



## The Population Dynamics of Belanger's Croaker (*Johnius belangerii*) at Barumun River, Panai Hilir District, Labuhanbatu Regency

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### ABSTRACT

*This study aims to determine the population dynamics of *J. belangerii* fish in the waters of the Barumun River, Labuhanbatu Regency. Sampling was carried out for 3 months, starting in October – December 2021. The results showed the relationship between length and weight of *J. belangerii* fish was negative allometric with a  $b$  value of 0.713 ( $b < 3$ ). The population of *J. belangerii* was dominated by individual lengths between 14.5 - 38 cm with a body weight range of 30-80 grams. The length of the totic acid ( $L_{\infty}$ ) is 41.55 cm with a growth coefficient ( $K$ ) of 0.430 per year. Natural mortality ( $M$ ) and fishing mortality ( $F$ ) were 0.937 and 0.892 per year, respectively. The level of exploitation ( $E$ ) obtained a value of 0.35. The condition of the population of *J. belangerii* based on the value of ( $F$ ), ( $N$ ), ( $E$ ) is not in a state of over-exploitation.*

#### **Dinamika Populasi Ikan *J. belangerii* di Perairan Sungai Barumun, Kecamatan Panai Hilir, Kabupaten Labuhanbatu**

**ABSTRAK:** Penelitian ini bertujuan untuk mengetahui dinamika populasi ikan *J. belangerii* yang ada di Perairan Sungai Barumun Kabupaten Labuhanbatu. Pengambilan sampel dilakukan selama 3 bulan, di mulai pada Oktober – Desember 2021. Hasil penelitian menunjukkan hubungan Panjang berat ikan *J. belangerii* adalah alometrik negatif dengan nilai  $b$  0,713 ( $b < 3$ ). Populasi ikan *J. belangerii* didominasi ukuran panjang individu antara 14,5 - 38 cm dengan kisaran berat tubuh 30-80 gram. Panjang asim totik ( $L_{\infty}$ ) adalah 41,55 cm dengan koefisien pertumbuhan ( $K$ ) adalah 0,430 pertahun. Mortalitas alami ( $M$ ) dan mortalitas penangkapan ( $F$ ) masing-masing sebesar 0,937 dan 0,892 per tahun. Tingkat eksploitasi ( $E$ ) diperoleh nilai 0,35. Kondisi populasi *J. belangerii* berdasarkan nilai ( $F$ ), ( $N$ ), ( $E$ ) tidak dalam keadaan over exploitasi.

### INTRODUCTION

The Berumun River is one of the major rivers in Labuhan Batu Regency, which empties into the Panai Hilir District. The width of the Berumun river ranges from 750-1,050 meters (Hasibuan & Khairul,

2021) (Rambey et al., 2021). The Barumun River has so far stored an immense potential of fishery resources. The waters of the Barumun River are used by the community for various activities, including as a source of water for bathing, washing toilets, fishing,

and as access for sea crossings. Multiple types of economical fish can also be found in the waters of the Barumun River, one of which is the other is Gulamah fish (*Johnius sp*)(Siagian. et al., 2017) (Khairul & Khairul, 2020).

*Johnius belangerii* is a type of fish from the Sciaenidae family inhabiting coastal waters that are not too deep (Ravanbakhsh et al., 2020). *J. belangerii* is widely known as tetet fish, gelodok fish and gulamah totot fish. The gulamah *J. belangerii* fish is one of the food consumption commodities that have economic value in the village around the Barumun River. This fish spreads in the waters of Thailand, Sumatra and Kalimantan (Rahardjo & Simanjuntak, 2008).

Gulamah fish are also able to survive in waters of low temperature, very cloudy and muddy (Faizah & Anggawangsa, 2019). The gulamah tetet fish (*J. belangerii*) has an elongated body shape and is covered with scales except at the tip of the head. While the dorsal fin is not severed, a deep groove between the rays of the fin is quite hard with the part of the fin that is very weak. This fish belongs to the type of predatory fish. Its food is in the form of small shrimp and small fish (Supeni et al., 2021). Gulamah tetet fish and gulamah batu (*J. belangerii* & *J. brachycephalic*) are often sold in several forms, including processed, smoked fish and dried into salted fish, with prices ranging from Rp. 19,000 - Rp. 26,000,-/ kg (Supeni et al., 2021).

The fishing of gulamah uses gill nets and trawl nets. Previously, gulamah fish was only used in the form of salted fish. Recently, the organs in the body of gulamah fish (*J. belangerii*), namely the swimming bubbles, have been widely used and even have a high selling value compared to the selling price of the meat itself, which has low economic value (Putri, 2018). In several East Asian countries such as Korea, Japan, and China, as well as several Southeast Asian countries such as the Philippines and Thailand, they have processed the bubble pool of gulamah

fish in the form of quite luxurious food at high-priced pegs known as Fish Maw.

The swimming bubbles in this fish have begun to be used in the medical world and the world of beauty. Trilaksani & Utama (2006) mentioned that one of the products that utilize the swim bladder is isinglass, a collagen protein-based product. Continuous fishing can lead to a decline in the population of this fish in the Barumun river (Siagian. et al., 2017).

Several studies related to gulamah fish have been published, including Research on growth patterns of gulamah fish reported by (Supeni et al., 2021). Meanwhile (Napisah & MaChrizal, 2021) said the relationship between length and weight and condition factors of gulamah fish in the Barumun river, then (Siagian. et al., 2017) population structure of gulamah fish in the Barumun river and (Baset, 2020) in Pakistani waters. (Imra et al., 2021) A test of the collagen characteristics of the swimming bubble of gulamah batu fish (*J. trachycephalus*) in the coastal waters of the city of Tarakan and further research on the growth pattern of gulamah fish were reported by (Supeni et al., 2021). Meanwhile, (Siagian. G et al., 2017) state the population structure of gulamah fish in the Barumun river. Simanjuntak. & Raharjo (2001) The food habits of tetet fish (*Johnius belangerii*) in the mangrove waters of Mayangan Beach, West Java. Research on the study of population dynamics of gulamah tetet (*J. belangerii*) in the Barumun River has never been published. This can be seen from the lack of scientific publications related to this study. Therefore, it is necessary to research the dynamics of the gulamah fish population to maintain the sustainability of gulamah fish resources. This study aims to determine the population dynamics of gulamah tetet fish in the Barumun River, Labuhanbatu Regency waters.

## METHOD

### Research Time and Place

A sampling of *J. belangerii* fish was done

for three months, starting from September to October – December 2021. The sampling locations were divided into 3 observation stations, each at 2°38'49.08"N; 100°6'30.23"E (Station 1), 2°37'22.94"N; 100°7'2.33"E (Station 2), 2°36'50.29"N; 100°5'56.95"E (Station 3) (Figure 1 ). Morphometric aspects were measured in the Ecology Laboratory of the Faculty of Teacher Training and Education, Labuhanbatu University.



**Figure 1.** Map of Sampling Locations (*J. belangerii*) in the Barumun River  
Tools and Materials

This study used several tools and materials for sampling gulamah fish in the Barumun river using a trill net. The length and weight of the fish obtained were measured using a calliper, and the total length of the gulamah fish was calculated from the snout to the tip of the tail fin using a metal ruler. The total weight of Gulamah fish was determined using a digital scale to an accuracy of 0.01 g. And data on the population density of gulamah fish (*J. belangerii*) using parameters, growth, natural mortality rate and total mortality.

#### Research procedure

##### Sampling Procedure

The gillnet is stocked from 21:00 - 04:00. Then, the fish were measured for total length and the standard length using a calliper (0.1 mm accuracy). The weight of gulamah fish was measured using a digital scale (0.1 g accuracy) in the ecology laboratory of the Faculty of Teacher Training and Education, University

Labuhanbatu. The sampling location in the Barumun River was determined based on information obtained from fishermen who used to catch this fish. The fishing gear in the form of gillnet is stocked once a day and left for  $\pm$  8 hours.

##### Data analysis

1. The growth pattern of gulamah fish was calculated using a linear allometric model (MAL), which calculated the constants a and b, referring to Le Cren 1951(Mote, 2018).

$$W = aL^b$$

Description :

W: Gulamah fish body weight (gram)

L: Fish body length (cm)

a and b = Exponential Value Constant

The value of b was obtained from the equation of the length of the weight of gulamah fish to determine the growth pattern. Then the test was done on the value of b to find whether the value of b is equal to 3 (isometric growth pattern) while the value of b is not equal to 3, then growth is defined (allometric growth). Furthermore, the growth parameters were estimated using the software FAO-ICLARM. Estimation of growth parameters was applied using the Von Bertalanffy growth formula(Sparre & Venema, 1999) with the equation:  
Asymptotic length ( $L_{\infty}$ ), growth coefficient (K), mortality, and recruitment (reconstructing recruitment from long time series - frequency data) were estimated using the FAO-ICLARM stock assessment tool (FISAT). Growth defined by the following von Bertalanffy growth function (Sparre & Venema, 1998) was used:

$$LT = L_{\infty} [1 - e^{-K(t-t_0)}]$$

Where: LT - length at age t; L - asymptotic length; K - growth coefficient; T<sub>0</sub> - a hypothetical age at which the length is zero. The von Bertalanffy growth equation's asymptotic length ( $L_{\infty}$ ) and growth coefficient (K) were estimated using the ELEFANT-1 routine in the FISAT 2 software.

The catch mortality rate (F) was calculated according to Pauly (1980):  $F=ZM$ .

$$L_t = L_{\infty} [1 - e^{-K(t-t_0)}]$$

Where;  $L_t$ - length of fish at  $t$ -life;  $L_{\infty}$ - theoretical maximum length,  $K$ - growth coefficient;  $t_0$  - theoretical life at length equal to zero. Asymptotic length with growth coefficient was calculated using ELEFANT I and FISAT II by entering the values of  $L_{\infty}$ ,  $K$ , and  $t_0$ :

$$E = F - F \cdot M \quad Z = M + F$$

Description:

E: Exploitation rate rate

F: Arrest mortality

M: Natural mortality

Z: Total mortality

## RESULTS AND DISCUSSION

The relationship between length and weight of gulamah tetet (*J. belangerii*) measured from 61 samples obtained during this study was  $b = 0.713$  ( $b < 3$ ). Therefore, the growth pattern of tetet fish allometric is negative. From the measurement results, the body length range of tetet fish is between 14.5 - 38 cm with a body weight range of 30-80 grams, the value of the relative weight condition factor ( $w_r$ ) and the coefficient of determination of  $r^2$  is 0.3184, and the value of  $b$  is 0.7134 in river waters. Barumon. The relationship between the length and weight of the gulamah tetet fish in this study can be seen in Figure 1. The relationship between the length and weight of the gulamah tetet (*J. belangerii*) in the waters of the Barumon River has a slope value ( $b$ )  $< 3$ , fish with a  $b$  value  $< 3$  The growth pattern is a negative allometric. This indicates that the length growth is faster than the weight growth.

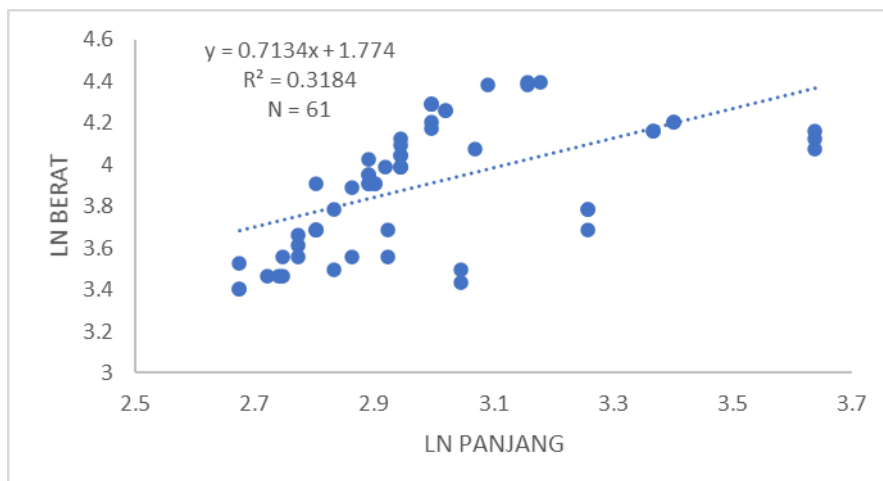
The same study has also been carried out by (Sofarini et al., 2018). The slope value of  $b < 3$  (1.6248) in snakehead fish (*Channa striata*) in Rawa Lake Panggang is located in Hulu Sungai Utara Regency, South Kalimantan. Furthermore, Nasution & Machrizal, (2021) obtained a  $b$  value of 2.48 fish during the study with a total sample of

41 individuals in the Barumon River. A similar study was conducted in Krueng Simpoe, Bireun Regency, Aceh. The analysis of the relationship between length and weight obtained a  $b$  value of 2,420. This indicates that the growth pattern of *Rasbora* sp fish, which is negative allometric ( $b < 3$ ), means that body length growth is faster than the growth pattern of *Rasbora* sp. body weight growth (Fuadi et al., 2016).

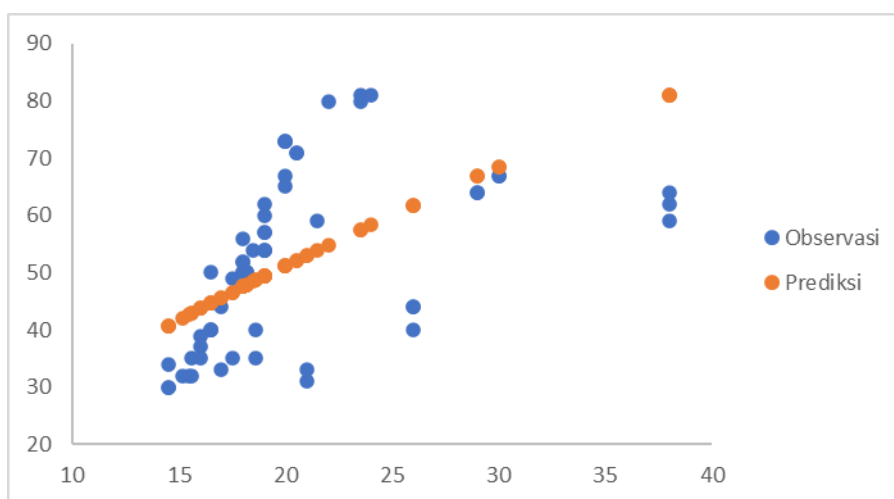
Furthermore, Anhar Sholichin et al.'s research obtained a value of  $b = 3.05$ , different from 3, indicating that Petek fish (*Leiognathus equulus*) in Semarang Bay Waters, Central Java, had positive allometric growth properties. This result means that the growth in weight is faster than the growth in length (Sholichin et al., 2021). Zulfahmi et al., (2021) said that along with the increase in fish body size, the tastes in fish food types also change (Fuadi et al., 2016).

In addition, the statement that growth or increase in length and weight of fish is not only influenced by heredity, sex, food, parasites and disease, but also water quality, such as temperature, dissolved oxygen and carbon dioxide in their habitat (Supeni et al., 2021). The same statement is shown by the growth pattern of several species that tend to grow negatively allometrically, which is related to their body morphology, which tends to be elongated so that the length growth is faster than the weight (Sofarini et al., 2018).

The length-weight relation of fish aims to see the growth pattern of fish with length and weight parameters. In other words, the length-weight relationship estimates weight through length or vice versa (Eko and Ni, 2019). Analysis of the relationship between length and weight using data on total length and wet weight of gulamah fish to see the growth pattern of fish with a relationship between length and weight is presented in the following pictures:



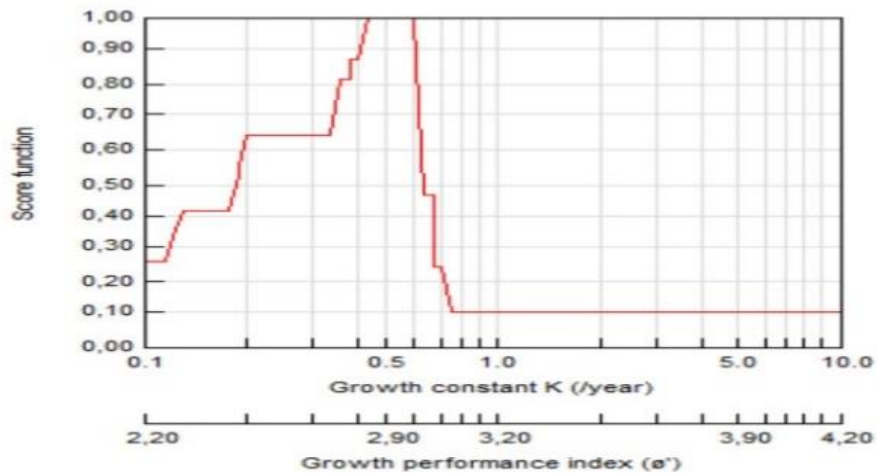
**Figure 1.** The Long-Headed Relations of Gulamah Tetet (*J. belangerii*) in the waters of the Barumun River



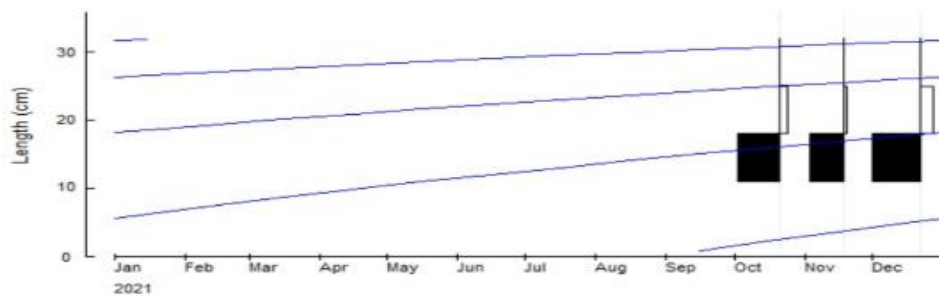
**Figure 2.** Comparison of the Long-Weight Relations between Observation and Prediction of Gulamah Tetet (*J. belangerii*) in the waters of the Barumun River

Growth parameters. Based on the values of  $L_{\infty}$ ,  $K$  and  $t_0$  using the von talanffy growth factor ( $K$ ) growth model of 0.430 per year, then by entering the asymmetrical length value of  $L_{\infty}$  is 41.55 cm, the estimated theoretical age value in fish (*J. belangerii*) is equal to zero ( $t_0$ ) is 0.0309.

Therefore, the growth equation has a value of  $L_t = 41.55[1 - e^{-0.430(t+0.0309)}]$ . Based on the results of the equation, the growth curve of gulamah tetet (*J. belangerii*) can be seen in Figures 3 and 4



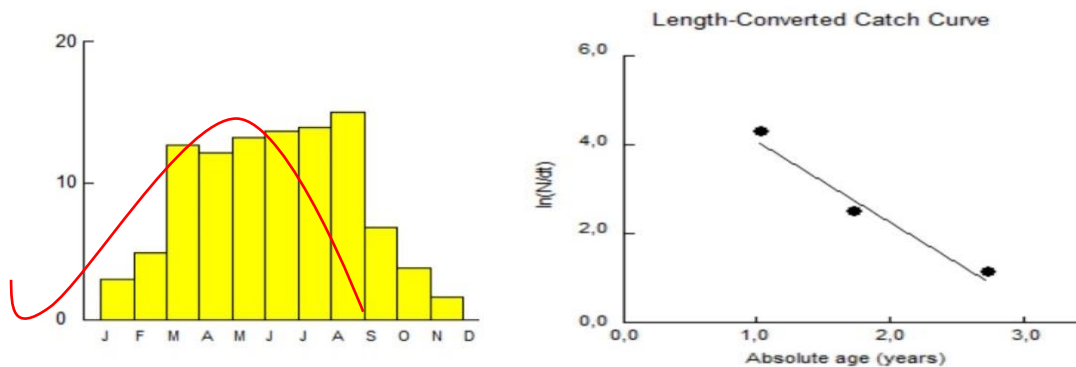
**Figure 3.** Growth Parameters of Gulamah Tetet (*J. belangerii*) in Barumun River



**Figure 4.** Growth of Von Bertalanffy Gulamah Tetet (*J. belangerii*) in Barumun River Waters

Von Bertalanffy's growth model shows the results of the analysis of the length and frequency of growth of gulamah tetet fish (*J.*

*belangerii*) in the waters of the Barumun river with the following equation:  $L_t = 41.55(1 - e^{-0.430(t+0.0309)})$   $K = (0.430)$   $L_\infty = 41.55$   $t_0 = 0.0309$



**Figure 5.** Recruitment Pattern (left) and Fishing Curve of Gulamah Tetet (*J. belangerii*) in Barumun River Waters (right)

The estimated natural death rate is 1.36642 year<sup>-1</sup>. The total mortality rate was 2,802 years<sup>-1</sup>. The mean normal mortality was 2.05 years<sup>-1</sup>, which indicates that deaths occurred regularly at the study site.

The main factors influencing recruitment patterns and mortality rates by increasing the decrease in natural mortality (M) and fishing mortality (F). The estimated natural death rate is 1.44 per year. While the total mortality rate is  $Z = 1.83$ , which means that natural mortality and fishing mortality are  $Z-M$  with a result of 0.937. Arrest mortality is the same as calculated by the formula  $F=Z-M$  with the result  $0.937/1.83 = 0.51$

Based on the growth parameters ( $L_{\infty}=41.55$  cm,  $K=0.430$  per year) and  $T=27.8$  HaiC, the value of natural mortality (M) was 0.9376. The estimated value of Z is 1.83 per year. The estimated M value is 0.9376 per year, and the estimated mortality due to fishing (F) is 0.89 per year. And the exploitation level is calculated with the formula  $E=F/Z$  and has a value of  $0.8924/1.83=0.4876$ .

## CONCLUSIONS AND SUGGESTIONS

The growth pattern of tetet (*J. belangerii*) in the waters of the Barumun River has a negative allometric ( $b = 0.7134$ ) with a growth constant of K (0.430 per year). Meanwhile, natural mortality was  $M=0.937$ , fishing mortality was  $F=0.892$  per year and  $Z=1.83$ , and the exploitation rate was  $E=0.487$ . The peak of recruitment occurs in August every year.

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