Sex Ratio And Length-Weight Relationship Of Snakehead Fish (*Channa striata*) In Tempe Lake Wajo District, Indonesia

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ABSTRACT

Tempe Lake is one of the lakes that had considerable fisheries resources, one of which was snakehead fish These fish was a fishery resource that has high economic value and was beneficial to human health because it was rich in albumin This study aims to determine the sex ratio and the length-weight relationship of snakehead and carried out six months from September 2018 - February 2019 The Stratified Random Sampling method has been used to collect the data The length weight relationship was analyzed using cubic equations and sex ratio by comparing the number of males and females in the sample To find out whether the value of b equal 3 and whether the number of males and females was different is used the student t test and chi square test respectively The results showed that 1,594 fish observed by gonad macroscopically had 515 (32 31%) males and 1,079 (67 69%) females, so that the sex ratio was 1 2 10 The chi square test stated the number of males and females was different The length weight relationship of male $W = 0\ 115\ L^{3\ 060}$ *, female* $W = 0\ 135L^{2\ 966}$ *and the combination* $W = 0\ 127L^{3\ 003}$ *Student t-test results showed that b = 3 which means isometric growth patterns*

Keywords Lake Tempe, snakehead, lenght weight relationship, sex ratio

INTRODUCTION

Tempe Lake is one of the lakes that has high fisheries resource potential in South Sulawesi This lake was a potential producer of fish for local and regional consumption (Haerunnisa*et al* , 2015) [1] and until the late 1960s was still known as the most important center of Indonesian freshwater fisheries production The annual production of Lake Tempe ranges from 37,000-40,000 tons and had reached 50,000 tons in 1959 so it was dubbed the Indonesian fish bowl, and continued to decline to 400%, even in the last 15 years fish production only reached 10,000 tons yearly (Bachtiar, 2015) [2] Besides the problem of decreasing production, other that catches are dominated by small-sized fish which are thought to be caused by sedimentation, pollution, use of fishing equipment that is not environmentally friendly, and overfishing (Nasrul, 2016) [3] The causes of reduced fish are caused by overfishing and habitat damage (Balkhis*etal* , 2011) [4], and pollution (Qiufen*etal* , 2013 [5] One of the primary fisheries resource potentials of Lake Tempe was snakehead fish, *Channastriata* (Samuel*etal* , 2010) [6] Snakehead fish have high economic value (Mahmud, 2016) [7] Aside from being a daily consumption of fish, snakehead fish is known to be very rich in albumin, one of the important types of protein needed in the human body (Fitriyani *et al* , 2013) [8] The high utilization of snakehead fish causes large scale fishing for snakehead fish The exploitation of snakehead fish in Lake Tempe is increasingly intensive and leads to destructive capture (Harianti, 2012) [9] The activity that causes the decline in fisheries resources according to the community was the intensive use of "*bungka toddo*" and "*jabbatroll*" (Ramadan *et al* , 2008) [10] Increasing the need for snakehead fish will affect stock availability in inland waters and this can threaten its survival in their habitat This study aims to obtain information about the sex ratio and length weight relationships of snakehead fish in Lake Tempe Wajo District, South Sulawesi, Indonesia

MATERIALS AND METHODS

The research was conducted from September 2018 to February 2019 The research site at Lake Tempe included three main fish landing sites that could represent the population of snakehead fish of Lake Tempe , namely in Tanasitolo, Tempe and Sabbangparu Sub-district (Figure 1)

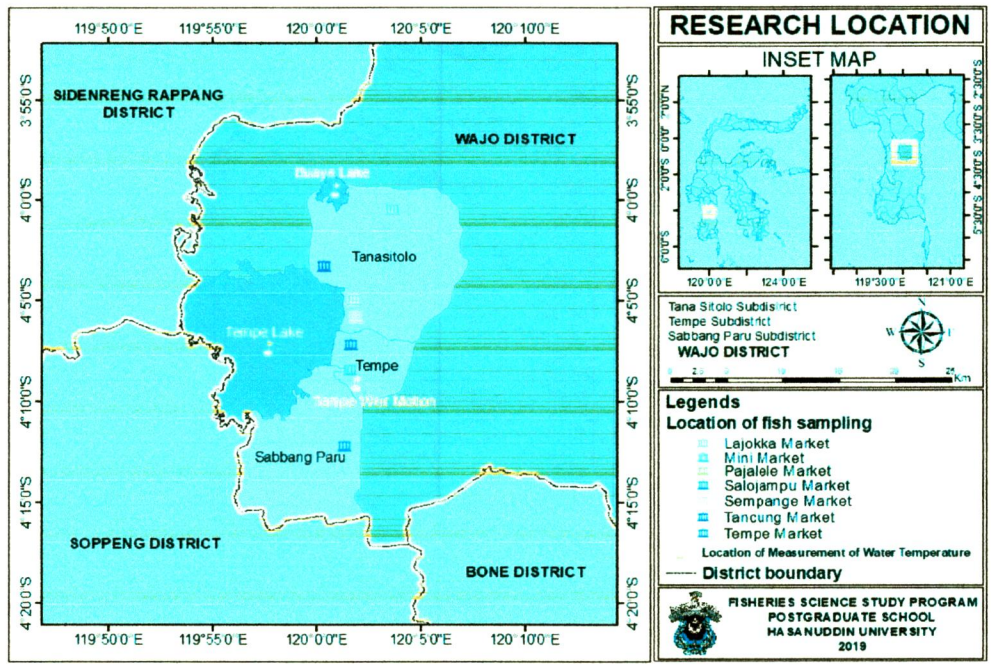


Figure 1. Research location

The materials used in this study were snakehead fish, digital scales, rulers, and surgical scissors. The method used was the survey method and sampling is done four times a month. In this study the measured fish length was total length, which was measured from the most anterior part of the mouth to the most posterior part of the caudal fin in a cm scale and weight with a gram scale. Taking sample fish using the Stratified Random Sampling method (Nasir, 2014) [11]. To find out the sex of the fish, gonadal surgery and observation were carried out morphologically (Lisna, 2013) [12]. Data on body length measurements are grouped based on body length class intervals. The number of fish samples observed during the study were as many as 1.594 fish.

Sex Ratio

The equation for calculating sex ratio according to Steel and Torrie, 1980 in Selviana., (2017) [13]. that is:

$$X = \frac{M}{F}$$

where
X = Sex ratio
M = Number of male fish (tail)
F = Number of female fish (tail)

To find out the number of males and females in the population was the same or different, *Chi-Square* Test has been used (Sudjana, 1992) [14]. The *Chi-Square* formula used is as follows:

$$X^2 = \frac{(|X - n\pi_o| - 0.5)^2}{n\pi_o(1-\pi_o)}$$

Where,
X = number of male fish
πo = chance of foreign type (= 0.5)
n = total fish

Length Weight Relationship

The length-weight relationship will be analyzed using a cubic equation, namely that the weight of the fish is a power of three in length (Effendie, 2002) [15]. The equation is:

$$W = a\,L^{b} \text{ or } \log W = \log a + b \log L$$

where
W = individual weight (grams)
L = total length (cm)
a = intercept (the intersection between the regression line and the y-axis)

b = regression coefficient (line slope angle)

Next from the above equation, when b was equal to 3 (b = 3) it shows that fish growth does not change its shape or the increase in length fish was balanced by the increase in weight (isometric growth) If b was greater than 3 (b> 3) it is called positive allometrics, which was the growth of weights faster than length increments If b was less than 3 (b <3), it is called negative allometric, which was a length increase faster than weight gain (Ricker, 1975) [16] To reinforce the value of b equal to or not 3, then testing the value of b with the t-test t calculated can be obtained by equation

$$t_{calculated} = \left|\frac{3 - b}{Sb}\right|$$

where
Sb = standard deviation from value b
The criteria for this test are if t calculated <t 0 05, its means that b = 3 and if t calculated > t 0 05, its means b ≠ 3

RESULTS AND DISCUSSION

Sex ratio

The results of this study indicate that snakehead fish obtained as many as 1,594 tails consisted of 515 male and female 1,079 tails The size of the male fish was 19 - 57 cm and for females 16 - 57 7 cm The number of males and females obtained at each observation was always different as shown in Table 1 The sex ratio of snakehead fish at Lake Tempe was 1 2 1 The sex ratio obtained statistically different significantly (p <0 05), it means that number of male and female was not the same, where in this research the number of female of snakehead fish is more than male This was in accordance with the research of Aida (2016) [17] that the monthly sex ratio of snakehead fish showed a higher proportion of female than male fish, possibly this is caused by different types of spawning between male and femaleof fish Olurin (2011) [18] reported that the sex ratio of snakehead fish was 1 4 This shows a significant difference between male and female sexes Nikolsky (1969) [19] reported that the sex ratio of one species of fish can vary from year to year in the same population, if there are differences in size in waters and differences in the number of one sex this may be due to differences in growth patterns from the fish itself and the difference in age of fish maturity of the first gonad fish

Length-weight relationship and growth pattern

The results of observations on the length and weight of snakehead fish found that the length and weight of the combined male and female were 16,0 – 57,7 cm and 30 – 1 954 gram respectively The length and weight of male snakehead fish were 19,0-57 cm and 40 – 1 840 gram respectively, and the length and weight of female were 16,0 – 57,7 cm and 30 – 1 954 gram respectively From the results of this study the distribution of the length of snakehead fish (*Channastriata*) is the total length is 16,0 cm – 57,7 cm and body weight ranges from 30 - 1954 grams Based on these data, it was found that the relationship between the length of the weight of the snakehead fish of Lake Tempe combined with female males, male and female as presented in Table 1 and Figure 2- 4

Table 1 Parameters of relationship between length and weight of snakehead fish (*Channa striata*) in Lake Tempe, Wajo District

Parameters	Combine	Male	Female
N	1 594	515	1 079
a	0,127	0,115	0,135
b	3,00	3,0601	2,966
$W = aL^b$	$W = 0{,}127L^{3.00}$	$W = 0{,}115L^{3.0601}$	$W = 0{,}135L^{2{,}966}$
R^2	0,899	0,911	0,920
T – test	b = 3	b = 3	b = 3

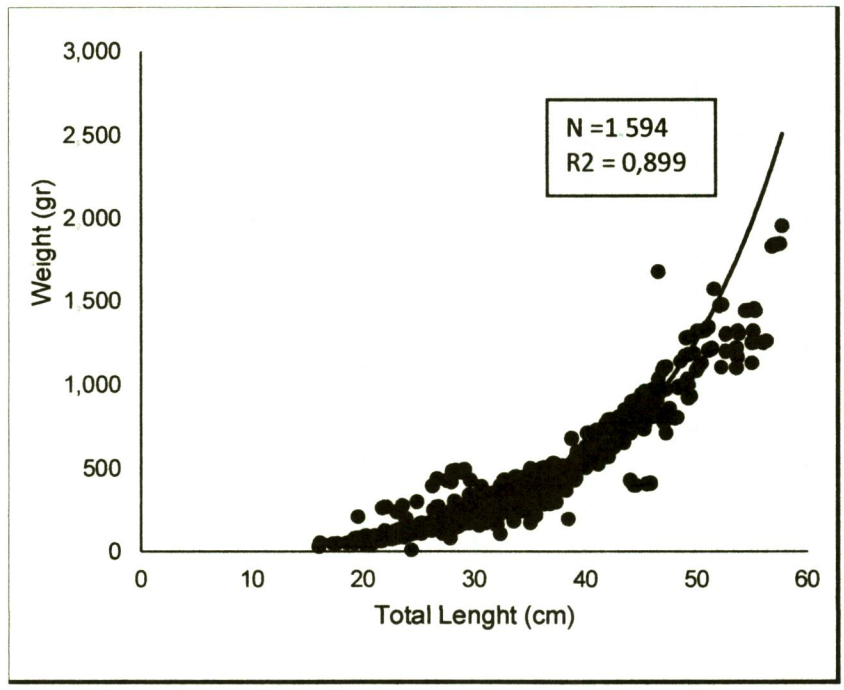
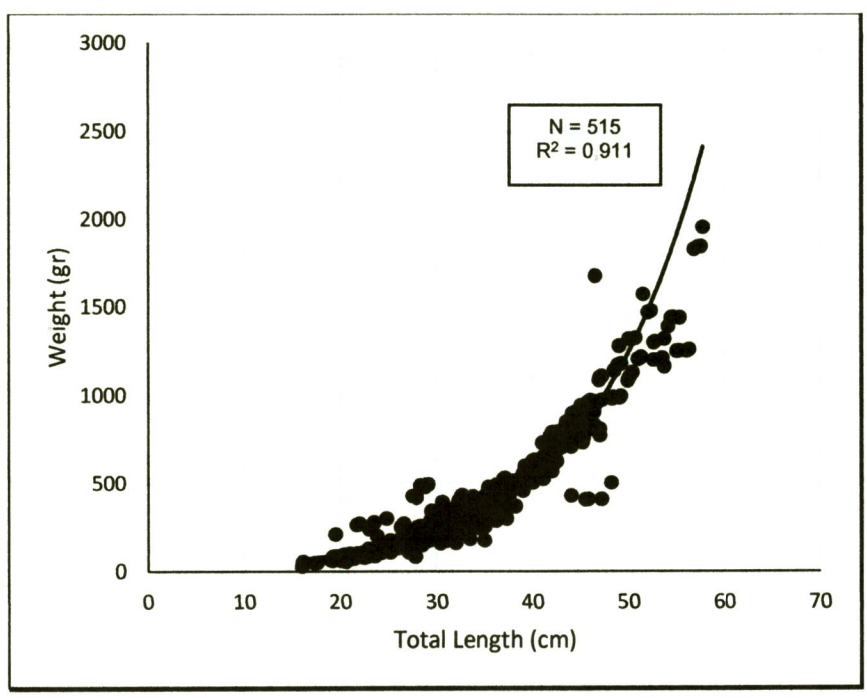


Figure2 Length weight relationship combined male-female of snakehead fish inTempe Lake Wajo district



Fifure 3 Length weight relationship of snakehead fish male in Tempe Lake Wajo District

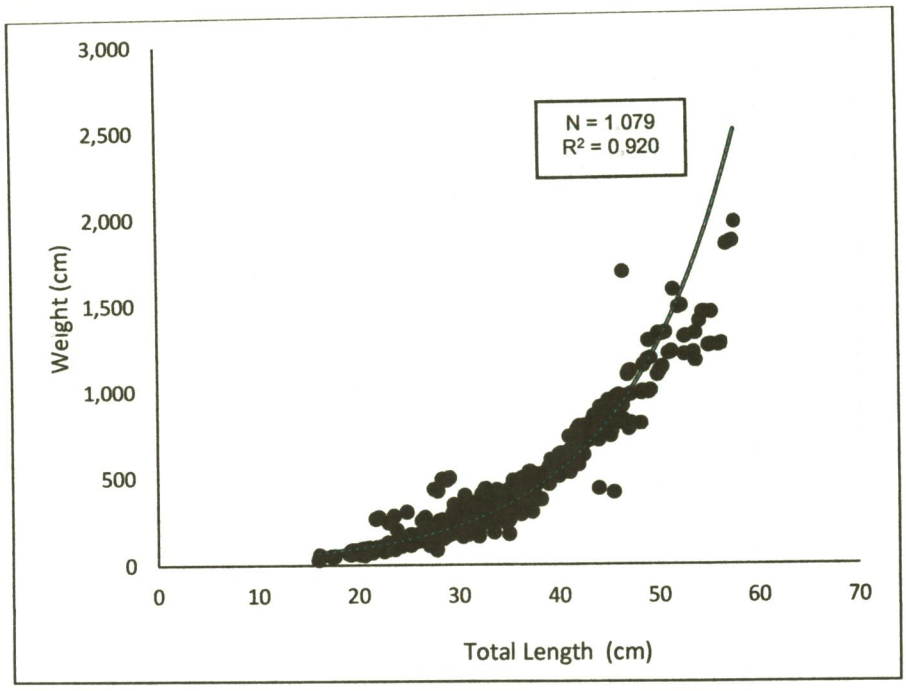


Figure4 Length weight relationship of snakehead fish female in Tempe Lake Wajo District

Student t-test results found that the value of b obtained in the equation of the relationship between the weight of the combined male and female of snakehead fish $W = 0{,}127L^{3.003}$, the relationship of the weight length of male of snakehead fish $W = 0{,}115L^{3.060}$, and the relationship between the weight of female snake fish $W = 0{,}127L^{2.966}$ were not significantly different from three or b = 3 (p> 0 05)so that it can be said that the growth pattern of the combined snakehead fish of female males, male, and female was isometric Isometric growth patterns can be interpreted that the increase in length and increase in weight both in snakehead fish male and snakehead female fish were the same Based on the values of the correlation coefficient (r) which approaches one showed the relationship between the length and weight was high significantly This was in accordance with the opinion of Andy Omar (2011) [20] which stated that the correlation value ranges from 0 70 - 0 89 means that the correlation is strong and the correlation value ranges from 0 90 to 1 00 means a very strong correlation The closeness of this relationship proves that the total length of fish influences the body weight of snakehead fish Generally the length increase will always be followed by the increase in body weight of the fish Length-weight relationships are important tools in fisheries management (Lawson et al , 2013) [21] The equation of the relationship between the length of the weight of snakehead fish has a very close correlation Based on the value of the correlation coefficient (r) obtained close to one The magnitude of the correlation value indicates that fish length increments are followed by weight gain

The growth pattern of snakehead fish in Lake Tempe was generally isometric, the increase in length is equal to the increase in weight, this is probably due to fish caught generally gonad mature This is in accordance with the statement of Arzita *et al* (2012) [22] that there was a relationship between the condition of gonadal mature fish and fish body weight where body weight will increase with the level of gonadal maturity The growth pattern of some spisies has a tendency to grow negatively in allometrics, this is related to the morphology of their bodies which tends to elongate, so the growth in length is faster than the weight (Riyadi, 1998 in Sofarini *et al* , 2018) [23] The growth of snakehead fish in each waters will be different, many factors that influence differences in fish growth include habitat differences, eating habits, fish activity, season, temperature, food availability, and trophic level (Cia et al , 2018) [24] The growth of snakehead fish in several locations shows results that are not much different from the results obtained from Lake Tempe

This is in accordance with the study of Vodounnou *et al* , (2017) [25] reporting that the growth pattern of snakehead fish in Takon Rawa is isometric with the equation $W = 0{,}0087\ TL^{3.0128}$ Cia et al , (2018) [23] that the growth pattern of male snakehead fish in Aopa Swamp waters is isometric (b = 3) Another study conducted by Aida (2016) [17] that in the Banjiran Swamp of Lubuk Lempan waters in South Sumatra, the growth pattern is negative allometric with the equation $W = 0{,}0003L^{2.671}$ with a closeness level close to one (1), presumably the fish caught are in the size of young fish Bolaji et al , (2016) [26] reported that snakehead fish in Nigerian Swamp followed negative allometric growth (b <2,807) Kusmini et al , (2015) [27] reported the growth of snakehead fish (*Channa striata*) was negative allometric where the value of b = 2 875, this value indicates that the growth of fish length is faster than the growth of weight

CONCLUSION

The male and female sex ratio is different, where the number of female fish is more compared to the number of male fish in the snakehead fish population at Lake Tempe Growth patterns of snakehead fish in Lake Tempe in a combined population of female males, male snakehead fish populations and female snakehead fish populations are isometric or increase in length and weight gain is equal or comparable

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