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Spatial analysis of fish species composition in relation to fishing gear in the upper stream of Brantas River, Malang, East Java, Indonesia

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Abstract. *Setyanto A, Setyohadi D, Irawan VB, Sudaryanti S, Caesar N, Kusuma WE, Mukti AT, Isdianto A, Adihapsari W, Lusiana ED, Utama AA, Prasetyo AP, Ekawaty R, Neka W, Akbarsyah N. 2025. Spatial analysis of fish species composition in relation to fishing gear in the upper stream of Brantas River, Malang, East Java, Indonesia. Biodiversitas 26: 4193-4200.* Inland water ecosystems in Indonesia, particularly in East Java with the Brantas River, hold significant potential for capture fisheries and aquaculture. Covering an area of 13.85 million hectares, this ecosystem includes rivers, natural lakes, and man-made reservoirs. The potential fish resources are projected to be substantial, with the capacity to enhance employment opportunities and boost regional income. However, the management and utilization of fisheries resources in inland waters remain underdeveloped, requiring optimization through appropriate policies and supportive infrastructure. The upper stream of the Brantas River not only provides water for industries and local water utilities but also functions as a critical habitat for various fish species, despite being predominantly managed by small-scale fishers. This study aims to evaluate the composition of fish catches based on fishing area and gear type in the Malang Raya Region of the Brantas River. A descriptive approach was employed for data collection, using random sampling from fishers at seven designated sampling stations. Data were collected within the rainy season through direct observation, interviews, and documentation. Statistical analysis was performed using ANOVA and Chi-Square methods, utilizing Microsoft Excel and SPSS version 27. The results indicate that variations in species composition of the catch were significantly influenced by the sampling stations and the types of fishing gear used.

Keywords: Batu City, Brantas River, Karangkates Reservoir, Malang, sili

INTRODUCTION

Over 1,400 different species of freshwater fish can be found in Indonesia (Kottelat and Whitten 1996). Among the world's leading freshwater fish-producing countries, Indonesia ranks fifth, following India, Bangladesh, China, and Myanmar. Indonesia contributes approximately 464 thousand tons, accounting for 4.1% of the global freshwater fish production (Funge-Smith and Bennett 2019). This figure may be an underestimate. There is a substantial potential for utilization of the fish resources that are located in these inland waters. These fish resources have the ability to provide employment possibilities, boost regional income, and contribute to the ensuring of food security. In addition to the marine capture fisheries sector, inland capture fisheries have the potential to play a significant part in satisfying the demand for fish consumption provided they are managed in an effective way (Funge-Smith 2018; Funge-Smith and Bennett 2019). On the other hand, the efforts that have been made to manage and make use of the resources of inland water fisheries have not yet reached their full potential (Susanto et al. 2020).

In the province of East Java, Indonesia, there are numerous inland water ecosystems that are dispersed across a number of different regions. These ecosystems include rivers, reservoirs, lakes, dams, and the like. There is still a substantial amount of untapped potential for fisheries resources in East Java, particularly in the areas of aquaculture and inland water capture fisheries operations. According to Huda et al. (2014), the southern region of

East Java is characterized by topographic features that are dominated by mountains that extend from west to east, and the northern region is comprised of lowlands that are generally gentle. In addition, the Brantas River, which is the second longest river in Java after the Bengawan Solo River, provides support for the possibility of inland capture fisheries in East Java (Virgiawan 2015). This river holds the distinction of being the second longest river in Java and plays a significant part of the lives of the people who live in the province of East Java. The Brantas River generates one billion kilowatt-hours of power annually, which is utilized by the community for industry to the extent of 144 million cubic meters and for The Local Government-Owned Water Utility (PDAM) to the extent of 243 million cubic meters annually. Additionally, the Brantas River serves as a habitat for aquatic biota, such as fish (Ahmad et al. 2021; ‘Aini and Alayubi 2022). This is a significant contribution to the river's ecosystem.

In addition to its origin in Batu City, which is located on the slopes of Mount Arjuna, the Brantas River flows through Blitar, Tulungagung, Kediri, Jombang, and Mojokerto before emptying into the Madura Strait via Sidoarjo and Surabaya. As a result of its large length, the Brantas River displays a wide range of aquatic features. These characteristics include a wide variety of biota as well as considerable physical and chemical changes that are influenced by a number of different variables (Feisal et al. 2023). In accordance with the findings of Buwono et al. (2021), the Brantas River is ranked among the most polluted rivers, its waters contaminated with a significant amount of microplastics. In the Batu City Region, there are a number of abandoned sand mining sites that may be found along the river's flow in numerous different locations. In the downstream region, the condition of the Brantas River in Malang City and Malang District has become increasingly worrying due to the pollution that has been caused by trash from both households and industries. According to Syaputri (2017) and Irawanto (2024), the water quality deteriorates as the river moves closer to its downstream end. As a result, only a small number of aquatic species are able to survive. The species composition of the catch of capture fisheries can be influenced by factors such as the topography of the river, the type of soil, and the features of the watershed (Maulana et al. 2017; Zhao et al. 2019). Using the different types of fishing gear and sampling sites that are located along the Brantas River in the Malang Raya Region, the purpose of this study is to determine the species of fish that were captured.

MATERIALS AND METHODS

Study area

This study was carried out at the Brantas River, East Java, Indonesia, between January and May 2024. The upstream region of the Brantas River encompasses three administrative areas: Batu City, Malang City, and Malang District. Two study areas were selected from each of the first two areas, while three areas were chosen from Malang District due to its relatively larger geographic coverage compared to the other two regions. The study area was carried out in seven segmentations upstream areas of the Brantas River, including station: 1. Tulungrejo (Bumiaji, Batu City), 2. Torongrejo (Junrejo, Batu City), 3. Mulyoagung (Dau, Malang District), 4. Dinoyo (Lowokwaru, Malang City), 5. Sawojajar (Kedungkandang, Malang City), 6. Turus Ternyang (Sumberpucung, Malang District), and 7. Karangkates Reservoir. Figure 1 and Table 1 depict a detailed description of the sampling station. Because of their differing geography, these seven locations represent three distinct upstream river habitats.

Table 1. Description of sampling area

Area	Coordinate	Administrative area	Area description
Tulungrejo	-7.8050 S, 112.5280 E	(Bumiaji, Batu City)	The river, 500 m from settlements, is 4-5 m wide, 15 cm deep, with 50 cm/s flow, stony-sandy bottom, shaded by pine, clear, 17°C, alkaline, 18-20°C, DO 6.6-7.03 mg/L.
Torongrejo	-7.9170 S, 112.5650 E	(Junrejo, Batu City)	Located near settlements (<100 m), the 3-4 m wide river is 35 cm deep, with 50 cm/s current, rocky-gravel bottom, clear alkaline water, 18-20°C, DO: 6.6-7.03 mg/L.
Mulyoagung	-7.9420 S, 112.5650 E	(Dau, Malang District)	Located near the main Malang-Batu route, the 6-8 m wide river has 25 cm depth, 50 cm/s current speed, sandy bottom, murky water, and alkaline conditions, 25-29°C, 6.4-6.6 mg/L DO.
Dinoyo	-7.9560 S, 112.5980 E	(Lowokwaru, Malang City)	In Malang City, the river is 8-10 m wide, 35 cm deep, with a 50 cm/s current, murky water, 25-29°C, basic pH, 6.4-6.6 mg/L DO, used for sanitation.
Sawojajar	-7.9770 S, 112.6580 E	(Kedungkandang, Malang City)	In Malang City, the river is 8-10 m wide, 35 cm deep, with 50 cm/s current; surrounded by housing, unshaded, gravel bed, turbid, 25-29°C, DO 6.2-6.6 mg/L, basic pH, used for bathing and washing.
Turus Ternyang	-8.1480 S, 112.4540 E	(Sumberpucung, Malang District)	Riverbanks near settlements with green water, no shade, 1-12 m depth, 24-28°C temperature, average dissolved oxygen 4.9-5.1 mg/L, and alkaline pH.
Karangkates Reservoir	-8.1480 S, 112.4540 E	(Sumberpucung, Malang District)	The plantation area, distant from settlements, has green, stagnant water with depths of 1-12 m, 23-28°C temperature, 5.0-5.1 mg/L dissolved oxygen, and alkaline pH.

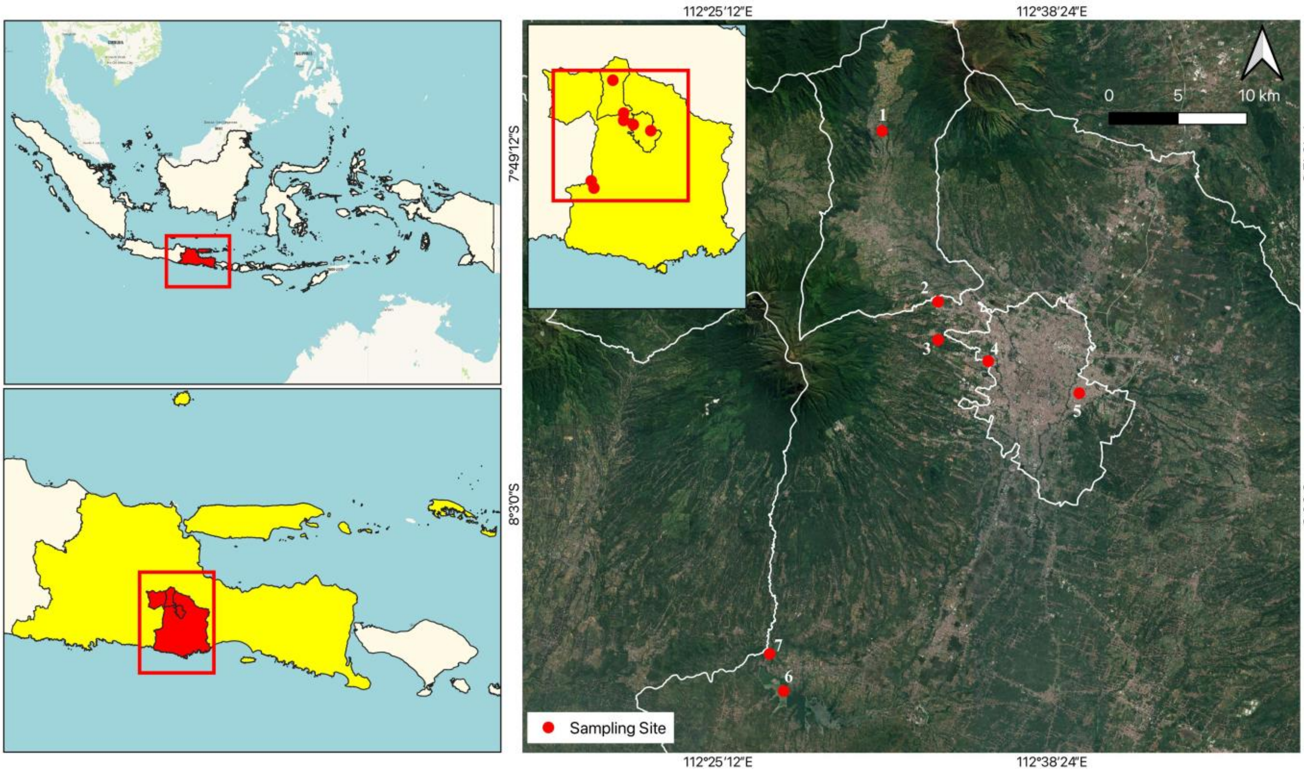

Figure 1. Seven key collection sites in the Brantas River's upstream region, East Java, Indonesia: 1. Tulungrejo, 2. Torongrejo, 3. Mulyoagung, 4. Dinoyo, 5. Sawojajar, 6. Turus Ternyang, 7. Karangkates Reservoir

Data collection

The data collection utilized fishing gear typically employed by local fishers in daily operations. The four most commonly used gear types were handlines/fishing rods, cast nets, scoop nets, and fish traps. Multiple specimens were collected from local fishermen residing in the vicinity of the sampling area. Samples were identified using the identification keys established by Murdy et al. (1994), Kottelat and Whitten (1996) and Kottelat (2013). The validity, taxonomic status, and current classification of each species were examined by Fricke and Eschmeyer (2022a, b). The specimens were maintained in a 10% formalin solution. Samples were systematically collected across fishing gears and sampling sites to ensure representative coverage. The data collected included both fish and non-fish organisms, and all individuals were enumerated and taxonomically classified to the species level.

Data analysis

Descriptive analysis provides a comprehensive summary and explanation of the characteristics of data, including detailed descriptions of fish species and the composition of catches in relation to river habitats and fishing efforts. Statistical analysis involves employing statistical techniques to evaluate hypotheses and derive conclusions. Once the assumptions of normality and homogeneity were met, the data were subsequently analyzed using parametric statistical tests. The following statistical tests are included in this process: Chi-Square and Analysis of Variance (ANOVA) (Fowler et al. 1998), The averages of various groups were analyzed to determine notable differences in species composition.

RESULTS AND DISCUSSION

Catch species

A study carried out in the Malang Raya Region along the Brantas River revealed a diverse array of 27 fish species (Figure 2), encompassing both local endemic varieties and those introduced from different ecosystems as shown in Table 2. In 1916, during the Dutch colonial era in Indonesia, more than 90 species of fish were discovered in the Brantas River (Weber and de Beaufort 1962), highlighting the ecological diversity and the ability of certain species to survive in changing river environments.

The findings align with earlier investigations carried out at four locations along the Brantas River: Batu, Malang, Kediri, and Sidoarjo (Ahmad et al. 2021; Hasan et al. 2022; Rohman et al. 2022). The variations occur due to the fact that the sampling sites in this study are confined to the upstream area of the Brantas River, where not only fish species were documented but also other fauna including prawns, snakes, turtles, and water monitors.

Figure 2. Picture of 27 samples collected from upstream of Brantas River, East Java, Indonesia. A. *Barbonymus gonionotus*, B. *Barbonymus beleroides*, C. *Mystacoleucus obtusirostris*, D. *Hampala macrolepidota*, E. *Tor tambra*, F. *Barbodes binotatus*, G. *Rasbora argyrotaenia*, H. *Cyclocheilichthys apogon*, I. *Clarias batrachus*, J. *Mystus nigriceps*, K. *Nemacheilus fasciatus*, L. *Channa limbata*, M. *Macrognathus aculeatus*, N. *Anabas testudineus*, O. *Oxyeleotris marmorata*, P. *Gambusia affinis*, Q. *Glyptothorax platypogon*, R. *Oreochromis niloticus* (orange), S. *Amphilophus labiatus*, T. *Andinoacara rivulatus*, U. *Parachromis managuensis*, V. *Oreochromis niloticus* (black), W. *Cherax quadricarinatus*, X. *Macrobrachium* spp., Y. *Acrochordus granulatus*, Z. *Amyda cartilaginea*, AA. *Varanus salvator*

Composition of catch results based on fishing area

The study results regarding the composition of the catch, conducted over a six-hour fishing period at the station a day, yielded data on the quantity of each species present. The catch composition was the highest at the fishing station located in the Brantas Turus Ternyang Sumberpucung River Basin, Malang District, with a total of 230 individuals and an overall fish weight of 4506.7 grams. The second largest capture occurred in the Karangkates Area, Sumberpucung, Malang District, totaling 186 biotas with an aggregate fish weight of 7467.1 grams. The third largest capture occurred in the Sawojajar Area, Kedungkandang, Malang City, totaling 106 specimens with an overall fish weight of 2440.7 grams. The variation in the number of catches may be attributed to disparities in the locations of fishing grounds (Ginting et al. 2013). Areas with typical current velocities can influence the catch. Elevated current velocities will influence the swimming capabilities of fish, as they may be swept away by the current when its speed surpasses that of the fish's swimming ability (Kandi et al. 2016). Station 1 (Tulungrejo, Batu): This location, noted for its closeness to the sand mining area, exhibits low species diversity, with only five species identified over six hours of sampling. The primary species present in this area is the Cakul Wader (*Barbodes binotatus*), accounting for 41.2% of the overall catch. This suggests a specific ecological area where various species have adjusted to particular environmental challenges. Stations 2 (Torongrejo, Batu) to 7 (Karangkates, Malang) exhibit distinct catch compositions, highlighting the variability of river ecological conditions. For instance, Station 6 in Turus Ternyang is recognized for its notable catch of prawns (*Macrobrachium* spp.), suggesting the existence of a particular ecological habitat or reduced pollution levels that foster enhanced aquatic biodiversity.

Table 2 shows the distribution of fish species and aquatic biota across seven research sites (Site 1 to Site 7). *Cyclocheilichthys apogon* is the most dominant species, especially at Site 4 with 53 individuals, and is present at almost all sites except Site 7. *Barbodes binotatus* is distributed across several sites, with the highest number at Site 6 (31 individuals). Some species have limited distribution, such as *Amphilophus labiatus*, which is only found at Site 7 with a large number of individuals (72). Species like *Gambusia affinis* is found at site 2 and 6 while *Mystacoleucus obtusirostris* at Site 4, 5, and 6. In contrast, species like *Glyptothorax platypogon* and *Acrochordus granulatus* are found only at Site 2 in small numbers. Overall, the variation in species distribution across sites indicates that specific environmental factors influence species abundance. Site 6 and Site 7 have higher species diversity compared to other sites, indicating that these locations provide more favorable habitats for various species.

Table 2. Species composition of catch based on fishing area

Species	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**Site 5**	**Site 6**	**Site 7**
Acrochordus granulatus / Acrochordid snakes	0	1	0	0	0	0	0
Amphilophus labiatus / Red Devil cichlids	0	0	0	0	0	27	72
Amyda cartilaginea / Softshell turtle	0	0	0	0	0	1	0
Anabas testudineus / Climbing perch	0	0	0	0	0	9	0
Andinoacara rivulatus /Green teror	0	0	0	0	0	0	6
Barbodes binotatus / Spotted barb	12	20	0	0	0	31	29
Barbonymus beleroides / Silver barb	0	0	0	0	5	23	0
Barbonymus gonionotus / Silver barb	0	0	1	0	10	2	6
Channa limbata / Dwarf Snakehead	4	5	0	6	0	3	0
Cherax quadricarinatus / Crayfish	0	0	0	0	0	2	0
Clarias batrachus / Walking catfish	1	2	4	5	0	7	0
Cyclocheilichthys apogon / Beardless barb	14	10	8	53	30	18	0
Gambusia affinis / Mosquitofish	0	8	0	0	0	18	0
Glyptothorax platypogon / Hillstream catfish	0	4	0	0	0	0	0
Hampala macrolepidota / Hampala barb	0	1	2	0	3	0	0
Macrobrachium spp. / Shrimp	0	0	0	0	0	49	0
Macrognathus aculeatus / Lesser spiny eel	0	0	0	0	0	2	0
Mystacoleucus obtusirostris / Yellow finned barb	0	0	0	20	46	5	0
Mystus nigriceps / Two-spot catfish	0	0	0	0	2	5	0
Nemacheilus fasciatus / Loach fish	0	0	0	19	7	23	0
Oreochromis niloticus (black) / Nile tilapia	0	0	0	0	0	0	27
O. niloticus (orange) / Nile tilapia	0	0	5	0	0	0	17
Oxyeleotris marmorata / Marble goby	0	0	0	0	0	0	8
Parachromis managuensis / Jaguar cichlids	0	0	0	0	0	0	16
Rasbora argyrotaenia / Silver rasbora	0	0	0	0	2	5	5
Tor tambra / Mahseer	3	1	0	0	0	0	0
Varanus salvator / Water monitors	0	0	0	0	1	0	0

Note: Site 1: Tulungrejo, Site 2: Torongrejo, Site 3: Mulyoagung, Site 4: Dinoyo, Site 5: Sawojajar, Site 6: Turus Ternyang, Site 7: Karangkates

The Chi-Square analysis resulted in a calculated value of 9593.5. In contrast, the table value, based on the degrees of freedom calculated as db = (7−1) × (27−1) =156, is 186. The calculated Chi-Square value exceeds the table value, suggesting a significant difference in species composition of the catch across various fishing stations or areas. The outcomes from the two-way ANOVA analysis indicate an F-calculated value of 4.288, compared to an F-table value of 1.493. The findings indicate a notable impact of species diversity in the catch at the fishing stations within the Brantas River Basin, located in the Malang Raya Region (Table 3). Additional Least Significant Differences (LSD) tests were performed to determine the significant differences in species composition among the various fishing stations in the catch.

The LSD test presented indicates variations among fishing stations concerning the species captured in the Brantas River Basin, Malang. Analyzing 27 species catch data across four replications, it was found that Stations 6 and 7 (Turus Ternyang, Sumberpucung, and Karangkates Reservoir) exhibited higher catch rates than other stations.

Composition of catch results based on fishing gear

The study results regarding the composition of the catch, derived from fishing gear used over a duration of six hours, yielded data on the quantity of each species. According to Table 4, the catch composition with the highest quantity was obtained using fishing gear numbered 369, resulting in a total weight of 13,154.1 grams. The second largest was caught using a cast net of 174 with a total weight of 3,532.8 grams. The third largest specimen was captured utilizing trap fishing gear, comprising 151 individuals with a cumulative weight of 2,363.4 grams. The species of fish that are captured is influenced by the fishing gear employed and the specific location designated for fishing activities (Pratiwi et al. 2015). This aligns with the findings of Maulana et al. (2017), which indicate that, aside from adverse weather conditions, additional factors influencing the catch consist of river catchment areas and the types of fishing gear employed.

The table shows the number of species caught using different types of fishing gear, namely Rod, Cast Net, Scoop, and Trap. The Rod is the most frequently used gear, particularly for species such as *A. labiatus* (61 individuals), *M. obtusirostris* (60 individuals), and *B. binotatus* (44 individuals). The Cast Net is also widely used, especially to catch *C. apogon* (65 individuals) and *A. labiatus* (31 individuals). Meanwhile, the Scoop is rarely used, with the highest number of catches being *G. affinis* (26 individuals). The Trap is mainly used for species like *Nemacheilus fasciatus* (33 individuals) and *Macrobrachium* spp. (49 individuals). Several species, such as *G. platypogon*, *Cherax quadricarinatus*, and others, are caught only with specific fishing gear. The data indicate that the type of fishing gear affects the species and quantity of fish caught, with certain gear being more effective in catching specific species compared to others. The findings from the Chi-Square analysis indicate a Chi-Square value of 2.139. In contrast, the critical value for Chi-Square, calculated with degrees of freedom df = (4-1)*(27-1) = 78, is 100. The findings suggest that the species composition of catches varies according to the fishing gear employed.

The findings from the two-way ANOVA analysis indicate an F-value of 1.749, while the F-critical value calculated using Microsoft Excel formulas is 1.678 (Table 5). Consequently, it can be inferred that differences in fishing gear and the species caught have a substantial impact on the composition of catch species in the Brantas River Basin, Malang Raya Region. Additional Least Significant Differences (LSD) testing is required to ascertain the significant differences in the effects of various fishing gears on the composition of catch species. The findings of the analysis are detailed in Table 6. Based on the LSD test analyzing the differences in fishing gear types on the number of catch species in the Brantas River Basin, Malang, using data from four types of fishing gear, 27 catch species, the total number of catch species, and four repetitions, it was found that fishing rod has a different species composition compared to cast nets, traps, and push nets.

Discussion

The observed differences can be linked to the distinct biotic conditions present at each station, with Stations 6 and 7 showing relatively low levels of pollution, as evidenced by the presence of aquatic plants (Islamy et al. 2024). The water quality of the Brantas River exhibits variation across its various regions (Buwono et al. 2021; Irawanto 2024), influencing the diversity of species present in the river's biota, such as fish, benthos, and plankton groups (Sihombing 2017; Zhao et al. 2019; Aida et al. 2022). The water quality along the river is significantly influenced by human activities (anthropogenic factors) (Feisal et al. 2023).

Results of other study suggested that the pollution level in the Brantas River fluctuates yearly, meanwhile, the degree of contamination increased from upstream to downstream (Lusiana et al. 2023). In general, water quality of the upstream Brantas River is affected by industrials and domestics discharge with inappropriate wastewater management. The pollution status is categorized as light to moderate based on Total Suspended Solids, Total Dissolved Solids, pH, DO, and hexavalent chromium parameters (Roosmini et al. 2018) and epiphytic microalgae (periphyton) indicator (Arsad et al. 2021).

Table 3. Two-Way ANOVA test on catch composition based on fishing stations

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected model	4645.923[a]	188	24.712	5.143	1
Intercept	706.827	1	706.827	147.112	.001
Species_Station	1086.923	26	41.805	8.701	.001
Station	345.034	6	57.506	11.969	.001
Species_Station*Station	3213.966	156	20.602	4.288	.001
Error	2724.250	567	4.805		
Total	8077.000	756			
Corrected total	7370.173	755			

Table 4. Composition of catch results based on fishing gear

Species	Fishing rod	Cast net	Scoop	Trap
Acrochordus granulatus	0	0	0	1
Amphilophus labiatus	61	31	0	7
Amyda cartilaginea	0	0	0	1
Anabas testudineus	6	3	0	0
Andinoacara rivulatus	2	4	0	0
Barbodes binotatus	44	28	0	20
Barbonymus beleroides	24	4	0	0
Barbonymus gonionotus	14	5	0	0
Channa limbata	10	0	5	3
Cherax quadricarinatus	0	0	0	2
Clarias batrachus	12	0	2	5
Cyclocheilichthys apogon	39	65	0	29
Gambusia affinis	0	0	26	0
Glyptothorax platypogon	0	0	4	0
Hampala macrolepidota	6	0	0	0
Macrobrachium spp.	0	0	0	49
Macrognathus aculeatus	2	0	0	0
Mystacoleucus obtusirostris	60	11	0	0
Mystus nigriceps	7	0	0	0
Nemacheilus fasciatus	16	0	0	33
Oreochromis niloticus (black)	18	9	0	0
Oreochromis niloticus (orange)	14	8	0	0
Oxyeleotris marmorata	7	1	0	0
Parachromis managuensis	13	3	0	0
Rasbora argyrotaenia	10	2	0	0
Tor tambra	4	0	0	0
Varanus salvator	0	0	0	1

Table 5. Two-Way ANOVA test on catch composition based on fishing gear

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected model	4992.574[a]	107	46.660	2.206	1
Intercept	1253.926	1	1253.926	59.297	.001
Fish_Gear	545.352	3	181.784	8.596	.001
Species	1891.699	26	72.758	3.441	.001
Fish_Gear*Species	2555.523	78	32.763	1.749	.005
Error	6851.500	324	21.147		
Total	13098.000	432			
Corrected total	11844.074	431			

Table 6. Least Significant Differences (LSD) tests in Species composition of catch related to fishing gear

Fish gear	Average	Notation
Push net	1	a
Trap	6	a
Cash net	6	a
Handline/Rod	14	b

The species of fish captured are influenced by the fishing equipment employed and the specific area in which it is utilized (Pratiwi et al. 2015). Several fish species identified in this study are likely to be categorized as invasive species, referring to those previously reported in the Bengawan Solo River, including striped snakehead (*Channa limbata*), red devil fish (*A. labiatus*), and tilapia (*Oreochromis niloticus*) (Haqqi et al. 2024). Understanding the relationship between wild fisheries and aquaculture is crucial for fostering sustainable and fair aquaculture growth (Fiorella 2022). Fishing gear is a crucial element within capture fisheries systems. The diversity in types and scales of fisheries and fishing gear utilized in public and inland waters is extensive (Ssempijja et al. 2024). Nonetheless, small-scale fisheries are prevalent in public and inland waters (Funge-Smith 2018). Inland fisheries are crucial for many socially, economically, and nutritionally vulnerable groups of people around the world. However, challenges in managing inland fisheries hinder a full understanding of their actual contributions (Funge-Smith and Bennett 2019). The spatial and temporal distribution of ecological systems in capture fisheries within inland and public waters requires scientific information to effectively manage capture fisheries in these regions (Utomo et al. 2024). In this context, a thorough examination of the Brantas River, specifically from its upstream to downstream areas, is essential. The species of fish captured are influenced by the type of fishing gear employed and the specific region in which this gear is utilized (Pratiwi et al. 2015). This aligns with the findings of Maulana et al. (2017), which indicated that both the fishing area and the type of fishing gear employed influence the species that are caught. The design of fishing gear is tailored to the specific target species. The habitat in which the target fish species reside will significantly impact their characteristics (Holubová et al. 2020). Consequently, various fishing gear is likely to function in distinct river regions, leading to relatively diverse types of catches.

The fish collected and identified ninety-three years previously encompassed regions from upstream to downstream, including lotic, limnetic, lentic streams, river estuaries, and even shallow coastal zones at the river mouth (Weber and de Beaufort 1962). Many specific estuarine, coastal, and brackish water fish species, such as those from the Clupeid, Ariidae, and Gobiid families, were identified and found in the Surabaya and Sidoarjo areas at that time. These fish are now rarely found in those regions, seemingly due to changes in the river's function and deteriorating water quality. The current ecological condition of the Brantas River, as indicated by fish species diversity, is extremely concerning compared to a century ago.

This study reveals a decline in the ecological condition of the Brantas River, marked by deteriorating water quality, reduced native fish diversity, and the spread of invasive species. Anthropogenic pressures, combined with the influence of fishing gear and site selection, have shaped the current biodiversity pattern. To prevent further degradation, continuous water quality monitoring, stricter regulation of industrial and domestic waste, and the adoption of sustainable fishing practices are essential. These measures will help protect aquatic biodiversity and secure the long-term sustainability of inland fisheries in the Brantas River.

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