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Composition of Tuna Catch *Hand Line* at the Fish Landing Base (FLB) Lonrae, Bone Regency, South Sulawesi Province, Indonesia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Fish landed at fishing ports generally come from various species, fisheries management has developed into a decentralized system. Tuna is one type of economically important fish in the world and is the third largest fishery commodity in Indonesia. The aim of this research is to determine the size composition of catches and analyze the relationship between length and weight of hand line tuna catches. Data collection techniques were carried out by observing and measuring as well as interviews with crew members of hand-line fishing boats who landed their catches at the Lonrae Fish Landing Base (FLB). Descriptive data is presented in the form of tables and graphs. The statistical analysis used is a simple regression between two variables, namely the length and weight of the fish. Next, to get the regression coefficients, the data is processed using the graphical

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method provided in MS Excel software. The catch of hand line tuna boats landed at FLB Lonrae, consists of three species of tuna, namely: yellowfin tuna (*Thunnus albacares*), skipjack tuna (*Katsuwonus pelamis*) and bigeye tuna *(Thunnus obesus*). The length-weight relationship of 876 Yellowfin tuna fish obtained a value of b=3.08, the length-weight relationship of 467 Skipjack Tuna fish obtained a b value of 2.71 and the length-weight relationship of 430 Bigeye tuna fish obtained a value of b=2.97 shows positive allometric growth where weight growth is faster than length growth. The tuna species composition observed at PPI Lonrae Bone Regency consisted of 3 species, namely Yellowfin Tuna, Bigeye Tuna and Skipjack. Composition of tuna species YFT=29.2% BET=11.8% and SKJ =58.97%.

Keywords: Tuna type; composition; FLB lonrae.

1. INTRODUCTION

Fisheries management in Indonesia has developed into a decentralized system, where each region can introduce regional-specific regulations [1]. To coordinate stock management at the national level, the government must have information from various regions [2]. Each region should have a number of data collection sites that provide sufficient sampling coverage to contribute to the national management plan [3].

Tuna is one type of economically important fish in the world and is the third largest fishery commodity in Indonesia after shrimp and bottom fish [4]. One of the fish landing places in South Sulawesi is the Lonrae Fish Landing Base which is located in Bone Regency, which is the location of a study carried out by the Masyarakat Dan Perikanan Indonesia (MDPI) and its team. Lonrae Fish Landing Base is one of the strategic ports for developing tuna fisheries using tuna hand-line fishing vessels (*Tuna Hand Lines*).

Therefore, knowledge is needed in catching tuna, if the tuna caught is not suitable for catching, it will result in the fish population decreasing, this is also linear with the sustainability of fish resources in the waters. Fish growth patterns can be determined through the relationship between length and weight of catch. The aim of this research is to determine the size composition of hand line tuna catches; and analyze the relationship between length and weight of hand line tuna catches. This research was carried out at PPI Lonrae, Bone Regency from August 2019 to July 2020.

2. MATERIALS AND METHODS

2.1 Method of collecting data

This research was conducted following the descriptive method [5]. Data collection techniques in the research were carried out by direct observation at the research location, and carrying out measurements and interviews (filling out questionnaires) with crew members of tuna hand-line fishing boats who landed their catch at Fish Landing Base Lonrae.

The sampling method is carried out after the fish are landed at the pier, with the number of samples taken being 20-30 percent of the number of ships that land their fish. Fish larger than 10 kilogram were measured for overall length and weight. Meanwhile, fish smaller than 10 kg are measured from baskets 1, 3, 5 and so on as many as 200 fish. Then morphometric measurements were carried out using a meter and then weighed using a digital scale [6]. The data that has been collected will be used as a database and entered into *I-Fish* (*Indonesia Fisheries Information System*), this site can be accessed by various stakeholders in the fisheries sector and used to inform fisheries managers.

2.2 Data Analysis

Descriptive data is presented in tabular form and depicted in graphical form. The statistical analysis used is simple regression analysis which uses two variables, namely the length and weight of the fish [7]. The relationship between length and weight almost follows the cubic law, meaning that the weight of the fish is the cube of its length, so the formula is generally used

$$W = a \cdot L^n$$

which is then transformed into a logarithmic equation to become

$$Log\, W = log\, c + n\, log\, L,$$

where W is the weight of the fish, L the length of the fish, c and L are constants or simply written as $Y = a + bX$, where $Y = log\, W$, $X = log\, L$, $a = log\, c$ (intercept), and b slope (constant).

After the length and weight data have been transformed into logarithmic form, then to obtain the regression coefficients the data is processed using the graphical method provided in MS Excel software.

3. RESULTS AND DISCUSSION

3.1 Composition of Types and Sizes of Catches

Ship catch*tuna hand line* landed at FLP Lonrae, Bone Regency, South Sulawesi, consisting of three species of tuna, namely: yellowfin tuna (*Albacore tuna* / Yellofin Tuna / Madidihang / YFT), Cakalang (*Katsuwonus pela*mis / Skipjack Tuna / SKJ) and bigeye tuna (BET).

3.1.1 *Thunnus albacore* / Yellowfin tuna/ Madidhang / YFT

The maximum fork length of yellowfin tuna is 180 cm and the size at first maturity is 103.3 cm, [8]. The second dorsal fin and anal fin of yellowfin tuna can be very long, sometimes reaching 20% of the total fork length Fig. 1. Yellowfin tuna is black/blue on the dorsal side, turning silver on the ventral side, with a yellow stripe on the half side line. The ventral side has 20 dashed vertical lines, which may appear as a column of small white/silver dots. The additional dorsal fin and additional anal fin are bright yellow and sometimes have a very narrow black border. Juvenile yellowfin tuna often congregate with skipjack tuna in waters less than 50m deep, with adult yellowfin tuna found deeper in the water column, usually between 50-250 meter [8].

3.1.2*Katsuwonus pelamis* / Skipjack tuna/ Cakalang/ SKJ

Skipjack tuna is a rapidly growing species, reaching a fork length of 42 cm after 150 days, and can reach a maximum length of 120 cm [9]. Skipjack tuna has no scales, except for the shield and lateral lines. The dorsal side is dark purple/blue and the ventral side and belly are silver. The ventral side has a number of clearly visible dark horizontal lines, usually 4 - 6. There are between seven and nine additional fins after the second dorsal fin, more of which can be seen in Fig. 2.

Fig. 1. *Albacore tuna* / Yellowfin Tuna / Madhidhang / YFT

Fig. 2. Katsuwonus pelamis / Skipjack Tuna / SKJ

3.1.3 *Tuna obesus* / Bigeye tuna / BET

Bigeye tuna has a maximum fork length of 200 cm. Bigeye tuna have distinctive large eyes and a rounded body. The ventral side is white and the dorsal side is black, edged with a thin blue line. The ventral and dorsal sides are separated by a golden/yellow half lateral line [9]. The dotted vertical line is usually on the ventral side and sometimes extends above the half lateral line. Additional fins are bright yellow with thick black edges Fig. 3.

3.1.4 Length and weight relationship

Based on research results, the number of small fish weighing less than 10 kg was measured per basket, not per fish unit. Data on the composition of small fish species by weight is much more informative than measuring the length per fish, this is used to facilitate fisheries management. The total catch can be determined based on the composition of species weighing more than 10 kg. To overcome this problem, a minnow conversion factor has been added to the I-Fish system. Conversion factor for calculating the weight (W) of fish in sub-sampling of small fish from the length (L) of fish using the length-weight relationship:

$$W = a \, x \, L^b$$

Where W is weight, L is length and a and b are coefficients. For each species in the I-Fish database, a and b values must be calculated. The sample data entered to calculate the a and b values are the length and weight values collected from 2019 to 2020 for each tuna species, namely as follows, 876 Yellow Fin Tuna fish, 467 Skipjack fish (K*atsuwonus pelamis)* and 430 Big Eye Tuna fish *(Tuna obesus)*. The following values are the a and b values selected for each species:

$$YFT : a = 1{,}18E - 05; \; b = 3{,}08$$
$$SKJ : a = 6.1E - 05 \, ; \, b = 2.71$$

$$BUT : a = 2{,}3E - 05 \, ; \; b = 2{,}97$$

These a and b values are integrated into the I-Fish system with the following process:

1. Calculate the weight of each fish using the formula above by calculating the a value and b value according to the species. More details can be seen in Table 1.

2. The calculation results species composition from sub-sampling of small fish with use percentages.

Formula:

Percentage of species X = (weight of species X / total weight of small fish sample)*100

YFT Percentage = (4.91/16.84)*100 = 29.2 %

BET Percentage = (2/16.84)*100 = 11.8 %

SKJ Percentage = (9.93/16.84)*100 = 58.97 %

3. Apply the percentages calculated above to the total weight of all small fish

To get the weight of different species < 10 kg

Total weight of all small fish = 3200 kg

Yellow fin tuna (YFT) wieght = 3200*(29.2/100) = 934.4 kg

Big eye tuna (BET) weight = 3200*(11.8/100) = 377.6 kg

Skpjack tuna (SKJ) weight = 3200*(58.97/100) = 1887 kg

Based on the results of the analysis of the relationship between length and weight during 1 year of research (August 2019–July 2020) for each species of tuna there are 876 YFT fish, 467 SKJ fish (Skipjacj) and 430 BET (Bigeye tuna) fish. The relationship between the length and weight of each type of tuna can be seen in Pictures 4, 5 and 6.

The results of the analysis of the relationship between length and weight of 876 Yellowfin tuna fish obtained a value of b = 3.08 indicating positive allometric growth where weight growth was faster than length growth [10]. Coefficient of determination R^2 = 0.98 indicates that the fish length factor will influence fish weight by 98%, while around 2% is influenced by other factors not included in the model. This model is quite good at explaining the relationship between length and weight of Yellowfin tuna fish.

Fig. 3. Tuna obesus / Bigeye Tuna / BET

Table 1. Calculation results of length and weight of tuna fish landed in FLB lonrae bone regency south sulawesi province

Species	Long	Weight Calculation ($W=aL^b$)	Final Weight	Total Weight (kg)
YFT	40		1.42	4.91
	45	$W = 1E\text{-}05L^{3,0833}$	1.92	
	35	$W = 1E\text{-}05L^{3,0833}$	1.25	
	22	$W = 1E\text{-}05L^{3,0833}$	0.32	
BUT	46	$W=2E\text{-}05L^{2,9716}$	2.00	2.00
SKJ	60	$W=6E\text{-}05L^{2,7095}$	4.30	9.93
	37	$W=6E\text{-}05L^{2,7095}$	1.02	
	40	$W=6E\text{-}05L^{2,7095}$	1.29	
	50	$W=6E\text{-}05L^{2,7095}$	3.32	
Total Weight of All Fish				16.84

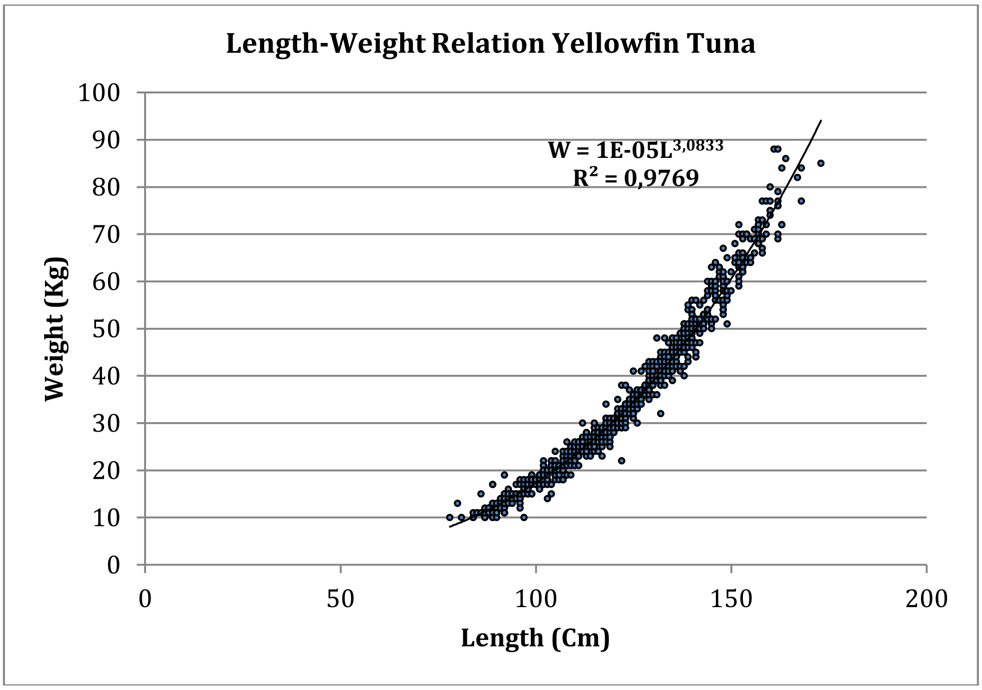

Fig. 4. Length-weight relationship of yellowfin tuna

Based on Fig. 5 the relationship between length and weight of 467 Skipjack Tuna fish *(Katsuwonus pelamis)*, a b value of 2.71 was obtained, indicating positive allometric growth where weight growth was faster than length growth [11]. Coefficient of determination R^2 = 0.87 shows that the fish length factor will affect the weight of the fish by 87%, while around 13% is affected by other factors that are not included in the model. This model explains quite well the relationship between length and weight of Skipjack tuna.

The results of the analysis of the relationship between length and weight of 430 Bigeye tuna fish obtained a value of b = 2.97 indicating positive allometric growth where weight growth was faster than length growth [12]. Coefficient of determination R^2 = 0.98 indicates that the fish length factor will influence fish weight by 98%, while around 2% is influenced by other factors not included in the model. This model is quite good at explaining the relationship between length and weight of Bigeye tuna fish.

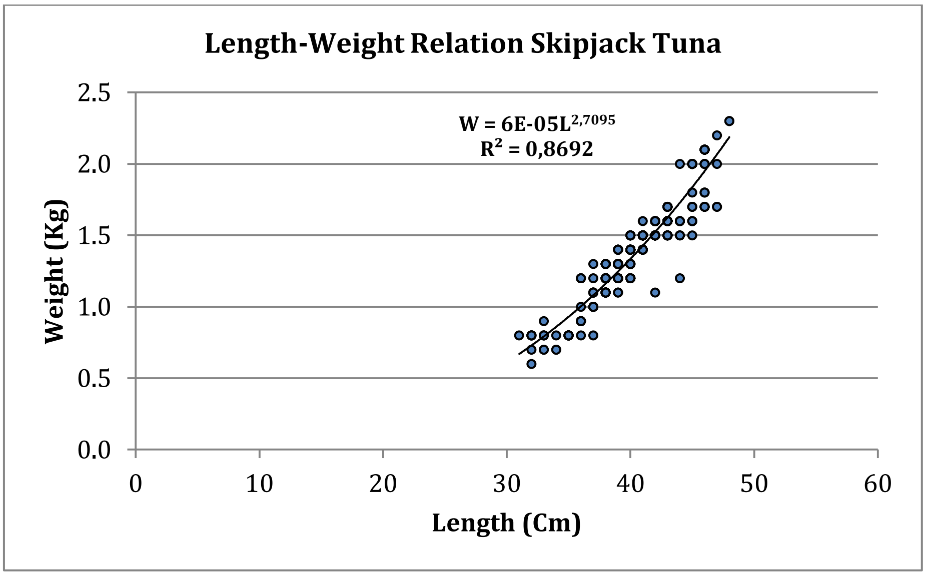

Fig. 5. Relationship between length and weight of skipjack tuna

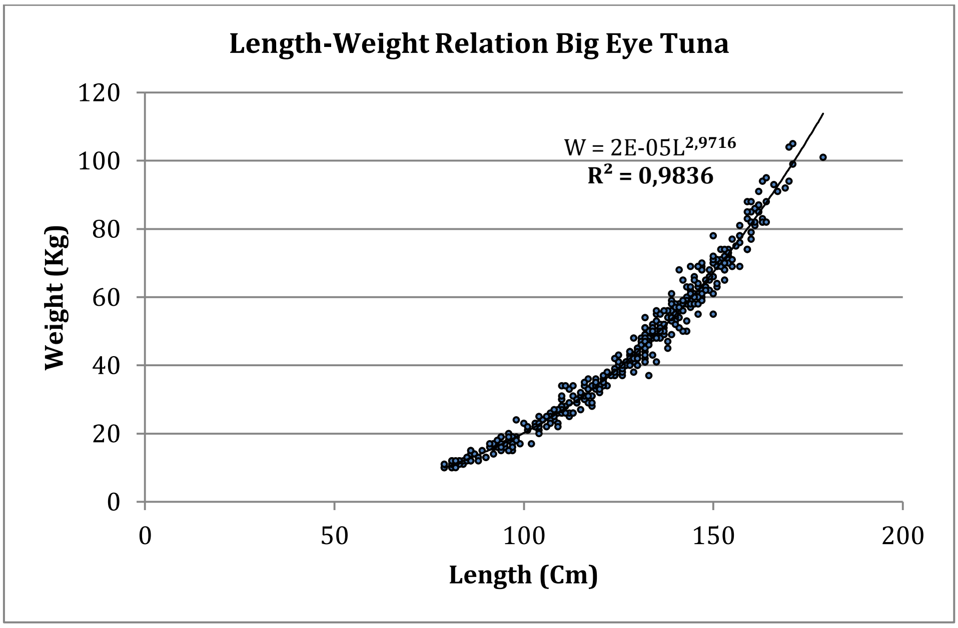

Fig. 6. Relationship between length and weight of big eye tuna

4. CONCLUSION

The composition of tuna species landed at Fish Landing Base (FLB) Lonrae, Bone Regency, South Sulawesi Provinve consists of 3 species, namely Yellowfin Tuna (*Thunnus albacore)*, Bigeye Tuna *(Tuhunnus obesus)* and Skipjack *(Katsuwonus pelamis)*. Composition of tuna species Yellowfine tuna = 29.2%, Bigeye tuna = 11.8% and Skipjack tuna = 58.97%. The relationship between length and weight of tuna fish is obtained as allometric growth where the growth in weight is faster than the growth in length.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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