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The Indication of Gastropods Extinctions at Intertidal Zone of the Teluk Nipah Waters, the Pesisir Selatan Regency the Province of the West Sumatera

Indikasi Kepunahan Gastropoda di Zona Intertidal Perairan Teluk Nipah Kabupaten Pesisir Selatan Provinsi Sumatera Barat

Afrizal Tanjung[*1]
[1]Department of Marine Science, Faculty of Fisheries and Marine, Universitas Riau, Pekanbaru, Riau
Kampus Bina Widya KM. 12,5, Simpang Baru, Kec. Bina Widya, Pekanbaru, Riau 28293, Indonesia
*Correspondent Author: afrizal.tanjung@lecturer.unri.ac.id

ABSTRACT

Intensive observation of gastropods, every March from the year 2008 to the year 2012, was carried out to document some indicators of gastropod extinction. The purposive sampling technic was used in this work. The physicochemical parameters of its habitat were also monitored during every sampling done. It was found that the intertidal substrate consist of sand, while the habitat parameters were more than 5,6 mg/L dissolved oxygen, pH around 7,0-7,2, salinity 30,2-32,2 ppt, temperature 28,6-29,6^{0}C, the visibility 100%. The number of species, the number of found gastropods, the abundance, and the maximum shell size of found gastropods showed decreasing from year to year, while routine collecting by the visitor and the marine organism shell collector, and the disturbance by the fisherman activities occurred. This indication showed a tendency for gastropods extinction.

Keywords: Decreasing, Disturbance, Extinction, Gastropods, Intertidal

ABSTRAK

Pengamatan intensif pada gastropoda, setiap bulan Maret mulai tahun 2008 sampai 2012 telah dilakukan untuk mendokumentasikan beberapa indikator musnahnya gastropoda. Teknik *sampling purposive* digunakan dalam pengamatan ini. Parameter- parameter Fisika dan kimia dari habitat juga dimonitor setiap kali samping dilakukan. Dari pengamatan didapatkan bahwa substrat dari daerah intertidal adalah pasir, oksigen terlarut lebih besar dari 5,6 mgl^{-1}, pH berkisar 7,0-7,2 , kisaran salinitas 30,2-32,2 ppt, Kisaran temperatur 28,6-29,6^{0}C, kecerahan 100%. Jumlah species yang ditemukan dan ukuran maksimum species dari tahun ke tahun pengamatan terjadi penurunan, sementara kegiatan koleksi rutin dari pengunjung daerah intertidal amatan, kegiatan koleksi oleh kolektor organisme laut, dan gangguan aktivitas nelayan senantiasa terjadi. Indikasi menunjukkan kecendrungan kemusnahan gastropoda.

Kata Kunci: Penurunan, Gangguan, Kepunahan, Gastropoda, Intertidal

INTRODUCTION

Gastropods are the most common or the largest class (75%) of living molluscs, which includes snails and slags (Lerman, 1986; Fish & Fish, 1989), the most successful among other classes of molluscs (Barnes *in* Malik, 2013), but gastropods at the intertidal zone of Teluk Nipah waters Pesisir Selatan Regency West Sumatera Province is being disturbance by the human activities, event any of them disappeared from their habitat. This information got from a villager who lives around the research location.

There are three main causes when a species disappeared from its habitat, that is anthropogenic impacts, ecological disturbance, and genetic disturbance. All of that is being occurred at the intertidal zone of the Teluk Nipah waters. Gastropods are usually actively exploited by the visitors and bay marine organisms shell collectors in the tour destination said area. Fisherman activities are the other reason which supposed as causes that disappearance. Fisherman activities will influence the growth rate of gastropods, and so it will impact the genetics of gastropods, agree with Tanjung (2012) that if the speeding up of organism exploitation is higher than

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the speeding up of its population growth rate, it will cause that organism will destroy in not so long time; therefore, the observation about the existence of the gastropods and also the human activities around its habitat should be done to know the indications of its extinction.

The investigation of the extinction of fishes are documented for the past 100 years in North America (Miller *et al*., 2011), whereas the investigation of the extinction of marine gastropods is not documented yet; therefore, documentation about some indicators of gastropods extinction has to be started as an effort to keep sustainable marine resources.

MATERIALS AND METHOD

Five kinds of information were needed to explain the indication of gastropods extinction., that is its species number, Pesisir Selatan Regency, its population number and abundance, its maximum size of collected shell from year to year, water quality, and frequency of human disturbance.

To know its species number, its population number and abundance, and its maximum size of shell, sampling of gastropods was out from three stations at the intertidal of the Teluk Nipah Water, The West Sumatera Province in five years. Observation on fisherman, Marine organisms shell collector, and beach visitor activities were done too. Sampling and observation were done every March yearly from 2008-2012 (Figure 1). Observation stations were fixed based on the purposive sampling technic (Tanjung, 2013). Station 1 is characterized by main tour activities, station 2 is placed at the fisherman activities and canal, and station 3 is fixed at a more natural condition area. Each station was taken ten plots 50 x 50 centimetres.

To get information about the habitat quality, measurement of water qualities (DO_2, pH, salinity, temperature, and visibility) was done in the field directly, while the substrate analysis (fraction) was done in the laboratory. Dissolved oxygen (DO_2) was measured with DO metres, salinity was measured with hand-refractometers, a pH indicator was used to measure pH, a thermometer was used for temperature, and a secchi disk for visibility.

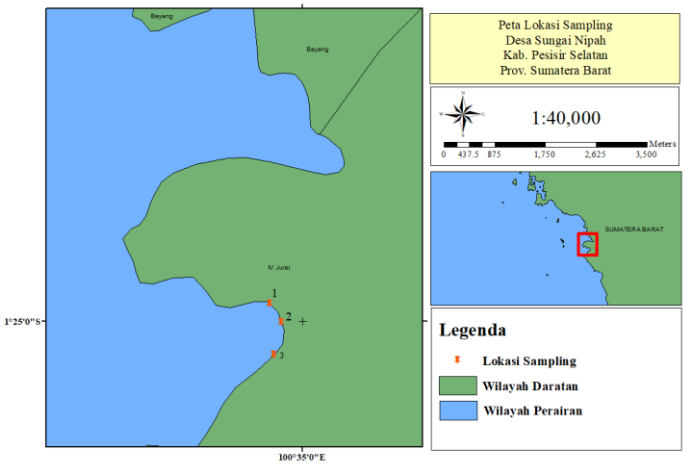

Figure 1. The Map of the sampling location

The samples of gastropods and substrate were taken at the time when the lowest tide occurred, and measuring the water quality was done at the time when the highest tide occurred. The sediment in each plot was dug for 50 x 50 x 10 centimetres for gastropod sampling, and the collected sediment was put into a macrobenthos sieve. The wet sediment sieving was done in the field directly, and then the found gastropods were put into a plastic bag and preserved with formalin 10%. The sample was identified based on Carpenter & Niem (1998); Robert *et al.* (1982); Buchanan (1984).

RESULT AND DISCUSSION

They were 15 species found at an intertidal zone of the Teluk Nipah waters in March 2008: *Conus coronatus* (Gmelin 1791), *Cyprae sp*, *Oliva oliva*, *Murex tribulus*, *Pythia* sp, *Polinices* sp, *Natica* sp, *Neverita sp*, *Rhinoclavis sinensis* (Gmelin 1791), *Strombus* sp, *Nerita chameleon* (Linneaus, 1758), *N.picea* (Recluz 1841), *N.polita*, *Monodonta labio*, and *Terebra* sp. There were 13 species found in March 2009: *Conus*

coronatus (Gmelin 1791), *Cyprae* sp, *Oliva oliva*, *Murex tribulus*, *Polinices* sp, *Natica* sp, *Neverita* sp, *Rhinoclavis sinensis* (Gmelin 1791), *Nerita chameleon* (Linnaeus, 1758), *N.picea* (Recluz 1841), *N.polita*, *Monodonta labio*, and *Terebra* sp. There were 12 species found in March 2010: *Conus coronatus* (Gmelin 1791), *Cyprae sp*, *Oliva oliva*, *Murex tribulus*, *Polinices sp*, *Natica sp*, *Neverita sp*, *Rhinoclavis sinensis* (Gmelin 1791), *Nerita chameleon* (Linnaeus, 1758), *N.picea* (Recluz 1841), *N.polita*, and *Monodonta labio*. There were 11 species found in March 2011 and March 2012: *Conus coronatus* (Gmelin 1791), *Cyprae* sp, *Oliva oliva*, *Murex tribulus*, *Polinices* sp, *Natica sp*, *Neverita sp*, *Rhinoclavis sinensis* (Gmelin 1791), *Strombus* sp, *Nerita chameleon* (Linneaus, 1758), *N.picea* (Recluz 1841), and *Monodonta labio*. These data showed decreasing in species numbers which were found from the observed location from the year the two species, *Pathya* sp and *Strombus* sp (Linneaus 1758) disappeared from their habitat in 2009. *Terebra* sp lose its habitat in 2010, and *N. polita* lost too in 2011 (Table 1).

The number of individuals of each species was also decreasing from year to year, except *Neverita* sp a little bit increase in 2011 (10 ind) and then decrease again in 2012 (7 ind), while *Polinices* sp increased in 2009 (14 ind) and 2011 (15 ind) and decrease again (11 ind) in 2012 (Table 1).

Table 1. Number of individuals for each species and number of species

Species	Sampling time				
	2008	2009	2010	2011	2012
Conus coronatus	22	21	19	18	15
Cyprae sp	18	16	15	13	8
Oliva olive	16	14	6	5	5
Murex tribulus	34	32	29	20	14
Phythia sp	14	-	-	-	-
Polinices sp	13	14	13	15	11
Natica sp	8	9	8	2	2
Neverita sp	9	8	7	10	7
Rhinoclavis sinensis	7	6	4	4	3
Strombus sp	12	-	-	-	-
Nerita chameleon	15	14	12	5	4
N. picea	14	12	11	10	3
N. polita	8	6	5	-	-
Monodonta labio	12	8	10	12	10
Terebra sp	3	1	-	-	1
Number of individuals	208	164	139	112	82
Species number	15	13	12	11	11

It has occurred a decrease in the species number which lives in the intertidal zone of the Teluk Nipah water from 2008-2012. This case is supposed due to the anthropogenic impacts: Every day fishermen do their activity in Station 2, the visitor comes to this area for a picnic, especially in Station 1, and the overhunting of marine organism shell collector. The activities like hanging down and starting sailing from land to the sea and back to the land again will cause instability on the substrate of the beach floor. This case will influence coastal organisms which live there, and so that place was not fit for an organism. Agree with Chiba & Roy (2013) said that the anthropogenic impact has led to widespread extinctions of species on oceanic islands. It can be seen from Table 1. It is shown by two species *Pithya* sp and *Strombus* sp disappeared from their habitat in 2009, and so *Terebra* sp and *Nerita polita* did after that. The activities of the collector and visitor will cause an ecological and genetic disturbance.

The average abundance of gastropods at the intertidal zone in March 2008 was 27,73 ind per m^2, 21,87 ind per m^2 in March 2009, 18,53 per m^2 in March 2010, 14,93 per m^2 in March 2011, 10,93 per m^2 in March 2012 (Table 2). This fact showed that the decreasing abundance from station to station and decreasing too from year to year have occurred in this area. The average abundance of Station 3 is the highest abundance (20,8 ind per m^2) followed by Station 1 (18,4 ind per m^2), and Station 2 has the lowest abundance (17,2 ind per m^2), see Table 2.

Based on the analysis of 50 g of the substrate which took from each plot, it could be told that the intertidal of the Teluk Nipah consists of sand. The activities of fishermen hanging down in the afternoon and to start sailing their fishing boats in the morning were routine every day, almost 8-12 fishing boat per day did their activities every day (Table 3). Almost every visitor will collect everything marine organism which is found in

the intertidal zone. If they did not get enough in number and satisfaction collection they will walk along the coast of the intertidal zone from Station 1 to Station 2, and the last to Station 3. Different from the collector of marine organism shells for the accessories material, they hunt weekly until they got enough in number.

Table 2. The abundance of gastropods at the sampling station

Sampling station	Abundance (ind)					Average
	2008	2009	2010	2011	2012	
1	27.2	21.6	18.4	13.6	11.2	18.4
2	14.8	20.8	17.6	13.6	9.2	17.2
3	31.2	23.2	19.6	17.6	12.4	20.8
Average	27.73	21.87	18.53	14.93	10.93	

Table 3. Disturbance of fisherman activities

Sampling station	Abundance (ind)				
	2008	2009	2010	2011	2012
1	0	1	0	0	0
2	11-12	11-12	8-10	8-12	8-10
3	0	0	1	1	0
Range	11-12	11-12	8-10	8-12	8-10

It is reasonable to say that human activities influenced the existence of gastropods in the intertidal zone. It can be seen from the value of gastropod abundance in each station, where station 2 had the lowest average abundance 17,20 ind per m^2 of gastropods among the others due to the highest level of disturbance that occurred there (Table 2).

At the station, the activities of fishermen were higher than the other two stations, with about 8-12 boat activities every day, while at station 1 and station 3 were almost nothing activities (Table 3). Station 1 is the station which is characterized as the place for a picnic or marine tour, whereas station 3 was characterized by the place's more natural aspect because nothing activity there. The highest average abundance of gastropods at station 3 was 20,8 ind per m^2 (Table 2). It showed that the station which has not have so many disturbances will have the highest abundance when compared with the station's many disturbances.

Not only will the fishermen's activities responsible for coastal organism disappearance from their habitat but also the habits of each visitor and the collector of marine organism shells cause that case. The effects of human activities did not affect directly in a short time, but the effects will destroy the habitat in a long time. The disturbance of habitat will reduce and isolate the space for gastropods' life. This statement agreed with Hogan (2010), who said that the most important causal anthropogenic impact are habitat destruction, overexploitation, pollution, and the introduction of alien species to an environment. More detail He said that habitat destruction is the greatest contributor to the extinction of many species; moreover, impacts on biota from habitat fragmentation is a critical mechanism of driving species to extinction. According to Nybakken (1988) that the decreasing average size of fish is an indication of overfishing.

The species lost from its habitat is the species which unable to adapt to the situation and condition changes. The species is able to adapt to the changes in their environment and will survive, but the habitat is not fit for them. It can be proved from the number and the maximum size. The number of species decreases from year to year and also the maximum size of found species decreases too (Table 1 and Table 5). It is agree with Chiba and Roy (2013) explained that body size itself is a well-recognized correlation of extinction.

It was got from the measuring of water quality: the dissolved oxygen was more than 5,6 mg/l, pH was 7,0-7,2, salinity was 30,2-32,2 ppt, the water temperature was 28,6-29,8^{0}C, and the visibility was 100% (Table 4).

Table 4. Waters quality at research location 2008-2012

Sampling time	DO (mg/L)	pH	Salinity (ppt)	Temperature (^{o}C)	Visibility (%)
2008	5.7-5.9	7.0-7.2	30.2-30.4	28.9-29.4	100
2009	5.7-5.8	7.1-7.2	30.4-30.6	28.6-29.4	100
2010	5.7-6.0	7.0-7.2	31.0-31.4	29.0-29.3	100
2011	5.7-5.9	7.1-7.2	31.2-32.2	29.0-29.6	100
2012	5.7-6.0	7.0-7.2	31.8-32.2	28.6-29.2	100
Range	5.7-6.0	7.0-7.2	30.2-30.4	28.6-29.6	100

The waters of the Teluk Nipah have a temperature of 28,6-29,6^{0}C. This temperature is not normal temperature for intertidal zone life, as said by Nontji (1993) that the temperature of the sea surface Nusantara is 28-30^{0}C. The dissolved oxygen content in the water of the Telauk Nipah was more than enough. Agree with

Nybakken (1988) said that dissolved oxygen is not a limiting factor, pH is not an important factor for the organism in the intertidal zone, and salinity is an important factor for intertidal life (Nybakken, 1988). Hylleberg & Vestergaard (1984) said that salinity is a major factor in species number for marine molluscs. The temperature has an important role, salinity is an important and major factor in coastal life, and dissolved oxygen is very needed for living gastropods, but the decreasing species number of gastropods at the intertidal zone of the Teluk Nipah waters is not related to the quality of water and substrate, because both qualities of water and quality of substrate were not different relatively from year to year, the event was not different either from station to station, and it those were still in normal limit for gastropods life (Table 4)

There were no species of gastropod samples which have the highest size reach the maximum size (Carpenter & Niem, 1998). All of them are smaller than the maximum size and it was almost decreasing from year to year (Table 5).

Table 5. Size of Found Shell and Maximum Size Shell of Each Species (Carpenter & Niem, 1998) in 2008-2012

Species	The shell size (cm)					Max size
	2008	2009	2010	2011	2012	
Conus coronatus	3.4-3.8	3.2-3.6	2.4-3.2	0.6-1.6	0.8-1.1	4.0
Cyprae sp	8.6-10.6	6.6-8.2	6.0-9.2	3.8-6.6	2.2-4.5	10.5
Oliva olive	2.8-3.6	1.6-2.4	1.2-2.0	1.8-2.2	1.0-2.0	4.0
Murex tribulus	8.8-9.2	8.1-8.8	6.9-8.7	7.2-8.6	8.2-8.6	10.5
Phythia sp	2.8-3.1	-	-	-	-	3.5
Polinices sp	3.4-4.4	3.4-4.2	4.0-4.2	3.2-3.6	2.2-3.2	6.0
Natica sp	2.3-3.3	2.2-3.2	2.9-3.0	2.8-3.2	2.8-3.6	8.5
Neverita sp	1.2-2.1	2.2-2.8	2.1-2.6	2.2-2.7	1.2-2.5	6.5
Rhinoclavis sinensis	2.3-3.4	3.2-4.6	3.6-3.9	2.4-4.2	1.2-2.2	7.0
Strombus sp	1.2-1.5	-	-	-	-	10.0
Nerita chameleon	1.5-3.2	2.8-3.0	1.4-2.8	1.2-2.4	1.0-1.2	4.0
N. picea	3.2-4.2	2.8-3.2	2.8-3.0	2.2-2.8	0.8-1.1	4.0
N. polita	2.3-3.5	2.8-3.2	2.6-2.8	0.6-0.8	-	4.0
Monodonta labio	2.0-2.9	2.2-2.6	2.4-2.6	2.0-2.4	1.0-2.0	4.0
Terebra sp	5.6-5.9	6.7-8.8	3.6-4.0	-	-	27.5

CONCLUSION

There are three things which show that gastropods extinction will occur at the zona intertidal of the Teluk Nipah waters if the situation and condition of gastropod habitat without treatment with a new policy from the Government: (1) the decreasing of species number from year to year, (2) the decreasing of found gastropods number and abundance from year to year, and (3) smaller maximum size found species in research location was then should be. All of that could be called an indication of gastropod extinction at the intertidal zone of the Teluk Nipah waters.

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