

Original article

**Keanekaragaman jenis ikan di Perairan Sungai Penyerang
Kecamatan Puding Besar Kabupaten Bangka**

Biodiversity of fish in Penyerang River at District of Puding Besar, Bangka Regency

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Abstract

Penyerang river is one of rivers which located in district of Puding Besar, Bangka regency. The mining and agricultural activities were increased at the district that lead to the decreasing of the quality of the environment, especially for the biodiversity of fish. The aim of this research was to investigate the diversity of fish, similarity index, and domination index of fish in Penyerang rivers, district of Puding Besar, Bangka Regency. The method used was survey-sampling method by placing six observation stations in way of purposive sampling. It was divided on certain stations, such as up, middle and down stream station, whereas two for each stations. The data collected was chemical and physical water parameters and fish sample by using gillnet, scoopnet and frock. The result shows that 18 fish species in Penyerang Rivers in District of Puding Besar, Bangka Regency composed of 13 genus and 9 families were found. The diversity of fish population and species in Penyerang River indicating on average range and was not dominate by certain species. Taken together, the populations of fish in Penyerang River were uniform.

Keywords : Biodiversity, Fish, Penyerang River, species

Introduction

Penyerang river is one of river which located in the district of Puding Besar, Bangka Regency. According to ETM (*Enhanced Thematic Mapper*) report, on 2007 Penyerang river length was ± 7500 m (Bakosurtanal, 2007). Environmental condition of Penyerang river was being a big stream spot for several rivers, either nature nor common river that used by human activities. This condition will might an impact for diversity of fish at Penyerang river. In addition, positive relation between diversity and environment were depend on two factors. First, increasing of micro-environment lead to diversity enhance. Second, a large area was more varies compared to small area (Wootton, 1991 in Yustina, 2001).

Recently, a massive project was came from agriculture and mining activities which can impact to dashriver in particularly. Department of Forestry and agriculture was reported on statistical data, during 2005 to 2007, agriculture field of Puding Besar district was increasing continuously from 187 ha to 297 ha, composed of rice and non-rice field. Those activities were resulted in decreasing river environment because of industry, human life and agriculture waste (Daryanto, 2004).

Effendy (2003) revealed that the agriculture field was being pollutant source for water environment. It was dangerous for aquatic environment due to continuously exposure that will making harmful effect.

Therefore, this study was aimed for investigate the diversity of fish, it relation between species, similarity index, and dominance index of fish in Penyerang river.

Method

This study was done on March to August 2010 in Penyerang river, Kayu Besi Village, district of Puding Besar, Bangka Regency. The sample has identified in Fisheries Laboratory, Faculty of Agriculture, Fisheries and Biology, University of Bangka Belitung.

Data Collecting

Data was collected by survey sampling method, which recorded a part of population data for being representative of research object (Surakhman, 1980 in Dwi, 2005). Moreover, sample of our study were obtained from certain observation station for being representative of biodiversity fish population in Penyerang river.

Stations of observation

Observed stations were chosen by *purposive sampling method*, based on personal considering at the research location (Fachrul, 2006). It was divided on certain station, such as up, middle and down stream station, whereas two for each stations.

Physical and chemical parameter measurement

Parameter measurement consist of physical (temperature, clarity, depth, current speed, wide), and chemical (pH, dissolved oxygen). Speed of current was measured by the ball and stopwatch.

Fish Sampling

Fish sample was collected by pull net (5 m length, 2 m wide and 0.5 cm mesh size) used only on the day. Gill net with 10 m length, 1.5 m wide, and 1.5 cm x 3 cm mesh size. It used only on the night. Besides that, *serokas* well as support the catching tools. In detail using the tools, pull net on each observed station was put into the river, both side of net pulled by wood or bamboo stick for opposite way with the river stream as 50 m in 3 times. Moreover, gill net should to blocking river stream and used on evening in order to checking the result on the next morning.

The caught fish were record, measure, transfer to 5-10% formalin, and labeled. The next step at laboratory, fish sample should to washing from the formalin, and then keep it into 70% alcohol.

Data Analysis

Fish Sample Identification

Sample delivered to Fisheries Laboratory of Agriculture, Fisheries and Biology Faculty, Bangka Belitung University. In order to identification of sample based on Kottelat, *et.al.* (1993) and Saanin (1984).

Relative Biodiversity

Relative biodiversity calculated by total percentage (Brower, *et al.* 1990).

$$Kr = \frac{ni}{N} \times 100 \%$$

Where Kr is relative abundance; ni is the amount of individuals -i; N is sum of individue of all species.

Frequency of availability

Availability frequent could indicate the large local population of certain species. According to (Brower, *et al.* 1990).

$$Fi = \frac{ti}{T} \times 100 \%$$

Where Fi is Frequency of the availability of caught species i (%); ti = number of stations where the species i been found; T = Amount of all stations.

Diversity Index

Diversity index was being one of ecology index that commonly use in evaluation of ecosystem based on biological factor. In obtaining biodiversity of fish, Shannon-Wiener index was used (Fachrul, 2006) :

$$H' = -\sum \left(\frac{ni}{N} \right) \ln \left(\frac{ni}{N} \right)$$

Where H' is index of Shannon-Wiener; Ni is number of individual species i; N is number of total individual of all species.

Criteria :

- H' < 1 : Low diversity
- 1 < H' < 3 : Medium diversity
- H' > 3 : High diversity

Similarity Index

Maximum diversity (H_{maks}) will appear if biodiversities of species at observed station showed uniformly or $H' = H_{maks} = \log_2$. Biodiversity formula to measuring Similarity index (E):

$$E = \frac{H'}{H_{maks}} = \frac{H'}{\ln S}$$

E = Index of similarity; H' = Shannon-Wiener Index of diversity; H_{maks} = maximum diversity; S = Number of species.

Similarity index in range 0-1. Index value which is close to 0 indicating that some species or individual were relative. It means some species are many than others or opposite. However, similarity index that is close to 1 indicating that some individual in species were uniform.

Dominance Index

Simpson's dominance Index (Legendre & Legendre, 1983 in Setyobudiandi, et al., 2009) was used to know the dominance index in this study :

$$C = \sum \left(\frac{ni}{N} \right)^2$$

Where C is Simpson's dominance Index, ni is number of individue of species i, N is total number of individue of all species.

Dominance index in range 0-1; index 1 indicating that highly domination (only one species was found at observed station). Index 0 indicating that no domination was found.

Result and Discussion

Environmental Parameter

Physical and chemical parameter of Penyerang river, district of Puding Besar, Bangka Regency, showed on table 1.

Table 1 Physical and chemical Parameter in Penyerang River

Parameter	Station					
	1	2	3	4	5	6
<i>Physical</i>						
- Temperature (°C)	26	25	25	26	24,5	25
- Clarity (%)	100	100	100	100	65,15	87,77
- Current speed (cm/s)	19,37	26,88	10,75	30,03	31,74	28,43
- Depth (cm)	46,44	55,88	48,78	40,66	92	87,22
- Width (m)	3,70	2,73	2,36	4,13	3,26	5,16
- Canopy cover(%)	±65	±70	±70	±75	±70	±80
<i>Chemical</i>						
- pH	5	5	5	5	5	5
- Dissolved oxygen (mg/L)	5,75	5,95	5,55	5,55	5,75	5,55
- Total Phospat (mg/L)	0,0041	0,0023	0,0045	0,0040	0,0043	0,0065
- Total N (mg/L)	60,0	41,8	47,4	17,5	6,50	14,2

The temperature of Penyerang river was 24.5°C – 26 °C, and average temperature was 25.25°C. According to Effendi (2003) temperature in 20°C – 30 °C was optimum for the growth of phytoplankton. It will provide more nutrients for the fish.

In addition, the river stream had a vital function for organism life, dissolved oxygen and mineral. Mason (1981) in Susilawati (2001) classified that Penyerang river was being one of the low to middle current river (10-25 cm/dt) - (25-50 cm/dt). It was potential for gather fish feeding due to some organic process make it happen. Barus (2000) described that the river with had low current was more comfortable for organism

habitat without certain adaptation. Our findings on the three of station (I, II, dan III) were low current categories, which located at upper part of Penyerang river. Moreover, the downstream part that consisted of IV, V, and VI station were average current categories.

pH value in Penyerang river was 5, or acid, but that condition still accepted. Usually, fish population was more optimum at 6.5-8.5 (Barus, 2000). Pescod, (1973) in Haryono (2001) explained that in range of pH at 4 – 11, fish could adapted. The acid condition of Penyerang River might because of some organic process, which is happen in the river bottom. The heavy forest that surrounded of Penyerang river makes it happen.

The dissolved oxygen at Penyerang river was 5.68mg/l, indicating good enough for fish environment based on Pescod (1973) in Haryono (2001) which reported the minimum dissolved oxygen was 3 mg/L. It found uniformly at all of observed station along Penyerang river. It was poor because of sunlight intensity was covered by canopy, which ranged 65%-80%, so the production of oxygen by photosynthesis is lacking.

The content of phosphate in the Penyerang river ranged from 0.0023 to 0.0065 mg/L with an average of 0.0042 mg/L. In general, the phosphate fertility range that containing water was divided into low, moderate and high level, based on value 0 to 0.02 mg/L, 0.021 to 0.05 mg/L, and 0.051 to 0.1 mg/L respectively (Effendi, 2003). Based on Effendi (2003), Penyerang river classified in low fertility levels. This suggests that the process of fertilization in plantations around the river, which will increase the phosphorus content, is not influential enough.

Total nitrogen is a representative of nitrogen in organic form (proteins, amino acids, urea) and inorganic (nitrite, nitrate, ammonia). Penyerang river has a total nitrogen values ranged from 6.50 to 60 mg/L, with an average value of 31.23 mg/L. According Tchobanoglous and Burton (1991) in Effendi (2003) total nitrogen of Penyerang river was slightly

concentration, so it is not harmful for fish life. The highest total nitrogen contained in the station I, II, and III which is an upstream and mid-stream area with an average value of 49.73 mg/L, while the lowest total nitrogen was in the station IV, V, VI, which is an area of mid to the lower river with an average value of 12.73 mg/L. The high concentration of total nitrogen in the upstream areas due to vegetation density, while in the downstream areas caused by the extent of river line, that allowing the nitrogen molecules spread more widely.

Resources conservation fish in the Penyerang river

Identification and analysis of fish in the Penyerang River presented in Table 2 and 3.

In generally, the fish that obtained in Penyerang River divided into 9 families and 18 species. Based on the types of fish seem that most was from the Cyprinidae family. Cyprinidae is freshwater fish that very large and could be found everywhere in the world except Australia, Madagascar, New Zealand, and South America (Kottelat, 1993).

Species composition is accumulative number of species. Table 2 shows that the composition of fish was vary at each observed station. *Dermogenys sumatrana* (julungjulung) found in each station. It was the most numerous in the station I (16 fish). Based on observations of the vegetation, the station I was dense of *Pandanus sp.* Julungjulung fish is herbivorous fish, feeding algae and kinds of tiny particles in order to adapt to their small mouth (Samuel, 2010). Due to its conditions, julungjulung fish allowed to be found in station I. In addition, the dense of vegetation at the station I was also supports the fish for covering their habitat that gather on the surface of the waters (Kottelat, 1993). Moreover, the most of fish was found at station VI, due to the station is the widest (about 5.10 m). The wide area is possible to having a more variety than the small areas (Wootton, 1991 in Yustina, 2001), resulting in abundance of fish.

Table 2 Fish composition of observed stations

No	Species	Composition of species							
		Family	Local name	Station					
				I	II	III	IV	V	VI
1	<i>Bettaanabatoides</i>	Osphronemidae	Tepala	-	+	+	+	-	+
2	<i>Channalucius</i>	Channidae	Kiung	-	-	-	-	-	+
3	<i>Channastrjata</i>	Channidae	Gabus	-	-	-	-	-	+
4	<i>Cyclocheilichthysarmatus</i>	Cyprinidae	Keperas	-	-	-	-	+	+
5	<i>Homalopterasp</i>	Balitoridae	Lenjing	-	-	-	-	+	-
6	<i>Osteochilusspilurus</i>	Cyprinidae	Kepaet	-	+	+	+	+	+
7	<i>Nandusnebulosus</i>	Nandidae	Ketiber	+	-	-	+	+	-
8	<i>Kryptopterussp</i>	Siluridae	Tepurong	-	-	-	-	-	+
9	<i>Luciocephaluspulcher</i>	Luciocephalidae	Templusok	-	-	+	-	-	+

10	<i>Mystus</i>	Bagridae	Baung	-	-	-	-	+	-
11	<i>Nemacheiluselangoricus</i>	Balitoridae	Pasir	+	+	-	+	+	+
12	<i>Neohomalopterajohorensis</i>	Balitoridae	Betutu	-	-	+	+	-	+
13	<i>Puntiusbinotatus</i>	Cyprinidae	Tanah	+	+	+	+	-	+
14	<i>Puntiusjohorensis</i>	Cyprinidae	Tepalapinang	-	-	+	-	-	-
15	<i>Rasborabankanensis</i>	Cyprinidae	Kemuntis	-	+	+	+	+	+
16	<i>Rasboracephalotaenia</i>	Cyprinidae	Seluanghitam	-	+	+	-	+	+
17	<i>Rasborasp</i>	Cyprinidae	Seluangmerah	-	+	+	-	-	+
18	<i>Dermogenyssumatrana</i>	Hemiramphidae	Julung-julung	+	+	+	+	+	+

Note : (-) = no fish were found; (+) = there were fish found

Tabel 3 Relative abundance of fish in observation station

No	Species	KelimpahanRelatif					
		Station					
		I	II	III	IV	V	VI
1	<i>Bettaanabatoides</i>	-	1.111	0.96	3.23	-	0.437
2	<i>Channalucius</i>	-	-	-	-	-	0.437
3	<i>Channastrata</i>	-	-	-	-	-	0.873
4	<i>Cyclocheilichthysarmatus</i>	-	-	-	-	6.45	0.873
5	<i>Homalopterasp</i>	-	-	-	-	2.15	-
6	<i>Osteochiluspilurus</i>	-	1.111	7.69	3.23	12.9	10.04
7	<i>Nandusnebulosus</i>	8	-	-	1.61	1.08	-
8	<i>Kryptopterus</i>	-	-	-	-	-	0.873
9	<i>Luciocephaluspulcher</i>	-	-	1.92	-	-	0.873
10	<i>Mystus</i>	-	-	-	-	1.08	-
11	<i>Nemacheiluselangoricus</i>	4	4.444	-	14.5	5.38	11.35
12	<i>Neohomalopterajohorensis</i>	-	-	0.96	3.23	-	0.437
13	<i>Puntiusbinotatus</i>	24	14.44	0.96	12.9	-	3.057
14	<i>Puntiusjohorensis</i>	-	-	0.96	-	-	-
15	<i>Rasborabankanensis</i>	-	55.56	52.9	56.5	21.5	10.04
16	<i>Rasboracephalotaenia</i>	-	7.778	6.73	-	41.9	20.52
17	<i>Rasborabeouforti</i>	-	1.111	23.1	-	-	38.86
18	<i>Dermogenyssumatrana</i>	64	14.44	3.85	4.84	7.53	1.31
Total		100	100	100	100	100	100

Note: (-) = none of fish; Green = highest frequent; Red = lowest frequent; Blue= Bangka original species.

The highest relative abundance of fish in the station I was *Dermogenyssumatrana* (Julungjulung) with a value of 64%. The highest relative abundance at station II, III, and IV is occupied by *Rasborabankanensis* (kemuntis) with the percentage of abundance was 55.56%, 52.9% and 56.5%, respectively. On the other hand, the highest relative abundance of station V and VI was *Rasboracephalotaenia* (blackseluang) with 41.9%, and *Rasborabeouforti* (red seluang) with 38.86%.

Based on observations of physical parameters, vegetation around the river was indicating normal for *Dermogenyssumatrana* (Julungjulung) have a relatively high abundance. Due to the dense vegetation is the most preferred habitat to find food and shelter. While at the station II, III, and IV *Rasborabankanensis* (kemuntis) is a species with the highest

relative abundance. It is distributed in the fresh waters of Sumatra and Borneo, as well as Penyerang river. *Rasborabankanensis* found in almost all stations, indicating for uniform relative abundance based on its value. It revealed that Penyerang river preferred habitat in accordance with *Rasborabankanensis*.

At the station V and VI, *Rasboracephalotaenia* (blackseluang) and *Rasborabeouforti* (redseluang) were the highest species due to preferred temperatures between 22-24°C and 22 – 25°C with an optimum pH value of 5-7.5 (Bleker, 1852).

Index of diversity, similarity, and dominance

The index value of fish diversity at each observation station ranged from 0.958 to 1.801. Based on these values, the diversity of fish species in the Penyerang river tend to moderate. It was indicating

stable biota communities or ecological pressures (Odum, 1993). The smallest diversity index found in the first station with 0.958, which means instability of biota community or heavily polluted water quality (Barus, 2000). Chemical parameters revealed that the total nitrogen in the station I was higher than other stations about 60 mg/L. This value indicating the total nitrogen was not good for fish (Tchobanoglous and Burton, 1991 in Effendi, 2003). However, the high value of total nitrogen at the first station is not clear yet.

Homological index value (E) of all observation stations ranged from 0.573 to 0.759 with an average value of 0.667. According to Krebs (1986) in Odum

(1993) the value of similarity should be $E \leq 0,4$: low similarity population; $0,4 < E \leq 0,6$: moderate similarity population; $E \geq 0,6$: high similarity population. Based on these criteria the Penyerang River has uniform population, which means, the population of fish spread evenly on all stations.

Simpson's dominance index on each station ranged 0,227 – 0,475. It means no dominant species found (Odum, 1993).

The index value of diversity, similarity and dominance of fish in the Penyerang River showed in Figure 1.

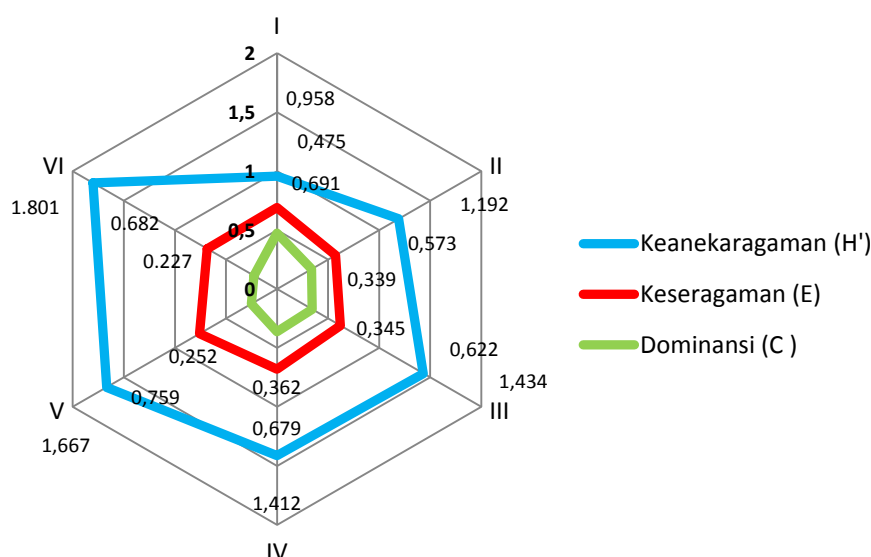


Figure 1 Index value of diversity, similarity and dominanty of fish in the Penyerang River

Conclusion

Our findings revealed that 18 fish species in Penyerang Rivers in Puding Besar District, Bangka Regency composed of 13 genus and 9 families. Kemuntis (*Rasborabankanensis*) was more than other species. The diversity of fish population and species in Penyerang River indicating on average range and was not dominated by certain species. Taken together, the populations of fish in Penyerang River were uniform.

Acknowledgment

Thank you very much for PT Timah, Tbk who has participated in funding support, because of their sponsorship, our research project could be finished.

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