Fish community structure in the mangrove forest of Panjang Island, Banten Bay, Banten, Indonesia

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Abstract. Research of fish community structure in Panjang Island, Banten Bay, Banten, Indonesia (E 106° 08’ 31.9” & S 5° 56’ 23.4” and E 106° 08’ 20.6” & S 5° 55’ 29.2”) has been conducted from October to December 2014 while spring tide. The aim of the research knew the fish biodiversity and fish community structure. The fishing method was used push net manually active. The location was at Station 1 (West) with sandy-mud and gravelled substrate and Station 2 (North) with the mud-reef substrate. In total, 1770 species were captured (14 families, 16 genera, and 21 species), the largest number were at Station 1 and in November (1.213 and 749 fish). Both stations had a low species diversity index (H') value (0.705 and 0.807). It supported by a low evenness index or distribution of individuals among species (E) value. Its high dominance index (D) value was due to the predominance of Ambassis gynnocephalus - Chandidae (908), Ambassis buruensis - Chandidae (297), Oryzias javanicus - Adrianichthyidae (265), Chelon sp. - Mugilidae (123), and Gerres sp. - Gerreidae (22) in large numbers. Chandidae is the most common fish in the mangrove ecosystem at Panjang Island as a resident fish.

1. Introduction

Mangrove is an important ecosystem in provisioning of enough amounts of food deriving from detrital pathways. Litter decomposition enriches the nutrients, nitrogen and phosphorus, temperature, salinity, and pH of water [1]. Mangrove often categorized as the most productive ecosystem in trophic water [2] and carbon storage from among all forest type [3]. Its primary productivity made it as nursery ground and feeding ground for various fish and the other economic important organisms such as shell and prawn [4]. Mangrove litters can enhance fish biodiversity and fisheries in the estuary and coastal area. Organic matters from litter decomposition determine the food chain of fish and invertebrates [5]. In the water ecosystem, mangrove has the main role in nutrient supplying, which increase fish productivity [6]. Vanished mangroves decrease fish productivity [7].

The existence of fish assemblages relies on the function and interaction of coastal ecosystem as the source of nutrients and protection area. 80% of commercial fish captured in Indonesia has a high correlation with the food chain in the Mangrove Ecosystems. Around 70% of the shrimp and fish life cycle captured in the estuary is in Mangrove ecosystem too [8].

Based on the previous research in 2012 by Ashuri (unpublished), there are three sampling area for potential mangrove in the south of Panjang Island, Banten Bay, Banten, Indonesia (E 106° 08’ 31.9” &
S 5° 56’ 23.4” and E 106° 08’ 20.6” & S 5° 55’ 29.2”). They are east side (Station 1), west side (Station 2), and the north side (Station 3). The amount of removed mangrove litter to sea sequentially are 4.741 g/m³/s; 5.169 g/m³/s; dan 3.854 g/m³/s (total = 13.764 g/m³/s), leaves organ gives the most amount of it. The research describes the potential of carbon sink and removal to the sea by mangrove is significant.

The relation between mangrove ecology function and fish community structure is an important thing to be reviewed. There is still no data about fish community structure in the mangrove ecosystem of Panjang Island, Banten Bay. So, this research will be conducted in order to get information about fish diversity and community structure in the mangrove ecosystem of Panjang Island, Banten Bay. Furthermore, hopefully, this research will be useful for mangrove ecosystem management of Panjang Island and other similar islands.

2. Methods
Sampling conducted at two different locations (Figure 1) at the mangrove ecosystem of Panjang Island with Push net as the main fishing gear. Sampling conducted from October to December 2014 during low tide.

Station A (E 106° 08’ 31.9” & S 5° 56’ 23.4”) located in the west side of Panjang Island. Its substrate was mixed of mud, sand, and gravel. Station B (E 106° 08’ 20.6” & S 5° 55’ 29.2”) located in the north side of Panjang Island. Its substrate was mixed with mud and reef. The collected sample was preserved using alcohol 70% inside the sample bag and categorized based on the location and species. The sample then being identified at Zoology Research Center Laboratory, Indonesia Institute of Science (LIPI), Cibinong, and being analyzed at Marine Biology Laboratory of Biology Department FMIPA Universitas Indonesia, Depok, Jawa Barat.

3. Results and discussion
In total, 1770 species were captured, and 21 species representing 14 families and 16 genera were identified while sampling (Figure 2). The most abundant fish species was *Ambassis gymnocephalus* (908 fish). Next species are *Ambassis buruensis* (297 fish), *Oryzias javanicus* (265 fish), *Chelon* sp.
(123 fish), and Gerres sp. (22 fish). The majority of those fish species comes from family Chandidae (both Ambassis gymnocephalus and Ambassis buruensis), Adrianichthyidae (Oryzias javanicus), Mugilidae (Chelon sp.), and Gerreidae (Gerres sp.). These fish also have various total body length.

![Figure 2. The total number of 5 fish species.](image)

![Figure 3. Total of fish biomass for Station 1 and two from October—December 2014.](image)

Fish from Chandidae family is the most abundant fish family that had been found at both sampling station. Based on Figure 3, Station 1 has more fish biomass than Station 2, especially from Chandidae. It was always present every month during sampling. The high D-value reached 0.910 at Station 1 (Figure 4), was due to a large of fish captured from Chandidae (450 from 908 fish in total) in November. The high abundant of Ambassis is supported by reproduction behavior in every month, so the larvae and juvenile of Ambassis will always exist along a year. Besides that, the mud-sandy substrate is a suitable habitat for Ambassis. The result of the research shows mud and sand as the majority substrate.
Figure 4. Value of $H'$, $E$, $D$ for Station 1.

Figure 5. Value of $H'$, $E$, and $D$ for Station 2.

Table 1. Water quality data.

| No  | Month | St | Time | Temperature (°C) | pH  | Salinity (%) | Dissolved particles (mg/ml) | DO (mg/ml) |
|-----|-------|----|------|------------------|-----|--------------|-----------------------------|------------|
| 1.  | October | 1  | 08.00 | 31.4             | 7   | 37           | 0.0001                      | 6          |
|     |        | 2  | 08.00 | 30.8             | 8   | 38           | 0.00018                     | 5.3        |
| 2.  | November | 1  | 08.00 | 30.6             | 7   | 30           | 0.00027                     | 7.4        |
|     |        | 2  | 08.00 | 30.2             | 7   | 33           | 0.00028                     | 7.9        |
| 3.  | December  | 1  | 08.00 | 28.6             | 9   | 33           | 0.0003                      | 6.8        |
|     |        | 2  | 08.00 | 28.9             | 8   | 30           | 0.00032                     | 7.1        |

The value of Shannon Wiener Index ($H'$) for Station 1 from October to December sequentially is 0.628; 0.238; and 1.251 with average 0.705. The fish community structure expressed by Shannon Wiener Index showed low diversity. It was supported by the value of Evenness Index ($E$) that gives 0.294 and 0.646 of Dominance Index ($D$). This result indicates that there are a group of certain species that have more dominant number than other species. Those species were *Ambassis buruensis* and *Ambassis gymnocephalus*. *Ambassis buruensis* that collected during October was 297 fish from total 350 fish and *Ambassis gymnocephalus* with 450 fish from a total of 471 fish collected during November.

The value of $H'$ for Station 2 from October to December sequentially are 0.838; 0.697; and 0.886 with average 0.807. The fish community structure expressed by Shannon Wiener Index showed low diversity too. It is supported by the $E$ and $D$ index value that indicates dominance from a certain species. Those species were *Oryzias javanicus* and *Ambassis gymnocephalus*. *Oryzias javanicus* dominated the catch during October with 73 fish from a total of 109 fish collected while *Ambassis gymnocephalus* dominated the catch during November, with 239 fish from a total of 278 fish collected.

Most of the most dominance fish were comes from Chandidae family. Chandidae dominated the fish community in the mangrove forest, Panjang Island because of the reproduction behavior along the year, so larvae and juveniles often appeared in the same location. Chandidae also the true resident of mangrove forest. The existence of Chandidae indicated the dominance of muddy substrate, which is the most suitable habitat for Chandidae too [9,10]. Mostly fish captured on this research at the juvenile stage. The commercial fish were captured too, such as Mugilidae, Gerreidae, Clupeidae, Serranidae, and Gobiidae family [11]. It can be concluded that Mangrove Forest of Panjang Island is needed to sustainably conserve, as we proved the importance of nursery ground, feeding ground, spawning ground, and enhance the commercial fish production [12-14].
Based on physical water quality parameter, the temperature is one of the main factors and gives the direct and indirect effect for the water life cycle. Temperature affects metabolism activity, photosynthesis rate, animal physiology and development process, and reproduction factor of the organism. The highest temperature is 31.4°C at Station 1 in October (Table 1). It caused by the dry season, so there was no rain in October. It also supported by open-area of sampling location, so higher light intensity is accepted. The rain started to fall in November and December. Because of that, the temperature rate is decreasing. The lowest temperature is 28.6 °C at Station 1 in December (Table 1).

Increasing temperature makes Dissolved Oxygen (DO) is at a low grade. It might affect the oxygen availability in the water ecosystem. Based on the observation, low DO (5.3 mg/l dan 6 mg/l) is happened when high temperature in October (Table 1). The variability of DO grade (5.3—7.9 mg/l; Table 1) also affected by the quantity of freshwater and seawater entering the sampling area.

The average pH is 7.67. It still on the range of ideal and productive water system for aquatic organisms, which is 6.5—8.5. pH changing in estuary does not give any effect to the circumstance. The role of seawater as the acid-base buffer is the answer. This function works as a filter for freshwater from the river and mangrove litter decomposition in an acid condition.

Salinity readings peaked in October (37—38‰) (Table 1). The supporting factor is that sampling data was on spring tide or full moon. It caused a few of sea water entering estuary and increasing the salinity. In November and December, the salinity is reaching a minimum, 30—33 ‰ (Table 1). Even though sampling data is still at the same time (full moon), but there is a raining that could decrease the salinity by mixing much freshwater.

The minimum dissolved particles are 0.0001 mg/ml in October, while the maximum is 0.00032 mg/ml in December (Table 1). The velocity of sea current is predicted as a determinant factor causing the maximum and minimum of the dissolved particle, or many said as turbidity and water clarity. The velocity of sea current could stir the base water system up, so particle resuspended. The more velocity of sea current the more particle resuspended and makes high water turbidity.

The value of the Shannon Wiener Index that showed low diversity on both stations could come from many factors. One of the factors is the season. The season could play a huge role in the diversity of fish species because most of the fish migrate during seasonal change [15]. It is related to the food supply and spawning behavior. Several kinds of research showed that spawning behavior could influence the diversity and composition of fish in the mangrove and seagrass bed ecosystem in a different season [16].

Characteristic of mangrove ecosystem that has a role as habitat shelter for some migratory fish makes the value of index changed frequently [17,18]. The composition of fish captured in the mangrove forest, Panjang Island prove it. It has various fish composition on different location and different month. It might conclude as migratory fish species is existing in the habitat [19,20].

4. Conclusions
A total of 21 species of fish from 16 genera and 14 families were captured by push net as the main fishing gear. Five most abundant fish species come from 4 fish. Those fish species are Ambassis gymnocephalus (908 fish), Ambassis buruensis (297 fish), Oryzias javanicus (265 fish), Chelon sp. (123 fish), and Gerres sp. (22 fish) that comes from family such as Chandidae (Ambassis gymnocephalus and Ambassis buruensis), Adrianichthyidae (Oryzias javanicus), Mugilidae (Chelon sp.), and Gerreidae (Gerres sp.). Chandidae family is the most common fish that could be found at the research site because that family is the true resident of the mangrove ecosystem.

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