Length-Weight and Age Group Analysis on Squid in the waters of Tomini Bay, Olimoo'o Village, Gorontalo Regency

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Abstract

The study was conducted in Tomini Bay Waters, Olimoo'o Village, Batudaa Pantai District, Gorontalo Regency from November 2015 to May 2016. This study aimed to determine the relationship between length and weight and age group of squid (Loligo sp). Samples were taken by random sampling method based on population availability. The length of the mantle and the weight of the squid were measured as many as 949 individuals. Analysis of the relationship between length and weight used the Hile (1936) method and the Bhattacharya (1967) method for estimating age groups. The results showed that the relationship between length and weight of squid had the equation $W = 0.0246\ L^{3.1688}$ which was a positive allometric with a correlation of 0.9679. The average body length was 10.9161 cm in the first age group, 18.9282 cm in the second age group, and 21.3724 cm in the third age group.

Keywords: Ligt-weight relation; age group; Loligo sp.

Introduction

Cephalopods are a group of soft animals (phylum Mollusca) which include Squid, Cuttlefish, Octopus and Nautilus. Cephalopods consist of 700 species known to live scattered in the sea surface layer, both in polar and tropical waters. Several cephalopods have commercial value and are one of the important biological resources in the marine fisheries sector, one of which is Loligo sp. (Roper et al, 1984 in Amin, et al, 2013).

According to Field (1963) in Karnan et al (2012), squid (Loligo sp) is a pelagic biota that is always in large groups which in its life cycle periodically migrate into shallower or relatively protected waters, such as straits and bays to spawn. Based on research conducted by Hamzah (1993) in Hamzah and Pramudji (1997), Tomini Bay is one of the distribution areas of squid in Eastern Indonesia. Therefore, squid is one of the potential fisheries resources in Gorontalo. Known as Suntung, Loligo sp is very popular and is often found in traditional markets.

Olimoo'o Village is one of the villages in Gorontalo Regency with an area of 1350 Ha, and is located in the coastal area of Tomini Bay. Most of the people's livelihoods are fishermen (Olimoo'o Village Profile, 2004). One of the catches of fishermen in Olimoo'o Village is Loligo sp, especially in certain seasons the availability is very abundant.

Currently, the availability of scientific information regarding the relationship between length and weight and the age group of Loligo sp in Tomini Bay is low. This is an impetus for the author to conduct research so that it can add information and as a consideration in making decisions to maintain the sustainability of Loligo sp in nature. The purpose of this study was to determine the relationship between length and weight and the age group of Loligo sp in the waters of Tomini Bay.

Research Methods

The tools and materials used in this study were a ruler with an accuracy of 1 mm, a scale with an accuracy of 0.1 grams, a digital camera, a cutting board, stationery and Loligo sp.

Samples were taken from fishermen's catches randomly based on population availability, so that they could represent the dominant sizes caught (Sitompul et al, 2014). Sampling is as much as 10% of the total

catch if the number is large, but if the number is small, it is taken entirely (Omar, 2002 in Kurniawan 2014).

The sample that has been measured during the study amounted to 949 individuals. The length measure used is the length of the mantle (Sparre and Venema, 1999 in Sitompul et al, 2014). The length of the mantle is measured from the tip of the mantle to the posterior end of the mantle between the wings. Weight measurement is done by weighing directly (Sitompul, et al, 2014).

According to Hile (1936) in Biring (2011), the analysis of the relationship between length and weight uses the formula:

$$W = aL^b$$

Furthermore, it is transformed into a logarithmic formula, thus forming a straight line equation.

$$\log W = \log a + b \log L$$

The values of a and b can be solved using the least squares method (Akyol et al., 2007 in Biring, 2011) and the a value obtained must be antiloged.

The formula shows an isometric growth pattern if b = 3, it means that the increase in body length and weight is balanced. Negative allometric growth pattern (allometric minor) if the value of b < 3, indicates that the increase in body length is faster than the increase in body weight. On the other hand, if b > 3 indicates a positive allometric growth pattern (allometric major), the body weight gain is faster than the body length increase.

According to Omar (2009) in Biring (2011), to measure the strength of the relationship between weight and length, correlation analysis is used with the formula:

$$r = \frac{N(\sum \log L * \log W) - (\sum \log L)(\sum \log W)}{\sqrt{\{N(\sum \log^2 L) - (\sum \log L)^2\}\{N(\sum \log^2 W) - (\sum \log W)^2\}}}$$

The method of Bhattacharya (1967) in Tilohe (2015) is used in the estimation of age groups, namely by dividing Loligo sp into groups of mantle length. Furthermore, the logarithm of the frequency of each group of mantle length is calculated. From the logarithm calculation, it is determined the logarithmic difference (Δ log F) between the existing groups, then mapping the mean value of each mantle length class as the X axis to the logarithmic difference, the frequency of the mantle length class as the Y axis, by drawing a straight line from the point that the largest to the smallest point, then the age group that intersects with the X axis is obtained. The intersection of a straight line with the X axis gives the value of $\bar{x}$ (the average length of individuals for each age group), the value of $\bar{x}$ can also be calculated using the formula:

$$\bar{x} = \frac{a}{-b}$$

Results and Discussion

Length-weight Relation

According to Smith (1996) in Asyani and Herlan (2013), biomass calculation can be done through weight measurement and can be used to estimate fishery production. In addition, age-related length-weight measurements can provide information on stock composition, gonad maturity, life cycle and growth (Fatioye and Aluajo, 2005 in Asyani and Herlan, 2013). Based on the measurement results, the mantle length ranges from 7.31-24 cm with a weight range of 13-686 grams. In contrast to the results of measurements made by Amin, et al (2013) the length of the mantle is between 14-35.5 cm and the weight is 10.2-115.8 grams. According to Danakusumah (1997) in Amin, at al (2013) the maximum length of Loligo sp is up to 36 cm and its weight can reach 1800 grams. The relationship between the length and weight of Loligo sp can be seen in Figure 1.

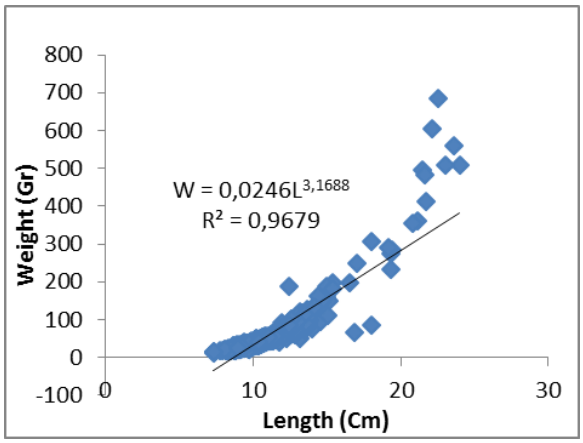

Figure 1. Length-weight relation of *Loligo sp* catch in Olimoo'o Village.

The length-weight relationship of Loligo sp has a value of b= 3.1688. The value of R^2 = 0.9679 indicates a very strong correlation between the length and weight of the squid. The value of b > 3 indicates that the growth of *Loligo* sp is positive allometric, i.e. the weight gain is faster than the length increase. This result is different from the research conducted by Sitompul et al (2014) in the Riau Islands, where the relationship between the length and weight of the squid obtained is $W = 0.3399L^{2.622}$. This value indicates that the squid found in the Riau Islands have a negative allometric growth pattern (b < 3) where the increase in length was faster than the increase in weight. According to Karnik and Chakraborty (2001) in Puspasari and Triharyuni (2013), several literatures state that *Cephalopods* in general and in particular for the *Loliginidae* group have an allometric growth pattern.

According to Mulfizal et al. (2012) in Desmawanti et al (2009), in general, the growth pattern depends on the physiological conditions and biological conditions of the organism such as gonadal development and feed availability. Furthermore, Muchlisin (2010) in Muchlisin et al (2014), states that environmental factors such as currents and waves also affect the growth pattern (b value) of aquatic animals including squid and fish. In general, fish that live in calm waters usually have a large b value, and conversely fish that live in fast current waters tend to have low b values, and active swimming fish will show a relatively low b value compared to passive swimming fish, this is related to how active the behavior of fish movements and the type of water in which these fish species live.

Age Group

Age and growth are population dynamics parameters that have an important role in the assessment of fishery stocks. Growth is the increase in length or weight over a certain period of time. Knowledge of aspects of age and growth of exploited fish stocks is absolutely necessary to study so that it can be used as a basis for consideration in stock management actions. The success and future of the fisheries sector depend on the addition of new individuals and the composition of the age class of fish stocks which are the goals of fisheries throughout the year (Biusing, 1987 in Ulfa, 2011).

Age group estimations were analyzed using the Bhattacharya method (1967) in Tilohe (2014) by using a logarithmic difference mapping to the class mean, the average length of each age group was obtained. Based on this method, obtained three age groups of *Loligo* sp in the waters of Tomini Bay, Olimoo'o Village, with an average body length of L1 = 10.9161 cm (in the length range of 7,31-13,98 cm), L2 = 18.8744 cm (12,32 – 18.99 cm), and L3 = 21.3724 cm (17,33 – 24,00 cm). The largest frequency was found in the class size of 8.98-10.64 cm as many as 458 individuals and the smallest frequency was found in the class size of 17.33-18.99 as many as 2 individuals.

The difference in the logarithm of total body length (Y axis) to the class median (X axis) in the first age group (L1) can be seen in Figure 2.

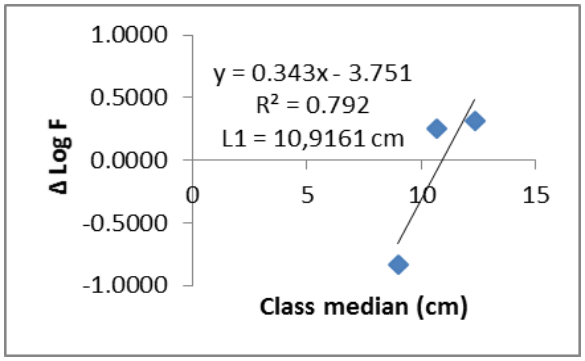

Figure 2. Logarithmic difference of total length to the class median of the L1 age group.

The difference in the logarithm of total body length (Y axis) to the class median (X axis) in the second age group (L2) can be seen in Figure 3.

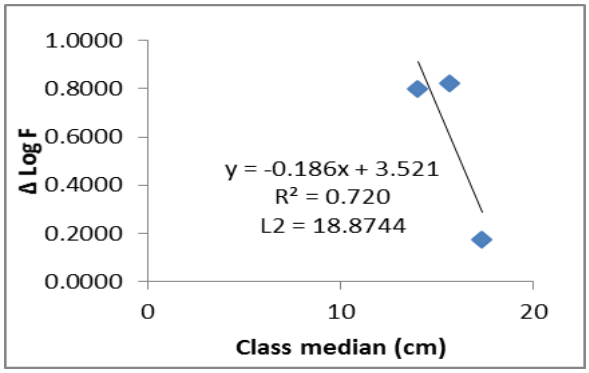

Figure 3. Logarithmic difference of total length to the class median of the L2 age group.

The difference in the logarithm of total body length (Y axis) to the class median (X axis) in the third age group (L3) can be seen in Figure 4.

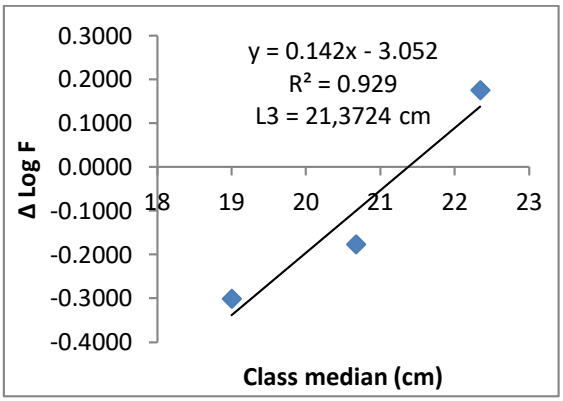

Figure 4. Logarithmic difference of total length to the class median of the L3 age group.

The results of this study in Olimoo'o Village are different from the research conducted by Muzakkir (2012), in the waters of Barru Regency with the number of samples taken at the research location as many as 1,533 individuals with a mantle length of 3-16 cm where the squid population obtained has a range of length 3-16 cm consisting of three age groups, namely 3-9 cm for the first age group, 9-12 cm for the second age group, and 12-16 cm for the third age group, with an average length of each 6.60 cm ,10.38 cm, 13.43 cm. The largest sample frequency was found in the range of 6-7 cm with a total sample of 247 individuals, and the smallest sample frequency was in the range of 15-16 cm with a sample size of 8 individuals.

The results of Kurniawan's research (2014), in the waters of the Spermonde Islands, Makassar City, showed that the squid obtained were 588 with a length ranging from 5.25 cm to 27.5 cm and consisted of three age groups, the first age group with a length of an average of 8.8752 cm, the second age group with an average length of 17.3797 and the third age group with an average length of 24.0157 cm. According to Nursinar et al, (2015), the size difference is thought to be influenced by differences in fishing gear, aquatic environment and seasonal factors that influence squid fishing for fishermen to get the smallest squid. The size of the largest squid was also not obtained, it is suspected that the squid had been caught before reaching a certain body size.

Conclusion

The relationship between length and weight of squid (Loligo sp) has the equation $W = 0{,}0246L^{3{,}1688}$ which is positive allometric, where the value of b is 3.1688, which means that the weight gain is faster than the length increase. The population of Loligo sp consists of three age groups, namely the first age group (L1) 10.9161 cm, the second age group (L2) 18.9282 cm and the third age group (L3) 21.3724 cm.

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