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Research Article

FISHERIES BIOLOGY ASPECTSOF YELLOW RASBORA (*RASBORALATERISTRIATA* BLKR 1854) FROM CENTRAL LOMBOK, INDONESIA

Evron Asrial[1]*., Ali Harris[2] and Abdolah[2]

[1]Department of Fisheries Resources Utilization, Faculty of Fisheries, University 45 Mataram
[2]Department of Aquaculture, Faculty of Fisheries, University 45 Mataram

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ABSTRACT

Yellow rasbora or pepudah *(Rasbora lateristriata)* is a petite and agile fish belonging to the native fish of Lombok Island, that can be found in almost all rivers on the island. The research aim is to provide morphometric and gonad data to find out the pattern of relation and growth pattern of pepudah. Fish samples were captured in the May-June 2017 period at Selaka River and Babak River (23 individuals/river). Identification of fish carried out in at Basic Laboratory, Fisheries Faculty, University 45 Mataram. Identification dataare processed quantitatively to describe the morphology of pepudah. MCR pattern is C = -a + b TL; LWR pattern is log W = -a + b log TL; and growth pattern is positive allometric (b = 3.06). The K valueis 0.952 which means the body shape is slightly flattened and the physical condition is ready to reproduce. Gonad maturity reaches: GSI > 3.0%, GI > 20, and GML = III-V. Biologically, there are differences of pepudah in Selakariver and Babakriver. Ecologically, waters of Babakriveris better able to provide raw materials for the necessities of life, survival, and breeding of pepudah.

INTRODUCTION

Indonesia's common waters are the habitat for the rasbora group (44 species) originating from South Asia and Southeast Asia (Kottelat *et al*., 1993). One of wich is yellow rasbora (*R.Lateristriata* Bleeker 1854). This fish is spread from Sumatra, Kalimantan, Jawa, Bali, Lombok, and Sumbawa (Weber and de Beaufort, 1916; Kottelat *et al*., 1993), and also in Bunguran Island (Weber and de Beaufort, 1916).

This species quite popular in Indonesia with the name of a *seluang* (Kalimantan, Sumatra) and *wade r*(Jawa).This fish is also known as *seluangekormerah* (Iriansyah *et al*., 2016), *wader pari* (Sentosa *et al*., 2008; Sentosa and Djumanto, 2010), *pantao* (Pamungkas, 2000; Nofrizal, 2011), *paray* (Setiawan, 2011), and *cecereh* (Weber and de Beaufort, 1916). Residents of Lombok Island call it by name pepudah or pudah. While the people in the research location (Lombok Tengah Regency) gave different names, i.e.*pepudahnyeleng* (Selaka River) and *pepudahbelo* (Babak River).

The existence of pepudah fish in the waters of Lombok Island has been known since 1916 through the publication of Weber and de Beaufort (1916). This petite freshwater fish species live in groups, has a stream line body shape that can swim rapidly, agile, and against the flow of waters. Endemic fish from the island of Lombok is found in almost all common waters. They can live and breed in the waters of rivers, lakes, swamps, reservoirs, dams, moats and paddy land. The anglers who live near of Mount Rinjani (North Lombok) mentioned that they saw this fish in the highlands more than 500 m above sea level. In an effort to manage fish resources into commercial (commercial) resources, holistic information is needed from several aspects/dimensions (Asrial *et al.*, 2015a; Asrial *et al.*, 2015b). One of them is the biology dimension, especially data about morphology and biology fisheries. Until now, there is no data and information about matters related to fish originating from Lombok. Therefore, it is necessary to do research on morphology and biological fisheries of pepudah fish that has never been done in Central Lombok.

This study provides data on morphometric characteristics, growth, and maturity of gonad of pepudah fish. Morphometric is the distance between the body parts with other body parts. The unit of measure used varies greatly. Thus, morphometric characters can provide information about differences between species of fish morphologically. In this study, the unit of measure used is millimeter (mm). To obtain a more rigorous morphometric measure, measured using the digital caliper.

Corresponding author:* **Evron Asrial
Department of Fisheries Resources Utilization, Faculty of Fisheries, University 45 Mataram

The results of the research are expected to be utilized and used as the basis for the management of fish resources of pepudah, and also used to carry out advanced research of the technology of aquaculture (reproduction techniques), fishing technology (environmentally friendly and sustainable fishing gear), and fish processing technology (fast food).

MATERIALS ANDMETHODS

Site and Period of Study

This research was conducted in Sungai Selaka and Babak River in the administration area of Central Lombok Regency, West Nusa Tenggara Province, Indonesia (Fig. 1). Data collection takes place for one month in the period May 17 - June 17, 2017. During this period, visited to the study sites were conducted four times by the authors to observe and catch fish samples. The identification of all sample fishes is done at Basic Laboratory of Faculty of Fisheries, University 45 Mataram.

Fig 1 Map of research location

Samples were caught in Selaka River and Babak River, each of 23 individuals/rivers, using lift net. The materials used consist of fresh water, Alcohol 70%, label paper, and tissue. While the main equipment used consists of plastic containers (jars), portable aerators, digital scales, digital caliper, cameras, GPS, surgical scissors, aquariums, stationery, and masks. Sampling fish data (cross section data) is used as the main research.

Data Collecting

The data collection activities on this research applied an independent survey method, explorative, and descriptive. Techniques of data collection consist of sampling techniques, obesrvation, interviews (dialogue), and documentation.

Fish sampling technique is done to get samples of fish, which in this research is pepudah (R. lateristriata). Fish samples were collected using an independent survey method, ie sampling activities were conducted on the initiative of the researcher, the researchers participated in sample fish collections, and were independent of others. Primary data were obtained from measurement, counting, and weighing per individual on all sample fish. The results are morphometric data, weight data, and gonad data.

According to Collins (1985), morphometric data was obtained from the measurements of selected fish specimens that have formed morphological characters (body size). Measurement of morphometric character of pepudah fish refers to Kottelat *et al*. (1993), and modified to obtain 29 morphometric characters (Fig. 2).

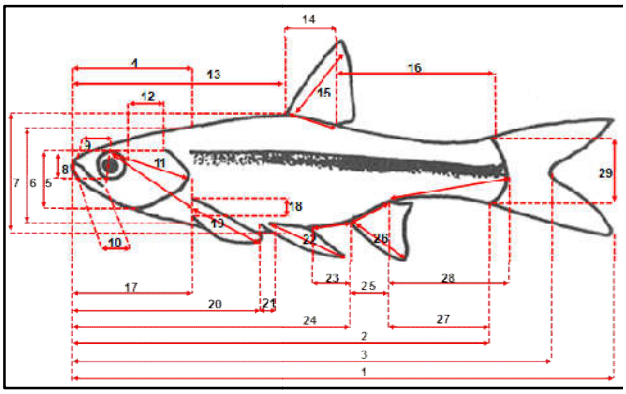

Fig 2 Yellow rasboramorphometric character

The morphometric character of yellow rasbora fish consist of (numbering follow Fig. 2): (1) Total Length (TL), (2) Standard Length (SL), (3) Caudal Length (CL), (4) Head Length (HL), (5) Head Width (HW), (6) Head High (HH), (7) Body Height (BH), (8) Wide Eyes (WE), (9) Upper Jaw Length (UJL), (10) Lower Jaw Length (LJL), (11) Eye Length (EL), (12) Head Length behind the Eyes (HLbE), (13) Long before Dorsal Fins (LbDF), (14) Long of Dorsal Fin Base (LDBF), (15) Dorsal Fin Height (DFH), (16) Long before Tail Trunk (LbTT), (17) Long before Pectoral Fin (LbPF), (18) Long of Pectoral Fin Base (LPFB), (19) Pectoral Fin Height (PFH), (20) Long before Ventral Fin (LbVF), (21) Long of Ventral Fin Base (LVFB), (22) Ventral Fin Height (VFH), (23) Long before Tail Trunk (LbTT), (24) Long before Anal Fin (LbAF), (25) Long of Anal Fin Base (LAFB), (26) Anal Fin Height (AFH), (27) Long of the Beginning of Tail Trunk (LAFBT), (28) Long of Tail Trunk (LTT), and (29) Tail Trunk Height (TTH).

Interview techniques were conducted on several key respondents who were local residents. The main objective is to explore information on the habitat, distribution, and utilization of pepudah fish, as well as its local names.

Method of Data Analysis

Morphometric Ratio

Evaluation of the morphometric ratio is performed on all characters. Characteristic evaluation is required to obtain a characteristic ratio value. The value of this morphometric character ratio will be used as a standard for the fish of the pepudah from Central Lombok Regency. Done by comparing each character length (C) of 28 characters (C No. 2-29, Fig. 2) with total length (TL)

$$\frac{C}{TL} x\ 100\%$$

Pattern of Morphometric Character Relation

Data were analyzed quantitatively (regression and comparative). To know the pattern of all morphometric character relation (MCR), also the level of precision/accuracy of data, the authors analyze the data by using simple regression method one by one between each character (dependent variable, C) with TL (independent variable). The equation is:

$\log C = a + b \log TL$

Description:

C = Characters (No. 2-29) a = Intercept

TL = Total Length b = Coefficient

Growth Patterns

Fish growth pattern is shown from the analysis of length and weight relationship (LWR). The growth pattern was analyzed by using simple regression method on two variables namely total length (TL) and weight (W) of fish. The LWR formula is $W = aL^b$. To obtain the linear equation used equation:

$log\ W = a + b\ log\ TL$

Description:

W = Weight a = Intercept

TL = Total Length b = Coefficient

LWR for all species was determined by the equation $log\ W = log\ a + b\ log\ TL$, where W is the fish (grams) and TL is the total length (cm), a is the intercept and b is the slope of the regression line. Prior to regression analysis of log W in log TL, log-log plots of length and weight values were performed for visual inspection of outliers (Froese, 2006).

Gonad Somatic Index (GSI)

Information on gonad maturity of each species of fish is needed to determine the readiness of fish to lay eggs with regard to their body length, or gonadal maturity associated with fish length (TL). The gonad somatic index (GSI) is an index value that shows the amount of changes that occur in the gonad quantitatively. When spawning occurs, the value of GSI will increase maximally. Gonad growth can be determined by calculating GSI (Solang, 2010) which is the weight ratio of gonads with sample fish weight (Effendie 2002). The equation is:

$$GSI = \frac{Wg}{Wb} x\ 100$$

Description:

GSI = Gonado Somatic Index (%)

Wg = Gonad Weight (grams)

Wb = Body Weight (grams)

Gonado Index (GI)

The Gonado Index (GI) is a calculation of body weight compared to the length of the body that follows the formulas: $GI = \frac{Wg}{L^3} x\ 10^8$ (Batts, 1972) and $GI = \frac{Wg}{L^3} x\ 10^7$(Tan and Tan,1974)

Description:

GI = Gonado Index

Wg = Gonad Weight (gram)

L = Body Length (mm)

Gonad Maturity Level (GML)

Gonad maturity level (GML) is a gradual growth or growth of gonads up to the maximum extent that occurs before and after the spawning process (Effendie, 2002). In this study, GML was derived from comparing the values of GSI and GI using the prevailing general standards. GI classification according Tan and Tan (1974) is Class I: GI <1 (not mature), Class II: GI 1-5 (to mature), Class III: GI 5-10 (to mature), Class IV: GI 10-20 (mature), and Class V: GI >20 (mature).

Condition Factors (K)

Condition factors (K) have been used: (a) to predict better fish conditions by weight and length (Bagenal and Tesch, 1978), (b) as an index of growth disorders and intensity of feeding (Fagade, 1979), (c) fish associated with long changes (Bakare, 1970; Fagade, 1979), (d) to estimate the reproductive cycle of fish (Welcomme, 1979; Effendie, 2002), and to explain fish's plumpness (Effendie, 2002). The K value of sample fish was calculated and estimated using following the equation by:

$K = 100\ x \frac{W}{L^3}$ (Froese, 2006)

$K = 10000\ x \frac{W}{L^3}$ (Effendie, 2002)

Description:

K = Condition Factors;

L = Body Length (cm)

W = Weight (grams)

When the growth pattern is equal to isometric then the condition factor (K) is calculated using the following formula (Effendie 1979):

$$K = \frac{10^5 W}{L^3}$$

When growth patternis allometric (negative & positive, b ≠ 3) then the relative condition factors (K) is calculated using the formula:

$$K = \frac{W}{aL^b}$$

Description:

K = Condition Factors; a = Intercept

W = Weight (grams); b = Coefficient

L = Body Length (mm)

RESULTS AND DISCUSSIONS

The majority of Lombok people are not too fond of eating pepudah, so this fish is not found in the traditional markets. There is no fishing activity by the fishermen in all areas of Lombok. The anglers who get the pepudah use it in the form of fresh fish as a family culinary. This fish is also used as feed for poultry (chicken, duck) which is kept in the yard of the resident's house.

Pepudah is not a target fish for anglers in Lombok. The utilization of this fish and other types of fish is done through fishing activities using fishing rods and low-power strum. The rise of destructive and illegal river fishing activities has been going on for more than two decades. It is suspected that the population of pepudah in Lombok decreases and the size is smaller.

Morphometric Character Ratio

The longest (7.98 cm) and the shortest (4.95 cm)pepudah fish were caught in the Babak River. While the average length of pepudah fish coming from Babak River is still longer than that coming from Sungai Selaka (Fig. 3).

Fig 3 Yellow rasborafish from Selaka River (left) and Babak River (right)

Morphometric character measurements were performed on all fish samples. The measurement data is used to calculate the morphometric character ratio (Tab. 1, Fig. 4, Fig. 5).

Tab 1 Morphometric character ratio (MCR) of pepudah from Selaka River and Babak River

No.	Ratio of Character	Average (%)		Greatest (%)	
		Selaka	Babak	Selaka	Babak
1	SL/TL	80.32	80.31	83.21	85.55
2	CL/TL	91.18	90.50	98.72	95.31
3	HL/TL	19.11	18.06	20.83	21.77
4	HW/TL	11.63	11.46	13.76	20.76
5	HH/TL	15.03	14.92	16.64	16.52
6	BH/TL	19.81	19.50	21.82	21.57
7	WE/TL	5.96	5.85	7.12	6.81
8	UJL/TL	5.77	5.21	7.92	5.60
9	LJL/TL	6.56	6.61	8.93	15.42
10	EL/TL	8.43	8.32	9.71	8.80
11	LHbE/TL	6.05	5.93	8.46	5.83
12	LbDF/TL	44.33	40.66	47.59	53.49
13	LDBF/TL	8.36	8.96	8.67	8.06
14	DFH/TL	16.60	17.54	18.78	35.62
15	LbTT/TL	29.99	29.84	33.12	33.56
16	LbPF/TL	21.10	20.14	39.71	41.83
17	LPFB/TL	4.00	4.11	4.80	3.74
18	PFH/TL	14.34	14.08	16.50	14.59
19	LbVF/TL	40.90	39.84	46.24	42.87
20	LVFB/TL	3.20	3.24	4.01	2.06
21	VFH/TL	11.96	11.60	17.00	14.11
22	LbTT/TL	14.76	14.91	18.19	20.74
23	LbAF/TL	54.92	54.58	61.20	70.47
24	LAFB/TL	7.61	7.57	8.77	6.21
25	AFH/TL	13.78	13.20	14.69	14.59
26	LAFB/TL	17.10	16.78	21.66	22.88
27	LTT/TL	19.39	19.12	20.71	24.38
28	TTH/TL	10.58	9.13	13.13	10.79

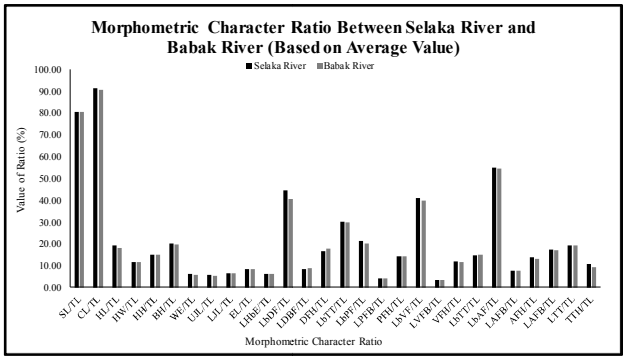

Fig 4 Morphometric character ratio (based on average value)

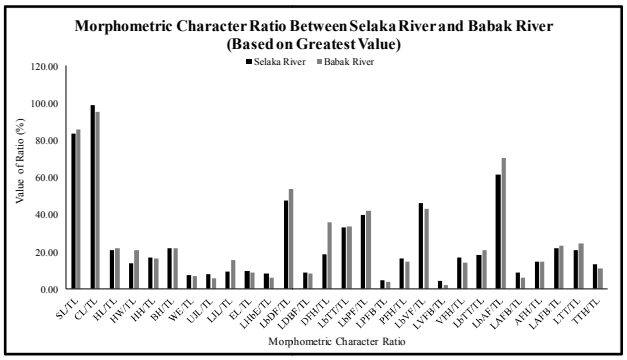

Fig 5 Morphometric character ratio (based on greatest value)

Pattern of Relation (Equation)

Pattern of Morphometric Relation

The morphometric relation pattern was obtained from the analysis using a simple regression method between the total length (TL) with each morphometric character (C = 28 characters). From the analysis results obtained 28 patterns of character relations in the form of equations/models.

The result of simple regression analysis shows that there are 17 strong character (67, 86%) (R^2> 60%) determined by individual P character (Tab. 2). In other words, most of the equations can be used to forecast. This is in accordance with the opinion of Sri Mulyono (pers. com., August 2001) which states that the effective model is used to predict whether the value of R^2 is greater than 60% since most of the data is scattered near the linear line.

Tab 2 Results of regression statistics

Selaka River	Regression Statistics	Babak River
35.61 - 99.60	r (%)	22.29 - 99.08
12.68 - 99.21	R^2 (%)	04.97 - 98.16
08.52 - 99.18	Adj. R^2 (%)	0.44 - 98.08
19 characters	r >80% (models)	17 characters
19 characters	R^2 >60% (models)	20 characters
21 characters	Adj. R^2 >50% (models)	19 characters

- r values ranging from 22.29% to 99.60% show the relationship between the character of the total length (TL) with the other 28 characters being at the level less closely to very closely. But still more characters have a very close relationship with the character of TL.

- Parameter R^2 (R Square) indicates the determination of independent variable (TL) against the dependent variable (28 other characters). R Square value 4.97-99.21% means TL variable does not affect until very strong influence other variables. At least, the formation of 17 characters is strongly influenced by the TL variable. And as many as 17 models can be used for forecasting because R^2 value is more than 60%.
- Adjusted R^2 is the ability of samples to find answers to the population. There are at least 19 models that have Adjusted R^2 value of more than 50%. Thus, the samples obtained have high accuracy.

It can be concluded that the relationship pattern of character TL with 28 other characters (C) has met the requirements of forecasting. The C (characters) in the formula is 28 morphometric characters of pepudah (number 2-29), whose details can be seen in Fig. 2.

The character relation pattern of all morphometric characters of yellow rasbora fish from Selaka River and Babak River is $C = -a + b\ TL$. The equation shows that each addition of one unit of total length then each morphometric character will increase as much as value of coefficient b. So the pattern of relationship is a positive relationship pattern.

Pattern of Length-Weight Relationship

Pattern of Length-Weight Relationship (LWR pattern) describes whether the influence of variable length (TL) in forming weight variable (W). In order to get the pattern then used a simple regression method to analyze the data.

The result of data analysis showed that the fish in Selaka River has a relationship model that follows the formula: $log\ W = -2.419 + 3.472\ log\ L$. Meanwhile, the LWR pattern of pepudah fish in Babak River is $log\ W = -1.809 + 2{,}653\ log\ L$. Through the merging of data from both of those rivers obtained models as a whole is$log\ W = -2.109 + 3.056\ log\ L$

Overall, the LWR model has the same pattern, as follows: if the TL variable increases one unit then the value of the variable W will increase by the value of coefficient b on the variable TL. It can also be said that the weight of the pepudah fish is strongly influenced positively with increasing length. Thus, the pattern of relationships formed is a pattern of positive relationships.

Fish Growth

Growth Patterns (b)

Fish body shape (fat, ideal, thin) can be shown from the value of growth pattern (b). The growth pattern is used as an indication to determine the effectiveness of feed in the waters, which is consumed by fish and fish body size.

The growth pattern of yellow rasbora fish in Sungai Selaka and Babak River was obtained through LWR analysis with simple regression method. The results of the analysis are as follows:

- In Selaka River, yellow rasbora fish have coefficient value b is 3.472. This value is meaningful as yellow rasbora fish has allometric positive growth pattern i.e. the rate of weight growth is faster than the rate of fish body length increase, and his body is fat.
- The coefficient b value of yellow rasbora in Babak River is less than 3, exactly 2.653. The growth pattern with that value is called negative allometric i.e. the length increase rate is faster than the weight growth rate of fish body, or thin body.

The condition is allegedly caused by the size of fish in Selaka River is bigger than fish in Babak River. This is in accordance with the opinion Kumar and John (2007) which states that the greater (adult) fish, the ability to eat more active/strong compared to adolescents/small fish.

The researchers conducted a combined LWR analysis to see the growth pattern of the rasbora fish because both streams were on the same line and the rasbora fish swam against the flow of water. From analysis result of LWR known value of b = 3.056 which mean positive allometric and body fat.

Positive allometric state is suspected because of the availability of sufficient natural feed to meet the needs of fish. This opinion is in line with Effendie (2002) which states that the most important external factors affecting fish growth are food (feed), in addition to temperature water/waters.

Condition Factor (K)

The condition factors are important for us to know and analyze/study as they are closely linked to: (a) physical fish for survival and reproduction (Effendie, 2002), (b) used as a standard for growth index and intensity of feeding (Fagade 1979), and (c) the reproductive cycle (Welcomme, 1979). The condition factor may be diminished in value as the length increases (Bakare, 1970, Fagade, 1979). The condition factor can be used as an indication of the availability of meat for commercial purposes (Effendie, 1997). Based on the statement, it can be concluded that the condition factor is directly related to biological aspects (reproductive biology) and economic aspects (fishery business), and indirectly related to technology (fish reproduction).

Based on the results of analysis of data length and weight of fish obtained K value of fish samples from each river. The paca fish from Selaka River have K = 0.612-2.430 or mean K = 1.044. While in Sungai Babak, K value of pepudah fish ranges from 0.452 to 1.018 or mean K = 0.861. The mean value of K on both rivers is 0.952 (Tab. 3).

Tab 3 Values of condition factors (K)

River	Condition Factors (K)		
	Averages	Min.	Max.
Selaka River	1.044	0.612	2.430
Babak River	0.861	0.452	1.018
Two Rivers	0.952		

The mean value of the combined K for both rivers is 0.952, closer to the value of 1. It can be interpreted that the physical readiness of pepudah fish in two rivers is in good condition to reproduce (reproduce) and increase survival. This is in accordance with the opinion of Yudha*et al.* (2015) that the value of the relative condition factor (Kn) offish that approaching or slightly exceeding 1 means the fish is in good physical condition for survival and reproduction.

Gonad Maturity

Gonads, especially the development of gonads, are among the parameters of growth of fish (Le Cren, 1951; Muchlisin *et al.*, 2010). Gonad maturity is associated with temporary growth patterns, which in this case is allometric growth (Effendie, 2002).

In this study, to assess the gonads maturity level (GML) used the results of gonad somatic index analysis (GSI) and gonad index (GI). GSI and GI using the data length and weight of fish which is the primary data in this study.

Overall, the GSI value of pepudah in SelakaRiver and Babak River is 3.23-13.21%. The average value of GSI of pepudah in Selaka River is 8.02, and in Sungai Babak is 7.89. The GI value of pepudah fish is greater than 20. In Selaka River, GI values are in the range of 44.12-141.70, and the value of GI in Babak River ranges from 25.22 to 98.96 (Tab. 4).

Tab 4 The GSI, GI, and LMG of yellow rasbora fish

GSI (%)	GI	LMG[1]	LMG[2]
Selaka River			
7.52	62.63	V	V
4.40	57.99	III	V
3.39	28.85	III	V
7.41	65.18	V	V
12.01	141.70	V	V
11.11	86.76	V	V
4.20	44.12	III	V
8.02	**87.34**	**V**	**V**
Babak River			
9.14	76.99	V	V
5.97	49.67	IV	V
13.21	98.96	V	V
3.23	25.22	III	V
7.89	**62.71**	**V**	**V**

According to Effendie (2002), a GI value (more than 20) and GSI, and GSI exceeds 4.46 (Diana, 2007) means "mature gonad" and GML is in level V. GML average values are identical to GML V that most eggs are released from gonads. Based on these results it can be presumed that yellow rasbora fish reproduce every month.

CONCLUSIONS

The LWR pattern of the pepudah fish follows a normal relationship pattern. The pepudah has a positive allometric growth (b) pattern, a slightly slender condition of the condition (K), and the gonad reaches GML V, indicating that the waters of Selaka River and Babak River provide and supply adequate feeding needs, and the water / water quality appropriate for their life to survive, grow, and multiply. Pepudah fish deserve to be a mother, and have enough meat to be traded by the community, and can be consumed for the fulfillment of protein needs for humans. It is suggested to follow up on the results of this study, especially research related to reproduction habitat, reproductive technique, and method of taming of pepudah fish for breeding.

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