Chapter – VIII

Summary

The ecobiology of this freshwater turtle species is little understood. Equally its breeding biology in terms of nesting, egg laying and egg incubation are not known. Moreover, the role of Ca which has obtained from the habitat site through food have not been understood. To assess the environmental cues and food spectrum in the habitat site, as well as in the gut of the species have been attempted.

Five areas were identified as habitat site(s) and recorded all possible abiotic and biotic components during the study periods (2008 to 2012) in the Morigaon district, Assam, India. They are Hamur Char (25°13′125″N and 88°17′173″E): HC, Tengatoli Char (29°23′007″N and 98°18′168″E): TC, Dimbur Char (26°27′001″N and 92°15′222″E): DC, Sitalmari Char (26°39′016″N and 092°2′0415″E): SC and Maderkuri Char (26°39′002″N and 92°26′125″E): MC.

The study periods had been selected as egg laying period (ELP: late September to early December) and egg hatching period (EHP: late May to early July).

During the study period of 2008-2012, total 1064 number of turtles were recorded in various habitat sites, out of which male was recorded as 31.10%, female 28.85% and juvenile 40.03%.

Light intensity was recorded 251.99 – 294.24 lux during ELP and 633.60 – 686.29 lux during EHP. Average rainfall was recorded as 56.98 – 66.14 mm during ELP and 279.91 – 291.27 mm during EHP. RH was recorded as 77.12 – 78.79 % during ELP and 83.74 – 85.01 % during EHP. During ELP maximum temperature was
recorded as 27.86 – 28.80 °C in air, 26.43 – 27.57 °C in soil and 27.67 – 28.78 °C in water. While, during EHP it was recorded as 33.14 – 35.33 °C (air), 28.69 – 29.85 °C (soil) and 28.11 – 29.16 °C (water). The physicochemical properties of habitat water was recorded as pH (6.41 – 6.72), free CO₂ (6.77 – 7.99) mg/l, DO (7.98 – 9.40) mg/l, Alkalinity (25.65 – 29.44) mg/l, Total hardness (23.16 – 27.38) mg/l, Transparency (62.91 – 68.43) cm, Chloride (11.84 – 15.05) mg/l, Phosphate (0.13 – 0.17) mg/l and Nitrate (0.13 – 0.16) mg/l.

Certain elements in habitat soil, water and food item estimated and the results was recorded as K (13.08 – 15.71 µg/g in soil; 1.65 – 2.11 µg/l in water), Ca (0.52 – 0.68 µg/g in soil; 0.28 – 0.39 µg/l in water; 1.46 – 2.94 µg/g in food), Mg (1.49 – 1.65 µg/g in soil; 0.014 – 0.028 µg/l in water; 1.12 – 1.64 µg/g in food), Se (0.052 – 0.65 µg/g in soil; 0.35 – 0.52 µg/l in water; 0.41 – 0.56 µg/g in food), Fe (3.53 – 7.22 µg/g in soil; 0.14 – 0.21 µg/l; 0.96 – 0.84 µg/g in food), Zn (0.16 – 0.24 µg/g in soil; 0.32 – 0.48 µg/l; 0.56 – 0.76 µg/g in food), Mn (0.11 – 0.16 µg/g in soil; 0.18 – 0.27 µg/l in water; 0.42 – 0.58 µg/g in food).

The morphometric variations of adult male, female and juvenile were recorded as CL (14.93 cm in male; 15.11 cm in female; 7.62 cm in juvenile), CW (11.20 cm in male; 11.30 cm in female; 6.04 cm in juvenile), PL (13.77 cm in male; 14.41 cm in female; 7.64 cm in juvenile), PW (6.31 cm in male; 6.69 cm in female; 3.02 cm in juvenile), SH (5.45 cm in male; 6.65 cm in female; 2.92 cm in juvenile; TL (2.37 cm in male; 1.48 cm in female; 0.79 cm in juvenile), BW (491.16 g in male; 519.00 g in female; 90.14 g in juvenile).
The length of GIT was recorded as 58.31 cm in male and 48.94 cm in female. The small intestine is the largest gut organ and in case of male it was recorded as 36.10 cm and in female it was 23.88 cm.

Microscopic examination of the stomach revealed the presence of two types of gastric glands, the granular glands are mainly of simple tubular type and opens into the gastric lumen by their pits. The mucosal lining of the intestinal villi is composed of three types of cells, simple columnar epithelial cells, goblet cells and endocrine cells.

The habitat area was observed with the growth of aquatic vegetation including pistia, lemma, nymphaea, utricularia, salvania and ipomoea and small animals i.e. fishes, mollusks, prawn, beetles, water insects, worms were also recorded.

The variation of food items in the stomach content was recorded using flushing method. In the live specimen, anabaena was recorded as the highest with 18.5% followed by pistia (17.0%) and the lowest was recorded for arthropoda with 1.2%. while in dead specimen spirogyra was recorded as highest with 23.5% followed by anabaena (18.7%) and the least was recorded for daphnia species with 1.8%.

Maximum 9 number of annuli was recorded during this investigation period as the age of turtles is correlates with the annual deposition of scute rings. The time variation of basking was also recorded, maximum number of turtles were recorded in the morning hours. Sitalmari Char showed the highest 11 number of turtles between 7-8 hrs followed by 9 (Dimbur Char). The lowest numbers of turtle were recorded in between 17-18 hrs as 1 in Sitalmari Char.
The morphometric parameter of eggs has been recorded during the study period. The values were recorded as average length 4.77 cm, mid diameter 2.35 cm and weight 16.89 g.

Maximum distance of nest from the water was recorded 150.32 m and the lowest distance 75.10 m. Nest depth variation was recorded 8.75 - 10.25 cm. Nest temperature variation was recorded as 24.10 - 25.46 °C. The clutch size variation was recorded as 5.50 – 8.18. During study period, highest number of nest were recorded at 60 (Hamur Char) and lowest was 34 (Sitalmari Char). The highest nest density was recorded at 0.054/m² in Tengatoli Char and the lowest nest density was shown by Maderkuri Char at 0.032/m².

Ex-situ hatching was carried out in natural environment and the highest incubation period was recorded 246 days with hatching rate 73%. The survival and mortality rate was recorded 75% and 25% respectively.

The hatchling parameters were recorded immediately after hatching. The average weight recorded as 12g, average length and breadth 5.5 cm and 4.5 cm respectively.

During embryonic developmental stages the phospholipid variation in egg yolk was recorded as maximum values in stage I (6.36 μg/g) followed by stage II (5.12 μg/g) followed by stage III as 2.82 μg/g. The range variation of calcium in the egg shell was recorded as 5.35 immediately after laying, 3.76 μg/g at mid incubation and 2.93 at post incubation.

However, the precise role of Ca in the biology of the species is yet to be understood. The significant presence of element profiles viz, K, Ca, Mg, Se, Fe, Zn, Mn in habitat soil, in water and in food of *P. tentoria* have been reported. The food habit of *Pangshura* genus has not been fully understood. Food spectrum obtained from the
gut of \textit{P.tentoria} suggest the herbivore nature for male and omnivore tendency for females while the juveniles are carnivore in nature.

The present findings on the ontogenic shifting from carnivory juvenile (90\% animal food) to herbivory adults (70\%) has been noted in this investigation. Interestingly the \textit{P.tentoria} female has the prefers small snails and minnows, though plant food are not uncommon.

The size of turtle increased steadily with age based on counting annuli. The maximum number of countable scute annuli observed in this investigation was 9. This data indicating that scute rings are deposited annually and that size corresponds to age in \textit{Pangshura tentoria}. During investigation period, basking of \textit{Pangshura tentoria} was shown peak in morning hours and sunny days in winter might be for the maintaining body temperature at around 34˚C and stimulate the synthesis of vitamin D and maintain Ca homeostasis.

The shape of eggs are somewhat elongated and the incubation period is reported to be 6-8 months. During the egg laying period the female \textit{P.tentoria} dig a hole of 8-10 cm and lays 5-8 number of eggs and covers the nest with sand. It is also recorded that the female turtle choose to construct the nest within a distance of 75 to 92 meters from the river water.

In \textit{P. tentoria}, the egg phospholipid may be necessary for the embryo which spent prolonged periods in the nest before emergence. Transfer of Ca to the embryo, initially withdrawn from the eggshell, is assumed to be responsible for the replacement of the yolk. The most important change in the configuration of the crystals of the calcareous layer of the egg shell occurred between the period of oviposition and hatching.