

ECOLOGY OF INDIAN ROOFED TURTLE, *PANGSHURA TECTUM* (GRAY 1831) IN BANGLADESH

Md. Lokman Hossain*, Shorab Uddin Sarker and Noor Jahan Sarker

*National Academy for Educational Management (NAEM), Dhaka

Department of Zoology, University of Dhaka

Dhaka-1000, Bangladesh

ABSTRACT

Indian roofed turtle, *Pangshura tectum*, was found in all types of aquatic habitats in Bangladesh. Of the 8 categories of habitats studied, the highest number (42.74%) was found in domestic ponds followed by derelict ponds, tanks, marshlands, canals, agriculture fields, lakes, streams and puddles. Most of the time the turtle was found in basking condition (60.09%), while rarely it was observed in burrowing condition. In addition to this, Indian roofed turtle spent 31.75% time in feeding and 8.16% in browsing.

Key words: Indian roofed turtle, ecology, habitat preference, behavioral patterns.

INTRODUCTION

Turtle plays an important role in socioeconomic conditions of Bangladesh. In 1980–2002, 3164.24 tons of freshwater turtle was exported from Bangladesh, and annual average earning from turtles and turtle products had been over Tk.7, 80,00,000 (Anonymous 2002). In the present decade the exploitation of the turtle meat increased significantly, these are consumed by a group of people for its delicacy (Rao 1987). Turtles play an important role in maintaining the ecological balance in nature (Sarker and Hossain 1997), and are important component of the biota in freshwater ecosystem. Freshwater turtles perform as scavengers in aquatic bodies viz. the rivers, ponds, other stagnant water bodies, and thus help keep aquatic systems free from pollution (Rao, 1987). Freshwater turtles have been subjected to human predation for centuries (Sandra and Daniela 2000). Indian roofed turtle, *P. tectum*, has been enlisted as vulnerable nationally (IUCN 2000).

Studies on ecology and habitat preference are very important for sustenance of any species in its natural habitat as well as in captivity. Although, some work have been done on the ecology of Indian roofed turtle by Fugler (1984), Barua and Islam (1986), Rashid and Swingland (1997), Hossain and Sarker (1993, 1995), Raju (1997). A number of experiments demonstrated that this species could be cultured commercially (Hossain 2000); therefore, detailed studies on behavior pattern, micro and macro habitat, feeding habit, browsing habit, basking habit, etc., have been felt very essential to exploit the species for commercial farming. The present investigation was undertaken to add some information to the existing knowledge on the above mentioned aspects of the species.

MATERIALS AND METHODS

The study was conducted between January 1997 and December 2000 at Matlab, Haziganj, Sonargaon, Naraynganj, Harirampur and Shivalaya upazilas of Bangladesh (Fig. 1).

Habitat assessment in captivity: An enclosure was made in the Zoological garden, Department of Zoology, Dhaka University, with 6 earthen jars (100 cm²). Twelve aquaria were placed to rear the turtles. Water supply was maintained smoothly in all seasons during the study period. An artificial habitat was developed in the enclosure having a variety of ecological conditions with different types of soil. There were some grounds made in the corner of the enclosure to estimate the ecological niche, behavioral patterns and nesting activities.

Habitat assessment in nature: Habitat preferences were calculated by observing the frequency of occurrence of the turtle in the study areas. The macro and microhabitats were differentiated in nature by extensive field visit. The ideal habitats were differentiated on the basis of abundance or availability of the turtle species. Sometimes, habitats were studied by accompanying the commercial turtle collectors. This facilitated to gather information on the methods of turtle collection from different habitats throughout the year. Habitat classification was based on the plant cover and moisture contents of the soil.

Data on habitats utilization and preferences were tested by one and two way analysis of variance (ANOVA). The means were differentiated by arc sign transformation and habitat preferences were calculated by Duncan's New Multiple Range Test (DMRT) (Duncan 1955). Chi Square test was done to compare different habitat in different seasons. SPSS (version 10.0) statistical package on a computer was used for data analysis.

RESULTS AND DISCUSSION

Aquatic habitat: Indian roofed turtle, *P. tectum*, preferred aquatic and perennial waterbodies, i.e., ponds, ditches, pools, lakes, canals, kuas, marsh, streams, etc. It was observed that the species prefer

aquatic systems with diverse aquatic vegetations. The notable vegetations were *Eichhornia crassipes* (Kachoripana), *Hydrilla verticillata* (Jhajipata), *Vallisneria spiralis* (Pataseola), *Spirodela polyrhiza* and *Lemna* spp. (Khudipana), *Enhydra* sp. (Helencha), *Pistia* spp. (Topapana), *Wolffia arrhiza*, *W. microscopia*, *Najas graminea*, *Potamogeton crispus*, *Limnocharis flava*, *Tenagocharis latifolia* (Patasheola), *Ottelia alismoides*, *Hydrocharis dubia*, *Blyxa auberti*, *Ipomoea aquatica*, *Aponogeton* spp, *Trapa* spp., *Ludwigia adscendens* and *Nymphaea* spp.

Macro habitat: In nature, *P. tectum* inhabited all types of stagnant waterbodies which includes, domestic ponds, derelict ponds (ditch), puddles, tanks, deghees (large and old pond), lakes, marsh areas, wetlands, flooded agriculture fields, canals, tributaries and distributaries originated from the Meghna Dhonaghoda, Dhakatia and Ichamati rivers.

In 1997, *P. tectum* was found mostly in domestic ponds and rarely in streams. The highest number (mean 67.2 ± 18.1) of turtle individuals (49.9%) was found in domestic ponds (range 41 and 102 individuals) and the average lowest number (mean 1.4 ± 0.6) of turtle individuals (1.1%) in the puddles. The highest number of turtles was found in domestic ponds in January and the lowest in July, and the habitat preference was statistically significant at 1% level with 11 degree of freedom ($\chi^2 = 26.02$).

In the four years study, it was found that the maximum number of *P. tectum* preferred the domestic ponds among the other 8 categories of aquatic habitats. The highest abundance of *P. tectum* was observed (49.93 %) from the domestic ponds in 1997 and the lowest in 1998 (36.61 %) (Table 1). There was highly significant difference in the mean distribution of *P. tectum* in different habitats in the study areas ($F = 56.01$, $df = 8/24$ and $p < 0.01$) and the highest preferred habitat was

domestic ponds followed by derelict ponds, tanks, marshlands, canals, agriculture fields, lakes, streams and puddles (Table 1) and there was no significant difference among the study period (1997- 2000) ($F = 1.591$, $df = 3/24$ and $p < 0.01$) (Table 2). Khan (1982) and Fugler (1984), Moll (1987, 1993), Raju (1997), stated that the turtle, *P. tectum* inhabits all types of stagnant and slow flowing rivers including small or moderate sized ponds with aquatic vegetation or algal bloom. Shrestha (1997) in his extensive investigation found that the turtle inhabited rivers, lakes, and marshlands under aquatic vegetations. Sarker and Hossain (1997) added that the turtle dwell stagnant waterbodies and rarely found in rivers and streams.

This variation between the study may have had due to different ecoclimatic condition of the study areas. Frazier and Das (1994) observed that it is usually found in large waterbodies. Das (1995), Hossain and Sarker (1993), Rashid and Swingland (1997) found the turtle throughout the country including Sundarban area of Bay of Bengal in southern Bangladesh .It lives in clear and warm deep water (Hans Hvass, 1964). It inhabits ponds, puddles, tank, *nullas* and other waterbodies such as roadsides, ditches, slow running rivers and systems (Raju and Patel, 1993). Therefore, most of the above studies are in good agreement with the present observations.

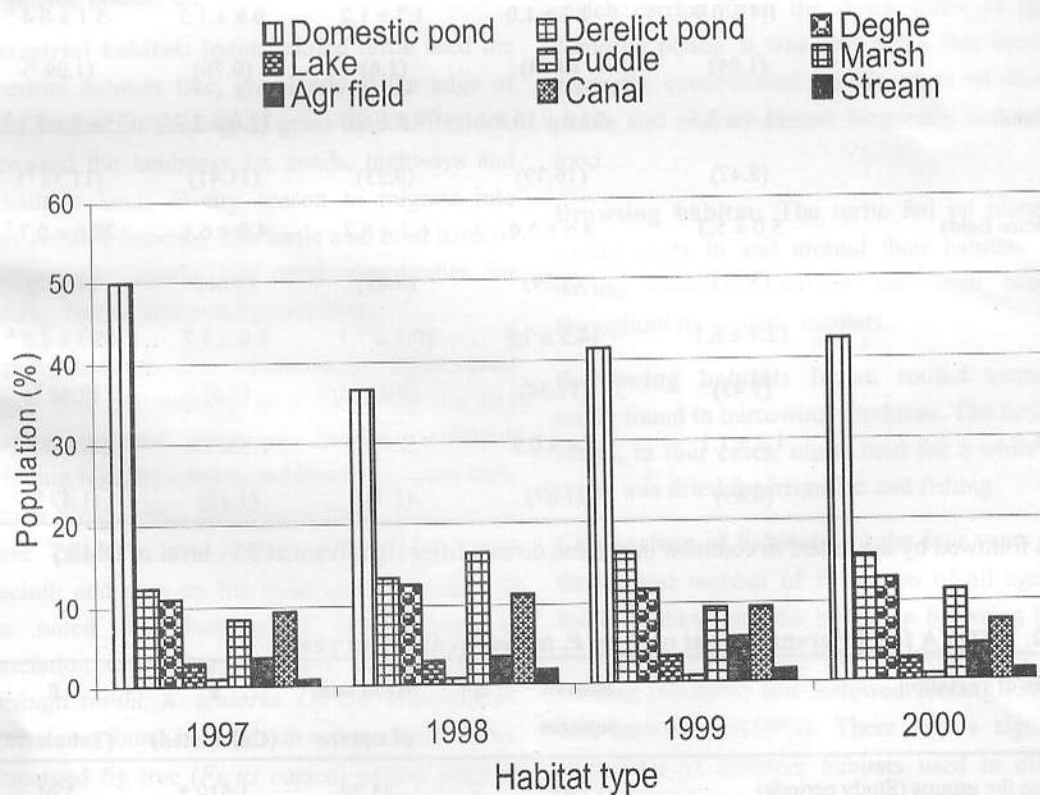


Fig. 1. Habitats used by *Pangshura rectum* in the study areas from 1997-2000.

Table 1. Habitat preferences of *Pangshura tectum* in nature (1997-2000)¹ (Figures in parentheses show percentage of occurrence).

Habitat type	Study period				Mean ± SD
	1997	1998	1999	2000	DMRT
Domestic ponds	67.2 ± 18.9 (49.93)	46.9 ± 7.7 (36.61)	44.1 ± 7.3 (41.62)	45.0 ± 4.9 (42.78)	50.8 ± 11 ^a (42.74 ^a)
Derelict ponds	16.7 ± 5.1 (12.38)	17.3 ± 5.1 (13.5)	16.4 ± 3.1 (15.47)	16.5 ± 3.8 (15.68)	66.8 ± 0.4 ^b (14.26 ^b)
Tanks	14.9 ± 3.1 (11.10)	16.2 ± 6.3 (12.64)	12.4 ± 2.4 (12.0)	13.5 ± 2.5 (12.83)	57.0 ± 1.6 ^b (12.14 ^b)
Lakes	4.1 ± 2.0 (3.05)	4.0 ± 1.8 (3.12)	3.6 ± 1.3 (3.40)	3.0 ± 2.0 (2.85)	14.7 ± 0.5 ^c (3.11 ^c)
Puddles	1.4 ± 0.9 (1.04)	1.2 ± 1.0 (0.94)	1.7 ± 1.2 (1.6)	0.8 ± 1.3 (0.76)	5.1 ± 0.4 ^c (1.09 ^c)
Marsh lands	11.4 ± 5.5 (8.47)	21.0 ± 10.8 (16.39)	9.8 ± 6.0 (9.23)	12.0 ± 3.7 (11.41)	54.3 ± 5.1 ^b (11.38 ^b)
Agriculture fields	5.0 ± 5.3 (3.71)	4.6 ± 5.6 (3.59)	6.1 ± 6.7 (5.45)	4.9 ± 6.1 (4.66)	20.6 ± 0.7 ^c (4.35 ^c)
Canals	12.7 ± 6.1 (9.43)	14.5 ± 7.9 (11.34)	10.1 ± 7.1 (9.53)	8.0 ± 3.7 (7.6)	45.3 ± 2.8 ^b (9.48 ^b)
Streams	1.2 ± 1.1 (0.89)	2.4 ± 0.9 (1.87)	1.8 ± 1.9 (1.7)	1.5 ± 1.4 (1.43)	6.8 ± 0.5 ^c (1.47 ^c)

¹Means followed by the letters in common in column do not differ significant at 5 % level of DMRT

Table 2. ANOVA for different habitat used by *P. tectum* in different years.

Sources of variation	Sum of squares	d f	Mean sum of square	F (Calculated)	F (Tabulated)
Between the groups (Study periods)	75.67	3	25.22	1.519 †	3.01
Between variety Sum of squares (Habitat)	7440.01	8	930.00	56.01**	3.36
Residual	398.47	24	16.60		

** Significant at 1% level; † Insignificant at 5% level.

Micro habitat: The Indian roofed turtle was found to inhabit in aquatic weeds like water hyacinth, water cabbage, water chestnut, watercress, *Trapa*, *Enhydra*, *Ipomoea*, *Ludwigia*, and other floating, semi-submerged and submerged, vegetation in and around the shallow water areas. In summer months, while the water level reduced to a certain depth, the food availability and shelter was hampered, and then the turtle entered into the mud. However, in case when aquatic habitats were dried up then the turtle left for other waterbodies. It was observed that *P. tectum* migrated to newly excavated places where water temporarily collects for a while. This turtle was found to adapt in habitats of different environmental conditions like puddle, drainage area, and polluted water, open latrine at the edge of the aquatic bodies, etc.

Terrestrial habitat: Indian roofed turtle used the terrestrial habitats like, grasslands at the edge of water bodies for feeding of grass-blades. Besides, it crossed the landmass i.e. roads, highways and agriculture lands in dry season to migrate into other suitable habitats. The turtle also used bank of ponds, tanks, canals, and other waterbodies for basking, resting and nesting purposes.

Basking habitat: The Indian roofed turtle, spent longer time for basking in a sunny day on any floating material such as emergent objects including logs, tree stems, sunken boats, sand bars, banana plants, semi submerged trees, piles of the waste products and rotten vegetation, water hyacinth and also on the bank aquatic bodies. It was noted that basking of this species in association with other sympatric congener's like *Kachuga smithi*, *K. tentoria*. On one occasion, *P. tectum* was found to climb up a branch of a semi-submerged fig tree (*Ficus carica*) over a pond at the height of three meters above water. The basking habitat of *P. tectum* was common in winter and parts of summer, it extended its neck and raised the head with limbs and relaxed during

basking. While basking, sometimes, one might climb up on the top of other turtles. They used to drop into water by encountering any danger or even in little disturbances.

In captive condition, the turtle was found to bask on the driftwood, floating banana plant, and the elevated portion in the middle of the cemented tank and bank of the mini ponds. But at night they remain inactive in weeds or mud under water.

Feeding habitat: The turtle was found to feed over the whole daytime by continuous movement in the aquatic habitats. Sometimes, they depended on the root of floating vegetation and also on semi-submerged weeds and fed stems or tender leaves by extending the neck. By swift crawling at the bottom of water, the turtle, sometimes, tried to snatch carrion from the down stairs of ghat of domestic ponds. It was also noted that the turtles generally concentrated on the stairs of domestic ponds and moved around frequently in search of food.

Browsing habitat: The turtle fed on plants and animal parts in and around their habitats. After having foods, *P. tectum* was seen browsing throughout the aquatic habitats.

Burrowing habitat: Indian roofed turtle was rarely found in burrowing condition. The turtle was found, in four cases, under mud for a while when water was dried for irrigation and fishing.

Comparison of habitats: In the four years study, the highest number of *P. tectum* of all ages was found basking and the lowest in browsing (Table 3). The highest percentage *P. tectum* was found basking (60.46%) that followed feeding (31.45%) and browsing (8.09%). There was a significant difference of different habitats used in different years ($F = 55.791$, $df = 11$ and $p < 0.01$) (Table 4). Das (1995) mentioned that basking takes place on riversides, banks of ponds, sandbars, driftwood and floating vegetation.

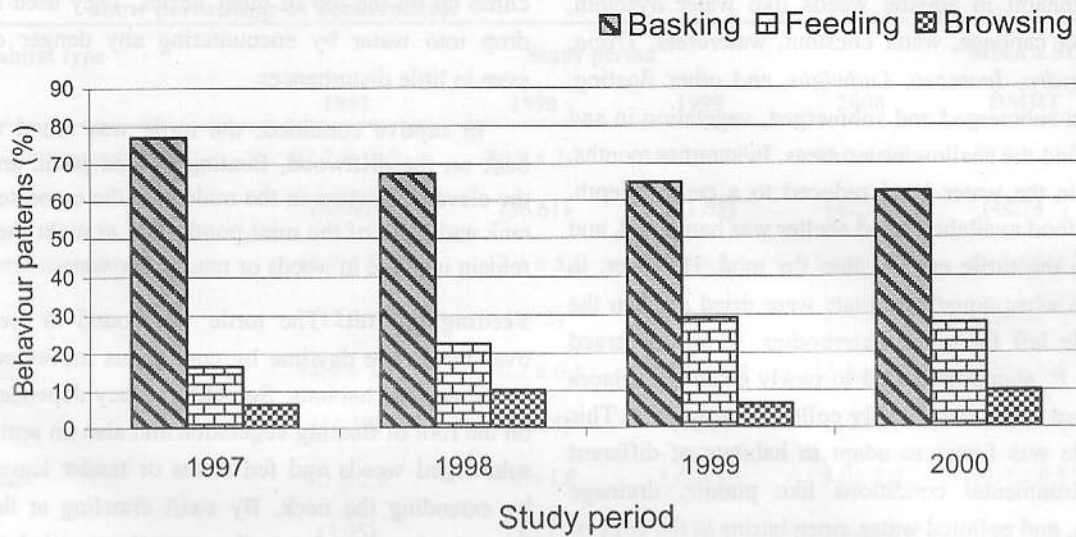


Fig. 2. Behavior patterns of *P. tectum* in nature from 1997 -2000.

Table 3. Behavior patterns *P. tectum* in nature (1997– 2000)¹ (Figures in parenthesis show percentage of occurrence)

Behavior patterns	Study period				Mean \pm SD DMRT	Percentage
	1997	1998	1999	2000		
Basking	90.0 \pm 25.2 (66.19)	75.3 \pm 14.6 (58.78)	61.8 \pm 23.9 (58.03)	59.7 \pm 19.2 (56.64)	71.7 \pm 12.1 ^a (66.09 ^a)	60.46
Feeding	36.1 \pm 32 (26.84)	39.8 \pm 29.5 (31.07)	37.9 \pm 24.1 (35.59)	35.3 \pm 21.6 (33.49)	37.3 \pm 1.7 ^b (31.75 ^b)	31.45
Browsing	8.41 \pm 4.9 (6.25)	13.0 \pm 5.3 (10.15)	6.8 \pm 2.7 (6.38)	10.4 \pm 2.2 (9.87)	9.6 \pm 2.3 ^c (8.16 ^c)	8.09

¹Means followed by the letters in common in column do not differ significant at 5 % level to DMRT.

Table 4. ANOVA for behavior patterns of *P. tectum*.

Source of variation	Sum of squares	df	Mean sum of square	F (Calculated)	F (Tabulated)
Between the groups (Patterns)	1113043.0	2	556521.6	55.79 **	8.02
Residual (Habitats)	89775.5	9	9975.56		

** Significant at 1% level

Indian roofed turtle, *P. tectum*, was observed mainly in habitat domestic ponds, derelict ponds, tanks, marshlands, canals, agriculture fields, lakes, streams and puddles. In Bangladesh, of about 1.3 million freshwater bodies, around 18% are derelict ponds (Anonymous 2002). These water bodies are filled with aquatic vegetation and used as breeding ground for mosquito and other obnoxious aquatic insects. Therefore, water bodies could be successfully brought under turtle cultivation.

The present investigation also shows that this species, as a carrion feeder helps scavenge water of water bodies thereby acts as water pollution controller.

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