Original Research Article

Biodiversity in the Cipeles River, Sumedang Regency, West Java Province, Indonesia

ABSTRACT

This study aims to determine the diversity of fish species and to analyze the condition of water quality in the Cipeles River, Summedang Regency, West Java Province, Indonesia. The research was conducted **for one month** ~~**from September 2020 to October 2020**~~. The research method used was census with purposive sampling technique. The sampling period is four times a week. Analysis of the data used in this study is the composition of fish species, relative abundance, diversity, and water quality with quantitative descriptive data analysis. The results showed that the fish caught were baung (*Mystus cavasius*), singaringan (*Mystus singaringan*), tilapia (*Oreochromis niloticus*), hampala (*Hampala macrolepidota*), paray (*Rasbora aprotaenia*), genggehek (*Mystacoleucus marginatus*), lalawak (*Barbonymus balleroides*), and and julung-julung (*Dermogenys pusilla*). The fish diversity index value was categorized as low with the highest relative abundance of genggehek fish (*Mystacoleucus marginatus*) at stations 1 and 3, and lalawak fish (*Barbonymus balleroides*) at station 2. The native fish of the Cipeles River that was able to adapt from 2001 until now is *M. marginatus*.

Keywords: Cipeles river; low; relative abundance; genggehek
Fish diversity Index Value

1. INTRODUCTION

One of the biological diversity that makes up the river ecosystem is fish.

Add reference The diversity of fish in all of Indonesia's freshwaters is very large, it is estimated that there are 4000 – 6000 fish species [1]. Types of freshwater fish in Java when compared to other islands in the Sunda Shelf area have a low diversity of fish species, namely 132 species [2]. the Diversity of fish species must be maintained as biological natural resources for breeding in the future.

The Cipeles River is a tributary that flows into the Cimanuk River, precisely in the Sumedang Regency segment. The main functions of the Cipeles River in supporting community activities include bathing and washing toilets (MCK), irrigation facilities for irrigation of rice fields, many people fishing, and utilizing land activities on river borders for plantations, rice fields, and industrial activities. This activity is suspected to have resulted in waste being dumped into the river which resulted in habitat destruction and a decrease in the quality of the Cipeles River. Damage and decline in the quality

of fish habitats increased exploitation of fish, and the transfer of functions of water bodies to other uses are factors that cause freshwater communities to experience pressure. [2].

Based on research in the last 12 years, namely Hermawan (2010) [3] stated that four species of fish caught in Leuwi, Cipeles River, including genggehek (*Mystacoleucus marginatus* Valenciennes, 1842), tagih (*Hemibagrus nemurus* Valenciennes, 1840), seseren (*Cyclocheilichthys sp* Valenciennes, 1842), and catfish (*Claris garipenus* Burchell, 1822). Meanwhile, Yustiati (2019) [4] conducted research on the Cipeles River before and after weir rengrang in the rainy season, 5 families of fish were caught consisting of 13 species including the cyprinidae family of seven species, namely genggehek (*M. marginatus* Valenciennes, 1842), paray (*Rasbora sp* Bleeker, 1854), seren *(Diplocheilichthys pleurotaenia* Bleeker, 1855), lalawak *(Barbonimus balleroides* Valenciennes, 1842), tawes *(Barbonimus gonionotus* Bleeker, 1849), bereum panon *(Barbode orphoides* Valenciennes, 1842) and hampala *(Hampala macrolepidota* Kuhl & Van hasselt, 1823), family bagridae is senggal *(Mystus gulio* Hamilton, 1822), keting *(Mystus nigriceps* Valenciennes, 1846), and baung (*Mystus cavasius* Hamilton, 1822), famili siluridae is gabel *(Ompok bimaculatus* Bloch, 1794), famili channidae is gabus *(Channa striata* Bloch, 1793), serta famili nemacheilidae is jeler *(Nemacheilus chrysolaimos* Valenciennes, 1846).

The development of fish diversity in the Cipeles River currently has many fish species that are experiencing population decline, disappearance, and even extinction. The causes of fish extinction in large areas include overexploitation of species (4%), introduction of exotic species (30%), and habitat destruction or loss (35%) [5]. Seeing these conditions, the diversity of fish in the Cipeles River has decreased.

Therefore, research is needed to determine and analyze the diversity of fish species in the Cipeles River, Summedang Regency. The results of the study can provide information about fish diversity in the Cipeles River as a basis for initial considerations for conservation policies and fisheries resource management**.**

2. MATERIAL AND METHODS

2.1 Research place

The research was conducted from September 2020 to October 2020 in the waters of the Cipeles River, Sumedang Regency, West Java Province, Indonesia.

2.2 Materials

The materials used in this study were fish caught in the Cipeles River, ice cubes for preserving fish samples, formalin for preserving fish samples, aquades for dilution of formalin, and samples of Cipeles River water.

2.3 Tools

This study uses 3 castnets / kecrik from gill nets with different mesh sizes, namely 0.59 inch, 2 inch, 3 inch, to catch fish in the Cipeles River, one Coolbox brand Marina Cooler 35S as a container for transporting caught fish samples with a volume of 33 liters, 2 millimeter blocks as a container for identification of fish samples. Sample bottle measuring 1.5 L as a container for water samples to be analyzed in the laboratory. DO meter brand Lutron type DO-5510 to measure dissolved oxygen content with an accuracy of 0.1 mgL^{-1}, pH meter brand Lutron type PH-207 with an accuracy of 0.1 to measure the acidity of waters, and Secchi disk, used to measure water brightness.

2.4 Research method

The research method used is a census with a purposive sampling technique. The study was conducted at three stations with four sampling times as a replication. The sampling period is four times a week. The determination of the research station is based on when conducting a preliminary survey, namely the determination of the station with consideration of easy access to the location and the existence of fishing activities that are often encountered.

2.5 Procedure

The research implementation consisted of preliminary research and main research. Preliminary research was conducted to determine the research station. The main research consists of in situ and ex situ research. In situ research is the measurement of physical and chemical water quality consisting of depth, temperature, pH, and DO. Ex-situ research, namely identification of fish species and measurement of chemical water quality in the form of nitrite and total ammonia (NH3-N) were analyzed at the Laboratory of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences, Padjadjaran University.

2.6 Observations Parameters

2.6.1 Fish Type Identification

Identification of fish species was carried out at the Laboratory of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences, Padjadjaran University which included species identification and was supported by analyzing descriptive morphometric and meristic characteristics with the help of the identification manual Kotellat *et al.* 1993 [6] and the book Species of West Java Freshwater Fish and their Protected Status Herawati *et al.* (2017) [7].

2.6.2 Relative Abudance

Determination of the relative abundance value of the population refers to [8] by using the following formula:

$$RA = \frac{\mathrm{ni}}{\mathrm{N}}\ x\ 100\%$$

Index:

RA = Relative Abundance

ni = Number of Individuals of Each Type

N = Number of Individuals of All

2.6.3 Diversity Index

Fish diversity is calculated using the Shannon-Weinner Diversity Index according to Odum (1993) [9]:

$$H' = \sum_{i=1}^{s} \text{pi In p}i$$

Index:

H' = Diversity index of Shannon – Weinner

pi = Comparison of the number of *i* type individuals with overall type

Ln= Nature logarithm

I = Total number of *i* type individuals

s = Number of all types

The diversity index ranges from 0 – 1 with categories as follows:

H' ≤ 1 = Low diversity

1 ≤ H' ≤ 3 = Medium diversity

H' ≥ 3 = High diversity.

2.6.4 Water Quality

Measurement of water quality parameters was carried out ex-situ and in-situ. In situ observations included depth, temperature, pH, and DO and ex situ observations included nitrite and total ammonia (NH3-N).

2.7 Data Analysis

All data generated and made into tables to facilitate the calculation process and analyzed quantitatively descriptively by providing a systematic description of the types/species at stations I, II, and III as well as water quality data analysis in a quantitative descriptive manner, namely describing the results of water quality data with quality standards. PP No. 22 of 2021[10].

3. RESULT AND DISCUSSION

3.1 Type Composition and Distribution

The diversity of fish in the Cipeles River during the study was obtained as many as 566 individuals belonging to eight species and four families. The composition of fish species at station I was found to be 202 individuals consisting of five species and grouped into three families, while at station II, 166 individuals were found and grouped into three families and station III was obtained as many as 198 individuals and grouped into four families. Species caught in the Cipeles River are classified into four families, namely bagridae, cichlidae, cyprinidae, and zenarchopteridae. (Table 1)

Tabel 1. Types of fish caught during research in the cipeles sungai river

Family (4)	Local Name (8)	Scientific Name	Based on Origin		Based on the IUCN Redlist		Station		
			A	I	DD	LC	I	II	III
Bagridae (25%)	Baung	*Mystus cavasius* Hamilton 1822	√			√	4	6	2

Cichlidae (12,5%)	Singaringan	*Mystus singaringan* Bleeker, 1846	√			√			6
	Nila	*Oreochromis niloticus* Linnaeus, 1758		√		√	8	2	4
	Genggehek	*Mystacoleucus marginatus* Valenciennes, 1842	√			√	144	26	154
Cyprinidae (50%)	Lalawak, Balar, Brek	*Barbonymus balleroides* Valenciennes, in Cuvier & Valenciennes, 1842	√			√	42	120	18
	Hampala	*Hampala macrolepidota* Kuhl & van Hasselt, 1823	√			√	4		
	Paray	*Rasbora aprotaenia* Hubbs & Brittan, in Brittan, 1954	√			√		12	12
Zenarchopteridae (12,5%)	Julung-julung	*Dermogenys pusilla* Kuhl Kuhl & van Hasselt, in van Hasselt, 1823	√		√				2
Percentage (%)			87,5	12,5	12,5	87,5	202	166	198

Based on the types of fish found in the Cipeles River, the most caught types of fish came from the cyprinidae family. Cyprinidae is a group of freshwater fish that dominate the number of species in the family. Susilawati (2001) [11], Sjafei et al. (2001) [12], Hermawan [3], Yustiati [4] and 2020 respectively stated that the cyprinidae family dominated the types of species caught in their research. The number of the Cyprinidae family as the largest group in the waters is evidence that this family is a true freshwater fishType composition and distribution [13]. The caught

species belonging to the cyprinidae family are *M. marginatus*, *B. balleroides*, *H. macrolepidota*, and *R. aprotaenia*.

Bagridae is the second largest family found during the study. The bagridae species found were *M. cavasius, M. singaringan*. Families cichlidae and zenarchopteridae each found one species. The results of the analysis of native fish in the Cipeles River found six species of fish including *M. marginatus*, *B. balleroides*, *H. macrolepidota*, *R. aprotaenia*, *M. cavasius*, *M. singaringan*, and *D. pusilla*. One species was introduced, namely *O. niloticus*. The presence of introduced fish can push the native fish population so that it endangers native or endemic fish [14].

Based on the IUCN red list status, seven species (87.5%) of fish are of low risk (Least Concern) status, meaning that the seven species are still commonly found in nature, namely *B. balleroides, M. marginatus,* and *O. niloticus*, but in table 2 species which are found in small quantities such as *H. macrolepidota, R. aprotaenia, M. cavasius,* and *M. singaringan*, it is necessary to study the conservation status. Meanwhile, one species (12.5%) has a data deficient status, namely *D. pusilla*. Conservation activities need to be carried out to find out the causes of the decline of native river species that cause extinction so that species diversity in the Cipeles River can be restored.

3.2 Relative Abundance and Diversity Index

The relative abundance of fish in the Cipeles River was found that *M. marginatus* was the most common type of fish found, a station I with a relative abundance of 71.29%, and station III of 77.8%, while at station II the most common fish found was *B. balleroides* with a relative abundance of 72.32% (Table 2). In addition, *M. cavasius* and *O. niloticus* fish were found at all research stations with relatively low abundance, namely *M. cavasius* relative abundance at station I of 1.98%, station II of 3.6%, and station III of 1.0 %, while the relative abundance of *O. niloticus* at station I was 3.96%, station II was 1.2%, and station III was 2.0%. The 4 fish were found at all research stations which showed that these fish had high adaptability to the environment and had a wide distribution. The distribution of fish as an ichthyogeographic term based on or viewed from the point of view of location (geographical location) is called geographic distribution [15].

Meanwhile, R. aprotaenia species were found at station II with a relative abundance of 7.2% and station III with a relative abundance of 6.1%. In contrast to M. singaringan, H. macrolepidota, and D. pusilla could only be found at one research station with a very low relative abundance, namely M. singaringan at station III with a relative abundance of 3%, H. macrolepidota was found at station I with an abundance of relative abundance of 1.98%, and D. pusilla was found at station III with a relative abundance of 1%. Fish that can only be found at one or two research stations have a narrow

distribution and the ability to adapt to the environment is not high. Habitat preference is a factor that causes an abundance of species found in one location but not found in other locations [16].

Tabel 2. Relative abundance and diversity of fish in the cipeles river

No	Species	Station I			Station II			Station III		
		Total	RA (%)	H'	Total	RA (%)	H'	Total	RA (%)	H'
1	*Mystus cavasius*	4	1,98	0,85	6	3,6	0,89	2	1,0	0,86
2	*Mystus singaringan*	-	-		-	-		6	3,0	
3	*Mystacoleucus marginatus*	144	71,29		26	15,7		154	77,8	
4	*Barbonymus balleroides*	42	20,79		120	72,3		18	9,1	
5	*Hampala macrolepidota*	4	1,98		-	-				
6	*Rasbora aprotaenia*	-	-		12	7,2		12	6,1	
7	*Oreochromis niloticus*	8	3,96		2	1,2		4	2,0	
8	*Dermogenys pusilla*	-	-		-	-		2	1,0	
	Total	202			166			198		

The results of the analysis of the fish diversity index value in the Cipeles River at the three research stations showed the results in the same category. Referring to criterion [9], the diversity index value ranges from 0.85 < H' < 0.89 including the low criteria. Low diversity is indicated by the number of species caught as many as eight species. The number of species and the number of individual variations of each species are getting smaller, than aquatic ecosystem has a smaller level of fish diversity, and the number of fish species and individual variations of each species is getting bigger than the aquatic ecosystem has a greater level of fish diversity [17].

The diversity and abundance of fish in the Cipeles River are related to the characteristics of the habitat and conditions of the river. Based on observations at each research station that the interaction of residents and community activities around the watershed such as bathing, washing toilets (MCK), and throwing garbage or waste into the river can pollute the waters. It was found that the observation of garbage disposal at station II which was adjacent to the Rengrang Weir around the bridge was smelly and dirty and the number of people washing Toilets at station III. In addition, the depth of the research station is uneven, ranging from 2 - 4 m. The upstream area has a depth of 1-3 m with the number of

species of tang caught by as many as 202 individuals from three families, while station 2 is deeper (2-3 m) when compared to stations I and 3 because it is close to the Rengrang Weir and the number of species caught is 166 from 3 species, and the downstream area is shallower than stations I and II with the number of species caught as many as 198 individuals from four species. [18] states that the diversity of fish species in waters is influenced by depth. The deeper water is, the fewer organisms are found [19].

When compared to research [4] fish diversity in the Cipeles river before and after the Rengrang Weir with H' between 0.5 to 1.4 which means low to moderate diversity, namely stations I and II of 1.4464 and 1.0789 meaning that diversity is included in the medium category, while at III of 0.5448 means that diversity is included in the low category. Research by Yustiati *et al.* [4] shows that the diversity of fish in the upstream is lower in the downstream river, inversely proportional to the current observation, namely the diversity of the downstream is higher than the upstream of the Cipeles River. It is suspected that the influence of the Rengrang Weir can inhibit fish migration upstream to downstream of the Cipeles River and migration from the Cimanuk River.

3.3 Types of Fish in the Cipeles Sungai River

Several studies related to the diversity of freshwater fish species in the Cipeles River have been carried out by Susilawati [11], Sjafei [12], Hermawan [3], Yustiati [4] dan sekarang (2020). Overall, the fish identified by the 5 researchers were found to be 34 species from 11 families (Table 3).

Tabel 3. Types of fish found in the cipeles river

Family	Fish Name	Researcher				
		a	b	c	d	e
Cyprinidae	*Barbodes balleroides*		√		√	√
	Barbodes gonionotus		√		√	
	Barbodes orphoides				√	
	Hampala macrolepidota	√	√		√	√
	Mystacoleucus marginatus	√	√	√	√	√
	Puntius binotatus		√			
	Puntius orphoides		√			
	Crossocheilus sp		√			
	Cyclocheilichthys	√		√		
	Diplocheilichthys pleurotaenia				√	
	Rasbora argyrotaenia		√			
	Rasbora aprotaenia		√		√	√
	Rasbora lateristriata	√	√			
	Tor douronensis	√	√			

Cichlidae	*Oreochromis niloticus*		√			√
Anabantidae	*Trichogaster trichopterus*		√			
	Anabas testudineus		√			
Bagridae	*Mystus cavasius*		√		√	√
	Mystus singaringan					√
	Mystus gulio		√		√	
	Mystus nemurus		√			
	Mystus nigricep				√	
	Mystus micracanthus		√			
	Glyplothorax platypogon		√			
	Hemibagrus nemurus	√		√		
	Hamibagrus nemurus	√				
Clariidae	*Clarias batrachus*		√			
	Clarias garipenus			√		
Channidae	*Channa striata*				√	
Mastacembelidae	*Macrognathus maculate*	√				
Synbranchidae	*Monopterus albus*		√			
Siluridae	*Ompok bimaculatus*				√	
Nemacheilidae	*Nemacheilus chrysolaimos*				√	
Zenarchopteridae	*Dermogenys pusilla*					√
	Total	8	21	4	13	8

Notes: (a) Susilawati (2001), (b) Sjafei *et al.* (2001), (c) Hermawan (2010), (d) Yustiati *et al.* (2019), (e) Now (2020)

The most common species found in the Cipeles River is the research of Sjafei et al. (2001) [12] compared to other researchers, namely 21 species from five 5 families of freshwater fish. Based on the research of Susilawati [11], Sjafei [12], Hermawan [3], Yustiati [4] and (2020) all researchers found *M. marginatus* species, while *H. macroledolepidota* was only not found in the 2010 research year [3]. The species *B. balleroides, Rasbora aprotaenia, M. cavasius* were discovered by Sjafei [12], Yustiati [4] and now (2020). *T. douronensis and R. lateristriata* were only found by Susilawati [11] and Sjafei [12]. *Cyclocheilichthys* and *H. nemurus* were discovered by Susilawati [11] and Hermawan [3]. *B. gonionotus and M. gulio* were found by Sjafei [12] and Yustiati [4]. Meanwhile, *D. pusilla, N. chrysolaimos, M. albus, O. bimaculatus, M. maculate, C. batrachus, C. Striata, C. garipinus, H. mestirus, G. paltypogon, M. micracanthus, M. Nemurus , M. nigricep, M. singaringan, A. testudineus, T. trichopterus, D. pleurotaenia, R. argyrotaenia, P. binotatus, P. orphoides, Crossocheilus sp,* and *B. orphoides* were found in only one researcher (Table 3). The original fish of the Cipeles River found were native to Indonesia, while the species *O.*

niloticus found by Sjafei [12] and now (2020) is an introduced fish. The presence of introduced fish in inland public waters has the potential to disrupt the structure of the native fish community [20].

Fish that can adapt in the Cipeles River are genggehek fish because this fish was found by all researchers and was also found in 2020. Meanwhile, several types of fish native to the Cipeles River which were only found by several researchers showed that there was a change in the habitat and conditions of the Cipeles River which caused fish not to be found. , lost or even extinct. Sjafei [12] stated that the condition of the Cipeles River was not good which indicated the presence of contaminants in the water characterized by the number of worms and moss on the river bank rocks, Hermawan [3] stated that the difference in the composition of the fish caught was thought to be caused by the landslide that occurred causing the Cipeles river to become cloudy. and the leuwi habitat (holes) are covered with sediments so that it interferes with the physiological processes and hiding places of fish, and Yustiati [4] stated that the construction of the Rengrang Weir by dredging the soil caused the transport of sediment along the river which affected the migration of fish for their survival and caused the extinction of species local.

3.4 Water Quality

The condition of the aquatic environment is a complex system and consists of various parameters that influence each other. Fish life is influenced by environmental factors consisting of depth, brightness, temperature, dissolved oxygen, dissolved carbon dioxide, pH, and nutrients [20]. Based on the results of the measurement of water parameters, the research shows that the water quality in the Cipeles River is still within normal limits for fish life according to standards based on government Regulation Number 22 Years 2021 (Tabel 4). Abiotic factors that have an important role for the life of aquatic organisms are temperature [21]. Temperature observations at station III obtained a lower temperature value than at stations I and II, this is presumably because when sampling was carried out in the morning which caused the surface of the water not to be directly exposed to sunlight. The Cipeles River is a typical tropical river namely the volume of river flow fluctuates during the rainy season which causes a sharp decline in water quality due to a large amount of rainfall that inundates the ground at the beginning of the rainy season [4].

Tabel 4. Cipeles river water quality

Parameter	Unit	Station			Standard PP No 22 Thn 2021
		1	2	3	
Temperature	^{o}C	29	29	25	Deviasi 3
Depth	m	2 - 4	2 - 3	1 - 2	-
pH	-	6	7,3	7	6 – 9

DO	-	7,7	6,61	7,03	4
Total Amonia (NH_3-N)	mgL^{-1}	0,001	0,002	0,002	0,2
Nitrit		0,031	0,030	0,028	0,06

What about hardness and salanity of the water ?

4. CONCLUSION

The diversity of fish found from 2001 to 2020 recorded 34 species from 11 families. The fish that can adapt is the genggehek fish because this fish was discovered by all researchers and was also found in 2020. The water quality of the Cipeles River is still within normal limits for fish life.

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