Fish composition and distribution patterns in the seagrass ecosystem of Lampung Bay waters, Lampung Province, Indonesia

[1,2]Isnaini, [3]Dietriech G. Bengen, [3]Tri Prartono, [4]Zainal Arifin

[1] Graduate School of Marine Science, IPB University, Bogor, West Java, Indonesia; [2] Department of Marine Science, Faculty of Mathematics and Natural Science, Universitas Sriwijaya, Indralaya, South Sumatra, Indonesia; [3] Department of Marine Science and Technology, Faculty of Fisheries and Marine Science, IPB University, Bogor, West Java, Indonesia; [4] Research Center for Oceanography, BRIN, North Jakarta, Indonesia. Corresponding author: Isnaini, isnainimawardi22@gmail.com

Abstract. The Bay of Lampung, located on the southern part of Lampung Province, is a relatively protected bay, where seagrass ecosystems can be found along its coastlines. High seagrass productivity has allowed it to provide a habitat for various organisms, including fish. This study was conducted from October 2018 to March 2019 in the waters of the Bay of Lampung, Lampung Province. This study aims to determine the composition of fish species in the seagrass meadow ecosystem, the correlation of environmental factors with fish composition, and to identify the degree of similarity among the species. Fish sample collection was performed at each station using a gillnet. Based on the research results, the conditions of the physicochemical and environmental factors were within the standard threshold for fish growth and life. This study found 54 species of 30 families, with a total number of 235 captured fish. *Siganus fuscescens* dominated the composition of fish species caught. During the transitional seasons I and II and based on the principal component analysis (PCA), the fish compositions at station 5KPLT and station 6MLT were high, as all the environmental factors had jointly affected the fish composition. During the west monsoon, the high level of fish composition at Station 1TL was affected primarily by pH and nitrate concentration. The similarity level of fish species was low, and there were four groups formed.
Key Words: abundance, seagrass meadows, water parameters correlation.

Introduction. A high level of seagrass productivity coupled with epiphytic and benthic algae can create a seagrass bed that would provide the habitat for various organisms. Therefore, abundant organic inputs can be utilized as energy sources in the existing food web throughout the seagrass ecosystem. Seagrass has the characteristics of rhizome morphology and thick canopy of leaves, which allow it to become hiding shelter from predation, as well as to enhance environmental quality, by reducing currents under the canopy, making it attractive for different fauna species (Heck Jr. & Orth 1980; Orth et al 1984; Duffy 2006). Several factors make seagrass habitats regarded as having fundamental roles in maintaining fish population and other invertebrate species, which are: (1) seagrass is a permanent habitat, so it allows fauna species to complete an entire life cycle; (2) sites of temporary nursery during the rejuvenation phase; (3) feeding grounds during the life phase; (4) shelter from predation (Jackson et al 2001).

The Bay of Lampung, located on the southern part of the coasts of Lampung Province, is facing toward the Sunda Strait, and it is an estuary with semi-closed, relatively protected, and far-from-land waters. Hence, the waters along the coastlines present a seagrass ecosystem with a seagrass density ranging between 50-1275 saplings m^{-2} (Pratiwi 2010). The waterbody of the Bay of Lampung is used for capture fishery, breeding grounds, tourism, and settlement activities, among other. Such variety of activities may influence the water quality and disturbances against the seagrass ecosystem and may also affect the abundance and the composition of ichthyofauna related to the seagrass meadows (Kikuchi 1974; Stoner 1983; Smith et al 1989; Duffy 2006).

As illustrated above, the seagrass ecosystem plays a vital role as spawning grounds, raising grounds, and feeding grounds for some ichthyofauna species, greatly dependent upon the seagrass habitat for their survival. This study examines the composition and the distribution patterns of the fish temporally and spatially related to the environmental factors of the waterbody.

Material and Method

Description of the study sites. The study was performed from October 2018 to March 2019 in the waters of the Bay of Lampung. The data collection was carried out at eight stations, which were determined for sampling purposes. Figure 1 presents the site map of the locations of the research stations.

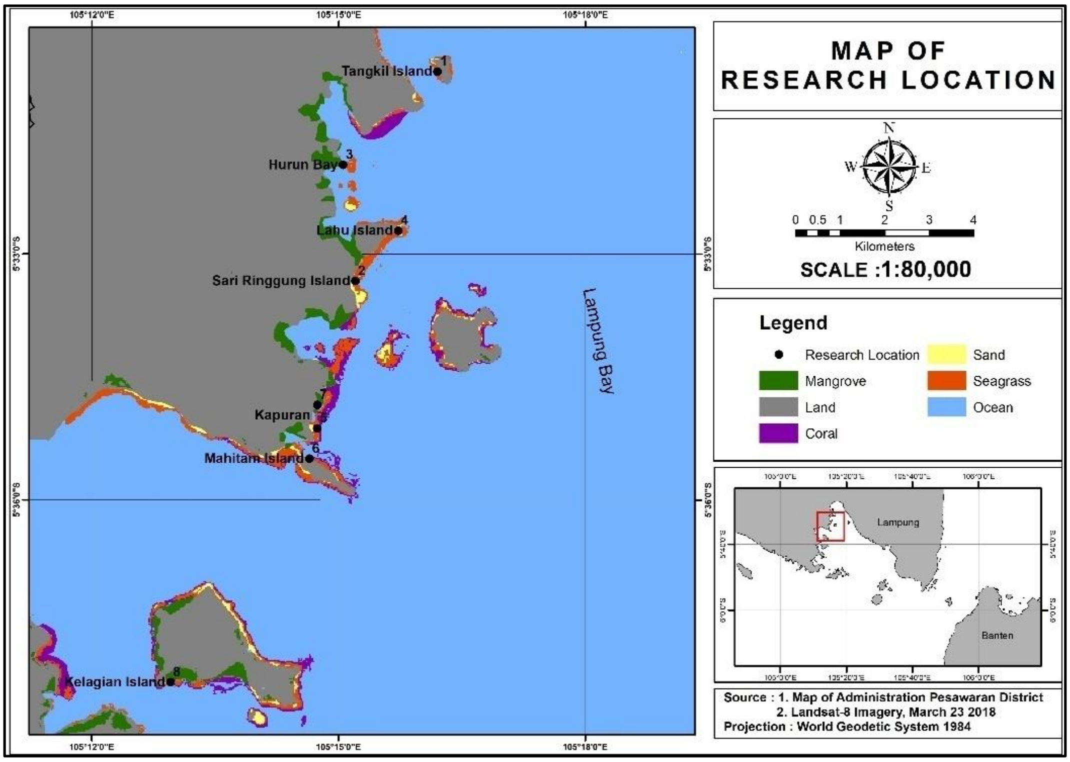

Figure 1. Map of research locations.

The distribution of the stations is based on four categories: seagrass only, seagrass within the proximity of mangroves, seagrass within the proximity of coral reef, and seagrass within the proximity of both mangroves and coral reef. The coordinate points of the research stations can be seen in Table 1.

Table 1

Coordinate points of the research stations

Location	*Station*	*Coordinate points*		*Description*
		S	*E*	
Island of Tangkil	1TL	05º30.764'	105º16.372'	Seagrass
Coast of Sari Ringgung	2SRL	05º33.331'	105º15.205'	Seagrass
Bay of Hurun	3THLM	05º31.915'	105º15.055'	Seagrass-mangrove
Lahu	4LLM	05º32.717'	105º15.727'	Seagrass-mangrove
Kapuran	5KPLT	05º35.128'	105º14.743'	Seagrass-coral reef
Island Mahitam	6MLT	05º35.499'	105º14.647'	Seagrass-coral reef
Kapuran	7KPLT	05º34.842'	105º14.743'	Seagrass-mangrove-coral reef
Island of Kelagian	8KGLMT	05º35.499'	105º14.647'	Seagrass-mangrove-coral reef

Environmental factors of waters. The measurements of the environmental factors were conducted at each research station. The environmental factors were surveyed and consisting of temperature, pH, and salinity. Meanwhile, the measurements of total suspended solids (TSS), nitrate (NO_3), nitrite (NO_2), and phosphate (PO_4) were performed by collecting seawater using a water sampler and placing it into sample containers (1000 mL). Furthermore, the samples were stored in a cool box and analyzed at the Laboratory of Industrial Research and Development Agency, Industrial Research and Standardization Regional Office, Palembang. The measurement of environmental factors was conducted twice every month.

Fish sampling techniques. The fish sample collection was conducted at each station using a gillnet, and the fish samples collected were then preserved with 40% formalin solution. The identification of the species was conducted at the Laboratory of Macro Biology, the Department of Water Resource Management, Faculty of Fishery and Marine Science, Bogor Agricultural University. Fish identification was conducted by referring to Masuda et al (1984), Allen (2000) and Allen et al (2003).
Data analysis. The composition of ichthyofauna calculated is the total composition of the species of each ichthyofauna group. The species composition is the ratio of the total individuals of a species collected to the total number of individuals captured during the sampling. The composition of species can be obtained with the following formula (Krebs 1989):

$Kr=(n_i/N)x100$

Where: Kr - relative composition (%); n_i - number of individual species; N - total number of all individual species.

The water environmental factors were analyzed at each station and in each season using the statistical approach with the XLSTAT program. This study used the Principal Component Analysis (PCA) to determine the correlation of the characteristics of physicochemical factors of the waters and the fish composition at each station and in each season.

The level of similarity was determined by the Bray-Curtis similarity index to identify the level of composition classification based on species similarity, where the data processing used the XLSTART program. The results of the calculation of the Bray-Curtis index are presented in the form of a dendrogram. The formula used was modified by Legendre & Legendre (1983).

$$Ib = \frac{\sum (X_{ij} - X_{ik})}{\sum (X_{ij} + X_{ik})} x100\%$$

Where: Ib - Bray-Curtis similarity index; X_{ij}, X_{ik} - species value of the i^{th} term in different period.

Results and Discussion. The conditions of the water environment can be illustrated based on the period of the season, which were: transition II, west season, and transition I seasons. Based on Table 2, the measurement results of environmental factors show that they are all in good conditions, within the optimal range (levels) for fish growth. The temperature levels during the observation period of transition II ranged between 29-32.5°C, and during the west season, they ranged from 29-30.7°C. During the transitional season I, they ranged between 30.5-32.3°C. The measurement results of the water pH obtained during the transitional II, west, and first transitional seasons were between 7.9-8.3, 7.9-8.2, and 8.1-8.4, respectively. Concerning the salinity levels, during transitional season II, they ranged from 32.7 to 34.7‰ and in the west season, they ranged from 33 to 34.7‰. During the transitional season I, they ranged from 30.3 to 32.9‰. The results of the analysis of TSS in the transitional season II, west season, and transitional season I show that they ranged from 39 to 132 mg L^{-1}, 4.6 mg L^{-1} to 13.7 mg L^{-1} and 19.4 to

48.9 mg L^{-1}, respectively. The analysis results of nitrate concentrations during the transitional season II ranged from 0.14 to 0.22 mg L^{-1}, as the results during the west season ranged from 0.05 mg to 0.18 mg L^{-1} and the results during the transitional season I ranged from 0.2 to 0.5 mg L^{-1}. Meanwhile, the nitrate and phosphate concentrations during the transitional season II, west season, transitional season I ranged from 0.001 to 0.027 mg L^{-1} and 0.001 to 0.041 mg L^{-1}, 0.001 to 0.016 mg L^{-1} and 0.002 mg to 0.003 mg L^{-1}, 0.01 to 0.05mg L^{-1} and 0.02 mg to 0.11 mg L^{-1}, respectively.

Table 2

Measurement results of environmental factors at each station

Period	*Environmental parameter*	*Station*							
		1TL	*2SRL*	*3THLM*	*4LLM*	*5KPLT*	*6MLT*	*7KPLMT*	*8KGLMT*
Transition II	Temperature (ºC)	29.0	30.6	32.5	29.7	29.7	30.3	32.4	30.3
	pH	7.9	7.9	8.2	7.8	8.0	8.2	8.3	8.2
	Salinity (‰)	33.7	34.3	34.0	33.7	32.7	33.7	34.7	33.7
	TSS (mg L^{-1})	39	50.5	67	42.5	132	41.5	41.5	42.5
	Nitrate (NO_3) (mg L^{-1})	0.15	0.16	0.15	0.22	0.14	0.16	0.21	0.16
	Nitrite (NO_2) (mg L^{-1})	0.003	0.003	0.003	0.002	0.001	0.001	0.027	0.003
	Phosphate (PO_4) (mg L^{-1})	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.002
West	Temperature (ºC)	29.0	29.8	30.7	29.4	29.3	29.9	30.7	29.9
	pH	8.2	8.1	8.1	8.2	7.9	8.0	7.9	8.1
	Salinity (‰)	33.2	33.3	31.7	33.0	34.3	34.3	33.0	34.7
	TSS (mg L^{-1})	10.6	8.6	10.2	13	2.2	13.65	7.8	4.6
	Nitrate (NO_3) (mg L^{-1})	0.175	0.075	0.065	0.045	0.07	0.045	0.045	0.085
	Nitrite (NO_2) (mg L^{-1})	0.009	0.001	0.002	0.001	0.001	0.001	0.041	0.001
	Phosphate (PO_4) (mg L^{-1})	0.01	0.01	0.012	0.0145	0.01	0.0185	0.046	0.01
Transition I	Temperature (ºC)	30.5	31.5	30.9	31.5	31.8	31.5	31.5	32.3
	pH	8.2	8.2	8.1	8.2	8.3	8.3	8.4	8.2
	Salinity (‰)	32.9	30.3	31.6	31.3	31.8	31.7	32.4	32.9
	TSS (mg L^{-1})	40	34.25	37	42.65	37.65	19.4	47.5	48.85
	Nitrate (NO_3) (mg L^{-1})	0.11	0.24	0.305	0.495	0.26	0.235	0.49	0.205
	Nitrite (NO_2) (mg L^{-1})	0.001	0.016	0.002	0.0105	0.012	0.0135	0.014	0.0125
	Phosphate (PO_4) (mg L^{-1})	0.015	0.04	0.035	0.045	0.09	0.06	0.105	0.04

Note: TSS - total suspended solids.

The composition of fish species. Fish species collected in the seagrass ecosystem of the Lampung bay waters consist of 54 species composed of 30 families with a total of 235 captured fish (Table 3). The fish species composition in the seagrass ecosystem of the Lampung bay waters is between 0.43-17.87%, as the total number of fish found in each station varied from 9 to 48 fish per station. *Siganus fuscescens* has the highest percentage in the composition. In this research, the distribution patterns of fish composition for each season consist of transitional II, west, and transitional I seasons. Based on Figure 2, the west season has the highest percentage of captured fish (36.5%) compared to the other seasons. The highest composition of fish (22%) was observed at the 5KPLT station, as the lowest was found at the 8KGLMT station, of 5%.

Table 3

The composition of fish species in seagrass meadows in the waters of the Bay of Lampung

Family	*Fish species*	*Station*								*Composition*
		1 *TL*	*2* *SRL*	*3* *THLM*	*4* *LLM*	*5* *KPLT*	*6* *MLT*	*7* *KPLMT*	*8* *KGLMT*	
Atherinidae	*Atherinomorus lineatus*				1					0.43
Balistidae	*Balistoides Viridescens*						1			0.43
Belonidae	*Tyolosurus crocodilus*	1								0.43
Carangidae	*Carangoides oblongus*				1	2	1			1.70
	Carangoides praeustus	1								0.43
	Caranx ignobilis					1		1		0.85
	Caranx sexfasciatus						5			2.13
	Selar boops	9								3.83
	Selaroides Leptolepis						5			2.13
	Trachinotus blochii		8	12	14	2		5		17.45
Chaetodontidae	*Parachaetodon ocellatus*					1				0.43
Chanidae	*Chanos chanos*						1			0.43
Dasyatidae	*Pteroplatytrygon violacea*							1		0.43
Drepaneidae	*Drepane punctata*							2		0.85
Echeneidae	*Echeneis naucrates*				1			1		0.85
Elepidae	*Elops hawaiensis*					1				0.43
Ephippidae	*Platax batavianus*						1			0.43
	Platax orbicularis							1		0.43
Gerreidae	*Gerres macracanthus*					2				0.85
	Gerres oyena	4		1			1	1		2.98
Haemulidae	*Diagramma pictum*	1					1	1		1.28
	Plectorhinchus gibbosus							4		1.70
	Plectrhinchus gibbosus					2				0.85
Holocentridae	*Monacanthus chinensis*	5				2			1	3.40
	Neoniphon sammara	1	2							1.28
Lethrinidae	*Lethrinus erythracanthus*	1								0.43
	Lethrinus harak		1			3	1		1	2.55
	Lethrinus olivaceus			1						0.43
	Lethrinus ornatus	1				4				2.13
Lutjanidae	*Lutjanus gibbus*	1								0.43
	Lutjanus russellii							1		0.43
	Lutjanus sp.					1	1			0.85
Megalopidae	*Megalops Cyprinoides*					1				0.43
Monacanthidae	*Pseudomonacanthus macrurus*	1								0.43

Table 3

The composition of fish species in seagrass meadows in the waters of the Bay of Lampung (continuation)

Family	*Fish species*	*Station*								*Composition*
		1 TL	*2 SRL*	*3 THLM*	*4 LLM*	*5 KPLT*	*6 MLT*	*7 KPLMT*	*8 KGLMT*	
Mugilidae	*Planiliza subviridis*				3	7				4.26
Mullidae	*Upeneus sundaicus*								1	0.43
Nemipteridae	*Scolopsis ciliata*					1	1			0.85
	Scolopsis lineata	*1*								0.43
Ostraciidae	*Lactoria cornuta*			1	1		1			1.28
Paralichtyidae	*Pseudorhombus elevatus*					1	2			1.28
Plotosidae	*Plotosus lineatus*		1				3			1.70
Pomacentridae	*Abudefduf septemfasciatus*					1				0.43
Scombropidae	*Scombrops boops*		1				1			0.85
Serranidae	*Epinephelus areolatus*					1				0.43
	Epinephelus fuscoguttatus					1				0.43
	Epinephelus sexfasciatus			1				1		0.85
Siganidae	*Siganus fuscescens*	15	2		2	5	14		4	17.87
	Siganus guttatus	2	1	2	4	8	1	4	1	9.79
	Siganus javus	1								0.43
	Siganus stellatus					1				0.43
	Siganus vermiculatus						2	2		1.70
Soleidae	*Pardachirus pavoninus*	1						1	1	1.28
Tetraodontidae	*Arothron immaculatus*			1						0.43
	Chelonodon patoca						1			0.43
Total		46	16	19	27	48	44	26	9	100.00

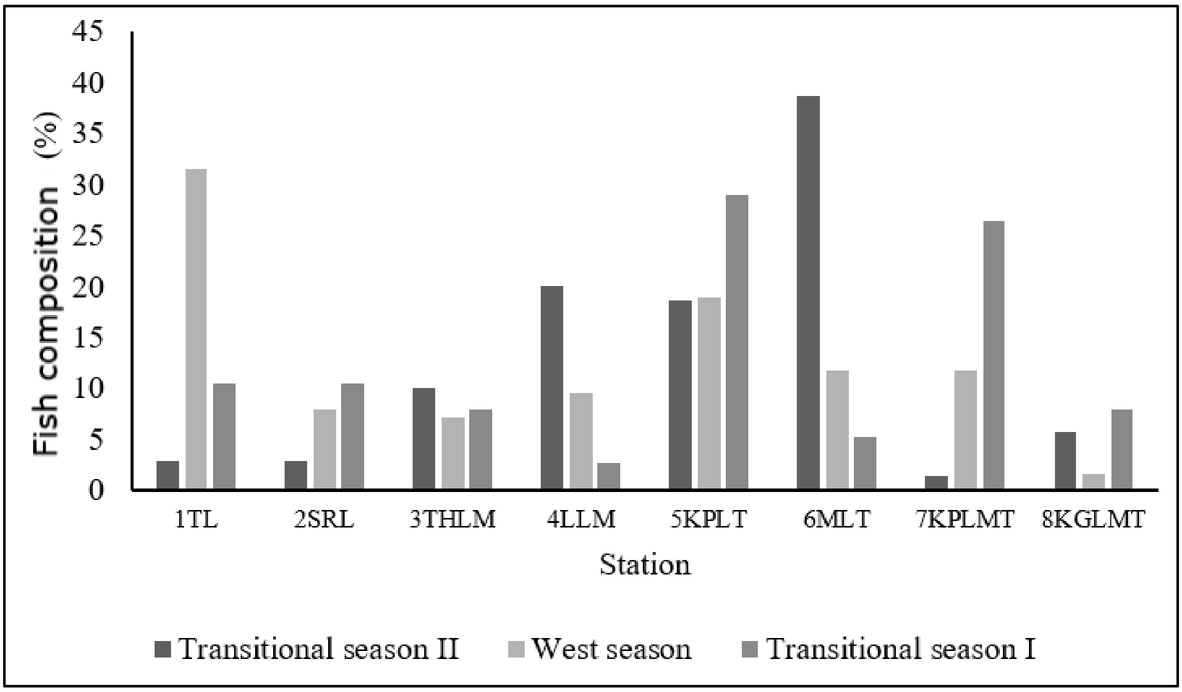

Figure 2. Fish composition in each season in the waters of the Bay of Lampung.

The correlation of water environmental factors and fish composition. The results of PCA on the physicochemical and environmental factors of the waters with fish composition per station are described by season, as presented in Figure 3a. The transitional season II shows two main axes (F1 and F2) with the particular property cumulative root around 70.25%. It means that the information obtainable from the analysis using such two axes represents 70.25% of the total information. Such information is illustrated by the F1 axis, which is 51.62%, while the F2 axis is 18.62%. The environmental factors, such as temperature, salinity, nitrate, and phosphate, become the unique properties of station 7KPLMT, located on the Coast of Kapuran, with ecosystems of seagrass, mangrove, and coral reef.

Meanwhile, TSS has unique properties in station 5KPLT. Based on Figure 2, the fish composition per season in the waters of the Bay of Lampung has the highest value during the transitional season II at station 6 MLT. In contrast, based on the PCA analysis, station 6MLT does not have the environmental factors as unique properties, meaning that all the environmental factors have almost as equal contributions as those in station 6MLT.

Based on Figure 3b, the observation results per station during the west season by PCA show that the physicochemical and environmental factors of the waters with fish are derived from two main axes (F1 and F2), with a particular property cumulative root of 61.64%. It means that 61.64% of the information can be obtained from the analysis using such two axes (F1 - 39.04%; F2 - 22.6%). Environmental factors such as temperature, nitrate and phosphate become the unique properties of station 7 KPLMT. Station 7 is located at the coast of Kapuran, having seagrass, mangroves, and coral reef. Meanwhile, the environmental factors pH and nitrate become the unique properties of station 1TL. Based on Figure 2, the highest fish composition occurred during the west season at station 1TL (31%), meaning that the high level of fish composition at station 1TL was affected by the pH and nitrate levels.

In the meantime, Figure 3c on the transitional season illustrates two main axes (F1 and F2) with the cumulative property root of 66.95%. The environmental factors of temperature, pH, nitrate, nitrite, and phosphate become the unique properties of station 7KPLMT. The highest level of fish composition during the transitional season I occurred at station 5KPLT (29%). It means that all the environmental factors jointly affected the fish composition.

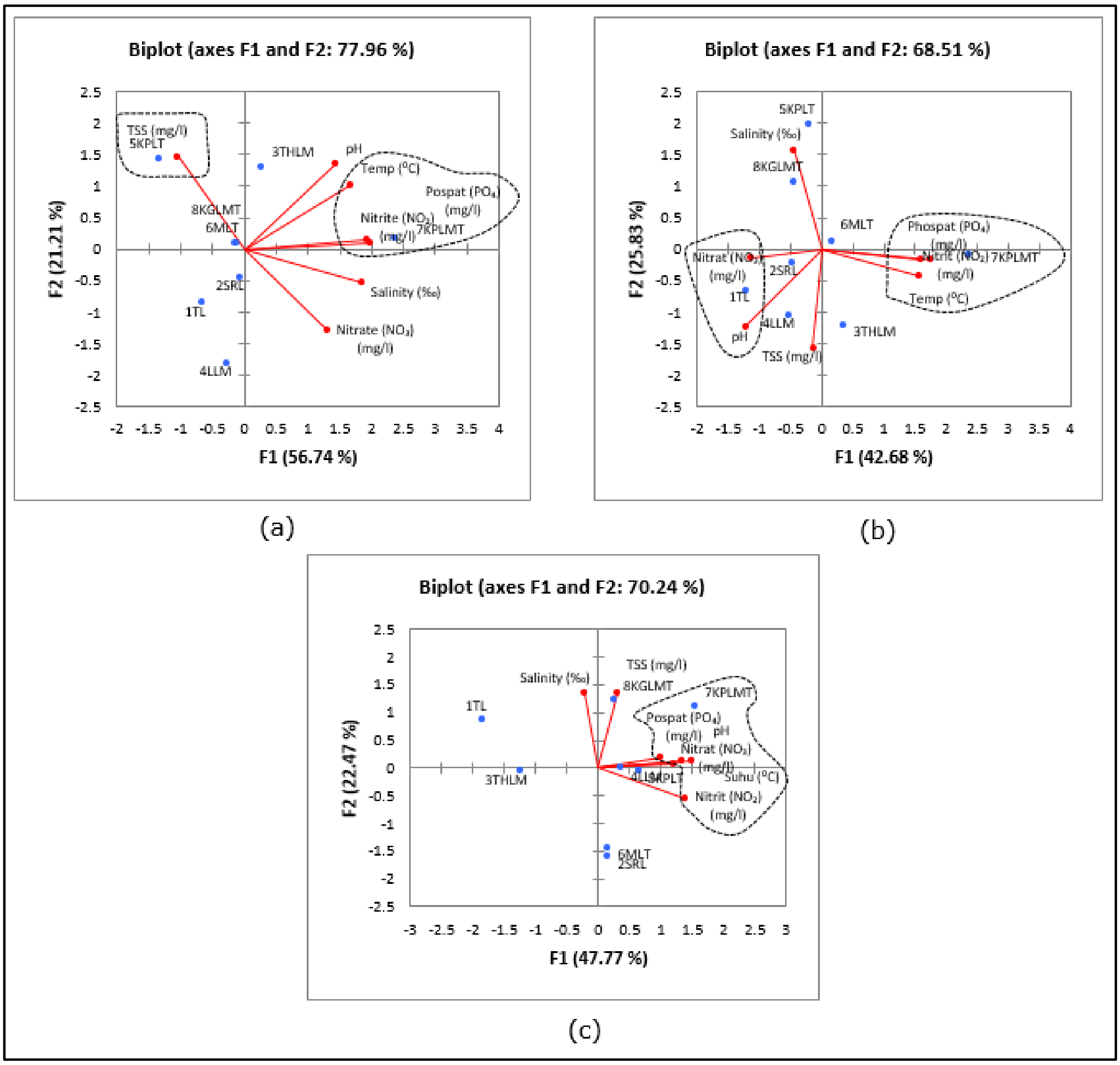

Figure 3. The Principal Component Analysis on the correlation of the physicochemical environmental factors in the waters with the amount of fish in each station; (a) transitional season II, (b) west season, (c) transitional season I.

Level of similarity of fish species. Based on the analysis results, the similarity level of fish species at all eight research stations can be seen in Figure 4. Four classes were formed. The first group consists of station 1TL and station 8KGLMT, as the second group consists of station 2SRL and station 6MLT. The third group consists of 3 stations, namely 3THLM, 4LLM, and 7KPLMT, as the fourth group consists of only one station, 5KPLT. The classification of the similarity level of the species is based on the dendrogram with low similarity. The highest level of similarity was 20%, between stations 3THLM and 4LLM. The low similarity is influenced by the significant number of species, 54 species, and only three major dominant fish species.

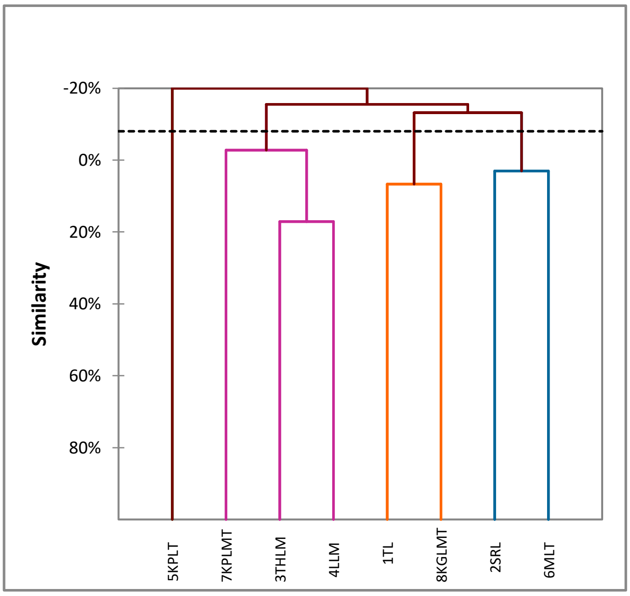

Figure 4. Dendrogram of the similarity level of fish species among stations.

The environmental factors in the waters of the Bay of Lampung are illustrated in Table 2. The temperature range of the waters is a very significant environmental factor for fish, since it can affect their metabolism activities and closely relates to the amount of dissolved oxygen. Based on the measurement results of the Lampung bay waters during the transition II, the west season and transitional season I can be categorized in good condition based on the temperature of the surface of the waters of the Bay of Lampung for the fish growth and life. The optimum temperature level in the tropical seas for fish life is usually ranging from 28 to 32°C, and it may be subject to some changes, with the permissible level of such deviation being up to 2°C of the normal temperature (KLH 2004; Kordi & Tancung 2007). A similar case occurs for the pH measurement results, which are good levels for the life of marine biotas, such as fish, ranging from 7 to 8.5. This pH level may change, and the permissible deviation is up to 0.2 pH unit (KLH 2004). A slight change from the normal pH level would result in an adverse effect on the buffer system. It can endanger the life of marine biota, as there would be an imbalanced level of CO_2. Apart from temperature, the salinity level is one of the most significant environmental factors of the waters, largely determining marine biota composition. In each observation period, the salinity was always within the optimum range. The normal salinity condition of seawaters globally varies between 33 and 37‰ (Kinne 1964). For the seawaters of Indonesia, the levels are generally and normally ranging from 28 to 33‰ (Nontji 2002). Each fish species has a different ability to adapt to water salinity, thus being euryhaline or stenohaline (Laevastu & Hayes 1982).

The TSS concentration in the Bay of Lampung during the transitional season II, west season, and transitional season I was in good condition for marine biota. Based on the standard quality of seawater for biota, the threshold ranges from 20 to 80 mg L^{-1} (Ministry of Environment 2004). High TSS concentration may affect the photosynthesis process and increase the temperature of the water surface, and, therefore, it would reduce the amount of oxygen released by water plants and disturb or adversely affect the lives of marine biota (Murphy 2007). Concerning nitrate concentration, it can be said that it is slightly exceeding the threshold value in this study. Nitrate in optimal levels has a good impact on the waters, increasing the production of phytoplankton and the total fish production (Lee & Jones-Lee 2005). Meanwhile, if the concentration exceeds the normal threshold, it would have some negative impacts, such as reducing the oxygen concentration in the waters and the growth of hazardous phytoplankton (Gypens et al 2009). The research results show a normal condition in respect to nitrite concentration, where the nitrate level in the waters is 0.001 mg L^{-1}, and not exceeding 0.06 mg L^{-1} (CCME 2010).

The fish species of the seagrass meadows found in the waters of the Bay of Lampung at each station varied between 9 and 48 fish per station. In a study on fish in seagrass meadows of the intertidal waters of Bay of Ekas, East Lombok, 35 species belonging to 28 families, with a total amount of 498 captured fish were found (Karnan et al 2019). The study of Syahailatua & Nuraini (2011) in the seagrass meadows of Tanjung Merah, North Sulawesi, showed that the fish samples collected in March 2003, April 2004, and September 2005 consisted of 137 species from 34 families. A different study in the seagrass meadows of the Island of Barrang Lompo found 28 fish species belonging to 14 families (Rappe 2010).

This study showed that the fish distribution pattern in each season differs in terms of percentage of capture or fishing yield, being affected by environmental water conditions. The seasonal conditions in Indonesian waters are greatly affected by wind systems, which affect the stream movements, especially surface streams (Nontji 2002). The highest composition of fish species was found at station 5KPLT, located at the coast of Kapuran, situated far from floating net cages activities and tourism, and, therefore, having a massive area of seagrass meadows with well-maintained large-size seagrass. The research results of Pratiwi (2010) inform that on the Coast of Kapuran, six species of seagrass were found with a total density of 1800 saplings m^{-2}. The fish found in the seagrass meadows is closely associated with the ecosystem of coral reefs and mangroves. The presence of the mangrove and seagrass ecosystems can increase the biomass and diversity of fish, as the presence of the coral reefs can function as a nursery habitat (Mumby et al 2004).

The dominant fish species captured consist of *Siganus fuscescens*, *Trachinotus blochii,* and *Siganus guttatus*. *S. fuscescens* species belongs to Singanidae family, and generally, and this family mainly lives around the coral reef ecosystem and in ecosystems where seagrass and seaweeds primarily grow (fishbase.se). The fish species associated with seagrass would depend on other ecosystems surrounding the seagrass meadows (Adrim 2006). At this research location, there are mangrove and coral reef ecosystems that determine the presence of fish species as the connector element of the seagrass meadows and such ecosystems. In the waters of Tanjung Tiram, Bay of Ambon, *Siganus canaliculatus* was dominant with a composition size of 62.9% (Latuconsina et al 2012). In the waters of Tanjung Merah, North Sulawesi, the dominant species found were *Apogon margaritophorus* and *Apogon hartzfeldii* (Syahailatua & Nuraini 2011). In the waters of the Bay of Sikao, Trang Province, Thailand, the dominant species consisted of *Atherinomorus duodecimalis*, *Sillago sihama,* and *Pelates quadrilineatus* (Phinrub et al 2015).

The similarity of fish species among the observatory stations was found in most of the captured fish, as the difference of the fish species was significant among the stations for a minimal number of individual fish (only one fish species found). It is argued that it is related to the variation of the physical and chemical parameter conditions of the waters at the time of fish capture, so that it affected fish catches, and the fishing location is around the mangrove and coral reef ecosystem. Seagrass meadows ecosystem are migration channels, areas where fish complete an entire life-cycle, or feeding grounds, so that they can also affect the structure of the fish community. According to Unsworth et al (2008), the coral reef ecosystems in the Indo-Pacific region affect the fish community structure in the seagrass meadows. Mangrove ecosystems provide organic substances to the food web, becoming feeding grounds for fish.

Conclusions. The conditions of physicochemical and environmental factors in the waters of the Bay of Lampung are still normal for fish growth and life. The highest composition of fish species in the waters of the Bay of Lampung is temporally found during the west season and spatially found at station 5KPLT, the Coast of Kapuran, with seagrass coral reef ecosystems. Fish species are dominated by *T. blochii*, *S. fuscescens* and *S. guttatus*. The correlation of the environmental factors of the waters with the composition of species determined by PCA during the transitional season II shows that station 6MLT does not have environmental factors as unique properties, meaning that all environmental factors influence the presence of fish composition. Station 1TL has the highest composition; based on PCA, the fish composition is affected by pH and nitrate concentrations. During transitional season I, the highest fish composition is at station 5KPLT, where all environmental factors jointly and equally affect the fish composition. The level of fish species similarity is low, with the highest similarity being 20%, and four groups are formed. The first group consists of station 1TL and station 8KGLMT, the second group consists of station 2SRL and station 6MLT, as the third group consists of station 3THLM, station 4LLM, and station 7KPLMT, and the fourth group consists of station 5KPLT.

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Authors:
Isnaini, Sriwijaya University, Department of Marine Science, Faculty of Mathematics and Natural Sciences, 30662 Indralaya, South Sumatra, Indonesia, e-mail: isnainimawardi22@gmail.com
Dietriech Geoffrey Bengen, IPB University, Department of Marine Science and Technology, Faculty of Fisheries and Marine Science, 16680 West Java, Indonesia, e-mail: dieter@indo.net.id
Tri Prartono, IPB University, Department of Marine Science and Technology, Faculty of Fisheries and Marine Science, 16680 West Java, Indonesia, e-mail: triprartono@yahoo.com
Zainal Arifin, BRIN (Badan Riset dan Inovasi Nasional), Research Center for Oceanography, 14430 North Jakarta, Indonesia, e-mail: arifin2010@gmail.com

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