Introduction

Feeding ecology is an important aspect of the life-history strategy of a species to understand the functional role of the fish within their ecosystems [1]. One of the most economically important and dominant species in the Nigerian coastal waters is *Pseudotolithus typus*. This species occurs in the estuaries and saline creek systems. *Pseudotolithus typus* is generally classified as omnivore or predator feeding mainly on aquatic insects, fish and plant debris. *Pseudotolithus typus* utilize various kinds of food resources available in their habitat [2].

The food and feeding habit of fish assemblage deals with their ability to have good nutritive foods which could improve...
their growth within their environment. Therefore, the dietary analysis of *Pseudotolithus typus* in their natural habitat enhances the understanding of their growth, abundance, productivity and distribution and seasonal fluxes in the type and magnitude of food available as well as the season it occurs. This study was designed to have the broad knowledge of the different species of prey in order to understand the quantitative connection between fish and their food organisms. Furthermore, this study adopts an ecosystem approach by quantifying the food organisms based on seasonal variation. This study presents more information on the gut and stomach content of *Pseudotolithus typus* in Lagos Lagoon. Previous reports on the Croakers in Nigeria include [3,4] and [5,6], also worked on Food habits of two species of *Pseudotolithus* (Sciaenidae) off Benin (West Africa) nearshore waters and implications for management and [7] also worked on Biometric characteristics, Food and feeding Habit and Sex Dimorphism of the Long Neck Croacker (*Pseudotolithus typus*) from Lagos lagoon.

Materials and methods

Study area

Lagos State lies between longitude 3°21"24"E and latitude 6°35"8"N. It is located at the South-Western of Nigeria. Lagos State consists of twenty local governments. Ikeja currently serves as an administrative seat of the State and of a local government. The study area is Makoko, located in Lagos Mainland Local Government Area of Lagos State. Makoko is one of the many water and shoreline settlements in Lagos State. Makoko is a shanty settlement located in the centre of Lagos city, along the banks of the Lagos lagoon. Makoko lies within the south-eastern part of Lagos metropolis. It is bounded on the North by Iwaya and University of Lagos; at the West, by Ebute-Meta; South, by the Third Mainland Bridge; and East by the Lagos lagoon [8].

Fish samples collection

Samples of *Pseudotolithus typus* were randomly obtained from September 2018 to February, 2019 from fishermen catches at Makoko landing point. The fish collection was done monthly for six consecutive months. A total of 93 specimens were collected and transported in ice-packed box to the wet laboratory of the Nigerian Institute for Oceanography and Marine Research (NIOMR) for further examination. These specimens were slit open and the contents displayed in Petri dishes with a small drops of distilled water added to agitate them and examined under a stereo light microscope (magnification up to 100×) to identify the food items using appropriate taxonomic guide (FAO Marine Fish identification guide). Information on Total Length, Standard length, Weight and identified food items were recorded into a data sheet for data analysis.

Food composition determination

Two methods were used to assess the food composition of the fish. These methods included frequency of occurrence and numerical method [10].

Frequency of occurrence

Stomach contents were examined and the individual food organisms sorted and identified. The number of stomachs in which each item occurs were recorded and expressed as a percentage of the total number of stomachs examined.

\[
\text{Frequency of Occurrence} = \frac{J_i}{P} 
\]

Where, is number of fish containing prey i and P is the number of fish with food in their stomach. iJ

This method demonstrates what organisms are being fed upon, but it gives no information on quantities or numbers and does not take in to consideration the accumulation of food organisms resistant to digestion [11].

Numerical method

This involved counting the number of each food item present in the stomach of the species and summing up these numbers to obtain the grand number of all food items in its guts [12]. The number of each food was expressed as a percentage of the grand total number of food items. Usually expressed as:

\[
\text{Percentage number of food} = \frac{\text{Total number of a particular food item}}{\text{Total number of all food items}} \times 100
\]

This method expresses the numerical importance of different food items, and gives relative importance of each food item.

Index of fullness

This is measured as the ratio of food weight to body weight as an index of fullness. This index can be applied to the food in the stomach, or to that in the whole digestive tract. It is usually expressed as parts per 10,000 ( or parts per decimals).

Gut contents were analyzed quantitatively. The various food items are identified. The food content found in the stomach was divided into three groups.

1. Full: Stomach was full with food
2. ½ Full: Stomach was ½ full
3. Empty: Stomach without food

Citation: OM Awotunde (2021) Stomach and gut content of Long Neck Croacker—*Pseudotolithus typus* (Bleeker,1863) from Lagos Lagoon, Nigeria. Ann Mar Sci 5(1): 001-006. DOI: https://dx.doi.org/10.17352/ams.000024
Guts Repletion Index (GRI)

Guts repletion index is number of non-empty guts divided by total number of guts examined, multiply by 100.

Represented as:

\[
GRI = \frac{\text{Number of non-empty guts}}{\text{Total number of guts examined}} \times 100
\]

Statistical analysis

Data obtained from the study were subjected to descriptive statistics (mean and standard deviation) and presented in graphs, pie chart and bar chart. Data were subjected to one way analysis of variance (ANOVA) and significant differences accepted at P < 0.05 using statistical package (SPSS version 14). Relationship between variables (Length and Weight) was analysed using regression.

Results

Stomach fullness

Figure 1–3 shows the degree of stomach fullness of *Pseudotolithus typus* samples during the wet season, degree of stomach fullness of *Pseudotolithus typus* samples during the dry season and degree of Stomach fullness of *Pseudotolithus typus* samples during wet and dry season.

Table 1 shows the gut repletion indices of *Pseudotolithus typus* samples from Lagos Lagoon during the wet and dry season. The gut repletion index was lower during the wet season with a mean value of 71.11 and higher during the dry season with a mean of 79.26. The maximum gut repletion index of 80.00 was obtained during the wet and dry season while the minimum of 60.00 was obtained during the wet season.

Table 2 shows the gut repletion index *Pseudotolithus typus* samples for the combined sampling period of six month and has a maximum value of 80.00 with the minimum of 60.00. The gut repletion index of *Pseudotolithus typus* samples from Lagos lagoon has a mean of 75.18 for both season. Figure 4 shows the gut repletion index of *Pseudotolithus typus* samples for each month samples from Lagos lagoon (September, 2018 – February, 2019) respectively.

Diet composition

The diet of *Pseudotolithus typus* samples from Lagos lagoon consisted mainly of crustaceans (shrimps) and Pisces (fishes). Other food items were unidentified partially digested fish, Unidentified partially digested Crabs, Cephalopods...
and Bivalves. Crustaceans constituted the most important prey group in samples and have a frequency of occurrence of 55.71%. *Parapeneausis longirostrics* had 5.71% while *Paeneus notialis* has the highest frequency of occurrence of 48.57%. Figure 4 shows the frequency of occurrence dietary composition of *Pseudotolithus typus* samples from Lagos lagoon, Nigeria (September, 2018 – February, 2019), while Figure 5 shows the numerical dietary composition of *Pseudotolithus typus* samples within the specified sampling period. Figure 6, shows comparison between the frequency of occurrence and numerical dietary composition of *Pseudotolithus typus* in Makoko Lagos lagoon, Nigeria (September–February) respectively.

Figure 7 Comparison between Frequency of Occurrence and Numerical dietary Composition of *Pseudotolithus typus* samples from Lagos lagoon, Nigeria during wet season while.

**Discussion**

**Gut repletion index of *Pseudotolithus typus***

Gut repletion index mean of 75.18% with minimum of 60% and maximum of 80% was observed during the combined sampling period. The observed mean gut repletion index for wet (71.11%) and dry (79.26%) season is an indication of high feeding intensity. The present information is not in agreement with reports of [13] who observed the 100% GRI in *C. Auratus* in Cross river estuary of Nigeria. The high % GRI exhibited by *P. typus* might be due to their ability to switch diets due to high abundance of food items.

Fish are capable of changing their gut morphology in response to available food resources and demonstrate high degree of plasticity. However, contrary to the report of high gut
The stomach and gut content of Pseudotolithus typus from Lagos lagoon show a great autotrophic pattern and are grouped into predatory or carnivores feeder. An overlap does not exist in the diet which increases competition among the fish and ensures a narrow spectrum of dietaries. From the study, it can be concluded that Pseudotolithus typus in Lagos lagoon utilize more than one source of food.

My recommendation is that the research should be intensified in other area of Pseudotolithus typus nutrition and microbial gut content in other to be able to determine the nutritional technicality of rearing the fish in a cultured environment. Also the pollution level of Lagos lagoon should be determined especially during the dry season (when the water level is low) to be able to determine the remediation methods to use in controlling such.

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