The relationship between mangroves and bivalves abundance in Cengkrong Beach, Trenggalek Regency

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Abstract. Cengkrong Beach in Trenggalek Regency has extensive mangrove forest. Mangrove forests play an important role in maintaining aquatic productivity and supporting people's lives. Bivalve is one of the biota that lives in mangroves and is used by the people around the mangrove forest. The research aims to identify mangroves and bivalves, analyze the abundance of mangroves and bivalves, and determine the relationship between mangroves and bivalves. Mangrove sampling was carried out on 6 transects. Each transect was made 7 with plots measuring 10 m x 10 m with a distance of 5 m and bivalve samples were taken using a 1 m x 1 m plot with 5 plots in that plot. Research data were analyzed using PAST 4.13. The results of the study found 15 species of mangroves and 4 genera of bivalves. The highest mangrove abundance value was *Rhizophora apiculata* with a value of 0.0092 indiv./m^2 and bivalves were of the genus *Isognomon* with a value of 4.138 indiv./m^2. The results of the analysis showed that there was a relationship between the mangrove *Sonneratia caseolaris* and the bivalve of genus *Pilsbryoconcha*, the mangrove *Aegiceras floridum* and the bivalve of genus *Geloina*, the mangrove *Avicennia alba* and the bivalve of genus *Saccostrea* and the mangrove *R. apiculata* and the bivalve of genus *Isognomon.*

1. Introduction

Mangroves are a very productive ecosystem. The invertebrate and vertebrate fauna in mangrove forests is rich in the number of species and the number of individuals of each species. The waters where mangroves grow provide suitable living and breeding places for large numbers of fish, shrimp, crayfish, shellfish and other aquatic organisms [1]. Mangrove forests have many functions: preventing erosion, stabilizing beaches, and providing suitable conditions for spawning. Mangrove forests also act as nurseries for many species of economic importance and function as pollution traps. For centuries, Indonesian people have used mangroves for wood, firewood, charcoal, tanning dye, and boat building. Genera often used for this purpose include Rhizophora, Avicennia, Bruguiera, Ceriops, Nypa, and Oncosperma [2].

Bivalves have an important role in mangrove forests, both ecologically and economically. Ecologically, bivalves have an important role in the food chain, namely as detritivores [3]. Several types of bivalves have important economic value as food, craft, and industrial ingredients [4]. Bivalves are one of the biota that live in mangrove forests and are used by communities around the mangrove forests.

The mangrove forests on Cengkrong Beach, Trenggalek Regency, are a conservation and recreation area. The research that has been carried out here shows that in each zone, the same types of species are still found due to natural factors and sea tides, so fallen fruit will be carried and grow in several

mangrove zones [5]. According to [6], successful mangrove rehabilitation can increase the diversity and population of aquatic biota. Considering the importance of the function of mangrove ecosystem areas for ecological balance and water productivity, information about biodiversity and the reciprocal relationship between mangroves and bivalves will be important to research. The research aims to identify mangroves and bivalves, analyze the abundance of mangroves and bivalves, and determine the relationship between mangroves and bivalves

2. Material and Methods

2.1. Study Area

The study was conducted at the Mangrove Forest in Cengkrong Beach, Trenggalek Regency, East Java Province, Indonesia. The location coordinates number latitude: 8°17'57.89" - 8°18'12.49" S and longitude: 111°42'8.96" - 111°42'17.21" E (figure 1).

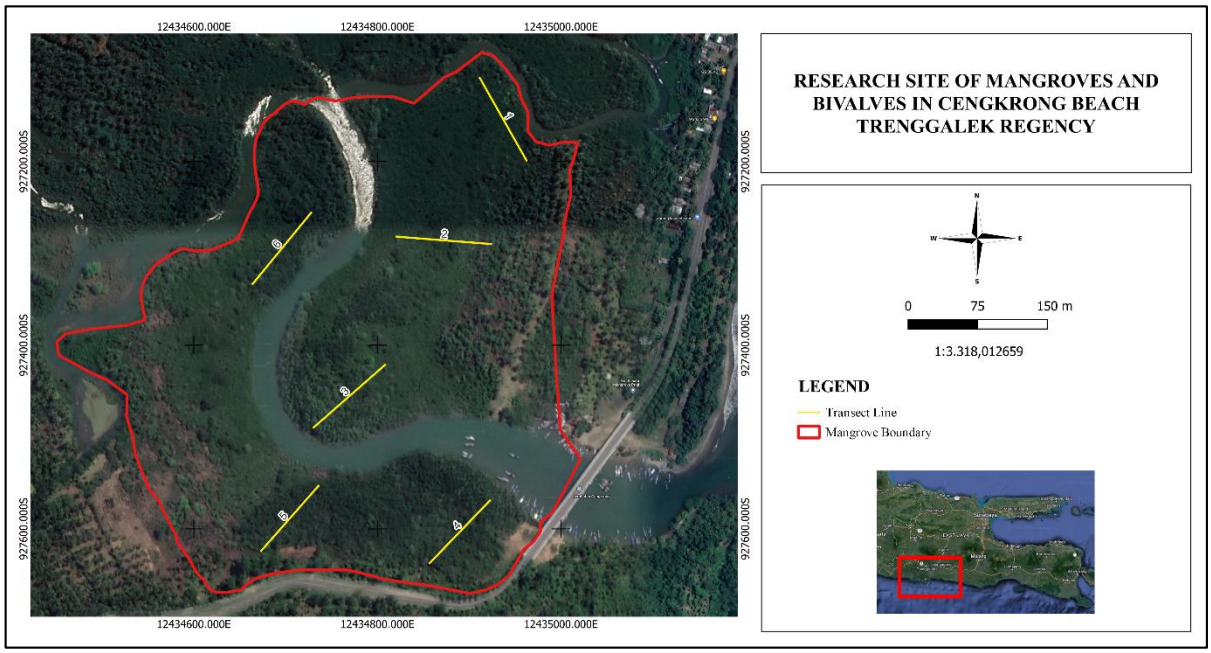

Figure 1. Research site. (Modification of Google Earth, 2023)

2.2. Data Collection

Mangrove sampling was carried out on 6 transects. Each transect was made into 7 plots measuring 10 m x 10 m with a distance of 5 m. Bivalve samples were taken by making 5 plots measuring 1 m x 1 m on the mangrove sampling plot. The number of mangroves and bivalves found in the plot was recorded, and samples of mangroves and bivalves were taken for identification in the laboratory.

2.3. Data Analysis

Data on the number of mangroves and bivalves were analyzed to determine their abundance. Clustering and Pearson's correlation analysis was carried out to determine the relationship between Mangroves and Bivalves using PAST 4.13.

3. Result and Discussion

3.1. Identification of Mangroves and Bivalves

The research results on Mangroves in Cengkrong Beach, Trenggalek Regency, found 2 classes, 6 orders, 8 families, 11 genera, and 15 species. The Mangrove classes are Polypodiopsida and Magnoliopsida. The Magnoliopsida class was found to be more numerous than Polypodiopsida.

Table 1. Identification of mangroves and bivalves in Cengkrong Beach Trenggalek Regency.

Class	Order	Family	Genus	Species
Polypodiopsida	Polypodiales	Pteridaceae	Acrostichum	*Acrostichum speciosum*
Magnoliopsida	Ericales	Primulaceae	Aegiceras	*Aegiceras floridum*
	Lamiales	Acanthaceae	Avicennia	*Avicennia alba*
			Acanthus	*Achanthus ilicifolius*
	Malpighiales	Rhizophoraceae	Bruguiera	*Bruguiera cylindrica*
				Bruguiera gymnorrhiza
			Ceriops	*Ceriops decandra*
				Ceriops tagal
			Rhizophora	*Rhizophora apiculata*
				Rhizophora mucronata
		Euphorbiaceae	Excoecaria	*Excoecaria agallocha*
	Myrtales	Lythraceae	Sonneratia	*Sonneratia alba*
				Sonneratia caseolaris
		Combretaceae	Lumnitzera	*Lumnitzera littorea*
	Sapindales	Meliaceae	Xylocarpus	*Xylocarpus mekongensi*
Bivalve	Venerida	Cyrenidae	*Geloina*	
	Ostreida	Ostreidae	*Saccostrea*	
		Isognomonidae	*Isognomon*	
	Unionida	Unionidae	*Pilsbryoconcha*	

Mangroves from the Malpighiales order, Rhizophoraceae family, are found in greater numbers than other groups. There are 15 mangrove species have been identified, as shown in table 1. The bivalves research in Cengkrong Beach, Trenggalek Regency, found 1 class, 3 orders, 4 families, and 4 genera: *Geloina, Saccostrea, Isognomon*, and *Pilsbryoconcha*.

3.2. Abundance of Mangroves and Bivalves

Mangroves found abundantly in Cengkrong Beach, Trenggalek Regency, are *Rhizophora apiculata* (0.0092 idiv./m^2) and *R. Mucronata* (0.0088 idiv./m^2) as shown in table 2. According to [7], the *Rhizophora* genus has characteristics that spread quickly and can grow and develop in habitats with high salinity to almost fresh water. [8] stated that *Rhizophora* has a level of dominance that can reach 90% of the vegetation growing in a location.

From the analysis results, as shown in table 2, the bivalve found abundantly in Cengkrong Beach, Trenggalek Regency, is the *Isognomon* genus, namely 4.138 indiv./m^2. [9] stated that the *Isognomon* genus is abundant because it has the characteristic of living attached to mangrove roots. *Isognomons* are arboreal bivalves that are often found in the mangrove areas of the Indo-Pacific.

3.3. The relationship between Mangroves and Bivalves

Clustering results using Morisita's similarity index (figure 2) show that at a similarity level of 80%, there is a relationship between the mangrove *Sonneratia caseolaris* and the bivalve of genus *Pilsbryoconcha*. Meanwhile, at a similarity level of 92.5%, there is a relationship between mangrove species and bivalve genera, namely *Aegiceras floridum* with *Geloina*, *Avicennia alba* with *Saccostrea*, and *R. Apiculata* with *Isognomon*.

Table 2. The abundance of mangroves and bivalves in Cengkrong Beach Trenggalek Regency.

Group	Taxon	Number (indiv.)	Abundance (indiv./m^2)
Mangrove	*Acrostichum speciosum*	1	0.0002
	Aegiceras floridum	27	0.0064
	Avicennia alba	27	0.0064
	Achanthus ilicifolius	4	0.0009
	Bruguiera cylindrica	22	0.0052
	Bruguiera gymnorrhiza	25	0.0059
	Ceriops decandra	17	0.0040
	Ceriops tagal	21	0.0050
	Rhizophora apiculata	**39**	**0.0092**
	Rhizophora mucronata	37	0.0088
	Excoecaria agallocha	5	0.0011
	Sonneratia alba	25	0.0059
	Sonneratia caseolaris	11	0.0026
	Lumnitzera littorea	11	0.0026
	Xylocarpus mekongensi	11	0.0026
Bivalve	*Geloina*	256	1.219
	Saccostrea	652	3.104
	Isognomon	**869**	**4.138**
	Pilsbryoconcha	260	1.238

Based on the results of Pearson correlation analysis (table 3), it can be seen that mangrove species are positively correlated with the bivalve genus, namely *S. Caseolaris* with *Pilsbryochonca*, *A. Floridum* with *Geloina*, *A. Alba* with *Saccostrea* and *R. Apiculata* with *Isognomon* with correlation coefficient values of 0.74, 0.72, 0.89 and 0.93 respectively.

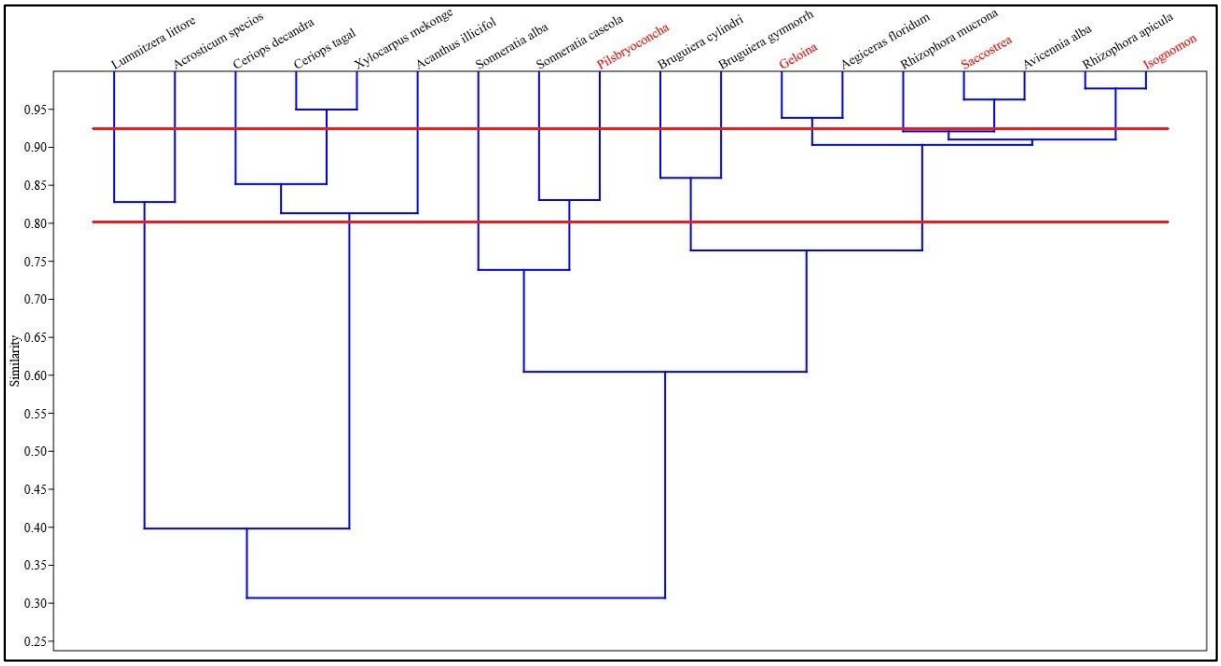

Figure 2. Clustering mangroves and bivalves using the Morisita's similarity index.

Saccostrea live attached to the pneumatophores of *Avicennia* and *Sonneratia* [10]. *Saccostrea* live attached to mangrove roots, because this organism cannot move or move places[11]. *Geloina* can live in various types of habitats in mangrove forest waters, such as various types of substrates and varying levels of salinity, including the habitat conditions of the *A. floridum* species, which tends to have muddy substrates and is constantly flooded by water with high salinity levels [12].

The mangrove *R. Apiculata* species has the highest positive correlation value with the bivalve of the *Isognomon* genus. In research, the *Isognomon* genus was found clustered on the roots of *R. apiculata*. [13] stated that the genus *Isognomon* can form aggregations consisting of 20 individuals at one point of tree root branching. Mangrove of the *S. caseolaris* species has a positive correlation with bivalve of the *Pilsbryochonca* genus. *S. caseolaris* and *Pilsbryoconcha* have similar habitats. Namely, they are not tolerant of high salinity levels and high temperatures [8, 14].

Table 3. Correlation between mangroves and bivalves.

	Geloina	***Saccostrea***	***Isognomon***	***Pilsbryochonca***
Avicennia alba	0.77	**0.89**	0.80	0.51
Aegiceras floridum	**0.72**	0.60	0.77	0.40
Rhizophora apiculata	0.61	0.74	**0.93**	0.14
Rhizophora mucronata	0.52	0.87	0.59	0.65
Ceriops decandra	-0.65	-0.93	-0.81	-0.44
Ceriops tagal	-0.41	-0.80	-0.64	-0.49
Xylocarpus mekongensis	-0.41	-0.80	-0.69	-0.49
Bruguiera cylindrica	-0.17	0.54	0.29	0.07
Sonneratia alba	0.54	0.39	0.15	0.70
Sonneratia caseolaris	0.61	0.29	-0.08	**0.74**
Bruguiera gymnorrhiza	0.07	0.18	-0.15	0.09
Lumnitzera littorea	0.13	-0.33	-0.00	-0.41
Acanthus ilicifolius	-0.87	-0.72	-0.76	-0.53
Acrostichum speciosum	0.43	-0.01	0.46	-0.30
Excoecaria agallocha	-0.20	-0.74	-0.40	-0.56

4. Conclusion

This study found 15 species of mangroves and 4 genera of bivalves. The highest mangrove abundance value was *R. apiculata* with a value of 0.0092 indiv./m^2, and the bivalve was of the genus *Isognomon* with a value of 4.138 indiv./m^2. The analysis results show that there is a relationship between mangrove species and bivalve genera, namely *S. caseolaris* with *Pilsbryoconcha*, *A. floridum* with *Geloina*, *A. alba* with *Saccostrea*, and *R. apiculata* with *Isognomon*.

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