



Observations on Threats to The Gharial Population in National Chambal Sanctuary, India

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ABSTRACT

The threats on riverine ecosystem increasingly harshly, it include sand mining, stone quarrying, illegal fishing, water extraction, riverside agriculture and such other activities posing the adverse impact on the wildlife in NCS. The present study was conducted in NCS Rajasthan during the session of 2015 to 2018 and observations were taken by using opportunistic Search and Stationary Count Method. The Sand mining and Fishing are considered as direct threat for the aquatic fauna in NCS. The sand mining were observed by various mechanical and manual means. The Water extraction for irrigation by engine pumps were recorded number of water pumps per km. The fisherman presence, fishing nets and ferries were observed in a large amount. The observed gharial population was 671.75 ± 118.14 per year with encounter rate of 1.6 per km. The lower stretch have good habitat matrix for gharial to perform different seasonal activities and in lack of other such habitats in upstream section, gharial population is being concentrated in lower stretch and compromising with the situation for their survival. In upcoming year, it is possible that in such area where the anthropogenic threats continuously increasing might cause a drastic damage to gharial habitat and can badly affect the upstream gharial population.

Key word: Gharial, Threats, Mean, Riverine ecosystem, Habitat.

INTRODUCTION

Chambal River, originated from Vindhyan Range near Mhow district of Madhya Pradesh, flows North-eastern direction, passing through Rajasthan, Madhya Pradesh and Uttar Pradesh. The Chambal River considered as the last repository of gharial and home of 86% of global gharial's populations¹. In 1978, Chambal River declared as a protected area for the conservation for Gharials.

India is a highly populated country symbolized with diversity of religions. Here, people are involved in performing different ceremonies along the holy rivers throughout the geographical area. Chambal is notorious among most of the North Indian Rivers as a home of bandits and dacoits and to refer the narrative of the Mahabharata epic, it is originated from the blood of thousands of animals sacrificed.

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Under such consideration, a little ceremonies can be observed in and along its banks. Chambal is also renowned among Ichthyologist, herpetologist, ornithologist and mammologist due to its high biodiversity. Unfortunately, due to the effect of various illegal practices the population of a large aquatic fauna, including fresh water turtles, crocodilians and large mammals like Gangetic Dolphin have declined drastically during the last few decades^{2,3,4,5,6,7,8,9,10}.

Sand mining is posing serious threats to the riverine ecosystem and its impact on nature will be disastrous^{11,12,13}. Recently, sand mining operations have drastically increased in different riverine protected areas, which threaten the wildlife populations. Other than sanding mining, illegal fishing, water extraction, riverside agriculture and such other activities posing the adverse impact on the wildlife in NCS. In the present research article direct and indirect threats on gharial population and possible conservation actions in NCS, Rajasthan has been discussed.

Study area:

The 960-km Chambal River lies between 25°02' to 26°26'N and 75°40' to 79°12'E. Originated from the Singar Chouri peak in the northern slopes of the Vindhyan range, at an elevation of about 843 m, 15 km west-south-west of Mhow in Indore District, Madhya Pradesh¹⁴. The Chambal River flows through 170+km in UP before joining the Yamuna River near Bhareh in Etawah District¹⁴. It consists of the large arc described by the Chambal River between Jawahar Sagar Dam (Coordinate; 25°02'N, 75°40'E) in Rajasthan and the Pachnada after Chambal-Yamuna confluence (Coordinate; 26°29'N, 79°14'E) in Uttar Pradesh^{15,16}. It is a typical anterior-

drainage pattern river, being much older than River Yamuna and Ganga, into which it eventually flows¹⁷. The construction of the Gandhi Sagar Dam (1960) in MP, the Rana Pratap Sagar Dam (1970), Jawaharsagar Dam (1973), and Kota barrage (1960) in Rajasthan have brought changes in the characteristic riparian habitat of Chambal, and the reproductive behavior of Gharial¹⁸.

The riverbed in the upper stretches of Chambal is rocky with a number of rapids. The perennial characteristic of Chambal is retained because of water from the rivers Kali-Sindh and Parbati in the upper reaches, many small drainages all along its course. The tributaries of the Chambal include Shipra, Choti Kalisindh, Sivanna, Retam, Ansar, Kali Sindh, Banas, Parbati, Seep, Kuwari, Kuno, Alnia, Mej, Chakan, Parwati, Chamla, Gambhir, Lakhunder, Khan, Bangeri, Kedel and Teelar^{14,19}.

The area lies within the semi-arid zone of north-western India at the border of Madhya Pradesh, Rajasthan and Uttar Pradesh States^{20,21}, and the vegetation consists of ravine, thorny forest²². Evergreen riparian vegetation is completely absent, with only sparse groundcover along the severely eroded riverbanks and adjacent ravine lands^{20,21}. Comprehensive air temperatures range from 2-46°C with a mean annual precipitation of 591.2mm, the major part of which is receive through the south-west monsoons^{20,21}.

The present study was conducted in NCS Rajasthan between 25°02' to 26°49'N and 75°40' to 78°13'E from Jawahar Sagar dam to Gadi Tidawali considering a length of approximate 422 kms. The Study area divided into 13 zones are as follows: -

Table 1: 13 Study Zones of selected Study Sites

S.No.	Starting location	Ending location	Stretch length
1	JSD	KB	27
2	RCG	HN	24
3	HN	MB	22
4	MB	GM	37.5
5	GM	BS	39
6	BS	PG	20.5
7	PG	RS	22
8	RS	MR	43
9	MR	MD	47
10	MD	GS	64
11	GS	DP	32
12	DP	SP	30
13	SP	GT	14
Total length			422

Abbreviation: JSD=Jawaharsagar Dam, KB=Kota barrage, RCG= Rangpur Chipa Ghat, HN=Hari ji Nimoda, MB=Mandawara Bridge, GM=Geinta Makhida, BG= Bagli Sevti, PG=Pali Ghat, RS=Rameshwar, MR=Maharajpura Riheta, MD=Mandrayal, GS=Gangoli Sarseni, DP=Dholpur, SP=Shankarpur, GT=Gadi Tidawali

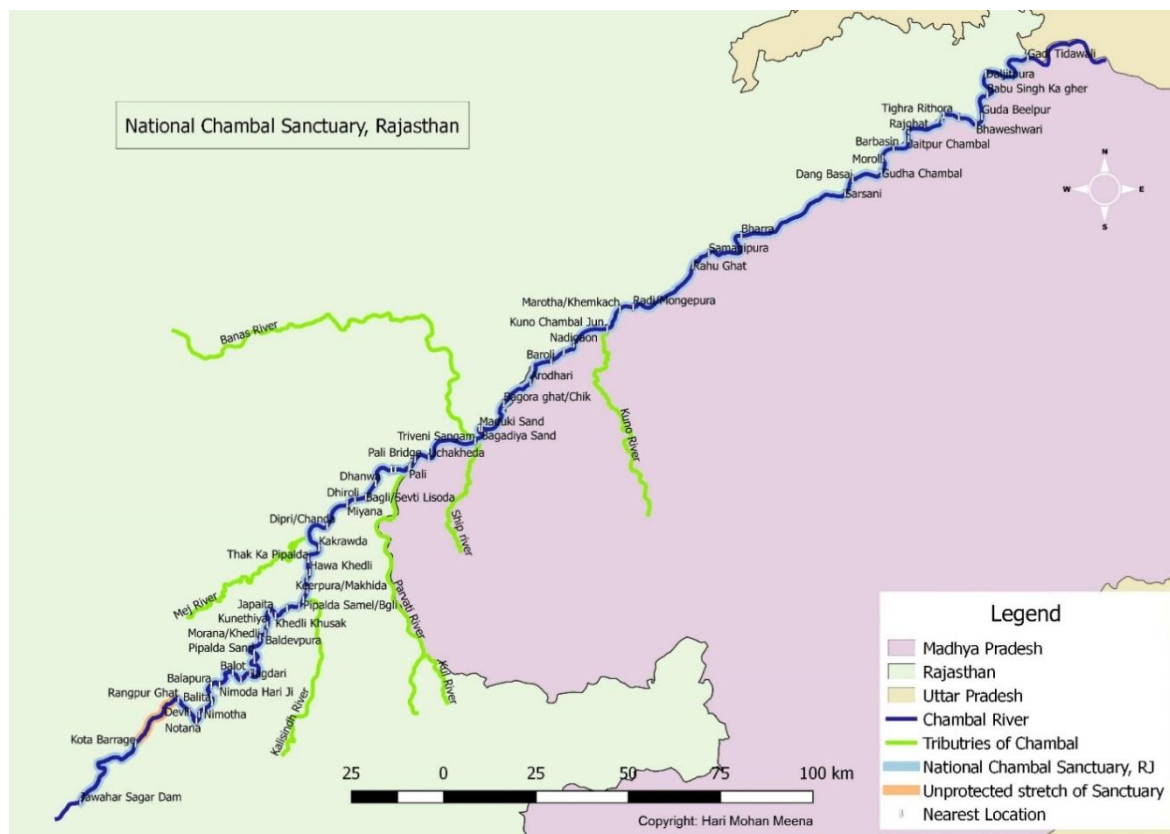


Fig. 1: Map of the Study Area

MATERIALS AND METHODS

To observe and record the threats, the study area was divided in 13 zones (Table 1). The “Opportunistic Search Method” is adopted for data collection related to sand mining, fishing, ferries and population status of Gharial. The same method was used by previously^{23,24,15,16,25,26}. It is based on direct observation during survey. Stationary Count Method is also applied to cross-tally the survey data to find out the best estimate. During the survey, animal count and threats were focused to evaluate the menace level within the study stretch.

During the investigation, the observations of anthropogenic activities were recorded on predesigned datasheet. For marking the population status, suitable nesting habitats of Gharial and human activities top-sheet of entire study area was used for annual replication survey during the session 2015-2018. For distant observation, Olympus (8-16x40) binocular was used for impeccable errors and Garmin etrex20 GPS device was

used to collect co-ordinates of different observations in the river.

Pre-monsoon and post-monsoonal surveys were conducted for each year of study. The survey was performed with help of country boat, motorboat or on foot between 09:00 hr and 17:00 hr. with a speeds of 7-15 km per hour, depending on the situation and geographical pattern of the river sections. For analysis, data were entered on a spreadsheet and statistical analysis was done on NCSS Software. Results are shown as Mean±SD.

OBSERVATIONS AND RESULT

During study session the sand mining by tractor was recorded 371, 387, 368, and 378 respectively with mean 376 ± 8.40 tractors/year. The maximum number of tractors was recorded in study zone -11 between Gangoli Sarseni and Dholpur. Sand mining by camel was recorded 11.25 ± 2.9 only in lowest study zone and sand mining by boat was recorded only in two study zones including Zone-2 between Ranpur Chipa ghat to Hari Ji Nimoda

and Zone-10 between Mandrayal to Gangoli Sarseni with mean 6.5 ± 1.91 and 7.5 ± 1.30 respectively (Table 2). Water extraction for irrigation by engine pump was recorded 1050, 1030, 1046, 1068 during the study period respectively with mean 1048.5 ± 15.6 per year. The maximum number of pumps recorded in study zone-6 with mean 274.5 ± 4.20 pumps. The fishermen presence were recorded 89, 97, 105 and 115 with mean 101.5 ± 11.12 fishermen and number of fishing nets were recorded 122, 119, 121 and 130 with mean = 123 ± 4.83 nets respectively during the study period from 2015 to 2018. Maximum number of fishermen presence was recorded in study zone-1 with mean 21.25 ± 2.75 and minimum in zone-7 with only 1 ± 1.15 fishermen. Most fishing recorded in study zone-9 with 25 ± 0.82

nets and least number of nets recorded in study zone-5 and zone-7 with mean 1.75 ± 0.5 nets (Table 3). Observation on presence of ferries within the study area was recorded 82, 85, 82 and 82 with mean 82.75 ± 1.5 ferries during the study period respectively, whereas maximum count was in study zone-5 where we recorded mean 25.75 ± 1.26 ferries throughout the study period.

The distribution of gharial population was maximum in study zone-12 with mean 168.8 ± 31.13 gharials, whereas the gharial population was recorded 619, 573, 653, 842 respectively during the study period with mean 671.75 ± 118.14 animals within the study area during the study period. The encounter rate of water pumps and gharial were recorded respectively 2.48 and 1.6 per km.

Table 2: Showing the sand mining by using various transportation methods in NCS.

Serial no. of study zone	Study sites		\bar{X} of trackers observed near sand bank	\bar{X} camel observed for sand mining	\bar{X} of boat (Sand mining by boat)
	From	To			
1	JSD	KB	0±0	0±0	0±0
2	RCG	HN	33.25±2.75	0±0	6.5±1.91
3	HN	MB	5±1.15	0±0	0±0
4	MB	GM	8.75±0.96	0±0	0±0
5	GM	BS	12±5.48	0±0	0±0
6	BS	PG	3.75±0.5	0±0	0±0
7	PG	RS	1.25±1.5	0±0	0±0
8	RS	MR	15.75±1.71	0±0	0±0
9	MR	MD	5.75±0.96	0±0	0±0
10	MD	GS	45.25±2.75	0±0	7.5±1.30
11	GS	DP	128±8.41*	0±0	0±0
12	DP	SP	87.25±11.84	0±0	0±0
13	SP	GT	30±3.37	11.25±2.9	0±0

Note: Data has been pooled for year 2015, 2016, 2017 & 2018 for quantify the rate of sand mining by using.

*maximum recorded value

Table 3: Shows other relative threats including private water extraction pumps, fishing, ferries and Gharial population within the study site

Study Zone		Avg. water pumps being used for irrigation (mean±SD)=Range	Fishermen presence in the zone (mean±SD)	Fishing nets found in the zone (mean±SD)	Number of ferry boats (mean±SD)	No. of gharials within the study zones
From	to					
JSD	KB	0±0	21.25±2.75*	22.75±4.03	0±0	0±0
RCG	HN	105.75±7.5	17.25±0.96	18.5±1.0	17.5±1.29	0±0
HN	MB	90.25±4.27	11.25±2.63	13±2.16	3.75±0.50	0±0
MB	GM	167.5±7.14	8.25±2.06	10±0.0	4.25±0.50	1.75±0.96
GM	BS	215.75±4.35	2.25±1.70	1.75±0.5	25.75±1.25*	4.75±0.97
BS	PG	274.5±4.20*	5.5±1.91	3±3.0	3.75±0.50	15±1.41
PG	RS	18±1.63	1±1.15	1.75±0.5	3.75±0.50	39.75±6.34
RS	MR	31.5±2.64	5.75±1.70	4±1.41	4.75±0.50	41.75±19.51
MR	MD	45.5±2.64	11±1.154	25±0.82*	3.75±0.50	89±23.66
MD	GS	43.75±3.86	5.25±0.95	5.25±1.5	4.5±0.57	42.75±15.24
GS	DP	18.25±4.78	3.75±1.70	3.75±2.87	3.25±0.50	133.5±46.05
DP	SP	16.25±1.70	3.75±1.70	6±1.63	1.25±0.50	168.8±31.13*
SP	GT	21.5±2.51	5.25±0.95	8.25±0.5	6.5±0.57	134.8±41.37

Note: data for year 2015, 2016, 2017 & 2018 has been pooled for quantify the rate of sand mining by using different resources

*maximum recorded value

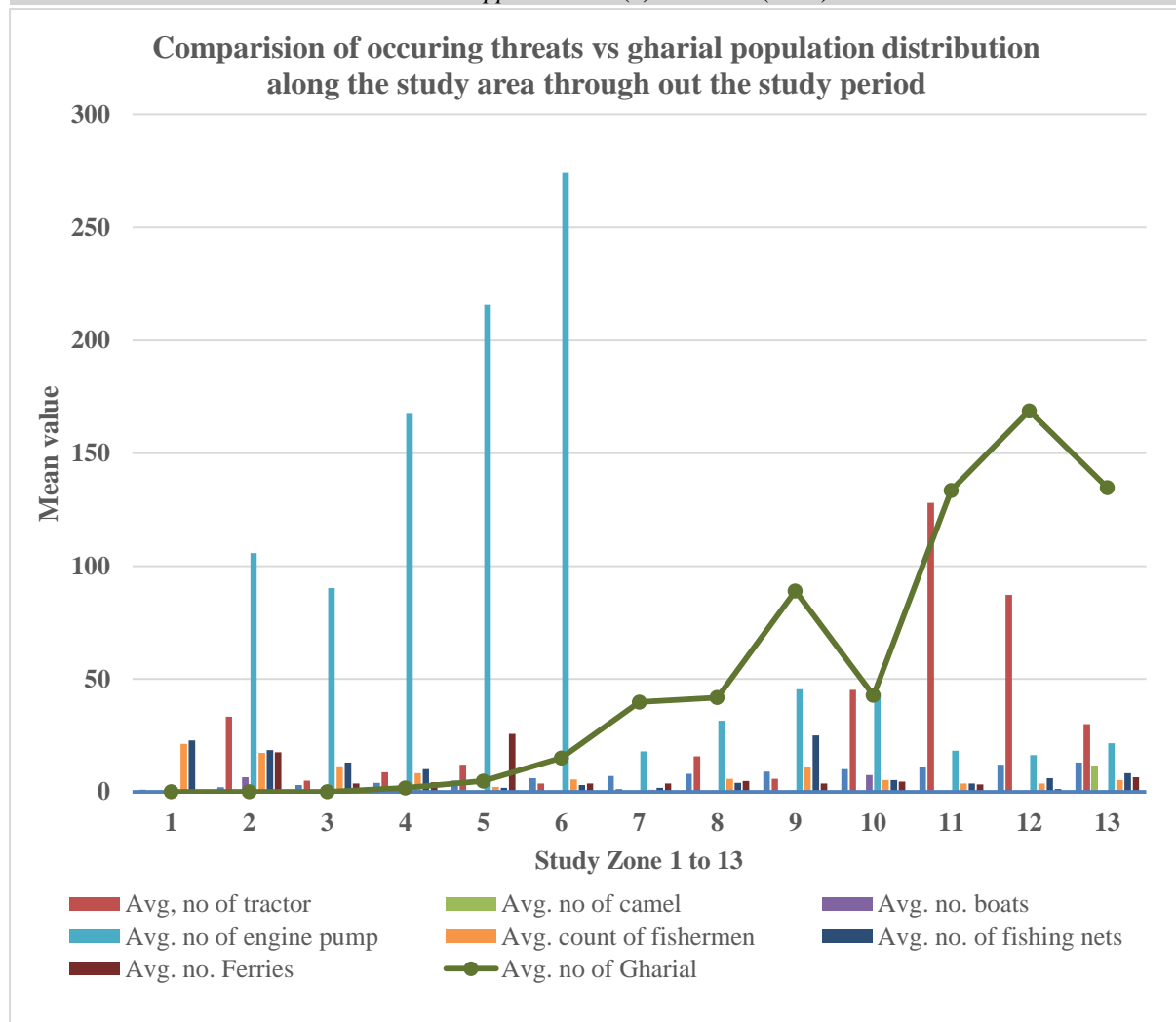


Fig. 2: Showing the comparison between occurring threats vs gharial population in Study area

Discussion: The result of present study indicates that high sand mining observed in study zone-11 with an average of 128 tractors between Gangoli Sarseni and Dholpur and in study zone-12 between Dholpur and Shankarpur stretch with an average of 87.25 tractors recorded, so study reveals that the Sand mining is a highly regular activity along the Chambal. The max gharial count recorded in study zone- 10, 11 & 12, indicate that this area is highly suitable for gharials. Few research emphasized about the impact of sand mining and reported that sand mining is the major anthropogenic activities in NCS, which is directly extracting the nesting habitats of river reptiles^{27,28}. It has been stated that various human activities comprising sand mining, poaching, fishing and riverside agriculture have been altered habitats in the core areas of the sanctuary^{27,28}. During the present study we

collected data on various threats including water extraction by villager using engine pumps, sand mining by tractors, camels and boats, presence of fishermen and fishing nets within the study area. The data reveals that high number of water pumps recorded in upstream section of the river from Rangpur Chipa Ghat to Pali Ghat but there is very less number of gharials recorded in this stretch ranged between 1.75 to 15±1.41 animals only. Though, there is no direct threats observed due to presence of water extraction pump for irrigation of riverside agriculture, but apparently it might be affecting the flow regime of the river during dry season. In previous studies from zone-2 to zone-6 water pump encounter rate was reported 4.31^{25,26} and 5.76¹⁵, when in current study in 2018 the same were reported 6.08 per km.

Fishing is considered as direct threat for the aquatic fauna of river system²¹. Result indicated that most fishing observed in study zone-9 which lies in lower stretch where an avg. gharial population was estimated 89±23.66 individuals. Eventually, it was observed that, the upper stretches of the river is less suitable for gharial in comparison of lower stretch. Number of gharial recorded higher in lower stretch where the human activities were also higher (Fig. 2). The lower stretch have good habitat matrix for gharial to perform different seasonal activities and in lack of other such habitats in upstream section, gharial population is being concentrated in lower stretch and compromising with the situation for their survival. In upcoming year, it is possible that in such area where the human threats continuously increasing might cause a drastic damage to gharial habitat and can badly affect the upstream gharial population in near future.

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