Final Evaluation Report

Your Details	
Full Name	Pawan Shantiprakash Pareek
Project Title	Understanding the nesting ecology to support recovery of last known wild population of the Red-crowned Roofed Turtle (*Batagur kachuga*) in Chambal River, India
Application ID	36911-1
Date of this Report	21 April 2023

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Characterisation of preferred and non-preferred nesting habitat			■	
Monitoring nesting activity		■		Females while nesting, could not be spotted
Recording micro-habitat parameters of nests			■	
Rearing of hatchlings and sex determination		■		Emerged hatchlings are being reared. External expert (Mr. Gerald Kuchling) could not travel due to health issues; thus, sexing will be done during his next visit.
Assessing hatchling fitness			■	

2. Describe the three most important outcomes of your project.

a). Characterisation of preferred and non-preferred nesting habitat –
Twenty-two samples for each nesting habitat attribute listed below were collected from both preferred as well as non-preferred sand banks. Data were digitised and analysed in Microsoft Excel. Nesting bank slope, sand particle size, sand hardness and softness and moisture of egg chamber showed a notable variation between the identified preferred and non-preferred sand banks.

Preferred nesting sand banks- A total of 22 *B. kachuga* nests were studied during the project period. The slope of nesting banks measured ranged between 420 - 200. The highest and lowest moisture content of the sand collected from the egg chamber was recorded as 5.68% and 0.72% respectively with an average of 2.99%. No artificial built structure was found near any of the nesting sand banks but the banks along Garaita and Bhawar were observed to be affected by sand mining activity while Murong had the heavy cattle movement.

Sample collected from nesting location for sand particle size measurements had the composition as - 94.06% sand of size 0.6–0.15 mm, 4.7% of size 0.09-0.045 mm, 0.3% of 2.7-1.18mm and very small portion (0.1%) of >0.045mm. The sand preferred for nesting contained 94% of coarse sand and remaining 6% of fine sand (Table 1).

Figure 1: A preferred B. kachuga nest at the edge of sloppy sand bank, PC- Pawan S Pareek.

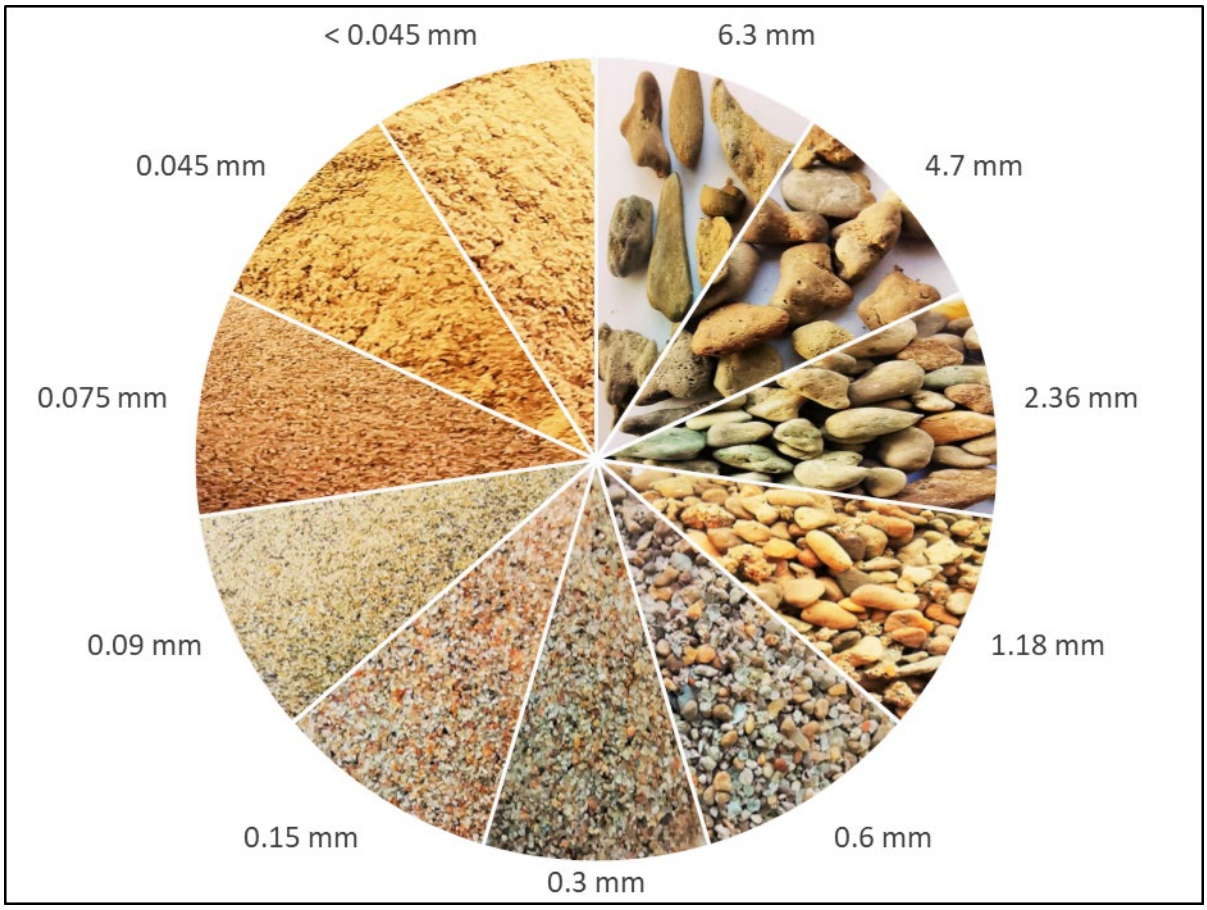
Table 1: Standard table (as per (S. Nagaprasad et.al, 2010)) used for the size references (Left) and the average weight & weight percentage measured from the collected samples (Right).

Particle	**Diameter (mm)**
Coarse sand	0.5-1
Medium sand	0.25-0.5
Fine sand	0.1-0.25
Very fine sand	0.05-0.1
Silt	0.002-0.05
Clay	<0.002

Sieve size	**Average weight (gm)**	**Weight (%)**
>2.7mm	0.1	0.0
2.7 – 1.18mm	1.5	0.3
0.6-0.15mm	472.8	94.6
0.09 – 0.045mm	23.5	4.7
<0.045 mm	0.7	0.1

*The International Classification (Atterberg) System refers only to soil particles under 2 mm:

Coarse sand	0.2-2 mm
Fine sand	0.02-0.2
Silt	0.002-0.02
Clay	<0.002



Non-preferred Sand Banks – The maximum and minimum moisture content of the sand was found to be 12.3 % and 7.6 %, which was higher than the preferred sand banks. Sand banks were flattened in comparison to the potential sand banks with the maximum angle recorded as 40 and the angle increased gradually on moving away from the water edge. The maximum depth recorded was 13 m, which gradually increased meaning it was shallow at edge and gradually increased while moving towards water. No nests were found on these sand banks.

Water pH and sand temperature did not show much variation between the preferred and non-preferred banks. pH recorded ranged from 7.4 to 8.2 and temperature recorded between 19.5 to 22 degrees Celsius. A notable difference was observed in the hardness and softness in both types of sand banks. The sand banks on which the nests were found were coarse (soft) and were not difficult to dig

a 50 cm hole by hand. On the other hand, sand banks on which no nest were found had hard or rigid layer of sand thus medium to high level (High: Unable to dig a 50 cm depth hole; Medium: Could dig to 50 cm, but with some struggle) difficulty in digging the 50 cm hole.

Figure 2: Different types of sand banks with diverse type of sand particles observed during the study, PC- Pawan S Pareek

b). Monitoring nesting activity

Three known nesting beaches Garaita, Barauli and Badpura were observed during the nesting season of 2022. Unfortunately, we could not spot any live nesting activity. A total of 22 signs and nesting impressions were observed during the project period. Associated activity like distance covered between water edges to nest, shape of nest and egg chamber measured and recorded.

Nesting impression of *B. kachuga* was bigger in size in comparison to the sister species Three-striped roofed turtle (*Batagur dhongoka*) nested during the same period. The difference can be visually observed by seeing the direction and amount of sand thrown around the nest during the egg chamber excavation. *B. kachuga* digs and throw the sand in a circular form, far from the egg chamber (up to 1-2 m), that means while digging for egg chamber *B. kachuga* female spin in a circle shape.

Figure 3: Typical shapes of B. kachuga (left) and B. dhongoka (right) nesting impressions, PC – Pawan S Pareek.

On an average female *B. kachuga* travelled 9.30 ± 4.2m from water edge to nest with the maximum distance recorded as 15.4 m and shortest 1.5 m. On comparing the total length of the sand banks, it was found that *B. kachuga* females only use one-third of the total length of the sand bank for nesting. The maximum and minimum depth of water at the location of nesting female emergence recorded was 17 m and 8 m respectively with steep depth and slow water flow. The inside shape of the egg chamber is as flowerpot slightly tapered in one side. The mean depth of full egg chamber recorded as in the study was 35 cm (SD=2.98, range=30-41, n=22). The shape of egg chamber can be visually differentiated into three different parts: the nest mouth (21% of nest depth), the laying wall (55% of nest depth) and the Incubation chamber (24% of nest depth; Figure 4).

Figure 4: A nesting trail with nest impression (in left) and egg chamber cast of B. kachuga. © Pawan S Pareek.

c). Assessing hatchling fitness

Three nests containing 15 eggs are artificially incubated in different incubating temperature of 29°C, 32°C and 35ºC at Garaita Chambal Conservation Centre, Etawah for comparing the hatching success between wild and artificially incubated nests. The eggs having relatively similar weight and size are selected for the artificial incubation to evaluate the effect of various incubation temperature on emerged hatchlings. A total of 50 hatchlings 35 from the wild and 15 from the artificially incubated nets are being reared at Garaita Chambal Conservation Centre, Etawah for fitness tests as well as sexing.

Table 2: Incubation time, morphological parameters and performance parameters assessed for *B. kachuga* incubated at three different temperatures.

Sr. no.	Variable	29^0 C (n=5)	32^0 C (n=5)	35^0 C (n=5)
1	Incubation time (days)	86	70	67
2	Hatchlings mass (gm)	32.9±0.85	34.9±0.95	24.3±0.62
3	Straight Carapace length (mm)	48.2±0.47	50±0.35	47.32±0.75
4	Straight Carapace Width (mm)	36.96±0.40	38.08±0.28	37.18±0.58
5	Hatchlings crawling speed (m/m)	9.26±0.38	9.84±0.23	8.44±0.45
6	Righting response (s)	5.8±0.83	5.2±0.83	6.4±0.54
7	First five-month survival	100%	100%	100%

The hatchlings emerged under the artificial incubation shows some variation in morphological as well as physiological performances. The hatchlings incubated at 32˚ C are having the large straight carapace length (SCL) and width (SCW) in compared to the hatchlings emerged at 29˚ C and 35˚ C. Similarly, the hatchlings emerged at 32˚ C have more body mass in compared to the hatchlings emerged at 29˚ C and 35˚ C. Incubation period was shortest at 35° C, intermediate at 32° C and longest at 29˚C. Overall performance of hatchlings like crawling and righting response decreased, when incubated at low and high temperatures. No significant observations could be made on naturally incubated hatchlings.

Successful characterisation of the nesting sand banks would help us to generate the critical values of the nesting attributes like the sand particle size, preferred moisture content of the nesting ground, slope of nesting sand banks, etc. Though these are preliminary data collected from a limited number of sand banks we would find application in the future study as well as planning and management decision for the protection of critical nesting banks and the conservation of this, critically endangered species.

Figure 5: The crawling speed (left) and righting response (right) assessment on *B. kachuga* hatchling. © Pawan S Pareek.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

- Temperature and humidity data logger (iButton) could not be procured as per the timeline due to international supply chain and shipping constraints post-COVID19 and unavailability of stocks in India. Temperature loggers have been procured in this nesting season for collecting some supporting data.

- Females while nesting, could not be spotted to record morphometric data.

4. Describe the involvement of local communities and how they have benefitted from the project.

Two people from the local community were engaged in the project activity as and when needed. Mr. Shishubhan Singh, local youth from the Garaita village, was engaged as the field assistant throughout the project period to help in the various activity like nesting survey, data recording, turtle keeping. The other person Mr. Santram Nishad, local from the fishing community was engaged as a boatman for the period of five month (February – June) for the helping the nesting survey.

5. Are there any plans to continue this work?

The current study was carried out in the lower section of the Chambal River on a limited number of sand banks. The study will be continued on the other sand banks and gradually expanded to the upper and middle section of Chambal section through the National Chambal Sanctuary, as the habitat and the geographic conditions vary along the stretch and no scientific data is available to support management decisions. This expansion will also help us to determine more generalised nesting bank assessment indices including a larger dataset, where the

critical values generated from this study may be considered as preliminary or baseline information collected from the limited number of sand banks on this protected stretch of the river.

6. How do you plan to share the results of your work with others?

We have planned to publish the results of this study in peered reviews journals like British Herpetological Society (BHS), British Ecological Society (BES) and Journal of Threatened Taxa (JoTT) as well as like to present the outcome as an abstract in upcoming National and International Symposium. Part of the study was presented in 2022, Annual TSA/IUCN-TFTSG Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles in Tucson, Arizona.

7. Looking ahead, what do you feel are the important next steps?

The further documentation of critical nesting habitat in the current stretch (lower) and expansion to the middle and upper section of Chambal River would be the important next step toward the standardisation of these results as well as to provide large data set for informed management decisions. Similar data on sister species (*B. dhongoka*) needs to be collected. This will help to understand the habitat preference overlap, or separation, or any specific adaptations among the two sister species inhabiting the same stretch of the river as *B. dhongoka* nests in higher numbers as compared to *B. kachuga* in the Chambal River. Additionally, a study on diet and husbandry practices would to be carried out to standardise and develop the husbandry protocols which will be very help full for captive conservation breeding to revive this critically endangered species, threatened towards extinction.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

A mobile turtle exhibit was launched during the World Wildlife Week - 2022 for the education and awareness among the riverine community of Chambal River. This was a mini truck, with decorated life size aquatic turtle models of species found in the Chambal River and audio-visual setup for screening of awareness films. This exhibit moved along the riverine village for conservation messaging and educational based short videos on Chambal's aquatic wildlife in each village. In six days, journey, this exhibit reached 30 riverine villages covering the 90 km along the Chambal River. Around 3000 people were reached with the conservation messages under this program.

9. Provide a full list of all the members of your team and their role in the project.

Pawan Shantiprakash Pareek – Execution of the entire project related work like data collection, designing of data sheet and analysis, report writing.

Shishubhan Singh - A local youth from the Garaita village, that assisted in the project activity like pre nesting survey, data collection and compilation, turtle husbandry related work like feeding, cleaning of tanks etc.

Santram Nishad - A boatman from local fishing community, who helped in the boat survey during the project.

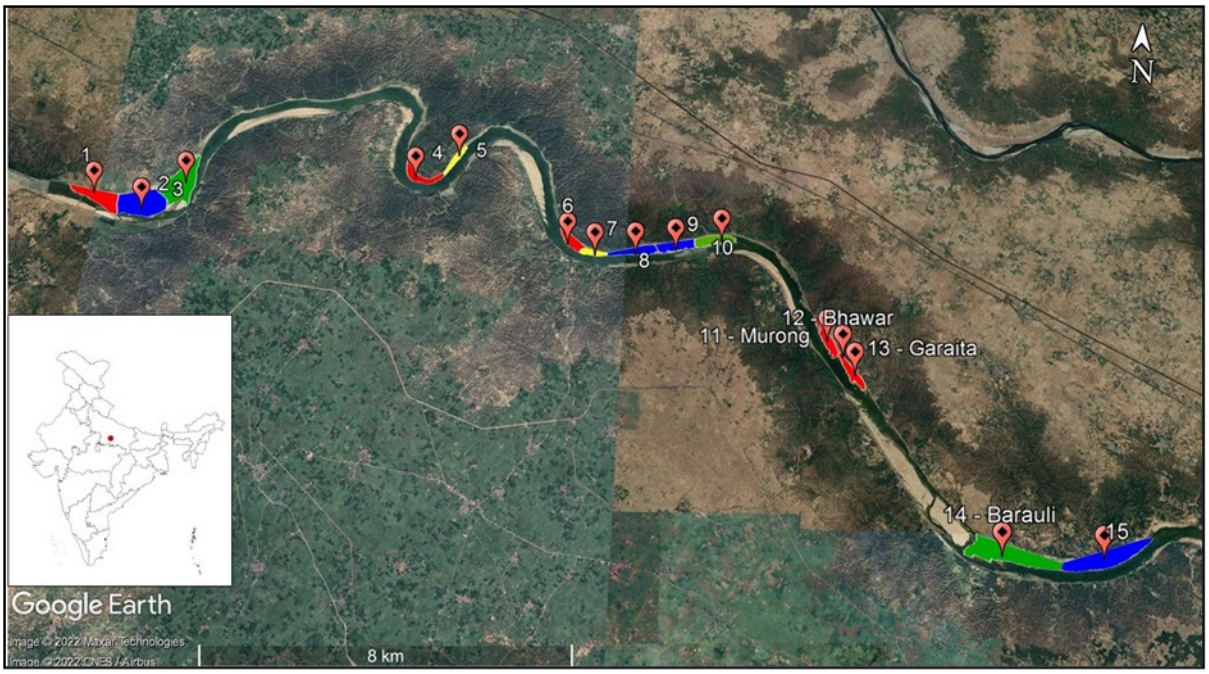
Dr. Saurabh Dewan – Supported in project execution, report writing, reviewing and editing.

10. Any other comments?

Measuring the slope of nesting sand banks using Abney level. © Shishubhan Singh.

Weighing of dried sand sample (left) and pouring of sand sample to test sieves. © Pawan Pareek.

Recording the B. kachuga nesting trail. © Shishubhan Singh.



Map showing the surveyed area with identified 15 sand banks and 4 sand banks assessed in this study - Murong, Bhawar, Garaita and Barauli.