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Seagrass Parameter Affect the Fish Assemblages in Karimunjawa Archipelago

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Abstract. Seagrass beds promote high species diversity, abundance and biomass, and become important habitats for some economically important fishes. Plants of seagrasses result in structurally highly complex habitats and offering feeding grounds, shelter from predation as well as nursery areas for diverse fish assemblages. However, research on fish communities in Southeast Asian seagrass bed is rarely conducted. In the present study fish assemblages in seagrass beds with different parameters (cover, diversity and similarity indices, domination) was investigated in the Karimunjawa Islands, Indonesia. The purpose of this study were to assess whether fish assemblages differ concerning on the abundance and the species number. This study was conducted on the seagrass bed on Karimunjawa Islands in Java Sea, particularly in the water of Menjangan Besar and Menjangan Kecil Island. Line-quadrant transect was used to assess seagrass data, while the occurrence and individual number of fish harboured in the selected seagrass bed was counted by using underwater visual census in the stationary point count transects. Seagrass cover in Menjangan Kecil Island (41%) with various canopy included both upper and lower canopy was considerable higher than those in Menjangan Besar Island (5%). Fish diversity, species composition and abundance are considerably different between the two study sites. This study revealed that seagrass density or cover and canopy structure affected the fish abundance and species number harboured.

1. Introduction

Seagrass beds promote high species diversity, abundance and biomass, and become important habitats for some economically important fishes [1], [2]. Plants of seagrasses result in structurally highly complex habitats and offering feeding grounds, shelter from predation as well as nursery areas for diverse fish assemblages [3].

Located in Southeast Asian seas, Indonesia is the heart of the coral triangle regions, contain the highest numbers of fish species in the world [4]. In Indonesia, seagrass beds cover shallow water part of coastlines and offshore islands, and can be vegetated by up to ten seagrass species [5] and 80 or more fish species [6], [5] within a single meadow. As their importance for fish species, they become of interest for people.

Most studies of fish assemblages in seagrasses have been performed in the Caribbean. Moreover, diversity of the fauna in Seagrass beds in Southeast Asia is distinctly higher [2], and may therefore generate a differ mechanisms in influencing fish assemblages. However, research on fish communities in Southeast Asian seagrass bed is rarely conducted [7], [8], [9], [10].

In the present study fish assemblages in seagrass beds with different parameters (cover, diversity and similarity indices, domination) was investigated in the Karimunjawa Islands, Indonesia. The purpose of this study were to assess whether fish assemblages differ concerning on the abundance and the species number.

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2. Methods

2.1. Study Area

The present study was conducted on the seagrass bed on Karimunjawa archipelago in Java Sea (Fig. 1). The archipelago is about 110 thousand hectare of wide, and consists of numerous islands and outspread reefs. It has a tropical climate, with an annual mean air and water temperature of 32 °C and 28 °C, respectively [12]. May to September is considered as dry, November to March as wet season. The tidal regime is predominantly semi-diurnal with a maximum tidal range at spring tide of 180 cm and an average tidal range of 80 cm (according to the tidal predictions for Semarang harbour). Seagrass bed close to Menjangan Kecil Island and Menjangan Besar Island were chosen as study area. Both islands are patch reefs crowned by corals and shallow subtidal seagrass beds. Both islands are not populated. Two different seagrass meadows of different canopy structure and species composition were chosen.

2.2. Seagrass parameters

Line-quadrant transect according to McKenzie [5] was used to assess seagrass data. A quadrat of 100 cm x 100 cm was randomly thrown along the transect line of 40m which stretched upright to the coast line the selected patches for the visual census. This transect line was then repeated 3 time with 25 m distance inter-transect in parallel with the coat line. 14 frame was then subdivided into 16 smaller sub-quadrats, each with a side length of 25 cm. The number of shoots of each seagrass species was counted.

2.3. Counting of fish harboured

13 occurrence and individual number of fish harboured in the selected seagrass bed was counted by using underwater visual census in the stationary point count transects [3]. In each site, three replicates of 100 m, 60 m and 30 long marked transect lines, were 8 employed upright to the coast line. A single rope with a length of 5 m was used as a visual guidance for quadrat size. After placing the line, the observer waited 3 min before counting to minimise fish disturbance.

74. Data Analysis

Fish were recorded as juveniles when they were smaller than one third of the maximum species' length [12] [5]. Data of both the seagrass and the fish were analysed descriptively and presented in graphs.

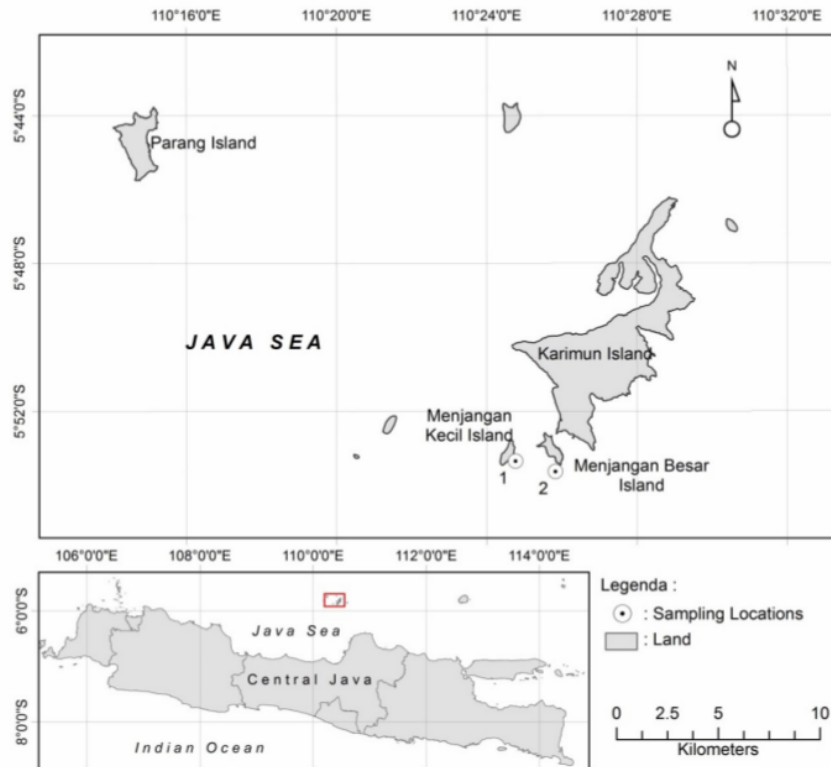


Figure 1. Overview of study area of Menjangan Kecil and Menjangan Besar Parang Islands in the Karimunjawa Archipelago

3. Result

3.1. Study Area

Seagrass cover in Menjangan Kecil Island (41%) was considerably higher than those in Menjangan Besar Island (5%). They were composed of *Enhalus acoroides*, *Thalassia hemprichii*, *Cymodocea rotundata*, *C. serrulata*, *Halodule uninervis*, *Halophila ovalis* and *H. minor* in different composition between the two sites (Fig.2.). Menjangan Besar Island was comprised only two species of seagrass, while seven seagrass species without any species domination ($C=0.21$) were found in Menjangan Kecil Island. Diversity of seagrass species as showed from the indices in here was moderate with high similarity (Fig.3.) It result in various canopy included both upper and lower canopy. The upper canopy was mostly generated from *E. acoroides* shoots. *T. hemprichii* comprised the second upper canopy. The rest other species together formed a lower canopy. *H. ovalis* found in higher stand with bigger leaf among the genus. The leaf shape was ovate, obovate or oblong. The two other species, *H. uninervis* and *H. minor* scarcely occurred.

Different types of canopy were performed in the Menjangan Besar Island. As there were only two species, they formed only high canopy in the seagrass path. *E. acoroides* and *T. hemprichii* stand in the relatively same composition and resulted in the low diversity of seagrass meadow.

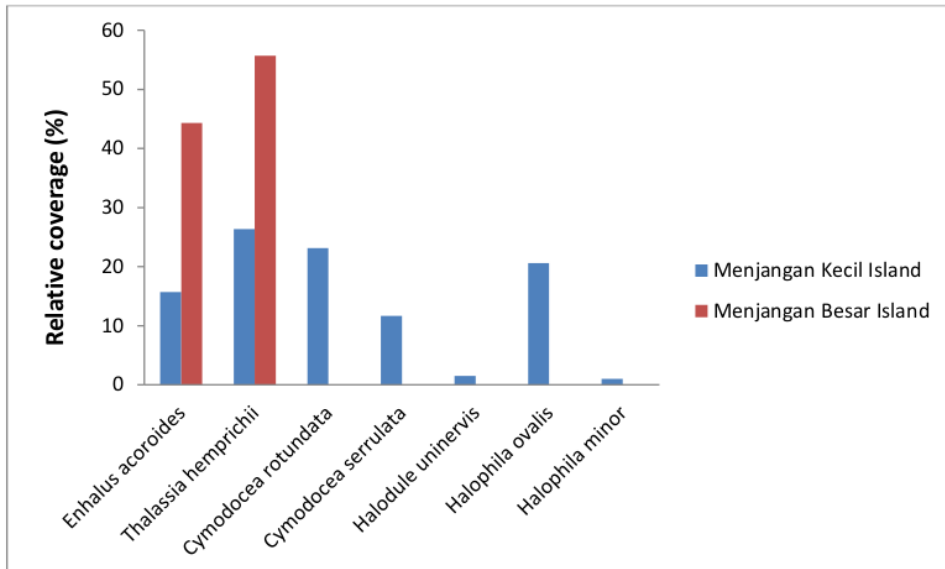


Figure 2. Species composition of seagrass meadow in Menjangan Kecil and Menjangan Besar Islands.

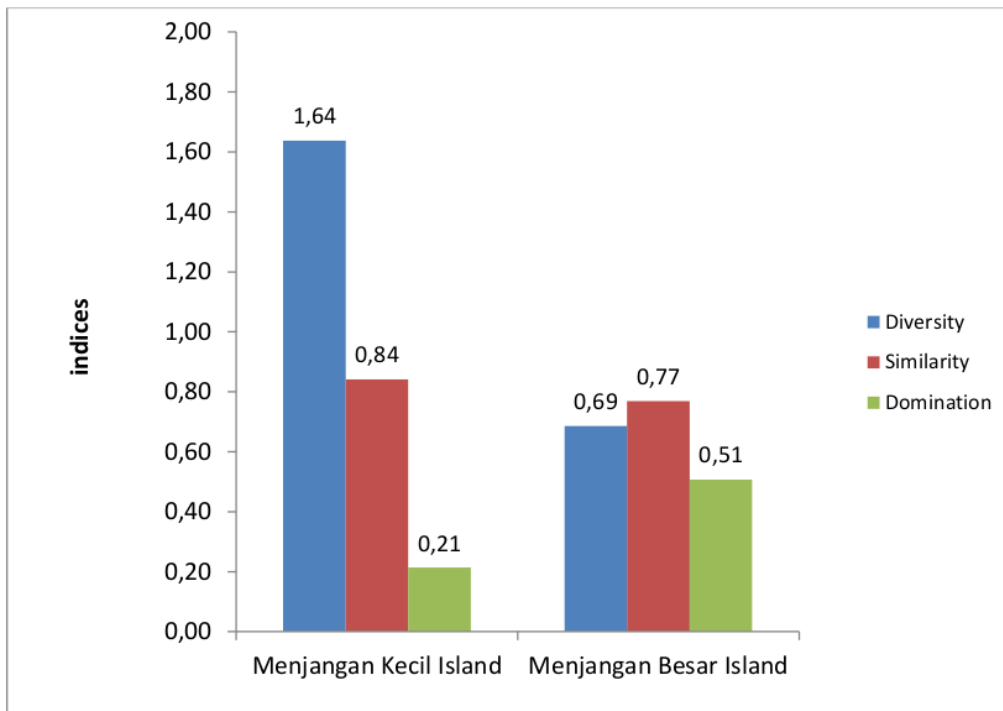


Figure 3. Diversity indices, similarity indices and domination of seagrass meadow in Menjangan Kecil and Menjangan Besar Islands.

3.2. Fish harboured in the seagrass meadow.

It seemed that there was a considerable different in the family, fish and species number between those in Menjangan Kecil Island and Menjangan Besar Island (Table 1). There were eight species of mangrove/seagrass-associated reef fish found in Menjangan Kecil island. Among the reef fish, *Abudefduf sexfasciatus* and *Sphyraena flavicauda* were the most abundance. In contrast, only 2 species of mangrove/seagrass-associated reef fish belong to Pomacentridae family were in Menjangan Besar Island. Seagrass species from family Engraulidae looked dominated among the fish in both waters.

Table 1. Harboured fish in the seagrass beds

Family/Species	Menjangan Kecil Island	Menjangan Besar Island	Note
Apogonidae			10
<i>Apogon margaritophorus</i>	10		Rf
<i>Cheilodipterus isostigmus</i>	5		Rf
Blenniidae			
<i>Petroscirtes variabilis</i>	14	3	Sg
Caesionidae			
<i>Caesio teres</i>	8		Rf
Chaetodontidae			
<i>Chaetodon octofasciatus</i>	5		Rf
Engraulidae			
<i>Encrasicholina heteroloba</i>	384	51	Sg
<i>Stolephorus waitei</i>	136	8	Sg
Monacantidae			
<i>Acreichthys tomentosus</i>	4		Sg
Nemipteridae			
<i>Pentapodus trivittatus</i>	7		Rf
Pomacentridae			
<i>Abudefduf sexfasciatus</i>	23	5	Rf
<i>Dischistodus prosopotaenia</i>	6	3	Rf
Sphyraenidae			
<i>Sphyraena flavicauda</i>	23		Rf
Syngnathidae			
<i>Syngnathoides biaculeatus</i>	5		Sg
Number of individu	630	70	
Number of Species	13	5	
Number of reef fish species	8	2	

6 Discussion

In the present study fish assemblages in seagrass beds with significantly different seagrass parameters were investigated. Fish diversity, species composition and abundance are considerably different between the two study sites, i.e between Menjangan Kecil Island and Menjangan Besar Island, even both are subtidal seagrass bed and close to reefs. This study revealed that seagrass density or cover and

canopy structure affected the fish abundance and species number harboured. Moreover, higher diversity and less domination seemed promoted higher fish number as well as species number. Pogoreutz et al. [4] found that fish assemblages in seagrass beds at different water depths and with differing canopy structure defined by significantly different shoot density, biomass and leaf area index (LAI), differed significantly in terms of species number, total abundance, and abundance of most common species. They revealed an effect of water depth and seagrass shoot density on total fish abundance and LAI, seagrass biomass and water depth affected the abundance of most common fish species.

It is generally approved that structurally rich seagrass beds, i.e. beds with high shoot density and/or biomass, provide good conditions, such as advance habitat complexity and food availability, and decreased predation pressure [13], [10]. High fish abundances in relation to high seagrass shoot densities were dealt with previous studies [10], [14]. Hovel et al. [13] found that significant relationships between seagrass biomass and animal densities were only detected at high seagrass biomasses, which is in contradiction with the finding of Pogoreutz et al. [4] that showed overall faunal abundance was found to be higher in beds with higher shoot densities and biomasses compared to beds with lower shoot densities, although certain taxa apparently preferred the less structured habitat [10]. The most abundant fish families in the present study were Engraulidae for seagrass species and Pomacentridae and Sphyraenidae for mangrove seagrass-associated reef fish. Similarly, Pomacentridae comprised the most abundant families in seagrass bed of the Spermonde Archipelago, Indonesia [4]. Conversely, the most abundant family in a seagrass bed at Wakatobi found by Unsworth et al. [2] was Apogonidae. These different results might be due to the sampling methods used or site-specific.

5. Conclusion

Fish diversity, species composition and abundance are considerably different between the two seagrass beds with different species parameters. Higher seagrass density or cover and canopy structure combination with lower domination resulted in the higher fish abundance and species number harboured. Different result in the most abundant family compared to those at Wakatobi might be due to the sampling methods used or site-specific.

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