Stock Estimates Of White Pomfret (*Pampus argenteus*) Based On Length And Weight Data In Pangandaran Waters

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ABSTRACT

White pomfret (*Pampus argenteus*) is one of the economically important fish and includes the leading commodity in Pangandaran Waters. Information on fishing biology of those species were still limited. The purpose of this study is to determine stock estimates including length-weight relationship, age group, growth, mortality and exploitation rate of white pomfret. Monthly length-frequency data have been collected from November 2018 to August 2019 at Cikidang fish auction. Fish length-frequency distribution was separated into a normal distribution using the Bhattacharya method with software of FiSAT (FAO-ICLARM Stock Assessment Tools). Estimation of population parameters used analytical model application with ELEFAN-1 (Electronic Length Frequency Analysis) program. The results showed that lengths distribution of white pomfret ranged between 19.3 cm - 36.8 cmTL. Length-weight relations was negatively allometric ($W = 0{,}1184L^{2{,}3719}$). Growth equation of white pomfret is $Lt = 53.04\ (1-e^{-0.26(t)})$. Natural mortality (M) was 0.60/year, fishing mortality (F) was 3.04/year and total mortality (Z) was 3.64/ year. The exploitation rate (E) was 0.84. It is mean that higher than optimal exploitation so that the white pomfret fish population in a state of overfished. It is necessary to better policy in the management of white pomfret through precaution approach and describing of biological and fishing aspect in Pangandaran Waters.

Keywords: Length-weight relationship, pampus argenteus, Pangandaran waters, stock estimates

1. INTRODUCTION

There are five main commodities that have high economic value, namely white pomfret, black pomfret, hairtail fish, lobster, and shrimp (windu, jerbung). White pomfret itself contributes worth of Rp. 2,201,592,162,40 (1,406 tons). This fish has high economic value due to its white meat and delicious taste so that it becomes the target of fishermen's catch. White pomfret in Pangandaran Regency was caught using a bottom gillnet fishing gear (Fisheries and Maritime Affairs Office of Pangandaran Regency 2016).

White pomfret fish can thrive in estuary areas. The spread of white pomfret is throughout the Indo-Pacific West from the Persian Gulf to Indonesia, Japan, Southwest Korea and Eastern China (Prihatiningsih et al. 2015; Hashemi et al., 2016). The characteristics of white pomfret fish have a flat and tall body shape that is almost like a rhombus, has a silvery-white color at the bottom and gray at the top, the body surface is almost covered with small black

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spots. White pomfret belong to the family Stromateidae with a body length of up to 60 cm. According to FAO (1999), white pomfret fish has a grouping behavior at the bottom of the water or water column near the coast to a depth of 100 m. Population dynamics can be used to manage white pomfret resources. Devi *et al.* (2008) and Singh and Gupta (2008). Length weight relationship data (LWRs) can also be used to determine possible differences between separate unit stocks of the same species (Gomiero and Braga, 2003; Froese, 2006; Gomiero et al., 2008).

Population dynamics studies quantitatively on at least four factors that can influence change, including age groups, growth, mortality and exploitation rate (Widodo and Suadi 2008).

Age groups analysis can explain fish growth and the effect of environmental changes on fish survival. Fish growth is one of the important aspects of knowing how fast fish growth and population is. Fish stock changes described in terms of mortality. Fish stock mortality is divided into two namely natural mortality caused by predation, disease or age and capture mortality caused by fishing (Sperre and Venema 1999).

Increasing white pomfret fishing efforts will lead to a decreased white pomfret fish population. Therefore the study of population dynamics is needed to know the feasible size of white pomfret fish to be caught by the fisherman in Pangandaran Regency.

2. MATERIAL AND METHODS

This study was conducted during November 2018 – August 2019 located in Cikidang fish auction, Pangandaran Regency, West Java. The method used in this research is the survey method. The survey method is a direct investigation that aims to get the facts of the symptoms that exist and look for factual information (Nurhayati 2006). The data used in this study are primary data and secondary data. Primary data obtained directly by researchers covering the length and body weight of fish, while the secondary data used is the data of white pomfret fish production obtained from the Fisheries and Maritime Affairs Office of Pangandaran regency 2017.

2.1 Length-Weight Relationship

The length-weight relationship refers to Effendie (1979), use the following formula:

$$W = a.L^b$$

Note:
W = Weight.
L = Length
a,b = Constants

The test value of b = 3 or b 3, a t-test (partial test) is performed at the 95% significance level. The hypothesis of value b assuming:

H 0: b = 3, the relationship between length and weight is isometric
H 1: b ≠ 3, the length relationship with weights is allometric

The pattern of length-weight relationships is positive allometric, if b> 3 (weight gain is faster than length gain), and negative allometric, if b <3 (length gain is faster than weight gain).

2.2 Age Groups

Bhattacharya (1967), stated that the estimation of the age group of hairtail fish can use length-frequency separation methods, namely:

1. Hairtail fish are divided into several length groups.
2. Then each total length frequency (N1 +) is calculated by its natural logarithm
3. Next, calculate the logarithmic difference of two adjacent frequencies (n ln N1 +). Δ ln N1 + = ln N1 + from the current line, minus ln N1 + from the previous line.
4. Make a complete plot by entering the middle-class value of each total length (x-axis) to the difference in the logarithm of the frequency of the length of the hairtail fish Δ ln N1 + (y-axis).
5. The intersection of the regression straight line with the x-axis gives the value of the average length of each group. The average number of each age group, the value is –a / b

2.3 Growth Rate

Estimation of the parameters of hairtail fish growth was carried out using the simplest method in estimating the Von Bertanlanffy equation by using the Ford Walford plot approach (Sparre and Venema 1999) [15]. Von Bertalanffy's growth equation is as follows:

$$Lt = L\infty \, (1-e^{-k(t-to)})$$

Note:
Lt = Fish length at age t (time unit)
L∞ = The maximum fish length theoretically (asymptotic length)
K = Growth Coefficient (unit time)
t0 = Theoretical age when the length is zero
K = -ln (β)
L∞ = α/(1-β)

2.4 Mortality Rate

Estimation of the natural mortality rate is using Pauly (1979) empirical formula which is compiled based on a regression analysis of M (year), K (year), L∞ (cm) and T (average annual water surface temperature in degrees Celsius) with using the following formula:

$$\text{Log10 } M = -0{,}0066-0{,}279 \times \text{Log10 } L\infty + 0{,}6543 \times \text{Log10 } K + 0{,}463 \times \text{Log10 } T$$

Note:
M = natural mortality rate (year)
L∞ = theoretically maximum length of fish (asymptotic length)
K = Growth Coefficient (unit time)
T = Average annual water surface temperature (^{o}C)

2.5 Exploitation Rate

Determination of the rate of exploitation is to compare the capture mortality (F) to total mortality (Z) (Pauly 1979):

$$E = \frac{F}{F+M} = \frac{F}{Z}$$

Information :
F = arrest mortality
Z = Total mortality (year)
M = natural mortality

According to Gulland (1983) mortality rates or exploitation optimal rates are:

Foptimal = M and Eoptimal = 0.5

Exploitation values > 5 are indicative of more fishing conditions especially due to capture Ernawati and Mohammad (2010).

3. RESULTS AND DISCUSSION

3.1 Production of *Pampus argenteus* in Pangandaran Regency

One of the big catches in Pangandaran Regency is the white pomfret. The percentage of fish catches are as follows, Rebon Shrimps (Mysis relicta) (35%), Hairtail fish (Trichiurus spp.) (30%), Mixed (7%), Dogol Shrimp (Metapenaeus spp.) (6%), Length jawed mackerel(6%) Rastrelliger spp.) (5%), White pomfret (Pampus argenteus) (5%), Mackerel (Scromberomorus spp.) (4%), Gulamah (Nibea spp.) (3%), Tiga Waja (Otolithes spp.) (4%) 3%), and Jerebung Shrimp (Fenneropenaeus merguiensis) (2%) (Figure 1).

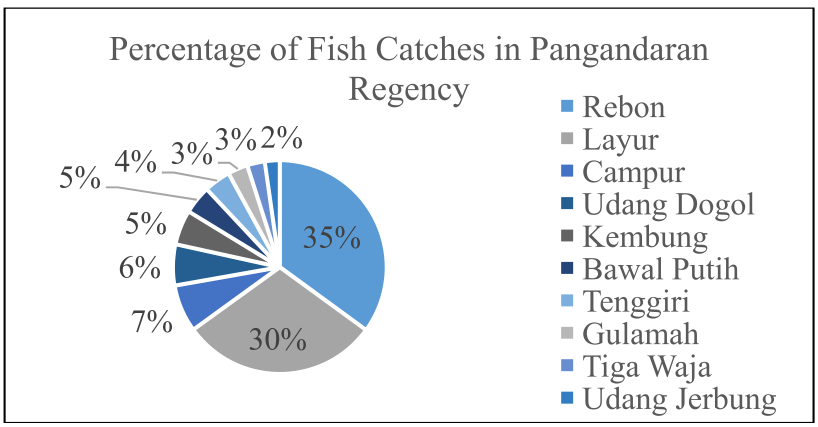


Fig. 1. Percentage of Fish Catches in Pangandaran Regency

According to the Fisheries and Maritime Affairs Office of Pangandaran Regency production data in 2017 white pomfret entered into 10 types of main commodities with a 5% percentage of catches, where the total production of white pomfret in 2017 was 91,298.88 kg with a production value of Rp.2,484. 788,635.00. White pomfret is one type of fish that has high economic value. The high price of white pomfret is due to the high interest in this fish so that market prices will remain high, white pomfret also intensively meets the needs of the export market (Prihatiningsih 2015).

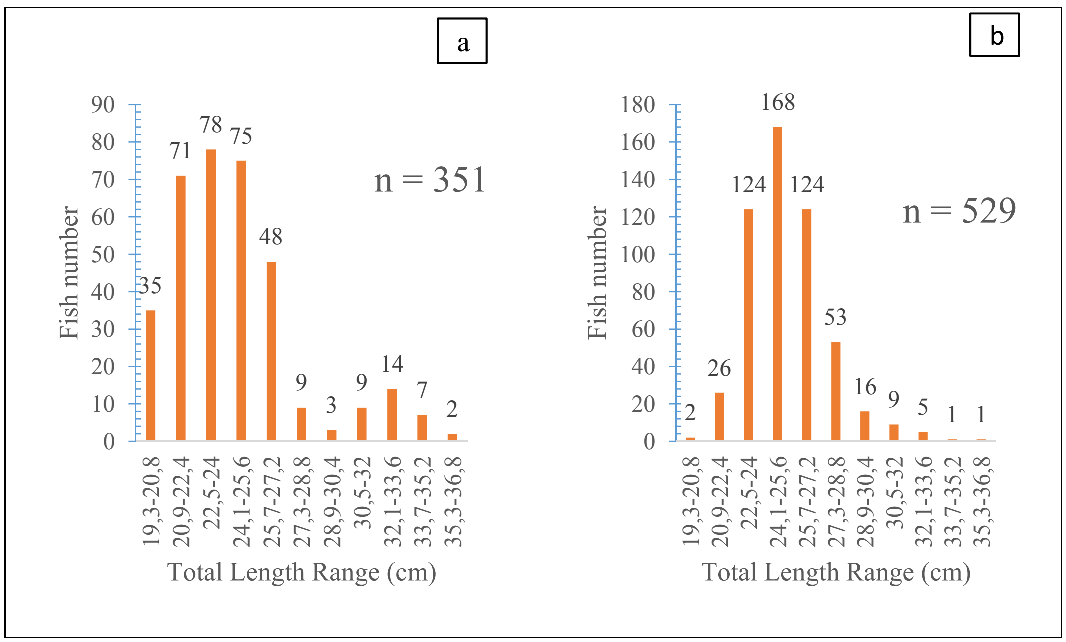
Based on data from the Pangandaran Regency in 2017, white pomfret is caught using gill nets, and white pomfret production is only available during the transition season II. Weather and wind speed greatly affect the amount of catch. According to Nurhaeti (2002) rainfall in Pangandaran has a positive effect on the catch season index value while the wind speed has a negative effect. Generally, Pangandaran has a tropical climate with 2 seasons, the dry season (east season) and the rainy season (west season) which will directly affect the fishing season in Pangandaran waters. The east monsoon occurs from May to October, when the northeast monsoon is not choppy and the waters are calm, so fishing operations at sea are not disrupted. The west monsoon occurs from November to April, during the western monsoon, many fishermen do not conduct fishing operations at sea because of the sea conditions with large waves and relatively large rainfall (Firmansyah 2018).

3.2 Length-Frequency Distribution

One important component in the discussion of the stock is length-frequency data. This data can be used as an indication of detection as seen from the movement of the average length of white pomfret caught in a certain period of time. Total white pomfret taken in November 2018 - January 2019 is 1200 fish. A total of 351 in November, 529 in December and 320 in January. The maximum length of captured white pomfret is 36.8 cmTL and the minimum length of fish taken is 19.3 cmTL.

In November 2018 the maximum length of white pomfret caught was 36.8 cmTL and the minimum length of white pomfret captured was 19.3 cmTL. In December 2018 the maximum length of white pomfret caught was 35.3 cmTL and the minimum length of white pomfret captured was 20.0 cmTL. While in January 2019 the maximum length of white pomfret is 34.5 cmTL

and the minimum length of white pomfret is 21.0 cmTL. The average number of white pomfret is 529 fish at intervals of 24.1-25.6 cmTL, with a maximum length of 36.8 cmTL and the minimum length captured is 19.3 cmTL (Figure 2).



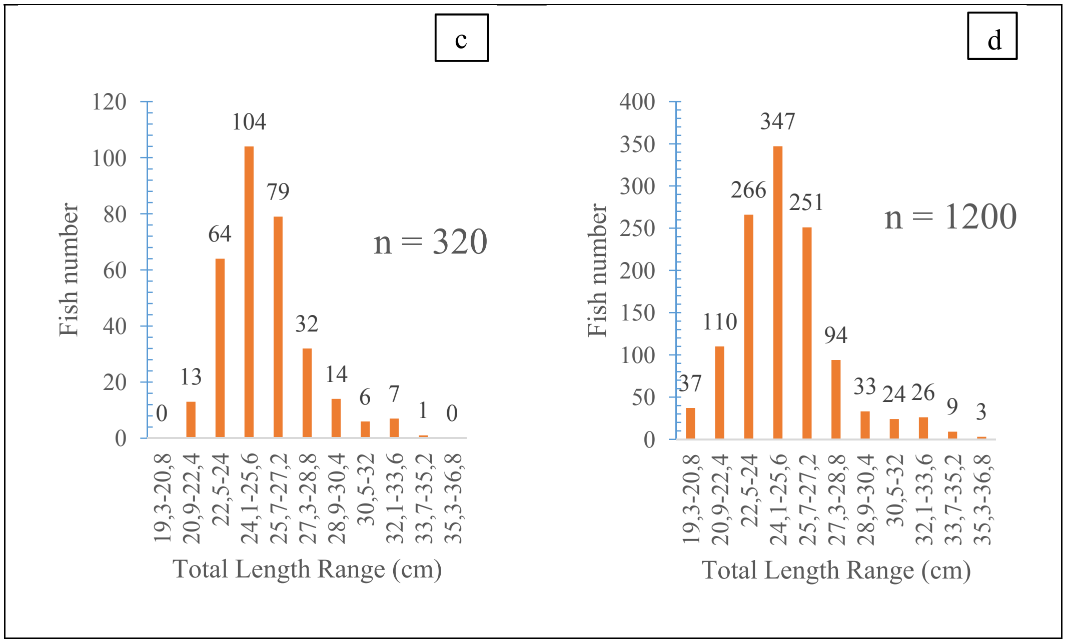


Fig. 2. Frequency Distribution of White Pomfret by Month
a) November 2018 b) December 2018 c) January 2019 d) Combined

The length-frequency obtained during the research ranged from 19.3 to 36.8 cmTL, the results of the analysis of the length-frequency can be seen in Figure 2. Based on Nasir's literature search (2016), in the Iraqi waters, the total length of white pomfret is smaller, which is between 6.5-35.0 cmTL and the most caught white pomfret is in size classes between 13.8 cmTL to 20, 8 cmTL. Meanwhile, according to Ghosh, et al. (2009) in Veraval waters, India, white pomfret caught in the size class between 6.0-38.9 cmTL with the most caught pomfret ranging from 22.5 cmTL to 26.5 cmTL.

The size of white pomfret caught in Tarakan waters, East Kalimantan ranges from 9.0-35.0 cmFL (Prihatiningsih, et al. 2015), in the Persian Gulf ranging from 9.5 to 31.2 cmFL (Amrollahi, et al. 2006), and in the Oman Sea ranged from 10.0 to 32.0 cmFL (Parsa, et al. 2017).

Based on research results, the minimum length of white pomfret caught is 19.3 cmTL. This value is much greater based on literature searches by Nasir (2016) compared to white pomfret in Iraqi waters by 6.5 cmTL. And greater than the minimum length of white pomfret in the waters of Veraval, India which is 6.0 cmTL (Ghosh, et al. 2009). Sofijianto, et al. (2016) stated that environmental conditions, differences in the size of fishing gear used, and variations in fishing intensity caused differences in the size of fish in Pangandaran Waters with research conducted in Iraqi Waters and in Veraval Waters, India.

Several factors can cause differences in the frequency of each size class. According to Effendie (1979) there are two factors, namely external factors and internal factors. External factors that can affect fish growth are food and temperature. While internal factors that influence fish growth include, sex, age, heredity, parasites, and disease.

3.3 Length-Weight Relationship

The results of the analysis of the relationship of body length of white pomfret obtained as many as 1200 tails can be seen in Table 1.

Table 1. Results of the Analysis of the Relationship Between Body Weight of White Pomfret in Pangandaran Waters November 2018 - January 2019

Parameter	Result
Fish number sample	1200
Total length range (cm)	19.3 – 36.8
Average of total length (cm)	25.1
Weight range (g)	100 - 798
Average of weight (g)	258
Log a	-0.9263
a	0.1184
Regression coefficient (b)	2.3719
Corelation coefficient (r)	0.8709
Regression equation	$W = 0{,}1184L^{2.3719}$
Test of T	$t_{count} > t_{table}$
Growth type	Negative Allometrics

Based on table 1, the white pomfret in Pangandaran Waters has a body length range of 19.3 - 36.8 cm and body weight of 100 - 789 g. The average body length of white pomfret is 25.1 cm and the average body weight of 258 g. Effendie (1997) states that the factors that cause the relationship of growth in the value of the length of the weight are internal (intrinsic) and external (extrinsic) factors. The internal factor is factors that are difficult to control, including heredity, age, sex, parasites and disease. While the main external factors affecting growth are food and water temperature.

The results of the regression coefficient b to 3 show that the value of b is different from 3, where based on the results of the t-test, tcount is greater than ttable. If the value of t is greater than t table then the value of b is different from 3, conversely, if the t count is smaller then the value of b is equal to 3 (Biring 2011). The results show that the exponential equation for the length-weight relationship of white pomfret is negative allometric which means

Length growth is faster than weight growth with a value of b is 2,371 and the equation is $W = 0{,}1184L^{2{,}371}$. These results are not much different from the research conducted by Prihatiningsih et al. (2015) that white pomfret in Tarakan, East Kalimantan is negative allometric, with a b value of 2.337 and the equation is $W = 0.1870L^{2{,}374}$. According to Effendie (1997), a fish that has a regression coefficient of less than 3 means that the length increase is faster than the weight gain. Fish growth is influenced by biological factors (gonad growth and sex), and their environment (food sufficiency and water conditions) (Nurhayati, et al. 2016)

The results of the analysis of the length relationship of white pomfret can be transformed into a length relationship curve of the white pomfret as seen in Figure 3.

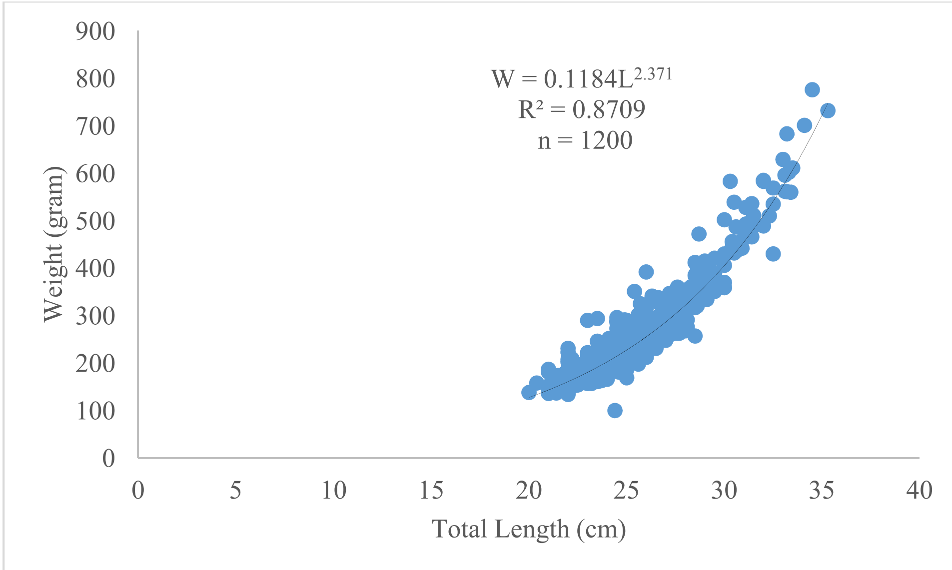


Fig. 3. Length-Weight Relationship Curves of White Pomfret in Pangandaran Waters November 2018 - January 2019

Based on the analysis, it was found that the correlation coefficient r of the relationship between the length of the weight of white pomfret, including a strong correlation that is equal to 0.8709. According to Prihatiningsih et al. (2015), white pomfret in Tarakan, East Kalimantan has a strong correlation coefficient with an r-value of 0.9160. This is in accordance with the opinion of Biring (2011) which states that if the value the correlation coefficient 0.70 - 0.89 indicates that there is a strong correlation between length and weight of fish, and what the value of the correlation coefficient is 0.40 - 0.69 indicating that there is a moderate correlation between length and weight of fish.

3.4 Age Groups

The average length of the cohort is a description of the age group of fish. Age can be determined from the length-frequency distribution through age group analysis because fish lengths of the same age tend to form a normal distribution. To represent age groups can be determined by grouping fish in length classes and using the mode of the class length. Fish of the same length come from the same birth. The size of the white pomfret is separated using the Bhattacharya method.

The Bhattacharya method can analyze the results of the separation of fish age groups using the help of ELEFAN (Electronic Lengths Frequency Analysis) contained in the FiSAT (FAO-ICLARM Fish Stock Assessment Tools) program. This method is done by identifying the number of normal curves contained in a length-frequency distribution curve obtained from sampling, because the basic principle of the method is based on the fact that in one cohort, the individuals will be spread following the normal distribution.

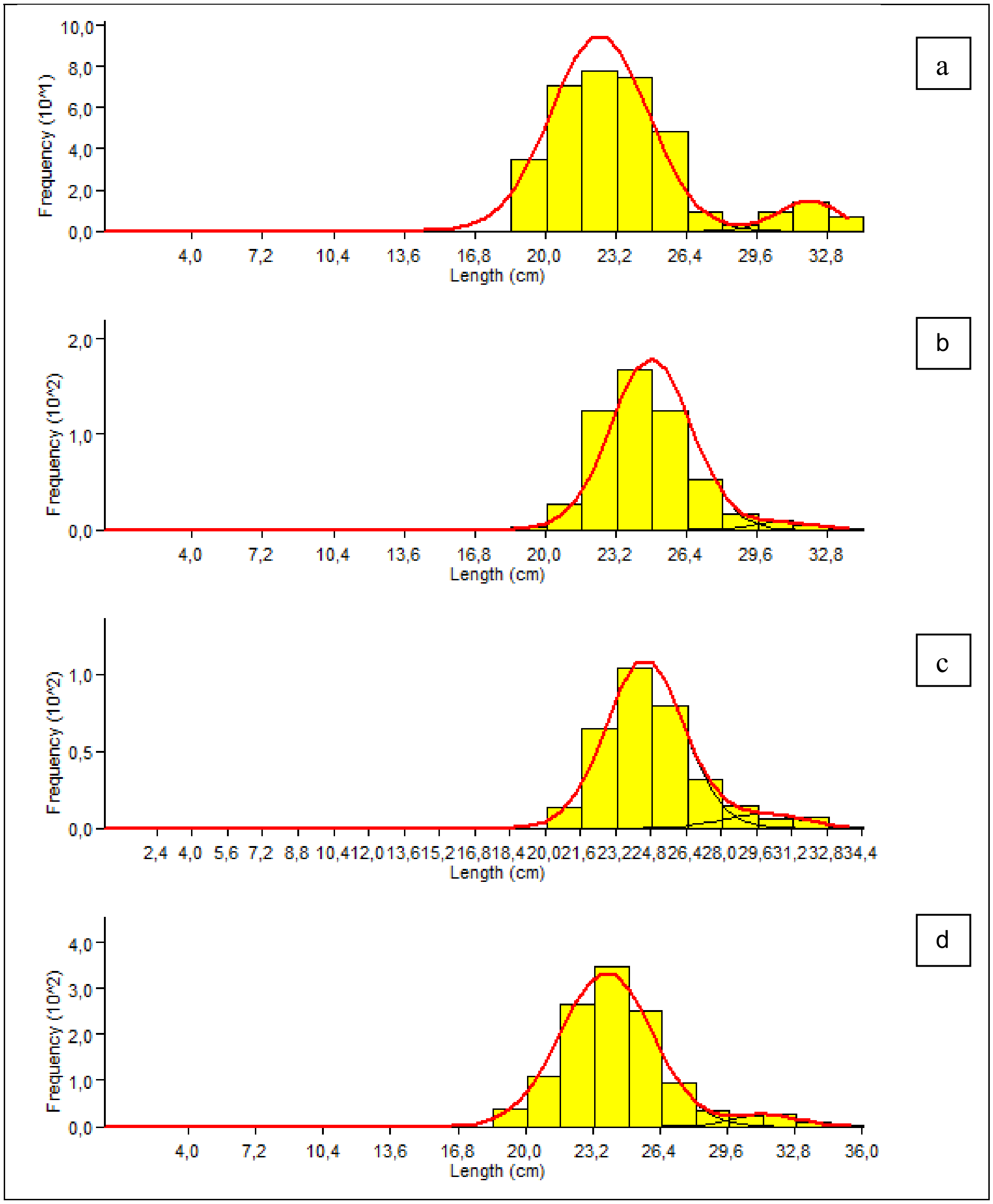


Fig. 4. White Pomfret Cohort by Month
a) November 2018 b) December 2018 c) January 2019 d) Combined

The results of the separation of age groups using the Bhattacharya method analyzed using the help of FiSAT II software showed that white pomfret in Pangandaran Waters has two age groups as shown in Figure 4.

Each sample taken during the study of white pomfret measured consisted of several groups of different lengths. As shown in Figure 4, in the data collection from November 2018 to January 2019 there were two-length groups. The analysis of the separation of length groups by the ELEFAN I method also provides information about the total population and the average length value of each size group. The following results of the analysis of the separation of size groups based on these values.

Table 2. Distribution of Length White Pomfret Groups

Month	Size Group	Average of Length (cmTL)	Sample
November 2018	1	22.5	329
	2	32.0	32
Desember 2018	1	24.9	516
	2	30.9	17
January 2019	1	24.5	301
	2	29.9	25
Combined	1	23.9	1149
	2	31.4	64

The first size group of white pomfret can be found in every observation, but for the second age group not found in every observation (Table 2). According to Prihatiningsih, et al. (2015), the difference in the distribution of this age group is thought to be due to the environmental conditions of the waters.

3.5 Estimation of Growth Parameters

Estimation of growth parameters is using the simplest method of estimating the Von Bertanlanffy equation, namely using the Ford Walford plot approach. Estimation of growth parameters is obtained by the ELEFAN I method which is processed using the FiSAT II Program. The results of the calculation of the growth rate of white pomfret using the ELEFAN I program obtained asymptotic length ($L\infty$) of 53.04 cmTL with a growth coefficient (K) value equal to 0.26. The tendency of uncertainty of the value of fish growth parameters is influenced by the composition of fish samples analyzed by the method or method used (Jamal, et al. 2011).

The $L\infty$ value obtained from the calculation is greater than that of white pomfret in Veraval Waters, India, which is 41.57 cmTL (Ghosh, et al. 2009). Whereas the value of K tends to be lower compared to research (Ghosh, et al. 2009) which is equal to 0.64 / year. For the value of t0 in this study obtained equal to zero, because according to Ahmad (2008) the age at the time of a fish measuring 0 cm is equal to zero. According to Aziz et al. (1992), differences in growth parameters ($L\infty$, K, t0) are caused by the difference in time, size of fish, season, fishing gear used and catching area at the time of sampling. In addition, according to Widodo (1998) differences in growth parameters are more influenced by the composition of fish samples by the method or method used. Therefore differences in the results of the growth parameter values carried out in the same or different locations are thought to be caused by differences in the time and method of sampling and the season of capture.

Table 3. Distribution of Length White Pomfret Groups

Location	$L\infty$	K	References
Tarakan, East Kalimantan	37.28	0.52	Prihatiningsih, *et al.* (2015)
Persian Gulf (Irak)	42.40	0.53	Mohamed (2008)
Persian Gulf (Iran)	33.90	0.55	Narges, *et al.* (2011)

Persian Gulf (Iran)	41.00	0.92	Parsamanesh (2001)
Oman Sea	32.55	0.30	Parsa, *et al.* (2017)
Veraval, India	41.57	0.64	Ghosh, *et al.* (2009)
Pangandaran	53.04	0.26	Present study

Table 3 shows the growth parameter values (L∞, and K) of white pomfret in various locations with different values. The difference in the value of growth parameters can be caused by 2 factors namely external and internal factors (Effendie 1997), external factors that can influence are the availability of food and temperature, while internal factors that can affect is heredity, parasites and disease. Therefore, variations in the values of L∞, and K in various regions are due to ecological differences, fish variability, and physiological differences.

Based on the analysis of the length-frequency data using the ELEFAN I method, the results as shown in the picture of the growth curve of Von Bertalanffy white pomfret (Figure 5).

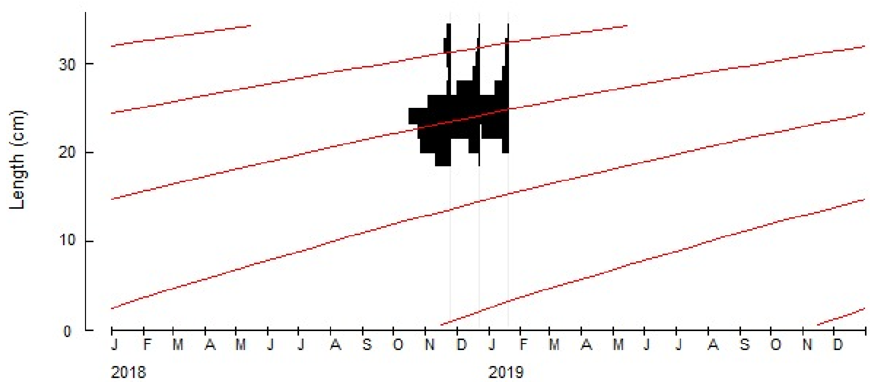


Fig. 5. Von Bertalanffy Growth Curve of White Pomfret in Pangandaran Waters November 2018 - January 2019

The cohort of the white pomfret will shift, which means with age, the size of the fish will increase. From the picture, it can be seen that there are shifts in the length size modes of white pomfret, which shifts to the right, Prihatiningsih, et al (2015) stated this shows the growth of white pomfret.

The growth equation value of white pomfret is $Lt = 53.04\ (1\text{-}e^{-0.26\ (t)})$. From these values, it can be made a relationship to the body length of white pomfret. Based on the results of the research, the relationship between length and age (Table 4) explains that white pomfret in Pangandaran Waters has an age range of 1.7 - 4.4 years.

Table 4. Distribution of Length White Pomfret Groups

Length (cm)	Age (year)
19.3	1.7398
21.0	1.9386
22.7	2.1483
24.4	2.3701
26.1	2.6055
27.8	2.8562
29.5	3.1244
31.2	3.4127
32.9	3.7243
34.6	4.0635
36.3	4.4335

The length-age relationship of white pomfret in table 4 can be transformed into the curve of the length-age relationship of white pomfret as shown in Figure 6.

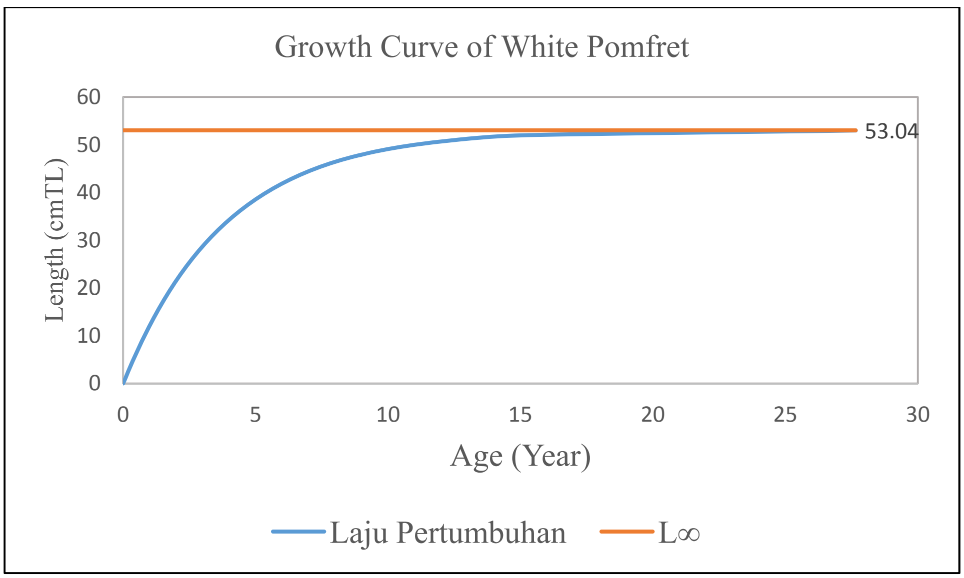


Fig. 6. Growth Curve of White Pomfret (*Pampus argenteus*) in Pangandaran Waters

The pictue above were the result of the FiSAT analysis, which consist of the fish age prediction to reach the asymptotic length. The growth of white pomfret is relatively fast at a young age and will slow down when entering old age to reach the asymptotic length. According to Fitrianingsih et al. (2015), this is because when fish reach adulthood, the energy obtained from food is used to replace and repair damaged body cells and are no longer used for growth. In addition, Biantoro (2014) states that fish experience relatively rapid growth at the age of 1-4 years, and tend to slow down when entering the age of 5.5 years. According to Armstrong et al., (2004) females in Southern cod stocks, inhabiting sea areas with temperatures reaching 16°C, can produce a substantial number of eggs at an early age due to rapid growth and early maturity. According to Rumondang (2016), fish will continue to experience length growth, even though the growth rate is relatively low even in adverse environmental conditions. An increase in length will generally continue even if the fish may be in a state of lack of food.

3.6 Mortality and Exploitation Rate

Based on the research results obtained a K value of 0.26 and an L∞ value of 53.04 cm which can be entered into Pauly's empirical formula for analyzing the estimated mortality and exploitation of white pomfret using an average temperature of 25oC. According to Fadika, et al. (2014) the average temperature in Pangandaran waters is 25oC throughout the year.

Table 5. Mortality and Exploitation Rate of White Pomfret

Location	M	F	Z	E	References
Tarakan, East Kalimantan	1.11	1.65	1.65	0.60	Prihatiningsih, *et al.* (2015)
Persian Gulf	0.58	1.49	2.07	0.72	Amrollahi, *et al.* (2006)
Oman Sea	0.75	0.78	1.55	0.51	Parsa, *et al.* (2017)
Veraval, India	1.20	2.11	3.11	0.64	Ghosh, *et al.* (2009)
Pangandaran	0.60	3.04	3.64	0.84	Present study

Table 5 shows the mortality rate and the exploitation rate of white pomfret from research results in various locations. According to Sofijianto, et al. (2016), differences in the results of estimated mortality rates and exploitation rates can be caused by differences in fishing locations, size representation of fish, and high fishing pressures on fish.

The results of the calculation of the estimated mortality rate of white pomfret in Pangandaran Waters with the help of FiSAT II software obtained natural Mortality (M), Capture Mortality (F) and Total Mortality (Z) respectively 0.60 / year, 3.04 / year and 3.64 / year. According to Kartini, et al. (2017), natural mortality is caused by several factors including disease, predation, stress, spawning, age, and food availability. As well as fishing mortality is a function of fishing effort which includes the type and fish number, the effectiveness of fishing gear, and the time of capture. Stock conditions with a catch mortality rate greater than the natural mortality rate indicate the symptoms of overexploitation, because capture mortality affects natural mortality.

Based on the analysis, the value of F> M is 3.04 / year. The magnitude of the mortality value of white pomfret fishing in Pangandaran waters is presumed to be due to the factor of catching that is done continuously. This is because when sampling from November 2018 to January 2019 is the season of white pomfret fishing in accordance with the statement of Nurhaeti (2002) where the peak season of catching white pomfret in the waters Pangandaran occurred in November. Therefore, in November in particular, the fishermen made this white pomfret the main target of fishing in Pangandaran waters.

The high rate of capture mortality and the decrease in natural mortality rate can indicate growth fishing which means that at least old fish because young fish do not have time to experience growth due to capture (Cia, et al. 2018). According to Sparre and Venema (1999), overfishing can disturb the fish growth rate due to most of large fish were caught during growht state, so in the future the ammount of fish will be reduce. Due to lack of the large fish number it will affected the breeding process, so does the new born fish.

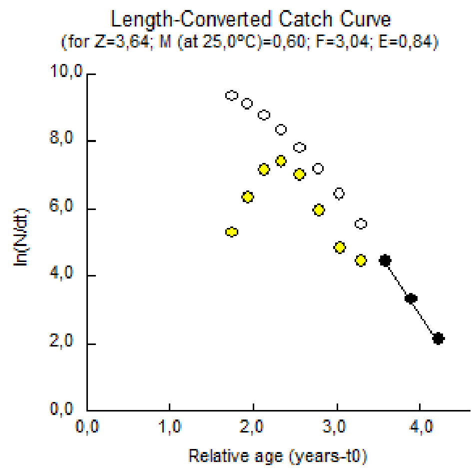


Fig. 7. Length-Converted Catch Curve of White Pomfret

The picture above shows the curve of white pomfret catches in estimating the total mortality of white pomfret. The empty circle is data that has not been fully recruited. The black circle is used in the calculation of the value of Z.

Based on the mortality rate due to capture (F) and the rate of exploitation (E), an E value of 0.84 is obtained. Gulland (1983) states that in an optimal stock, fish deaths due to fishing must be the same as natural death so it assumes a maximum sustainable exploitation rate equal to E = 0.5. This shows that the population of white pomfret in Pangandaran waters is higher than optimal so that it can be said that the population of white pomfret is overfishing and a better policy is needed in the management of white pomfret in this area. According to Fitrianingsih et al. (2015), arrest mortality will be even greater if the exploitation rate is higher. And the high rate of arrest mortality indicates overfishing (Widodo 2008).

The estimated value of exploitation rate (E) can be a rough description of the exploitation of white pomfret in Pangandaran Waters even though the E value obtained is relative so that it can be overestimated or underestimated (Setyawan, et al. 2018).

4. CONCLUSION

Based on the research that has been carried out, it can be concluded that:

1. The length-weight relationship of white pomfret in Pangandaran Waters is negative allometric following the equation $W = 0.1184L^{2,371}$.
2. Obtained 2 age groups with an average first age group of 23.9 cm and the second age group of 31.4 cm.
3. Analysis of population parameters obtained L∞ value of 53.4 cmTL and growth rate (K) of 0.26 / year with the equation $Lt = 53.04 (1\text{-}e^{-0.26\ (t)})$
4. Mortality due to capture (F) = 3.04 / year is greater than the natural mortality (M) = 0.60 / year and total mortality (Z) = 3.64 / year.
5. The exploitation rate (E) is 0.84, which means that the exploitation rate has exceeded its optimum value (E = 0.5).

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