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ORIGINAL ARTICLE

Eco-Ethology of Kachuga Tecta in River Yamuna

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ABSTRACT

The present work, brought about from 2018 to 2019, offers information about the eco-ethology of Kachuga in the Yamuna River at the Agra strech. Research output came up as Kachuga tecta focused on its habit (behavioral patterns). The Kachuga in its natural state was studied, viz., basking, feeding, browsing, and burrowing and habitat preferences as along the Ghat, under vegetation, lotic section (flowing river with pace), and drainage point under pollutional stress are mentioned in the present paper.

Key words: *basking, lotic section, digging, bangladesh*

INTRODUCTION

The present study of river Yamuna was conducted at 3 sampling stations(Sites) viz., Poia Ghat site ("1'), Rambagh site ("2") and Taj tourist walk site("3") and within a stretch of 12 kms. Investigation on Bio-eco-ethology of turtle species *Kachuga tecta* was done. Here according to plan of work three stations aforesaid were studied hence here only geography of such particular section of Yamuna stretch is mentioned. The river Yamuna at Agra lies between 27º11′2.59″N latitude and 78º1′47.58″E longitude in general at an average altitude of 561 feet above the sea level.

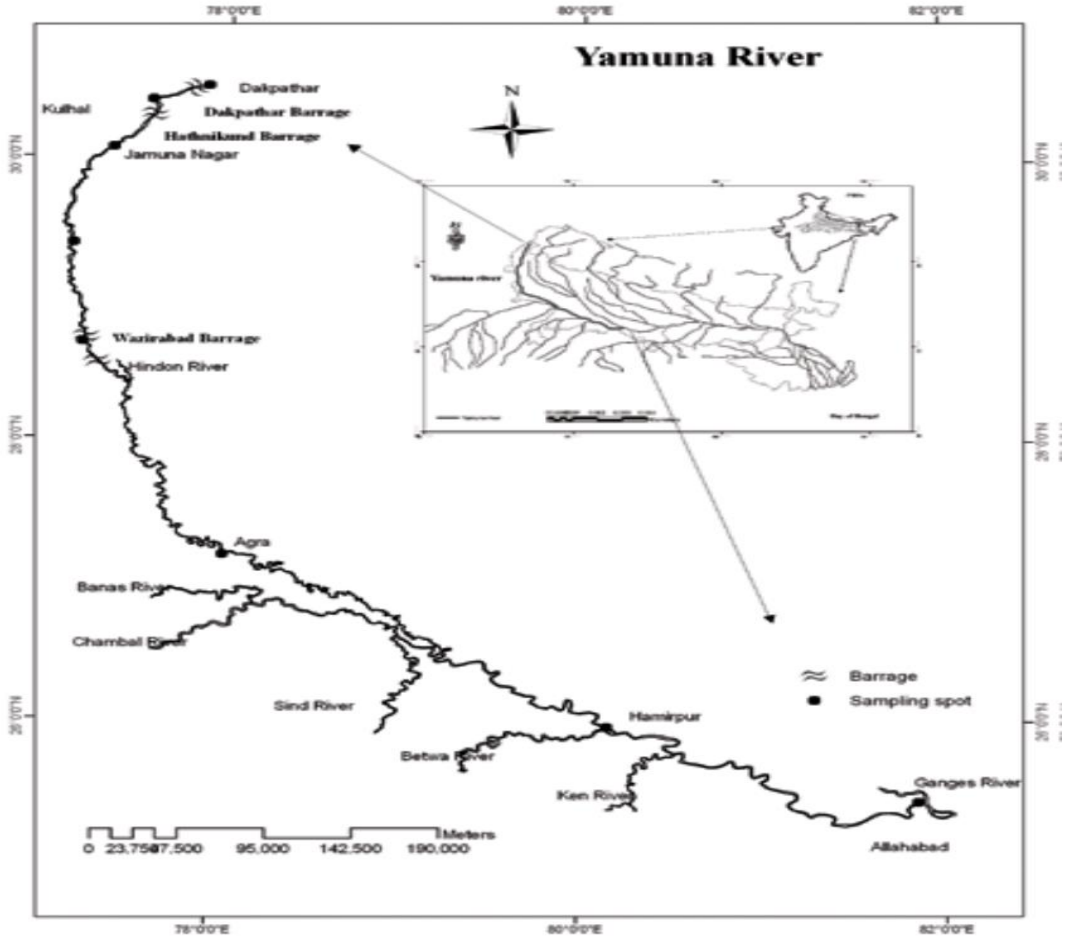
The city is famous for its leather industries around the globe that is artificialy discharging untreated wastewater from domestic sewage and indusrial effluents in the river Yamuna, the ultimate source of water for daily needs for people. Along with tanneries, various other industries like that of metal plating, metal refining, iron, generators making and glass industry are also located in the premises of the city which adds to the melancholy of the Agraites.

Pope (1939 and 1955), Ashley (1955), Carr (1952), Brongersma (1969) assessed the eco-biology and natural history and hierarchy of certain chelonians. In present research author didn't take physicochemical factors into consideration, but he selected the sites where kachuga lived in different levels of pollution. He studied the different habits and different habitat along different locations. Which location was fittable for kachuga in term of its eco-ethology, it was discussed in this paper using perfect stastistical analysis, ANOVA. Some research works have also been carried out on the ecology, habitat status and the trend of trade of freshwater turtles and tortoises in Bangladesh and other countries by Nicolas (1995), Shrestha (1995; 1997), Sarker and Hossain (1997), Hossain (2000), Sandra and Daniela (2000), Narayan *et al*. (2006).

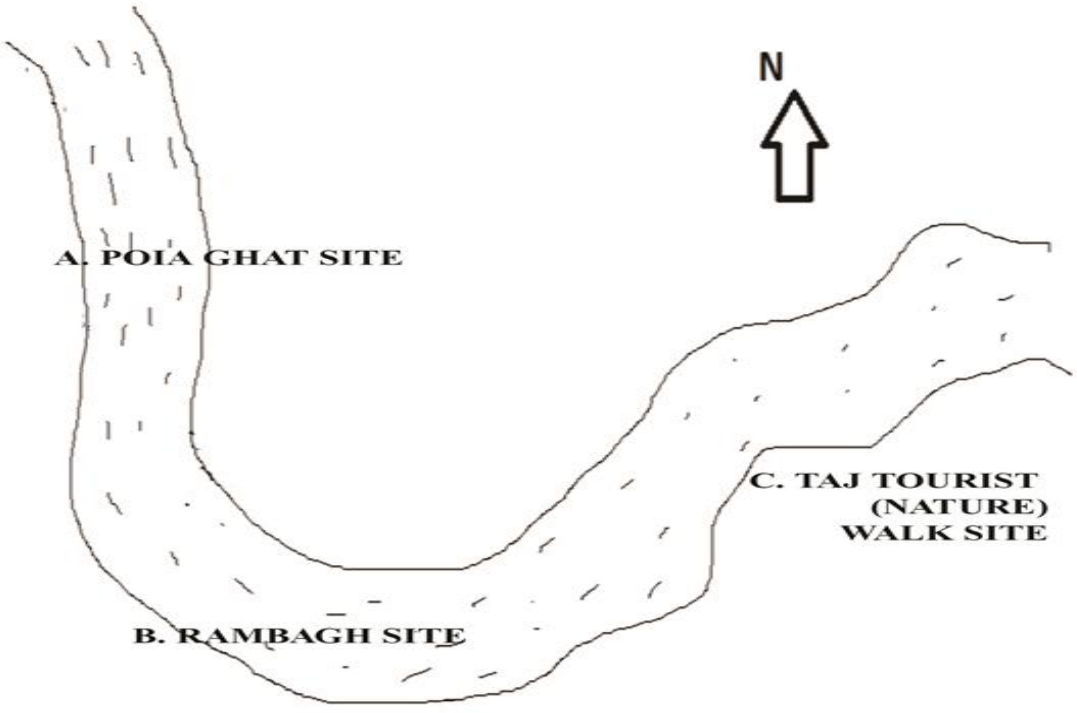
METHODOLOGY

FOR ECO-ETHOLOGY:

Four kinds of habits (behavioral patterns) of Kachuga in natural state were studied viz., Basking, Feeding, Browsing and Burrowing. To watch their activities in natural sites like A, B & C, author tried to notice their all behavior aforesaid and readings were taken (mentioned in observation section of this thesis). all readings were taken from march 2018 to February 2019. In 12 months all habits were looked by author in each month and their mean values were tested for further calculation and interpretations. Basking habit was observed by seeing them as they were laid open in low depth regions under direct sunlight as sun bath or sun rest at all stations. During basking most of them were climbed up each other. They extended their necks, raised their heads and finally relaxed. Their month-wise frequency noted down and all values changed by taking their respective habits, statistical means.



Map: this map is taken fro the book The Ecology and Fishery Status of River Yamuna by A. P. Sharma, M.K. Das, S. Samanta, S.K. Paul and S. Bhowmick.



Rough design of Experimental station in river Yamuna at Agra Stretch.

When there was a sunny day they were laid on logs, stems, sand bars, thick plants debris, litter, rotten & river side floating vegetation, the most of the kachuga were found as baskers showing their *basking* pattern along the banks of river at each studied site viz., 1, 2 & 3. When they were found in usual way moving in any niche, they were observed *feeding* on submerged weeds and soft plant tissues along the water surface to a little depth. While if author watched them feeding at water bottom they were involved feeding on rotten fishes and carried from Yamuna ghats.
Next habit observed was *browsing*. Some of the Kachuga those were fed (plants and animals parts) earlier around their habitats, they started browsing. Their no. was counted as in previous counting for other habits. *Burrowing* habit of kachuga was located by the presence of breathing hole and from grass bed and other habitats along with their trails. Their no. also were counted as in previous counting for other habits. For conclusion 2 way ANOVA test was applied and counted tabulated and calculated values. Acceptance or rejection of Null hypothesis (H_0) was verified by both values comparison at level of 5% significance.
Habitat preference of each turtle species was determined by river area observation with the help of a binocular. Habitat types were marked by taking the river bank status, flora nature (both aquatic and terrestrial) and the water depth during summer. Whenever Kachugas were sighted, the observations with respect to the species, total animals, sex, location etc. were recorded in the field map sheets. Four kinds of habitat preferences or choices of kachuga in natural state (at each site of river Yamuna as 1, 2 & 3) was studied 1. *Along Ghat, 2.Under vegetation, 3.Lotic section (flowing river with pace) and 4. Drainage point* (where drains leading in to river at all studied sites). No special method was applied for noting their separate habitats. Only their number or density or frequency was taken as readings. Author took help local fisherman and washerman while to count the numbers of turtles from lotic section as flow of water was faster and on drainage points. For their counting morning hours were chosen at each month during the study. Their monthwise frequency noted down and all values changed by taking their respective habitats, statistical means. For conclusion 2 way ANOVA test was applied and counted tabulated and calculated values. Acceptance or rejection of Null hypothesis (H0) was verified by both values comparison at level of 5% significance.

OBSERVATIONS

Habit (Behaviour Patterns) of Kachuga Tecta at Three Different Sites 1, 2 & 3 . All Values Are Average Values Taken From One Year Values through Monthly Readings

Table 1: Habitat Preference of Kachuga Tecta at Three Different Sites 1, 2 & 3. All Values Are Average Values Taken From One Year Values through Monthly Readings

S.NO.	HABIT	SITE 1	SITE 2	SITE 3
1	Warming up (Basking)	25	19	18
2	Feeding (Eating)	18	08	18
3	Looking around (Browsing)	14	15	11
4	Burrowing (Digging)	7	10	4

Table 2: Habitat Preference of Kachuga Tecta at Three Different Sites 1, 2 & 3 (Shallow Area)

HABITAT	SITE 1	SITE 2	SITE 3
Shallow area (Along ghat)	25	18	28
Hide Under vegetation	18	12	9
Flowing area (Lotic section)	10	18	12
Exit points of nallah (Drainage point)	20	24	18

RESULT AND DISCUSSION

Four type of ethology or habits of living or behaviour pattern were observed at 03 experimental sites viz. "1", "2" and "3" as research focused over biological characteristics studied for biotic factors (eco-ethology). Firstly author observed, analysed and concluded , while studying kachuga habits in 4 states as 1. Warming up (basking) 2. Eating (feeding) 3. Looking around (browsing) and 4. Digging (burrowing)

Among four types of habits at site "1", 25 Kachuga were observed in basking state, 18 kachuga found in feeding state ,14 found doing browse and only 7 were in state of burrowing. At station "2" the number for all for habits one by one as 19, 08, 15, 10 respectively. Likewise At site "3" the number for all for habits one by one as 18, 18, 11, 04 respectively.

Thus if we analyze 04 kinds of ethology of state of nature or habits of kachuga at 3 studied sites then by investigating and interpreting the data it was confirmed that no considerable difference in the numericity of turtles in 04 habits at 03 sites.

When two way ANOVA classification method applied with table was interpreted author concluded doing experiments that between seasons F1 (calculated value) was -5.0369, while F1 (tabulated value) was 4.76 @ 5% level of significance. Calculated value was very lower than tabulated value; its means Null (Ho) Hypothesis was accepted, because no difference was found , it just insignificant.{Ho = no difference between habits in different seasons}. At between sites, when author observed that calculated values (-6.948) found less than tabulated ones (19.33@ 5% level of significance); again difference was totally insignificant. In this case again Ho accepted , so no difference among ethological pattern or Habit or behaviour among stations or sites was noticed .

It is conclude that all 3 sites like 1, 2 & 3 did not showed difference in their habits; its means four kinds of habits through all sites were not different in their individual spectrum i.e., at all sites. Basking nature had highest peak and burrowing was least though difference in their density was statistically indifferent.

Therefore no special factor was responsible for their changing in numbers for population density different stations. All three stations or sites had same proportion in their habits. The same frequency of showing the nature of basking at highest (60.46%) and lowest as browsing (8.09%) in Indian roofed turtle, Pangshura tectum in Bangladesh by Hussain *et al*., 2006. Das in 1985 mentioned that basking habit found in riversides, along banks of ponds, ditches and floating vegetation. In present investigation all kinds of habit shown by kachuga almost along the riverside. Hossain *et al*., 2012 noted food habits and feeding behaviour of spotted flapshell turtle in Bangladesh. They observed that food consumption was highest in monsoon and lowest in winter season. Feeding frequency was higher in captivity than in nature. The species was carnivorous. The present study resembles in term of higher feeling in monsoon season.

Second parameter as a part of ecological feature was observed as Habitat preferences (occurrence or distribution) of Kachuga at three different stations viz., 1, 2 & 3 .

Four types of Habitat (niches) preferences was given by Kachuga as 1.Along ghats 2. Under vegetation 3. Lotic section of river 4. Drainage points. These above four types of niches were located in each experimental station (1, 2 & 3). From 1 total 73 Kachuga were seen. Among those maximum density was found along the ghats and minimum as in the lotic section of river (flow is higher). Almost same occupancy was observed at 2 and 3 sites. (72 & 67 in numbers). Trend of occurrence was noted at all studied sites as along ghats (muddy bottom in marshland area) >Under vegetation > Drainage points > Lotic section of river.

When author made 2 way ANOVA table some interpretation came up as follows: Between habitats : calculated values (14.63) > expected values (4.76) @ 5 % level of significance. Thus in such case H_0 became rejected i.e., difference was just significant, means 4 types of habitat were inhabitated by different numbers or frequency of Kachuga and this was statistically proved. It clearly indicates that difference in frequencies of occurrence of turtle species in different habitats might be due to certain reasons, like at moderate pollutional sites they were higher in numbers as at Along ghats, Under vegetation, Drainage points than lotic section of river.

No anyone physico-chemical parameter was able to effect the frequency of turtle in other studies. Same trend of habitat preference was read out at all three sites 1, 2 & 3. Even at drainage points

where maximum dirtiness found, frequency of turtle was in moderate proportion that justifies that they act as scavangers of liteer, diry things of river instead of being polluto-sensitive species.
Although different researchers had analysed water quality of Yamuna river but no evidence is available yet which supports the hypothesis of adverse or negative or lethal or toxic impact of any physico-chemical parameter or character on turtle,s density in per unit area in per unit time.
In present thesis researcher is supposed to find or explore the new area of research on turtle – Kachuga tecta having been impacted by limnology of river Yamuna.
In present research physicochemical parameters were not calculated but on the basis of locations of river Yamuna it can be said that no factor or parameter inspite of having sharp changed values of their concentartions over time period had probably nothing to do or had no adverse effects with and over eco-ethology including counting, distribution, abundance and other studied parameters in question. Shrestha, (2008) investigated that weedy sites, slow running rivers, oxbows lakes reservoirs with muddy bottom had been preferable niches for flapshell turtles. His work corroborates with present work since in later work along ghats and under vegetations locations have been most choosy habitats for turtle species.
Over four years study on habitat of spotted flapshell turtle, Lissemys punctata in Bangladesh, Lokman Hossain (2008) *et al*., enumerated that maximum density of *L. punctata* was observed along marsh lands and agricultural lands (macro-habitats). They observed highest abundance (19.4%) in 1999 and lowest abundance (16.1%) in year 2000. Their works resembles with present work on Yamuna as in latter Kachuga got asylum or preferred habitat along the ghats with muddy and marshy lands under water at all experimental stations. Although their work has difference with present task in other aspects as they found turtles mostly in terrestrial habitats while in present task the entire investigation was accomplished in aquatic habitat.

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