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INTENSITY AND PREVALENCE OF ECTOPARASITES IN FISH CAUGHT BY FISHERMEN IN THE JATIGEDE RESERVOIR, SUMEDANG REGENCY, WEST JAVA PROVINCE

Rosidah*, Yusi Fauziah, Titin Herawati, Walim Lili

Faculty of Fisheries and Marine Sciences, Padjadjaran University, Indonesia

*E-mail address: ros_ahdi@yahoo.com

ABSTRACT

This study aims to determine the type, intensity, and prevalence of ectoparasites of fish caught by fishermen from Jatigede Reservoir. The research was carried out in the dry season until the transition season, from September to November 2019. The fishing gear used to take fish samples was fishing rods, throwing nets, and gill nets. Sampling was carried out four times with two-time intervals every two weeks. The number of fish caught was 76 consisting of 12 species including 5 families namely the Cichlidae, Cyprinidae, Bagridae, Channidae, and Eleotridae families. The research results obtained 7 genus ectoparasites namely Trichodina, Trichodinella, Vorticella, Epistylis, Dactylogyrus, Gyrodactylus, and Transversotrema. Ectoparasites that have the highest intensity were Epistylis which value was 10 ind/fish and ectoparasites with the lowest intensity value were Transversotrema which was 1 ind/fish. The highest intensity from fish was Tilapia of 26,17ind/fish and the lowest intensity was long whiskers catfish, striped snakehead, Asian redtail catfish, Marble goby, and local name beureum panon of 0. The highest prevalence of ectoparasites was Trichodina at 22.37%, the lowest prevalence was Vorticella and Transversotrema at 1.31%. The fish with the highest prevalence was Common carp of 100%, the lowest prevalence was long whiskers catfish, striped snakehead, Asian redtail catfish, Marble goby, and local name beureum panon of 0.

***Keywords*:** Ectoparasites, Intensity, Jatigede Reservoir, Prevalence

1. INTRODUCTION

Jatigede Reservoir has an area of ± 4122 Ha and lived in Sumedang Regency, West Java. This reservoir was built by damming the Cimanuk River with a total area of 3035.34 ha (Cimanuk-Cisanggarung River Area Center 2009) and was inaugurated on August 31, 2015. The Jatigede Reservoir submerges five sub-districts and is a multifunctional reservoir. The functions of this reservoir include power generation, irrigation, flood control, and fisheries. But the primary purpose of this reservoir is as an irrigation facility covering an area of 90,000 ha in the North Coast of West Java and a Hydroelectric Power Plant (PLTA) with a capacity of 110 megawatts and providing raw water with a holding capacity of 3,500 liters per second

for the Sumedang, Indramayu, Majalengka, and Cirebon, and flood control for an area of 14,000 ha (Fitriani 2013).

The Central River Basin (BBWS) (2016) states that the function of the Jatigede reservoir in the fisheries sector is to capture fisheries. The fish communities in the storage reservoir were original fish from the dammed waters of the Cimanuk river. Cimanuk River is a river that has been polluted because it is widely used as a toilet (bathing, washing, and toileting) and the disposal of various garbage and waste from both housing and industry. That is it will cause the water quality to decrease, thereby reducing the fish's resistance to parasites and diseases.

2. RESERCH METHODS

2.1 Tools and Materials

The tools used in the research are fish plastic, pH meter, DO meter, thermometer, camera, cool box, ruler, scale, millimeter block, aquarium, and fiber. Aerator, Dissecting set, binocular microscope, petri dish, tray, object glass and cover glass, tissue, label paper. The material used is fish caught by fishermen from the Jatigede Reservoir maximum of 10 fish/species, as objects of observation, physiological NaCl, formalin, Giemsa.

2.2. Research Methods

The method used in this research is the survey method. The sampling method used the purposive sampling technique. Sugiyono (2012) states that purposive sampling is a sampling technique with considerations. Based on the preliminary survey, the average number of catches of fisher has decreased so that the number of fish studied is a maximum of 10 fish/species. The sampling period does five times. The research map can observe in Figure 1.

Figure 1. Research Station at Jatigede Reservoir

Observations made to measure the physical and chemical factors of the waters include temperature, pH, and DO. Observations made in the laboratory consisted of ammonia content and ⟦BOD⟧_5 in jatigede reservoir water samples, as well as data on the body length of fish, the weight of fish. Ectoparasitic examination observes signs on the surface of the body, gills, fins, and operculum of the fish. Samples are examined using the natif method, which is a direct examination method and observation of parasites using a microscope.

2. 3. Observed Parameters

2.3.1. Parasite Identification

Observation of parasites using a microscope and identification of parasites using book and journal guides.

2.3.2. Intensity

The intensity of ectoparasites in fish is the average number of ectoparasites in infected fish.

$$\textbf{Intensity} = \frac{\textit{Number of infecting ectoparasites A}}{\textit{Number of fish samples infected with parasite A}}$$

2.3.3. Prevalence

Prevalence is the percentage of infected fish from the total number of fish samples examined.

$$\text{Prevalence} = \frac{\text{Number of infected sample fish}}{\text{Number of sample fish examined}} \textbf{ x100\%}$$

Table 1. Intensity criteria by to Williams and Bunkley (1996)

No	Intensity (in/tail)	Infection Rate
1	<1	Very low
2	1-5	Low
3	6-55	Currently
4	51-100	Critical
5	>100	Awfully
6	>1000	Superinfection

Table 2. Prevalence criteria by to Williams and Bunkley (1996)

No	Prevalence	Category	Information
1	100-99 %	Always	Very severe infection
2	98-90 %	Almost always	Severe infection
3	89-70 %	Usually	moderate infection
4	69-50%	Very often	Very often infection
5	49-30 %	Generally	Just the same
6	29-10 %	Often	Needle infection
7	9-1 %	Sometimes	sometimes
8	<1-0,1 %	Seldom	Seldom
9	< 0,1-0,1%	Very rarely	Very rarely infection
10	<0,01	Almost never	Infection never

2.3.4. Support Parameters

The supporting parameters observed included the water quality of the Jatigede reservoir, namely temperature as measured by a thermometer, dissolved oxygen as measured by a DO meter, pH as measured by a pH meter, and ammonia content as measured by spectrophotometry.

2.4. Data Analysis

The data obtained from the results of the study in the form of the type and number of ectoparasites, prevalence, intensity, and water quality data were analyzed descriptively.

3. RESULT AND DISCUSSION

3.1. Fish Community in Jatigede Reservoir

The fish caught by fishermen during the study in the Jatigede Reservoir, Sumedang Regency, West Java, from September to November 2019 was 76 fish (Table 3), or an average of 19 fish per sampling. These fish belong to five families, namely Cichlidae which consists of Tilapia (Oreochromis niloticus), Red devil (Amphilophus citrinelles), and Jaguar (Parachromis managuensis); the Cyprinidae family, namely Tawes fish (Systomus gonionotus), Hampal (Hampala macrolepidota), Mas (Cyprinus carpio), Lalawak (Barbonymus balleroides), and Beureum panon (Systomus orphoroides); the Bagridae family, namely the Billy fish (Hemibagrus mumrus) and Senggal (Mystus gulio); family Channidae namely Cork fish (Channa striata); The last family Eleotridae is Betutu fish (Oxyeleotris marmorata).

Table 3. Types and quantities of fish caught by fishermen in Jatigede Reservoir

No	Area Name	Family	Species	Comman Name	Fish sample		Average length (cm)
					Tail	%	
1	Nila	Cichlidae	*Oreochromis niloticus* (Linnaeus, 1758)	*Nile tilapia*	10	13,16	22.2
2	Red Devil		*Amphilophus citrinellus* (Günther, 1864)	*Midas cichlid*	10	13,16	19.75
3	Jaguar		*Parachromis managuensis* (Günther, 1867)	*Jaguar guapote*	9	11,84	16.9
4	Tawes	Cyprinidae	*Systomus gonionotus* (Bleeker, 1849)	*Silver barb*	10	13,16	17.71
5	Hampal		*Hampala macrolepidota* (Kuhl & Van Haselt, 1823)	*Hampala barb*	10	13,16	17.86
6	Mas		*Cyprinus carpio* (Linnaeus, 1758)	*Common carp*	2	2,63	21.48
7	Lalawak		*Barbonymus balleroides* (Valenciennes, 1842)	-	9	11,84	24.52
8	Beureum Panon		*Systomus orphoroides* (Valenciennes, 1842)	-	3	3,95	29.22
9	Tagih	Bagridae	*Hemibagrus nemurus* (Valenciennes, 1840)	*Asian redtail catfish*	1	1,31	36.5
10	Senggal		*Mystus gulio* (Hamilton, 1822)	*Long whiskers catfish*	6	7,89	21.6
11	Gabus	Channidae	*Channa striata* (Bloch, 1793)	*Striped snakehead*	1	1,31	42
12	Betutu	Eleotridae	*Oxyeleotris marmorata* (Bleeker, 1852)	*Marble goby*	5	6,58	25.53

Total		76	100	

Red devil fish is the fish caught by most fishermen, which is more than ten fish, but only 10 fish are used as research samples, and the lowest catches are Billion fish and Cork fish. This happens because the Red Devil is an endemic fish in Costa Rica and Nicaragua, the states of Central America, and parts of Asia, and was introduced in Indonesia. This fish can drag indigenous fish and other fish and can live in all kinds of aquatic environmental conditions. According to Purnamaningtyas & Tjahjo (2013), red devils are very easy to adapt to their environment, so they have a high ability to adjust to fluctuations in the availability of feed.

3.2. Genus and Number of Ectoparasites in Fish Captured by Fishermen in Jatigede Reservoir

The number of ectoparasites that attacked the sample fish was 126 individuals which were divided into two phyla, namely the phylum Protozoa and Helminthes. The phylum Protozoa consists of the genera Trichodina, Trichodinella, Vorticella, and Epistylis, while the phylum Helminthes consists of the genera Dactylogyrus, Gyrodactylus, and Transversotrema Figure 2.

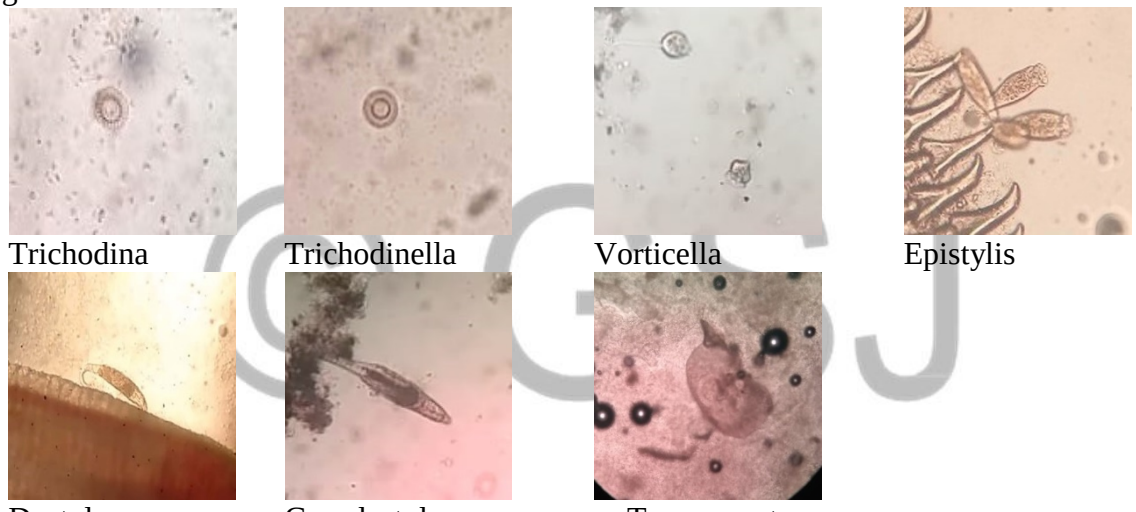

Figure 2. Types of Ectoparasites Found

More ectoparasites were found from the phylum Protozoa as many as 77 individuals or 61.1%, while from the phylum Helminthes as many as 49 individuals or 38.9% (Table 4). This is because the phylum Protozoa can reproduce quickly. As stated by Amirullah et.al (2012), the phylum Protozoa has a life cycle and reproduces rapidly under optimum conditions within ±24 hours.

Table 4. Genus and Number of Ectoparasites Attacking Fisherman's Catches

Ectoparasite		Type of fish												Total	
Filum	Genus	Ham	Red	Nil	Taw	Jag	Bet	Lal	Seng	Tag	Mas	Gab	Beu	Ekor	%
Protozoa 77 ekor (61,1%)	Trichodina	3	18	15	1	1	0	5	0	0	4	0	0	47	37.3
	Trichodinella	0	3	2	0	0	0	3	0	0	0	0	0	8	6.3
	Vorticella	0	0	3	0	0	0	0	0	0	0	0	0	3	2.4
	Epistylis	0	20	0	0	0	0	0	0	0	0	0	0	20	15.9
Helminthes 49 ekor	Dactylogyrus	0	2	35	2	0	0	0	0	0	0	0	0	39	31.0
	Gyrodactylus	0	0	5	1	1	0	0	0	0	1	0	0	8	6.3

(38,9 %)	Transversotrema	0	0	0	0	0	0	1	0	0	0	0	0	1	0.8
Total		3	43	60	4	2	0	9	0	0	5	0	0	126	100
Percentage (%)		2.4	34.1	47.6	3.2	1.6	0	7.1	0	0	4.0	0	0	100	

The most common ectoparasites found from the phylum Protozoa were Trichodina as many as 47 individuals or 37.3%. Trichodina is a parasite that is easy to reproduce, capable of infecting several organs of the fish body, not a specific parasite because it can attach to all types of fish, actively swimming freely. According to Sufriyanto et.al, (2013) Trichodina reproduces by a division that takes place in the host's body, can escape from the host, and can live for more than two days without a host. While the fewest ectoparasites from the phylum protozoa were Vorticella as many as 3 or 2.4%. The small number of Vorticella is due to solitary life and an environment that is not suitable for growth (Novita et.al 2016).

The most common ectoparasites found from the Helminthes phylum were Dactylogyrus as many as 39 individuals or 31.0% of the total number of ectoparasites found. Dactylogyrus sp has a wide distribution in freshwater fish species. The spread of Dactylogyrus sp is seen from its ovivar life cycle. Adult Dactylogyrus sp will produce many eggs to the bottom of the water, then develop into larvae and move freely to find a definitive host for their development. In addition, high ambient temperatures will cause Dactylogyrus sp to multiply faster (Fitri 2013).

The fewest ectoparasites were Transversotrema as many as one tail or 0.8% of the total number of ectoparasites found. According to Amirullah et al (2012) Transversotrema is an ectoparasite of the Trematode class whose reproduction is relatively long and requires an intermediate host. Transversotrema requires more than one host and takes a long time to develop (Amirullah et.al 2012).

3.3 Ectoparasites that attack fish organs

Examination of ectoparasites resulted in ectoparasites on the surface of the fish skin (skin, scales, and fins) more were found by 87 tails or 69.05%, while ectoparasites that attacked the gills were 39 tails or 39.95%. The surface of the fish body is the outermost part of the fish that is in direct contact with the water surface so that it is more susceptible or more easily infected with ectoparasites. According to Riko et.al (2012), ectoparasites can damage the fish skin layer, and under the scales is the best substrate for parasites to attach. The results can be seen in Table 5.

Table 5. The genus and number of ectoparasites that attack fish organs, body surfaces, and fish gills

Parasite Genus	Body Surface (Skin, Scales, Fins)		Gill	
	Total (tail)	Percentage (%)	Total (tail)	Persentase (%)
Trichodina	47	37.30	0	0
Trichodinella	8	6.35	0	0
Vorticella	3	2.38	0	0
Epistylis	20	15.87	0	0
Dactylogyrus	0	0.00	39	39.95
Gyrodactylus	8	6.35	0	0
Transversotrema	1	0.79	0	0
Total	87	69.05	39	39.95

The most common ectoparasites found on the body surface were Trichodina as many as 47 tails or 37.30% and the least was Tranversotrema as many as one tail or 0.79%. This is thought to be due to the transmission of Trichodina through the body surface using body friction.

The types of ectoparasites found in the gills were Dactylogyrus as many as 39 individuals or 39.95%. This is because the gills are the habitat of Dactylogyrus and is a relatively good place to support its growth and development because it provides blood and oxygen as a source of nutrition for Dactylogyrus which is a gill worm. Yazid et.al (2012) stated that the gills provide a food source in the form of blood and media suitable for maximum reproduction of Dactylogyrus.

The number of Dactylogyrus found in the gills will cause the gills to be damaged and the oxygen exchange process in the gills to be disrupted. This happens because the parasite type Dactyrogyrus sp. can cause closed gill surfaces, damage to the epithelium, and coupled with excessive mucus production will interfere with oxygen exchange so that which can cause fish to die because they are unable to breathe (Akbar 2011).

3.4 Ectoparasite Intensity

The overall intensity of ectoparasites infecting fish caught by fishermen in Jatigede Reservoir was 6.3 ind/fish, which means 6 ectoparasites were infecting one fish caught
Table 6.

Table 6. The intensity of Ectoparasites in Fish Captured by Fishermen in Jatigede Reservoir

Intensity per Ectoparasite (individual/fishtail)		Ectoparasite Intensity per Fish Type (individual/fishtail)											
Phylum	Genus	Ham	Red	Nil	Taw	Jag	Bet	Lal	Seng	Tag	Mas	Gab	Beu
Protozoa (3,21)	Trichodina (2,76)	1,50	3,60	3,00	1,00	1,00	0	2,50	0	0	4,00	0	0
	Trichodinella (2)	0	1,50	1,00	0	0	0	3,00	0	0	0	0	0
	Vorticella (3)	0	0	3,00	0	0	0	0	0	0	0	0	0
	Epistylis (10)	0	10,00	0	0	0	0	0	0	0	0	0	0
Helminthes (3,77)	Dactylogyrus (7,80)	0	2,00	17,50	1,00	0	0	0	0	0	0	0	0
	Gyrodactylus (1,14)	0	0	1,67	1,00	1,00	0	0	0	0	1,00	0	0
	Transversotrema (1)	0	0	0	0	0	0	1,00	0	0	0	0	0
Total Intensity per Fish Type		1,50	17,10	26,17	3,00	2,00	0	6,50	0	0	5,00	0	0

The highest intensity value, namely the Helminthes phylum, was higher at 3.77 and the lowest was the Protozoa phylum at 3.21. Dactylogyrus has a high-intensity value from the Helminthes phylum, which is 7.80 or 8 fish per fish, including in the medium category. This means that Dactylogyrus can produce up to 100 eggs. The intensity of Transversotrema has the lowest intensity value of the Helminthes phylum of 1 or 1 fish per fish including in the low category, because this parasite takes a long time to develop, is host-specific, requires more than one host (Amirullah et.al 2012).

The highest intensity value of the phylum Protozoa, namely Epistylis of 10 or 10 fish per fish is included in the medium category because epistylis lives in colonies and almost

attacks all freshwater fish including seeds (Septyan et.al 2014). While the lowest intensity value, namely Trichodinella, of 2 fish per fish was included in the low category. This is presumably because the water conditions in the Jatigede Reservoir do not support the breeding of this parasite. This is by the statement of Hoffman (1967), Trichodinella requires an optimum temperature of 20-26°C, while the average temperature in the Jatigede Reservoir is 27°C.

Tilapia has the highest intensity value among other fish, which is 26.17, which is included in the medium category, because of the ease with which Tilapia can adapt to any environmental conditions so that parasites can breed well.

Senggal, Billy, Gabus, Betutu, and Beureum Panon fish have the lowest intensity value of 0 or are not infected with ectoparasites. This happens because the number of these fish is very rarely found in the waters of the Jatigede Reservoir so that the intensity is low.

3.5 Ectoparasite Prevalence

The number of fish infected with ectoparasites was 20 fish or 26.3% and 46 fish or 73.7 of the total number of 76 fish were not infected (Table 7). The highest prevalence of ectoparasites among all ectoparasites, namely Trichodina from the phylum Protozoa, was 19.36%, meaning that the number of fish affected by Trihcodina was only 19 of the number of fish observed (76 fish), included in the frequent category which means frequent infections. The highest prevalence of Trichodina is because this ectoparasite does not have a specific host and is easily transmitted to other fish through body friction. The lowest prevalence value was Vorticella at 1.31% or infecting 1 fish from the number of fish observed, including the occasional category which means the infection rate is occasional. Vorticella that live solitary does not colonize so few are found in the host's body. This is by the statement of Samsu et.al (2014), all Vorticella are solitary and attached to the substrate with contractile stalks.

Table 7. Ectoparasite prevalence in fish caught by fishermen in Jatigede Reservoir

Prevalence per Ectoparasite (%)		Ectoparasite Prevalence per Fish Type (%)											
Filum	Genus	Ham	Red	Nil	Taw	Jag	Bet	Lal	Seng	Tag	Mas	Gab	Beu
Protozoa	Trichodina (19,36)	20,00	50,00	50,00	10,00	11,11	0	22,22	0	0	50,00	0	0
	Trichodinella (6,58)	0	20,00	20,00	0	0	0	11,11	0	0	0	0	0
	Vorticella (1,31)	0	0	10,00	0	0	0	0	0	0	0	0	0
	Epistylis (2,63)	0	20,00	0	0	0	0	0	0	0	0	0	0
Helminthes	Dactylogyrus (6,58)	0	10	20,00	20,00	0	0	0	0	0	0	0	0
	Gyrodactylus (9,21)	0	0	40,00	10,00	11,11	0	0	0	0	50,00	0	0
	Transversotrema (1,31)	0	0	0	0	0	0	11,11	0	0	0	0	0
Total Prevalence per Fish Type		20,00	60,00	60,00	20,00	11,11	0	22,22	0	0	100	0	0

Gyrodactylus has the highest prevalence value from the Helminthes phylum of 9.21% or infects 9 fish from the number of fish observed (76 fish) because Gyrodactylus can infect all types of fish. According to Amirullah et.al (2012), the nature of Gyrodactylus does not

have a specific host and is cosmopolitan so that it can infect all types of fish. Transversotrema has the lowest value of 1.31% including the occasional category which means the infection rate is sometimes. Transversotrema has a long enough time to breed.

The highest prevalence value is found in goldfish (Figure 3), which is 100% including the category that always means very severe infection. This was presumably because the carp examined were in the form of 8-10 cm (ngaramo) seeds so they had low body resistance so they were easily attacked by ectoparasites. The larger the size of the fish, the better the fish's immune system, so that the condition of the body's resistance of seed-sized fish is still weak and very susceptible to environmental changes so that they are more susceptible to parasites (Novy 2015). In addition, goldfish are not specific hosts for ectoparasites, making the prevalence value large.

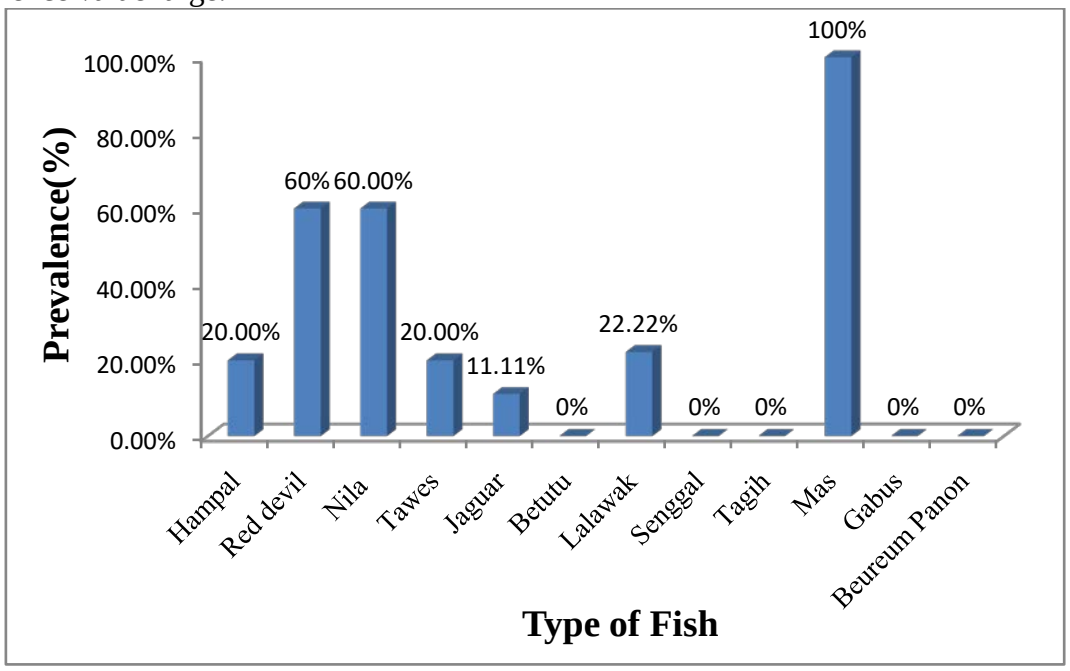

Figure 3. Ectoparasite prevalence per fish species in Jatigede reservoir 2019

Senggal, Billy, Gabus, Betutu, and Beureum Panon fish have the lowest intensity value of 0 or are not infected with ectoparasites. This happens because the number of these fish is very rarely found in the waters of the Jatigede Reservoir so that the possibility of infection is small.

3.6 Water Quality of Jatigede Reservoir

The results of observations of water quality parameters in the Jatigede Reservoir are still good enough to be used for fish life, as can be seen in Table 8.

Table 8. Parameter kualiatas air di Waduk Jatigede

Parameter	Unit	Take-up				Average
		1	2	3	4	
Temperature	°C	28,0	27,5	26,3	27,0	27,2
pH	-	7,5	7,24	7,6	7,53	7,47
DO	mg/L	6,2	6,1	4,0	6,0	5,6
BOD	mg/L	4,0	5,6	5,1	4,4	4,8
Ammonia	mg/L	0,185	0,352	0,287	0,417	0,310

3.6.1 Temperature

The average temperature of the Cimanuk river at 09.30 WIB tends to be cold at 27º. The safe temperature for fish ranges from 23º-29ºC with an optimum temperature of 24ºC (Asdak 2007, Rahardjo et al. 2011).

3.6.2 pH

The average pH of the waters of the Jatigede Reservoir is 7.47, which is normal for fish life. If the pH 4 will not grow well and 10 will cause death (S. Amirullah et.al 2012).

3.6.3 Dissolved Oxygen (DO)

The average value of Dissolved Oxygen (DO) is 5.6 mg/L which indicates that it is still quite good. This is by Baihaqi's research (2016), the DO content in the Jatigede Reservoir ranges from 5.1-5.9 mg/L and meets the DO value requirements for class II and class III water quality standards.

3.6.4 Biochemical Oxygen Demand (BOD)

The average Biochemical Oxygen Demand (BOD) is 4.8 mg/L, which is water with light-polluted criteria. The high BOD value is because the waters of the Jatigede Reservoir have been polluted.

3.6.5 Ammonia

The average ammonia level in Jatigede Reservoir is 0.310 mg/L, which means the waters are still good for fish development because according to research by Baihaqi (2016), ammonia levels of 0.55 mg/L will cause fish growth to be disrupted and even to death.

3. CONCLUSIONS

The water quality of Jatigede Reservoir is still quite good and still suitable for fish life compared to other reservoirs in West Java such as Jatiluhur, Cirata, and Saguling Reservoirs. The results of Pigoselpi's research (2017) show that the water quality status of the Jatiluhur reservoir based on "UA-EPA" is moderately polluted, almost heavily polluted with a value of -30 class C. The results of Soetrisno's research (2011) state that the waters of the Cirata Reservoir have been eutrophicated because they are polluted by nutrients from various waste sources.

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