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Feeding Ecology and Growth Performance of the Critically Endangered *Batagur baska* in Captivity

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***Abstract*.—We studied the feeding ecology of hatchling and juvenile Northern River Terrapin (*Batagur baska*) from April 2017 to April 2018 in captivity in Bangladesh. We made direct observations daily after providing foods in the late morning around 0930. We weighed food before and after the feeding season to measure the amount of food intake. We also obtained growth measurements at the end of the month. The consumption of greens was highest by the hatchlings (82%) and juveniles (73%), followed by vegetables (11% and 12%, respectively), fruits (6% and 10%), fresh shrimp (1% and 2%), and dry shrimp (0.3% and 2%). Food consumption and growth increased during the rainy and summer seasons. Food consumption was lower in January relative to the remainder of the year. Growth of juveniles increased from April to November and that of hatchlings from July to November. There were no substantial differences in food consumption among seasons. The relationship between food consumption and growth in body mass, carapace length, and plastron length were positive and significant for both juveniles and hatchlings. We also found positive and significant relationships between mean body mass and growth in carapace length and plastron length for both juveniles and hatchlings. Food consumption had significant and large effects on hatchling and juvenile growth. We found hatchlings attained higher growth rates than juveniles. Our study summarizes the food preferences, consumption rates, and associated growth rates that can be applied to range-wide captive breeding and rearing activities as a protocol for *Batagur baska*.**

Key Words.—Bangladesh; *ex situ* conservation; food and feeding; hatchlings; juveniles; Northern River Terrapin

Introduction

The Northern River Terrapin, *Batagur baska* (Gray 1830), is one of the largest estuarine and long-lived emydids in the world (Pandit 2013). *Batagur baska* has a distribution that includes India, Bangladesh, and Myanmar (Praschag et al. 2008a,b; Moll et al. 2009; Weissenbacher et al. 2015; Praschag and Singh 2019). During the 19th and 20th centuries, large populations of this species were present in the Hugli River of India and the Ayeyarwady and Bago rivers of Myanmar (Praschag et al. 2008a,b; Moll et al. 2009). In Bangladesh, *B. baska* is known to occur in large rivers and estuaries in the coastal districts of Noakhali, Barisal, and Khulna (Morshed and Sobhan 2014). The global wild population of *B. baska* has decreased by more than 90% over the last two centuries. From being abundant in the 19th Century, this species now has fewer than 100 mature individuals remaining (Praschag and Singh 2019). Populations of this species have also been decimated in the wild in Bangladesh (Moll 2009; Weissenbacher et al. 2015). This decline is attributable to a variety of causes, including removal of the mangrove forests and sand mining (Moll 1997; Moll et al. 2009; Pandit 2013; Behera et al. 2019), exploitation of eggs and adults, and loss, degradation, and fragmentation of habitat (Pandit 2013; Weissenbacher et al. 2015; Stanford et al. 2018; Praschag and Singh 2019; Behera et al. 2019). Other causes of decline include the illegal turtle trade (Rashid and Khan 2000; Praschag and Singh 2019), incidental capture in fishing nets and traps, accidental death by collision with motorboats, loss of nesting beaches, destructive fishing practices, and unseasonal floods (Pandit 2013). These causes pose serious threats to this species globally, including in Bangladesh (Moll et al. 2009; Pandit 2013; Praschag and Singh 2019). The species is now ranked as Critically Endangered (CR) globally by the International Union for Conservation of Nature (Moll et al. 2009; Stanford et al. 2018; Praschag and Singh 2019) and regarded as one of the most threatened chelonians in the world (Das 1997; Rhodin et al. 2018; Stanford et al. 2018). *Batagur baska* is also listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix I, where commercial trade of the species is strictly prohibited (Praschag and Singh 2019).

Understanding the feeding ecology of a species is an essential component of assessing its ability to survive and is vital for management and conservation plans, whether in undisturbed or highly disturbed habitats (Rahman et al. 2015). *Batagur baska* consumes whatever is available in their habitat to maximize the daily intake of required energy and nutrients to thrive and survive (Duli 2009). They are browsers, often feeding sporadically for several hours before satiation (Moll et al. 2009). Most feeding occurs at high tide when vegetation is exposed and fruits from low hanging limbs hang down in the water (Moll 1984). The species is omnivorous but predominantly herbivorous from the hatchling stage (Moll 1978, 1980; Pandit 2013). Besides leaves and stems, fruit (overwhelmingly mangrove fruit) and mollusks shells (pelecypods of unidentified species) were found in the fecal samples of *B. baska* (Moll 1980; Whittaker 1983; Moll et al. 2009).

Concerning their threatened conservation status, the Bangladesh Forest Department, the Turtle Survival Alliance, Zoo Vienna, Austria, and *Prokiti o Jibon* Foundation, Bangladesh, have undertaken species recovery efforts under Project Batagur. Recovery largely includes species reintroduction enabled by captive breeding efforts at Bhawal National Park in Bangladesh (Morshed and Sobhan 2014; Weissenbacher et al. 2015). The knowledge obtained from zoo-based research is especially important for species whose natural population become limited or decimated, such as *B. baska*, and can also contribute significantly to the survival of offspring hatched or born in the natural habitat (Weissenbacher et al. 2015). Therefore, the current study aimed to investigate the preferred food items, monthly and seasonal variation in food consumption, and growth response of hatchlings and juveniles with foods provided in captivity. The study provides baseline information and knowledge that can be applied to future captive breeding and rearing activities for population recovery programs. The study will also provide insights for future conservation efforts of the species in Bangladesh or elsewhere in the world.

Materials and Methods

Study area and tank facilities.—We conducted the study from April 2017 to April 2018 at Bhawal National Park, (24°5′45″N, 90°24′14″E), Gazipur, Bangladesh. This study site inside the park has 15 cement rearing tanks for juveniles and hatchlings. Seven tanks were large (4.27 × 3.04 × 0.91 m) and eight tanks were smaller (1.83 × 1.83 × 0.91 m). Each tank has watering and dewatering facilities, and the water depth of both sized tanks was 0.76 m.

We used five juveniles (four from the year 2014 and one from 2015), and 61 hatchlings from 2017 in our study. We obtained hatchlings after hatching of eggs in June 2017 and no foods were provided that month, but we measured their growth at the end of the month. We tagged both hatchlings and juveniles with Passive Integrated Transponders (PITs) to enable individual identification. Two of the 61 hatchlings died, one in February and another in March of 2018. As a result, we studied 60 individuals in February and 59 individuals in both March and April of that year. We differentiated hatchlings and juveniles by their age and morphology. We distinguished juveniles from adults by size, carapace shape, and plastron color (Pritchard and Trebbau 1984; Ernst and Barbour 1989). We confirmed that our turtles were hatchlings after comparing our initial measurement of carapace length (CL), plastron length (PL), and body mass (BM) to the measurements of an average CL of 60 mm, PL of 55 mm (Edward O. Moll, unpubl. report), and average BM of 45 g (Sanyal and Seth 1992). We also considered hatchlings to be 11 mo old and juveniles to be 34–45 mo old. During this study, we used two large and five small tanks for rearing juveniles and hatchlings, respectively. We labeled each tank with the number of individuals it contained: tank number 1 had four juveniles, tank number 2 had one juvenile, and tank numbers 3–7 had nine, 10, 13, 13, and 16 hatchlings, respectively. We changed water in all tanks once a week to maintain good water quality. We divided the study period into summer (March-June), rainy season (July-October), and winter (November-February).

Feeding protocols and monitoring.—We categorized food as greens including Water Hyacinth (*Eichhornia crassipes*), Water Spinach (*Ipomoea aquatica*), Cabbage (*Brassica oleracea*), and Taro (*Colocasia esculenta*) leaves; fruits including banana (*Musa* sp.) and Jackfruit (*Artocarpus heterophyllus*); vegetables including Sweet Gourd (*Cucurbita maxima*) and Wax Gourd (*Benincasa hispida*), and animals including fresh shrimp (*Penaeus* sp.), dry shrimp (*Macrobrachium* sp.), and mollusks (*Pomacea* sp.). We provided *I. aquatica* and *E. crassipes* following Nyok and Heng (2005), Moll et al. (2009), and Pandit (2013). We also followed Weissenbacher et al. (2015) and Nyok and Heng (2005) to provide fruits and animal food. We provided *B. oleracea*, *C. esculenta*, and vegetables (*C. maxima*, *B. hispida*) based on their omnivorous feeding habit. We offered hatchlings and juveniles the same food items provided on the surface of the water in each tank. We adjusted the amount of food according to the size and abundance of hatchlings and juveniles in each tank. Among the limited food supply in the project site, we measured feeding preferences for both hatchlings and juveniles based on the amount of food consumption per day. We identified highly preferred foods when hatchlings and juveniles consumed these items whole or left very small parts, whereas if most of the food remained, it was referred to as least preferable food. We supplied food in the late morning (0930).

Before provisioning, we measured the weight of the meals using a digital scale. We offered foods regularly, twice a day for hatchlings. We also provided foods once a day for the juveniles but when we observed rapid growth, we changed the food schedule immediately. We did not provide any food every fourth day to juveniles to avoid problems with bone calcification resulting from excessive growth rates (Weissenbacher et al. 2015). We cleaned the remnants of food every day before delivering fresh food items. We calculated the amount of food consumed by groups of turtles by subtracting the remnants from the supplied food items. We supplied the selected food items for 22 d in a month and we did not provide food in 8 d. We supplied only greens for 10 d, vegetables mixed with greens for 6 d, fruits mixed with greens for 4 d, and animal diets mixed with greens for 2 d. We spent 5–6 d each month in the project site. In our absence, the caretaker of the project recorded feeding data according to our prescribed instructions for the rest of the days and we collected it afterward.

Observing growth performance.—We monitored growth rate by taking measurements of BM, CL, carapace width (CW), PL, and carapace height (CH) to the nearest 0.01 mm using a slide caliper. We measured the growth of juveniles and hatchlings for 12 mo (April 2017 to March 2018) and 11 months (June 2017 to April 2018), respectively. We evaluated the growth of hatchlings and juveniles in terms of the mean mass gained by the individual as well as the mean increase in CL and PL per individual.

We processed data in computer software in combination with Statistical Package for Social Science (SPSS Inc., Chicago, Illinois, USA) and (MS Excel Inc., Westerville, Ohio, USA). We performed Repeated Measures ANOVA and Simple Linear Regression to find the relationship between the amount of consumed food and growth rates of turtles. We also assessed the relationship between mean mass and growth using Linear Regression. Furthermore, we used One-way ANOVA with Bonferroni *post hoc* comparisons to identify differences in food consumption among seasons. We determined statistical significance at $P < 0.05$.

Results

Food preferences and consumption.—We observed variation in food choice and consumption between hatchlings and juveniles. *Batagur baska* preferred *I. aquatica*, *C. maxima*, *Musa* sp., and both *Penaeus* sp., and *Macrobrachium* sp. *Brassica oleracea*, *C. esculenta*, *B. hispida*, *Pomacea* sp., and *A. heterophyllus* were the least preferred foods. We found the highest consumption of greens (82% for hatchlings and 73% for juveniles) followed by vegetables (11% and 12%, respectively), fruits (6% and 10%), fresh shrimp (1% and 2%), and dry shrimp (0.3% and 2%). Greens made up the larger of the food consumed by juveniles (Table 1) and hatchlings (Table 2).

Juveniles consumed a large amount of food (1.57–1.96 kg/mo) from August to December and less food (0.92 kg/mo) from June to July (Table 1). In the case of newly emerged hatchlings, the amount of consumed

Table 1. Diets and the total amount of food consumed each month (in kg) by five juveniles of the Northern River Terrapin (*Batagur baska*) from Bangladesh. The abbreviation Veg. = vegetables.

	Shrimp					
Month	Fresh	Dry	Veg.	Greens	Fruits	Total
April 2017	0.03	0.02	0.14	0.73	0.08	1.31
May 2017	0.03	0.02	0.26	0.69	0.10	1.10
June 2017	0.03	0.02	0.10	0.69	0.08	0.92
July 2017	0.03	0.02	0.06	0.73	0.08	0.92
August 2017	0.03	0.02	0.16	1.16	0.20	1.57
September 2017	0.03	0.02	0.20	1.12	0.20	1.57
October 2017	0.03	0.02	0.25	1.46	0.19	1.96
November 2017	0.03	0.02	0.25	1.28	0.20	1.79
December 2017	0.03	0.02	0.25	1.32	0.20	1.83
January 2018	0.03	0.02	0.12	1.00	0.08	1.25
February 2018	0.03	0.02	0.12	0.85	0.08	1.10
March 2018	0.03	0.02	0.12	1.00	0.08	1.25
Total	0.37	0.25	2.03	12.03	1.57	16.6

Table 2. Diets and the total amount of food consumed each month (in kg) by hatchlings of the Northern River Terrapin (*Batagur baska*) from Bangladesh. There were 61 hatchlings in each month except for February 2018 (n = 60) and March and April 2018 (n = 59). The abbreviation Veg. = vegetables.

	Shrimp					
Month	Fresh	Dry	Veg.	Greens	Fruits	Total
July 2017	0.001	0.001	0.004	0.03	0.0	0.04
August 2017	0.003	0.002	0.04	0.58	0.0	0.62
September 2017	0.003	0.002	0.06	0.54	0.0	0.60
October 2017	0.005	0.003	0.12	0.93	0.06	1.12
November 2017	0.005	0.003	0.12	0.90	0.06	1.09
December 2017	0.005	0.003	0.12	0.93	0.03	1.09
January 2018	0.020	0.003	0.12	0.81	0.08	1.03
February 2018	0.020	0.003	0.12	1.06	0.14	1.34
March 2018	0.010	0.003	0.12	0.81	0.08	1.02
April 2018	0.010	0.003	0.12	0.78	0.08	0.99
Total	0.082	0.026	0.94	7.37	0.53	8.95

Table 3. Monthly average growth in body mass (BM), carapace length (CL), and plastron length (PL) of five juvenile Northern River Terrapin (*Batagur baska*) from Bangladesh. The abbreviation SD = standard deviation.

	BM (g)	CL (mm)	PL (mm)
Month	Mean ± SD	Mean ± SD	Mean ± SD
April 2017	322.4 ± 56.4	127.8 ± 6.3	112.6 ± 8.7
May 2017	343.6 ± 58.1	133.4 ± 7.1	118.0 ± 3.7
June 2017	404.0 ± 49.5	136.0 ± 8.2	118.8 ± 6.8
July 2017	428.0 ± 69.0	141.2 ± 6.9	123.4 ± 6.9
August 2017	458.8 ± 75.7	143.6 ± 7.4	126.6 ± 7.2
September 2017	488.8 ± 86	148.4 ± 8.0	130.2 ± 7.8
October 2017	518.4 ± 92.3	150.4 ± 9.1	131.4 ± 8.7
November 2017	530.8 ± 95.4	150.2 ± 9.3	132.0 ± 8.6
December 2017	522.8 ± 93.7	151.0 ± 9.0	133.0 ± 9.0
January 2018	528.2 ± 112.5	151.0 ± 9.0	133.0 ± 9.0
February 2018	522.8 ± 100.8	152.0 ± 11.6	133.0 ± 9.0
March 2018	522.0 ± 102.9	152.0 ± 11.6	133.0 ± 9.0

food was smaller (0.04 kg/d) in July, but the food consumption of hatchlings increased each month up to December (Table 2). The amount of consumed food by juveniles and hatchlings decreased in January. Food consumption was not significantly different among seasons for hatchlings ($F_{2,7}$ = 3.151, P = 0.106) or juveniles ($F_{2,9}$ = 1.413, P = 0.293).

Growth.—Average BM, CL, and PL of juveniles increased each month from April to November (Table 3). There was no increase in average BM from December to March and the highest average BM was achieved in November (Table 3). There was also no growth in CL or PL from December to March (Table 3). The average BM of hatchlings at emergence was 46.7 g (Table 4) and BM increased each month from July to November (92.1–164.6 g). There was no increase in average BM from December to March, and the average BM was highest in April. The growth in CL and PL was 61.82 mm and 56.8 mm, respectively, in the first month after hatching. The average growth of hatchlings for CL and PL increased each month (Table 4). Comparison between body size (CL and PL) and BM for both hatchlings and juveniles showed that the growth rate was higher in hatchlings than in juveniles (Fig. 1). The mean BM of hatchlings doubled within the first month (mean mass 92.1 ± 9.6 standard deviation g; Table 4).

Table 4. Monthly average growth in body mass (BM), carapace length (CL), and plastron length (PL) of hatchling Northern River Terrapins (*Batagur baska*) from Bangladesh. There were 61 hatchlings in each month except for February 2018 (n = 60) and March and April 2018 (n = 59). The abbreviation SD = standard deviation.

	BM (g)	CL (mm)	PL (mm)
Month	Mean ± SD	Mean ± SD	Mean ± SD
June 2017	46.7 ± 2.5	61.82 ± 1.8	56.8 ± 2.8
July 2017	92.1 ± 9.6	83.69 ± 2.7	72.36 ± 3.4
August 2017	113.3 ± 10.0	92.64 ± 3.3	79.46 ± 3.9
September 2017	140.7 ± 20.0	101.2 ± 3.7	87.33 ± 4.0
October 2017	159.3 ± 16.0	104.4 ± 3.6	89.98 ± 3.6
November 2017	164.6 ± 17.0	106.7 ± 4.5	91.98 ± 3.8
December 2017	163.8 ± 17.0	106.0 ± 3.8	92.25 ± 3.9
January 2018	163.1 ± 17.0	106.2 ± 83.6	92.49 ± 3.8
February 2018	160.0 ± 17.0	106.2 ± 3.8	91.88 ± 3.8
March 2018	163.5 ± 17.0	106.2 ± 4.0	92.32 ± 3.9
April 2018	175.9 ± 21.0	107.8 ± 4.3	93.92 ± 4.2

The measures BM, CL, and PL for both juveniles and hatchlings were significantly positively related to food consumption (Fig. 2, Table 5). Food consumption had a significant and large effect on the growth of hatchlings and juveniles (Table 6). We also found positive and significant relationship between mean body mass and growth for CL and PL of both juveniles and hatchlings (Fig. 3, Table 5).

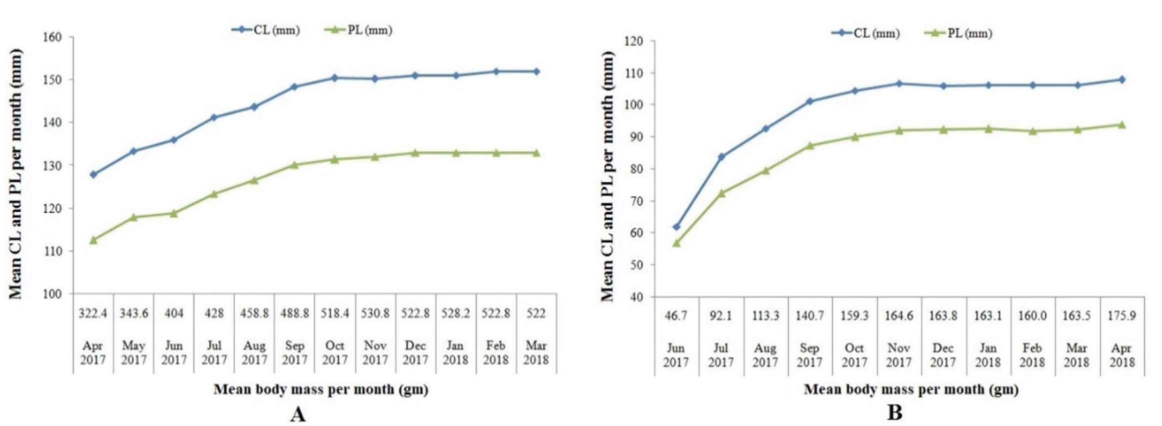

Figure 1. Relationship between body size (carapace length, CL, and plastron length, PL) and body mass of (A) juvenile and (B) hatchling Northern River Terrapins (*Batagur baska*) from Bangladesh.

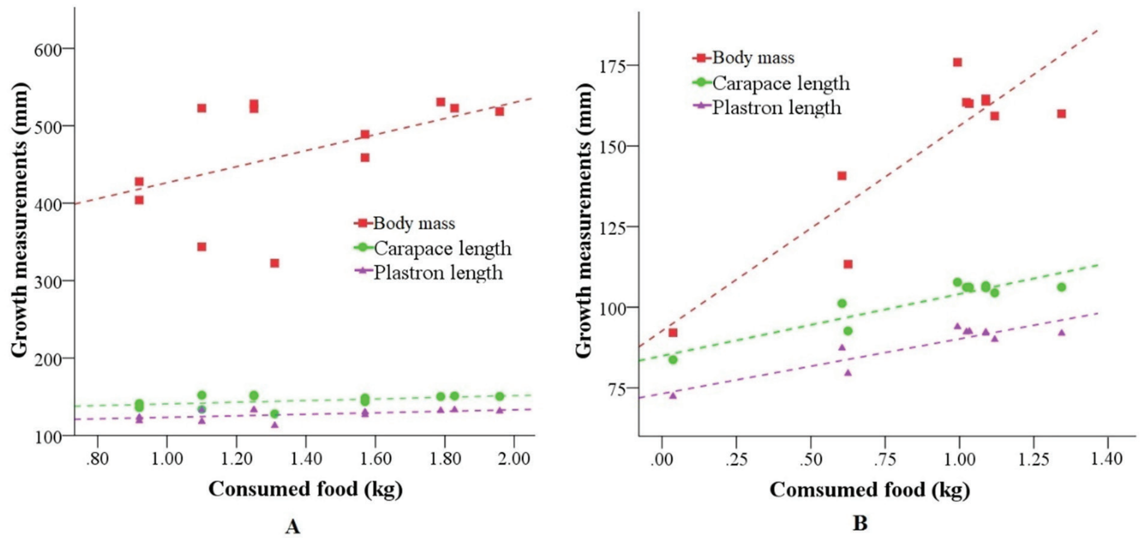

Figure 2. Growth of *Batagur baska* in relation to consumed food of (A) juvenile and (B) hatchling Northern River Terrapins (*Batagur baska*) from Bangladesh.

Discussion

Consumption and preferred food items.—*Batagur baska* is a highly omnivorous species (Moll 1984; Duli 2009; Pandit 2013) and is predominantly herbivorous in the wild (Smith 1931; Moll 1978; Pandit 2013). We found both hatchlings and juveniles consuming greens, vegetables, animals, and even a variety of fruits, which support the findings of Moll et al. (2009) and Weissenbacher et al. (2015). Consumption of greens was the highest by both age categories, which accelerated sustained growth and satisfied their nutritional requirements (Duli 2009). *Ipomoea aquatica* was the most preferred plant food for both hatchlings and juveniles. This plant maintains a constant growth rate of turtles when turtles are held in freshwater for a more extended period (Moll et al. 2009). It also produces the best overall growth rate and hatchlings highly preferred this food item (Norkarmila et al. 2002; Nyok and Heng 2005; Duli 2009). We supplied *E. crassipes* for its water purifying characteristic and both hatchlings and juveniles fed on this plant, but only at low rates. Our results match those of Halimah (1987) who stated that *E. crassipes* was least consumed and produced the poorest growth rate for *B. baska*.

Animal food, including fresh and dry shrimp, fish, and pellet feeds, supported high growth rates of hatchlings and juveniles, probably due to their high protein content (Moll et al.2009; Weissenbacher et al. 2015). In the wild, *B. baska* consumes more animal food such as mollusks to gain enough protein and calcium to reach the adult stage (Duli 2009; Pandit 2013). Norkarmila et al. (2002) also observed rapid growth of hatchlings fed fish and pellet feed, as did Nyok and Heng (2005), who provided dietary protein via frog feed and Tilapia (*Tilapia* sp.) feed. During the study period, both hatchlings and

Table 5. Regression analysis showing the relationship between consumed food and mean body mass with growth of hatchling and juvenile Northern River Terrapins (*Batagur baska*) from Bangladesh. The abbreviation Adj. = adjusted.

Growth parameters	Hatchlings			Juveniles		
	Adj. r^2	Regression equation	*P*-value	Adj. r^2	Regression equation	*P*-value
Consumed Food						
Body mass	0.775	92.65 + 63.65 × consumed food	< 0.001	0.166	322.91 + 103.56 × consumed food	0.003
Carapace Length	0.823	84.86 + 19.20 × consumed food	< 0.001	0.133	129.88 + 10.78 × consumed food	< 0.001
Plastron Length	0.799	73.20 + 16.97 × consumed food	< 0.001	0.155	113.68 + 9.71 × consumed food	< 0.001
Mean Mass						
Carapace Length	0.972	49.16 + 0.351 × mean mass	< 0.001	0.976	93.52 + 0.110 × mean mass	< 0.001
Plastron Length	0.988	45.03 + 0.289 × mean mass	< 0.001	0.968	83.13 + 0.094 × mean mass	< 0.001

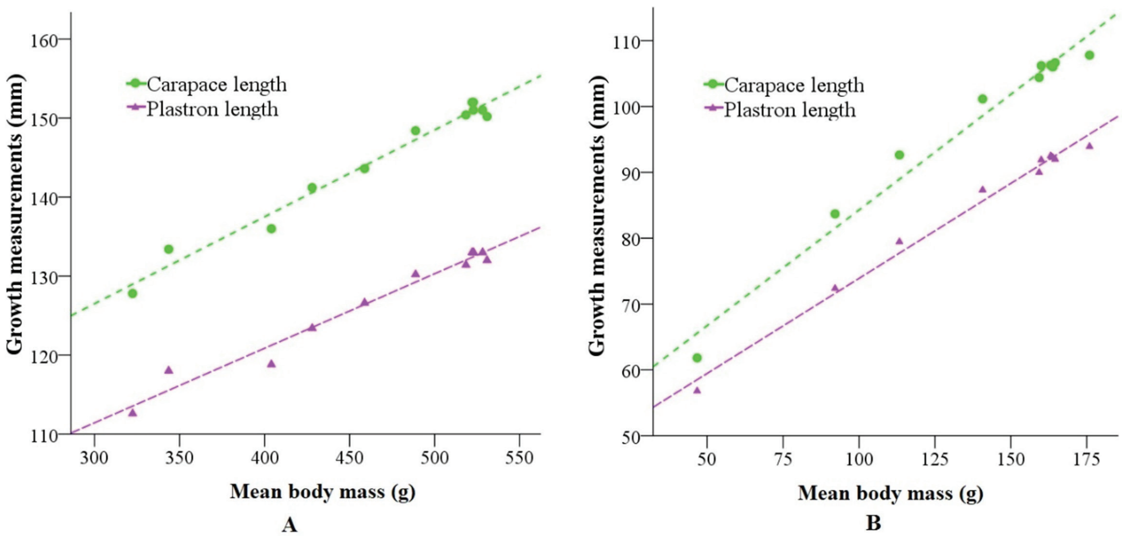

Figure 3. Growth in relation to mean body mass of (A) juvenile and (B) hatchling Northern River Terrapins (*Batagur baska*) from Bangladesh.

juveniles preferred vegetables (*B. hispida*, *C. maxima*). Juveniles feed on a variety of greens (dandelions, lettuce, *I. aquatica*) and vegetables (Moll et al. 2009), but Pandit (2013) found that hatchlings preferred *B. oleracea*, which is inconsistent with our study. *Batagur baska* consumes fruits such as carrots, apples, mangrove apples (*Sonneratia* sp.), ripe bananas (*A. heterophyllus*), and Mango (*Mangifera indica*) depending upon their availability (Moll et al. 2009; Pandit 2013; Morshed and Sobhan 2014; Weissenbacher et al. 2015). *Sonneratia* sp., a dietary staple according to Moll et al. (2009), probably meets the nutritional requirements of *B. baska* (Duli 2009). Similarly, we found ripe banana to be preferred and consumed by both hatchlings and juveniles during the study period. Supplied food items like greens, vegetables, fruits, and animals were conducive to enhancing the growth rate of *B. baska* in captivity.

Table 6. Output of Repeated Measures ANOVA showing the significant effect of the amount of consumed food on three measures of growth for both hatchling and juvenile Northern River Terrapins (*Batagur baska*) from Bangladesh.

	F	*P*-value	Effect size (Ƞ)^2
Hatchlings			
Body mass	120.57	< 0.001	0.668
Carapace Length	57.79	< 0.001	0.491
Plastron Length	114.71	< 0.001	0.660
Juveniles			
Body mass	5.37	0.030	0.573
Carapace Length	6.17	0.004	0.607
Plastron Length	5.27	0.010	0.569

Monthly and seasonal variation in food consumption.—Food consumption was similar among seasons as greens and animal foods were available and supplied year round. Food consumption was lower in January, perhaps due to low air temperatures. We also found reduced movement of *B. baska*, which remained still under water in tanks during this colder month. Minton (1966) and Sial et al. (2016) reported similar observations for another geoemydid, the Brown Roofed Turtle (*Pagshura smithii)*. They stated that this species remains inactive and stops feeding in the colder months and they tend to burrow themselves either on land or under the water for hibernation. They become active again after the winter season under captive conditions. Kamruzzaman (2016) also observed that hatchling *B. baska* consumed larger amounts of food (3% of their total body mass) daily in the warmer month (March-August) and took less amount of food daily during cold weather.

Growth.—We observed growth for both hatchling and juvenile *B. baska* supplied with food in captivity. Similarly, Moll (1980) and Weissenbacher et al. (2015) reported that hatchlings and juveniles gained higher growth in hatchery conditions in response to supplied foods. After the emergence of hatchlings in June and initiation of feeding in July, the mass and growth of hatchlings were doubled within one month. Our findings were consistent with Weissenbacher et al. (2015), who stated that hatchlings began feeding soon after emergence and doubled in size within the first month.

On the other hand, our results were inconsistent with the findings of Nyok and Heng (2005), who reported that 6 mo old hatchlings fed with *I. aquatica* achieved an average body mass gain of 13.66 g per individual, but their CL did not increase in relation to body mass. At the end of the study period, juveniles gained a mean mass of 522 ± 102.9 (standard deviation) g per individual. The average mass of the juveniles was almost stable due to less food being consumed in January. The growth rate was higher in hatchlings than juveniles, probably due to the hatchlings consuming larger amounts of supplied foods to grow rapidly.

Because *B. baska* is listed as Critically Endangered by the International Union for Conservation of Nature (Moll et al. 2009; Stanford et al. 2018; Praschag and Singh 2019) and is listed on Appendix I of CITES, it may be unable to survive without stringent *in situ* and *ex situ* conservation efforts. Considering their threatened status, we emphasize that more research on various ecological and conservation aspects of this species in its range is critical. The results of our study summarize the food preferences, consumption, and associated growth that can be applied to range-wide captive breeding and rearing activities as a protocol for this species.

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