Gastrointestinal helminth parasites, stomach content analysis and condition factor of *Bostrychus africanus* (sleeper gobies) and *Periophthalmus papilio* (mudskipper)of Ikpukulu-Ama Creek, Port Harcourt, Rivers State, Nigeria

Abstract

Bostrychus africanus and *Periophthalmus papilio* are important fisheries of parts of southern Nigeria. However, there is 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 provideinformation on the parasites as well as stomach content analysis and condition factor of both fish species for academic and reference purposes. A total of 62 *Bostrychusafricanus* and thirty-six (36) *Periophthalmuspapilio* were caught for analysis using basket traps on the mudflats of the creek. Sampling was done in September, 2023. In the laboratory, samples were identified and examined for parasites using standard techniques. Nematodes, *Raphidascaroides africanus*(16.1%), were isolated from *B. africanus*,whereas acanthocephalans,*Neoechinorhynchus* sp.(2.8%), were isolated from *P. papilio*. The result of this study suggests a parasite preference of *B.africanus* over *P. papilio*.Stomach content analysis showed 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). There is a dearth of information on the stomach content of *P. papilio*and therefore, is suggested for future studies. Scientific reasons for parasite preference of *B.africanus* over *P. papilio* should be elucidated.

Keywords: Acanthocephalans, Bonny River, gastrointestinal helminths, gobiids, mudflats.

Introduction

Fishes are a significant food source in Africa, particularly in the Niger-Delta of Nigeria (Ezenwaka and Nweke, 2021), playing a crucial ecological and economic role in the food chain (Abowei and Ezekiel, 2013). Fish is known to provide vital nutrient such as omega-6 oil and the cholesterol level is relatively very low (Abu and Agarin, 2016). Gobiids, such as *Bostrychus africanus* and *Periophthalmus papilio,* are carnivoresthat feed on crustaceans and other benthic invertebrates, small fishes and insects. Many species pass through a marine larval stage during which they feed on planktons (Ugbomeh *etal.,* 2018). The analysis of fish stomach content,

which depends on food availability and varying by location, provides information about their feeding habits and culture potential (Chukwu and Princewill, 2019).

Nonetheless, fish health can be negatively impacted by parasites, especially helminth parasites, which leave fish susceptible to infections (Kaur, 2014). Fish health is determined by their condition factor, which varies by species and season (Seiyaboh (2018), and is influenced by anthropogenic activities, food abundance, diet, ideal temperature, and salinity (Abowei, 2009; Atama *etal.*, 2013; Ugbomeh *et al*., 2018). Fish regularly ingest larval stage of helminth parasites because of the abundance and diversity of these parasites in the aquatic ecosystem (Lagrue *etal.*, 2011). 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 (Kayode *etal.*, 2012; Soham and Gadahar, 2016).

Gobiidsare commonly infected by gastrointestinal helminths.However, scientific reporting of parasitic infections in these fish species is scanty. Ugbomeh *etal*. (2018) found Ascaridida nematodes in *B. africanus* and *P*. *papilio*, with higher parasite infection prevalence in *B. africanus*. Robert *etal*. (2022) found *Raphidascaroidesafricanus* in Rumuolumeni and Afikpo markets in Port Harcourt, Nigeria; while, Elele and Aziaka (2019) 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 (Akinsanya *etal.,* 2007; Oribhabor *etal.,* 2010; Worgu and Okaka 2012; Oribhabor *etal*., 2012). 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*) (Ugbomeh and Okereke, 2015), study of phytoplankton communities (Okoseimiema *et al*., 2020), heavy metal concentrations of surface water, sediment samples, fish and plankton from same creek (Ijeoma and Joshua, 2019; Okoseimiema and Vincent-Akpu, 2020), etc. There is 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 thecreek.

Materials and Methods

Study Location

Ikpukulu-Ama Creek (Figure1) is located at Latitude N 4^{o} 44’6.65320” and Longitude E 7^{o}1’40.61060”. 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 (Okoseimiema *et al*., 2020).

Sampling Protocol

Fish samples (sixty-two specimens of *Bostrychusafricanus* and thirty-six *Periophthalmuspapilio)* 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 ice-chest to the Parasitology Laboratory, Department of Animal and Environmental Biology, Rivers State University, Port Harcourt, for identification and parasitological examination.

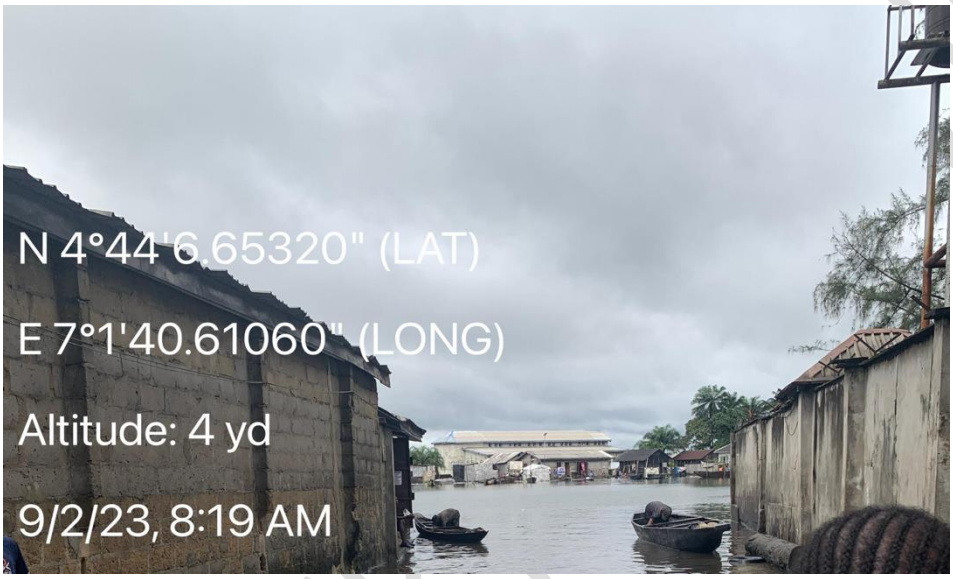

Fig. 1: Photograph of Ikpukulu-Ama Creek, Borikiri, Port Harcourt, showing its geographic coordinates

Fish samples were identified using the taxonomic keys described by Ssentongo *et al*. (1986) and Schneider (1990). 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 computeFulton's condition factor (CF) according to Zhelev *et al.* (2015) as follows: $CF= BW /TL^3 \times 10^2$, where BW is the wet body weight of fish in g and TL is 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 microscopicallyfor parasites in Petri dishes containing physiological saline. The contents of the Petri dishes were carefully examined for analysis of the stomach content.Parasite species presentwere identified according to Paperna (1996) and Moravec (2019) and were fixed in 70% ethanol.

Data analysis

Parasite prevalence and mean intensity of infection were calculated according to the formula of Bush *et al*., (1997).

Results

Morphometric characteristics and Condition Factor of *Bostrychusafricanus* and *Periophthalmuspapilio* of Ikpukulu-Ama Creek, Borikiri, Port Harcourt

*Bostrychus africanus*specimens examined in this study had wet body weight 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 weight 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 (Table1).

Table 1: Morphometric Values and Condition Factor of*Bostrychusafricanus* and *Periophthalmuspapilio*, Ikpukulu-Ama Creek, Borikiri, Port Harcourt, Rivers State.

	Bostrychusafricanus	***Periophthalmuspapilio***

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

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* examinedwere infected with *Rhaphidascaroides africanus*with mean intensity of approximately one parasite per infected host. Only one (1) *P. papilio* specimen was infected with the acanthocephalan, *Neoechinorhynchus* sp, showing aprevalence of 2.8% (Table2).

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

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 thestomach 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.

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 *etal*. (2018) were not significantly less in length, but they were heavier.Abowei and Hart (2008) and Ogamba *etal*. (2014) 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, occurrence of nematode parasite had been recorded in *B. africanus* and *P. papilio*, though of different species. Ugbomeh *et al*. (2018) recovered Ascarid nematodes in their work which is different from the species recorded in this study.*Raphidascaroides africanus*infestation was also reported by Robert *et al.* (2022) in *B. africanus*. These parasites are commonly associated with *B. africanus* in Africa (Moravec, 2019). Acanthocephalan infection in gobiids had not been well documented as there is 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 (Kayode *etal.*, 2012;Soham and Gadahar, 2016).

It was observed that prevalence of parasite infection and mean intensitywas higher in *B. africanus*than*P. papilio*, which is similar to the report of Ugbomeh *et al*. (2018). Both gobiids hereby examined have a parasitic mode of life and occupy similar ecological niches (Chukwu and Princewill, 2019; Abiaobo *et al.*, 2021), 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 stomach 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 (2019) 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.* (2021) reported similar condition factor values, between 0.9 and 1.2. Similarly, Moslen and Daka (2017) reported condition factor of *P. papilio* ranging from 1.12 to 1.45. In this present study, *B. africanus* had 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 (2017) reported mean condition factor of 1.35 for the same species from New Calabar River, Nigeria.Condition factor of fish, which varies by species and season according to Seiyaboh (2018), 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 (Abowei, 2009; Atama *etal.*, 2013;Ugbomeh *et al*., 2018). Fish health is also impacted by parasites which leaves them vulnerable to subsequent infections by pathogenic agents.

.Conclusion

The study revealed that the gastrointestinal helminth parasites of *Bostrychusafricanus* and *Periophthalmuspapilio*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.

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