Study of The Status of Diversity and Potential of Fish in The Downstream Area of The Brantas River (Mojokerto, Sidoarjo, Surabaya) as an Effort to Conserve Biological Biota in East Java

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Abstract

The Brantas River is also a good aquatic habitat for the growth and development of fish. The types of fish in the river have the potential to be developed as a superior product of a region, as an effort to combine conservation efforts and economic development for local communities. However, the potential of river fisheries has not been maximized, therefore the need for a study of the potential of natural resources, especially fisheries that support environmental sustainability so that the utilization of the potential resources of the lower reaches of the Brantas River can improve the welfare of the surrounding community. Sampling was carried out at nine station points by purposive random sampling. Data analysis used is quantitatively based on the calculation of Shannon-Wienner diversity index (H'), dominance index (Di) and Pearson correlation test. The results obtained showed that the fish found in the lower reaches of the Brantas River amounted to 17 species classified into 13 families. The diversity index ranges from 1.32 - 2.22 with a medium index category. The dominance index is included in the low category, which means that there is no dominating fish species. Of the 17 fish species, 9 species have been cultivated, 7 species have the potential to be cultivated and 1 species is not cultivated.

Keywords: Brantas River, Species Diversity Index, Dominance Index

Introduction

Rivers are an important ecosystem for humans today. Rivers are the main habitat of aquatic animals that have a high protein content such as fish (Subakti *et al*., 2022). The Brantas River is the longest river in East Java Province, with a length of about 320 km^2 and a river water flow area of about 12,000 km^2. The source of the Brantas River water comes from Mount Arjuno which is located in Sumber Brantas Village, Bumiaji District, Batu City. The Brantas River flows through several cities and regencies in East Java, including Malang, Blitar, Tulungagung, Kediri, Jombang, Mojokerto, Sidoarjo and Surabaya. The Brantas River plays a very important role in East Java (Hartini and Dewi, 2021).

The Brantas River is an important source of raw water, especially for domestic consumption, for irrigation, industrial processing, recreation, power generation, aquaculture water sources and so on (Dhiani, 2019). The Brantas River plays an important role in people's lives in the fields of agriculture, fisheries, livestock and drinking water, besides that the Brantas River also acts as a National Food Barn in East Java Province (Hartini and Dewi, 2021). The Brantas River is also a good aquatic habitat for the growth and development of fish in river waters (Hayati *et al*., 2017).

Fish are vertebrate animals that live in water and breathe using gills that function to take oxygen in water and have fins that are used for swimming (Rahmat *et al*., 2021). Fish are vertebrates that live in waters (Siska et al., 2020). Fish habitats can vary such as rivers, lakes, prone and ponds. In general, fish can be divided into consumed fish and ornamental fish (Muslim *et al*., 2020). Fish is one of the

biodiversity that has a role to maintain ecosystem stability, a source of germplasm, and an economic source. (Wahyuni *et al*., 2018).

Fish diversity in waters can illustrate the complexity of aquatic ecosystems. Diversity indices are commonly used as a measure of ecosystem conditions (Erika et al., 2018). Fish species diversity illustrates the entire scope of ecology and describes the evolution of species that are closely related to a particular environment (Syafei, 2017). Fish can be divided into consumed fish and ornamental fish. Fish species in rivers have the potential to be developed as superior products of an area, as an effort to combine conservation efforts and economic development for local communities (Jusmaldi et al., 2019).

The caught fish in the Brantas River are mostly local fish that have high potential for cultivation (Fitriani *et al*., 2022). The potential of river fisheries that can be developed includes catch fisheries of inland public waters, as well as aquaculture (Windi and Istiqamah, 2021), but these potentials have not been maximized, therefore the need for a study of the potential of natural resources, especially fisheries that support environmental sustainability so that the utilization of the potential of downstream resources of the Brantas River so as to improve the welfare of the surrounding community (Restuwati *et al*., 2022).

Material and Methods

Sampling site

This research was carried out by collecting data twice in February and October 2023 based on seasonal differences, February during the rainy season and October during the dry season. The location of this research is the downstream area of the Brantas River in Mojokerto, Sidoarjo and Surabaya (Figure 1.)

Water quality

The water quality parameters (^oC), pH, dissolved oxygen, and brightness were measured at each location immediately after specimen collection

Fish collection and species identification

Fish sampling is collected using fish nets assisted by fishermen. Fish sampling by netting was carried out using a stocking net and a siphon. Sampling using a stocking net is carried out for 1 hour. The collected fish were separated according to their species, then the number of individuals was counted. After that, each type of fish was washed and put into a coolbox, then the samples obtained from the location were documented and identified.

Data analysis

A. Diversity Index

$$H' = -\sum \left(\frac{ni}{N}\right) \ln \left(\frac{ni}{N}\right)$$

Description:
H′ = Species diversity index
ni = Number of individuals of the i-th species
N = Total number of individuals
ln = Natural logarithm

B. Dominance Index

The dominance index is used to determine the dominance of species in an area. The dominance index is calculated using the following formula (Samitra and Rozi, 2018).

$$Di = \sum \left(\frac{ni}{N}\right)^2$$

Description:
Di = Dominance index
ni = Number of individuals of type-i
N = Total number of individuals of all species

Station	Coordinates		Location	Description
	Latitude	Longitude		
1	7˚27′45″S	112˚25′38″E	Mentikan, Prajurit Kulon, Mojokerto	Residental, Agricultural
2	7˚27′28″S	112˚26′14″E	Magersari, Mojokerto	Industry, residential
3	7˚26′39″S	112˚28′12″E	Mergelo, Kranggan, Mojokerto Regency	Residential, industrial
4	7˚32′35″S	112˚46′58″E	Kupang, Jabon, Sidoarjo Regency	Industry, residential
5	7˚32′06″S	112˚49′18″E	Kupang, Jabon,	Agriculture, Near

Figure 1. Coordinates sampling site

Result and Discussion

Fish Species In The Lower Brantas River Area

The results of fish sampling conducted with fishermen in February and October 2023, obtained 17 species of fish at nine different station points in the Lower Brantas River area which were classified into 13 families. Fish sampling was carried out in February and October 2023, in February 2023 the total number of individuals obtained was 1457. While in October 2023 the total number of individuals obtained was 1523.

In February 2023 the highest family was Cyprinidae (24.75%), according to Murni *et al*. (2014) Cyprinidae is a very common fish family found in fresh waters. Besides having the highest number of species, the Cyprinidae family also dominates in terms of the number of individuals. In October 2023 the highest family was Cichlidae (23.76%) According to Faradiana *et al*. (2018) the Cichlidae family can live in a variety of different aquatic habitat conditions even in poor water conditions, this is due to the excellent adaptability of these fish. Other species found in the least number of individuals came from the Latidae, Plotosidae, Scatophagidae, and Mugilidae families. These families were caught around the waters of the river estuary. River estuaries play a strategic role in aquatic ecology including habitat for various stages of fish stadia, spawning areas for nurturing, foraging, and traveling (Mote, 2017).

Fish Diversity In The Lower Reaches Of The Brantas River

The value of the fish diversity index at nine station points in the lower reaches of the Brantas River ranged from 1.32 - 2.18 in February 2023 and 1.36 - 2.22 in October 2023, the results obtained were included in the criteria for moderate diversity, this is in accordance with the opinion of Setyobudiandi *et al*., 2009 in Erika et al., 2018 that the value of diversity 1 < H'<3 includes criteria for moderate diversity. The number of individuals and the high variety of species make the biodiversity level of fish in an aquatic environment will be higher, and conversely, the fewer the number of individuals and the variety of fish species, the lower the diversity level of fish in an aquatic environment (Erika *et al*., 2018).

While the dominance index ranged from 0.05 - 0.15 in February 2023 and 0.03 - 0.14 in October 2023 the dominance index results obtained were Di < 1 and included low criteria. This is in accordance with Odum (1998) in Erika et al. (2018) if the dominance value <1 indicates that the dominance includes low criteria. Low dominance indicates that there is no species that dominates other species and fish species are evenly distributed. the smaller the dominance index value, the more diffuse the dominance pattern (Febrian *et al*., 2022).

Famili	Species	Local Name
Mugilidae	*Mugil cephalus*	Belanak
Cichlidae	*Oreochromis niloticus*	Nila
	Oreochromis mossambicus	Mujair
Channidae	*Channa striata*	Kutuk, Gabus
Bagridae	*Mystus nigriceps*	Rengkik
	Mystus singaringan	Keting
Eleotridae	*Oxyeleotris marmorata*	Bloso, Betutu
Poecilidae	*Gambusia affinis*	Gatul
Scatophagidae	*Scatophagus argus*	Kiper
Ariidae	*Hexanematichthys*	Dukang, Kedukang

Figure 2. Fish spesies found in lower Brantas River

Fish Potential in the Lower Brantas River

The fish caught in the lower reaches of the Brantas River resulted 1 species of ornamental fish, 10 species of consumed fish, and 6 species included in both consumed and ornamental fish. In addition, 53% of the fish were cultivated, 41% of the captured fish had the potential to be cultivated, and 6% were uncultivated fish. Biologically and economically, local fishes (native and endemic) have the potential to be developed into aquaculture commodities. Biologically, local fish are suitable for cultivation if they can live in a limited environment. Economically, local fish are worth cultivating if they have consumers or enthusiasts (Muslim *et al*., 2020).

Water quality

The results of water quality measurements in February 2023 in the table above, the temperature at nine station points ranged from 25.5-28.9^{O}C. Brightness at nine station points ranged from 25 - 30 cm. pH of all stations ranged from 7.9 - 8. DO at nine station points ranged from 3.1-5.2 mg/L. The results of October 2023 water quality measurements in the table above, the temperature at nine station points ranged from 26 - 28.9^{O}C. Brightness at nine station points ranged from 25 - 33 cm. pH of all stations ranged from 7.2 - 8. DO at nine station points ranged from 3.2 - 5.1 mg/L.

The results of water quality measurements obtained temperature in the lower reaches of the Brantas River ranged from 25.5 - 28.9 ° C. The results of temperature measurements in this range are still classified as good. This is in accordance with the opinion of Buwono et al. (2017) which states that the good temperature range for fish growth is 25-33 ° C. The results of the study of the brightness value of the nine station points are 24-30 cm. Brightness that supports the life of aquatic biota is in the range of 20-40 cm. The lower brightness is influenced by the higher turbidity of the water, as a result the lower the penetration of light through the water (Hasibuan, 2017). The measurement results obtained pH values from nine station points are 7.4 - 8.2. The pH value still meets the specified water quality standards. According to Wahyuni and Zakaria (2018), a good pH value for the life of aquatic organisms ranges from 6 - 9. The results of the DO value research at nine station points are in the range of 3.1 - 5.1. Based on the quality standards of PP No. 22 of 2021, the minimum DO value of river waters is 4 mg/L.

Conclusion

Species found in the lower reaches of the Brantas River (Mojokerto, Sidoarjo, Surabaya) consisted of 17 species. Fish diversity in the lower reaches of the Brantas River (Mojokerto, Sidoarjo, Surabaya) is categorized as moderate.

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