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Habitat Characteristics and Abundance of Mangrove Crabs in the Mangrove Forest of Concong Dalam Village in Concong District Indragiri Hilir Regency

Karakteristik Habitat dan Kelimpahan Kepiting Bakau di Hutan Mangrove Desa Concong Dalam Kecamatan Concong Kabupaten Indragiri Hilir

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ABSTRACT

This study was carried out in February 2024 in Concong Dalam Village, Concong District, Indragiri Hilir Regency, to know the habitat characteristics, types and distribution of abundance and size of mangrove crabs. This research uses a survey method by determining stations using purposive sampling consisting of 3 stations, where at each station, nine traps are installed with an area of around 628 m^2/trap within 1 x 24 hours. Each trap is given chicken head bait in the morning at low tide, with two traps lifted at each high tide. A one-way ANOVA test was carried out to determine differences in abundance between stations. The results showed that the substrate was muddy with a moderate organic content of 12,82%. There were two species of mangrove crabs, including *Scylla serrata* and S.tranquebarica, where *S. serrata* dominated the population. The average abundance of mangrove crabs in the area was a value of 47,76 ind/ha, and there were no significant differences among stations. The size distribution of the species *S. serrata* (shell length 6-9,12 cm; shell width 9,08-13,31 cm; and weight 130-380 g), while in the species *S. tranaubarica* (shell length 6,52-6,98 cm; shell width 10,11-10,54 cm and weight 180 g). Small sizes dominated the population of mangrove crabs.

Keywords: Mangrove crabs, Abundance, Habitat, Concong Dalam Village

ABSTRAK

Penelitian ini dilaksanakan pada bulan Februari 2024 di Desa Concong Dalam Kecamatan Concong Kabupaten Indragiri Hilir, dengan tujuan mengetahui karakteristik habitat, spesies dan kelimpahan serta sebaran ukuran kepiting bakau. Penelitian ini menggunakan metode survei dengan penentuan stasiun pengambilan sampel secara *purposive sampling* yang terdiri dari 3 stasiun. Setiap stasiun diletakkan 9 bubu dengan luas area sekitar 628 m^2/bubu dalam waktu 1 x 24 jam. Setiap bubu diberikan umpan kepala ayam, peletakan bubu dilakukan pagi hari pada waktu surut dengan 2 kali pengangkatan bubu pada setiap waktu pasang. Untuk mengetahui perbedaan kelimpahan antar stasiun dilakukan uji One Way ANOVA. Hasil penelitian menunjukkan bahwa substrat lumpur memiliki kandungan bahan organik sedimen sebesar 12,82 %. Ditemukan dua spesies kepiting bakau diantaranya *Scylla serrata* dan *S. tranqubarica*, dimana *S. serrata* mendominasi populasi. Kelimpahan kepiting bakau di Desa Concong Dalam memiliki nilai rata-rata 47,76 ind/ha dan tidak terdapat perbedaan signifikan antar stasiun. Distribusi ukuran spesies *S. serrata* (panjang kerapas 6-9,12 cm; lebar kerapas 9,08-13,31 cm; dan bobot 130-380 g) dan spesies *S. tranaubarica* (panjang kerapas 6,52-6,98 cm; lebar kerapas 10,11-10,54 cm; dan bobot 180 g). Distribusi ukuran populasi kepiting bakau didominasi oleh ukuran kecil.

Kata Kunci: Kepiting Bakau, Kelimpahan, Habitat, Desa Concong Dalam

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INTRODUCTION

Concong Dalam Village is a coastal area in Concong District, Indragiri Hilir Regency, Riau Province. Concong Dalam Village is topographically from lowlands with peat and brackish swamp areas to mangrove forests. The mangrove forest ecosystem functions as a foraging place, a breeding ground, and a spawning ground for aquatic fauna such as mangrove crabs. Mangrove crabs are one of Indonesia's most significant fishery resources because of their vast habitat in mangrove forests and brackish waters. Mangrove crabs live in the mud around the roots of mangroves by digging holes and are more active at high tide with a reasonably wide area range. Mangrove crabs utilize their sense of smell in foraging, so to catch or trap mangrove crabs requires a type of bait with a pungent aroma (Mulyo et al., 2020). The mangrove forest area in Concong Dalam Village has experienced a decline in quality and area due to the clearing of residential land and excessive tree felling.

The utilization of mangrove ecosystems in Concong Dalam Village is increasing, including mangrove crab fishing activities for consumption and commercial purposes, both local and export. Suppose conditions like this continue without proper supervision and regulation of utilization. In that case, it is feared that excessive exports will cause a decrease in natural stocks (Tetelepta et al., 2012) with the excessive activity and exploration of mangrove crabs in Concong Dalam Village continuously without paying attention to damage and nature preservation. Therefore, it is necessary to research the ecological status, abundance, and size distribution of mangrove crabs so that efforts can be made to preserve their abundance.

Many studies on mangrove crabs have been carried out, including research by Serosero (2011) about the habitat characteristics of mangrove crabs in the coastal waters of Todowongi Village, West Halmahera Regency, about the abundance of mangrove crabs (*Scylla* spp.) in the Setapuk Singkawang mangrove rehabilitation area (Yulianti & Sofiana, 2018), about the abundance and characteristics of mangrove crabs in the mangrove ecosystem in Busung Village, Sri Kuala Lobam District, Bintan Regency (Saputra et al., 2020). However, there has been no research data on mangrove crabs in Concong Dalam Village, Concong District, Indragiri Hilir Regency, so this research was carried out.

MATERIALS AND METHOD

Time and place of research

This research was carried out in February 2024. Sampling was conducted in Concong Dalam Village, Concong District, Indragiri Hilir Regency (Figure 1). Sample analysis was conducted at the Marine Biology Laboratory, Department of Marine Sciences, Faculty of Fisheries and Marine, Universitas Riau.

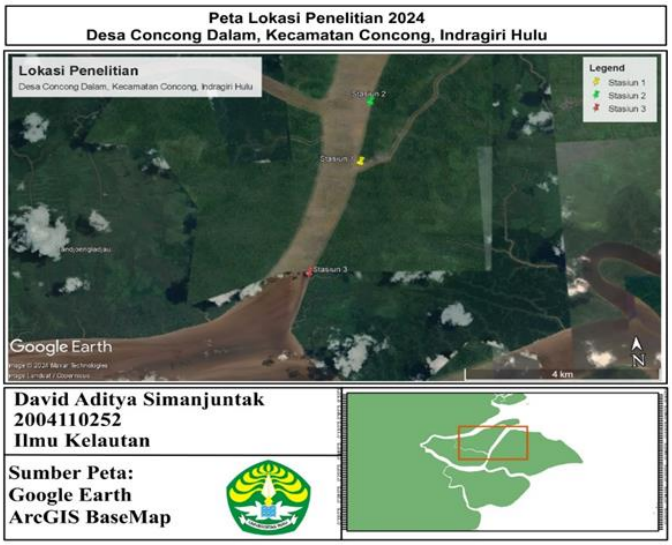


Figure 1. Research location

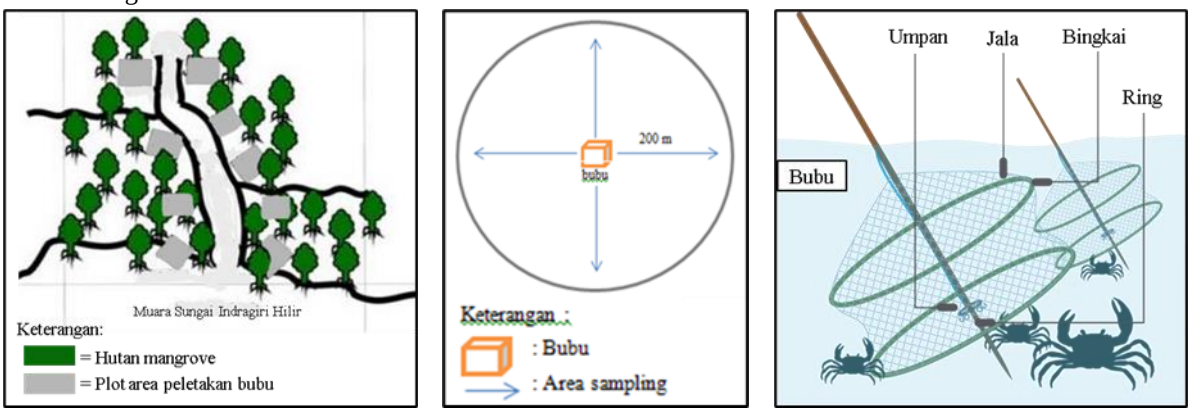
Methods

This study uses a survey method by observing and sampling directly in the field, which includes measuring arch parameters in the form of temperature, salinity, pH, sedimentary organic matter, type of aquatic bottom substrate and mangrove crab samples. The samples were then analyzed in the Marine Biology laboratory of the Faculty of Fisheries and Marine, Universitas Riau.

Procedures

Purposive sampling was used to determine the location of the research sampling. The sampling location consists of 3 locations, including Station I, a mangrove area adjacent to community settlements affected by human activities. Station II is a mangrove area far from human activities, and Station III is a mangrove area used for crab fishing.

Mangrove crabs were sampled using bubu as a trap with a bubu mouth opening ranging from 10-20 cm. Sampling was carried out on each plot with an area of about 628 m^2/bubu within 1 x 24 hours with a total of 9 bubu. Each bubu is given chicken head bait, and the bubu is laid in the morning at low tide, with 2 times lifting the bubu at each high tide. The caught crab samples are put in a cool box and taken to the Laboratory for identification and analysis. An illustration of mangrove crab sampling at each bubu per area between stations can be seen in Figure 2.



(a) (b) (c)

Figure 2. Mangrove crab sampling scheme at each station (a), area of sampling/bubu (b), Bubu fishing equipment design (c)

Environmental parameter measurements were carried out directly, including temperature, salinity, water pH and sediment sample collection. Sediment sampling was carried out using a paralon pipe with a 5 >10 cm diameter on each plot of ±1000 g, then put into plastic. Sediment sampling was carried out to determine the substrate type and sedimentary organic matter content. Sediment fraction analysis was carried out using wet sifting and pipette methods. The multi-level sieve method is used to obtain Ø-1-Ø4, while for the pipetting method, volumetric pipettes are used to obtain Ø5-Ø7. The data obtained is tabulated to calculate the percentage of sediment particles. The classification of sediment types is based on the proportion of the size content of gravel, sand and mud particles by plotting the percentage value of sediment particles in the Sheppard triangle. The analysis of organic matter content in sediment was carried out using the Loss on Ignition method (Rifardi, 2012), as follows.

$$BOT\ (\%) = \frac{a-c}{a-b} \times 100\%$$

Information:

a = Weight of the cup and sample after drying at 105°C (g)

b = cup weight (g)

c = weight of the cup and sample after combustion temperature 550°C (g)

The caught crab samples were taken to the Marine Biology Laboratory, Department of Marine Sciences, Faculty of Fisheries and Marine, Universitas Riau, to be identified. Identification is done by observing physical shapes/characteristics/characteristics using identification books (Desyana et al., 2023) and related literature journals. The abundance and relative abundance of mangrove crabs based on the number of individuals per unit area is calculated using the formula Odum (1993) as follows:

$$Di = \frac{\sum ni}{A} \quad (1)$$

$$KR = \frac{ni}{N}\ x\ 100\% \quad (2)$$

Information:

Di = Abundance of crabs (ind/ha)
ni = Total number of individuals for type
A = Sampling area (628 m^2)
KR = Relative abundance of the ith species
N = Number of individuals

The size distribution of mangrove crabs includes the carapace (PK) length measured from the middle forehead curve to the dorsal part's abdominal limit. The width of the carapace (LK), measured from the end of the last anterolateral spine on the right to the end of the previous spine on the left, and the weight of the mangrove crab. The mangrove crabs found are divided into 3 class groups based on size (Saputra et al., 2020).

The research data is presented in the form of tables and graphs. To find out if there is a difference in abundance between stations, a statistical analysis is carried out using the One Way ANOVA analysis test and the Least Significant Difference (LSD) test if there is a significant difference with the help of SPSS (Statistical Package for the Social Sciences) Software.

RESULT AND DISCUSSION

General conditions of the research location

The mangrove forest ecosystem in Concong Dalam Village has an area of ±500ha. There are mangrove species from 5 families and 11 species, including *A. alba, A. marina, B. cylindrica, C. tagal, R. apiculata, R. mucronate, R. stylosa, N. fruticans, S. ovata, S. alba,* and *X. granatum* (Irma et al., 2020). Mangrove forests can filter water and sediment from the mainland and become a protector and buffer against water waves and winds from the ocean. The mangrove forest ecosystem is also a habitat and life cycle of the biota. The productivity of mangrove forests is supported by the input of organic matter from land and sea and from within the ecosystem, which comes from mangrove litter, a food source for aquatic biota such as mangrove crabs.

Mangrove crabs live along mangrove forest areas by utilizing the lush mangrove forest by digging holes and found around the roots of mangroves. Young to adult crabs are often found in holes in muddy habitats around mangrove roots (Tarumasely et al., 2022). Several parameters, including temperature, pH and salinity of the waters, influence the habitat conditions of mangrove crabs in mangrove ecosystems. The results of water quality measurements in Concong Dalam Village at high tide can be seen in Table 1.

Table 1. Value of water quality parameters in mangrove areas at high tide time

No	Parameter	Unit	Station		
			I	II	III
1	Temperature	^{0}C	25	27	27
2	pH	-	6.8	6.7	6.7
3	Salinity	Ppt	6	7	6

The results of water quality measurements at each station at the time of high tide have values that are not much different. The temperature of the waters ranges from 25-27 ºC, the pH of the seas ranges from 6.7-6.8, and the salinity of the waters ranges from 6-7‰. The water temperature value > 25 ºC is still feasible to support the survival of mangrove crabs. In general, the pH of seawater is alkaline, and the pH value of the water between 6.5-9 is still good for the life of mangrove crabs (Shelley & Lovatelli, 2011; Siahainenia et al., 2016). The confluence of freshwater inputs from land and ocean influences the salinity of the waters. Mangrove crabs have been known to tolerate salinity levels of waters between 2-40 ppt. According to Sara et al. (2014), adult mangrove crabs are generally able to live in low-salinity areas because of their excellent osmosis regulation. The sediment substrate type is based on the percentage of gravel, sand and mud fraction types. The results of the measurement of the percentage and type of sediment substrate in Concong Dalam Village can be seen in Table 2.

Table 2. Percentage of sediment substrate factions and types in Concong Dalam Village

Station	Plot	Sediment Faction (%)			Types of Sediment
		Gravel	Sand	Sludge	
I	1	0,37	6,53	93,10	Sludge
	2	0,30	9,26	90,43	Sludge
	3	0,27	4,59	95,10	Sludge
II	1	0,26	5,46	94,27	Sludge
	2	1,26	8,19	90,55	Sludge
	3	0,35	6,13	93,53	Sludge
III	1	1,09	6,18	92,72	Sludge
	2	0,19	5,34	94,47	Sludge
	3	0,38	5,69	93,92	Sludge

The results of the measurement of the type of sediment substrate between plots at each station are dominated by mud. This can be due to the presence of mangrove plants and the strength of currents and waves. According to

Rifardi in Alhadad et al. (2024), currents and waves are the main force factors that determine the direction and distribution of sediments, and this strength is also what causes different sediment characteristics so that at the bottom of the water it is composed of various groups of sediment fraction types. Mangrove forests have distinctive supporting roots, thus reducing water movement; this condition causes fine substrate particles to settle around the mangrove roots, forming a collection of soft sediment layers that are very difficult to drain outward (Saputri & Muammar, 2018). Mangrove forests also affect the distribution of organic matter in the waters. The results of the sediment organic matter content measurement in Concong Dalam Village can be seen in Table 3.

Table 3. Total sediment organic material content in the mangrove area of Concong Dalam Village

Station	Plot 1	Plot 2	Plot 3	Average
I	17,61	12,23	11,81	13,88
II	12,04	11,12	12,08	11,75
III	11,25	14,55	12,73	12,84

Each station's total sediment organic matter content has an average value of 12.82%. The highest total sedimentary organic matter was found at station I, with a percentage of 13.88%, while the lowest was at station II, with 11.75%. The high content of sedimentary organic matter at Station I can come from household waste and mangrove litter that decays, is swept away, and settles on the bottom of the water; the opposite is found at Station II. Organic matter is vital in determining soil fertility, both physically, chemically, and biologically (Yuningsih et al., 2014).

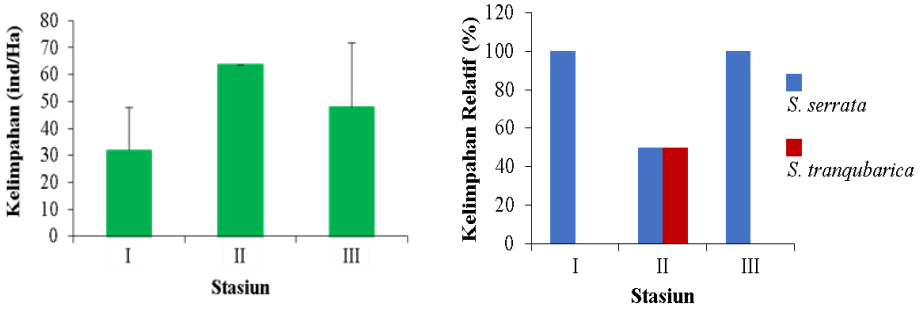
Types and abundance of mangrove crabs

Based on the results of mangrove crab analysis research, there are two species of mangrove crabs. The species *S.serrata* has a greenish carapace, like the color of olive, with an H strip shape on the carapace that is not deep. This type has a pointed spine shape on the frontal margin (carapace front spines) has sharp spines in the corpus, and pleopods are not patterned and have a reddish to orange tip. The species *S.tranquebarica* has a greenish to blackish carapace with the shape of an H path on the inner carapace, and has spines in front of the head that are generally blunt and have spines on the claws and have a color at the tip of the claws reddish (Desyana et al., 2023).

(a) (b)

Figure 3. Types of Mangrove Crab Species, *Scylla serrata* (a), *Scylla tranqubarica* (b)

The abundance of mangrove crabs in Concong Dalam Village ranges from 31.84-47.77 ind/ha with an average of 47.76 ind/ha. The results of calculating the relative abundance (KR) between mangrove crab species were obtained in *S. serrata* species with a value of 77.77% and in *S. tranqubarica* with a score of 22.22%. The results of the calculation of the abundance and relative abundance of mangrove crabs at each station can be seen in Figure 4.



(a) (b)

Figure 4. Abundance of individuals (a), relative abundance (b) mangrove crab

The abundance of mangrove crabs at each station is highest at station II with a total of 63.68 ind/ha, and the lowest abundance is found at station I with a total of 31.84 ind/ha, and the abundance of mangrove crabs at station III has a value of 47.77 ind/ha. The lowest abundance at station I can be caused by its proximity to residential areas with various activities, so only *S. serrata* species are found. According to Chadijah et al. (2013), the lowest abundance of mangrove crabs is generally found in zones with low levels of mangrove vegetation density and around residential areas. Mangrove crabs will seek out and inhabit areas supporting their lives.

The highest abundance was found at station II with a value of 63.68 ind/ha, and *S.serrata* and *S. tranquebarica* species were found. Station II is a mangrove forest area that is still good, is from a residential area, and has minimal anthropogenic activities. According to Sari et al. (2021), the abundance of mangrove crabs is influenced by several environmental factors, such as the abundance of mangrove plants around the station and the abundant food intake. Station III is a mangrove crab fishing area for residents. The destruction of mangrove ecosystems can cause a decline in the population of mangrove crabs in nature as a natural habitat due to overfishing activities or overexploitation (Siahainenia et al., 2016).

In addition to mangrove density and anthropogenic activity, physical factors of the aquatic environment and biological factors also impact the abundance of mangrove crabs. The interaction and competition of mangrove crabs with other biota in the food chain can affect the distribution of abundance to the distribution of mangrove crab size in the waters.

Mangrove crab size distribution

The size distribution is based on carapace length (PK), carapace width (LK) and weight (g) based on size class. The results of the calculation of the size distribution of each mangrove crab species in each class can be seen in Figure 5.

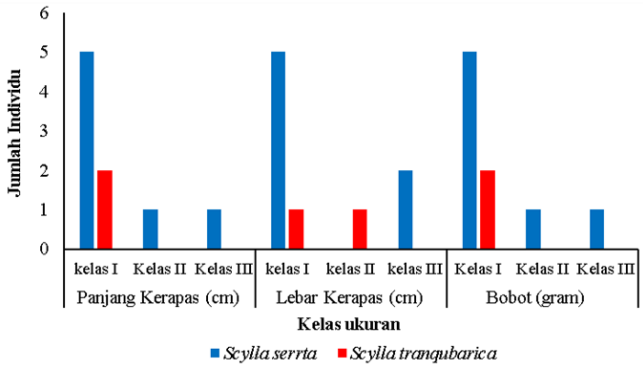


Figure 6. Distribution of individual sizes of mangrove crabs in each class

Note:

Length		Width		Weight	
Class I	: < 7,06 cm	Class I	: < 10,49 cm	Class I	: < 213,33 g
Class II	: 7,07 – 8,08 cm	Class II	: 10,50 – 11,9 cm	Class II	: 213,34 – 296,97 g
Class III	: > 8,08 cm	Class III	: > 11,9 cm	Class III	: > 296,97 g

It was found that seven individuals *of S. serrata* were unevenly distributed in each class with a length of 6-6.98 cm (class I), 7.61 (class II) and 9.12 (class III); the width of the crab was 9.08-10.43 cm (class I) and 11.98-13.31 cm (class III); and the crab weight was 130-190 g (class I), 250 g (class II) and 380 g (class III). In the species *S. tranaubarica*, two individuals were found distributed at a length of 6.52-6.98 cm (class I), a width of 10.11 cm (class I) and 10.54 (class II), and a weight of 180 g (class I). The distribution of mangrove crab size groups is dominated in class I, which has a small size.

Size distribution is a method of measuring the shape of the outer body, which is used to compare the size of living things. The results of the distribution of individual sizes of each class were found that the length of the carapace was more dominant in class I with an average size of < 7.06 cm, the width of the carapace I with an average size of < 10.49 cm, and the weight in class I with an average weight of < 213.33 g. Mangrove crabs have three phases of life, namely juvenile, young and adult, which can be known from the width of the carapace where juveniles are < 7 cm, 7 < 12 cm are the young phase and > 12 cm for the adult phase (Sara et al., 2014). According to the regulation of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia Number 56/Permen-Kp/2016 article 3, mangrove crabs that can be caught are mangrove crabs with a carapace width of over 15 cm or a weight of more than 200 g/head.

CONCLUSION

The characteristics and quality of the aquatic environment in Concong Dalam Village are relatively the same as the type of sludge sediment, and the total organic matter content of the sediment ranges from 12.82%. Two species of mangrove crabs were found, including *S. serrata* and *S.tranqubarica*, with an average abundance of 47.76 ind/ha, and there was no significant difference in the abundance of mangrove crabs between stations. The highest abundance was found in the species *S. serrata*. The distribution of size groups in each class found that the length of the carapace, the width of the shell and the weight of mangrove crabs were more dominant in class I with small size.

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