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WORD COUNT 3144
TIME SUBMITTED 30-OCT-2023 01:37PM
PAPER ID 103823506

International Journal of Fisheries and Aquatic Research

International Journal of Fisheries and Aquatic Research
ISSN: 2456-7248; Impact Factor: RJIF 5.44
Received: 23-01-2019; Accepted: 19-02-2019
www.fishjournals.com
Volume 4; Issue 2; April 2019; Page No. 32-35

The relationship between the length of weight and the condition factor of the tor fish (*toro soro* valenciennes 1842) In asahan river

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Abstract
This study aims to establish the relationship of length-weight and evaluate the condition of the condition of fish Tor (Tor soro) in the waters of Asahan River, North Sumatra. Sampling was carried out once a month from February to May 2019. A total of 756 fish were caught using 1.5 - 3 inch mesh-gill nets. The total length and weight of sample fish ranges from 120 - 250 mm and 64 - 161 grams, respectively. The relationship of length-weight is W = $3.000x10^{5}$ 2.72 Log L. These results indicate that the long-weight relationship has a high correlation (R^2> 0.978). The conductive factor varies from 0.977 to 1,070. Females have better conditions than male fish.

Keywords: weight length, condition factor, tor soro, Asahan River

1. Introduction
The fish population Tor (*Tor soro*) the North Sumatra region is threatened with extinction, especially on the Asahan River. Based on the results of interviews with several fishermen, there is an indication of a decline in fish populations. This is indicated by the catch that begins to decline for this reason, a study of the relationship between the length of the weight and the condition of the tor condition is necessary. Long-weight relationships are important factors in the study of fish biology and stock estimation (Sparre *et al*., 1989) [23]. This equation helps to predict fish weight from its length. Fish biomass is often calculated from abundance through length using long weight relationships (Kirkhuerer *et al*., 2005) [16]. Many researchers have suggested the relationship between the weight of fish in an area / waters, among others, Dulcic & Glamuzina (2006) [5]; Britton & Harper (2006); Giarrizzo *et al*. (2006) [10]; and Balart *et al*. (2006) [2]. On the other hand there are also many writings that highlight only HPB one type of fish, for example Bok & Oray (2001) [3]; Šantić *et al*. (2006) [24]; Morica *et al*. (2006) [26]; and Metin *et al*. (2006) [18].
The condition factor is a number that indicates fish obesity. From a nutritional point of view, the condition factor is fat accumulation and gonadal development (Le Cren, 1951) [17]. Condition factors indirectly indicate the physiological conditions of fish that receive influence from intrinsic factors (gonadal development and fat reserves) and extrinsic factors (availability of food resources and environmental stress) (Nikolsky, 1969) [19]. Weatherley & Rogers (1978) [25] and Hossain *et al*. (2006) [13] added that in addition to showing the condition of fish, condition factors provide information when fish spawn. Ribeiro *et al*. (2004) [21] prove that condition factors are useful in evaluating the importance of various areas of fish spawning. The purpose of this study was to establish a long-weight relationship and evaluate the conditions of tor soro fish as well as the factors that influence it in Asahan River.

2. Materials and methods
The study was carried out in the waters of Asahan River in February to May 2019. Sample fish were obtained through capture by using 1.5, 2, and 3 inch mesh gills. Catches are carried out every month. The caught fish is preserved in 5-10% formalin solution and then analyzed in the Aquaculture Laboratory. In the laboratory each sample fish is measured its total length (from the tip of the nose to the tip of the longest tail fin) to the nearest millimeter and weighed to the nearest gram. This data is used to determine the relationship between fish weights and fish condition factors. After measurement, the fish is dissected to see the gender and level of gonad maturity.
The length-weight relationship is calculated using the relationship W = a Lb with W is the weight of the fish (gram), L is the length of the fish (mm), a and b are constants. The t test ($p < 0.05$) is used to test whether the value of b = 3 or not. If the value of b = 3 means that the fish has an isometric growth pattern, conversely if b ≠ 3 means the fish growth pattern is allometric. The relative condition factor (Kn) is calculated using equations (Le Cren, 1951) [17] Kn = W / W *, W is weighted body weight (grams) and W * is calculated body weight (grams) of the equation of the long weight relationship. The condition factor is calculated monthly and based on the level of gonadal maturity for males and females respectively.

3. Results & Discussion
The number of Tor (Tor Soro) fish caught during 4 months of the study was 358 tails. The most caught fish found in Station 1 is 123, Station 2 is 129 and Station 3 is 96, shown in Figure 1. The high catch in one is related to the availability of food in the form of higher plankton compared to other zones. Plankton abundance at station 1 (phytoplankton 15 678 cells / l and zooplankton 14 567 ind / l), Station 2 (phytoplankton 10 134 cells / l and zooplankton 7 865 ind / l) and station 3 (phytoplankton 5 775 and

zooplankton 1 853 ind / l). The abundance of fish in a waters is influenced by the state of its food (Hinz *et al*. 2005), the main food source in the waters is plankton (Wiharyanto 2011).

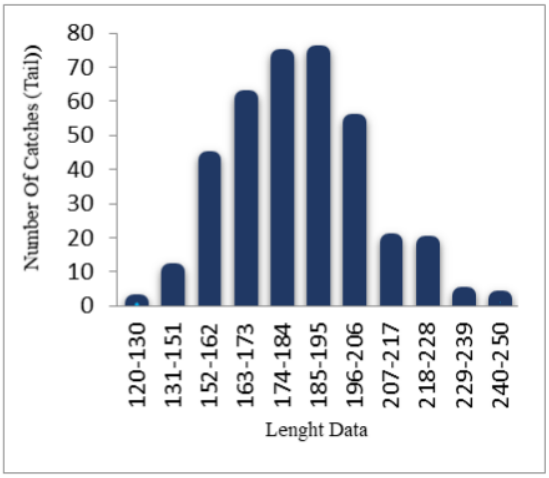

Fig 1: Amount of Fish Tor ((Tor Soro) Caught by Station

The equation model of the relationship length (L) and weight (W) of tor fish is Log W = -3 x 105 + 2.72 Log L with R2 = 0.82 (Figure 2). Based on the testing of the value of b with the t-test obtained the value of fish b is significantly different from the value of 3. The pattern of tor fish growth is positively allometric (b> 3), which is weight gain faster than the increase in length.

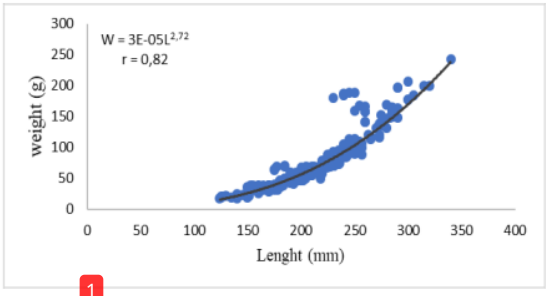

Fig 2: Relationship between the length and weight of fish Tor

The growth pattern of Tor Fish in Asahan River is known by looking at the relationship of fish weight length as one of the parameters of fish growth. Overall, fish growth patterns are allometric positive. According to Hile, 1963 was referenced by Effendie (1997) [8], One of the values that can be seen from the relationship of length of fish weight is the form or type of growth. If b = 3, it is called isometric, which indicates that the fish does not change its shape and the length of the fish is balanced by the increase in weight. If b <3 is called negative allometric, if the increase in length is faster than its weight, if b> 3 is called positive allometric, which indicates that its weight gain is faster than its length. Growth pattern of Tor Fish Asahan River which is positive allometric or Fat (Effendie, 1997) [8]. But the constant value of the regression results (b) Tor soro fish tends to be higher than the Tor tambroides fish. This shows that fish growth patterns are also influenced by gene / hereditary factors. According to Effendie (1997) [8], factors that influence growth are factors that are difficult to control such as heredity, sex, age, parasites, and diseases and external factors that include food and water temperature. At location I the value of the regression results constant (b) tends to be slightly higher. This is influenced by The availability of food such as ficus (Tobing, 2015) which is favored by Fish Tor (Haryono, 2006).

Coefficient value b on Tor spp. on the Bahorok and Berkail rivers affected by the behavior of these fish. Fish Tor spp. is one of the fish that is very fond of heavy currents (Haryono, 2006). This indicates that Fish Tor spp. is one of the active swimmers fish. So that more energy is used for movement and length increase so that fish can move more easily. Muchlisin *et al*. (2010) explained that the coefficient of b was influenced by fish behavior, active swimmer fish showed a lower value of b compared to passive swimmer fish.

The high value of the regression results constant (b) which is one of the parameters of the growth pattern is also caused by the sampling technique. Sampling was done using an electrofishing Units Backpack with a 12 volt voltage. This will affect the size of the target fish caught. According to Mulfizar *et al*. (2012) Factors that influence growth include physiological and environmental conditions such as temperature, pH, salinity, geographical location and sampling technique. The diversity of exponential values (b) the relationship of length and weight between the above species of fish is closely related to ontogenetic development (Türkmen *et al*., 2002); differences in age, gonadal maturity, gender, geographical location, and environmental conditions (fishing activities); gastric fullness, disease, and parasitic pressure (Le Cren, 1951; Neff & Cargnelli, 2004; Ecoutin *et al*., 2005) [17, 6].

Figure 3 shows the factors of the relative conditions of tor fish each month for 4 months, the magnitude of each of which ranges from 1-1.41 in male fish and 1-1.3 in female fish. Factors in total average conditions range from 1.11-1.41. Factors in the relative conditions of male fish are always smaller than female fish indicating that the condition of female fish is better than male fish throughout the year. Increasing factors in the condition of male and female fish from February to May 2019 are understood because the spawning period of fish takes place between April-May; then in April male and female fish were found which had finished spawning (Rahardjo & Simanjuntak, 2007) [22]. The value of the condition of the condition increases towards the peak of the spawning season and decreases after the spawning period is also found in Barbus sclerater fish (Encina & Granado-Lorencio, 1997) [7]; Engraulis encrasicolus (Millán, 1999) and Trachurus mediterraneus (Tzikas *et al*., 2007). This phenomenon can be understood because the main energy source used is for the development of gonads and spawning (Lizama & Ambrósio, 2002). The growth pattern of male and female fish in each zone is allometric positive (b> 3), ie the length increase is not as fast as the weight of the fish, while the Tor Soro fish growth pattern in the Asahan River is isometric (b = 3) Weight is proportional to the increase in total length. (Rumondang and Azizah 2017) [20].

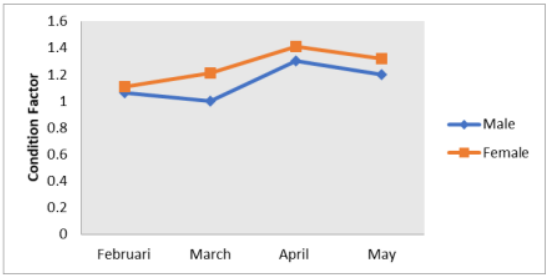

Fig 3: Conditions Factor

Fluctuations and variations in the value of the tor conditions are also caused by fluctuations in food availability (quality and quantity) in the waters. This fact was revealed through the study of fish food composition types that variations in the proportion of food used by fish are related to fluctuations in food stocks in the waters (Rahardjo & Simanjuntak, 2012). Several other researchers revealed similar things (Enchina & Granado-Lorencio, 1997 [7]; Riberio *et al*., 2004; Lalèyè, 2006). The high condition factor is an indication of an increase in reproductive activity, so that during this period it is suspected in the spawning season. Besides being able to describe the condition of reproductive activity (time and duration of gonadal maturation), the value of the condition factor also illustrates the abundance of food in the realm of Weatherley and Gill 1978). Variations in values are also influenced by gender (Effendi 1979) [8]. The average value of a higher condition factor in male individuals is thought to be closely related to the amount of energy needed for the development of the testis that is greater than for the ovary.

Table1: Factors in Male and Female Tor (Tor Soro) Fish Conditions from Each Gonad Maturity Level (GML)

GML	Condition Factor							
	Male				Female			
	N	Range	Average	±Sd	N	Range	Average	±Sd
I	15	0.71-4.87	1.00	0.43	35	0.6-2.94	1.01	0.21
II	58	0.17-1.44	1.02	0.17	40	0.3-5.35	1.21	0.31
III	40	1.01-1.47	1.06	0.11	75	0.71-1.25	1.41	0.08
IV	55	0.80- 2.50	1.2	0.56	40	0.77-5.54	1.11	0.01

Tor fish (Tor Soro) found in this study have varied conditions. The value of the condition factor tends to increase along with the increase in GML (Table 4). This is due to changes in the weight of the gonad at each stage of the GML. Female fish have a greater factor than male fish. Effendi (1979) [8] states that gonad weight gain of females is 10-25% of body weight and in 5-10% male fish. This phenomenon is commonly found in several species of fish such as Barbus sclateri and Heterobranchus longifilis (Anibeze 2000), Mystus nemurus (Sukendi 2001), Sciadeichthys luniscutis and Amblypharyngodon mola (Gupta and Banerjee 2013).

Several other factors that are thought to be the cause of fluctuations and variations in the value of fish condition factors are food availability (quality and quantity) that fluctuates in rivers and flood swamps (Enchina and Granado-Lorencio, 1997 [7]; Riberio *et al*. 2004; Laleye *et al*. 2006); the main energy source is used for gonadal development during the reproductive season (Lizama and Ambrosio 2002); during the spawning season fish do not do eating activities, but use fat reserves in the body for energy supply (Lizama and Ambrosio 2002); differences in size or age of fish (Enchina and Granado-Lorencio 1997) [7] and parasitic pressure (Neff and Cargnelli 2004).

4. Conclusions

The description above gives some conclusions, namely: The pattern of growth of fish torpositive allometric character; Females have the best conditions throughout the year in terms of greater conditions, longer lifespan, and greater number of individuals; The value of the condition of male and female fish conditions increases towards the peak of the spawning season and decreases after the spawning period; The value of the condition factor decreases with increasing gonad maturity until GML III, then the condition factor increases in IV GML and decreases again after the fish spawn.

Acknowledgments

Thank you, the writer, said to the Republic of Indonesia Ministry of Research, Technology and Higher Education (RISTEKDIKTI). Thank you for those who contribute to the development of their ideas and support.

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