

Type of article: Original Research Article

## **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**

### **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, it 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.

### **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 *etal.* [4] found Ascaridida nematodes in *B. africanus* and *P. papilio*, with higher parasite infection prevalence in *B. africanus*. Robert *etal.* [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.

## **Materials and Methods**

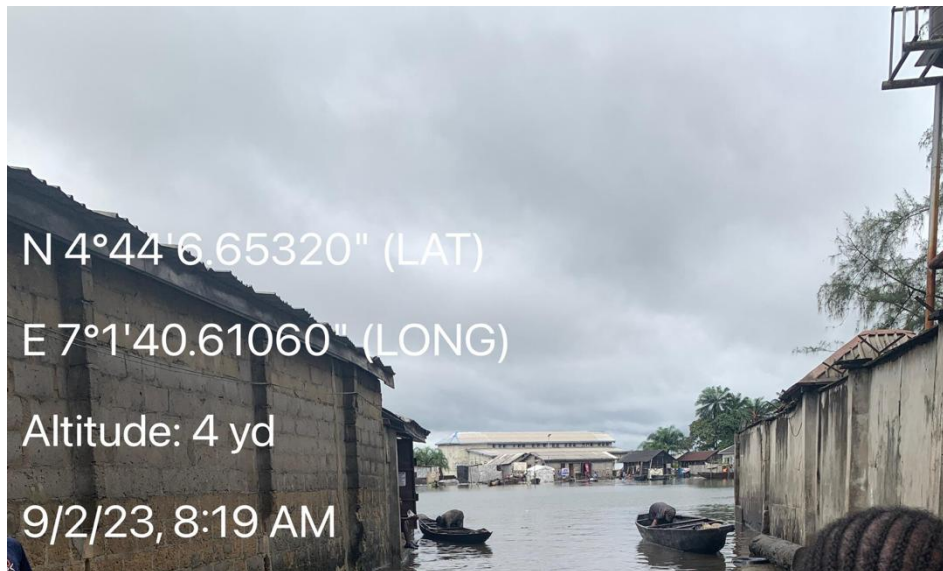
### **Study Location**

Ikpukulu-Ama Creek (Figure 1) is located at Latitude N 4° 44' 6.65320" and Longitude E 7° 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 35 ppt and it is surrounded by dredging facilities and some petroleum oil servicing companies [20].

### **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 an 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.* [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.

## Data analysis

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

## Results

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

*Bostrychusafricanus* 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).

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

Parameters	<i>Bostrychusafricanus</i>		<i>Periophthalmuspapilio</i>	
	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* 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).

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

Parasites	Fish Species		<i>Periophthalmus papilio</i>	
	<i>Bostrychus africanus</i> Prevalence (%)	Mean Intensity (±Stdev)	Prevalence (%)	Mean Intensity (±Stdev)
<i>Rhaphidascaroides africanus</i>	16.13	1.4 ± 1.0	-	-
<i>Neoechinorhynchus</i> 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 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.

## 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].

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] 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.

## **Conclusions**

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.

### **Competing Interests**

Authors have declared that no competing interests exist.

### **Authors' Contributions**

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

### **References**

1. Ezenwaka CO, Nweke OS. Prevalence of gastrointestinal helminthes associated with *Synodontis schall* from Otuogori River, Ogbia Local Government, Bayelsa State. IOSR J AgricVet Sci. 2021;14(3):06-10.
2. Abowei JFN, Ezekiel EN. The length-weight relationship and condition factor of *Chrysichthys nigrodigitatus* (Lacepede, 1803) from Amassoma River flood plains. Sci Agri. 2013; 3(2):30-37.
3. Abu OMG,Agarin OJ. Length-weight relationship and condition factor of Silver Catfish (*Chrysichthys nigrodigitatus*) from the Lower Reaches of the New Calabar River, Niger Delta. Intl J Inno Stu Aqua Bio Fish. 2016;2(4):1-7.
4. Ugbomeh AP, Okere S, Sokari GM, Aisien MSO, Wala C. Helminth parasites of gobies from two creeklets of the New Calabar River, Rivers State, Nigeria. Asian J Biol, 2018;6(4):1-10.

5. Chukwu KO, Princewill K. Stomach content of the Sleeper Fish, *Bostrychus africanus* from the New Calabar River, Nigeria. Res Rev: J Vet Sci Tech.2019;8(3):13-16.
6. Kaur P. Histopathological effect of Senga species (Cestode: Pseudophyllidae) in the intestine of Piscia host. World J Pharm Sci.2014;3(2):1506-1513.
7. Seiyaboh EI. Variation in condition factor of some freshwater fishes from Epie Creek, Bayelsa State, Nigeria. Annals Ecol Env Sci. 2018;2(2):47-51.
8. Abowei JFN. The abundance, condition factor and length-weight relationship of some *Sardinella maderensis* (Jenyns, 1842) from Nkoro River, Niger Delta, Nigeria. Adv J Food SciTech. 2009;1(1):65-70.
9. Atama C, Okeke O, Ekeh F, Ezenwaji N. Length -Weight relationship and condition factor of six cichlid species of Anambra River. J Fish Aqua.2013;4(5):82-86.
10. Lagrue C, Kelly D, Hicks A, Poulin R. Factors influencing infection patterns of tropically transmitted parasites among a fish community: Host Diet, Host – Parasite Compatibility or Both. J Fish Bio. 2011;79(4):466-485.
11. Kayode O, Okafor J, Alade A, Oronaye O. Helminth parasites of *Sarotherodon galilaeus* and *Tilapia zilli*, (Pisces; Cichlidae) from River Oshun, South West Nigeria. Intl J Aqua Sci.2012;3(3):49-55.
12. Soham P, Gadahar D. Isolation and identification of helminth parasite eggs having zoonotic potency from sewage-fed pond sediment, West Bengal, India. Intl J Adv Res Biol Sci, 2016;3(1):283-291.
13. Robert B, Wodi S, Walters V, Numdi FC, Amuzie CC. Prevalence of *Raphidascaroides africanus* in market-derived gobies (*Bostrychus africanus*), Port Harcourt, Nigeria. Intl J Bio Res Adv.2022;2(1):1-8.
14. Elele K, Aziaka BO. Evaluation of parasites associated with mudskipper *Periophthalmus* spp. sold in selected waterfronts market in Port Harcourt Metropolis, Rivers State, Nigeria. Nig JParasitol.2019;40(2):169-174.
15. Akinsanya B, Otubanjo A, Ibidapo C. Helminth biload of *Chrysichthys nigrodigitatus* from Lekki Lagoon, Lagos, Nigeria. Turk J Fish Aqua Sci. 2007;4(7):83–87.
16. Oribhabor J, Ogbeibu E, Okaka E. The parasites gastrointestinal Helminth of some Scianid Species (Croakers) in a Niger Delta Mangrove Creek, Nigeria. Trop Freshwater Bio, 2010;91(7):15–23.
17. Oribhabor J, Ogbeibu E, Okaka E. (2012). The gastrointestinal helminth parasites of the threadfin fish, *Polydactylus quadrifilis* (Family: Polynemidae) in a Niger Delta mangrove creek, Nigeria. Intl J Ani Vet Adv.2012;4:240 -243.
18. Worgu M, Okaka E. A comparative of Study gastrointestinal Helminth parasites infection of fresh and brackish water fishes from Warri River, Southern Nigeria. Afr Res Rev.2012;6(2):13–23.

19. Ugbomeh AP, Okereke AB. Assessment of cadmium and lead in the barnacle (*Semibalanus balanoides*) and oyster (*Crassostrea gasar*) in Port Harcourt, Nigeria: Risk assessment of oyster consumption. Res Rev: Res J Biol.2015;3(4):7-11.
20. Okoseimiema IJ, Vincent-Akpu IF. Distribution of trace metals in water, sediment and biota from Ikpukulu-Ama creek, Port Harcourt, Rivers State, Nigeria. Nig J Fish.2020;17(1):1912-1924.
21. Ijeoma FV, Joshua OI. Trace metals in water, sediment and biota from Ikpukulu-Ama Creek Port Harcourt, Rivers State, Nigeria. *Preprints.org*; 2019;DOI: 10.20944/preprints201904.0145.v1.
22. Okoseimiema IJ, Vincent-Akpu IF, Onyeagbodor P, Oriakpono EO. Composition of phytoplankton communities in Ikpukulu-Ama Creek, Niger Delta.Intl J Contemp App Res.2020;7(2):21-31.
23. Ssentongo GW, Ukpe ET, Ajayi TO. Marine fishery resources of Nigeria: a review of exploited fish stocks. Published by Publications Division. Rome, Italy: Food and Agriculture Organization of the United Nations, Via delle Terme di Caracalla; 1986.
24. Schneider W. FAO Species Identification Sheets for Fishery Purposes. Field Guide to the Commercial Marine Resources of the Gulf of Guinea. Rome, Italy: Food and Agricultural Organization of the United Nations; 1990.
25. Zhelev ZM, Popgeorgiev GS, Mehterov NH. (2015). Changes in the hepatosomatic index and condition factor in the population of *Pelophylax ridibundus* (Amphibia: ranidae) from anthropogenically polluted biotopes in southern Bulgaria. Part II. Bulg J Agri Sci.2015;21:517-522.
26. PapernaI. Parasite, Infestations and Disease of Fishes in Africa—An Update. CIFA Technical Paper;1996;31:1-220.
27. Moravec F. Parasitic nematodes of freshwater fishes of Africa. 1st edition. Czech Republic: Czech Academy of Sciences; 2019.
28. Bush AO, Lafferty KD, Lotz JM, Shostak AW. Parasitology meets ecology on its own terms: Margolis et al. revisited. J Parasitol.1997;83(4):575–583.
29. Abowei JFN, Hart AI. Artisanal fisheries characteristics of the fresh water reaches of the lower Nun River, Niger Delta, Nigeria. J App Sci Env Mgt.2008;12:5-7.
30. Ogamba EN, AboweiJFN, Onugu A. Length-weight relationship and condition factor of selected finfish species from Odi River, Niger Delta, Nigeria. JAqua Sci. 2014;29(1A):1-12.
31. Abiaobo NO, Asuquo IE, Ejiogu IN, James EJ. Aspects of the biology of *Periophthalmus barbarus* (Mudskipper), from Jaja Creek, Niger Delta, Nigeria. Ecol Evol Bio.2021;6:15-22.
32. Moslen M, Daka ER. Length-weight relationship and condition factor of *Periophthalmus papilio* (Bloch & Schneider, 1801) obtained from a tidal creek in the Bonny Estuary, Nigeria. J

33. Chukwu KO, Ansa EJ. Length-weight relationship and condition factor of *Bostrychus Africanus* from New Calabar River, Nigeria. NigJ Fish.2017;16:1584-1590.

UNDER PEER REVIEW