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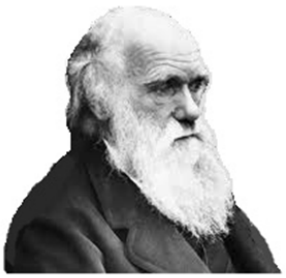

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Length Weight Relationship and Condition Factor of Indo-Pacific King Mackerel (*Scomberomorus guttatus*) in Pangandaran Water, West Java, Indonesia

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ABSTRACT

Scomberomorus guttatus is an economical valuable fish in Pangandaran, West Java, Indonesia. Indeed, the catch of large pelagic fish in Pangandaran water is dominated by *Scomberomorus guttatus* at around 42.30% of the total production of large pelagic fish in 2015-2017. The purpose of this research is to analyze length-weight relationship and condition factors of *Scomberomorus guttatus*. The samples were collected in August and September 2018 at Cikidang Fishing Port, Pangandaran Regency, West Java. The *Scomberomorus guttatus* observed during the research had total length ranging from 205 to 685 mmTL, and the length-weight relationship of *Scomberomorus guttatus* in Pangandaran water was indicated by the equation $W = 0.0000038L^{3.0839}$. Furthermore, the growth pattern of *Scomberomorus guttatus* is positive allometric (b = 3.0839), meaning that weight growth is faster than length growth, while its condition factor range from 0.52 to 1.54 (average - 1.00 ±0.08).

***Keywords*:** Indo-Pacific, condition factor, length-weight relationship, *Scomberomorus guttatus*, Pangandaran water

1. INTRODUCTION

Indo-Pacific King Mackerel known as *Scomberomorus guttatus* is the most catched of large pelagic fish group in Pangandaran water. *S. guttatus* production during 2007 until 2015 in

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Pangandaran water is 488.95 tons, the most *S. guttatus* production is 94.02 tons in 2015, while the least production is 26.04 tons in 2010 [1]. Increasing of *S. guttatus* production during this period occurs because of the demand increasing for *S. guttatus* so that fisherman increasing their efforts to catch *S. guttatus* more.

An attempt of fish resources management is more needed, considering the utilization increasing intensity. If there is no management it will cause a huge loss of fish resources diversity. That management cannot be done with a single decision but must be carried out with comprehensive consideration and its relation to biological estimation, so that stock assessment and management need to be integrated. The main purpose of stock assessment is to prepare a precise estimate of the catch and biomass of the population and try to make predictions about the impact of various management policies [2].

Length-weight relationships information in biological fisheries is one of the information that needs to know relating to fish resources management, for example in determining fishing gear selectivity in order to catch only decent-sized fish [3]. Length-weight measurement also relate to age data so that can give an information about stock composition, mortality, life cycle, growth and production [4].

Length-weight relationships analysis also can estimate the condition factor or relative health conditions of fish populations (**Figure 1**). Condition factors can show either biologically or commercially information [5].

Figure 1. Indo-Pacific King Mackerel - *Scomberomorus guttatus* (Bloch and Schneider, 1801)

The purpose of this research is to analyze length-weight relationships and condition factor of *Scomberomorus guttatus* in Pangandaran water. This research is expected to give an information and advice for management of *S. guttatus* in Pangandaran Regency, West Java, Indonesia.

2. MATERIALS AND METHODS

2. 1. Time and Research Location

This research was conducted in June until December 2018. The sampel was collected in August until September 2018 at the Cikidang Fishing Port, Pangandaran Regency, West Java.

2. 2. Materials and Tools

The material is *S. guttatus* caught using gill net in Pangandaran water. The instruments used in this research were millimeter blocks, digital scales (0.1 gram accuration), baskets, stationery, and camera.

2. 3. Methods

Fish sampling was carried out using the stratified random sampling method. Fish samples were taken from five different piles that randomly selected. Fish samples were taken based on how small, medium and large sizes in each pile. The fish samples collected from the five stacks were 161-195. Sampling was done once every month for two months.

2. 4. Data Analysis

2. 4. 1. Length-Weight Relationship

Analysis of the length-weight realtionship using an equations by [5] as follows:

$$W = a \times L^b$$

To find the values of log a and b using the formulae:

$$\log a = \frac{\sum \log W \times \sum (\log L)^2 - \sum \log L \times \sum (\log L \times \log W)}{N \times \sum (\log L)^2 - (\sum \log L)^2}$$

$$b = \frac{\sum \log W - (N \times \log a)}{\sum \log L}$$

where: W = weight (gram), L = total length (mm),
a = intercept, b = slope, N = total fish.

2. 4. 2. Condition Factor

The condition factor was calculated using an equation by [5] as follows:

$$K = \frac{W}{aL^b}$$

Where:
K = condition factor, W = weight (gram),
L = total length (mm), a = intercept,
b = slope.

3. RESULTS AND DISCUSSION

3. 1. Distribution of Lenght Frequency

S. guttatus observed during the research were 356 fishes, 161 in August and 195 in September. *S. guttatus* observed had total length of 205 to 685 mmTL. The size of *S. guttatus* shows different results in two months observation. The range of total length in August was 205 to 596 mmTL while in September it was 260 to 685 mmTL. The increase of the minimum total length from August to September shows that the mackerel grow during the research. Monthly size distribution of *S. guttatus* in Pangandaran water can be seen in **Figure 2** and 3.

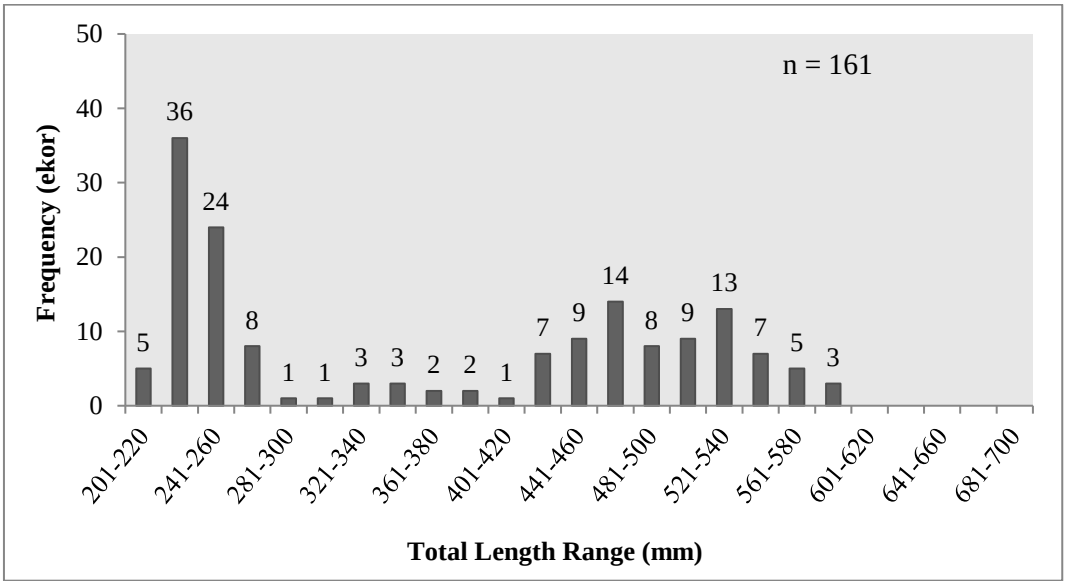

Figure 2. Length frequency distribution of *Scomberomorus guttatus* in August

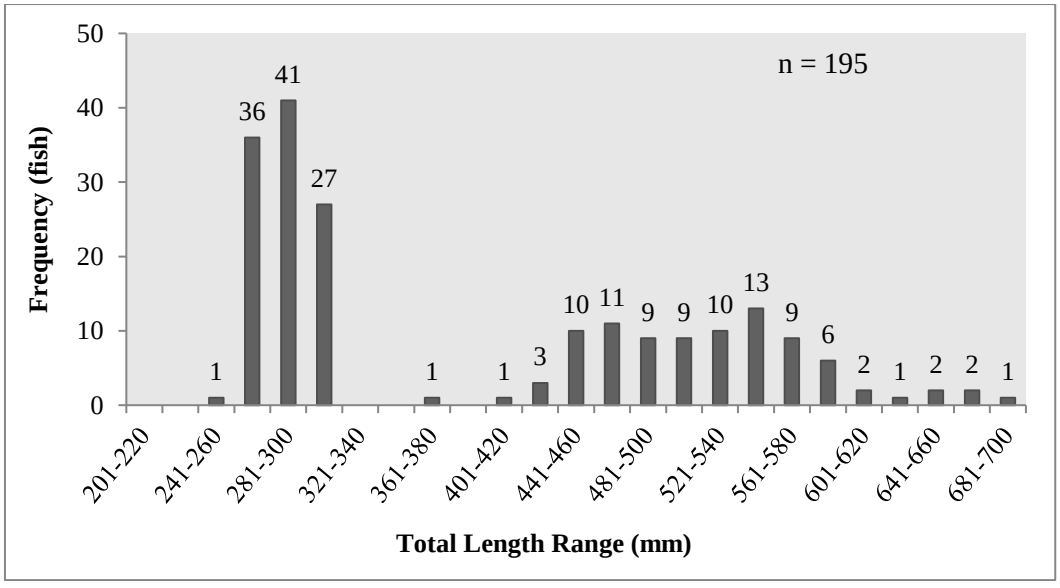

Figure 3. Length frequency distribution of *Scomberomorus guttatus* in September

The size of *S. guttatus* in the Bay of Bengal, Bangladesh, ranged from 250-700 mmTL [6]. Furthermore, the size of *S. guttatus* in Moro water, Riau Islands, Indonesia, ranged from 220-690 mmFL [7]. The difference in the size range of fish caught from various waters is caused by habits and availability of food, age, environmental conditions and fishing gear used [8].

3. 2. Length-Weight Relationship

Length-weight relationship of *S. guttatus* in Pangandaran water shows by the equation $W = 0.0000038L^{3.0839}$. The coefficient of determination (R^2) is 0.9938 means that the length affected the weight by 99.38%. According to b value (b = 3.0839), the growth pattern of *S. guttatus* in Pangandaran water is isometric, it means that the weight growth is as fast as the length growth.

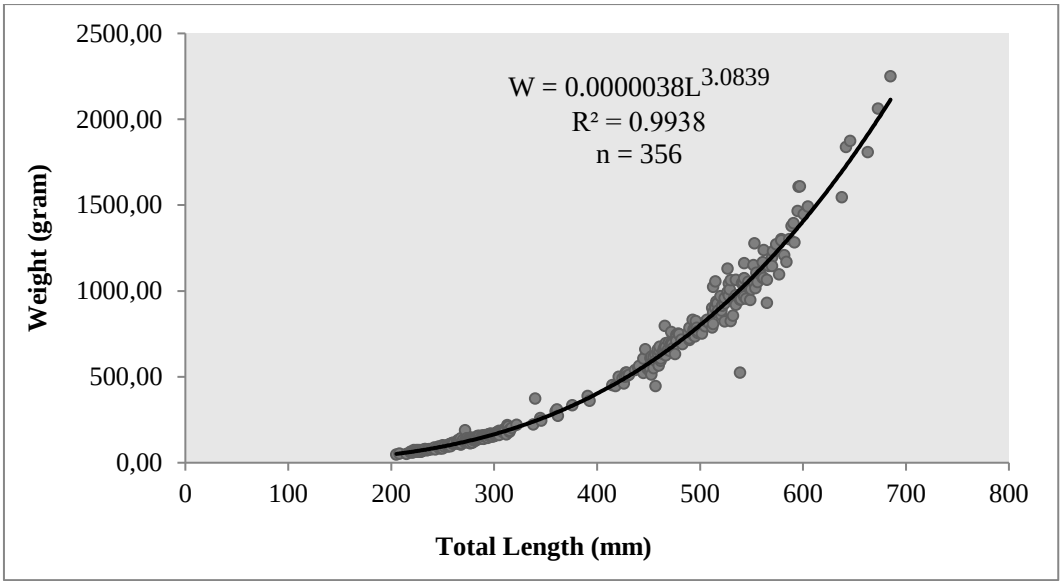

Figure 4. Length-weight relationship of *Scomberomorus guttatus*

Length-weigth relationship is relative, means it can change according the time. If there are environmental conditions change and food availability, the value of the length-weight relationship will change too [9]. The geographical differences can affect b value in the same species [10]. The difference in b value also can caused by differences in number and variation of observed fish sizes [11].

Table 1. Length-weigth relationship of *Scomberomorus guttatus* in different location

Research Location	$W = a \times L^b$	N (fish)	Growth Pattern	Reference
Mannar and Palk gulf, India	$W = 0.01011L^{2.8605}$	-	Negative allometric	[12]

Research Location	$W = a \times L^b$	N (fish)	Growth Pattern	Reference
Karnataka water, India	$W = 0.023L^{2.782}$	200	Negative allometric	[13]
Bengal bay, Bangladesh	$W = 0.0101L^{2.8622}$	2.366	Negative allometric	[6]
Northern Bengal bay, India	$W = 0.00001L^{2.894}$	480	Negative allometric	[14]
Karachi water, Pakistan	$W = 0.167227L^{2.1214}$	278	Negative allometric	[15]
Western waters of Indonesia	$W = 0.0096L^{3.002}$	-	Isometric	[16]
Cilacap water, Indonesia	$W = 0.01L^{3.008}$	2.297	Isometric	[8]
Moro water, Indonesia	$W = 0.00002L^{2.738}$	3.307	Isometric	[7]
Pangandaran water, Indonesia	$W = 0.0000038L^{3.0839}$	356	Isometric	This research

3. 3. Condition Factor

Value of *S. guttatus* condition factor in Pangandaran water from August to September 2018 ranged from 0.52 to 1.54 (average 1.00 ± 0.08). The smallest condition factor value was found in the sample with the length of 539 mmTL and weight of 524 grams identified in August, while the largest condition factor value was found in samples with 272 mmTL length and 188.7 grams of weight identified in September.

Proportion of *S. guttatus* observed in August with K < 1 is 50,31% (81 fishes from 161 total fish), while proprotion in September with K < 1 is 46.67% (91 fishes from 195 total fish). The proportion of fish with a value of K <1 from August to September is incrasing. It shows the environmental changing factors from August to September affected fish growth. Differences of factors condition value in different times or seasons show the differences in environmental factors that affected fish growth [5].

August is the end of the eastern season and September is the beginning of the second transition season in South Java Sea, that usually occurs an upwelling [17]. Upwelling is the the water mass reversal from the inner layer to the surface layer. The upwelling water contains richness of nutrient because of high distribution of chlorophyll-a. The nutrient in Pangandaran water from August to September has an effect on the growth of *S. guttatus* that live there.

Apart from being affected by food availability, the conditions factor value is also affected by the condition of the fish gonads. The increasing in condition factor value occurs when the fish is filling its gonad with sex cells and will reach its peak before the spawning period [5].

The value of K <1 which was found in August and September shows that *S. guttatus* in Pangandaran water has passed its spawning season while an increase in the value of K from August to September illustrates that fish stocks are undergoing a recovery process after spawning. This is in accordance with the results of research by [8] in Cilacap water which has the same coastline with Pangandaran water, spawning season for *S. guttatus* takes place in March and June.

K values range from 1-3 describe good conditions and have a plump body [18]. Condition factor of *S. guttatus* in Pangandaran water in August and September is relatively good even though the shape of the body tends to be flat (as shown in **Figure 1**). The condition of *S. guttatus* in Pangandaran water is better compared to the condition factor of *S. guttatus* in Bengal bay. The growth of *S. guttatus* in Bengal bay, India, is bad because the weights growth is not directly proportional to the increase of length growth so that the shape of the body is flat [14].

One of the management information needed is the growth pattern and condition factor of fish in order to predict fish spawning season [18]. Based on results of the research, Indo-pacific *S. guttatus* in Pangandaran water in August and September have passed the spawning season. In order for fish stocks to be maintained it is necessary to apply regulations to control the fishing season (opened or closed season). Fishing closed season can be done in March and June so that at that time the fish are given the opportunity to reproduce and the *S. guttatus* stocks remain sustainable [19-36].

4. CONCLUSIONS

The *Scomberomorus guttatus* in Pangandaran water had a total length range of 205-685 mmTL. The growth pattern of *S. guttatus* was isometric (b = 3.0834) which means that weight growth is faster than growth in length. The condition factor values ranged from 0.52 to 1.54 (average 1.00 ±0.08). The value of the condition factor shows that *S. guttatus* in Pangandaran water have a flat body.

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