Threats of Sand Mining on the nesting of Turtles and Gharial in the National Chambal Sanctuary, Madhya Pradesh

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CONTENT

	Page No.
Acknowledgement	**3**
1. Introduction	**6**
2. Objectives	**11**
3. Methodology	**12**
4. Observation	**14**
5. Conservation Strategies	**58**
6. Reference	**62**
7. Appendix	**66**

INTRODUCTION

Freshwater ecosystems may be the most endangered ecosystems in the world. Decline of biodiversity are far greater in fresh waters than in the most affected terrestrial ecosystems (Sala *et al*., 2000). Freshwater ecosystem supporting the human survival on earth. The main reason is the proportionate richness of inland water as a habitat for plants and animals. Over 10,000 fish species live in fresh water (Lundberg *et al.*, 2000).Approximately 40% of global fish diversity and one quarter of global vertebrate diversity being represented in fresh water ecosystem. It becomes clear that as much as one third of all vertebrate species are confined to fresh water. Yet surface freshwater habitats contain only around 0.01% of the world's water and cover only about 0.8% of the Earth's surface (Gleick, 1996).

Habitat degradation is brought about by an array of interacting factors. It may involve direct effects on the aquatic environment such as extraction of river for sand or indirect impacts that result from changes within the drainage basin. For example, forest clearance is usually associated with changes in surface runoff and increased river sediment loads that can lead to habitat alterations such as shoreline erosion, smothering of littoral habitats, clogging of river bottoms or floodplain aggradations. Flow modifications are ubiquitous in running waters (Dynesius and Nilsson, 1994; Voro smarty *et al.*, 2000; Nilsson *et al.*, 2005).

Sand mining activities was reported in the Cuthbert Bay turtle sanctuary in the middle Andaman, the beach handed to contractors for sand mining, which affected the turtles populations and defeated the purpose of establishing the sanctuary. In the Andaman and Nicobar eight species of sea turtles populations in the island are dwindling rapidly due to a variety of reasons. One of the most crucial reasons being the large-scale destruction of turtle nesting beaches due to sand mining for the construction of

industries (Sekhsaria, 2000). Studies has done in the Andaman and Nicobar 21 marine turtle nesting beaches were lost during 1981 to 2000, due to sand mining (Sekhsaria, 2002). In July 2002 it was reported that beach sand mining was taking off in the state with mining leases and prospecting licenses being granted by the state government, after initial objections by the Ministry of Environment and Forests (MoEF). The State government granted a mining lease to Tran's world Garmet to explore beach minerals over a 95 hectare area in Srikurmam (confluence of the river Nagavali) in Srikakulam district. The main objection given by the Ministry of Environment earlier in giving clearances to undertake mining on Vizag beach was that the deployment of machines to excavate the beach sand minerals would destroy the nests of *Lepidochelys olivacea* (Anon. 2002 a). Similar conditions were observed in Ganges and Brahmaputra tributaries, the habitat of the Ganges River dolphin *Platanista gangetica* in the Kulsi River, a tributary of the Brahmaputra, is affected by sand mining. The sand extraction has caused silting of the dolphin habitat, smothering of bottom fauna and lowering of the productivity of the river by blocking the sun-light and preventing photosynthesis. This ecological degradation has a serious impact on the fish production on which the dolphin depend for food. A survey was conducted in Assam during 1997 the dolphin population were observed in a 10-km stretch of the river, they are now restricted to be a 5-km stretch as the downstream portions silted up (Mohan *et al.* 1998). Mining operations have caused tremendous pollution in the water of river Sankhini and other rivers and streams (Anon, 2002b). As a consequence of run-off from the mines, a 32 km stretch of the Sankhini river is called "lal pani*"* (Red water) by the tribal people who see the earth bleeding from the wounds inflicted on it by the miners, this was the serious hazard for river. The impact on both the terrestrial and aquatic ecosystems in the region has been tremendous (Anon, 1995). The National Institute of Oceanography (NIO)

was published a paper in 1985 on the ‘Effect of mining activities on the clam fisheries and bottom fauna of Goa estuaries (Parulekar *et al*., 1986). Mining of coral sands for the cement industry has been the main cause for the destruction of corals on the Gujarat coast in the past. About 0.5 million tone of coral material was mined every year since 1947. Currently, all the lease of calcareous sands was terminated. As the mining was not rigorously controlled, live corals were often the casualty of dredging. Besides, mining operations resulted in re-suspension of enormous quantities of sand, which covered the corals and killed them. It is considered that about 50% of the corals are destroyed in an area of 35 sq. km (Anon, 2002c). There are about 2,500 mines and quarries for the production of boulders, grit, building stones, slate, sand limestone and other minerals in Himachal Pradesh. The mining of stones, gravel and sand from riverbeds has adversely affected the ecology of rivers and streams. Thousands of truckload of gravel and sand are removed daily from the rivers and streams of Himachal Pradesh. The activity has resulted in the vanishing the feeding and breeding grounds of juvenile and adult fishes (Anon, (2002d). Unregulated mine discharge has damaged the river system and reduced the habitat values for wildlife, study showed that iron ore mining in the area has greatly affected the habitat utilization patterns by elephants (Singh and Choudhury, 1999*)*. Uncontrolled sand mining from almost every river in Kerala poses a serious threat to riverine ecosystems. The rules regarding sand mining have made stringent in nine major rivers in 1999 following a High Court directive but there has been considerable pressure to relax the rules. The Centre for Earth Sciences has in its reports indicated the impact of this mining and the even the Kerala Assembly Committee on Environment has said that sand mining has taken a heavy toll on the Kerala Rivers (Mathew, 2000). Kovalipaalam, Kerala, has come to prominence due to protection of an olive ridley nesting site by a local fishing community. Unfortunately, the conservation

initiative and the nesting ground is under serious threat of disappearing due to illegal sand mining in Kottapuzha estuary, drained by the river Kottapuzha, north of Kovalipaalam. Sandy beach spreads over an area of 50 acres stretching from the estuary mouth towards Kolavipaalam, and is an ideal nesting site (Kutty, R., 2001). A study by the Western Ghat station of Zoological Survey of India categorically states that the sand mining activity along with illegal coastal construction poses a very serious threat to the turtle nesting habitat at Kolavipaalam (Gopi and Radhakrishnan 1999). The local group, the Theeram Prakruti Samrakshan Samiti, which has been involved in the turtle conservation efforts, is fighting a legal battle to stop the illegal sand mining. Theeram activists filed a case in the Kerala High Court five years back to prevent the illegal sand mining. The court ordered the appointment of a committee to study the matter and the committee recommended restricted mining. Despite the court order illegal mining continues unabated (Basheer, 2003).

Madhya Pradesh is one of the major mineral producing states of the country, although after Chhatisgarh was carved out of it a considerable part of the former states mineral wealth is divided. MP has large deposits of bauxite, copper, manganese, coal, dolomite, limestone etc. These deposits are located mostly in the districts of Shahdol, Balaghat, Mandla, Rewa, Satna, Sidhi, Betul, Dindori and Chhindwara. Many of these areas overlap with some of the finest forests and wildlife habitats in the state. In July 1995 the Expert Committee on Mining of the Ministry of Environment and Forest had estimated that in the nine months before that time, approximately 8,000 ha of vital tiger and leopard habitat had been opened up for mining by various State Governments. The committee had raised concern over how lands were being diverted without adequate attention at the ecological impacts. According to a report of the Chief Controller and Auditor General (CAG), the Wildlife (Protection) Act 1972 is being badly ignored in Madhya Pradesh as illegal mining is being carried out in

many reserve forest of the state. The CAG has taken serious note of the illegal mining being carried out in the forest reserves of MP and suggested the Forest Department to take immediate steps to check these activities and preserve the rich flora and fauna of the state (Bhattacharya, 1995). Son Gharial Wild life Sanctuary, Madhya Pradesh is affected by illegal sand mining and an investigation was carried out by Kalpavriksh in 1999 in this area. In the nesting grounds of the Gharial and mugger are being destroyed by the sand mining activities. Since the natural predation rate is already very high it is necessary to ensure that all impacts due to human activity are minimum (Neeraj *et al.,* 2003). The Ken Gharial Wildlife Sanctuary, Madhya Pradesh, the Panna Tiger Reserve and the Gangau Wildlife Sanctuary are in close proximity to each other and are all affected by mining. Illegal mining of Diaspor and Pirophilite stone has been carried out in the Ken Gharial Wildlife Sanctuary, Madhya Pradesh (Anon, 1999).

In India scientific studies on Environmental impact of mining have been carried out in different forests (Ramprasad, 1992). Scientific information on environmental impact, wildlife species, habitats destruction were published in journals of international repute to spread the awareness among scientific community (Rao, 1991; Singh and Singh, 1991). Researchers conducted studies on various aspects of wildlife of M.P. (Ali *et al.,* 1985, Rao, 1991; MP SBSAP, 2002; Rao and Saksena, 2003).

The National Chambal Wildlife Sanctuary in Utter Pradesh region is impacted by illegal sand mining activities. An enquiry report submitted by the Utter Pradesh forest department in 2002 indicated that the illegal mining are going on five sites in the sanctuary. Mining has been extensive in areas like Viprawali and Mahngauli ghats in the Bah range of Agra district and Udi in Etawah district. The Hastinapur WLS on the banks of the Ganga, also faces the impacts of illegal mining (Dubey, 2003). The Union Minister for Environment &

Forests indicated that a grant of mining lease within this sanctuary by the MP state government had come to their notice and they had asked the state government to compile with the provisions of the laws (Anon, 2001).

The National Chambal Sanctuary is a Riverine sanctuary. The Chambal River is a perennial river. The prime habitat characteristics of the river is the long stretches of sand banks. These sand banks are very much useful for the aquatic animals for nesting and basking. Reptiles in the river such as Gharial, Mugger and fresh water turtles come out on the sand bank for basking and laying eggs specially constructed by individual female. Some insect species and mammals like Mole rats also make burrows in the sand banks. Shore birds like skimmers, lapwings, plovers etc. laying their eggs on the sand bank and incubate till they hatch and sand mining activities

The present study was carried out to assess the impact of sand mining on the nesting and basking sites of Gharial and turtles in the National Chambal Sanctuary in particular and Dolphin, Mugger and otters in general. Though the proposed study area is between Rajghat to Barai of National Chambal Sanctuary but the population estimation of reptilians and mammalians population has been given for the entire stretch i.e. Pali (Sheopur, M.P.) to Panchnada (Etawah, U.P.).

THE OBJECTIVES OF THE STUDY:

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

MATERIALS AND METHODS

The Present study was carried out in National Chambal Sanctuary, Morena from Rajghat on National Highway 3 (M.P. and Rajasthan Border) to Barai (M.P. and U.P. border) in a distance of around 200 Km. Rajghat is around 70 Km. north of Gwalior and 20 Km. from crocodile rehabilitation centre, (Deori Gharial Rearing Center, Morena). Map Show location of National Chambal Sanctuary.

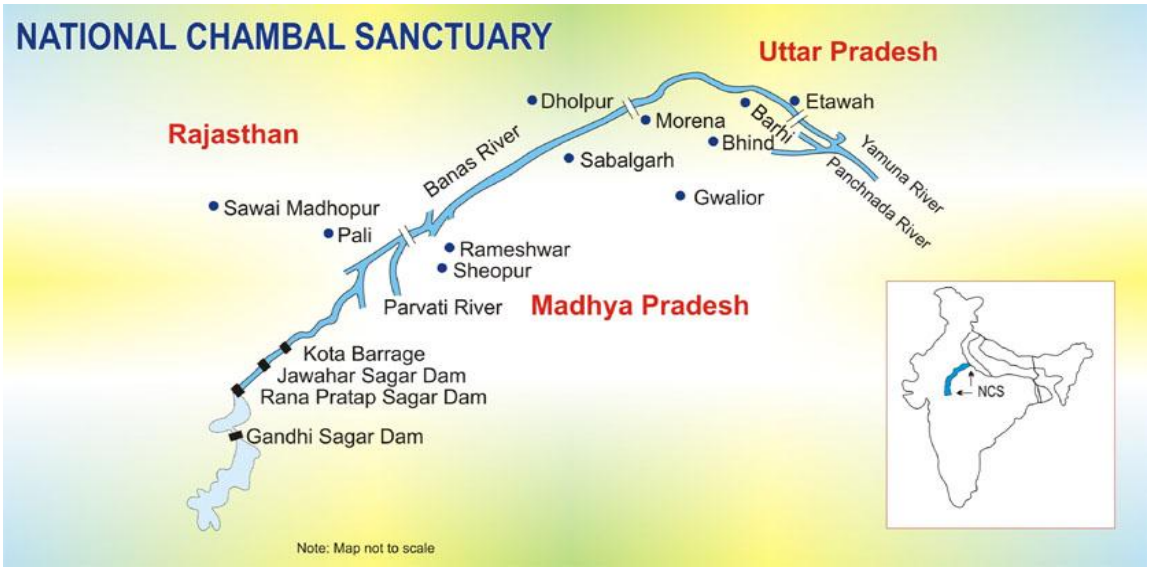

Figure- 1 Field Station at Deori Gharial rearing centre, Morena

To identify the key habitats of Gharial, Mugger, Otters, Dolphin and Turtles:

A detailed survey was carried out by motorboat, and walking along the river bank in the entire study area (Raj Ghat to Barai). Key habitats of animals were observed on the basis of animals sighted and habitats preference. Field map sheets were prepared from a topo-sheet (1:50,000). Geographical locations of all habitats were taken with the help of Global position system (GARMIN -12).

Threat assessment for these critical habitats

The Chambal River was divided into 04 zones on topo-sheet and the survey was carried out in a span of 12 days. Observations were recorded using the binoculars, camera and global positing system (GARMIN-12). Geographical locations of all nesting sites were taken with the Global position system (GARMIN -12). Sand mining sites were regularly monitored through walking along the river banks and all informations were recorded including its geographical locations. Satellite imagery of study area (Raj Ghat to Barai) was also taken into consideration and all data were interpreted on the Study area map to understand the threats.

Data sheets were prepared to record field observations; interview results, past records etc. and neighborhood communities were consulted at various points with regards to the sightings of aquatic animal's including Gharial, Mugger, Dolphin, Turtles in the recent past.

Sale and Berkmuller Method (1988)-

Nest search was conducted in the wild for reptiles (Turtles and Crocodiles) on the basis of track signs as described by Sale and Berkmuller (1988). Reptilians make many trials for the search of suitable nesting site before laying eggs. These leave ample signs that can then be traced with ease.

OBSERVATIONS

Population Status

Annual survey was conducted in the National Chambal Sanctuary in the month of February 2007. More than 18 people including scientists and researchers from Jiwaji University, Gwalior, Madras Crocodile Bank Trust, Chennai, WWF-India New Delhi, Delhi University, NGOs from Etawah and Bhopal, field staff of Madhya Pradesh, Rajasthan and Uttar Pradesh Forest Department participated in the 12-days survey. Groups of 8-10 persons in two motor boats conducted the survey from Kuhanjapur in Parbati River for a stretch of 40 Km that started on 2nd February 2007 and then from Pali to Pachhnada in Chambal River for 395 Km. Due to untimely rains the survey was stopped in middle at Rajghat on 9th February and again resumed on 23rd February 2007 from Rajghat to Pachhnada for four days. Informations were collected by the members of survey team on the basis of sightings of crocodiles (both Gharial and mugger), turtles (hard shell and soft shell), dolphins, otters and human activities in the areas were also reported to investigate the impact on various key habitats.

Gharial population

The first estimate of Gharial population in the Chambal River was based on field study by H R Bustard, FAO Consultant to India in 1975. According to him the Gharial population was said to be around 107. Dr. L.A.K. Singh (1984-85), estimated the Gharial population in the Chambal River which was 451-605. The Madhya Pradesh Forest Department has been conducted biodiversity estimation exercises from 1986 to 2006. Gharial population was 627 in 1986, 1242 in 1997 and 635 in 2006. A preliminary analysis shows an increasing trend in the populations of Gharial estimated since 1979 as may be seen from the Table-1.

The major fluctuations in Gharial populations have raised concern for its protection in the Chambal River. Highest population density was observed in the year 1996-97 and found a drastic declined in 2003. In the current survey conducted in 2007 the observed density was 1.860 per km^2 (Table- 2). The estimates were made based on direct count of Gharial during annual estimation. A detailed estimate of Gharial during this year is given in Table-3. Co-ordinate of the geographical locations were taken for all Gharials sighting and names of the nearest villages were also recorded (Table- 4). A total of 137 sites were identified during the annual population estimation exercise where Gharials were basking. A total number of 865 Gharial of various size groups were sighted in the stretch 465 km of the river. There were sighting of 20 males and 188 adult females. It is presumed that the adult female number may be much more than what was sighted. However, the increase in the populations of different size classes cannot be readily explained, especially the increase in the population of adults by 30 individuals (16.9%) in a single year. The most likely reason for this is of course, more effort went into the 2007 survey, resulting in better sighting of Gharial.

Figure- 2 Gharial Sizes in NCS

Fig-3 Adult Male Gharial at Babu Singh ka Gher

Fig- 4 Adult Female Gharial at Sahaspura

Mugger Population

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. In 1984-85 only 33 muggers were enumerated against 605 Gharial in the entire sanctuary. In 2006, a slight increased in the number of muggers was also noticed compared to numbers enumerated in 1997. In 2006, muggers were enumerated with a crude population density of 0.44 muggers/km in stretch of 395 km. from Atar-Sarsaini contained maximum number of mugger (33). In the current survey 194 Muggers were sighted in 465 km stretch (Table-5**)**

Fig. 5 Muggers in National Chambal Sanctuary, M.P.

Dolphin Population

Ganges River Dolphin (*Platanista gangetica*) commonly know as Susu is an endemic fauna of Ganga-Brahmaputra river system of India, Nepal and Bangladesh. The Ganges river dolphins prefer to stay in the deep zone of the river, in and around the confluence of two or more rivers, at the meandering and below sand bars where two channels reunite and create eddy–counter current system in all these habitats. Populations of river cetaceans have declined drastically in recent years and much of their ranges have been lost. River cetaceans are threatened in many ways. Over harvesting of fish and crustaceans reduces the availability of their prey. Deforestation and intensive flood plain farming increasing the sediment load of river channels and degrade dolphin habitat. Industrial effluent, sewage, mining waste and agriculture runoff contaminates water. Dolphins die from accidental entanglement in gill nets, and mortality rates increasing as the use of these nets spreads. Possibly the most significant threats to river cetaceans are the construction of large water development structures most notably dams, barrages.

The dolphins of the Chambal River were first surveyed in 1983-84 and 1985 when 44 and 47 animals were enumerated simultaneously (Table-6**)**. The population of dolphins observed in a survey conducted on behalf of WWF-India in 2002 was found to be 93 between Rahughat and Panchhnada (stretch of 315 km) but during the survey of 2006 only 69 dolphins could be detected in the 255 Km stretch between Chinouni and Chakarnagar. The stretch from Chambal-Yamuna confluence was very rich in dolphins population. In the latest survey, conducted in the 2007 the observed density was 0.195/ km^2 (Table-7). Dolphins were sighted in 28 sites from Bharra to Pachhnada. Total 91 individuals were observed out of which 52 were adults, 26 were young and 13 were calves (Table-8).

Fig-6 Fresh water Dolphin in Ganges River System Photo-Dr. Sandeep Behera

Turtle Population:

Enumeration of turtles by individual species, when basking in same size group is difficult from a distance. Turtles sighting during the survey were categories as hard or soft shell turtles. The number of turtles sighted during such survey was not indicative of the actual population size of the turtles in the river. All turtles sighted were counted and noted on the data sheets. A total of 714 hard shell turtles and 82 soft shell turtles sighted during the survey 2007. The density of hard-shell turtle were 1.53 turtle per km and soft shell turtle were 0.176 turtle/km (Table-9). The following seven species of fresh water turtles were observed during the survey and represent the entire assemblage of turtles recorded from the Chambal: *Pangshura tentoria, Kachuga dhongoka, Kachuga kachuga, Hardell -thurjii, Aspideretes gangeticus, Lissemy -punctata anderoni, Chitra indica.*

Although the turtle nesting and basking sites were distributed through out the sanctuary, a comparison of the sighting frequencies during the present survey and previous surveys afford insight into the possible population trends of turtles in the river.

Fig.- 7 Fresh water turtle in National Chambal Sanctuary, M.P.

Otter population

The tracks marks of otters were located on the sand bank on mid islands at Babu Singh gher; however, no otter was sighted during the survey of 2007.

KEY HABITATS OF GHARIAL, MUGGER, OTTERS, DOLPHINS AND TURTLES IN THE NATIONAL CHAMBAL SANCTUARY, MADHYA PRADESH

Besides annual surveys, reptilians as well as mammalians key habitats in Chambal were surveyed many times during study period to ascertain the habitat types.

Key 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 upto 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.

Total useful habitats of Gharial were observed from Raj ghat to Barai (160 km stretch). 130 km area was suitable habitat for the Gharial populations and only 30 km area was not much supported the life activities of this important member of aquatic ecosystem (Table- 10).

1. Tighri rithora

Tighri Rithora is located in the north of Chambal River and it is 15 km down of Rajghat. This site is geographically located at N 26° 41' 05 .5" E 078° 02'35. 4". The topography of the area is subjected to natural and human alternations. One bank of this site is sandy and other is rocky. At this site a big, mid River Island is located. Island is best site for the safeguard of aquatic wildlife species.

Figure 8- Island of Tigari Rithora

2. Babu S. Gher-

It is 33 Km down from the Rajghat of Morena District in National highway no-3. It is important sites for Gharial Population. This site is geographically located at N 26° 44' 23 .2" E 078° 06'37. 9". Babu S. Gher have a little meandering of River and a small rocky patch also available of this site besides muddy and sandy bank on the other site. In the summer season a small mid inland also formed in the mid river, which is goods place for the basking for Gharial.

Figure-9 Babu Singh ka Gher in the NCS, M.P.

3. Daljit ka Pura-

Daljit ka pura is located in the Ambah of Morena district. This site is geographically located at N 26° 46' 35 .6" E 078° 06' 05.5". One bank is sandy and other side is rocky muddy habitats. Water flow is also slow.

Figure-10 Daljit ka pura in the NCS, M.P.

4. Barsala –

Barsala is 55 Km down from the Rajghat of Morena district in the National highway no-3. This site is geographically located at N 26° 47' 43 .6" E 078° 11'09. 4". One bank is sandy and other side is muddy or an upper bank is ravines habitats. Water flow is slow.

Figure- 11 Barsala in the NCS

5. Bindwa/Used-

Bindwa is 2 Km downs of Pinahat in U.P. and Used Ghat in M. P., This site is geographically located at N 26° 50' 14 .2" E 078° 23'06.3". One site bank is Sandy and other bank is hardly muddy, in the mid river have a small concrete and vegetation patch. Water flow of this site is fast.

Figure-12 Bindwa in the NCS

5. Sahas Pura

Sahaspura is located in Porasa Tehsil of Morena District. This site is geographically located at N 26° 46' 41 .1" E 078° 31'36.0". Sand banks are available on both sites. At this site a big, mid River vegetated Island is located. Water flow is fast and river is formed a deep narrow stretch.

Figure-13 Sub adults Gharial basking at Sahas pua

6. Ater/Salimpura

Ater is located in Bhind District. This site is geographically located at N 26° 45' 47.8" E 078° 39'31.2". One site sand banks and other site is agricultural land.

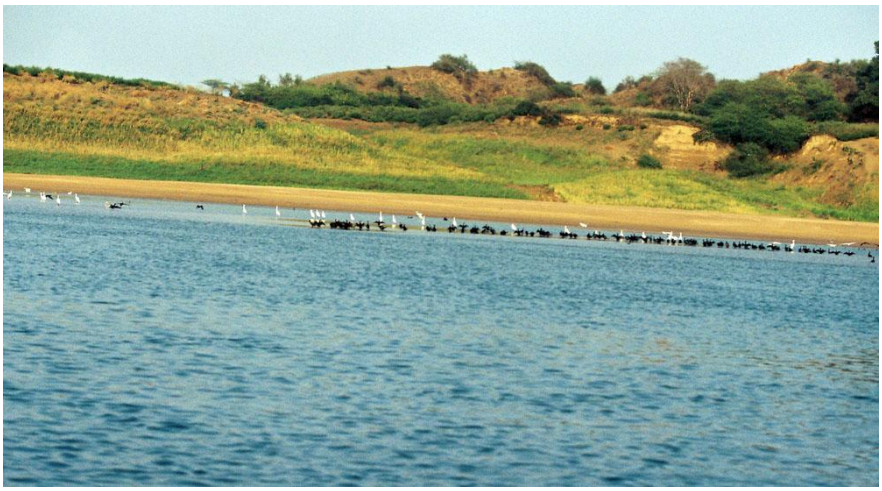

Figure-14 Ater in the NCS

7. Bijora –

Bijora is located near the Phoof tehsil of Bhind district. This site is geographically located at N 26° 45' 58.1" E 078° 45'51.0".It is very good sand banks. Both sides sand banks are present and upper bank of river is forest land.

Figure-15 Bijora sand bank in NCS

8. Ranpura/Barai

Ranipura is 5 Km upstream of Barai. This site is geographically located at N 26° 41' 50.8" E 078° 52'26.6". Both sides have muddy banks and make many islands on mid river.

Figure- 16 A view of Barai ghat of the NCS

Key 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

consists of an average 28 (10 - 48 range) eggs per clutch. During the Study following sites was observed key habitats of Mugger. Table-11 Shows the major habitats of Muggers in the NCS, Madhya Pradesh.

Figure- 17 Key habitats of Muggers in NCS

Key Habitats of Otters:

Otters are one semi aquatic animal members of family mustilidae that evolved 30 million years ago. There are 13 species of otters placed in 4 genera of which 3 species are found in India. The smooth coated otter has been reported from Karnataka, Kerala, Andhra Pradesh, Madhya Pradesh, Maharastra, Bihar, Gujarat, Himachal Pradesh, Punjab, Uttar Pradesh and West Bengal.

The government of India has afforded protection to smooth coated otter on schedule II of the wildlife (protection) act, 1972, which prohibits there trapping and killing. Otters are secretive, thinly, distribution was by direct and indirect evidences such as counting the number of signs particularly sprint left by the animals on tater base. Other signs more frequently used in the field for assign presence of otter one halts (der sites) footprints and food remains.

Babu S. Gher is the only site observed in the study area for otters. It is geographically located at N 26° 44' 23 .2" E 078° 06'37. 9". Babu S. Gher has a little meanderings the River and a small rocky patch also available at one side and other side has muddy and sandy banks.

Figure-18 key habitats of otters in the NCS

Key Habitats of Dolphin:

Though, the people of the Indian subcontinent since time immemorial knew the Ganges River dolphin, it was first discovered to science by Roxburgh in 1801. The animal has been referred in ancient literature of our country, but John Anderson published the first scientific report on the dolphin in 1879. It was also mentioned as "Khuk- abi" in Babarnama during the Mughal period, when the rural folk used to burn dolphin oil for lighting their homes. The older generation of fishermen community still regards Susu as the vahan (carrier) of the Ganga - which is their source of livelihood.

The Ganges River Dolphin commonly called ‘Susu’ or ‘Soons’, differs from marine species. It is blind as it has eyes without lens, its snout is longer as it grovels in mud for food, its dorsal fin is very small and it is the only cetacean with ceacum. To compensate the loss of vision the animal has a very efficient echolocation. When the dolphin leaps from the glories of the Ganga, it certainly looks like a huge fish. Though resembling a fish morphologically, the Ganges dolphin is in fact a mammal. The dolphin respires through lungs and emerges above the water surface to inhale air through a blow-hole on its melon, the head. Inhaling and exhaling produces a typical sound of "Sooooooosssss", which is the basis for its vernacular names. During the study period following key habitats of Dolphins were observed:

Gharora

It is situated near Rajghat and down to Railway Bridge. This site is geographically located at N 26° 39` 32. 3`` E 077° 57` 08.0``. It is 1 km stretch of deep water pool where water depth is 22- 24 feet. One bank is sandy and other bank is muddy habitat.

Tigri rithora

Tigri Rithora is located in the north of Chambal River and is 208 km down stream of Pali and 15 km down stream of Rajghat. This site is geographically located at N 26° 41` 31. 0`` E 078° 01`09.3``. The topography of the area is subjected to natural and human alternations. One bank of this site is sandy and other is rocky. At this site a big, mid River Island is located. Dolphin sighting are very common at this site. River is deep to down stream of Tigri Rithora. Water depth is 24-26 feet.

Fig- 19 Dolphin site of Tighri Rithora

Daljit ka pura

Daljit ka pura is located in the Ambah of Morena district. This site is geographically located at N 26° 45` 22. 5`` E 078° 06` 51.8`` One bank is sandy and other side is rocky muddy habitats. Water depth is 26-28 feet. Water flow is slow.

Racher

Racher is located near Ambah of Morena district. This site is geographically located at N 26° 49` 05. 0``E E 078° 16` 24.6``. River bank of Utter Pradesh side is sandy and Madhya Pradesh side is muddy habitat. It is Deep water pool and water depth is 32 -36 feet.

Ater

Ater is located in Bhind District. This site is geographically located at N 26° 45' 53 .3", E 078° 37'09. 2" It is good site for Dolphin. Water depth is 28 -30 feet.

Magera ka pura

It is 15 Km down of Ater site. This site is geographically located at N 26° 47' 10 .0" E 078° 40'57. 6'. Both sides have muddy banks. Water depth is 26 -28 feet.

Dinpura

It is located 4 Km down of Maghera ka pura. This site is geographically located at N 26° 47' 44 .6" E 078° 43'12. 3" .Both banks are sandy rocky. Water depth is 24-26 feet.

Bijora

Bijora is located near the Phoof tehsil of Bhind district. This site is geographically located at N 26° 45' 30 .1" E 078° 46'47. 3". It is very good sand banks site. Water depth is 22-24 feet.

Rani pura

Ranipura is 5 Km upstream of Barai. This site is geographically located at N 26° 41' 49 .8", E 078° 53'29. 8". It is muddy one side and flat sandy bank on other side. Water depth is 20-22 feet.

Figure- 20 Magher ka Pura Important Dolphin habitat of NCS

Figure-21 Daljit ka Pura; important Dolphin Site in the NCS

Key Habitats of Turtles:

The habitat of turtles in the Chambal River is characterized by expanses of open sand which is sparsely covered with a variety of herbs, the most common in the open sand being *Tamarix dioca*. Some turtle species frequently dig nests adjacent to the *Tamarix*. On some

occasions soft-shell turtles also dig nests near this vegetation. The *Tamarix* on the open sand help prevent the wind from eroding the sand and exposing nests. Aquatic and semi-aquatic vegetation are similar along entire Chambal River. Vegetarian turtles feed on this vegetation. The submerge plants are *Vallisnaria spiralis, Ceratophyllum demersum, Hydrella verticellata, Chara* species, *Nitella* species, *Potamogeton demersum, P. crispus, Zennichlia* species, etc. *Zygenema, Odogonium* and *Spirogyra* are the main algae which occur along the banks. The most common emergent occurring along the banks are cattails (*Typha sp*.) and several species of grasses. Herbivorous turtles in the wild mostly feed on *Potamogeton* and *Zennichelia* species. Young turtles take shelter among the aquatic vegetation. During summer the aquatic vegetation dries up due to low water level, however, during wet season the vegetation is completely submerged in the flood waters. The river-side vegetation is sparse in most of the southern (M.P.) side of the river. Major tree species are *Acacia Arabica, A. catechu, Zizyphus marutiana* etc. *Trionyx gangeticus* travel more than 500 m and lay eggs under the shade of *Acacia* trees.

The following seven species of fresh water turtles were observed during the survey : *Pangshura-tentoria, Kachuga-dhongoka, Kachuga-kachuga, Hardella-thurjii, Aspideretes-gangeticus, Lissemys-punctata anderoni, Chitra indiaca***.**

Turtles move in the entire stretch of the river and they lay eggs in the sandy or muddy habitat of sand beach or islands.

Figure- 22 Turtles basking on the rock

ASSESSMENT OF THREATS TO THE CRITICAL HABITATS OF GHARIAL, MUGGER, OTTERS, DOLPHINS AND TURTLE-

Due to various anthropogenic activities to cater the needs of growing population, the degradation of freshwater ecosystems by a variety of stressors has increased logarithmically. The wildlife habitat in the Sanctuary is mostly aquatic with terrestrial habitats within 1 Km from the mid riverbank. The micro-habitats are: deep water pools, shallow riffle areas, sand peninsulas, muddy banks, sand banks (steep and flat sand banks), rocky banks, nallas, steep river-slide cliffs, xerophytes vegetation on the banks, etc.

Sand banks are very much useful for the aquatic animals for nesting and basking. Being aquatic animals the reptiles in the river such as Gharial, mugger and freshwater turtles come out on the sand bank for basking and laying eggs specially constructed by individual female. Some insect species, mammals like moles rats also make burrows in the sand banks for living. The sand on the river is very much used by locals for agriculture. The locals

grow vegetables like tomatoes, kakdi, kheera, fruits like tarbooj, etc. on the wet sand banks mixed with soil. The extraction of sand for construction work is a major usage from different rivers including Chambal River. Sand mining is one of the major human activities in the National Chambal Sanctuary. During the study period total 28 sand banks were observed from Rajghat to Barai at the stretch of 200 Km (Table-12).

THREAT ASSESSMENT OF GHARIAL:

The Gharial (*Gavialis gangeticus*) is the last surviving species from a very ancient lineage of crocodilians 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 assess on the Gharial habitats in the National Chambal Sanctuary, Madhya Pradesh**.**

Sand mining

The National Chambal Sanctuary is a riverine Sanctuary. The Chambal 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 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 was observed at 9 sites (Rajghat/Piparai, Tigari Rithora /Mahuwa khera, Kuthiana/Kathumra, Puraini, Malbasai/DaljitPura, Chursalai, Sahas Pura, Ater and Barai) in the year 2006 and 10 sites (Rajghat/Piparai, Tighari Rithora, Kuthiana, Puraini, Daljit ka pura, Barsala**,** Sukhadhyan ka Pura, Sahas, Pura Barai) in the 2007 (Table- 13 and Table 14). Comparative Sand mining sites of National Chambal Sanctuary was observed during the study period- 1978-2007 (Table- 15).

Table 15 Sand mining in NCS, M.P. from 1978-2007

Year/Name of site	1978-79	1984	1985	1986	1987	1988	1989	1991	1993	1994	1995	1996	1997	2005	2006	2007
Rajghat/Piparai		Y	Y	Y	Y	Y	Y*	Y*	Y*	Y*	Y*	Y*	Y*	Y*	Y*	Y
Tighari Rithora										Y			Y	Y	Y	Y
Mahuwa kheda								Y			Y	Y	Y	Y		Y
Kuthiana					Y	Y	Y	Y		Y		Y	Y	Y	Y	Y
Babu S. gher									Y		Y			Y		
Puraini							Y			Y		Y	Y		Y	Y
Daljit ka pura						Y								Y	Y	Y
Barsala									Y		Y					Y
Sukhadyan ka pura					Y		Y	Y						Y		Y
Chursalai								Y			Y			Y	Y	
Holapura										Y			Y			
Kachiara							Y	Y			Y					
Useth			Y	Y	Y	Y	Y		Y			Y	Y	Y		
Bijila/Bindwa								Y		Y						
Vich ka pura													Y			
Khurd						Y				Y	Y			Y		
Jalalpura													Y			
Sahas pura						Y									Y	Y
Ranipura										Y	Y	Y		Y		
Ater		Y	Y	Y	Y	Y	Y	Y	Y				Y		Y	
Maghera ka pura									Y	Y						
Kosad											Y	Y	Y	Y		
Bijora										Y						
Barai		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Total no. of Site		3	4	4	6	8	8	9	7	11	10	8	12	13	9	10

Y*- Legal Sand mining site from 1989 to 26 Dec. 2006. Y- Yes

Source- Sand mining data (1978 to 2003) was collected from Secondary sources- Forest department, literatures and local people)

Figure- 23 Sand mining sites observed in the National Chambal Sanctuary, Madhya Pradesh

Gharial nesting sites were observed at 7 sites (Tigari Rithora, Baboo singh gher, Puraini, Bindwa, Sahaspura/JalalPura, Guda and Chiloga/Bijora) in the 2006 but only 4 sites (Tighari Rithora, Baboo singh gher, Barsala, Sahas pura) were observed in the 2007 (Table – 16 and Table-17).

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 National Chambal Sanctuary, Madhya Pradesh from 1978 to 2007 are shown in the Table-18.

Table-18 Number of Gharial nest from 1979-2007 (data collected from 2006-07 during the study period)

Year/Name of site	1978-79	1984	1985	1986	1987	1988	1989	1991	1993	1994	1995	1996	1997	2005*	2006*	2007*
Tighari Rithora	3	6	8	9	12	12	13	15	16	12	14	12	16	14	17	13
Babu S. gher	2	2	6	7	7	9	11	12	11	11	9	13	11	12	11	9
Puraini	2	4		3	6	4	5		3	4	3		6	4	3	
Daljit ka Pura							3		2	2	1	4	2	2		
Barsala			2			2		3		4	3		2	5		6
Sukhdhyan ka pura								4	3		2	3	1			
Bindwa				2		2		1	4	3	2	4	4	2	4	
Sahas Pura		1	3	2	3	3	5	3	8	6	4	5		7	7	4
Guda									2		3	4	2	3	4	
Chilonga						2	1		2						3	
Ater					3	1	3	4	2	3	4	6	2	3		
Barai								1		2	1	3		3		
Total Nest of Study area	**7**	**13**	**19**	**23**	**31**	**35**	**41**	**43**	**53**	**47**	**46**	**54**	**46**	**55**	**49**	**32**
Total Nest of NCS	**12**	**28**	**33**	**37**	**45**	**50**	**57**	**60**	**64**	**68**	**75**	**77**	**81**	**84**	**64**	**54**

. * Nest from 1979- 1997 was collected from Forest department

Sand mining activities were recorded in both the states, 7 sites were in Madhya Pradesh and 3 sites were in Rajasthan. 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, 2007). 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 then 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. 5 sites (Rajghat/Piparai, Tighari Rithora, Mahuwa Kheda, Kuthiana, Barsala) fall in scale III, 4 sites (Puraini, Daljit ka pura, Sukhadhyan ka pura and Sahas pura) come under scale II and only one site (Barai) came in scale I (Table-19).

Figure- 24 Nesting site of Gharial at Babu Singh ka gher

Figure-25 Nesting site of Gharial at Sahaspura

The Department of Mining, Government of Madhya Pradesh was given 108 hect. area on lease for sand extraction at the Piparai (Rajghat) in the National Chambal Sanctuary. The major mining activity was carried out traditionally near Rajghat Bridge on the National highway No. 3, four km south of Dholpur, Rajasthan. There is a good transport facility in this area and sand is heavily extracted for supply to major cities as far as Delhi. After the intimation of high court, legal sand mining area was stopped from 26 December 2006. Year wise Production of sand and income of State mining co-operation and department of mining, Madhya Pradesh government from legal sand mining site, shown in Table-20**.**

Figure-26 Legal sand mining board for villagers

Fishing

During the Survey, Fishing on commercial scale was observed in most of the stretches. Fishermen were seen using nylon gill nets and other advance fishing gear. Fishing activities was recorded from 60-70 percentage of the Chambal River flowing within the sanctuary. Interrogation of fishermen in the upper stretches revealed that they worked for fish contractors who resided in Rajasthan where planned sanctuary management is yet to come into force because of this state's non participation in the National Chambal Sanctuary project. Illegal fishing is rampant and occurs on a scale, which apart from directly causing mortality of Gharial in net accidents is likely to affects the food availability for Gharial and reduced the carrying capacity of the river for pisivorous aquatic vertebrates like Gharial, muggers, dolphins and otters. The most of serious implication of fishing arises from the fact that the fishing regime has changed from the pre sanctuary notification period to that in the current time. Previously, fishing was carried out by different contractors who required fishing rights auctioned by the district authorities. The contractors used the services of fishermen from outside the sanctuary areas, which were forced to discontinue fishing

activity and leave when the contract fishing system was scraped. Today the local residents of the area are gradually discovering the economic benefits of fishing and once this becomes incorporated into the local economy, as is happening at present, curbing and regulating fishing will become more and more difficult if not impossible. Fishing pressures have also become acute at the upstream and downstream most extremities of the sanctuary. Major Fishing sites were observed in the study are shown in Table- 21**.**

Fig. 27- Fishing activity in Chambal River

Agricultural practices/ wood collection

This is the most serious of long term threats because it damages habitats and alienates wildlife from it. The practices of agriculture on the banks of the Chambal and harvesting of fuel wood leads to heavy erosion in the ravines and increased turbidly of the water as well as silt deposition and resultant stream shrinkage. During summer when the water level recedes, the exposed and expanding sand banks are used for growing vegetables and the *Tamarix* growth on the islands which now become accessible is hacked down, disturbed the Gharial nest sites. More impertinently human activities on increased number of sand banks due to cucurbit horticulture will digitally alienate Gharial of all size classes from basking habitats and will lead to permanent emigration of animals from these areas as has occurred in the yamuna and many other norths' Indian River.

Figure 28- Fire Wood collection in the NCS

Figure- 29 Agricultural practices of river banks site

Ferry

Ferry is also disturbing the habitats of Gharial. In the Chambal River have a more than 25 places of ferry which lead to human presence round the clock ultimately shifting basking and nesting Gharials permanently.

Figure- 30 ferry at the Kuthiana ghat in the NCS

Water extraction

Unsustainable water abstraction for agriculture and large scale human consumption will also render the aquatic habitat of the sanctuary uninhabitable for large aquatic wildlife for the conservation of which the sanctuary was created. Water abstraction activities were also observed in the study area. Due to this activity water level is going down which further alienates Gharials and dolphins in these areas Table 22.

Table- 22 Major Water extracted sites observed in study site

Name of the Bank	Number of pumps	Geographical Location	
		Latitude	Longitude
Tighari Rithora	6	N 26° 41` 38. 7``	E 077° 59` 53.5``
Mahuwa kheda	2	N 26° 41` 33. 5``	E 078° 01` 11.1``
Kuthiana	5	N 26° 43` 08. 8``	E 078° 05` 28.5``
Babu S. gher	4	N 26° 43` 11. 8``	E 078° 05` 28.6``
Barsala	7	N 26° 47` 04. 5``	E 078° 09` 49.8``
Sukhadyan ka pura	4	N 26° 48` 36. 4``	E 078° 10` 19.8``
Kachiara	3	N 26° 49` 47. 6``	E 078° 16` 22.6``
Useth	4	N 26° 51` 44. 5``	E 078° 20` 01.2``
Bijila/Bindwa	6	N 26° 50` 14. 2``	E 078° 23` 06.3``
Sahas pura	3	N 26° 46` 51. 9``	E 078° 30` 51.3``
Ater	5	N 26° 46` 18. 4``	E 078° 37` 41.2``
Maghera ka pura	3	N 26° 47`10. 0``	E 078° 40` 57.6``
Bijora	3	N 26° 45`32.8``	E 078° 46` 14.1``
Barai	7	N 26° 42`46.4``	E 078° 50` 59.5``

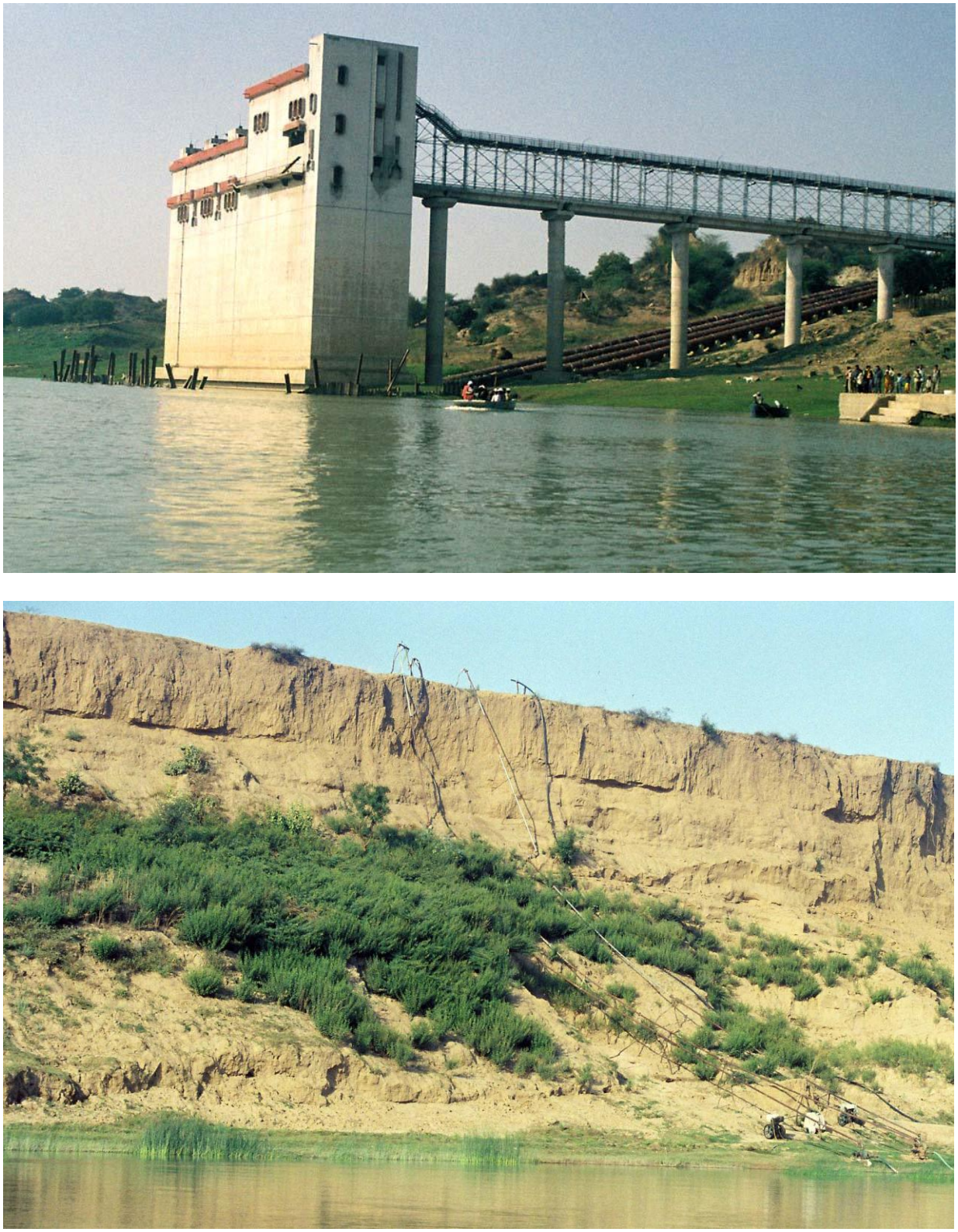

Figure-31 Water Development activity in the River bank of Chambal

Population dynamics of Gharial and threats level were shown in (Table-23).

Table 23 Population dynamics of Gharial and threats in NCS

2006 Year Population							2007 Year Population						
Habitats sites	**Adults**		**S.A.**	**Y**	**H**	**M.B.P.**	**Adults**		**S.A.**	**J.**	**Y**	**H**	**M.B.P.**
	M	**F**					**M**	**F**					
Bhanpur/Piprai	-	3	1	1	1	HSM,HP	-	2	3	5	-	3	HSM, HP
Garora	-	-	-	-	-	HSM,HP		3	1	1	-	-	HP,LSM
Tigri rithora	1	6	2	1	-	HSM	2	22	3	23	5	3	HSM
Mahuwa khera	-	-	-	-	-	HSM	1	2	3	2	-	-	HSM
Baveshari Temple	-	-	-	-	-	LFS,	-	-	-	-	2	-	AgP
Kuthiana	-	-	-	-	-	HP	-	-	-	-	1	-	HP
Babu S.Gher	1	6	6	2	-	HP,	1	8	-	17	-	-	HP, LSM
Puraini	-	8	7	3	-	HSM,Ag.P	-	-	-	1	6	7	HSM
Daljit ka pura	1	2	6	3	2	LSM	-	2	3	9	4	3	HSM
Barsala	1	6	4	4	1	HP	-	-	-	-	5	2	HSM
Sukhdyan ka pura	-	2	3	1	1	LSM	-	-	-	2	-	--	LSM
Holapura/Bela ka pura	-	2	2	1	-	HP	-	-	-	1	-	-	HP
Kachiara	-	-	-	-	-	LFS,Ag.P	-	4	-	-	-	-	LFS
Riya Baranda	--	-	-	-	-	LFS	-	1	3	-	-	-	LFS
Useth	-	10	5	6	24	HP	-	-	1	9	-	-	HP
Bindwa	-	6	11	22	18	LSM	-	1	2	-	2	1	HP
Khurd	-	3	19	12	13	LFS	-	-	-	3	4	3	LFS
Shivlal pura	1	9	2	13	-	LFS	-	-	-	1	-	-	LSM
Jalalpura UP	-	-	-	-	-	HP	-	-	3	-	-	-	HP
Sahaspura	-	13	7	2	5	LSM	-	-	-	-	5	4	LSM
Ranipura	-	-	-	-	-	Ag.P	1	6	5	5		1	HP
Ater/Salimpura	1	23	31	-	-	LSM	1	10	6	32	1	1	LSM
Maghera ka pura/Dinpura	-	5	3	5	24	LFS	-	11	14	9	3	8	LFS
Bijora	1	8	2	1	9	HP	1	6	5	22	3	3	LFS
Gadayaya,	-	-	-	-	-	HP	-	2	-	8	2	-	LFS
Ranpura/Barai	-	-	-	13	17	Ag.P	-	3	5	19	3	2	LFS

*HSM- high sand mining, LSM- low sand mining, LFS- low fishing site, HFS- High fishing site, HP-Human pressure,
HAg- High agriculture, LAg- low agriculture , M.B.P.- Major Biotic pressures, A-Adults, S.A.- Sub adults, Y.-yearling, H.- hatchling , J. Juvenile

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-24)**.**There was only one nesting site i.e. Bindwa in the study area earlier in 2006 which was also found lost in 2007 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 (Table-25).

Table-25 Muggers Population dynamics and threats in NCS

2006 Year population						**2007 Year population**				
Habitats sites	**A.**	**S.A.**	**Y.**	**H.**	**M.B.P.**	**A.**	**S. A.**	**Y.**	**H.**	**M.B.P.**
Piparai	-	-	-	-	HSM	-	3	-	-	HSM
Garora	2	2	-	-	LSM	-	-	-	-	LSM
Tigri Rithora	6	-	-	-	HSM	5	3	-	-	HSM
Kuthiyana	4	3	1	-	HSM	1	-	-	-	HSM
Baboo S. ger	-	-	-	-	LSM, HP	-	1	-	-	HP
Pura Daljit	1	-	-	-	LSM, HP	-	-	-	-	LSM
Chursalai	6	-	-	-	HP	2	-	-	-	HP
Holapura	-	-	-	-	Ag.P	2	1	-	-	LFS
Kachiara	-	-	-	-	LFS	1	1	-	-	LFS
Riya Baranda	-	-	-	-	LFS	2	1	1	-	LFS
Rachar	2	-	-	-	LFS	-	-	-	-	LFS
Useth	7	-	-	-	HP	2	1	-	-	LSM
Bijila		-	-	-	HP	1	-	-	-	LFS
Bindwa	4	2	-	-	HP	-	-	-	-	HP
Shiv lal ka pura	-	-	-	-	LSM	1	-	-	-	LFS
Khurd	1	-	-	-	LFS	-	-	-	-	LFS
Ater	6	2	-	-	LSM,LFS	-	-	-	-	LSM
Maghera ka pura	-	-	-	-	LFS	1	-	1	-	LFS
Dinpura	2	-	-	-	LFS	1	-	-	-	LFS
Kosad	-	-	-	-	LFS	2	-	-	-	LFS
Bijora	3	-	-	1	LFS	-	-	-	-	HP

*HSM- high sand mining, LSM- low sand mining, LFS- low fishing site, HFS- High fishing site, HP-Human pressure,
HAg- High agriculture, LAg- low agriculture , M.B.P.- Major Biotic pressures, A-Adults, S.A.- Sub adults, Y.-yearling, H.- hatchling

THREATS ASSESSMENT OF OTTERS:

Otter are semi aquatic members of family Mustilidae that evolved 30 million year ago. There are 13 species of otters placed in 4 genera of which 3 species are found in India. The smooth coated otter has been reported from Karnataka, Kerala, A.P., M.P., Maharashtra, Bihar, Gujrat, H.P., Punjab, UP, and West Bengal.

At only one habitat site (Babu S. Gher) indirect evidences of otter's presence was seen in the study area. One more site which was not part of the study area i.e. Dangbasai where many indirect evidences of otter's presence were observed.

Various human activities such as ferry, grazing, bathing, agricultural practiced, sand mining etc. are directly or indirectly effect the habitats of otters.

THREATS ASSESSMENT FOR DOLPHINS:

1. Large water development projects, including embankments, high dams and barrages have had profound effects on the ecology of Asian Rivers, and they are certainly the main causes of habitat degradation within some large river environment. . A series of multipurpose dams at Gandhi Sagar (M.P.), Rana Pratap Sagar (Raj.), Jawahar Sagar (Raj.) and Kota Barrage (Raj.) have been erected in the upper reaches of the Chambal River.
2. Accidental capture in fishing gear is among the most critical threats facing river cetaceans. Riverine fisheries tend to be decentralized and seasonal. In some cases, there is strong disincentive for fishermen to report by catch because they can be prosecuted for causing the death of dolphin. In other cased fishermen to keep the carcass for oil, to be sold or used in their own household. In the Ganges river system, according to Sinha (1998), small-mesh monofilament plastic nets cause the greatest

damage because of their extensive use and because dolphins cannot break free of them once entangled. Dolphin also become entangled in large-mesh nets but, apparently, often manage to escape. Sinha (1998) reported that the incidence of entanglement changed seasonally for different age classes. Juvenile dolphins are caught mainly in nets set in shallow waters during the onset of the monsoon, while adults are generally caught during the dry season in the main channel. Mortality caused by rolling hooks, explosive and electricity. Fishing with electricity is particularly damaged because of its non-selective effects and the rapid increased in the numbers of fishermen using the method. All three fishing methods are illegal, but regulations are generally not enforced. Destructive disordered and as a tonic for treating importance and asthma. Pregnant women sometimes drink the oil in the belief that is will ensure a healthy baby.

3. The water quality of Asian river is badly degraded and nurgening human population guarantees that the problems will worse (Dudegeon, 1992). Although governments have taken some measures to control pollution, levels of fecal Coli form from human sewage, trace metals from industrial and mining activities, and dangerous compounds, including PCB's butyl tins from boat paints and dioxins from "green revolution" pesticides remain high and are increasing in many areas. Dolphins may be particularly vulnerable to this type of pollution because they feed at the top of the food chain. River dolphins of India may be greater risk from environmental contamination than marine cetaceans. In the Chambal River Major fishing, sand mining and agricultural activities are shrinkage of Dolphins habitats.

Key habitats for dolphins were observed in the study area and fishing sites among the key habitats were also located with the help of Global Positioning System. Population dynamics of dolphin and threats were observed (Table-26).

Table- 26 Dolphin population dynamic and biotic pressures in NCS

Habitats	Year 2006			Major Biotic pressures*	Year 2007			Major Biotic pressures
	Adults M/F	Juvenile	calves		Adults M/F	Juvenile	calves	
Gharora	2	-	-	HSM	2	-	-	HSM
Tighari Rithora	1	-	-	HSM, LFS	1	-	-	HSM, LFS
Daljit ka pura	1	2	-	LSM	2	2	1	LSM
Racher	1	2	-	HFS	-	-	-	HFS
Kachiara	-	-	-	HFS	-	-	1	HFS
Riya Bareda	-	-	-	HFS	-	1	1	HFS
Used ghat	-	-	-	LFS	1	-	-	HP
Khurd	-	-	-	LFS	1	1	1	LFS
Ghoda	-	-	-	LFS	-	1	1	LFS
Ranipur/Ater	1	4		HP, LSM	-	-	-	HP
Magher ka pura		1	-	HP, LFS	2	2	-	HP, LFS
Dinpura	4	3	1	LFS		2	2	LFS
Kosad	-	-	-	HFS	4	2	3	HFS
Bijora	-	1	-	HP,LFS	1	-	-	LFS
Kot	1	1	-	HP	-	-	-	HP
Pachhaya gaon	-	-		HP, LFS, HAg	3	1	1	HP, HAg
Ranipura	1	2	1	Hag,		2	-	HAg

*HSM- high sand mining, LSM- low sand mining, LFS- low fishing site, HFS- High fishing site, HP-Human pressure, HAg- High agriculture, LAg- low agriculture,

THREATS ASSESSMENT OF TURTLES:

The ever-increasing human pressures on turtle habitats such as sand mining, agriculture, reclamation of wetlands and riparian areas, alteration of rivers for irrigation and generation of hydroelectric power, pollution, siltation, eutrophication, and intensive fishing have not only taken a heavy toll of turtle biomass, but also have disrupted nesting and reproduction. In northeast India, many are burnt alive during grassland burning (as management tool) in PAs and species such as *G. hamiltonii* is among the worst affected. In the hilly regions, many are injured or easily caught during burning of the hill side for

jhum (slash-and-burn shifting cultivation) and *P. mouhotii* and *M. emys* are among the worst affected.

Lack of proper understanding of species biology has hindered to take suitable measures for conservation management. Both demographic and ecological data of turtles are needed to take suitable measures for their protection and these data are available only although long-term research. In India water development projects, water pollution and commercial exploitation have affected fish and wildlife resources in many areas (Rao, 1985).

Following major threats were observed:

Sand mining

Nesting of Turtles was surveyed in 2006 and 12 sites were observed. Most of the nesting sites were shifted to other sites due to sand mining (Table-27).

Fishing-

Due to fishing activities various turtles are caught in the net and after some times they found dead in the nets. Fishing sites were shown in the description of threats to the Gharial. Different types of fishing nets such as hook and gill nets were found.

Figure- 32 Fishing nest in the NCS

Figure-33 Turtle Caught in fish net

Nest predation-

Turtle nests were predated by jackals and hyena in the national Chambal sanctuary. It was also observed that predatory birds such as Egyptian vultures (*Neophron percnopterus*) were attacking on soft shell turtle such as *Lissemys punctata* and also feeding on a dead *Kachuga dhongoka*.

Figure-34 - Jackal comes for nest predation

Poaching

Soft shell turtles, *Aspideretes gangeticus* and *Lissemys punctata* were observed at upper stretch of Chambal River.

Fig. 35 *Aspideretes gangeticus* caught by poachers

CONSERVATION STRATEGIES OF GHARIAL, MUGGER, OTTERS, DOLPHINS AND TURTLES –

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. The revenue so generated through sand mining should be channelised into a development fund for the sanctuary, which could be used partly for its maintenance and the rest for socio-economic progress of the villages located within the sanctuary.
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. Attempts may be made to take them away from fishing by involving them in alternative activities like aquaculture outside the sanctuary limits or recruiting them for operating boats of the department for ferrying tourists or training them to serve as guides utilizing the inherent skills and intimate knowledge of the local through their involvement in eco-tourism and eco development activities. This would not only lessen their dependence on the natural resources of the sanctuary but actually generate an interest in its well-being.
4. Illegal sand mining and fishing need to be curved. But this requires sufficient forces and resources.

5. Cucurbit cultivation and agricultural activities also need to be controlled at crucial sites for Gharial by either identifying alternative sites for cultivation or any other feasible means.
6. It is recommended that special emphasis should be given on protection of nesting islands, especially during the critical nesting period. These islands are very much useful for Gharial basking as well as for nesting. The nesting should be given high priority under management.
7. Department should be provide stringent protection measures to reduce the biotic pressure on Chambal 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 National Chambal 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 Chambal.

Conservation Strategies for Otters:

Following conservation strategies could be formulated for Otters:

1. Rocky stretches are needed special attention.
2. Cutting and loping of trees along the banks, should be prohibited.
3. It is suggested that management activities such as monitoring of otter population should be regularly maintained to minimize biotic pressures such as cultivation, grazing and mining along the bank in the National Chambal sanctuary.

4. Mass public awareness campaign should be undertaken to educate people, especially fishermen inhabiting closer to wetlands habitats about the ecological role of otters and their wetland habitats which ultimately provides goods and services to the human society.

Conservation Strategies for Dolphins:

Based on the finding of the recent study, conservation strategies are as follows:

Careful monitoring of the dolphin population should be continued, in the National Chambal Sanctuary. It is recommended that spatial emphasis be given for protection of dolphin habitat (deep pull channels) and tributaries confluence area especially during the dry season. This could take the form of periodic patrolling by the staff in protected zones. The maximum dolphin density area should be protected, given high priority under management. The National Chambal Sanctuary is the longest riverine sanctuary holds the best dolphin population in the state. There is an urgent necessity to carryout study in feeding pattern, behavior and breeding biology to render their systematic management and conservation possiblity. In Chambal the illegal fishing activities are being carried out from the Rajasthan banks or people entering from the Rajasthan side, due to lack of inter- state coordination between Rajasthan , M.P. and U.P. There is no single institutional platform where coordination matters of all the state units are discussed. It is suggested that the solution may be to immediately post field staff along banks in Rajasthan. Local people are more likely to support measures for protecting cetaceans if they are linked to providing sustainable benefits to local communities. Riverine fisheries should be managed on a sustainable basis for the benefits of local communities. Ideally the enforcement of fishing regulations should be accomplished on a community level. Legislation that addresses cetacean issue of a directed killing,

fisheries regulations to reduce accidental killing, discharge a harmful pollutants and the environmental impacts of development projects can be useful tool for conservation. But legislation without awareness and enforcement is meaningless.

Conservation Strategies for Turtles:

1. The captive breeding programme for endangered turtle species should be initiated immediately, since it could serve a variety of conservation needs. It could secure a potential gene bank for the species and provide a supply stock for potential introduction in many areas. Different State Forest Departments can take up such programmes.
2. Effective conservation of freshwater turtles in Chambal and in other areas of turtles in India depends on public knowledge and sympathy on financial support, and on the interests of the State and Union Governments. Different Government and non Govt. organization should support the turtle conservation programmes by allotting funds for such
3. In recent past poaching of soft shell turtles were observed in Chambal especially *Lissemys punctata* and *Aspideretes gangeticus* being targeted for human consumptions.

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APPENDIX -

Table-1 Gharial Population trends in the National Chambal Sanctuary, Madhya Pradesh

Year	Section of river surveyed in Km.	Length of river surveyed	Details of Gharial enumerated			
			Total adults	Total sub adults and Juveniles	Total H'ling &Y'ling	Total Population
Pre 1979	major breeding sites	250	30	43	34	107
1983-84	Rahu ka gaon – Pachhnada	315	37	369	45	451
1984-85	Pali- Pachhnada	425	49	491	65	605
1985-86	Pali-Gyanpura/Jagtouli	385	66	391	170	627
1988	Pali-Pachhnada	425	114	536	170	820
1990	Pali-Pachhnada	425	113	727	142	982
1993	Pali-Pachhnada	425	186	305	407	898
1994	Pali to Bhare	415	202	418	488	1108
1995-96	Pali to Bhare	415	212	445	557	1214
1996-97	Pali to Bhare	415	226	459	554	1239
1997-98	Pali to Bhare	415	238	509	542	1289
2003	Pali - Chakarnagar	395	150	265	99	514
2004	Pali - Chakarnagar	395	158	276	118	552
2005	Pali - Chakarnagar	395	169	280	135	584
2006	Kuhanjapur - Chakarnagar	435	189	148	298	635
2007	Kuhanjapur - Pachhnada	465	208	445	212	865

Table-2 Density of Gharial population – (Gharial density observed in 2006-07 during the study period)

Year	Pre-1979	1983-84	1984-85	1985-86	1988	1990	1993	1994	1995-96	1996-97	1997-98	2003	2004	2005	2006	2007
Gharial Population	107	451	605	627	820	982	898	1108	1214	1239	1289	514	552	584	635	865
Density	0	1.432	1.424	1.629	1.929	2.311	2.113	2.670	2.925	2.993	3.106	1.301	1.397	1.478	1.607	1.860

Table : 3 Distribution and size class composition of Gharial observed during survey 2007

Date	Name of River section	Approx. dist. (km.)	Adults		Sub -adults	Juveniles	Yearlings	Hatchlings	Total for Zone
			Male	Female					
2.2.07	Kuhajapur – Khatoli	20	-	-	-	-	-	-	0
3.02.07	Khatoli - Rameshwar	46	1	3	-	-	-	-	4
4.02.07	Rameshwar - Chenpur	37	-	2	17	-	-	-	19
5.02.07	Chenpur – Nitinwas	20	2	10	-	-	-	-	12
6.02.07	Nitinwas - Atar	22	1	4	2	3	-	2	12
7.02.07	Atar - Batesura	22	2	8	3	-	1	2	16
8.02.07	Batesura - Sarseni	42	2	2	-	-	1	-	5
9.02.07	Sareseni - Rajghat	30	3	32	6	14	4	9	68
23.02.07	Rajghat - Holapura	59	3	31	9	63	17	14	137
23.02.07	Holapura - Usedghat	19	0	2	2	6	5	4	19
24.02.07	Usedghat- Ater	35	1	4	2	7	4	1	19
25.02.07	Ater - Barhi	40	2	32	30	88	12	14	178
26.02.07	Barhi – Chakarnagar	35	3	54	30	107	54	20	268
26.02.07	Chakarnagar – Pachnada	38	0	4	3	53	20	28	108
TOTAL		**465**	**20**	**188**	**104**	**341**	**118**	**94**	**865**

Table 4. Geographical location of Gharial sightings in the National Chambal Sanctuary, 2007

Km. stretch	Latitude	Longitude	Nearest village
0--5	N 25° 50' 41 .0"	E 076° 33'47. 8"	Pali
5--10			
10--15			
15--20			
20--25			
25--30			
30--35			
35--40			
40--45			
45--50	N 26° 02' 35 .5"	E 076° 52'36. 8"	Gobarda
50--55			
55-60	N 26° 05' 58 .4"	E 076° 55'06. 4"	Baroli
60--65	N 26° 07' 48 .5"	E 076° 59'36. 4"	Chenpur
65-70	N 26° 08' 29 .6"	E 077° 00'05. 9"	Nadigaon
70--75	N 26° 10' 25 .4"	E 077° 01'59. 9"	Nadigaon
75--80	N 26° 10' 48 .0"	E 077° 03'25. 2"	Jimarchha
80--85			
85--90	N 26° 13' 56 .3"	E 077° 09'11. 4"	Barotha
90--95	N 26° 13' 59 .4"	E 077° 11'24. 6"	Godha
95--100			
100--105	N 26° 16' 33 .2"	E 077° 16'47. 6"	Atar
105--110			
110--115			
115--120			
120--125			
125--130	N 26° 22' 10 .4"	E 077° 26'50. 3"	Kalarghati
130--135	N 26° 24' 13 .6"	E 077° 26'51. 8"	Bharra
135--140	N 26° 24' 35 .6"	E 077° 29'15. 7"	Karitir
140--145			
145--150	N 26° 25' 57 .5"	E 077° 33'25. 8"	Sevar/Pali Bridge
150-155-			
155--160			
160--165	N 26° 30' 07 .0"	E 077° 40'34. 2"	4 Km Before Sarsaini
165--170			
170--175	N 26° 30' 07 .0"	E 077° 40'34. 2"	Dangbasai
175--180	N 26° 32' 43 .6"	E 077° 48'57. 5"	Tursipura
180--185	N 26° 35' 34 .2"	E 077° 49'40. 9"	Bawasin
185--190	N 26° 37' 22 .7"	E 077° 53'54. 4"	Bindwa
190--195	N 26° 38' 58 .5"	E 077° 53'46. 3"	Jaitpur
195--200	N 26° 39' 28 .8"	E 077° 56'24. 8"	Bhanpur/Piprai
200--205			
205--210	N 26° 41' 05 .5"	E 078° 02'35. 4"	Tigri rithora
210--215	N 26° 41' 05 .5"	E 078° 02'35. 4"	Mahuwa khera

215-220	N 26° 40' 11 .8"	E 078° 04'46. 3"	Baveshari Temple
220--225	N 26° 41' 53 .8"	E 078° 05'44. 3"	Kuthiana
225--230	N 26° 44' 23 .2"	E 078° 06'37. 9"	Babu S.Gher
230--235	N 26° 47' 33 .5"	E 078° 06'30. 7"	Daljit ka pura
235--240	N 26° 47' 24 .5"	E 078° 08'37. 3"	Daljit ka pura
240--245	N 26° 47' 43 .6"	E 078° 11'09. 4"	Barsala
245--250	N 26° 48' 36 .4"	E 078° 10'19. 8"	Sukhdyan ka pura
250--255	N 26° 49' 27 .9"	E 078° 12'28. 2"	Holapura
255-260	N 26° 49' 47 .6"	E 078° 16'22. 6"	4 km before from Kachiara
260--265	N 26° 50' 41 .1"	E 078° 16'25. 7"	Riya Baranda
265--270	N 26° 51' 48 .4"	E 078° 18'58. 8"	4 km before from Useth
270--275	N 26° 51' 44 .5"	E 078° 20'01.2"	Useth
275--280	N 26° 50' 14 .2"	E 078° 23'06.3"	Bindwa
280--285	N 26° 49' 27 .3"	E 078° 25'37.1"	Khurd
285--290	N 26° 47' 42 .9"	E 078° 27'13.6"	Shivlal pura
290--295	N 26° 47' 23 .3"	E 078° 27'30.1"	Jalalpura UP
295--300	N 26° 46' 41 .1"	E 078° 31'36.0"	Sahaspura
300-305			
305--310	N 26° 45' 19 .5"	E 078° 36'55.8"	Ranipura
310--315	N 26° 45' 47.8"	E 078° 39'31.2"	Ater/Salimpura
315--320	N 26° 47' 10.0"	E 078° 40'57.6"	Maghera ka pura/Dinpura
320--325			
325--330			
330--335	N 26° 45' 58.1"	E 078° 45'51.0"	Bijora
335-340	N 26° 45' 51.6"	E 078° 48'32.3"	Gadayaya, MCBT
340--345			
345--350	N 26° 41' 50.8"	E 078° 52'26.6"	Ranpura/Barai
350--355			
355--360	N 26° 39' 44.2"	E 078° 56'30.8"	Naigarh
360--365	N 26° 40' 36.8"	E 078° 59'36.3"	Gyanpura
365--370	N 26° 36' 55.4"	E 079° 00'42.2"	Kanakpura/Sankari
370--375	N 26° 35' 42.9"	E 079° 00'59.3"	Barechha
375--380			
380--385	N 26° 33' 05.5"	E 079° 05'06.9"	Chakarnagar
385--470	N 26° 32' 41.2"	E079° 05' 22.1"	Chakarnagar to Panchanda

Table 5: Distribution and size class composition of Mugger observed during Survey 2007

Area Covered (date)	Approx. dist. (km.)	Adults	Sub-adults	Juveniles	Yearlings	Hatchlings	Total of Zone
Kuhajapur – Khatoli (2.2.07)	20	1	-	-	-	-	1
Pali - Rameshwar (3.02.07)	46	14	5	1	-	-	20
Rameshwar - Chenpur (4.02.07)	37	28	15	3	-	-	**46**
Chenpur – Nitinwas (5.02.07)	20	16	2	2	1	-	21
Nitinwas - Atar (6.02.07)	22	5	1	-	1	-	7
Atar - Batesura (7.02.07)	22	8	1	-	1	-	10
Batesura - Sarseni (8.02.07)	2	8	1	-	-	-	9
Sareseni - Rajghat (9.02.07)	30	7	1	2	-	1	11
Rajghat - Usedghat (23.02.07)	78	19	4	2	2	1	28
Usedghat- Ater (24.02.07)	35	8	2	-	-	-	10
Ater - Barhi (25.02.07)	40	8	5	1	-	-	14
Barhi – Pachnada (26.02.07)	73	10	6	-	-	1	17
TOTAL		132	43	11	5	3	194

Table-6 Dolphin Population trends in the National Chambal Sanctuary, Madhya Pradesh

Year	Survey period	Stretch of river surveyed	Length of river surveyed in Km	Population
1983-84	Dec-Jan	Pali-Pachhnada	435	44
1985	December	Pali-Pachhnada	435	47
1988	February	Pali-Bhare	425	50
1989	March	Pali-Bhare	425	55
1990	March-April	Pali-Bhare	425	59
1991	Feb-March	Pali-Bhare	425	62
1993	Feb-March	Pali-Pachhnada	435	72
1994	Jan-Feb	Pali-Bhare	425	75
1995-96	Dec-Jan	Pali-Bhare	425	84
1996-97	Feb-March	Pali-Bhare	425	89
1998	June	Rajghat -Pachhnada	230	83
2001	Jan-March	Rajghat -Pachhnada	230	88
2002	Jan-March	Rahu ka gaon-Pachhnada	330	93
2003	Feb-March	Pali-Chakarnagar	395	66
2003	March-April	Rahu ka gaon –Bhare	315	81
2004	Feb-March	Pali-Chakarnagar	395	63
2005	January	Pali-Chakarnagar	395	65
2006	February	Kuhanjapur -Chakarnagar	435	54
2007	February	Kuhanjapur-Pachhnada	465	91

Table-7 Density of Dolphin population

Year	1983-84	1985	1988	1989	1990	1991	1993	1994	1995-96	1996-97	1998	2001	2002	2003	2003	2004	2005	2006	2007
Dolphin	44	47	50	55	59	62	72	75	84	89	83	88	93	66	81	63	65	54	91
Density	0.101	0.108	0.117	0.129	0.138	0.145	0.165	0.176	0.197	0.209	0.360	0.382	0.281	0.167	0.257	0.159	0.164	0.124	0.195

Table-8 Dolphin Population estimation in the National Chambal Sanctuary, Madhya Pradesh 2007

Name of Stretches	**Adults**		**Adolescent**	**Calves**	**Total of Zones**	**Geographical location**		**Nearest Vill.**
	Male	**Female**				**Latitude**	**Longitude**	
Pali -Rameshwar								
Rameshwar –Chenpur								
Chenpur-Nitanwas								
Nitanwas-Atar								
	1				1			Atar
Atar-Batesura								

Batesura-Sarsaini		1		1	2	N 26° 23' 39 .3"	E 077° 26'06. 7"	Bharra
Sarsaini-Rajghat								
Rajghat- Used ghat	2				2	N 26° 39' 33 .0"	E 077° 57'14. 1"	Garora
		1			1	N 26° 41' 34 .8"	E 078° 00'29. 4"	Tighari rithora
	1	1	1	1	4	N 26° 46' 35 .6"	E 078° 06'05. 5"	Daljit ka pura
				1	1	N 26° 49' 02 .1"	E 078° 16'22. 4"	Kachiara
		1	1		2	N 26° 50' 12 .5"	E 078° 16'25. 1"	Riya Baranda
	1				1	N 26° 51' 59 .8"	E 078° 22'09. 0"	Ushed ghat
Usedghat-Ater			1		1			
			1		1			
		1	1	1	3	N 26° 49' 26 .6"	E 078° 26'06. 4"	Khurd

	1				1			
			1		1			
			1	1	2	N 26° 47' 23 .3"	E 078° 27'30. 1"	Godha
		1	2		3	N 26° 45' 53 .3"	E 078° 37'09. 2"	Ranipura/Ater
Ater- Barai								
	2	2			4	N 26° 47' 10 .0"	E 078° 40'57. 6"	Maghera ka pura
		2	2		4	N 26° 47' 44 .6"	E 078° 43'12. 3"	Dinpura
	2	2	2	3	9	N 26° 47' 02 .3"	E 078° 43'35. 6"	Kosad
		1			1	N 26° 45' 30 .1"	E 078° 46'47. 3"	Bijora
	1	2	1	1	5	N 26° 45' 51 .6"	E 078° 48'49. 6"	Pachhayagaon
		2			2	N 26° 41' 49 .8"	E 078° 53'29. 8"	Ranpura/Barai
Barai-Panchanda	1	3	2	1	7	N 26° 41' 25 .5"	E 078° 57'21. 2"	Khera Ajab Singh
	1	1	2	1	5	N 26° 40' 20 .5"	E 078° 56'47. 8"	Khera Ajab Singh
		1	3		4	N 26° 40' 27 .0"	E 078° 58'32. 6"	Gyanpura
	2	1	1		4	N 26° 38' 27 .3"	E 078° 59'38. 2"	Sankari/Kanakpura
	1	2	2		5	N 26° 35' 32 .1"	E 079° 01'08. 1"	Barechha
		1			1	N 26° 34' 24 .7"	E 079° 03'28. 4"	Barechha
		1	1		2	N 26° 34' 01 .5"	E 079° 04'13. 3"	Sahson
	1	8	1	2	12	N 26° 31' 04 .9"	E 079° 12'41. 0"	Mahuvasuda
	17	**35**	**26**	**13**	**91**			

Table-9 Turtles population trends in the National Chambal Sanctuary

Survey Year	Density	
	Hard shell turtles (per km)	**Soft shell turtles (per km)**
1984-85	3.16	0.06
1985-86	5.36	0.19
1988	5.62	0.21
1994	4.92	0.73
1995-96	5.18	1.00
1996-97	6.12	0.62
1997-98	6.17	0.76
2004	1.56	0.18
2005	1.82	0.27
2006	1.41	0.12
2007	1.53	0.17

Table-10 Estimated of Suitable habitat areas of Gharial

S. No.	**Gharial seen (Suitable habitat)**		**Gharial not seen (Un suitable habitat)**	
1.	**Survey Stretch**	**Km**	**Survey Stretch**	**Km**
2.	0-5	5	5-10	5
3.	10-105	95	105-110	5
4.	110-125	15	125-135	10
5.	135-145	10	145-150	5
6.	150-155	5	155-160	5
	Total	**130**		**30**

*On the basis of species present during the survey From Raj ghat to Barai. # 0 km is Pali

Table-11 Key habitats of Mugger in the NCS

S. No.	Near Village	Geographical location	
		Latitude	**Longitude**
1.	Tigri Rithora	N 26° 41` 36. 3``	E 077° 59` 52. 8``
2.	Kuthiyana	N 26° 40` 17. 5``	E 078° 04` 57. 6``
3.	Chursalai	N 26° 49` 27. 7``	E 078° 12` 28. 4``
4.	Useth	N 26°51` 48. 2``	E 078° 19` 14. 5``
5.	Bindwa	N 26° 49` 56. 0``	E 078° 23` 14. 3``
6.	Ater	N 26° 45` 23. 4``	E 078° 36` 58. 9``
7.	Bijora	N 26° 46` 08. 9`	E 078° 45` 54. 7``

Table-12 Geographically Location of River Sand Bank in the NCS

S. No	Name of the Bank	State	Geographical Location	
			Latitude	**Longitude**
1.	Rajghat/Piparai	MP	N 26° 39` 37. 1``	E 077° 55` 22.9``
2.	Tighari Rithora	M.P.	N 26° 41` 38. 7``	E 077° 59` 53.5``
3.	Mahuwa kheda	MP	N 26° 41` 33. 5``	E 078° 01` 11.1``
4.	Kuthiana	Raj.	N 26° 43` 08. 8``	E 078° 05` 28.5``
5.	Babu S. gher	M.P.	N 26° 43` 11. 8``	E 078° 05` 28.6``
6.	Puraini	Raj.	N 26° 44` 23. 2``	E 078° 06` 37.9``
7.	Daljit ka pura	M.P.	N 26° 46` 35. 6``	E 078° 06` 05.5``
8.	Barsala	Raj.	N 26° 47` 04. 5``	E 078° 09` 49.8``
9.	Sukhadyan ka pura	M.P.	N 26° 48` 36. 4``	E 078° 10` 19.8``
10.	Chursalai	Raj.	N 26° 49` 27. 9``	E 078° 11` 32.3``
11.	Holapura	M.P.	N 26° 49` 37. 7``	E 078° 12` 50.5``
12.	Kachiara	U.P.	N 26° 49` 47. 6``	E 078° 16` 22.6``
13.	Rudawali	M.P.	N 26° 51` 27. 8``	E 078° 17` 21.3``
14.	Useth	U.P.	N 26° 51` 44. 5``	E 078° 20` 01.2``
15.	Bijila/Bindwa	M.P.	N 26° 50` 14. 2``	E 078° 23` 06.3``
16.	Vich ka pura	U.P.	N 26° 49` 09. 4``	E 078° 24` 23.6``
17.	Khurd	M.P.	N 26° 49` 26. 6``	E 078° 26` 06.4``
18.	Jalalpura (Island)	U.P.	N 26° 47` 11. 5``	E 078° 28` 49.9``
19.	Sahas pura	M.P.	N 26° 46` 51. 9``	E 078° 30` 51.3``
20.	Ranipura	U.P.	N 26° 45` 43. 5``	E 078° 37` 05.9``
21.	Ater	M.P.	N 26° 46` 18. 4``	E 078° 37` 41.2``
22.	Salimpura	U.P.	N 26° 45`47. 8``	E 078° 39` 31.2``
23.	Maghera ka pura	M.P.	N 26° 47`10. 0``	E 078° 40` 57.6``
24.	Kosad	U.P.	N 26° 46`31. 1``	E 078° 44` 08.5``
25.	Bijora	U.P.	N 26° 45`32.8``	E 078° 46` 14.1``
26.	Jori	M.P.	N 26° 43`42.0``	E 078° 50` 37.6``
27.	Baroli	U.P.	N 26° 41`56.0``	E 078° 51` 50.3``
28.	Barai	M.P.	N 26° 42`46.4``	E 078° 50` 59.5``

Table-13 Geographical Coordinate of Sand mining Sites in the NCS, M.P. 2006

S.N.	Name of site	State	Geographical Coordinates	
			Latitude	Longitude
1	Rajghat/Piparai*	M.P.	N 26° 41` 81. 1``	E 077° 59` 31.9``
2	Tigari Rithora	M.P.	N 26° 41` 37. 9``	E 078° 00` 13.7``
3	Kuthiana/Kathumra	Raj.	N 26° 40` 27. 7``	E 078° 05` 23.4``
4	Puraini/Kisrauli	Raj.	N 26° 45` 24. 8``	E 078° 06` 40.8``
5	Malbasai/DaljitPura	M.P.	N 26° 47` 15. 2``	E 078° 09` 00.6``
6	Chursalai	M.P.	N 26° 49` 19. 4``	E 078° 11` 59.9``
7	Sahas Pura	M.P	N 26° 46` 98. 9``	E 078° 31` 37.8``
8	Ater	M.P	N 26° 45` 51. 7``	E 078° 39` 38.9``
9	Barai	M.P	N 26° 42` 23. 3``	E 078° 54` 34.5``

*****Rajghat, the only legal sand mining site till 26 Dec. 06

Table-14 Geographical coordinates of Sand mining sites in the NCS, M.P. 2007

S.No.	Name of the Sites	State	Geographical location	
			Latitude	Longitude
1.	Rajghat/Piparai	M.P.	N 26° 39' 37 .1"	E 077° 55' 22.9"
2.	Tighari Rithora	M.P.	N 26° 41' 39 .1"	E 077° 59' 56.5"
3.	Mahuwa Kheda	M.P.	N 26° 41' 33 .5"	E 078° 01' 11.1"
4.	Kuthiana	Raj.	N 26° 40' 16 .7"	E 078° 04' 58.1"
5.	Puraini	Raj.	N 26° 40' 47 .3"	E 078° 05' 41.0"
6.	Daljit ka pura	M.P.	N 26° 46' 35 .6"	E 078° 06' 05.5"
7.	Barsala	Raj.	N 26° 47' 06 .5"	E 078° 01' 52.0"
8.	Sukhadhyan ka Pura	M.P.	N 26° 48' 36 .4"	E 078° 10'19. 8"
9.	Sahas pura	M.P.	N 26° 46' 51 .9"	E 078° 30' 51.3"
10.	Barai	MP	N 26° 42` 23. 3``	E 078° 54` 34.5``

Table: 16 Nesting sites of Gharial and their locations in the NCS, Madhya Pradesh, 2006

S.N.	Name of site	State	Geographical coordinate	
			Latitude	Longitude
1.	Tigari Rithora	M.P.	N 26° 41` 37. 9``	E 078° 00` 13.7``
2.	Baboo singh gher	M.P.	N 26° 43` 11. 8``	E 078° 05` 28.6``
3.	Puraini	RAJ.	N 26° 45` 24. 8``	E 078° 06` 40.8``
4.	Bindwa	U.P.	N 26° 50` 10. 0``	E 078° 06` 40.8``
5.	Sahaspura/JalalPura	U.P.	N 26° 47` 30. 5``	E 078° 27` 21.6``
6.	Guda	M.P.	N 26° 45` 00. 5``	E 078° 34` 21.0``
7.	Chiloga/Bijora	M.P.	N 26° 45` 45. 5``	E 078° 48` 54.3``

Table: 17 Nesting sites of Gharial and their locations in the NCS, Madhya Pradesh, 2007

S. No	Name of the Bank	State	Geographical Location	
			Latitude	Longitude
1.	Tighari Rithora	M.P.	N 26° 41` 37. 9``	E 078° 00` 13.7``
2.	Baboo singh gher	M.P.	N 26° 43` 11. 8``	E 078° 05` 28.6``
3.	Barsala	Raj.	N 26° 47` 06. 5``	E 078° 10` 52.0``
4.	Sahas pura	M.P.	N 26° 47` 11. 5``	E 078° 28` 49.9``

Table- 19 Sand mining intensity of NCS 2007

S.No.	Name of the Sites	State	Area (hec.)	No. of Tractors	Intensity of mining	Geographical location	
						Latitude	**Longitude**
1.	Rajghat/Piparai	M.P.	10	12	III	N 26° 39' 37 .1"	E 077° 55' 22.9"
2.	Tighari Rithora	M.P.	50	3	III	N 26° 41' 39 .1"	E 077° 59' 56.5"
3.	Mahuwa Kheda	M.P.	100	16	III	N 26° 41' 33 .5"	E 078° 01' 11.1"
4.	Kuthiana	Raj.	9	22	III	N 26° 40' 16 .7"	E 078° 04' 58.1"
5.	Puraini	Raj.	1	11	II	N 26° 40' 47 .3"	E 078° 05' 41.0"
6.	Daljit ka pura	M.P.	1	3	II	N 26° 46' 35 .6"	E 078° 06' 05.5"
7.	Sukhadhyan ka Pura	M.P.	2	4	II	N 26° 48' 36 .4"	E 078° 10'19. 8"
8.	Barsala	Raj.	2	49	III	N 26° 47' 06 .5"	E 078° 01' 52.0"
9.	Sahas pura	M.P.	2	2	II	N 26° 46' 51 .9"	E 078° 30' 51.3"
10.	Barai	MP	1	2	I	N 26° 42` 23. 3``	E 078° 54` 34.5``
			178	**124**			

* I= Less than 10 tractors per day, II= less than 50 tractors per day, III=more than 50 tractors per day

Table- 20 Production and Income of Legal Sand mining at Piparai (Bhanpur)

S.N.	Total area in (hec.)	Years	Total Production Sand (Cub. Mm.)	Income of Sand	
				STMC M.P. *(Caror)	M.P. Govt. (Lac)
1	108.310	1999-2000	77600	20.98	20.98
2		2000-2001	13905	23.42	23.42
3		2001-2002	154266	39.78	39.78
4		2002-2003	132628	51.55	51.55
5		2003-2004	171851	50.52	50.52
6		2004-2005	18345	18.97	18.97
7		2005-2006	88356	21.99	21.99

STMC- State mining cooperation

Table- 21 Major fishing sites of the study area

S.No.	Name of the site	Geographical coordinate	
		Latitude	Longitude
1	Mahuwa khera	N 26° 41` 33. 5``	E 078° 01` 11.1``
2	Daljit ka pura	N 26° 46` 35. 6``	E 078° 06` 05.5``
3	Holapura	N 26° 49` 37. 7``	E 078° 12` 50.5``
4	Kachiara	N 26° 49` 47. 6``	E 078° 16` 22.6``

Table- 24 Muggers nesting sites in NCS

S. No	Name of the Sites	State	Geographical location	
			Latitude	Longitude
1	Tigari Rithora	M.P.	N 26° 41` 37. 9``	E 078° 00` 13.7``
2	Baboo Singh gher	M.P.	N 26° 43` 11. 8``	E 078° 05` 28.6``
3	Bindwa	U.P.	N 26° 50` 10. 0``	E 078° 06` 40.8``
4	Sahaspura/JalalPura	U.P.	N 26° 47` 30. 5``	E 078° 27` 21.6``

Table 27: Status of Turtles nesting in 2006 of National Chambal Sanctuary, Madhya Pradesh

S.N.	Name of Site	Geographical location	
		Latitude	**Longitude**
1	Garora (near rail bridge)	N 26° 41` 81. 1``	E 077° 59` 31.9``
2	Tigari Rithora	N 26° 41` 37. 9``	E 078° 00` 13.7``
3	Baboo singh gher	N 26° 43` 11. 8``	E 078° 05` 28.6``
4	Puraini	N 26° 40' 47 .3"	E 078° 05' 41.0"
5	Puradaljit	N 26° 46` 35. 6``	E 078° 06` 05.5``
6	Bindwa	N 26° 50` 10. 0``	E 078° 06` 40.8``
7	Shiv lal Pura	N 26° 47` 30. 5``	E 078° 27` 21.6``
8	Sahas pura	N 26° 47` 30. 5``	E 078° 27` 21.6``
9	Mahuwa (Ater)	N 26° 46` 17. 5``	E 078° 37` 50.2``
10	Chilonga/Bijora	N 26° 45` 45. 5``	E 078° 48` 54.3``
11	Jori	N 26° 43` 21. 5``	E 078° 50` 51.0``
12	Barai	N 26° 42` 23. 3``	E 078° 54` 34.5``