Original Research Article

STRUCTURE OF THE FISH COMMUNITY IN THE JATIGEDE RESERVOIR POST SIX YEARS OF FLOODING

ABSTRACT

Jatigede Reservoir began to be inundated in August 2015. The fish caught at the beginning of the 2017 inundation were 9 families consisting of 17 species (Andani et al. 2017). This research aims to determine the structure of the fish community living in the Jatigede Reservoir after six years of inundation. The research was carried out from November 2020 to April 2021 at the Jatigede Reservoir, using the survey method. Primary data which includes the relative abundance of fish, diversity index and fish uniformity. The fish sampling method used a purposive sampling method with 3 repetitions carried out at five stations representing the Jatigede Reservoir area. Data processing using Microsoft Excel to produce fish community structure in Jatigede Reservoir. The fish community structure in Jatigede Reservoir during the research consisted of 9 families, namely cyprinidae, cichlidae, eleotridae, bagridae, loricariidae, pangasiidae, zenarchopteridae, ambassidae and poeciliidae. At stations 2 and 3, it was categorized as stable with a moderate diversity index ranging from 1.08 to 1.73, moderate uniformity ranging from 0.56 to 0.83. At stations 1, 4 and 5 the fish community structure was categorized as unstable, with low diversity ranging from 0.57 to 0.97 and moderate uniformity ranging from 0.51 to 0.60.

Keywords: *Community structure, Fish, Jatigede Reservoir.*

1. INTRODUCTION

Jatigede Reservoir, located in Sumedang Regency, West Java Province, has an area of ± 4,122 ha. This reservoir was built by damming the Cimanuk River, in addition, the water source of the Jatigede Reservoir reservoir also comes from the Cialing and Cinambo rivers and several other major rivers. The function of the Jatigede Reservoir is to irrigate 90,000 ha of irrigation canals, control 14,000 ha of flooding and the hydroelectric power source is capable of generating electricity of 690 GWh/year with a capacity of 110 MW. In addition, it is also a capture fisheries sector and the tourism sector. The activities of the surrounding community create a lot of ecological pressure for the aquatic ecosystem in the Jatigede Reservoir which has a negative impact on the structure of the fish community, and can eliminate the main function of the reservoir aquatic ecosystem so that there will be a decrease in the fish population which makes fish unable to adapt in the long term and also causes a decline. or experiencing extinction (Ungaro *et al.* 1998).

Fish community structure is a basic aspect in fish resource management (Estrada et al., 2008). Changes in the structure of fish communities are very helpful in evaluating changes caused by environmental degradation. The condition of the aquatic environment greatly determines the abundance and distribution of organisms in it, but each organism has different environmental needs to live related to the characteristics of its environment. The reason for fish choosing a place to live, according to their body conditions, is abundant food sources, suitable for breeding and spawning. In addition to

these conditions, environmental factors are very influential on fish life. Other factors that influence water temperature, brightness, dissolved oxygen, and pH.

According to Andani et al. (2017) fish caught and identified in Jatigede Reservoir as many as 9 families consisting of 17 species of which Jatigede comes from fish native to the Cimanuk River and introduced fish. Meanwhile, in the research results of Herawati *et al*. (2020) of fish caught in the Jatigede Reservoir as many as 14 families consisting of 30 species. Fish species that can adapt to the reservoir environment will grow, breed, and dominate, while fish species that are less or unable to adapt will decline rapidly and become extinct (Yuanda et al. 2012). As the years go by, there is a change in the structure of the fish community in the Jatigede Reservoir. Changes in species will have an important impact on the structure of the fish community. This research aims to determine and determine changes in the structure of fish communities living in Jatigede Reservoir after six years of inundation.

2. METHODOLOGY

This research was conducted at 5 stations in Jatigede Reservoir, Sumedang Regency. Sampling was taken for 5 months with 3 collections at each station in November 2020 – April 2021. Sampling was carried out at five station locations, namely the estuary of the Cimanuk River, Cialing River, Cimuja River, Cacaban River, and Cihonje River as shown in Figure 1 The location is an inundated area of the Jatigede Reservoir so that the fish in the river will fill the waters of the reservoir. Data collection activities carried out in the field include taking samples of fish caught by fishermen at each station. Observations of fish samples were carried out at the Fisheries Resource Management Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University.

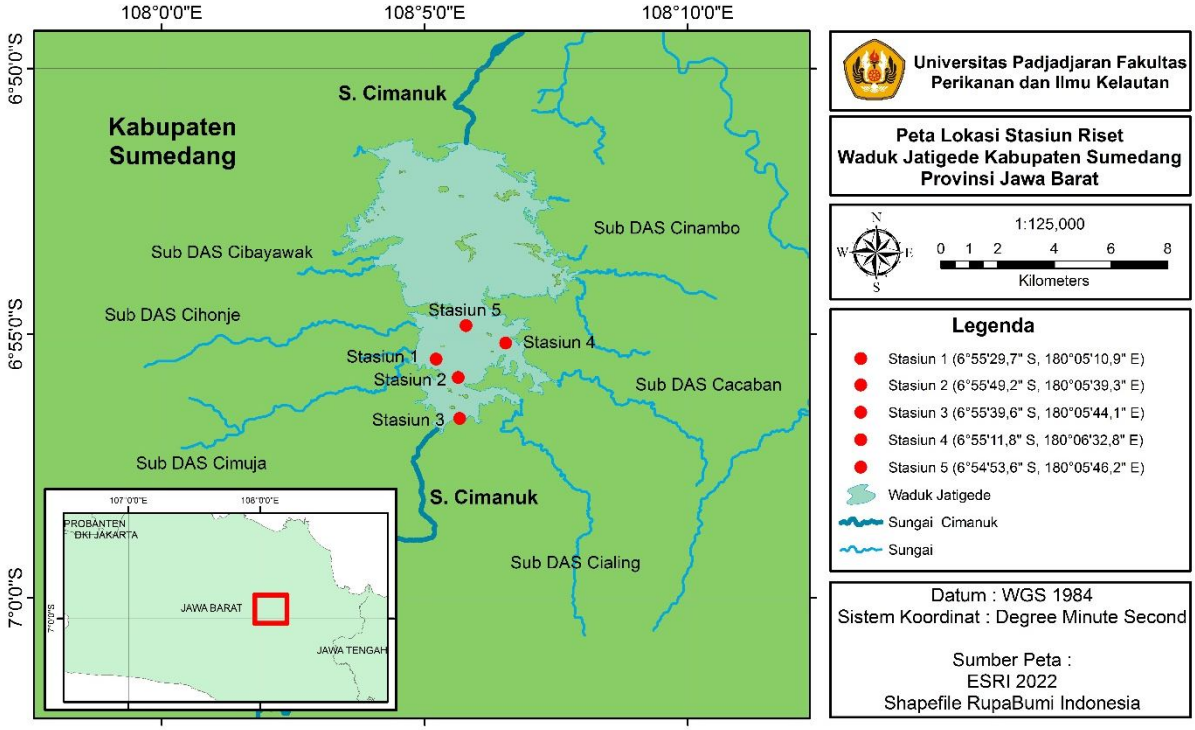

Figure 1. Map of the Jatigede Reservoir research location

- Station 1, coordinates 6°55'29.7" S 108°05'10.9" E. The estuary of the Cimuja river is located in Cimalaka District.
- Station 2, coordinates 6°55'49.2" S 108°05'39.3"E. The estuary of the Cialing river is located in Wado District.
- Station 3, coordinates 6°55'39.6" S 108°05'44.1" E. The reservoir inlet is from the Cimanuk river in Wado District.
- Station 4, coordinates 6°55'11.8" S 108°06'32.8" E. The estuary of the Cacaban river is located in the District of Cadas Ngampar.
- Station 5, coordinates 6°54'53.6" S 108°05'46,2" E. The estuary of the Cihonje River in Cisitu District.

The sampling method used a purposive sampling method. Each type of fish caught was then identified using the reference Kottelat (1996) and fishbase (www.fishbase.org). Analysis of the data from the results to be obtained were analyzed using the parameters:

Relative Abundance of Fish

To determine the relative abundance value of the fish population, it is calculated using the formula according to Michael (1994).

Relative abundance of fish populations:

$$\boldsymbol{KR = \frac{ni}{N} x\ 100\%} \qquad (1)$$

Information :
KR = relative abundance
Ni = Number of individuals of each species
N = Number of individuals of all species

Fish Diversity Index (H')

In determining the value of fish diversity using the Shannon-Wiener method (Odum 1993).

Diversity of fish :

$$\mathbf{H' = -i = 1npi\ ln\ pi} \qquad (2)$$

Information:
H' = Diversity Index
Pi = Comparison between the number of individuals of the 1st species with the total number of individuals (ni/N)
I = 1,2,3…..n
category
H' ≤ 1 = Low diversity,
1 ≤ H '≤ 3 = Medium diversity,
H' ≥ 3 = High diversity.

Fish Uniformity Index (E)

The uniformity index describes the balance of the ecosystem. The uniformity index can be calculated using the Shannon-Wiener equation (Fachrul 2007).

$$\boldsymbol{E = \frac{H'}{H'max}} \qquad (3)$$

Information:
E = uniformity index
H' = diversity index
H' max = maximum diversity index
S = total number of species

The uniformity value categories range from 0-1 as follows:
0 ≤ E ≤ 0.4 = small uniformity, depressed community structure,
0.4 ≤ E ≤ 0.6 = moderate uniformity, unstable community structure;
0.6 ≤ E ≤ 1.0 = high uniformity, stable community structure.,

3. RESULTS AND DISCUSSION

Relative Abundance of Fish

The results of the research showed that the structure of the fish community in the Jatigede reservoir has different compositions, abundances, and fish community structures. The types of fish caught during the study were 285 fish. In all stations, 9 families and 15 species were found which are shown in Table 1. including the cyprinidae family with 4 species including lalawak fish (*Barbonymus balleroides*), vacuum fish (*Hampala macrolepidota*), carp (*Cyprinus carpio*), and seren fish (*Diplochelychys pleurotaenia).*), from the family cichlidae 4 species, namely tilapia (*Oreochromis niloticus*), red devil (*Amphilophus labiatus*), jaguar (*parachromis managuensis*), and *Amphilophus citrinellus*, family eleotridae namely betutu

fish (*Oxyeleotris marmorata*), bagridae family namely tagih fish (*Hemibagrus mestirus*), family loricariidae namely broom fish (*Pterygoplichthys pardalis*), family pangasiidae namely catfish (*Pangasiodon hypopthalmus*), family zenarchopterus namely julung - julung fish (*Dermogenys pusilla*), family ambassidae namely glass fish (*Ambassis reticulatus*), family poeciliidae namely fish thousand (*Gambusia affinis*).

Table 1. Types of Fish Caught and Identified in Jatigede Reservoir

Family	Local Name	Latin Name	Based on Origin	
			Original	Introduced
Cyprinidae (27%)	Lalawak	*Barbonymus balleroides*	√	
	Hampala	*Hampala macrolepidota*	√	
	goldfish	*Cyprinus carpio*		√
	Seren	*Diplochelychys pleurotaenia*	√	
Cichlidae (27%)	Red devil	*Amphilophus labiatus*		√
	parrot fish	*Oreochromis niloticus*		√
	Jaguar	*parachromis managuensis*		√
	Midas	*Amphilopus citrinellus*		√
Eleotridae (7%)	Betutu	*Oxyeleotris marmorata*	√	
Bagridae (7%)	Tagih	*Hemibagrus nemurus*	√	
Loricariidae (7%)	Sapu-sapu	*Pterygoplichthys pardalis*		√
Pangasiidae (7%)	Patin	*Pangasiodon hypopthalmus*		√
Zenarchopteridae (7%)	Julung-julung	*Dermogenys pusilla*	√	
Ambassidae (7%)	Kaca	*Ambassis reticulatus*	√	
Poeciliidae (7%)	Seribu	*Gambussia affinis*		√

A total of (27%) of the cyprinidae family includes 6 species, namely lalawak fish (*Barbonymus balleroides*), hampala (*Hampala macrolepidota*), goldfish (*Cyprinus carpio*), and seren (*Diplochelychys pleurotaenia*), (27%) from the cichlidae family of 4 species, namely tilapia (*Oreochromis niloticus*), red devil (*Amphilophus labiatus*), jaguar (*parachromis managuensis*), and *Amphilophus citrinellus*, each (7%) from the eleotridae family, namely betutu fish (*Oxyeleotris marmorata*), bagridae family, namely billfish (*Hemibagrus mumurus*), family loricariidae namely broom fish (*Pterygoplichthys pardalis*), family pangasiidae namely catfish (*Pangasiodon hypopthalmus*), family zenarchopterus namely julung-julung fish (*Dermogenys pusilla*), family ambassidae namely glass fish (*Ambassis reticulatus*), family Poecilidae namely thousand fish (*Gambusia affinis*). The number of species from the cyprinidae and cichlidae families resulted in a high relative abundance of fish, this is presumably because the species from the cyprinidae family are native fish of the Cimanuk River which are carried into the Jatigede Reservoir and have the widest distribution compared to other fish. cichlidae have a high adaptability to the environment, so they are able to adapt to ecosystem conditions in the Jatigede Reservoir (Herawati et al. 2020).

In contrast to previous research, the number of fish found in the Jatigede Reservoir in 2017 in the early stages of inundation according to Andani et al. (2017) showed as many as 9 families consisting of 17 species. A total of 13 species are native fish of the Cimanuk River and 4 other species are introduced fish. During the research, the fish that were not caught included genggehek, nilem, hike, paray, tawes, mujair, sepat, gabus, senggal, milkfish and berod fish, allegedly due to the disconnection of the fishing route from upstream to downstream and vice versa or due to the inappropriate nature of the reservoir habitat flooded (Herawati et al. 2020). Fish that cannot be caught have various factors that cause fish to not be caught including a change or even loss of habitat, excessive resource exploitation, pollution in the habitat or its surroundings, habitat competition, and one of them is the introduction of foreign invasive fish (Dudgeon et al. 2006). Where an increase in the population of potentially invasive introduced fish will suppress the native fish population in the area. The presence of these types of fish can cause several types of fish native to the Cimanuk River to decline because they cannot compete for food and habitat (Dewantoro and Rachmatika 2016).

The large abundance of trout shows that these fish can adapt well in the Jatigede Reservoir from the initial inundation stage to the present. The hollow fish can grow well with water conditions at a pH of 7-8, and a temperature of 27-29°C (Herawati et al 2017). Fish that have a relatively high abundance and are able to adapt to the environment around their habitat and utilize the potential of existing resources to carry out their daily needs (Gonawi 2009).

Fish Diversity Index (H'), Fish Uniformity (E)

The results of the calculation of fish diversity (H') and fish uniformity index (E) at all research stations are presented in table 2 below:

Table 2. Diversity Index and Fish Uniformity

Indeks	Stasiun					Kisaran		
	1	2	3	4	5	Rendah	Sedang	Tinggi
Diversity (H')	0,576	1,08	1,73	0,97	0,82	≤ 1	1 - 3	≥ 3
Criteria	Low	Medium	Medium	Low	Low			
Uniformity (E)	0,52	0,56	0,83	0,60	0,51	≤ 0,4	0,4 - 0,6	≥ 0,6
Criteria Comunity	Medium Labile	Medium Stable	High Stable	Medium Labile	Medium Labile			

Fish Diversity Index (H')

Based on the results of the Shannon-Wiener fish diversity index (H') that has been identified in table 2 above, the diversity index value (H') at the five research stations including station 1 is 0.57, station 2 is 1.08, station 3 is 1.73, station 4 is 0.97, and station 5 is 0.82. Based on the results of the calculation of fish diversity at stations 2 and 3, the diversity index value (H') is in the medium category according to the Shannon-Wiener criteria where the index value is around 1.08 H'≤ 1.73. At stations 1, 4 and 5 the diversity index was categorized as low based on the Shannon-Wiener criteria where the index ranged from 0.57 H'≤ 0.97, this is similar to the statement of Septiningsih *et al*. (2021) that at the same station at stations 4 and 5 the water conditions are high in organic waste content derived from leftover feed and fish waste from aquaculture activities, so that fish can obtain their food from leftover fish feed from aquaculture activities.

Station 3, which is the inlet of the Jatigede Reservoir, flows from the Cimanuk River, which has a higher diversity and abundance of native fish from the Cimanuk River. Diversity is thought to be due to the movement of the current which is slightly calm and the color of the water is cloudy brown, slightly calmer currents also provide natural food that is more diverse (Sugiharta 2019). The high and low diversity index depends on the variation in the number of individuals of each fish species caught, the greater the number of fish species and the number of individual species of each species, the greater the level of fish diversity in an aquatic ecosystem, and vice versa the smaller the number of fish species and the number of species. individual of each species, the level of fish diversity in an aquatic ecosystem will also be smaller (Sriwidodo et al. 2013).

Fish Uniformity (E)

The results of the calculation of the uniformity index are categorized as high ranging from 0.51 E 0.83 at stations 2 and 3. The results of the two index values can be concluded that the fish communities at stations 2 and 3 are said to be stable. Uniformity shows the number of individuals of each species is the same or evenly distributed (Pasengo 1995 in Hasanah et al 2014). As in research conducted by Adiwiguna (2018) that the uniformity of fish in the upper reaches of the Cimanuk River is high, so that the fish are spread fairly evenly and there are no species that are very abundant in other species. At stations 1, 4 and 5 the uniformity index value was categorized as moderate, ranging from 0.51 E 0.60. The criterion of the uniformity value of fish species is close to 0, so the distribution of individuals between species is relatively unequal, besides that there is a group of certain species that are abundant (Ardani and Organsastra 2009 in Shaleh and Chakim 2018). The highest abundance of fish at stations 1, 4 and 5 was Hampala fish because of the high number of fish caught in the number of individuals compared to other types of fish. According to Setyowati (2017) that the smaller the uniformity index (E), the smaller the uniformity of a population and the individual distribution of the population is abundant, while the larger the value, the greater the uniformity of a population where the type and number of individuals of each species is evenly distributed or uniform. The moderate uniformity index can be caused by the presence of one or several species that have more number of individuals than the number of individuals of other types.

4. CONCLUSION

Within 6 years after the Jatigede Reservoir was inundated, the abundance of fish species changed both in the number of species and the ratio between native fish and introduced fish. The composition of the fish caught and identified were 275 fish consisting of 9 families and 15 species of fish, the hollow fish (*Hampala macrolepidota*) which was the fish with the highest abundance. The highest diversity index was found at station 3 of 1.73, the lowest was 0.57 at station 1, followed by the highest uniformity index at station 3 of 0.83 and the lowest of 0.51 at station 5.

REFERENCES

Andani, A., Herawati, T., & Hamdani, H. (2017). Identification and inventory of adaptable fish in Jatigede Reservoir at the early inundation stage. *Journal of Marine Fisheries*, *8*(2), 28-35.

Adiguna, IGABP, Restu, IW, & Ekawaty, R. (2018). Fish Community Structure at the Badung River Estuary Mangrove Area Forest Park (Tahura) Ngurah Rai, Bali. *Current Trends in Aquatic Science*, *1*(1), 72-79.

Adiwiguna, I. 2018. *Fish Diversity in Cimanuk River Before and After Jatigede Reservoir, Sumedang Regency, West Java Province*. [Thesis] Faculty of Fisheries and Marine Sciences UNPAD. Jatinangor.

Andria, AF, & Rahmaningsih, S. (2018). Technical Study of Abiotic Factors in Excavated Clay Reservoir PT. Semen Indonesia Tbk. for the Utilization of Fish Cultivation with KJA Technology [Technical Study of Abiotic Factors in Clay Embankment Used at PT. Semen Indonesia Tbk for Utilization of Fish Cultivation with KJA Technology]. *Scientific Journal of Fisheries and Marine Affairs*, *10*(2), 95-105.

Dewantoro. GW, Rachmatika. I. 2016. *Foreign Introduced And Invasive Fish Types In Indonesia*. LIPI Press, Jakarta. 192 p.

Dudgeon, D., Arthington, AH, Gessner, MO, Kawabata, ZI, Knowler, DJ, Lévêque, C., Naiman, RJ, Prieur-Richard, AH, Soto, D., Stiassny, MLJ, & Sullivan, CA 2006 Freshwater biodiversity: Importance, threats, status and conservation challenges. In *Biological Reviews of the Cambridge Philosophical Society*. 81(2), 163–182. https://doi.org/10.1017/S1464793105006950.

Estrada, A., Real, R., & Vargas, JM (2008). Using crisp and fuzzy modeling to identify favorability hotspots is useful to perform gap analysis. *Biodiversity and Conservation*, *17*(4), 857–871. https://doi.org/10.1007/s10531-008-9328-1.

Effendi Hefni. 2003. *Water Quality Review*. Yogyakarta: Kanisius.

Fachrul., 2007. *Sampling method Bioecology*. Earth Literacy Publisher.

Frasawi, A., Rompas, RJ, & Watung, JC (2013). Potential of fish farming in Embung Klamalu Reservoir, Sorong Regency, West Papua Province: A study of the physical and chemical quality of water. *e-Journal of Aquaculture*, *1*(3).

Gonawi, GR (2009). Habitat and Community Structure of Nekton in Cihideung-Bogor River, West Java.

Hasanah, AN, Rukminasari, N., & Sitepu, FG (2014). Comparison of abundance and community structure of zooplankton on Kodingareng and Lanyukang islands, Makassar City. *Torani Journal of Fisheries and Marine Science*, *24*(1).

Herawati, T., Mustikawati, R., Diliana SY, Andani, A. 2017. *Types of Fish in Jatigede Reservoir in the Early Inundation Period (2015-2017)*. UNPAD PRESS. Bandung.

Herawati, T., Akhodiah, S., Yustiati, A., Dhahiyat, Y., & Lili, W. 2020. Histological analysis of ovarian development of Hampala macrolepidota Kuhl & Van Haselt, 1823 from Jatigede Reservoir, West Java. In *IOP Conference Series: Earth and Environmental Science* 535(1), 1-9.

Kordi, KMGH. 2009. Aquaculture. PT Citra Aditya Bakti. Bandung.

Kottelat, M., & Whitten, T. (1996). *Freshwater fishes of Western Indonesia and Sulawesi: additions and corrections* (p. 8). Hong Kong: Periplus editions.

Michael, P. 1994. Ecological Methods for Investigation field and laboratory. UI Press. Jakarta.

Odum, EP (1993). Ecological Fundamentals. Translator: Tjahyono Samingan.

Government Regulation No. 22 of 2021. (2021). Government Regulation Number 22 of 2021 concerning Guidelines for Environmental Protection and Management. *State Secretariat of the Republic of Indonesia*, *1*(078487A), 483. http://www.jdih.setjen.kemendagri.go.id/

Shaleh, FR, & Chakim, C. 2018. Structure of Fish Community Downstream of Bengawan Solo River, Lamongan Regency. *Scientific Journal of the Faculty of Fisheries, Lamongan Islamic University*, *9*(1), 1-7.

Setyowati, I. 2017. *Distribution of Diversity of Fish Captured by Throwing Nets at the Jatigede Reservoir Inlet*. Thesis. Faculty of Fisheries and Marine Sciences UNPAD. Sumedang.

Septiningsih, VS, Zahidah, HH, & Herman, D. (2021). Distribution of phosphate concentration and its impact on fertility of Jatigede reservoir Sumedang, West Java. *International Journal of Fisheries and Aquatic Studies*. 9(4), 223-229.

Sriwidodo, DWE, Budiharjo, A., & Sugiyarto, S. (2013). Diversity of fish species in the inlet and outlet areas of Gajah Mungkur Wonogiri Reservoir. *Asian Journal of Tropical Biotechnology*, *10*(2), 43-50.

Sugiharta, A. 2019. Fish Feeding Habits in Cimanuk River Outlet Area of Jatigede Reservoir. Thesis. Faculty of Fisheries and Marine Sciences, Padjadjaran University.

Ungaro, N., Marano, G., Marsan, R., & Osmani, K. 1998. Demersal fish assemblages biodiversity as an index of fishery resources exploitation. *Italian Journal of Zoology*. 65, 511-516.

Yuanda, MA, Dhahiyat, Y., & Herawati, T. (2012). Fish Community Structure in the Upper Cimanuk River, Garut Regency. *Journal of Marine Fisheries*, *3*(3), 229-236.