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Population of Coconut Crab (*Birgus latro*) in Fam Island, Raja Ampat, Indonesia

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Abstract

This research was conducted inthe villages of Korwo Iba and Meos Ambower, Fam Islands Raja Ampat Regency, Southwest Papua Province, will be implemented within 3 years, namely 2020 to 2022. The purpose of this study was to evaluate the coconut crab population and its sex population (comparison of the number of male and female sexes), the relationship between body weight and length coconut crab carapace. This research uses descriptive quantitative and qualitative with the technique of reviewing the results of previous research journals. The data analysis used was the calculation of the relationship between length and weight of fish growth by Effendi 2002. The method of collecting morphometric data from a number of coconut crab samples. Based on the research results obtained,p.s The population of coconut crabs decreased because the male coconut crab population was more dominant than the females, vegetation factors and the activity of local people who caught coconut crabs for trade or consumption. The relationship between carapace length and body weight of the coconut crab produces a value of b less than 3 (<3) which indicates a negative allometric, which means that the length gain is faster than the body weight gain.

Keywords: Coconut Crab, Population, Meos Ambower, Korwo Iba

1. Introduction

Walnut crab or also known as Robber Crab and Coconut Crab, have different names in each region. The walnut crab (Birgus latro) is a species of crustacean that is considered endangered and classified as vulnerable by the IUCN (International Union for Conservation of Nature). This crab is the center of attention because of its large size and unique behavior. Walnut crabs live in areas that are damp and dark and avoid the sun to reduce the occurrence of evaporation on their bodies (Mardiana et al., 2023).

The habitat that Birgus latro likes most is coastal vegetation and bushes in supralittoral areas, inhabiting caves or rock holes and looking for food at night (nocturnal) (Jahidin, 2010). In addition, it is also known as an animal that has great strength in lifting weights because it can lift up to 29 kg. If allowed to live up to 30 years, the coconut crab (Birgus latro) is different from other types of crabs (Rahman et al., 2016). Based on food trials in rearing containers, it was found that coconut remained the main food for coconut crabs apart from bananas and sweet potatoes. Another trial said that keeping coconut crabs provided coconut as the main food for coconut crabs (Serosero et al., 2018).

Coconut crab habitat is spread across eastern Indonesia, namely on the islands of Sulawesi, Nusa Tenggara, Maluku and Papua. One of the coconut crab habitats is in the Fam Islands. The Fam Islands are located in the southwestern part of Waigeo Island and the sea of Batanta Island, Raja Ampat Regency, Southwest Papua Province. The Fam Archipelago is an island that has a diversity of coastal and marine resources, one of which is the kanari crab. The purpose of this study was to evaluate the coconut crab population and its sex population (ratio of the number of male and female sexes), the relationship between body weight and carapace length in the Fam Islands, especially in Korwo Iba and Meos Ambower villages, as well as its future development. The results of this study are expected to provide information regarding the potential of the coconut crab population in the Fam Archipelago and development opportunities to make this island a walnut crab conservation area in Eastern Indonesia.

2. Materials And Methods

Research Site.

This research was conducted in Korwo Iba Village and Meos Ambower Fam Islands, Raja Ampat Regency, Southwest Papua Province, for 3 years, namely 2020 to 2022. The Fam Islands (Figure 1) area is in the Dampier Strait Region which is geographically located in the southwest of Waigeo Island and northwest of Batanta Island. This area is located in the western part of Area III of the Dampier Strait Marine Protected Area, which borders the Halmahera Sea, North Maluku Province. In general, the Fam Islands area can be divided into three clusters/parts, namely the Piaynemo Islands (Piaynemo Island, Keruo Islands and Rufas Island), Pam Islands and their surroundings (Pam Besar Island, Pam Kecil Island, Napsi Island, Myoskor, Myosba Island, Andau Besar Island, Andau Kecil Island, Inus Island, Yar Island, Manaru Island, Mangkinan Island) and the Bamboo Islands (Bamboo Island, Matop Island, Pamali Besar Island, Pamali Kecil Island).(Anonim, 2018)

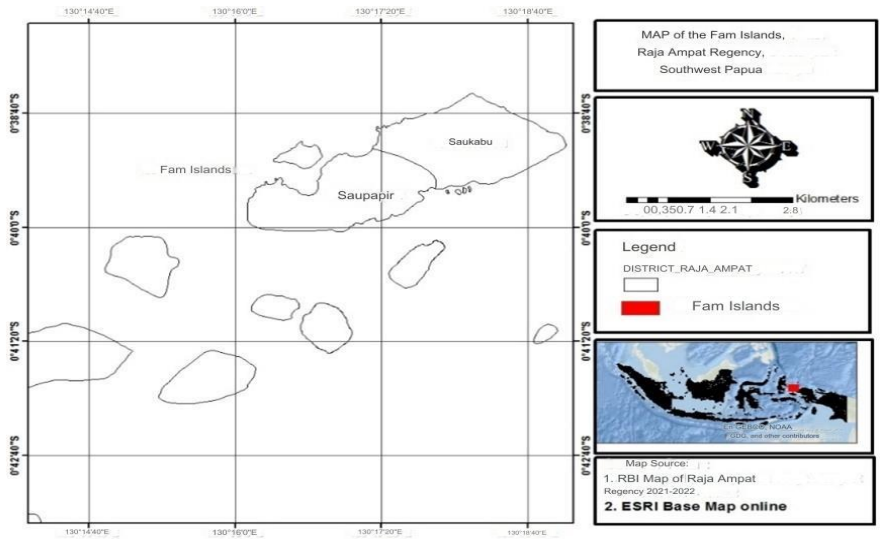

Figure 1. Fam Island

Data Collection Procedures.

This study uses descriptive quantitative and qualitative techniques by reviewing research journals on coconut crab habitat that have been published nationally and internationally relating to coconut crab habitat in Indonesia. This study also involved collecting data on the length and weight of Birgus latro. This study used the method of collecting morphometric data from several samples of walnut crabs. The body length of the coconut crab is measured from the tip of the shell to the tip of the tail, while the weight is measured using a digital scale with high accuracy. The data collected was then analyzed to identify the pattern of relationship between length and weight in coconut crabs.

Data Analysis. Analysis of the data used in this study is to calculate the long-weight relationship calculated based on the formula according to (Effendi, 2002).
w=aL^b
Which is then transformed into a linear equation with the logarithm of the equation, so the equation becomes:
Log W= log a+b log L
W = Weight of fish (grams)
L = Fish Length (mm)
a = intercept (Cutting the length-weight relationship curve with the y-axis)
b = Estimation of the coefficient of length-weight relationship
N = Number of Samples

The b value obtained from this calculation can reflect the pattern of fish growth. If the value of b = 3, then the growth pattern is isometric or weight gain corresponds to the increase in length of the fish, and if the value of b ≠ 3, then the growth pattern is allometric. Allometric growth patterns are divided into two, namely positive allometric and negative allometric. If the b-value is less than 3 it is called a negative allometric (length gain is faster than weight gain), and if the b-value is greater than 3 it is called a positive allometric (weight gain is faster than length gain) (Mutaqqin et al., 2016).
In this study, the long-weight relationship was analyzed using simple linear regression. Meanwhile, to find out the value of b = 3 or b, a t test is carried out with the formula according to≠ (Effendie, 1979) that is:
t=(3-b)/Sb
Where S = Standard deviation
b= constant
Then the results of the t test are compared with the value of t table, if t count > t table then the value of b = 3 and if t count < t table then the value of b is 3.≠

3. Results and Discussion

The population of Coconut Crab

Based on the results of calculating the number of coconut crab populations in the three years of this study, data on the coconut crab population were obtained at Korwo Iba villagein 2020 there are 175 crabs, in 2021 there will be 157 crabs and in 2022 there will be 82 coconut crabs. While the total population in Meos Ambower village in 2020 there were 334 individuals, in 2021 there were 245 individuals and in 2022 there were 160 coconut crabs. The figures show that Village Meos Ambower has a larger population of coconut crabs compared to Korwo Iba. Total population of coconut crabs in Korwo Iba and Meos Ambower of the Fam Islands can be seen in Figure 2.
The existence of *Birgus latro* can be found in rocks, tree roots, and between rocks as a place to protect themselves from predators and have enough food. Judging from the physical characteristics of the coconut crab habitat on Meos Ambower beach, it is dominated by areas of bush vegetation, coconut trees which are sufficiently supportive for habitat for coconut crabs and rocky substrate texture and rocky rock crevices arranged starting from the shoreline. to the land which is covered with soil, while the sand is suitable as a hiding place for coconut crabs, especially in avoiding rock predators which are arranged from the shoreline to the land which is covered with soil, as for sand.

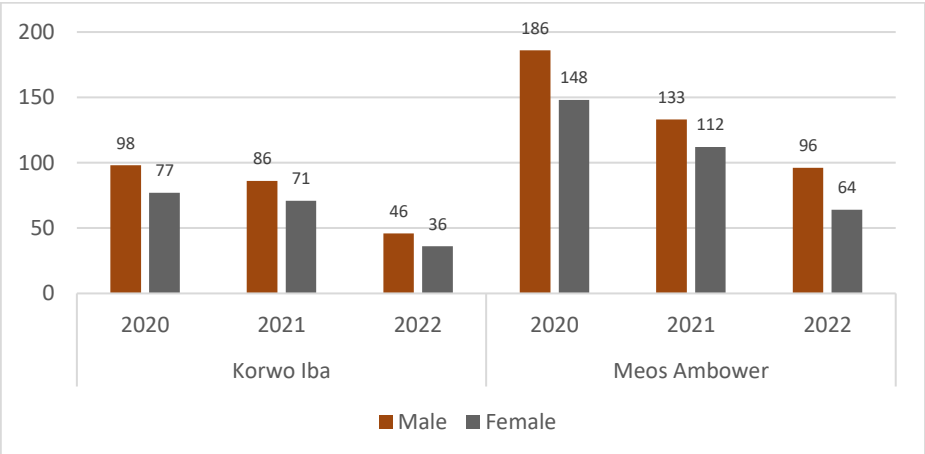

Figure 2. Number of Population of Coconut crabs in Korwo Iba Village and Meos Ambower

Vegetation is something that cannot be separated from the coconut crab's habitat. It can be found in areas overgrown with large trees, damp, rock crevices or holes and dark. In addition, the condition of the texture of the substrate and coconut crab is also influenced by the density of vegetation conditions. This is in accordance with what was said by Jahidin (2010), that the coconut crab population is also affected by habitat vegetation. The smaller the number of coconut crabs and other vegetation, the less the number of coconut crabs caught, and vice versa, if the density of coconut and other vegetation is high. , then more coconut crabs are caught(Abubakar dan Ma'sitasari, 2019).

But these two research locations, both experienced a decrease in population from the first year to the third year. The coconut crab population has decreased due to the activities of the local community who catch coconut crabs for trading because they have a high selling value. Other factors that influence are weather conditions and the environment where the coconut crab lives also greatly affects its survival, one of which is rainfall which is also a factor that affects the condition of the coconut crab's body in changing its behavior and looking for food.

As said (Mardiana et al., 2023)the effective time for walnut crabs to find food is during drizzling rain, because low rainfall does not harm walnut crabs and makes it easier for them to breathe and to find food. The walnut crab will hide in its nest if there is heavy rain because it will endanger its life. This is a form of adaptation of the behavior of walnut crabs. According to (Asera et al., 2022) the diverse distribution of coconut crabs occurs due to the availability of food. The habitat of the coconut crab (*Birgus latro*) has been disrupted due to the clearing of residential plantations and changes in the function of the forest, so that these activities will have an impact on the coconut crab's foraging activities.

Coconut Crab is a fishery resource that has high economic value, so it needs to be protected so it doesn't become extinct. The decline in the Coconut Crab population in nature is estimated to be due to changes in the environment (habitat, food and predators) which are indirectly caused by human activities (deforestation, occupancy, arrival of transmigrants bringing predatory animals, and exploitation) as well as by overfishing (M. Aris dan S. Malan, 2021).

***Male and Female Population*.**

The results of population calculations in 2020 on Korwo Iba Island show that there are 175 coconut crabs, consisting of 88 male sexes and 77 female sexes. In 2021 there were 157 coconut crabs consisting of 86 male and 72 female, and in 2020 there were 80 coconut crabs consisting of 46 male and 36 female. Meanwhile, there were 234 coconut crabs obtained in 2020 on Meos Ambower Island, consisting of 186 males and 148 females. In 2021, there were 345 coconut crabs consisting of 133 males and 112 females, while in 2022, the total number of coconut crabs was 160 consisting of 96 males and 64 females.

The male coconut crab population is more dominating than the female sex. This condition is one of the obstacles in the breeding process of coconut crabs, where the number of males is more than the number of females. This is a major impact on the decline in the coconut crab population. Apart from the small number of female coconut crabs, male coconut crabs also find it difficult to find partners for spawning and environmental conditions are also a determining factor. This is in accordance with research(Refiani & Sulistiono, 2009), stated that the exploitation of the coconut crab population continues to this day, where the habits of people who catch coconut crabs are more focused on the larger size regardless of the sex of the coconut crab.

A population if the sex ratio is not balanced then the development of the population is hampered. The balance of male and female sex ratios can disrupt the development of crabs until the recruitment phase, so that population declines can occur. The cause of this imbalance is thought to be due to the influence of behavior, spawning season, size at first maturity and growth. The sex ratio is important to know because it affects the stability of the population of coconut crab species (Yuyun Abubakar, Sunarti, 2021). To control this, there needs to be an effort from the government to maintain the Fam Archipelago as a marine protected area to protect coconut crabs from extinction.

Carapace Length and Body Weight of Birgus latro.

Calculation results of carapace length and body weight of coconut crabsKorwo Iba and Meos Ambower villages can be seen in Figure 3.

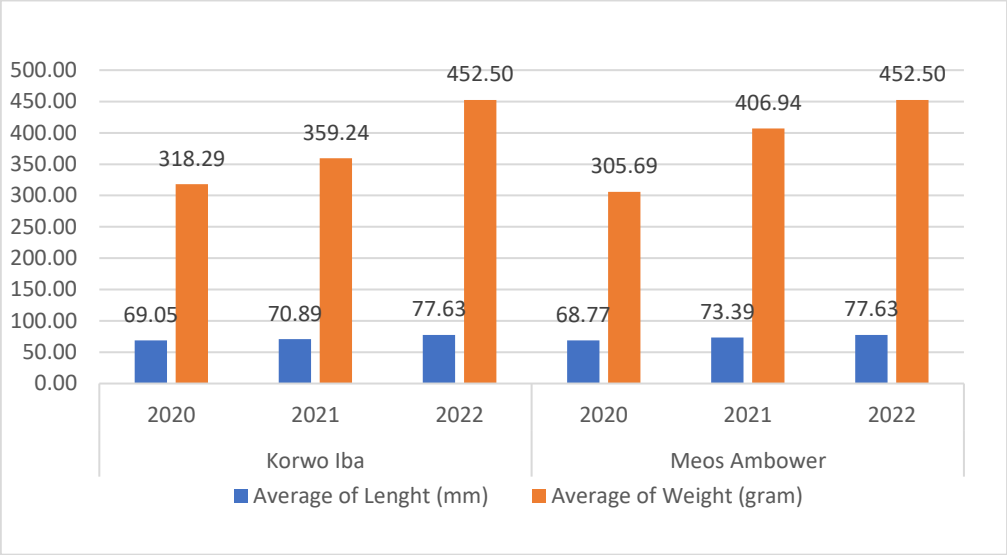

Figure 3. Carapace Length and Body Weight of the *Birgus latro*

Based on Figure 3 above, the calculation of the carapace length of the coconut crab in Korwo Iba village ranged from 69.05 – 77.63 mm, while the carapace length of the coconut crab in Meos Ambower kerkisar was between 68.77 - 77.63 mm. The highest carapace length calculation is in 2022 with a size of 77.63 mm at the Korwo Iba and Meos Ambower Village locations. And the lowest average carapace size was found in 2020 with a size of 68.77 mm in Meos Ambower village. Coconut crabs at these two locations, if seen from the length of their carapace, are considered to have reached gonadal maturity andare in the reproductive phase of both males and females.

This is in accordance with what is said(Supyan et al., 2015b)that, the smallest size of mature gonad male coconut crab is about 30 mm thoracic length (in the type of female coconut crab). In female crabs it is thought that the gonads first mature at about 35 mm in thoracic length. At the time of coconut crabs, they need sufficient quantity of food and nutritional quality to support reproductive processes and gonadal maturity. The age at first maturity of the gonads is estimated to be more than five years with a thorax ± 22.5 cm long. Obed et al. (1991) also stated that coconut crabs will reach gonadal maturity when they reach the age of 3.5 and five years (Obed et al. 1991 and Schiller 1992).(Supyan et al., 2015a).

Other literature says that the average length of being caught is an important thing to study because by correlating the average size of being caught with the size at first maturity, it can give an idea of whether the crab resource is still sustainable or has been over-exploited. This information can provide information on whether the size of the crabs caught have experienced spawning or have not experienced spawning. It is important to know the size of the first gonad maturity in crabs because by knowing the value of Lsmf, it can be used to develop a management concept for the survival of these animals (Supyan et al., 2015b).

Meanwhile, the highest average body weight of the coconut crab is found in 2022 with a weight of 452.5 grams at the locations of Korwo Iba and Meos Ambower Villages. And the lowest average body weight was found in 2020 with a weight of 305.69 grams in the village of Meos Ambower. The body weight of coconut crabs in Korwo Iba village ranged from 318.29 – 452.50 grams, while the body weight of coconut crabs in Meos Ambower village ranged from 305.69 – 452.50 grams. HThe relationship between carapace length and coconut crab body weight in Korwo Iba village can be seen in Table 1.

No	Location	Year	Average Length(mm)	Average weight (grams)	a	b	R^2	r	FC Average	Long relationship is heavy
1	Korwo Iba	2020	69.05	318.29	0.00438	1.68842	0.54	0.97	2.27	W = 0.00438L1.68842
		2021	70.89	359.24	0.00200	2.79885	0.96	1.00	1.01	W = 0.00200L2.79885
		2022	77.63	452.50	0.00245	2.74596	0.97	1.00	1.01	W = 0.00245L2.74596
2	Meos Ambower	2020	68.77	305.69	0.01747	2.28037	0.79	0.99	1.06	W = 0.01747L2.28037
		2021	73.39	406.94	0.00493	2.59673	0.93	1.00	0.96	W= 0.00493L2.59673
		2022	77.63	452.50	0.00245	2.74596	0.97	1.00	1.01	W = 0.00245L2.74596

Based on Table 1, the value of b is less than 3 (<3) so it can be concluded that the allometric is negative, which means that the length gain is faster than the weight gain. This b value can also reflect the growth pattern of coconut crabs in Korwo Iba and Meos Ambower.

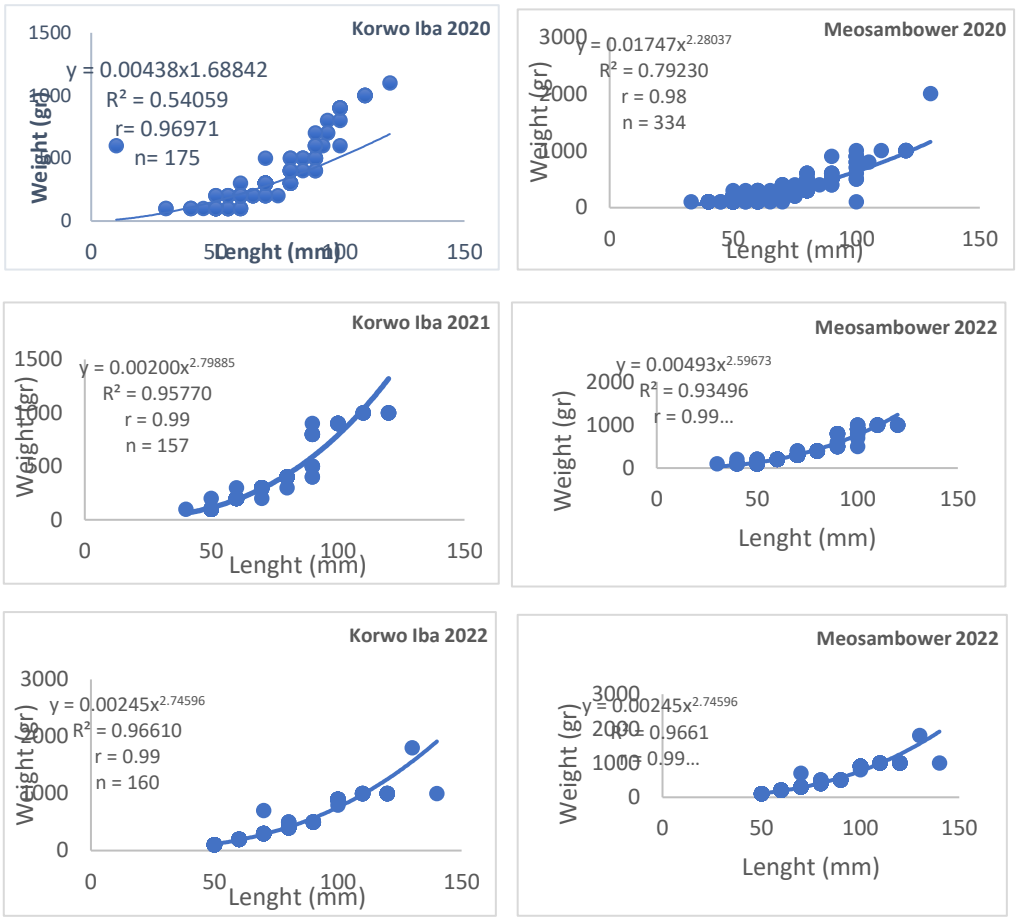

Figure 4. Regression analysis of the relationship between length and weight of *Birgus* ***latro***

This is in accordance with what is said (Effendi, 2002), if the value of b <3, then the fish is fat, where the weight gain is faster than the increase in length (Figure 4). According to (Barus, 2011)adding that weight can be thought of as a function of length. The relationship between length and weight almost follows the cubic law, namely that the weight of the fish is the cube of its length. But the relationship that exists in fish is actually not the case because the shape and length of fish are different. Fish growth patterns can be identified by analyzing the length-weight ratio of fish. The results of this study are expected to provide information about the potential of walnut crabs in the Fam Archipelago and development opportunities to make this island a walnut crab conservation area in Eastern Indonesia. Coconut crab is an iconic species that has a slow growth, low survival. To safeguard this important resource for present and future generations. The current management approach should be refined and formalized as management measures and regulations (Nadia Helagi et al., 2015)

4. Conclusion

The coconut crab population is decreasing because the male coconut crab population is more dominant than the female, vegetation factors and the activity of local people who catch coconut crabs for trade or consumption. The relationship between carapace length and body weight of coconut crab results in a value of b less than 3 (<3) which indicates a negative allometric, which means that the length gain is faster than the body weight gain.

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