

Size structure and gonad maturity of red snapper *Lutjanus malabaricus* in Pinrang waters, Makassar Strait, South Sulawesi, Indonesia

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ABSTRACT

The aim of this study was to determine the size structure, gonad maturity and sex ratio of red snapper *Lutjanus malabaricus*. The present research was conducted from March to July 2020 in Pinrang waters, Makassar Strait South Sulawesi. The parameters observed including size structure, gonad maturity and sex ratio. Data analysis was used Chi-square for sex ratio and size at first maturity was calculated using Spearman Karber equations, the gonad sample was histological analyzed. The results showed that a total of 1040 fish which consisted of 505 males and 535 females. The total length of snapper ranged from 19.5 to 69.5 cm with the sex ratio is equally distributed. Gonadal maturity level was under immature (36%) and mature gonad (64%). The size of the first-time maturity was 29 cm (male) and 37 cm (female).

Key words: Red snapper, Size structure, Gonad maturity, Sex ratio

Introduction

Red snapper fish or *Lutjanus malabaricus* is known as one of sought-after fisheries commodity in the market. This fish species can be found throughout Indonesia, encompassing Java sea, Sunda strait, South Java, Borneo, Sulawesi and Natuna Island at depth 30 and 100 meters. The red snapper has been extensively targeted from small scale to large industrial fishing vessels using several fishing gears such as drop-lines, bottom long-lines and fish traps. It is exacerbated by the unregulated commercial fishing (Blaber *et al.*, 2005). Most of large fleets operate in eastern Indonesia, particularly, South Sulawesi waters. This condition leads to serious concern on wild red snapper stock in this region. The increase of fishing pressure on red snappers indicates there

needs major improvement in managements of red snapper. Thus, baseline data related to reproductive biology of red snapper in the Pinrang waters of South Sulawesi are required.

Pinrang waters have been known as one of the best fishing grounds for red snapper in South Sulawesi. The red snapper has been the main commodity for fisheries capture which has significantly contributed to the livelihood of local people. In recent years, the fishing yield has gradually dwindled in Pinrang waters. Local fishermen are desperate due to the loss of a source of income. This condition also shows the exploitation rate of red snapper is uncontrolled. The need for a study to clearly investigate the current state of red snapper in Pinrang waters, including, size structure, gonadal maturity and sex ratio.

Overfishing can be considered, if the size of fish capture is small and having an early gonad maturation. However, there has been little information published on the reproductive biology of commercially important red snappers *L. malabaricus* in Pinrang waters, Makassar Strait.

Materials and Methods

Study site

The present study was conducted from March to July 2019 in Pinrang waters. This site has been a main fishing ground for red snappers in Pinrang waters of South Sulawesi. There are two seasons in the fishing ground, including dry and rainy season.

Length of fish

The sampling was carried out during the dry season. The sampling was performed using gillnet. Each of fish was identified and the total length of fish (± 1 mm) was also measured.

Size at first maturity

The size at first maturity was calculated according to using Spearman Karber Method (Udupa, 1986) as follows:

$$\text{Log } M = xk + \frac{x}{2} - (x \sum pi)$$

$$\text{Anti-log } m (M) = m \pm 1.96 \sqrt{\text{var } m}$$

Where:

- m = log size at first gonad maturity
- xk = log mean value of fish length class
- x = log addition of fish length in mean value
- p = the proportion of mature gonad at first size class,
- M = length of fish at first gonad maturity

Results

Length size distribution

The total number of fish capture during the study period was 532 fish that consisted of 226 males and 306 females' fish. Total length of fish ranged from 19.5 to 69.5 cm. The dominant size of fish capture was 39.5 cm and size of 69.5 cm was rarely captured during the study period (Figure 1).

Gonadosomatic Index (GSI)

Based on the observation, the GSI was divided into four stages, stage I immature (undeveloped), stage II maturing (early development) stage III mature

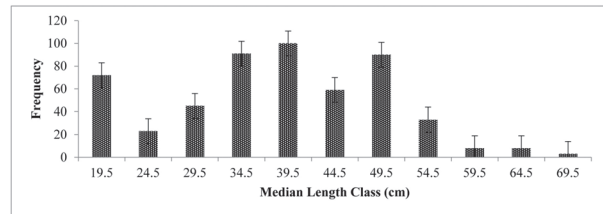


Fig. 1. Length size distribution of red snappers *Lutjanus malabaricus* in Pinrang Waters, South Sulawesi

(maturation stage) and stage IV fully mature. GSI frequency (%) for red snapper related to the maturity both males and females in each sampling time can be seen in Figure 2 and 3.

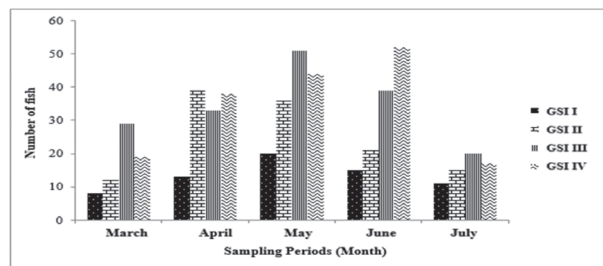


Fig. 2. Gonadosomatic Index of red snapper *Lutjanus malabaricus*

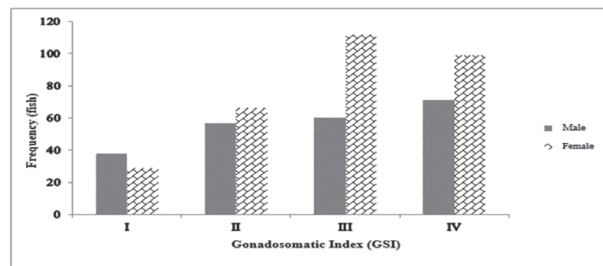


Fig. 3. Gonadosomatic index of males and females red *Lutjanus malabaricus*

Discussion

The observations made on the long frequency of red snapper indicated a tendency to spread normally with a long frequency mode of fish of 40 fish. The size of the catch is not much different from the catch obtained in the Northern Waters of Cirebon, Java Sea where the snapper catch has a total length of 19.6 - 66.6 cm (Noija *et al.*, 2014). Similarly, *Lutjanus synagris* snapper catches range in total length from 14.7 to 56 cm in females and 16.5 to 54.3 cm in males with a total fish catch of 434 females and 336 males in Abrolhos waters, Brazil (Freitas *et al.*, 2014). In addition, *Lutjanus argentiventris* snapper catches in

the range of a total length of 10.8 to 59 cm using fishing gear in California waters. These differences in size are caused by the type of fishing gear used in each study (Pinon *et al.*, 2009).

The GSI of red snapper on June was mostly at GSI IV (Figure 2). The results showed that a total 36% of red snapper caught at immature gonad level (GSI I and II). A total of 64% were at mature (GSI III and IV). This indicates that the highest spawning of red snapper in Pinrang waters occurred in June. Most of female red snapper caught in the study area was at GSI III and IV, whereas the GSI I is very rare (Figure 3). Each species is having a different size at first gonad maturity. Even in the same species, the size of fish at first maturity level might be also different. According to Effendie (2002) claimed that at geographically dispersed at latitudes of more than five degrees, there will be differences in size and age when fish reaches first gonad maturity level. In addition, the difference in size also occurs due to differences in ecological conditions of the waters.

The length of the fish that first gonad maturity in red snapper is used to analyze the number of fish which allow to be exploited for commercial fishing. Female fish reaches its first gonads maturity at length of 29 cm and males at 37 cm. John and Ramirez (2016) found the size of *Lutjanus synagris* at first gonads maturity ranged from 16.9 to 28.9 cm in Columbia Waters that caught using, longlines and gill net. Similarly, Oktaviani and Kurniawan (2017) stated that the size of *Lutjanus vitta* snapper at first gonads maturity was 252 mm (males) and 187 mm (females) in Jakarta Bay. Ramachandran *et al.* (2014) the size of *Lutjanus vita* at first gonads maturity was 15.8 cm (females) and 14.5 cm (males) in Indian waters. Furthermore, Viana *et al.* (2015) found the size of red snapper at first gonads maturity was 16.4 cm (males) and 17.1 cm (females) in the waters of Pernambuco, Brazil. Almamari *et al.* (2017), the size at first gonads maturity of *Lutjanus coeruleolineatus* was 28.1 cm (males) and 29.7 cm (females) in the Oman waters. The difference in the size at first gonads maturity due to changes in environmental conditions, abiotic factors, genetic population, differences in the location of the area, water quality, and the magnitude of fishing pressure (Abubakar *et al.*, 2019).

Conclusion

The size structure of red snapper *Lutjanus*

malabaricus is relatively large. Snapper fish in the mature gonad stage are mostly caught between March and July in Pinrang waters. Snapper sex ratio is considered in a balanced condition.

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