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Diet Composition and Dynamics in Fish Species of Ogun Coastal Water, Southwest, Nigeria

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ABSTRACT: Diets composition and dynamics of *Eugerres plumieri, Gobioides broussonnetii, Elops aurus, Oreochromis niloticus* and *Heterotis niloticus* in Ogun Coastal water were examined. The fish species were obtained from local fishermen fortnightly between August and October, 2021. The fishes were immediately placed on iced chess after collection and identification before transporting to the laboratory for further examination. All the stomachs of the fishes examined and the contents were analysed using numerical and frequency of occurrence methods. Results indicated that *O. niloticus* and *E. aurus* fed on analogous foods which were principally macrophytes, *Chlamydomonas* species and Spirogyra. Other food items observed in all the fish species includes detritus, sand grains and insect parts. High similarity in the diets dynamics of *E. aurus* and *E. plumieri* indicated food competition between the fish species which they both showed high level of trophic flexibility and probably possess same ecological niche.

Keywords: Coaster water, Feeding habit, Food content, *Heterotis niloticus*

Introduction

The goal to achieve sustainable fisheries and meeting the growing fish demand worldwide is continuously driving the studies on the biology of fisheries resources. The potential yield and exploitation of water bodies for fisheries production and fish population are distorted by recruitment, growth, reproduction and mortality rate, environmental factors and seasonal changes (Adeyemi *et al.*, 2009; Abdul *et al.*, 2016). These factors have made the pattern of fish population unpredictable, thus, affecting its assemblage, exploitation and biology.

Despite array of information on fish biology (Marshall *et al.*, 2006; Abohweyere and Falaye, 2008; Akombo *et al.*, 2014; Oladunjoye *et al.*, 2020), on fish feed (Oladunjoye *et al.*, 2021), populations dynamics and fish community structure in Nigeria, the need to monitor the changes in the biology of fishes that will sustainably guide its exploitation, sustainability and established results that will guide the development of fisheries policies and foresee the possible effects of seasonal changes on their biology.

Fish has been known as a perishable staples (Adeyemi *et al.*, 2009) in the tropics which are caused by high temperature change accelerating bacterial and enzymatic reaction on their gut and stomach content (Eyo, 2001). Fisheries food and feeding habits answered the challenges arising in relation to human exploitations which vary from time to time. This forms the fundamental troubles caused to comprehend the qualitative and quantitative link relating different fish species and their foods. Seasonal changes influence the quality and quantity of available food for food consumption and digestion rate in organisms.

The importance of fisheries resources such as aquaculture has generated a lot of interest over the years. Aquaculture provides a cheap source of animal protein as it contains adequate nutrition for growth. In the wild, diversity of foods available is nutrients in solid or liquid form and host of different plants and animals. Information on the diet and trophic relationship in fishes of Ogun coastal water in relation to their dynamics

need to be understood. Oransaye and Nakpodia (2005) adducted that dietary composition and dynamics of freshwater fishes should be continuously examined for successful fishery growth, abundance, production, management and organism distribution (King, 1994).

Studies on diet composition and trophic ecology of different fish species from several water bodies showed *Schilbe mystus* in two artificial lakes in Southwestern Nigeria (Ayoade, 2011), *Elops lacerta* from Ologe lagoon, Lagos, Nigeria (Lawson and Aguda, 2010) and trophic ecology of commercial fishes in the Cross River, Calabar, Nigeria (Offem *et al*., 2009) has been documented. Fish dietary habit and stomach contents are essential technique used in fish ecology to examine trophic relationships in water bodies. Fish depends on energy received from its food to perform biological activities such as growth, development, reproduction and other metabolic activities. Hence, the need to study the food types needed for basic requirements for fish growth as well as fish population. Feeding is one of the main activities for daily living in fish and therefore, dedicated a large portion of their energy in searching for food.

The study of food and feeding habits of *E. plumieri, G. broussonnetii, O. niloticus, E. aurus* and *H. niloticus* will be of significant to fishery biology knowledge and fisheries resources. The study investigated their diet composition and dynamics in fishes of Ogun Coastal River, Iwopin, Southwest, Nigeria.

Materials and methods

Sample collection and examination: A total number of 50 species of *E. plumieri, G. broussonnetii, E. saurus, O. niloticus* and *H. niloticus* of 10 samples each were collected in October, 2021 at the River bank from the fishermen from Ogun coastal water, Iwopin, Ogun State, Nigeria. Ogun coastal water lies between longitudes 6°28′59.99″ N and latitude of 4°23′59.99″ E (Figure 1). The samples were stored in iced chess and transported to the laboratory for further examination. Iwopin has an area of 1,000 km^2 with population density of 103.2/km^2 and 103,200 human populations (NPC, 2016).

Total length (TL), standard length (SL) and weight of each fish species were measured using a standard calibrated measuring board. The samples were taken to the laboratory, identified to the species level using the field guide (Olaosebikan and Raji, 2013) and sorted into sexes. The total length (TL), (a measurement from the tip of the snout to the extended tip of the caudal fin) was measured with a meter rule on a measuring board to the nearest 0.1cm, while the total weight (W) was recorded using a sensitive scale (Model: EK 5350) to the nearest 0.1 g. The sex of the samples captured over each sampling period was determined. This was done by the visual observation of the external features and examination of the various gonads. Females were recognized by the distended aperture and males were recognized by the presence of testes. Each fish sample was viscerally dissected from mouth to anus to expose the internal organs. The gut of each fish was stretched out and the length was measured.

Fish gut from each species was carefully extracted by cutting-open the abdominal portion with the aid of a pointed nose pair of scissors. Meanwhile, the gut; tip of oesophagus to the end of the rectum (Adebisi, 2002) was carefully removed by the use of forceps. After the dissection of the specimens, stomach was removed and the fullness of stomach was observed. The stomach contents were preserved in 5% neutral formaldehyde and later emptied into a petri dish. Fish specimens were identified to species level with the aid of Reed *et al.* (1967), Idodo-Umeh (2002), Nwani *et al.* (2010) and Olaosebikan and Raji (2013) before sorting into male and female sexes. Measurement of total length and body weight were measure using a standard measuring board and a triple beam balance (OHAUS 210 Model) respectively. Only the macro-organisms observed in the stomachs were sorted and examined. Samples of the items observed were identified to the lowest possible taxons and counted.

The stomach contents were analyzed using the intensity of feeding which was determined by the degree of dissension of stomach and were grouped into different categories. The weight of the stomach contents was measured using an analytical balance to the nearest 0.1g and the gastro-somatic index (GaSI) was calculated using formula suggested by Froese *et al.* (2014).

$$\text{Gastro-somatic index (GaSI)} = \frac{\text{Weight of the Stomach}}{\text{Total weight of the Fish}} \times 100$$

Statistical analysis: Data obtained were subjected to statistical analysis using the Social Science Statistical Package (SPSS) version 20.0 (IBM Corp, 2011). Mean morphometric parameters were compared among the fish species using One- way Analysis of Variance (ANOVA). Results were presented as mean ±Standard deviation of mean. Post-hoc test was done using the Student-Newman-Keuls (SNK) and P value less than 0.05 was considered to be statistically significant.

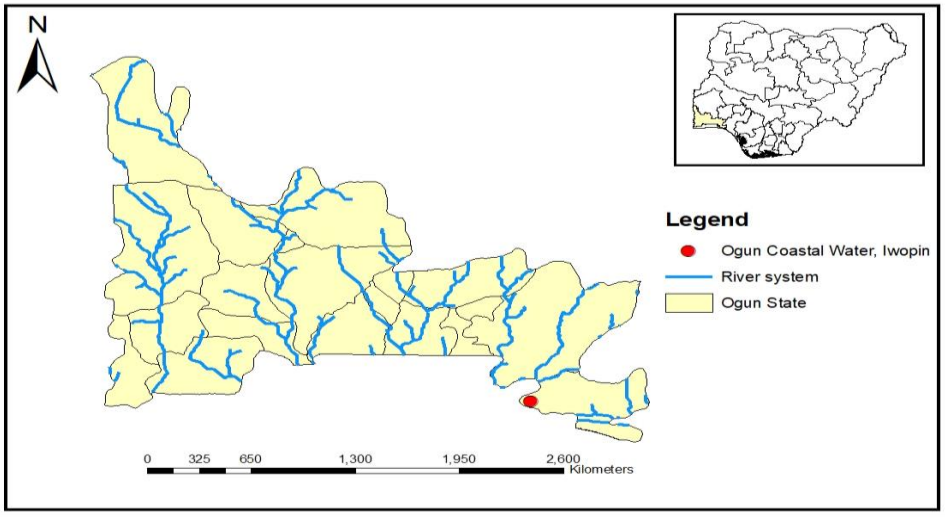

Figure 1: Map of the study area showing Ogun coastal water, Southwest, Nigeria as sampling site

Results

Abundance of food content in fish stomach: The abundance of food content in the fish species stomach of Ogun coastal water, Iwopin, Ogun State is represented in Figure 2. Result showed that food items of the fish species in water body include fish, algae, *Pseudocalanus* spp, crabs and plant materials. Fish was only found in the stomach of *E. saurus* and *E. plumieri*, while *H. niloticus* and *O. niloticus* only had algae present in their stomach. Similarly, the stomach of *E. plumieri* contained crabs and plant materials, meanwhile *Pseudocalanus* spp was only found in *H. niloticus*.

Prevalence of food contents in the stomach: The prevalence (%) of food content in the stomach of fishes in Ogun coastal water, Iwopin, Ogun State Nigeria is presented in Table 1. It was observed that the prevalence of food contents in the stomach of the fish species studied varied in relation to individual fish species. Of all the fish species studied, only *E. saurus* had no individual with empty stomach. However, 60% of *H. niloticus* and *E. plumieri* and 40% of *O. niloticus* and *G. broussonnetii* had empty stomach.

Results showed that *H. niloticus* fed mainly on algae (20 %) or combination of algae and *Pseudocalanus* spp (20 %). Similarly, *O. niloticus* fed mainly on algae (50 %) and some other plant (10 %) materials. Also, *G. broussonnetii* fed mainly on plant materials (40 %) and a combination of plant materials and crabs. On the other hand, the total stomach contents of *E. saurus* (100 %) and *E. plumieri* (40 %) were mainly fishes.

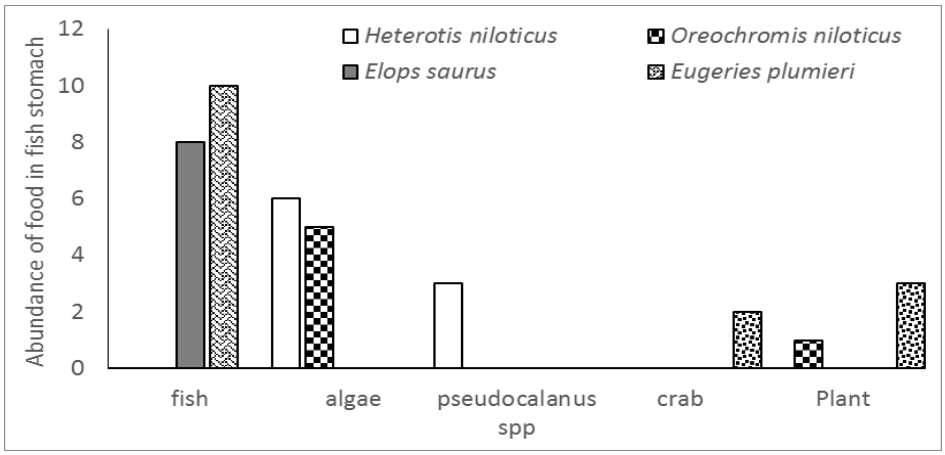

Figure 2: Abundance of food contents in the stomach of fish species in Ogun coastal water, Iwopin, Southwest, Nigeria

Table 1: Prevalence (%) of food content in the stomach of fishes in Ogun coastal water, Nigeria E. plumieri

	Empty stomach	**Fish only**	**Algae only**	***Pseudocalanus* spp only**	**Algae and *Pseudocalanus* spp**	**Crab Only**	**Plant Only**	**Crab and plant**
H. niloticus	60	0	20	0	20	0	0	0
O. niloticus	40	0	50	0	0	0	10	0
E. saurus	0	100	0	0	0	0	0	0
E. plumieri	60	40	0	0	0	0	0	0
G. broussonnetii	40	0	0	0	0	0	40	20

Discussion

Fish stomach contents of Ogun coastal water reported food items in line with records documented for Baguma creek which indicated that they fed on a complete organisms (euryphagous) except the bottom feeders of Cichlidae (S*arotherodon melanotheron and Tilapia guineensis*) and Mugilidae (*Liza falcipinnis*, *Mugil cephalus* and *Mugil curema*) as reported by Olojo *et al.* (2003). It is noted that highly dominated benthic and planktonic species are predatory feeders as reported by Fagade and Olaniyan (1973); Fagade (2009) on Lagos Lagoon fish species which revealed a slight change in food items.

Also, the result observed might be ascribed to the habitats, relative abundance of prey organism and individual food habitat as observed by Alfred-Ockiya (2001), Abdul *et al.* (2016), Alhassan and Ansu-Darko (2011) with exception of *E. larceta, E. aeneus, C. hippos, Sphyraena spp and P. quadrifilis* which are piscivorous predators. Apart from benthic feeders and pisicivorous fish species, the diet dynamics from the fishes are largely unspecialized in their feeding habits which confirmed the findings of Welcomme (1979) and Olojo *et al.* (2003) that unspecialized dietary habits and food resources are optimal means for fish survival in their habitats.

The occurrence of crabs in the diet of some fish species examined could be attributed to the fact that the fish species are predatory fishes which have uneven feeding habit and likely to take a huge meal when their prey is on hand (Fagade and Olaniyan, 1973). However, Shrimps juveniles were usually dominant food items of the predatory fishes and the abundance of these shrimps could be attributed to the fact that penaied adults living offshore and spawn in deeper waters which forms habitat for the juveniles in the estuaries (Khan *et al.,* 2001; Zhang *et al*., 2006). Fish species that are predators also feed on the lobster which is a dominant food item at periods when shrimps were not available.

Often, mud containing detritus is constantly accessible for the bottom feeders that tend to have wide variety of food items, meanwhile, fish species with intermittent feeding habits liable to high empty stomach (Odun, 2000). The presence of plant materials in the stomach of *E. plumieri, G. broussonnetii, O. niloticus, E. aurus* and *H. niloticus* agreed with the finding of Imevbore and Bakare (2001), Alhassan and Ansu-Darko (2011) which documented presence of detritus in addition to other food items such as zooplankton, fishes, insects, phytoplankton as well as insects parts.

High similarity in the diets dynamics of *E. aurus* and *E. plumieri* suggest some level of food competition between the fish species which they both showed high level of trophic flexibility. Also, relatively low percentage of empty stomach in the fish species studied is an indication that food is available in the water body but in poor variety and natural foods. Appropriate monitoring of the water food richness in Ogun coastal water should be fostered to ensure successful fishery management plans that could primarily support fish production with proper management approach.

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