The composition of mollusks in mangrove ecosystem conservation area Bagek Kembar, West Lombok

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Abstract. Mangrove association mollusks was one of the indicator to describe the status of mangrove ecosystem’s health. This research aimed to analyze the condition of mangrove rehabilitation based on the composition of association mollusks compared with non-rehabilitation area which resulted from a natural succession. It held on July 2019 at mangrove conservation area Bagek Kembar, West Lombok. Data collection method used stratified random sampling by placed some plots sized 1x1 m randomly in a larger plot (10x10 m) which have been determine randomly before. The result showed that there are 24 species of association mollusks which belong to 11 families found in these area. The abundance of mollusks in natural and rehabilitation mangrove was different which is in a row 50.2647 ind/m² and 88.4 ind/m². Cerithidea cingulata has the highest abundance among the other species with the number of abundance 48.8 ind/m² in non-rehabilitation ecosystem and reach 29.17 ind/m² in rehabilitation area. Based on this research, the condition of mangrove conservation Bagek Kembar still categorized as non-stable condition for supporting the survival of mangroves associated mollusks.

1. Introduction
Mangrove ecosystem is a specific ecosystem of coastal area that plays multiple functions such as physical, ecological, and economical function [1]. This ecosystem called as productive area because of the richness of organic sources which are being use as nutrition sources and habitat of mollusks and other fauna [2]. However, the destruction of mangrove occurred and become a big problem in almost the whole territory of Indonesia, included in Lombok. Mujiono (2016) reported that the mangrove ecosystem which still in well condition in Lombok was about 1.643 ha or approximately 49,7% of 3.305 ha total mangrove Lombok island [3]. In Pannikiang island, the total value of the total stem carbon deposits in the mangrove stands reached a total carbon stem portion of 640,512 tons with a maximum range of 859,174 tons and a minimum of 421,871 tons [4]. As an effort in order to reduce the rate of mangrove destruction rate, then rehabilitation of mangrove ecosystem was conducted.

Rehabilitation of mangrove ecosystem was a great solution for the destruction of mangrove ecosystem issues [1]. In order to enactive the rehabilitation effort, monitoring of the current condition of rehabilitation mangrove need to be conducted [5,6]. Monitoring of mangrove ecosystem health can be conducted by studying the composition of association fauna such as Mollusks. Then, in order to determining the current health condition of those ecosystem, it can be compared with the composition of mollusks community in natural ecosystem. The result will showing the similarity between the rehabilitation and natural area. As the similarity increase, the healthy rate of the ecosystem will increase too.

Mollusks is one of the largest animal phyla after Arthropod which has distinctive characteristics that is a soft body [7]. Mollusks can become a bio-indicator to determine the stability of mangrove ecosystem because of its specificity of microhabitat and nutrition each species [2,5]. The diversity and abundance of mollusks were very influenced by the characteristic of vegetation of mangrove, therefore, the structure of community of mollusks be able to determine the mangrove ecosystem health [6].

One of mangrove ecosystem that have been rehabilitee by planting Rhizophora spp. is mangrove conservation area Bagek Kembar, West Lombok. Rhizophora spp. was planted in area which was...
former of salt or fishpond dam. Other former of dam were not intentionally planted but covered by Avicennia spp. as the result of an occurred of natural succession. By this research, the composition of these kind of mangrove ecosystem was compared in order to monitoring the current condition of rehabilitation of mangrove in Bagek Kembar area.

2. Methods
This research conducted on July – August 2019 at Mangrove Conservation Area, Bagek Kembar, West Lombok (Figure 1) by comparing 2 stations which are the plantation area (station 1) and non rehabilitation area (an area which resulted from natural succession) or station 2. Data collection method used stratified random sampling by placing some plots sized 1 x 1 m randomly [8–10]. The mollusks samples were collected from 1 m² quadrate that was positioned under the peg in mangrove area [10]. All the mollusks were collected from the surface of substrate, on the part of the tree (height of 1.5 m from the surface), or excavated from the substrate of mangrove 15 cm in depth. Identification of mollusks used references [11,12].

![Figure 1. Location of sampling.](image)

The abundance of each species calculated by the following formula [9]:

\[
D_i = \frac{\text{The amount of species } i}{\text{the width of sampling area}}
\]

Besides, it also calculates the index of diversity \( H' \) and the index of dominance \( C \), the following is:

\[
H' = \sum_{i=1}^{s} (pi)(\ln pi) \quad \text{and} \quad C = \sum_{i=1}^{s} pi^2
\]

with:
H’ : Diversity index Shannon-Wienner  
Pi : ni/N is the comparison of the number of individual found of i species (ni) to the total individuals (N)  
The diversity index criteria [8]:

| H’ value | Category |
|----------|----------|
| H’ < 1   | Diversity of species low, productivity low, ecosystem unstable |
| 1.0 < H’ < 3.322 | Diversity of species medium, productivity sufficient, ecosystem stability medium |
| H’ > 3.322 | Diversity of species high, productivity high, ecosystem stable |

3. Results

There are 24 species of mollusk live in Mangrove conservation area Bagek Kembar which are spread in rehabilitation and non-rehabilitation area. These 24 species of mollusks belong in 13 families such as Assimineidae, Cerithidae, Ellobidae, Potamididae, Batillariidae, Onchidiidae, Plakobranchidae, Littorinidae, Neritidae, Himnoeaidae, Thiaridae, Nassaridae, and Isognomonidae. Isognomonidae is the only species of Bivalvia found in the plotted area, meanwhile other family of mollusk is included in class Gastropoda.

19 numbers of species found in plantation area (station 1), then in non-rehabilitation area (station 2) there are 21 species of mollusks found. The diversity of mollusks live in mangrove conservation area Bagek Kembar, West Lombok was shown by table 1.

| Table 1. diversity of mollusks live in mangrove conservation area Bagek Kembar. |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Famili          | Spesies         | Presentation of Species | Station 1 | Station 2 |
| 1. Assiminea lutea | ++              | ++++              |             |            |
| 2. Cerithium coralium | +              | ++              |             |            |
| 3. Melampus sp.    | ++              | +                |             |            |
| 4. Cassidula nucleus | +              | +                |             |            |
| 5. Cerithidea cingulata | ++++         | ++++             |             |            |
| 6. Cerithidea quoyii | +++             | +++              |             |            |
| 7. Telescopium | +              | ++              |             |            |
| Batillaria zonalis | ++              | +                |             |            |
| Platevindex sp.    | +              | +                |             |            |
| 8. Terebralia palustris | ++             | +                |             |            |
| 9. Terebralia sulcata | +             | ++              |             |            |
| 10. Zeacuman sp.  | -              | +                |             |            |
| Batillariidae      | ++              | +                |             |            |
| 11. Plakobranchidae | +              | +                |             |            |
| 12. Littorina scabra | +              | +                |             |            |
| 13. Littorina lutea | +              | +                |             |            |
| 14. Littorina carinifera | ++         | +                |             |            |
| 15. Nerita planospira | -             | +                |             |            |
| 16. Nerita histiroa | +              | +                |             |            |
| 17. Clithon faba | +              | -                |             |            |
| 18. Nerita spp.     | +              | -                |             |            |
| 19. Nassarius olivaceus | +              | -                |             |            |
Isognomonidae  

24. *Isognomon alatus*  

(+): present; (++): Abundance > 1 ind/m² < 5 ind/m²; (+++) abundance > 5 ind/m² < 10 ind/m²; (++++) abundance >10 ind/m² < 25 ind/m²; (+++++): abundance > 25 ind/m².

The number abundance each species of mollusk in mangrove conservation area, Bagek Kembar, West Lombok shown by figure 2 and 3.

![Mollusks abundance in Natural Succession area](image)

**Figure 2.** The abundance of mollusk in non-rehabilitation area
4. Discussion

Based on the result shows at Table 1 and Figure 2 and 3, the diversity and abundance of mollusks in non-rehabilitation area (station 2) was higher than the rehabilitation area (station 1) at mangrove ecosystem bagek Kembar, West Lombok. Table 1 shows that 13 families of mollusks comprising 24 species of mollusks has discovered with dissemination of mollusks are 21 species found in station 2 and 19 species found in station 1. The diversity index of mollusks shows that both location has medium level of diversity by reaching diversity index 1.381 in rehabilitation area and 1.481 in non-rehabilitation area. The diversity of mollusks found in station 2 was a little more than station 1. That may occur caused by the diversity of mangrove vegetation in station 2 which higher than station 1, wherein this condition can increased the capability of ecosystem to provide more ecological niche or microhabitat for every specific mollusks [13]. This kind of condition of mollusks community structure supported by Zvonareva (2015) who faced a similar result as this research in natural and rehabilitation mangrove area in Dam Bay, Vietnam [14].

If we compare with other research, the number of species lived in Bagek Kembar mangroves ecosystem was less than other location. Mujiono (2010) found 59 species of mollusks in Ujung Kulon, Banten [15], meanwhile other research in Lombok’s mangrove ecosystem by Mujiono (2016) discover 31 species of mangroves Gastopods [3], and Isnaningsih (2015) found 25 species of mollusks in West and East Lombok District [17]. It may occur because this research area was an early exist ecosystem which was resulted from plantation of mangroves and a natural succession occurred on dormant dam, therefore it still at the early stages of succession with the condition of habitat that are not yet very stable and compatible for other species of mollusks [16].

The differences between those stations shows at the abundance level of mollusks. The abundance of mollusks in station 2 reach 88.4 ind/m² which was more than the abundance of mollusks in station 1 that only reach 50.264 ind/m². Moreover in a large plot wherein 3 plots of mollusks placed in station 2, the abundance of mollusk as much as 942 ind/m². The abundance of mollusks in both station influenced by vegetation structure which covering these location and its environmental condition. Mangrove vegetation in station 1 dominated by Rhizophora spp. which planted as an effort for
rehabilitate the mangrove area, meanwhile in station 2 was dominated by *Avicennia* spp. Supriharyono (2009) reported that several mangrove living mollusks were leaning to live on or surrounding the genus *Avicennia* spp. of mangroves just than *Rhizophora* [17], with the result that the domination of *Avicennia* spp. will triggered the abundance of mollusks in station 2. As an example, most *Littorina* spp. in this research found cling on trunks or roots of *Avicennia* spp., or in station 1 where *Avicennia* spp. was rarely grow, this genus of mollusks adhered on the stem of *Sesuvium portulacastrum* and rarely found on *Rhizophora* spp.

Another factor that caused large differences of abundance of mollusk in those stations is the specific environmental condition in both stations especially the type and condition of substrate. Station 1 generally have loam type substrate (10 cm in depth) which only inundated when the highest tide occur and caused low moisture of substrate. Comparing with station 2, the substrate of mangrove were vary such as loam, sandy mud, and soft mud with depth 5 to 50 cm. Most of station 2 were always inundated which caused the high number of moist. The substrate condition which has high moist and inundated was very compatible for mangrove mollusks especially Potamididae family [3,6,15]. Potamididae is a group of mangrove-associated mollusks with the highest abundance and diversity in this research. There are 5 species of Potamididae found in both station with the abundance reach 42.598 ind/m² in station 1 and 66.583 ind/m² abundance of station 2. The combination of vegetation structure and the environmental condition trigger the abundance of mollusks in station 2. Other environmental parameters such as air temperature, light intensity, and substrate acidity were similar in both stations which mean that this parameters were not have much influence to the diversity and the abundance of mollusks there. Those environmental parameters rate measured: air temperature 28 – 33°C, substrate acidity 6.7 – 7.5, and light intensity 150 - 2000 lx.

However, if this result compared with other research which conducted in other mangrove ecosystem, the abundance of mollusks in this area counted as high abundance level. The abundance of mollusks in Segara Anakan mangrove, Cilacap only gain 58.2 ind/m², even the diversity of mollusks there was higher than the result of this research [18].

According to the differences between station 1 and station 2 based on diversity dan abundance of mollusk, the similarity rate of those location can be measured. The similarity shows by number of ISS (Index similarity Sorensen) and Percent of Similarity (PS) [19]. ISS rate calculated reaching 0.567, then the number of PS reach 83%. These result shows that the similarity of species found and the proportion of each species in station 1 and 2 can categorized as medium-high level of similarity. By the number of similarity rate, the differences condition of mangrove vegetation structure and environmental parameters of those station were not brought too large gap of differences of mollusk structure. But, it may occur because these area were still in early stage of succession. When it come to higher level of succession, this similarity may will change too.

5. Conclusion

There are 24 species of mollusks found in mangrove conservation area Bagek Kembar, West Lombok which belong to 13 families such as *Assiminidae, Cerithidae, Elllobidae, Potamididae, Batillariidae, Onchidiidae, Placobranchidae, Littorinidae, Neritidae, Himnoieaidae, Thiaridae, Nassaridae, and Isognomonidae*. Non-rehabilitation area has a higher number abundance of mollusks with 88.4 ind/ m² meanwhile the rehabilitation area reached 50.264 ind/ m². The highest abundance in both location reached by *Cerithidea cingulata*. The diversity index shows that both location categorized as medium diversity and stability of ecosystem by only reaching diversity index 1.381 in rehabilitation area and 1.481 in natural succession area. The last is the similarity of these ecosystem shown by similarity of species (ISS) and percent of similarity (PS) also indicated that the mollusks composition was high similarity by reaching ISS 0.567 and PS 83%.
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