ADSUJSR 13 (2) (2025) 70 - 75
Adamawa State University Journal of Scientific Research
(ADSUJSR)
ISSN: 2705-1900 (Online); ISSN: 2251-0702 (Print)
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INVESTIGATIONS ON THE DIVERSITY OF PARASITIC PROTOZOA INFECTING FISH ALONG THE IMIRINGI AXIS OF THE KOLO CREEK IN OGBIA, BAYELSA STATE, NIGERIA

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Received in January 2026
Accepted in January 2026

Abstract

Fish is recognized as a significant nutrient source for protein and a source of livelihood to rural inhabitants; but its sustainability in the natural waters is threatened by parasitic infestations. Nevertheless, this study investigates the diversity of parasitic protozoa infecting fish along the Imiringi axis of the kolo creek in Ogbia. A total of 72 fish were sampled for infections of parasitic protozoa and 17 (23.6 %) were reportedly positive of various pathogenic protozoa Species. The parasitic protozoal load recorded in this study was 36, unevenly distributed among the fish species examined. The study displays high diversity of parasitic protozoa suggesting threat to fish sustainability. The study established that parasitic-protozoa will thrive in every aquatic ecosystem with sufficient hydrological properties supporting proliferation and dispersal. The study further established that ecto and endo-parasitic protozoa infect fish in combination and complicate severity of infection, compromising health and market value. Fish species residential at the benthic zone are most vulnerable to infections of parasitic protozoa within the water ecosystem. The rural resident and fisher men should adopt community-based protection against water contamination to discourage parasite bloom and improve fish health in the nature water ecosystem.

Keywords: Diversity, Fish, Parasitic, Protozoa, water ecosystem.

Introduction

Fish constitute a principal source of protein and other vital nutrients necessary for tissue development and ensuring nutrition security. However, fishing form an essential part of the rural livelihood in Imiringi. It is a way of life and means of survival due to restricted agricultural practice in the island. A greater number of households within the island survive on fishing which have constituted a major determinant of the economy of the non-urban island, and have supported secondary industries within the rural communities and help in easing poverty. According to Ekine and Nathaniel, (2025), the significant of fish in supporting human existence is beyond consumption as food, the act of fishing present a means of survival to several household in Ogbia (Imiringi) and individuals trading on fish also pursue it as a sole source of income in the area. Nevertheless, the sustainability of fish in the natural aquatic ecosystem is relatively threatened by parasitic infestations which many a times is aggravated by water pollution common in the Niger Delta region. Notable among parasitic agents of threat to fish sustenance are protozoa.

Parasitic protozoa have been identified as important invertebrate animals pathogenic to fish in fresh water ecosystem (Alemneh *et al.,* 2024; Okoye *et al*., 2024; Ekine and Nathaniel, 2025). The environmental atmosphere within the aquatic ecosystem which are not limited to poor water quality and elevated organic matter provide the protozoa parasite with the intense fore to proliferate and increases fish susceptibility (Woo *et al.,* 2020; Osime and Anagha, 2020; Kolodziej-Sobocinska, 2019). A variety of protozoa parasites have been reported in fish. These parasitic protozoa can colonize specific regions within the fish body, including the skin, gills and internal organs not excluding the blood (Osime and Anagha, 2020; Omeji *et al*., 2011; Iyaji and Eyo, 2009). The presence of parasitic protozoa in fish can result to dysfunction (Alemneh *et al.,* 2024; Ejere *et al.,* 2014; Buchmann, 2022), impairment (Banyigy *et al*., 2023) and reduce immune potency (Shukla *et al.,* 2024; Dezfuli *et al.,* 2023; Holzer *et al.,* 2021) and fish death in very severe cases (Manaf and Zamri, 2025; Alemneh *et al.,* 2024; Darabus *et al.,* 2024; Sardinha-Silva *et al*., 2022). These invertebrate animals are active natural agent regulating fish populations in non-artificial aquatic ecosystems. However, the eruption of parasitic protozoa in artificial fish rearing system can mean huge economic disadvantage to the farmer and can prompt food insecurity.

Parasites of protozoa origin are noticeable threat to aquatic lives, responsible for a variety of disease conditions in fish (Dahani and Khatouf, 2025; Stentiford *et al.,* 2020; Buchmann, 2015), and perpetrating financial loss in aquaculture. Regardless of the standing of parasitic protozoa as organisms of threat to fish health, data on their diversity in natural fresh water ecosystem in the study area is scarce with various research stressing much on helminths pathogens of fish and protozoa parasites been insufficiently reported. Therefore, a clear understanding on the diversity of parasitic protozoa infecting fish can be beneficial to the rural fisher men and fish marketers in sustaining healthy fishing practice and mitigate protozoal bloom in the natural waters. The outcome of this study can also raise consciousness among the rural inhabitants on the necessity for adequate fish preparation to mitigate risk of food-borne parasitic protozoal infections. Therefore, this study was aimed at assessing the occurrence and diversity of parasitic protozoa infecting fish along the Kolo creek fresh water ecosystem in Imiringi.

Materials and Methods

Study: Fish samples for this study was collected from the Imiringi axis of the Kolo creek in Ogbia Local Government Area of Bayelsa State, Nigeria. Imiringi community is an Island surrounded by creeks and Rivers including the Kolo creek. Fishing constitutes a prominent culture among the people of Imiringi and fish trading form a major source of livelihood of the indigenous people of Imiringi community. The area experience restricted agricultural practice due to limited farming land, and depend so much on fishing as a way of live. Imiringi is located at Latitude 4.87’88^o N and Longitude 6.37’58^o. The area is characteristics of intensive oil exploration, encouraging protozoal bloom.

Collection of fish: A total of 72 fish samples comprising of *Claris auguillaris, Clarotes laticeps* and *Cithariuns citharus* were purchase from the fisher men within the Island. Each time of fish sampling, the purchased fish was immediately conveyed to the laboratory for parasitological examination and fish identification.

Fish Examination: In the laboratory, the fish samples were physically assessed using hand lens for surface body parasites, the length and weight of the fish samples were determined using a wooden ruler and electronic weighing balance respectively.

Laboratory procedure: The fish was killed and the gills and intestines were removed from each fish into a distinct Petri dish with normal saline and was left undisturbed for two hours at room temperature. At the expiration of two hours, a drop of Giemsa stain was added and was viewed on electronic-microscope of x4, x10 objectives on a glass slid as documented in Osaji-Nwafil *et al.* (2023). For each fish killed, 2 drops of the blood were placed on a grease free glass slid and allowed to dry and a drop of Giemsa stain was fixed on each slid washed with laboratory running water and were air dried at room temperature as documented in Osaji-Nwafil *et al.* (2023) and Ekine and Nathaniel (2025).

Data Analysis: The result in this study was presented in tables using simple percentages (n/N x100). Test for significance on the abundance of parasitic protozoa and most infective fish species was carried out using one way ANOVA in SPSS version 23.

Results

Protozoal infestation of fish in Imiringi

The study sampled 72 fish for parasitic protozoa and recorded an infective rate of 23.6%. The fish species samples were *Claris auguillaris* 25 (34.7%), *Clarotes laticeps* 20 (27.8%) and *Cithariuns laticeps* 27 (37.5%) with a corresponding infective rate of 6 (35.3%), 2

(11.7%) and 9 (53.0%) for *Claris auguillaris*, *Clarotes laticeps* and *Cithariuns laticeps* respectively.

Table 1: Protozoal infestation of fish in Imiringi

Fish species	No sampled (%)	Infected (%)
Claris auguillaris	25 (34.7)	6 (35.3)
Clarotes laticeps	20 (27.8)	2 (11.7)
Cithariuns laticeps	27 (37.5)	9 (53.0)
Total	**72 (100)**	**17 (100)**

Protozoal load of fresh water fish in Imirigi

The parasitic protozoal load recorded in this study was 36, unevenly distributed among the fish species examined. The protozoal load in *Claris auguillaris* was 17 (47.2%), *Clarotes laticeps* had a protozoal load of 11 (30.6%) and the protozoal occurrence in *Cithariuns laticeps* was 8 (22.2%) respectively.

Table 2: Protozoal load of freshwater fish in Imiringi

Fish species	Protozoal Load	% Protozoal Load
Claris auguillaris	17	47.2
Clarotes laticeps	11	30.6
Cithariuns laticeps	8	22.2
Total	**36**	**100**

Diversity of protozoal Parasites in fish in Imiringi

The parasitic protozoa recorded in fish in this study were 36. The diversity of specific protozoa species revealed that *Trihodina heterodun* was 3 (8.3%), *Ichthyophthirius* had 12 (33.3%), The occurrence of *Trichiphyrya* was 4 (11.1%), the population of *Piscinodium pilular* was 8 (22.2%), *Myxosphordin* 3 (8.3%) and *Acanthmoeba* occurrence was 6 (16.7%). These parasitic protozoa were unevenly distributed among the investigated fish.

Table 3: Diversity of protozoal Parasites in fish in Imiringi

	Fish species			
	***Claris auguillaris* (%)**	***Clarotes laticeps* (%)**	***Cithariuns laticeps* (%)**	**Total (%)**
Parasite species				
T. heterodun	2 (11.8)	0	1 (12.5)	3 (8.3)
Ichthyophthirius	7 (41.2)	5 (45.4)	0	12 (33.3)
Trichiphyrya	1 (5.4)	2 (18.2)	1 (12.5)	4 (11.1)
P. pilular	4 (23.5)	1 (9.1)	3 (37.5)	8 (22.2)
Myxosphordin	0	1 (9.1)	2 (25.0)	3 (8.3)
Acanthmoeba	3 (17.6)	2 (18.2)	1 (12.5)	6 (16.7)
Total	**17 (100)**	**11 (100)**	**8 (100)**	**36 (100)**

Discussion

This study tested the occurrence and diversity of pathogenic protozoa of fish within the Imiringi axis of the Kolo creek in Ogbia, Bayelsa State, and established that parasitic protozoa are true pest of fresh water fish in the study area. Table 1 revealed a total fish protozoal infections of 23%, suggesting a slight infestation. This result can be attributed to the water contamination with crude oil products obvious in the study area. The contamination of the fresh water ecosystem alters the physical and chemical properties of the ecosystem and promote protozoal bloom and increases fish vulnerability. In a separate report, Ekine and Nathaniel (2025), Dezfuli *et al.,* 2023 and Sitjà-Bobadilla *et al*. (2016) states that anthropogenic activities which could alter water properties can directly impact on fish immune system and exposes fish and other aquatic lives to severe pathogenic invasion.

The infection rate among the examined fish as seen in this study was uneven. For instance, *Cithariuns laticeps* 53.0% was highly infected, closely followed by *Claris auguillaris* 35.3% and the rate of infection in *Clarotes laticeps* 11.7% was considerably low. This observation implies that the rate of susceptibility is dependent on the immune resistant of the fish species. The result further points that fish micro habitant and feeding option could serve as a medium of exposure to infections of parasitic protozoa. For instance, *Citharinus citharus* which is known to colonize the fresh water floor were the most infected. This is because at the river floor, *Citharinus citharus* could have survived on dirt precipitates from the creek enclosing protozoal infective stage like the cyst and increases its chances of infections with parasitic protozoa. However, *Clarotes laticeps,* which are relatively residential at surface water zone were less infected. This observation adheres with Abowei *et al.* (2011) and Ekine and Nathaniel (2025) who reports that bottom residing species of fish are at risk of parasitic infections in the aquatic habitat. Alemneh *et al.* (2024) opined that fish species at the substratum zone are most prone to contaminated organic matter which in the other hand multiply their chances of encountering infective agents.

Table 2 revealed a disparity between infection pattern and parasite load against the investigated fish species. Protozoal count of 47.2% was reported in *Clarias anguillaris* closely followed by *Clarotes laticeps* 30.6% and the most infected fish species, *Citharinus citharus* had a parasitic protozoal load of 22.2 %. This observation suggests that though more *Citharinus citharus* may have been vulnerable to protozoal infections but *Clarias anguillaris* provide a conducive atmosphere for protozoal replication and survival and houses more protozoa species than any other fish investigated. This result implies that *Clarias anguillaris* is a suitable definitive host for parasitic protozoa.

A variety of parasitic protozoa were encountered in this study, which includes *Trihodina heterodun, Ichthyophthinis, Trichiphyrya, Piscinodium pilular, Myxosphordin,* and *Acanthmoeba.* This observation is indicative that protozoa constitute a noticeable component of biodiversity in the aquatic ecosystem and should be considered as prevalent fish pathogens. Diversity of protozoal parasites as noticed in this study concur with Ekine and Nathaniel (2025) who reported 72.0% protozoa as parasites of fresh water fish against other invertebrate animals parasitic to fish within the Niger Delta, Nigeria. The most populated protozoan parasitic to fish in this study was *Ichthyophthirius* 33.3%. Next to *Ichthyophthirius* was *P. pilular* 22.2%. The abundance of *Ichthyophthirius* can be connected to its adaptive strategy to survive vertebrate host system and established infcetion. *P. pilular* flourish in habitats rich in organic matter which is typical of the Niger Delta waters. The occurrence of *Acanthamoeba* 16.7% and *Myxosporidium* 8.3% in this study implies that both ecto- and endo-parasitic protozoa are active pathogens of fish population, strongly inflicting injuries that could potentially weaken the physiological performance and market value of fish.

Conclusion

The study established that protozoal parasite thrive in every aquatic ecosystem with sufficient hydrological properties supporting proliferation and dispersal. The study further established that ecto and endo-parasitic protozoa infect fish in combination and complicate severity of infection, compromising health and market value of fish species. The rural resident and fisher men should adopt community-based protection against water contamination to discourage parasite bloom and improve fish life in the natural fresh water ecosystem. Fish species residential at the benthic zone of the fresh water habitat are most vulnerable to infections of parasitic protozoa within the water ecosystem.

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