The length-weight relationship of the bigeye scad (*Selar crumenophthalmus*) captured by purse seiner from FMA 716 of North Sulawesi seawaters:

A comparative study of the target species sizes on May and August 2022

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Abstract

As a small pelagic fish forming a shoal on coastal seawaters, bigeye scad (Selar crumenophthalmus Bloch 1793), having an important economic value, is frequently captured in the FMA 716 of North Sulawesi seawaters, notably by small fishing gears such as purse seines. The intensiveness captures of the fish may affect the sustainability and continuity of the species. The research aims at analyzing some biological reproduction aspects of bigeye scad based on 400 captured samples, every 200 tails on May 2022 on Agust 2022, taken at random from the purse seine capture which landed at the coastal fishing port of Tumumpa, Manado. Data are analyzed referring to some common formulas, such as the M/F ratio, W-L relationship (W = aLb, W = weight, g), L = length (cmFL), a and b constants, condition factor (K), length at first capture (Lc50%). The length at first maturity (Lm50%) refers to Chodrijah and Faizah (2018), i.e., 18.91 cmFL for males and 17.98 cmFL for females as references. The value of Lm50% was compared with that of Lc50% for determining their worthiness. In general, there were 400 fish samples of both fishing seasons with a total weight of 64,554 g, where the length and weight were 21.56 ± 0.12 cm and 161.39 ± 3.53 g on average, respectively, following the relation W = 0.0827 L3.5185 (r = 0.90; R = 81.0%). Of 400 samples, there were 176 males (44% of the total samples) with a weight of 25,234 g (39.1% of total weight), where its length and weight ranged 20.93 ± 0.15 cm and 143.38 ± 3.81 g in average respectively, following the relation W = 0.1486 L 3.0725 (r = 0.86; R = 73.3%);. While the rest consisted of 224 females (56% of total samples) with the weight of 39,320 g (60.9% of total weight), where the length and weight ranged from 22.05 ± 0.15 cm and 175.54 ± 4.80 g in average respectively, following the relation W = 0.0626 L 3.7273 (r = 0.89; R = 79.3%). The sex and weight ratios were 1:1.27 and 1:1.56, respectively. In May, there were 200 samples with a weight of 33,439 g (51.8% of total weight) consisting of 96 males (48%) and 104 females (52%), with the weight of 42.4% and 57.6% respectively. For 96 males, the length and weight of males ranged from 20.94 ± 0.22 cm to 147.79 ± 5.52 g in average respectively, following the relation W = 0.1495 L 3.0770 (r = 0.86; R = 74.6%); while for 104 females, the length and weight of females ranged 22.25 ± 0.21 cm and 185.11 ± 6.89 g in average respectively, following the relation W = 0.0567 L 3.8076 (r = 0.90; R = 80.3%). The sex and weight ratios were 1:1.08 and 1:1.36, respectively. Without regard to gender, the length and weight ranged 21.62 ± 0.17 cm and 167.20 ± 5.15 g on average, following the relation W = 0.0865 L 3.4926 (r = 0.91; R = 82.4%). In August, there were 200 samples with a weight of 31,115 g (48.2% of total weight) consisting of 80 males (40%) and 120 females (60%), with the weights of 35.5% and 64.5% respectively. For 80 males, the length and weight ranged 20.91 ± 0.20 cm and 138.08 ± 4.93 g in average respectively, following the relation W = 0.1519 L 3.0455 (r = 0.88; R = 76.9%); while for 104 females, the length and weight ranged 21.88 ± 0.20 cm and 167.24 ± 6.34 g in average respectively, following the relation W = 0.0791 L3.5471 (r = 0.88; R = 78.0%). The sex and weight ratios were 1:1.50 and 1:1.82, respectively. Without regard to gender, the length and weight ranged 21.49 ± 0.16 cm and 155.58 ± 4.71 g in average respectively, following the relation W = 0.0838 L 3.5010 (r = 0.90; R = 81.2%). By using Lm50% reference 18.91 cm and Lc 18.33 cm, it was found that 69.0% of 200 fish samples is classified as the bigeye scad species, which are still worthy captures, with K ranges 1.82 - 2.73 (2.26 ± 0.02). Using Lm reference 18.91 cm and Lc 19.12 cm, it found that 70.0% of 200 fish sampels is classified that the bigeye scad species are ppropriate to catch. In this case, it means that the bigeye scad captured at two different fishing seasons from the FMA 716 of the North Sulawesi seawaters are still within a worthy size range to catch. The use of the given mesh size range of the webbing is highly effective in catching these fish.
Keywords: bigeye scad, length-weight relationship, FMA 716, fish conservation

INTRODUCTION

Categorized as pelagic fish economically important and moderately cheap and loved by the community; the fish, bigeye scad (*Selar crumenophthalmus*) (Fig. 01) that stocks are always available all year round, live in forming a *shoal*, and frequently associated with the presence of coral reefs on the sea floor of less than 170 m of depth (Djuhanda *in* Hidayat, 2005; White *et al*., 2013; Fauzi *et al*., 2018). Referred to Widodo *et al*., (1993), the fish with total length can reach 23 cm or 20 cm in general average, is classified into class *Actinopterygii*, family *Carangidae*, and genus *Selar*. This voracious carnivore species actively search at nightday the larvaes of the *family Clupeidae, Balastidae, Cephalopoda, Serranidae,* and crabs as foods

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(Kimura, 2011). The high demands on the fishes increase the catching activity of the spesies, and in turn, it will interfere

Fig. 01. Bigeye scad (*Selar crumenophthalmus*, Bloch 1793)

the fish stock sustainability, notably in WPP 716 coastal seawaters as a whole. The goal is aimed at analyzing some biological reproduction aspects of the bigeye scad (*Selar crumenophthalmus*) captured by purse seiners from WPP 716 of North Sulawesi seawaters.

METHODS

The research applied a descriptive-quantitative method by using some common outils and equipment to measure length and weight size of the target fish, bigeye scad (*Selar crumenophthalmus*), captured **at** two different fishing seasons by purse seiners from FMA 716 of North Sulawesi seawaters which unloaded their catch at the fish auction of the coastal fishing port of Tumumpa-Manado. A total of 400 tails of bigeye scad are selected by a *systematic random sampling*. Firstly, 200 tails on May 2022 (representing a 1st transition season, April to May 2022) and 200 tails on August 2022 (representing a dry season, June to September 2022). Sex ratios, weight ratios, length and weight structures and L-W relations, condition factors, and the worthy size of the species, are calculated by applying some formulas commonly used to the biological reproduction aspects, which are briefly described below.

Sex and weight ratio

Fish gender is determined by a fish stomac surgery. The calculation of sex ratio of the captured species is to show the fish population steadiness between male and female of captured fish at certain period (Effendie, 1979). The sex and weight ratio can also be used to assess the success of spawning by comparing the number or weight of male and female fishes in certain seawaters, to be used on production, recruitments, and conservation of the fish resources. Sex ratio (SR) is a ratio between the number of male and the number of female fishes. Statitically, the sex ratio is expected to have a ratio 1:1. Weight ratio is the ratio between the total weights of all male fishes and the total weights of all female fishes.

Fish length - weight structure

Fish length and weight structure analysis is intended to determine the frequency distribution of captured fish of two different fishing sesons based on the measurement of weight (g) anf fork length (cm) of captured fish. The frequency distribution graph consists of the percentage of captured fish plotted on y-axis and class interval (length or weight of captured fish) plotted on x-axis (Steel and Torrie, 1980; Walpole, 1995).

L-W relationship

The length of fish size samples is determined by using the ruler of 30 cm (0.1 mm) of length, while the weight by using the electronic kitchenscale of 500 g (0.1 g). All data is used to assess the fish growth. The growth is the changement of both length and weight of a living organisms in certain period of time (Erna, 1996). Physically, the growth is expressed by the

changement of number or size cells forming fish body tissues in a certain period of time and measured then in length and weight units (Rahardjo, 2011). The research is to assess the L-W relationship and the distribution of their physical body size which is very important to predict the physical growth model of target fish in certain fishing seasons (Bayliff, 1966 *in*Omar, 2012).

According to Ricker (1975) *in* Effendie (1979) and Omar (2012), the legth and weight relationship is expressed as $W = aL^b$, where W is weight (g), L is *fork length* (cm), a and b are growth coefficients, that can be expressed as $\log W = \log a + b \log L$, where $(\log W) = Y$ and $(b \log L) = X$, refferring to a simple linear regression $Y = a + bX$, a and b are contants and r (coefficient of regression) are calculated using a common formula. After using *t-test students* on b value (Everhart and Youngs, 1981), there will be found three possible types of fish growth, i.e: if $b = 3$, means fish growth is a isometric (increasing in fish length is followed by increasing in weight); if $b < 3$, means fish growth is a negative allometric (increasing in fish length is faster than increasing in weight); and if $b > 3$, means fish growth is a positive allometric (increasing in fish length is slower than increasing in weight). The above formulas are also applied to each season and to each gender. The L-W relationship is also influenced by gender, maturity level, season, and fullness level of stomach (Hasnia, 1997).

Condition factor

Condition factor (K) is a non-invasive assessment tool for determining whether the fish are properly nourished or not. Based on the L-W relationship, condition factor is expressed as a numerical value of K. The condition factor of a fish reflects physical and biological circumstances and fluctuations by interaction among feeding conditions, parasitic infections and physiological factors (Le Cren 1951). The study of the fish condition factor may be suposed as a physical study of external condition of fish body whether the body is fatness or flatness for the role of seawater conditions as the environment where the fish naturally live and grow.

There are two ways to compute a condition factor. Firstly, according to Htun-Han (1978), by using a Fulton's condition factor, $K = 100WL^{-3}$ where W is a given weight of fish (g), L is a given length of fish (cmFL). This Fulton's condition factor (K) is intended for the fishes having an isometric growth type ($b = 3$) (Okgerman, 2005), with K varies 0.5 to 2.0. Secondly; according to Effendie (1979), by using a relative condition factor, $K_n = 100\ W/W'$ where W is a given weight (g), W' ($= aL^b$) is an estimation weight (g) with L is length of fish (cmFL), while a and b are constants. If K_n ranges from 1.0 to 2.0, the fish is categorized as a less flattened fish, and if K_n ranges from 2.0 to 4.0 means a quite flattened fish (Vakily *et al*., 1986). The condition factor is closely related to the seawater fertility. If $K < 100$ means the fish population lives in a bad fertile seawater; conversely, if $K > 100$ the fish population lives in a very good fertile seawater (Anderson and Newmann, 1996).

Length at first maturity ($L_m50\%$)

Data of the length at first maturity (**$L_m50\%$**) of bigeye scad (*Selar crumenopththalmus*) is obtained, as a reference, from the precedent research carried out by Muharam, Kantun and Moka (2020) on 2,352 samples of bigeye scad (1,151 males and 1,201 females) captured from WPP 716 of (North) Gorontalo seawaters unloaded on Kwandang national fishing port from March to May 2020. They found out **L_m 50%** at **18.91 cmFL** for male and **17.98 cmFL** for female. The taking of this **$L_m50\%$** as reference was based on the same Fishery Management Area (FMA) i.e. WPP 716. The $L_m50\%$ value means that all captured bigeye scads should have a fork length of more than 18,91 cm for male and more than 17.98 cm for female.

Length at first capture ($L_C50\%$)

The determinaton of the length at first capture ($L_C50\%$) is carried out by forming a graph

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of the relationship between the fish size (sb-x) and the cumulative frequency of captured fish (sb-y), resulting a S-curve. Furhermore, the catches are classified into two groupes based on their length size to find: worth capture and unworth capture (Dewanti, 2018). The length at first capture ($L_C50\%$) or worth capture is absolutely needed for predicting the length at first maturity L_m ($L_m50\%$). According to Atikasari (2021), there are two situations relating to the size of captured fish i.e. unworthy captured size ($L_c50\% < L_m50\%$) and worthy size of captured fish ($L_c50\% > L_m50\%$), with the utilization level is distinguished by two ways of computation: (a) unworthy size of captured fish (%) = (Nbr. of Lc < Lm) / total captures) and (b) unworthy size of captured fish (%) = (Nbr. of Lc > Lm) / total captures). In other words, an eco-friendly fishing gear is a fishing gear being capable to capture a target fish of target when the length at first capture ($L_c50\%$) is greater than the length at first maturity ($L_m50\%$).

DISCUSSION

Coastal fishing port of Tumumpa-Manado

Before 2005, the fish landing place (PPI, type D), was builded along the river side of Kuala Jengki, close to the traditional market 'Bersehati' of Manado. After that time, this place was replaced to Tumumpa Dua village of Tuminting District of Manado City, and their status became a coastal fishing port (Tipe C) refers to the Maritime and Fishery Ministry's Decision No. Kep. 10/Men/2005 which is now under-administered by Regional Technical Implementation Unit of Marine and Fisheries Service of the Maritime and Fishery Ministry.

RTIU (2022) reportewd that at least 135 purse seiner fishing vessels using this coastal fishing port as their fishing base for various sizes of gross tonnage (GT), namely, 5.2% of ≤ 10 - 20 GT, 62.2% of 20-30 GT, 31.1% of > 30 GT), and others (1.5%) of < 10 GT with the widths varying from 4,5 m to 5,5 m in average, which captured the fishes at Fishery Management Area (FMA) 716, situated around the north of Manado and Amurang, and Siau and Talaud archipelago of the Celebes Sea. The captures are generally dominated by skipjacks (*Katsuwonus pelamis*), *Decapterus* sp., , *Auxis* sp. *Euthinnus* sp., *Selar* sp., and *Sardine* sp. baby or little tuna, and sometimes tunas of modeste sizes which were accidentally entering the webbing.

Length-weight size features of samples

Table 1 briefly presented some statistic parameters of 400 tail samples of bigeye scad captured by different sizes of purse seiners at two different fishing seasons from FMA 716 of North Sulawesi seawaters, which consisting of 200 tails on May 2022 and 200 tails on August 2022, by weight (W), length (L), gender, and fishing season. The grand total of weight for 400 sample was 64,554 g, with the length size (in cmFL) and weight size (in g) were 21.56 cm (with s ± 0.12 cm) and 161.39 g (± 3.53 g) in average respectively. Table 2 showed that the average weight per cmFL was equivalent to 7.43 g (± 0.13 g).

On May 2022 (Table1) , the weight of 200 samples (50% of grand samples) was 33,439 g (51.8% of grand total weight), they had the average length and weight of 21.62 cm (± 0.17 cm) and 167.20 g (± 5.15 g) respectively, where 1 cm in average length was equivalent to 7.67 g (± 0.18 g) in average weight (Table 2) While on August 2022 (Table 1), the weight of 200 samples (50% of grand samples) was 31,115 g (48.2% of grand total weight), they had the average length and weight of 21.49 cm (± 0.16 cm) and 155.58 g (± 4.71 g) respectively, where 1 cm in average length was equivalent to 7.19 g (± 0.17 g) in average weight. From these two facts, with the same number of samples (each 200 tails of samples), the average size of weight on May 2022 was heavier than 0.49 g than on Agust 2022. Or, there was a significantly difference in average size of weight between May 2022 and August 2022 where on May 2022 was greater than on August 2022 (Table 2).

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Table 1. Length and weight structure of bigeye scad (_Selar crumenophthalmus_) captured by purse seiners from FMA 716 by gender and fishing season

Gender	Season	n (tails)	Length (cmFL)		Weight (g)			
			L ± sd	Range	W ± sd	Range	Total	%
May	Male	96	20.94 ± 0.22	20.72 - 21.16	147.79 ± 5.52	142,27 - 153.31	14,188	48.0
	Female	104	22.25 ± 0.21	22.04 - 22.46	185.11 ± 6.89	178.22 - 192.00	19,251	52.0
Sub-total		200	21.62 ± 0.17	21.45 - 21.79	167.20 ± 5.15	162.05 - 172.35	33,439	50.0
August	Male	80	20.91 ± 0.20	20.71 - 21.11	138.08 ± 4.93	133.15 - 143.01	11,046	40.0
	Female	120	21.88 ± 0.20	21.68 - 22.08	167.24 ± 6.34	160.90 - 173.58	20,069	60.0
Sub-total		200	21.49 ± 0.16	21.33 - 21.65	155.58 ± 4.71	150.87 - 160.29	31,115	50.0
Male	May	96	20.94 ± 0.22	20.72 - 21.16	147.79 ± 5.52	142,27 - 153.31	14,188	48.0
	August	80	20.91 ± 0.20	20.71 - 21.11	138.08 ± 4.93	133.15 - 143.01	11,046	52.0
Total		176	20.93 ± 0.15	20.78 - 21.08	143.38 ± 3.81	139.57 - 147.19	25,234	44.0
Female	May	104	22.25 ± 0.21	22.04 - 22.46	185.11 ± 6.89	178.22 - 192.00	19,251	54.55
	August	120	21.88 ± 0.20	21.68 - 22.08	167.24 ± 6.34	160.90 - 173.58	20,069	45.45
Total		224	22.05 ± 0.15	21.90 - 22.20	175.54 ± 4.80	170.74 - 180.34	39,320	56.0
GRAND TOTAL		400	21.56 ± 0.12	21.44 - 21.68	161.39 ± 3.53	157.86 - 164.92	64,554	100

Source: Original research data (2022)

Furthermore, the gender analysis related to average lenght and weight, showed that there were 176 males (39.1% of samples) with 44% of grand total weight and 224 females (60.9% of samples) with 56% of grand total weight. For males, the average size of length and weight were 20.93 cm (± 0.15 cm) and 143.38 g (± 3.81 g) respectively, which meant that every 1 cm of length size was equivalent to 6.82 g (± 0.14 g) of weight size in average (Table 1 and 2). For females, the average size of length and weight were 22.05 cm (± 0.15 cm) and 175.54 g (± 4.80 g) respectively, which meant that every 1 cm of length size was equal to 7.91 g (± 0.17 g) of weight size in average (Table 2). Or, in the simple words, the female weight size was heavier than 1.09 g in average than the male for every 1 cm of length size, while the female length size was longer than 1.12 cm in average than the male. The female weight size was heavier than 32.16 g in average than the male. By these facts, the difference of every 1 cm of the length size of male will be equivalent to the increasing of 28.71 g in average weight size of female. With 200 tails of samples taken from each fishing season, the average size of length and weight on May 2022 were greater than those on August 2022.

From 200 samples taken on May 2022, we found 96 males (52% of 200 samples with 42.4% of the total weight) and 104 females (48% of 200 samples with 57.6% of its total weight of 33,439 g). For 96 males, the average size of length and weight were 20.94 cm (± 0.22 cm) and 147.79 g (± 5.52 g) respectively, which meant that every 1 cm of length size was equivalent to 7.02 g (± 0.20 g) of weight size in average (Table 1 and 2); For females, the average size of length and weight were 21.88 cm (± 0.20 cm) and 167.24 g (± 6.34 g) respectively, which meant that every 1 cm of length size was equivalent to 7.59 g (± 0.25 g) of weight size in average (Table 1, 2). Or, in the simple words, the female weight size was heavier than 1.25 g in average than the male for every 1 cm of length size, while the female length size was longer than 1.31 cm in average than the male. The female weight size was heavier than 37.16 g in average than the male. By these facts, the difference of every 1 cm of the length size of male will be equivalent to the increasing of 28.49 g in average weight size of female.

From 200 samples on August 2022, we found 80 males (40% of 200 samples with 35,5% of the total weight he total weight) and 120 females (60% of 200 samples with 64.5% of its total weight of 31,115 g). For 80 males, the average size of length and weight were 20.91 cm (± 0.20 cm) and 138.08 g (± 4.93 g) respectively; which meant that every 1 cm of length size was equivalent to 6.58 g (± 0.18 g) of weight size in average (Table 1 and 2). For females, the average size of length and weight were 21.88 cm (± 0.20 cm) and 167.24 g (± 6.34 g) respectively, which meant that every 1 cm of length size was equivalent to 7.59 g (± 0.23 g) of weight size in average (Table 1, 2). From the above cases, we can say that the female weight

size was heavier than 1.01 g in average than the male for every 1 cm of length size, while the female length size was longer than 0.97 cm in average than the male. The female weight size was heavier than 29.16 g in average than the male. By existing data, the difference of every 1 cm of the length size of male will be equivalent to the increasing of 30.06 g in average weight size of female.

Table 2. Average weight of each cmFL of bigeye scad (*Selar crumenophthalmus*) captured by purse seiners in FMA 716 by gender and fishing season

Season	Gender	n	(W/cmFL) ± s (g)	Range (g)
Grouped	All	400	7.43 ± 0.13	7.30 - 7.56
	Male	176	6.82 ± 0.14	6.68 - 6.96
	Female	224	7.91 ± 0.17	7.74 - 8.08
May	All	200	7.67 ± 0.18	7.49 - 7.85
	Male	96	7.02 ± 0.20	6.80 - 7.22
	Female	104	8.27 ± 0.25	8.02 - 8.52
August	All	200	7.19 ± 0.17	7.02 - 7.36
	Male	80	6.58 ± 0.18	6.40 - 6.76
	Female	120	7.59 ± 0.23	7.36 - 7.82

Sex ratio of captured fish on May and August 2022

Fauzi, Setyobudiandi and Suman (2018) found that the sex ratio of the species target was 1:1.05 captured on Natuna seawaters, but Chodrijah and Faizah (2016) found that the capture in FMA 716 which landed at national fishing port (PPN) of Kwandang, North Gorontalo on February-November 2016, had a sex ratio of 1:1.2. This value was not too different with which found that by Zamroni and Suwarso (2011) in Banda seawaters i.e. 1:1.44, and by Syam *et al.* (2003) in Central and North Molucca seawaters, and Iwai (1996) in Hawai seawaters. This researh showed the sex ratio of 1:1.08 on May 2022 and 1:1.50 on August 2022 (Table 3). The first sex ratio of 1:1.08 on May 2022, was very close to the sex ratio of 1:1.05 found by Fauzi, Setyobudiandi and Suman (2018). Overall, the sex ratio of combined fishing seasons, May and August 2022, was 1: 1.27; unfortunately, however, the *chi-square test* (χ^2) requires statistically, the sex ratio must be 1:1 between male and female fish.

By using α 5% for X^2 test on each 200 bigeye scad samples both on May 2022 (96 males, 104 females) and on August 2022 (80 males, 120 females), thus, the grand total of 400 tails (176 males, 224 females), it yielded that $X^2_{corrected}$ (2.283) < $X^2_{0.95}$ (3.841), which meant that the number of capture was statistically proportional both in gender and in fishing season, with C (coef. of contigency) 0.075 and r (correlation among attributes) 0.076. *The Levene's test of equality of variances* showed that the average size of length was from the same varian; conversely, however, it was not for the average size of weight.

Table 3. Sex and weight ratio of bigeye scad captured by purse seiners from FMA 716 of North Sulawesi seawaters on May and August 2022

Parameter	May 2022			August 2022			Grouped		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Nbr. of samples (n)	96	104	200	80	120	200	176	224	400
(%)	48.0	52.0	100	40.0	60.0	100	44.0	56.0	100
Sex ratio (M/F)	1 : 1.08			1 : 1.50			1 : 1.27		
Weight (gram)	14,188	19,251	33,439	11,046	20,069	31,115	25,234	39,320	64,554
(%)	42.4	57.6	100	35.5	64.5	100	39.1	60.9	100
Weight ratio (M/F)	1 : 1.36			1 : 1.82			1 : 1.56		
Conversion factor*	1.26			1.21			1.23		

Conversion factor from sex ratio to weight ratio (Ex: 1.08 in SR_F = 1.36 in WR_F, 1 SR_F = 1.26 WR_F)

The comparison between the genders in nature, male and female, is expectedly ideal or in

a equal condition. i.e. 1:1, in order to the fish stocks have a chance to reproduce higher for sustainining their life in nature. In other words, the number of female must be at least greater than male (Effendie, 1977). Furhermore, Senen *et al.* (2011) affirmed that the equal number between males and females indicates that one male fish will fertilize one female fish. Data above showed that the sex ratio of 1:1.08 on May 2022 is rather proportional compared to 1:1.50 on August 2022, however, the secondly is more adequate because one male fish has a chance to fertilize more than 1 female or 10 males can fertilize 15 females. The comparison of gender for the fishes living in shoals can reach an optimal condition if the female number is greater quantity than males to assure a process recruitment can continue for their sustainability of life in a population.

Regarding the two fishing season situations, the sex ratio will be different from time to time and from one fishing season to another one. It might be influenced by the uncertainty of gender type to catch, and also the ignorance of the richness of these aquatic resources where fishes live and reproduce. The higher sex ratio resulted the higher weight ratio and the lower conversion factor from sex ratio to weight ratio. The sex ratio and weight ratio on August (1:1.50 1and 1:1.82 respectively) were higher than those on May (1:1.08 1and 1:1.36 respectively), which yielded the conversion factor was lower on August than other on May (1.21and 1.25 respectively). Or, more the number of female fishes, more their weights and lower the conservation factor between them. Totally, on May and August 2022, the sex ratio was 1:1.27 and weight ratio 1:1.56 with the conversion factor was 1.22.

Under the Table 4, we clearly saw that on the dependent variable L (cmFL), there was a significant difference (0.00 < 0.05) between gender (G), male and female, in average size of length; conversely, we cannot find it (0.062 > 0.05) between fishing season (S), May and August, and also between the interraction of gender and fishing season (GS) (0.116 > 0.005). On the dependent variable W (g), we found, statistically, a significant difference between gender (0.00 < 0.05) and between fishing season (0.00 < 0.05) in average size of weight; conversely, there was no, statistically, the difference (0.202 > 0.05) between the interraction of gender and fishing season in average size of weight.

Table 4. Relationship among gender, season and its interaction on L-W size of bigeye scad captured by purse seiners from FMA 716 North Sulawesi seawaters on May dan August 2022

Source of variation	df	Length (cmL)				Weight (g)			
		SS	MS	F_c	Sig.	SS	MS	F_c	**Sig.**
Intercept	1	180,895.7	180,895.7	161,185.9	0.000	9,967,292.5	9,967,292.5	10,009.5	0.000
Gender (G)	1	126.7	126.7	112.9	0.000	108,152.5	108,152.5	108.6	0.000
Season (S)	1	3.9	3.9	3.5	0.062*	18,614.8	18,614.8	18.7	0.000
GS	1	2.8	2.8	2.5	0.116*	1,624.4	1,624.4	1.6	0.202*
Std. error	396	444.4	1.1			394,331.2	995.8		

W-L relationship of bigeye scad by fishing season and gendre

Table 5 below statistically showed the relationship of L-W of bigeye scad captured by purse seiners from FMA 716 of Norh Sulawesi seawaters by gender and by fishing season. The table showed that all b coefficients have a value of greater than 3 (b > 3) varying from 3.0473 (male fishes on August) to 3.8088 (female fishes on May). The b coefficients of female fish are 3.8088 on May and 3.5485 on August, and 3.5239 for both seasons, where b of 3.7287 for female and of 3.0742 for male fishe; while for male fish, b of 3.0785 on May and 3.0473 on August. By using α 5% (0.05), it resulted that all L-W relationship has a high significative correlation (0.00 < 0.05, r ≈ 1) with r 0.86 on May and 0.88 on August for male fish; while for female fishes, r 0.90 on May and 0.88 on August. In both fishing seasons, we found r 0.86 for male and 0.89 for female fish and r 0.89 for both genders.

T-student test of 95% level of convidence for b coefficient on $W = aL^b$, resulted that we have to accept that $b \neq 3$, means, the fishes have a positive allometric growth where the increasing in fish weight is followed by the increasing in the fish length for both fishing seasons and genders. Table 4 showed us all b coefficients, both on gender (male and female fish) and on fishing season (May and August 2022), and also without taking into consideration the gender and the fishing season, all have $b > 3$ which giving the meaning that all the fish samples have the growth type classified positive allometric.

Table 5. W-L relationship of bigeye scad captured from FMA 716 of North Sulawesi seawaters by gender and fishing season

| Fishing season | Gender | n | Variable | Unstandardized Coef. | | $t_{(\alpha/2)}$ | Sig. | r | R^2 | Regression equation |
				B	Std. Error					
May + August	M+F	400	(Constant)	-2.4942	0.114	-21.951	0.000	0.900	0.810	Y = -2.4942 + 3.5198 X
			Length	3.5198	0.085	41.297	0.000			$W = 0.0826 \, L^{3.5198}$
	Male	176	(Constant)	-1.9087	0.186	-10.288	0.000	0.856	0.732	Y = -1.9087 + 3.0742 X
			Length	3.0742	0.141	21.878	0.000			$W = 0.1483 \, L^{3.0742}$
	Female	224	(Constant)	-2.7724	0.172	-16.135	0.000	0.890	0.792	Y = -2.7724+ 3.7287 X
			Length	3.7287	0.128	29.144	0.000			$W = 0.0625 \, L^{3.7287}$
May	M+F	200	(Constant)	-2.4491	0.153	-16.007	0.000	0.908	0.823	Y = -2.4491+3.4940 X
			Length	3.4940	0.115	30.472	0.000			$W = 0.0864 \, L^{3.4940}$
	Male	96	(Constant)	-1.9027	0.245	-7.782	0.000	0.864	0.744	Y = -1.9027+ 3.0785 X
			Length	3.0785	0.185	16.627	0.000			$W = 0.1492 \, L^{3.0785}$
	Female	104	(Constant)	-2.8711	0.252	-11.380	0.000	0.896	0.800	Y = -2.8711+ 3.8088 X
			Length	3.8088	0.187	20.331	0.000			$W = 0.0566 \, L^{3.8088}$
August	M+F	200	(Constant)	-2.4815	0.159	-15.561	0.000	0.901	0.811	Y = -2.4815+ 3.5023 X
			Length	3.5023	0.120	29.252	0.000			$W = 0.0836 \, L^{3.5023}$
	Male	80	(Constant)	-1.8873	0.249	-7.571	0.000	0.877	0.767	Y = -1.8873+ 3.0473 X
			Length	3.0473	0.189	16.137	0.000			$W = 0.1515 \, L^{3.0473}$
	Female	120	(Constant)	-2.5391	0.232	-10.941	0.000	0.883	0.779	Y = -2.5391+ 3.5485 X
			Length	3.5485	0.173	20.484	0.000			$W = 0.0789 \, L^{3.5485}$

Chodrijah and Faizah (2018) also found in FMA 716 of Kwandang (North Gorontalo) seawaters that bigeye scad (*Selar crumenophthalmus*); however, some researcher found different results. For exemple, Siwat *et al.*(2016), confirmed that bigeye scad had a negative allometric growth captured from FMA 712 of Semarang seawaters, a part of Java Sea, while Barr *et al.*, (2016) found that the sepecies had a positive isometric growth in the Gulf of Manzanillo. AGUSTA LEONI ELFRIDA PURWASIH*, SURADI WIJAYA SAPUTRA, dan WIWIET TEGUH TAUFANI Menurut Tesch *dalam* ElHaweet (2013), variasi nilai b dapat disebabkan oleh beberapa faktor, seperti fase pertumbuhan, dampak musim, kisaran ukuran panjang, faktor kondisi relatif dan selektifitas ukuran tangkap. Kemudian Damora & Wagiyo (2012) menambahkan perbedaan nilai b pada hubungan panjang berat menunjukkan pertumbuhan yang bersifat relatif, artinya dapat berubah menurut waktu. Jenning *et al*. (2001), mengemukakan secara umum, nilai b tergantung pada kondisi fisiologis dan lingkungan seperti: suhu, pH, salinitas, letak geografis dan teknik sampling. Froese, (2006) menyatakan kondisi biologis seperti perkembangan gonad dan ketersediaan makanan dapat mempengaruhi nilai b.

L-W size structures of bigeye scad captured on both fishing seasons

Figure 2 described the size structures of fish length (cmFL) and fish weight (g) of the 400 samples, where 83.8% of fishes captured at the length of 20.1 - 23.2 cm, consisting of 27.8% of fishes had the length of 21.7 - 22.4 cm, 23.3% of 20.9 - 21.6 cm, 18.5% of 20.1 - 20.8 cm and 14.2% of 22.5 - 23.2 cm; the rests (16.2%) captured at other length groupes. Then, 76.7% of weight is grouped in 121 - 200 g, distributing in 26.8% of 121 - 140 g, 19.5% of 141 - 160 g, and 15.5% of 181 - 200 g, and 14.9% of 201 - 280 g); the rests (23.3%) captured at other weight
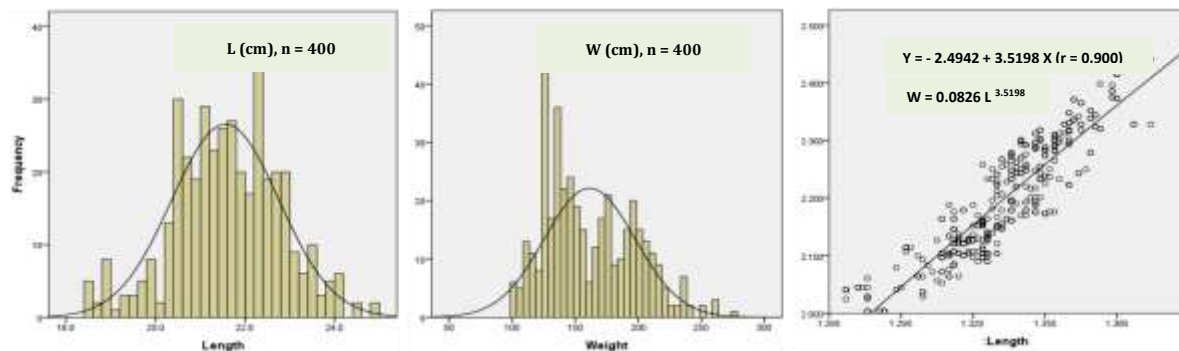
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groupes.

Fig.2. L-W size structures of 400 tails of bigeye scad captured by purse seiners
from FMA 716 of North Sulawesi seawaters on May and August 2022

L-Wsize structures of male bigeye scad captured on both fishing seasons

On both fishing seasons, May and August 2022 (Table 1), we find 176 (44.0%) male fishes of 400 captured samples. Fig. 3 shows that 84.1% of male fishes have the length of 19.9 - 22.6 cm while the rests (15.9%) distributed at others length categories. Furhermore, 64.8% of male fishes captured at weight of 115 - 156 g (26.1% of 115 - 128 g, 25.0% of 129 - 142 g, and 13.7% of 143 - 156 g), while the rests (35.2%) captured at others weight categories.
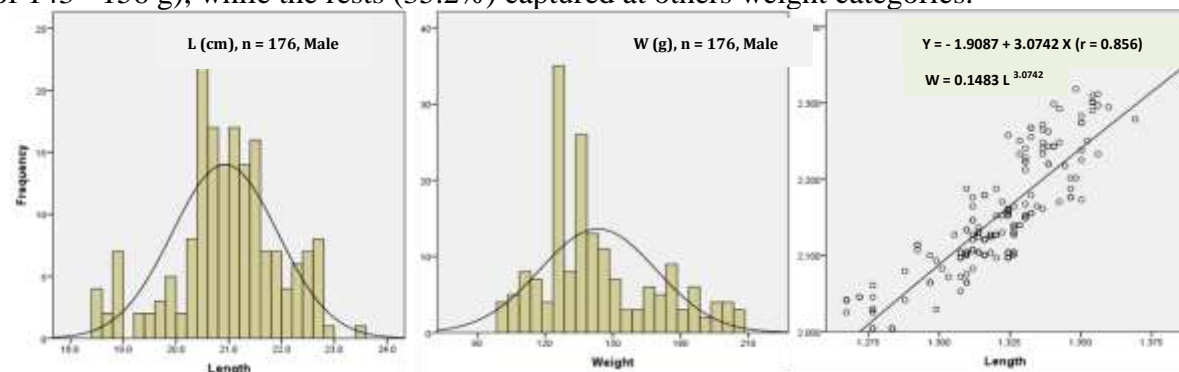

Fig.3. L-W size structures of 176 tails of male bigeye scad captured by purse seiners
from FMA 716 of North Sulawesi seawaters on May and August 2022

L-Wsize structures of female bigeye scad captured on both fishing seasons

On both fishing seasons, May and August 2022 (Table 1), we find 224 (56.0%) female fishes of 400 captured samples (Tabel 1). Fig.4 shows that 83.5% of female fishes have the length of 17.8 - 20.9 cm, which consisting of 32.6% with the length of 19.4 - 20.1 cm, 21.4% of 20.2 - 20.9 cm, 18.3% of 18.6 - 19.3 cm, and 11.2% of 17.8 - 18.5 cm; the rests (16.5%) was captured at others legth categories. At weight term, 87.9% of fishes were captured with the weight of 123 - 232 g, which consisted of 23.2% of 189 - 210 g, 52.6% of 123 - 188 g dan 12.1% of 211 - 232 g), while the rests (12.1%) are captured at others weight categories.
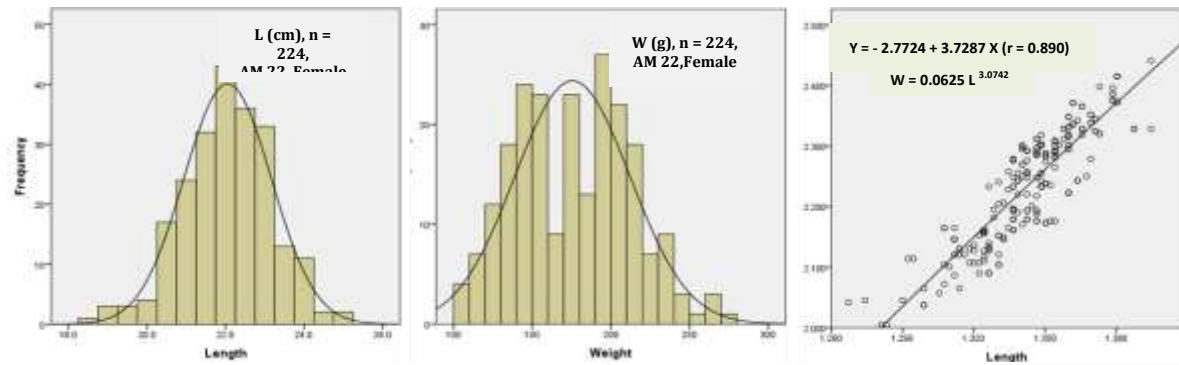
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Fig.4. L-W size strucures of 224 tails of female bigeye scad captured by purse seiners
from FMA 716 of North Sulawesi seawaters on May and August 2022

L-Wsize structures of bigeye scad captured on May 2022

The data analysis of 200 tails of bigeye scad samples captured on May 2022, have the length of 18.5 - 24.8 cm (21.62 ± 0.17 cm in average) with the weight of 101 - 260 g (167.20 ± 5.15 g in average). Fig. 5 shows that 81.5% of fishes are captured at the legth of 20.1 - 23.2 cm (30.5% of 21.7 - 22.4 cm, 19.5% of 20.5 - 21.6 cm, 17.0% of 22.5 - 23.2 cm and 14.5% of 20.1 - 20.8 cm); the rests (18.5%) are captured at other legth categories. Selanjutnya, 93.0% tertangkap dengan berat 121 - 220 g (20.5% berat 181 - 200 g, 19.0% berat 121 - 140 g dan masing-masing 16.0% berat 141 - 160 g dan 161 - 180 g, 11.0% berat 201 - 220 g, daa 10.5% berat 101 - 120 g), sedangkan sisanya (7.0%) tertangkap pada sebaran ukuran berat lainnya.
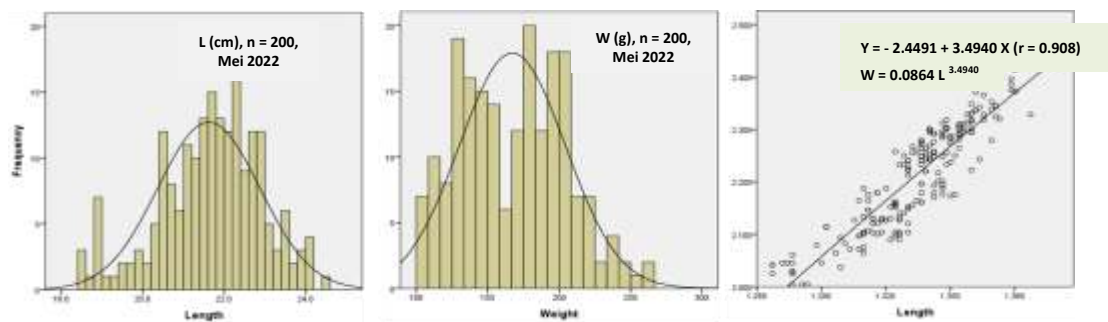

Fig.5. L-W size structures of 200 tails of bigeye scad captured by purse seiners
from FMA 716 of Noth Sulawesi seawaters on May 2022

L-Wsize structures of male bigeye scad captured on May 2022

Data analysis on 96 samples of bigeye scad on May 2022, find that the fork length average is of 18.60 ± 0.21 cm with its weight average of 147.79 ± 5.52 g. Fig. 6 shows that 66.7% of the captured fishes have a length of 17.8 - 19.5 cm (25.0% of them have the length of 19.0 - 19.5 cm, 21.9% of 18.4 - 18.9 cm, 19.8% of 17.8 - 18.3 cm and 11.5% of 22.1 - 22.6 cm), the rests (33.3%) are captured at other length distribution. Selanjutnya, 69.8% of the species are captured at the weight of 115 - 184 g (21.9% of 115 - 128 g, 16.7% of 129 - 142 g and each 15.6% of 143 - 156 g and 171 - 184 g), while the rests (30.2%) are captured at other weight distribution.
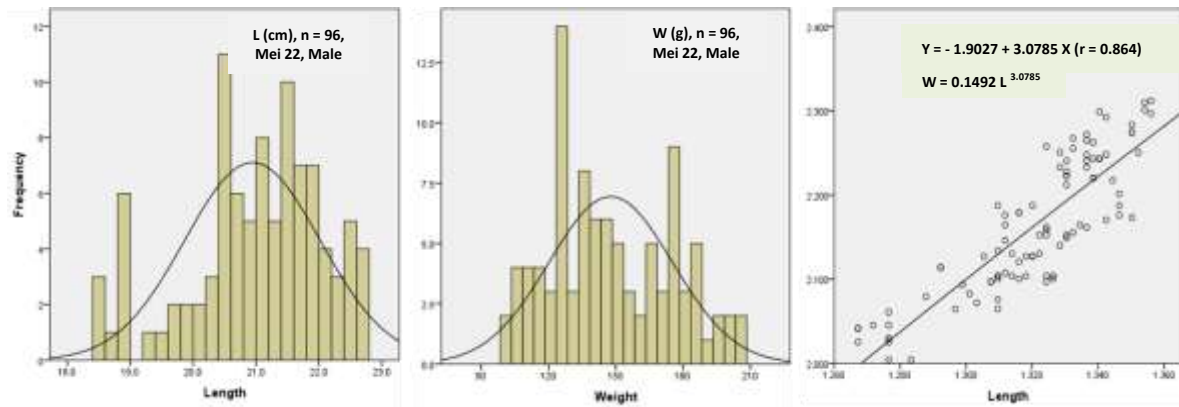
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Fig.6. L-W size structures of 96 tails of male bigeye scad captured by purse seiners
from FMA 716 of North Sulawesi seawaters on May 2022

L-Wsize structures of female bigeye scad captured on May 2022

Hasil analisis data diperoleh bahwa panjang ikan selar females males (n = 104 ekor) yang tertangkap purse seiner dari WPP 716 perairan laut Sulawesi Utara pada Mei 2022 memiliki kisaran 16.5 - 21.8 cm (rerata 19.83 ± 0.21 cmFL) dengan berat 101 - 260 g (rerata 185.11 ± 6.89 g. Gambar 07 memperlihatkan 79.8% ikan ini tertangkap pada panjang 18.6 - 21.3 cmFL (29.8% panjang 19.3 - 19.9 cmFL, 26.0% panjang 20.0 - 20.5 cmFL, 13.5% panjang 20.7 - 21.3 cmFL dan 10.6% panjang 18.6 - 19.2 cmF, sisanya (20.2%) tertangkap pada sebaran ukuran panjang lainnya. Selanjutnya, 75.0% ikan ini tertangkap ini dengan kisaran berat 143 - 226 g (28.8% berat 185 - 205 g, 19.2% berat 206 - 226 g, 15.4% berat 164 - 184 g dan 11.5% berat 143 - 163 g), sisanya (25.0%) tertangkap pada sebaran ukuran berat lainnya.
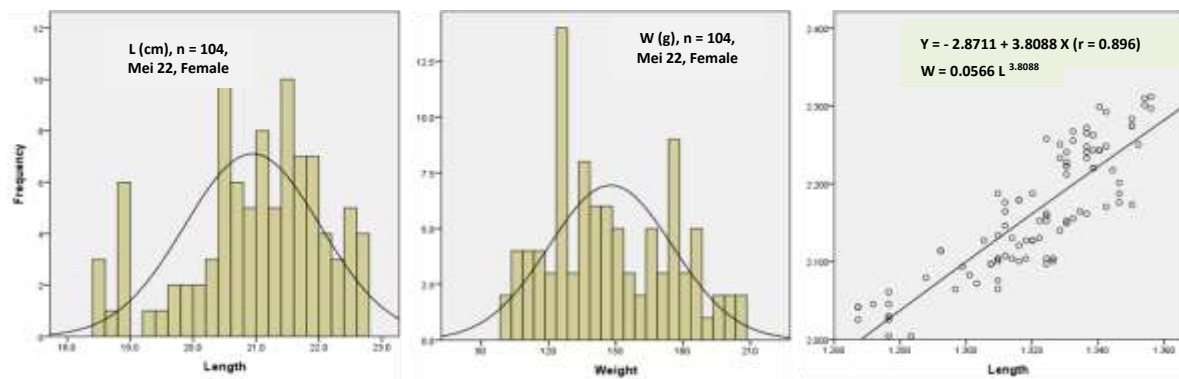

Fig.7. L–W size structures of 104 tails of female bigeye scad captured by purse seiners
from FMA 716 of North Sulawesi seawaters on May 2022

L-Wsize structures of bigeye scad captured on August 2022

From 200 bigeye scad samples captured on August 2022 dari perairan FMA 716 Sulawesi Utara memiliki panjang 18.5 - 24.8 cmFL (rerata 21.49 ± 0.16 cmFL); dengan berat 101 - 276 g (rerata 155.58 ± 4.71 g). Gambar 08 menunjukkan 86.0% ikan tertangkap memiliki panjang 20.1 - 23.2 cmFL (27.0% ukuran 20.9 - 21.6 cm, 25.0% ukuran 21.7 -22.4 cm, 22.5% ukuran 20.1- 20.8, dan 11.5% ukuran 22.5 -23.2 cm), sedangkan sisanya (14.0%) tertangkap pada sebaran ukuran lainnya. Selanjutnya, 82.0% tertangkap pada ukuran 123 - 210 g (40.5% berat 123 - 144 g, 18.0% berat 145 - 166 g, 12.0% berat 167 - 188 g serta 11.5% tertangkap dengan berat 189 - 210 g); sedangkan sisanya (18.0%) tertangkap pada sebaran ukuran lainnya (Gambar
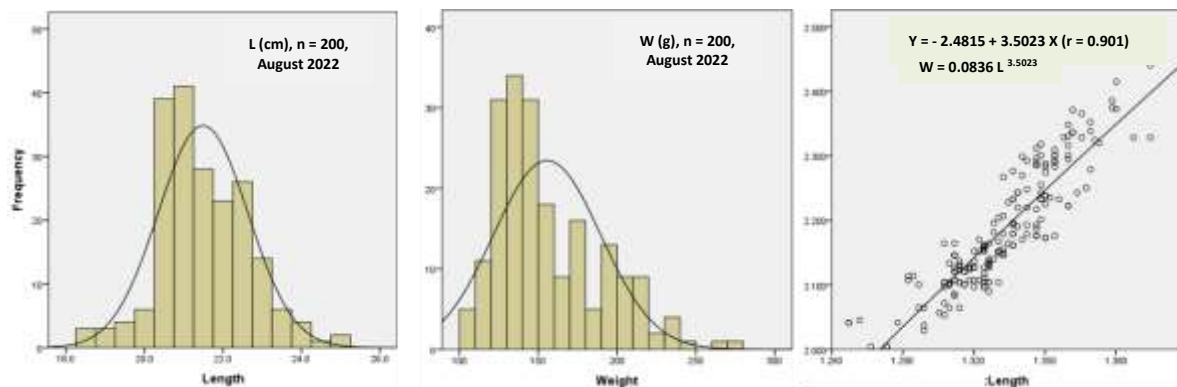
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08).

Fig.8. L-W size structures of 200 tails of bigeye scad captured by purse seiners
from FMA 716 of Noth Sulawesi seawaters on August 2022

L-Wsize structures of male bigeye scad captured on August 2022

Hasil analisis data dari 80 ikan males (40.0%) dari 200 sampel ikan selar bentong yang tertangkap pada musim kemarau (Agustus 2022) dari WPP 716 ini diperolwh panjang berkisar 18.5 - 24.0 cmFL (rerata 20.91 ± 0.20 cmFL) dengan berat 101 - 220 g (rerata 138.08 ± 4.93 g). Gambar 09 menunjukkan 67.6% ikan ini tertangkap pada panjang 19.9 - 21.2 cmFL (46.3% panjang 20.6 - 21.2 cmFL dan 21.3% panjang 19.9 - 20.5 cmFL); sisanya (32.4%) tertangkap pada ukuran panjang lainnya (1.3 - 10.0%). Selanjutnya, 71.3% ikan males yang tertangkap memiliki berat 131 - 160 g (40.0% berat 131 - 145 g dan 31.3% berat 116 - 130 g); sisanya (28.7%) tertangkap dengan kisaran 1.3 - 8.8%. Analisis hubungan L-W menunjukkan bahwa pertumbuhan ikan ini bersifat alometrik positif.
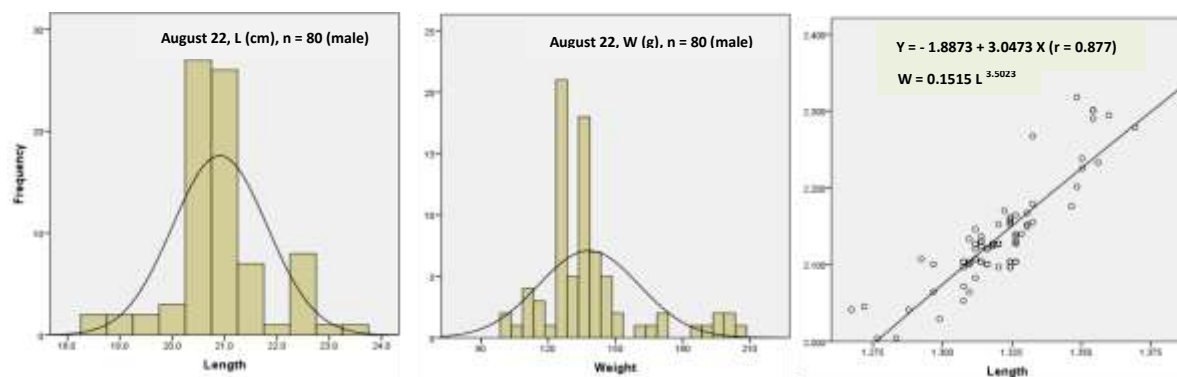

Fig.9. L-W size structures of 80 tails of male bigeye scad captured by purse seiners
from FMA 716 of North Sulawesi seawaters on August 2022

L-Wsize structures of female bigeye scad captured on August 2022

Hasil analisis data dari 120 ikan selar bentong females (60,0%) dari 200 sampel ikan yang tertangkap pada musim kemarau (Agustus 2022), diperoleh panjang ikan berkisar 18.5 - 25.8 cmFL (rerata 21.88 ± 0.20 cmFL) dengan berat 101 - 284 g (rerata 167.24 ± 6.34 g). Gambar 10 memperlihatkan 79.2% ikan yang tertangkap berukuran 20.3 - 22.9 cmFL (masing-masing 29.2% berukuran 21.2 - 22.0 cmFL dan 22.1 - 22.9 cmFL, serta 20.8 cmFL berukuran 20.3 - 21.1 cmFL); sisanya (20.8%) berukuran 1.7 - 9.2%. Selanjutnya, 83.3% ikan female yang tertangkap memiliki berat 124 - 215 g (28.3% berat 124 - 146 g, 21.7% berat 147 - 169 g,

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masing-masing 16.7% tertangkap dengan berat 170 - 192 g dan 193 - 215 g; sisanya (16.7%) tertangkap pada ukuran berat lainnya (0.8 - 7.5%). Analisis hubungan L-W ikan ini menunjukkan bahwa pertumbuhan ikan ini bersifat alometrik positif.
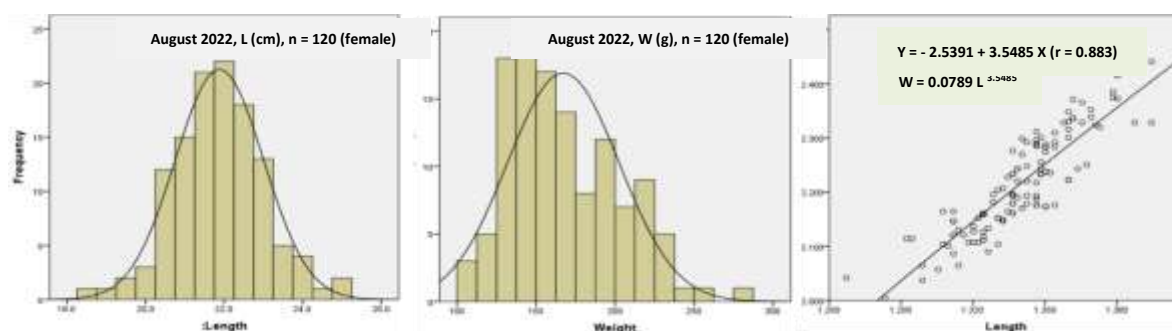

Fig.10. L-W size structures of 120 tails of female bigeye scad captured by purse seiners from FMA 716 of North Sulawesi seawaters on August 2022

Condition factor (K)

Table 5 below shows the value of condition factors (K) for bigeye scad captured by purse seiners from FMA 716 of North Sulawesi seawaters on May,August, and on both. The condition factor K in average is 1.59 ± 0.02 for total of 400 species samples, with K 1.55 ± 0.02 for 176 males and 1.62 ± 0.02 for 224 females, where K value for female species is greater than male species, both on May and August. We can also see that K value on May is greater than on August. and all samples have a body form bentuk tubuh yang kurang pipih sesuai nilai kisaran K 1.0 - 2,0 berdasarkan Vakily *et al*., (1986). Menurut Anderson dan Newmann (1996), value K > 100 means that seawater condition in FMA 716 of North Sulawesi where the population of bigeye scad live are very suitable for them.

Table 5. Condition factor of bigeye scad captured by purse seiners from FMA 716 of North Sulawesi seawaters on May and/or August 2022

Fishing season	Statistics	K by gender		Total
		Male	Female	
May and August	n (tails)	176	224	400
	Mean ± sd	1.55 ± 0.02	1.62 ± 0.02	1.59 ± 0.02
	Range	1.53 - 1.57	1.60 - 1.64	1.57 - 1.61
May	n (tails)	96	104	200
	Mean ± sd	1.60 ± 0.03	1.66 ± 0.03	1.63 ± 0.02
	Range	1.57 - 1.63	1.63 - 1.69	1.61 - 1.65
August	n (tails)	80	120	200
	Mean ± sd	1.50 ± 0.02	1.58 ± 0.03	1.55 ± 0.02
	Range	1.48 - 1.52	1.55 - 1.61	1.53 - 1.57

Veronika, *et al*., (2018), researhed the L-W relationship of *Cucumber* sp. from four different seawaters in Northeast coastal areas of Sri Lanka, and found that K value > 100 of 2.26 ± 0.02, meant that the seawaters have abundantly foods (preys) or less predator density. *On the contrary*, if K value < 100 means insufficient food availability in nature, such as less of preys, high predator density (Muchlisin, 2014). Besides of the food availability in nature and many predators, biotic and abiotic factors and lost of fishery management can also influence the reduction of this K value.

Table 5. The fork length size (cmFL) and weight (g) of the bigeye scad at first captured   by gendre from FMA 716 of North Sulawesi seawaters on May and August 2022

Lc	Parameter	May + August			May			August		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
< Lc 50%	n (ekor)	80	110	190	44	51	95	36	59	95
	(%)	42.11	57.89	100	46.32	53.68	100	37.89	62.11	100
	W (g)	9,994	16,364	25,055	5,537	8,150	13,097	4,479	8,332	12,284
	(%)	39.89	65.31	100	42.28	62.23	100	36.46	67.83	100
≥ Lc 50%	n (ekor)	96	114	210	52	53	105	44	61	105
	(%)	45.71	54.29	100	49.52	50.48	100	41.90	58.10	100
	W (g)	15,240	22,956	39,499	8,651	11,101	20,342	6,567	11,737	18,831
	(%)	38.58	58.12	100	42.53	54.57	100	34.87	62.33	100
Total	n (ekor)	176	224	400	96	104	200	80	120	200
	(%)	44.00	56.00	100	48.00	52.00	100	40.00	60.00	100
	W (g)	25,234	39,320	64,554	14,188	19,251	33,439	11,046	20,069	31,115
	(%)	39.09	60.91	100	42.43	57.57	100	35.50	64.50	100

Worthy fish size to catch

For both seasons, May and August 2022, all bigeye scad, males and females, captured by *purse seiners* from WPP 716 of North Sulawesi seawaters that unloaded at the coastal fishing port of Tumumpa-Manado were categorized as appropriate fish size to catch ($L_c > L_m$), or had passed their maturity stage (Table 6).

Table 6. The size of the bigeye scad (*Selar crumenophthalmus*) at first captured and its comparaison with the size at first maturitywhich captured from FMA 716 of North Sulawesi seawaters on May and August 2022

Season	Gender	Nbr.of species (n)			First captured Lc50% (FL)	First maturity Lm50% (FL)	Lc > Lm?	χ^2_{hit}	χ^2_{table}
		< Lc	≥ Lc	Total				χ^2 0.95(1) = 3.84	
May	M	44	52	96	21.05	18.91	Lc > Lm		
	F	51	53	104	22.30	17.98	Lc > Lm	0.354 < 3.84	
	Total	95	105	200	21.68	18.45*	Lc > Lm		
August	M	36	44	80	20.80	18.91	Lc > Lm		
	F	59	61	120	21.83	17.98	Lc > Lm	0.522 < 3.84	
	Total	95	105	200	21.31	18.45*	Lc > Lm		
May+ August	M	80	96	176	20.90	18.91	Lc > Lm		
	F	110	114	224	22.11	17.98	Lc > Lm	0.653 < 3.84	
	Total	190	210	400	21.52	18.45*	Lc > Lm		

Notes: (1) Referred to Muharam, et al. (2020), size at first maturity (Lm50%) of male bigeye scad was 18.91 cmFL and female 17.98 cmFL, and average size (*) of Lm50% 18.45 cmFL, captured from WPP 716 of North Gorontalo seawaters
 (2) All bigeye scad at the first captured had passed their first maturity (Lc50% > Lm50%)
 (3) $\chi^2_{hit} < \chi 2_{table}$: Both male and female fishes captured had same possibilities to catch at first time (Lc50% cmFL)

Length at first captured (Lc)	Length (cmFL)						
	n	X	s	X ± 1.96*s√n	Min	Max	L (cm)
< Lc 50%	190	20.55	0.74	20.55 ± 0.11	18.5	21.4	-
≥ Lc 50%	210	22.47	0.71	22.47 ± 0.10	21.5	24.8	-
Total	400	21.56	1.20	21.56 ± 0.12	18.5	24.8	-
Weight (g)							
< Lc 50%	190	131.87	15.36	131.87 ± 2.18	101	181	25,055
≥ Lc 50%	210	188.09	27.52	188.09 ± 3.72	140	276	39,499
Total	400	161.39	36.04	161.39 ± 3.53	101	276	64,554

% (38.81%), ≥ Lc 50% (61.19%)

CONCLUSION AND RECOMMENDATION

Conclusion

In the first transition season (May 2022), a sex ratio of 1:1.08 was obtained, with a fork length (FL) of 16.0 - 21.8 cm (average 19.24 ± 0.17 cm), a weight ranging from 101 - 260 g (average 167.20 ± 5.16 g), and a weight ratio of 1:1.82. The L-W relationship follows W = 0.1429 L 3.2402 (r = 0.93 and R = 0.96), is positive allometric, with a condition factor (K) of 1.81 - 2.87 (average 2.31 ± 0.03). With Lm (reference) of 18.45 cm and Lc = 19.33, where 74.0% of the 200 fish caught were categorized as suitable for capture. In the dry season (August 2022), a sex ratio of 1:1.50 was obtained, with a fork length (FL) range of 16.2 - 22.4 cm (average 19.09 ± 0.16 cm), weight ranging from 101 - 276 g (average 155.58 ± 4.73 g), with a weight ratio of 1:1.34. The W-L relationship follows W = 0.1536 L 3.1686 (r = 0.92 and R = 0.84), is positive allometric, with a condition factor (K) of 1.82 - 2.73 (average 2.21 ± 0.03). With Lm (reference) of 18.45 cm and Lc = 18.83, where 69.0% of the 200 caught trevally were categorized as suitable for fishing. Overall (May and August 2022) a sex ratio of 1:1.27 was obtained, with a fork length (FL) range of 16.0 - 22.4 cm (average 19.17 ± 0.12 cm), weight ranging from 101 - 276 g (average 161.39 ± 3.54 g), with a weight ratio of 1:1.55. The W-L relationship follows W = 0.1510 L 3.1890 (r = 0.92 and R = 0.84), is positive allometric, with a condition factor (K) of 1.82 - 2.73 (average 2.26 ± 0.02). With Lm (reference) of 18.45 cm and Lc = 19.12 cm, 70.0% of the 200 caught trevally were categorized as suitable for capture.

Recommendation

Bigeye scad (*Selar crumenophthalmus* Bloch 1793), captured by purse seiners in two different fishing seasons from WPP 716 of North Sulawesi seawaters are still at legal sizes, it is indispensable to make since early a new official regulation to limitate the captured fish sizes of potential and economic for fishes forming a dense shoal along year, notably captured by *purse seiners*.

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