STOMACH CONTENT ANALYSES OF TILAPIA ZILLII AND HEMICHROMIS FASCIATUS IN THE GOLINGA RESERVOIR IN THE TOLON DISTRICT OF THE NORTHERN REGION OF GHANA

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ABSTRACT

The food habits of Tilapia zillii and Hemichromis fasciatus in the Golinga Reservoir were studied from November 2013 to April 2014 by employing the points and frequency of occurrence methods. Condition factor and some physicochemical parameters such as temperature, conductivity, pH and dissolved oxygen of the water were monitored. Out of 85 stomachs of Tilapia zillii containing food, the fish fed mainly on 48.95 % of plant materials, 26.02 % of algae and 12.03 % of debris, 9.58% sand grains and 4.04 % of insects. Of the 107 specimens of Hemichromis fasciatus examined,the species preferred fish and fish parts (50.33 %), insects (22.17 %) and zooplanktonic organisms (17.42 %) such as rotifers and cladocerans to algae (4.01 %) and debris (1.03 %). All water parameters were found to be within permissible limits for aquatic life and livestock use and other domestic purposes except for conductivity which was low (85.46 ± 0.018 µS/cm). Mean temperature was 27.74 ± 0.13 ^{o}C, dissolved oxygen was 7.76 ± 1.0 mg/L and pH 7.02 ± 0.03. The mean condition factors of T. zillii and H. fasciatus were 3.25 and 3.93 respectively suggesting that the fish were in a very good condition. Considering the observed food habits of the two species, H. fasciatus can be classified as invertevore – piscivore and T. zillii a herbivore – detritivore. The broad spectrum of food items eaten by these cichlids and their preference for different food items could be strategies adopted to avoid interspecific competition as such a potential for polyculture. Again due to the varied distribution of these food items in the water, the fish are able to judiciously utilize its food resources in the water. The study revealed low numbers of Tilapia zillii which affected further investigation into its size distribution. It is recommended that populations of H. fasciatus should be reduced to prevent it from drastically reducing the numbers of Tilapia zillii and other non carnivorous fish species.

KEYWORDS*: Fish species; condition factor; food habits; algae*

INTRODUCTION

The understanding of fish diet provides information on grouping of fish with respect to their food, method of feeding, determination of the population parameters of some species that cannot be determined by other methods and subsequent successful culture (Abowei, 2010).

According to Reid (1990), cichlids have the largest group of endangered species among vertebrate families in waters all over the world. The Northern Region of Ghana has a number of reservoirs, dug outs and river systems that is habited by a great number of aquatic fauna which serve as a source of cheap protein in most homes of which the Golinga reservoir is no exception. However, in Abban *et al.* (2002) and Amevenku and Quacoopome (2006) dwindling catches have become a common problem for over 20 years with possible

reasons for their decline being over exploitation of stocks, environmental degradation and low water levels.

In the Golinga reservoir, *Hemichromis fasciatus* is a very abundant tilapia species whiles *Tilapia zillii* is one of the least abundant among the tilapia species. Studies show that both species are highly prolific and hardy, capable of thriving well in any aquatic system. However the variation in their numbers has necessitated this study, to bring to light reliable scientific data on their food habits, condition factor and some water parameters of the reservoir where they thrive in for sustainable management of the reservoir.

MATERIALS AND METHODS

The study was carried out in the Golinga reservoir in the Northern Region of Ghana. It is found lying within latitude 9^0 N and 10^0 N and Longitude $1^0 00'$ N and 2^0 W (Kpodonu and Momade, 2008). The reservoir has a surface area of about 18ha, mean depth of 2.473 m and a volume of 15623 m^3 at full capacity

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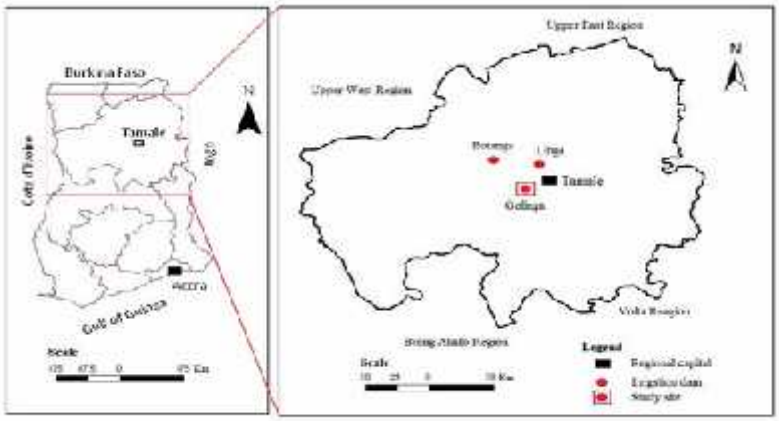

Figure-1. Location map of the study area.

Data collection

Fish sampling and collection

A minimum number of 35 fish specimens were obtained using cast and gill nets of mesh sizes varying between 25.4, 50.8 and 76.2mm from artisanal fishermen monthly each month for a period of six months. Fish samples were preserved in 10 % formalin solution to reduce post mortem digestion and transported to the laboratory for detailed studies. In the laboratory standard length was taken from the tip of the lower lip to the beginning of the caudal fin to the nearest 0.1cm using a fish measuring board and the body weight taken with an electronic scale to the nearest 0.01g. Fish were dissected and the guts removed, poured out into a petri dish for stomach content analyses. Contents were taken with a dropper and placed on slides and viewed under a microscope. Stomach contents were analyzed using the frequency of occurrence and "points" method (Bagenal & Braum, 1978; Hyslop, 1980; Lima Junior & Goitein, 2001). The frequency of occurrence method estimates the percentage of stomachs in a sample containing a given food item whereas the "points" method gives the bulk contribution of each food item to the total food consumed. Points were awarded to each stomach according to its degree of fullness; 10 points for full stomach, 5 for half stomach and 2.5 for quarter filled stomach. Empty stomachs were excluded from the analysis. The total number of points awarded to each stomach was subdivided

among the food items present according to their relative contribution to the total stomach content. The percentage composition of each of the food items was determined by summing up the points awarded to the item and dividing it by the total points awarded to all stomachs containing food, and the resulting value expressed as a percentage.

Condition factor (K) of the experimental fish was estimated from the relationship:

K= $\frac{100W}{L^3}$ (Fulton's index)

Where K = condition factor

W = weight of fish (g)

L = Length of fish (cm)

Measurement of physicochemical parameters

Temperature (^{0}C), dissolved oxygen (mg/L), pH and conductivity (µS/cm) were measured *in situ* at the three predetermined stations (100 m interval) in three replicate samples using a Hanna Checktemp1 multipurpose meter. Monthly readings of the parameters were calculated as means of triplicate measurements and their associated standard errors determined using Minitab (Version 15).

RESULTS AND DISCUSSION

Food habits of fish species

Of the 107 stomachs of *Hemichromis fasciatus* examined, 38 stomachs representing 79.17 % contained food. The fish fed more on fish parts occurring in 85 % of the total stomachs examined and constituted 21 % (Figure 2). Zooplankton was consumed by 70 % of the specimens examined and formed 32 % composition. It ingested considerably on stones occurring in 40 % of the stomachs and constituting 12 % of the stomachs examined. Debris composed of 20 % and were found in 30 % of the stomachs examined.

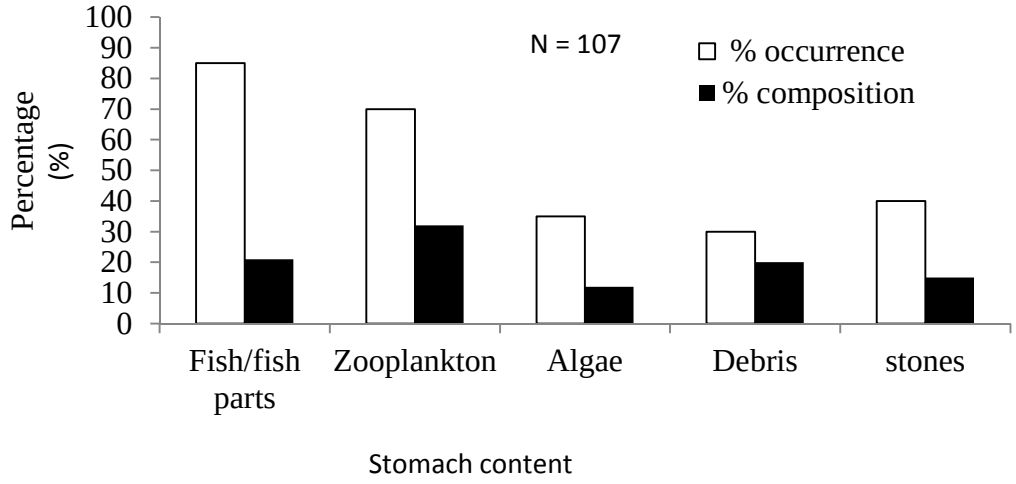

Figure 2: Composition and frequency of occurrence of stomach contents of *Hemichromis fasciatus* in the Golinga Reservoir from November 2013 to April 2014

The well being of fish could be determined partly by the quality and quantity of food it takes. The diet of *H. fasciatus* in this study however revealed some similarity in its food habits to populations in the Tarkwa Bay in Nigeria (Ugwumba, 1988). Fish and fish parts and algae were the common food items fed by the species in the Golinga Reservoir and Tarkwa Bay.

Tilapia zillii

Out of the 85 stomachs containing food, the cichlid preferred algae with composition 50 %, plant materials 28 %, insects 12 % and detritus 10 % (Figure 3). These food items respectively occurred in 50 %, 28 %, 12 % and 10 % of the total stomachs examined. *T. zillii* fed mainly on algae, plant materials and considerably on detritus, insects which did not differ markedly from that of species studied elsewhere in West Africa (Fagade & Olaniyan, 1973).

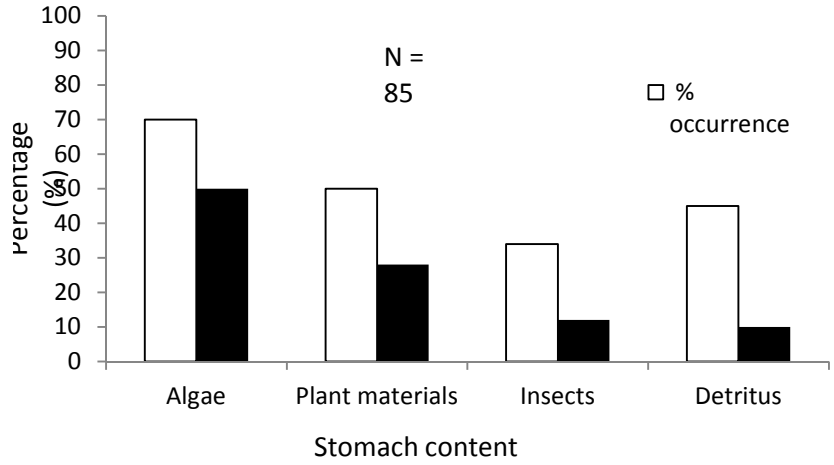

Figure 3: Composition and frequency of occurrence of stomach contents of *Tilapia zillii* in the Golinga Reservoir from November 2013 to April 2014

Apart from the major food items fed by these fishes, both species also picked a variety of other food items reiterating an observation by Liem (1984) in Alhassan *et al.* (2011) that teleost including cichlids were able to exploit more than one source. This ability to exploit different varieties of food with a few of their foods overlapping is important in reducing competition for food resources. This is so because even the similar food items bein fed by these species were preferred at different rates.

The preference of *H. fasciatus* for fish, zooplankton and algae and *T. zillii* for plant materials, algae and insects allows the species to utilize judiciously food in the entire water column since these food items occupy different niches within the habitat. This phenomenon according to several authors (Bagenal & Braum, 1978; Hyslop, 1980; Lima Junior & Goitein, 2001) is a potential for polyculture.

Physicochemical parameters

Table 1 illustrates the means of all the physicochemical parameters measured during the study period. All parameters were within the acceptable range by FAO (1993) suitable for the sustenance of aquatic life and domestic use. The conductivity of the reservoir was low (84.01 - 87.14 µS/cm) and this is similar to the findings of Mustapha (2008) on the Oyun reservoir in Nigeria where the water had a low ionic

content. The slight differences in conductivity of these systems were probably associated with catchment geology. The low conductivity of the reservoir might suggest low water hardness which according to several authors has the potential of supporting diverse freshwater organisms (Mwaura, 2006; Mustapha, 2008; Ayele, 2010). The mean temperature of the reservoir also suggests a peculiarity of water in the tropics where due to their prolonged exposure to sunlight have high temperatures. The study also revealed that the reservoir water is highly aerated (7.43 - 8.02 mg/L) which could possibly be as a result of low decompositional activities in the water, wind mixing and high photosysnthetic activities.

Table 1. Average and mean values of physicochemical parameters of the Golinga Reservoir from November 2013 to April, 2014

Physicochemical Parameter	Average range	Mean value ± S. E
Temperature (^{0}C)	25.6 - 30.3	27.74 ± 0.13
Dissolved oxygen (mg/L)	7.43 - 8.02	7.73 ± 1.0
Conductivity (µS/cm)	84.01 - 87.14	85.58 ± 0.018
Ph	6.97 - 7.11	7.02 ± 0.03.

S. E denotes standard error

Condition factor of the fish species

The condition factor of *Hemichromis fasciatus* and *Tilapia zilliii* were 3.93 to 4.74 respectively. According to Abowei (2010) condition factor greater than 2 suggests the fish is in a very good condition. Considering the mean condition factors of the two fishes, it implies the fish is growing well. This could be as a result of ready availability of their food resources in the reservoir. Furthermore, the observed physicochemical parameters could be providing favorable environmental conditions for the growth of the fish.

Conclusion and recommendation

The varied group of food items being fed by *Hemichromis fasciatus* and *Tilapia zilliii* suggests a potential for polyculture and an ability to prevent interspeciific competition. Furthermore, the general wellbeing of both species was good suggesting good management practices occurring around the reservoir.

However, considering the ever declining numbers of *Tilapia zilliii* which prevented further studies of the species with corresponding increase in the populations of *Hemichromis fasciatus* it will be sustainably wise for community management teams, Government and stakeholders to institute measures to reduce the numbers of *Hemichromis fasciatus*. Extended study of this research should be carried out on these species for a year to bring into light possible inherent factors leading to this observation.

REFERENCES

Abowei, J. F. N. (2010). Salinity, dissolved oxygen, pH and surface water temperature conditions in Nkoro River, Niger Delta, Nigeria. Advance Journal of Food Science and Technology, 2, 360 - 400.

Alhassan, E.H., Abass, C. and Bayorbor, T. (2011). An Investigation into the Food and Feeding Habits of Sarotherodon Galilaeus (Pisces: Cichlidae) in a Shallow Tropical Reservoir

Amevenku, F. Y. and Quacoopome, T. (2006). Fish and Fisheries of the Botanga and Libga Reservoirs in Northern Ghana,

West Africa. West African Journal of Applied Ecology, vol. 14, 2008.

Antwi, L. A. K. & Ofori-Danson P. K. (1993). Limnology of a tropical reservoir (The Kpong Reservoir in Ghana). Journal of Tropical Ecology, 34,75 - 87.

Bagenal, T. B. & Braum, E. (1978). Eggs and early life history. In T. Bagenal (Ed.), Methods for the assessment of fish production in freshwater, (3rd ed.), (pp. 165-201). Oxford: Blackwell Scientific Publications Limited.

Hyslop, E. J. (1980). Stomach content analysis - a review of methods and their application. Journal of Fish Biology, 17, 411- 429.

Kpodonu, T.A and Momade, F.Y., (2008). Heavy metals in the Libga, Bontanga, Golinga reservoirs. In: Abass, C., (2010). Stomach content of the catfish Clarias auguillaris in the Golinga Reservoir. Thesis submitted to the University for Development Studies. Faculty of Renewable Natural Resources

Lima- Junior, S. E. & Goitein, R. (2001). A new method for the analysis of fish stomach contents. Maringá, 23, 421 - 424.

Mustapha, M. K. (2008). Fish fauna of the Oyun reservoir, Offa, Nigeria. Turkish Journal of Fisheries and Aquatic Sciences, 8, 309 - 319.

Mwaura, F. (2006). Some aspects of water quality characteristics in small BBB6 555BN6shallow tropical man-made reservoirs in Kenya. African Journal of Science and Technology, 7, 82 – 96.

Needham, J. G. & Needham, P. R. (1962). A Guide to the Study of Freshwater Biology (5th ed.).N6T San Francisco: Holden – day, Inc.

Reid, G. M. (1990). Captive breeding for the conservation of cichlid fishes. Journal of Fish Biology 37: 157. Dio: 10: 111/j.1095- 8649.1190-tb05031.xLake Malawi. Retrieved 2007 – 04-19.

Ugwumba, A. A. A. (1988). The food and feeding ecology of juveniles of some culturable fish species in Nigeria (Technical Paper No. 31). Nigeria, Nigerian Institute for Oceanography and Marine Research.