Global Scientific JOURNALS

GSJ: Volume 7, Issue 9, September 2019, Online: ISSN 2320-9186
www.globalscientificjournal.com

FISH DIVERSITY IN CIPELES RIVER AT RENGRANG WEIR IN SUMEDANG REGENCY, WEST JAVA, INDONESIA

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ABSTRACT

This study aimed to find out the diversity of fish in Cipeles river at Rengrang weir. This study was conducted from November 2018 until January 2019. This study was conducted with a purposive sampling method in three research stations with two samples as replications. The sampling period was carried out once a month. The research was conducted by in situ and ex situ method. The parameters observed include water quality, diversity index, dominance index, and equitability index. The data obtained were analyzed using a comparative descriptive method. The result of the research shows that there are 5 families of fish identified, consisting of 13 species. The fish diversity index at station I and station II indicate a moderate diversity with the value of $1.079 \leq H' \leq 1{,}447$ and low dominance with a value of $0.306 \leq C' \leq 0.4446$. Station III indicate low diversity with a value of $H' \leq 0.545$ and high dominance with a value of $C' \geq 0.768$, while station I, II and III indicate low equitability with value of $0{,}403 \leq E \leq 0{,}108$. Based on those three index values, it can be concluded that the fish community at station I is categorized as unstable and the fish community at stations II and III are categorized as depressed.

Keywords: *diversity index, dominance index, equitability index, Cipeles river, Rengrang weir, Sumedang.*

INTRODUCTION

Cipeles is a river that upper stream flows from the Sukasari district of Sumedang. As a sub-watershed of the Cimanuk River, this river passes Pasanggrahan, Padasuka, Sumedang city, Situraja, Darmaraja, Wado, Cadasngampar and Tomo. The main use of Cipeles River is as irigation cannals, toilet and washrooms. The problems come arose in Cipeles Rives in the late ten years as the water discharge decreasing (Hermawan, 2010)[4] and the increasing of sedimentation rate causes siltation in several stream (*leuwi*) along the Cipeles River. This river owns about 53 *leuwi* which can be found along the river itself. *Leuwi*, which is the part of the river body with slow-flowing characteristics, with relative depth in 1 metre down, on the edge of *leuwi* also overgrown with river vegetation like Bambu (*Bambusa sp*.), Kopo (*Hibiscus tiliaceus*), Bintaro (*Cerbera manghas*), Kelapa (*Cocos nucifera*), and Johar (*Cassia siamena*) shows that *leuwi* becomes the perfect area as habitat for foraging, spawning and upbringing several types of native river fish like Tagih (*Hemibagrus nemurus*), Lalawak (*Barbodes bramoides*), Hampal (*Hampala macrolepidota*), Genggehek (*Mystacoleucus marginatus*), and Tawes (*Barbodes gonionotus*) (Hermawan, 2010)[4].

Rengrang weir geographically lies on 6°48’58.87’’S and 108°01’27.27’’E. The planned construction of the Rengrang weir is administratively located between Cijambe–Malaka, on the border of Paseh district and Situraja district in Sumedang, West Java province. The impact of the construction can affect fish communities along the Cipeles river, before and after the Rengrang weir. Land dredging will also affect sediment to transport along the river and prevent fish from migrating properly for foraging, spawning, finding suitable areas for their survival and also delivering the extinction of local fish species.

Variety of living creature found in the Cipeles river which is a flowing tributary to Cimanuk river has been previously denounced by Sjafei *et al*. (2017)[16], stating that the water condition of Cipeles river is not in a good condition as moss and worms are mostly found on riverbank rocks that indicate contaminant in the water. The occurence of several ecological problems like the increasing of sedimentation rate and the decreasing of water discharge in the last ten years are suspected to bring the breakdown of the habitat which later will interfere the ecological condition and the diversity of fish resources along the Cipeles river. Thus, the update information is needed regarding to the fish ecobiological in Cipeles river related to the eating habit, growth, reproduction and fish adaptation pattern. The interaction between the people who live and work nearby with the fish resources will bring the fish exploitation in that area (Hermawan, 2010)[4]. Activities like fishing and the modification of the environment have an impact on abundance, productivity and community structure (Jaureguizar *et al*. 2008)[5]. The great fish extinction is caused by the damage or the loss of habitat (35%), exotic species introduction (30%) and over-exploitation (4%). Habitat damage is closely related to the increasing of population, the uncertainty over land allocation, economic policy in development, high poverty rate and industrial activities. The loss of our biological diversity brings the food supply, ecotourism chances, forest resources, biofarma and energry in threat (Reid and Miller, 1989)[14].

Considering the problems mentioned above, the research on the diversity of fish in Cipeles river before and after Rengrang weir is required. The result of this study provides the latest information as a preliminary consideration in fisheries conservation and resource management policies for the limited database concerning the variaties of fish in Cipeles river.

MATERIALS AND METHODS

Materials

The materials used for conducting this study are as follows; a) Catched fish from Cipeles river before and after the Rengrang weir, b) Ice cubes, to preserve water and fish samples, c) Aquades, to clean the instruments of water samples measurement, d) Water sample of Cipeles river

Research Method

This study used survey as its research method. The sampling location determined by purposive sampling and the sampling method determined by the researcher based on certain criteria. The sampling is conducted at three research stations with two samples as replications. The sampling period is carried out once a month. The determination of the research station is based on the results of the preliminary survey with consideration of accessibility and the existence of fishing activities.

Research Procedure

The research consists of preliminary and main research. The preliminary research is conducted to determine the research station. The main research consists of *in situ* and *ex situ* approaches. The *in situ* approach is to find out the composition of the catch. The measurement of water quality includes transparency of light, turbidity, temperature, pH, and depth. The *ex situ* approach is to measure ammonia content in water samples and identification of fish species.

Research Parameter

1. Water Quality

The measurement of water quality parameters carried out with in situ approach on each research station. The observation of measured water quality includes light, depth, temperature, ammonia (NH3), pH and DO.

2. Diversity Index

$$H' = -\sum_{i=1}^{s} \text{pi} \ln pi$$

Index :

H’	: Diversity Index of Shannon – Wienner
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' > 3 : High diversity
1 < H' < 3 : Medium diversity (moderate)
H' < 1 : Low diversity

3. Equitability Index

$$E = \frac{H'}{H\ max}$$

Index :
E : Equitability index
H' : Diversity Index of Shannon – Wienner
H'max : Maximum equitability = ln S
S : Number of species

The equitability index ranges from 0 – 1 with categories as follows:
$0 < E \leq 0{,}4$: Low equitability, depressed community
$0{,}4 < E \leq 0{,}6$: Medium equitability, unstable community
$0{,}6 < E \leq 1{,}0$: High equitability, stable community

4. Dominance Index

$$C = \sum_{i=1}^{n} pi^2$$

Index :
C : Dominance index
pi : Proportion of fish species individuals
i : 1, 2, 3, ... n

The dominance index ranges from 0 – 1 with categories as follows:
$0 < C < 0{,}5$: Low dominance
$0{,}5 < C \leq 0{,}75$: Medium dominance
$0{,}75 < C \leq 1{,}0$: High dominance

RESULTS AND DISCUSSIONS

Fish Abundance

There are 13 species found in the identified catch from each research station in Cipeles river. The abundance of each station shows that there is a dominance from one particular fish, like Genggehek fish at station III and Lalawak fish at station I and station II (Figure 1).

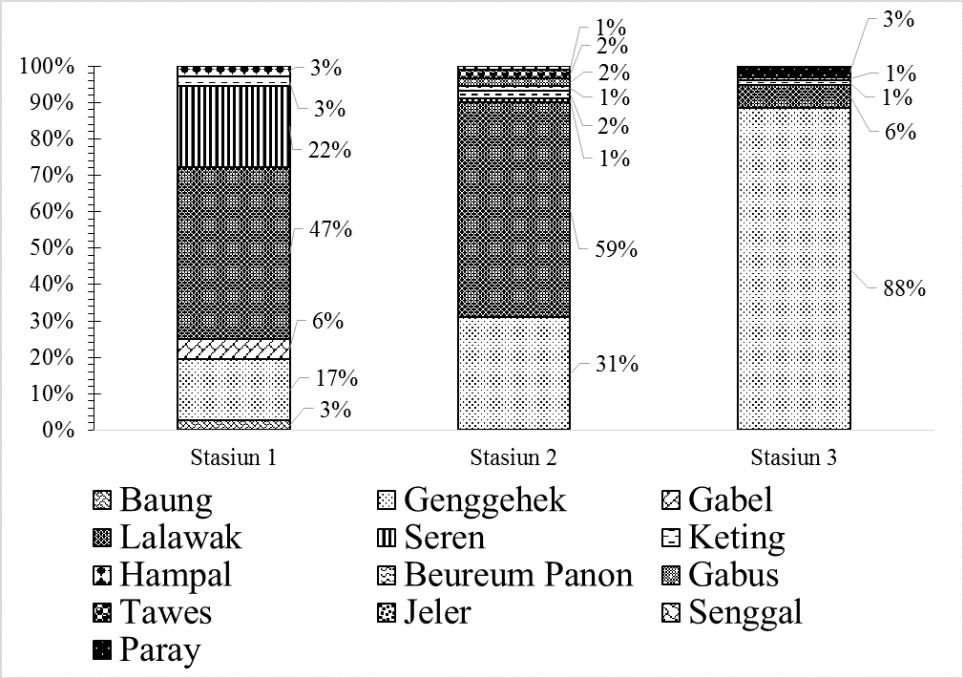

Figure 1. Fish Abundance in Cipeles River

The abundance of fish are categorized into 5 families, includes 7 species of Cyprinidae family (50%) consisting Beureum Panon (*Barbodes orphoides*), Lalawak (*Barbonymus balleriodes*), Seren (*Diplocheilichthys pleurotaenia*), Hampal (*Hampala macrolepidota*), Genggehek (*Mystacoleucus marginatus*), Tawes (*Barbonymus gonionotus*) and Paray (*Rasbora sp*.), 1 species of Siluridae family (7,14%) consisting Gabel (*Ompok bimaculatus*), 1 species of Nemacheilidae family (7.14%) consisting Jeler (*Nemacheilus chrysolaimos*), 3 species of Bagridae family (21.42%) consisting Baung (*Mystus cavasius*), Keting (*Mystus nigriceps*), and Senggal (*Mystus gulio*). The number of fish from Cyprinidae family dominates the number of catched fishes compared to the other families found. In line with statement of Yustiati *et al*. (2019)[20] that most caught fish in the upstream of Cimanuk also comes from the Cyprinidae family. It is thought to occurred since fish from this family are likely more compatible to live in the habitat of Cipeles river and also because fish from the Cyprinidae family are found mostly in freshwater (Buwono *et al*. 2017)[1]. While only small amount of introduced fish found in Cipeles river such as Baung, Gabus, and Gabel. Introduced fish have a preference to live in an environment where the quality of the habitat has generally decreased as indicated by the condition of erosion in the riverbanks or lack of vegetation (Rachmatika *et al*. 2017)[11].

Diversity Index

Diversity is correlation between the number of species and the number of individuals of each type in a community (Kottelat *et al.* 1993)[7]. Fish diversity index shows various result on each station as seen in Figure 2.

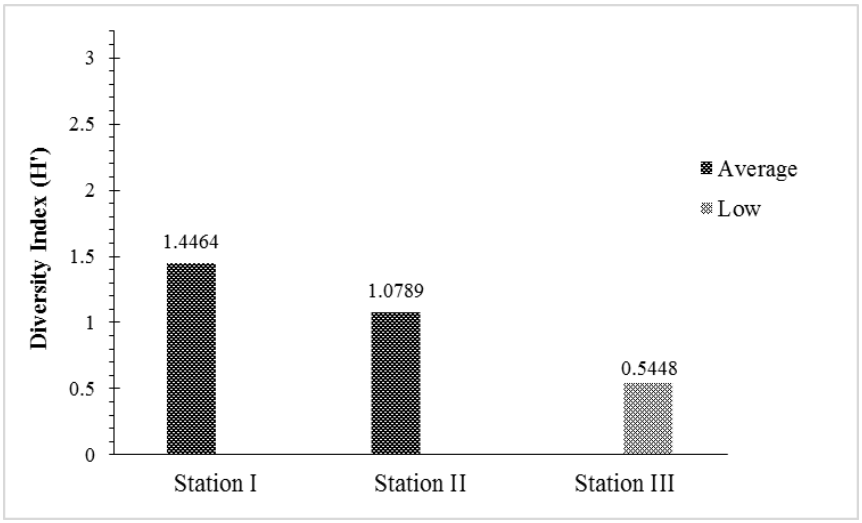

Figure 1. Diversity Index of Fish in Cipeles River

Based on the results of fish diversity index (H') of Shannon-Wiener, the index at station I and II shows a value of 1.4464 and 1.0789 which means the diversity categorized as average, indicating that the condition of the diversity in both station I and II are still good. Whilst, at station III, it is found that the diversity index shows a value of 0,5448 which means the diversity is categorized as low, indicating that the diversity is not in a good condition. It is due to the location of station III itself which sets on the downstream of Cipeles river. There are 7 species found in station I, 8 species at station II and 6 species at station III. Scheimer & Zalewski (1992)[15] stated that the diversity of the habitat and water quality are also taken into account as the cause of a diverse variaties of fish in the rivers.

Equitability Index

Equitability is the proportion of each type of fish in an ecosystem. The equitability index (E) at station I which is located before Rengrang weir shows a value of 0.4036 which categorized as low. At station II, before Rengrang weir the values lies on 0.2398 which belongs to low category. The same result appears in station III which only shows a value of 0.1076 (Figure 3).

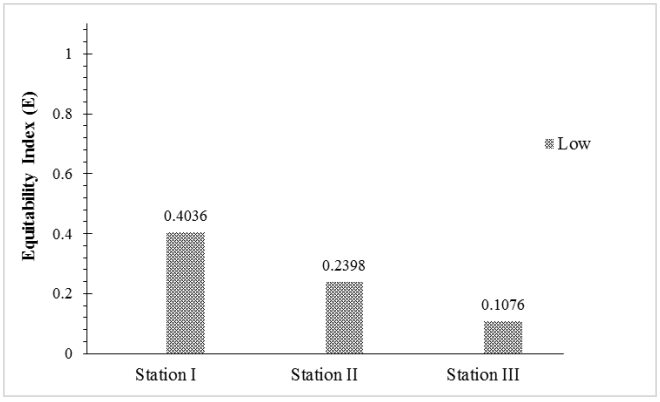

Figure 2. Equitability Index of Fish in Cipeles River

The results is in line with the statement of Krebs (1985)[9], the smaller of E value, the smaller the equitability of a population. The greater of E value, the greater the equitability of a population is. From the data, it can be concluded that all of the stations (I, II and III) shows low equitability. This low values of the equitability due to one type of fish that dominates each station. Odum (1996)[10] stated that a stable environment characterized by its balanced conditions and contains diverse lives without one dominant species. The diversity (H'), the equitability (E) and the dominance (C) is an index that is often used to evaluate the state of an aquatic environment based on the biological conditions. The low value of diversity in spite of a considerable amount kinds of fish is caused the equitability index in the three stations belong to the depressed category. It shows the inequality of the number of individuals for each type of fish at each station (Rappe, 2010)[13]. Environmental changes in the river will also affect the presence of fish communities located on the downstream. (Yuanda *et al*. 2012)[19].

Dominance Index

The dominance index is used to find out whether the communal waters have been introduced by invasive fish. The dominance index (C) at station I and II which are situated before and after Rengrang weir shows a value of 0.3056 and 0.4454. It means the dominance is in low category. Whilst, at station III the value lies on 0.7682 which means the dominance is in high category (Figure 4).

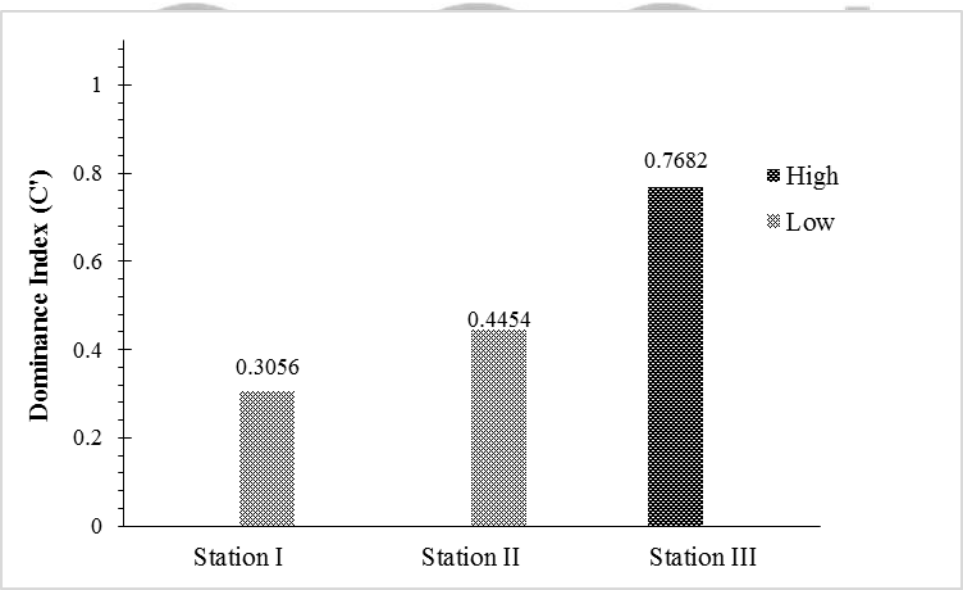

Figure 3. Dominance Index of Fish in Cipeles River

Lalawak fish dominates the most in station I and II while Genggehek fish dominates the number of catch at station III. Fish that fill reservoirs built by damming a river generally from the origin river. Fish that are able to adapt to changes in the environment will become dominant (Kartamihardja, 2008)[6]. Genggehek and Lalawak fish are likely to be dominant, which also occurs in the Jatigede Reservoir (Warsa *et al*. 2016)[18]. In line with the statement of Herawati *et al*. (2018)[3], Lalawak is a native fish of Cimanuk river, the downstream of Cipeles river. Lalawak fish are benthopelagic and have adapted well with the environment change. It makes

this kind of fish lives accordingly with flowing and stagnant aquatic habitat (Rahardjo *et al*. 2014)[12]. Krebs (1972)[8] added that contaminated water commonly has low category of diversity and is mostly dominated by one particular species.

Water Quality

Good quality of water is very influential on optimal survival and growth rates direcly and indirectly. Parameter of water quality measured during the study included stream, temperature, depth, light penetration, pH, DO and ammonia. The data were obtained by measuring with *in situ* approach at the research field and *ex situ* approach at the laboratory. The results of water measurement from the research shows that the quality of water in Cipeles river is close to normal limit but not entirely according to the standard based on Government Regulations (PP) No. 82/2001[2] (Table 1). Ammonia amount on each station mostly higher in January compared to the previous month is probably caused by the high amount of waste entering the riverbank. Cipeles river which is the sub-watershed of Cimanuk river is a typical example of a tropical river, where the volume of river flows fluctuates according to the amount of rainfall. Rainwater flushes the ground at the beginning of the rainy season which results in a sharp decrease in river water quality. Therefore, although the quality of river water is still good for the life of aquatic organisms, there is potential for pollution from the watershed, especially at the beginning of the rainy season. (Susilo *et al*. 2016)[17].

Table 1. Water Quality of Cipeles River

Parameters	Unit	Station I		Station II		Station III		Std*
		29 Dec '18	25 Jan '19	29 Dec '18	25 Jan '19	29 Dec '18	25 Jan '19	
Stream	m/sec^{-1}	1.01	0.67	0.92	0.81	0.72	0.6	-
Temperature	°C	28.4	26.2	28.8	28.4	29.3	28.5	Dev. 3°
Light Penetration	cm	23	30	20	27	24	32	>25
Depth	m	3.0	3.0	3.4	3.4	2.9	2.9	-
pH	-	8.2	7.14	6.24	7.18	8.55	7.33	6-9
DO	mg/L^{-1}	6	5.2	6.6	5.6	6.2	7	>3
Ammonia	mg/L^{-1}	0.016	0.002	0.002	0.003	0.055	0.007	<0,02

Source: (*) Government Regulation No. 82/2001[2]

CONCLUSIONS

It can be concluded that the Cipeles river before the Rengrang weir shows medium diversity index, low dominance, low equitability and unstable structure of fish community, while the Cipeles river after the Rengrang weir shows low diversity, high dominance, low equitability and depressed fish community.

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