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THE PHYTOPLANKTON UPTAKE FROM GUT CONTENT ANALYSES OF CICHLIDS AND CLARID FISHES IN RESERVOIRS IN JOS METROPOLIS

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Abstract

An investigation of the gut content analyses of two Cichlids namely *Oreochromis niloticus,Tilapia zillii* and a Clarid (*Clarias gariepinus*) of selected water reservoirs namely Kogingirin, Liberty, Lamingo and Tolemache in Jos metropolis was carried out in August, November 2015 and February 2016. A total of 123 phytoplankton species were identified, and distributed into five classes namely Bacillariophyceae (63), Chlorophyceae (55), Cyanophyceae (1), Dinophyceae (1) , Euglenophyceae (3) and 47 genera. This comparative study of the algal uptake of these three fishes of economic importance revealed that *Oreochromis niloticus* had 88 species of algae in the gut, followed by *Tilapia zillii* (55) and *Clarias gariepinus* (11). In addition, 25 species were common to the Cichlids (*Oreochromis niloticus* and *Tilapia zillii*), Five (5) were exclusively identified in *Clarias gariepinus* and only 4 were common to all three fishes. The implication of these findings to Aquaculture practices, fish culture and fish farming is geared towards a solution to availability of live food for larval feeding.

Keywords: **Phytoplankton, Cichlids, Clarid, Fishes, Reservoirs, Jos.**

Introduction

Fishes are good source of aquatic food that provides macronutrients (proteins and lipids) as well as micronutrients (vitamins and minerals) and gives nourishment to the human body (Mishra, 2020). Over the years, fishes have gained importance as a source of food for human beings because they are cheap and a rich source of animal protein, vitamins, especially vitamin A (Retinol) among others (Offem *et al.*, 2009). Fish, like any animal, require adequate nutrition for proper growth and survival. The availability of food and feeding habitsof fishes in natural water bodies is different among the species but all the fishes require protein-rich live food for better growth, efficient breeding, and survival (Mandal *et al.*, 2009). Phytoplankton cells could be used as a natural food of fish as they are rich in vitamin precursors, growth promoters, and essential fatty acids (Awasthi *et al*., 2006). Understanding species diversity and distribution patterns of Phytoplankton is of great importance to aquaculture as it serves to evaluate the complexity and resources of these habitats (Kumar *et al*., 2006). Thus, one of the key factors to successful fish culture is the understanding of some biological fundamentals, especially food and feeding behaviour. The feeding habits of fish contributes an active area of research to those seeking to ascertain the food and feeding habit of fish (Nath *et al.*, 2015), identify the trophic relationships present in aquatic ecosystems, and also for fisheries managers concerned with factors that affect the fishery. The gut content analysis gives information about the type of food material that is available to the fishes in the food chain (Babare *et al*., 2013). The aim of this study is to identify the phytoplankton species in the guts of two species of Cichlid and Clarid fishes as a step towards harnessing live food for rearing fish larvae.

Materials and Methods

Study area/ Sampling areas

The study area is Jos, Plateau State, Nigeria. The sampling areas covered four water reservoirs managed by the State Water Board namely Kogingirin, Lamingo, Liberty, and Tolemache. The X/Y coordinates for the various sampling areas respectively are as follows: Kogingirin - 492935.5/1097574; Lamingo - 494731.9/1095977; Liberty - 492386.7/1093951 and Tolemache - 496650.1/1093889.

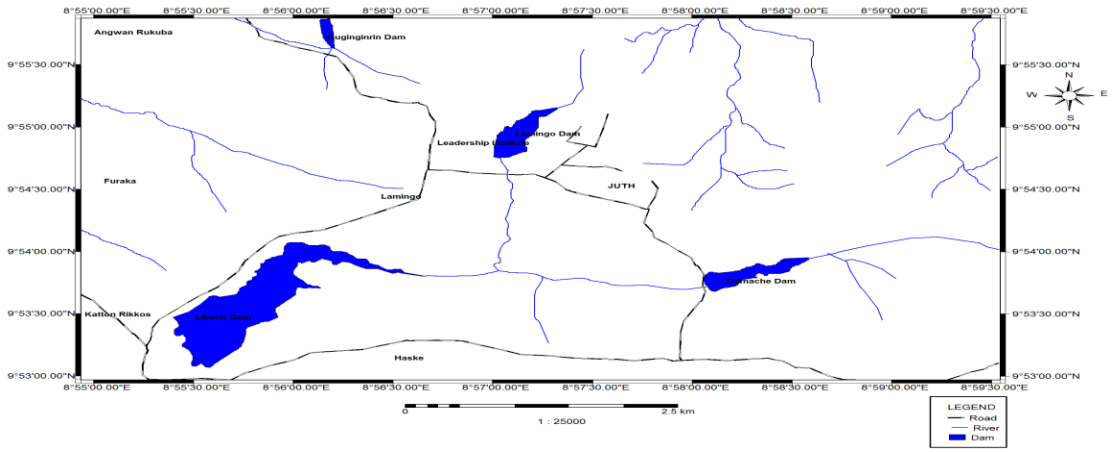

Figure1. Map Showing the Different Water Reservoirs (Satellite Image; areas in blue).

Experimental procedure

The fish species were obtained from the different reservoirs at three different occasions in August, November 2015, and February 2016, using 4.40cm mesh size nets. Identification of the fish species was carried out with the aid of relevant keys.

Gut content analyses were carried out on freshly caught fishes of the three species in the four reservoirs during the different sampling occasions, by taking out complete gut content of each fish, and making an incision in the abdomen (Gupta & Gupta, 2006). The contents were emptied into carefully labelled plastic containers and preserved in 4% formalin solution. Qualitative analysis was carried out with the help of an ordinary light microscope. The phytoplankton species were identified, enumerated and classified into classes, genera and species using a coloured phycokey by Baker (2012) and other relevant identification keys.

Results

The microalgal composition found in the gut content samples was very diverse being represented by 123 species distributed across five classes namely Bacillariophyceae (63), Chlorophyceae (55), Cyanophyceae (1), Dinophyceae (1), Euglenophyceae (3) and 47 genera. Furthermore, 88, 55 and 11 species were recorded for *O. niloticus*, *T. zillii* and *C. gariepinus* respectively.

Four (4) of the phytoplankton species were common to all three fishes which include *Pinnularia accuminata*, *Pinnularia subcapitata, Pinnularia sublinearis* and *Surirella linearia* (Table 1). Twenty-five (25) species were common to the Cichlids (*Oreochromis niloticus* and *Tilapia zillii*) (Table 1). The species common to the Cichlids were distributed into the following classes: Baccillariophyceae (14), Chlorophyceae (9), Dinophyceae (1) and Euglenophyceae (1) (Table 1). On the other hand, five (5) species (*Navicula* sp, *Coelastrum pulchellum*, *Staurastrum avicula*, *Trachemona*s sp and *Trachemonas playfairi*) occurred exclusively in *Clarias gariepinus.*

The distribution of phytoplankton species showed that in all the three fish species, Baccilariophyceae had the highest numbers of species followed by Chlorophyceae with a notably good representation of species of Euglenophyceae in *Clarias gariepinus.*

Baccilariophyceae was represented by 49, 55 and 64 percent of the species in *Tilapia zillii, Oreochromis niloticus* and *Clarias gariepinus* respectively (Figures 1-3). A notable observation is the comparatively higher proportion of Euglenopnyceae in the gut of *Clarias gariepinus* compared to the Cichlids (Figure 3).

Table 1 List of Phytoplankton Species common to the *O.niloticus* and *T.zillii*

Class	Species	Class	Species
Baccilariophyceae	*Cymbella ventricosa***	**Chlorophyceae**	*Closterium acerosum* **
	*Gomphonema parvulum***		*Closterium navicula*
	Navicula sp **		*Cosmarium contractum* **
	Navicula subtilissima		*Cosmarium decoratum*
	Nitzschia sp **		*Netrium* sp 1 **
	Pinnularia accuminata *		*Netrium* sp 2
	Pinnularia appendiculata **		*Netrium interruptum*
	Pinnularia biceps		*Scenedesmus acuminatus* **
	Pinnularia sp		*Scenedesmus quadricauda*
	Pinnularia divergens	**Dinophyceae**	*Peridinium bipes* **
	Pinnularia intermedia	**Euglenaphyceae**	*Euglena oxyuris* **
	Pinnularia subcapitata *		
	Pinnularia sublinearis *		
	Surirella linearia */**		

* Species common to all three species studied
** Genera common to all cichlids

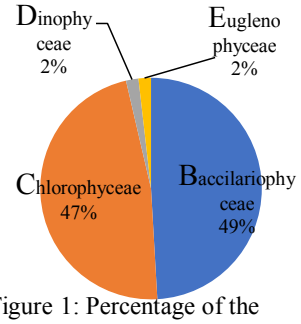

Figure 1: Percentage of the Different Classes of Phytoplankton Species from Gut of *Tilapia zillii*

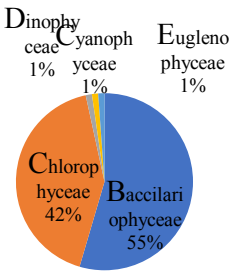

Figure 2: Percentage of the Different Classes of Phytoplankton from the Gut of *Oreochromis niloticus*

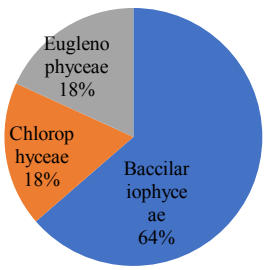

Figure 3: Percentage of the Different classes of Phytoplankton Species from the Gut of *Clarias gariepinus*

Discussion

The 123 phytoplankton that were taken up by the fish species in the study is an indication of the diverse algal composition in the reservoirs. This number of phytoplankton evident in the gut content of the three fish species considered gave an insight into the food habits of the fishes, thereby presenting the different phytoplankton species as food resources for them. This agrees with reports of Shalloof & Khalifa (2009) who reported *Tilapia* feeding on algal filaments and diatoms; Shalloof *et al.* (2009) on the Cichlids feeding on blue green and green algae and El Gamal & Ismail (2005) on *Clarias gariepinus* having a wide range of diet. The five main classes of algae found in the three fish species studied, is also a pointer to the observation that fishes (especially the *Oreochromisniloticus*) are able to select and choose the preferred foodstuff, and does not consume food at random. This observation agrees with the work of Abdel- Tawwab (2003) who observed the same in the stomach of *Oreochromis niloticus* being a phytoplanktivore. The preference of diatoms (Baccilariophyceae) by *Oreochromis niloticus* agrees with the work of Shalloof & Khalifa (2009) and Onyeche *et al*., (2013). Onyeche *et al*., (2013) noted that since Cichlidae are more of surface feeders, their short upper jaw enabled them to easily grab desmids and diatoms at the water surface. Algal species occurred more in the Cichlids than the Clarid because of the difference in their feeding habits. The fewer species in the algal uptake for *Clarias gariepinus* could be as a result of their being carnivorous feeding more on fish and fish parts as noted by Offem *et al.,* (2009). The four species namely *Pinnularia accumunata*, *Pinnularia subcapitata*, *Pinnularia sublinearis* and *Surirella linearia* (Baccilariophyceae) which was clearly identified from the gut contents of the three fishes portrayed a case of food selectivity and algal type preference. These specific phytoplankton species identified as preferred by the fishes gives hope for solving the problem of fish larval feeding through the usage of algae for natural fish feed formulation. This is because deliberate incorporation of algae in fish feed formulation is geared towards reduction of production cost and easier accessibility of locally available alternative ingredients. In conclusion, this finding is a positive step for harnessing available unutilized natural resources for fish diets, which could go a long way in reducing the high cost and unavailability of suitable live food for feeding fish larvae which promises to benefit the fish farmer.

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