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HABITAT QUALITY MUD CRAB (SCYLLA SP) IN MANGROVE ECOSYSTEM OF WAROPEN REGENCY, PAPUA PROVINCE

Sukardi[1)], Amrullah[2)], Dahlia[2)]

[1)] Student of the Applied Masters in Food Security, Pangkep State Agricultural Polytechnic
[2)] Food Security Applied Masters Study Program, Pangkep State Agricultural Polytechnic
* Correspondence : sukardisudiono1977@gmail.com

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Habitats characteristics, Scylla sp and Mangrove ecosystems

ABSTRACT
Mangrove crab (Scylla sp) is one of the leading fishery commodities in Waropen Regency which has quite high economic value and is typically associated with mangrove ecosystems so that the existence and sustainability of mangrove ecosystems has a serious impact on the existence of mangrove crab populations. This study aims to examine the condition of the ecological quality of mud crab (Scylla sp) habitat in the mangrove ecosystem of Waropen Regency which stretches from Masirei District to Wapoga District. Collecting ecological data using the point quarter technique method and collecting mud crab data using a catch survey method using a purposive random sampling method using a folding trap. The results showed that the mud crab (Scylla sp) habitat quality index (IKH) ranged from 18-90 which was in the "good" category (Index value 68-90) with an area of 21,818.60 hectare and "moderate" (Index value 44- 66) with an area of 673.58 hectare. Ecologically, the mangrove ecosystem of Waropen Regency is good enough to support the survival of mangrove crabs

INTRODUCTION

Mangrove forests are important ecosystems that support life in coastal areas and in maintaining the balance of biological cycles in their environment. For living things, the mangrove ecosystem has ecological and economic functions. Ecologically, mangroves act as a habitat for fish, crabs and shellfish species that have high economic value. In areas that have a very high density, mangroves grow well supported by the presence of large rivers so that they are able to provide sufficient nutrients for mangrove growth (Hendrawan et al, 2018).

Indigenous peoples on the coast of Waropen Regency live from mangrove forests which have economic benefits in finding crabs, shrimp, fish and shellfish which sustain and support the community's livelihood. Given the importance of mangrove forests for indigenous peoples who live on the coast of Waropen Regency, think that mangroves have done all the actions that a mother does for her child, caring for, feeding, guarding, protecting, and supporting their lives. All of these things are felt by the coastal indigenous people of Waropen Regency in their.

Mud crabs are typically associated with mangrove forests that are still good, so loss of habitat will have a serious impact on crab populations. move to look for food elsewhere, although still in the same habitat area. Mud crabs tend to stay in the same habitat, although they do not always return to the same point, sometimes there is an exchange of individuals between habitats that are close neighbors ((Wijaya et al, 2019).

Mangrove ecosystems also function to produce various foods needed by mangrove crabs (Scylla sp) in the form of organic material and other types of natural food. In their natural habitat, mangrove crabs (Scylla sp) consume various types of feed including algae, rotting leaves. , roots, types of snails, frogs, frogs, shell meat, shrimp, fish, animal carcasses (Tarumaseli, 2022).

One of the end products of mangrove ecosystem services is mangrove crabs as a support for community life, especially for small scale fisheries who live around mangrove forests which are fishery commodities that have high economic value (Larosa et al., 2013).

This study aims to examine the condition of mud crab habitat quality in the mangrove ecosystem of Waropen Regency where the results of this study are expected to become a reference and information for mangrove crab fishermen and stakeholders in the area in an effort to utilize and manage mangrove crab resources in a sustainable manner.

METHODOLOGY

LOCATION AND TIME OF RESEARCH

This research was conducted in the mangrove ecosystem of Waropen Regency which stretches from Masirei District to Wapoga District. The survey locations consisted of 5 sampling stations namely Masirei, Demba, Urei Faisei, Oudate and Wapoga. (Figure 1). The research was conducted for 4 months from November 2022 – February 2023

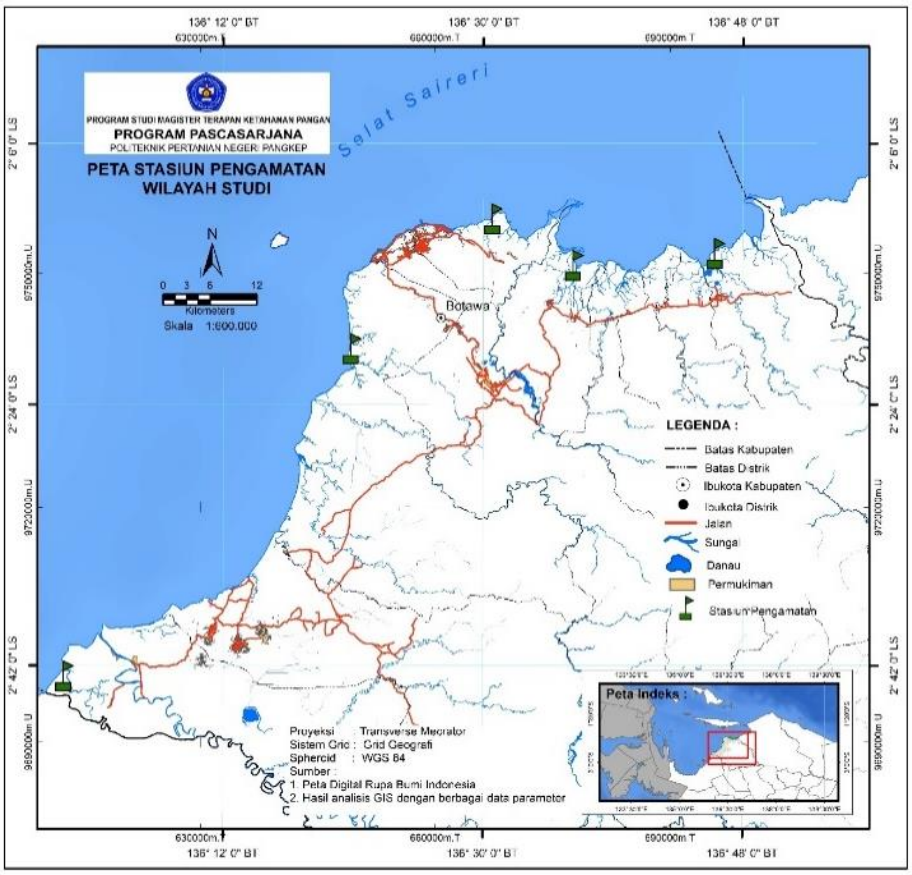

Figure 1. Observation Station Locations

METHOD

Mangrove vegetation data was collected using the method. Data collection was carried out using the point quarter technique (Wilkinson et al, 1994) where each station was carried out purposively sampling by making observation points in a straight line with a distance of 10 meters from each point. the size of each sample plot is 10 x 10 meters. While the data on the abundance of mud crabs was placed coincidentally in the mangrove vegetation data collection area using folded crab traps. Ecological data includes water quality parameters (temperature, salinity, water pH, substrate pH and DO), substrate texture, tides, dominant vegetation type and mangrove vegetation density.

ANALYSIS

The composition of the types and structures of mangrove vegetation is carried out by equation (Komalasari et al, 2022).

$$D = \frac{n}{A} \quad \ldots\ldots (1)$$

where *D* is the species density, *n* is the total number of stands of a particular species and *A* is the total area of the plot

$$RD = \left[\frac{n}{\sum n}\right] x\ 100 \quad \ldots\ldots (2)$$

RD is the relative density of a particular species, n is the total number of stands of a particular species and $\sum n$ is the total area of all stands.

Analysis to see the substrate fraction was carried out by the sieving method and pipettes were carried out in the laboratory. Grouping into substrate texture classes refers to Hanafiah (2007). Water quality parameters were measured and tested in the laboratory. To determine the ecological quality of mud crab habitat, the habitat quality index value (IKH) approach was used which was compiled based on the modified mud crab suitability index (Setiawan et al, 2012) with the habitat ecological quality criteria presented in Table 1

Table 1. Ecological Quality Criteria for Mud Crab Habitat (*Scylla* sp)

Parameter	Quality Range	Quality Class	Dignity	Score	Weight
Oceanographic Parameters and Vegetation					
Tidal Amplitude (m)	1,5 – 2,0	Good	5	2	10
	1 – <1,5 & >2 – 2,5	Medium	3		6
	<1 & >2,5	Bad	1		2
Vegetation	Mangrove Vegetation *(Rhyzhopora* spp, *Xylocarpus* spp, *Avecennia* spp, *Aegiceras* spp,*Bruguiera* spp)	Good	5		10
	Swamp Forest *(Nypa* spp, *Ceriops* sp)	Medium	3	2	6
	Dryland Forest, *Secondary land forest*, *fields and settlements*	Bad	1		2
Kerapatan Vegetasi	Dense	Good	5	3	15
	Medium	Medium	3		9
	Sparse	Bad	1		3
Chemical and Physical Parameters of Water and Soil					
Temperature (°C)	25 – 35	Good	5	2	10
	18 - <25	Medium	3		6
	18 - >35	Bad	1		2
Salinity (ppt)	15 – 25	Good	5	2	10
	>25 – 30	Medium	3		6
	<15 - >30	Bad	1		2
Water pH	7,5 – 9	Good	5	1	5
	6,5 – <7,5	Medium	3		3
	<6,5 & >9	Buruk	1		1
Dissolved Oxygen (mg/L)	>4	Good	5	2	10
	3 – 4	Medium	3		6
	<3	Bad	1		2
Soil Substrate/Texture Fraction	Sandy loam, dusty loam, dusty loam, dusty loam	Good	5	3	15
	Clayey loam, Sandy clay, Dusty clay loam, Loamy sand, Sandy loam, loam, dusty loam, clay, silt	Medium	3		9
	Loamy Sand, Sand	Bad	1		3
Substrate pH	7,5 – 8,5	Good	5	1	5
	6,5-<7,4	Medium	3		3
	<6,5 & > 8,5	Bad	1		1

FINDING AND DISCUSSIONS

CHARACTERISTICS OF MANGROVE CRAB HABITAT

The condition of the mangrove ecosystem for mud crab habitat in Waropen Regency in this study was limited by several water quality parameters (temperature, salinity, water pH, and DO), substrate texture, substrate pH, tides, type and density of mangrove vegetation.

According to Weinstein et al. (1980) and Islam et al. (2000) that mud crab habitat is influenced by several environmental factors that affect the abundance and distribution of mud crabs, in general the main factors that limit the distribution of invertebrates in mangrove ecosystems are considered salinity, temperature and sediment characteristics.

WATER QUALITY PARAMETERS

The physical and chemical quality of the water and the substrate in this study resulted in the value of each collection made at each station as well as data on the distribution of water quality in the form of a spatial map. The value of the measurement results of water quality parameters with each variable is shown in Table 2.

Tidal and Substrate Fractions

Based on the analysis of substrate texture, the mangrove ecosystem in Waropen Regency is dominated by silt loam at stations 1, 2 and 3, clay loam at station 4 and loam at station 5 (Table 3 and Figure 2).). While the area of puddles during high tide conditions can be seen in Figure 7.

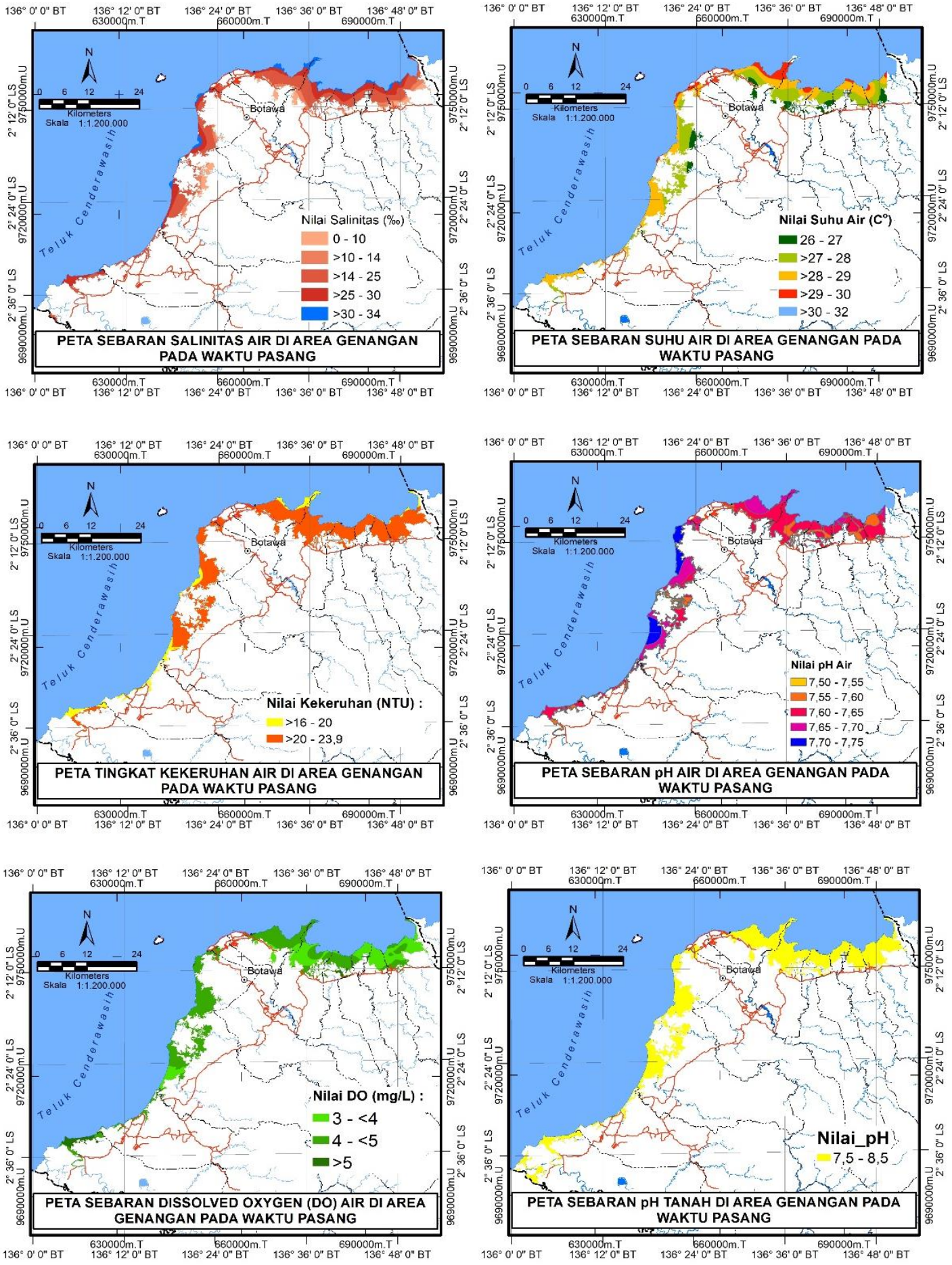

Figure 2. Map of Distribution of Water Quality and Substrate in Study Locations

Table 2. Water Quality Parameter Values at Observation Stations

Parameters	Observation Station					Method
	I	II	III	IV	V	
Temperature (°C)	29	28	29,5	30	28,5	In situ
Salinity (ppt)	29	28	29	30	30	laboratory
Water pH	7,58	7,60	7,64	7,55	7,5	laboratory
DO (mg/L)	4,61	5,00	4,72	3,90	5,2	laboratory
Ammonia (mg/L)	0,452	0,530	0,622	0,568	0,554	laboratory
Nitrite (mg/L)	0,015	0,019	0,012	0,015	0,014	laboratory
Nitrate (mg/L)	0,054	0,046	0,035	0,042	0,026	laboratory
Fosfate (mg/L)	0,032	0,028	0,022	0,020	0,034	laboratory
Turbidity (NTU)	23,9	20,4	21,3	19,2	21,0	laboratory

Source: Result of measurement and laboratory analysis

Table 3. Substrate Quality Parameter Values at Observation Stations

Stations	*Fraksi Substrat (%)*				*pH*
	Sand	*Dust*	*Clay*	*Substrate Texture*	
I	12	84	16	dusty loam,	7,78
II	14	66	20	dusty loam,	7,65
III	15	68	17	dusty loam,	7,55
IV	23	40	37	clay loam	7,62
V	33	47	20	clay	7,54

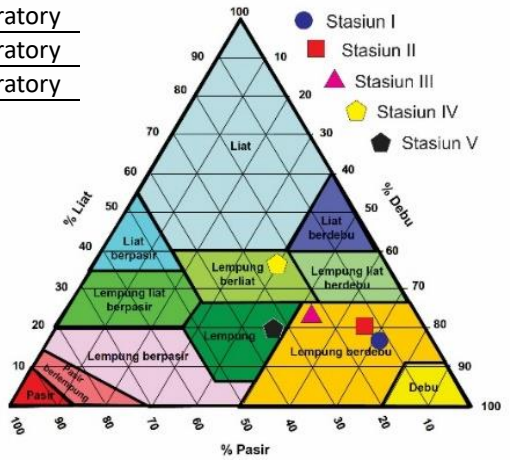

Figure 3. Substrate fraction at the observation site

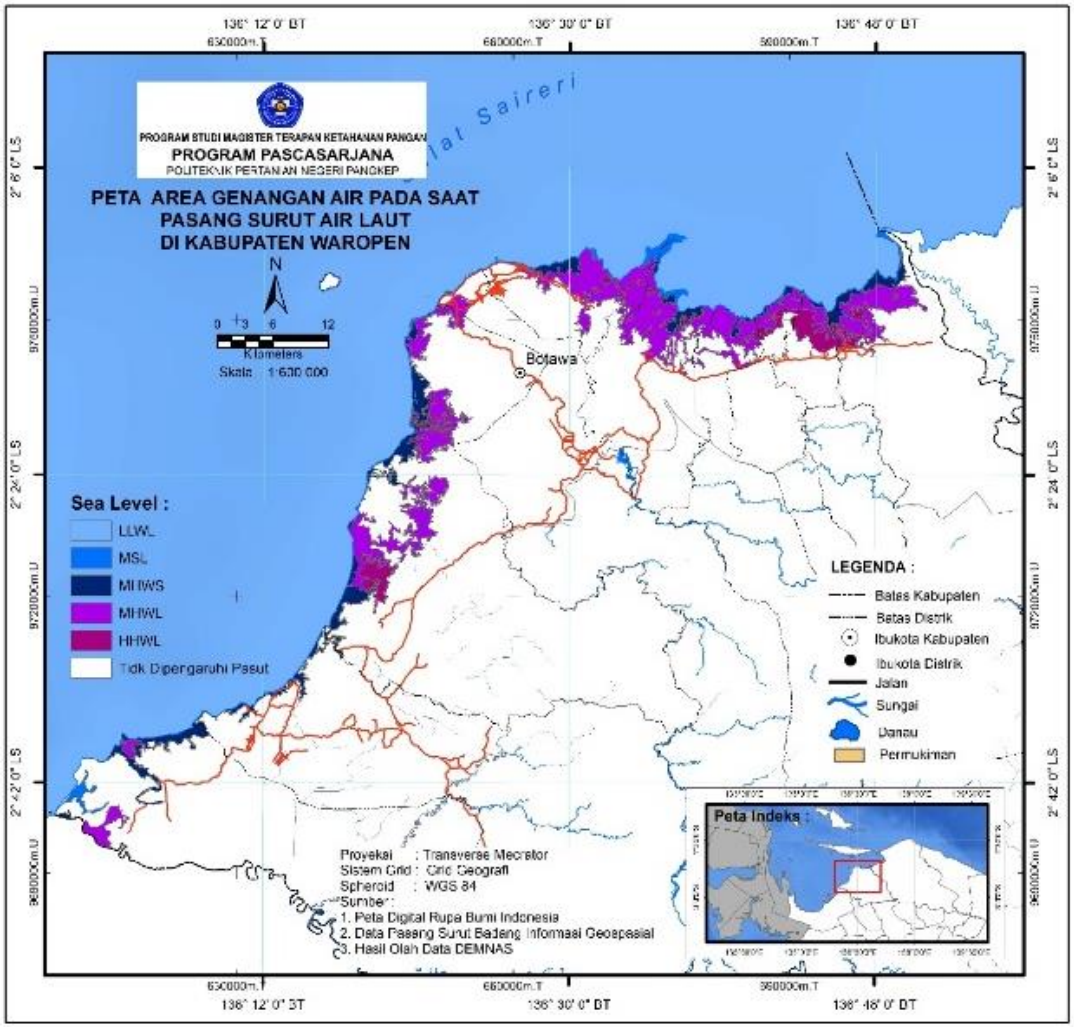

Figure 4. Map of distribution of substrate pH and stagnant water areas during tides in mangrove forests

MANGROVE VEGETATION TYPE AND DENSITY

The types of mangrove vegetation found at 5 (five) observation stations were dominated by the type of Rhizophora apiculata. Based on the observation, mud crabs like mangrove vegetation which has a root system that can be used as a shelter for mud crabs.

Based on the mangrove density criteria based on the Decree of the Minister of State for the Environment No. 201 of 2004 that the density of trees at the study site was in the range of > 1500 ind/ha, thus indicating that the criteria for density of mangrove forest at the observation location/station had very dense criteria

Table 4. Criteria for Mangrove Density at Observation Stations

Stasiun	Kerapatan Pohon (Ind/ha)	Dominan Jenis	Kriteria
I	2625	*Rhizopora apiculata*	Very Dense Forest
II	3050	*Rhizopora apiculata*	Very Dense Forest
III	2900	*Rhizopora apiculata*	Very Dense Forest
IV	2975	*Rhizopora apiculata*	Very Dense Forest
V	2700	*Rhizopora apiculata*	Very Dense Forest

From the results of the analysis of mangrove forest canopy density using the NDVI method by utilizing Landsat 8 satellite imagery in 2021 it has a minimum NDVI value of -0.18 and a maximum NDVI value of 0.78, then a density classification is carried out which is divided into 3 canopy density classes, namely: rare, medium and dense meetings (Ministry of Forestry, 2005). From the results of ArcGIS 10.5 software data processing, it was found that the density value of mangrove forest vegetation can be seen in Table 5.

Table 5. Density Level of Mangrove Forest in Waropen Regency

Density Class	Year 2021	
	Area (hectare)	%
Sparse forest	1.120,02	4,39
Medium	9.131,16	36,39
Dense forest	14.860,33	59,22
Total	**25.111,51**	**100,00**

The density level of the mangrove forest canopy using NDVI analysis found that the mangrove forest category was still dominated by a dense density of 14,860.33 hectare or 59.22% of the total area of mangrove forest, namely 25,111.51 hectare at stations 1, 2 and 3. This indicates that the health level of mangrove vegetation in Waropen Regency is very healthy and supports the survival of aquatic biota, especially mangrove crabs associated with mangrove forests.

MUD CRAB ABUNDANCE

The data obtained at the observation station, obtained the number of mud crabs from a total of 456 obtained stations. Based on the results of the total abundance analysis from the results of data collection can be seen in Table 6

Table 6. Number of Types and Abundance of Mangrove Crab at each Station.

Station	Species	Number of Individual			Total	Abundance (Ind/hectare)
		1(a)	2(b)	3(c)		
1	*Scylla serrata*	54	25	37	116	1450
	Scylla. Olivacea	-	-	-	-	-
	Scylla paramamosain	-	-	-	-	-
	Scylla tranquibarica	-	-	-	-	-
2	*Scylla serrata*	45	26	29	100	1250
	Scylla. Olivacea	-	-	-	-	-
	Scylla paramamosain	-	-	-	-	-
	Scylla tranquibarica	-	-	-	-	-
3	*Scylla serrata*	39	18	31	88	1100
	Scylla. Olivacea	-	-	-	-	-
	Scylla paramamosain	-	-	-	-	-
	Scylla tranquibarica	-	-	-	-	-
4	*Scylla serrata*	46	22	44	112	1400
	Scylla. Olivacea	-	-	-	-	-
	Scylla paramamosain	-	-	-	-	-
	Scylla tranquibarica	-	-	-	-	-
5	*Scylla serrata*	14	11	15	40	500
	Scylla. Olivacea	-	-	-	-	-
	Scylla paramamosain	-	-	-	-	-
	Scylla tranquibarica	-	-	-	-	-
	Jumlah Total :	198	102	156	456	5700

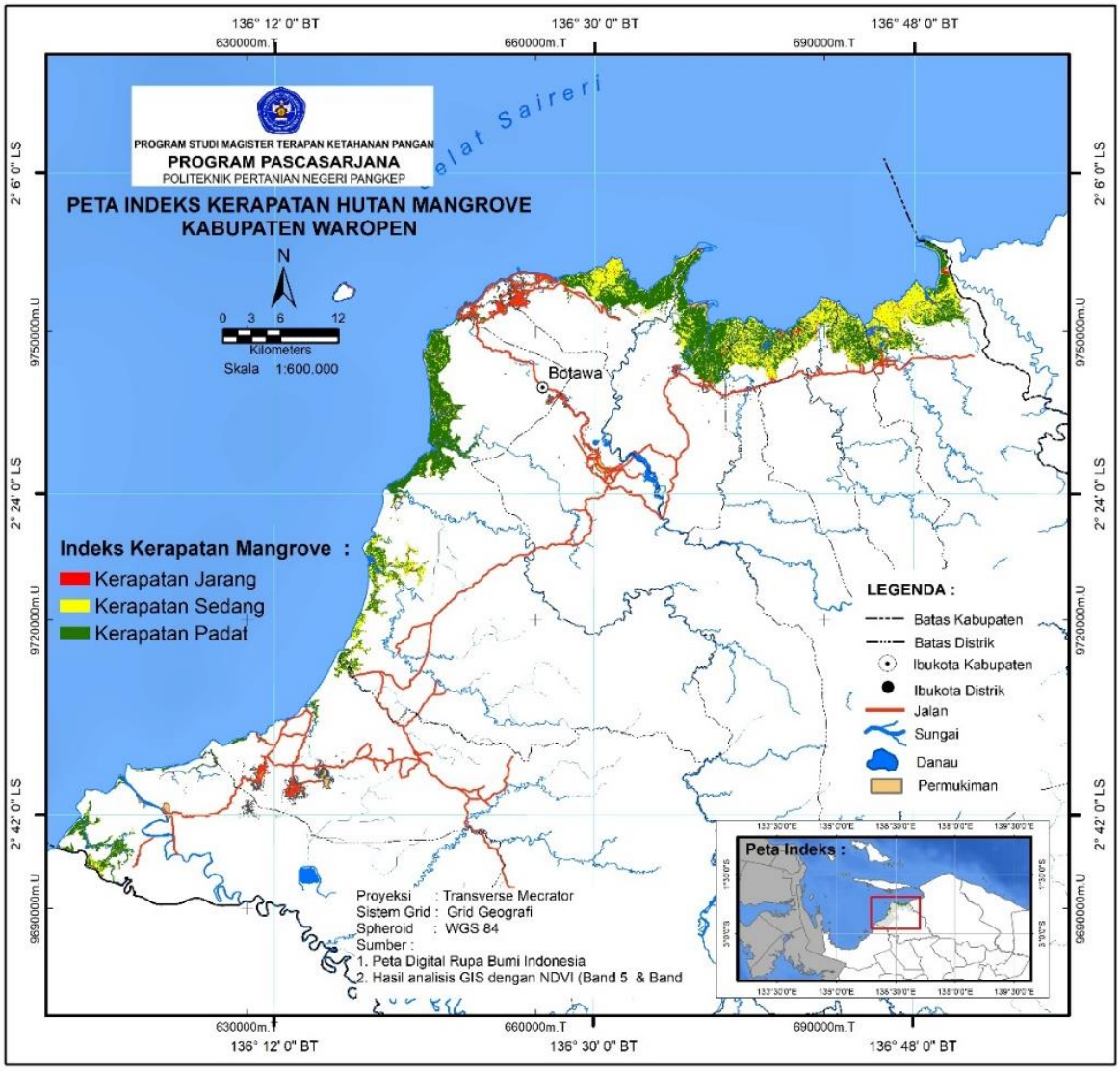

Figure 5. Mangrove Forest Density Index Map of Waropen Regency

QUALITY OF MANGROVE CRAB HABITAT

The quality of the mangrove ecosystem for mud crab (Scylla sp) habitat was assessed through the habitat quality index (IKH) approach. The habitat quality index (IKH) is compiled by making a matrix of habitat quality criteria, namely by weighing and making a range of qualities, namely good, medium and bad for each parameter that has a close relationship to mangrove crabs based on literature studies (Setiawan et al, 2012). Parameters that have a strong influence are given a weight of 3, a weight of 2 is given to a parameter that has a moderate influence, and a weight of 1 is given to a weaker parameter, while the scoring of each parameter is based on the actual value or condition. The total value of the habitat quality index (IKH) is obtained from the total multiplied by the value of each parameter (Pi) with the weight of the parameter itself (bi), with the following calculation

$$IKH = \sum(bi\ x\ Pi) \quad \text{.....(3)}$$

where, *IKH is* Habitat Quality Index*, bi* is the weight of the ith parameter and *Pi* is the score of parameter i. Habitat quality class intervals are calculated based on the equal interval method, in order to obtain class intervals as presented in Table 5.

Table 7. Index Value and Quality Category of Mud Crab Habitat (Scylla sp)

No	Index	Category
1	18 – 42	Bad
2	> 42 – 66	Medium
3	> 66 – 90	Good

Description: Minimum Value (Min) = 18, Maximum Value (Max) = 90, Interval class = 24

Based on the results of the analysis, the habitat quality of mud crabs in Waropen Regency is in the "Good" category where based on the results of a geographic information system (GIS) analysis, a map of the distribution of mud crab habitat quality can be seen in Figure 10. The best habitat quality index is in the Regency area. The eastern and central Waropen are Masirei District, Wonti District, Risai Sayati District, Soyoi Mambai District, Urei Faisei District, Waropen Bawah District and Oudate District while in the western part, namely Inggerus District and Wapoga District are in the medium category. The IKH criteria are in the good category of 21,818.60 ha, while the medium category is 673.58 ha. This indicates that the habitat quality index (IKH) of mud crabs in Waropen Regency is in the good category.

From an ecological perspective, the mangrove ecosystem in Waropen Regency in general supports the survival of mud crabs or in other words, ecologically the mangrove area is suitable as a habitat and has the potential for the growth and development of mud crabs (Scylla sp). The mud crab problem is not only caused by the destruction of mangrove forests, but is also faced with the problem of accumulated market demand which is quite promising which has an impact on overfishing of mud crabs in nature, as well as climate change and a lack of management intervention as well as a lack of knowledge or skills possessed by the community. fishermen in exploiting mangrove crab resources, so as to ensure that mud crab fishing activities in Waropen Regency can continue and are not threatened with a drastic reduction, it is necessary to manage mangrove ecosystems properly so that the quality of the environment does not decrease. In addition, it is also necessary to manage mangrove crab fisheries in an integrated manner from ecological, social and technological aspects

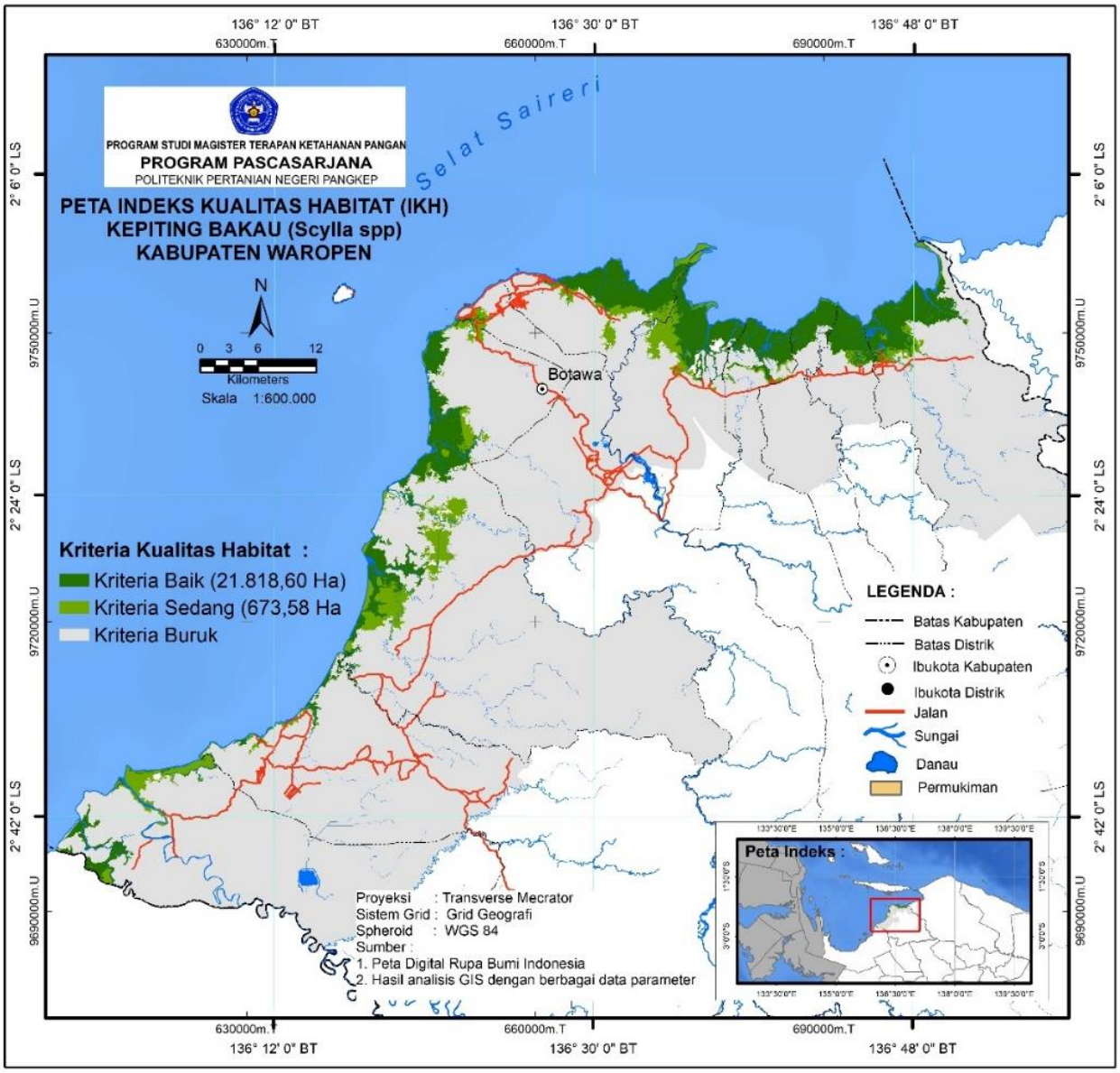

Figure 1. Map of Mud Crab Habitat Quality Index (IKH) in Waropen District

CONCLUSION

The ecological quality of the mangrove ecosystem in Waropen Regency is generally in good condition and sufficiently supportive for the survival of mud crabs. The relationship between habitat quality and mangrove crabs shows a positive correlation, namely the higher the value of habitat quality, the higher the abundance of mud crabs produced.

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