# OCCURRENCE AND COMPOSITION OF FORAGER AND CARNIVORE FISHES IN IVO RIVER SOUTHEAST NIGERIA

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**ABSTRACT**

*Studies on occurrence of forager and carnivore fish composition in Ivo River Southeast Nigeria were carried out. A total of 54 individuals were collected representing 12 species and 8 families. Three stations 1 (upstream Ivo River), 2 (Ivo Dam), and 3 (downstream Ivo River) were selected. Station 2 recorded 32 individuals with 0.33 F/C while in Stations 1 and 3, there were 12 individuals with 0 F/C and 10 individuals with 0.25 F/C respectively. Cichlidae dominated the fish family with 35.1% while alestidae (20.4%)> clarotidae (12.9%)>schilbeidae (11.1%)>hepsetidae (9.2%)>clariidae (7.5%) and cyprinidae and mormyridae constituted 1.9% each. Shannon-Weiner diversity indices (H) was highest in Station 2 (H=2.182) and lowest in Station 3 (H=1.609). Ivo River had a low fish abundance and diversity while the occurrence of carnivorous fish was more than foragers, this showed an unbalanced fish population in all the stations. The impoundment in station 2 along with the different anthropogenic activities and the feeding relationship could be implicated for the unbalanced fish population. Hence an immediate sustainable restoration approach should be put in place to conserve and establish a balanced fish population in Ivo River.*

**Keywords**: Fish yield, abundance, water quality, sustainability.

## INTRODUCTION

The inland freshwater bodies of Nigeria are composed of diverse array of different fish species (Olaosebikan and Raji, 2013). Early research showed that Nigerian inland water bodies are endowed with 100 species in Lake Kanji and 85 in Ogun River. Yem *et al*., (2011) documented 90 species from 25 families in seven Lakes covering the six geographical zones of Nigeria. The ever increasing human population along with its attendant industrialization had brought about a direct pressure on the fish fauna through overfishing and pollution (Ogamba *et al*., 2017 and Ogueri *et al*., 2018). There are other developmental projects like road/ bridge construction, drainage channeling , dredging and dam construction which have all adversely upset the biotopes of the fish at the detriment of their survival (Olaosebikan and Bankole, 2005).

Although, several ichthyofauna works have considered the abundance of fish viz a viz the factors for survival. Falaye and Jenyo-Oni (2015) and Taiwo *et al*., (2018) studied the interrelationship between fish abundance and physico-chemical parameters in Erelu Reservoir Oyo State and Opa Reservoir, Osun State respectively. In the southeast Nigeria, Odo *et al.,* (2009) assessed the fish abundance and their morphometrics in Anambra River Basin while Francis and Sikoki (2014) reported the fish abundance in Oguta Lake Imo State with a sustainable approach and most recently Ogueri *et al*., (2018) assessed heavy metals in fish and the physico-chemical properties of Oguta, Lake, Imo State.

Ivo River is mainly recharged by a network of water bodies that connect Aku River, Ikwo and Ivo Rivers, Ishiagu, Ebonyi State and Ivo Dam, Mpu/Okpanku boundary, Enugu State (Ezekwe *et al*., 2013). The river is also linked to several ephemeral streams and ponds. The river has a high potential for fish yield and abundance because of the large area cover. There are several reports on the various human perturbations in and around the area. However, the fish stock in the river might be disturbed because of these extrinsic stressors. The physico-chemical parameters of some parts of the river basin showed high levels of metal loadings (Aroh *et al*; 2007., Ezekwe *et al*., 2013) while the presence of elevated levels of nutrients which were possibly washed into the water body from fertilizers applications from surrounding farms have also been documented (Oyediran *et al*., 2017).

Beyond the aforementioned extrinsic factors, the forager/carnivore population ratio of the fish fauna mainly controlled by the feeding relationship is an intrinsic factor that should be investigated in other to understand the diminishing or increasing trend of fish abundance in the river. The feeding relationships among the fish to a great extent determines whether a fish population will be balanced or not (Taiwo *et al*., 2018). Ipinmoroti (2013) classified the fish that feed principally on other fish and cannot attain the optimum size of adult without such foods as carnivores "C'' species, while the other fish in the population are grouped as foragers "F'' species which feed on plankton, plant, crustaceans, insects and occasionally eat smallerfish. Das and Chakrabarty (2006) observed that the intrinsic factors like feeding relationship and predation are very essential in forming the fish population structure in a water body while the extrinsic factors are more important in different climatic zones.

It means that the occurrence of a species in a particular trophic level viz a viz their dominance is dependent on various ecological factors. However, a balanced fish population has more foragers, but they must not be overcrowded to avoid food scarcity and eventual depletion. Ipinmoroti (2013) suggested 2.0 as an ideal forager to carnivore ratio for a balanced fish population. The current study will only consider the occurrence of the different fish trophic levels and relate them to the possible prevailing ecological factors in and around the study area as they are connected to the fish survival.

Although, Uche *et al*., (2017) reported the ichthyofauna of Ivo River but with emphasis on the fish abundance and diversity, while Asiegbu *et al*., (2019) studied the fish fauna in relation to plankton community in the same water body and recently Oyediran *et al*., (2019) only reported the impact of impoundment on fish fauna in Ivo River. It is therefore essential to study the occurrence of the trophic levels in order to determine the dominance group and ascertain the balance status of the fish fauna in Ivo River.

## MATERIALS AND METHODS

The sampling was in three stations for the purpose of the study.

Station 1: This station is upstream of Ivo River, which is close to Federal College of Agriculture Ishiagu, Ebonyi State on longitude 70 33' 53.54'' E and latitude 50 54.47.16''N with elevation of 168ft above sea level.

Station 2: Ivo Dam (where the impoundment was constructed) at Mpu, Enugu State on longitude 70 38' 20.57''E and latitude 50 57' 31.64''N with elevation 124ft above the sea level.

Station 3: This station is the downstream of Ivo River, which is Ivo River at Okpanku, Enugu State on longitude 70 38' 34.45 and latitude 50 59' 07.89'' N with elevation of 131ft above the sea level. Fish were caught at the stations using 1.5" gill nets. The fish caught from each of the stations were identified by using key guides of Olaosebikan and Raji, (2013) and Fishbase (2019)

### Data Analysis

The total number of fish samples were recorded per species. Fish diversity was determined with Shannon-Wiener diversity index using Palaeontological statistical software package (PAST 3). Balance in fish population was calculated using Forage: Carnivore ≥2 (Taiwo *et al*., 2018)

## RESULTS AND DISCUSSION

The results of the study showed that 12 fish species belonging to 8 families were recorded which comprised of 12 from 7 species, 32 from 12 species and 10 individual specimens of 6 species at Station 1(Upstream Ivo River), Station 2 (Ivo Dam), and Station 3 (Downstream Ivo River) stations respectively. The checklist of the fish caught is presented in Table 1. The relative numerical abundance are shown in Figure 1. The cichlids ranked highest (35.5%) followed by Alestidae (20.4%) and Clarotidae (12.5%), shilbedae (11.1%), hespitidae (9.2%), clariidae (7.5%) and least was cyprinidae and momyridae with 1.9% each. The diversity indices showed that Ivo Dam at Station 2 was more diverse than Stations 1 and 2 upstream and downstream Ivo River respectively as shown in Figure 2. There were more carnivorous fish species in all the stations of the river, the forager to carnivore ratio was 0.33 in Ivo Dam at station 2 and the lowest was in station 1 downstream (Table 2).

The low fish abundance observed in Ivo River could be associated with perturbations occasioned by the different anthropogenic activities in and around the river course. Although, the current report had similar number of fish families compared to the work of Uche *et al*., (2016) in the same river. However, the family tetraodontidae represented by *Tetraodon linetus* while *Parachanna obscura* a channidae were documented in the earlierwork and not in this study. While only six families were recorded by Asiegbu *et al*., (2019) in the samewater body. Contrarily, there were more fishabundance in Oguta Lake and Anambra River Basinas reported by Francis and Sikoki (2014) and Odo *et al*., (2009) respectively, these water bodies are in the same geographical zone with Ivo River. The high metal loadings and alkaline drainage from the mining discharge in the river had been earlier documented by Ezekwe *et al*., (2013), while Oyediran *et al*., (2017) reported a similar poor waterquality in Ikwo River an adjoining water body of Ivo River, the authors also implicated the wastes from the mining activities in the area. The relative high number of species among cichlidae is not surprising,the family are prolific and easily adapted to diverse water quality conditions. The high fish diversityobserved in Ivo Dam at station 2 may possibly be attributed to the relative stable water quality in lentic water systems compared to constantly fluctuating water quality properties mostly seen in lotic water as observed in the upstream Station 1 and downstream Station 2. The water quality stability in the Ivo Dam could have also resulted in more food availabile for the different trophic levels as reported by Ipinmoroti (2013). The impoundment of the river course at Station 2 i.e Ivo Dam possibly imposed a structural change in the river, this condition further encumbered fish migration, reproduction and other essential ecological variables. Jellyman and Harding (2012) had earlier reported the adverse effects of the impoundment and dam construction on fish abundance and diversity.

The low ratio of forager to carnivore fish species in the study site could be attributed to the unregulated fishing already reported in the water body (Uche *et al*., 2016) and probably a preference

for the carnivorous species. The abundance of the carnivores could also imply that they are more adapted to the ecological changes in the water bodies. The occurrence of most foragers especially the cichlidae in Ivo Dam at Station 2 shows that the impoundment was more suitable for this group. The lentic water system like Ivo Dam has been reported to have high record of fish abundance more than their connecting water bodies (Yem *et al* ., 2011 and Amin *et al*., 2017). The construction of the dam is more suspected to contribute to the low forager to carnivore ratio, the ecological change created a permanent migration barrier for fish especially from downstream Ivo River. The low forager to carnivore ratio signified that Ivo River has an unbalance fish population as described by Taiwo *et al.* (2018). This is an indicator of severe ecological disturbance in Ivo River. This condition if not quickly attended to could lead to threats on fish fauna survival in the river. Further research should be carried out on other aquatic lives such as plankton as they are occupying the base of the food web and they are also a food source to most of the foragers. Strict regulations as regards the fishing activities and wastes discharge in and around the river should be enacted, monitored and well adhered to.

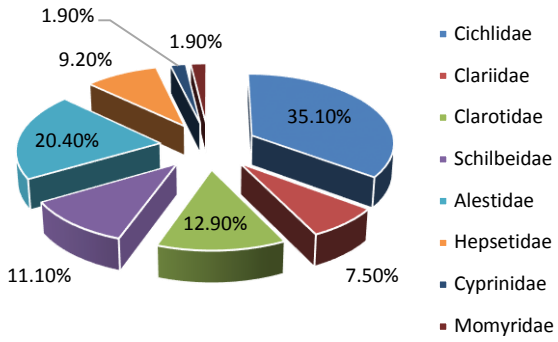


Figure 1: Percentage Relative fish abundance in Ivo River

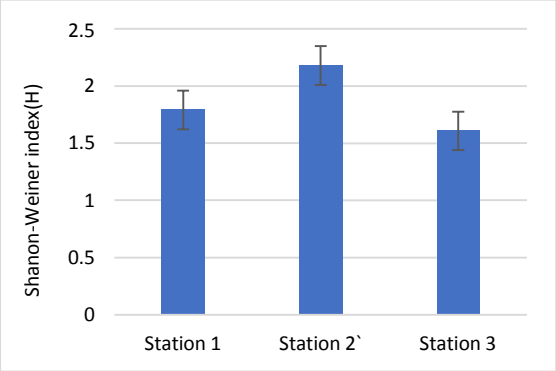


Figure 2: Shannon-Weiner diversity of fish fauna in Ivo River

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**Table 1: Relative Abundance of Fish Fauna in Ivo River**

| Fish Family | Station 1 | Station 2 | Station 3 | Total | % Relative Abundance |
|---|---|---|---|---|---|
| **Cichlidae** | | | | | |
| *Hemichromis fasciatus* | 0 | 9 | 0 | 9 | 16.6 |
| *Coptodon zilli* | 0 | 4 | 0 | 4 | 7.4 |
| *Oreochromis niloticus* | 0 | 4 | 0 | 4 | 7.4 |
| *Sarotherodon melanotheron* | 0 | 1 | 1 | 2 | 3.7 |
| Total | **0** | **18** | **1** | **19** | **35.1** |
| **Clariidae** | | | | | |
| *Clarias gariepinus* | 0 | 1 | 0 | 1 | 1.9 |
| *Clarias camerunensis* | 0 | 1 | 0 | 1 | 1.9 |
| *Clarias buthupogon* | 1 | 1 | 0 | 2 | 3.7 |
| Total | **1** | **3** | **0** | **4** | **7.5** |
| **Clarotidae** | | | | | |
| *Chrysichthys auratus* | 0 | 2 | 0 | 2 | 3.7 |
| *Chrysichthys nigrodigitatus* | 0 | 4 | 1 | 5 | 9.2 |
| Total | **0** | **6** | **1** | **7** | **12.9** |
| **Schilbeidae** | | | | | |
| *Schilbe mystus* | 0 | 1 | 0 | 1 | 1.9 |
| *Schilbe intermedius* | 2 | 1 | 2 | 5 | 9.2 |
| Total | **2** | **2** | **2** | **6** | **11.1** |
| **Alestidae** | | | | | |
| *Hydrocynus forskalii* | 2 | 0 | 4 | 6 | 11.1 |
| *Alestes macrolepidolus* | 1 | 0 | 0 | 1 | 1.9 |
| *Micralestes elongates* | 4 | 0 | 0 | 4 | 7.4 |
| Total | **7** | **0** | **4** | **11** | **20.4** |
| **Hepsetidae** | | | | | |
| *Hepsetus akawo* | 1 | 3 | 1 | 5 | 9.2 |
| Total | **1** | **3** | **1** | **5** | **9.2** |
| **Cyprinidae** | 2 | | | | |
| *Labeao parvus* | 0 | 0 | 1 | 1 | 1.9 |
| Total | **0** | **0** | **1** | **1** | **1.9** |

| | | | | | |
|---|---|---|---|---|---|
| **Momyridae** | | | | | |
| *Marcusenius kainjii* | 1 | 0 | 0 | 1 | 1.9 |
| Total | **1** | **0** | **0** | **1** | **1.9** |
| **Total of number of species** | **7** | **12** | **6** | | |
| **Grand Total** | **12** | **32** | **10** | **54** | **100** |

**Table 2. Fish families and their trophic levels**

| Fish Family | Station 1 | Station 2 | Station 3 |
|---|---|---|---|
| **Herbivore** | | | |
| **Cichlidae** | | | |
| *Tillapia zilli* | 0 | 1 | 0 |
| *Oreochromis niloticus* | 0 | 1 | 0 |
| *Sarotherodon melanotheron* | 0 | 1 | 1 |
| **Cyprinidae** | | | |
| *Labeao parvus* | 0 | 0 | 1 |
| Total | **0** | **3** | **1** |
| **Carnivore** | | | |
| **Cichlidae** | | | |
| *Hemichromis fasciatus* | 0 | 1 | 0 |
| **Clariidae** | | | |
| *Clarias gariepinus* | 0 | 1 | 0 |
| *Clarias camerunensis* | 0 | 1 | 0 |
| *Clarias buthupogon* | 1 | 1 | 0 |
| **Clarotidae** | | | |
| *Chrysichthys auratus* | 0 | 1 | 0 |
| *Chrysichthys nigrodigitatus* | 0 | 1 | 1 |
| **Schilbeidae** | | | |
| *Schilbe mystus* | 0 | 1 | 0 |
| *Schilbe intermedius* | 1 | 1 | 1 |
| **Alestidae** | | | |
| *Hydrocynus forskalii* | 1 | 0 | 1 |
| *Alestes macrolepidolus* | 1 | 0 | 0 |
| *Micralestes elongatus* | 1 | 0 | 0 |
| **Hepsetidae** | | | |
| *Hepsetus akawo* | 1 | 1 | 1 |
| **Momyridae** | | | |
| *Marcusenius kainjii* | 1 | 0 | 0 |
| Total | 7 | 9 | 4 |
| **Forager carnivore ratio (F/C)** | **0`** | **0.33** | **0.25** |