



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2020; 8(1): 1175-1180

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Received: 16-11-2019

Accepted: 18-12-2019

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## Assessment of sand quality of nesting and basking sites of crocodile and turtles in the Chambal River, India

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DOI: <https://doi.org/10.22271/chemi.2020.v8.i1p.8411>

### Abstract

Sand banks are very much useful for the aquatic animals for nesting and basking specially in crocodile and turtles. 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.

The Physico-chemical characteristic of 20 nesting and basking sites of crocodiles and turtles in the Chambal River were carried out between Pali-Chakar nagar riverine stretch, approx. 425 kms during nesting season April, 2006. The sand quality parameters namely average temperature (29.2 °C), average moisture content (8%), average pH (7.5), average electric conductivity (1.3 u mho/cm), average available nitrogen (93.7 Kg/h.), average available phosphorous (3.8 Kg/h.) and average potash (416.6 Kg/h.), were analysed reflects on the pristine nature of the river in Chambal. The sand quality analysis indicated that the river sand in the River area is pollution free and can serve as a good habitat for many aquatic animals including reptilian species.

**Keywords:** Chambal, nesting, breeding, reptiles, characteristics etc.

### Introduction

The habitat quality of different aquatic animals had been extensively analyzed in different aquatic bodies. The animals include turtles (Rao, 1990) <sup>[16]</sup>, Crocodiles (Singh, 1978; 1985; Rao 1988; Sharma, 1991) <sup>[26, 25, 15, 22]</sup>, Otters (Hussain, 1993) <sup>[5]</sup> and wetland birds (Ali and Vijayan, 1986) <sup>[1]</sup>. These aquatic animals prefer different habitat characteristics like deep or shallow waters, fast or slow flowing Rivers, and sandy or muddy or Rocky River banks for various activities like feeding, basking and breeding. Habitat preferences by various size/age groups were also reported for turtles (Rao, 1990) <sup>[16]</sup>; Crocodiles (Singh, 1978, 1985) <sup>[26, 25]</sup> and Otters (Hussain, 1993, Taigor, 2007, 2009, Taigor and Rao, 2008, 2010a, 2010b, 2014) <sup>[5, 30, 32, 33, 35, 21, 34, 31]</sup>.

Temperature, water, and respirator gases are considered the most important physical variables affecting the survival of reptilian embryos (Packard and Packard, 1988) <sup>[12]</sup>. Water quality changes linked to sand and gravel mining include increases in turbidity, changes to water temperature, changes to the distribution and availability of habitats and increased pollutants and salt water intrusion (Koehnken, L, 2018, Singh *et al*, 2014, Sulekha, *et al*. 2014, Sitaram and Rao, 2012) <sup>[6, 23, 28, 27]</sup>. Factor affects and connotation of Sand quality of riverine habitats, Nesting and basking patterns of crocodile and turtles are discussed in this paper.

### Material and Methods

20 sand samples from important crocodile nesting sites were collected during pre-monsoon period in day time 0900-1700 hour for analysis. 7 variables i.e. as temperature, moisture content, pH, electrical conductivity, available nitrogen, available phosphorus and available potash were estimated. Detailed methods for determination of each variable adopted are described as under: sand samples were collected in polythene bags, oven dried and subject to various chemical analyses such as electrical conductivity, available nitrogen, available phosphorus and available potash in the laboratory. Temperature and pH of the sand samples were recorded in the field during the day times. Standard procedures described o the text by Piper (1966) were followed for sand samples analysis.

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## Results and discussion

The physico-chemical characteristics of sand from Crocodile and Turtle nesting sites in the Chambal River were studied. Various parameters like temperature, moisture content, pH, electric conductivity, available nitrogen, available phosphorous and potash were analysed.

The river banks filled with sand of varied nature are important habitats for basking and nesting of crocodiles, turtles, birds and otters (Rao, 1990) [16]. The physico-chemical characteristics of sand from the nesting sites were analyzed. From the results of sand sample analysis, it is evident that typical chemical characteristics of sand are required for development of the egg. Temperature, water and respiratory gases are considered the most important physical variables affecting the survivable of reptilian embryos (Packard and Packard, 1988) [12]. Carr and Hirth (1962) [2] determined that below a depth of 30 cm, sand temperatures at South West Bay beach stayed between 27-29.5 °C over a 61d period during the nesting season. Thus, eggs would not be exposed to

temperatures likely to induce mortality- i.e., above 33 °C or below 25 °C (Miller, 1982, Rao *et al.* 2016) [8, 18].

The overall chemical composition of the soil is regulated by its moisture content, which depends upon the temperature. In the present study nest, temperature 30.1 °C at Tighari Rithora and Puraini and 28 °C Gyanpura and Sahaspura. Sharma (1991) [22] observed temperature was as 31 °C in Baroli and Gyanpura. The moisture content was more where temperature was low. Sushant *et al.* (1983) observed temperature variations from 30.5 to 32.5 °C at one section of Chambal River in 1977 when moisture content was found to be 5-7% by weight. In the nest of Gharials, the temperature may influence greatly the development of embryo and in early stages of incubation; it helps in determination of sex (Webb *et al.* 1983) [36]. In the present study soil temperature at Gharial nesting sites are ranged from 28 °C to 31 °C. Fig. 1 and 2 The nest temperature is regulated depending on the physical characteristics of sand. Suitable sand is a primary requirement of Gharial to nest at the required temperature for successful incubation of eggs.

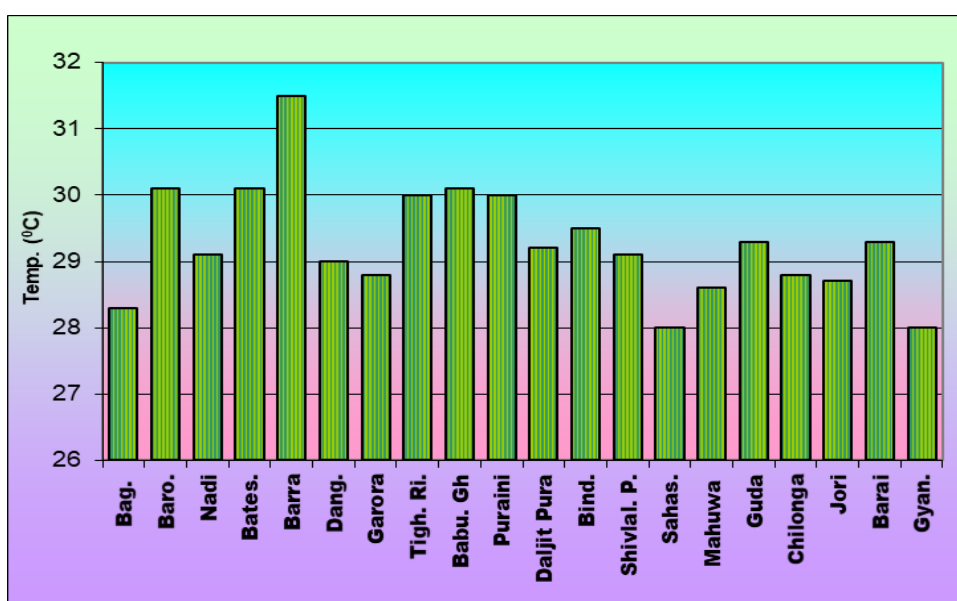


Fig 1: Variations of temperatures in different nesting and basking sites

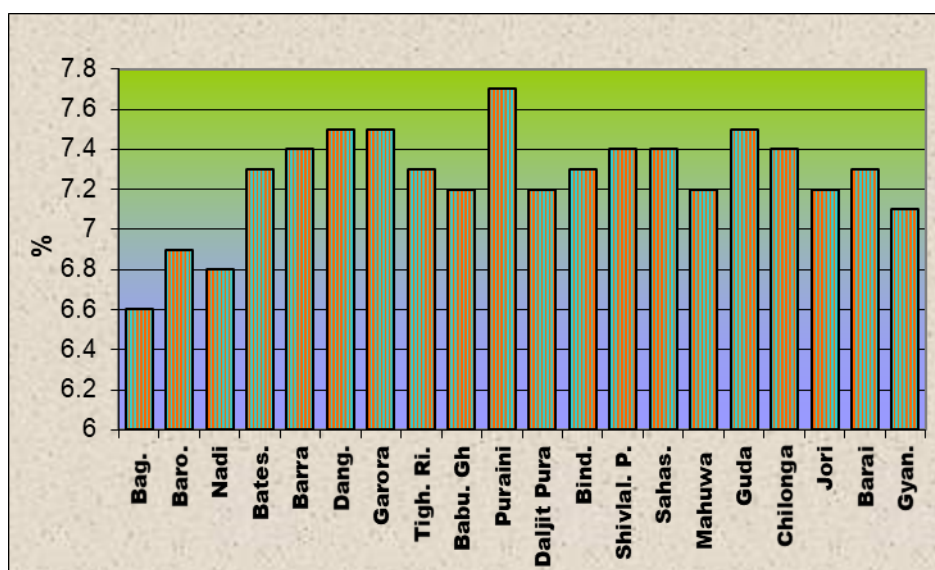


Fig 2: Variations of moisture content in different nesting and basking sites

In the summer season the pH of sand ranged from 8.3 to 9. It was minimum at Bagadia (8.3) while maximum at Gyanpura

(9.0). Sharma (1991) [22] recorded minimum pH at Barra (7.2) and maximum at Kenjara (7.8). The details soil survey

revealed that pH of sand on the Chambal River ranged from 7.1 to 9.0 (Pre-irrigation detailed soil survey report of Morena tehsil by V.K. Mishra, 1974) <sup>[9]</sup>. Murthy *et al.* (1982) <sup>[11]</sup> stated that pH of vertical and associated soils is related to the nature of the parent material and topographic situation and it generally shows an increasing trend though depth in arid,

semi-arid and dry sub humid areas and in low lying situations due to a corresponding increase in CaCO<sub>3</sub> and salts in sub soil layers under Indian conditions although pH varied from soil to soil ranging mostly 7.5 to 8.6 it may also range from 9.0 to 9.5 at place losing signs of alkalinity. Fig. 3

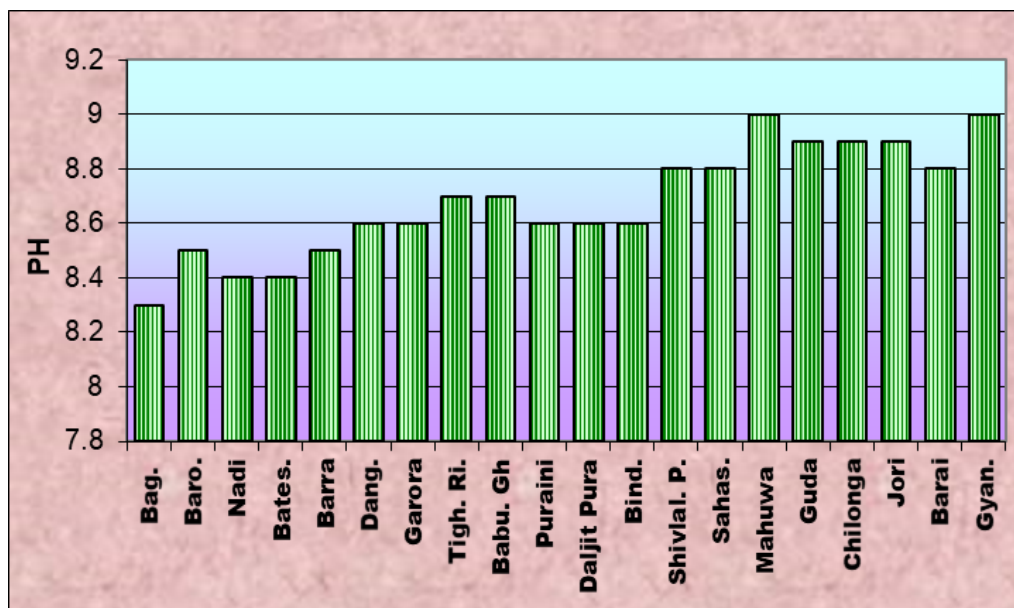


Fig 3: Variations of pH in different nesting and basking sites

Richards (1954) <sup>[19]</sup> stated that electrical conductivity is an indicative measure of water-soluble salts present in the soil. The electric conductivity of saturation extract is related to total soluble salts depending upon the texture. The amount of these salts affects physico-chemical properties of soil largely. The excessive accumulation of exchangeable sodium in the soil reveals an adverse effect on soil physical properties and effects nutrition disorders like high Na, low Ca and high pH. The electrical conductivity of the sand samples from the Chambal River varied from 0.9 to 3.2 u mho/cm in summer

session. During the study period, minimum electric conductivity was found at Baroli, Daljit ka Pura, Sahaspura and Mahuwa (0.9 u mho/cm) and maximum was at Barai (3.2 u mho/cm). Sharma (1991) <sup>[22]</sup> reported maximum electric conductivity at Gyanpura, Puraini and Barai (0.48) and minimum was at Tighari Rithora (0.30). Roy *et al.* (1967) <sup>[20]</sup> also reported that electrical conductivity of Raisen district of M.P. ranges from 0.25 to 1.25 m. mhos/cm at 25 °C in 1:2.5 soil water suspensions. Fig. 4

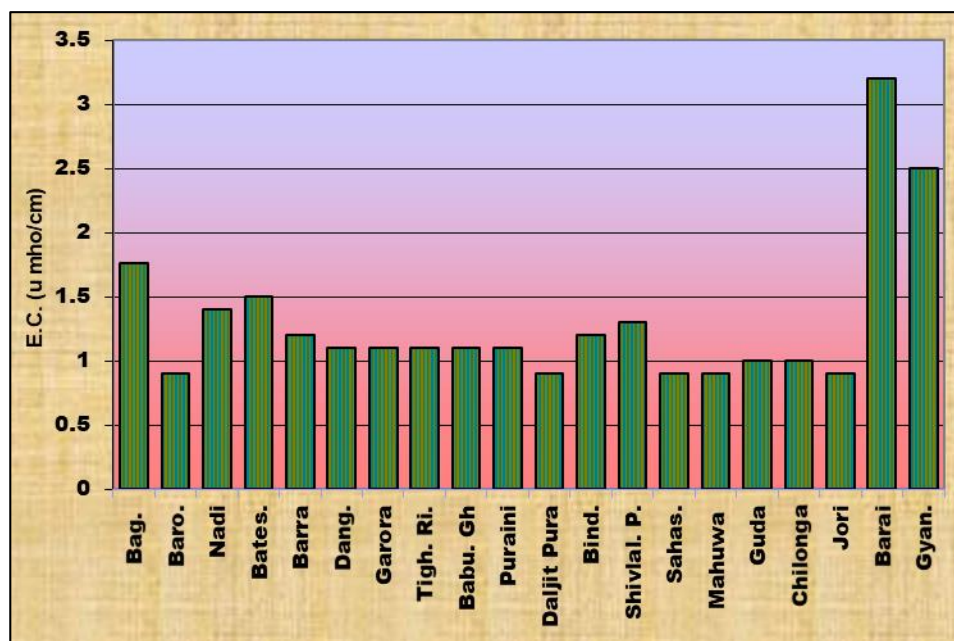


Fig 4: Variations of electrical conductivity in different nesting and basking sites

The Indian soils have very low nitrogen content because of the tropical climate. Singh *et al.* (1971) <sup>[24]</sup> found that soils of

Indore blocks were low in available nitrogen. The alluvial soils of Chambal division have low nitrogen level. The

available nitrogen was found to vary from 62 kg/h to 175 kg/h. in the present study. It is observed that high amount of available nitrogen was found in the sand at Bindwa (175 kg/h) and low amount at Dang Basai (62 kg/h). Sharma (1991) [22] found high amount of available nitrogen was at Puraini (198.6

kg/h) and low amount of nitrogen amount was at Baroli (186.2 kg/h). From the results of available nitrogen, it appears that there is no definite correlation between available nitrogen and formation of nests. Fig. 5

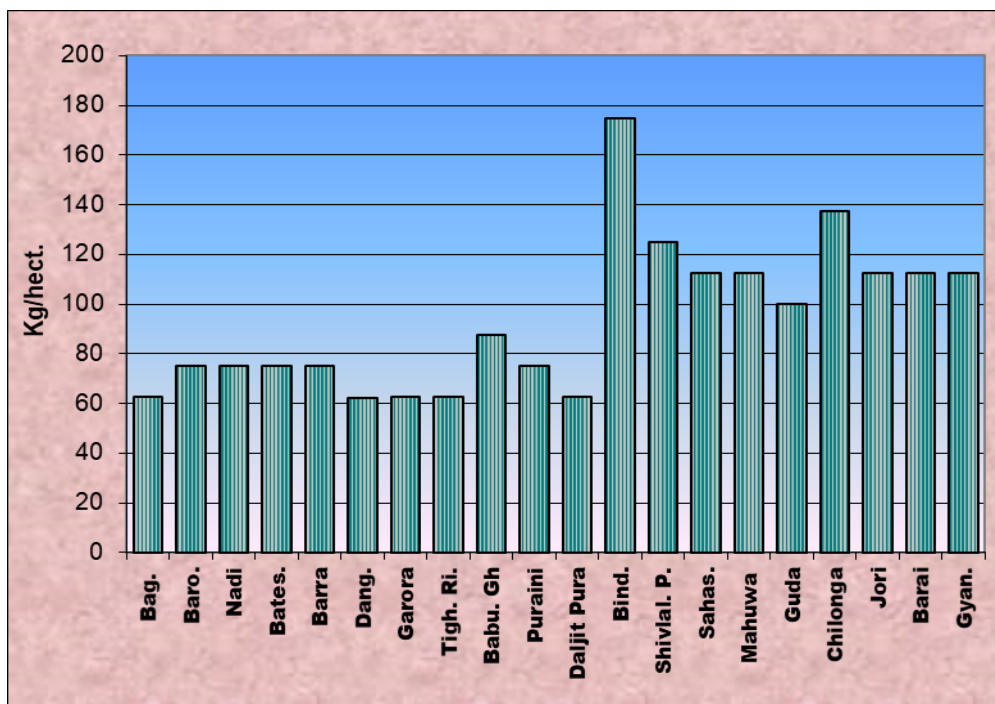


Fig 5: Variations of available nitrogen in different nesting and basking sites

During the present study, available phosphorus in the sand was found to vary from 0.25 kg/h to 22 kg/h. It was observed that high amount of Available Phosphorous was found at Daljit ka Pura (22 kg/h) and low amount was at Barra (0.25 kg/h). Sharma (1991) [22] reported high amount of available Phosphorous at Baroli (6.52 kg/h) and low amount of nitrogen

amount at Nadigaon (3.48 kg/h). Godfrey *et al.* (1954) [3] observed that total phosphorous showed decreased in the profile. The phosphorous measured in B-horizon was less than in A and C-horizons. They concluded that a definite relationship exists between quantity and distribution of phosphorous and stage of profile development. Fig. 6

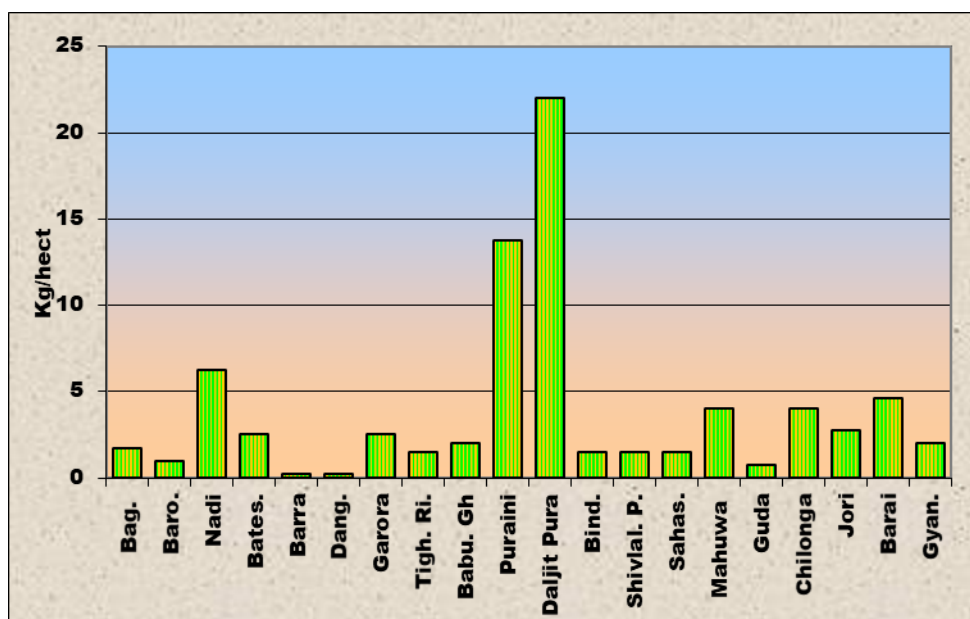


Fig 6: Variations of available phosphorus in different nesting and basking sites

In case of available Potash, it ranged from 57.2 kg/h to 800 kg/h in the study period. It was observed that high amount of Potash was found at Gyanpura (800 kg/h) and low amount was at Batesura (57.2 kg/h). According to Sharma (1991) [22] high amount of Potash was at Gyanpura (198.2 kg/h) and low

amount of Potash was at Barra (127.6 kg/h). Ramamoorthy *et al.* (1969) observed that out of the reported 184 districts of India, 36 were low, 98 medium and 50 districts had high values in available potash status. Fig. 7

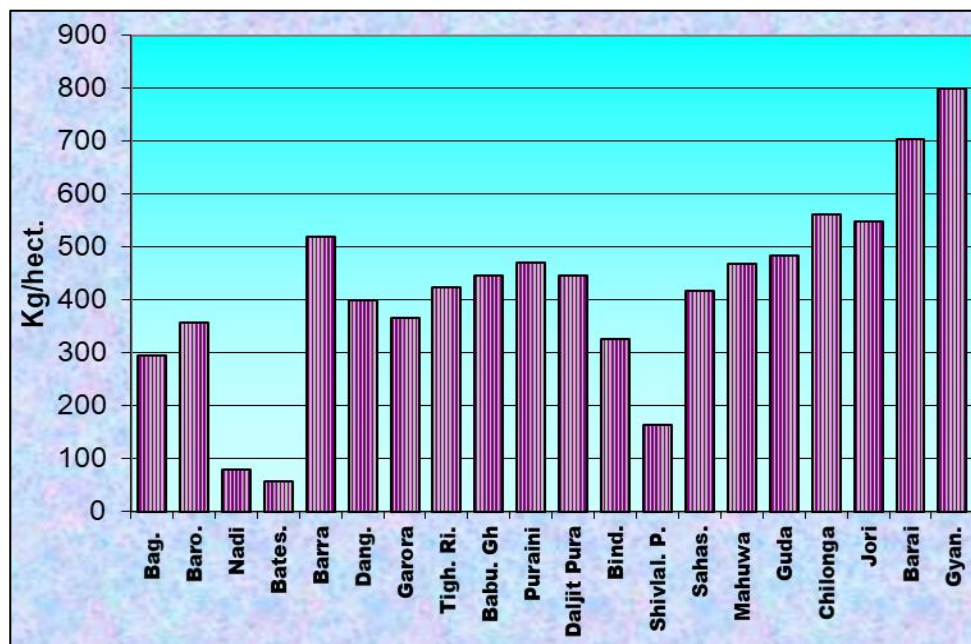


Fig 7: Variations of available Potash in different nesting and basking sites

### Conclusion

The Chambal River is perennial, having its origin in Vindhyan Range near Mhow district of Madhya Pradesh. It flows in a North-eastern direction, passing through Rajasthan up to the point where its major tributary, Parbati joins it near Pali. Thereafter, it flows in an eastern direction, forming the boundary of M.P. and Rajasthan and M.P. and Uttar Pradesh. The Chambal River is a good habitat for large number of aquatic animals including a variety of fishes, crocodiles, turtles, migratory birds, aquatic mammals like dolphin and otter. Sand-banks, sand-bars and sand-spits are important resting and breeding sites, in the National Chambal Sanctuary, for the gharial, mugger, nine species of fresh-water turtle, and ground-nesting birds like the Indian skimmer, black-bellied tern, little tern, small pratincole and thick-knee, among others (Hussain, 2009; Moll, 1997; Sundar, 2004, Meena *et al.*, 2017, Rao *et al.*, 2013) [4, 10, 29, 7, 17]. In this studies, baseline sand characteristics of nesting and basking sites of Crocodile and Turtles were only analyses. For assessment of influence of sand characteristics in riverine habitats, nesting and basking patters of Crocodiles and turtles need to be conducted systematic long-term study.

### Acknowledgement

We are thankful to head, School of Studies in Zoology, Jiwaji University, Gwalior for provided laboratory facility. We are also thankful to the Forest department of Madhya Pradesh for local assistance and permission to work. We are also thankful to Agricultural College, Gwalior for analysis of sand samples.

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