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# Parasitic Infection of Amphibians from an Open Dumpsite and Otofure, the Host Community in Ovia North East LGA, Edo State, Nigeria

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**ABSTRACT:** Open dumpsites provide ample and stable food sources for most animals, but they also make them more susceptible to illnesses and pollutants. Amphibians are typically drawn to these areas because of the abundance of prey and relative moisture. However, the ongoing burning at the dumpsite may jeopardize any creature that lives in this ecosystem. The purpose of this study was to assess amphibian diversity and parasite infections at an open dumpsite and its host town, Otofure, in Ovia North-East Local Government Area, Edo State, Nigeria. The Visual Acoustic Encounter Survey method was utilized to collect amphibian samples at night. Six amphibian and 14 parasite species were found at both sites. Though more parasite species were discovered in amphibians from the community (not at the dump site), parasitic intensity was generally modest at both locations. *Sclerophrys maculata* was the most infected amphibian at both sites, but it had a greater infection rate in the community. The study's findings indicate that the dump site environment was less tolerable for free-living parasites and their vectors due to contamination with various chemical and organic wastes, as well as the elevated temperature caused by the constant burning of refuse.

**Keywords:** Open dumpsite, Amphibians, Parasites, Otofure, Edo State

## Introduction

Otofure dumpsite is an open dump that accommodates garbage from residents, hospitals, schools, marketplaces, electrical and mechanical shops, and other companies in Ugbowo, Uselu, Isihor, Oluku, and the surrounding areas. The abrupt surge in rural-urban expansion caused by population growth has also culminated in an increase in garbage generation (Hoornweg *et al*., 2013; Oka and Bassey, 2017). The abundance of food materials at the dumpsite attracts a variety of species. However, garbage dumps may have detrimental consequences for species, especially amphibians, because they can spread infections and pathogens, affecting their health and abundance (Matejczyk *et al*., 2011; Plaza and Lambertucci, 2017). The abundance of insects and other detritus feeders (which adult amphibians feast on), combined with the dumpsite's relative dampness, make it a sanctuary for amphibians. The Otofure community is a tropical rainforest that is rapidly growing into an urban region. Urbanization is one anthropogenic activity that significantly alters amphibian habitats (Aisien *et al*., 2017). The impact of land use changes on amphibians is obvious not solely in population decrease, but also in the parasite-host interaction (McKenzie, 2007; Rohr *et al*., 2008a;b).

Recent studies have focused on dumpsite investigation, but the majority of these studies have primarily focused on its animal composition (Oka and Bassey, 2017), impacts on wildlife and ecosystems (Plaza and Lambertucci, 2017; Ekeu-wei *et al*., 2018; Oriakhi and Okonofua, 2022), heavy metals assessment (Imasuen and Omorogieva, 2013; Iyebor *et al*., 2020), and trace metals assessment in amphibians (Akinsanya *et al*., 2020; Okeagu *et al*., 2022). The available literature revealed that there is a scarcity of information on amphibian and parasite infection in dumpsites. The purpose of this study was to explore amphibian diversity and parasite infection at an open dumpsite and the host town of Otofure in Ovia North East Local Government Area, Edo State, Nigeria. Because the Otofure dumpsite is exposed, it is frequently burned. Ideally, the dumpsite should not be burned, yet smokers and unknown individuals frequently do so (personal communication). Nonetheless, the persistent burning could harm the survival of any creature that lives in this ecosystem.

## Materials and methods

*Study area:* Amphibians were collected from a government-owned open dumpsite at Otofure Community, Ovia North East Local Government Area, Edo State, Nigeria (Latitude 6°27'30" and 6°28'0"N and Longitude 5°35'40" and 5°36'10"E) and at 100 meters away from the dumpsite (Fig. 1). The dumpsite came into functionality about 20 years ago (personal communication) and it is under the Ministry of Environment Waste Management Board, Edo State Government. The State Waste Management Board collects garbage from designated locations and from houses and deposits them at the site. This dumpsite was once a burrow pit where lateritic sand was excavated for road construction. Cassava (*Manihot esculenta*) is grown at the upland part of the dumpsite, with several small scavengers' shelters at the outskirt. Solid waste is deposited at the lower part (down slope) of the dumpsite on daily basis. Otofure Community is a tropical rainforest that has been converted to secondary forest by human settlement, farming, and other commercial activities.

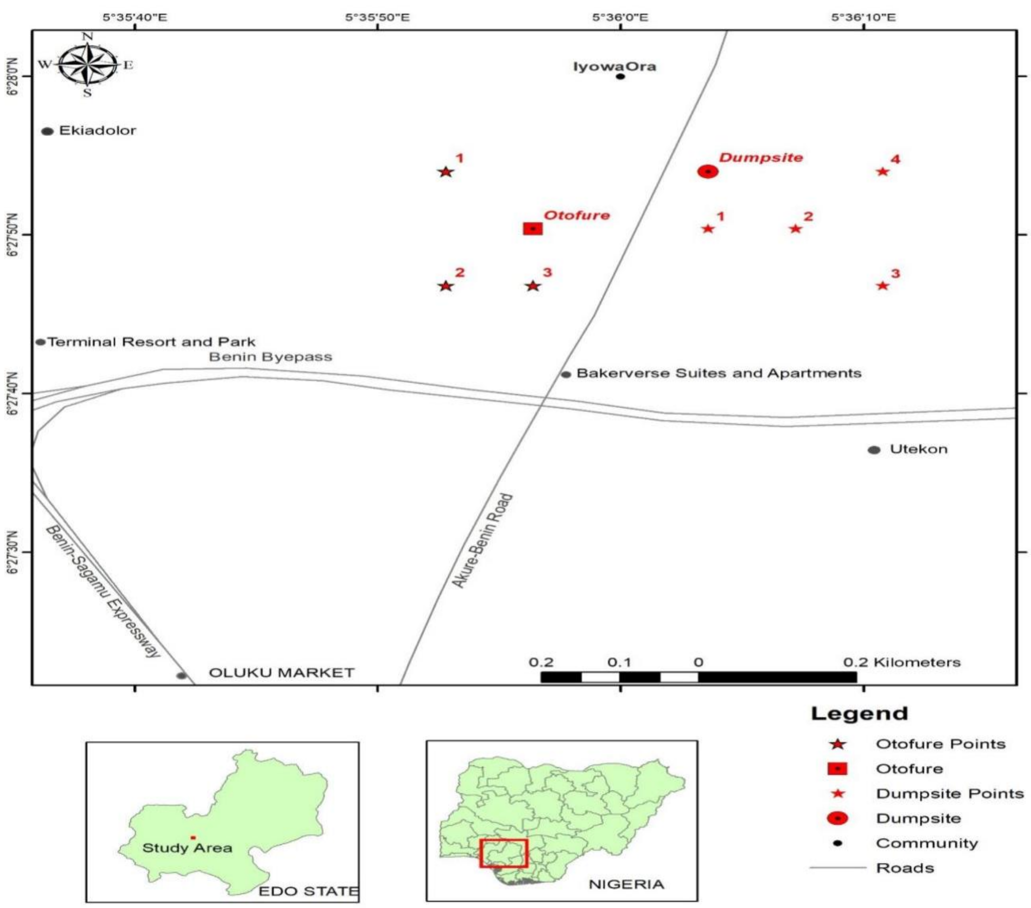


**Fig. 1:** Maps of Nigeria, Edo State and study area showing the sampled location at Otofure (dumpsite and Community), Ovia North East LGA, Edo State, Nigeria

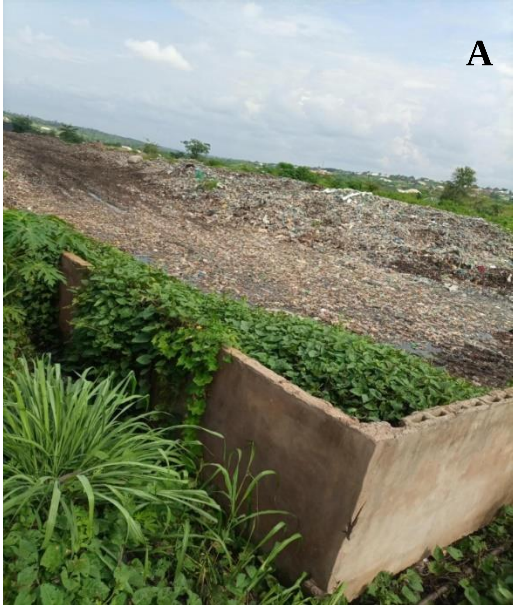



**Plate 1A and B:** Dumpsite and Scavenger shelter at Otofure, Ovia North-East LGA, Edo State, Nigeria

**Plate 2:** Sampled residential area at Otofure community, Ovia North-East LGA, Edo State, Nigeria

*Collection and identification of amphibians:* Amphibians were handpicked at night (07:00 p.m. - 12:00 a.m.) from around grasses, scavenger shelters, open space littered with waste, water puddles and along road paths using Visual Acoustic Encounter Survey method (Crump and Scott, 1994) for four months (October and November of 2021 and 2022). Amphibians were identified based on morphological characters according to Schiøtz (1999) and Rodel (2000). Small amphibians were kept in plastic bottles with perforated caps while the bigger ones and toads were kept in baskets. They were then taken to the laboratory for parasitological examination.

*Postmortem examination of amphibians for parasites:* In the laboratory, amphibians were euthanized by immersion in Benzocaine solution or by exposure to chloroform vapour in a killing jar. Before dissection, the snout-vent length (SVL) of each amphibian was measured. The parts examined for parasites were gastro-intestinal tracts (GIT), which was separated into; oesophagus/stomach, small intestine, and large intestine/rectum. The lungs, urinary bladder, liver and body cavity were also examined. Each part was placed in petri dish containing 0.72% saline solution and teased opened under a dissecting microscope to release parasites into the saline solution for retrieval.

*Isolation, preservation, processing of parasites and identification:* Recovered parasites were transferred to petri-dishes containing 0.72% saline solutions. Nematodes were fixed in hot 70% alcohol and preserved in well labeled specimen bottles containing fresh 70% alcohol while cestodes and digeneans were flattened under cover slip pressure on microscope slides, fixed with 5% formal-saline and preserved with the same fixative in well labeled specimen bottles. Pentastomids were fixed and preserved in 70% alcohol-saline.

Before staining, preservative was removed from the platyhelminthes by washing them for 4 hours in several changes of tap water at 30 minutes interval. The parasites were then stained in weak acetocamine solution for 3 to 6 hours. Thereafter, the stained parasites were rinsed with tap water for 10 minutes to remove excess stain. The parasites were then dehydrated in increasing sequence of alcohol concentrations (30:50:70:90:100%). In the 30% alcohol, the parasite was dehydrated for 30 minutes while in the other alcohol series, the timing was 1hour each except for the 90% alcohol, which could be more if necessary. The dehydrated specimens were initially exposed for 3 to 5 minutes in 50:50 alcohol/xylene before clearing in absolute xylene for 3 minutes. Canada balsam was used to make a permanent mount. The slides were thereafter dried in the oven. Nematodes and pentastomids were temporarily mounted in lactophenol. Parasites identification was done with the aid of appropriate keys (Yamaguti, 1971; Prudhoe and Bray, 1982; and Khalil *et al*., 1994). Digital photographs were taken using a camera connected to a Nikon Apha Phot-2-Microscope, either of the whole parasites or of their diagnostic characteristics.

*Statistical analysis:* Amphibian diversity was analyzed using alpha diversity indices [Shannon diversity (H'), Simpson (I-D), Margalef (d), Equitability or Evenness (J), and Dominance (D)]. Diversity t test was used to test for significant difference between the two sites of sampling. Prevalence and mean intensity of parasitic infection were calculated and the significant difference ($P>0.05$) was tested with Chi square goodness-of-fit.

## Results

A total of 153 amphibians (87 from the dumpsite and 66 from the host community) were examined for their parasites infection. The amphibians encountered from both sites included *Sclerophrys maculata*, *Ptychadena bibroni*, *P. mascareniensis* and *P. pumilio*. *Ptychadena oxyrhynchus* occurred only at the dumpsite while *Hoplobatrachus occipitalis* was restricted to the host community (Otofure). A higher amphibian species diversity (H'=1.382) was recorded at the dumpsite than in the Otofure community (H'=1.235). However, Otofure community had more species richness (d=0.9547) than the dumpsite (d=0.8957).

An overall prevalence of 63.2% and 68.2% ($p>0.05$) was recorded at the dumpsite and host community, respectively (Table 1). The most infected amphibian was *S. maculata* with a prevalence of 72.2% and 91.2%, respectively at the dumpsite and the host community while the least infected was *P. mascareniensis* (25.0%) from the dumpsite and *P. pumilio* (20.0%) from the community.

**Table 1:** Amphibians encountered in dumpsite and the host community, Otofure in Ovia North-East Edo State, Nigeria

| Amphibian species | Dumpsite | | | Otofure community | | |
|---|---|---|---|---|---|---|
| | **No. examined** | **No. infected** | **Prev. (%)** | **No. examined** | **No. infected** | **Prev. (%)** |
| **Bufonidae** | | | | | | |
| *Sclerophrys maculata* | 36 | 26 | 72.2 | 34 | 31 | 91.2 |
| **Dicroglossidae** | | | | | | |
| *Hoplobatrachus occipitalis* | - | - | - | 02 | 01 | 50.0 |
| **Ptychadenidae** | | | | | | |
| *Ptychadena bibroni* | 18 | 12 | 66.7 | 03 | 02 | 66.7 |
| *P. mascareniensis* | 12 | 03 | 25.0 | 12 | 08 | 66.7 |
| *P. oxyrhynchus* | 02 | 01 | 50.0 | - | - | - |
| *P. pumilio* | 19 | 13 | 68.42 | 15 | 03 | 20.0 |
| **Total** | 87 | 55 | 63.2 | 66 | 45 | 68.2 |
| Dominance_D | 0.2813 | 0.3302 | | 0.3531 | 0.5131 | |
| Simpson_1-D | 0.7187 | 0.6698 | | 0.6469 | 0.4869 | |
| Shannon (H') | 1.383 | 1.259 | | 1.235 | 0.9673 | |
| Evenness_e^H/S | 0.7976 | 0.7042 | | 0.6876 | 0.5262 | |
| Margalef (d) | 0.8957 | 0.9982 | | 0.9547 | 1.051 | |
| Equitability_J | 0.8595 | 0.7821 | | 0.7672 | 0.601 | |

Overall, 14 parasites species were recorded in amphibians examined in this study, 11 (1 Pentastomida, 9.1%; 1 Cestoda, 9.1%, 2 Digenea, 18.2% and 7 Nematoda, 63.6%) of these were reported from the host community (OC) while 10 (1 Cestoda, 10.0%, 1 Digenea, 10.0% and 8 Nematoda, 80.0%) were from the dumpsite (DS). Among the parasites are *Raillietiella* sp., *Cylindrotaenia jaegerskioeldi*, *Diplodiscus fischthalicus*, *Mesocoelium monodi*, *Aplectana* sp., *Amplicaecum africanum, Ophidascaris* sp. larva, *Camallanus dimitrovi*, *Chabaudus* *leberrei*, *Cosmocerca commutata*, *C. ornata*, *Physaloptera* sp., *Rhabdias africanus* and *Rhabdias* sp. *Amplicaecum africanum, C. leberrei,* and *Physaloptera* sp. were peculiar to the amphibians from the dumpsite while *Raillietiella* sp., *D. fischthalicus, C. dimitrovi* and *Rhabdias* sp. were only recovered from amphibians in the community as shown in Table 2.

Seven multi-host parasites including *M. monodi*, *Aplectana* sp., *A. africanum*, *Ophidascaris* sp. larva, *C. commutata*, *C. ornata* and *Physaloptera* sp. which infected between two and five amphibian species were recorded in the DS. In the OC, the multi-host parasites were *C. jaegerskioeldi*, *D. fischthalicus*, *Aplectana* sp., *Ophidascaris* sp. larva, *Cosmocerca commutata* and *C. ornata. Cylindrotaenia jaegerskioeldi, M. monodi*, *Chabaudus leberrei*, and *R. africanus* were single host parasites in the DS while *Raillietiella* sp., *C. dimitrovi*, *R. africanus* and *Rhabdias* sp. were recovered from single species of amphibian in OC.

*Ptychadena bibroni* was the most infected amphibian in the dumpsite harboring 7 species of parasites followed by *S. maculata* and *P. pumilio* (6 parasites species each), *P. oxyrhynchus* (3 species) and *P. mascareniensis* (2 species). In Otofure community, *S. maculata* haboured the highest parasite species (7 species) followed by *P. mascareniensis* (5 species). Others (*H. occipitalis*, *P. bibroni*, and *P. pumilio*) were infected with 2 species of parasites each. The small intestine was the most infected organ and it harbored 8 (57.1%) species of parasites. This was followed by the large intestine (6; 42.9%), and oesophagus/stomach (5; 35.7%). The lungs had the lowest number of parasites being infected with 3 (21.4%) species. There was no parasitic record in the mouth, urinary bladder, liver, and body cavity in this study.

A total of 577 parasites (365 from DS; 212 from OC) were recovered from the amphibians with an overall mean intensity of 6.64 and 4.71 parasites/infected amphibian respectively, from the dumpsite and community.

**Table 2:** Parasites and site of infection in amphibians from dumpsite and the host community, Otofure in Ovia North-East Edo State, Nigeria

| Parasite | Amphibian Host | Host location | Site of infection |
|---|---|---|---|
| **Pentastomida** | | | |
| *Railliettiella* sp. | *S. maculata* | OC | LG |
| **Cestoda** | | | |
| *Cylindrotaenia jaegerskioeldi* | *S. maculata* | DS & OC | SI |
| | *H. occipitalis* | OC | SI |
| | *P. mascareniensis* | OC | SI |
| **Digenea** | | | |
| *Diplodiscus fischthalicus* | *P. bibroni* | OC | LI/R |
| | *P. mascareniensis* | OC | LI/R |
| *Mesocoelium monodi* | *S. maculata* | OC | SI |
| | *P. bibroni* | DS | SI |
| | *P. pumilio* | DS | SI |
| **Nematoda** | | | |
| *Aplectana* sp. | *S. maculata* | DS & OC | SI & LI/R |
| | *P. bibroni* | DS | OE/ST, SI & LI |
| | *P. mascareniensis* | DS & OC | LI |
| | *P. oxyrhynchus* | DS | SI |
| | *P. pumilio* | DS | LI/R |
| *Amplicaecum africanum* | *P. bibroni* | DS | OE/ST, SI & LI |
| | *P. pumilio* | DS | OE/ST, SI |
| *Ophidascaris* sp. larva | *P. bibroni* | DS | OE/ST, SI & LI |
| | *P. pumilio* | DS | OE/ST |
| | | DS & OC | SI |
| | *P. mascareniensis* | OC | LI/R, BC |
| *Camallanus dimitrovi* | *H. occipitalis* | **OC** | SI |
| *Chabaudus leberrei* | *P. bibroni* | DS | LI/R, OE/ST |
| *Cosmocerca commutata* | *S. maculata* | DS & OC | SI & LI |
| | *P. oxyrhynchus* | DS | SI |
| | *P. pumilio* | DS & OC | SI & LI |
| *C. ornata* | *S. maculata* | DS & OC | SI & LI |
| | *P. bibroni* | DS | SI & LI |
| | *P. mascareniensis* | DS & OC | LI |
| | *P. pumilio* | DS | SI |
| *Physaloptera* sp. | *S. maculata* | DS | SI |
| | *P. bibroni* | DS | OE/ST, LI/R |
| *Rhabdias africanus* | *S. maculata* | DS & OC | LG |
| *Rhabdias* sp. | *P. bibroni* | OC | LG |

**Key:** BC: Body cavity, DS: Dumpsite, LG: Lungs, LI/R: Large intestine/rectum, OC: Otofure community, OE/ST: Oesophagus/stomach, SI: Small intestine

The prevalence and mean intensity of helminth parasites recovered from *Ptychadena* spp. is presented in Table 3. The *Ptychadena* spp. infected with the only cestode (*Cylindrotaenia jaegerskioeldi*) recorded in this study was *P. mascareniensis* from Otofure/host Community with a prevalence of 66.67% and mean intensity 1.75±1.16 parasites/infected amphibian. Of the two digeneans encountered, only one was recorded from *Ptychadena* spp. in each site. *Diplodiscus fischthalicus* was recorded at OC with prevalence of 6.67% (MI, 2.0±1.41) and 25.0% (MI, 1.33±0.58) from *P. bibroni* and *P. mascareniensis*, respectively, while *M. monodi* occurred in *P. bibroni* (prevalence, 5.56%; MI, 10.0) and *P. pumilio* (prevalence, 5.26%; MI, 2.0). Eight nematode parasites were recorded in *Ptychadena* spp. from DS while five were recovered from those at OC. In the DS, both *Aplectana* sp. and *C. commutata* had the highest prevalence of 50.0% in *P. oxyrhynchus.* Similarly, *Ophidascaris* sp. larva and *C. commutata* had a prevalence of 26.32% in *P. pumilio* from DS. *Chaubaudus leberri* and *Physaloptera* sp. respectively infected *P. bibroni* with prevalence of 16.67% (MI, 2.67±1.15) and 11.11% (MI, 1.0) at DS. In OC, *Rhabdias* sp. had the highest prevalence (66.67%) of nematode infection in *P. bibroni* while the highest mean intensity of 13.50±9.19 was recorded for *Ophidascaris* sp. larva infection in *P. mascareniensis.*

**Table 3:** Prevalence and mean intensity of helminth parasites in *Ptychadena* spp. from dumpsite and the host community, Otofure in Ovia North-East Edo State, Nigeria

| Parasite | Host | Dumpsite | | Otofure Community | |
|---|---|---|---|---|---|
| | | **Prevalence (%)** | **MI±S.D** | **Prevalence (%)** | **MI±S.D** |
| **Cestoda** | | | | | |
| *C. jaegerskioeldi* | *P. mascareniensis* | - | - | 66.67 | 1.75±1.16 |
| **Digenea** | | | | | |
| *D. fischthalicus* | *P. bibroni* | - | - | 6.67 | 2.0±1.41 |
| | *P. mascareniensis* | - | - | 25.0 | 1.33±0.58 |
| *M. monodi* | *P. bibroni* | 5.56 | 10.0 | - | - |
| | *P. pumilio* | 5.26 | 2.0 | - | - |
| **Nematoda** | | | | | |
| *A. africanum* | *P. bibroni* | 22.23 | 2.0±0.82 | - | - |
| | *P. pumilio* | 5.26 | 1.0 | - | - |
| *Aplectana* sp. | *P. bibroni* | 16.67 | 1.34±0.58 | - | - |
| | *P. mascareniensis* | 16.67 | 2.0±1.41 | 8.33 | 3.0 |
| | *P. oxyrhynchus* | 50.0 | 2.0 | - | - |
| | *P. pumilio* | 21.05 | 1.75±0.5 | 6.67 | 5.0 |
| *Ophidascaris* sp. larva | *P. bibroni* | 22.23 | 1.50±0.58 | - | - |
| | *P. mascareniensis* | - | - | 16.66 | 13.50±9.19 |
| | *P. pumilio* | 26.32 | 1.60±0.5 | 6.67 | 5.0 |
| *C. leberri* | *P. bibroni* | 16.67 | 2.67±1.15 | - | - |
| *C. commutata* | *P. oxyrhynchus* | 50.0 | 1.0 | - | - |
| | *P. pumilio* | 26.32 | 2.0±0.96 | 13.33 | 1.50±0.71 |
| *C. ornata* | *P. bibroni* | 11.11 | 2.50±0.71 | - | - |
| | *P. mascareniensis* | 8.34 | 2.0 | 8.33 | 4.0 |
| | *P. pumilio* | 15.79 | 1.67±0.58 | - | - |
| *Physaloptera* sp. | *P. bibroni* | 11.11 | 1.0 | - | - |
| *Rhabdias* sp. | *P. bibroni* | - | - | 66.67 | 1.0 |
| | *P. pumilio* | - | - | 6.67 | 1.33±0.58 |

Table 4 shows the prevalence and mean intensity of parasites from *S. maculata* and *H. occipitalis* from dumpsite and host community, Otofure in Ovia North-East LGA, Edo State. The lung worm, *Raillietiella* sp. was only recorded in *S. maculata* from the community with a prevalence of 2.94% and intensity of 1.0. *Cylindrotaenia jaegerskioeidi* was recorded at both sites with a prevalence of 25.0% (intensity, 2.8±13.6 parasites/infected host) and 17.65% (MI, 1.17±0.41) in *S. maculata* from DS and OC, respectively. This parasite was recovered from *H. occipitalis* at OC with 50.0% prevalence and 2.0 intensity of infection. *Mesocoelium monodi* infected only *S. maculata* from OC with prevalence of 5.88% and mean intensity of 1.0.

The highest prevalence of nematode infection in *S. maculata* from DS was recorded for *C. ornata* with prevalence of 33.33%, followed by *R. africanus* (27.78%), *C. commutata* (22.22%) and *Aplectana* sp. (16.67%). *Physaloptera* sp. had the least prevalence (13.89%) and mean intensity (3.40±15.6) and was only recorded in *S. maculata* from DS. In OC, *R. africanus* had the highest prevalence of 67.65% (MI, 1.35±0.49) in *S. maculata*. *Camallanus dimitrovi* infection was recorded only in *H. occipitalis* (prevalence, 50.0%; MI, 5.0).

**Table 4:** Prevalence and mean intensity of parasites in *S. maculata* and *H. occipitalis* from dumpsite and host community, Otofure

| | | Dumpsite | | Otofure Community | |
|---|---|---|---|---|---|
| **Parasite** | **Host** | **Prevalence (%)** | **MI±S.D** | **Prevalence (%)** | **MI±S.D** |
| **Pentastomida** | | | | | |
| *Raillietiella* sp. | *S. maculata* | - | - | 2.94 | 1.0 |
| **Cestoda** | | | | | |
| *C. jaegerskioeidi* | *S. maculata* | 25.0 | 2.78±13.6 | 17.65 | 1.17±0.41 |
| | *H. occipitalis* | - | - | 50.0 | 2.0 |
| **Digenean** | | | | | |
| *M. monodi* | *S. maculata* | - | - | 5.88 | 1.0 |
| **Nematoda** | | | | | |
| *Aplectana* sp. | *S. maculata* | 16.67 | 7.50±20.4 | 61.76 | 1.48±0.75 |
| *C. dimitrovi* | *H. occipitalis* | - | - | 50.0 | 5.0 |
| *C. commutata* | *S. maculata* | 22.22 | 8.88±31.6 | 26.47 | 3.11±2.15 |
| *C. ornata* | *S. maculata* | 33.33 | 5.33±24.1 | 23.53 | 3.75±2.19 |
| *Physaloptera* sp. | *S. maculata* | 13.89 | 3.40±15.6 | - | - |
| *R. africanus* | *S. maculata* | 27.78 | 5.80±20.0 | 67.65 | 1.35±0.49 |

## Discussion

The low amphibian species diversity documented at the dumpsite and the host community, Otofure, under inquiry could be attributed to the short sampling time (October to November of 2021 and 2022), as well as the deteriorated condition of the study area. Because of the dumpsite's unique characteristics, sampling was only possible during these times (late wet and early dry season). During the wet season, the dumpsite (DS) becomes so marshy that it is nearly impossible to access, whereas in the dry season, the DS is typically burned and there is little animal activity. Nonetheless, the DS exhibited a marginally higher amphibian diversity ($p>0.05$) than the host community. This is most likely owing to the abundance of food resources at the dumpsite, including arthropods and maggots that the amphibians prey on (Sparling *et al*., 2000; Ogoanah and Uchedike, 2011). Plaza and Lambertucci (2017) found that the quantity of food that exists in waste dumps could boost animal health, abundance, reproductive performance, population growth, and survival rates. Dumpsites can also serve as refuges for certain animal populations (Oka *et al*., 2016; Oka and Bassey, 2017).

In addition to the copious leftover foods, the Otofure landfill contains household debris such as used clothes and broken electronics, among other things. All of these factors contribute to the provision of moisture and the retention of water, both of which are critical for amphibian life. There was no evidence of tree frogs at any site in our investigation. Tree frogs are commonly associated with highly forested environments. The lack of these frogs could be attributed to extensive deforestation, habitat change, and the degraded state of the area. Otofure community (OC) is a new emerging neighborhood with many residential buildings popping up at a rapid pace. The edible frog (*Hoplobatracus occipitalis*) was completely absent from the dumpsite and was rarely seen in the town. The scarcity of this semi-aquatic frog could be attributed to the lack of water bodies and the contaminated state (Edo-Taiwo *et al*., 2023) of the few that exist in the dumpsite and Otofure, respectively. This investigation observed only one species of toad, *Sclerophrys maculata*, which was the most dominant and infected amphibian at both sites (Table 1). This toad is often associated with savanna and forest (Rodel, 2000), but it has also been observed in great numbers near human residences due to abundant leftover foods (Edo-Taiwo and Ibizugbe, 2024).

The prevalence of parasites in amphibians from both sampling sites could be attributed to the existence of unclean places such as shallow water bodies and moist environments, which are also conducive to parasite development (Rahman and Shakmah, 2014). The number and prevalence of parasitic infections in amphibians from the two sites (DS: 10, 63.2%; OC 11, 68.2%) were low when compared to the study of Edo-Taiwo *et al*. (2020), in which a higher parasite species number (17) and prevalence (75.6%) in six amphibian host species from a degraded/altered rainforest biotope in Edo State were reported. Nonetheless, Aisien *et al*. (2017) observed a similar number (06) of amphibian and parasite species (10) from a changed environment in Port Harcourt, Nigeria.

Several multi-host parasite species were found in amphibians at both sites studied. It is worth noting that hosts (whether of different taxa) that coexist and experience similar ecological conditions are more likely to be infected by the same parasite taxa (Aho, 1990). Habitat loss or degradation can cause host crowding in the few remaining favorable areas, increasing the degree of parasite infection (Bush *et al*., 1997; Hechinger and Lafferty, 2005).

Overall, nematode parasites dominated other parasites infections at both locations with representation of 10 species (71.43%). Pentastomid and cestode had one species (7.14%) each while digenean two species (14.29%). This high dominance has also been observed in other amphibian studies from damaged settings (Aisien *et al*., 2017; Imasuen and Aisien, 2019; Edo-Taiwo and Aisien, 2020; Edo-Taiwo *et al*., 2020). It has been observed that in degraded environment parasites which do not require intermediate host in the successful completion of their life cycle thrive more than those which need one or more intermediate hosts (Mckenzie, 1999; Marcogliese, 2004) because of the possible elimination of the intermediate hosts. Nematode infections occur through direct penetration of the host while the other groups require the assistance of intermediate hosts. The dominance of nematodes over other groups is therefore expected in a degraded environment like DS and OC.

*Raillietiella* sp., a pentastomid, infected only one *S. maculata* in the population at intensity of 1.0. The intermediate host of this parasite is scatophagous insects (such as cockroaches), and it is expected that the population will be large due to rapid urbanization and garbage dumps in the study area, which will invariably result in a high prevalence of *Raillietiella* sp. infection; however, this was not the case. The near-absence of the parasite is most likely owing to the eradication of the insect's intermediate host as a result of the intense burning at the dumpsite. This parasite has also been found to have a modest prevalence (4.36%) in *Bufo regularis* (*Sclerophrys regularis*) in south-western Nigeria (Aisien *et al*., 2001). Edo-Taiwo *et al*. (2020) found a greater prevalence of 50.0% with intensity of 19 parasites per infected host and 33.3% (intensity, 1.0) in *S. regularis* and *P. pumilio*, respectively from a changing rainforest biotope in Edo State.

*Cylindrotaenia jaegerskioeldi* was the cestode recovered from amphibians at both sites, with a higher prevalence of 66.67% in *P. mascareniensis* from OC. Aisien *et al*. (2017) reported a similar prevalence (66.7%) in *Amietoprynus regularis* from an urbanized rainforest biotope in Port Harcourt, Nigeria, and attributed the high prevalence to an increase in vector (beetle) population due to environmental changes. The intermediate host could have been substantially removed by the constant burning at DS, explaining the low prevalence record.

The two digeneans (*D. fischthalicus* and *M. monodi*) recovered from amphibians in this investigation had a low prevalence and intensity regardless of where the amphibians were found. *Diplodiscus fischthalicus* was exclusively restricted to amphibians examined at OC while the more cosmopolitan *M. monodi* was found in amphibians at both locations. This could be due to the unrestricted movement of the arthropod intermediate host between the DS and OC. Digeneans are parasites with a complex life cycle that requires one or more intermediate hosts. Rapid urbanization and habitat changes, particularly burning at the community and dumpsite, may have reduced the diversity of potential intermediate hosts (molluscs and arthropods) required for the effective completion of the digenetic life cycle (Marcogliese, 2005). Edo-Taiwo *et al*. (2020) found a greater prevalence (9.09%-53.33%) of *M. monodi* infection in amphibians from a disturbed biotope in Edo State. The authors attributed the high incidence to an increase in vector populations caused by environmental changes.

Most nematodes recovered from the amphibians under investigation were matured adults with the exception of *Ophidascaris* sp. and *Physaloptera* sp. which occurred as larvae. These parasites are believed to use amphibians as transport host to reach their definitive hosts (Aisien *et al*., 2003; Imasuen *et al*., 2012; Edo-Taiwo and Aisien, 2020; Edo-Taiwo *et al*., 2020). Adult *Ophidascaris* sp. was reported by Awharitoma *et al*. (2017) from snakes examined in Benin City. *Ophidascaris* infections are common in reptiles (Martins *et al*., 2003). The other larval parasite, *Physaloptera* sp. was recovered from two hosts (*S. maculata* and *P. bibroni*). The adult of this parasite has been noted to be parasite of reptiles, birds and mammals (Baker, 1987; Anderson, 2000). The occurrence of this parasite in amphibians has also been observed by Aisien *et al*. (2009). *Aplectana* sp. was the most common nematode at the DS, infecting all amphibian species with a prevalence ranging from 16.67% to 50%.

## Conclusion

Though there were fluctuations in species diversity, prevalence, and intensity of parasite infections in frogs investigated from the dumpsite and the host community, Otofure, they were not statistically significant (p>0.05). All of this suggests that whatever is happening at the dumpsite is also happening in the surrounding community. As a result, there is an urgent need to relocate the dumpsite far from human settlements. The residents of the Otofure community have cried out for this move.

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