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Research Article

Production, Fishing Season and Fishing Ground of the Dominant Fish (*Euthynnus affinis, Mene maculata, Leiognathus equulus*) Caught by Boat Seine in Palabuhanratu Indonesia

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ABSTRACT

Boat Seine net is a very productive fishing gear in Nusantara Fisheries Port (NFP) Palabuhanratu. Boat Seine was a fishing unit that has the third largest contribution to the provision of fish stocks in 2019, which is 9% of the total production volume of NFP Palabuhanratu after lift net (40%) and longline (35%). The purpose of this study was to analyze the composition of the main catch, productivity, fishing season and to analyse the fishing ground in Palabuhanratu Bay. The type of data collected in this study was quantitative data. Primary data from interviews and field observations of fish landing activities at Palabuhanratu in October 2020 were used to compile this study's data, which included the type of fishing gear used, the composition of the types, and the production of the catch. Secondary data collected were monthly catches and trips made by Boat Seine fishing units. By analyzing the data of Boat Seine net fishing from 2015 to 2019, descriptive analysis method was used to investigate the composition of Boat Seine net catch. The results of the research showed that mackerel (*Euthynnus affinis*), moonfish (*Mene maculata*), and ponyfish (*Leiognathus equulus*) are the dominant fishes caught at the Palabuhanratu waters. The productivity level of Boat Seine net was 348 Kg/Trip in 2015, which increased to 603 Kg/Trip in 2019. The mackerel season occurs around May to September and November. Moonfish fishing season occurs in March, September and October. Ponyfish fishing season occurs in January, March, May, October, November, and December. Boat Seine net fishing grounds in the waters of Palabuhanratu Bay are relatively stationary around the waters of Palabuhanratu Bay.

Keywords: CPUE, Fishing Area, Fishing Season Index, Productivity

ABSTRAK

Alat tangkap payang merupakan alat tangkap yang sangat produktif di Pelabuhan Perikanan Nusantara (PPN) Palabuhanratu. Payang merupakan unit penangkapan ikan terbesar ketiga yang memiliki kontribusi terhadap penyediaan stok ikan tahun 2019, yaitu sebesar 9% dari total volume produksi PPN Palabuhanratu setelah lift net (40%) dan longline (35%). Tujuan dari penelitian ini adalah untuk menganalisis komposisi, produktivitas, musim penangkapan, dan daerah tangkapan alat tangkap payang di teluk Palabuhanratu. Jenis data yang dikumpulkan dalam penelitian ini adalah data kuantitatif. Data primer yang merupakan hasil wawancara dan observasi lapangan kegiatan penelitian di Palabuhanratu pada bulan Oktober 2020 digunakan untuk menyusun data penelitian ini yang meliputi jenis alat tangkap yang digunakan, hasil tangkapan, dan produksi hasil tangkapan. Data sekunder yang dikumpulkan adalah produksi hasil tangkapan bulanan dan jumlah trip unit payang. Dengan menganalisis data hasil tangkapan payang dari tahun 2015 sampai dengan tahun 2019, analisis deskriptif digunakan untuk mengkaji komposisi hasil tangkapan payang. Hasil dari penelitian ini menunjukkan ikan kembung (*Euthynnus affinis*), ikan eteman (*Mene maculata*), dan ikan peperek (*Leiognathus equulus*) merupakan hasil tangkapan utama di perairan Palabuhanratu. Tingkat produktivitas payang pada tahun 2015 sebesar 348 Kg/Trip meningkat menjadi 603 Kg/Trip pada tahun 2019. Musim ikan tenggiri terjadi sekitar bulan Mei sampai September dan November. Musim penangkapan ikan bulan terjadi pada bulan Maret, September dan Oktober. Musim penangkapan ikan ponyfish terjadi pada bulan Januari, Maret, Mei, Oktober, November, dan Desember. Daerah

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penangkapan payang di perairan Teluk Palabuhanratu relatif masih berada di sekitar perairan Teluk Palabuhanratu.

Kata kunci: CPUE, Daerah Penangkapan Ikan, Musim Penangkapan Ikan, Produktivitas

1. Introduction

Palabuhanratu Bay is very potential and strategic for capture fisheries, this was supported by the catch that was obtained at the Nusantara Fisheries Port (NFP) Palabuhanratu are classified as high economic value fish such as: Hairtail (Trichiurus sp.), tuna (Thunnus sp.), mackerel (Euthynnus sp.), southern red snapper (Lutjanus sp.), mackerel (Scomberromo sp.), and various other fish. Boat Seine was a fishing unit that has the third largest contribution to the provision of fish stocks in 2019, which is 9% of the total production volume of Palabuhanratu NFP after lift net (40%) and longline (35%) (Dinas Kelautan dan Perikanan Kabupaten Sukabumi, 2020). Boat Seine net was a fishing gear that has relatively high productivity because it is an active fishing gear. Boat seines are known in almost all Indonesian marine waters. The names of Boat Seine in various regions are different, including payang (Jakarta, Tegal and Pekalongan), payang uras (Bali), payang gerut (Bawean), or jala lompo (East Kalimantan, South Sulawesi) (Genisa, 1998). It has been a long time since this fishing tool was used, Boat Seine can be classified as a traditional fishing tool. The existence of Boat Seine net fishing units in Indonesian marine fisheries are considered important both in terms of productivity and the number of workers involved.

The fishing gear that is widely used by fishermen from Palabuhanratu is boat seine. There are 68 units in 2019 (PPN Palabuhanratu 2020). Boat seine is a fishing gear made of nets and boat seine fishing gear including wings, body, pockets, ropes, and ballast (Purwangka et al. 2013). Boat seine fishing gear is a fishing gear used to catch swarm of pelagic fish (Sulistiawan and Pagiyar 2012) the species of pelagic fish which have high economic value and are mostly caught by boat seine fishing gear are skipjack tuna (*Katsuwonus pelamis*). The production volume of skipjack tuna in PPN Palabuhanratu obtained by boat seine fishing gear in 2019 is 115.3 tons or 10.3% of the total volume of skipjack production at PPN Palabuhanratu (PPN Palabuhanratu, 2020).

The catch from the boat seine fleet in Palabuhanratu has provided the largest contribution to the total catch (Wijopriyono and Rachmawati, 2015). Information on the presence of fish to determine the fishing area with the right boat seine can increase the success of catching the boat seine fleet. According to Sulistiawan and Pagiar (2012) the percentage of successful fishing with boat seine in Palabuhanratu based on the number of settings and setting time is still low.

Estimating the pattern of fishing season is one of the efforts to obtain information about the presence of fish in a fishing area. Fishermen usually do not conduct empirical studies, and follow changes in seasonal patterns that just happen. Management of changing seasonal patterns can increase fishing efficiencies, so that fishermen can make good preparations before carrying out fishing operations and get high catches. therefore, information on peak season predictions and seasonal patterns are required. (Chodrijah, U., Hariati, T. 2017). Based on this, the authors are interested in conducting research to find out how much Boat Seine net productivity, Boat Seine net dominant fishing season so that it provides optimal benefits for fishermen and to know about the catchment area for Boat Seine net fishing gear that operates in Palabuhanratu waters. This information is important and will hopefully help fishermen choose when and where to operate their boat seines. The purpose of this study was to analyze the composition of the boat seine catch, the productivity of the main catch, the fishing season, and to analyze the fishing ground for boat seine gear in Palabuhanratu Bay.

2. Material and methods

This research was conducted at NFP Palabuhanratu, Sukabumi, in October 2020. Interviews were conducted with 20 fishermen, the head of Palabuhanratu Fishing Port, and their staffs, using a survey method. The information obtained is in the form of data on catch production, catch composition, and other information. The information collected is then processed and analysed in Department of Fishery Resources Utilization, Faculty of Fisheries and Marine Sciences, IPB University. Primary data from interviews and field observations of fish landing activities at Palabuhanratu Fishing Port in October 2020 were used to compile this study's

data, which included the type of fishing gear used, the composition of the types, and the production of the catch. Secondary data collected were monthly production and trips by boat seine fishing units from 2015-2019. This data was obtained from statistical data from the Department of Maritime Affairs and Fisheries of Sukabumi Regency. Descriptive analysis was used to investigate the composition of Boat Seine catches through the analysis of Boat Seine catch data from 2015-2019.

2.1. Productivity

According to Wudji and Suwarso (2015), CPUE calculations with the following formula:

$$CPUE_i = \frac{Catch_i}{Effort_i}$$

Where :
CPUEi : catch per effort expended at time-i (kg/trip)
Catchi : catch at time-i (kg)
Efforti : effort expended at time-i (trip)

If the value of the CPUE trend increases from year to year, it can be considered that the fish resources in the area are relatively good, which means that the fishing business is presumably still profitable and vice versa if the CPUE trend decreases, it is suspected that overfishing symptoms will begin (Prasetyo et al., 2018)

2.2. Fishing Season Index

According to Wahju et al. (2011) the calculation steps are as follows:

1) Arrange a series of CPUEi from January 2015 until December 2019

$$ni = CPUEi$$

Where:
i : 1, 2, 3,....., n
ni : CPUE sequence-i

2) Arrange moving average CPUE for 12 months (MA)

$$MAi = \frac{1}{12}\left(\sum_{i=i-6}^{i+5} CPUE\right)$$

Where:
MAi : moving average 12 month sequence-i
CPUEi : CPUE sequence-i
i : 6, 7,..., n-5

3) Arrange moving average centered CPUE (MAC)

$$MACi = \frac{1}{2}\left(\sum_{i=i}^{i=1} MAi\right)$$

Where:
MACi : moving average centered CPUE sequence-i
MAi : moving average 12 month sequence-i
i : 7, 8, ..., n-5

4) Month Average Ratio (MAR)

$$MARi = \frac{CPUEi}{MACi}$$

Where:
MARi : month average ratio-i
CPUEi : CPUE sequence-i
i : 6, 7, ..., n-5

5) Arrange average value in matrix ixj for each month, starting form June-July. Next calculate the value of the total average ratio each month, then calculate the total of whole average and catching season pattern.

(1) The average ratio for sequence month-i (ARSMi)

$$ARSMi = \frac{1}{n}\left(\sum_{j=1}^{n} ARSMij\right)$$

Where :

ARSMi : average ratio for sequence month-i
ARSMij : average ratio for sequence month i x j
i :1, 2, ..., 12
j : 1, 2, 3, ..., n

(2) Total of month average ratio (TMAR)

$$TMAR = \sum_{i=1}^{12} ARMSi$$

Where :
TMAR : total month average ratio
ARMSi : average ratio for sequence month-i
i : 1, 2, ..., 12

(3) Calculate correction factor

The ideal value of JRRB is 1200, however, many factors cause the value to stray from 1200, therefore, the month average ratio must be corrected with a value, called correction factor (CF).

$$CF = \frac{1200}{TMAR}$$

Where :
CF : correction factor
TMAR : Total of month average ratio

(4) Catching seasonal index

$$FSIi = ARSMi \; x \; CF$$

Where :

FSIi : fishing seasonal index sequence-i
ARSMi : average ratio for month sequence-i
i : 1, 2, ..., 12

Fishing Season Index (FSI) used to determine the appropriate time to carry out fishing operations so that the level of profit obtained by fishermen can be maximized with sustainable fish resources. According to Zulkarnain *et al*. (2012), fishing season is divided into three categories. The category are lean season with an FSI value of less than 50%, normal season with an FSI value between 50% to 100%, and peak season with an FSI value of more than 100%.

2.3. Boat Seine Net Fishing Ground

Data was taken to make a map of the distribution of fishing areas using coordinate point data (latitude and longitude) obtained from boat seine activities at NFP Palabuhanratu. Respondents who were selected were the captain or crew of the boat. The data collected to make a map of the distribution of fishing areas, the size of the gross tonnage (GT), the coordinates of the fishing location and the time of capture. The data processed using hardware tabulated in Microsoft Excel and then converted into position data (Degree, Minute, Second / D°M'S". The latitude and longitude data will be turned into numerical formulas. Then processed using ArcGIS 10.3 software to form a thematic map that is a map of the distribution of fishing areas in the NFP Palabuhanratu. The high fishing activity in an area indicates that the area is likely to have an abundant distribution of fish, so that the area can be used as a good area for fishing activities. (Rivai et al. 2017).

3. Results and Discussion

3. 1. Results

3.1.1. Catch Composition

The main target catch for Boat Seine net fishing gear was mackerel or pelagic fish, but there are also any other fish species caught in this fishing gear. Based on the results of the research seen from the last 5 years in the waters of Palabuhanratu bay, the catch was dominated by mackerel (*Euthynnus affinis*) by 39%, moonfish (Mene maculata) by 26%, ponyfish (Leiognathus equulus) by 18%, but there are also 17% of other species were caught. The composition of the Boat Seine net catch during the last 5 years can be seen in Figure. 1.

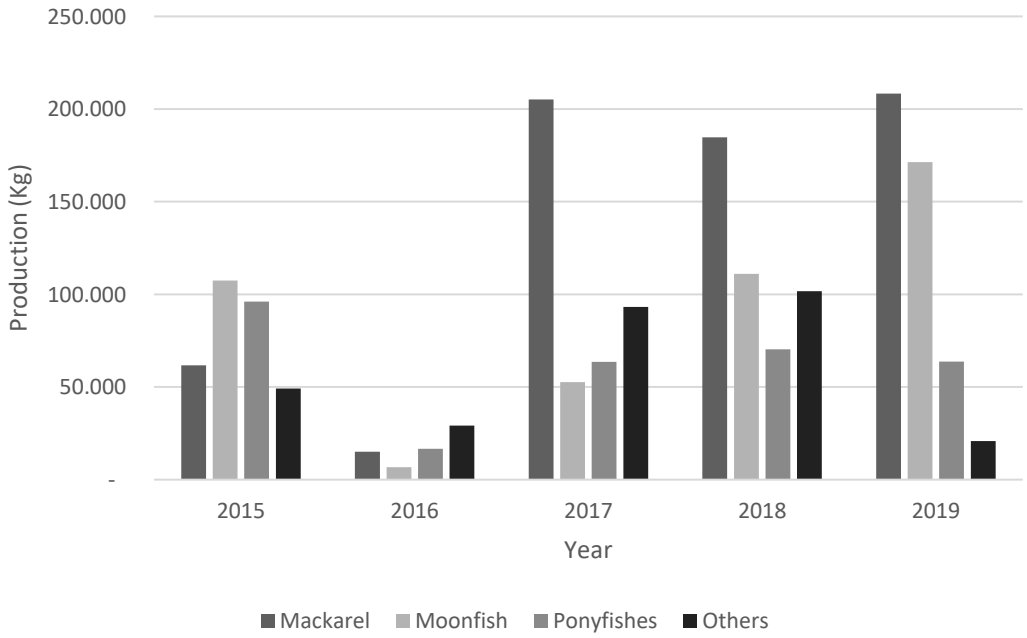

Figure 1. Number of Boat Seine net Catch in 2015-2019

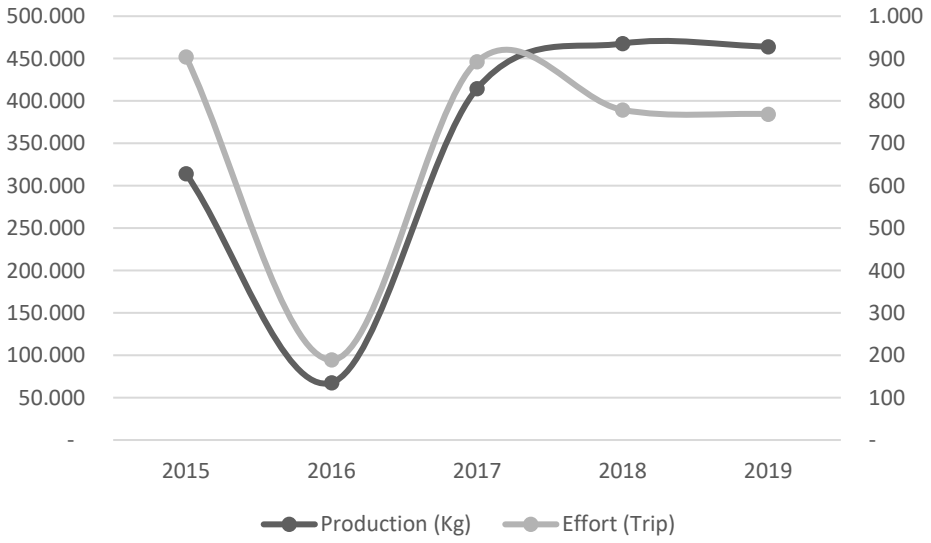

Figure 2. Boat Seine net production and effort from 2015-2019

3.1.2. Boat Seine net Production

Based on Figure 2, it can be seen that the production of boat seine fishing gear at PPN Palabuhanratu in 2015-2019 fluctuated. In 2015, the production of boat seine was 314,328 Kg. In 2016, the production of boat seine decreased significantly to 67,619 kg. In 2017-2018 the production of boat seine increased again to 414,571 kg and 464,124 Kg and then in 2019 it decreased again to 464,124 Kg.

3.1.3. Productivity

The productivity of Boat Seines at NFP Palabuhanratu has increased from year to year. The lowest productivity value occurred in 2015 which was 348 kg/trip. The highest Boat Seine productivity value in Palabuhanratu occurred in 2019 which was 603 kg/trip. The increase in Boat Seine productivity is due to the increase in the number of catches accompanied by a decrease in the number of fishing trips.

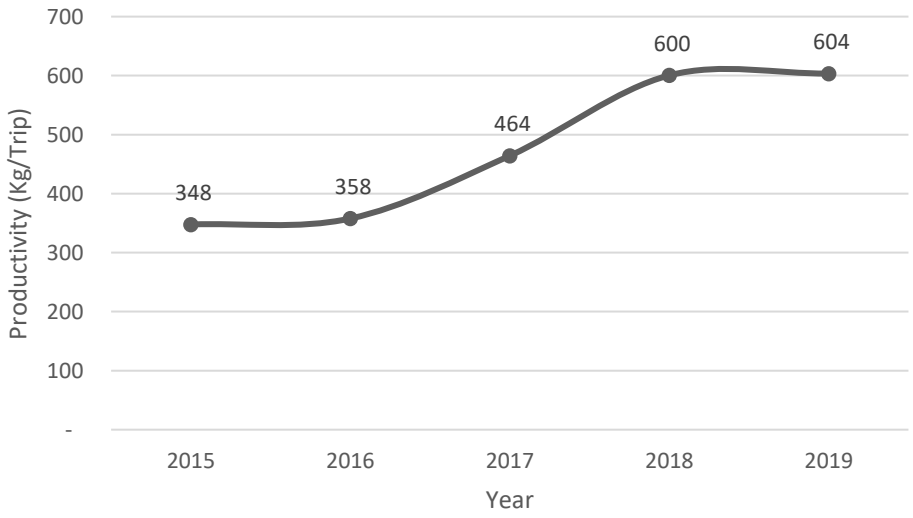

Figure 3. Boat Seine net productivity from 2015-2019

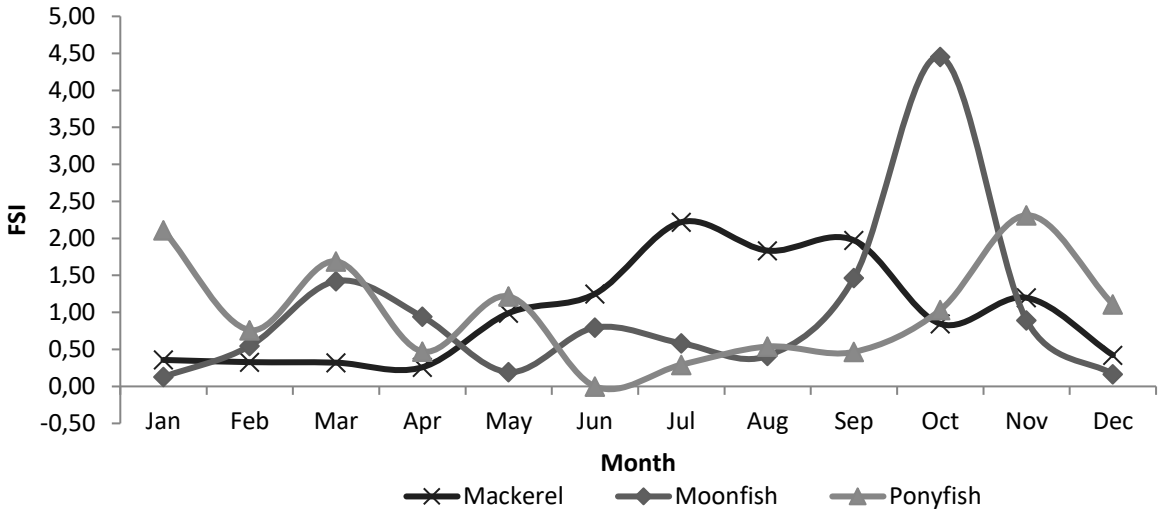

Figure 4. Mackerel, moonfish and ponyfish fishing season index

3.1.4. Fishing Season Index

This analysis uses monthly CPUE data for a specific time (from 2015-2019). Based on the FSI value, it can be seen the trend of the fishing season so that the right fishing time can be determined. The fishing season index value can be seen in Figure. 4.

The mackerel fishing season based on the fishing season index value shows that the mackerel season occurs around May to September and November where the fishing season index value is above 100%. According to Ulrich and Andersen (2004), the consecutive seasonal index is the number of indices above 100% in a row where the value of this consecutive seasonal index describes the length and shortness of the fishing season. The highest mackerel fishing season index occurred in July (221.95%) and the lowest occurred in March (32.04%)

Based on the FSI value, moonfish fishing season in Palabuhanratu bay occurs in March, September and October. Meanwhile, January, February, April to August, and December are bad season for catching moonfish. The peak of the moonfish fishing season based on the calculation of the fishing season index value occurred in October (445.39%) and the lean season in January (12.80%)

The best fishing season for catching ponyfish in Palabuhanratu Bay, namely January, March, May, October, November, and December. Peak Ponyfish fishing season occurs in November (231.28%) and June is the lean season (0.00%).

3.1.5. Boat Seine Net Fishing Ground

The fishing ground location is around Batu Belah, Ciletuh bay, Lawang Jampang, and Cikepuh as well as in the waters of Palabuhanratu Bay and its surroundings. The fishing ground positions that are often used by Boat Seine net net fishermen are as presented in Table 1 and Figure 5.

3. 2. Discussions

Boat Seine nets were quite effective for catching pelagic fish, especially mackerel (Euthynnus affinis). These fish dominate the catch of large pelagic fish in Palabuhanratu. In addition to these types of fish, other pelagic fish are sometimes caught, such as tuna (Thunnus sp.), Dolphin fish (Coryphaena hippurus), litte tuna (Scomberomerous sp.), moonfish (Mene maculata), Ponyfish (Leiognathus sp.), Scad (Decapterus sp.), and others (Rahmat, 2016). This is consistent with the results, the dominant catches of Boat Seine net were mackerel (Euthynnus affinis) by 39%, moonfish (Mene maculata) by 26%, Ponyfish (Leiognathus equulus) by 18%, and another 17% of the species were caught.

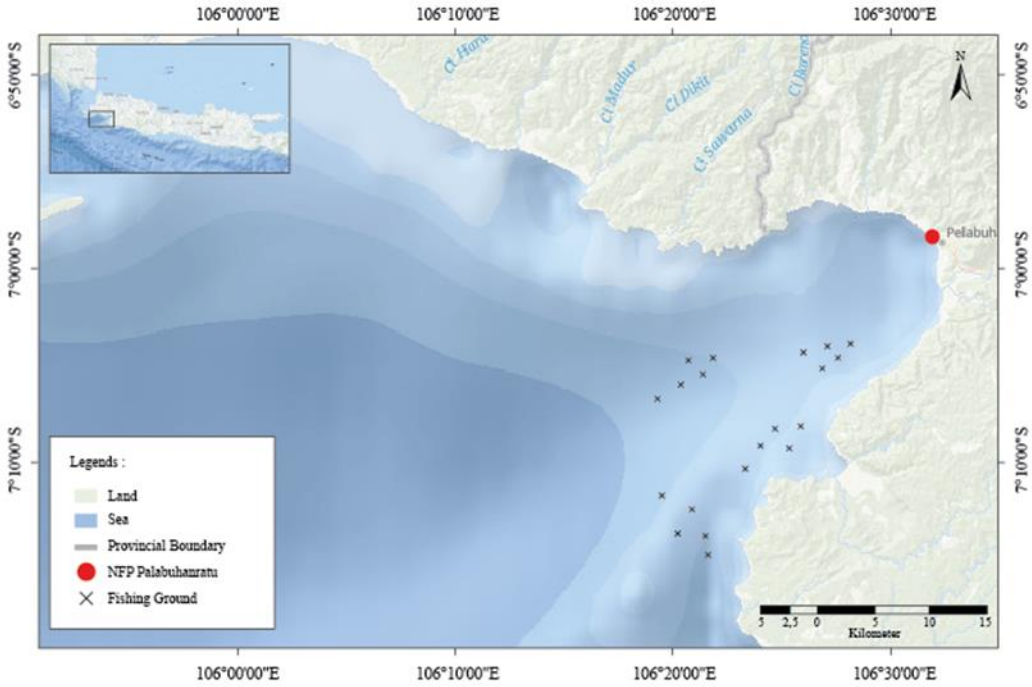

Figure 5. Boat Seine Net Fishing Grounds

The composition of the types of boat seine catches varied and generally were pelagic fish, there were also several types of demersal fish caught boat seine fishing gear. The types of demersal fish that were landed by the boat seine fishing unit at the PPN Palabuhanratu included mackarel, moonfish and ponyfish. There was a diurnal migration pattern of fish where the migration pattern is a form of fish response to the environment. The forms of migration patterns include looking for food, avoiding predators, and spawning (Zainuri 2019). The catch of demersal fish by boat seine fishing gear is also influenced by fishing ground of boat seine and the depth of the boat seine net when it is operated, the boat seine operated by fishermen from Palabuhanratu generally reaches a depth of 45-60 meters, while the type of demersal fish caught is at a depth of 5-110 meters. still including the depth of operation of the boat seine so that the demersal fish are also caught.

The catch of fish is also influenced by technical factors in its operation, technical factors have an influence on the effectiveness that increases the productivity of the fishing unit. Technical factors that influence the productivity of boat seine include the length of time required for setting and hauling where the faster the time required, the fewer fish that escape. The influence of the technical aspect is influenced by the number of crew members in the fishing operation. The results of the correlation analysis between ABK (crew) and technical factors indicate a negative correlation, which means that if the first variable is large, the second variable is small (Sarwono 2006). So that it can be explained that if the number of crew members is more, the time needed for setting and hauling is less. The effect of the number of crew members on the length of time required is related to the division of tasks and efficiency of resources so that determining the right number of crew members is necessary to increase the effectiveness of fishing gear operations and increase productivity.

Productivity can provide information to fishermen about the ability level of a fishing gear to obtain catches. If the fishing area is known in advance, it will be more effective and efficient to increase fishing productivity (Nurhayati et al., 2018; Rahman et al., 2019; Saraswati et al., 2019). Fishermen can make the fishing process easier and reduce the risk of losing money. An increase in fishing business and production in the long term can cause a decrease in fish biomass and fishermen's income. In the long run, an increase in fishing business and production may result in a decrease in fish biomass and fishermen's income. The productivity level of NFP Palabuhanratu has grown from 2015 to 2019. This may be due to the effect of the efficiency of

fishing gear operations (Mayu et al., 2018) which includes fishing tactics (Budiarti et al., 2015), environmental factors such as fishing area regulation (Masturah et al., 2014), and oceanographic conditions (Gaol & Sadhotomo, 2007). The abundance of fish in a waters cannot be separated from the parameters of oceanographic conditions (such as temperature, salinity, waves, pH, currents, and chlorophyll-a) (Arifin, 2014). These parameters have no effect in addition to the distribution of fish, but also as an indicator of fish migration, schooling behavior, spawning, and the availability of food in the waters (Setyohadi, 2011). In addition, the number of trips from year to year causes the depletion of fish resources (Nababan & Sari, 2007; Purwanto & Nugroho, 2011). The business of Boat Seine net fishing is still very profitable, and the catch rate can be increased. This is evidenced by the fact that the productivity value of Boat Seine net fishing gear has increased from 2015 to 2019.

In Boat Seine net fishing, information about fishing season patterns is also required. Currently, most fishermen still rely on experience from generation to generation (Wudji et al., 2012; Wudji & Suwarso, 2015). In addition to determining the fishing season pattern of each type of fish, it is hoped that fishing activities will be carried out on time and under control, and fishing will be more effective and efficient by knowing the fishing area in advance (Harjanti et al., 2012; Branenda et al., 2019). The optimal season for tuna fishing occurs in the dry season and transitions season in June, July, August, September and November. The peak season for tuna fishing occurs in July. Other research revealed that Euthynnus affinis is a typical warm water species that does not a preference for low temperature, thus ocean temperature plays an important role in the distribution of Euthynnus affinis (Chiou & Lee, 2004). Euthynnus affinis prefer to live in warmer surface water with the average value of Sea Surface Temperature 29.46 °C and lower Chl-a concentration of 0.3 mg m-3 (Hidayat et al., 2016). Chl-a seemed to be one of the dominant factors to explain the variability in the study area. Thermal or Chl-a fronts often indicate areas of high biological productivity, and hence a high probability finding fish. Primary production provides an attractive habitat for small pelagic fish species (Syamsuddin & Yuliadi, 2018). Overall the condition of the waters and the chlorophyll-a of the waters showed a relationship between the optimal content of environmental parameters and the content of chlorophyll-a had an influence and role on the productivity of tuna fishing in Boat Seine net fishing gear (Mudjib et al., 2013). Chlorophyll-a as an organic product of phytoplankton has a directly proportional relationship. Phytoplankton density has a role in the arrangement of food chains in free waters as producers and triggers the formation of more complex food chains, one of which is the presence of carnivorous/predatory fish such as tuna, tuna, skipjack, and other large fish. Environmental factors support the consistency of the food chain, one of which is the current that plays a role in the circulation of materials in the waters. Mujib et al. (2013) stated that potential fishing ground in Palabuhanratu waters includes areas: Cimandiri, Tanjung Kembar, Gedogan, Ujung Karang Bintang, Ujung Sodongprapat, and Amuran Bay. The potential area is still in the bay of Palabuhanratu. In general, the fishermen call the fishing area with their respective nicknames. Thus, the results of the study indicate the suitability of the results that the fishing area is around Palabuhanratu bay.

4. Conclusions

The results of the research showed that mackerel (Euthynnus affinis), moonfish (Mene maculata), and ponyfish (Leiognathus equulus) were the dominant fishes caught at the Palabuhanratu waters. The lowest productivity value occurred in 2015 which was 348 kg/trip. The highest Boat Seine productivity value in Palabuhanratu occurred in 2019 which was 603 kg/trip. The mackerel season occurs around May to September and November. Moonfish fishing season occurs in March, September and October. Ponyfish fishing season occurs in January, March, May, October, November, and December. The fishing ground of Boat Seine net in the waters of Palabuhanratu Bay is relatively still around the waters of Palabuhanratu Bay.

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