Evaluation of small pelagic fishing gear production as part of small scale fishery in FMA 573 Indonesia (A Case Study of Pangandaran Landing Site)

Lantun P Dewanti[1], Heti Herawati[2], Izza M Apriliani[1], Rusky I Pratama[2], Alexander Khan[1]

[1] *Laboratory of Fishing Management and Tecnologi, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Indonesia*

[2] *Fishery Department, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Indonesia*

ABSTRACT

Small pelagic is one of the fishery commodities in Fisherise Management Area (FMA) 573 besides large pelagic fish, demersal and crustacean. Based on the status of small pelagic fish resource utilization in that area, it has shown signs of overfishing level. Fishing activities for small pelagic fisheries usually occur in coastal areas and dominated by small-scale fisher. The aims of this research is to assess regarding production and productivity of small-scale fisher at the Pangandaran Landing Site (one of the coastal area part of FMA 573) calculated based on fishing effort and catch per unit of effort (CPUE). The research location chosen was Pangandaran Landing Site as one of the fish landings located in South Coast of West Java as part of FMA 573. This location was chosen because this area mostly consists of small-scale fisher. This research was conducted in 2019-2020 using a survey method. The collected data consists of primary data and secondary data which are collected through direct surveys to the data provider agencies. The data obtained are qualitative data and quantitative data which will be analyzed and interpreted descriptively. The results showed that the annual small pelagic fish production in Pangandaran Landing Site was 1,801 tons with the dominant type of small pelagic fish was ***Rastrelliger negelectus****. The type of fishing gear used by fisher dominated by gill nets such as drift gill nets, stationary gill nets and trammel nets. The highest production and fishing effort to catch small pelagic fish is the stationary gill net. The average annual CPUE of fishing gear was 0.84 ton per trip and the highest CPUE of fishing gear occurred in 2014 (1.01 tonnes per trip).*

Keyword: *CPUE, fishing effort, small pelagic fisheries, small scale fisheries, FMA 573 and Pangandaran Landing Site*

1. INTRODUCTION

Small pelagic groups are epipelagic, living on the surface to a depth of 200 m of the ocean. This group is able to perform horizontal and vertical migration [1]. In general, small pelagic fish live to form schooling, in large groups. [2]. According to the Ministry of Marine Affairs and Fisheries Republic of Indonesia, Ministerial Decree No. 47/2016 Concerning Estimation of Fisheries Potential in Indonesian FMAs [3], the potential of small pelagic fish resources in FMA 573 reaches 630,521 tons / year with total allowable catch (TAC) 504,417 tons per year. However, at this time the level of utilization of small pelagic resources is already in the overfishing level with a utilization rate of 1.50 or 150%. This indicates the need for good management of the small pelagic fish resources that exist in the area. Sustainable management of pelagic fish resources is needed to maintain the sustainability of fish resources in Indonesian Fisheries Management Area [1].

According to the Regulation of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia [4] FMA in Indonesia consists of eleven (11) territory. FMA 573 was fisheries management area covering the Indian Ocean, southern of Java to the south of Nusa Tenggara, Savu Sea and Western of Timor Sea. According to Ministerial Decree No 77/2016 concerning the Fisheries Management Plan for the State Fisheries Management Area

of the Republic of Indonesia 573 [5], the province which has the authority and responsibility for managing fish resources in FMA 573 consists of 8 (eight) provincial governments (Banten Province , West Java Province, Central Java Province, Yogyakarta Special Region Province, East Java Province, Bali Province, West Nusa Tenggara Province, and East Nusa Tenggara Province). The coastal areas of West Java which part of Indian Ocean are Pangandaran, Palabuhanratu, Garut, Cianjur and Tasikmalaya. The characteristics of the oceans (Indian Ocean) have high waves and fluctuating oseaographic conditions for fishing activities. This causes these areas not have as much small-scale fishery production as in the coastal areas of the Java Sea (FMA 712). Small-scale fisheries in the Southern Region of Java focus on small scale of small pelagic, demersal and crustacean fish. Meanwhile, the potential for large pelagic fish is utilized by large-scale fishing fleets (business scale).

2. METHOD

The research location chosen was Pangandaran Landing Site sebagai salah sat pendaratan ikan di Pesisir Selatan Jawa Barat. Lokasi ini dipilih sebab daerah ini merupakan daerah yang secara mayoritas terdiri dari nelayan skala kecil. Penelitian ini dilaksanakan pada tahun 2019-2020 dengan menggunakan metode survey. Data yang dikupulkan terdiri data primer dan data sekunder yang dikumpulkan melalui survey langsung ke instansi penyedia data. Data yang diperoleh bersifat data kualitatif dan data kuantitatif yang akan dianalisis dan diinterpretasikan secara deskripsi. Catch data and unit effort units are calculated to find out the CPUE value. Unit effort is the number of operational boat fishing trips [6].

3. RESULT AND DISCUSSION

3.1. Production of Small Pelagic Fishery

Small pelagic fish production data collected was production data from 2010 to 2015. It was obtained from the Fisheries, Marine and Food Security Office of Pangandaran Regency. Since Pangandaran becoming a new autonomous region in West Java, production has grown from year to year. In 2010 the production reached 485 tons per year. In 2011, pelagic fish production decreased to 275 tonnes. During 2012 to 2015, there was a gradual increase. In 2012 the production of pelagic fish was 621 tons, in 2013 it increased to 710 tons and in 2014 it was 1,476 tons. In 2015, production reached a significant increase of 7,261 tons, where this production was the highest compared to previous years. A picture can be seen in Fig. 1. Indonesian territorial waters are the route of the monsoon system, which reverses two times a year which affects the fishing season [7]. The abundance of pelagic fish is very sensitive to environmental changes, especially the spatial distribution of salinity generated by monsoons [8].

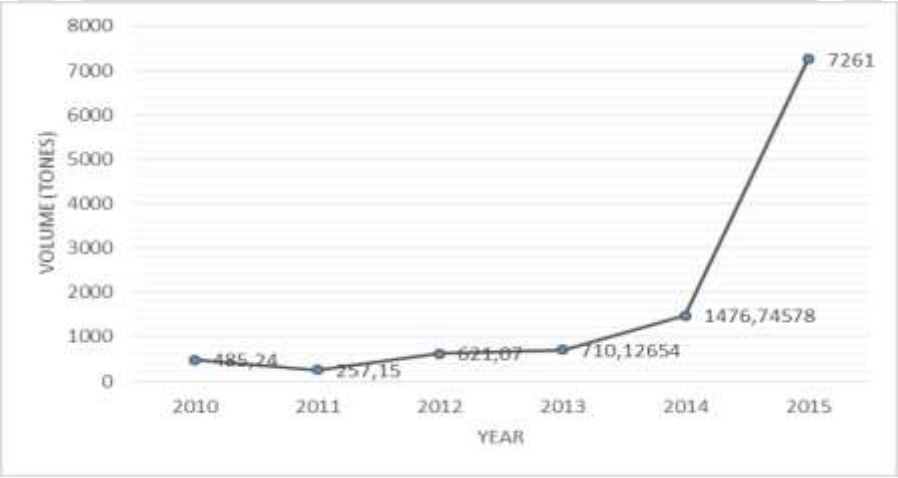

Fig 1. Small pelagic fish production in Pangandaran Landing Site

Small pelagic fish species in Pangandaran have relatively high diversity. Several types include *Rastrelliger negelectus, Rastrelliger kanagurta, Anodontostoma sp, Sardinella Lemuru, Scomberoides sp, Decapterus Selaroides* etc. (Fig. 2). The diversity of this pelagic fish can be influenced by the similarity of habitat and feeding of the gorund. The abundance of fish in the fishing grounds can be caused by special factors. According to Chodrijah [8]

changes in environmental conditions affect several types of fish to migrate, such as *Decapterus* sp and many migratory fish following changes in water salinity. In addition, the existence of food sources is also a factor in the abundance of pelagic fish. Habitat with chlorophyll-a and optimal temperature is the main factor compared to other oceanographic parameters. Therefore, the success factor in fishing activity is accuracy to decide a suitable fishing ground for fishing operations [9][10].

From Fig. 2 shows that the highest production of small pelagic fish is *Rastrelliger negelectus*. In addition, several other types include *Rastrelliger kanagurta, sardinella lemuru, Scomberoides sp, decapterus sp* and so on. The high production of certain types is influenced by the type of fishing gear operated by local fishermen. Rastrelliger sp is a type of small pelagic fish that has high commercial value in Indonesia, so it becomes a catch target for fishermen [11]. According to Al-Zibdah and Obat [12] the scombridae family is an important commercial fishery resource in the world. High production has a good impact on fishermen's income, but on the other hand it can reduce the availability of fish resource stocks. Overexploitation of certain types of fish can threaten the sustainability of fish resources. The lack of areas that can be reached by small-scale fishers causes over-exploitation in coastal areas because fishermen are unable to reach farther fishing areas. for this reason, fishing operations are only carried out during the peak season, so that optimum results will be increase fish productivity and sustainable resources [2].

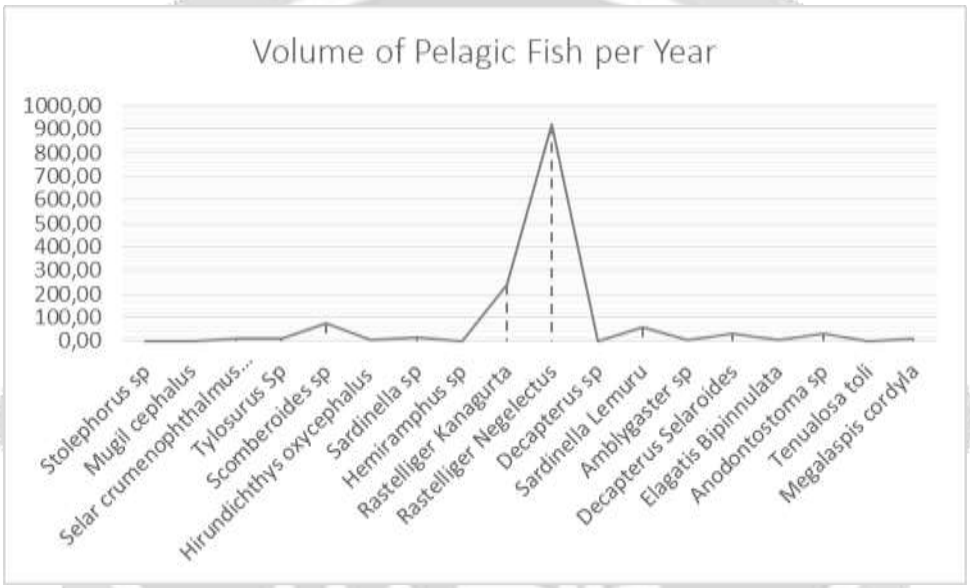

Fig 2. Volume of Small Pelagic fish per Year

3.2. Small Pelagic Fishing Gear

There are several types of fishing gear used by fishermen in Pangandaran as shown in Fig. 3 and Fig 4. The fishing gear for small pelagic fish is dominated by the net fishing gear group. Several types of gill nets, such as drift gill net, stationary gill net and trammel net, are the most popular choices for fisher. Moreover, several types of fishing gear from the net lift group such as boat lift net and lift net set are also chosen by many fisher. Beach seine and mini purse seine become fishing gear which also used to catch small pelagic fish.

Stationary gill net is the fishing gear with the highest average volume each year with an average annual production of 661 tons. Drift gill net is the second highest production fishing gear after stationary gill net. Drift gill net produces 599 tonnes of small pelagic fish per year. Furthermore, trammel net becomes fishing gear with the highest production of 321 tons per year. The group of nets is an effective type of fishing gear used to catch small pelagic fish. The nature of pelagic fish which schooling and migrating makes this type of net still the best option.

On Fig. 4 shows the production of small pelagic fish by type of fishing gear. As an activity that utilizes wild natural resources, fishing activity have the opportunity to fluctuate in production. Besides of being affected the availability of pelagic fish resources in nature, this is also affected by seasonal conditions and the oceanography of fishing grounds. In addition, the factors of effort (such as fishing trips and fishing cappacity) also affect changes in annual production. According to Utami et al. [13] fish production may fluctuate annually, this is reasonable because fish production is not only affected by the number of fishing efforts undertaken, but also by other factors such as labor, abundance of fish resources, and capital.

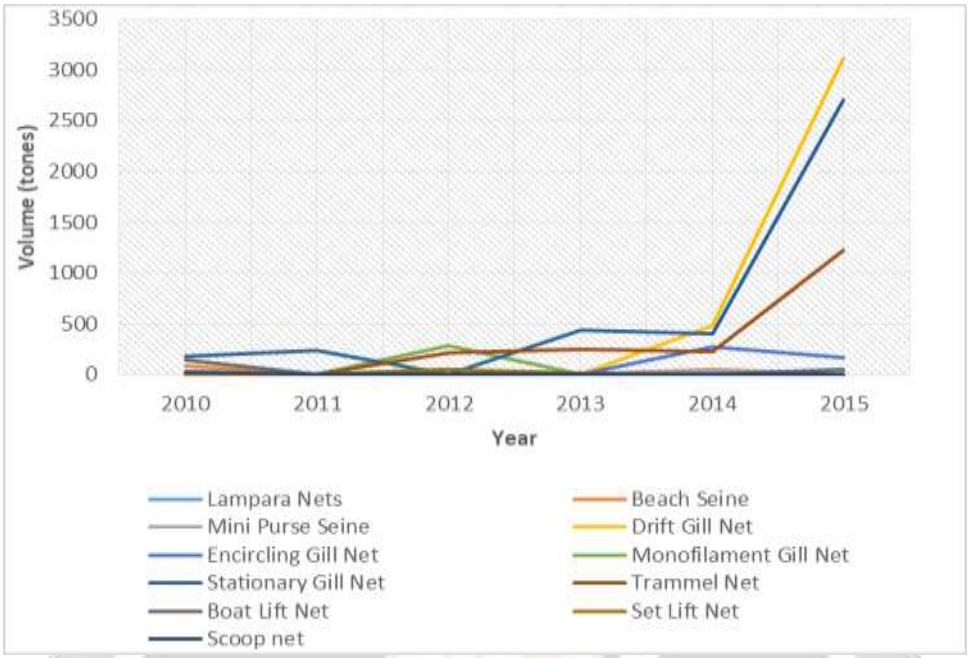

Fig 3. Annual Production based on Fishing Gear used by Small Scale Fisher

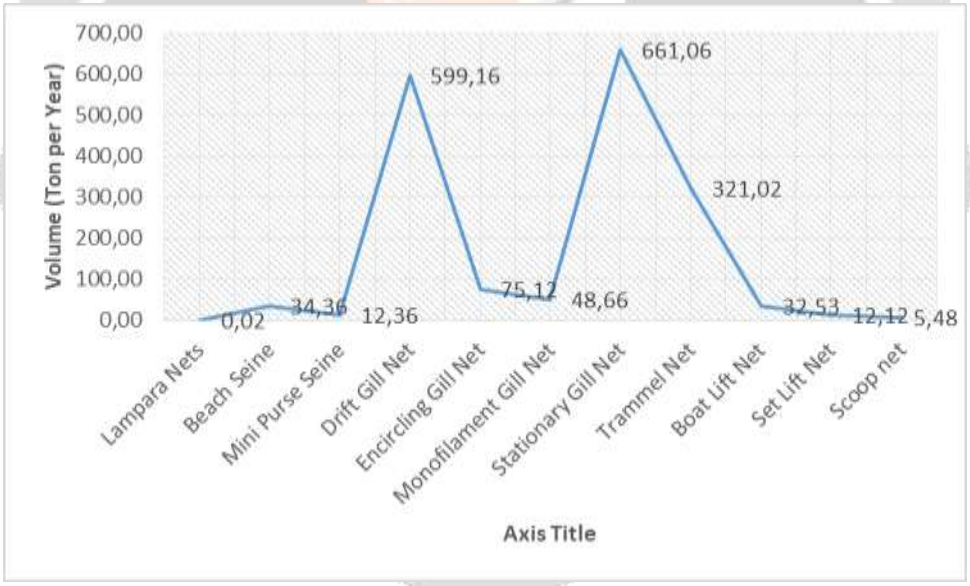

Fig 4. Average production of small pelagic fish per year based on Fishing Gear

3.3. Catch per Unit of Effort (CPUE) for Small Pelagic Fishing Activity

Figure 5 shows fishing effort data on small scale for small pelagic fishing activities. In addition, the fishing power index (FPI) is also calculated to determine the type of fishing gear with the highest CPUE (Table 1). The fishing effort used in the calculation is the trip or the amount of fishing activity. The highest fishing effort is shown by the type of gill net fishing gear. In line with its high production, the gill net fishing gear group also carries out high fishing activities. Stationary gill net is the fishing gear with the highest fishing effort. However, as a fishing gear that produces high production, this fishing gear is also the fishing gear with the highest productivity (CPUE).

Fishing effort is usually used as an indicator for changes in catch numbers, adjusting the efficiency of the catch and measuring the benefits. In addition, fishing effort is also used as information to minimize the number of responses as a sustainable management effort [14]. Several types of indicators used as fishing effort are fishing time (hour or trip), ship capacity, ship engine unit or number of labour (fishers) [14].

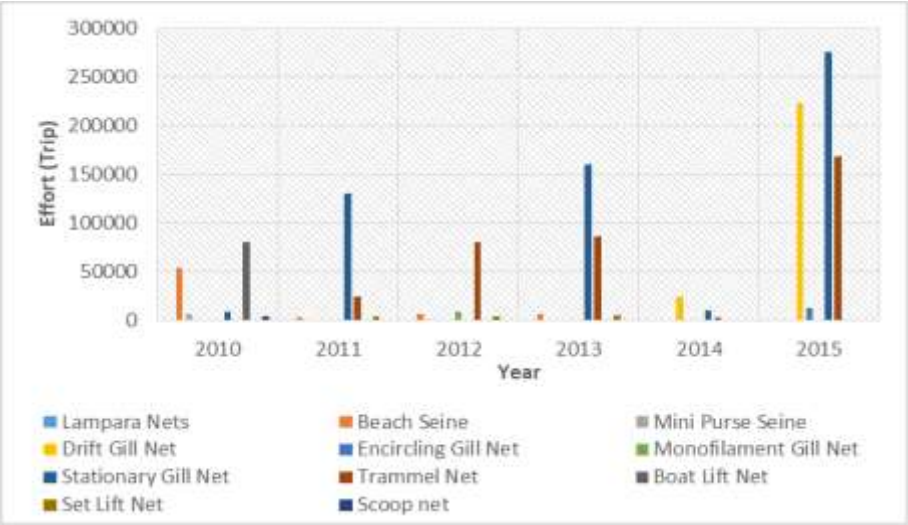

Fig 5. Annual Fishing Effort Fo Small Pelagic Fishing Activity

Fig 6 is the trend of CPUE fishing gear that catches pelagic fish every year. The highest CPUE occurred in 2014. The CPUE value describes the productivity of the fishing gear used to catch small pelagic fish. The Changes of fishing effort numbers can be used as an indicator that measures the abundance of fish resource stocks (including pelagic fish). If the CPUE decreases, this will also illustrate the decline of abundant resources stock [14]. In addition, fishing effort information can also be used as an indicator to predict fishermen's income and fishery profitability [15].

Table 1. CPUE dan FPI and fishing gear that used to Small Pelagic Fishing Activity

No.	Fishing Gear	Catch (Tones)	Effort (Trip)	CPUE (Catch/Trip)	FPI
1	Lampara Nets	0,11	10	0,01	0,01
2	Beach Seine	206,19	72.055	0,00	0,00
3	Mini Purse Seine	74,15	8.290	0,01	0,01
4	Drift Gill Net	3.594,94	248.764	0,01	0,01
5	Encircling Gill Net	450,71	13.680	0,03	0,03
6	Monofilament Gill Net	291,99	9.649	0,03	0,03
7	Stationary Gill Net	578.991,55	588.455	0,98	1,00
8	Trammel Net	1.926,12	365.347	0,01	0,01
9	Boat Lift Net	195,17	81.851	0,00	0,00
10	Set Lift Net	72,71	14.372	0,01	0,01
11	Scoop net	32,89	4.680	0,01	0,01

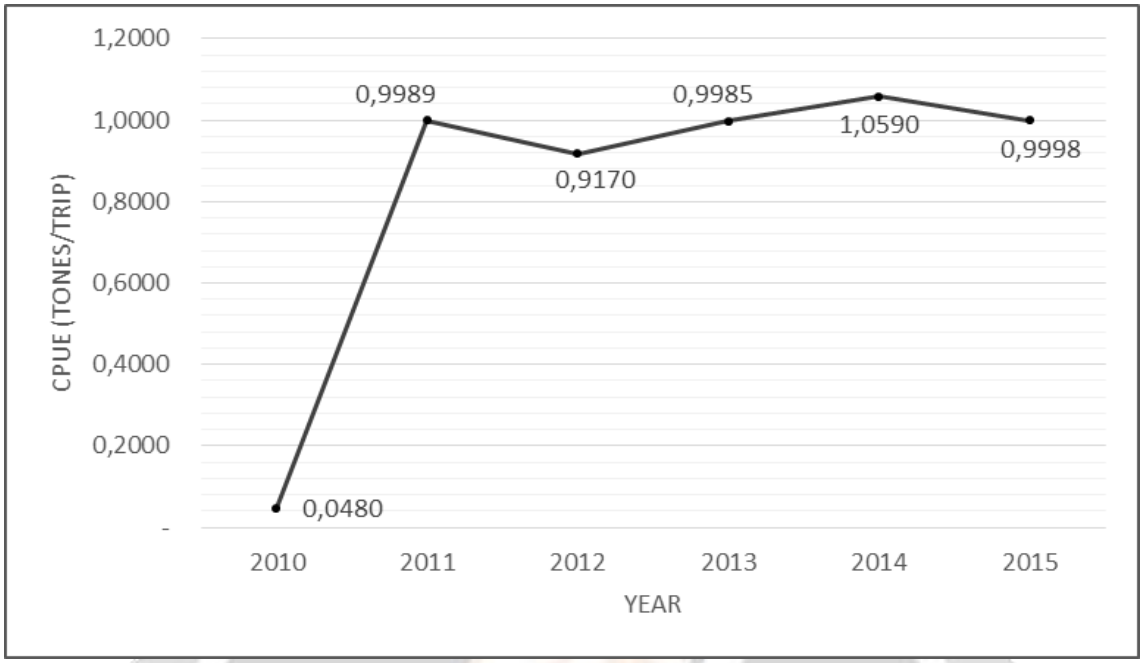

Fig 6. CPUE of Small Pelagic Fishing Gear

4. CONCLUSIONS

The conclusions of this research are::

1. The annual small pelagic fish production in Pangandaran Landing Site was 1,801 tons with the dominant type of small pelagic fish was *Rastrelliger negelectus*.
2. The type of fishing gear used by fisher dominated by gill nets such as drift gill nets, stationary gill nets and trammel nets.
3. The highest production and fishing effort to catch small pelagic fish is the stationary gill net.
4. The average annual CPUE of fishing gear was 0.84 ton per trip and the highest CPUE of fishing gear occurred in 2014 (1.01 tonnes per trip).

5. REFERENCES

[1] Ma'mun A, Priatna A, Hidayat T, Nurulludin N. Distribution and Potential of Pelagic Fish Resources in the Territory of the Republic of Indonesia 573 Fisheries Management (Wpp Nri 573) Indian Ocean. *J Researchers in Indonesia*. 2017; 23 (1): 47.

[2] Simbolon, D., Wiryawan, B., Wahyuningrum, P. I., & Wahyudi, H. (2011). The utilization rate and the fishing season pattern of Lemuru in the waters of the Bali Strait. *Buletin PSP*, 19(3).

[3] Ministry of Marine Affairs and Fisheries Republic of Indonesia, Ministerial Decree No. 47/2016 Concerning Estimation of Fisheries Potential in Indonesian FMAs, Jakarta, 2016

[4] Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia. *Regulation of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia No.18 / PERMEN-KP / 2014 Regarding the Regional Fisheries Management Territory of the Republic of Indonesia*. 2014. Jakarta, Indonesia.

[5] Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia. Ministerial Decree No 77/2016 concerning the Fisheries Management Plan for the State Fisheries Management Area of the Republic of Indonesia 573. 2016. Jakarta, Indonesia.

[6] Tampubolon PARP, Sulistyaningsih RK, Nugraha B. Troll Line Neritic Sheets Fisheries In Strait, East Lombok (FMA 573). *IOTC*. 2015; (Fma 573): 1-14.

[7] Rahman, M. A., Syamsudin, M. L., & Agung, M. U. K. (2019). The Effect of Season on Oceanographic Conditions in Determining the Catching Area of Skipjack (Katsuwonus pelamis) in Southern Waters of West Java. *Fisheries and Marine Sciences Journal*, 10(1).

[8] Chodrijah, U., & Hariati, T. (2017). Season for catching small pelagic fish in the Java Sea. *Indonesian Fisheries Research Journal*, 16(3), 217-233.

[9] Zainuddin, I. A. M. M., & Mallawa, A. (2012). Determination Of Habitat Characteristics Of Potential Small Pelagic Fish With A Spatial Approach In Synjai Waters Determination Of Local Potential Fish Habitat Characteristics Small Pelagic Spatial. Reserach Journal of Faculty of Marine Sciences and Fisheries, Universitas Hasanuddin, Makassar, 10.

[10] Yusop, S. M., Mustapha, M. A., & Lihan, T. (2021). Determination of spatio-temporal distribution of Rastrelliger kanagurta using modelling techniques for optimal fishing. *Journal of Coastal Conservation*, 25(1), 1-17.

[11] Nurdin, S., Mustapha, M. A., Lihan, T., & Zainuddin, M. (2017). Applicability of remote sensing oceanographic data in the detection of potential fishing grounds of Rastrelliger kanagurta in the archipelagic waters of Spermonde, Indonesia. *Fisheries Research*, *196*, 1-12.

[12] Al-Zibdah M, N Obat. 2007. Fishery status, growth, reproduction biology and feeding habit of two scombrid fish from the Gulf of Aqaba, Red

[13] Utami, Gumilar, Sriati. 2012. Bioeconomic analysis of catching layur fish (Trichirus sp.) In Parigi waters, Ciamis Regency. *Journal of Aquatica*. 3(3): 137-144

[14] McCluskey, S. M., & Lewison, R. L. (2008). Quantifying fishing effort: a synthesis of current methods and their applications. *Fish and fisheries*, *9*(2), 188-200

[15] Rahikainen, M. and Kuikka, S. (2002) Fleet dynamics of herring trawlers-change in gear size and implications for interpretation of catch per unit effort. *Canadian Journal of Fisheries and Aquatic Sciences* 59, 531–541.