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Research Article

The Differences of Population Density and Morphometrics Character of Berungan (*Telescopium telescopium*) from Two Mangrove Area (Leachate Runoff and Charcoal Furnace Area) in Batam City, Indonesia

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ABSTRACT

The purpose of this research was to investigate the differences in population density and morphometric characters of Berungan (*Telescopium telescopium*), around two locations that has different substrates. Samples were taken by placing 5 transects it contain plot 10 m x 10 m and sub-plots of 1m x 1m with randomly in two station research. Data were analysed to perceive the comparison of population density and morphometrics characters of Berungan by using Mann Whitney test and descriptive analysis. The research showed 297 individuals consisted 0.155 population density in 2nd station compared to 62 individuals on population density 0.7425 in 1st station. Mann-Whitney test using Minitab 14, showed the significant difference of densities between two stations (P_{value} 0.0304 on α 0.05). Morphometrics showed the average length was 8.94 and 4.66 cm while average diameter was 4.73 and 2.54 cm for two stations respectively. The significant differences in population density of *T. telescopium* was observed between the two station with the different level of nutrients. This nutrient was possibly derived from the leachate of domestic waste dumpsite.

Keywords: *population density; morphometrics; Telescopium telescopium, leachate, heavy metal.*

1. Introduction

Mangrove, as coastal areas of tropical or sub-tropical ecosystems are considerably dynamic and have hight productivity and high economic value. This condition is largely determined by the organic-rich substrate allowing the high diversity of flora and fauna. Bengen (2004) state there are a wide variety of organisms that live in the mangrove ecosystem such as fish, mollusks, shrimp, crabs and worms. The ecological functions of mangrove are as nursery, feeding and spawning grounds..

Kabir et al. (2014) reported mangrove biological resources are often found in coastal areas are mollusks. They have shell exoskeleton. The variety of shells; spiral like the snail; or cone-like sea slug. Mollusks are one of the dominant invertebrate groups in the mangrove community and are thought to play an important ecological role in the structure and function of mangrove systems. Rangan, (2015) reported the popular and largest species of mollusks are gastropods. There are 55,000 species inhabit marine habitats distributed from coast to deep sea. Kabir et al. (2014), the gastropods are suitably adapted to various macrohabitats of the mangrove ecosystems.

Most of genus of gastropods are popular in Batam island is Berungan *(T. telescopium)*. Local communities often catch berungan for malay wedding party dishes. Hamsiah (2012), stated that these animals have habitat in the mangrove area and most are detritus-eaters. Moreover, Hamsiah (2012), reported general biota food from this Potamididae family consists of: fine organic matter, particulate detritus and diatoms that settle in the bottom of the waters as well as various types of algae.

There are some areas of the Batam Island that have mangrove vegetation stands. Some of them are Telaga Punggur region which is palced to processing of domestic waste dumpsite, and the others area is Sungai Bongkok it place in coastal areas of Tanjung Piayu sector. As the only dumpsite and processing in Batam City, it has a potential of environmental problems, especially contamination of leachate from possibly uncontrolled management. It can cause odors, lowering the quality of ground water, sea water, and the emergence of various insects and disease vectors that can damage the health of the surrounding communities.

Based on the above issues, this study was to assess population density of Berungan

(T. telescopium) in the mangrove area that became runoff leachate from waste dumpsite in Telaga Punggur Batam and compare it to the mangrove habitat in Sungai Bongkok which not affected by dumpsite waste leachate runoff.

2. Research Methods

The method used in this research was exploration with an intra-regional comparisons technique for whichthe density and individual morphometrics of *T. telescopium* in two observation stations were compared.

Time and place research

Research was conducted on mangrove habitat around the waste dumpsite Telaga Punggur and Sungai Bongkok Tanjung Piayu Batam, Kepulauan Riau Province, from September to November, 2015.

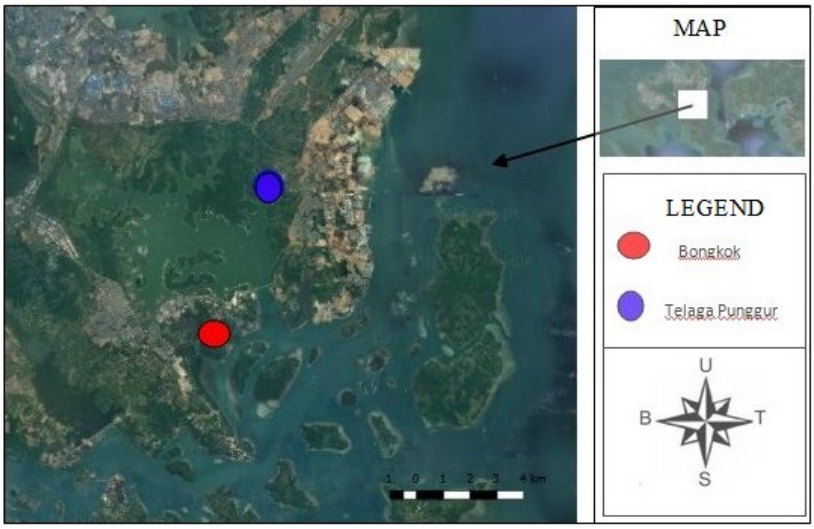

Figure1. Maps of station research. Sungai Bongkok (N1.02862 E104.07683) and Telaga Punggur Dumpsite (N1.05014 E104.12002).

Data collection

Two different sites have been selected for sampling purpose i.e. Sungai Bongkok, (N; 1° 1'48.71, E; 104° 5'4.86), a coastal area where is adjacent with mangrove charcoal production plant, Tanjung Piayu Batam, and Telaga Punggur Batam (N :1 ° 2'39.33, E ;104 ° 7'8.83) which is considered as an area of leachate runoff from the domestic waste dumpsite. The population density of *T. telescopium* is collected by placing 4 square randomized. This contains 10m x 10m on each research station (Telaga Punggur and Sungai Bongkok). This sampling method is based on the use of squares method, Ellenberg 1979 *in* Hutomo, (1986). Frame squares measuring 1x1 m Then at each of those, 1m x 1m subplot were applied by using a nylon rope, and 5 subplots were chosen. Layout of this square plot can be seen on figure 2 below. *T. telescopium* was collected at the lowest tide, above the substrate and attached to the mangrove roots within each sub-plot is taken entirely and put in labeled plastic bags. Furthermore morfometrics was counted and measured (length and diameter) for each sample.

Data analysis

To determine the population density (ind/m²) *T. telescopium* using the following formula:

D = N/A

Where:

D =density (ind/m²)
N = number of individuals
A = area of observation plots (Odum, 1996).

Statistical data analysis

Statistical data analysis was used a Minitab 14.1 software for the test: Mann-Whitney, Analysis, was also used for further test to examine estimated median mark of a continuously distributed population.

3. Result and Discussion

It found 62 individuals *T. telescopium* on Sungai Bongkok station research. Population density of *T. telescopium* for each plot are presented in Table 1. Based on Table 1. above, it can be seen that the population density of *T. telescopium* for each plot on mangrove habitat in Sungai Bongkok ranged between 12-18 individuals. The Highest density found in 1st plot (18), and the lowest it found in 4th plot (12) individuals. The high number of individuals on 1st plot due to mangrove stands) which is dominated by *Rhizophora spp*. Sufficiently tight so *T. telescopium* can be associated either with the environment. Because *T. telescopium* is one of Gastropods that many live in brackish or mangrove forest dominated by mangrove trees *(Rhizophora spp.).* While the 4th plot relatively few of mangrove stands, it can be be said to be critical on condition. This is due to illegal logging of mangrove wood by local people and then burn them to charcoal carbon. Yarsi (2013) reported, the massive destruction of mangrove vegetation around the coastal area of Tanjung Piayu Batam, majority caused by the exploitation of wood as charcoal. There are 20 active charcoal kiln production process. Every day on average each furnace requires 60-90 mangrove logs, it's mean requires 45.000 mangrove log within 1 month for burning.

The study of population density *T. Telescopium* on mangrove habitat around the 2nd station of Telaga Punggur found 297 individuals. Table 1 showed that the population density of *T. telescopium* for each plot it ranged between 52-91 individuals. The highest density found in 1stplot. (91), and the lowest for the plot abundance found in 4th plot (52). High density of this station possibility due to the rich organic nutritions that contain of leachate that produce by Telaga Punggur waste dumpsite. This leachate flow to the mangrove areas. Allegedly this leachate contains a lot of food of *T. telescopium*. According (Soekendarsi et al., 1996) in Hamsiah., 2002), these animals more immerse themselves in the mud rich in organic matter than in the mud. (Yeanny, 2007) stated that the gastropod is an animal that can live and thrive in different types of substrates that have the availability of food.

According to Table 1. above, it can be seen that the low density of *T. telescopium* within 3rd and 4th plot, estimate caused by position of 4th is the farthest from outlet of leachate among all of the plots in the mangrove habitat around the waste dumpsite Telaga Punggur. Allegedly farther from leachate drainage outlet, the availability of organic material that contain food of *T. telescopium* will wane. So the number of population density is relatively lower.

Tabel 1. Population density of T. telescopium in Sungai Bongkok and Telaga Punggur.

Station 1 Sungai Bongkok							Station 2 Telaga Punggur						
Plot	Sub-plot					∑	Plot	Sub-plot					∑
	1	**2**	**3**	**4**	**5**			**1**	**2**	**3**	**4**	**5**	
1	5	4	2	4	3	18	**1**	20	15	14	21	21	91
2	5	3	4	3	2	17	**2**	9	17	16	15	12	69
3	2	4	3	4	2	15	**3**	22	18	15	17	13	85
4	1	4	1	2	4	12	**4**	12	10	9	10	11	52
			∑			**62**				∑			**297**

Comparison of population density

The study of population density *T. telescopium* on mangrove habitat between Sungai Bongkok and the landfill area of waste dumpsite of Telaga Punggur as it shown in Table. 2.

Population density (ind / m²) can be determined by counting the number of individuals are then compared with a spacious plot of observations. Based on Table 2 it can be seen that there is a significant difference in the number of individuals between the 1st station to 2nd station. The higher the number of individuals of 2nd are 297 individuals while the lower number of individuals at 1st station (62). Figure 2. showed comparative density (ind/m²) *T. telescopium.*

Figure 2. showed there are different population density of *T. telescopium*. Station 2 that placed near from outlet of waste domestic dumpsite have higher density. (0.7425 ind/m²), compare to Station 1 (0155 ind/m²). *T. telescopium* high population contained in the station 2 allegedly caused by a large supply of nutrients derived from leachate, which flows into the mangrove habitat around the landfill. *T. telescopium* like delicate habitats that contain various organic materials that become a source of food. Screenivasan and Natajaran (1991) in Hamsiah et al. (2002) describe in general, food biota of this potamididae family consists of: fine organic material, particulate detritus and diatoms that settle to the bottom waters as well as various types of algae.

Low abundance in the Sungai Bongkok allegedly due to massive illegal cutting of mangrove trees, majority of the genus Rhizophora spp which is the habitat of T. telescopium. While the landfill around the mangrove tree in Telaga Punggur inclined slightly. The reduction of the mangrove plant communities caused by illegal logging affecting the reduced supply of organic material which is a source of food and the food chain of various aquatic fauna in the mangrove habitat, which includes T.telescopium.

Mangrove fauna in the mangrove ecosystem shows two scattered distribution pattern vertically fauna and flora that spreads horizontally. One fauna that spreads horizontally (living on or in the substrate) that occupy a variety of habitats such as forests *Rhizopora spp* is *T. telescopium*. Basically, the contribution of mangroves to the sea life is through garbage avalanche vegetation (including dirt / the remains of dead animals) to the forest floor. This garbage will decompose by fungi and bacteria into the detritus, the remains of which are the main food for the primary consumer. In addition, the main consumers will support microbial life at the consumer level and upper middle-consumers in mangrove habitat (Kusmana, 2011).

Tabel 2. Abundance *T. telescopium* on mangrove habitat between Sungai Bongkok and Telaga Punggur.

Plot	S. Bongkok	T. Punggur
Plot 1	18	91
Plot 2	17	69
Plot 3	15	85
Plot 4	12	52
Number of Ind.	62	297
Density (ind/m²)	0.155	0.7425

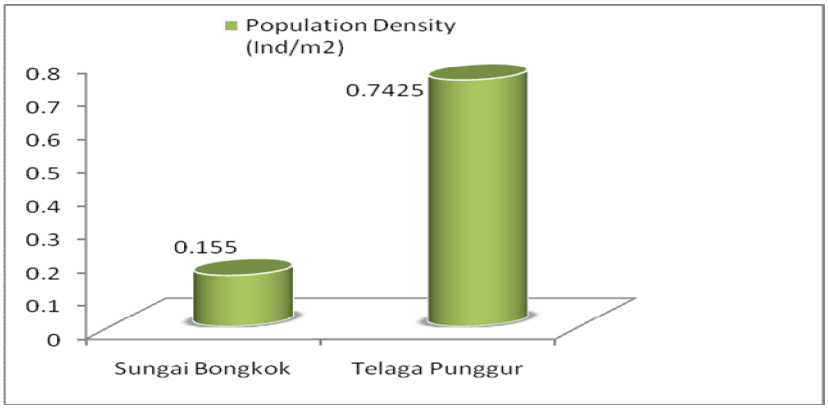

Figure 2**.** Comparison of population density between Sungai Bongkok and Telaga Punggur

In addition to this difference is caused by exploitation of *T. telescopium* by local people whose taken this mollusks as dish, they serve this *T. telescopium* as side dish other than fish. While in the mangrove habitat around the Telaga Punggur there is no activity against to this mollusks. This information was obtained from local residents around Tanjung Piayu coast.

Statistical analysis to proved the differences of population density in two station research is done with the Mann-Whitney test using Minitab 14. The results of this test reject that zero starting hypothesis (H0) and accept the alternative hypothesis (Ha). Where there are significant differences in the population density of the second research station. This difference is seen from the difference between the median of both sites. Where the median of the population in station 1 is 0.1600 and station 2 is 0.7700, P_{value} of 0.0304 at the 95% confidence level (α 0.05).

Morphometric differences of T. telescopium between Sungai Bongkok and Telaga Punggur

The results of the average morphometric measurements (length and diameter) *T. telescopium* at each observation station, can be seen in the Table. 3

Average length of *T. telescopium* highest in Sungai Bongkok, 8.94 cm. While the average length of T.telescopium Pungur are lowest with an average 4.66 cm. The average diameter of *T. telescopium* for each station ranged between 2:54 - 4.73 cm. The highest average of diameter it found in Sungai Bongkok with an average diameter of 4.73 cm While the average of Telaga Punggur are lowest with an 2.54 cm.

T. telescopium morphometric shown differences in the two observation stations allegedly due to differences in heavy metal. The content of heavy metals is thought to inhibit the growth of *T. telescopium*, so that there is a difference between the two station observations morphometric.

The presence of heavy metals, either from natural sources or from anthropogenic sources in aquatic sediments systems is one of the most important environmental problems, especially since this sediment is an important reservoir of elements and pollution of other substances (Ridgway and Shimmield, 2002 *in* Hidayati et al., 2016). Heavy metals in waters can be adsorbed into sediment rapidly resulting in contamination affecting ecosystems (Hidayati et al., 2016).

There are two factors that known to affect the weight of mollusk. They are heavy metals and salinity medium. One of the heavy metal is Chromium. Chromium accumulation in the body of shells are reported to be losing weight. Conversely, if the concentration of chromium in the body shells decreases, then the weight will go up. (Eisler, 2000). Contamination is a major form of anthropogenic impact in estuarine systems, acting as a stressor which influences the composition and health of ecological communities (Susanto et al., 2014).

Table 3. Comparison of average morphometric (length and diameter)

Plots	Morphometrics (cm) at Sungai Bongkok		Morphometrics (cm) at Telaga Punggur	
	Length	Diameter	Length	Diameter
Plot 1	8.88	4.52	3.81	2.12
Plot 2	8.81	4.78	3.9	2.14
Plot 3	8.89	4.75	4.78	2.64
Plot 4	9.2	4.9	6.18	3.29
Averege	**8.94**	**4.73**	**4.66**	**2.54**

Table. 4. representing the difference chromium content on both sites.
Table. 4. Chromium content of both station research. Reported by analysis laboratory Aquatic Productivity and Environmental (ProLing), Department of Aquatic Resources Management – Bogor Agricultural University).

	Khromium (mg/kg)	
Plot	Sungai Bongkok	Telaga Punggur
Plot 1	6.13	21.12
Plot 2	0.2	268.85
Plot 3	0.19	24.74
Plot 4	24.86	0.18
averege	**7.84**	**78.72**

The high accumulation of heavy metal chromium (Cr) inside of the body of *T. Telescopium* contained in 2nd station, due to the mangrove habitat here got leachate runoff from domestic waste dumpsite Telaga Punggur. Allegedly leachate contained many heavy metals include chromium (Cr). Based on field observations in landfill Punggur, there are many household waste, which is one source of the heavy metals chromium. Heavy metal pollution of the marine environment occurs because of the process that is closely connected with the use of these metals in human life, and intentionally or unintentionally throwing various types of toxic waste including heavy metals into aquatic environments.

Chemical wastes such heavy metals in sea water ecosystems from anthrophogenic activities input such as industrial effluent, urban runoff, domestic activities etc were serious probleme for aquatic ecosystems (Aziz et al., 2015).

4. Conclusion

There was a significant difference on population density of Berungan *(T. telescopium)*, between two sites that contain different substrates. The first location on Sungai Bongkok which has thin mangrove tree stands due to exploitation for mangrove charcoal, has a lower population density compare to Telaga Punggur which relatively good condition mangrove tree stands and has substrate that rich in organic material, derived from leachate runoff. Furthermore, the morphometric aspect between two site also showed the significant difference. Berungan which found on Sungai Bongkok site has larger on body size than that found in Telaga Punggur which relatively small (dwarf). This fact possibly caused by heavy metals contained by leachate water will inhibit the growth of Berungan.

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