Abundance and growth of tinfoil barb (*Barbonymus schawanefeldii*) in Tasik River, South Labuhanbatu, North Sumatera, Indonesia

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Abstract. Tinfoil barb, *Barbonymus schwanefeldii*, is freshwater fish found in North Sumatra waters, where the water quality factors influence its abundance and growth. The research about the abundance and growth of *B. schwanefeldii*) was conducted in Tasik River, South Labuhanbatu, North Sumatera, from July to August 2020. The sampling was carried out using a 1.25 inches mesh size at three different stations. There were 176 fish caught during the research, with the help of fishers, at each station. The results showed an abundance of fish at the station I of 2 ind m^{-2} and at station II and III of 1 ind m^{-2}. The results for the growth of the von Bertalanffy model was Lt=143.85 (1-EXP$^{(-1.6)(1.8116-(-0.0634))}$) where L∞=143.85 mm, growth rate (K)=1.6 $year^{-1}$, t0=-0.0634 years and tmax=1.81 years.
Key Words: Von Bertalanffy, water quality, barbus, Barumun River, FiSAT II.

Introduction. Tinfoil barb, *Barbonymus schwanefeldii*, is a freshwater fish found in the waters of North Sumatra, where water quality factors influence its abundance and growth. The Tasik River empties into the Barumun River, which flows along the Panai Hulu District, Labuhanbatu Regency. The surrounding community widely uses the Tasik River for various activities such as industrial waste disposal, household waste, fish auction places, ports, and fishing. Pollutants resulted from this activity made the water's color becoming more cloudy (Siagian et al 2017). The Tasik River is a habitat for various fish species and it is used by the surrounding community as livelihood and daily food source. Many species of nekton organisms live in these rivers, in particular fish (Muhtadi et al 2014), such as the *B. schwanefeldii*.

B. schwanefeldii is a freshwater fishery resource. This fish is often called as lampam fish, tengadak fish, kapiek, kapiat, lempem, lempam (Desrita et al 2018; Muhtadi et al 2017). Before revising the name validity, *B. schwanefeldii* was included in the Barbus, Barbodes, Puntius, and Systomus groups. The total synonym for *B. schwanefeldii* reaches 12 names. In English, it is called tinfoil barb (Kusmini et al 2015). *B. schwanefeldii* has a flat body shape with silvery-white color, the dorsal fin is red mixed with black at the ends, the pectoral fin, pelvic and anal fins are red, the tail fin is red mixed with orange with black and white striped edges (Kottelat et al 1993). According to Isa et al (2012), the average size of this fish is between 10 and 25 cm and weighs around 200-600 g.

Species diversity consists of two components, namely the number of present species (leading to species richness) and the relative abundance of species. The difference in relative abundance at each location was influenced by the water quality parameters and by the presence of fishing activities (Septiano 2006). There are various antrophogenic activities in Tasik River such as fishing, disposal of domestic and agricultural waste, and others. These activitieses result in a decrease of the number of *B. schwanefeldii* populations, affecting the fish survival rate and growth. Therefore, the study aimed to conduct a research on the abundance and growth of *B. schwanefeldii* in the Tasik River.

Material and Method

Experimental materials. The materials used in this study included GPS (Global Positioning System), pH meter, DO meter, scale stick, secchi disk, thermometer, digital caliper, coolbox, ruler, net, millimeter block paper, stationery, digital camera and *B. schwanefeldii*specimens.

Experimental design. Fish samples were collected using a net with a mesh size of 1.25 inch. Fish were collected 3 times in 2 months at 3 different station locations in the Tasik River, South Labuhanbatu, North Sumatra, from July to August 2020. All *B. schwanefeldii* that were caught were placed into a coolbox and then their length and weight were measured. Growth parameters (K and L∞) were estimated using the ELEFAN I method accommodated in the FiSAT II software.

Data analysis. The fish abundance in the river was calculated using the following formula (Odum 1996):

$$X = \frac{Xi}{n}$$

Where:
X - tinfoil barb abundance;
Xi - total number of tinfoil barb at the i-the observation station;
N - the area of the net.

Growth parameters (K and L∞) were estimated using the ELEFAN I method, accommodated in the FiSAT II software (Gayanilo et al 2005). Growth tinfoil barb was estimated using the Von Bertalanffy formula as follows (Sparre & Venema 1999):

$$Lt = L\infty\,[1 - e^{-K(t-t_0)}]$$

Where:
Lt - fish length at age t (cm);
L∞ - length at infinite time (cm);
t_0 - theoretical age of fish at 0 cm length;
K - von Bertalanffy growth coefficient.

Water quality can be expressed by several parameters including physical and chemical parameters (Sahabuddin et al 2014). Water quality parameters measured in this research can be seen in (Table 1).

Table 1

Water quality parameters

Parameters	*Tools*
Temperature	Thermometer
Depth	Scale stick
Brightness	Secchi disk
pH	pH meter
Dissolved oxygen	DO meter

Results and Discussion

Abundance of B. schwanefeldii. There were 176 *B. schwanefeldii* samples collected from the Tasik River in this research. The results showed that the highest abundance of *B. schwanefeldii* was observed at station I with 2 ind m^{-2}, while the lowest abundance was recorded at stations II and III with 1 ind m^{-2}. The abundance graphic of *B. schwanefeldii* can be seen in Figure 1.

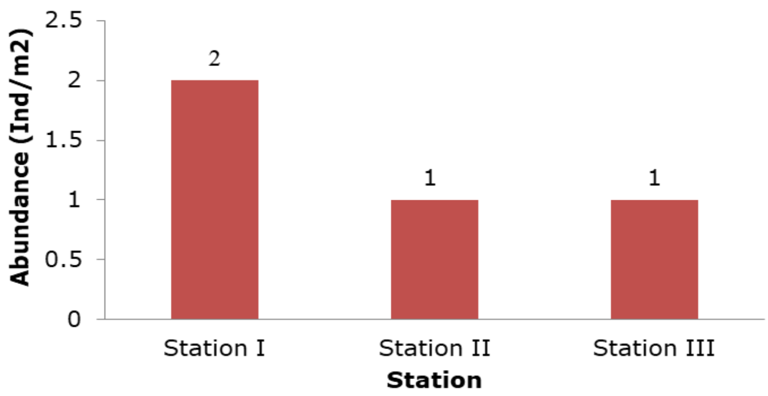

Figure 1. Abundance of *Barbonymus schwanefeldii*.

Water quality parameters and fishing activities influence the abundance at each station. The water quality parameters at the three stations didn't differ significantly. pH, DO, current speed, and depth values were more appropriate at station I than at stations II and III. At the station I, the pH value was 6.9 while at stations II and III it was 6.8, still livable. According to Irianto (2005), the cyprinid fish can live in water with 6.0-8.0 pH.

Besides the pH, the highest dissolved oxygen (DO) value was also found at station I, with 6.3 mg L^{-1}. The higher the oxygen level of water, the better the waters for fish growth and abundance. According to (Effendi 2003), the dissolved oxygen (DO) for aquatic organisms habitat should be greater than 5 mg L^{-1}. Another physical parameters that had more appropriate value at station I were the current and depth. Station I had a faster current than other stations with muddy substrate. This was because Station I is closer to the Barumun River, the main river, and it causes more mud entering the Station I than other stations. According to Desrita et al (2018), *B. schwanefeldii* prefer strong currents with slightly muddy water.

Station I is deeper than station II and station III with 7.6 cm. The fish abundance was higher at the station, which was deeper than the other stations, although differences were not too significant. According to Siahaan (2012), the shallower the water, the fewer fish are caught; on the contrary, the deeper the water, the higher the fish abundance. The temperature and brightness parameters were more appropriate at stations II and III than at station I. There is a correlation between the brightness and temperature: the higher the brightness, the higher the temperature. During the study, water temperature reached 28.3ºC at station I, 28.2ºC at station II and 29ºC at III station. Because there was no significant difference in temperatures, the abundance at each station did not differ significantly. According to Effendi (2003), temperature plays a critical role in controlling the aquatic ecosystems conditions.

Brigthness is also a critical parameter for the fish habitat. The amount of sunlight that enters the water affects the photosynthesis process in aquatic plants or phytoplankton, which are food for tinfoil barb. Stations II and III had higher brightness values than station I. According to Effendie (2002), brightness can affect the photosynthesis process because the amount of sunlight entering the water column. The intensity of sunlight acts as a natural stimulent for fish in cultures, which affects their growth.

Water quality. The temperature has an essential role in determining fish and other aquatic organisms' growth. The water temperature at the research locations ranged between 28.2 and 29ºC. The highest temperature was observed at the location III with 29ºC, while the lowest water temperature was recorded at the location II with 28.2ºC, and the water temperature at the station I was 28.3ºC. The water temperature is still suitable for fish growth in this river. According to Tatangindatu et al (2013), the optimal temperature to support fish growth ranges between 28-32ºC. According to Huwoyon et al (2010), *B. schwanefeldii* can live at temperatures between 25 and 30ºC. According to

Ghufran et al (2010), when the temperature increases extremely, it can cause fish mortality. Based on water quality measurements in the Tasik River, water quality data can be seen in Table 2.

Table 2

The measurement result of water quality

Parameter	*Unit*	*Station*					
		I		*II*		*III*	
		Average	*Standard deviation*	*Average*	*Standard deviation*	*Average*	*Standard deviation*
				Physical			
Temperature	ºC	28.3	±0.7	28.2	±1.9	29	±0.95
Current flow	m s^{-1}	0.20	±0.04	0.17	±0.95	0.16	±0
Depth	cm	77.6	±45.42	60.53	±15.79	64.3	±19.45
Brightness	cm	9.67	±7.23	13.5	±11.3	14.5	±12.13
				Chemical			
pH	-	6.9	±0.43	6.8	±0.15	6.8	±0.17
DO	mg L^{-1}	6.3	±1.36	5.8	±0.47	6.2	±0.9

Based on the results of the study, the current flow from each station in the Tasik River ranged from 0.16 to 0.20 m s^{-1}. The fastest current was found at station I with 0.20 m s^{-1} and the lowest current was at station III with 0.16 m s^{-1}. The substrate type will affect the flow velocity, but the flow velocity in an ecosystem cannot be determined with certainty because it is very volatile. According to Siahaan et al (2012), the gravity, the river's width, and the river water's material make the upstream flow faster.

Brightness is an essential factor for photosynthesis and primary production in waters. The waters brightness in the research location was measured by Secchi disk. The results showed that the highest brightness value was at station III with 14.5 cm and the lowest was at station I with 9.67 cm, while the brightness value at station II was 13.5 cm. According to Nuriya et al (2010), brightness means water transparency and can be determined visually by using a Secchi disk. The water depth at each study location ranged from 62.04-86.31 cm. The deepest water was observed at station I with 77.6 cm, while the lowest depth was at location II with 60.53 cm, and the depth at station III was 64.3 cm. This depth is suitable for supporting the life of tinfoil barb, dominated by small to medium size specimens (60-147 cm). According to Haryono & Subagja (2008), the suitable depth for small and medium size fish/juveniles is less than 1 m depth.

The degree of acidity (pH) shows the concentration of hydrogen ions in water. The organisms tolerance to pH vary and, in general, most aquatic organisms are sensitive to pH changes. The pH in this research ranged from 6.8 to 6.9, meaning that the pH at the research location was neutral or normal and suitable for the growth of tinfoil barb. According to Islama (2014), tinfoil barb lives well if the pH is 5-7.

Dissolved oxygen measurement is crucial, playing a vital role in the respiration process of organisms. Naturally, these chemical compounds are present in waters with appropriate levels and changes in levels can affect the life of organisms that live in waters. In this research, the DO value at each station was 6.3, 5.8, and 6.2 mg L^{-1}, respectively. According to Hapsari (2013), optimal DO concentration for *B. schwanefeldii* is not less than 5 m L^{-1}.

Growth performance of B. schwanefeldii. The growth of *B. schwanefeldii* can be estimated according to the von Bertalanffy model (total of 157 samples), obtained through the ELEFAN I sub-program of FiSAT, from the length after an infinite period (L∞); in *B. schwanefeldii* it was 143.85 mm with K of 1.6 per year and R of 0.593, as in Figure 2.

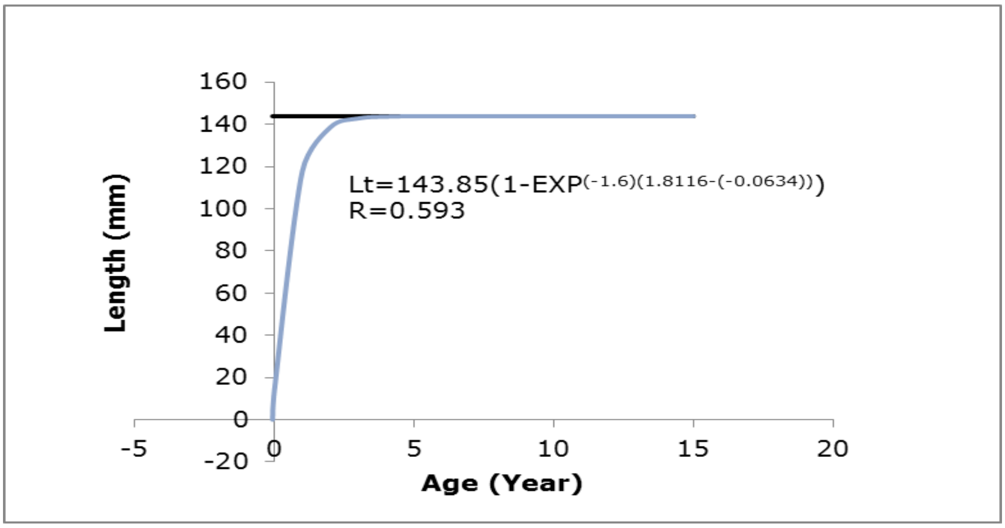

Figure 2. The von Bertalanffy model for *Barbonymus schwanefeldii* growth.

Growth parameters equation of *B. schwanefeldii* in the Tasik River from the FISAT II program was Lt=143.85 (1-EXP$^{(-1,6)(1,8116-(-0.0634))}$), where L∞=143.85 mm, growth acceleration (K)=1.6 year^{-1}, t_0=-0.0634 years and t_{max}=1.81 years. The fishes' size that were caught during the observation were less than 92 mm, which means that the fish's age based on the above equation is still under one year old. The growth of *B. schwanefeldii* found in the Tasik River is in fast pace during the first and second years and slowing down after three years. According to Rumondang (2016), the age group of carps (minnows) from the Cyprinidae family in subtropical and tropical areas is generally two years old.

The total length measurements of 157 *B. schwanefeldii* samples ranged from 60 to 143 mm. The analysis from the Bertalanffy model showed the correlation value of the tinfoil barb growth was 0.593, indicating a weak relationship between the length and the age of *B. schwanefeldii*. According to Sarwono (2006), a value of the correlation coefficient >0.75 shows a strong relationship while a value <0.75 shows a weak relationship.

The K value of *B. schwanefeldii* in the Tasik River was 1.6 per year. This value was relatively high, marked by the fast growth of the tinfoil barb in the Tasik River, which reach their asymptotic length in two to three years. The asymptotic length is the maximum length of the fish. According to Sparre & Venema (1999), the K value is a parameter that determines how quick the fish reaches their asymptotic length and, in general, fish that have high K values can reach their asymptotic length within one to two years, and most of them were short-lived.

Conclusions. The highest abundance of *B. schwanefeldii* was found at station I, followed by station II and station III. The water quality in the Tasik River is still in good condition for the life of the fish in the river. Station I is deeper than station II and station III with 7.6 cm. The fish abundance was higher at the station, which was deeper than the other stations, although differences were not too significant. Stations II and III had higher brightness values than station I. The von Bertalanffy model equation for the growth of *B. schwanefeldii* was Lt=143.85 (1-EXP$^{(-1.6)\ (1.8116-(-0.0634))}$). The analysis from the Bertalanffy model showed the correlation value of *B. schwanefeldii* growth was 0.593, indicating a weak relationship between length and age.

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Conflict of interest. The authors declare no conflict of interest.

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