THE GASTROINTESTINAL HELMINTH PARASITE COMMUNITY OF THE BOBO CROAKER, *PSEUDOTOLITHUS ELONGATUS* (BOWDICH, 1825)

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Helminths compose a significant percentage of the parasites of fish. They inhabit the tissues and organs of fish leading to a wide range of health impacts ranging from mild to deadly infections. *Pseudotolithus elongatus* is a croaker caught wildly from marine and estuarine aquatic ecosystems in Rivers State, Nigeria. This research investigated the gastrointestinal helminth parasites of *P. elongatus* purchased from fishers at Abonnema, Port Harcourt, Nigeria. Purchase of fish was done from October to December, 2021 and transported in ice chest to the laboratory where they were measured and examined for parasites. Fish had average total length of 22.6±0.62cm and average wet body mass of 29.5±2.3g. Cestode and nematode parasites were isolated from these hosts, fixed and identified using appropriate guides. Twenty-four fish were examined and total prevalence of infection was 58.3%. The parasite community was comprised of a cestode (*Proteocephalus* sp.) and nematodes (*Anisakis* sp., *Labeonema africanum*, *Physalopteroides* sp., *Amplicaecum* sp., and *Gendria* sp.). *Anisakis* sp. (54.2%) was most prevalent infecting thirteen of the fourteen infected hosts. Health impacts of the parasites are discussed. It is concluded that *P. elongatus* serves as host to a community of helminth parasites in the aquatic environment. The prevalence of *Anisakis* sp. observed in this research calls for public health concerns.

Keywords: fresh fish, croakers, *Anisakis*, *Proteocephalus*, nematode parasites.

INTRODUCTION

Helminth parasites including cestodes, trematodes and nematodes affect fisheries all over the world (Salgado-Maldonado *et al.*, 2020; Odum & Amuzie, 2021) leading to losses in fish harvests and sales and sometimes, resulting into zoonotic infections (Williams *et al.*, 2022). *Anisakis* sp. for instance, have been reported from several fish species in various regions in the world (Morozińska-Gogol, 2019). This nematode parasite, though using marine fish as intermediate hosts and marine mammals as definitive hosts can cause severe infections in man (Bao *et al.*, 2019). Other helminths causing severe losses to fisheries and zoonosis include

Diphyllobothrium sp. (diphyllobothriasis), *Clonorchis sinensis* (clonorchiosis), *Opisthochis* sp. (opisthorchiosis), etc. (Chai *et al*., 2005).

The bobo croaker, *Pseudotolithus elongatus*, is an important fisheries resource in the coastal waters of Nigeria (Isangedighi & Ambrose, 2016). Together with other species harvested from inland water systems, they are generally referred to as 'fresh-fish', and are a local delicacy among local dwellers, fishers and even visitors, especially in the Niger Delta region of Nigeria. Research has shown that the species provides a good host system for the study of helminth parasites of fish as it is reported to host several parasites (Abraham *et al*., 2005; Ogbeibu *et al*., 2014). Another report (Amuzie, 2021) isolated didymozoid trematodes and some unidentified nematodes from *P. elongatus* harvested from Nembe waterside, Port Harcourt, Nigeria. The predatory behaviour of this species (Oribhabor & Ogbeibu, 2012) exposes them to contact with the intermediate hosts of several parasites.

This research was thus conducted to add to the growing literature on aspects of the parasitology of *Pseudotolithus elongatus*. This is to provide more insights into the parasite community of the fish species.

MATERIAL AND METHODS

Study Location

Abonnema (04º46' N, 007º00' E) is a coastal city located along the Sombreiro River system, a tributary of the Niger River (Ezekiel *et al*., 2011). It is a fishing settlement located in Akuku-Toru Local Government Area of Rivers State, Nigeria.

Sample collection and examination

Twenty-four individuals of *Pseudotolithus elongatus* (Fig. 1) were purchased from fishers at Abonnema between October and December, 2021. The catch was unusually low during the period resulting in very few numbers of fish examined. These were transported to the Entomology and Parasitology Laboratory, Department of Animal and Environmental Biology, Rivers State University, Port Harcourt – Nigeria, within 4 hours of capture for examination.

Total lengths (in centimetre) of the fish specimens were obtained by the use of a graduated meter rule. Wet body mass (in grams) was measured by means of an electronic weighing balance (Denver instrument, model TP-512A).

Fig. 1. *Pseudotolithus elongatus*, Abonnema, Rivers State.

Each sample was dissected by an incision through the anal pore to expose the gastrointestinal organs. The stomach and intestines were excised into separate Petri dishes containing 0.85% physiological saline. A longitudinal cut through each organ was made to expose its contents and enhance the detachment of parasites. The Petri dish was examined under a compound microscope; helminth parasites were carefully removed using forceps and plastic pipettes. They were immediately positioned on a microscope slide with few drops of saline solution added, covered with a cover slip and viewed under the microscope using X10 and X40 objective lenses. Afterwards, cestodes were fixed in 5% formol saline and nematodes were first stretched in hot water and then fixed in 70% ethanol.

Parasite Identification and Computation of Prevalence and Mean Intensity of Infection

Cestodes were identified using keys from Paperna (1996) while nematodes were identified after Moravec (2019).

Prevalence was calculated as percentage of infected hosts, while mean intensity of infection was calculated as number of parasites per infected host (Bush *et al.*, 1997).

RESULTS AND DISCUSSION

Cestode and nematode parasites were isolated from fourteen infected fish hosts. Thus, an overall prevalence of 58.3% was observed. Six species of helminth parasites were encountered in this research: one cestode (*Proteocephalus* sp.) and five nematodes (*Anisakis* sp., *Labeonema africanum*, *Amplicaecum* sp. (larval forms), *Physalopteroides* sp., and *Gendria* sp.).

Prevalence and Mean Intensity of Infection

Thirteen host specimens (54.2%) were infected with *Anisakis* sp. with intensity ranging from one to five parasites per infected host. Mean intensity of infection with this parasite was calculated to be 2.0 parasites per infected host (Table 1). It was found to be the most prevalent parasite in the fish samples examined.

Labeonema africanum and *Physalopteroides* sp. each infected five (20.8%) hosts. Intensity of infection ranged from one to two parasites per infected hosts for *L. africanum* and one to three parasites for *Physalopteroides* sp., but mean intensity of infection was about one parasite per infected host for both parasites.

The cestode, *Proteocephalus* sp., and the nematodes, *Amplicaecum* sp. and *Gendria* sp., each infected one host specimen, with mean intensities of one parasite per infected host (Table 1). While other parasites encountered were found alone in infected hosts, *Proteocephalus* sp. co-occurred with *Anisakis* sp. in one host.

Anisakid nematodes are popular for gastrointestinal and allergic pathologies in man (Morozińska-Gogol, 2019; Audicana, 2022). The parasite causes harm whether dead or alive (Golden *et al.*, 2022) due to the possibility of its proteins eliciting allergies in persons consuming infected products. Modern techniques involving molecular studies have been advocated for the proper identification of the species (Caldeira *et al*., 2021).

Table 1

Prevalence and Mean Intensity of Gastrointestinal Helminth Parasite Infection in *Pseudotolithus elongatus*, Abonnema, Rivers State, Nigeria

Parasite	**Number of Infected Hosts**	**Prevalence (%)**	**Mean Intensity ± stdev**
Cestoda			
Proteocephalus sp.	1	4.2	1.0 ± 0.0
Nematoda			
Anisakis sp.	13	54.2	2.0 ± 1.3
Labeonema africanum	5	20.8	1.2 ± 0.4
Amplicaecum sp.	1	4.2	1.0 ± 0.0
Physalopteroides sp.	5	20.8	1.4 ± 1.0
Gendria sp.	1	4.2	1.0 ± 0.0

Labeonema species are nematodes of the Cosmocercidae family and have been described from freshwater fish of Africa (Moravec & Van As, 2004; Moravec & Jirku, 2017). Impact of this nematode on the health of its host is unavailable. However, another cosmocercid, *Paradollfusnema amphisbaenia*, was reported to bring about inflammatory infiltrations in the small intestine of its lizard hosts (Filogonio *et al*., 2013). The feeding patterns of these parasites, which involve scraping the intestine, could account for injuries on the intestinal mucosa and wall and other internal organs.

As also reported in this research, larval forms of the nematode *Amplicaecum* sp. have been encountered in fish (Obiekezie *et al.*, 1988; Hamouda, 2018). From

existing literature, adult forms of this parasite have not been recorded in any fish; it will therefore be of research interest to study the infection patterns of this parasite in fish hosts.

Reports on the isolation of *Physalopteroides* sp. from fish hosts is sparse. Most available literature are on its infection in amphibians and reptiles (Bursey & Goldberg, 2001, 2016). *Gendria* species have been reported from different species of fish in Africa including *Schilbe* sp. (Moravec & Jirku, 2017) and clarid fishes (Mwita, 2014). Generally, there is a research gap on the histological impacts of several nematode parasites on their fish hosts. For instance, the histological or otherwise, health impact of *Amplicaecum* sp., *Physalopteroides* sp., and *Gendria* sp. on their hosts are largely unavailable.

Tapeworms of the genus *Proteocephalus* have been reported to infect fishes, amphibians and reptiles (Hanzelova & Scholz, 1999). According to Russell (2017), *Proteocephalus ambloplitis* infecting bass in Maine, U.S.A., is not zoonotic, however, in the fish host, larval migration and transformation from the procercoid to the plerocercoid stage causes damage to the "spleen, liver and reproductive organs". The parasite destroys the internal organs resulting in stunted growth.

CONCLUSIONS

The bobo croaker, *Pseudotolithus elongatus*, is host to several parasites thereby providing a good system for the study of helminth parasites. In this research, six parasite species – one cestode (*Proteocephalus* sp.) and five nematodes (*Anisakis* sp., *Labeonema africanum*, *Amplicaecum* sp., *Physalopteroides* sp., and *Gendria* sp.) were isolated from fourteen infected hosts.

Anisakis sp. is of public health importance, and isolating it at a prevalence of 54% in this widely consumed fish raises concern on the incidence of anisakidosis within the geographical area of this research. This calls for vigilance on the part of medical personnel in the identification of cases since the disease can present with symptoms similar to other abdominal infections. Public health parasitologists are also required to investigate the infection since there has been no reported cases in Nigeria.

Though most of the parasites do not have zoonotic potentials, except for *Anisakis* sp., they could harm the host by inflicting injuries in host tissues that could become secondarily infected by microbes thereby reducing the economic value of the fish. Also, research on the infection patterns of *Amplicaecum* sp. in fish hosts is recommended.

Studies on the histological impact of helminth parasites, especially of nematodes, on their fish hosts are recommended to fill the established research gap. There is literature on ultrastructure of several nematode parasites, but very little on their health impacts on fish hosts.

REFERENCES

ABRAHAM J.T., AKPAN P.A., AKPAN O.E., 2005, *Occurrence of parasites in Pseudotolithus elongatus and Cynoglossus senegalensis in Cross River Estuary, Nigeria*. Global Journal of Pure and Applied Sciences, **11**: 45–49.

AMUZIE C.C., 2021, *Unidentified gastro-intestinal nematode parasites from Pseudotolithus elongatus, Rivers State, Nigeria*. International Journal of Biological Research Advancement, **1**: 15–20.

AUDICANA M.T., 2022, *Anisakis, something is moving inside the fish*. Pathogens, **11** (3): 326.

BAO M., PIERCE G.J., STRACHAN N.J.C., PASCUAL S., GONZÁLEZ-MUÑOZ M., LEVSEN A., 2019, *Human health, legislative and socioeconomic issues caused by the fish-borne zoonotic parasite Anisakis: Challenges in risk assessment.* Trends in Food Science & Technology, **86**: 298–310.

BURSEY C.R., GOLDBERG S.R., 2001, *Physalopteroides arnoensis n. sp. (Nematoda: Physalopteroidea) and other intestinal helminths of the mourning gecko, Lepidodactylus lugubris (Sauria: Gekkonidae), from Arno Atoll, Republic of the Marshall Islands, Oceania*. Journal of Parasitology, **87** (1): 135–138.

BURSEY C.R., GOLDBERG S.R., 2016, *A new species of Physalopteroides* (*Nematoda: Physalopteroidea*) *in Emoia atrocostata (Squamata: Scincidae) from Peninsular Malaysia.* Comparative Parasitology, **83** (2): 221–226.

BUSH A.O., LAFFERTY K.D., LOTZ J.M., SHOSTAK A.W., 1997, *Parasitology meets ecology on its own terms: Margolis et al. revisited*. Journal of Parasitology, **83** (4): 575–583.

CALDEIRA A.J.R., ALVES C.P.P., SANTOS M.J., 2021, *Anisakis notification in fish: an assessment of the cases reported in the European Union Rapid Alert System for Food and Feed (RASFF) database*. Food Control, **124**; https://doi.org/10.1016/j.foodcont.2021.107913.

CHAI J.Y., DARWIN MURRELL K., LYMBERY A.J., 2005, *Fish-borne parasitic zoonoses: status and issues*. International Journal for Parasitology, **35** (11–12): 1233–1254.

EZEKIEL E.N., HART A.I., ABOWEI J.F.N., 2011, *The physical and chemical condition of Sombreiro River, Niger Delta, Nigeria*. Research Journal of Environmental and Earth Sciences, **3** (4): 327–340.

FILOGONIO R., TOLEDO G.M., ANJOS L.A., RAJÃO B., GALDINO C.A., NASCIMENTO L.B., 2013, *Infection patterns of Paradollfusnema amphisbaenia (Nematoda: Cosmocercidae) in a population of Amphisbaena wuchereri (Squamata: Amphisbaenidae) from Minas Gerais state, south-eastern Brazil, and its relations with host size, sex and fat body mass*. Journal of Helminthology, **87** (2):135–140.

GOLDEN O., CALDEIRA A.J.R, RANGEL L.F., SANTOS M.J., 2022, *Seafood safety and food-borne zoonoses from fish*. European Food Safety Authority Journal, **20** (S1); https://doi.org/10..2903/j.efsa.2022.e200409.

HAMOUDA A.H., 2018, *Epizootiological studies on some parasitic infections in Bagrus bajad from Lake Nasser, Egypt.* Alexandrian Journal of Veterinary Sciences, **58** (1): 40-47.

HANZELOVA V., SCHOLZ T., 1999, *Species of Proteocephalus Weinland, 1858 (Cestoda: Proteocephalidae), Parasites of Coregonid and Salmonid Fishes from North America: Taxonomic Reappraisal*. The Journal of Parasitology, **85**: 94–101.

ISANGEDIGHI I.A., AMBROSE E.E., 2016, *Trophic spectrum of Pseudotolithus elongatus (Sciaenidae: Teleostei) in Imo River estuary, Nigeria*. International Journal of Fisheries and Aquatic Studies, **4** (6): 108–111.

MORAVEC F., JIRKU M., 2017, *Some nematodes from freshwater fishes in central Africa*. Folia Parasitologica, **64** (2): DOI: 10.14411/fp.2017.033.

MORAVEC F., 2019, *Parasitic nematodes of freshwater fishes of Africa.* 1st edition. Czech Academy of Sciences, Czech Republic, 412 pp.

MORAVEC F., VAN AS J.G., 2004, *Nematodes from the squeaker fishes Synodontis nigromaculatus and S. vanderwaali from the Okavango River, Botswana, including three new species*. Systematic Parasitology, **59**: 169–187.

MOROZIŃSKA-GOGOL J., 2019, *Anisakis spp. as etiological agent of zoonotic disease and allergy in European region – an overview*. Annals of Parasitology, **65** (4):303–314.

MWITA C., 2014, *Metazoan parasites of clarid fishes, Lake Victoria: Reflection of the original fauna in the lake?* Natural Science, **6**: 651–658.

OBIEKEZIE A.J., MOLLER H., ANDERS K., 1988, *Disease of the African estuarine catfish Chrysichthys nigrodigitatus (Lacepede) from the Cross River estuary*. Nigerian Journal of Fish Biology, **32**: 207–221.

ODUM B., AMUZIE C.C., 2021, *Helminth parasites of Caranx hippos (Crevalle Jack) and Sardinella maderensis (Madeiran Sardinella) from two fishing settlements in Okrika, Rivers State, Nigeria*. Nigerian Journal of Parasitology, **42** (1): 75–80.

OGBEIBU A.E., OKAKA C.E., ORIBHABOR B.J., 2014, *Gastrointestinal helminth parasites community of fish species in a Niger Delta tidal creek, Nigeria*. Journal of Ecosystems, 10 pp.; http://dx.doi.org/10.1155/2014/246283.

ORIBHABOR B.J., OGBEIBU A.E., 2012, *The food and feeding habits of fish species assemblage in a Niger Delta mangrove creek, Nigeria*. Journal of Fisheries and Aquatic Science, **7**: 134–149.

PAPERNA I., 1996, *Parasites, infections and diseases of fishes in Africa – An update. CIFA Technical Paper*. No. 31, Rome, FAO, 220 pp.

RUSSELL D., 2017, *The bass tapeworm* (*Proteocephalus ambloplitis*). Retrieved from Fish Health Issues-ebook, June 27, 2022; https://www.maine.gov/ifw/docs/Fish%20Health%20Issues-ebook.pdf;

SALGADO-MALDONADO G., CASPETA-MANDUJANO J.M., MARTÍNEZ-RAMÍREZ E., MONTOYA-MENDOZA J., MENDOZA-FRANCO E.F., 2020, *Diversity of helminth parasites of freshwater fish in the headwaters of the Coatzacoalcos River, in Oaxaca, Mexico*. International Journal for Parasitology: Parasites and Wildlife, **12**: 142–149.

WILLIAMS M., HERNANDEZ-JOVER M., SHAMSI S., 2022, *Parasites of zoonotic interest in selected edible freshwater fish imported to Australia*. Food and Waterborne Parasitology, **26**: e00138, https://doi.org/10.1016/j.fawpar.2021.e00138.

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