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FISH COMMUNITY STRUCTURE IN THE MIDDLE OF BRANTAS RIVER, EAST JAVA, INDONESIA

Struktur Komunitas Ikan di Sungai Brantas Bagian Tengah, Jawa Timur, Indonesia

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ABSTRACT

Fish are important biological indicators used to determine the health of an ecosystem. Fish community structure is dynamic and influenced by various environmental pressures. Changes in fish community structure in river ecosystems, such as in the waters of the Brantas River, East Java, can reflect the ecological conditions of these waters. The objective of this study was to evaluate the fish community structure in the middle section of the Brantas River based on ecological indices, including relative abundance, diversity, evenness, and species dominance. The research method was conducted through surveys of local fishermen's catches at six observation stations in the middle section of the Brantas River, covering the Tulungagung to Kediri area, from July to September 2024. The ecological index values showed moderate diversity (H' 1.16–1.80), relatively high evenness (E 0.83–0.95), and low to moderate dominance (C 0.18–0.33). Based on the results of this study, it shows that the fish community in the middle section of the Brantas River is still in the moderate diversity category with good distribution, but there are indications of dominant species in certain locations and the presence of introduced species that require attention in monitoring and sustainable management.

Keywords: Brantas River, Ecology Index, Fish Community Structure, Fish Species

ABSTRAK

Ikan merupakan indikator biologis penting yang digunakan untuk menentukan tingkat kesehatan suatu ekosistem. Struktur komunitasnya bersifat dinamis dipengaruhi oleh berbagai tekanan lingkungan. Perubahan struktur komunitas ikan dalam ekosistem sungai seperti di perairan Sungai Brantas, Jawa Timur dapat mencerminkan kondisi ekologis perairan. Tujuan dari penelitian ini adalah untuk mengevaluasi struktur komunitas ikan di Sungai Brantas bagian tengah berdasarkan indeks ekologi meliputi kelimpahan relatif, keanekaragaman, keseragaman, dan dominansi spesies. Metode penelitian yang dilakukan melalui survei hasil

tangkapan ikan nelayan lokal pada enam stasiun pengamatan di Sungai Brantas bagian tengah meliputi wilayah Tulungagung hingga Kediri pada Juli-September 2024. Nilai indeks ekologi menunjukkan keanekaragaman sedang (H' 1.16–1.80), keseragaman relatif tinggi (E 0.83–0.95), dan dominansi rendah–sedang (C 0.18–0.33). Berdasarkan hasil penelitian tersebut menunjukkan bahwa komunitas ikan pada ruas tengah Sungai Brantas masih berada pada kategori keanekaragaman sedang dengan pemerataan yang cukup baik, namun terdapat indikasi penguatan dominansi pada lokasi tertentu serta kemunculan spesies introduksi yang perlu menjadi perhatian dalam pemantauan dan pengelolaan berkelanjutan.

Kata Kunci: Indeks Ekologi, Spesies Ikan, Struktur Komunitas Ikan, Sungai Brantas

INTRODUCTION

Rivers, as flowing aquatic ecosystems, play a vital role in supporting freshwater fish diversity, providing a source of protein for communities, and supporting small-scale fisheries. Fish diversity in rivers is strongly influenced by water quality and surrounding ecological conditions, as the aquatic environment determines habitat suitability for specific species (Hanifah & Chamid, 2022). Furthermore, the physical, chemical, and morphological conditions of the waters influence the distribution and abundance of specific species in each segment (Smith et al., 2022). The integration of these factors is ultimately reflected in the structure of fish communities, so good habitat quality is closely related to higher species diversity and more balanced communities (Sari et al., 2020).

The structure of fish communities in river ecosystems is dynamic, influenced by various environmental pressures. Changes in land use within watersheds are known to modify water characteristics and habitat quality, leading to shifts in species composition, dominance patterns, and relative abundance of fish (Kour et al., 2021). These pressures are further amplified by non-selective capture fisheries, which have the potential to alter population structure and reduce the presence of more vulnerable species. Furthermore, the introduction of invasive species can increase competition and predation, threaten the persistence of local species and contribute to changes in fish community structure (Raj et al., 2021).

The Brantas River, located in East Java, stretches approximately 320 km and serves as a vital water source for domestic, agricultural, and industrial purposes (Beselly et al., 2021). The middle reaches of the Brantas River, stretching between Tulungagung and Kediri, face environmental pressures from human activities around the river basin. Research by Sidjabat et al. (2020) revealed that lead (Pb) pollution in the middle reaches of the river can affect water quality, leading to health impacts for aquatic biota, including fish living in the river. Other research also shows that pollutants such as heavy metals can negatively impact fish health and alter the structure of fish communities in the river (Tuska et al., 2025). This pollution can lead to a decline in fish species sensitive to changes in water quality or directly kill individuals within the population (Jargal et al., 2024).

Based on these conditions, measuring the diversity and structure of fish communities in the middle Brantas River is crucial as part of efforts to monitor ecosystem health and the condition of fish stocks. Surveys of species composition and community structure provide an overview of the level of threat to fish diversity and the species that are still able to survive and support local fisheries. This study specifically aims to describe the composition and richness of fish species, assess local diversity through diversity, evenness, and dominance indices, and evaluate differences in community composition between stations using abundance-based dissimilarity measures and cluster analysis.

RESEARCH METHODS

Research Time and Location

The research was conducted from July to September 2024, with three sampling sessions at each research station, namely the middle section of the Brantas River, covering the Tulungagung to Kediri area. The research locations were determined using purposive sampling. Six observation stations were designated: Station 1 (Rejotangan District, Tulungagung), Station 2 (Bendosari District, Tulungagung), Station 3 (Ngantru, Tulungagung), Station 4 (Kaliombo, Kediri), Station 5 (Mojoroto, Kediri), and Station 6 (Waruturi Dam, Kediri) (Figure 1).

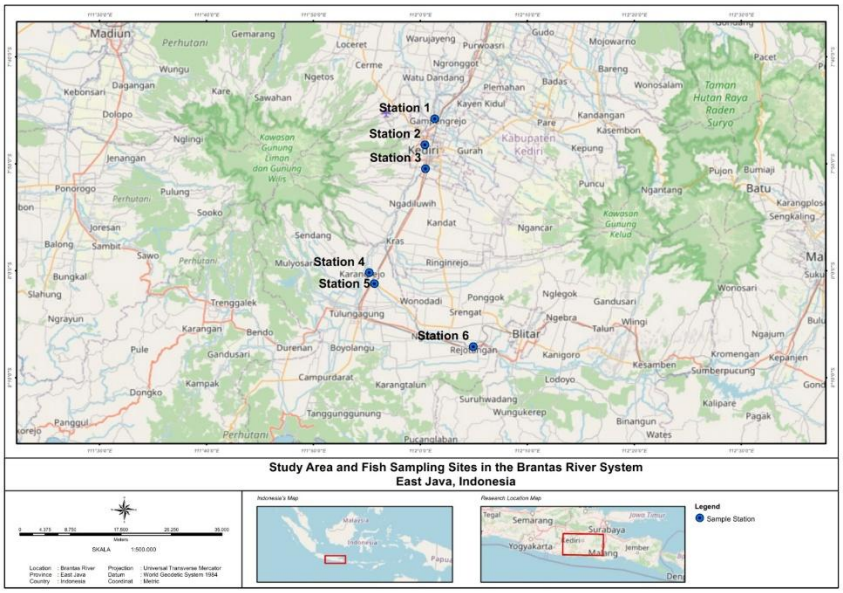

Figure 1. Fishing Locations in the Middle Brantas River

Species Identification

Data collection was conducted using a survey method, recording and collecting all fish caught by local fishermen using handlines, cast nets, and traps at each station. All fish caught were then counted and identified to the species level using the Indonesian freshwater fish identification guide (Murdy et al., 1994; Kottelat & Whitten, 1996; Kottelat, 2013). Species abundance data at each station were then compiled into a species-station matrix as the basis for analyzing fish community structure in the middle Brantas River.

Data Analysis

Fish community structure was analyzed through calculations of relative abundance, diversity index, evenness, and dominance. The relative abundance of each species was calculated as a percentage of the total individuals at a station using the formula (Utama et al., 2019):

$$K_j = \frac{n_i}{N} \times 100\%$$

Where:
Kj = relative abundance of the i-th species (%)
ni = number of individuals of the i-th species
N = total number of individuals of all species
The species diversity index was calculated using the Shannon–Wiener index (Utama et al., 2019):

$$H' = -\sum_{i=1}^{S} p_i \ln (p_i)$$

Where:
H' = diversity index
pi =ni/N = proportion of individuals of the i-th species
S = number of species at the station
Diversity criteria:

- H' < 1: low diversity
- 1 < H' < 3: moderate diversity
- H' > 3: high diversity

Community evenness was calculated using the Pielou evenness index (Hidayat & Nurulludin, 2017):

$$E = \frac{H'}{\ln S}$$

Where:
E = evenness index
S = number of species
Evenness criteria:

- E > 0.6: high evenness
- 0.4 < E <0.6: moderate evenness
- E < 0.4: low evenness

The dominance index is used to determine the level of dominance of a species in the community at each station. Simpson's dominance index is calculated using the formula (Utama et al., 2019):

$$C = \sum_{i=1}^{S} \left(\frac{n_i}{N}\right)^2$$

Where:
C = Simpson's dominance index
ni = number of individuals of the i-th species
N = total number of individuals of all species
The C value ranges from 0–1; values closer to 1 indicate strong dominance by one or a few species, while values closer to 0 indicate the absence of highly dominant species in the community.

RESULT

Species Composition

Research in the middle Brantas River (Tulungagung to Kediri) yielded a total of 468 fish individuals representing 16 species. The fish community was composed of a combination of native and introduced species from several families, namely Cyprinidae, Clariidae, Mastacembelidae, Channidae, Nemacheilidae, Bagridae, Osphronemidae, Anabantidae, Cichlidae, and Loricariidae (Table 1).

Overall, the species with the highest number of individuals were *Barbonymus balleroides* (97 individuals) and *Mystacoleucus marginatus* (88 individuals), followed by *Oreochromis niloticus* (56 individuals), *Rasbora argyrotaenia* (30 individuals), *Nemacheilus pfeifferae* (27 individuals), *Barbodes binotatus* (25 individuals), and *Hypostomus plecostomus* (24 individuals). Other species were captured in lower numbers, ranging from 4 to 19 individuals.

The Cyprinidae group, specifically *Barbonymus balleroides*, *Mystacoleucus marginatus*, and *Barbonymus gonionotus*, were recorded at almost all research stations, except for

Barbonymus gonionotus, which was not found at Station 3. This makes small cyprinids the primary constituent of the fish community in the middle reaches of the Brantas River.

The absence of *Barbonymus gonionotus* at Station 3 can be interpreted as an indication of local-scale microhabitat heterogeneity, which influences the composition of the fish community between observation points. *Barbonymus gonionotus* tends to be associated with slow-flowing to relatively calm waters, so changes in physical habitat conditions or local water quality can reduce the likelihood of this species being observed at a particular station (Hertika et al., 2024).

Spatial Variation in Catch Abundance

Spatially, fish catches varied between stations. The highest catches were recorded at Stations 3 and 6, with 118 and 117 individuals, respectively. Station 1 yielded 100 individuals, Station 5 50 individuals, Station 4 44 individuals, while the lowest catch was at Station 2 with 39 individuals. This difference indicates variations in fish abundance along the middle section of the Brantas River.

Based on the relative abundances in Table 1, the dominant species at each station were as follows: at Station 1, *Oreochromis niloticus* was the dominant species with an abundance of 23% of the total catch; at Station 2, *Barbonymus balleroides* dominated with an abundance of 41%; at Station 3, *Rasbora argyrotaenia* was the dominant species with an abundance of 25%; at Station 4, *Barbonymus balleroides* reappeared as the dominant species with an abundance of 27%; while at Stations 5 and 6, *Mystacoleucus marginatus* was the dominant species with abundances of 38% and 39%, respectively. Thus, at each station, there was one main species that contributed the largest proportion of the total individuals caught.

Fish Community Ecological Index

The fish community structure in the middle Brantas River is illustrated by the ecological index values in Figure 2. The ecological index values in Figure 2 indicate that the fish community structure in the middle Brantas River is in the moderate diversity category (H' 1.16–1.80), according to the diversity index classification with a range of $1 < H' \leq 3$, which is considered moderate. Stations 1 (H' = 1.80) and 3 (H' = 1.71) represent relatively more diverse communities compared to the other stations, while Station 5 (H' = 1.16) exhibits the lowest species diversity in the observed segment.

The evenness (E) range of 0.83–0.95 indicates that the distribution of individuals across species is generally quite even, as it falls on a scale of 0–1, with values approaching 1 indicating increasingly balanced species abundance. Consistent with this, Simpson's dominance (C) values of 0.18–0.33 indicate that dominance tends to be low to moderate, with the lowest dominance at Stations 1 and 3 (C = 0.18–0.19) and the highest dominance at Station 5 (C = 0.33).

Table 1. Abundance of Fish Caught in the Middle Brantas River

No	Species	Local Name	Total (fish)	Species Abundance (%)					
				I	II	III	IV	V	VI
1	*Hampala macrolepidota*	Hampala	7	2	0	0	0	2	3
2	*Barbonymous balleroides*	Bader	97	18	41	0	27	36	28
3	*Mystacoleucus marginatus*	Keprek	88	19	8	0	2	38	39
4	*Barbonymous gonionotus*	Tawes	31	10	26	0	25	0	0

No	Species	Local Name	Total (fish)	Species Abundance (%)					
				I	II	III	IV	V	VI
5	*Clarias batrachus*	Lele	14	9	0	0	11	0	0
6	*Mastacembelus notophthalmus*	Berod	10	0	0	0	0	0	9
7	*Channa striata*	Gabus	4	0	0	0	9	0	0
8	*Barbodes binotatus*	Wader Cakul	25	0	0	21	0	0	0
9	*Rasbora argyrotaenia*	Wader Pari	30	0	0	25	0	0	0
10	*Nemacheilus pfeifferae*	Uceng	27	0	0	23	0	0	0
11	*Mystus gulio*	Keting	13	0	0	11	0	0	0
12	*Labrus trichopterus*	Sepat Biru	9	0	0	8	0	0	0
13	*Anabas testudineus*	Betik	14	0	0	12	0	0	0
14	*Oreochromis niloticus*	Nila	56	23	26	0	25	24	0
15	*Amphilophus labiatus*	Red Devil	19	19	0	0	0	0	0
16	*Hypostomus plecostomus*	Sapu-sapu	24	0	0	0	0	0	21
Total			468	100	100	100	100	100	100

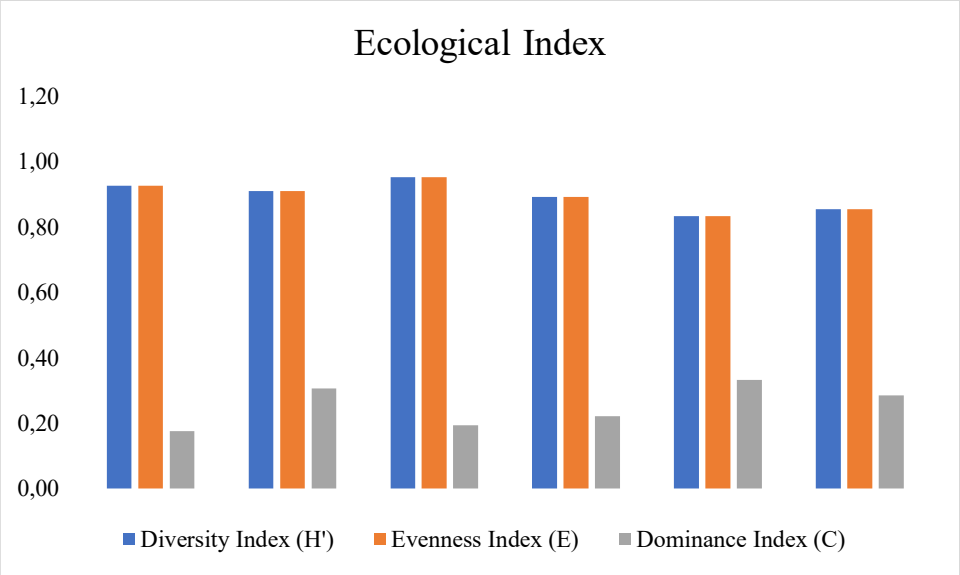

Figure 2. Ecological Index Value of Fish Caught in the Middle Brantas River

DISCUSSION

Species Composition

The fish composition in the middle Brantas River is dominated by the Cyprinidae family, namely *Barbonymus balleroides, Mystacoleucus marginatus, Barbonymus gonionotus, Rasbora argyrotaenia*, and *Barbodes binotatus*. Cyprinidae are found predominantly in various river segments, including the upper, middle, and lower reaches (Fitriani et al., 2022). The

results of this study also align with research conducted by Hasan et al. (2022), which found that Cyprinidae dominate fish catches in the Brantas River, encompassing 12 genera and 15 species (Hasan et al., 2022). Ecologically, the dominance of Cyprinidae in the Brantas River is associated with adaptive traits that enable fish to adapt to fluctuating aquatic environmental conditions (Kaviasaru et al., 2022).

Furthermore, the high prevalence of introduced species such as *Oreochromis niloticus* and *Hypostomus plecostomus* has the potential to impact the structure of local fish communities. *Oreochromis niloticus* can suppress native fish species composition through feeding competition (Nugraheni et al., 2023). Meanwhile, *Hypostomus plecostomus* is known for its burrowing behavior, which can disrupt bank stability, increase the risk of erosion, and trigger increased turbidity, impacting sensitive aquatic organisms (Prakash et al., 2022).

Spatial Variation in Catch Abundance

The variation in capture fisheries abundance indicates an uneven distribution of abundance among research stations in the middle reaches of the Brantas River. River conditions, including physical and chemical variations, as well as river size, contribute to differences in fish community composition (Feng et al., 2024). *Oreochromis niloticus* dominated Station 1, *Barbonymus balleroides* dominated Stations 2 and 4, *Rasbora argyrotaenia* dominated Station 3, and *Mystacoleucus marginatus* dominated Stations 5 and 6. These findings indicate that habitat conditions at each location tend to be more suitable for certain species, thus contributing a greater proportion of the catch (Rostika et al., 2022). In general, the dominance of cyprinid species at several stations is also consistent with the characteristics of the Brantas River, resulting in their abundance (Setiyowati et al., 2020).

Fish Community Ecological Index

The ecological index value indicates that the fish community structure in the middle reaches of the Brantas River has a moderate diversity value. This indicates that the level of species diversity is not dominated by a few species. Research conducted in this area indicates that H' values range from 1.16 to 1.80, which is included in the moderate diversity category (Fitriani et al., 2022). Species diversity reflects water quality and stability (Muzaki et al., 2024).

Species evenness indicates a fairly even distribution among species. Evenness values close to 1 indicate a balanced distribution of individuals across species, indicating that no single species significantly dominates the ecosystem. Fish communities with high evenness often exhibit less pressure from dominant species, thus promoting diversity and resilience to environmental change (Yuniari et al., 2025). Similarly, low dominance values indicate no dominant species. This is consistent with the principle that when evenness is high, dominance tends to be low, and the community will exhibit more stable diversity (Yuniari et al., 2025).

CONCLUSION

A total of 468 fish were collected during the study in the middle Brantas River. The fish caught comprised 16 species, dominated by members of the Cyprinidae family, namely Barbonymus balleroides and Mystacoleucus marginatus. Differences in total abundance and dominant species between observation stations indicate spatial variations in fish community structure. Observations of fish community structure were conducted based on ecological indices, namely diversity, evenness, and dominance indices. The results showed moderate species diversity (H’ 1.16–1.80) with relatively high evenness (E 0.83–0.95) and low–moderate dominance (C 0.18–0.33). These values indicate that the community is generally quite even, although at some stations there was an increase in the dominance of certain species. Further monitoring is needed to strengthen the basis for sustainable management of Brantas River fish resources.

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