Composition and diversity of fish species in mangrove ecosystem at Muara Binuangeun, Lebak, Banten

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Abstract. Mangrove ecosystem is an ecosystem in coastal areas that have a high diversity of fish species, and different location has its unique fish composition. Research on mangrove ecosystem at Muara Binuangeun is not yet done and needed to discover the composition and diversity of fish species. Research of composition and diversity of fish species in mangrove ecosystem at Muara Binuangeun, Lebak, Banten, had been conducted in May and November 2015. Catch per Unit of Effort (CPUE) was used as a method with push net and boat net as fishing gear. Fishing was conducted during low tide. Collected samples were preserved with 10 % Formalin Solution and then being identified at the laboratory. In total, 106 fishes were collected from 11 families and 28 species. Istigobius ornatus was the most relative abundant species (19.81 %) and the highest relative frequency too. The diversity index value of mangrove ecosystem was 2.846. The composition of collected fish showed several migrant species from seagrass bed and coral reef ecosystem.

1. Introduction
Mangrove ecosystem is an ecosystem in coastal areas that have a high diversity of species, especially fish. It was caused by the structure and characteristics of mangrove vegetation, such as the wide canopy and complex root structure [1,2]. The wide canopy of mangrove has a function as a habitat for many terrestrial animals, such as birds, insects, mammals, and reptiles [1,2]. Complex root structure gives shelter and habitat for many aquatic species too, such as fishes, prawns, and crabs. Those characteristics make mangrove ecosystem becoming a good place for many fish species for sheltering, spawning, and foraging [3,4].

Several kinds of research about the composition of fish species in the mangrove ecosystem showed the most common family that can be found relatively frequent. Those species come from families such as Sphyraenidae, Chaetodontidae [5], Haemulidae, Lutjanidae, Pomacentridae, Scaridae [6], Atherinidae, Clupeidae, and Gerreidae [7].

Mangrove ecosystem, especially in Muara Bieuangeun, Lebak, Banten, has a vast potential for human economic activities too, such as fisheries. Pratiwi's research at Muara Binuangeun showed that some species that were caught by the fisherman was a species that use mangrove ecosystem as habitat and nursery site [8]. However, the composition of fish species in the mangrove ecosystem at Muara Binuangeun, Lebak, Banten, was not confirmed yet.
The purpose of this research is to define the composition and diversity of fish species in the mangrove ecosystem at Muara Binuangeun, Lebak, Banten. Furthermore, hopefully, this research can be a consideration in the management of coastal areas at Muara Binuangeun, Lebak, Banten.

2. Method
Collecting samples on this research was conducted at Muara Binuageun, Lebak, Banten, during May and November 2015. Samples were collected during low tide in 3 different locations at the mangrove ecosystem. The sample then being identified at Marine Biology Laboratory of Biology Department FMIPA UI, Depok. This research was conducted for seven months, started in May 2015 until January 2016.

The tools that were used for this research consisted of collecting sample tools and identifying tools. Collecting sample tools were GPS GARMIN, DO meter, refractometer ATAGO, thermometer, pH indicator, zip-lock bag, bottle sample, preservation tools, push net, and boat net. Identifying tools were digital caliper NANKAI, microscope, dissecting set, and digital camera SONY DHC H300. The materials that were used for this research were collected fish sample, and preservation materials, such as sea water, fresh water, tissue, and 40 % formalin solution.

The research was conducted using Catch per Unit of Effort as a fishing method, with time as an effort unit [9]. Fishing was conducted during 3 hours for each locations using push net and boat net as fishing gear. Collected fish then preserved in 10 % formalin solution made by dissolving 40 % formalin solution with fresh water. The preserved sample then kept on labeled bottle sample [10,11].

The fish that had been preserved then kept cool at sample storage until the end of the identification process. Identification process using morphometric and meristic characters in defining the species of fish. Other characteristics such as mouth type, tail fin type, color, dots, and marks were used too. This process used several identification books.

The quantification of the relative value of abundance and frequency was used in order to analyze the data. Several indexes were used, such as Shannon-Wiener diversity index (H'), evenness index (E), and Simpson's dominance index (D) [12]. The results then were analyzed descriptively to defining the characteristics of fish species diversity at the location based on composition and abundance [13,14].

3. Results and discussion

3.1. Composition and diversity of fish species
In total, 106 fishes were captured from 28 species and 11 families. The most relative abundant species and the highest relative frequency was *Istigobius ornatus* (Figure 1 & 3). All fish species and family that were captured can be seen in Table 1.

*Istigobius ornatus* is a native species of coastal areas from Gobiidae [15], and spend its life cycle at that area [16]. Those characteristics were in accordance with the collected fishes found from juvenile to adult. These species become the most relative abundant too because of its adaptive characteristics such as body coloration is very similar to its habitat, so it becomes very hard to be found especially from predators. Moreover, mangrove ecosystem characteristics at Muara Binuangeun is very suitable as a habitat for this species.

The next fish is *Halichoeres argus* from Labridae (Figure 1). This species is the most common species at the seagrass bed ecosystem [17], because its adaptive characteristics were more suitable at seagrass beds ecosystem rather than the mangrove ecosystem. The only reason that made this species possible to be found at the mangrove ecosystem and has high relative abundant value was the presence of channel that connected between mangrove and seagrass bed ecosystem at the sampling site. Those conditions are very similar to Unsworth et al. research at Wakatobi Marine National Park that using mangrove-seagrass continuum concept [17]. Mangrove-seagrass concept divided ecosystem at coastal areas into three categories: mangrove ecosystem, the edge between mangrove and seagrass bed ecosystem, and seagrass beds ecosystem [17]. Moreover, this concept can be used at the sampling site.
Halichoeres argus that found at mangrove hide between dead coral reefs and complex root structure of mangroves. Those places become a shelter for many fish species (especially H. argus), and the access between those structures was connected by a channel. This channel becomes a migration route too, so H. argus and other fish species could move between mangrove and seagrass beds ecosystem [7].

Table 1. The composition of fish species and family.

| No. | Scientific name         | Family          | May 15 | Nov 15 | Total Fish | Relative Abundance (%) | Relative Frequency |
|-----|-------------------------|-----------------|--------|--------|------------|------------------------|--------------------|
| 1   | Acanthurus blochii      | Acanthuridae    | 0      | 1      | 1          | 0.943                  | 2.778              |
| 2   | Antennarius sp.         | Antennariidae   | 0      | 1      | 1          | 0.943                  | 2.778              |
| 3   | Nectamia fusca          | Apogonidae      | 0      | 1      | 1          | 0.943                  | 2.778              |
| 4   | Blenniidae sp.1         | Blenniidae      | 1      | 0      | 1          | 0.943                  | 2.778              |
| 5   | Istiblennius dussumieri  | Blenniidae      | 0      | 2      | 2          | 1.887                  | 2.778              |
| 6   | Istiblennius edentulus  | Blenniidae      | 2      | 2      | 4          | 3.774                  | 5.556              |
| 7   | Salarias sp.            | Blenniidae      | 0      | 1      | 1          | 0.943                  | 2.778              |
| 8   | Chaetodon auriga        | Chaetodontidae  | 0      | 1      | 1          | 0.943                  | 2.778              |
| 9   | Chaetodon melanotus     | Chaetodontidae  | 0      | 1      | 1          | 0.943                  | 2.778              |
| 10  | Acentrogobius nebulosus | Gobiidae        | 2      | 5      | 7          | 6.604                  | 5.556              |
| 11  | Amblygobius stethophthalus | Gobiidae     | 0      | 1      | 1          | 0.943                  | 2.778              |
| 12  | Asterropteryx semipunctata | Gobiidae     | 1      | 4      | 5          | 4.717                  | 11.111             |
| 13  | Bathygobius cocosensis | Gobiidae        | 1      | 1      | 2          | 1.887                  | 5.556              |
| 14  | Gnatholepis cauerensis  | Gobiidae        | 1      | 5      | 6          | 5.660                  | 8.333              |
| 15  | Istigobius ornatus      | Gobiidae        | 11     | 10     | 21         | 19.811                 | 16.667             |
| 16  | Periophthalmus sp.      | Gobiidae        | 1      | 0      | 1          | 0.943                  | 2.778              |
| 17  | Halichoeres argus       | Labridae        | 0      | 14     | 14         | 13.208                 | 8.333              |
| 18  | Halichoeres chloropterus | Labridae       | 0      | 2      | 2          | 1.887                  | 2.778              |
| 19  | Halichoeres marginatus  | Labridae        | 0      | 5      | 5          | 4.717                  | 5.556              |
| 20  | Halichoeres miniatus    | Labridae        | 0      | 1      | 1          | 0.943                  | 2.778              |
| 21  | Halichoeres sp.1        | Labridae        | 0      | 2      | 2          | 1.887                  | 5.556              |
| 22  | Moolgarda sp.           | Mugilidae       | 0      | 4      | 4          | 3.774                  | 2.778              |
| 23  | Abudefjaf septemfasciatus | Pomacentridae  | 3      | 1      | 4          | 3.774                  | 11.111             |
| 24  | Chrysiptera glauca      | Pomacentridae   | 1      | 2      | 3          | 2.830                  | 5.556              |
| 25  | Chrysiptera unimaculata | Pomacentridae   | 0      | 2      | 2          | 1.887                  | 2.778              |
| 26  | Scorpaenodes sp.        | Scorpaenidae    | 0      | 1      | 1          | 0.943                  | 2.778              |
| 27  | Scorpaenopsis sp.       | Scorpaenidae    | 0      | 10     | 11         | 9.434                  | 2.778              |
| 28  | Arothron hispidus       | Tetraodontidae  | 1      | 1      | 2          | 1.887                  | 5.556              |

Eggleston et al. [7] and Unsworth et al. [17] stated that this channel that connected between mangrove and seagrass beds ecosystem made the function between both habitats as shelter and nursery site more optimal, so more diverse fish species can be found. Furthermore, this channel can create more diverse microhabitat, and the condition can increase the diversity in the channel and the main ecosystem [7].
The next fish is *Abudefduf septemfasciatus* from Pomacentridae that has high relative frequency (Figure 2). Pomacentridae is the most common family that inhabits coral reefs [18], but the juvenile commonly inhabits mangrove and seagrass bed ecosystem. This species can be found relatively frequent at mangrove ecosystem because of the presence of food sources for this species [19]. Supratomo stated in his research that ecosystem at coastal areas has a function as grounding food for many coral reef fish species, especially Pomacentridae [20]. His research also stated that Pomacentridae has a diet as an herbivore, and many herbivore foods such as algae and mangroves litter can be found very common at the sampling site.

All *A. septemfasciatus* that caught were juvenile, and this result is in accordance with Griffith's research [21]. Adult commonly inhabits coral reefs ecosystem [18]. These results support the function of mangrove ecosystem as a nursery ground for many coral reef fish species [5], especially Pomacentridae.

\[ 	ext{Figure 1. Five highest relative abundant value of 5 species in the mangrove ecosystem.} \]

\[ 	ext{Figure 2. Five highest relative frequency value of 5 species in the mangrove ecosystem.} \]

\[ 	ext{Figure 3. Fish species with the most relative abundant and highest relative frequency, *Istigobius ornatus*.} \]

\[ 	ext{Figure 4. The results of Diversity, Evenness, and Dominance index of the mangrove ecosystem.} \]

3.2. Diversity, evenness, and dominance index value
The results of diversity, evenness, and dominance index of mangrove ecosystem can be seen in Figure 4. Diversity index's value is categorized as moderate (1 ≤ H' ≤ 3), evenness index's value as high (E > 0.6), and dominance index's value as low. The results are quite similar to the related research in the seagrass bed ecosystem that had been conducted in the same period and location [22]. It is because most of the fish that had been collected at this research could be found too at the seagrass bed ecosystem.
Those fish most probably used the same channel that connects the mangrove and seagrass bed ecosystem.

4. Conclusion and suggestion

4.1. Conclusion
Fish species composition at Mangrove ecosystem at Muara Binuangeun, Lebak, Banten, consists of 28 species and 11 families. *Istigobius ornatus* was the most relative abundant and the highest relative frequency species. The value of diversity index is categorized as moderate. The composition of fish that collected showed the presence of non-native fish species that migrate from seagrass beds and coral reefs ecosystem.

4.2. Suggestion
Further research is needed and should be conducted with more varies fishing gear. More sampling time and other factors should be considered too.

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