



Morphometric variation and reproductive aspects of the coral hind grouper (*Cephalopholis miniata*) harvested in the northern coast of Aceh, Indonesia

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ABSTRACT

The coral hind grouper (*Cephalopholis miniata*) is one of the essential fisheries commodities in Indonesia and the Aceh region. However, scientific data on its morphometrics and biology are limited. This study aimed to observe the morphometric, meristic, length frequency distribution, sex ratio, gonad development stage, gonad somatic index, and fecundity of *C. miniata* fished from the northern coast of Aceh, Indonesia. The study was conducted from June 2020 to January 2021. *Cephalopholis miniata* samples were obtained from Pelabuhan Perikanan Samudera (PPS) Lampulo, Kuta Alam District, Banda Aceh, Indonesia. The samples were analyzed at the Laboratory of Genetics and Aquatic Biodiversity, Faculty of Marine Fisheries, Universitas Syiah Kuala. In total, 184 specimens of *C. miniata* were measured during this study. Out of 184, 60 samples were used in the morphological measurement. The results showed that the total length of *C. miniata* fish caught in the northern waters of Aceh ranged between 75-295 mm (average 211 ± 30 mm) and not yet reached the maximum size, with female fish dominating the samples. The gonadal maturity level mainly was stage II, with the peak of spawning occurring in October. The GSI value of *C. miniata* fish ranged from 0.01-4.77%, with the length at first mature of 205 mm TL. Besides, the total fecundity produced by *C. miniata* ranged from 7,126-279,785 eggs. The fecundity of *C. miniata* was positively correlated with the total length, body weight, and weight of the gonads. This study provides baseline data on the morphometric, meristic, and reproductive biology of grouper *C. miniata* in the northern waters of Aceh, beneficial as a reference for further research.

INTRODUCTION

Located at the western tip of Sumatra Island, between the Indian Ocean and the Malacca Strait, the northern waters of Aceh has diverse and abundant marine resources (Brown, 2007; Muklis *et al.*, 2009; Baird *et al.*, 2012; Rudi *et al.*, 2012). The region

consisted of several small islands, such as Weh Island, Breueh Island, Teunom Island, Nasi Island, and Bunta Island (Baird *et al.*, 2005; Campbell *et al.*, 2007). This region is endowed with fish resources widely used by the traditional fishermen in the area and those from outside the area (Kurnia *et al.*, 2016; Haridhi *et al.*, 2021).

One of the targeted fish groups in the region is the grouper (family Epinephelidae), including the coral hind grouper (*Cephalopholis miniata*) (Fadli *et al.*, 2020; Fadli *et al.*, 2021). *Cephalopholis miniata* live in coral reefs, with 2-150 meters depth (White *et al.*, 2013). They are protogyny hermaphrodites and reproduce sexually (Craig *et al.*, 2011). The fish feed mainly on other selected fish (Shpigel & Fishelson, 1989).

The increasing market demands and the high economic value of the grouper fish have forced fishers to use various techniques to catch the fish, including using destructive fishing methods, catching all fish without considering the size, and modifying various fishing gears (Andamari, 2005; Mariskha & Abdulgani, 2012; Ramadhani *et al.*, 2017). These activities are feared to hamper the grouper population, leading to scarcity of the fish themselves (Alamsyah *et al.*, 2013). Therefore, it is necessary to manage the fish in sustainable fisheries management.

One of the essential data needed for this management is the biological information of the species, including its morphometric, meristic, and reproductive biology. This study aimed to observe the morphometric and meristic characters and aspects of reproductive biology (sex ratio, gonad development stage, gonad somatic index, and fecundity) of *C. miniata* in the northern waters of Aceh so that it can be used as a reference for further research.

MATERIALS AND METHODS

This research was conducted from June 2020 to January 2021. Fish samples were from fishermen's catch in the northern waters of Aceh at Pelabuhan Perikanan Samudera (Ocean Fishing Port-PPS) Lampulo, Kuta Alam District, Banda Aceh, Aceh (Fig. 1). The fish were identified based on Heemstra & Randall (1993) and Craig *et al.* (2011). Furthermore, the fish samples were taken to the Laboratory of Genetics and Aquatic Biodiversity, Faculty of Marine and Fisheries, Universitas Syiah Kuala to measure the morphometric and meristic characters and their reproductive biology aspects.

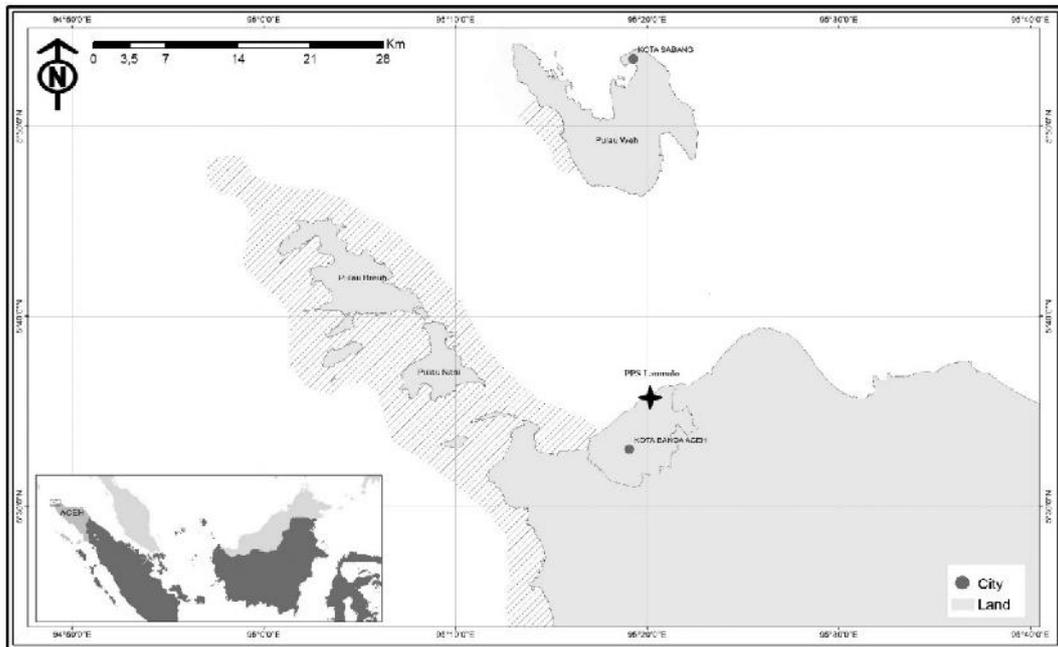


Fig. 1. Location of PPS Lampulo (black star) and the grouper fishing ground (dashed line) in the Aceh northern coast.

Morphometric and meristic measurement

A total of 12 traditional morphometric characters and 30 morphometric truss network characters were measured on 60 fish samples using a digital caliper (Mitutoyo, CD-6CS, Error = 0.01 mm). Morphometric characters were determined based on **Muchlisin (2013)** and **Batubara *et al.* (2018)** (Fig. 2 and Fig. 3). At the same time, eight meristic characters were counted based on **Muchlisin (2017)** (Fig. 4).

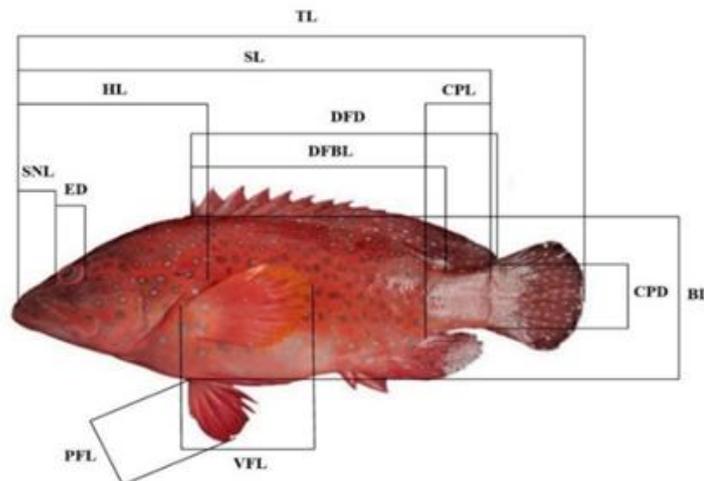


Fig. 2. Traditional morphometric characters measured in *Cephalopholis miniata* samples harvested in the Aceh northern coast.

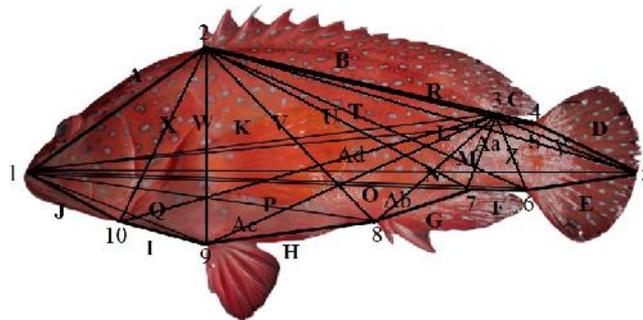


Fig. 3. Truss network morphometric characters measured in *Cephalopholis miniata* samples harvested in the Aceh northern coast.

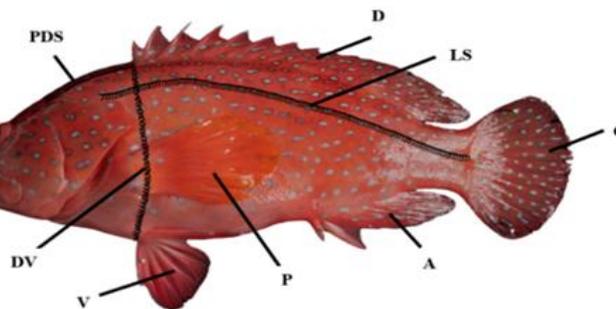


Fig. 4. Meristic character calculation in *Cephalopholis miniata* samples harvested in the Aceh northern coast.

Reproductive Biology

The observations on aspects of reproductive biology were observed from 184 specimens of *C. miniata*, including the total length (TL), body weight (W), gonad weight (w), sex, gonadal maturity level, the size of the first ripe gonads, fecundity, etc.

Data analysis

The fish were grouped into five stages of gonadal maturity level following the work of **Effendie (2002)**. While gonad somatic index (GSI) was calculated based on the work of **Muchlisin *et al.* (2010)**, as follows: $GSI (\%) = \frac{\text{gonad weight (g)}}{\text{Total body weight (g)}} \times 100$. The size of the first mature gonads was done with the logistic curve approach based on **King (2013)**. In addition, regression analysis was used on several research parameters, including total length between fecundity, bodyweight between fecundity, and gonad weight between fecundity. Other measured data are presented in tables and figures and were analyzed descriptively by comparing them to applicable references and reports.

RESULTS

Morphometric and meristic measurements

In general, the results of traditional morphometric character measurements of *C. miniata* varied from the measured characters. The highest variation was found in total length (TL), ranging from 162.7 mm to 294.1 mm (mean 204.4 ± 23.38 mm), followed by the standard length (SL), ranging from 131.2 mm to 244.4 mm (mean 166.5 ± 20.06 mm). The character with the lowest variation was eye diameter (ED) with a size of 9.2-13.9 mm (mean 10.7 ± 1.0 mm), followed by a snout length character (SNL) with a size of 11.0-25.5 mm (mean 15.0 ± 2.8 mm) (Table 1).

The results of the truss networks of *C. miniata*, also showed variations in the size of each observed morphometric characteristic. The highest variation was found in M (the distance measured from the tip of the mouth to the end of the tail fin), with a size of 162.7-294.1 mm (mean 204.3 ± 23.3 mm), and the lowest variation was in C (distance measured from the end of the dorsal fin to the beginning of the upper caudal fin), with a size of 15.2-26.8 mm (mean 19.0 ± 2.6 mm) (Table 2).

Table 1. Traditional morphometric measurement values in *Cephalopholis miniata* samples harvested in the Aceh northern coast.

No	Character	Min (mm)	Max (mm)	Mean \pm SD (mm)
1	TL	162.7	294.1	204.42 ± 23.38
2	SL	131.2	244.4	166.48 ± 20.06
3	HL	49.8	92.1	64.35 ± 7.66
4	CPL	18.9	36.2	24.56 ± 3.27
5	SNL	11	25.5	14.97 ± 2.74
6	DFD	88.1	158.1	108.88 ± 12.76
7	DFBL	71.3	130.7	89.25 ± 10.92
8	ED	9.2	13.9	10.68 ± 1.00
9	CPD	16.8	36.3	23.32 ± 3.33
10	BD	45.3	87	57.37 ± 7.39
11	PFL	36.5	65.6	45.19 ± 5.54
12	VFL	28.7	53.3	36.01 ± 4.14

The calculation of the meristic characteristics of *C. miniata* also showed variations. The highest variation was found in the number of the scales; namely, the lateral scales (LS) ranged of 96-139 (mean 111 ± 10.16), and the lowest number was found in the transverse body scales (PDS), ranging from 38 to 76 (mean 52 ± 7.99). The highest variation on the fin was the dorsal fin (D) (IX.15-IX.17), and the lowest variation was the pelvic fin (V) (I.5) (Table 3).

Table 2. Morphometric *truss networks* measurement value in *Cephalopholis miniata* samples harvested in the Aceh northern coast.

No	Character	Min (mm)	Max (mm)	Mean \pm SD (mm)
1	A	54.6	103	67.26 \pm 8.69
2	B	71.8	128.5	89.56 \pm 10.80
3	C	15.2	26.8	18.98 \pm 2.55
4	D	31.4	58.8	39.54 \pm 4.77
5	E	32.7	56	39.89 \pm 4.68
6	F	19.5	37.4	24.60 \pm 3.57
7	G	21.1	48.7	29.62 \pm 5.00
8	H	40.5	83.1	56.45 \pm 8.88
9	I	21.9	43	28.31 \pm 4.24
10	J	29.4	51.9	37.07 \pm 4.93
11	K	108.9	214.5	146.19 \pm 17.91
12	L	129.3	242.2	166.13 \pm 19.58
13	M	294.1	162.7	204.30 \pm 23.33
14	N	129.3	244.7	165.80 \pm 19.82
15	O	108.4	210.7	142.10 \pm 17.64
16	P	89	167.7	115.87 \pm 13.72
17	Q	50.2	90.5	63.26 \pm 8.19
18	R	86.9	154.6	108.72 \pm 12.69
19	S	107.7	214.3	147.90 \pm 17.85
20	T	88.1	169.6	114.39 \pm 14.68
21	U	71.4	140.6	93.83 \pm 12.00
22	V	53.5	120.6	78.02 \pm 11.16
23	W	46.3	86.6	57.00 \pm 7.83
24	X	44.2	90.8	58.84 \pm 8.60
25	Y	45.8	85.3	58.08 \pm 7.02
26	Z	22.3	46.6	29.48 \pm 4.36
27	Aa	18.1	39.5	25.23 \pm 3.67
28	Ab	37.1	73.4	47.86 \pm 7.03
29	Ac	47	141.1	94.92 \pm 14.77
30	Ad	89.3	176.1	119.89 \pm 14.94

Table 3. Meristic character calculation value in *Cephalopholis miniata* samples harvested in the Aceh northern coast.

No	Character	Min (mm)	Max (mm)	Mean \pm SD (mm)
1	LS	96	139	111 \pm 10.16
2	DV	40	69	53 \pm 4.63
3	PDS	38	76	52 \pm 7.99
4	D	IX. 15	IX. 17	-
5	C	15	17	-
6	A	III. 8	III. 9	-
7	V	I. 5	I. 5	-
8	P	15	17	-

Length-size distribution

The measurements carried out on 184 samples of *C. miniata* showed that the length of the grouper *C. miniata* ranged from 75-295 mm (mean 211 ± 30 mm). The length was divided into nine classes, with a class length of 26 mm. The first, second and third classes were 75-100 mm (average 88 ± 9 mm; $n=2$), 100-126 mm (mean 113 mm) and 126-152 mm (mean 139 mm), respectively. However, no fish sample was found in these three classes. The fourth class was 152-179 mm (mean 165 ± 4 mm), consisting of 16 fish (9%). The fifth class was 179-204 mm (mean 191 ± 7 mm), with 65 fish (35%). The sixth class was 204-230 mm (mean 217 ± 7 mm), with 52 fish (28%). The seventh class ranged from 230 to 255 mm (average 242 ± 8 mm), with 39 fish (21%). The eighth class was 255-281 mm (mean 268 ± 5 mm) with six fish (3%) and the ninth class was 281-307 mm (mean 294 ± 5 mm), with 4 fish (2%) (Fig. 5).

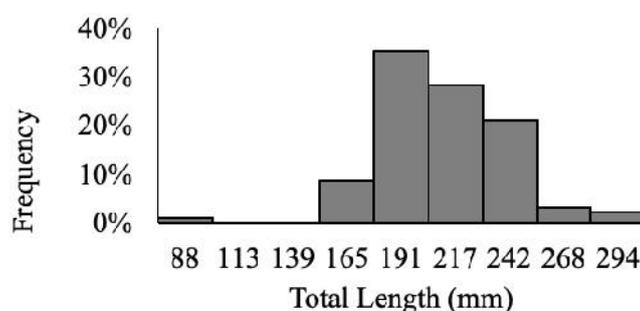


Fig. 5. Length frequency distribution of *Cephalopholis miniata* samples harvested in the Aceh northern coast.

Sex ratio and gonad development stage

The female fish (181) was more dominant than the male (3), with the sex ratio being 1: 0.02. The gonad maturity level (GML) of *C. miniata* was mostly in stage II (90 females and three males). Based on monthly observations of GML, the peak spawning of *C. miniata* had occurred in October (known from the large number of fish caught in stage III (16 of 30 samples collected)). In addition, the GSI value of *C. miniata* fish is higher in female fish than in males. The female GSI values ranged from 0.01-4.77% (mean $0.86 \pm 1.07\%$) while 0.19-0.31% (mean $0.24 \pm 0.06\%$) for the male (Table 4).

Table 4. Gonad development stage and GSI of *Cephalopholis miniata* samples harvested in the Aceh northern coast.

Month	Total Sample	Total fish based on gonad development stage (%)					GSI (%)
		I	II	III	IV	V	
June	33	27.27	51.52	18.18	3.03	0.00	0.01 - 3.05 (0.51±0.55)
July	31	9.68	45.16	22.58	22.58	0.00	0.09 - 4.61 (1.17±1.27)
August	29	13.79	65.52	17.24	3.45	0.00	0.01 - 3.90 (0.44±0.73)
September	30	23.33	53.33	10.00	13.33	0.00	0.08 - 3.54 (0.80±1.02)
October	30	3.33	26.67	53.33	16.67	0.00	0.10 - 4.77 (1.80±1.39)
November	30	23.33	63.33	13.33	0.00	0.00	0.01 - 1.59 (0.39±0.34)

The length at first mature

The length at first maturity was $L_m = L_{50}$, carried out using a logistic curve approach, where the range of fish body length was 50% gonad maturity. The length at first maturity of *C. miniata* was found at 205.22 mm TL (Fig. 6).

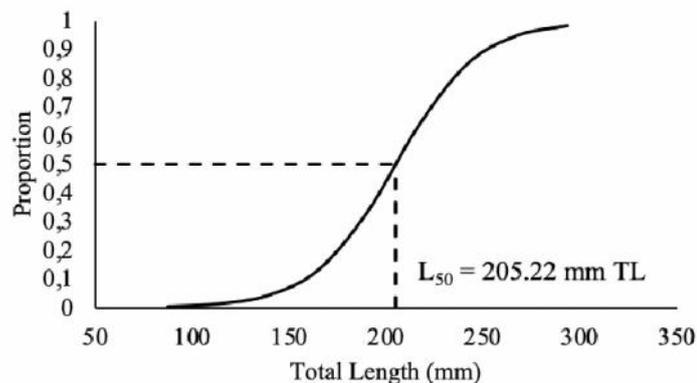


Fig. 6. The length at first mature of the *Cephalopholis miniata* gonads in the northern waters of Aceh.

Fecundity

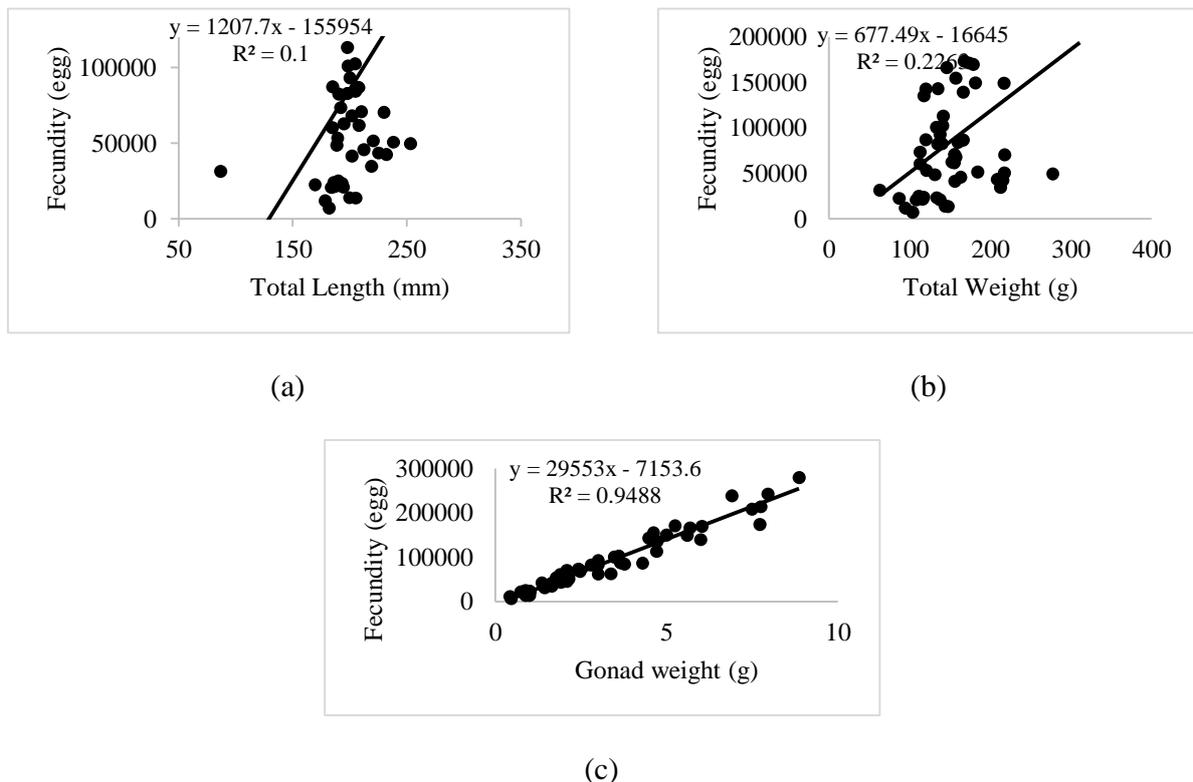
The fecundity of *C. miniata* fish was calculated from 54 samples and found that the total fecundity (FT) ranged from 7,128-279,785 eggs ($90,268 \pm 67,568$ egg). The highest FT was obtained in September with the number of eggs ranging from 34,623-224,546 ($155,380 \pm 85,639$ egg) (Table 5).

Table 5. Total fecundity (FT) of in *Cephalopholis miniata* samples harvested in the Aceh northern coast.

Month	Min (egg)	Max (egg)	Mean \pm SD (egg)
June	13,833	87,200	38,083 \pm 25.970
July	7,128	173,590	80,735 \pm 49.764
August	13,647	213,728	74,399 \pm 79.366
September	34,623	242,546	155,380 \pm 85.639
October	11,939	279,785	106,701 \pm 67.430
November	20,743	70,671	51,012 \pm 24.152

Relationship between total length, total weight, gonad weight, and fecundity

There was a strong relationship between fecundity, total length and total weight. The fecundity increased with the increase in total length and body weight. A similar trend was also observed in the gonad weight (the fecundity increased as the gonad weight increased (Fig. 7). The gonad weight of *C. miniata* ranged from 0.43-8.87 g (3.30 ± 2.23 g).

**Fig. 7.** The correlation between total length and fecundity (a), the correlation between total weight and fecundity (b), and the correlation between gonad weight and fecundity (c) of *Cephalopholis miniata* samples harvested in the Aceh northern coast.

DISCUSSION

The morphometric measurement describes the shape of the fish morphology and distinguishes the differences between species using multivariate statistics analysis (Akmal *et al.*, 2018). The measurement of morphometric characters revealed different variations between the observed characters. Traditional morphometric measurements showed that the highest variation was found in the total length (TL), with a maximum size of 294.1 mm, and the second-highest variation was the standard length (SL)(244.4 mm). The measurement of the morphometric character of truss networks reported that the highest variation was in the character M (the distance from the tip of the mouth to the end of the tail fin) or called TL of the fish (294.1 mm), followed by the character N, measured from the distance from the tip of the mouth to the base of the lower tail fin (244.7 mm). Next was the character L, measured from the distance from the tip of the mouth to the base of the upper caudal fin (242.2 mm). Measurement of L and N characters in morphometric truss networks is the same as traditional morphometric measurements on standard length (SL) characters, and only the difference lies in the final position of the measurement, namely top (L), bottom (N), and middle (SL). Therefore, the resulting values were similar between the two methods. Measuring the morphometric characters of truss networks provide more detailed results for describing fish morphology than traditional morphometric measurements (Ariyanto *et al.*, 2011).

Both morphometric measurements revealed that *C. miniata* caught in the northern Aceh region was 59% of the maximum TL of *C. miniata* that can reach a maximum size of 500 mm (White *et al.*, 2013). The *C. miniata* caught in the northern waters of Aceh are small in size and have not yet reached the maximum size of their growth. Similar findings were also reported by Aznardi & Madduppa (2020) on *E. areolatus* fish at the Muara Angke, North Jakarta, with the size of 14.40-20.80 cm (around 50% the maximum size of *E. areolatus*) (Craig *et al.*, 2011). The high market demand and selling price are suspected to be why *C. miniata* fish are caught in small sizes. If this continues, the population growth will be hampered, even leading to scarcity (Alamsyah *et al.*, 2013).

The measurement of the meristic character of *C. miniata* showed that the fish has linear lateral scales of 96-139 (mean 111 ± 10.16 scales), head scales of 40-69 (mean 53 ± 4.63 scales), and transverse body scales of 38-76 (mean 52 ± 7.99 scales). The lateral line scales (linnea lateralis) in groupers are varied, such as 39 scales in *Anthias anthias* (Tuncer *et al.*, 2011), 71 in *Epinephelus darwinensis*, 52-60 in *E. diacanthus*, and 63-71 in *E. daemeli* (Heemstra & Randall, 1993). The difference in the number of scales is influenced by the size of the fish scales themselves. Another measured meristic character is the fin. *Cephalopholis miniata* had IX.15-IX.17 dorsal fins, 15-17 caudal fins, III.8-III.9 anal fins, I.5 pelvic fins, and 15-17 pectoral fins, confirming the statement of Heemstra & Randall (1993), *C. miniata* have IX.14-IX.16 dorsal fins, III.8-III.9 anal fins, and 17-18 pectoral fins.

In addition, this study revealed that observed *C. miniata* was dominantly females. *Cephalopholis miniata* is a protogine hermaphrodite fish. **Tresnati (2001)** stated the sex ratio of hermaphrodite fish will not be balanced between males and females in the water. It is also in line with the research conducted by **Alamsyah et al. (2013)** in *P. areolatus* grouper in Karang Kapota waters, Wakatobi Regency, reporting the sex ratio obtained was 4:1 (91 females: 24 males). Survival in a population can be maintained with a balance between female and male fish, or more dominated by female fish (**Bal & Rao, 1984**). Internal and external factors strongly influence the sex ratios. Internal factors include behavior, mortality rate, and growth, while external factors include population density, food availability, and the food chain balance (**Effendie, 2002**).

The gonad maturity level is analyzed to estimate the spawning time of fish (**Khairunnisa, 2018**). The observed gonad maturity level indicated that *C. miniata* is multiple spawners. It is suspected that *C. miniata* always spawn every month, or spawning occurs throughout the year. **Effendie (2002)**, argued that fish that spawn throughout the year have different levels of gonad maturity each time the sample is taken. A similar finding has also been reported that some groupers are spawning throughout the year, such as *P. areolatus* in the waters of Karang Kapota, Wakatobi Regency, where gonad maturity level III and IV were found in January and February (**Alamsyah et al., 2013**), *E. areolatus* in the waters of Galesong Village from March to May (**Sitepu, 2014**), *E. sexfasciatus* in the waters of Glondonggede Tuban in October and November (**Mariskha & Abdulgani, 2012**). In addition, the peak of spawning of *C. miniata* fish in the northern waters of Aceh is estimated to occur in October. The highest number of gonad maturity levels III and IV obtained is a sign of peak spawning even though the fish spawning occurs throughout the year (**Mariskha & Abdulgani, 2012**).

This study also revealed a higher number of gonadally immature fish (125 fish from 184 samples) caught in this region, indicating that the utilization of *C. miniata* resources in the northern waters of Aceh did not apply the sustainable fishing practice. A good fishing practice catch the fish that have reached their maximum size, or at least 90% of the fish caught have reproduced so that the recruitment process and fish population in nature can be maintained and stable (**Saranga et al., 2019**). Without practicing good fisheries management, it is likely that *C. miniata* in the northern waters of Aceh will decrease sharply.

The observed GSI was varied each month, ranging from 0.01 to 4.77%. A similar finding has also been reported in some groupers, such as *E. areolatus* in the waters of Galesong Village (0.04-4.82%) (**Sitepu, 2014**), *E. sexfasciatus* in the waters of Glondonggede Tuban (0.01-10.84%) (**Mariskha & Abdulgani, 2012**), and *P. areolatus* fish in the waters of Karang Kapota, Wakatobi Regency (0.63-12.68%) (**Alamsyah et al., 2013**). The difference in GSI values was affected by several factors, including the gonad weight of the female fish, which is greater than that of the male fish, the length and bodyweight of the fish (**Mariskha & Abdulgani, 2012**). The GSI value is closely related

to the gonadal maturity level. According to **Alamsyah *et al.* (2013)** GML value will increase, following the level of gonad maturity. This is also in line with **Effendie (2002)**, arguing that the GSI value will reach the maximum value when spawning occurs. The highest GML value occurred in October, in line with the peak spawning of *C. miniata* fish occurred in that month.

This study also revealed that the length at first maturity of *C. miniata* was ranged from 87-253 mm (mean 205 ± 25 mm), with the length at first maturity (L50) being 205 mm. It is smaller than the average size of the length at first maturity of *C. miniata* of 260 mm reported by **Froese & Pauly (2021)**. The small length at first maturity in the northern waters of Aceh is probably due to overfishing and intensive fishing pressure. The same observation was found in the research of **Hasanah *et al.* (2019)**, in Bullet tuna (*Auxis rochei*) at PPI Labuan Bajo, reporting the length at first maturity was smaller than the size in previous studies. The small fish produced mature gonad to maintain their population in nature. The size of fish suitable for catching can be known from the first time the fish gonads ripen, with a size longer than the size when the gonads first ripen (**Alamsyah *et al.*, 2014**). The size suitable for catching fish *C. miniata* in the northern waters of Aceh is longer than 205 mm SL. The size of the first gonad maturity in water will change in line with the size of the gonad mature fish obtained. The difference in the size of the fish when the gonads first mature was influenced by internal and external factors. Internal factors can be the fish's size, age, and physiological characteristics, while external factors are currents and temperature (**Lagler *et al.*, 1977**).

Fecundity is the number of ripe and ready to be released at spawning and are present in the gonads of female fish (**Khairunnisa, 2018**). The total fecundity obtained in this study ranged from 7,128-279,785 eggs (average $90,268 \pm 67,568$ egg), and the highest fecundity was in September. Groupers have different amounts of fecundity between species, such as 150,000-500,000 eggs of *E. microdon* (**Slamet & Tridjoko, 2005**), 45,768-492,243 eggs of *Plectropomus leopardus* (**Andamari, 2005**), 100,000-300,000 eggs of *C. altivelis* (**Putri *et al.*, 2013**), and 13,950-880,892 eggs of *P. areolatus* (**Alamsyah *et al.*, 2013**). Differences in fecundity can be caused by several factors, including species differences, fish physiological conditions, aquatic environment (**Ballerena, 2012**), the thickness or thinness of the protective layer found in the gonads (**Khairatunnisa, 2018**), gonad weight, and egg size (**Alamsyah *et al.*, 2013**).

The analysis of the relationship between gonad weight and fecundity showed the coefficient of determination (R^2) of 0.95, meaning that 95% of the increase in the number of eggs (fecundity) was influenced by the increase in body length of the fish, while other factors influenced the other 5%. Generally, the amount of fecundity is strongly influenced by the length and bodyweight of the fish (**Umar & Kartamihardja, 2011**). However, the fecundity produced in each fish is not always directly proportional to the size and body weight, where fish with a larger body size does not always have an enormous fecundity, and vice versa (**Alamsyah *et al.*, 2013**).

The weight of gonads influenced the amount of fecundity produced in *C. miniata* because it is not always directly proportional to the size and body weight of the fish; for example, the size of 185 mm has a fecundity of 87,200 grains, more than the size of 253 mm which has a fecundity of 49,543 grains. Similar findings were reported by **Alamsyah et al. (2013)** in the waters of Karang Kapota, Wakatobi Regency, *P. areolatus* with a size of 39 cm have more fecundity than the size of 40 cm (807,749 and 600,624 grains respectively). Similarly, **Andamari (2005)** reported that in the waters of Sulawesi and Maluku, *P. leopardus* fish with a size of 28.5 cm had more fecundity than the size of 30.6 cm (94,467 eggs and 49,368 eggs respectively).

Finally, this study presents the basic data on the morphometric, meristic, and reproductive biology of grouper *C. miniata* in the northern waters of Aceh and can be used as a reference for further research.

CONCLUSION

This study presents fundamental data on the morphometric, meristic, and reproductive biology of grouper *C. miniata* in the northern waters of Aceh. In general, *C. miniata* fish caught in the northern waters of Aceh have not yet reached their maximum size, with negative allometric growth patterns, and were dominated by female fish. The gonadal maturity level was dominated by level II, with peak spawning occurring in October. The GSI value of *C. miniata* fish ranged from 0.01 to 4.77%, with the size of the first gonad maturity of 205 mm TL. The total fecundity produced by *C. miniata* ranged from 7,126-279,785 eggs, and the relative fecundity was between 69 and 1,504 eggs. The weight of the gonads has a stronger influence on the size of the fecundity produced by *C. miniata* fish than by the length and weight of the fish. This research can be used as a reference for further research.

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