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# Isolation and Identification of Ectoparasites and Endoparasites of Some Freshwater Fishes Collected from Kargo Dam, Jaji, Kaduna State, Nigeria

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**ABSTRACT**
Parasitic infection remains a persistent threat to fish health and productivity in Nigeria's inland waters, yet many small dams and reservoirs remain unsurveyed for the parasites their fish stocks carry. This study examined the ectoparasites and endoparasites of five freshwater fish species from Kargo Dam, Jaji, Kaduna State, Nigeria (October 2025–February 2026). Two hundred and eighty fish were examined, *Clarias gariepinus* (n = 64), *Oreochromis niloticus* (n = 53), *Labeo coubie* (n = 49), *Synodontis schall* (n = 56) and *Heterotis niloticus* (n = 58), by dissection and microscopy, with findings tested using chi-square analysis. Overall, 141 fish (50.36%) carried at least one parasite, prevalence being highest in *Heterotis niloticus* (65.52%) and lowest in *Labeo coubie* (38.78%); the species difference was significant, $\chi^2(4, N = 280) = 9.82$, $p = .044$. In total, 257 parasites across seven taxa were recovered: four ectoparasites (127, 49.42%) led by *Dactylogyrus spp.* and *Gyrodactylus spp.*, and three endoparasites (130, 50.58%) dominated by *Camallanus spp.* Both groups were unevenly composed, $\chi^2(3, N = 127) = 16.15$, $p = .001$ for ectoparasites and $\chi^2(2, N = 130) = 15.98$, $p < .001$ for endoparasites, though the ecto-endo split did not differ from parity, $\chi^2(1, N = 257) = 0.04$, $p = .852$. Fish stocks at Kargo Dam thus carry a fairly diverse, moderately heavy parasite burden with clear implications for fish health, aquaculture output and, given *Clinostomum spp.*, food safety. These findings establish a parasitological baseline for Kargo Dam that underscores the need for sustained monitoring. Regular monitoring and improved water management are recommended.

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## INTRODUCTION

Fish remain one of the cheapest and most widely available sources of animal protein in Nigeria, and the rivers, lakes and small dams that make up the country's inland fisheries sustain the livelihoods of a great many rural households (Food and Agriculture Organization [FAO], 2020). That productivity is not guaranteed, however: parasitic infection can slow fish growth, interfere with reproduction, damage tissue and, at its worst, trigger mass die-offs (FAO, 2020). Fish parasites fall broadly into two groups – ectoparasites, which live on the skin, fins and gills, and endoparasites, recovered mainly from the gut, body cavity and internal organs – and both matter for reasons beyond fish welfare alone. Some genera, *Clinostomum* and *Camallanus* among them, carry zoonotic or food-safety implications when infected fish are eaten undercooked.

A fair number of Nigerian studies have looked at the parasite fauna of species such as *Clarias gariepinus* (African catfish), *Oreochromis niloticus* (Nile tilapia), *Labeo coubie* (African carp), *Synodontis schall* (Schall catfish) and *Heterotis niloticus* (African bonytongue), and prevalence figures from these surveys vary a great deal depending on where the fish were sampled, the season, the host species itself, and even its sex and size (Ejere *et al.*, 2014; Onoja-Abutu *et al.*, 2021; Nwadike *et al.*, 2024; Mowang *et al.*, 2025). Closer to the present study, surveys of the Kaduna River and its associated ponds have put gastrointestinal helminth prevalence at around 50% in mixed fish assemblages, with nematodes such as *Contracaecum* and *Camallanus* and trematodes such as *Clinostomum* among the dominant taxa (Dikwa *et al.*, 2024; Inegbenosun *et al.*, 2025). On the ectoparasite side, monogeneans (*Dactylogyrus* and *Gyrodactylus*), branchiurans (*Argulus*) and ciliates (*Chilodonella*) have repeatedly turned up as the main skin and gill parasites of *Clarias gariepinus* and *Oreochromis niloticus* in Nigerian ponds and rivers alike (Kawe *et al.*, 2016; Mowang *et al.*, 2025).

Kargo Dam at Jaji, Kaduna State, is one such water body, a man-made impoundment that a number of local households still depend on for fishing, yet its fish have never been screened for parasites in any published study. Because water quality, stocking density and fishery management practices all influence parasite transmission in small impoundments, closing this gap is important for both fisheries management and public health. The present study therefore set out to isolate and identify the ectoparasites and endoparasites infecting *Clarias gariepinus*, *Oreochromis niloticus*, *Labeo coubie*, *Synodontis schall* and *Heterotis niloticus* at Kargo Dam, and to test statistically whether prevalence and parasite composition varied meaningfully across host species and parasite groups.

The specific objectives of the study were to collect and examine fish species for ectoparasites, collect and examine fish species for endoparasites, identify and classify the recovered parasite species, and determine the prevalence and intensity of parasitic infection among the fish species examined using inferential statistics to test the significance of observed differences. It was hypothesised that parasite prevalence and composition would differ significantly among the five fish species and between the ectoparasite and endoparasite groups.

## MATERIALS AND METHODS

### Study Area

Kargo Dam sits at Jaji, in Kaduna State, north-western Nigeria (approximately 10°49′N, 7°34′E). It is a small, permanently impounded body of water that has long supported subsistence and small-scale artisanal fishing for the surrounding communities, and it has also undergone infrastructural rehabilitation work in recent years, a sign of how much it still matters locally. As with other minor reservoirs across the Kaduna River basin, its fish community is mixed, made up of catfishes, cichlids, cyprinids and mochokids, and it was from this assemblage that the present sample was drawn.

### Study Duration

Sampling and parasitological examination ran for five months, from October 2025 to February 2026, spanning the tail end of the rainy season into the early dry season.

### Fish Sample Collection

In all, 280 fish across five species were collected with the help of local fishermen, who used cast nets, hooks and traps at several points around the dam: *Clarias gariepinus* (n = 64), *Oreochromis niloticus* (n = 53), *Labeo coubie* (n = 49), *Synodontis schall* (n = 56) and *Heterotis niloticus* (n = 58). Fish were brought to the laboratory live or on ice in clean, well-aerated containers to keep them from deteriorating, and every specimen was processed within 24 hours of capture. Each fish was identified to species level using standard field guides, and its total length and weight were recorded before dissection began.

### Examination for Ectoparasites

Every fish was first checked externally for ectoparasites. The skin, fins and gills were examined by eye for anything visible, such as *Argulus spp.*, after which mucus was scraped from the skin and the gill filaments were removed and examined under a light microscope for monogeneans (*Dactylogyrus spp.* and *Gyrodactylus spp.*) and ciliates (*Chilodonella spp.*). Parasites recovered at this stage were preserved in physiological saline or 70% ethanol until they could be identified.

### Examination for Endoparasites

The fish was then opened along the ventral surface to expose the body cavity. The gut, liver and other visceral organs were removed, slit open and examined in physiological saline under a dissecting and light microscope for helminths, trematode larvae and myxosporean cysts. Nematodes (*Camallanus spp.*), trematodes (*Clinostomum spp.*) and myxosporean spores recovered in this way were counted and preserved for identification.

### Parasite Identification

Parasites were identified to genus level from their morphology under a compound light microscope, drawing on established taxonomic keys and on comparison with parasite records already published for Nigerian freshwater fish (Dikwa *et al.*, 2024; Inegbenosun *et al.*, 2025; Mowang *et al.*, 2025).

### Statistical Analysis

For each fish species, prevalence was taken as the number of infected fish divided by the number examined, multiplied by 100, following Bush *et al.* (1997), a convention still applied in recent Nigerian fish parasitology studies (Inegbenosun et al., 2025). Beyond these descriptive frequencies and percentages, three inferential tests were run: a chi-square test of independence to check whether infection status was associated with fish species, and two chi-square goodness-of-fit tests to check whether the recovered ectoparasite and endoparasite taxa were evenly represented within their respective groups, and whether the overall ectoparasite-to-endoparasite split departed from an expected 1:1 ratio. Significance was set at $p < .05$, and all analyses were run in IBM SPSS Statistics (version 25).

## RESULTS AND DISCUSSION

### Prevalence of Infection by Host Species

A total of 141 of the 280 fish sampled (50.36%) carried at least one parasite. Prevalence was far from uniform across species, ranging from 38.78% in *Labeo coubie* up to 65.52% in *Heterotis niloticus* (Table 1), with *Clarias gariepinus, Synodontis schall* and *Oreochromis niloticus* falling in between in that order. A chi-square test of independence confirmed that this spread was not simply chance, $\chi^2(4, N = 280) = 9.82$, $p = .044$, indicating that some species were genuinely more prone to infection than others.

**Table 1: Prevalence of Parasitic Infection among Fish Species Examined from Kargo Dam, Jaji, Kaduna State**

| Fish species | No. examined | No. infected | Prevalence (%) |
|---|---|---|---|
| *Clarias gariepinus* | 64 | 34 | 53.13 |
| *Oreochromis niloticus* | 53 | 22 | 41.51 |
| *Labeo coubie* | 49 | 19 | 38.78 |
| *Synodontis schall* | 56 | 28 | 50.00 |
| *Heterotis niloticus* | 58 | 38 | 65.52 |
| **Total** | **280** | **141** | **50.36** |

N = 280. Chi-square test of independence: $\chi^2(4, N = 280) = 9.82$, $p = .044$.

An overall prevalence of 50.36% puts Kargo Dam in much the same range as fish sampled directly from the Kaduna River and Kaduna Metropolis, where Inegbenosun *et al.* (2025) recorded gastrointestinal helminth prevalence of 50.9% in a mixed assemblage that included *Labeo coubie* and *Oreochromis niloticus,* and where Dikwa *et al.* (2024) reported a broadly similar pattern in fish from the Kaduna River and nearby domestic ponds. That two independent surveys within the same river system arrive at comparable figures hints that the parasite load seen here is less a quirk of Kargo Dam itself than part of a wider, catchment-level pattern across Kaduna State's inland waters. The species effect found in the present study, $\chi^2(4, N = 280) = 9.82$, $p = .044$, echoes Inegbenosun *et al.*'s (2025) own finding of a significant species-related difference in helminth prevalence for the Kaduna Metropolis assemblage ($\chi^2 = 5.88$, $p = .015$) – two separate datasets pointing to the same conclusion, that host species identity genuinely shapes infection risk in this river system.

*Heterotis niloticus* stood out here with the highest prevalence (65.52%), and this lines up with work from the Anambra River basin, where Nwadike *et al.* (2024) found gastrointestinal helminth prevalence as high as 72.8% in the same species, dominated by nematodes and an acanthocephalan recovered mostly from the gut. At the other end, the lower prevalence in *Labeo coubie* (38.78%) sits comfortably within the range Inegbenosun *et al.* (2025) reported for cyprinids sampled alongside other species in the Kaduna River. Such species-to-species differences are usually put down to feeding habits, habitat choice, immune status and body size – all factors that shape how much a fish is exposed to parasites and how well it fends them off – and the statistically significant species effect found here fits that explanation well (Nwadike *et al.*, 2024).

**Composition and Relative Abundance of Recovered Parasites**

The 280 fish yielded 257 individual parasites in all, spanning seven genera – four ectoparasite taxa and three endoparasite taxa (Table 2). Ectoparasites made up 127 of these (49.42%) and endoparasites 130 (50.58%), a split close enough to even that a chi-square goodness-of-fit test against an expected 1:1 ratio found no significant difference, $\chi^2(1, N = 257) = 0.04$, $p = .852$ – in other words, external and internal parasites contributed roughly equal shares of the total burden.

Within the ectoparasite group, *Dactylogyrus spp.* was the most numerous (44 individuals, 34.65% of ectoparasites), just ahead of *Gyrodactylus spp.* (42; 33.07%), with *Argulus spp.* (22; 17.32%) and *Chilodonella spp.* (19; 14.96%) recovered less often; this unevenness was statistically real, $\chi^2(3, N = 127) = 16.15$, $p = .001$. The endoparasite group showed an even sharper skew: *Camallanus spp.* alone accounted for nearly half of all endoparasites recovered (63 individuals, 48.46%), well ahead of *Clinostomum spp.* (41; 31.54%) and *Myxosporidia* (26; 20.00%), $\chi^2(2, N = 130) = 15.98$, $p < .001$.

**Table 2: Composition and Relative Abundance of Ectoparasites and Endoparasites Recovered from Fish at Kargo Dam**

| Category | Parasite taxon | No. recovered | % of category | % of total (N = 257) |
|---|---|---|---|---|
| Ectoparasite | *Argulus spp.* | 22 | 17.32 | 8.56 |
| Ectoparasite | *Dactylogyrus spp.* | 44 | 34.65 | 17.12 |
| Ectoparasite | *Gyrodactylus spp.* | 42 | 33.07 | 16.34 |
| Ectoparasite | *Chilodonella spp.* | 19 | 14.96 | 7.39 |
| **Subtotal** | **Ectoparasites** | **127** | **100.00** | **49.42** |
| Endoparasite | *Camallanus spp.* | 63 | 48.46 | 24.51 |
| Endoparasite | *Clinostomum spp.* | 41 | 31.54 | 15.95 |
| Endoparasite | *Myxosporidia* | 26 | 20.00 | 10.12 |
| **Subtotal** | **Endoparasites** | **130** | **100.00** | **50.58** |
| **Grand total** | **All parasites** | **257** | **—** | **100.00** |

N = 257. Goodness-of-fit tests: ectoparasite taxa, $\chi^2(3, N = 127) = 16.15$, $p = .001$; endoparasite taxa, $\chi^2(2, N = 130) = 15.98$, $p < .001$.

*Camallanus spp.* was overall the single most abundant parasite taxon recovered (24.51% of all 257 parasites), followed by *Dactylogyrus spp.* as the leading ectoparasite (17.12%), while *Chilodonella spp.* and *Myxosporidia* were the least represented taxa within their respective groups.

*Camallanus spp.* was clearly the dominant endoparasite in this study, and the goodness-of-fit test leaves little doubt that this dominance is real rather than a sampling artefact, $\chi^2(2, N = 130) = 15.98$, $p < .001$. That fits a broader pattern: *Camallanus* turns up again and again as one of the principal nematode genera in Nigerian rivers and dams, from the Kaduna River system to the Benue and Niger Rivers and several water bodies further south (Onoja-Abutu *et al.*, 2021; Dikwa *et al.*, 2024; Inegbenosun *et al.*, 2025). Because *Camallanus* relies on crustacean intermediate hosts, it tends to thrive where zooplankton and benthic invertebrates are abundant, conditions common in nutrient-rich impoundments such as small dams. *Clinostomum spp.* is worth flagging separately: as the agent of "yellow grub" disease and an occasional cause of human infection when fish are eaten undercooked, its presence here is a reminder that fish from the dam should be thoroughly cooked before consumption (Inegbenosun *et al.*, 2025).

The ectoparasite pattern told a similar story of unevenness, $\chi^2(3, N = 127) = 16.15$, $p = .001$, with *Dactylogyrus spp.* and *Gyrodactylus spp.* far outnumbering *Argulus spp.* and *Chilodonella spp.* Monogenean dominance of this kind has been reported often enough in Nigerian fish farms and rivers, where these flukes are consistently the most common ectoparasites of *Clarias gariepinus* and *Oreochromis niloticus*, ahead of crustacean and ciliate parasites (Kawe *et al.*, 2016; Mowang *et al.*, 2025). Part of the explanation may lie in their life cycle: monogeneans need no intermediate host, so they can spread quickly wherever fish are held at high density. Even so, *Argulus spp.* and *Chilodonella spp.* were both recovered, the former a mobile crustacean capable of real skin damage and secondary infection, the latter a ciliate linked to mass mortality under poor water quality, so fish at Kargo Dam are clearly exposed to the full range of ectoparasite groups seen elsewhere in Nigeria (Kawe *et al.*, 2016). The relative abundance of the seven recovered taxa is summarised in Figure 1.

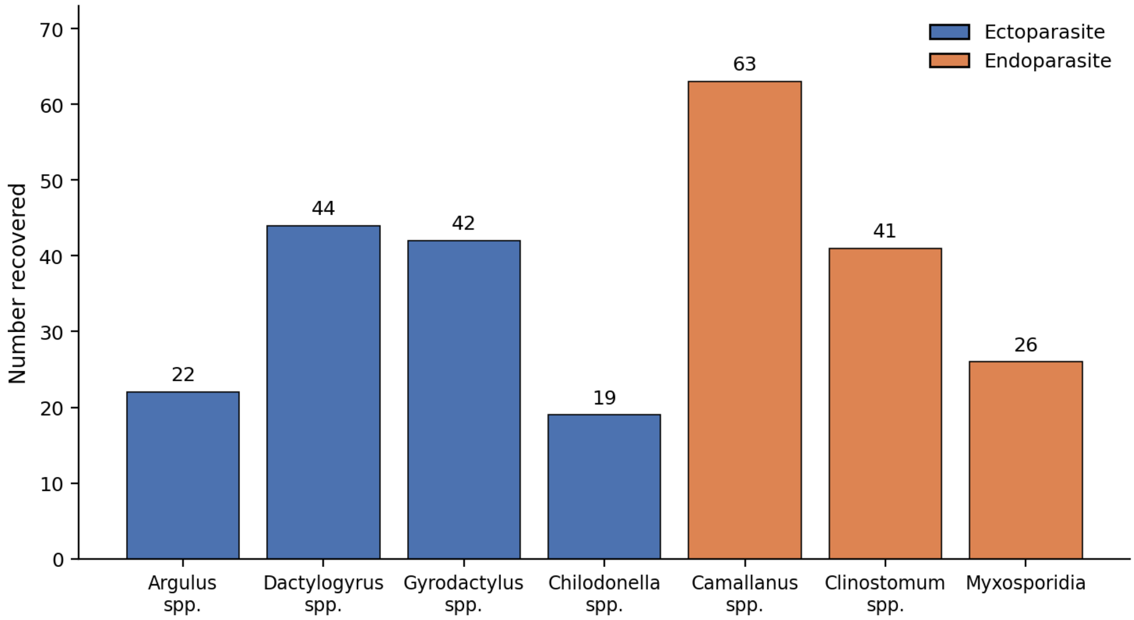


Figure 1: Relative Abundance of Ectoparasite and Endoparasite Taxa Recovered from Fish at Kargo Dam

The most notable result was the near-even split between ectoparasites (49.42%) and endoparasites (50.58%), a difference statistically indistinguishable from a 1:1 ratio, $\chi^2(1, N = 257) = 0.04$, $p = .852$. That balance suggests both transmission routes are equally active at the dam: free-living infective stages spreading through the water for ectoparasites, and food-web transmission through intermediate hosts for endoparasites. A similar pattern has been noted in other Nigerian water bodies with comparably mixed fish assemblages (Ejere *et al.*, 2014).

## CONCLUSION

This study established, for the first time, the ectoparasites and endoparasites carried by fish stocks at Kargo Dam, revealing a fairly diverse and moderately heavy parasite load. Overall prevalence stood at 50.36% across the 280 fish examined, with *Heterotis niloticus* the most heavily infected species and *Labeo coubie* the least, a difference confirmed statistically, $\chi^2(4, N = 280) = 9.82$, $p = .044$. *Camallanus spp.* and *Dactylogyrus spp.* emerged as the clearly dominant endoparasite and ectoparasite taxa respectively, even though the two parasite groups contributed statistically equal shares of the overall burden. These findings sit comfortably alongside earlier parasitological work elsewhere in the Kaduna River basin and other Nigerian freshwater systems, and they give Kargo Dam a parasitological baseline it did not previously have.

Based on these findings, it is recommended that fish stocks at Kargo Dam be monitored regularly for parasites so that any change in prevalence or abundance over time is picked up early; that fish handlers and consumers be encouraged to cook fish from the dam thoroughly, particularly given the zoonotic risk posed by *Clinostomum spp.*; that agricultural and fisheries extension agencies sensitise local fishermen to simple measures that reduce transmission, such as avoiding overcrowding of fish during transport and holding; and that future work examine seasonal variation, host sex and size, and molecular confirmation of the parasites identified here, building on the baseline this study provides.


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## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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