Length-weight relationships of three popular fishes from Banda Aceh, Indonesia

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Abstract. Study on the length-weight relationships and conditions factors of three popular fishes consumption has been done in Banda Aceh in October 2017. This study was conducted to stock assessment and condition of fish. The data was collected at Lampulo Fishery Port, Banda Aceh. Data analysis was done using linear allometric Model (LAM). The results of the length-weight relationships showed that all three species of fish experienced negative allometric growth patterns. The highest b value is shown in Sardinella fimbriata with a value of 2.44, followed by Oreochromis niloticus (2.30) and Euthynnus affinis (2.08). The value of Fulton's (K) condition factor indicates that all three fish species have value> 1.6 with a mean of 3.03. Furthermore, the value of relative weight (Wr) condition factor of three types of fish shows a value> 100 with a mean of 100.23. Thus it can be concluded that the values of K and Wr indicate the environmental conditions of the three types of fish in a stable condition.

1. Introduction

Length-weight relationship is one of the important aspects of the fisheries biologist for fish growth pattern estimate [1]. In addition to the length-weight relationship, it can also reflect the physiological state and the development of the fish [2] as well as fish health and productivity [3,4].

In ontogenetic development of fish, fish shape can be varied (positive allometric growth (b> 3) or negative (b <3), or not (isometric growth, b = 3)[5]. In Aceh waters, it has a variety of fish species, both derived from fresh water and sea water such as S. fimbriata, O. niloticus and E. affinis [6]. The length measurement conducted on popular fish in the Banda Aceh is to obtain information about variations in weight and length of fish individuals and fish groups S. fimbriata, O. niloticus and E. affinis. Length-weight relationship information is critical in planning a better strategy in the refineries of fisheries resources.

However, the lack of availability of information about the length-weight relationship and the pattern of growth of fish in Aceh waters make this study interesting to be done. Therefore, this research aims to provide information about the length-weight relationship and the pattern of growth of three species of popular fish from the waters of Banda Aceh.

2. Materials and Methods

2.1 Location and time

Survey and sampling were conducted during October 2017. Data is collected on fish auction place (TPI) Lampulo, Banda Aceh.
2.2 Data analysis

2.2.1 The length and weight relationship

Analysis of heavy long relationship was using allometric Linear Model (LAM) refers to [1]:

\[ W = a \cdot L^b \]  \hspace{1cm} (1)

Where: W is the weight of fish (g), L is a total fish length (mm), a and b are constants.

2.2.2 The condition factor

The condition factor was analyzed in the study include Fulton condition factor (K) and the relative weight of the condition factor (Wr). The Fulton condition factor was analyzed referring to formula [1]:

\[ K = \frac{W \cdot L - 3}{100} \]  \hspace{1cm} (2)

Where: K is the Fulton condition factor, W is the weight of fish (g), L is a total fish length (mm), -3 is a correction factor on the length coefficient which leads to number one.

Further analysis of the relative weight of the condition factor (Wr) refers to Froese [7]:

\[ Wr = \left( \frac{W}{W_s} \right) \times 100 \]  \hspace{1cm} (3)

Where: Wr is weight relative condition factor, W is the weight of fish (g), Ws is the standard weight (g) estimated from the allometric Linear Model (LAM) who analyzed earlier.

3. Results and Discussion

The results of length-weight relationship showed that three species of fishes suffered negative allometric growth pattern. It shows that the additional of weight and length of the fish is not balanced, which increase in length occurs faster than the addition of the fish weight. The analysis showed the highest value of coefficient b of 2.44 on the S. fimbriata, followed by O. niloticus (2.30) and E. affinis (2.08) (Table 1).

The Fulton condition factor (K) (Table 1) showed a very good result that is > 1.6, so it can be concluded that fishing locations are still in good condition for the fish survival. It also shows that the fish habitat and food availability are still sufficient for the fish survival. While weight relative condition factor (Wr) (Table 1) shows the value of > 100, it means that the number of predators is fish habitat and fish stable environmental conditions (Table 1).

| Species     | Ind. | coefficient b | Determination of R (%) | Correlation r (%) | Fulton K | Wr    |
|-------------|------|---------------|------------------------|-------------------|----------|-------|
| E. affinis  | 22   | 2.08          | 84.87                  | 91.09             | 3.07     | 100.12|
| S. fimbriata| 23   | 2.44          | 75.89                  | 86.39             | 2.89     | 100.14|
| O. niloticus| 20   | 2.30          | 61.25                  | 78.73             | 3.14     | 100.44|
| Average     | 21.67| 2.27          | 74.00                  | 85.40             | 3.03     | 100.23|

Table 1. The relationship between the heavy length (b) and condition factor (K and Wr) fish in the fish auction place (TPI) Lampulo, Banda Aceh.
Analysis long relationship weight of fish consumption in Banda Aceh showed a b mean value of 2.27 (allometric negative). The highest value of coefficient b shown in *S. fimbriata* with a value of 2.44, followed by *O. niloticus* (2.30) and *E. affinis* (2.08). On value of b coefficient, although there is a difference but not significant, here the resulting samples of each individual observation are relatively the same visually.

While Fulton's condition factor value (K) indicates the average value of 3.03, Fulton's highest value is shown by *O. niloticus* of 3.14, followed by *E. affinis* (3.07) and *S. fimbriata* (2.89). Although there are differences in the average value of K, However, it is not different significantly. The mean value of K show the stable environmental conditions (> 1.6) [8]. According to Muchlisin et.al [1] the stable state indicate that the waters has minimal living organisms, predators and competitors. The stable water condition indicates that there is an availability of food source for organisms [9].

The relative condition of weight factor (Wr) shows the value of 100.23. These results show the stable condition (> 100) in locations where fish are caught. According to Muchlisin et.al [10] Wr indicates stable water conditions where the fish is still able to overshadow the life of the organism. According to Zuia et.al [11] food source is an important factor for the survival of aquatic organisms. Although the average yields of b value, the consumption of fish shows negative growth. The environment condition where these fish live is still in a stable state, this matter can be seen from the value of K and Wr.

**Figure 1.** Linear regression length and weight of fish, wherein a) *E. affinis*, B) *S. fimbriata* and c) *O. niloticus*.
4. Conclusion

Heavy long relationship analysis showed that the three species of fish suffered allometric negative growth, which means additional weight and length of the fish is not balanced in all three species.

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