Factors Influencing the Distribution of Bivalve at Intertidal Zone of The Sungai Nipah, The Pesisir Selatan Regency, West Sumatera

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ABSTRACT

This study has been done in March 2013. It aimed to find out the factors that have influenced on the distribution of bivalves in the intertidal zone of Sungai Nipah bay. The purposive sampling method was used to choose three stations at the intertidal zones of the bay.The occurrences of bivalves and the frequencies of disturbanceswere recorded. Other parameters on the sites were also measured either in the field or in the lab. As a result, there were 21 species found in the area understudy. Other findings were: 1) the further the sites from the coast line, the more abundance the animals were, 2) opposite to the organic content in the sandy substrate, the increase of both current speed and disturbances, had shown influence on the decrease of abundance; although there was no different distribution pattern between the stations observed. Other parameters on the habitats showed there were no influence on the abundance and the distribution pattern.

***Keywords**:* bivalve, abundance, distribution patter

INTRODUCTION

Bivalves arethe most common or the largest class (75%) of living mollusks, which includes snail and slags (Lerman, 1986; Fish and Fish, 1989). The Bivalves were easily recognized by the present of two valves joining by a hinge and often by complex arrangements of hinge teeth (Walls 1982). This class has a large economic important value; it includes clams, oysters, scallops, mussels, and quahogs, and shipworms as an exception (Walls 1982).

Its distribution is worldwide, and it includes in the coastal waters of west Sumatra. Some of these species have been exploited as protein resources but some others only use for decorative purposes. According to the local villagers, the number of bivalves tended to decrease due to human activities in the coastal waters of Sungai Nipah; even any of them have been disappeared from their habitat. The local fishermen use the beach of Sungai Nipah as their boat landing and as their starting point to go the sea, while the domestic tourists use another part as a good place for recreation.

Study on the abundance and the diversity of bivalves has been done in some places in West Sumatera Province; for examples (Nurdin, et al. 2006) and (Nurdin, et al. 2010). However, none of those related to the bivalves in Sungai Nipah. This study was carried out to document the abundance and the distribution of bivalve at intertidal area of the bay of Sungai Nipah, and it included some factors influencing it. It expected that this study can be used as basic information for management purposes in that area.

METHODS

Field survey was taken in March 2013 at the intertidal zone of the bay of Sungai Nipah (Figure 1).Three stations were chosen purposively. The Station 1 was located in the area of public recreation, station 2 was at the fishermen's boat landing, and station 3 was the area with less of human activity.Each station was divided into three sampling sites; namely, upper tidal, middle tidal, and lower tidal. Samples of bivalves were taken on each site with 50x50 cm square plot with 10 cm of substrate depth by using a shovel. The sample of the substrate was sieved with 1 mm screen size then the number of bivalves was counted in the field. Some specimens were collected and put in plastic bag with 10 % formaldehyde for further identification in the lab; it is based on Robert et al. (1982), Dharma (1988), Carpenter and Niem (1998).Fifty gram of sediment from each sites were also collected for organic content analysis in the laband anhydro-oceanography data such as temperature, salinity, pH, and Dissolved Oxygen and current speed were measured directly in the field as well.The physical factors that might influence the population and the distribution of bivalves

Morisita's Index of dispersion was used to determine the distribution pattern of bivalve in each stations then the significant deviations from 1.0 (random) were assessed by Chi-quare ; if the calculated value greater then critical value, then the Morisita's index is significantly different from 1.0. It meant that the dispersion likely has either a uniform or clumped distribution (Khow 2009). Sannon-Winner formula as in English et al (1994) is also used to get the diversity value of species at each stations.

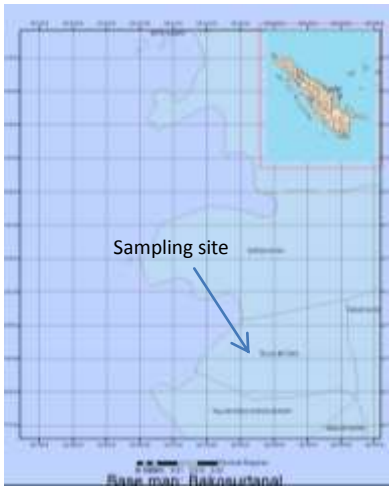

Figure. 1. Location of sampling

RESULTS

The results showed that there were 21 species found in the whole area under study and as much as 244 in term of individual (Table 1). These species consisted of: *Arca sp., Batista violacea (Lamarck, 1806), Bornea balalaika, Circe scripta (Linneaus 1758), Codakiainterupta, Codakiatigerina, Ctenoidescatherinae, Cyclinasinensis, Decatopecten radula, Donaxdeltoids, D. faba (Gmelin 1791), D. incarnatus (Gmelin 1791), Lioconchaornate, Mactracuneata, M. maculate, M.violacea (Gmelin, 1791), Mesodesnatidae, Periglypta sp., Tellinavirgate, Trachycardiumangulatum, Tridacnaelongate*.

Tabel 1.The Bivalves found at each stations Sungai Nipah, in March 2013.

Species	Stations		
	1	2	3
Arcasp	6	5	-
Batista violacea (Lamarck, 1806)	16	-	-
Bornea balalaika	4	2	6
Circe scripta (Linneaus 1758)	5	6	1
Codakiainterupta	-	10	3
Codakiatigerina	6	6	7
Ctenoidescatherinae	-	2	-
Cyclinasinensis	4	2	3
Decatopecten radula	3	-	8
Donaxdeltoids	-	7	6
D.faba (Gmelin 1791)	2	12	1
D.incarnatus (Gmelin 1791)	-	8	3
Lioconchaornata	2	1	1
Mactracuneata	-	-	1
Mactramaculata	3	-	2
Mactraviolacea (Gmelin, 1791)	4	8	7
Mesodesnatidae	-	-	7
Periglyptasp	6	5	8
Tellinavirgate	7	10	8
Trachycardiumangulatum	4	6	7
Tridacnaelongata	3	-	-
		90	79
		15	17

Table 1 showed that there was no different on the total number of species found at Station 1 and 2 except at Station 3 (17 species). However, in term of the total number of individual, it varied between Stations. The highest was at the Station 2 (90) then it followed by the Station 1 and 3.

The average density on each station or at different sites of sampling points can be seen on Table 2. The average of bivalve between stations (1, 2, and 3) and between sites (upper, middle, and lower) showed significant different (*T-test P<0.05*). The highest figure between stations was at the Station 2 (30 m^{-2}) and at the lower tidal between sites; that was 33.33 m^{-2}.

Table 2. The average density of bivalve at each sampling sites in March 2013

	Density (m^{-2})			
Stations	Upper	Middle	Lower	Averages
1	15	27	33	25
2	22	33	35	30
3	18	29	32	26.33
Averages	18.33	29.67	33.33	

The diversity of bivalves has the same category at all stations, in term of the Shannon-winner's index; that was moderately diverse and the highest was at the Station 3. In term of Morisita's indexes, the distribution pattern of bivalves might be classified as clamped dispersion for the whole stations. However, it was only at the station 1 that significantly away from 1.0 (random). This conclusion was based on Chi-square (X^2) test where its calculated value was greater than the value at the table; with *v* and *α* given.

Table 3.The indices of diversity and dispersion of bivalves in March 2013

Stations	Indices		Chi-test for dispersion	
	Shannon-Winners	Morisita's Indexes	X2	Xt
1	2.54	1.13	8.68	7.81
2	2.55	1.06	4.4	
3	2.63	1.09	6.22	

Tabel 4 provides the condition of water quality and organic content in the substrate of sampling sites. The average of water quality such as DO, pH, and visibility were almost the same between stations, except the organic content in the substrate; at the station 3 was relatively high compared to the organic found at other stations.

Tabel 4 .Water quality and organic content on substrate at sampling sites, in March 2013

Category	DO	pH	Salinity	Visibility	Organic
	(mgl^{-1})		(ppt)	(%)	(%)
Station 1					
Upper	5.4	7	30.4	100	4.24
Middle	5.4	7.1	31.2	100	4.14
Lower	5.2	7	31.2	100	5.18
Average	5.33	7.03	30.93	100	4.52
Station 2					
Upper	5.4	7.1	28.6	100	5.57
Middle	5.3	7	30.1	100	6.56
Lower	5.2	7.2	30.1	100	8.76
Average	5.3	7.1	29.6	100	6.96
Station 3					
Upper	5.2	7.1	30.2	100	6.64
Middle	5.2	7	30.1	100	6.24
Lower	5.2	7.1	30.1	100	7.21
				100	6.7

The current speed can be seen on Tabel 5. The averages ranging from 0.27 to 42 cms^{-1}. The averages was significantly different for both station 1 and 3 to the station 2 (*T-test, P<0.05*), where at the station 2 was the lowest one comparing to others.

Tabel 5. The average of current speed at each stations in March 2013.

Category	Current Speed (cms^{-1})		
	St. 1	St. 2	St. 3
Upper	0.39	0.27	0.39
Middle	0.42	0.30	0.42
Lower	0.39	0.38	0.39

According to the fishermen, the number of boats that landed on or out of the beach varied from time to time, it depends on the fishing season. The head of Marine and Fishery Agency said that, this year, the number of fishermen reached 80 house hold that depended on marine fishery. At least around 50 fishing boats were operated in Sungai Nipah. During the bad weather and rough wave condition, most of the fishermen stayed at home and do another job or fix their gears and boat. At this circumstance, the boat will be anchored longer on the beach. Based on observation during study, the frequency of boat landing was about at least 4 times a day around the station 2.

So far, there were no commercial fishermen that specifically collecting on bivalves, except some creative local people collecting skeleton of some bivalves and gastropods, and it included coral rubbles for decorative purposes. These people added that such more economic species had been hard to find on their habitat.

DISCUSSION

Based on the Table 1, it showed that the total number of individual of bivalves was not in line to the number of species found on each station. For examples, The Bivalves at station 2 was higher in the number of individual but lower in term of number of species. Besides, the spatial density was also high at this station. In fact, the beach around this station had been used intensively as a starting point or boat landing. For this instance, it does not necessarily mean that the activities of boat landing do not give influence on the bivalves because broken skeletons were easily seen around the beach. The highest total number of individual might be related to the ability of the species to adapt on the boat disturbances and suitable substrate to be occupied.

Furthermore, the substrate on this Station 2 consisted on sandy mud where there is a brook shield, meaning a small stream flowing into the beach. In addition, the current speed was also lower comparing to other stations. So, the input of organic material and food supplywere higher. Different with the station 2, the substrate at the Station 1 and 3 had lower organic content, but bigger in particle size of substrate; mostly consisted of sandy beaches and easy to be transported due to fast current speed. So it was harder for juvenile to settle, to be distributed, or growing well on these sites.Increasing current speed can also give impact on feeding rate of bivalve(Sobral and Widdows 2000). (Nurdin, et al. 2010) stated in his report that the diversity and the distribution of bivalve depend on the particle size of substrate and environmental factors. Considering the environmental factors such as DO, pH, salinity, and visibility, seem that there was no harm to the bivalves in this area. In another word, all of water quality parameters were still suitable for bivalve to grow.The organic content in the substrate at station 2 was slightly higher comparing to the substrate at station 1 and 3.

The impact of bivalve exploitation might be very low at this moment since the there was no intensive commercial activity in this region. However, in the nearby location, there was a fact of collecting bivalves that can be seen at the location of recreation areas at the bay of Sungai Nipah or at Cerocok Beach. The exploitation activities on this bivalves tended to focus on the more commercial ones both as for food supply or for decorative purposive.(Nurdin, et al. 2006)and(Nurdin, et al. 2010) had stated in both of his report that exploitation has decreased the density of bivalves in different location in west sumatera such as in Pasumpahan Island and in the bay of Sungai Pisang, in Padang City.

CONCLUSIONS

Sungi Nipah bay. The distribution pattern can
at one station that really significantly clamped

dispersion. The density of bivalve in intertidal area tended to increase further offshore. It seems that physical disturbances, current speed and organic content were important factors that might influence the distribution of bivalve in the bay of Sungai Nipah, Pesisir Selatan.

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