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RESEARCH ARTICLE

Inventory of Freshwater Fish Parasites in Tarakan City, North Kalimantan, Indonesia

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Abstract. Parasitic infections pose potential threats to fish health and freshwater aquaculture productivity. This study aimed to identify parasite taxa and determine their prevalence and mean intensity in cultured freshwater fish in Tarakan City, North Kalimantan, Indonesia. The study was conducted in May 2026 at the Fisheries Biology Laboratory, Borneo Tarakan University. A total of 60 juvenile fish, comprising 30 Nile tilapia and 30 catfish, were collected from aquaculture ponds. Ectoparasites and endoparasites were examined through microscopic observations of mucus, skin, gills, intestines, and muscle tissues. Parasites were identified based on morphological characteristics, and their prevalence and mean intensity were analyzed descriptively. Seven parasite genera were identified, comprising five genera in Nile tilapia and six in catfish. *Trichodina* sp. exhibited the highest prevalence in both Nile tilapia (100%) and catfish (100%), with mean intensities of 66 and 9 parasites/infected fish, respectively. In Nile tilapia, *Gyrodactylus* sp. (60%), *Argulus* sp. (40%), *Dactylogyrus* sp. (20%), and *Centrocestus* sp. (20%) were also identified. In catfish, *Ichthyophthirius* sp. exhibited a prevalence of 60% and the highest mean intensity (151 parasites/infected fish), followed by *Dactylogyrus* sp. and *Gyrodactylus* sp. (40% each), and *Centrocestus* sp. and *Oodinium* sp. (20% each). These findings demonstrate the occurrence of multiple parasite taxa in cultured freshwater fish and highlight the importance of regular parasite monitoring and health management in freshwater aquaculture.
Keywords: freshwater fish, parasite identification, parasite prevalence, mean intensity, aquaculture.

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INTRODUCTION

Global fish farming production is projected to reach approximately 185.4 million tons (FAO, 2024). Aquaculture continues to expand to meet the demand for animal protein, making communities increasingly dependent on fishers' catches. Based on the consumer price index (CPI), the figure for 2025 is projected to reach 106.1 million tons, with annual inflation of approximately 1.23% attributed to rising service-sector prices. Nevertheless, average fish consumption in Tarakan is reported to be approximately 21,732 tons per capita (BPS, 2024). With the increasing availability of animal protein, freshwater fish remain in high demand and are widely available for daily consumption.

The considerable potential for freshwater fisheries development is supported by the availability of inland water resources and the expansion of community-based aquaculture enterprises. Major cultivated commodities include Nile tilapia (*Oreochromis niloticus*), catfish (*Clarias* sp.), common carp (*Cyprinus carpio*), and pangasius catfish (*Pangasius* sp.), alongside opportunities to develop various freshwater ornamental fish species. The expansion of aquaculture activities can help meet food demand while increasing community income. However, these activities face several challenges, including suboptimal water quality, inappropriate stocking densities, feed management issues, and fish health problems, particularly parasitic diseases. Parasitic infections can cause tissue damage, stunted growth, and deteriorating fish condition, and in some cases increase the risk of secondary infections, thereby affecting aquaculture productivity. Parasitic infections in freshwater fish have also been documented in North Kalimantan. Fish health assessments in the Tarakan area have indicated the presence of parasites such as *Dactylogyrus* sp. and *Trichodina* sp. in tilapia, as well as *Dactylogyrus* sp. in catfish. The occurrence of these parasites highlights the importance of prioritizing fish health in the development of freshwater aquaculture in the region. Consequently, research aimed at identifying and cataloging parasites in cultured freshwater fish and ornamental fish is essential for determining parasite species, prevalence rates, and the specific organs affected by infection. Such information provides baseline data on the health status of freshwater fish in North Kalimantan and supports the implementation of appropriate disease prevention and control measures, ultimately improving the productivity and sustainability of aquaculture operations.

However, the intensification of fish farming has been accompanied by an increase in fish health problems, particularly parasitic infections (Paredes-Trujillo *et al.*, 2021). Parasites represent a limiting factor in aquaculture operations because they can cause physiological disturbances, retard growth, reduce feed utilization efficiency, increase susceptibility to secondary infections, and even cause fish mortality (Cahyadi *et al.*, 2019; Sigit *et al.*, 2019). The occurrence of parasitic diseases is influenced by interactions among hosts, pathogens, and suboptimal environmental conditions. Consequently, fish health management is essential for ensuring the success of sustainable aquaculture systems. Parasites can be found in various parts of fish, including the skin, fins, mucus, and gills, as well as internal organs such as the digestive tract and other body tissues (Putri *et al.*, 2020). Based on their infection sites, fish parasites are broadly classified into ectoparasites, which inhabit external structures such as the skin, fins, and gills, and endoparasites, which inhabit internal organs and tissues, including the digestive tract (Rahmawati, 2014). The presence of these parasite groups can compromise fish health and cause economic losses in aquaculture operations if appropriate control measures are not implemented.

Several studies in Indonesia have reported the occurrence of various parasites in freshwater fish. Azisah *et al.* (2023) identified three groups of parasites infecting tilapia at several aquaculture sites, affecting organs and tissues such as the fins, gills, intestines, and mucus. Meanwhile, Irwandi *et al.* (2017) reported that freshwater fish were infected by several important parasite genera, including *Dactylogyrus* sp., *Trichodina* sp., *Gyrodactylus* sp., and *Ichthyophthirius* sp., which may reduce aquaculture productivity when parasite prevalence is high.

Although studies on fish parasites have been conducted in various regions of Indonesia, information regarding the diversity of freshwater fish parasites in North

Kalimantan Province, particularly Tarakan City, remains very limited (Ihsan *et al.*, 2023). Existing research has generally focused on a single fish species or aquaculture site, providing an incomplete picture of parasite composition across different freshwater fish species and their distribution among aquatic habitats. Consequently, baseline data on parasite species, affected organs, prevalence rates, and parasite distribution in freshwater fish in Tarakan City are currently unavailable. This lack of information represents a research gap that needs to be addressed to support fish health management, disease control, and fishery resource conservation programs in North Kalimantan. The novelty of this study lies in compiling the first comprehensive inventory of parasite diversity across various freshwater fish species in Tarakan City. The resulting information is expected to provide baseline data for developing fish disease surveillance programs, biosecurity strategies, and health management practices for cultured fish, as well as supporting freshwater fish biodiversity conservation in North Kalimantan Province. Therefore, this study aims to inventory the various types of parasites infecting freshwater fish in Tarakan City, North Kalimantan Province, as a scientific basis for fish health management and the development of sustainable aquaculture.

METHODS

The research was conducted in May 2026 at the Fisheries Biology Laboratory, Faculty of Fisheries and Marine Sciences. The practical session on fish parasite identification utilized various laboratory instruments to facilitate sample collection, preparation, and microscopic examination. The equipment used included Petri dishes, a digital scale for weighing fish, tissues, an inoculating loop, a Bunsen burner, an autoclave, a dropper pipette, a mortar and pestle, a scalpel, a beaker, a light microscope, a tray, a ruler, microscope slides, and coverslips. The primary materials used in this practical session were live freshwater fish of various sizes obtained from aquaculture facilities or freshwater bodies. Sampling was conducted through a survey using purposive sampling at several freshwater fish farming units in Tarakan City, North Kalimantan. Samples were collected directly from farmers' ponds, considering the cultured fish species, fish health status, and specimen availability. The fish species examined included Nile tilapia and catfish, with 30 individuals sampled from each species.

Ectoparasite examination began by measuring the length and weight of each fish using a ruler and digital scale to obtain baseline biometric data. Subsequently, each fish was humanely euthanized by inserting a dissecting needle into the brain until nervous system function ceased. An external morphological examination (gross anatomical examination) was then conducted using a magnifying glass to inspect the mouth, eyes, gills, fins, scales, tail, and body surface for abnormalities or parasitic infestations. Mucus samples were collected by scraping the fish's body surface using a microscope slide or sterile scraping instrument, after which the collected material was placed on a microscope slide with a drop of distilled water to prevent drying and covered with a coverslip. Additionally, a gill filament was excised, placed on a microscope slide, and covered with a coverslip. Fish fins were also excised and prepared using the same procedure. All prepared samples were examined under a microscope, beginning at low magnification and increasing to higher magnification when necessary. Any ectoparasites detected were recorded according to their infestation sites, numbers, and morphological characteristics.

Endoparasite examination began by measuring the length and weight of each fish before dissection (necropsy). Following dissection, internal organs, including the liver, stomach, intestines, and kidneys, were carefully removed and placed in separate Petri dishes to prevent cross-contamination. Each organ was visually examined using a magnifying glass to detect relatively large parasites. Subsequently, the organs were cut or scraped using scissors or a scalpel to obtain thin preparations for microscopic examination. Each preparation was placed on a microscope slide, a drop of distilled water was added to maintain sample moisture, and a coverslip was applied. The preparations were then examined under a microscope at various magnifications to identify the

presence of endoparasites. All observations were systematically documented, including the type of organ examined, parasite species identified, infestation sites, and morphological characteristics, as the basis for the practical report. Parasites were identified using identification keys and relevant fish parasitology literature. Data obtained from parasite identification were analyzed descriptively according to the types of parasites identified (Arsyad *et al.*, 2025).

Data obtained from parasite examinations were analyzed using quantitative descriptive methods by calculating parasite prevalence and mean intensity for each fish species examined. Prevalence was calculated to determine the percentage of infected fish relative to the total number of fish examined, while mean intensity was calculated to determine the average number of parasites found per infected fish. These values were subsequently compared according to fish species and the parasite taxa identified.

The results were presented in tables and graphs containing information on fish species, the number of fish examined, the number of parasite-positive fish, parasite taxa, prevalence values (%), and mean parasite intensity (parasites/infected fish). Prevalence was using the formula (Anshary, 2019):

$$\text{Prevalence (\%)} = \frac{Number\ of\ infected\ fish}{Number\ of\ examined\ fish}\ x\ 100$$

Meanwhile, Parasite intensity was calculated using the formula (Anshary, 2019):

$$\text{Mean Intensity} = \frac{Total\ number\ of\ parasites\ found}{Number\ of\ infected\ fish}$$

RESULTS AND DISCUSSION

The types of parasites identified in several freshwater fish species are described as follows:

Trichodina sp.

One of the important ectoparasitic infections affecting freshwater fish is trichodiniasis, a disease caused by the protozoan *Trichodina* sp., which generally infects external structures such as the skin, fins, and gills (Azizah *et al.*, 2022), although it has also been reported in internal organs, including the urinary tract, rectum, and cloaca. Approximately 112 species of *Trichodina* have been identified in fish, although they generally cause similar health problems. Protozoa belonging to this family occur as parasites in freshwater and marine fish species worldwide (Taufiq *et al.*, 2023). Juvenile fish aged one year or younger are particularly susceptible to infection. Fish infected with *Trichodina* sp. (Figure 1) may exhibit weakness, dull and pale body coloration, excessive mucus production, reduced appetite leading to weight loss, sluggish movements, frequent rubbing against pond walls, skin irritation, and a shiny body surface resulting from increased mucus secretion, while infected fry may experience fin damage or loss (Yuliani *et al.*, 2023; Ihsan *et al.*, 2023).



Figure 1. *Trichodina* sp.

Several studies have demonstrated that the ectoparasite *Trichodina* sp. plays an important role in weakening fish immunity. A weakened immune system may increase susceptibility to secondary infections. Mortality generally occurs as a result of excessive mucus production. This disease is transmitted through water or direct contact with infected fish, and transmission is facilitated by poor water quality in fish-rearing environments. This organism reproduces through binary fission, with the resulting individuals either remaining on the original host or seeking new hosts in the water. Fish infected with *Trichodina* sp. can be treated by immersion in a 40 ppm formalin solution for 24 hours or a 150–200 ppm formalin solution for 15 minutes. Observations of fish infected with this parasite revealed abnormal behavior, changes in skin coloration, and reduced appetite. Consequently, infected fish become weak, mucus production increases, and exhaustion may eventually occur because excessive mucus accumulation on the gill lamellae interferes with oxygen exchange (Moeller, 2001). As a result, the body appears shiny, while *Trichodina* sp. can survive at water temperatures of 22–25 °C but may die within 8–10 hours without finding a host, although the time required for death is longer at lower temperatures. During sampling, rainy weather and relatively stagnant pond water were observed, conditions that favored the rapid proliferation of *Trichodina* sp. Malachite green at a concentration of 0.1 g/m³ for 24 hours is also commonly used. In general, treatment techniques effective against white spot disease are also considered effective against *Trichodina* sp.

***Gyrodactylus* sp.**

According to Arsyad *et al.* (2025), *Gyrodactylus* sp. commonly infects freshwater fish, including GESIT Nile tilapia (*Oreochromis niloticus*) and other species. Clinical signs associated with *Gyrodactylus* sp. infection include reduced appetite, weakness, dark body coloration, slow growth, excessive mucus production, and skin inflammation accompanied by redness at the parasite attachment sites, as well as frequent rubbing of the body against surrounding objects. These characteristics can be observed in Figure 2. The identified *Gyrodactylus* sp. is presented below.

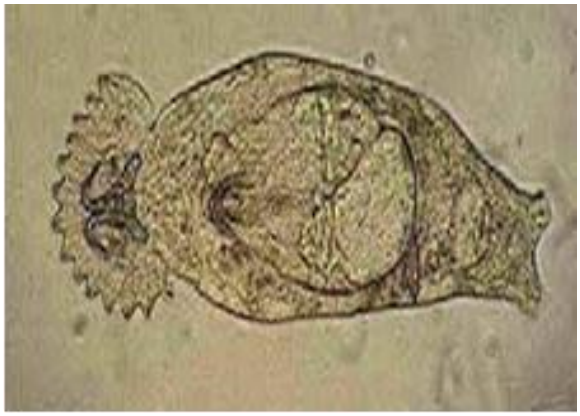


Figure 2. *Gyrodactylus* sp.

Gyrodactylus sp. is most commonly found on the skin and fins of fish, although it may also occur on the gills (Arsyad *et al.*, 2025). This parasite is classified as an ectoparasite because it infects the external surfaces of the fish's body. The life cycle of *Gyrodactylus* sp. does not require an intermediate host, allowing larvae emerging from hatched eggs to immediately seek a fish host. Within 4–10 hours without finding a host, the parasite may mature again and produce eggs within 7–8 days. The resulting eggs may be deposited on the gills or aquatic substrates. These eggs hatch within 3–5 days, depending on water temperature.

***Dactylogyrus* sp.**

Dactylogyrus sp., as shown in Figure 3, is commonly found on fish gills and can infect external body structures because these parasites occur in the water, making external organs, particularly the gills, the initial sites of infection. Fish gills are highly susceptible to diseases and parasitic infections because they consist of elongated, closely arranged structures covered by thin membranes. This characteristic makes the gills particularly vulnerable to infection because they function as the primary site of gas exchange as water passes through them (Lianda *et al.*, 2015; Ihsan *et al.*, 2023).



Figure 3. *Dactylogylus* sp.

According to Gusrina (2008), gills infected with this parasite appear pale or whitish and produce excessive mucus. This condition interferes with gas exchange in the gills, thereby disrupting respiration and osmoregulation in fish. Irawan (2004) further reported that fish infected with *Dactylogyrus* sp. typically exhibit weight loss, irregular or jerky swimming movements, damaged gill covers that cannot close properly, and skin that may lose its translucent appearance.

Dactylogyrus sp. does not require an intermediate host during its life cycle, allowing larvae emerging from hatched eggs to immediately seek a fish host. If a host is not found within 4–10 hours, the parasite will mature again and produce eggs within 7–8 days. The resulting eggs may be deposited on the gills or aquatic substrates and hatch within 3–5 days, depending on water temperature. *Dactylogyrus* sp. is classified as a monogenean trematode worm (Nurbaiti & Herlina, 2022).

***Argulus* sp.**

Argulus sp. damages the skin of its host to obtain blood, often causing reddish lesions at the attachment or feeding sites. In addition to these clinical signs, the parasite can be easily observed with the naked eye as a transparent, rounded, flattened organism measuring approximately 5–12 mm in diameter. A pair of eye spots can be observed on its head. Kabata (1985) explained that fish infected with this parasite may exhibit clinical signs such as lethargy, remaining in pond corners, loss of appetite, dull skin coloration, torn or peeling fins, detached scales, and bleeding wounds. Fish infected with *Argulus* sp. frequently display signs of irritation, including rubbing their bodies against objects in the water, as a result of the parasite's feeding activity. *Argulus* sp. infections may also facilitate secondary bacterial infections. *Argulus* sp. (Figure 4), commonly known as fish lice, is an ectoparasite that attaches to the external surface of the fish's body.



Figure 4. *Argulus* sp.

Argulus sp. reproduces through copulation, with females attaching their eggs to hard substrates such as rocks or wood. The number of eggs ranges from 20 to 300. The eggs measure approximately 0.28–0.30 mm in length and 0.22–0.24 mm in width. The eggs hatch after approximately 12 days at temperatures ranging from 15.2 to 26.1 °C. Newly hatched larvae die if they fail to find a host within 36 hours. Adult parasites that remain without a host for more than nine days will also die (Kabata, 1985).

***Centrocestus* sp.**

Centrocestus sp. was found only three times during sampling events 1 and 2, in three fish. *Centrocestus* sp. is a metacercaria belonging to the digenetic trematode group. This parasite was found on the caudal fin of the observed catfish; however, its typical predilection site is actually on the gill filaments, where it is surrounded by permanent host cells. This metacercaria is oval in shape, elongated in form, and when observed under a microscope, it appears to move or rotate. The observed effects in fish infected with *Centrocestus* sp. (Figure 5) included slow and lethargic movement, and the fish were often seen hanging with their heads above the water surface. This parasite may have dangerous effects when this type of trematode infects the gills, because it can cause abnormal gill function that is harmful to most freshwater fish species, especially by affecting the cartilage around the respiratory tissue of the fish (Mitchell, 2005).

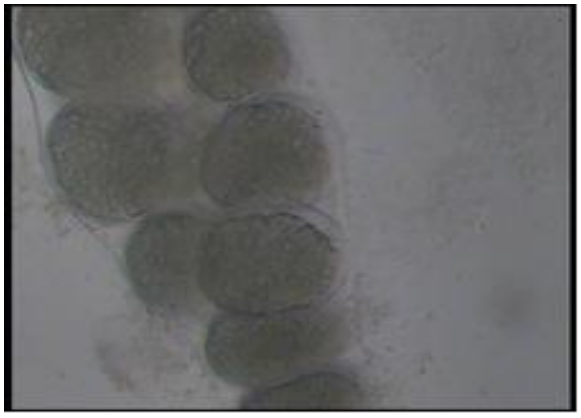


Figure 5. *Centrocestus* sp.

Ichthyophthirius multifiliis

The parasite grows and causes swelling on the surface of the fish's skin. Morphologically, *Ichthyophthirius multifiliis* is round and actively motile, possesses a clearly visible C-shaped macronucleus, and is covered with cilia (Yulianti *et al.*, 2019). As the parasite develops, the cavity containing it ruptures, and the damaged epithelium leaves an open wound, exposing the dermis to the surrounding water. Under these conditions, fish experience osmoregulatory imbalance. In addition to the body surface, the gill epithelium is also a target of this parasite. The presence of "Ich" in the internal organs of fish is even more dangerous because *Ichthyophthirius multifiliis* (Figure 6) not only damages epithelial tissue but also impairs gill function. This occurs because the gill

lamellae become filled with mucus, while the lamellar surfaces normally function in ion exchange. Consequently, excretion and osmoregulation are disrupted. Under these circumstances, fish mortality is generally high because of impaired oxygen absorption.

Commonly known as white spot disease, this parasitic infection affects nearly all freshwater fish species and has a cosmopolitan distribution, meaning that the parasite can survive and thrive worldwide. *Ichthyophthirius multifiliis* commonly infects the epidermis of the body, fins, and gills. Therefore, this parasite is classified as an ectoparasite. Clinical signs in infected fish include irritation and frequent rubbing of the body against pond edges. In advanced infections, fish may be observed jumping to the water surface and gasping for air, exhibiting reduced appetite, discoloration, sluggish movements, reduced responsiveness to stimuli, and excessive mucus covering the body. The reproductive stages of this parasite, including adult and juvenile stages, are strongly influenced by environmental factors. *Ichthyophthirius multifiliis* is classified as a parasite capable of existing in both free-living and parasitic stages.

Ichthyophthirius multifiliis infects the epithelium of freshwater fish during the theront stage (an individual that has recently emerged from the trophozoite cell). If the theront fails to find a host within 48 hours, it dies. The trophozoite stage represents the adult-sized form of *Ichthyophthirius multifiliis* within the fish's body. Its life cycle lasts approximately 7 days at 10 °C and 13–15 °C, 12 days at 18–12 °C, and 3–6 days at 23–24 °C. Other influencing factors include pH and dissolved oxygen concentration. Water pH values below 5 or above 10 and an oxygen concentration of 0.2 m/L can cause mortality in *Ichthyophthirius multifiliis* at all developmental stages.



Figure 6. *Ichthyophthirius multifiliis*

***Oodinium* sp.**

Oodinium sp. (Figure 7) was not detected in all examined fish, with only one fish found to be infected by this parasite. *Oodinium* sp. generally infects the body surface by attaching itself through root-like structures and is known to infect goldfish. *Oodinium* sp. is classified as a type of algae because it contains chlorophyll (Wirawan *et al.*, 2018).

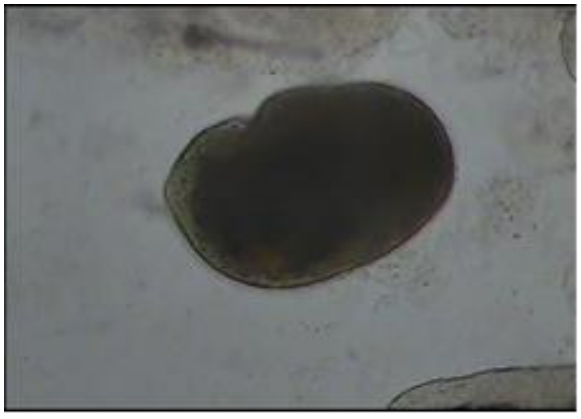


Figure 7. *Oodinium* sp.

Oodinium sp. is a flagellated organism classified as a protozoan, although some sources categorize it as an alga because it contains chlorophyll. *Oodinium* sp. is a parasite that commonly infects fish under poor water-quality conditions. *Oodinium* sp. immediately seeks a fish host because it may die within 24 hours if no suitable host is found. The presence of *Oodinium* sp. on the skin and mucous membranes of fish gills is characterized by the appearance of fine white spots. These spots are considerably smaller than those associated with ichthyophthiriasis (white spot disease). Because of their extremely small size, these spots generally become visible only when they have multiplied extensively or covered portions of the fish's skin or body. At this stage, infected fish may appear to be covered with flour or fine powder, while in certain cases, the body surface may exhibit a rust-like appearance. Without appropriate treatment, the infection may remain undetected until the disease reaches an advanced stage or the fish has died. Based on the observations, parasites were identified that may affect seasonal coverage, indicating the need for further research across different locations (Morales-Serna *et al.*, 2024).

Overall, tilapia were infected with five parasite genera: *Trichodina*, *Gyrodactylus*, *Dactylogyrus*, Argulus, and *Centrocestus*, while catfish were infected with six parasite taxa: *Trichodina* sp., *Centrocestus* sp., *Dactylogyrus* sp., *Oodinium* sp., *Gyrodactylus* sp., and *Ichthyophthirius multifiliis*. These findings indicate considerable parasite diversity across both cultured fish species. Based on prevalence, the most dominant parasite was *Trichodina* sp., which was detected in 100% of tilapia and 100% of catfish examined. Meanwhile, in terms of mean intensity, *Ichthyophthirius multifiliis* in catfish exhibited the highest value, reaching 151 parasites per infected fish (Table 1). The high intensity of Ichthyophthirius infection warrants particular attention because severe infections of the skin and especially the gills can impair respiration and increase the risk of mortality. Interestingly, the pale gills observed in tilapia and catfish may be associated with several gill-infesting parasites, particularly *Trichodina* sp., *Dactylogyrus* sp., and *Centrocestus* sp. However, because these clinical signs are nonspecific, they should be described as clinical manifestations observed in infected fish rather than as symptoms definitively attributable to a single parasite genus.

Table 1. Prevalence and Intensity of Parasites Identified in Freshwater Fish

Fish	Parasite	Prevalence	Intensity	Information
Tilapia	*Trichodina*	100	66	
	Gyrodactylus	60	3	Deformed, body covered in
	Dactylogyrus	20	5	fungus pale gills and body
	Argulus	40	1	appearing black.
	Centrocestus	20	1	
Clarias	*Trichodina*	100	9	
	Centrocestus	20	1	
	Dactylogyrus	40	2	The gills are pale and the body is
	Oodinium	20	1	deformed
	Gyrodactylus	40	2	
	Ichtyophitirius	60	151	

Pale gills may be associated with parasitic infections of the gills, although this clinical sign is not specific to any particular parasite genus. *Trichodina* sp. infestation of the gills has been associated with increased mucus production, gill pallor, multifocal whitish areas, and damage to the gill epithelium. *Dactylogyrus* sp. infection is commonly associated with hyperplasia, hypertrophy, necrosis, congestion, and impaired gill function, which may explain respiratory distress and gill discoloration, although these manifestations are not pathognomonic. Encystment of *Centrocestus* sp. in the gills can also induce hyperplasia, necrosis, and damage to gill cells. Microscopic examination of gill preparations can reveal *Centrocestus* cysts attached to the gill lamellae and their associated tissue lesions. *Ichthyophthirius multifiliis* may also contribute to the

occurrence of pale gills in catfish because this parasite infects the skin, fins, and gills, causing necrosis, hyperemia, lamellar fusion, inflammatory cell infiltration, anemia, and increased mortality, particularly when secondary infections occur (Mohdali *et al.*, 2025).

Parasitic infections caused by *Oodinium* sp. in cultured fish produce clinical manifestations ranging from behavioral abnormalities and physical changes in the integument to severe histopathological lesions in respiratory structures, including damage to the gill lamellae, respiratory epithelium, fins, and skin. Furthermore, infected fish exhibit a marked reduction in mobility and frequently lose their balance while swimming. A substantial decline in feeding response results in severe emaciation and an abnormal body appearance. Affected fish may also exhibit hypersensitivity or abnormal startle responses to movements in their surroundings (Widiartini *et al.*, 2022).

CONCLUSION

This study identified seven parasite taxa infecting freshwater fish in Tarakan City, North Kalimantan, comprising *Trichodina* sp., *Gyrodactylus* sp., *Argulus* sp., *Dactylogyrus* sp., *Centrocestus* sp., *Oodinium* sp., and *Ichthyophthirius multifiliis*. Five parasite taxa were identified in Nile tilapia (*Oreochromis niloticus*), while six were found in catfish (*Clarias* sp.). *Trichodina* sp. exhibited the highest prevalence in both fish species, reaching 100%, with mean intensities of 66 parasites per infected tilapia and 9 parasites per infected catfish. Meanwhile, *Ichthyophthirius multifiliis* showed the highest mean intensity, reaching 151 parasites per infected catfish, with a prevalence of 60%. These findings demonstrate the diversity of parasitic infections in cultured freshwater fish and provide baseline information on parasite occurrence, prevalence, and intensity in Tarakan City. Regular fish health monitoring and appropriate aquaculture management practices are therefore recommended to support parasite prevention and control and the sustainability of freshwater aquaculture in the region.

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AUTHOR CONTRIBUTIONS

The authors declare that their respective contributions to this manuscript are as follows: DPS is the main contributor who designed the study, wrote the manuscript, and revised the article. RM is a supporting author who assisted in the implementation of the study and AIN served as the third contributed to the revision of the manuscript. The authors have submitted a signed Author Declaration Statement.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in the conduct of the research, data analysis, or preparation and publication of this article.

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REFERENCES

Anshary, H. (2019). *Parasitologi ikan: Biologi, identifikasi, dan pengendaliannya*. Deepublish.

Arsyad, N. S., Atma, C. D., Dharmawibawa, I. D., & Rahmawati, S. E. (2025). Deteksi Ektoparasit pada Ikan Nila (*Oreochromis niloticus*) di Balai Benih Ikan (BBI) Desa

Aik Bukak Kecamatan Batukliang Utara Kabupaten Lombok Tengah. *Biocaster: Jurnal Kajian Biologi, 5*(3), 119–125. https://doi.org/10.36312/biocaster.v5i3.408

Azisah, N., Hamdillah, A., & Harlina, H. (2023). Inventarisation of parasites on tilapia (*Oreochromis niloticus*) in some aquaculture farms. *Jurnal Akuakultur Nusantara, 1*(1), 40–47. https://jurnal.fpik.umi.ac.id/index.php/JANUS/article/download/343/367

Azizah, H., Nugraha, A., Juniantito, V., & Cahyaningsih, U. (2022). Eksplorasi Parasit pada Ikan Nila (*Oreochromis niloticus*) dari Penjual Ikan Lokal di Dramaga, Bogor. *Jurnal Kajian Veteriner, 10*(2), 153–164.https://doi.org/10.35508/jkv.v10i2.7973

Badan Pusat Statistik. (2024). *Statistik Indonesia 2024*. https://www.bps.go.id/id/publication/2024/02/28/c1bacde03256343b2bf769b0/statistik-indonesia-.html

Cahyadi, J., Satriani, G. I., Gusman, E., & Weliyadi, E. (2019). *Parasit dan penyakit ikan*. Myriah Publisher.

Food and Agriculture Organization of the United Nations. (2024). *World food and agriculture – Statistical yearbook 2024*. https://doi.org/10.4060/cd2971en

Gusrina. (2008). *Budidaya ikan jilid 3*. Direktorat Pembinaan Sekolah Menengah Kejuruan, Direktorat Jenderal Manajemen Pendidikan Dasar dan Menengah, Departemen Pendidikan Nasional. http://ftp.lipi.go.id/pub/Buku_Sekolah_Elektronik/SMK/Kelas%20XII/Kelas%20XII_smk_budidaya_ikan_gusrina.pdf

Ihsan, B., & Sitinjak, R. S. (2023). Prevalence of ectoparasites in tilapia (*Oreochromis niloticus*) in Tarakan. *Jurnal Medik Veteriner, 6*(2), 185–190. https://doi.org/10.20473/jmv.vol6.iss2.2023.185-190

Irawan. (2004). *Budidaya Ikan Air Tawar: Ikan Gurame, Ikan Nila*. Yogyakarta, Kanisius.

Irwandi, Yanti, A. H., & Wulandari, D. (2017). Prevalensi dan Intensitas Ektoparasit pada Insang Ikan Nila Merah (*Oreochromis* sp.) di Keramba Apung Sungai Kapuas Desa Kapur Kabupaten Kubu Raya. *Protobiont, 6*(1), 20–28. https://doi.org/10.26418/protobiont.v6i1.18146

Kabata, Z. (1985). *Parasites and diseases of fish cultured in the tropics*. Taylor & Francis.

Lianda, N., Fahrimal, Y., Daud, R., Rusli, R., Aliza, D., & Adam, M. (2015). Identifikasi Parasit pada Ikan Nila (*Oreochromis niloticus*) di Irigasi Barabung Kecamatan Darussalam Aceh Besar. *Jurnal Medika Veterinaria, 9*(2), 101–103. https://doi.org/10.21157/j.med.vet..v9i2.3807

Moeller, R. B., Jr. (2001). *Bacterial disease of fish*. California Animal Health and Food Safety Laboratory System, University of California.

Mohdali, G. A., Mahdy, O. A., Abdel-Moneam, D. A., Khalefa, H. S., Shaalan, M., & Marzouk, M. S. (2025). A cross-sectional analysis and immunological study of parasitic infections in *Solea aegyptiaca* and *Tilapia zillii* from Qarun and Wadi El-Rayan Lakes. *Egyptian Journal of Veterinary Sciences*. https://doi.org/10.21608/EJVS.2025.344377.2560

Morales-Serna, F. N., López-Moreno, D., Osuna-Cabanillas, J. M., Marín-Enríquez, E., Vallarta-Zárate, J. R. F., & Amezcua, F. (2024). Parasites as indicators of population connectivity of a small pelagic fish in the Gulf of California. *Fisheries Research, 276*, Article 107058. https://doi.org/10.1016/j.fishres.2024.107058

Nurbaiti, I., & Herlina, S. (2022). Deteksi Keberadaan Parasit pada Ikan Papuyu (*Anabas testudineus*) yang Dipelihara di Hapa pada Kolam Ekstensif. *Jurnal Penelitian Belida Indonesia, 2*(1), 21–30. https://doi.org/10.59900/pbelida.v2i1.55

Paredes-Trujillo, A., Velázquez-Abunader, I., Papiol, V., del Rio-Rodríguez, R. E., & Vidal-Martínez, V. M. (2021). Negative effect of ectoparasite burdens on the condition factor from farmed tilapia *Oreochromis niloticus* in the Yucatan, Mexico. *Veterinary Parasitology, 292*, Article 109393. https://doi.org/10.1016/j.vetpar.2021.109393

Putri, M., Fauziah, N. A., & Agustin, V. H. (2020). Identifikasi Endoparasit dan Ektoparasit Ikan Hias Air Tawar di Pasar Ikan Sasana Mina Magelang. *Prosiding*

Seminar Nasional MIPA Kolaborasi, 2(1), 122–126. https://proceeding.unnes.ac.id/SNMIPA/article/view/448/

Rahmawati, D. (2014). Studi identifikasi dan prevalensi cacing endoparasit pada ikan layur (Trichiurus savala) di Tempat Pelelangan Ikan (TPI) Brondong Kabupaten Lamongan [Skripsi, Universitas Airlangga]. Repository Universitas Airlangga. https://repository.unair.ac.id/26350/

Sigit, M., Candra, A. Y. R., Hidayat, A. R., & Sasmita, R. (2019). Derajat Infestasi *Trichodina* sp. pada Lele Dumbo (*Clarias gariepinus*) di Empat Kolam Pembudidayaan di Kabupaten Sumenep. *VITEK: Bidang Kedokteran Hewan, 9*, 10–17. https://doi.org/10.30742/jv.v9i0.61

Taufiq, M., Verdian, A. H., & Bokau, R. J. M. (2023). Pendederan Nila Merah (*Oreochromis niloticus*) dengan Salinitas Berbeda. *Jurnal Perikanan Terapan, 4*(1), 27–37. https://doi.org/10.25181/peranan.v4i1.4043

Widiartini, K. L., Antara, K. L., Mahardika, K., & Setiabudi, G. I. (2022). Parasite prevalence *Oodinium* sp. in cantang hybrid grouper cultivated in recirculating aquaculture system. *Advances in Tropical Biodiversity and Environmental Sciences, 6*(3), 79–84. https://doi.org/10.24843/ATBES.2022.v06.i03.p03

Wirawan, I. K. A., Suryani, S. A. M. P., & Arya, I. W. (2018). Diagnosa, Analisis dan Identifikasi Parasit yang Menyerang Ikan Nila (*Oreochromis niloticus*) pada Kawasan Budidaya Ikan di Subak "Baru" Tabanan. *Gema Agro, 23*(1), 63–78. https://doi.org/10.22225/ga.23.1.661.63-78

Yuliani, I., Pratiwi, R. H., & Yulistiana. (2023). Analisis Tingkat Serangan Parasit pada Ikan Nila (*Oreochromis niloticus*) dan Ikan Lele (*Clarias gariepinus*) di Balai Benih Ikan (BBI) Ciganjur. *Biota: Jurnal Ilmiah Ilmu-Ilmu Hayati, 8*(1), 68–80. https://doi.org/10.24002/biota.v8i1.5502

Yulianti, I. E., Restu, I. W., & Sari, A. H. W. (2019). Prevalensi dan Intensitas Ektoparasit Ikan Bawal Air Tawar (*Colossoma macropomum*) pada Usaha Perikanan Rakyat (UPR) di Desa Sepanjang, Kecamatan Glenmore, Banyuwangi. *Current Trends in Aquatic Science, 2*(1), 87–94. https://ojs.unud.ac.id/index.php/ctas/article/view/49580