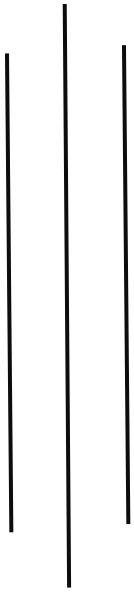
Population status, distribution pattern and conservation threats of Gharial (*Gavialis gangeticus*) in Karnali River, of Bardia National Park, Nepal

Researcher
Bikram Singh
Institute of Forestry, Tribhuvan University

Supervisor
Menuka Maharjhan, Phd
Professor, Tribhuvan University



Supported by
IUCN-SSC, Crocodile Specialist Group

Equipment support by
IDEA WILD

December, 2022

Bikram Singh
December, 2019
E-mail: bikramsingh2051@gmai.com

Tribhuvan University
Institute of Forestry,
Hetauda Campus, Hetauda Nepal
Website: www.iofhc.edu.np

Citation: Singh. B., 2019. Population status, distribution pattern and conservation threats of Gharial (*Gavialis gangeticus*) in Karnali River, of Bardia National Park, Nepal

Abstract

The *Gavialis gangeticus* is the solitary member of the family Gavialidae and is listed as a "Critically Endangered" species in IUCN Red Data Book, 2007. Gharial is considered as an indicator species of healthy freshwater ecosystems. Although, previously Gharial was found in Myanmar, Pakistan, Bhutan and Bangladesh, the species is probably extinct from these countries. Government of Nepal has focused on Critically Endangered Species Gharial as protected (National Park and Wildlife conservation act 1973) species. Furthermore, Department of National park and conservation area had recently made a "Gharial Conservation and action plan 2018-2022". Presently, there are 84 Gharials in Narayani River, 82 Rapti River, 31 in Babai and 1 in Karnali River, totaling 198 Gharials in Nepal (DNPWC, 2018). In Karnali, 45 of 1246 Gharials were released till 2017 for wild population enhancement. The project main aim was population status, distribution and habitat monitoring of Gharial in Karnali river, Bardiya National Park, Nepal. The survey was carried out in both Karnali part adjacent to bardiya National park and west side karnali towards Kailali side. The survey was fascinated by making the five sections in which each 500m data were collected. Moreover, Spotlight survey were conducted in limited sections. Presently, there is no any Gharials in Karnali river but we saw Mugger crocodile in survey. The habitat components is not sufficient for Gharials(no Sand bank, no light depth, high velocity of river). The river bank is moreover covered by gravels, bounders and stones. Additionally, human activities (Swimming, Irrigational channel, fishing, rafting, bathing, extraction of sand/gravel etc) is significantly harm habitat of Gharial profoundly.

The captive breeding of Gahrials and its releasing to river is not substantial resolution of population recovery strategy of in wild. Thus integration of habitat suitability study and its maintenance, anthropogenic activities resolved are essential components for population enhancement.

Key words: Captive breeding, Suitability, Anthropogenic activities

Introduction

The Gharial (Gavialis gangeticus) is listed as Critically Endangered species by IUCN belonging to family Gavialidae(Choudhury et al. 2007). Gharials play a role in maintaining the freshwater ecosysytem by its functioning activities considered as keystone species (Behera et al. 2014, Singh and Rao 2017). Until 1940s, Gharials were widely distributed in the major River systems from Indus River in Pakistan in the west to the Gangetic flood plains of India, Nepal, Bangladesh, Bhutan, and to Irrawaddy in Myanmar in the east (Neil 1971, Maskey 2006). The Gharial population was estimated from 5,000 to 10,000 during that period (Whitaker et al. 1974 and Thapaliya et al. 2009). But just in three generations since 1940's, there has been about more than 90% decline in Gharials populations (Whitaker and Daniel 1978, Maskey 1989, Choudhury et al. 2007). And by mid-1970s, the species became limited to only 2% of its historical range and pushed to the verge of extinction. Currently, Gharials are found only in Nepal and India, and are possibly extinct from Bangladesh, Bhutan, Myanmar and Pakistan (Behura and Singh 1978, Maskey 1989, Choudhury et. al 2007).

Gharial population is estimated to be around 550 breeding adults globally with 88% confined within National Chambal Sanctuary, India (Lang 2016). Despite the release of over 3000 Gharials in India from 1979-1993 (Ross 1998, Messel et al. 1992) and 1156 in Nepal from 1981-2016, the growth of the species has not been significant.

Gharial (Gavialis gangeticus) and the Marsh Mugger (Crocodylus palustris) are the two species of crocodilians found in Nepal. Gharial is one of the protected wildlife listed in Schedule I of National Parks and Wildlife Conservation Act, 1973. Current population of Gharial is estimated to be 198 individuals in Nepal with the adult population of 85 individuals (6 males and 79 females) (Acharya et al. 2017). The core population is confined to Rapti and Narayani river, Chitwan National Park and Babai river and Karnali river, Bardiya National Park.

Gharials need specific habitat and diet. They prefer convergence of fast flowing Rivers and spend most of the time in water (Nair et al. 2012). Nearby high sand banks are used for basking, nesting and laying egg and largely spend day time basking on the sand banks in winter. They are very well adapted to aquatic life style. They have weak limbs and hence do not have the ability to walk in the semi-upright position as other crocodilians do and can only move in forward sliding motion (Nawab et al. 2013). They exclusively feed on fishes, though juveniles may feed

on a variety of invertebrate prey species such as insects and smaller vertebrates such as frogs (Whitaker 2007).

Present global Gharial population is estimated to be around 550 breeding adults with 88% confined within National Chambal Sanctuary, India (Lang, 2016). Despite the release of over 3000 Gharial in India from 1979-1993 (Ross 1998, Messel et al. 1992) and 1156 in Nepal from 1981-2016, the growth of the species has not been significant. In Nepal and India, the populations are scattered and isolated, being restricted to small stretches of Rivers and streams (DNPWC, 2018)

Karnali river of BNP is one of the potential habitats for Gharial in Nepal. However, Gharial habitat in Karnali River is under threat due to irrigation dams, fishing and over flooding. Moreover, 41 Gharial were released in Karnali River till 2017 by Gharial Conservation and Breeding Center (GCBC). However, their survival rate hasn't been recorded yet (DNPWC, 2018). Being inhabitant of Karnali river catchment, i.e. Dhangadhi, Kailali district and highly interested in wildlife conservation program, I have witnessed the declining status of Gharial in Karnali River which motivates me to explore their status in this river. Thus, this research project assessed the current status, distribution including habitat and disturbances monitoring of Gharial in Karnali river of BNP. The output will be beneficial for government and other private organizations for preparing Gharial conservation program especially in Karnali river of BNP. The project aims to provide the status, distribution and conservation threats of Gharial in Karnali River of Bardiya National Park (BNP), Nepal. The specific objectives are:

1. To assess the status of Gharial in Karnali river.

2. To map out distribution of Gharial of Karnali river.

3. To monitor habitat and disturbances for Gharial in Karnali river.

Methodology

Study area

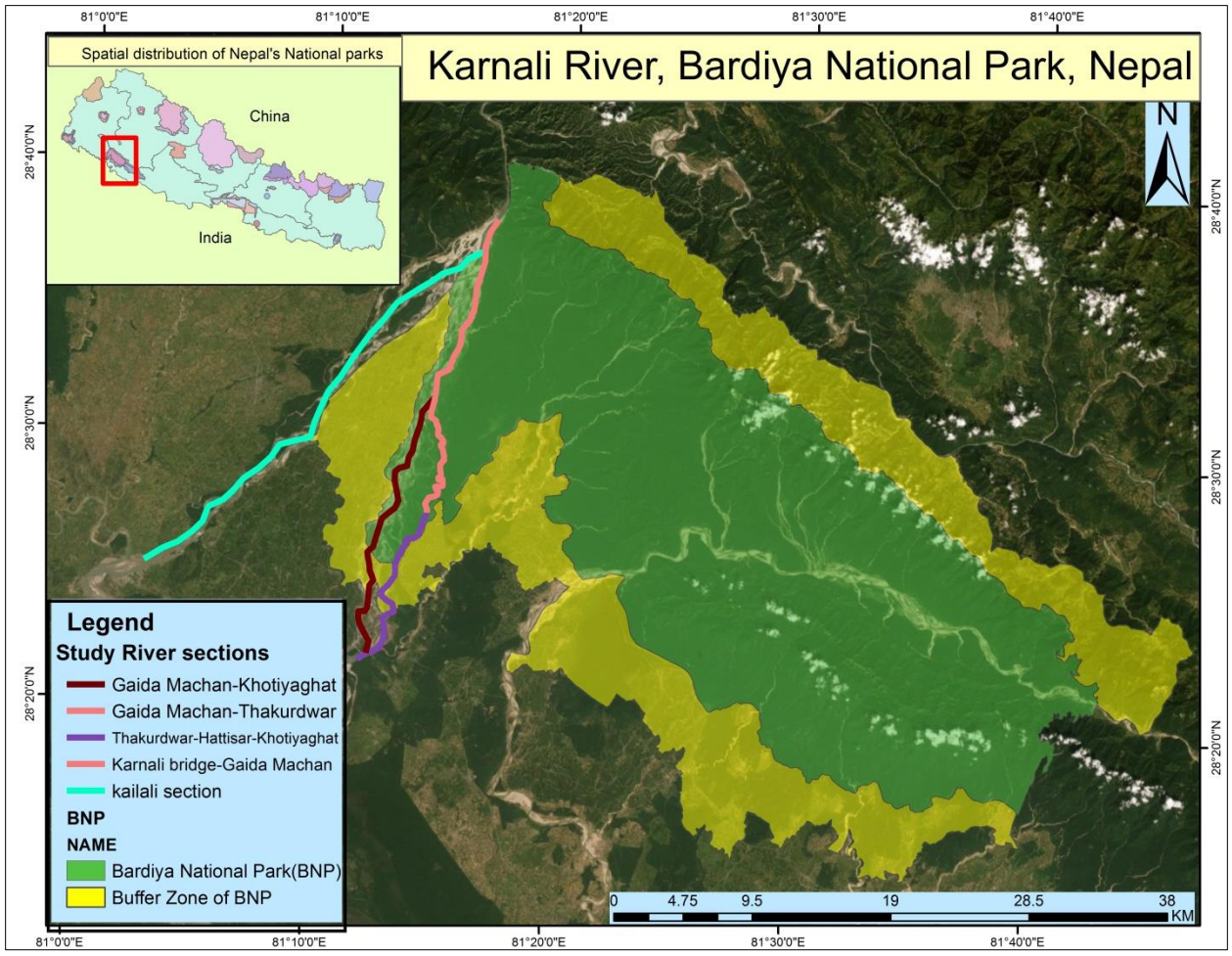


Figure 1 Map showing study location

Field data were collected on the basis of section of Karnali River. There were two channel of Karnali River in western Part of BNP i.e. Adjacent to BNP and Kailali side section. Thus BNP side section was sub-divided into 4 sections (Table 1) whereas Kailali side section consider as one section.

Table 1 Sections details

SN	Segment Name	Length(km)
1	Karnali bridge to Gaida Machan	13.4
2	Gaida Machan to Thakurdwar	10.0
3	Hattisar to Khotiyaghat	12.8

4	Gaidamachan-Hattisar-Khotiyaghat	19.7
5	Kailali side section	32.8

Population survey, habitat and disturbance monitoring

Separate survey was conducted for each section. Rubber boat was used in accessible segment whereas foot walking was also adopted. The population survey sheet was prepared (Appendix I Sheet 1). The habitat was monitored though all study area making segment of 500m replication distance. The habitat monitoring sheet was made (Appendix I table sheet 2).

Indirect Sightings

The Gharial presence was confirmed through indirect sightings based on the fresh body markings of Gharial. The count was considered only if the fresh marking supported by the evidence of animal jumping into the water before the observers could actually make a count and there won't wet animal coming out to bask within the range of 500 m.

Spotlight count

Night-time spotlight surveys were started approximately 30 minutes after sunset. Around 3-4 people will visit the bank of river for night survey. During survey, high battery power torch, datasheets and GPS was used for sighting, and recording of Gharial information. Gharial size will be estimated to the nearest foot measurement (e.g. 1 – 2ft, 3 – 4ft) when possible. If we are unable to approach close enough to determine species, Gharial will be recorded as an "eye shine". Counts will conduct on the same section of river on separate nights will be treated as separate count. Counts will only done while travelling in one direction (e.g. we won't include sightings while returning from survey). Night-time spotlight survey will done 3 to 4 days and nights on the western section of Karnali River. Spotlight count was challenging to study site because of multi-channelize of Karnali River. Thus our groups didn't able to survey in all sections.

Key informant survey

Discussion with key informants (5-10 people) was carried out with knowledgeable persons from local community about habitat of Gharial and current disturbances.

Secondary data collection

The study will be further supplemented with secondary information's from different sources i.e. publications, CSG's newsletters, articles etc.

Data Analysis

- The distribution of Gharial in the Karnali River will be mapped using Arc map software.
- The collected data was compiled and analyzed using MS Excel/SPSS.

Limitation

Spotlight survey was done in limited section.

Result and Discussion

Population status

After doing 3 replicate field surveys in all segments, we didn't get Gharial population in Karnali River. However Mugger crocodiles were observed in Karnali River. Spotlight survey was carried out at probable section but no any Gharial individuals were observed. Total Gharial realesed in Karnali River till 2018 were 45(DNPWC, 2018). The population distribution of Gharial can be presented (Fig 2) in Karnali in 2016. In contrast, there was no any Gharial population in 2019. The main cause of dis-appearing the Gharial in Karnali River is lack of suitability habitat.

Also we did spotlight survey for half of Karnali-GaidaMachan section and Thakurdwar-Hattisar-Khotiyaghat. However, we are unable to survey to whole section by spotlight survey due to inaccessibility and risk of wildlife (Royal Bengal Tiger, Asiatic Elephant etc.)

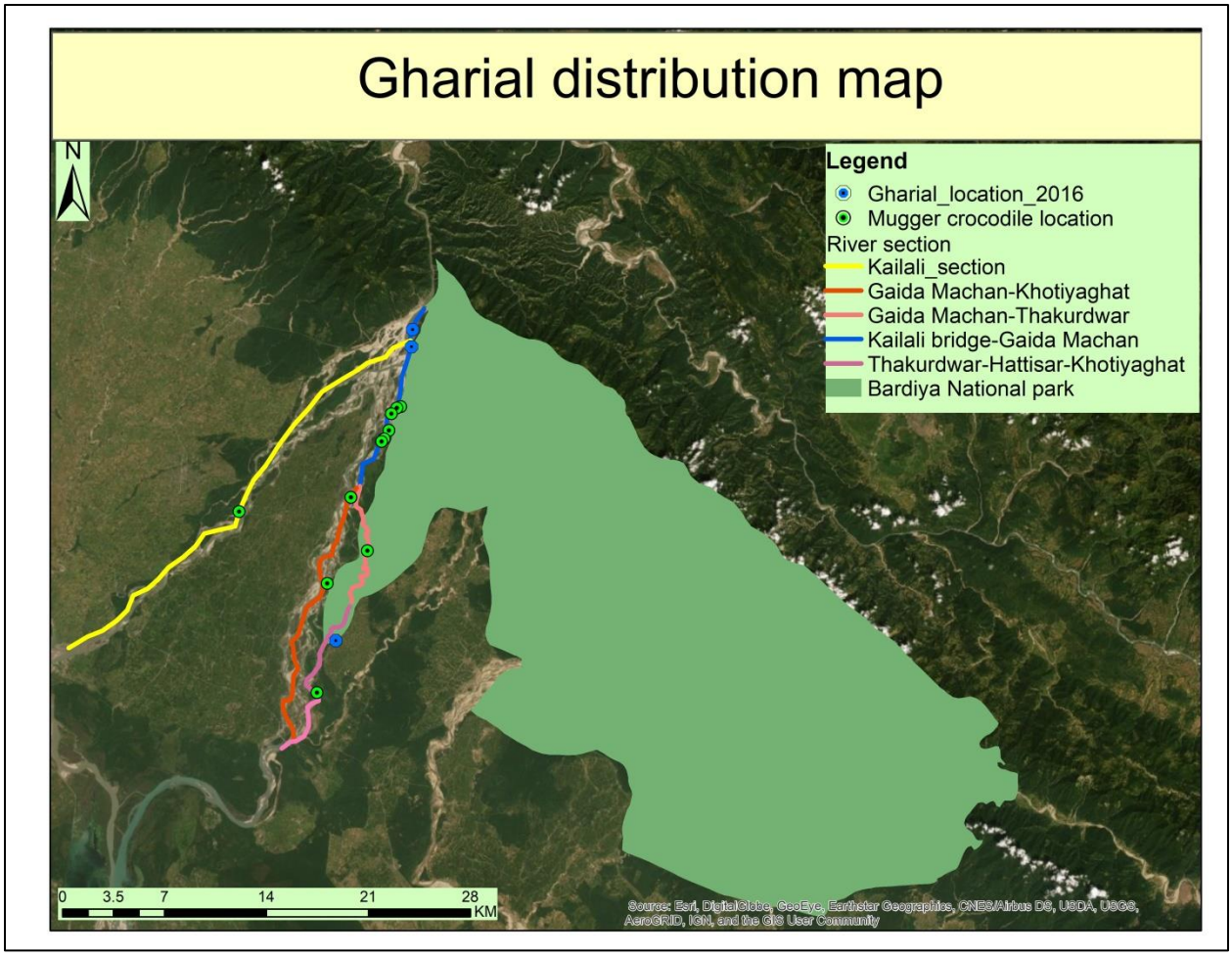


Figure 2 Map showing distribution of Gharial

Habitat Monitoring

Major habitat components were observed on the baisis of mentioned habitat monitoring sheet (Appendix I sheet 2).

Gharial prefers confluence of fast flowing Rivers and spends most of the time in water (Nair et al. 2012). Nearby high sand banks are used for basking, nesting and laying egg and largely spend day time basking on the sand banks in winter. They are very well adapted to aquatic life style. They have weak limbs and hence do not have the ability to walk in the semi-upright position as other crocodilians do and can only move in forward sliding motion (Nawab et al. 2013). Studies report that Gharials occupy River stretch where there is zero to very low level of disturbance,

presence of fine sand banks, especially deep pools with River confluence and greater prey availability (Nair 2010, Malla et al. 2012).

On analysis of collected data for habitat evaluation, we got less suitability habitat for Gharial.

Gharial prefers high sand bank for basking, nesting and laying egg and largely spend day time basking on the sand banks in winter. The presence of sand deposition was analyzed in each sections either presence and absence of sand (Fig 3). The deposition of sand is significantly present in Karnali bridge-Gaida Machan and Gaida Machan-Thakurdwar section. Due lack of sufficient sand deposition in river bank is one of the causes of Gharial population disappearing.

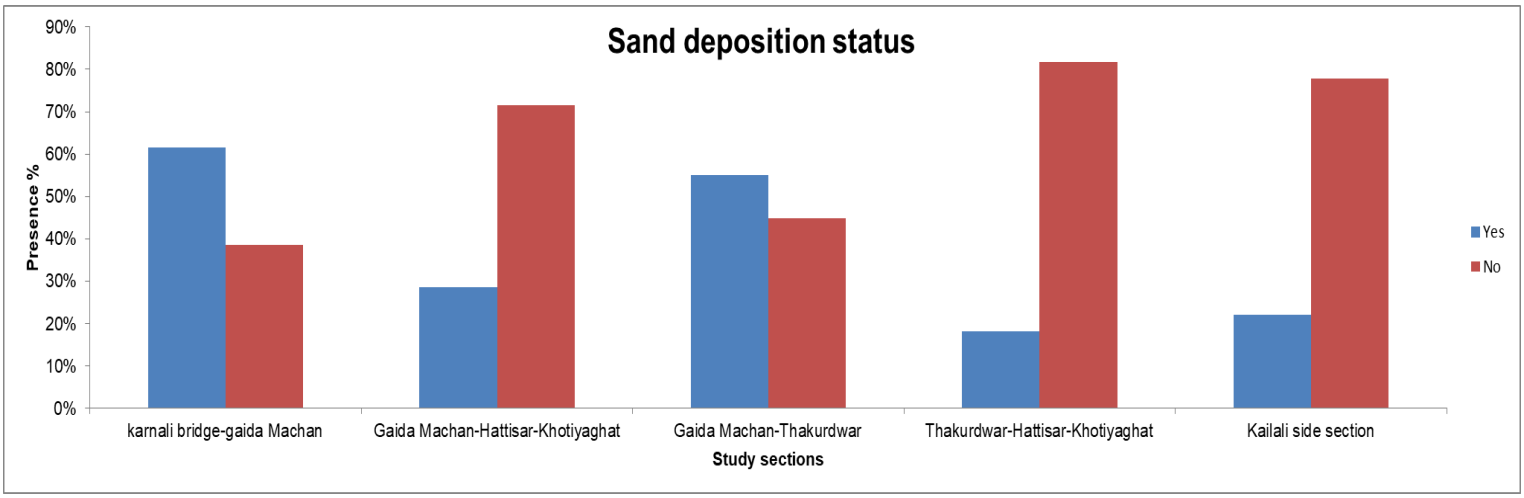


Figure 3 Sand deposition status for each study section

Habitat disturbances

The habitat of Gharials was significantly disturbed due to human activities in Karnali River. Some of the disturbances were recorded during survey are

Rafting, Camping, Swimming and Bathing

Karnali River is allowed for rafting and camping in bank of River. Thus people used to swimming in river. Local people bathing scene was also observed during survey. The disturbances were seen all river section except Gaida Machan to Thakurdwar section.

Extraction of Sand/Gravel

Sand/Gravel extraction is observed in section: Kailali-Gaida Machan.

Fishing

Fishing was observed in Karnali-Gaida Machan and Thakurdwar-Khotiyaghat section mainly.

Livestock and pollution

The river is polluted by plastic bottles, old clothes and wastes in Thakurdwar-Hattisar-Khotiyaghat section.

Discussion

Government of Nepal plays a crucial role for recovering of Gharial population in wild. Thus Department of National Park and wildlife conservation under Ministry of Forest and Environment had designed Gharial Conservation Action Plan for Nepal 2018-2022 which is one of 10 priority actions of Nation Biodiversity Strategy and Action Plan 2014-2020. Till 2017, 45 of 1246 Gharial individuals were released in Karnali river (DNPWC, 2018). In contrast, there was no any Gharial observation in our survey. Similarly, in the survey of Bardiya National Park collaboration with National Trust for Nature Conservation (NTNC); Gharial was not sighted in karnali river part (BNP, 2019). The habitat for Gharial is not sufficient in Karnali river. Furthermore, anthropogenic activities (Fishing, Swimming, Rafting, Sand/gravel extraction etc) are doing frequently. From key informants, high flooding during monsoon may a cause of Gharial unable to stay there resulting loss.

Conclusion

The Habitat components are lacked and profound anthropogenic activities in Karnali river. Thus, Gharial population hasn't seen in Karnali River. Before releasing the Gharials, we should do feasibility study at releasing river. Captive breeding and releasing to river is not solution for population recovery of Gharial in wild.

References

Behera S.K., Singh H. and Sagar V. (2014) Indicator Species (Gharial and Dolphin) of Riverine Ecosystem: An Exploratory of River Ganga. In: Sanghi R. (eds) Our National River Ganga. Springer, Cham. pp 121-141

Behura B. K. and Singh L. A. K. (1978) Conservation of crocodiles in India. Indian Forester (Spec. Issue on Inter. Symp. on Tiger) 83-92.

Choudhury B.C., Singh L.A.K., Rao R.J., Basu D., Sharma R.K., Hussain S.A., Andrews H.V., Whitaker N., Whitaker R., Lenin J., Maskey T., Cadi A., Rashid S.M.A., Choudhury A.A., Dahal B., Win Ko Ko U., Thorbjarnarson J and Ross J.P. (2007) Gavialis gangeticus. The IUCN Red List of Threatened Species 2007: e.T8966A12939997.

Lang J.W. (2016) India - Gharial Ecology Project. Crocodile Specialist Group Newsletter 35(1):10-14.

Maskey T., Cadi A., Ballouard J.M. and Fougeirol, L. (2006) Gharial conservation in Nepal: Results of a population reinforcement program.

Nair T., Thorbjarnarson J.B., Aust P., Krishnaswamy J. (2012) Rigorous gharial population estimation in the Chambal: implications for conservation and management of a globally threatened crocodilian. Journal of Applied Ecology 49: 1046-1054.

Nawab A., Basu D.J., Yadav S.K. and Gautam P. (2013) Impact of Mass Mortility of Gharial Gavialis gangeticus (Gmelin, 1789) on its Conservation in the Chambal River in Rajasthan. In: Sharma B., Kulshreshtha S., Rahmani A. (eds) Faunal Heritage of Rajasthan, India. Springer, Cham

Neill, W. T. (1971) The last of the ruling reptiles: alligator, crocodiles and their kin. Columbia Univ. press, Ithaca, New York, N.Y. 486 pp

Ross J.P. (1998) Crocodile status, survey and conservation action plan. 2nd edition IUCN/SSC Gland, Switzerland and Cambridge, UK

Thapaliya B.P., Khadaka M. and Kafley H. (2009) Population Status and Distribution of Gharial (Gavialis gangeticus) in Nepal. The Initiation, Vol. 3, 2009. ISSN: 2091- 0088. Student Forum for Forestry Research and Environment Conservation (SUFFREC), Kathmandu Forestry College, Kathmandu, Nepal.

Whitaker R. and Daniel J.C. (1980) The status of Indian crocodilians. J. Bombay Nat. Hist. Soc. 75 (suppl.): 1238-1245.

Whitaker R., Rajmani V.C., Basu D. and Balakrishnan V. (1974) Preliminary survey of Gharial. Madras Snake Park Trust Rep. pp 1-17

Photo-plate



Figure 4 Mugger crocodile



Figure 5 Tent camping at Karnali River Bank (Habitat disturbance)



Figure 6 Our Field work team



Figure 7 Boating and Night time survey

Gharial population monitoring sheet 1

Gharial Monitoring in Karnali River 2019

Date: …… Replicate no:…… Observer Name: ……

Segment Name: ……

Start GPS: N: …… E: …….. Start Time: …… Weather: ……..

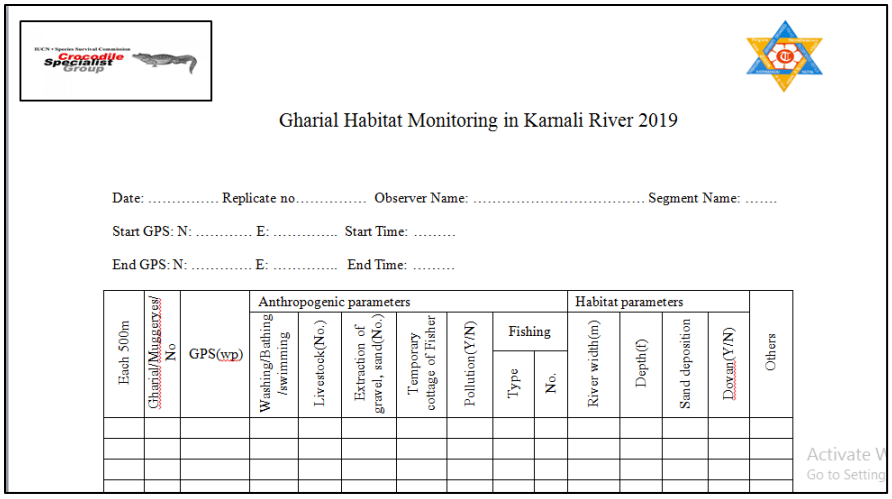
End GPS: N: …… E: …….. End Time: …… Weather: ……..

Time	Weather	Species	No.	Place	GPS (wp)	Age group							River flow	Activity	Substratum
						Adult			Sub-adult	Juvenile	Yearling	Unknown age			
						M	F	UN							

Note: Habitat Substratum: F=Female, M=Male, UN=Unknown, Sandy bank (SB), Grassy Bank (GB), Muddy Bank (MB), Boulders/Gravel Bank (BB), Water (W), Others specify (O)

Activity: Basking (B), Fishing (F), Swimming (S), **River Flow:** Fast flowing, (FF) Slow flowing (SF), Stagnant (ST)

Gharial habitat monitoring sheet 2



Gharial Habitat Monitoring in Karnali River 2019

Date: ..... Replicate no..... Observer Name: ..... Segment Name: .....

Start GPS: N: ..... E: ..... Start Time: .....

End GPS: N: ..... E: ..... End Time: .....

Each 500m	Gharial/Muggerzes/ No	GPS(wp)	Anthropogenic parameters							Habitat parameters				Others
			Washing/Bathing /swimming	Livestock(No.)	Extraction of gravel, sand(No.)	Temporary cottage of Fisher	Pollution(Y/N)	Fishing		River width(m)	Depth(f)	Sand deposition	Dowan(Y/N)	
								Type	No.					

Activate W
Go to Setting