# Sex Ratio And Size At First Maturity Of Blue Swimming Crab (*Portunus pelagicus*) at Salemo Island, South Sulawesi

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## *Abstract*

*Blue swimming crab (Portunus pelagicus) is an economical valuable fisheries important commodity due to high demand and availability jobs created for the fishermen. Therefore blue swimming crab has been heavily exploited from Salemo Island. This study aimed at comparing the sex ratio and the size at first maturity of blue swimming crab caught in mangrove ecosystems, coral reefs, and seagrass. Sex ratio was analyzed using chi square test and the size at first maturity was analyzed using the Spearman-Karber formula. The results showed the sex ratio of males and females blue swimming crab caught in every ecosystem is balanced. The size at first maturity of blue swimming crab caught in mangrove, seagrass and coral reefs, each to the male 81.08 mm, 102.36 mm and 102.87 mm in width and size of female 94.54 mm, 83.35 mm, 98.31 mm width. In a reference to government regulations, the blue male swimming crab caught in the coral reef and seagrass ecosystems have yet to size at first maturity is allowed to be captured.*

***Keywords:*** *blue swimming crab, sex ratio, size at first maturity, Salemo Island*

## Introduction

Blue swimming crabs (*Portunus pelagicus*) are widely distributed among the West Indo-Pacific region (Sienes *et. al*., 2014; Ikhwanuddin *et al.,* 2012). This species is one of the economical valuable fisheries important commodity because of the high demand and availability jobs created for the fishermen (Lai *et al*., 2010; Sahoo *et al.,* 2011; Anand and Soundarapandian, 2011; Johnston *et al.,* 2011). According to Kembaren *et al*., (2012) the production of blue swimming crab in Indonesia occupied third place after China and the Philippines, with a production value of 16.4% or 28,000 tones from the rest of the world's production. Based on the report of the World Bank (2012), South Sulawesi contributes 21% of the total catch of blue swimming crab in Indonesia. Pangkep, Salemo Island is one of the largest producers of blue swimming crab and the centers of blue swimming crab in South Sulawesi. Over 70% blue swimming crabs caught at the sea due to the inability of cultivation supplied (Soesilo and Budiman, 2006), the high economic value of blue swimming crab triggers fishermen to massive exploitation caused decrease in natural populations, in both quantity and quality (Fujaya *et al*., 2014).

The resource availability of blue swimming crab in Indonesia has been decliniry mainly due, the poor natural population management (Ali *et al.,* 2014). This is mainly caused by high exploitation and the damage of habitat. Habitat conditions strongly influence on characteristics of biological resources. The characteristics of the habitat of blue swimming crab are very diverse, ranging from the estuary to the sea. The area of the estuary serves as nursery and feeding ground, the spawning season of female leave the estuary towards the sea to conduct spawning (Kumar *et al*., 2003; Sahib, 2012). The habits of the blue swimming crabs that inhabit some habitats, considering into the dynamic resources, constantly changing according to time and space, the understanding of these changes must also be understood as a cornerstone in the management of fisheries (Adam *et al*., 2006).

Sustainability of blue swimming crab export activities reflect the blue swimming crab sustainability resources. To ensure the blue swimming crab resources reproductive aspects remain sustain, related information is needed for the management. The purpose of this research is to find out the sex ratio and the size at first maturity of blue swimming crab caught in mangrove ecosystem (estuary), seagrass, and coral reefs.

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## Material and Methods

This research was conducted from March until July 2015 in Salemo Island, Pangkep, South Sulawesi. Samples taken from three locations, mangrove ecosystem that represents the area of the estuary, seagrass and coral reefs represent the sea area. Survey method and sampling of blue swimming crab was done using *bubu* (traditional fish trap) and gillnets. Sampling was conducted 8 (eight) times during 5 (five) months of research. The number of samples are 457. The total sample was captured on the mangrove ecosystem (estuary) is 250, in seagrass 92, and in reef 115.

Each blue swimming crab samples were separated based on the sex and measured the carapace width using a digital caliper with an accuracy of 0,1 mm. Size at first maturity of gonad presumes the by identify of the level of maturity which refers to the level of blue swimming crab gonadal maturity criteria Sunarto (2012) and modification of the Castiglioni and Fransozo (2006).

The parameters analyzed include sex ratio and the size of first maturity. Sex ratio is calculated by counting the number of the males and females from samples taken during the study. Sex ratio can be calculated by using the Chi-square test (Hasan, 2010) using the formula below:

$$\chi^2 = \sum_{i=1} \frac{(O_i - E_i)^2}{E_i}$$

$O_i$ refers to the value of observation, $E_i$ refers to the value of expectations. To find out the size of the width on the first maturity then it can be calculated using the equation of Spearman Karber (Udupa,1986).

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

95% confidence interval:

$$\text{anti log m} = \text{m} \pm 1,96 \sqrt{x^2 \Sigma \left( \frac{pi - qi}{ni - 1} \right)}$$

where xk is the middle value of the logarithm at the time blue swimming crab matured, X is the difference between the logarithms of the middle value, M is the value of the logarithm, pi is ri/ni, ri is the number of matured gonad to class-I, ni is the number of blue swimming crab to class-I. and qi are 1-pi.

## Result and Discussion

### *Sex ratio*

Sex ratio of the blue swimming crab observation (*Portunus pelagicus*) caught around the waters of the Salemo Island, found total sample at the mangrove ecosystem caught on (estuary) were 250, seagrass 92, and reef 115. Gender comparisons obtained of males and females blue swimming crab caught in mangrove ecosystems 52.4%: 47.6% (1.1:1), 64,1% seagrass ecosystems: 35.9% (1.7:1), 50.4% of the coral reef ecosystem: 49.6% (1.01:1) (Fig. 1).

Chi-Square analysis shows a comparison between the males and females each month on the ecosystem of mangrove, seagrass and coral reefs, all of which are not different or the same as the condition 1:1 ($\chi^2$=3,304: df=4; P>0,05), ($\chi^2$ =3,030: df=4; P>0,05), dan ($\chi^2$ =7,145: df=4; P>0,05).

There is no sex ratio difference of blue swimming crab (*Portunus pelagicus*) caught in mangrove ecosystems, coral reefs, and seagrass. Sex ratio 1:1 is equal to the sex ratio of the blue swimming crab caught 16 years ago in Salemo Island station III were the sample taken (Rukminasari, 1999). This result shown that the bottom trap and gillnet are unselective towards male and female. The existence of a balance between individual males and females allows blue swimming crab chosen their mate, where males play a role in controlling the success of mating (Rukminasari, 1999).

A balanced sex ratio also reported on a blue swimming crab caught in Karnataka, southern India 51% male and 49% female (Dineshbabu *et al*., 2008) in Trang Thailand 1.17:1 after tested there was no statistical significant difference (P > 0.05) between males and females a 1:1 sex ratio (Nitiratsuwan *et al*., 1995). Sex ratio is used as an indicator to assess the ability of the blue swimming crab maintains the running recruitment (Ault *et al*., 1995).

Water temperature can determine the magnitude of the sex ratio of organism captured (Xiao and Kumar, 2004). The water temperature in Salemo Island during the study ranged from 29-32 $^{o}$C, the temperature range does not affect the occurrence and feeding activity of a male or female on mangrove ecosystems, coral reefs, and seagrass.

### *Size at first maturity*

The results of the size at first maturity blue swimming crabs (*Portunus pelagicus*) caught in mangrove (Fig. 2), seagrass (Fig. 3), and coral reefs (Fig. 4) each to the male 81.08 mm, 102.36 mm and 102,87 mm in width and size of female 94.54 mm, 83.35 mm, 98.31 mm in width, respecting on the mangrove ecosystem, the size at the first maturity of males are smaller than females, this occurs because the size of the size at first maturity are vary greatly among different types of the caught of blue swimming crabs as s individuals and derived from one age of group or of the same length is not always must reach the size at first maturity in same time (Udupa, 1986) whereas in seagrass ecosystems and coral reefs, females smaller than males. The male size caught in the coral reef and seagrass ecosystems caused males harness more energy for metabolism to the growth rather than for gonads development.

According to Sunarto (2012) this may be used as a reference in determining the size of a decent catch. Decent size capture is very important in fisheries resource management activities. In the guidelines for sustainable fisheries governance (code of conduct for responsible fisheries) made FAO requires coastal States to set the size of a decent capture of resources of fisheries.

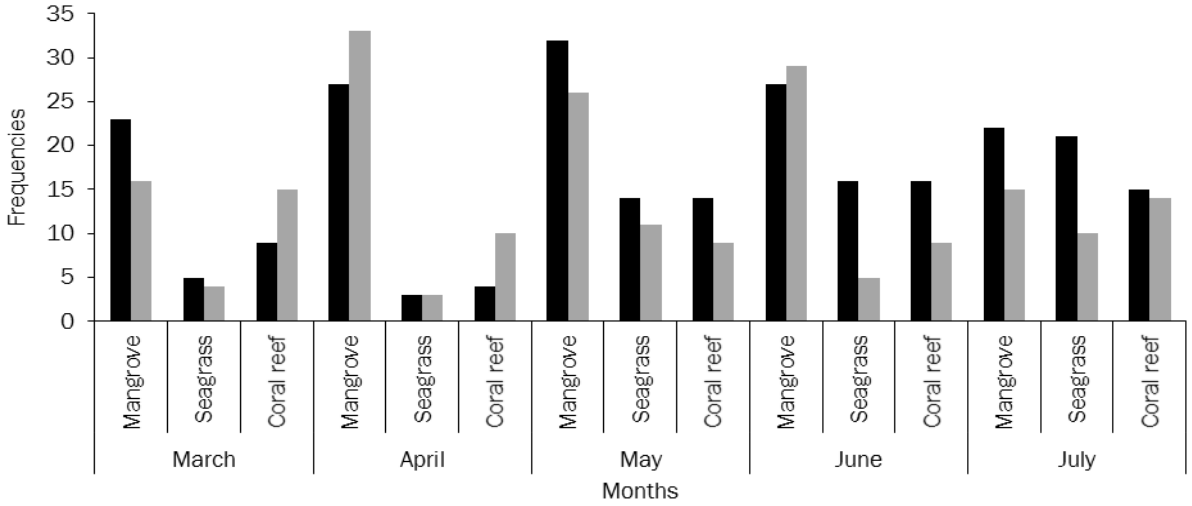


**Figure 1.** The percentage of the number of individual males and females caught on mangrove ecosystems, coral reefs, and seagrass. **Note:** ■ = male, ■ = female

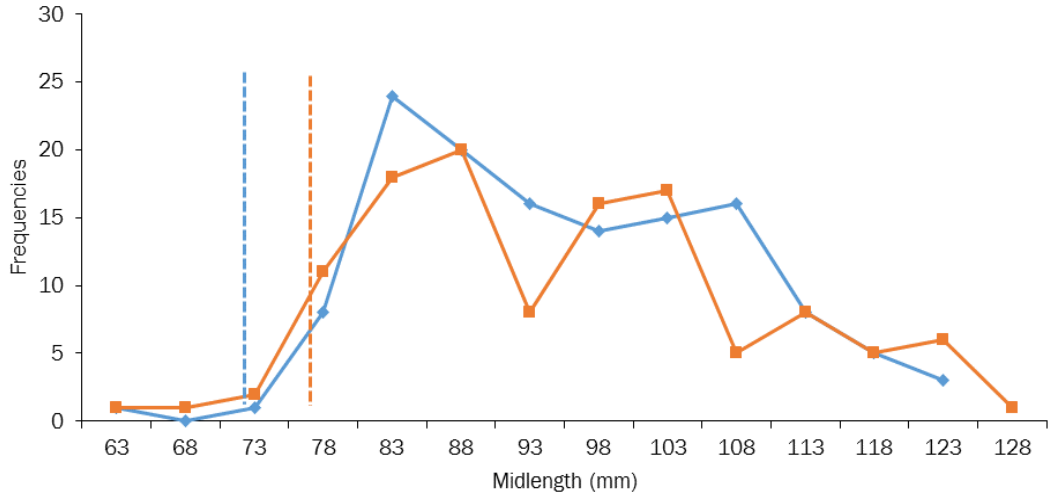


**Figure 2.**The size of first maturity of males and females caught in mangrove ecosystem
**Note :** = size at first maturity, = female, = male

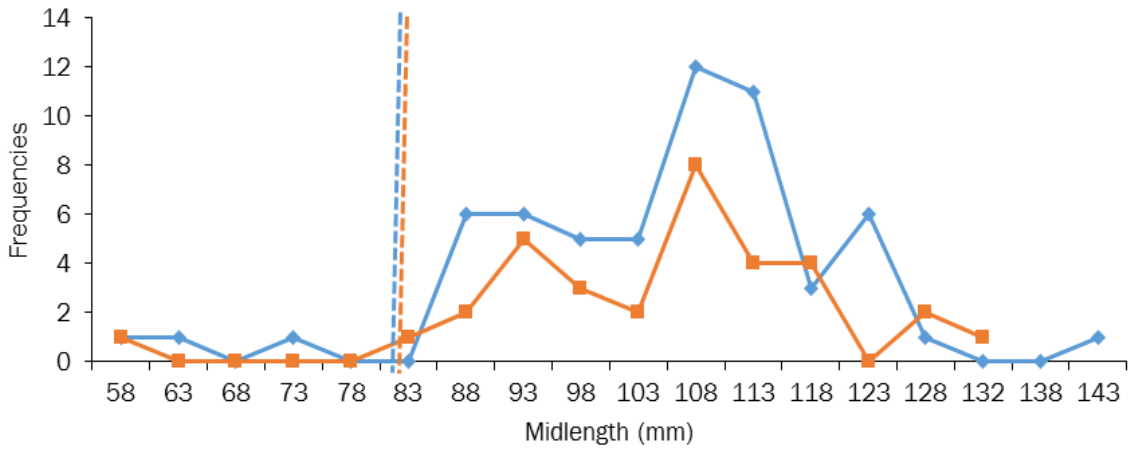


**Figure 3.** The size of first maturity of males and females caught in seagrass ecosystem
**Note :** = size at first maturity, = female, = male

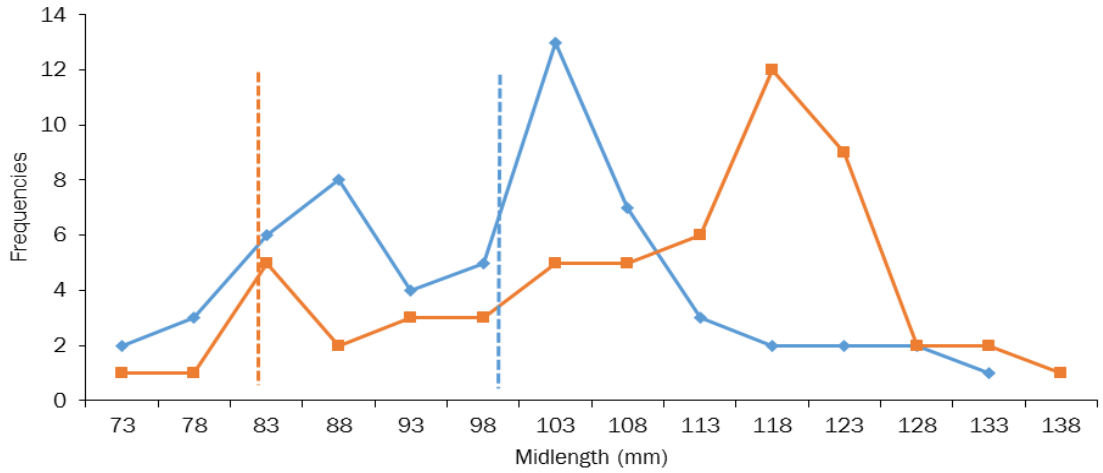


**Figure 4.** The size at first maturity of males and females caught in the coral reef ecosystem
**Note :** = size at first maturity, = female, = male

Based on PERMEN-KP/2015, the size of a blue swimming crab is allowed to be caught over 10 cm (100 mm), in a reference to government regulations, the blue swimming crab male caught in the coral reef and seagrass ecosystems have to reach the size of first time maturity been allowed to be caught. According to Bahtiar *et al*., (2012) catching blue swimming crab that does not fit standard will lead to occurrence of the stock depletion.

The size of first maturity in Salemo Island is greater than that found in Bone waters that is 71,63 mm carapace width range with 69,36-73,97 mm (Kembaren *et al*., 2012). Width of the carapace size blue swimming crab in Bandar Abbas, with an average of 91.5 mm with range 32-139 mm (Ehsan *et al*., 2010). Unlike the blue swimming crab caught in Demak waters the malessize of 128 mm width, while the blue swimming crab females amounted to 101 mm size width (Sunarto, 2012). Ikhwanuddin *et al*. (2009) mentions that the males and females size in Sarawak is 85 mm and 95 mm.

The difference size caused by the characteristics of the environment and geography. According to Kembaren *et al*., (2012) carapace width gonads is influenced by growth rate which is the direct function of the temperature. According to Lagler *et al*. (1977) some of the factors that influence the duration of gonadal maturation in marine life are difference species, age and size, as well as the individual physiology. External factors that influence the current temperature, among other

things, the presence of individuals of different genders, and spawning ground.

## Conclusion

The sex ratio of blue swimming crab caught in mangrove ecosystems, coral reefs, and seagrass balanced between males and females in 1:1. The size at first maturity on blue swimming crab caught in the mangrove, seagrass and coral reefs, each male 81.08 mm, 102.36 mm and 102.87 mm in width and size of female 94.54 mm, 83.35 mm, 98.,31 mm. When referring to the government regulation, the blue male swimming crabs caught in seagrass and coral reef ecosystems that have not yet reached the size at the first maturity have been allowed to be captured.

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