Available online at www.worldscientificnews.com

World Scientific News

An International Scientific Journal

WSN 133 (2019) 121-131 EISSN 2392-2192

Difference Effect of Mouth Width Size and Operating Depth of Sodo (Push net) on the Catch of Rebon Shrimp (*Acetes indicus* H. Milne Edwards, 1830) in Tanah Kuning Waters, North Kalimantan, Indonesia

Rahmayani*, Herman Hamdani, Junianto, A. Mahdiana Izza

Faculty of Fisheries and Marine Science, Padjadjaran University,
Jl. Raya Bandung Sumedang Km. 21, Jatinangor 45363, Jawa Barat, Indonesia

*E-mail address: rahmayani15001@mail.unpad.ac.id

ABSTRACT

Sodo (push net) is a fishing gear used to capture Rebon shrimp (*Acetes indicus* H. Milne-Edwards, 1830) by fishermen in Tanah Kuning water and it has a construction for varied operation depth. The purpose of this study was to determine the combination of the size of the mouth width and depth of operation of Sodo to get the most Rebon shrimp catch in the waters of Tanah Kuning. The study method used is experimental with Randomized Block Design (RBD). The first group is the size of the width used, equaling 4.8 m, 6 m, and 7.2 m, and depths of 0.5 to 3 m, and 4 to 6 m. The catch data was taken on January 15-22 2019. The results show that the A2B1 treatment, which is a combination of the size of the mouth width of 6 m and operated at a depth 0.5 – 3 m, was the best treatment, with the highest catch of mass 238 kg.

***Keywords*:** Sodo mouth width size, depth, sodo, Rebon shrimp, *Acetes indicus*

(Received 26 March 2019; Accepted 11 April 2019; Date of Publication 07 August 2019)

1. INTRODUCTION

Waters of Bulungan Regency are the largest fisheries sector in North Kalimantan with an area of about 1,982,075 hectares and a coastline of 381,755 kilometers. The fishing business in Bulungan Regency estimated fish stock/MSV of 29,000 tons a year with the production of new sea fishing 8,671.5 tons/year or only 29.9% of the potential. In other words the capture fisheries business in Bulungan Regency has not been done optimally.

One of the biggest fisheries product contributors in Bulungan Regency comes from Tanah Kuning Village, Tanjung Palas Timur District. Tanah Kuning Village is an area in the eastern part of Bulungan Regency. This area is one of the centers for fishing and producing (dry / wet), anchovy and shrimp (DKP Bulungan 2015) [1].

The main commodity landed at Tanah Kuning fish landing (PPI) base is Rebon Shrimp. Rebon Shrimp is a type of white shrimp from the genus *Acetes* inhabit coastal estuarine waters in tropical, subtropical and temperate parts of the world (Xiao 1993) [2]. Shrimp Rebon has a body length ranging from about 1 to 3 cm and cannot grow into large numbers, live in large numbers and emerge periodically in certain months. The spawning season occurs in the summer of July and August with the peak in July (Oh 2002) [3]. Shrimp Rebon is a commodity that has a high economic value. The Rebon shrimp landed at PPI Tanah Kuning was captured using Sodo (fishing gear push net).

Sodo (push net) is one of the fishing gears that is included in the push net. Sodo's operation is driven, where the net is placed in front of the boat (Abdulaziz 2018) [4]. Push trawl is included in the category of trawl referred to in article 2 of the Regulation of the Ministry of Maritime Affairs and Fisheries No. 2 of 2015. Push nets can be used to effectively sample both pelagic and littoral larval fish communities (Claramunt 2005) [5]. The sodo fishing gear is usually used to catch Rebon shrimp. Broadly speaking, the sodo construction consists of wooden framed mouth parts, bodies and bags (Apandi 2007) [6]. The sodo fishing gear used in Tanah Kuning Village, namely Sodo, is made of ‘waring’ and wood-framed base material which is operated by boat. Sodo fishing equipment operating in Tanah Kuning waters is characteristic with several differences including the size of the length of the bag, the width of the opening of the mouth and the length of the stick frame. In addition to differences in the construction of fishing gear, there are also differences in the depth of operation, where the variables are thought to affect the catch.

The right size of fishing gear is needed in order to obtain optimal catches. The width of the sodo mouth and the ideal operating depth of the catch of Rebon shrimp in Tanah Kuning waters is very important to know and study in order to obtain optimal catches. The purpose of this study was to determine the combination of the size of the mouth width and the depth of operation of Sodo to get the highest Rebon shrimp catch in the waters of Tanah Kuning.

2. RESULTS / EXPERIMENTAL

The study of Rebon shrimp capture using sodo fishing gear (push net) was carried out in the waters of Tanah Kuning, Bulungan Regency, North Kalimantan in January 2019. The material used in this study was data on Rebon shrimp weight caught by sodo nets. The equipment used is 6 units of fleet catching sodo nets, meters, Global Positioning System (GPS), thermometers, refractometers, scales, cameras, and stationery. The method used is the

experimental method. There were 6 treatments with each treatment carried out with 3 repetitions as follows.

Table 1. Notation treatment.

Notation	Sodo mouth opening width, m	Depth, m
A1B1	4.8	0.5-3
A2B1	6	0.5-3
A3B1	7.2	0.5-3
A1B2	4.8	4-6
A2B2	6	4-6
A3B2	7.2	4-6

Construction of sodo fishing gear according to Kusuma (2017) consists of stalks / sticks, frames, legs / shoes, sodo bodies, pockets, buoys, and lifting ropes. The sodo operation procedure begins by attaching and binding to the wooden stick, the stick that has been connected to the lowered net (setting). Sodo is then pushed along the shore for 3-4 hours (towing). The catch is raised above the ship via cod end (hauling) (Kusuma 2017) [7].

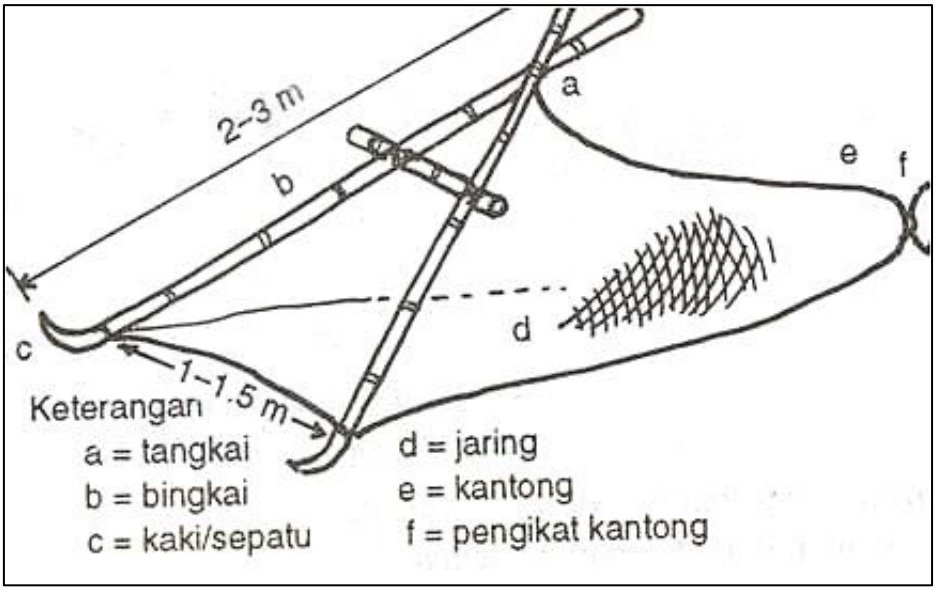

Figure 1. Sodo (Push net)

The data taken in this study are primary data and supporting data. Primary data was taken by conducting observations, measurements and interviews directly with sodo fishing fishermen in Tanah Kuning Village. Conducting surveys and measurements of Sodo's mouth width and comparing catches were based on mouth width and operating depth, while the supporting data in the form of environmental parameters covered physical conditions of waters which include water temperature and salinity.

The parameters of this study are the total weight of caught rebon shrimp and water quality which includes salinity and water temperature. Analysis of the data used is descriptive in the form of case studies. Weight data for the number of catches collected was then analyzed using Analysis of Variance (Anova), with F test. The experimental design used was factorial randomized block design (RBD). The F statistic test basically shows whether all the independent variables included in the model have a joint effect on the dependent variable (Kuncoro 2003) [8]. Fhit <Ftab accepts H0 if there is no relationship between the two variables on the catch, and Fhit> Ftab rejects H0 if there is a relationship between the two variables on the results of the conversation. If there is a difference between the treatment followed by the Duncan Test to determine the width of the sodo mouth and the depth of operation, then it gets the best Rebon shrimp catch. Water quality data covering temperature and salinity were analyzed descriptively comparatively.

2. 1. Research Sites

The research place is located in Tanah Kuning Village, Tanjung Palas Timur District, Bulungan Regency, North Kalimantan. It is located 81.8 km from the city center of Bulungan Regency which can be reached for 156 minutes using public transportation. The majority of the residents of Tanah Kuning Village work as traditional fishermen. Some of the boat stops are in Muara Sungai RT 01 and some are on the beach side RT 02. The beachside of RT 02 is a fish landing base (PPI) that serves as a place for weighing Rebon shrimp caught, collecting data, and selling it directly to collectors. The operation area of the sodo fishing gear in Tanah Kuning Village at least fulfills several criteria for fishing operations, such as flat bottom surface (sloping). It has a muddy sand substrate which is an area suitable for fishing gear such as sodo and there is no coral reef ecosystem around the site research so that it does not have the potential to damage the environment.

2. 2. Sodo Catch (Push net)

Catch results the catch of sodo fishing gear in Tanah Kuning Village, which was obtained after 3 repetitions, was dominated by Rebon shrimp, because this fishing gear was deliberately designed to catch Rebon shrimp. Other catches are Jerbung shrimp, Vaname shrimp, Windu (Black tiger) shrimp, Small Layur fish, Gulama fish, Pepetek fish, Crab and Jellyfish [19-37].

Data on the number of Rebon shrimp catches obtained during the study period can be seen in the following graph – Figure 3.

The overall weight of Rebon shrimp caught by sodo net, caught during the study was 1202 kg or as much as 1.2 tons. Based on the graph of the catch data above, it can be seen that there are differences in the number of catches based on the treatment. The average catch was as follows: A1B1 = 72 kg, A2B1 = 79.33 kg, A3B1 = 69 kg, A1B2 = 65.33 kg, A2B2 = 62 kg, and A3B2 = 56 kg. The A1B1 treatment received a total catch of 216 kg, the A2B1 treatment got 238kg of total catch, and the A3B1 treatment got a total catch of 207 kg. The size of the

mouth that is not too wide causes the operating time (towing) to be faster because it does not filter the volume of water in large quantities so that it can pass through the catchment area which is getting more and more long. The wide mouth width causes the sodo net to filter the volume of water in large quantities and the fast operating time, so it can increase the catch (efficiently), while the mouth size that is too wide causes the towing process to last longer, because to much water is filtered through sodo's mouth so that it makes the ship move more slowly. This is considered to be less efficient in fishing operations.

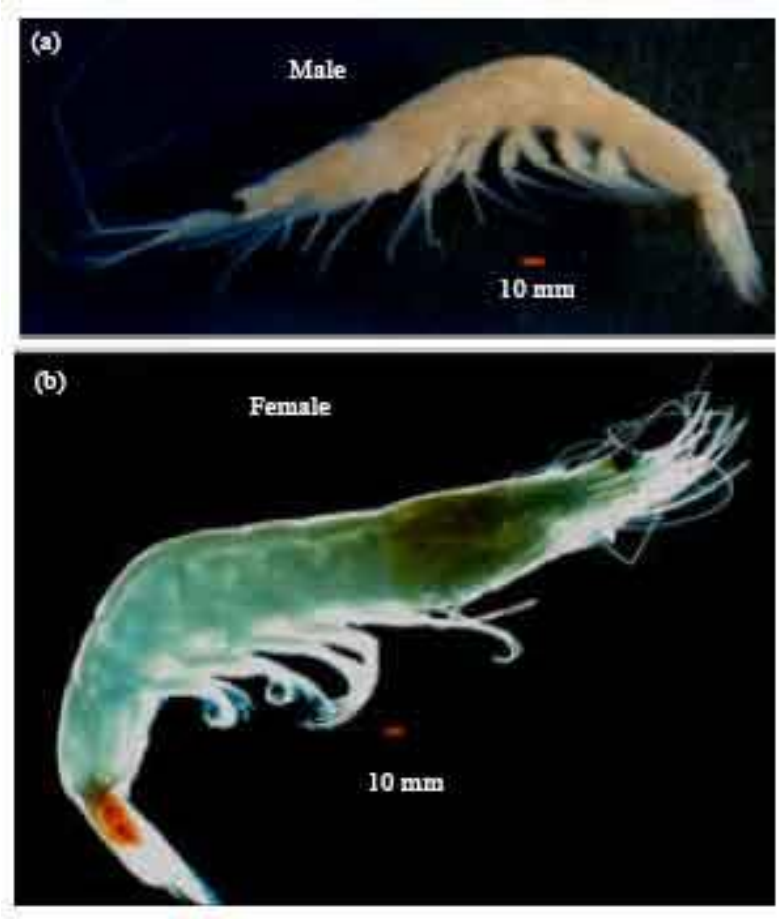

Figure 2. Rebon shrimp (*Acetes indicus* H. Milne Edwards, 1830).
Distribution: Indo - West Pacific.

The A1B2 treatment obtained a total catch amount of 196 kg. The number of catches treated by A1B2 is higher than the catches of A2B2 and A3B2. This is because A1B2 has a smaller size of mouth width so it does not filter the volume of water in large quantities and accelerate the speed of movement of the ship. The faster the movement rate of the ship, the longer the path of the fishing area that is traversed so that higher volume of water is filtered. The wider the size of the sodo mouth which is operated at a depth of 4-6 meters, the more difficult it is to carry out fishing operations because of the influence of the water fields such as very choppy waters and sodo which do not reach the bottom of the waters.

The more filtered water or the maximum mouth width will make the volume of filtered water during fishing operations greater in number and the catches theoretically getting bigger. Based on research, Ermasuri (2000) states that differences in the size of the mouth width of the fishing gear influence the amount of the catch and do not show differences in the size of the catch [9]. Ayodhyoa (1981) states that opening the net mouth maximally during towing can filter out the volume of water that is increasing so that the number of catches can be as much as possible [10].

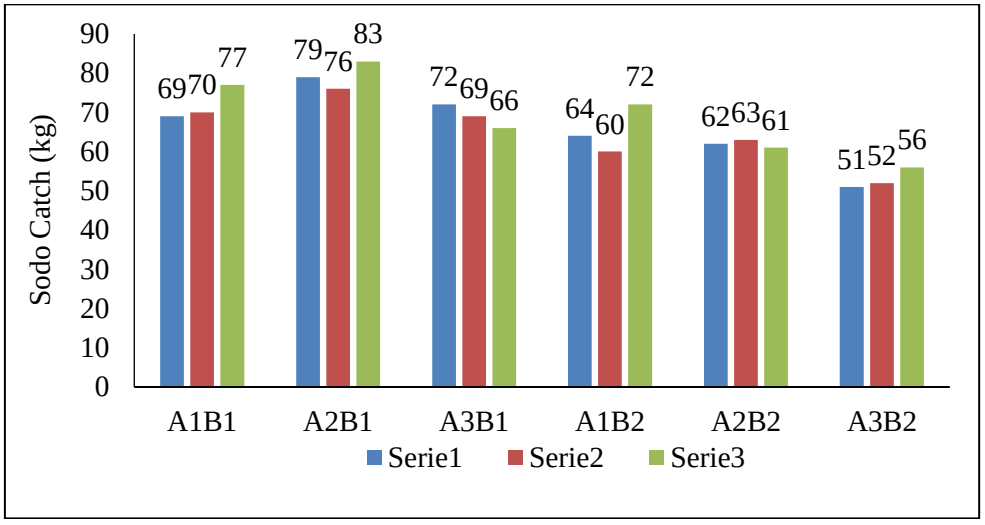

Figure 3. Data on amount of catch

The catch of Rebon shrimp increases with the increasing width of Sodo's mouth, then after crossing the peak, at a certain point the catch decreases. Hanafi (2011) states that the increase in the length of the net used will cause the fishing area to be wider, but on the other hand it causes the operation time of the fishing gear to be longer [11]. The curve of mouth width measurement pattern on the catch can be seen in the following graph (Figure 4).

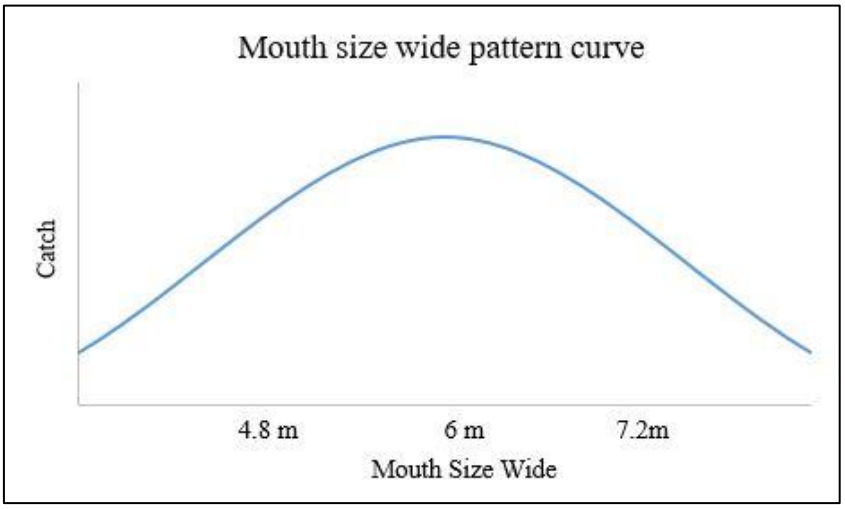

Figure 4. Mouth size wide pattern curve

The difference in the number of Rebon shrimp caught is thought to be influenced by the size of the mouth width of the sodo fishing gear used. Putri (2013) stated that the net length variable had a positive and significant effect on the catch. The dependence of the length of the net to the catch shows a fairly high correlation, and shows the relationship between the length of the net and the very close catch [12].

Based on the results of the study, the total weight of Rebon shrimp caught for 3 repetitions at a depth of 0.5-3 meters ranged from 66 to 83 kg, and at a depth of 4-6 meters the total weight of caught Rebon shrimp was only 51-72 kg. Depth value of catch is 6.17, where the value of Fhit > Ftab so that there is a significant difference in the treatment of depth which is very significant at the test level of 95% and 99%.

Most Rebon shrimp was caught in shallow areas (less than 4 m) close to the mouth of the river with characteristics of turbid waters and slightly wavy. The number of catches decreases with increasing depth of operation, presumably because rebon shrimp look for food towards the beach or river estuary which has many plankton. This is made clear by Odum (1996) who states that shallow water is an area affected by tides, where fresh water mixes with sea water and fertile areas by water resources [13]. Budiman (2006) also states that fertile waters are utilized by microscopic organisms to carry out photosynthesis where, when the waters are hot, optimal sunlight penetration can reach the bottom of the shallow waters so that this proves that depth affects a lot of whether or not the catch is due to food sources [14]. The curve of the depth pattern towards the catch can be seen in the following graph (Figure 5).

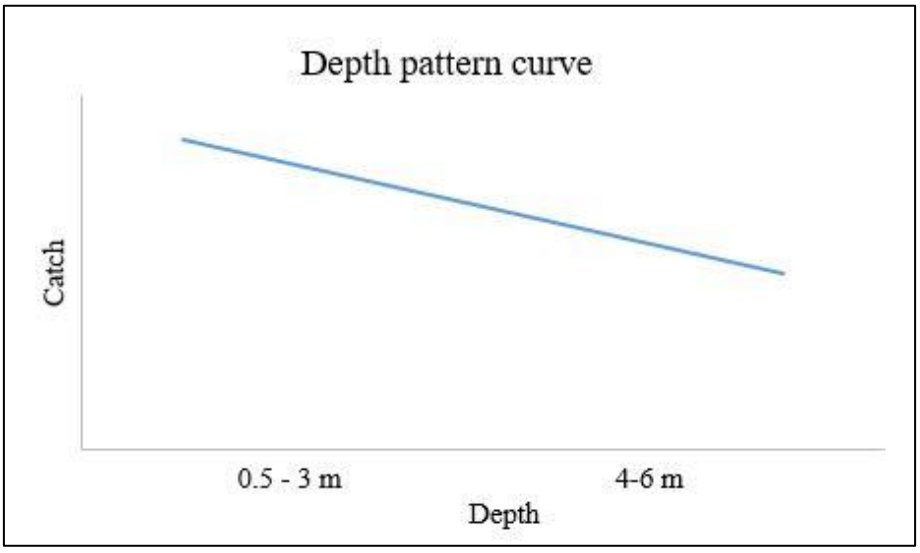

Figure 5. Depth pattern curve

Adult shrimps prefer clear waters with a depth of 1-5 meters, while young shrimps are more tolerant of turbid waters (Kanna 2006) [15], and Kusuma (2012) states that the depth of installation of fishing gear affects catch [16]. Shrimps are spread from shallow waters to deep sea waters, but commercial fishing activities are centered in shallow waters, namely the depth of waters of 5-6 m (Sjahrir 2001 in Prasetiyo 2014) [17].

Repeat Fcount value (2.39) is smaller than Ftable value at the test level of 95% (4.1) and 99% (7.56) which means accept H0, so it can be concluded that the test does not affect the

amount of rebon shrimp catch. The treatment count value (20.94) is greater than the Ftable value at the test level of 95% (3.33) and 99% (5.64) which means reject H0, so it can be said that there is a relationship between the treatment of the number of catches.

Duncan's further test was carried out with the aim of testing the differences between all treatment couples. The test results showed that there were significant differences in all treatments (operating depth, mouth width, and both interactions) which were quite significant, and there were no significant differences between replications at the 95% test level. However, there was no significant difference in the interaction between depth and width of the mouth opening at the test level of 99%.

2. 3. Water Quality Parameters

External factors have an important influence on the activity of aquatic organisms. Temperature is one of the external factors that influence fish production and influences important activities in fish such as breathing, growth, reproduction and appetite (Huet 1971 in Lusianti 2013) [18]. The value of temperature at a depth of 0.5-3 m ranges from 27-28 °C, while the temperature value at a depth of 4-6 m ranges from 26-27 °C. Manurut Zulpikar (2016), classified temperature conditions of 23.5-30.8 °C as still suitable for the life of shrimp [19].

Salinity is a limiting factor for the survival of macrozoobenthos, including crustaceans, both living in freshwater, brackish water, and seawater (Pratiwi 2010) [20]. The salinity value at a depth of 0.5-3 m averaged around 24.5 ppt and the salinity value at a depth of 4-6 m averaged around 26.5 ppt. Alfitriatussulus (2003) in (Pratiwi 2010) states that, the optimum salinity for crustaceans ranges from 23-26 ppt and the optimum value of tolerance to salinity in seawater is 35 ppt [20]. Estimation of the catching area of rebon shrimp by Tanah Kunig fishermen is still traditional in nature by seeing natural signs. According to the fishermen of Tanah Kuning Village, the best catching area for rebon shrimp is an area that is still affected by fresh water or an area close to the mouth of the river. The waters are slightly choppy and the color of the water is slightly cloudy.

3. CONCLUSIONS

The results of the study showed that the treatment of A2B1 was a combination of sodo 6 m wide mouth size and operated at a depth of 0.5 - 3 m which was the best treatment with the highest catch of 238 kg.

References

[1] Fisheries and Marine Service. Bulungan: Ministry of National Education, 2016.

[2] Y. Xiao, G.J. Greenwood. The Biology of *Acetes* (*Crustasea*; Sergestidae). *Oceanogr. Mar. Biol. Annu. Rev*., 31 (1993) 259-444.

[3] C.W. Oh, and I.J. Jeong. Fisheries Biology of Shrimp in the South Western Waters of Korea. *J. Korean Fish. Soc*., 35(3) (2002) 223-230.

[4] M.H. Abdulaziz, A.N. Bambang, A.D. Fitri. Analysis Friendliness Environment Gear in Demak Regency. *Journal of Fisheries Resources Utilization Management and Technology*, 7(2) (2018) 89-95.

[5] R.M. Claramunt, D.E. Shoup, D.H. Wahl. Comparison of Push Nets and Tow Net for Sampling Larval Fish with Implication for Assessing Litoral Habitat Utilization. *North American Journal of Fisheries Management*, 25 (2005) 86-92.

[6] Y. Apandi. Techniques for Maintenance and Maintenance of Fish Catchers. *Cv. Citra Karya Utama Press*, Bandung, 2007.

[7] P.A. Kusuma, D. Wijayanto, and A.D. Fitri. Technical and Financial Analysis of the Business of Sodo (Push Net) Fishing Equipment with Targeted Arresting of Shrimp on Bedono Village and Timbulsloko Village, Sayung District, Demak Regency. *Journal of Fisheries Resources Utilization Management and Technology*, 6(4) (2007) 341-351.

[8] Kuncoro, Mudjarat. Research Methods for Business & Economics. Erlangga, Jakarta, 2003.

[9] Ermasuri. Effect of Mouth Beam Trawl Openings on the Catch of Juvenile Fish in Seagrass Banten Bay Waters. *Thesis of the Faculty of Fisheries and Marine Science of IPB* (unpublished), Bogor, 2000.

[10] H.A.U. Ayodhyoa, Ayodhyoa. Fishing Methods. Dewi Sri Foundation, Bogor, 1981.

[11] Hanafi, Ade. Effect of Difference in Wing Length and Horse Power Machine (Hp) on Catches of Payang Fishing Gear in Jatirejo Village, Lekok District, Pasuruan, East Java. *Agriva Unbraw Journal*, 1 (1) (2011) 1-2.

[12] M.N. Putri, H. Busono, Sardiyatmo. Analysis of the Connection between Vessel Lengths and Payang Jabur (Boat Seine) Net Lengths as Result of Fisheries Catches which Landed in Asemdoyong Coastal Fishing Port Pemalang. *Journal of Fisheries Resources Utilization Management and Technology*, 2(3) 2013) 40-50.

[13] P. Eugene Odum. Ecology Basics; Third Edition. Yogyakarta. *Gadjah Mada University Press*, Tjahjono, 1996.

[14] Budiman. Analysis of Demersal Fish Distribution as the Base of Coastal Resource Management in Kendal Regency. *Post-graduate Thesis of Diponegoro University*, Semarang, 2006.

[15] I. Kanna. Lobster Catching, Hatchery, Enlargement. Kansisius. Yogyakarta, 2006.

[16] R.D. Kusuma, Asriyanto, and Sardiyatmo. Effect of Depth and Different Bait on Results of Catching Lobster (*Panulius* sp.) with Lobster Nets (*Bottom Gill Net Monofilament*) in Argopeni Waters District, Kebumen. *Journal of Fisheries Resources Utilization Management and Technology***,** 1(1) (2012) 11-12.

[17] A. Prasetiyo H. Boesono, and Asriyanto. Analysis Catching Produce Tiger Shrimp (*Penaeus semisulcatus*) in Double Rig Shrimp Net Based on Difference Time in Arafura Waters Papua. *Journal of Fisheries Resources Utilization Management and Technology*, 3(2) (2014) 62-71.

[18] F. Lusianti. Effectiveness of Use of Rice Husk, Rice Straw, and Wood Fiber as Filter Material in Undergravel Filter System for Maintenance of Best Tilapia. *Thesis*. Fisheries Cultivation Study Program, Faculty of Fisheries and Marine Science, Bogor Agricultural University, Bogor, 2013.

[19] T.R. Zulpikar, Ferasyi, Sugito. Analysis of Water Quality Effects on the Risk of White Spot Syndrom Virus (WSSV) Disease on Vannamei (*Litopenaeus vannamei*) Shrimp in Peudada Subdistrict of Bireuen District. *Depik*, 5(1) (2016) 1-6.

[20] R. Pratiwi. Association of Crustaceans in the Seagrass Ecosystem of Lampung Bay Waters. *Marine Science*, 15(2) (2010) 66-76.

[21] W.D. Chiou, C.C. Wu, and L.Z. Cheng. Spatio-temporal distribution of sergestid shrimp *Acetes intermedius* in the coastal waters of Southwestern Taiwan. *Fish. Sci.*, 66 (2000) 1014-1025.

[22] R.B. Forward. Diel vertical migration. Zooplankton photobiology and behaviour. *Oceanogr. Mar. Biol. Annu. Rev.*, 26 (1988) 361-393.

[23] Y. Xiao, J.G. Greenwood. Distribution and behaviour of *Acetes sibogae* (Decapoda, Crustacea) in an estuary in relation to tidal and diel environmental changes. *J. Plankton Res.*, 14 (1992) 393-407.

[24] W.D. Chiou, J.J. Hwang, L.Z. Cheng, *et al*. *Fish. Sci.*, 71 (2005) 361. https://doi.org/10.1111/j.1444-2906.2005.00988.x

[25] W.D. Chiou C.C. Wu, L.Z. Cheng. Spatio-temporal distribution of sergestid shrimp *Acetes intermedius* in the coastal waters of southwestern Taiwan. *Fish. Sci.*, 66 (2000) 1014-1025.

[26] Y. Xiao, J.G. Greenwood. The biology of *Acetes* (*Crustacea*, Sergestidae). *Oceanogr. Mar. Biol. Ann. Rev.*, 31 (1993) 259-444.

[27] W.D. Chiou. The sergestid shrimp (*Acetes intermedius*) fishery of Taiwan. *Fish. Exten. Spec. Publ. NKIMT*, Taiwan, 12 (2002) 1-26.

[28] W.D. Chiou, L.Z. Cheng, C.T. Chen. Effects of lunar phase and habitat depth on vertical migration patterns of the sergestid shrimp *Acetes intermedius*. *Fish. Sci.*, 69 (2003) 277–287.

[29] V.D. Deshmukh. Biology of *Acetes indicus* Milne Edwards in Bombay waters. *Indian Journal of Fisheries*, 49(4) (2002) 379-388.

[30] Raushan Kumar, K.A. Martin Xavier, Manjusha Lekshmi, Vignaesh Dhanabalan, Madonna T. Thachil, Amjad K. Balange, and Venkateshwarlu Gudipati. Development of functional extruded snacks by utilizing paste shrimp (*Acetes* sp.): process optimization and quality evaluation. *Journal of the Science of Food and Agriculture*, 98(6) (2017) (2393-2401).

[31] Asep Prihanto, Rahmi Nurdiani, and Muhamad Firdaus. Mining Products from Shrimp Processing Waste and their Biological Activities. *Seafood Science*, (2014) (397-432), 10.1201/b17402-19.

[32] Xiaojun Zhang, Yang Zhang, Chantel Scheuring, Hong-Bin Zhang, Pin Huan, Bing Wang, Chengzhang Liu, Fuhua Li, Bin Liu and Jianhai Xiang. Construction and Characterization of a Bacterial Artificial Chromosome (BAC) Library of Pacific White Shrimp, *Litopenaeus vannamei*, *Marine Biotechnology*, 12(2) (2009) (141-149), 10.1007/s10126-009-9209-y.

[33] V.D. Deshmukh. Status of non-penaeid prawn fishery of India and stock assessment of *Acetes indicus* Milne Edwards off Maharashtra. *Indian Journal of Fisheries,* 40(1&2) (1993) 50-62.

[34] V.K. Pillai. Larval development of *Acetes indicus* H. Milne Edwards (*Crustacea*: Decapoda: Sergestidae) from Bombay waters. *Journal of the Marine Biological Association of India,* 15(2) (1973) 587-595.

[35] Vignaesh Dhanabalan, Martin Xavier, Nagalakshmi Kannuchamy, Kurukkan Kunnath Asha, Chongtham Baru Singh, Amjad Balange. Effect of processing conditions on degree of hydrolysis, ACE inhibition, and antioxidant activities of protein hydrolysate from *Acetes indicus*. *Environmental Science and Pollution Research*, 24(26) (2017) 21222–21232. https://doi.org/10.1007/s11356-017-9671-4

[36] S. Basheeruddin, and K. Nayar, Nagappan. A preliminary study of the juvenile fishes of the coastal waters off Madras city. *Indian Journal of Fisheries,* 8(1) (1961) 169-188.

[37] Boone Yee Wong, Han Ki At Alan Ong, Gideon Khoo. Length-Weight Relationships of *Acetes* sp. Sampled Along the West Coast of Peninsular Malaysia. *Sains Malaysiana* 44(3) (2015) 379-386.