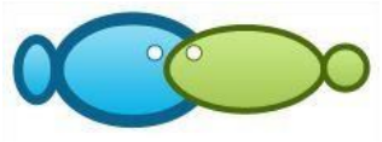
Composition and biodiversity of shrimp catch with trammel net in Banyuasin coastal waters of South Sumatera, Indonesia

by Fauziyah Fauziyah

Submission date: 12-Mar-2022 08:50AM (UTC+0700)
Submission ID: 1782362497
File name: 01Fauziyah_2018_Bioflux_composition_and_biodiversity.docx (123.4K)
Word count: 4399
Character count: 22372



Composition and biodiversity of shrimp catch with trammel net in Banyuasin coastal waters of South Sumatera, Indonesia

[1]Fauziyah, [1]Fitri Agustriani, [1]Wike A. E. Putri, [1]Anna I. S. Purwiyanto, [2]Yulianto Suteja

[1] Program Study in Marine Science, Faculty of Mathematics and Natural Sciences, Sriwijaya University, Palembang, Indonesia; [2]Marine Science Department, Faculty of Marine and Fisheries, Udayana University, Bali, Indonesia. Corresponding author: A. I. S. Purwiyanto, anna_is_purwiyanto@unsri.ac.id

Abstract. The coastal waters of Banyuasin have potential shrimp resources and the exploitation rate is still below 70%. Trammel net is the pre-eminent fishing gear of shrimp used by local fishermen. This research aimed to analyse the composition and biodiversity of trammel net catch in Banyuasin coastal waters of South Sumatera, Indonesia. An experimental fishing method was used for data collection by fishing ground following the local fishermen habit. The composition and biodiversity of trammel net cacthes were quantitified based on the weight of each caught species. The results for 11 trips produced an average catch of 8.964 kg consisting of main catch (61.76%), by-catch (14.36%) and discarded catch (23.88%). The main catch was Banana prawn (*Fenneropenaeus merguiensis*) with high relative abundance (RA) of 61.8% and high availability frequency of 100%. Most of the catch had an inter-trip similarity (Cs > 50%), mean value of medium diversity index (H' = 1.54), moderate evenness index (J' = 0.48) and low dominance index (D = 0.38). This condition showed that the community structure of the species caught by the trammel net was in a fairly stable state with the number of species spread fairly evenly and no species dominated each other.

Key Words: fishing gear, main catch, by-catch, discarded catch, indexes.

Introduction. Generally, estuary waters have important ecological roles, among others, as a source of nutrients and organic matter transported through tidal circulation, habitat providers for some fish and shrimp species that depend on the estuary as a shelter ground, feeding ground, reproduction area, and nursery ground. Estuary waters are commonly used by humans for settlements, fishing grounds and fish resource cultivation, transportation routes, ports and industrial estates (Dwirastina & Abidin 2013).

The Banyuasin coastal waters are strongly influenced by the condition of Sungsang estuary waters, parts of estuaries in South Sumatera which are densely populated. The high potential of fish and shrimp resources in Banyuasin costal waters is utilized by the community as a fishing activity center. Shrimp catching is generally conducted by using three types of instruments, namely trammel net, mini trawling, and push net. The previous study on the potential of fishery resources in coastal areas of Banyuasin District conducted by Djamali et al (2002) showed that the dominant shrimp species in Sungsang waters were from the Penaeidae family such as *Feneropenaeus merguensis* (white shrimp), *Penaeus monodon* (giant tiger prawn/Asian tiger shrimp) and *Metapenaeus ensis* (brown shrimp). According to Septifitri et al (2010), shrimp is a leading commodity of fishery in South Sumatra with the utilization rate of still below 70%. In addition, the trammel net is the most important fishing gear to catch shrimp in the waters.

Although shrimp is a leading commodity in South Sumatra Province, utilization rate of this species is not yet optimal as well as shrimp fisheries management. The potential should be well utilized so that it can become a core competency that can compete with other regions, in addition to be the prime mover of the regional economy.

One of the efforts that must be done is to provide comprehensive data and information from the shrimp resource aspect, the physico-chemical conditions of waters, the technique of catching operation, processing, marketing, and the policy of shrimp resource management.

In order to provide comprehensive data and information, it is necessary to conduct a preliminary study of the composition and biodiversity of shrimp catch with trammel net. According to Pino-Del-Carpio et al (2014), biodiversity information within an area is vital for the development of adequate conservation strategies. The diversity and abundance of fish species in any ecosystem are indicators of ecosystem well being and should be characterized for conservation and management purpose (Rumeaida et al 2014). Consequently, information on fish species diversity and abundance should be first investigated before any assessment on fish health community can be carried out (Foltz 1982). The aims of this research were to analyze the composition and diversity of trammel net catches in Banyuasin coastal waters of South Sumatera, Indonesia. The results of this study are expected to provide information on the level of trammel net ability to catch and the diversity of catches obtained.

Material and Method

Description of the study sites. This study was conducted in September 2017 in Banyuasin coastal waters, Banyuasin District, South Sumatera Province. Determining the location of trammel net was carried out in accordance with the fishing ground area. The sampling coordinates are presented in Table 1 and Figure 1.

Table 1

Sampling coordinates in Banyuasin coastal waters of South Sumatra, Indonesia

Trip	*Catch area*		
	Activities of trammel net operation	*Latitude*	*Longitude*
1	Setting	S 02.16'12.4"	E 104.58'32.0"
	Hauling	S 02.16'03"	E 104.58'33"
2	Setting	S 02.15'56.0"	E 104.58'56.4"
	Hauling	S 02.15' 59.3"	E 104.58'55.3"
3	Setting	S 02.17'03.8"	E 105.00'40.8"
	Hauling	S 02.17'49"	E 105.00'20"
4	Setting	S 02.15'40.3"	E 104.58'53.6"
	Hauling	S 02.17'10.6"	E 104.58'38.8"
5	Setting	S 02.16'22.8"	E 104.59'05.9"
	Hauling	S 02.17'12.4"	E 104.58'54.0"
6	Setting	S 02.16'6.59"	E 104.58'58.87"
	Hauling	S 02.16'11.64"	E 104.58'13.65"
7	Setting	S 02.16'00.8"	E 104.59'00.5"
	Hauling	S 02.15'26.2"	E 104.58'56.7"
8	Setting	S 02.16'00.7"	E 104.59'00.7"
	Hauling	S 02.16'17.2"	E 104.59'45.1"
9	Setting	S 02.17'30.5"	E 105.00'29.8"
	Hauling	S 02.18'04.4"	E 104.59'57.6"
10	Setting	S 02.17'28.3"	E 105.00'26.3"
	Hauling	S 02.16'41.1"	E 104.58'17.6"
11	Setting	S 02.16'50.8"	E 104.58'09.9"
	Hauling	S 02.17'25.3"	E 104.57'32.2"

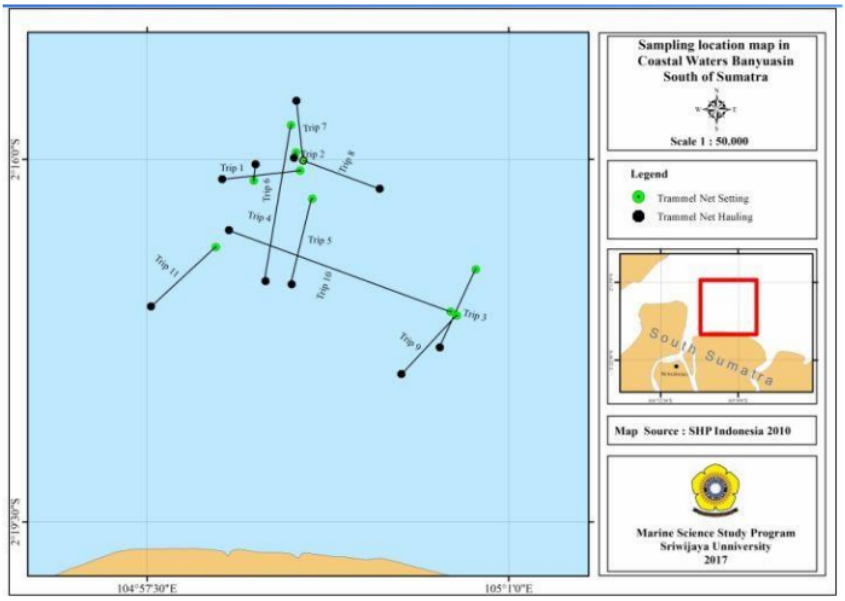


Figure 1. Sampling locations map.

Data type. The data collected in this research were primary and secondary data. The primary data were those obtained from survey results. The secondary data were obtained from various sources such as literature, documents, archives, and annual reports from relevant agencies. The primary data obtained from the survey results were the fish catch composition of each trip (the weight of each species caught).

Method of collecting data. The primary data collection method used in this research was experimental fishing method. The sampling of the catch was selected based on the fishing ground of local fishermen. The sampling was conducted using a trammel net and the catch was separated by a trip. The catch was identified first to determine the species (local, common name and scientific name) and then the catch weight was calculated (Wiyono 2011). The composition of the catch was calculated based on Carles et al (2014). In this study the composition of the catch was calculated based on the weight of each species caught (shrimp and non shrimp).

Composition of the catch. The trammel net catch composition was calculated based on the weight percentage of the main catch (MC), the bycatch (BC) and the discarded catch (DC) of the total catch. The MC of trammel net was shrimp while other species were included in the BC group (non-shrimp species that have economic value) or DC (species that have no economic value).

Diversity of the catch. The diversity of trammel net catches was analyzed using different equations and Decision Making Criteria. Relative abundance (RA), frequency of appearance (FA), diversity index (H'), evenness index (J'), dominance index (D) and similarity index (Cs) were calculated based on Rilov & Benayahu (2000), Okyere et al (2011), Ravanbakhsh et al (2016), Mondal et al (2010), Davari et al (2011), and Chao et al (2006) respectively. Decisions Making Criteria were based on Nurfiarini et al (2015), Carles at al (2014), Odum (1998), Gunawan & Jumadi (2016).

Results

Composition of the catch. The average trammel net catch for 11 trips was 8.964 kg consisting of main catch, by-catch and discarded catch (Table 2).

Table 2

Composition of trammel net catch

Trip	*Composition of the catch (kg)*			*Total catch*
	BC	*DC*	*MC*	
1	0.804	3.655	3.300	7.759
2	1.436	1.430	5.700	8.566
3	2.272	3.591	9.800	15.663
4	1.838	1.578	12.600	16.016
5	1.269	1.849	8.300	11.418
6	0.350	1.614	1.100	3.064
7	1.043	1.333	2.500	4.876
8	1.125	2.845	2.200	6.170
9	1.672	1.495	5.500	8.667
10	1.580	2.234	4.800	8.614
11	0.773	1.918	5.100	7.791
Total	14.162	23.542	60.900	98.604
Average	1.287	2.140	5.536	8.964
%	14.36%	23.88%	61.76%	100%

BC: by-catch; DC: discarded catch; MC: main catch.

The main catch of trammel net was *F. merguiensis*. Thirteen (13) species by-catch products were found: 1) Yantai stingray (*Hemitrygon laevigata*), 2) blue swimming crab (*Portunus pelagicus*), 3) hairtail (*Trichiurus lepturus*), 4) dusky-hairfin anchovy (*Setipinna melanochir*), 5) tongue sole (*Cynoglossus* sp.), 6) Waigieu seaperch (*Psammoperca waigiensis*), 7) Belanger's croaker (*Johnius belangerii*), 8) Chacunda gizzard shad (*Anodontostoma chacunda*), 9) yellow pike conger (*Congresox talabon*), 10) spineless cuttlefish (*Sepiella inermis*), 11) shorthead anchovy (*Encrasicholina heteroloba*), 12) kawakawa (*Euthynnus affinis*) and 13) giant catfish (*Netuma thallasina*). A total of nine (9) catched species were discharged into the sea because they have no economic value, such as; 1) cat shark (*Atelomycterus balinensis*), 2) half-smooth golden pufferfish (*Lagocephalus spadiceus*), 3) giant harpiosquillid mantis shrimp (*Harpiosquilla raphidea*), 4) pony fish (*Eubleekeria jonesi*), 5) mangrove horseshoe crab (*Carcinoscorpius rotundicauda*), 6) silver tripod fish (*Triacanthus nieuhofii*), 7) periscope crab (*Podophthalmus vigil*), 8) rock-snail (*Vokesimurex blakeanus*), and 9) scalloped perchlet (*Ambassis nalua*). The percentage of the main catch was higher (61.76%) than by-catch (14.36%) and discarded catch (23.88%).

Catch diversity. Trammel net catches (Tables 3 and 4) indicated that RA and FA of both *F. merguiensis* and *H. raphidea* had the highest value compared to other species. *F. merguiensis* has the highest relative abundance (RA = 61.8%) than *H. raphidea* (RA = 6.3%).

The same results were also shown on the frequency of appearance where *F. merguiensis* as the main catch was always caught on each trip (FA value = 100%). While the *H. raphidea* was almost caught on each trip (FA value = 91%). In addition to *F. merguiensis*, *Cynoglossus* sp., *L. spadiceus*, and *E. jonesi* were always caught on every trip (FA = 100%) with moderate RA, except *Cynoglossus* sp., with low RA. In addition to *Cynoglossus* sp., the high frequency of appearance and low abundance occurred to *S. inermis*, *A. balinensis*, *V. blakeanus*. and *P. vigil*. While the other species have low RA and FA, such as: *T. lepturus, S. melanochir, P. waigiensis, C. talabon, A. chacunda, E. affinis, N. thallasina, E. heteroloba, T. nieuhofii, C. rotundicauda,* and *A. nalua.*

In general, most species of trammel net catches had a similarity (Cs > 50%) between the trips (Table 5). However, between trip 1 and trip 6, trip 3 and trip 6, trip 3 and trip 7, trip 4 and trip 6, and trip 4 and trip 7 have no similarities ((Cs ≤ 50%). The value of diversity index (H') in each trip varied (the H' value ranges from 1.01 to 1.97), but all values of H' belonged to a moderate category (Table 6). The variation in H' resulted from the variation of the number of individuals caught (n_i) and the total number of catch species (N). Table 6 also shown that the value of J' for each trip had varied values and category (the J' value ranges from 0.32 to 0.69) where the average value of J' was included in the moderate category. This means that the spread of individuals between species is fairly even. In addition, the D value also had varied (the D value ranges from 0.17 to 0.62) and almost all of the D values in each trip were included in the low category. The low category of D value indicates that there are no species dominate each other.

Table 3
Characteristics of species trammel net based on relative abundance (RA) and frequency of appearance (FA)

Relative abundance (RA)	*Frequency of appearance (FA) of species captured*		
	High (FA > 71.42)	*Moderate (42.86 < FA < 71.43)*	*Low (FA < 42.86)*
High (RA > 5.686%)	*F. merguiensis* *H. raphidea*		
Moderate (2.845 < RA < 5.686)	*P. pelagicus* *J. belangerii* *L. spadiceus* *E. jonesi*		
Low (RA < 2.845)	*Cynoglossus* sp. *S. inermis* *A. balinensis* *V. blakeanus* *P. vigil*	*H. laevigata*	*T. lepturus* *S. melanochir* *P. waigiensis* *C. talabon* *A. chacunda* *E. affinis* *N. thallasina* *E. heteroloba* *T. nieuhofii* *C. rotundicauda* *A. nalua*

Table 4

Relative abundance (RA) and frequency of appearance (FA) of trammel net catch

Composition	Common name*	Scientific name*	Trammel net catch per trip (kg)											Total (kg)	RA (%)	FA (%)
			1	2	3	4	5	6	7	8	9	10	11			
MC	Banana prawn	*Fenneropenaeus merguiensis*	3.3	5.7	9.8	12.6	8.3	1.1	2.5	2.2	5.5	4.8	5.1	60.9	61.8^{H}	100^{H}
BC	Yantai stingray	*Hemitrygon laevigata*	0.1	0.2	0.5	0.2	0.2	-	-	0.3	-	0.2	-	1.7	1.7^{L}	64^{M}
	Blue swimming crab	*Portunus pelagicus*	0.2	0.2	0.3	0.6	0.3	-	0.6	0.2	0.4	0.4	0.2	3.2	3.3^{M}	91^{H}
	Hairtail	*Trichiurus lepturus*	0.2	-	-	-	-	-	-	-	-	-	-	0.2	0.2^{L}	9^{L}
	Dusky-hairfin anchovy	*Setipinna melanochir*	0.1	-	-	-	-	-	-	-	-	-	-	0.1	0.1^{L}	9^{L}
	Tongue sole	*Cynoglossus* sp.	0.2	0.3	0.5	0.1	0.3	0.1	0.5	0.1	0.3	0.3	0.1	2.7	2.7^{L}	100^{H}
	Waigieu seaperch	*Psammoperca waigiensis*	-	0.0	0.3	0.1	-	-	-	-	-	-	-	0.5	0.5^{L}	27^{L}
	Belanger's croaker	*Johnius belangerii*	-	0.5	0.1	0.3	0.3	0.3	-	0.3	0.8	0.5	0.3	3.4	3.4^{M}	82^{H}
	Yellow pike conger	*Congresox talabon*	-	0.0	-	-	-	-	-	-	-	-	-	0.0	0.0^{L}	9^{L}
	Chacunda gizzard shad	*Anodontostoma chacunda*	-	0.0	-	-	-	-	-	-	-	-	-	0.0	0.0^{L}	9^{L}
	Spineless cuttlefish	*Sepiella inermis*	-	0.3	0.2	0.5	0.2	-	-	0.3	0.2	0.3	0.2	2.1	2.1^{L}	73^{H}
	Shorthead anchovy	*Encrasicholina heteroloba*	-	-	0.1	-	-	-	-	-	-	-	-	0.1	0.1^{L}	9^{L}
	Kawakawa	*Euthynnus affinis*	-	-	0.1	-	-	-	-	-	-	-	-	0.1	0.1^{L}	9^{L}
	Giant catfish	*Netuma thallasina*	-	-	0.1	-	-	-	-	-	-	-	-	0.1	0.1^{L}	9^{L}
DC	Cat shark	*Atelomycterus balinensis.*	0.6	0.2	0.5	-	0.2	0.3	0.2	0.4	-	-	0.3	2.6	2.6^{L}	73^{H}
	Rock snails	*Vokesimurex blakeanus*	0.2	0.1	0.3	0.1	0.2	-	-	0.1	0.1	0.1	0.2	1.3	1.3^{L}	82^{H}
	Half-smooth golden puffer fish	*Lagocephalus spadiceus*	0.2	0.5	0.9	0.2	0.6	0.2	0.3	0.6	0.5	0.3	0.5	4.8	4.8^{M}	100^{H}
	Giant harpiosquillid mantis shrimp	*Harpiosquilla raphidea*	0.7	0.3	0.9	0.7	0.4	-	0.4	0.5	0.6	1.5	0.4	6.2	6.3^{H}	91^{H}
	Pony fish	*Eubleekeria jonesi*	0.4	0.2	0.6	0.3	0.4	0.1	0.3	0.2	0.2	0.2	0.3	3.2	3.2^{M}	100^{H}
	Mangrove horseshoe crab	*Carcinoscorpius rotundicauda*	0.9	-	-	-	-	-	-	0.8	-	-	-	1.6	1.7^{L}	18^{L}
	Silver tripod fish	*Triacanthus nieuhofii*	0.8	-	0.2	0.1	-	-	-	0.1	0.0	-	-	1.2	1.2^{L}	45^{M}
	Periscope crab	*Podophthalmus vigil*	-	0.1	0.3	0.2	0.1	-	0.2	0.2	0.1	0.1	0.2	1.6	1.7^{L}	82^{H}
	Scalloped perch let	*Ambassis nalua*	-	-	-	-	-	1.1	-	-	-	-	-	1.1	1.1^{L}	9^{L}
	Total catch		*7.8*	*8.6*	*15.7*	*16.0*	*11.4*	*3.1*	*4.9*	*6.2*	*8.7*	*8.6*	*7.8*	*98.6*		

Notes: H: High; M: Moderate; L: Low; BC: by-catch; DC: discarded catch; MC: Main catch; *: According to valid name from www.fishbase.org and www.sealifebase.org.

Table 5

Similarity index (Cs) of trammel net catch

Trip	Trip 1	Trip 2	Trip 3	Trip 4	Trip 5	Trip 6	Trip 7	Trip 8	Trip 9	Trip 10	Trip 11
Trip 1		64% S	67% S	69% S	72% S	50% N	67% S	81% S	67% S	67% S	67% S
Trip 2	-		75% S	79% S	81% S	55% S	52% S	76% S	77% S	77% S	77% S
Trip 3	-	-		73% S	76% S	50% N	48% N	77% S	79% S	71% S	71% S
Trip 4	-	-	-		80% S	50% N	48% N	81% S	92% S	83% S	75% S
Trip 5	-	-	-	-		63% S	60% S	85% S	87% S	87% S	87% S
Trip 6	-	-	-	-	-		53% S	57% S	56% S	56% S	67% S
Trip 7	-	-	-	-	-	-		55% S	53% S	53% S	63% S
Trip 8	-	-	-	-	-	-	-		88% S	80% S	80% S
Trip 9	-	-	-	-	-	-	-	-		91% S	82% S
Trip 10	-	-	-	-	-	-	-	-	-		82% S
Trip 11	-	-	-	-	-	-	-	-	-	-	

Notes: S: similar (Cs > 50); N: not similar (Cs ≤ 50).

Table 6

Diversity (H'), evenness (J') and dominance (D) index of trammel net catch

Trips	Diversity (H')		Evenness (J')		Dominance (D)	
	Value	Category	Value	Category	Value	Category
Trip 1	1.97	moderate	0.62	high	0.22	low
Trip 2	1.43	moderate	0.45	moderate	0.45	low
Trip 3	1.61	moderate	0.51	moderate	0.40	low
Trip 4	1.01	moderate	0.32	low	0.62	moderate
Trip 5	1.22	moderate	0.38	low	0.54	low
Trip 6	1.53	moderate	0.48	moderate	0.27	low
Trip 7	1.60	moderate	0.50	moderate	0.30	low
Trip 8	2.18	moderate	0.69	high	0.17	low
Trip 9	1.40	moderate	0.44	low	0.42	low
Trip 10	1.54	moderate	0.49	moderate	0.35	low
Trip 11	1.40	moderate	0.44	low	0.44	low
Average	*1.54*	*moderate*	*0.48*	*moderate*	*0.38*	*low*

Note: high (H' > 3; J' ≥ 0.6; D > 0.7); moderate (1 < H' ≤ 3; 0.4 < J' < 0.6; 0.5 < D ≤ 0.7); low (H' < 1; J' ≤ 0.4; D ≤ 0.5).

Discussion. The higher percentage of main catch than by-catch or discarded catch was in line with the composition of trammel net catch in Cilacap waters, Indonesia (Djasmani et al 2010; Saputra et al 2010) and in the waters of Saengga of Bintuni Bay Regency, Indonesia (Iskandar 2010). The opposite results occurred in the composition of trammel net catch in Pelabuhan Ratu waters, Indonesia (Kartawijawa et al 2011; Hufiadi 2008) and the waters of Pasir Beach Kebumen, Indonesia (Prasetyo et al 2015) where the by-catch was greater than the main catch. According to Djasmani et al (2010), the shrimp catch with a trammel net was influenced by several factors, namely the density of shrimp biota, oceanographic condition, and the condition of fishing gear. Shrimp density was influenced by feed density, predator, spawning season, and other biological factors. Oceanographic conditions, especially high waves and strong currents affected the decrease of the catch. Besides, the trammel net catch in the dark moon was higher than in the full moon. The higher by-catch than the main catch in a water was likely due to higher fishing effort (overcapacity) as well as multi-species waters characteristics.

One species of discarded catch i.e. *C. rotundicauda* known as living fossils and phylogenetic relicts (Selander et al 1970). The IUCN Red List has classified as threatened species. In Indonesia, this species is one of the priority marine species to be protected (MMAF 2013). Local fishermen already have local wisdom by releasing the species when caught.

The RA and FA variation of trammel net catch species were suspected due to the differences in species tolerance to aquatic physics-chemical conditions. Physics-chemical water conditions affected primary productivity (Kannappan & Karthikeyan 2013) and

primary productivity would affect fish abundance (Gonzales-Solis & Torruco 2013) in estuary waters.

The variation in the number of individuals and the total number of species were thought to be caused by the aquatic physic-chemical factors (Kannappan & Karthikeyan 2013; Gonzales-Solis & Torruco 2013), and biological factors. Physical-chemical factors are tidal, temperature, current velocity, salinity, nutrients, and substrate conditions, whereas biological factors are usually associated with patterns of adaptation and distribution of species and number of predators. These factors will affect the stability of the community that is the ability of the community to avoid the impact of the interference of its components.

Brower et al (1990) suggests that a community be said to have high species diversity when there are many species with relatively equal of individual numbers and also low biodiversity when the number of species is low and the number of individuals is uneven. According to Krebs (1978), the factors affecting diversity were time, space heterogeneity, competition, predator, and productivity. The longer the community develops, the more heterogeneous the environment, the higher the primary productivity, and the lower the competition intensity and predation, the higher the species diversity level. The results of this study obtained average of H' values which were moderate conditions. This condition illustrated that the waters ecosystem was stable (Krebs 1978; Carles et al 2014; Gunawan & Jumadi 2016).

The evenness index varies (low, medium, high) and the average evenness index of 11 trips was included in the moderate category. In other words, the spread of individuals between species and equilibrium ecosystem was fairly equal. This result was also marked by the average value of low dominance index indicating that no species dominate other species or community structures in a stable condition. The results of this study are in accordance with Fauziyah et al (2012) research in estuary waters of Sembilang South Sumatra National Park showing that the fish community structure was in a stable condition with the number of individuals or species spread evenly and no one dominated.

Conclusions. The main catch of trammel net was *F. merguiensis* (61.76%). The remaining was by-catch (14.36%) and discarded catch (23.88%). The catch species between trips were mostly similar (Cs > 50%), low dominance index (0 < average D = 0.38 ≤ 0.5), moderate diversity index (1 < average H' = 1.54 ≤ 3) as well as moderate evenness index (0.4 < averageJ' = 0.48 < 6). This condition depicted that the community structure was in a fairly stable condition with the number of species spreading fairly equally and no species dominated.

Acknowledgements. We would like to thank Sriwijaya University for grant funding for this research (funding of DIPA Unsri). We are also grateful to the anonymous reviewers of the final version of the manuscript. Special thanks to Tim Banyuasin for helping this research.

References

Brower J. E., Zar J. H., von Ende C. V., 1990 Field and laboratory method from general ecology. Third edition, Wm. C. Brown Publishers, Dubuque, Lowa, 237 pp.

Carles, Wiyono E. S., Wisudo S. H., Soeboer D. A., 2014 [Characteristics of capture fisheries in Simeulue Districts sea waters area]. Marine Fisheries 5(1):91-99. [in Indonesian]

Chao A., Chazdon R. L., Colwell R. K., Shen T. J., 2006 Abundance-based similarity indices and their estimation when there are unseen species in samples. Biometrics 62:361-371.

Davari N., Jouri M. H., Ariapour A., 2011 Comparison of measurement indices of diversity, richness, dominance, and evenness in rangeland ecosystem (case study: Jvaherdeh-Ramesar). Journal of Rangeland Science 2(1):389-398.

Djamali A., Mayunar, Septifitri, 2002 [Study of the potential of fishery resources in the coastal area of Musi Banyuasin Regency]. Seminar Process for Strengthening the Development of the Marine and Fisheries Sector in South Sumatra, Department of Marine and Fisheries, South Sumatra, pp. 67-75. [in Indonesian]

Djasmani S. S., Djumanto, Sari S. T., 2010 [Shrimp capture composition of ciker net on fishermen of Tegalkamulyan in Cilacap District]. Jurnal Perikanan 12(2):64-71. [in Indonesian]

Dwirastina M., Abidin M., 2013 [Construction and catching of trammel net nets operating in Estuari of Musi River, South Sumatra]. Buletin Teknik Litkayasa 11(1):19-22. [in Indonesian]

Fauziyah, Ulqodry T. Z., Agustriani F., Simamora S., 2012 [Economical fish resource biodiversity to support the management of the Sembilang National Park (TNS) Banyuasin District South Sumatra Province]. Jurnal Penelitian Sains 15(4):164-169. [in Indonesian]

Foltz J. W., 1982 Fish species diversity and abundance in relation to stream habitat characteristics. Proceeding of Annual Conference of Southeast Association of Fish and Wildlife Agencies 36:305-311.

Gonzales-Solis A., Torruco D., 2013 Fish assemblage structure in relation to environmental conditions in a tropical estuary. Revista de Biologia Marina y Oceanografía 48(3):553-563.

Gunawan E. H., Jumadi, 2016 [The diversity of protected, forbidden and invasive species and distribution of fish in the Rawadanau Banten conservation area]. Jurnal Perikanan dan Kelautan 6(1):67-73. [in Indonesian]

Hufiadi, 2008 [The proportion and composition of trammel net catches at Pelabuhan Ratu]. Bawal 2(2):69-74. [in Indonesian]

Iskandar D., 2010 [Comparison of shrimp catches using lapdu, giltong and trammel net in Saengga waters, Bintuni Bay Regency]. Jurnal Saintek Perikanan 5(2):80-87. [in Indonesian]

Kannappan T., Karthikeyan M. M., 2013 Diversity of fishes in relation to physcio-chemical properties of Manakudy estuary, southwest coast of India. International Journal of Biodiversity and Conservation 5(7):396-407.

Kartawijawa T., Ardani, Hamka E., Komarudin D., Jati A. K., Thenu I. M., Febri S. P., Dirwana I., Gigentika S., Johannes S., Sholeh K., 2011 [Analysis of the level of environmental friendliness of trammel net fishing gear in Teluk Palabuhan Ratu]. Buletin PSP 19(2):253-266. [in Indonesian]

Krebs C. J., 1978 Ecology: the experimental analysis of distribution and abundance. Second edition, Harper & Row, New York, 678 pp.

MMAF [Ministry of Marine Affairs and Fisheries] 2013 [Endangered aquatic biota in Indonesia]. Direktorat KKJI, Jakarta, 257 pp. [in Indonesian]

Mondal D. K., Kaviraj A., Saha A., 2010 Water quality parameters and fish biodiversity indices as measures of ecological degradation: a case study in two floodplain lakes of India. Journal of Water Resource and Protection 2(1):85-92.

Nurfiarini A., Kamal M. K., Adrianto L., Susilo S. B., 2015 [Fish resource biodiversity in Estuari Segara Anakan, Cilacap, Central Java]. Bawal 7(2):25-34. [in Indonesian]

Odum E. P., 1998 [Ecological vignettes: ecological approaches to dealing with human predicaments]. Samingan T., Srigandono B. (eds), Universitas Gadjah Mada Press, Yogyakarta, 824 pp. [in Indonesian]

Okyere I., Aheto D. W., Aggrey-Fynn J., 2011 Comparative ecological assessment of biodiversity of fish communities in three coastal wetland systems in Ghana. European Journal of Experimental Biology 1(2):178-188.

Pino-Del-Carpio A., Arino A. H., Villarroya A., Puig J., Miranda R., 2014 The biodiversity data knowledge gap: assessing information loss in the management of Biosphere Reserves. Biological Conservation 173:74-79.

Prasetyo W., Rosyid A., Dewi D. A. N. N., 2015 [Difference of catch, profitability of trammel net and gill net in Pasir Sea, Ayah Districts, Kebumen Regency]. Journal of Fisheries Resources Utilization Management and Technology 4(4):116-124. [in Indonesian]

Ravanbakhsh M., Amini T., Hosseini S. M. N., 2016 Assessment of conservation status in Caspian Sea coastal area by the use of diversity indices. Journal of Biodiversity and Environmental Sciences 8(3):12-21.
Rumeaida M. P., Daud S. M. M., Badri F. M. I., 2014 Fish diversity and abundance in Bidong Island, South China Sea, Malaysia. AACL Bioflux 7(3):176-183.
Rilov G., Benayahu Y., 2000 Fish assemblage on natural versus vertical artificial reefs: the rehabilitation perspective. Marine Biology 136:931-942.
Saputra S. W., Wijayanto D., Solichin A., 2010 [Productivity and business prospects of trammel net fisheries on Cilacap Regency, Central Java]. PENA Akuatika 2(1):1-10. [in Indonesian]
Selander R. K., Yang S. Y., Lewontin R. C., Johnson W. E., 1970 Genetic variation in the horseshoe crab (*Limulus polyphemus*), a phylogenetic "relic". Evolution 24(2):402-414.
Septifitri, Monintja D. R., Wisudo S. H., Martasuganda S., 2010 [Fisheries infrastructure needs analysis in order to capture fisheries development based on commodities of South Sumatra Province]. Jurnal Saintek Perikanan 5(2):8-13. [in Indonesian]
Wiyono E. S., 2011 [Characteristics of catched fish with "illegal" fishing gear on the north coast of West Java]. Jurnal Bumi Lestari 2(2):208-214. [in Indonesian]

Composition and biodiversity of shrimp catch with trammel net in Banyuasin coastal waters of South Sumatera, Indonesia

ORIGINALITY REPORT

6%	2%	4%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universiti Malaysia Terengganu UMT Student Paper	1%
2	R Arya, S Sariffuddin, A Bilqis. "Mapping of Pollution Load Capacity of Tidal Manggar Watershed, Balikpapan City", IOP Conference Series: Earth and Environmental Science, 2019 Publication	1%
3	www.nusantarasurfcharters.com Internet Source	1%
4	Submitted to Benedictine University Student Paper	1%
5	Submitted to The University of the South Pacific Student Paper	1%
6	chao.stat.nthu.edu.tw Internet Source	1%
7	moorparkca.gov Internet Source	1%

8	Song-ping Luo, Bing-hui He, Qing-ping Zeng, Nan-jie Li, Lei Yang. "Effects of seasonal variation on soil microbial community structure and enzyme activity in a Masson pine forest in Southwest China", Journal of Mountain Science, 2020 Publication	1 %

Exclude quotes	On	Exclude matches	< 1%
Exclude bibliography	On		