Grow and released" program.
7. Department should be provided stringent protection measures to reduce the biotic pressure on Sone River such as poaching, cultivation along the bank and sand mining.
8. Presently there is a need to continue "Grow and released" program.

Conservation Strategies for Muggers:

In the Sone Ghariyal Sanctuary Muggers population shows an increasing trend. As per scientific assumptions, Muggers are main competitor for food of Gharial and therefore, there is a need to make constant observation to understand the population dynamics of muggers. This would probably be the only way to ascertain the level of competition between both the top predators of Sone river.

Eco-Tourism Development of Sone Ghariyal/ Crocodile Sanctuary-

According to the administrative setup and management Sone Ghariyal and crocodile sanctuary is managed by the forest department under the supervision of director, Sanjay Gandhi National Park Sidhi (M.P.). The area is absolutely attached with dense forest. The Bhramarsen is a beautiful place for picnic and eco-tourism. The famous Novelist of Sanskrit Ban Bhatt had been born in this village and wrote a beautiful limitless novel in which various beautiful sequences. The village have a well sculptured temple of Lord Shiva. Bardi-Khatai is an important place which was established by Chandel, S. during 12th century. There is a Shoal in village

Bicharhi where riverine systems are form north river Sone, West River Gopad and South Sone is flowing at the confluence of river Gopad into Sone. It is a beautiful place for eco-tourism.

RECOMMENDATIONS

Some useful aspects proposal for holistic management and conservation of the sanctuary and Gharial and Mugger species are as under:-

1. The Sone Crocodile Sanctuary, with all male Gharials species wiped out has result in a blockage of their breeding. There is present time essential of reintroduce male Gharials species from other habitats for ensure the breeding and propagation of the species, otherwise it will result in their extinction in the Crocodile sanctuary. During the present study, we have found suitable Gharial release site, which is *Jogdah*.
2. To give an improvement to the existing population of Gharials species, discharge of juvenile Gharials should also be made. The juveniles necessary to the man-made enclosure made in *Jogdah* and then be discharge to various sites from there. The right sites for gharial discharge are - *Terideh, Bhelki, Jogdah, Kajardeh and Kuthulideh*.
3. The Forest Staffs member in the field should be given technical training in terms of handling of Gharial eggs, man med nest construction and caring during hatching time of the eggs.
4. A complete vigilance against stopping sand mining fishing, agriculture activity and grazing activities animals in the Sanctuary should be maintained.
5. The regional population who are depend upon fishes for food should be made aware of management and conservation values of endangered species.
6. To maintain of near natural flow of system in the dry months, time to time water release from the

Dam may be provided to optimize the depth and flow require of Gharial and Mugger.

7. The water quality standard of the River may also be analysis on a continue basis to find out pollution status of the river water system.
8. Field member should be facilities with proper apparatus and knowledge to keep scientific record of the population trends in Gharial and Mugger.

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