ASPECTS OF BREEDING ECOLOGY OF FRESHWATER TURTLE (*Pelusios niger*) IN THE WILD IN ZARIA, KADUNA STATE NIGERIA

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Abstract: The study surveyed the aspects of breeding ecology of freshwater Turtle (*Pelusios niger*) in the Wild in Zaria, Kaduna State Nigeria. Three points were sampled at A, B, and C of the water pool, morning (7.00am – 8.00am) and evening (5.00pm – 6.00am) daily. Data collected were subjected to One-way analysis of variance (ANOVA) using SAS 9.1 version to determine significant difference (P<0.05). The means were separated using Duncan Multiple Range Test (DMRT) where differences exist.The results revealed that water quality parameters during rearing of breeding period of freshwater small turtle in all the locations A, B, and C in Zaria: mean temperature(27.98±0.17^{ao}C - 28.60±2.31^{ao}C), mean pH (9.18±0.36^{a} - 9.20±1.25^{a}), e EC (234.90±0.98^{a} – 236.89±2.62^{a} µms^{-1}), TDS (180.97±1.21^{a} – 120.86±1.32^{a} ppm), BOD (56.40±0.32^{a}ppm - 58.50±1.13^{a}ppm), COD (11.18±0.24^{a} – 11.70±0.22^{a} ppm), nitrates (0.02±0.01^{a} – 0.04±0.02^{a} ppm), nitrites (0.001±0.01^{a} – 0.002±0.01^{a} ppm),and ammonia (0.002±0.01^{a} – 0.003±0.02^{a} ppm). Therefore, the water quality parameters were all within the acceptable ranges for reproduction and production of aquatic organisms.

Keywords: Breeding, ecology, freshwater, *Pelusios niger*, turtle, wild

Introduction

Freshwater turtles are widely distributed in almost all types of aquatic habitats (Bonin *et al*., 2006); reproductive and feeding strategies in the wild vary substantially (Pearse, 2001). However, most are opportunistic carnivores or omnivores, consuming invertebrates, small vertebrates, and aquatic vegetation (Luiselli *et al*., 2011). Adult freshwater turtles live in water body and feed with aquatic plants such as duckweed (*Lemna* spp.), pondweed (*Elodea* spp.), and hornwort (*Ceratophyllum* spp.) are frequently used (Rawski, 2018). For some tropical and subtropical turtle species, fruits may also be used (Rawski, 2018). Turtles are diapsids of the order Testdines characterized by a special bony or cartilaginous shell developed from their ribs and act as a shield. Turtles are classified as amniotes, along with other reptiles, birds, and mammals (Fergus, 2007), like other amniotes, turtles breathe air and do not lay eggs underwater, although many species live in or around water bodies (Huang and Lin, 2002). The taxonomic nomenclature that applies to freshwater small turtles is: Kingdom – Animalia, Phylum – Chordata, Class: Reptilia, Order –Testudines, Family: Pelusiodae, Genus: *Pelusios*, species: *niger* (Luiselli *et al.*, 2011)

Turtles are ectotherms – animals commonly called cold-blooded-meaning that their internal temperature varies according to the ambient environment (Luiselli *et al.*, 2011). However, because of their high metabolic rate, they have a body temperature that is noticeably higher than that of the surrounding water (Fergus, 2007). Sparkling clear water is not always an indication of its purity. Many 'invisible factors' that can have detrimental effects on your turtles' general health and reproductive physiology include increased water acidity or excessive alkalinity (pH), excessive salinity, incorrect temperature, hardness and levels of chlorine, chloramines, nitrate, nitrite and ammonia (Craig, 2014).

Turtle hatchlings may not consume any food due to yolk sac absorption, which satisfies some of the nutritional needs (Mitchell and Tully, 2009). The hatchlings of most freshwater turtle species are almost strictly carnivorous (Bouchard and Bjorndal, 2006), so their growth performance is correlated with the concentration of crude protein (CP) in the diet. The optimal CP level for young is assumed to be as high as 39–46.5% (Zhou *et al*., 2013) and is likely dependent on the energy content of the diet should be at the level of 32–36 mg/kJ–1 (Zhou *et al*., 2013). There is sparse information on the Aspects of Breeding Ecology of Freshwater Turtle (*Pelusios niger*) in the Wild in Zaria, Kaduna State Nigeria. Hence, this study tends to survey the aspects of breeding ecology of freshwater Turtle (*Pelusios niger*) in the Wild in Zaria, Kaduna State Nigeria.

Materials and Methods

It is located at latitude 11^{o}4' N and 7^{o}58 E. The average annual rainfall is approximately 107.5 cm. The average daily temperature recorded maximally 36.6^{o}C around April and falls to 23.3^{o}C around October. The relative humidity ranges between 70% and 80% in August and minimum around 15 – 20% in December (Mamman *et al.*, 2000). The location is characterized by rocky terrains, water pools (borrowed pits) due to mining activities that took place few years age, discharged water from overhead concrete tank of Kaduna State Urban Water Supply, aquatic plants/weeds, and shrubs (Fig. 1).

Three points were sampled at A, B, and C of the water pool, morning (7.00am – 8.00am) and evening (5.00pm – 6.00am) daily. Some water quality parameters were monitored during breeding period such as temperature, pH (acidity and alkalinity), electrical conductivity, and TDS were determined using Hanna Instrument (Digital Model S358236HANA), Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), hardness and levels of chlorine, nitrate, nitrite and ammonia (APHA, 2005) were determined at Multi-User Laboratory, Department of Chemistry, Faculty of Physical Sciences, Ahmadu Bello University, Zaria. The field work lasted between May and July, 2019. Camera was used to snap pictures of the location and aquatic plants were observed in the location.

Data collected were subjected to One-way analysis of variance (ANOVA) using SAS 9.4 version to determine significant difference (P<0.05). The means were separated using Duncan Multiple Range Test (DMRT) where differences exist.

Results and Discussion

The results in Table 1: revealed that there was no significant difference (P>0.05) in mean temperature during rearing of breeding period of freshwater small turtle (*Pelusios niger*) in

all the locations A, B, and C in Zaria. Although, location A had the highest value 28.60±2.31^{a}^{o}C while location C had the lowest value 27.98±0.17^{a}^{o}C. In terms of pH location B had 9.20±1.25^{a} which was the highest while location A had the lowest 9.18±0.36^{a} among the locations but they were not statistically significant (P>0.05). The electrical conductivity of all the locations do not differ significantly (P>0.05) with location B with the highest value 236.89±2.62^{a} µms^{-1} while location C had 234.90±0.98^{a} µms^{-1} was the lowest among the locations. In terms of total dissolved solute (TDS), there was no statistically significant (P>0.05) with the locations but location B had the highest value of 120.86±1.32^{a} ppm while location C had 180.97±1.21^{a} ppm which was the lowest among the locations. There was no significant difference (P>0.05) in all the locations however location C had the value of 58.50±1.13^{a} ppm which was the highest in BOD and location C had the value of 56.40±0.32^{a} ppm. The COD of all the locations were not statistically significant (P>0.05) but location B had highest with the value 11.70±0.22^{a} ppm, although location A had the lowest value of 11.18±0.24^{a} ppm. Location A had the lowest nitrates value 0.02±0.01^{a} ppm while location C had the highest with 0.04±0.02^{a} ppm, even though it was not significant (P>0.05) among the locations. The highest value of nitrites was found in locations (A and C) and lowest value was in location B (0.001±0.01^{a} ppm). The ammonia values do not differ significantly (P>0.05) among the locations but the highest was found in location C (0.003±0.02^{a} ppm). The ecology of *Pelusios niger* was shown in Fig. 1.

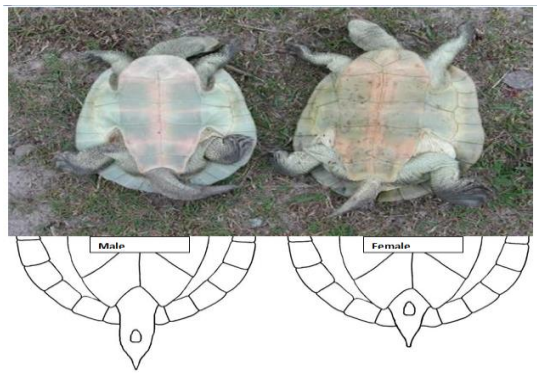
Table 1: Water quality parameters during rearing of breeding period of freshwater small turtle in Zaria

Location	T (^{o}C)	pH	EC (µms^{-1})	TDS (ppm)	BOD (mg/l)	COD (mg/l)	Nitrate (ppm)	Nitrite (ppm)	Ammonia (ppm)	P- value
A	28.60±2.31^{a}	9.18±0.36^{a}	235.98±3.24^{a}	190.54±1.12^{a}	57.60±1.26^{a}	11.18±0.24^{a}	0.02±0.01^{a}	0.002±0.01^{a}	0.002±0.02^{a}	0.002
B	28.50±1.25^{a}	9.20±1.25^{a}	236.89±2.62^{a}	120.86±1.32^{a}	56.40±0.32^{a}	11.70±0.22^{a}	0.03±0.01^{a}	0.001±0.01^{a}	0.002±0.01^{a}	0.001
C	27.89±0.17^{a}	9.20±0.90^{a}	234.90±0.98^{a}	180.97±1.21^{a}	58.50±1.13^{a}	11.50±0.32^{a}	0.04±0.02^{a}	0.002±0.01^{a}	0.003±0.02^{a}	0.002

Means with the same superscripts are not significantly different (P>0.05);: T = temperature, DO = dissolved oxygen, EC = electrical conductivity, TDS = total dissolved solids

Fig. 1: Sampling station

Plate I: ***Pelusios niger***



Source: Craig (2014)

Plate 2: Male and female ***Pelusios niger***

The results revealed that water quality parameters during rearing of breeding period of freshwater turtle (*Pelusios niger*) in all the locations A, B, and C in Zaria:mean temperature (27.98±0.17^a – 28.60±2.31^{ao}C).This was in line with Davies and Ansa (2010) who suggested that mean water temperature between 20 and 30^{o}C is suitable for aquatic organisms. Similarly, Khan *et al.* (2013) also recommended the mean water temperature range of 21 and 31.9^{o}C for tropical aquatic organisms and also added that temperature beyond 32^{o}C respiration would lead or result to physiological stress, poor feed conversion, and poor growth rate and same effects would be noticed when temperature was below 21^{o}C. According to Davies and Ansa (2010) noted that the reproductive and immune system of the majority of aquatic organisms has an optimum performance at mean water temperatures above 20°C.

The results were within the range suggested by Sikoki and Veen (2004) that the normal pH value for reproduction, survival and growth performance of aquatic organisms should be between 6.7 and 10. Davies and Ansa (2010) also reported that it was necessary to keep the pH range of between 7.6 and 10 to maintain good water turtle population in water in the tropics. The higher the pH value the higher the toxicity of ammonium while the lower the pH value the higher the toxicity of sulphates and cyanides (Craig, 2014). The result obtained in this study was also within the range reported by Davies and Ansa (2010) pH range of 6.5 to 10.5, which was also reported to be good for tropical fish production.

The EC (234.90±0.98^a – 236.89±2.62^a µms^{-1}) andTDS (180.97±1.21^a – 120.86±1.32^a ppm) observed during the study could be due to rocky nature which washed down rock salts and discharge from Zaria water supply in the study area, was lower than the findings of Sikoki and Veen (2004) who observed the range of 390 to 505 µms^{-1} electrical conductivity and TDS of 150 to 230 ppm. Water can contain many dissolved substances from organic and inorganic compounds (rocks), and soils which are described as 'trace elements'. These elements are important in sustaining life within all ecosystems (Craig, 2014). However, the BOD (56.40±0.32^a – 58.50±1.13^a ppm), COD (11.18±0.24^a – 11.70±0.22^a ppm) observed in the study was in line with (Craig, 2014) who reported that raising carbonate hardness levels most good aquarium, should be below 80 ppm. The mean nitrates (0.02±0.01^a – 0.04±0.02^a ppm), nitrites (0.001±0.01^a ppm – 0.002±0.01^a), ammonia (0.002±0.01^a – 0.003±0.02^a ppm) were within the acceptable limits of the reproductive and production of freshwater small turtle in Nigeria (Luiselli *et al.*, 2011).Habitat of freshwater turtles had various amounts of plant matters, aquatic plants such as duckweed (*Lemna* spp.), pondweed (*Elodea* spp.), and hornwort (*Ceratophyllum* spp.) are frequently used (Rawski, 2018), and Neem tree. Algae such as *Spirulina* spp (Fig. 1) are also used in commercial fish and turtle diets, and they are also available in a dried form and may be used as a separate feed component. For some tropical and subtropical turtle species, fruits may also be used (Rawski, 2018).

Conclusion and Recommendation

The water quality parameters were all within the acceptable limits for reproduction and production of aquatic organisms. Habitat of freshwater turtles should be provided with various amounts of plant matter, aquatic plants such as duckweed (*Lemna* spp.), pondweed (*Elodea* spp.), and hornwort (*Ceratophyllum* spp.) are frequently used. Algae such as *Spirulina* spp. are also used in commercial fish and turtle. Further research should be carried out on relative abundance and diversity of *Pelusios niger* and other species to ensure conservation and management.

Conflict of Interest

Authors declare there is no conflict of interest related to this study.

References

Bonin F, Devaux B & Dupré A 2006. *Turtles of the World*. Baltimore, USA, Johns Hopkins University Press, 416 pp.

Bouchard SS & Bjorndal KA 2006. Ontogenetic diet shifts and digestive constraints in theomnivorous freshwater turtle *Trachemys scripta*. *Physiolology. Biochemistry and Zoology*, 79: 150–158.

Craig L 2014. Caring for Australian Freshwater Turtles in Captivity, pp. 1 – 14, Www.Turtles.Net.Au

Fergus C 2007. *Turtles:* Wild Guide. Mechanicsburg, PA: Stackpole Books, p. 8. *ISBN* 9780811734202.

Davies OA & Ansa E 2010. Comparative assessment of water quality parameters of freshwater tidal earthen ponds and stagnant concrete tanks for fish production in Port Harcourt, Nigeria. *Int. J. Sci. and Nat.*, 1(1): 34-37.

Gibbons JW 1990. Editor. *Life History and Ecology of the Slider Turtle*. Washington DC, USA, Smithsonian Institution Press, 368 pp.

Huang CH & Lin WY 2002. Estimation of optimal dietary methionine requirement for softshell turtle, *Pelodiscus sinensis*. *Aquaculture*, 207: 281–287.

Khan S, Shahnaz M, Jehan N, Rehman S, Shah MT & Din I 2013. Drinking water quality and human health risk in Charsadda district, Pakistan. *J. Cleaner Produc.*, 60: 93-101.

Kurnaz A, Mutlu E & Uncumusaoğlu AA 2016. Determination of water quality parameters and heavy metal content in surface water of Çiğdem Pond (Kastamonu/Turkey). *Turk. J. Agric. - Food Sci. and Techn.*, 4(10): 907-913.

Luiselli L, Akani GC, Ebere N, Rugiero L, Vignoli L, Angelici FM, Eniang EA & Behangana M 2011. Food habits of a pelomedusid turtle, *Pelomedusa subrufa*, in tropical Africa (Nigeria): The effects of sex, body size, season, and site. *Chelonian Conserv. Bi.*, 10: 138–144.

Mamman AB, Oyebanji JO & Peters SW 2000. *Nigeria assured* (survey of states). Vol. 2. Gabumo Publishing Co. Ltd Calabar.

Mitchell MA & Tully TN 2009. *Manual of Exotic Pet Practice*. St. Louis, USA, Elsevier Health Sciences, 546 pp.

Rawski M, Mans C, Kierończyk B, Świątkiewicz S, Barc A & Józefiak D 2018. Freshwater turtle nutrition – A review of scientific and practical knowledge. *Annual Animal Science*, 18(1): 17–37.

Sikoki FD & Veen JV 2004. Aspects of Water Quality and the Potential for Fish Production of Shiroro Reservoir Nigeria. *Living Sys. Sustainable Devt.*, 2: 7.

Zhou F, Ding XY, Feng H, Xu YB, Xue HL, Zhang JR & Ng WK 2013. The dietary protein requirement of a new Japanese strain of juvenile Chinese soft shell turtle, *Pelodiscus Sinensis Aquaculture*, 412: 74–80.