DEVELOPMENTAL STAGES OF SOUTHERN RIVER TERRAPIN (*Batagur affinis*) IN WILDLIFE CONVERSATION CENTER BOTA KANAN, PERAK, MALAYSIA

Hairul, M.S.*[1,2] & Shahrul Anuar, M.S.[1]

[1]School of Biological Sciences, Universiti Sains Malaysia, 11800 USM, Penang, Malaysia
[2]Department of Wildlife and National Parks (DWNP) Peninsular Malaysia,
KM 10, Jalan Cheras, 56100 Kuala Lumpur

**Corresponding author: hairul@wildlife.gov.my*

ABSTRACT

The developmental stages of River Terrapin, *Batagur affinis* were studied in the Wildlife Conservation Center at Bota Kanan, Perak. The main objectives of this study were to investigate the eggs morphometric of *B. affinis,* and to investigate the growth rate of *B. affinis* hatchlings. The parameters of hatchling growth and eggs were measured using digital callipers. A Pearson's coefficient test was carried out to determine correlation between weight and egg size. The large size of the eggs showed that the eggs do not necessarily heavier. The results shows that no correlation between egg size and egg weight. This study found an optimum growth of the hatchlings development, which is in the third to fifth weeks.

Keywords: *Batagur affinis*, egg size, correlation, growth rate, morphometric, weight size.

INTRODUCTION

The river terrapin, *Batagur affinis* or locally known as "tuntung" is one of the world's most critically endangered terrapins. This terrapin inhabits coastal rivers, estuaries and mangrove swamps from East India and Bangladesh and Eastward to Myanmar, and possibly Western Thailand. Population from the Peninsula Malaysia and Sumatra, traditionally treated as conspecific, turned out to represent the distinct species *B. affinis* (Cantor, 1847). This species recently recognized as closely related species with *B. baska* (Ernst and Barbour 1989; Iverson *et al*., 1992; Praschag *et al.,* 2007).

Morphologically, *Batagur baska* is highly distinct from *B. affinis* (Praschag *et al.,* 2007; 2008). *Batagur affinis* from the East and West Coasts of the Peninsular Malaysia are also known to be differed morphologically (Moll, 1980). External morphology of the estuarine *Batagur* male and female is based on personal observations and data by Anderson (1879), Rashid and Swingland (1997), and Moll (1980). They were proved that the male *B. baska* has elongated and pointed head with upturned snout, black head, pale bluish colour around nostrils area, the rest of the head and distal part of the neck is deep black, passing into rich crimson at the base of the neck, iris matte with greenish yellow, forelimbs with brilliant rosy carmine, hind limbs, tail and thighs in dull reddish purple colour. Carapace during mating season is rich brown to reddish, and in some individuals is slightly marbled with darker lines, plastron having a rosy yellow tint.

Generally, the *B. affinis* are largely herbivorous in the wild (Smith, 1931; Hendrickson, 1961; Moll, 1978). *B. affinis* juveniles have been reported to be omnivores. The hatchlings are more carnivores, eat molluscs to gain enough calcium, but turn to be herbivorous when reach adult (Moll, 1984).

The majority of terrapins hatch eggs in the sand (Risley, 1933). The nest site was deeply shaded (Anderson, 1958). The substrate forming the nest may vary from sand to clay (Vestjens, 1977). It may be high water holding capacity because of an abundance of organic material or it may present

an exceedingly dry condition. The varied locations of incubating eggs suggest that the embryos development can stand diverse microclimate conditions (Pifano, 1960). Thermal tolerances onto eggs probably depend on a multitude of variables.

Main objectives of this study are to investigate the eggs morphometric of *B. affinis* and to investigate the growth rate of its hatchlings.

METHODOLOGY

Study site

The study was conducted in the Wildlife Conservation Center at Bota Kanan, Perak. The river terrapin captive breeding program was initiated in 1968, to study and understand the behaviour of this species. In 1977, Department of Wildlife and National Park (PERHILITAN) Perak State, has established a conservation centre next to the sandy bank. The programme has successfully managed to hatch captive eggs since 1980 (Ministry of Natural Resources and Environment, 2011).

Measurements

The terrapin hatchlings were weighed using digital scales. The Carapace Length (LC), Carapace Width (WC), Plastron Length (LP) and Plastron Width (WP) were measured using digital calliper for terrapin hatchlings. There are two methods for terrapin shell measurement: curved and linear measurement. Terrapins were marked with paint on their carapace to avoid double captured.

Terrapin eggs

The data on the egg was taken randomly based on egg weight and egg size from different nests. Eggs per nest were measured before translocated to the nesting site. Eggs weight was weighed with digital scales, and egg size was measured using a digital calliper.

Rates of hatchlings growth

An experimental rate of hatchling growth was carried out every two weeks from February 4th, 2011. The study has started on the first day of the hatched and ended at the week of seven (March 18, 2011). The study involved 15 hatchlings that were placed in a square plastic basin (38 x 30 x13 cm). Water is poured approximately half-filled in a basin, and hatchlings were put inside the basin and placed in a room. Each terrapin was marked with numbers started 1-15 on the top of turtle plastron. Physical measurements and weight are recorded. In addition, the food (*Ipomea aquatica* and "tilapia" fish pallet) was provided every morning, the diets were based on a specific rate (four percent (%) of a body weight).

Statistical analysis

Pearson's correlation coefficient was used to test the relationship between two variables; egg weight and egg size.

RESULTS

Hatchlings growth rate

The overall mean size of hatchlings increased every two weeks. This situation indicates that hatchlings were raised until week seven. The growth rate of hatchlings increasing week by week with a maximum reached of 77.57g in the final week of study. All morphometric data is shown in Table 1.

Table 1. Hatchlings morphometric data analysis

Week	Standard	Mean	Std. Deviation	Minimum	Maximum
1	LC (mm)	66.62	3.414	57.89	71.04
	WC (mm)	67.69	2.27	64.92	73.18
	LP (mm)	59.2	2.375	55.3	63.25
	WP (mm)	23.41	1.264	21.73	26
	W (g)	48.61	4.914	42	58
3	LC (mm)	69.89	2.508	66.39	73.69
	WC (mm)	69.88	2.511	67.57	76
	LP (mm)	61.63	2.465	57.66	66.14
	WP (mm)	24.33	0.875	23.11	26.15
	W (g)	55.6	5.501	49	68
5	LC (mm)	75.15	2.518	71.3	79.56
	WC (mm)	73.86	2.428	71.21	80.48
	LP (mm)	66.22	2.669	61.82	71.48
	WP (mm)	26.18	0.992	24.66	28.61
	W (g)	70.23	6.359	61.6	84.4
7	LC (mm)	77.63	2.513	73.66	80.98
	WC (mm)	75.46	2.395	72.77	81.8
	LP (mm)	68	2.777	63.63	72.7
	WP (mm)	26.5	1.125	24.88	29.33
	W (g)	77.57	7.049	66.3	88.2

Notes: LC=Length of carapace; WC=Width of carapace; LP=Length of plastron; WP=Width of plastron; W=Weight.

The optimum growth of the hatchlings was in the third to fifth week of hatchlings development (Figure 1). The results showed in overall average carapace length is 72.32±10.95 mm, width of carapace is 71.7±9.60 mm, length of the plastron is 63.76±10.29 mm, and width of the plastron is 25.11± 4.26 mm. While the average weight of hatchlings growth was 63.00±23.82 g.

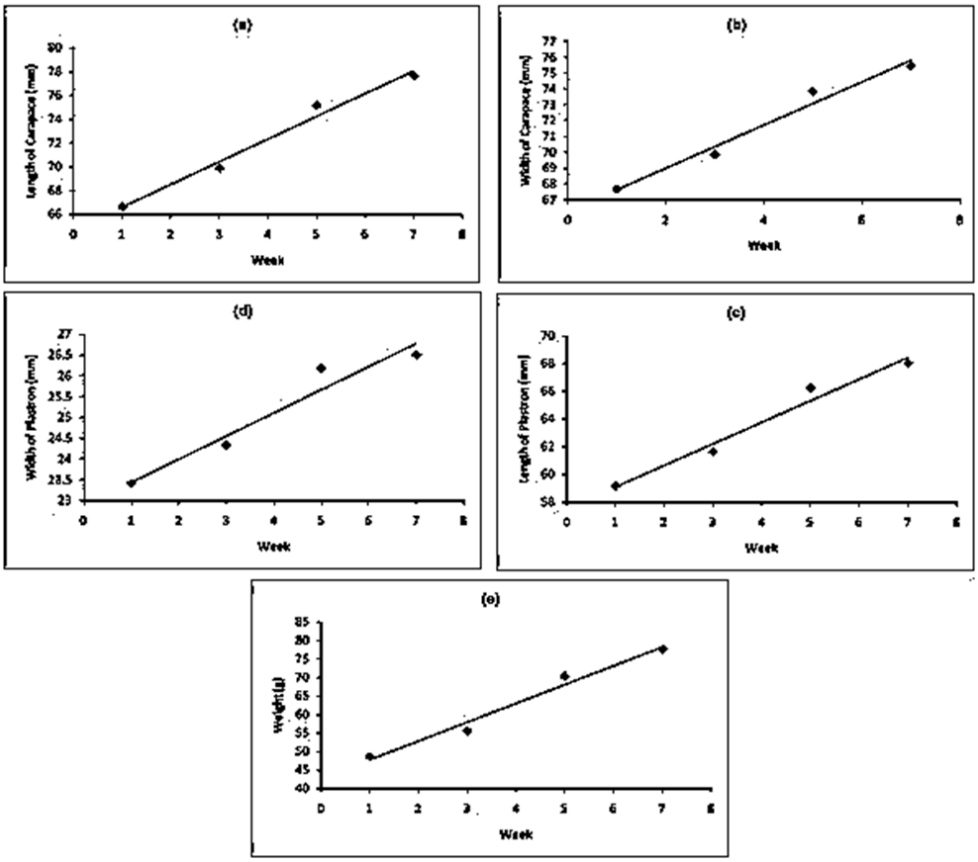

Figure 1. Morphometric variables of hatchlings; a) length of carapace; b) width of carapace; c) length of plastron; d) width of plastron; e) weight.

Morphometric of eggs

A total of 20 eggs were collected from selected nests for analysis. The mean of egg size was 6.06±0.16 centimetre (cm), while the mean of egg weight was 62.1±5.33g. Figure 2 shows a negative correlation between egg size and egg weight.

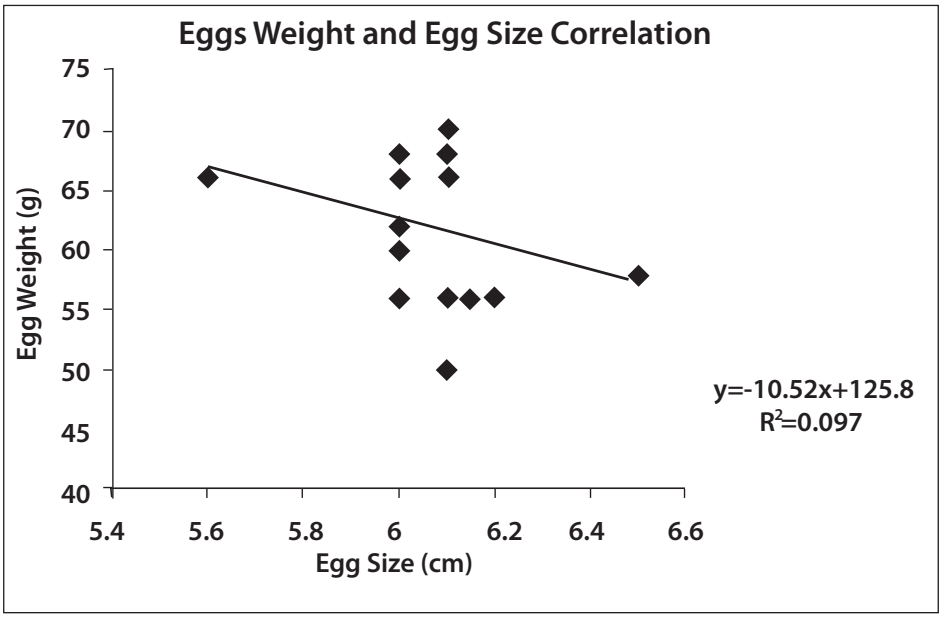

Figure 2. A scatter graph show correlation between egg size and egg weight of mother terrapin.

DISCUSSION

This study revealed an optimum growth of the hatchlings development in the third to the fifth week. This condition probably due to the diet, a 'tilapia' pellets, which swell and dissolve easily in water compared to water spinach. It may also due to the hatchlings that fed slowly in the first and second week. In addition, it was due to the food supply, which has been streamlined from the first week. However, the graph shows a positive growth in the current study. Similar results showed in Tuan Afifah (1989), which had fish and water spinach diet. He reported that terrapins fed with fish attained better carapace growth, this proved that rich protein diet is essential to support terrapin growth.

There was no correlation between egg size and egg weight. Large size of the eggs does not necessarily heavier (Solomon, 1987). He stated that the weight generally more influenced by the thickness of egg shell, egg albumen content (white egg), vitellus (egg yolk), and air-corner cell in the egg. In addition, the thicker shell is heavier, the egg contains high vitellus albumen is more severe, while the egg with a large air cell is less severe.

CONCLUSION

There was no correlation between egg size and egg weight as the large egg size does not necessarily heavier as it may influenced by several factors. Diet with rich protein is essential to support terrapin growth. This study also revealed an optimum growth of the hatchlings development in the third to fifth weeks. However, the hatchlings grew at a slower rate in the fifth to the seventh weeks of the study.

ACKNOWLEDGEMENTS

We thank the Department of Wildlife and National Parks State of Perak for granting permission to conduct this study. Thank to Wan Nazarudin Wan Ngah, Head of Wildlife Conservation Center at Bota Kanan, Perak who helped me complete this study. Finally, the first author wish to express his gratitude and love to his dearest mother, Siti Nordi Lambak on her prayer and blessings given to him indefinitely.

REFERENCES

Anderson, J. (1879). Anatomical and zoological researches, comprising an account of the zoological results of the two expeditions to Western Yunnan in 1868 and 1875; and a monograph of the two cetacean genera Platanista and Orcella. Bernard Quaritch, London.

Anderson, P.K. (1958). The photic responses and water-approach behavior of hatchling turtles. *Copeia*: 211-215.

Ernst, C.H. & Barbour, R.W. (1989). Turtles of the world.

Hendrickson, J. (1961). Conservation investigations on Malayan turtles. *Malayan Nature Journal* 21st Anniversary Special Issue: 214**,** 23.

Iverson, J.B. & Debevec, A. (1992). A revised checklist with distribution maps of the turtles of the world. Green Nature Books.

Moll, E. & White, F. (1978). The Indian Ocean Coastal Belt. Biogeography and Ecology of Southern Africa. Junk, *The Hague*, 561-98.

Moll, E. (1980). Natural history of the river terrapin, *Batagur baska* (Gray) in Malaysia (Testudines: Emydidae). *Malaysian Journal of Science*, **6**: 23-62.

Moll, E. (1984). River terrapin recovery plan for Malaysia. *Journal of Wildlife and Parks*, **3**: 37-47.

Pifano,C., Ortiz. I. & Alvarez, A. (1960). The Ecology, under natural and laboratory conditions, of species of Phlebotomus in Guatopo, Miranda. With special reference to P. panamensis, the Vector of Cutaneous Leishmaniasis in Venezuela. Archivos Venezolanos de Med. *Tropical Parasitologia Medica*, **3**: 63-71.

Praschag, P., Hundsdörfer, A. & Fritz, U. (2007). Phylogeny and taxonomy of endangered South and South East Asian Freshwater Turtles Elucidated by mtDNA Sequence Variation (Testudines: Geoemydidae: *Batagur, Callagur, Hardella, Kachuga, Pangshura*). *Zoologica Scripta*, **36**: 429-442.

Praschag, P., Hundsdörfer, A.K. & Fritz, U. (2008). Further specimens and phylogenetic position of the recently described leaf turtle species Cyclemys gemeli (Testudines: Geoemydidae). *Zootaxa*, **29**: 2009.

Rashid, S. & Swingland, I. (1997). On the ecology of some freshwater turtles in Bangladesh, pp. 225-242.

Risley, P.L. (1933). Observations on the natural history of the common Musk Turtle: Sternotherus odoratus (Latreille). University of Michigan.

Smith, M.A. (1931). The Fauna of British India Including Ceylon and Burma: Reptilia and Amphibia Vol. I: Loricata Testudines Vol II: Sauria; Vols III and IV.

Solomon, S. (1987). Egg shell pigmentation. Egg Quality: Current problems and recent advances (eds R.G. Wells & C.G. Belyarin), pp. 147-157. But-terworths, London, UK.

Vestjens, W. (1977). Breeding behaviour and ecology of the Australian Pelican, *Pelecanus conspicillatus*, in New South Wales. *Wildlife Research*, **4**:37-58.

Editor's Note: This river terrapin population was also referred to as *Batagur baska* in the past.