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# Gastrointestinal Helminth Parasites, Stomach Contents and Condition Factor of *Bostrychus africanus* (*Sleeper gobies*) and *Periophthalmus papilio* (*Mudskipper*) found in Ikpukulu-Ama Creek, Port Harcourt, Rivers State, Nigeria

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***Authors' contributions***

*This work was carried out in collaboration among all authors. Author ACC designed the research, participated in the laboratory analysis and wrote the first draft of the manuscript; Author HIA carried out the field surveys and sampling and also participated in the laboratory analysis; Author ECO worked on literature searches and proofread and improved on the manuscript. All authors read and approved the final manuscript.*

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## ABSTRACT

**Aim:** *Bostrychus africanus* and *Periophthalmus papilio* are important fisheries in parts of southern Nigeria. However, there is a dearth of information on the gastrointestinal helminths of these gobiids, especially from the Ikpukulu-Ama Creek, Port Harcourt, Rivers State, Nigeria. This research was, therefore, necessary to provide information on the parasites as well as stomach content analysis and condition factor of both fish species.
**Study Design:** A total of 62 *Bostrychus africanus* and thirty-six (36) *Periophthalmus papilio* were caught for analysis using basket traps on the mudflats of the creek.
**Place and Duration of Study:** Sampling was done at the Ikpukulu-Ama Creek, Port Harcourt, Rivers State, Nigeria in September, 2023.
**Methodology:** In the laboratory, samples were identified using morphometric characteristics and identification keys and examined for parasites using standard diagnostic techniques.
**Results:** Nematodes, *Raphidascaroides africanus* (16.1%), were examined from *B. africanus*, whereas acanthocephalans, *Neoechinorhynchus* sp. (2.8%), were observed from *P. papilio*. The result of this study suggests a parasite preference of *B. africanus* over *P. papilio*. Stomach content analysis showed the presence of crab parts and muddy sediments in *B. africanus*. Condition factor was better in *B. africanus* (1.1 to 1.8) than in *P. papilio* (0.7 to 1.1).
**Conclusion:** There is a dearth of information on the stomach content of *P. papilio* and therefore, is suggested for future studies, and scientific reasons for the parasite preference of *B. africanus* over *P. papilio* should be elucidated.

*Keywords: Acanthocephalans; Bonny River; gastrointestinal helminths; gobiids; mudflats.*

## 1. INTRODUCTION

Fishes are a significant food source in Africa, particularly in the Niger-Delta of Nigeria [1], playing a crucial ecological and economic role in the food chain [2]. Fish is known to provide vital nutrients such as omega-6 oil and the cholesterol level is relatively very low [3]. Gobiids, such as *Bostrychus africanus* and *Periophthalmus papilio,* are carnivores that feed on crustaceans and other benthic invertebrates, small fishes and insects. Many species pass through a marine larval stage during which they feed on plankton [4]. The analysis of fish stomach content, which depends on food availability and varies by location, provides information about their feeding habits and culture potential [5].

Nonetheless, fish health can be negatively impacted by parasites, especially helminth parasites, which leave fish susceptible to infections [6]. Fish health is determined by their condition factor, which varies by species and season [7], and is influenced by anthropogenic activities, food abundance, diet, ideal temperature, and salinity [4,8,9]. Fish regularly ingest the larval stage of helminth parasites because of the abundance and diversity of these parasites in the aquatic ecosystem [10]. These parasites can obstruct the intestinal tract of fish, affecting food digestion and absorption, leading to morbidity and mortality, economic losses, and a potential risk of zoonosis [11-12].

Gobiids are commonly infected by gastrointestinal helminths. However, scientific reporting of parasitic infections in these fish species is scanty. Ugbomeh et al. [4] found Ascaridida nematodes in *B*. *africanus* and *P*. *papilio*, with higher parasite infection prevalence in *B*. *africanus*. Robert et al. [13] found *Raphidascaroides africanus* in Rumuolumeni and Afikpo markets in Port Harcourt, Nigeria; while, Elele and Aziaka [14] reported the presence of monogenean, digenean, cestode and nematode parasites in *Periophthalmus* species obtained from some waterfronts in Rivers State, Nigeria. A few authors in Nigeria have reported helminth parasite infestations in freshwater fish in Nigeria, but there doesn't seem to be much information available about fish parasites in the brackish water habitat, with only a few publications on brackish water [15-18]. The Ikpukulu-Ama Creek has been examined for some studies including assessment of cadmium and lead concentrations in barnacles (*Semibalanus balanoides*) and oysters (*Crassostrea gasar*) [19], study of phytoplankton communities [20], heavy metal concentrations of surface water, sediment samples, fish and plankton from same creek [21-22] etc. There is a paucity of information regarding aspects of the parasite communities infecting fish inhabiting the Ikpukulu-Ama Creek.

This research was therefore conducted to examine two gobiids, *B. africanus* and *P. papilio* for their gastrointestinal helminth parasites, their stomach content analysis and condition factor, contributing to biological research data related to the Creek.

## 2. MATERIALS AND METHODS

### 2.1 Study Location

Ikpukulu-Ama Creek (Fig. 1) is located at Latitude N 4º 44'6.65320" and Longitude E 7º1'40.61060". It is a small tidal creek in the Niger Delta region that flows through a small fishing settlement behind Government Comprehensive Secondary School, Borikiri in Port Harcourt City Local Government Area of Rivers State, Nigeria. The Creek is also a tributary of the Bonny River that flows into the Atlantic Ocean. It has salinity values ranging from 5 ppt to 35ppt and it is surrounded by dredging facilities and some petroleum oil servicing companies [20].

### 2.2 Sampling Protocol

Fish samples (sixty-two specimens of *Bostrychus africanus* and thirty-six *Periophthalmus papilio)* were caught from the Ikpukulu-Ama Creek at Borokiri by the use of basket traps set in the muddy part of the Creek and examined for gastrointestinal helminth parasites, stomach content analysis and condition factor in this study. Sampling was done weekly in September, 2023. The fish samples were transported in an ice-chest to the Parasitology Laboratory, Department of Animal and Environmental Biology, Rivers State University, Port Harcourt, for identification and parasitological examination.

Fish samples were identified using the taxonomic keys described by Ssentongo et al. [23] and Schneider [24]. The total length was measured using a meter rule while the body weight of each fish specimen was measured using a sensitive weighing balance (model: Camry EK5350). Microsoft Excel was used to compute Fulton's condition factor (CF) according to Zhelev et al. [25] as follows: $CF= BW /TL^3 \times 10^2$, where BW is the wet body weight of fish in g and TL is a total length of fish in cm.

For parasitological examination, a longitudinal section was made through the anal pore of each fish specimen. The exposed gastrointestinal tract was excised, slit longitudinally and examined microscopically for parasites in Petri dishes containing physiological saline. The contents of the Petri dishes were carefully examined for analysis of the stomach content. Parasite species present were identified according to Paperna [26] and Moravec [27] and were fixed in 70% ethanol.

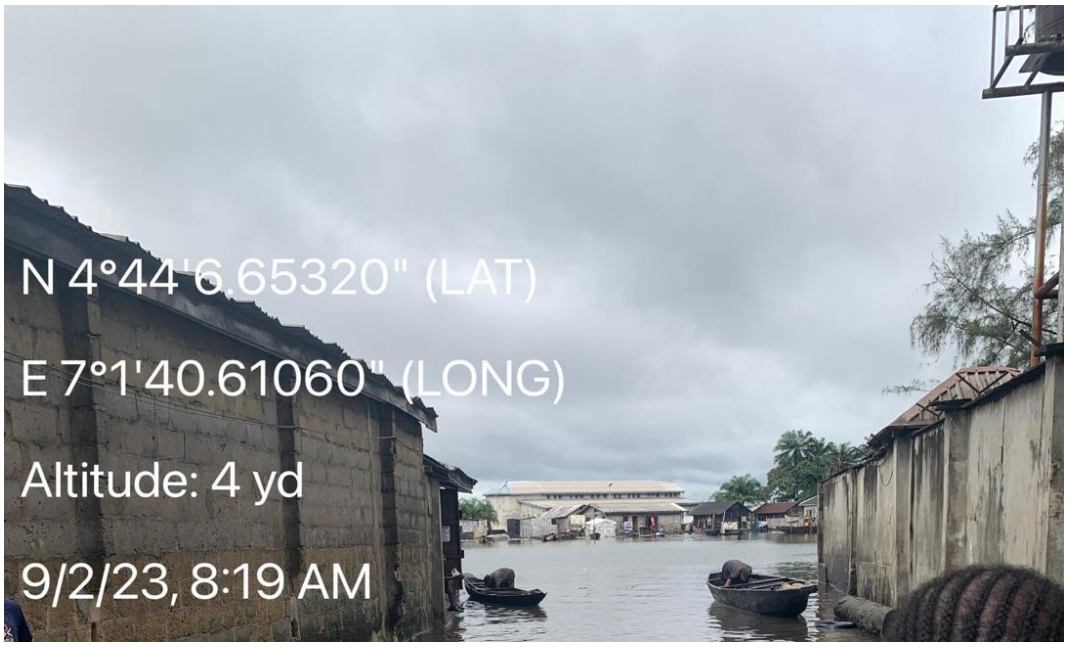


**Fig. 1. Photograph of Ikpukulu-Ama Creek, Borikiri, Port Harcourt, showing its geographic coordinates**

### 2.3 Data Analysis

Parasite prevalence and mean intensity of infection were calculated according to the formula of Bush et al. [28].

## 3. RESULTS

### 3.1 Morphometric Characteristics and Condition Factor of *Bostrychus africanus* and *Periophthalmus papilio* of Ikpukulu-Ama Creek, Borikiri, Port Harcourt

*Bostrychus africanus* specimens examined in this study had wet body weights ranging from 10.0g to 21.0g with a mean value of about 12.9g. Their total length values ranged from 8.8cm to 11.3cm, and their condition factor, 1.1 to 1.8 with a mean value of 1.4 (Table 1).

The *P. papilio* samples examined had wet body weights ranging from 4.0g to 15.0g. Their total length was in the range of 7.9cm to 11.5cm, with a mean value of 9.6cm. The condition factor of these *P. papilio* specimens ranged from 0.7 to 1.1 with a mean value of 0.9 (Table 1).

### 3.2 Parasitic Helminths Isolated from *Bostrychus africanus* and *Periophthalmus papilio* of Ikpukulu-Ama Creek, Borikiri, Port Harcourt

Two parasitic helminth species, *Rhaphidascaroides africanus* (Nematoda) and *Neoechinorhynchus* sp. (Acanthocephala), were encountered in this study.

Ten (16.1%) of *B. africanus* examined were infected with *Rhaphidascaroides africanus* with a mean intensity of approximately one parasite per infected host. Only one (1) *P. papilio* specimen was infected with the acanthocephalan, *Neoechinorhynchus* sp, showing a prevalence of 2.8% (Table 2).

### 3.3 Stomach Content Analysis of *Bostrychus africanus* and *Periophthalmus papilio*, Ikpukulu-Ama Creek, Borikiri, Port Harcourt

The stomach content of *B. africanus* included parts of crabs and muddy sediments. The crabs were present in the stomach of ten (10) *B. africanus* while others were mostly composed of muddy sediments. The feeding habit of the *P. papilio* from this River could not be ascertained as there were no fragments of particles left in the stomach of the samples examined, except for mud particles.

## 4. DISCUSSION

According to the study, the mean length of the *B. africanus* and *P. papilio* samples was 9.8 cm and 9.6 cm, respectively. On the other hand, the samples analyzed by Ugbomeh et al. [4] were about the same size in length, but heavier. Abowei and Hart [29] and Ogamba et al. [30] hypothesized that heavier fish samples of a given length are in better condition than less weighty fish.

This study result revealed the presence of the gastrointestinal nematode, *Raphidascaroides africanus* infective in *B. africanus*, and the acanthocephalan, *Neoechinorhynchus* sp. infective in *P. papilio*. Elsewhere, the occurrence of nematode parasite had been recorded in *B. africanus* and *P. papilio*, though of different species. Ugbomeh et al. [4] recovered Ascarid nematodes in their work which is similar to the species recorded in this study. *Raphidascaroides africanus* infestation was also reported by Robert et al. [13] in *B. africanus*. These parasites are commonly associated with *B. africanus* in Africa [27]. Acanthocephalan infection in gobiids has not been well documented as there is a paucity of information on the subject. Nematodes can obstruct the intestinal tract of fish, affecting food digestion and absorption, and their presence in fish indicates a potential risk of zoonosis [11-12].

**Table 1. Morphometric Values and Condition Factor of *Bostrychus africanus* and *Periophthalmus papilio*, Ikpukulu-Ama Creek, Borikiri, Port Harcourt, Rivers State**

| | ***Bostrychus africanus*** | | ***Periophthalmus papilio*** | |
|---|---|---|---|---|
| Parameters | Range | Mean | Range | Mean |
| Wet Body Weight (g) | 10.0 – 21.0 | 12.9 ± 2.5 | 4.0 – 15.0 | 8.0 ± 2.9 |
| Total Length (cm) | 8.8 – 11.3 | 9.8 ± 0.5 | 7.9 – 11.5 | 9.6 ± 1.0 |
| Condition Factor | 1.1 – 1.8 | 1.4 ± 0.2 | 0.7 – 1.1 | 0.9 ± 0.1 |

*± standard deviation*

**Table 2. Prevalence and mean intensity of parasites of *Bostrychus africanus* and *Periophthalmus papilio*, Ikpukulu-Ama Creek, Borikiri, Port Harcourt**

| Parasites | Fish Species | | | |
|---|---|---|---|---|
| | ***Bostrychus africanus*** | | ***Periophthalmus papilio*** | |
| | **Prevalence (%)** | **Mean Intensity (±Stdev)** | **Prevalence (%)** | **Mean Intensity (±Stdev)** |
| *Raphidascaroides africanus* | 16.13 | 1.4 ± 1.0 | - | - |
| *Neoechinorhynchus* sp. | - | - | 2.78 | 1.0 ± 0.0 |

It was observed that the prevalence of parasite infection and mean intensity was higher in *B. africanus* than *P. papilio*, which is similar to the report of Ugbomeh et al. [4]. Both gobiids hereby examined have a parasitic mode of life and occupy similar ecological niches [5,31], so differences in parasite prevalence could simply be as a result of host preference by the parasites and the intensity depend on prevailing environmental conditions.

Several of the samples examined presented with empty stomachs especially the *P. papilio*, but the few with stomach content (which were ten (10) of *B. africanus*) all had crab parts and muddy sediments. This is in consonance with the report of Chukwu and Princewill [5] that crab parts are the most important food items of *B. africanus*. However, it is important to note that stomach content depends on food availability and this would vary by sample location. Surprisingly, information on the stomach content analysis of *P. papilio* in Nigeria is sparse.

The mean condition factor for *P. papilio* was slightly below 1.0, though values ranged from 0.7 to 1.1. Abiaobo et al. [31] reported similar condition factor values, between 0.9 and 1.2. Similarly, Moslen and Daka [32] reported the condition factor of *P. papilio* ranging from 1.12 to 1.45. In this present study, *B. africanus* had a condition factor which indicated good health status, having values ranging from 1.1 to 1.8, and a mean of 1.4. Chukwu and Ansa [32,33] reported a mean condition factor of 1.35 for the same species from New Calabar River, Nigeria. The condition factor of fish, which varies by species and season according to Seiyaboh [7], is a measure of the physiological state of the fish and is dependent on anthropogenic activities, food abundance, diet, the ideal temperature and salinity for growth [4,8-9]. Fish health is also impacted by parasites which leaves them vulnerable to subsequent infections by pathogenic agents.

## 5. CONCLUSIONS

The study revealed that the gastrointestinal helminth parasites of *Bostrychus africanus* and *Periophthalmus papilio* of Ikpukulu-Ama Creek, Rivers State, Nigeria are composed of nematodes and acanthocephalans. *B. africanus* had a higher prevalence of parasite infection. Stomach content analysis was only possible in *B. africanus,* which was mainly comprised of Crab parts, while *P. papilio* had an empty stomach. Condition factor was better in *B. africanus* than in *P. papilio*. Literature on the stomach content of *P. papilio* is scarce and is suggested for future studies. Reasons for parasite preference of *B. africanus* over *P. papilio* should be elucidated.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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