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Bioecological Aspects of Snakeskin Gourami (*Trichopodus pectoralis*) in the Flooded Swamp Waters of Bilah River, Labuhanbatu Regency

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Abstract

Background: The potential fish resources of snakeskin gourami (*Trichopodus pectoralis)* in the flooded swamp waters of Bilah river, Labuhanbatu Regency, are pretty high. Thus, this is one of the essential resources and has economic value. This study aimed to inform the bioecological aspects of snakeskin gourami fish (*T. pectoralis)*. **Methods:** The determination of 3 sampling points was done using the purposive random sampling method. The sampling of *T. pectoralis* was carried out using the trap. The data analysis presented information on the abundance of Gonad Maturity Level, growth pattern, the Fulton (K) factor condition, and the Pearson correlation among environment parameters to the *T. pectoralis* population, which was presented quantitatively. **Results:** The results showed the length-weight relationship of *T. pectoralis* in the allometric category. The average relative weight (Wr) for male *T. pectoralis* was 100.46 ± 8.37, and for females was 99.83 ± 2.30. The mean value of the Fulton's (K) factor condition in male *T. pectoralis* (8.94 ± 0.54) and female *T. pectoralis* (9.27 ± 0.67). **Conclusions:** *T. pectoralis* showed an allometric category and domination of the first gonadal maturity level. It describes that the female is abundant in optimum condition and ensures for future generations, and Pearson's correlation result informs that increasing the value of environmental parameters will affect the optimization of *T. pectoralis* life

Keywords: Fulton's Condition Factor; Growth pattern, Snakeskin gourami; *Trichopodus pectoralis*

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Introduction

The Snakeskin gourami fish or *Trichopodus pectoralis* has economic value for fisheries. This fish can be a source of protein for urban and rural residents, which is initially only consumed in rural areas (Elfachmi & Muliati, 2018). Snakeskin gourami fish (*T. pectoralis*) is a freshwater species as one of the fisheries resources and is relatively abundant in swamp waters (Supeni & Azizah, 2020). *T. pectoralis* lives in muddy places where there are shallow pools of water, and lots of aquatic plant vegetation, such as in the flooded swamp waters of Bilah river, Labuhanbatu Regency. The swamp habitats usually get waterlogging from rainwater flooding (rainy season) or permanent swamps (Rais et al., 2020).

T. pectoralis fish has morphological characteristics, namely the abdomen is gray and black with a combination resembling the color of the body of a snake, the body shape is flat (compressed), the lateral line is straight with a complete and perfect arrangement, the scaly body, and the position of the mouth is correct at the tip of the nose (terminal). In addition, the mouth is small and can be hidden (*protractile*) (Oktafia et al., 2012). Rahardjo (2014) stated that the snakeskin gourami fish of the *Trichopodus* genus is a periphyton-eating fish that uses microalgae of the *Bacillariophyceae* class as its leading food. The most consumed *Bacillariophyceae* are Melosira, Navicula, and Diatoma.

T. pectoralis fish is a resource with economic value that can become additional income for improving the surrounding community's economy, for example, around the area in the flooded swamp waters of the Bilah River. This swamp is one of the suitable locations for the habitat of *T. pectoralis* fish. The selling price of this fish in the Labuhanbatu Regency market is around Rp. 20,000 – Rp. 50,000 per kilogram. The exploitation of *T. pectoralis* fish in the flooded swamp waters of the Bilah river is oriented to fishing activities carried out routinely over time using traditional baits and fishing gear operated in shifts by changing fishing areas and adjusted to the fishing season or the existing water depth in flooded swamp waters. The decline in the population of *T. pectoralis* fish in the flooded swamp waters of the Bilah River, Labuhanbatu Regency, is thought to be influenced by high anthropogenic activity in the form of overfishing of the *T. pectoralis* fish population and household waste (inorganic and organic) from the community around the swamp environment.

Several studies have been conducted regarding fish of the Trichopodus *or* Tricoogaster genus, including (Ahmad *et al.*, 2019) regarding the study of the potential of *T. pectoralis* as poultry feed in Lebo Taliwang, West Sumbawa Regency, the spawning of snakeskin gourami fish (*T. pectoralis*) Regan 1910 in West Sumbawa Regency, Taliwang Lake, Sumbawa (Tampubolon & Rahardjo, 2011), the structure of the length and weight of the snakeskin gourami (*T. pectoralis*) in flooded swamp waters (Supeni & Azizah, 2020), and the natural spawning of the snakeskin gourami fish (*T. pectoralis* Regan, 1910) with significant parent sizes different in controlled containers (Sundari, 2015).

Based on the research history and concerns about the population in their natural habitat, it becomes the basis of the urgent importance of conducting a study on informational studies related to the bioecological aspects of the snakeskin gourami fish (*T. pectoralis*) in the flood swamp waters of the Bilah river, Pangkatan District, Labuhanbatu Regency. This study will present data in the form of aquatic environmental conditions factors related to growth patterns, an abundance of Gonad Maturity Level (GML), and biological aspects of the *T. pectoralis*. Therefore, the researcher hopes this study can become a primary data reference for implementing policies by the Labuhanbatu Regency government as a stakeholder for the survival of the snakeskin gourami fish (*T. pectoralis*) in its natural habitat (swamp waters).

Figure 1. Research Location Map

Method

The sampling was carried out in areas in the flood swamp waters of the Bilah river from December 2021 to February 2022 with the selection of three station points (Figure

1). Based on the purposive random sampling methods, the research location description can be found in Table 1.

Table 1. Research Location Description

Station	Location	Ordinate point	Vegetation	The intensity of human Activity
1	Pangkatan	2° 9'9.12" N, 99°59'13.44" E	Oil Palm Plantation & grass	High
2	Tangkahan	2°10'47.73" N, 100° 0'50.13" E	Oil Palm Plantation	Sufficient
3	Aluran Naga	2°11'16.08" N, 100° 1'2.97" E	Oil Palm Plantation & grass	Measly

Instrument

The tools used in this study included a digital camera, measuring instrument (30 cm ruler), digital caliper with 0.1 mm accuracy, digital scale, scalpel, surgical tub, bucket, milliliter paper, 70% alcohol, aqua dest, and oil palm fruit as bait, the traps as fishing gear for *T. pectoralis* with a detailed size of 50 cm x 30 cm x 15 cm (Figure 2).

Figure 2. Trap tools of *T. pectoralis*

Data collection

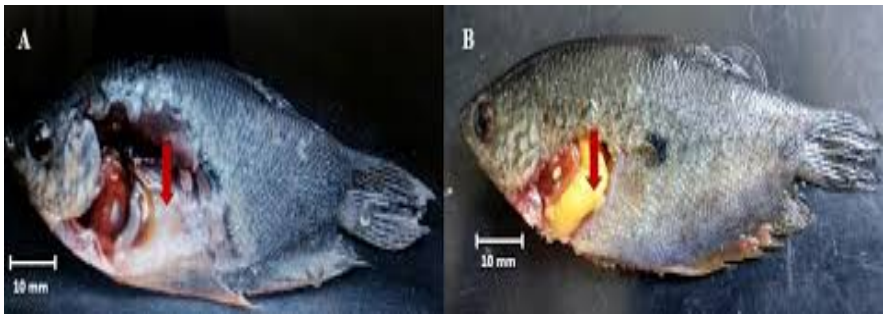
Data were collected once a month, using a trap (Figure 2), with ten subpoints per station as the replication to get valid data.

Procedure

The sampling procedure steps were 1) the sampling of snakeskin gourami fish (*T. pectoralis*) carried out at each station contained active-living specimens using trap fishing gear with palm kernels as bait, 2) the calculation of the number of catches and sex selection were carried out (male-female) v, 3) the measurement of morphometric and body weight on each individual caught *T. pectoralis* using micrometer with an accuracy of 0.01 cm, and measurement of weight using a digital scale with an accuracy of 0.01 gram.

Sex Morphology Observation of *T. pectoralis*

The difference in morphology of male and female snakeskin gourami (*T. pectoralis*) can be seen in Figure 3. The morphology refers to information from Sari et al. (2018) Regarding the morphology of the female *T. pectoralis*, which is pale dark in color, and the length of the dorsal fin does not extend to the caudal fin. While the male *T. pectoralis* is bright and dark in color, and the dorsal fin length exceeds the caudal fin. Ahmad (2019) added that the snakeskin gourami (*T. pectoralis*) body structure is dominated by bones and a small composition of meat, as well as mucus covering the surface of the body. Snakeskin gourami (*T. pectoralis*) can survive even in places that lack oxygen and are fast in breeding, so *T. pectoralis* will be easy to cultivate and develop.



(a) (b)

Figure 3. The differences in morphology of male and female *T. pectoralis*, (a) Male; (b) Female

The Observation of Gonad Maturity Level (GML) of T. pectoralis

The fish measured their length and body weight. Then, the fish was dissected to determine the sex and Gonad Maturity Level (GML). GML was determined based on the Cassie method (Table 2).

Data analysis

Growth Pattern Analysis

They are analyzing the growth of correlation width and weight to determine the growth pattern of *T. pectoralis* in nature. The researchers used a specific equation to find the relationship between width and total weight. The value of b was used to calculate the growth rate of the analyzed parameters. If the value of b result showed equals 3 (b=3), the growth pattern is isometric (the pattern of width growth is the same as the growth of weight). In addition, if the value of b is higher than 3 (b>3), the growth pattern is positively allometric (weight growth is faster than width growth). Furthermore, if the value of b is lower than 3 (b < 3), the growth pattern is negatively allometric (width growth is faster than weight growth). The formula employed in this study using the King, (1995) equation is as follows.

$$W = a\ L\ b \text{ or } LnW = Lna + bLnL$$

Where: W = the average weight of *T. pectoralis* (gr); L = the average carapace width of *T. pectoralis* (cm); a = constant; b = exponential value between 2-5.

Table 2. The Morphology of Gonad Maturity Level (GML) of *T. pectoralis*

GML	Male	Female
Immature Gonads	The testicles are like shorter threads, limited visibly at the ends of the body cavity and clear in color.	Ovaries like threads to the body cavity, transparent color, clear surface, and small surface
1	The size of the testes is larger, milky white, and the shape is clearer than GML 0	The size of the ovary is larger, and the color of the egg is yellowish, which cannot be seen by the eye
2	The surface looks jagged, the color is getting whiter, the size of the testes is getting bigger, and in a preserved state, it is easy to break	Ovaries are yellow morphologically; the eggs begin to look grain by the eye
3	As in stage II, it is clear and the testes are getting denser	The ovaries are getting bigger, yellower, and easy to separate, the oil grains don't appear to fill -1/3 of the abdominal cavity, and the intestines are squeezed
4	The back of the testicle is deflated, and near the release, it is still full.	Ovaries are wrinkled, and thick walls and side eggs are present near the release of many such as stage II.

Condition Factors Analysis (Fulton)

The condition factors can be seen in the weight of *T. pectoralis* in numbers. Factor analysis for each sample was carried out using the relative weight (Wr) and condition factor coefficients. The researchers used the following equation to calculate the relative weight (Wr).

$$Wr = W / Ws \times 100$$

Where: Wr = relative weight gained; W = weight of each sample; Ws = predicted standard weight of the same sample because it is calculated from the combined length-weight regression through the distance between species. For the factor analysis of the condition of *T. pectoralis*, the researchers employed the equation that had been used by King (1995) dan Effendi (2002), as follows.

$$Kt = 100\ W / L3$$

Where: Kt = condition factor; W = the average body weight of *T. pectoralis* (gr); L = the average body length of *T. pectoralis* (cm); 3 = the length coefficient to ensure that the value of K tends to come near to the value of 1.

Result

The Growth Pattern of T. pectoralis

The results of the analysis of the growth pattern of the snakeskin gourami (*T. pectoralis*) in the flooded swamp waters of Bilah river were distinguished based on the sex ratio, where the value of the length-weight relationship of the *T. pectoralis* was obtained with a value of (b) of 2 .5123, while the female (b) was 3.2588. The relationship between the length and weight of the male *T. pectoralis* can be seen in Figure 3.

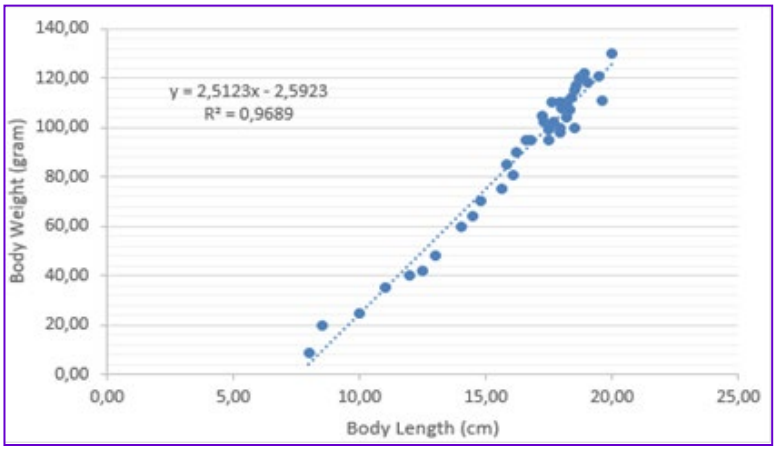


Figure 3. The relationship between the length and weight of the male *T. pectoralis*

The results of the analysis of the length-weight relationship of snakeskin gourami (*T. pectoralis*) (Figure 4) show that males (b = 2,5123) show a negative allometric growth pattern. It has a negative allometric growth pattern (length gain is faster than weight gain). The analysis results of the length-weight relationship of female *T. pectoralis* fish are known (b = 3.2588), showing a positive allometric growth pattern. It means that if b>3, the relationship is positive allometric, where the weight gain is more dominant than the length increase. Whereas, if b <3, the relationship formed is negative allometric, where the increase in length is more dominant than the increase in body weight.

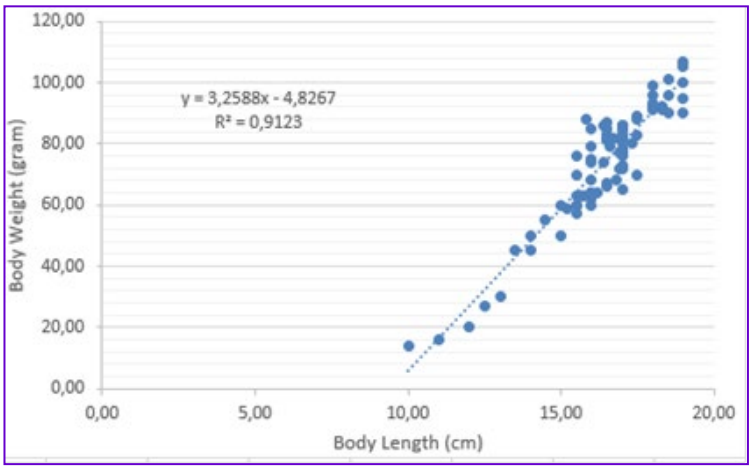


Figure 4. The relationship between the length and weight of the female T. *pectoralis*

The Condition Factor (Fulton) of T. pectoralis

Suwarni (2009); Merantika et al. (2014) stated that the interpretation of Fulton's condition factor value is if the fish that gets the condition factor value is 0-1, then the fish is classified as a flat or not fat fish. In addition to growth patterns, the condition factors are also part of the growth parameters. The condition factors indicate if the fish is in a good or bad condition regarding their physical ability to survive and reproduce (Syafrialdi et al., 2020). Napisah & MaChrizal (2021), added that if the Fulton condition factor value is above 100, the water population is still in good condition. On the other hand, if the value is below 100, the population in the flooded swamp waters is in poor condition. The results of the analysis of the biological parameters of the snakeskin gourami (*T. pectoralis*) can be seen in Table 3.

Table 3. Biological parameters of *T. pectoralis* in flooded swamp waters of Bilah river

Parameter	Male	Average	Female	Average
Total length (cm)	7,28 – 20,00	16,32 ± 3,19	9,20 – 21,10	16,63 ± 1,25
Weight of fish measured, W (grams)	9,27 – 130,57	88,46 ± 2,12	10,35 – 117,20	74,43 ± 3,13
Predicted weight, Ws (grams)	13,93 – 139,29	89,72 ± 3,55	15,54 – 127,76	77,86 ± 1,17
Relative weight, (Wr)	64,63 – 123,32	100,46 ± 8,37	76,43 – 136,30	99,83 ± 2,30
Fulton (K) condition factor	3,86 – 16,56	8,94 ± 0,54	4,62 – 15,84	9,27 ± 0,67
Coefficient of determination (r^2)	0,9689	-	0,9123	-
b value	2,5123	-	3,2588	-

The results of the study in table 3 show that the relative weight (Wr) for the male *T. pectoralis* (64.63 – 123.32 grams BW), the average (100.46 ± 8.37), and the female fish (76 .43 – 136.30 grams BW) on average (99.83 ± 2.30). The Fulton (K) condition factor value of male *T. pectoralis* (3.86 – 16.56) on average (8.94 ± 0.54) and female fish (4.62 – 15.84) on the average mean (9.27 ± 0.67). Based on the value of these condition factors, it can be seen that the snakeskin gourami (*T. pectoralis*) has a level of plumpness that is not much different.

Gonad Maturity Level (GML) of T. pectoralis

The results of the analysis of the abundance of male gonad maturity levels (Figure 5) can be seen that the male *T. pectoralis* in the flood swamp waters of the Bilah river were dominated by males with gonad maturity first level (GML 1) category as many as 31 individuals/m2 with body length from 13.30 to 17.91 cmBL. The lowest gonad maturity levels found at the fourth (GML IV) of GML category, as many as 3 individuals/m^2 with body length from 18.04 to 20.00 cm BL. The females *T. pectoralis* with gonadal maturity the first level category (GML I) were 70 individuals/m^2 body length from 12.61 to 14.83

cmBL, and the lowest is at the fourth (GML IV) as many as 6 individuals/m2 with size class 17.82 to 21.00 cm BL.

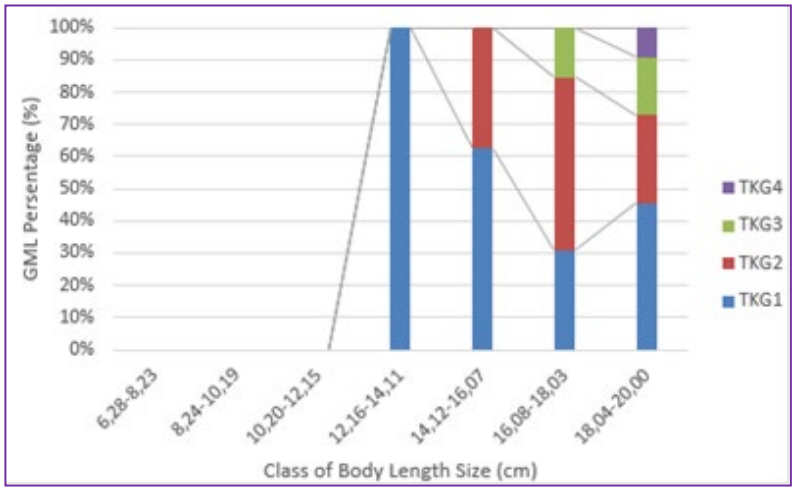


Figure 5. The abundance of Gonad Maturity Level (GML) of Male *T. pectoralis*

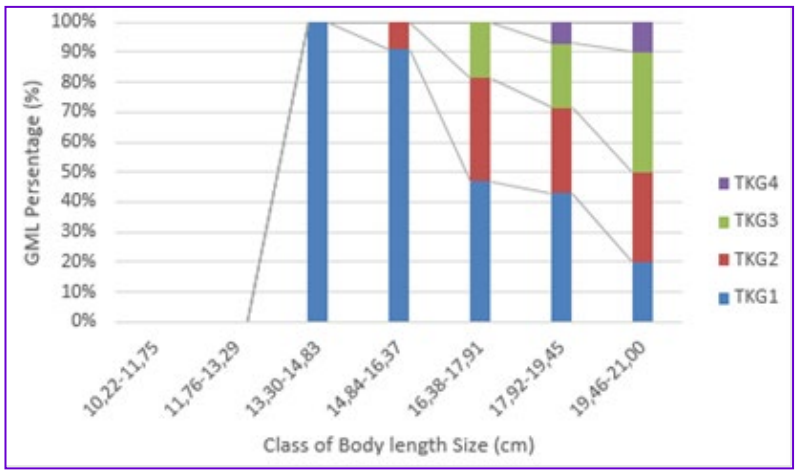


Figure 6. The abundance of Gonad Maturity Level (GML) of Female *T. pectoralis*

Pearson's Correlation between Environmental Parameters to T. pectoralis Catch

Water quality factors play an essential role in hatching fish eggs. If the broodstock of snakeskin gourami (*T. pectoralis*) is found in these waters, the water quality in the spawning process is very suitable (Laila et al., 2020). Rochvita (2014) informed that the reproductive performance of *T. trichopterus* is more influenced by environmental quality, such as water temperature and the solubility of oxygen and phenol. The results of the Pearson Correlation between Environmental Parameters and *T. pectoralis* fish caught in table 3 show that the water temperature parameter has an r^2 value of 0.955, oxygen solubility (DO) has a value of 0.778, and water brightness has a value of 0.729, the environmental parameter of water pH r^2 has a value of 0.729. 0.647, the Nitrate parameter has a correlation value of 0.729, and the environmental parameter Phosphate has an r^2 value of 0.696 (Table 4).

Table 4. The Results Pearson Correlation of Environmental Parameters to *T. pectoralis*

No.	Environmental Parameters	Pearson Correlation (r^2)
Physics		
1	Water Temperature	0,955
2	Water Brightness	0,729
Chemical		
3	DO	0,778

4	Water pH	0,647
5	Nitrate	0,729
6	Phosphate	0,696

Discussion

The growth of *T. pectoralis* fish is in the allometric value category. This can be due to the increased use of natural food for growth and reduced trophic competition so that fish growth is better (Faradonbeh et al., 2015; Rais et al., 2020). In addition to the feed availability factor, the proportional form of growth also varies according to other factors such as sex, growth phase, stomach contents, gonadal development, and genetics (Muthmainnah, 2013). Fluctuations in the value of the length-weight relationship of the snakeskin gourami (*T. pectoralis*) are also thought to be influenced by high human activities around the habitat. Rais et al. (2020) mentioned that the pressure, mainly due to environmental changes, is of particular concern for the sustainability of the snakeskin gourami population, where environmental change factors greatly influence the quantity of the population that is the object of the catch. If not handled, fish fishing activities can potentially reduce fish population stocks in the waters of their natural habitat.

The high rainfall during the study period caused the area to receive water input into flooded swamp waters. The movement of the Activity of *T. pectoralis* fish against the current velocity in the waters where the fish live also plays a role in determining the value of the length-weight relationship of the fish. Accordance to Muchlisin et al. (2010) stated that the behavior of fish also influences the size of the b value. For example, active swimming fish (pelagic fish) shows a lower b value than passive swimming fish (mostly demersal fish) which states that fish living in fast currents generally have a lower b value. On the other hand, fish that live in calm waters will produce a considerable b value. According to Nofrita et al. (2013), the b value generally depends on physiological and environmental conditions, such as temperature, pH, geographic location, sampling technique, and biological conditions.

Tanaka, W. et al. (2015) added a change in a growth pattern which indicates pressure on the population of *T. pectoralis*. These changes can be seen in the snakeskin gourami (*T. pectoralis*) growth, which becomes faster and reaches a longer age than in previous years. The changes in nutritional conditions, availability of natural food, habitat, and hydrological factors make fish must be able to adapt to their growth to continue to reproduce. Sukendi (2013) added that body size affects the amount of fecundity, egg diameter, and gonadal maturity index.

Sarma (2015), stated that the relationship between the length and weight of fish is essential in the development of swamp fishery to show the relationship between population dynamics, growth patterns, fish stocks, gonad development, and general condition of fish, body shape comparisons of different groups of fish. Wujdi et al. (2012) also mentioned that the growth pattern of fish could be determined from the value of the constant b from the relationship between the length and weight of the fish. If b=3, the growth is isometric (length gain is proportional to weight gain). If b=3, the relationship formed is allometric (length gain is not proportional to weight gain). The allometric category is divided into two categories: positive and negative. Muttaqin et al. (2016) explained that if the b value is below 3 (b<3), it is called negative allometric (length gain is faster than weight gain). If the b value is above 3 (b>3), it is called positive allometric (weight gain is faster than the increase in length).

Jusmaldi et al. (2020) informed that the growth pattern of the snakeskin gourami (*T. pectoralis*) in the Lempake Dam, East Kalimantan, is classified as a harmful allometric category (male b=2.71; female b=2.86) (Faqihudin et al., 2019). Mentioned that the growth pattern of *T. tricopterus* fish in the downstream waters of the Elo Magelang river is allometric. Nurdin (2017) stated that the growth pattern of *T. tricopterus* fish in the downstream waters of the Sunter river, North Jakarta, is allometric. Nafis (2021),

informed that the growth pattern of male *T. trichopterus* in the waters of Rawa Pening Semarang is categorized as positive allometric (male b=3.23; female b=3.20), which indicates weight gain is significantly faster than length (P<0,05).

Likewise, the phenomenon of growth patterns in other Trichopodus genera in Indonesian waters is today. Halawa (2021) informed that the growth pattern of *T. leeri* in flooded swamps of the Seruai river, Deli Serdang, North Sumatra, is classified as a harmful allometric category (b=2.83). Agus et al. (2022) informed that the growth pattern of *T. pectoralis* in the waters of Rawa Pening Semarang is classified as a harmful allometric category (b=2.77). Amriyah (2018) informed that the known growth pattern of the genus *Tricogaster* in the Banjarnegara reservoir is the species *T. pectoralis* belonging to the Isometric category (b=3.06). Rezeki (2013) informed that the growth pattern of *T. leeri* in the flooded swamps of the Tapung river, Riau, is classified as a harmful allometric category (male b=1.36; female b=1.84).

The results from Table 2 showed the condition factors value; it can be seen that the snakeskin gourami (*T. pectoralis*) has a level of plumpness that is not much different. Baizura's study (2022) in the waters of Rawa Pening Semarang informed that the condition factor value of the male snakeskin gourami (*T. pectoralis*) ranges from 0.565-1.663 with an average of 1.013, while the female fish ranges from 0.807-2.018 with an average of 1.007. Nafis (2021) informed that the condition factors of male *T. pectoralis* in the waters of Rawa Pening Semarang range from 0.83-1.36 with an average of 1.01 and female fish ranges from 0.79-1.20 with an average of 1.02. Jusmaldi et al. (2021) informed that the condition factors of female *T. tricopterus* fish in flooded swamp waters range from 1.472-1.555, and males range from 1.024-1.082. Nurdin (2017) informed that the condition of *T. tricopterus* fish in flooded swamp waters ranges from 1.2130--1.7126 for males, while for females ranges from 1.4891-1.8178. Jusmaldi et al. (2021) suggested that the growth pattern and relative condition factors of the snakeskin gourami (*T. pectoralis*) are influenced by the number of fish populations with variants of gonad maturity and body shape. According to Blackwell et al. (2000); Sentosa & Satria (2015) in addition to the availability of food, aquatic environmental factors and management of fishery resources can also affect the condition of fish. Good habitat conditions will support the growth of fish and are reflected in the value of the condition factor.

The results of the analysis of gonadal maturity level (GML) (Figures 5 & 6) snakeskin carp (*T. pectoralis*) in flood swamp waters, Labuhanbatu Regency showed dominated by T. pectoralis in the first category gonadal maturity level (GML I), for males found 44.28% and women 46.15%, and fourth (GML IV) as the lowest found 4.28% and women 3.84%. This is in line with the results of Nurdin's study (2017), which reported the distribution of GML of the genus *Trichopodus* in the downstream waters of the Sunter river, North Jakarta, is dominated by GML 1. The gonad maturity level is directly proportional to fecundity, where the higher the level of gonad maturity, the higher the fecundity value obtained. Puspaningdiah (2014) concluded that fecundity is influenced by fish's body length and body weight. The result has shown an indication of the development of the gonad too, where the development of oocytes can cause an increase in the value of the gonadal maturity index. Sukendi (2013), stated that the male sepat fish gonads of *T. leeri* with the fourth stage of GML (IV) are known to have a semen volume of 0.214 ml, spermatozoa concentration of 19.543 x 109 cells/ml, spermatozoa viability of 83.46%, the fecundity of 15185 grains, diameter size eggs of 0.81 mm, egg maturity of 83.58 % and the survival rate of 91.88%.

The fish population in the research observation area may be influenced by the availability of feed nutrients and the time of the season, which causes the dynamics of the quantity of water discharge entering the swampy habitat around the habitat. Herliwati (2013) suggested that the difference in water depth between seasons gives different characteristics of the physical-chemical and biological properties of water, which in turn will affect behavior, movement patterns (local crocodiles), and biological conditions of swamp fish, where species such as *T. pectoralis* are periodically doing limited around the

swamp water environment. According to Sundari (2015), in the domestication of the snakeskin gourami (*T. pectoralis*), its necessary to evaluate the growth to prepare the application of operational standards for the propagation and development of aquaculture fish populations. The success of the repeated reproduction phase is the development of artificial reproductive techniques in a seed production activity with genetic engineering as well as the selection and crossbreeding for breeding, where the natural spawning of finches on a laboratory scale is known to produce optimum fecundity.

The result Pearson correlation between environmental parameters and the population of *T. pectoralis* caught (Table 3) shows that the acquisition of the highest Pearson correlation value in the research location was known to have a unidirectional correlation (positive r^2 value) at a water temperature of (r^2 = 0.955). This means that if the fluctuations in water temperature in the flood swamp waters of the Barisan river, Labuhanbatu Regency, increase, it will affect the increase in the growth rate of *T. pectoralis* in that location. According to Froese (2014), the snakeskin gourami (*T. pectoralis*) live in habitats with temperatures ranging from 23–28^{o}C in the flood swamp waters of the riverbanks. Sanjaya et al. (2021) informed that the optimal water temperature for the snakeskin gourami (*T. pectoralis*) life is 29±1°C. Lingga & Susanto (1993) added that the water temperature is said to be excellent and optimal for the survival of the snakeskin gourami, with changes in day and night temperatures not more than 50C.

There is a unidirectional correlation (positive r^2 value) between the effect of water brightness parameters on the population of snakeskin gourami (*T. pectoralis*) caught in the study area of (r^2=0.729). This means that fluctuations in the value of water brightness will also increase the impact on the population of *T. pectoralis* fish in the flooded swamp waters of the Barisan river, Labuhanbatu Regency. Bianingrum (2015) stated that a light intensity of 500 lux affects the optimum performance of growth, stimulates metabolism, fish appetite, and survival of the snakeskin gourami (*T. pectoralis*), where the comprehensive visibility makes it easier for the sepat fish to find and prey on its food. Taufik (2007) stated that light intensity plays a critical role in seed survival and fish growth, especially in vision-feeding seeds, which rely on vision to catch a feed.

The obtained value of DO (Demand oxygen) is also the most influential parameter on the abundance of the *T. pectoralis* fish population in waters such as the flooded swamp of the Bilah river. It is evident from the acquisition of the Pearson correlation value (r^2 = 0.778), which means that there is a positive/unidirectional correlation to the population of *T. tricopterus* fish. In other words, the higher the dissolved oxygen level in the flooded swamp waters of the Bilah river, the better the life of the population of *T. trichopterus*.

Dissolved oxygen in water is influenced by temperature, salt content, and partial pressure of gases in the air and water, and compounds quickly oxidize in the water. The higher the temperature, salt content, and partial pressure of gases dissolved in water, the solubility of oxygen decreases. Swamp waters have distinctive physical, chemical, and biological characteristics. There are many aquatic plants with oxygen content and low pH. On the other hand, CO_2 is relatively high because many decomposition processes occur. The types of fish that dominate swampy waters have an additional breathing apparatus (labyrinth), so they can take oxygen directly from the air (Asyari, 2017).

Obtaining the lowest parameter correlation to the population of snakeskin gourami (*T. pectoralis*) caught in the swamps of the research location is known to be in the water pH and phosphate parameters with Pearson correlation values of (r^2=0.647) and (r^2=0.696), respectively. This means that the unidirectional Correlation (positive r^2 value), namely fluctuations in water pH and water phosphate values, will affect the life of the *T. trichopterus* fish population in the flooded waters of the Barisan river, Labuhanbatu Regency (Laila et al., 2020). Froese & Pauly (2007) stated that the optimum pH range for the life of *T. pectoralis* in the waters is 6.5–9.

Samuel & Nasution (2002) stated that waters close to floodplain areas are usually surrounded by swamp habitats and are inhabited by fish populations with a high

tolerance for acidic water (low pH water), such as *T. pectoral*. Ramadhan & Yusanti (2020) informed that the flooded waters of the Bilah river have natural food sources with a variety of feeds that are by the conditions of stable biota community stability, sufficient productivity, fairly balanced ecosystem conditions, and moderate ecological pressure.

Conclusions

The snakeskin gourami (*T. pectoralis*) was one of the abundant fishery resources where found in the flooded swamp water in Bilah river, Labuhanbatu Regency. The analysis of the length-weight relationship found that the growth pattern of males *T. pectoralis* belonged to the harmful allometric category (b = 2.5123) and females belonging to the positive allometric category (b = 3.2588). It is known that *T. pectoralis* caught is dominated by individuals with a first Gonadal Maturity Level (GML I) category of 45.95%. The value of the Fulton (K) condition factor obtains as the average value of the Fulton (K) condition factor in males (8.94 ± 0.54) and females (9.27 ± 0.67). This result describes the abundance of the female gourami population in optimum conditions and ensures for the future generation. Pearsons Correlation result between the physic-chemical environment parameter and the *T. pectoralis* abundance showed that positive Correlation for water temperature (R2 = 0.995), water brightness (R2 = 0.729), and demand oxygen (DO) (R2 = 0.778) which means increasing the value of environmental parameters would affect the optimization of *T. pectoralis* life in this habitat.

Declaration statement

The authors reported no potential conflict of interest.

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