

PARAMETERS OF GROWTH, MORTALITY AND FISHING RATE OF BONYLIP BARB (*Osteochilus waandersii*) FISH IN LAKE KERINCI, JAMBI

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ABSTRACT

A study with the aims to evaluate the parameters of growth, mortality and fishing rate of bonylip barb fish (*Osteochilus waandersii*) was conducted in Kerinci Lake, Jambi from April to October 2013. Field surveys were done to collect fish samples. The samples were obtained from the catches of fishermen who used gillnets with mesh size of 1.0 to 3.0 inches to catch the fish. Results show that the bonylip barb fish population in Kerinci Lake was dominated by individual fish length size of 15.5 to 20.5 cm with a frequency of 40%. The growth pattern was allometric (-). Asymptotic length (L_{∞}) reached 32.50 cm and growth coefficient (K) was 0.85 per year. Growth performance (Φ'), the rate of natural mortality (M), the rate of fishing mortality (F) and the total mortality rate (Z) were respectively 2.953, 1.47 per year, 0.87 per year and 2.34 per year. So the exploitation rate of bonylip barb fish populations (E) was 0.37. The spawning season peak of bonylip barb fish in Kerinci Lake is expected to occur at the beginning of the rainy season was around September.

Keywords : Growth, mortality, bonylip barb fish, Lake Kerinci

INTRODUCTION

Lake Kerinci in Jambi Province, included the type of tectonic lake having an area of approximately 4,200 hectares with a depth of 110 meters and located at an altitude of \pm 783 meters above sea level. In the fisheries sector, the lake is famous for its semah mahseer fish (*Tor duoronensis*), a consumption fish with higher economic value than other types of freshwater fish such as hampala barb fish, striped snakehead, spiny eel, and asian swamp eel. With the passage of time from year to year and the increasing of the human population, semah mahseer fish in Lake Kerinci tends to diminishing. Current information, there were only three dominant species of fish caught in Lake Kerinci which was from fishermen's catch, while the fish species of semah mahseer was relatively rare caught (only occasionally).

The first dominant fish species was nile tilapia (*Oreochromis niloticus*), an introduction fish which was

successfully grown and reproduced in Lake Kerinci. The second dominant was hampala barb (*Hampala macrolepidota*) that was classified as wild fish, and the third dominant was bonylip barb (*Osteochilus waandersii*). Habitat of nile tilapia and hampala barb fish during their life was in the waters of the lake, while the bonylip barb fish in the dry season more live in the waters of the river and the rainy season was generally located in the waters of the lake. Bonylip fish is one of the few species of native freshwater fish in Lake Kerinci which still survive today compared with other kinds of fish species that need to be preserved. For those case, it was required a good management of these fish resources. Decreasing the number of lake native freshwater fish was also complained by a number of people,

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especially Kerinci People who has profession as fishermen. Because of scarcity of fish that happen to make their income was reduced (Metro Jambi "Native Fish Species Kerinci Start", August 24, 2011).

Because the bonylip barb fish (*Osteochilus waandersii*) was one of the dominant fish species caught in Lake Kerinci and also become a mainstay commodity of the fishermen to increase their income in addition to Nile tilapia and hampala barb fish, it was necessary to well manage this fish population so that the fish can be sustainable and optimally utilized. The purpose of the study was to evaluate the parameters of growth, mortality and the fishing rate of bonylip barb (*Osteochilus waandersii*) fish population in Lake Kerinci as an important information for the management of bonylip barb fish resources in the lake so the population will remain stable and can be utilized in a sustainable manner. The focus of this study was the growth parameters, natural mortality, fishing mortality, exploitation rate and recruitment patterns of bonylip barb (*Osteochilus waandersii*) populations in Lake Kerinci, Jambi.

MATERIALS AND METHODS

The study was conducted in Lake Kerinci located in the Kerinci Régency, Jambi Province (Figure 1). The study was done from April to October 2013. Bonylip barb (*Osteochilus waandersii*) fish samples used in this study are collected from the catches of fishermen using gillnets with mesh size from 1.0 to 3.0 inches (1, 1 ½, 1 ¾, 2, 2

½, 2 ¾ and 3-inch). Locations of gillnet installation were in some places, namely: inlet area, near the rice fields, outlet area, close to residential areas and in the middle of the lake.

Fish length was measured using a measuring board with accuracy up to the smallest scale of 0.1 cm and its weights weighed to the accuracy of 0.1 grams each individual bonylip barb fish. The measurement data of the fish length and weight, to then analyzed to determine the growth pattern of fish, whether isometric (b=3) or allometric (b≠3), which was calculated from the formula of the length and weight of fish relationship proposed Effendie (1979) namely :

$$W = a * L^b \dots\dots\dots (1)$$

where,
 W = weight of fish (gram),
 L = total length (cm),
 a and b = constants

Value of the constant "b" obtained from the equation, to further was tested the accuracy of the value of b=3 by using the "t-test" (Steel & Torrie, 1976 ; Walpole, 1995). Estimation of von Bertalanffy growth parameters, namely the total asymptotic length (L∞) and growth coefficient (K) were calculated using the program Elefan I (1987) in a computer program package FISAT II (Gayanillo et al., 1995). Estimating the value of t₀ (age at time of zero length) was calculated based on the equation of Pauly (1984), namely :

$$\text{Log} (- t_0) = -0.3922 - 0.2752 \text{ log} (L^\infty) - 1.038 \text{ log} (K) \dots\dots\dots (2)$$

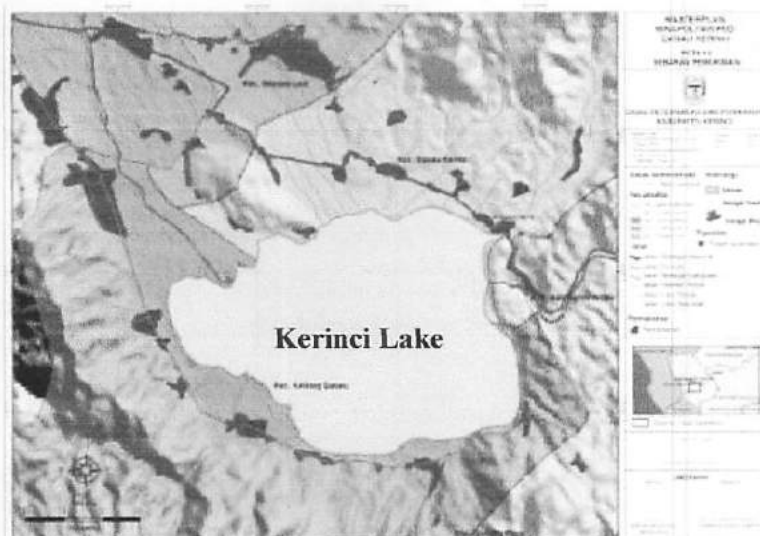


Figure 1. Research location of bonylip barb fish in Kerinci Lake.

Growth performance index (Φ' , phi-prime) was calculated using the equation of Pauly & Munro (1984) as follows :

$$\Phi' = \text{Log}_{10}K + 2 \text{Log}_{10}L^{\infty} \dots\dots\dots (3)$$

The rate of natural mortality (M) was estimated by using an empirical model of Pauly (1980), namely :

$$\text{Log} (M) = -0,0066 - 0,279 * \text{log}(L^{\infty}) + 0,6543 * \text{log}(K) + 0,4634 * \text{log} (T) \dots\dots\dots (4)$$

where :

- L^{∞} = asymptotic total length
- K = growth coefficient
- T = the average water temperature of Kerinci Lake (24.5° C)

The coefficient of total mortality (Z) was calculated from the catch curve based on the length converted catch curve (Pauly, 1983) that the calculation was performed using a computerized

program package FISAT II (Gayanilo *et al.*, 1995). The coefficient of fishing mortality (F) was calculated from the equation

$$F = (Z - M) \dots\dots\dots (5)$$

The rate of exploitation (E) was calculated using the equation

$$E = F / Z \text{ (Pauly, 1980)} \dots\dots\dots (6)$$

RESULTS AND DISCUSSION

The bonylip barb fish, *Osteochilus waandersii* (family Cyprinidae) that many caught in Kerinci Lake, Jambi as shown in Figure 2, had white on the abdomen and greenish on the back and there were 32-33 scales in the lateral line. There was a clear black stripe along the body of the gill slits until the end of the middle fingers of the tail fin.

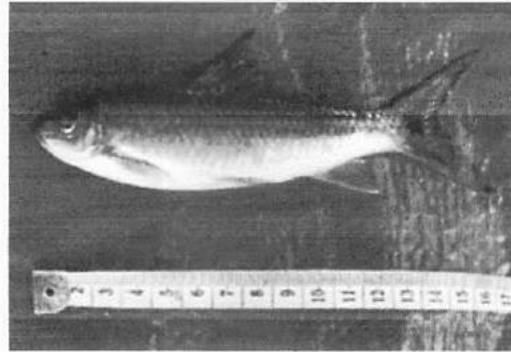


Figure 2. Bonylip Barb (*Osteochilus waandersii*) Fish from Kerinci Lake

The analysis results of the length-weight relationship of bonylip barb fish in Lake Kerinci followed a functional equation of $W = 0.0163 L^{2.8309}$ (Figure 3) with a regression coefficient (R^2) = 0.9526. T test results against the

parameter "b" to get the value of t-count = 3.478 was greater than t-table = 1.96, thus the value of the parameter "b" in contrast to 3 which shown the growth pattern of fish was allometric (-).

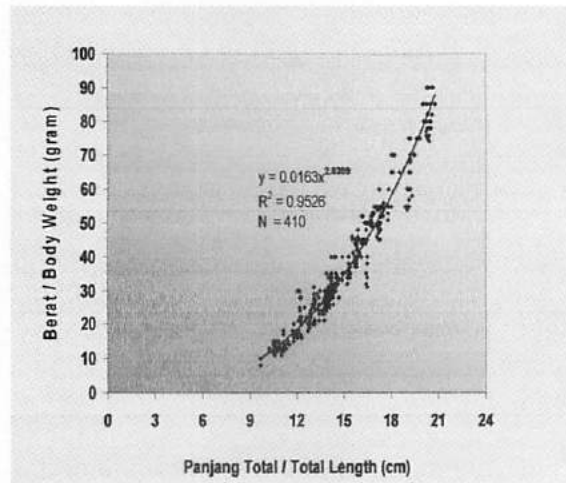


Figure 3. Length-Weight Relationship Curves of bonylip barb fish in Lake Kerinci

Fish growth patterns of bonylip barb that were allometric (-) indicated that the length was faster than the weigh. The fish that had a pattern of allometric growth (-), it means the growth of the fish does not belong to the ideal (lean).

Furthermore, from 1,090 fish samples which was measured their total

length from April to October 2013 (Appendix 1), it turned out fish population of bonylip barb in Lake Kerinci was more dominated by individuals which had size of length between 15.5 to 20.5 cm with a frequency of 40% (Figure 4).

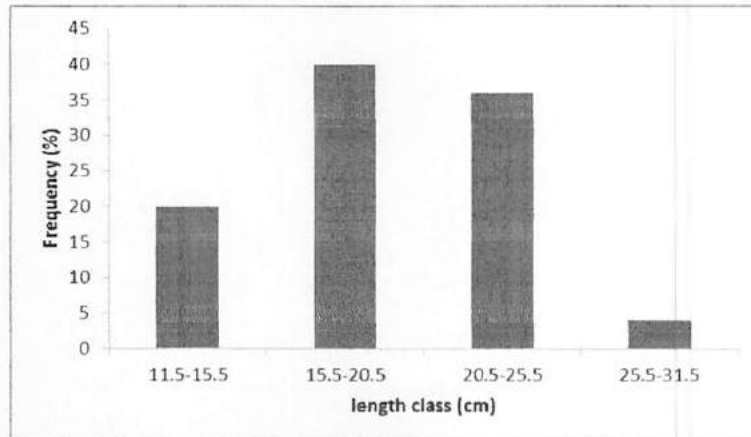


Figure 4. Total Length Distribution of Bonylip Barb Fish in Kerinci Lake

The analysis results on the frequency distribution of length from monthly catches by using the program package FISAT II showed that the growth model of bonylip barb

(*Osteochilus waandersii*) fish in Lake Kerinci followed the von Bertalanffy equation was:

$$L_t = 32.50 * (1 - \exp(-0.85 * (t - (-0.18)))) \text{ or } L_t = 32.50 * (1 - e^{-0.85 * (t + 0.18)}) \text{ (Figure 5).}$$

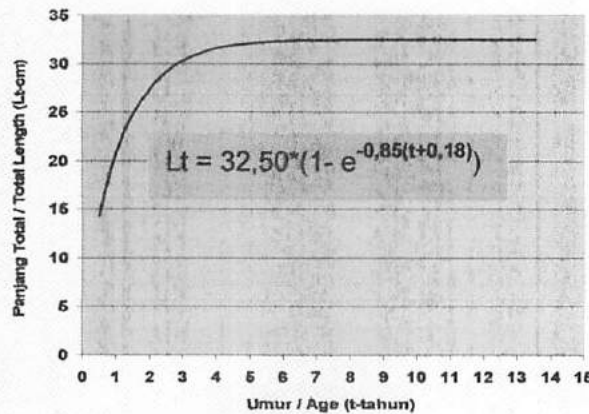


Figure 5. Growth Curve of Bonylip Barb Fish in Kerinci Lake

Of the growth models provided information that the bonylip barb fish in Lake Kerinci was able to grow up to a length of 32.50 cm with growth rate (K) of 0.85 per year. Growth coefficient (K) is a curvature which gives an idea of how fast a fish can grow to reach its infinity length (infinity length, L_∞) (Sparre & Venema, 1999; Pauly, 1983).

Bonylip barb fish is the native fish of Lake Kerinci (Department of Animal Husbandry and Fisheries Kerinci, Jambi). The results showed that there were bonylip barb fish in Lake Kerinci could tolerated water quality conditions

of the lake so that they could adapted and proliferated. Based on the catches of fishermen who used fishing gear of gillnets, the results were classified as dominant and able to compete with other fish species that were also dominant such as Nile tilapia (*Oreochromis niloticus*) and hampala barb fish (*Hampala macrolepidota*).

Fish population parameters of bonylip barb (*Osteochilus waandersii*) in Lake Kerinci obtained from the analysis were listed in Table 1. Based on analysis using FISAT II program by entering a parameter value of L_∞ , K and

the mean water temperature were obtained that the natural mortality rate of fish (M) of 1.47 or $M = 1.47$. Furthermore, the analysis by using a model of length converted catch curve, the value of total mortality (Z) of 2.34. Value of fishing mortality (F) was obtained from $F = Z - M$ was equal to 0.87. Fishing or exploitation rate value was $E = F / Z$ was equal to 0.37. Fishing rate value (E) was 0.37, indicated that

the rate of fishing in Lake Kerinci was still below the optimum value ($E = 0.5$). This means that bonylip barb fishing effort in Lake Kerinci was not reached the optimal value. It was thought to have something to do with the activity of floating net cages (KJA) conducted by the switching activity of fishermen who became farmers fisheries fish and also due to the age factor (no more power to catch fish in the waters of the lake).

Table 1. Population Parameter Analysis Values of Bonylip Barb from Kerinci Lake

No	Parameters	Simbol	Values
1	Infinity Length	L_{∞}	32.50
2	Growth Coefficient	K	0.85
3	Age at Length of 0 cm	t_0	-0.18
4	Growth Performance Index	Φ	2.953
5	Natural Mortality	M	1.47
6	Fishing Mortality	F	0.87
7	Total Mortality	Z	2.34
8	Exploitation Rate	E	0.37

Further analysis of the results with FISAT II program to evaluate the recruitment pattern of bonylip barb fish in Lake Kerinci can be seen in Figure 6. It is estimated that the fish had a recruitment peak in a year. It was indicated the bonylip barb fish in this lake spawns only once a year. Suspected

the spawning of the fish was closely related to the coming of the rainy season was around the month of July to September. Based on patterns of recruitment, spawning season of bonylip barb fish was estimated to occur in September

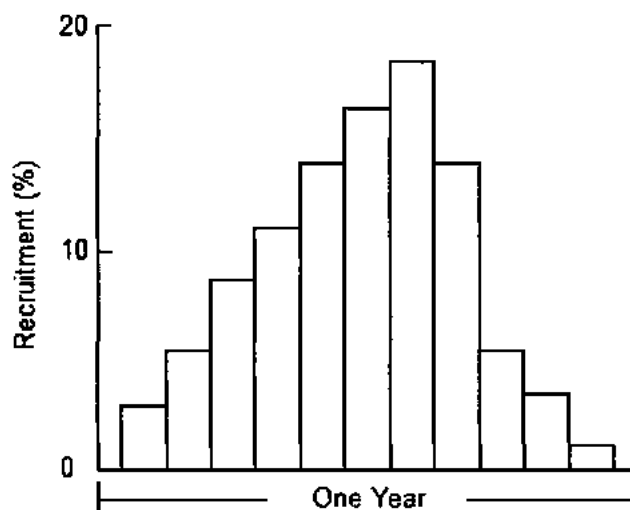


Figure 6. Recruitment Pattern of Bonylip Barb Fish in Kerinci Lake

CONCLUSION

1. The growth pattern of bonylip barb (*Osteochilus waandersii*) fish in Lake Kerinci was allometric (-), the length growth was faster than the growth in weight.
2. Bonylip barb fish in Lake Kerinci could grow up to infinity length (L_{∞})= 32.50 cm with growth rate (K) = 0.85/year, the fishing rate was at 0.37 was still below the optimum value of 0.5.
3. Bonylip barb fish in Lake Kerinci could spawn once a year when it is expected to spawn at the beginning of the rainy season in September.

ACKNOWLEDGEMENTS

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Appendix 1. Length Frequency Data of Bonylip Barb (*Osteochilus waandersii*) Fish from Fishermen's Catch in Kerinci Lake (research in 2013)

No	ML	Apr	Mei	Jun	Jul	Agt	Sep	Okt	Sum
1	11.5	10	7						17
2	12.5	16	9	5	2	5			37
3	13.5	13	7	5	6	9			40
4	14.5	14	11	11	11	7	2		56
5	15.5	13	9	13	13	11	5	3	67
6	16.5	8	6	16	8	11	5	2	56
7	17.5	9	10	16	9	16	12	7	79
8	18.5	9	12	23	18	13	17	15	108
9	19.5	11	8	17	15	17	16	12	96
10	20.5	7	5	12	21	15	19	11	90
11	21.5	9	5	9	16	9	10	15	73
12	22.5	6	8	8	13	12	10	19	76
13	23.5	22	13	9	12	15	9	21	101
14	24.5	19	12	11	9	13	13	13	90
15	25.5	7	6	6	9	12	11	5	56
16	26.5				4	2	9	7	22
17	27.5				2	1	2	4	9
18	28.5						2	5	7
19	29.5						1	1	2
20	30.5							5	5
21	31.5							3	3
Sum		173	129	161	168	168	143	148	1090