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MORALITY BEFORE KNOWLEDGE

Potentially toxic freshwater fish varieties

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ABSTRACT
Polluted waters generally contain materials harmful to human health, factory waste, metal waste, community waste can pollute these waters. Although polluted, there are some organisms that are able to survive in such conditions, such as catfish. The purpose of this article is to determine the diversity in aquatic ecosystems polluted by textile waste through bioindicators in the form of fish. The result of this study was the discovery of 3 species of fish that are able to adapt to polluted waters, namely Clarias batrachus, Pterygoplichthys pardalis, and Fundulus Grandis. The method used is in the form of a literature study on topics relevant to the purpose of this article. The results show that polluted water conditions can affect diversity in aquatic ecosystems, evidenced by the development of invasive species and the reduction of native species in a freshwater ecosystem. Species that are able to survive in polluted water conditions may contain harmful substances such as heavy metals and should not be consumed by humans.

KEYWORDS: freshwater fish; pollution; toxic; waters

1. Introduction

Water pollution is the release of substances into water bodies that make water unfit for human use and disrupt aquatic ecosystems (Nathanson, 2023). Water pollution is influenced by rapid urbanization, human activities have a significant impact on the ecological environment. With the large amount of urban wastewater discharge and urban drainage systems into watersheds, the impact on water quality in the region is greater. This in turn affects aquatic life and agriculture, and therefore affects humans living in the area (Liyanage and Yamada, 2017). One of the wastes that is often encountered in rivers is textile waste, such as the rest of dyeing fabrics / materials, water from the washing industry, and wastewater from textile processing processes. Textile waste has characteristics such as color, very alkaline, very high BOD (Biochemical Oxygen Demand), and high suspended solids (Said, 2002).

Freshwater fish are fish that live in freshwater environments, such as rivers, lakes, and ponds As many as 41 percent of the number of fish species known to live in fresh water. Freshwater fish differ physiologically from marine fish in several aspects. Their gills must be able to diffuse water while simultaneously maintaining salt levels in body fluids. To survive in fresh water, fish need physiological adaptations aimed at maintaining a balance of ion concentrations in the body. This is due to rapid speciation which makes scattered habitats possible to live in (Merdeka, 2020). Fish that are able to adapt to waste or polluted rivers are often bioindicators in an ecosystem. Bioindicator is a term taken from

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environmental toxicology and is defined as an organism or biological reaction that indicates the presence of contaminants through the appearance of characteristic symptoms or measurable responses. These organisms (or communities of organisms) provide information about changes in the environment or environment. the amount of environmental pollutants by modifying physiologically, chemically, or behaviorally (Kovalchuk and Kovalchuk, 2016).

There are several reasons for choosing to raise this topic. With the development of the factory industry, especially those near waters, of course, it will not be separated from the environment and how it affects the surrounding ecosystem. Some people may think that in polluted water there would be no living things that would want to live there, but it is not like that. It turns out that there are some animals that are able to survive in conditions of polluted water. One of the common animals that are in polluted waters is fish. This article aims to find out whether fish in polluted waters have a wide diversity and why they can survive these extreme environmental conditions, as well as the effects of polluted environments on these fish. Generally, fish in polluted water contain harmful substances in the body, such as heavy metals.

2. Methods

Using the method of literature study. A literature study method is an academic paper that demonstrates knowledge and understanding of scientific literature on a particular topic placed in context. The literature review also includes a critical evaluation of the material; This is why it is called a literature review and not a literature report. Literature review is a literature review process (The University of Edinburgh, 2023).

The literature source used as a reference contains topics that are relevant to the main topic in this article, namely about the diversity of freshwater fish in polluted water.

3. Results and Discussion

The results of the literature study show that there are 3 types of fish that are commonly found in rivers polluted with waste in Indonesia.

Table 1. Types of fish found in polluted rivers

Types of Fish	Types of pollution	Pollution Adaptation	Reference
Clarias batrachus	Textile Waste	It is tolerant to external ammonia polluted water and can convert ammonia into non-essential amino acids and less toxic urea through the ornithine-urea cycle.	(Robins, 2017)
Pterygoplichthys pardalis	Textile Waste	Adapts to changes in water quality, uses outflows from sewage	(Capps et al., 2011)

		treatment plants as thermal shelters and can tolerate different salinities.	
Fundulus Grandis	Waste oil, waters with hazardous pollutants	Express genes capable of restraining waste.	(Garcia et al., 2012)

Catfish are a group of fish belonging to the order Siluriformes or Nematognathi. This fish is so named because of the protruding whiskers, which resemble cat whiskers. Catfish vary in size and behavior, ranging from the three largest living species to detritivores, and even small parasitic species (Ferguson, without years.).

Catfish are generally tolerant of low dissolved oxygen levels and can survive high levels of pollution, but they still need well-oxygenated water to thrive. Dissolved oxygen is one of the most important aspects of water quality and its management in catfish pond cultivation. Catfish can survive at very low dissolved oxygen levels, but well-oxygenated water is highly recommended. This is easily achieved by means of aeration or a good flow rate. Batrachus catfish can breathe air from the surface of the water, which allows it to survive in habitats with low oxygen levels (Li et al., 2018).

In terms of tolerance to pollution, catfish are considered a tolerant species and can survive in all types of environments, both clean and polluted. Catfish are classified as "somewhat tolerant" and do not need very clean water to survive, but also do not like highly polluted water. The most tolerant fish species in general is the catfish *Clarias batrachus,* very tolerant of external ammonia and can convert ammonia into non-essential amino acids and less toxic urea through the ornithine-urea cycle (Robins, 2017). However, it is important to note that although catfish can survive in polluted water, this is not necessarily healthy for them and can affect their overall growth and health (Okomoda et al., 2019). *Clarias batrachus* is highly resistant to various environmental stresses, due to the harshness of its natural habitat, where drought, poor water quality, and famine are common (Iqbal, no year.)

Because catfish (*Clarias batrachus*) are able to survive in polluted water, they are also able to survive in water that has been contaminated with textile waste. Textile waste is known as one of the most dangerous types of waste for aquatic ecosystems. This waste is able to reduce dissolved oxygen levels through hydrosulfide and block the entry of sunlight into water which is very important for aquatic ecosystems. About 40% of commonly used textile dyes contain organically bound chlorine, a carcinogen. In addition, the heavy metals contained in textile waste are not *biodegradable,* or biodegradable. If heavy metals enter the organs of fish that live in polluted waters, it will be able to cause various diseases for these fish (Kant, 2012).

Catfish found in the source, it is stated that they are not found directly at the waste disposal point, there are certain distances for the discovery of specimens with a distance of 50m-200m from the point of waste disposal (Emere and Dibal, 2013)

Based on one literature source, in polluted waters there can be invasions of other species that are better adapted to extreme conditions such as water pollution. One example of such adaptable fish found during a literature study is the armored catfish (*Pterygoplichthys pardalis*). This catfish is one of the catfish species known to be invasive and can damage diversity in an aquatic habitat (Saba et al., 2020). *Pterygoplichthys pardalis is* very tolerant of poor water quality and is commonly found in polluted waters. This fish can thrive in a variety of acidic to alkaline waters with a pH range of about 5.5 to 8.0; can also adapt very quickly to hard water, besides that these fish adapt to changes in water quality and can use the outflow from the sewage treatment plant as a thermal shelter (USFWS, 2018). *Pterygoplichthys pardalis* can tolerate different salinities. Tests have shown

that individuals maintained at a salinity of 0.2 ppt are able to survive sudden (acute) salinity exposure to up to 10 ppt (Capps et al., 2011).

Armored catfish (*Pterygoplichthys pardalis*) is able to breed well in polluted waters, so its numbers can exceed the number of other fish in the place and reduce the diversity of aquatic ecosystems. Generally, in certain waters, fishermen fish certain types of fish to be sold and consumed for the wider community. But with the emergence of invasive species of armored catfish, fishermen's income in certain waters gradually decreases. Fishermen generally do not hunt armored catfish because this catfish species can contain heavy metals in their organs. This is also one of the factors why armored catfish can thrive and become invasive in species native to some waters (Rao and Sunchu, 2017).

The cause of its adaptability is the presence of additional organs in its abdomen, which allow it to adapt to hypoxic conditions in waters with little dissolved oxygen (da Cruz et al. 2013 in Elfidasari et al., 2020)

One of the places invaded by this species is in Lake Tempe, South Sulawesi, Indonesia (Febrianti et al. 2019). and Ciliwung river, Jakarta, Indonesia (Elfidasari et al., 2020).

There are fish species that are able to survive in polluted aquatic environments other than catfish, known as killifish (*Fundulus Grandis*) which are able to survive in waters exposed to pollutants. They have evolved and survived in polluted waters that have a lethal rate of up to 1,000 times. Killifish develop resistance that has been considered impossible in massive pollution levels in natural habitats. This species can express genes that are able to hold waste in the environment and make this as immunity in themselves. (Garcia et al, 2012).

4. Conclusions

Water pollution is considered a major problem facing freshwater and marine environments; This leads to negative impacts on human health in addition to other organisms. Freshwater ecosystems with biota living in them are considered a dangerous threat to the people who consume them. In addition, pollution or water pollution can also affect the diversity of an aquatic ecosystem due to the presence of invasive species that develop rapidly and drive out native species in the ecosystem. The public is expected not to catch let alone consume fish that are in polluted waters of factory waste, because the harmful content in these fish can enter the body and trigger damage to the human body.

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Author Contribution

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