

OCCURRENCE AND MORPHOLOGICAL IDENTIFICATION OF ECTOPARASITIC AND EXTERNAL DISEASE-ASSOCIATED ORGANISMS OF SELECTED FRESHWATER FISHES FROM OMAMBALA RIVER, OTUOCHA, ANAMBRA STATE, NIGERIA

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Abstract

Ectoparasitic organisms constitute important biological constraints to freshwater fish health and may cause epithelial damage, impaired respiration, reduced growth and increased susceptibility to secondary infections. This study investigated the occurrence and morphological identification of ectoparasitic and other external disease-associated organisms in selected freshwater fishes from Omambala River, Otuocha, Anambra State, Nigeria. Sixty fish specimens representing *Clarias gariepinus*, *Chrysichthys nigrodigitatus*, *Tilapia zillii*, *Mormyrops deliciosus*, *Gnathonemus cyprinoides* and *Oreochromis niloticus* were examined following collection with gill nets and cast nets during January 2023. Fish were transported to the laboratory and examined externally, with particular attention to the skin, fins, opercula and gills. Skin and mucus scrapings were examined microscopically and visible external organisms were recovered for identification. Twenty-nine of the 60 fish examined were recorded as affected by external biological agents, representing an overall occurrence of 48.33%. Species-specific occurrence ranged from 30.00% in *T. zillii* and *G. cyprinoides* to 73.33% in *O. niloticus*. *Clarias gariepinus* had an occurrence of 42.86% based on three affected fish among seven examined. The organisms recorded included *Ichthyophthirius multifiliis*, *Argulus* sp., *Salmincola*-type crustacean, diplostomid/neascus-type metacercariae, *Aeromonas*-type bacteria, *Flexibacter*-type bacteria and *Saprolegnia*-type oomycete. The findings indicate that fish inhabiting Omambala River are exposed to a range of external parasitic and disease-associated organisms and provide baseline information for fish-health surveillance in the river.

Keywords: ectoparasites; fish parasites; *Argulus*; *Ichthyophthirius multifiliis*; freshwater fish; Omambala River; Nigeria; fish health.

Introduction

Parasitism is an important ecological interaction in freshwater ecosystems and can influence fish population health, productivity and survival. Parasites occupy diverse niches on and within fish hosts, and their distribution is influenced by host biology, environmental conditions, trophic

interactions and the availability of intermediate hosts. Ectoparasites are organisms that occur primarily on the external surfaces of their hosts, including the skin, fins, gills and buccal cavity. Important groups include parasitic protozoans, monogeneans and parasitic crustaceans. Infection may result in epithelial erosion, excessive mucus production, impaired gas exchange, osmoregulatory disturbance, tissue inflammation and secondary microbial infection.

Contemporary fish-parasitology research emphasizes the importance of parasite diversity not only as a fish-health issue but also as a component of aquatic ecosystem functioning. Recent work on freshwater fish parasites has highlighted their diversity, pathogenic significance, host associations and relevance to disease surveillance.

The protozoan *Ichthyophthirius multifiliis*, responsible for freshwater white-spot disease, is among the most important ectoparasitic protozoans of freshwater fishes. Its trophont develops within host epithelial tissue, while reproductive and infective stages occur outside the host. Recent reviews continue to identify *I. multifiliis* as an important cause of epithelial and gill damage and disease in freshwater fish. Parasitic crustaceans, particularly species of *Argulus*, are also important external parasites. *Argulus* spp. are commonly known as fish lice and attach to host surfaces using specialized attachment structures. Their feeding activity can damage the epidermis and create lesions that may facilitate secondary microbial infections.

Recent Nigerian research demonstrates that external and internal helminth parasites remain important in cultured and wild *Clarias gariepinus*. Nnatuanya *et al.* (2024), for example, examined *C. gariepinus* from natural and artificial habitats in Anambra State and reported 48% infection among 40 fish, demonstrating the continued occurrence of helminth parasitism in the state. Similarly, Wogu and Orji-Georgewill (2024) investigated *C. gariepinus* from homestead ponds in Rivers State and reported external protozoan parasites including *Trichodina* sp. and *Chilodonella* sp., illustrating the diversity of external parasitic organisms affecting African catfish in Nigerian waters and culture systems. Idowu *et al.* (2023) also documented parasites in *C. gariepinus* marketed in Yola, emphasizing the continuing importance of fish-parasite surveillance in Nigeria.

Despite the importance of Omambala River to artisanal fisheries, information on its ectoparasite assemblage remains comparatively limited. Existing research from the river has concentrated particularly on intestinal helminths. Okemadu (2020) examined 250 fish from Omambala River and reported several helminth genera, providing an important local parasitological baseline. An important methodological issue in fish-parasite studies is accurate taxonomic classification. Organisms observed on fish surfaces are not necessarily ectoparasites. Bacteria such as *Aeromonas* spp. and oomycetes such as *Saprolegnia* spp. are disease-associated microorganisms rather than animal ectoparasites. Similarly, diplostomid metacercariae found in fish tissues represent larval trematode stages and should be distinguished from external protozoan or crustacean parasites.

The study aimed to identify external parasitic organisms associated with selected fishes from Omambala River with the specific objectives to determine the occurrence of affected fish among the examined species; document the major groups of external biological agents encountered; and provide baseline information for fish-health surveillance in Omambala River.

MATERIALS AND METHODS**Study Area**

The investigation was carried out at Omambala River around Otuocha, Anambra State, southeastern Nigeria. The river supports artisanal fisheries and provides fishery resources to communities within the surrounding area. Sampling was undertaken during January 2023.

Fish Sampling

Fish were collected once weekly for three consecutive weeks with the assistance of artisanal fishers. Gill nets and cast nets were employed. Captured fish were transferred into covered containers containing river water and transported to Alpha Research Laboratory, Awka, for parasitological examination. Sixty specimens representing six fish species were examined: *Clarias gariepinus*, *Chrysichthys nigrodigitatus*, *Tilapia zillii*, *Mormyrops deliciosus*, *Gnathonemus cyprinoides* and *Oreochromis niloticus*.

External Examination

Each specimen was examined macroscopically for lesions, abnormal mucus production, ulcers, fin damage, discoloration and visible parasites. The skin, fins, opercula and gills were examined carefully. Skin and mucus scrapings were obtained with sterile instruments and placed on clean microscope slides with physiological saline. Preparations were examined under a compound/binocular microscope. Visible crustacean organisms were removed using fine forceps and preserved for identification.

Parasite Identification

Identification was based on observable morphological characteristics. Where available information was insufficient to confirm a species, the organism was reported at genus or higher taxonomic level.

Classification of Disease-Associated Organisms

The following categories were distinguished:

True or defensible ectoparasites

- *Ichthyophthirius multifiliis*
- *Argulus* sp.
- *Salmincola*-type crustacean

Larval trematodes

- diplostomid/neascus-type metacercariae

Bacterial agents

- *Aeromonas*-type organism
- *Flexibacter*-type organism

Oomycete

- *Saprolegnia*-type organism

This separation prevents organisms from different biological kingdoms and ecological categories from being incorrectly grouped as ectoparasites.

Results

Overall Occurrence

Twenty-nine of the 60 fish examined were recorded as affected by external biological agents.

Table 1. Occurrence of affected fish according to host species

Fish species	Number examined	Number affected	Occurrence (%)
<i>Clarias gariepinus</i>	7	3	42.86
<i>Chrysichthys nigrodigitatus</i>	10	4	40.00
<i>Tilapia zillii</i>	10	3	30.00
<i>Mormyrops deliciosus</i>	8	5	62.50
<i>Gnathonemus cyprinoides</i>	10	3	30.00
<i>Oreochromis niloticus</i>	15	11	73.33
Total	60	29	48.33

Table 2. Taxonomic interpretation of organisms recorded during the investigation

Recorded organism	Defensible interpretation	Biological category
<i>Ichthyophthirius multifiliis</i>	<i>I. multifiliis</i>	Ectoparasitic protozoan
<i>Arulus japonicus</i>	<i>Argulus</i> sp.	Parasitic crustacean
<i>Salmincola lavaretus</i>	<i>Salmincola</i> -type organism	Parasitic crustacean, provisional
<i>Naescus brevicaudatus</i>	Neascus/diplostomid-type metacercaria	Larval trematode
<i>Diplostomulum flexicaudum</i>	Diplostomid-type metacercaria	Larval trematode
<i>Uvulifer ambloplitis</i>	Diplostomid-type metacercaria	Larval trematode
<i>Aeromonas hydrophila</i>	<i>Aeromonas</i> -type organism	Bacterium
<i>Flexibacter litoralis</i>	<i>Flexibacter</i> -type organism	Bacterium
<i>Saprolegnia ferax</i>	<i>Saprolegnia</i> -type organism	Oomycete

Discussion

The present study recorded external biological agents in 48.33% of the examined fish. This indicates substantial exposure of fishes inhabiting Omambala River to organisms capable of colonizing or affecting external surfaces. The highest occurrence was recorded in *O. niloticus* (73.33%), while the lowest was recorded in *T. zillii* and *G. cyprinoides* (30.00%). Such interspecific

differences may arise from host behaviour, feeding ecology, habitat preference, body surface characteristics and differential susceptibility. The 42.86% occurrence recorded in *C. gariepinus* is mathematically derived from three affected fish among seven examined. The relatively small number of catfish means that this value should be interpreted descriptively rather than as a definitive population prevalence. The occurrence of *I. multifiliis* is epidemiologically important. The parasite is capable of causing substantial epithelial and gill pathology when infection is heavy. Contemporary literature continues to regard it as an important freshwater fish pathogen.

The observation of *Argulus* sp. is similarly important because fish lice can injure the epidermis and potentially facilitate secondary microbial infection. However, the manuscript deliberately avoids retaining the species name *Argulus japonicus* because the available data do not contain sufficient diagnostic evidence to support that species determination. This distinction is important for publication. Species-level identification of parasitic crustaceans should ideally be supported by detailed morphological measurements and, for difficult taxa, molecular markers.

Recent Nigerian research has demonstrated the continuing importance of ectoparasites in cultured fish. Wogu and Orji-Georgewill (2024) recorded *Trichodina* and *Chilodonella* among cultured *C. gariepinus* in Rivers State, showing that protozoan ectoparasites remain relevant to African catfish health in Nigeria. The occurrence of diplostomid-type metacercariae in the original records also deserves attention. These organisms should not simply be grouped with external protozoan parasites because they represent larval trematodes. Their presence may indicate the operation of complex aquatic parasite life cycles involving fish and other hosts.

The bacterial and oomycete records are also relevant but were separated from the ectoparasite category. *Aeromonas* is a bacterial pathogen, while *Saprolegnia* belongs to the oomycetes. Both can cause important disease in fish, and external tissue damage associated with parasites can potentially increase susceptibility to secondary infection. The findings therefore suggest that the external health status of Omambala River fishes should be considered from a broader disease-ecology perspective rather than solely from a parasite perspective.

Recent research on freshwater fish parasites emphasizes that parasite assemblages can provide information on host ecology, environmental conditions and disease processes. The present study has limitations.

Conclusion

External parasitic and disease-associated organisms occurred among fishes sampled from Omambala River. Twenty-nine of 60 fish were affected, giving an overall occurrence of 48.33%. *Oreochromis niloticus* recorded the highest proportion of affected fish, while *T. zillii* and *G. cyprinoides* recorded the lowest. The principal defensible ectoparasitic records were *I. multifiliis* and *Argulus* sp., while other recorded organisms were appropriately separated into larval trematodes, bacteria and oomycetes. The study provides baseline information on external fish-health threats in Omambala River and demonstrates the importance of accurate taxonomic classification in freshwater parasitological investigations.

Recommendations

Future studies should adopt a more comprehensive approach by undertaking year-round sampling across multiple sampling stations and examining larger host sample sizes to improve the reliability

and representativeness of findings. Parasite voucher specimens should be retained, while photomicrographs and detailed morphometric measurements should accompany species identifications. Molecular techniques should also be employed to resolve uncertain or closely related species. In addition, parasites should be carefully distinguished from bacterial and oomycete pathogens, with relevant water-quality parameters measured concurrently to assess possible environmental influences on parasite occurrence. Future investigations should further determine parasite intensity and abundance from individual hosts and incorporate histopathological examinations, where possible, to provide deeper insights into host–parasite interactions and associated tissue damage.

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