



## GROWTH PATTERN AND CONDITION FACTOR OF THE WHITE-SPOTTED RABBITFISH, *SIGANUS CANALICULATUS* (PARK, 1797) IN MARINE COASTAL WATERS OF LUWU, BONE BAY, SOUTH SULAWESI, INDONESIA

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### Abstract

Rabbit fish (*Siganus canaliculatus*) is very common in the marine coastal waters of Luwu, Bone Bay, South Sulawesi. The aim of the study is to assess the Length-Weight Relationship and Condition Factor of this species. A total of 1686 specimens consisting of 1277 males and 409 females were randomly collected on a monthly basis between February 2017 and January 2018 from fishers in the marine coastal waters of Luwu. The total length (TL) of fishes were measured to the nearest 1 mm using a fish measuring board and the total wet weight (TW) was recorded to the nearest 0.01 g using an electronic balance. The parameters a and b of the LWR were estimated using the logarithmic transformation of the equation. Condition Factor (CF) of the individuals was calculated. The results of study showed that the growth type of *S. canaliculatus* was isometric growth for female and negative allometric growth for male. The values of condition factor varied between 0,816 and 1,938. The result of study can be useful to fishery management practices for helping sustain the siganid fisheries and improving fisher livelihoods.

**Keywords:** Growth pattern, Condition factor, *Siganus canaliculatus* Bone Bay.

### Introduction

Siganids are economically important fishes in Indonesia and dictates a high demand in the fish markets of this region. These Fishes are attracted the attention of mariculturists of the Indo-Pacific regions mainly because of their herbivorous food habits, rapid growth and commercial value (Randall *et al.*, 1997). One of the representatives popular of the family Siganidae is Rabbit fish (*Siganus canaliculatus*). This species distribute among sea grasses, mangroves, and estuaries and also in shallow lagoons of tropical marine coastal environments.

Rabbit fish (*S. canaliculatus*) is abundant in the coastal waters of the Bone Bay Luwu, South Sulawesi (Suardi *et al.*, 2016). This species can be developed both as activity of economy of coastal communities especially the regional fishermen, and as source of district revenue (Halid *et al.*, 2016). Coastal waters area of Luwu is a very vital function for being a spawning area, sheltering and feeding area for *Siganus canaliculatus* (Suardi *et al.*, 2016).

Even though *S. canaliculatus* has commercial and cultural importance, there is an information lack about the length-weight relationship and condition factor of this species in the marine coastal waters of Luwu, South Sulawesi. The aim of the present study is to assess the length-weight relationship and condition factor of the white-spotted rabbitfish, *S. canaliculatus*. The information of the result of this study is an important tool for fisheries biology studies, through providing information on sustainable exploitations required for fisheries management.

### Materials and Methods

The study was conducted in the marine coastal waters of Luwu Regency, the Bone Bay, South Sulawesi, Indonesia.

Location of the sampling area was 6°27, 19 "-3 8'37,81" S and 120 14'4,35 "-120 17'36,17" E geographically. Coastal waters area of Luwu Regency, South Sulawesi, Indonesia locates in the northern of Bone Bay. This location is one of the fishing areas in South Sulawesi (Musbir *et al.*, 2018).

A total of 1686 specimens of *S. canaliculatus* consisting of 1277 males and 409 females were randomly collected on a monthly basis between February 2017 and January 2018 from fishers. The fish were brought to the laboratory and after washing, their total length (TL) was measured to the nearest 0.1 mm using a fish measuring board and the total wet weight (TW) was recorded to the nearest 0.01 g using an electronic balance.

Data on total length and total wet weight were recorded for each fish. The parameters a and b of the LWR were estimated using the logarithmic transformation of the equation (Ricker, 1975) :

$$W = a \cdot L^b$$

$$\text{Log } W = \text{Log } a + b \text{ Log } L$$

Condition Factor (CF): Individual values of the CF were obtained through the following formula (Ricker, 1975):

$$K = 100 \cdot W/L^3$$

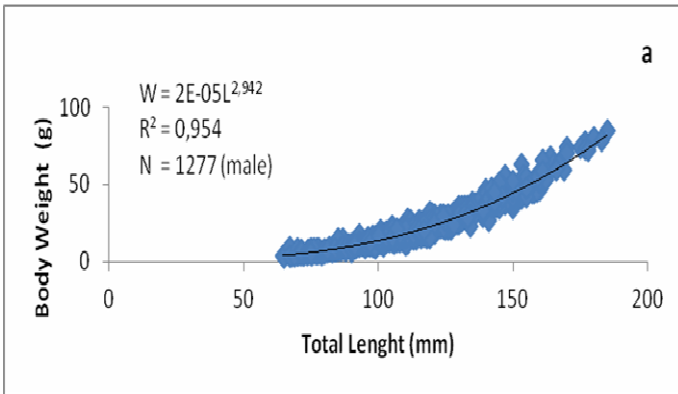
where K is condition factor, W is weight (g), L is length (mm)

### Results

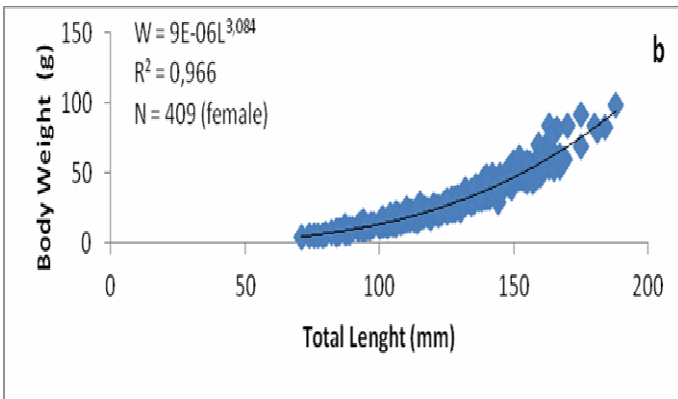
**Length-weight relationship (LWR) :** The logarithmic values of observed length and weight of both sexes were plotted (Table 1) and the regression lines fitted to the data indicated straight line relationship (Fig. 2, 3, & 4).

**Table 1 :** Length-weight relationship of the White-spotted Rabbitfish, *Siganus canaliculatus* (Park, 1797) in Marine Waters of Luwu, The Gulf of Bone Bay, South Sulawesi, Indonesia.

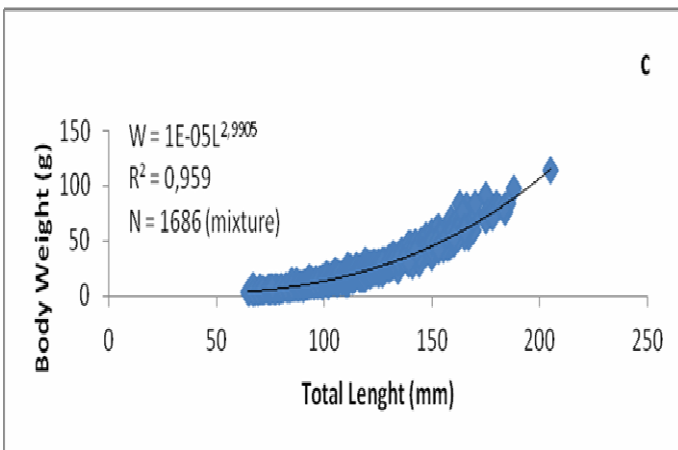
Parameter	Males	Females	Mixture
Total number of Specimens	1277	409	1686
The range of total length (mm)	65-205	71-188	65-205
The average of total length (mm)	115±20.57	125±23.28	117±21.69
The range of Body Weight (g)	12.99-113.88	14.6-98,2	12.99-113.88
The average body weight (g)	22.25±12.51	55.75±23.34	24.13±14.25
Growth Type	negative allometric	isometric	negative allometric



**Fig. 2 :** Relationship between body weight (g) and total length (cm) for *Siganus canaliculatus*, Male of Bone Bay, South Sulawesi, Indonesia.



**Fig. 3 :** Relationship between body weight (g) and total length (cm) for *Siganus canaliculatus*, Females (in marine waters of Bone Bay, South Sulawesi, Indonesia).



**Fig. 4 :** Relationship between body weight (g) and total length (cm) for *Siganus canaliculatus*, Mixture, in marine waters of Bone Bay, South Sulawesi, Indonesia.

The regression equations of length-weight relationships of *S. canaliculatus* was Males:  $W=0,0002 L^{2,94}$ , Females:  $W=0,000009 L^{3,08}$ , Mixture Male and Females:  $W= W=0,00015 L^{2,9905}$ . Means of the total length and body weight for the males and females are given in Table 1 respectively. A highly correlation was observed between total length and body weight for both sexes with correlation coefficient  $r = 0.955$  in male and  $r = 0.966$  in female.

**Condition factor (K)**

The values of condition factor (K) of *Siganus canaliculatus* was  $1.343\pm0.163$  for males and  $1.376\pm0.153$  for females.  $1.351\pm0.161$  for mixture (Table 2).

**Table 2 :** Condition Factor in Male, Female, Mixture of *Siganus canaliculatus* (a), Male (b) Females (c) Mixture, in marine waters of Bone Bay, South Sulawesi, Indonesia.

Parameter	Sexes		
	Males	Females	Mixture
Condition Factor	0.816-1.938	0.967-1.938	0.816-1.938
The Average of Condition Factor	1.343±0.163	1.376±0.153	1.351±0.161

In the present study, the largest *S. canaliculatus* specimen encountered at 205 mm TL and 113,88 g BW.

**Discussion**

In the present study, regression coefficients (b) of length-weight relationship were smaller than 3 in male showed negative allometric growths indicates that the fish becomes lighter and implied that the weight increased at a lesser rate than the body length. In the contrast with female that b was 3 showed an isometric growth implied that the weight increased In the same proportion as the length increased the body weight increased. The fish grows systematically or isometrically for a value of 3. A value less than 3 showed that the fish becomes lighter (negative allometric), b is greater than 3.0, indicates that the fish becomes heavier (positive allometric).

The present results are more or less similar to the previous ones. The negative allometric growth *S. canaliculatus* in Saudi Arabian Gulf waters near Dammam was exhibited  $b = 2.7$  (Wassef and Hadry, 2001). The species *Siganus luridus*, and *Siganus rivulatus* from the coast of Benghazi, Libya showed also negative allometric growth (Elbaraasi, 2014). However, *S. canaliculatus* from Gulf of Mannar, south India increases proportionately to the length as to be almost 3 (for males  $b = 3.0304$ , for females  $b = 3.3990$ ) (Anand and Reddy, 2012). The relationship between length and weight suggesting a good in growth of male and female due to the values of correlation coefficient were  $r>0.9$  for male,  $r>0.9$  for female, and  $r>0.9$  for mixture. The weight

of fish increased when they utilize the food items that are available for growth and energy (Kamaruddin *et al.*, 2012).

The largest recorded specimen For *S. canaliculatus*, from the Western Indian Ocean Waters was 25.1±0.6cm in TL Diani coastal waters, 18.2±0.6 cm in Msambweni coastal waters and 22.7±0.4cm in Shimoni coastal waters (Wambiji *et al.*, 2008). TL of *S. canaliculatus* in the Arabian Sea coast of Oman was 37.5 mm (Al-Marzouqi *et al.*, 2011). 34 cm in Jubail marine wildlife sanctuary, Saudi Arabia (Al-Qishawe *et al.*, 2014). 28 cm from the Arabian Gulf, Saudi Arabia (Tharwat., 2005).

The present results show that K values varied between 0.8162 and 1,9385. The condition factor may vary among fish species in different locations (Blackwell *et al.*, 2000). Condition factor is usually used to indicate the suitability of the Environment. Condition factor K of *Siganus canaliculatus* was 0.909±0.018 for in Msambweni from the Western Indian Ocean Waters (Wambiji *et al.*, 2008).

A difference of condition factor of fishes *S. canaliculatus* in the present study probably have been attributed to spawning and feeding reasons. The high values of the K for the *Siganus canaliculatus* fish may be related to the suitability of habitat ecology for the species, which lead to a high feeding activity and body fullness. The high values are may be also due to intense gonad activity and high productivity of fish. On the other hand, the low values may be due to less feeding activity. This result is agreed with the study of Tharwat *et al.* (2003) on investigation of *Siganus* species in the Arabian Gulf and Red Sea who showed that the most fishes were full with herbs and algae. Condition factors of =1 indicate a good level of feeding and proper environmental conditions (Ujjania *et al.*, 2012). Based on the result of study, Condition factors <1 for *S. canaliculatus* showing no proper environmental conditions of habitat for this species, whereas, values >1 showing suitable conditions of this environment for these fishes.

The values of condition factor K was influenced by fishing (Pervin and Mortuza, 2008), and also due to factors such as differences in food availability and environmental conditions (Khara and Khillare. 2013) and feeding, gonad maturity, sex, stomach fullness, health, season, habitat (Petrakis and Stergiou, 1995; Panase and Mengumphan, 2015).

The Length-Weight Relationship and Condition Factor of the White-spotted Rabbitfish, *Siganus canaliculatus* in the present study suggest that it is important for the development of suitable management measures for sustainable harvest of the resource. Relationship between length and weight of the fish has numerous practical applications in fishery biology especially for proper exploitation and management of the population of fish species (Odat, 2003 and Khara and Khillare, 2013).

### Conclusion

The siganid fishes (*S. canaliculatus*) in the marine waters of Bone Bay was isometric growth for female and negative allometric growth for male. The length-weight relationship and condition factor of *S. canaliculatus* indicated a favorable response of the fish to the habitat. The result of present study can be useful to fishery management practices and could go along way in helping sustain the siganid fisheries and improve fisher livelihoods.

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