

## POPULATION PARAMETERS OF BLUE SWIMMING CRAB *PORTUNUS PELAGICUS* IN THE TIWORO STRAIT, SOUTHEAST SULAWESI

### PARAMETER POPULASI RAJUNGAN *PORTUNUS PELAGICUS* DI SELAT TIWORO SULAWESI TENGGARA

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#### ABSTRACT

The blue swimming crab (*Portunus pelagicus*) has a wide distribution in the fishing ground waters for fishermen's activity in the Tiworo Strait. The coastal area of Tiworo Strait has quite a lot of crab potential. Therefore, it is used as one of the pilot locations for sustainable crab management projects of the Indonesian Blue Swimming Crab Association (APRI). Growth, total mortality, natural death, fishing mortality, and the exploitation rate were the population parameters of crabs that need to be known so that management can be carried out in a sustainable manner of fisheries. A study on the population parameters of crabs has been conducted in the Tiworo Strait, based on carapace width frequencies data collected from Juli to December 2021 and analyzed using FISAT (FAO-Iclarm Stock Assessment Tool) II. The total sample is 7,809 samples, where the number of male blue swimming crabs is 3,295 samples and 4,514 females. The average size of the blue swimming crab carapace width caught was 107.57 mm for males and 110.65 mm for females. The results of the study showed that the growth rate (K) was 1.01/year, the total mortality rate (Z) was 0.67/year, the natural death rate (M) was 1.25/year, and the fishing mortality rate was 0.58/year. The exploitation rate (E) of blue swimming crab was 0.86, which showed symptoms of over-exploitation, so the management of crabs in these waters must be carried out more carefully to sustain the availability of crab resource stocks.

**Keywords:** blue swimming crab, width, weight, Tiworo Strait

#### ABSTRAK

Rajungan (*Portunus pelagicus*) tersebar luas di perairan daerah penangkapan ikan sebagai sumber tangkapan nelayan di Selat Tiworo. Kawasan pesisir Selat Tiworo mempunyai potensi rajungan yang cukup banyak. Oleh karena itu, lokasi ini dijadikan sebagai salah satu lokasi percontohan proyek pengelolaan rajungan berkelanjutan dari Asosiasi Pengelolaan Rajungan Indonesia (APRI). Pertumbuhan, kematian total, kematian alami, kematian penangkapan, dan laju eksploitasi merupakan parameter populasi rajungan yang perlu diketahui agar pengelolaan perikanan dapat dilakukan secara berkelanjutan. Telah dilakukan kajian parameter populasi rajungan di Selat Tiworo berdasarkan data frekuensi lebar karapas yang dikumpulkan pada bulan Juli hingga Desember 2021 dan dianalisis menggunakan FISAT (FAO-Iclarm Stock Assessment Tool) II. Jumlah sampel sebanyak 7.809 sampel, dimana jumlah rajungan jantan sebanyak 3.295 sampel dan betina sebanyak 4.514 sampel. Rata-rata ukuran lebar karapas rajungan yang ditangkap adalah 107,57 mm untuk jantan dan 110,65 mm untuk betina. Hasil penelitian menunjukkan laju pertumbuhan (K) sebesar 1,01/tahun, laju kematian total (Z) sebesar 0,67/tahun, laju kematian alami (M) sebesar 1,25/tahun, dan laju kematian penangkapan ikan sebesar 0,58/tahun. Tingkat eksploitasi (E) rajungan sebesar 0,86 menunjukkan gejala eksploitasi berlebihan, sehingga pengelolaan berkelanjutan atas rajungan di perairan tersebut harus dilakukan untuk menjaga ketersediaan dan keberlanjutan stok sumber daya rajungan.

**Kata Kunci:** rajungan, kepiting, lebar, berat, Selat Tiworo

## I. INTRODUCTION

The territorial waters of Pamandati Village, Konawe Regency, south of Southeast Sulawesi, is a cluster of the Tiworo Strait Fisheries Management Areas (FMA). The crab (*Portunus pelagicus*) is an organism that has a fairly wide distribution in the waters of the Tiworo Strait. The preferred habitat for this organism is a sandy substrate mixed with a bit of mud near mangrove forests, river mouths, and waters overgrown with seagrass (La Sara and Astuti, 2015; La Sara *et al.*, 2016).

Fishermen initially caught these organisms only to meet the family's consumption needs. This organism began to be exploited commercially around the last two decades when the price was high due to consumer demand from several countries, especially the USA and some Asian countries. This situation implies that the population of this organism is exploited intensively throughout the year (La Sara and Astuti, 2015; La Sara *et al.*, 2016). Currently, crab populations in several locations in the Tiworo Strait have shown symptoms of over-exploitation (La Sara *et al.*, 2016).

Rational management actions so that crab resources can be in a sustainable balance are influenced by several important factors, one of which is the population parameter. Therefore, research on the study of blue swimming crab population parameters is essential. This research is expected to benefit sustainable fisheries resources and can provide information to related parties, fishermen, and the government, to manage crabs sustainably. This study aims to describe the growth of the crabs in the fishing ground of Pamandati Village in the Tiworo Strait.

## II. RESEARCH METHODS

### 2.1. Time and Place of Research

The research was conducted in July – December 2021 in the Tiworo Strait, Southeast Sulawesi (Figure 1).

These waters are one of the most significant crab habitats in Southeast Sulawesi. The life cycle of crabs occurs in these waters since they mate and release their eggs in deep waters (spawning ground). The eggs hatch and develop into larvae (zoea), then grow into juveniles in shallow waters - the intertidal zone (nursery

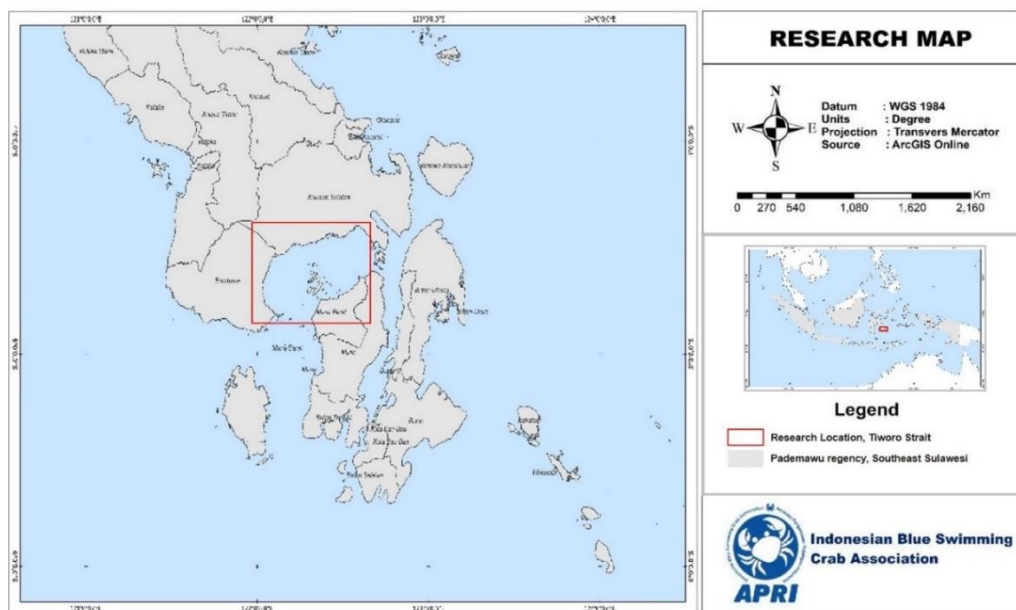


Figure 1. Crab sampling locations in the Tiworo Strait, Southeast Sulawesi.

ground), and reach juvenile and adult sizes (fishing ground), then mate again (La Sara *et al.*, 2016).

**2.2. Material and Data**

A sampling of crabs was taken at Pamandati Village, South Konawe, which was obtained from the catch of traps that were landed in mini plants. Parameters measured and observed included carapace width, weight, sex, and gonadal maturity. Carapace width was measured using a 30 cm ruler. The weight of the individual crabs was measured using an analytical balance fleco i2000 (accuracy level 0.1 g), which was tabulated in a carapace width frequency distribution table using the help of the Microsoft Excel program.

**2.3. Data Analysis**

The average width of first gonad maturity (CW<sub>m</sub>) was obtained from the carapace width analysis using the logistic function graph according to King's equation:

$$P = 1 / (1 + e^{-r(CW - CW_m)}) \dots\dots\dots (1)$$

Description : *P* = proportion of matured females; *r* = slope of the logistic curve ; *CW<sub>m</sub>* = size of maturity at 50% crab's population is mature.

The width first caught (L<sub>c</sub>) was obtained from the analysis of the carapace width logistic function (Sparre and Venema, 1992):

$$SL = 1 / (1 + (S_1 - S_2L)) \dots\dots\dots (2)$$

Description : *SL* = size at first capture (logistic curve); *S<sub>1</sub>* = intercept regression of carapace width and frequency; *S<sub>2</sub>* = sloper regression of carapace width and frequency; *SL<sub>50%</sub>* = *S<sub>1</sub>/S<sub>2</sub>*.

Growth parameters, growth coefficient (K), and carapace width (CW) were obtained from the frequency of carapace width (Sparre &

Veneme, 1992):

$$CW_t = CW^\infty (1 - e^{-k(t-t_0)}) \dots\dots\dots (3)$$

Determination of asymptotic/infinite carapace width (CW) and growth coefficient (K) using the ELEFAN program packaged in FISAT II software (Gayaniilo *et al.*, 2005). Theoretical age (t<sub>0</sub>) with the equation of Natural mortality (M) using the empirical equation of Pauly (1980):

$$\text{Log } M = -0.0066 - 0.279 \text{ L} + 0.654 \text{ Log } K + 0.4534 \text{ Log } T \dots\dots\dots (4)$$

Description : *M* = Natural death rate; *CW* = Maximum total carapace width; *K* = Growth rate; *T* = Temperature.

Estimated total mortality (Z) was performed using the width-converted catch curve method in the FISAT II package (Gayaniilo *et al.*, 2005; Pauly, 1983). Catch mortality (F) and exploitation rate (E) were calculated by the formula (Pauly, 1983) :

$$Z = F + M \text{ dan } E = F/Z \dots\dots\dots (5)$$

**III. RESULT AND DISCUSSION**

The size of the blue swimming crab caught was 87.5 – 157.5 mm. In Figure 2, there is a frequency of the width of the crab's carapace, which reflects the size group of crabs caught. The highest peak of the crab caught during the study was July – December 2021 at a size of 101.5 mm – 115.5 mm, with male crabs caught during the study ranging from 107.57 mm and female crabs with an average of 110.65 mm. The average size of the crab in this study is smaller than that obtained in Pati waters (north coast of Java), namely males 123.36 mm and females 124.88 mm (Ernawati *et al.*, 2015). Environmental factors and different fishing pressures in each research location cause these differences.

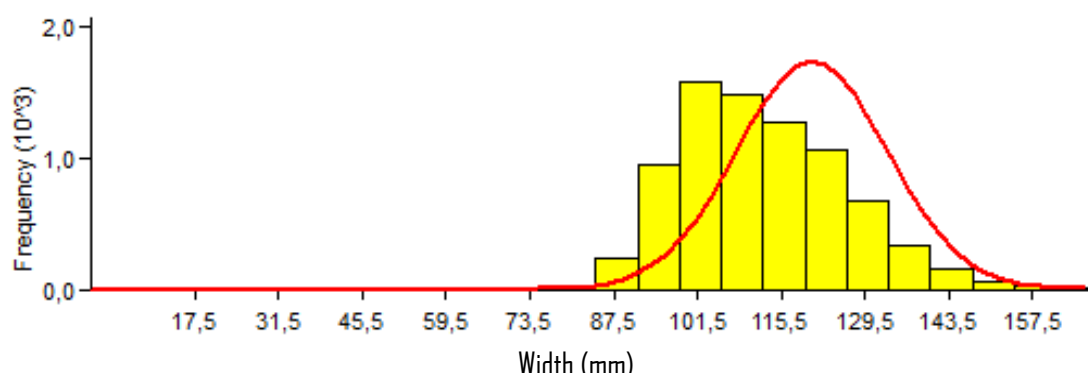


Figure 2. Frequency distribution of crab carapace width caught in the Tiworo Strait.

Analysis of the swimming crab population parameters by not distinguishing the sexes obtained a growth rate (K) of 1.01 years. The value of K crabs in this study is not much different from those obtained in other Indonesian waters, such as in Bone waters, namely male crabs of 1.27 years<sup>-1</sup> and female crabs of 1.08 years (Kembaren *et al.*, 2012), Pati waters obtained for male crabs at 1.26 years and female crabs at 1.13 years<sup>-1</sup> (Ernawati, 2013), Belitung waters were obtained for female crabs at 1.02 years (Ernawati *et al.*, 2015), East Lampung waters were obtained for petite crabs males by 1.2 years<sup>-1</sup> and females by 1.1 years (Zairion, 2015). A lower K value was obtained for the crabs found in the waters of Lasongko Bay, namely 0.69 (Hamid *et al.*, 2016).

The total mortality rate (Z) of crabs in the water Pamandati Village on the Tiworo Strait was 0.67 per year, the natural mortality rate (M) was 1.25 per year, and the fishing mortality rate (F) was 0.58 per year. The mortality rate (Z, M, F) of the crabs in this study is smaller than that obtained in the waters of Lasongko Bay, where the Z value is 3.42 years<sup>-1</sup>, the M value is 0.87 years<sup>-1</sup>, and the F value is 2.55 years<sup>-1</sup> (Hamid *et al.*, 2016). However, it tends to be more extensive when compared to that obtained in Pati waters, where the Z value of male crabs is 6.19 years<sup>-1</sup> and female crabs is 6.24 years<sup>-1</sup>, the M value of male crabs is 1.18 years<sup>-1</sup>, and female crabs are 1.27 years<sup>-1</sup>, and the F value of male crabs is 4.97 years<sup>-1</sup> and female

crabs are 5.01 years<sup>-1</sup> (Ernawati, 2013). The mortality rate (M) due to fishing depends and varies according to the diversity of fishing efforts each year. The variation in the total mortality rate (Z) from year to year is primarily influenced by the mortality rate due to fishing. In contrast, the natural death rate does not vary much. Natural death rates cover various events like death due to predation, disease, and aging.

The results of this study indicate that the value of exploitation rate (E) for crabs in the Tiworo strait was 0.86. According to the criteria of (Pauly *et al.*, 1984), the value of the rational and sustainable exploitation rate in waters is at the value of  $E < 0.5$  or the highest value of  $E = 0.5$ . This already shows symptoms of over-exploitation, or the crabs' utilization level in this area has been more caught. For this reason, caution is needed in managing crab resources in these waters. The exploitation rate in this study was also lower than the crab exploitation rate in the waters of Trang, Thailand, which were 0.83 and 0.82 for males and females, respectively. This is due to the different fishing pressures in the two aquatic environments.

#### IV. CONCLUSION

Tiworo Strait, as one of the pilot locations for sustainable crab management projects of the Indonesian Blue Swimming Crab Association (APRI), has quite a lot of crab potential. Studying about parameter

population of crabs is essential to understand the growth and mortality of BSC, especially in the waters of Tiworo Strait. This study found that the utilization level has been carried out intensively (over-exploitation), so the management of crabs in these waters must be carried out more carefully to sustain the availability of crab resource stocks.

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