The growth and exploitation rate of yellowstripe scad (Selaroides leptolepis Cuvier, 1833) in the Malacca Strait, Medan Belawan Subdistrict, North Sumatera Province

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Abstract. Yellowstripe scad included the one of commodity that has an important economic value in the Malacca Strait. Fish were found mostly in Indonesian of waters made this fish as one of the main target catch. But, it can had negative impact on the population of the fish. The study is done at Belawan Waters on March until May 2017 that which is purposed to study about the frequency distribution of length, determine the parameters of growth and, determine mortality rate and the rate of exploitation in order to provide appropriate management model for the fish resource. Yellowstripe scad was observed around 360 samples with the length range between 110 - 175 mm. The fish separated by bhattacarya method used the aid software FISAT II. A pattern of growth Yellowstripe scad alometrik negative with growth coefisien (K) 1.1 with length asimtotic (L∞) 181.65. The rate of mortality total (Z) yellowstripe scad 4.34 per year at the rate of mortality natural (M) 1.204 per year and rate mortality by fishing (F) 3.136 per year in order to obtain the rate of exploitation 0.722. The value of this exploitation rate has exceeded the value of the optimum exploitation of 0.5.

1. Introduction

Yellowstripe scad is one type of important economic. Many people like it because it tastes good and the price is relatively. The fish is done by catching throughout the year so that the existence of behavior Yellowstripe scad is almost active like there every day.

Continuous capture without thinking the fish resources resulted in the threat of sustainability of this fish in the malacca strait. To know the extent of Yellowstripe scad exploitation, it is necessary to study the biological aspect in mean to growth pattern. Stated that the length measurement of fish weight aims to determine the variation of specific weights and lengths of individual fish or individual groups as guidance on obesity, health, productivity and visiologic conditions including gonadal development [7].

The economic and ecological potential of Yellowstripe scad is good enough so that it is necessary to review the basic information of fisheries biology to support the management of the resources of Yellowstripe scad in order to create a sustainable and environmentally friendly catch. Long-term frequency distribution and long-term relationship are important information to see growth and rate of exploitation which is one of consideration factor in setting fishery management strategy. Research purposes to determine the growth of fish in the malacca strait.
2. Material and Method

Time and Place
This research was conducted from March to May 2017. One time a month, of the length of fish weight. The fish samples were obtained from the catch of Yellowstripe scad in the Malacca Strait, Medan Belawan Subdistrict, North Sumatra Province.

Tools and materials
The tools used in this study is a gill net with a mesh size of 2 inches that serves to catch fish Selar Yellow, gauges fish with a precision of 1 mm to measure the length of the fish, digital scales to weigh the weight of fish, GPS to determine the coordinates of the sampling station, refakto meter to measure water salinity, thermo meter to measure water temperature, Cool box for the sample container, mengkukur DO meter for dissolved oxygen (DO) and the measuring vessel 5 GT.

Materials used in this study is Selar Yellowstripe scad (Selaroides leptolepis) as samples, ice for handling the fish so that the fish stay fresh after being arrested and wipes.

Problem formulation
Weights can be considered as a function of length. The length and weight relationship can follow the law of cubic where the weight of the fish is the rank of three of its length. But the actual relationship in fish is not so because the shape and length of the fish is different. Therefore, the long relationship weight of Yellowstripe scad using a common formula that is: [2]

\[ W = aL^b \]  

Information:
- \( W \): Weight (gram)
- \( L \): Length (cm)
- \( a \): Intersection of the long-weight relationship curve with the y-axis
- \( b \): Estimation of long-weight growth pattern

The condition factor is the state or the pledge of the fish expressed in the figures. The calculation of condition factors is based on length and weight. Calculation of this condition factor to look at the length and weight of some fish reach maximum or minimum conditions. The condition factor can be calculated by the formula: [1]

The value of \( b \neq 3 \) (allometric) then the condition is determined by the formula:

\[ FK = \frac{W}{aL^b} \]  

Information:
- \( FK \): Condition factor
- \( W \): Weight of fish (gram)
- \( L \): Total length of fish (mm)
- \( a, b \): Constants

Walford plot Ford is one of the simplest methods of predicting the growth parameters \( L_\infty \) and \( K \) of the von Bertalanffy equation with interval sampling the same time [3]. The following is the von Bertalanffy growth equation:

\[ L_t = L_\infty (1 - e^{-(k(t-t_0))}) \]  

Information:
- \( L_t \): Fish length at age \( t \) (time unit)
- \( L_\infty \): Theoretical maximum length (asymptotic length)
K : Growth coefficient (per unit time)
T₀ : Theoretical life at length is zero

The rate of mortality of capture (F) can be determined using the following formula:

\[ F = Z - M \] (4)

Determined by comparing the rate of exploitation of fishing mortality (F) of the total mortality (Z) [6] [9]

\[ E = \frac{F}{F+M} = \frac{F}{Z} \] (5)

The rate of fishing mortality (F) or the rate of exploitation in the optimum according to [9] are:

\[ F_{\text{optimum}} = M \]
\[ E_{\text{optimum}} = 0.5 \]

Information:
E = Exploitation rate
F = Coefficient of capture mortality
M = Natural coefficient of death

Terms:
1. If E> 0.5 indicates a high rate of exploitation (overfishing).
2. If E <0.5 indicates a lack of utilization (underfishing).
3. If E = 0.5 indicates optimal utilization.

3. Results and Discussions

3.1 Results

The From the analysis of heavy long relationship known that heavy long relationship equation Yellowstripe scad Selar from March to May was W = 0.002L^{1.926} b Values obtained after t test (a = 0.05) on the value of b is known that fish Selar Yellow Has a negative allometric growth pattern, meaning that the length increase is faster than weight gain [1]. Can be seen in Figure 1.

![Figure 1](image)

**Figure 1.** Long Relationship Relationship of Yellowstripe scad during March – May, n =360

The value of the condition of the female Yellowstripe scad in March was 0.865-1.276 while in the Yellowstripe scad Yellow male of 1.120-1.818. The value of Yellow female Selar Fish condition factor in April was 0.865-1.153 while the Yellowstripe scad Yellow male was 0.861-1.277. In May of 0.877-1.368 while in the Yellowstripe scad Yellow male of 0.836-1.201. The factor value of Yellowstripe scad condition in the Malacca Strait has range 0.836-1.818 (flat) with negative allometric growth pattern. Can be seen in Figure 2.
Figure 2. The Value of Yellowstripe scad Selection Factor Based on Observation Time.

The values of the growth parameters used as the basis to obtain Von Bertalanffy equation Yellowstripe scad Selar \( L_t = 181.65[1-e^{(-1.1t+0.53394)}] \). Based on the equation - the equation of Von Bertalanffy, growth charts Yellowstripe scad can be seen in Figure 3.

Figure 3. Growth Charts (\( L_t \), Fish Selar Yellow)

The result of analysis of total mortality rate (Z) on Yellowstripe scad obtained 4.34 per year consisting of natural mortality (M) Yellowstripe scad is obtained 1.204 per year, and the fishing mortality (F) is 3.136 per year so that the rate of exploitation (E) 0.722 per year.

3. 2. Discussion

From the analysis of heavy long relationship known that heavy long relationship equation Yellowstripe scad Selar from March to May was \( W = 0.002L^{1.928} \). The value of \( b \) obtained after t test (\( a = 0.05 \)) to the value of \( b \) is known that Yellowstripe scad has a negative allometric growth pattern, which means long increase faster than weight gain [1].

The pattern of Yellowstripe scad growth in Belawan waters, Malacca Strait is different from [8] study of long-term relationship analysis, obtaining a \( b \) value of 1.926. Differences in the value of \( b \) can be caused by several factors such as environmental conditions, different fishing locations and physiology of the fish itself. This explanation conform statement in [4] factors that cause different values of \( b \) in addition to species differences are environmental factors, different fish stocks in the same species, fish development stage, gender, maturity level of gonads, even differences Time of day due to changes in stomach contents. Add that the difference in the value of \( b \) can also be due to the difference in the number and variation of fish sizes observed [4].

Analysis of the relationship of length and weight of Yellowstripe scad in, Malacca Strait has negative allometric growth pattern with the calculation of condition factor (FK) ranged from 0.836 and
1.818 Value Factor of Yellowstripe scad condition shows that Yellowstripe scad is in flat condition. According to Effendie (2002) statement that the value of K in fish a slightly flat body ranged between 1 - 2, whereas in the less flat fish between 2 - 4. The results of this study Yellowstripe scad in Malacca Strait, Tanjung Beringin Subdistrict, Serdang Bedagai Regency has a condition factor value ranging from 0.711 - 1.551 [5]. The condition factors will also differ depending on the sex of the fish, the season or the location of the capture as well as the condition factor also influenced by the maturity level of gonad and the abundance of food [4].

Von Bertalanffy growth equation is formed for Fish Selar Yellow is the \( L_{\infty} = 181.65[1-e^{-1.1(t+0.53394)}] \) These results indicate that the length of fish caught is smaller than the length asymptote (Infiniti). Pauly (1983) states that the value of the maximum length obtained during sampling in the field generally do not have a considerable margin away with \( L_{\infty} \), the results of this study are also in accordance with the fish yellowstripe scad caught in the Sea Natuna has a maximum length of 310 mm and has the asymptotic length \((L_{\infty})\) equal to 330 mm [3].

Curves of Yellowstripe scad growth by entering data of age (year) and data of theoretical length (mm) of fish, theoretically total length of fish is 182.7 mm and growth rate of Yellowstripe scad start stop at age 15.6 month and Selar fish Male yellow at the age of 13.8 months or less than 3 years. Azis (1989) in Sari, et al (2013) explains that the long-term growth curve of fish that occurs rapidly at a young age and increasingly slow along with age until reaching its asymptotic length where the fish does not grow longer.

The result of analysis of mortality rate of Yellowstripe scad obtained by total mortality rate (Z) Yellowstripe scad 4.34 per year with natural mortality rate (M) equal to 1.204 per year and mortality of catch (F) 3.136 per year. The estimated value of the exploitation rate (E) of this study is 0.722 per year, the value shows the difference of the estimated Z value obtained [5] in the Malacca Strait, Tanjung Beringin Subdistrict at 4.99 per year, Sapira (2013) at Landing Ikan Dusimas Malang Village Meeting is 0.784. Differences in total mortality values indicate that there is a difference in stock of Yellowstripe scad in waters caused not only fishing activity but also due to natural death.

4. Conclusions

Yellowstripe scad (S. leptolepis) in Malacca Strait, Medan Belawan Subdistrict, North Sumatera Province during the study has negative allometric growth pattern which means long increase faster than weight gain. The Bertonffy Von equation formed is \( L_{\infty} = 181.65[1-e^{-1.1(t+0.53394)}] \). The value of the exploitation rate of Yellowstripe scad in Malacca Strait, Medan Belawan Subdistrict, North Sumatera Province has overfishing status because the rate of exploitation exceeds the optimum value of 0.5 that is 0.722.

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