Estimated Potential of Madidihang Tuna (*Thunnus albacares*) landed at the Port of the Archipelago Fisheries in Palabuhanratu.

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ABSTRACT

The estimated potential of tuna is needed in fishing activities, to maintain the sustainability and sustainability of tuna resources. This research was carried out at the PPN in Palabuhanratu, Sukabumi, West Java, in May 2019, using a quantitative descriptive analysis method by calculating the production results with capture effort. This research aims to analyze the production of annual catches, estimate the maximum sustainable potential and estimate the utilization rate of yellowfin tuna. The data used in this study are production data and data on the number of fishing trips by calculating productivity, maximum sustainable potential, and utilization rates. CPUE (Catch per Unit Effort) shows that the average annual production of yellowfin tuna is 295.408 tons with an average fishing effort of 1348128 trips per year. Based on the calculation using the Schaefer model, the estimated maximum sustainable potential or MSY of yellowfin tuna is 517.381 tons per year with a total allowable catch of 413.904 tons. The average percentage value of the utilization rate of yellowfin tuna resources is 71%, so it is categorized as moderate. Port of the Indonesian Fishery in Palabuhanratu in 2013-2017 which has not been overexploited, it is still possible to make additional fishing efforts but must be done in close monitoring to maintain the sustainability and sustainability of the yellowfin tuna resources to remain stable.

Keyword: - *fisheries, fishing gear, Thunnus, Indonesia, fishing port, sustainable fisheries*

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1. INTRODUCTION

According to Pane [1], one of the largest fishing ports on the South Coast of Java and even the largest in West Java is located in Palabuhanratu District, namely the Nusantara Fisheries Port (PPN) of Palabuhanratu Sukabumi, West Java. The condition of the South West Java waters that face and directly borders the Indian Ocean is very potential water because it is included as one of the paths or areas of yellowfin tuna migration. The waters of the Indian Ocean to the south of Java itself are included in the territory of the Republic of Indonesia Fisheries Management Area (WPPNRI) 573.

The potential of large pelagic fish resources in the Indian Ocean waters is 386.260 tons per year with a production of 188.280 tons per year and a utilization rate of 48,74%. Potential fishery resources are not spread evenly to each area of Southern Java. The level of exploitation also varies according to the number of fishermen and equipment owned [2]. In the southern waters of Java, namely in the Indian Ocean, the use of tuna resources has been going on for a long time and has contributed greatly to the fisheries sector in Indonesia [3]

Increasing fishing intensity can cause yellowfin tuna to experience fishing pressure resulting in decreased production. The decline in production can occur due to the absence of access restrictions such as overcapacity, excess investment and overfishing [4]. Based on research results, biologically the types of yellowfin tuna are proven to be more fully exploited, as evidenced by the actual catch in 2012 of 27.521 tons, past the Total Allowable Catch (TAC) of 23.825 tons [5]. This research aims at analyzing the annual catch production, estimating the sustainable potential and estimating the utilization rate of yellowfin tuna in the Palabuharatu Archipelago Fishery Port.

2. METHOD

This research was conducted in May 2019, with the location of the research being in the Archipelago Fisheries Port of Palabuhanratu, Sukabumi Regency, West Java Province. This research was conducted using a survey method. This method is based on direct observation to the field. Surveys are critical observations and investigations to obtain good information on a particular problem in a particular area or location or extensive studies that are patterned to obtain the information needed [6].
Data retrieval is done using secondary data. Secondary data needed in this research is periodic data (time series) of the production of yellowfin tuna catches at the Port of Nusantara Fisheries in Palabuhanratu for the last 5 years and data on per-gear capture efforts. This data is the main data in the analysis, obtained from the annual report of the Palabuhanratu Archipelago Fisheries Port.

Research Procedure

1. Conduct direct observations to the field for data collection and collection, in the form of secondary data covering production data for yellowfin tuna and the number of fishing gear and the number of trips of each fishing gear.
2. Identifying and tabulating data obtained from the annual report of the Palabuhanratu Archipelago Fisheries Port.
3. Perform processing and analyzing tabulated data.

Research Parameters

The parameters in this research that are measured are the catches and catching efforts including production data for yellowfin tuna, CPUE, and standardization of catching effort.

Arrest Results per Arrest Attempt

CPUE (catch per unit effort) can find out fisheries production in an area has increased or decreased. CPUE is a method used to determine the results of the amount of fisheries production that is averaged on an annual scale, CPUE also aims to analyze the abundance of fisheries resources in an area by comparing fishing efforts with production results [7].

Fishing Equipment Standardization

The purpose of standardization of fishing gear is to uniform different units of effort so that it becomes the same unit of effort. The selection of standard fishing gear is based on whether or not the fishing gear is dominant in an area. The fishing gear used as a standard has a fishing power index or fishing power index (FPI) [6]. FPI value of other capture attempts (CPUE) fishing gear compared to standard fishing gear CPUE.

Standard capture efforts are obtained using the Gulland formula (1983):

$$FPIi = CPUEi / CPUEs$$
$$SE = \sum FPIi \times fi$$

Description:
FPIi = Capability factor type of fishing gear i
Fi = Number of attempts of fishing gear type I (trip)
SE = Standard Effort (standard effort)

Data analysis

The processed data will be analyzed descriptively quantitative. Quantitative descriptive analysis is one technique in analyzing data by describing or describing data that has been collected and making conclusions. Data analysis is used to estimate the level of fish productivity, estimate the level of sustainable potential, and estimate the level of utilization of yellowfin tuna in the PPN Palabuhanratu.

CPUE Analysis (Catch Per Unit Effort)

The data used are data from Palabuhanratu VAT which has been validated. CPUE (Catch per Unit Effort) is obtained using the formula:

CPUE = c / f
Description:
CPUE = Catches per unit of effort
C = Total number of catches of the fishing fleet per unit time
F = Number of capture attempts from a fishing fleet per unit of time
After the CPUE value is obtained, it is then included in the Schaefer formula, so that the sustainable potential of fish resources or MSY (maximum sustainable yield) and fMSY is obtained as follows:

Analysis of Maximum Sustainable Potential (MSY)

The Schaefer model is a parabolic equation that has a maximum value of Y (i) or MSY, at a given level of effort:

fopt = (- a) / 2b

The catch at the optimal level of effort will be achieved a state of MSY can be calculated through the formula:

MSY = (- a) / 4b
Description:
MSY = Maximum sustainable yield (maximum sustainable yield)
Fopt = Number of optimum attempts

Utilization Rate Analysis

The number of catches allowed (JTB) is the ratio between the catch with the MSY value, so that:
Utilization rate = (Ci / MSY) X 100%
Description:
Ci = Number of fish catches in the i year
MSY = maximum sustainable potential

3. RESULT AND DISCUSSION

Fisheries Production in PPN Palabuhanratu

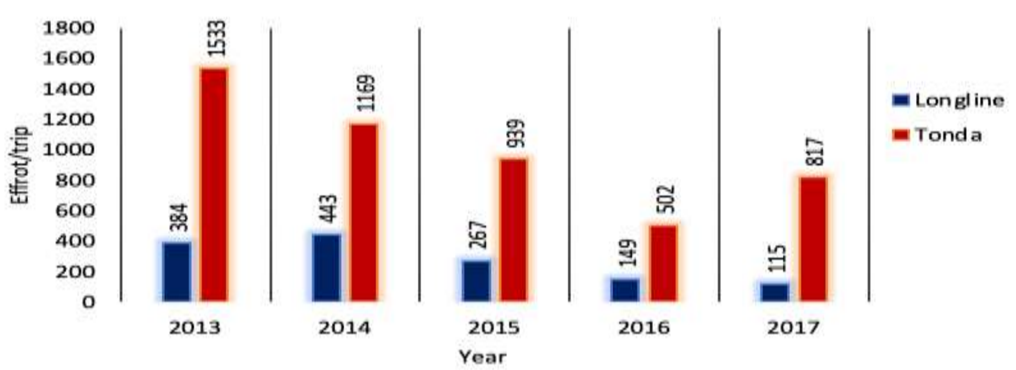

Fig-1. Number of Efforts (Trips) for Tuna Longline and Troll Fishing in the Port of Fisheries in Nusantara Palabuhanratu in 2013 - 2017

(Source: Processed Data 2019)

The Madidihang tuna fishing effort based on fishing equipment (trip) shows that the highest effort (trip) is produced by the Trolling Fishing gear in 2014 with a total of 1533 trips. The lowest amount of effort (trip) is generated by Longline, which occurred in 2017 with 115 trips. Specifically, Bangkapan can be seen in Figure 3, the lowest amount of effort produced by Trolling Fishing Tackle that occurred in 2016 with 502 trips while the highest number of attempts generated by Longline occurred in 2014 with 443 trips.

This is due to a moratorium on foreign-made vessels and violations of transshipment abroad [7]. The decline in the effort to arrest because many find foreign-made ships that carry operational violations.

Another factor that causes a downward trend in the fishing effort is the increase in fuel prices, which also impacts the operational costs of fishing activities, moreover especially in the catching of longline fishing gear which takes about eight months to one year to operate. Another factor that also influences is the increasingly distant fishing grounds caused by overexploitation activities carried out in fishing areas whose locations tend to be closer, in addition to requiring a longer time when carrying out fishing operations also require relatively higher costs [8].

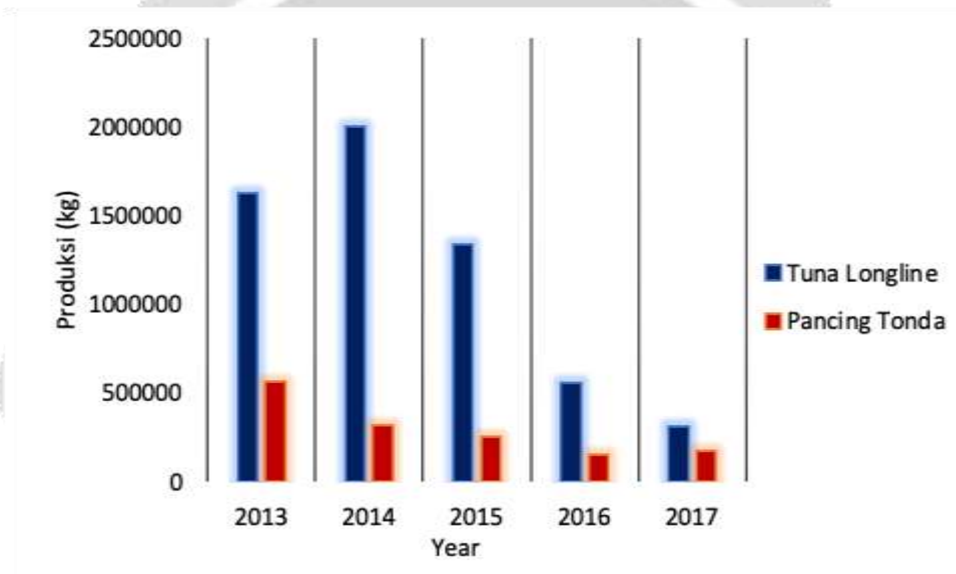

Fig-2. Madidihang Tuna Fish Production in PPN Palabuhanratu

(Source: Processed Data 2019)

Madidihang tuna production based on fishing gear (kg) landed at the Nusantara Fisheries Port of Palabuhanratu was in 2014 produced by longline tuna fishing gear with a total production of 1,999,719 kg with the highest production value of Rp. 69,056,176,400. The lowest production of yellowfin tuna in 2016 was produced by trolling with a total production of 148,992 kg with a production value of Rp. 3,561,112,500. Specifically, it can be seen in Figure 4, the lowest catch produced by Tuna Longline is in 2017 with a total production of 308,350 kg with a production value of Rp. 10,781,528,000 while the highest catch produced by Tonda Fishing was in 2013 with a total production of 563,346 kg with a production value of Rp. 13,314,750,057. Fluctuations in catches are influenced by the number of fishing efforts, the presence of fish and the success rate of fishing operations [8]. The catch is not only influenced by the abundance of fish in a particular area but depends on the number of units and the efficiency of fishing gear and the length of time of the fishing operation.

Capturing Efforts and Catches Per Unit Efforts

Table 1. Fishing Equipment Standardization

Year	Longline		Trolling	
	Catch (kg)	*Effort* (trip)	*Catch* (kg)	*Effort* (trip)
2013	1624695	384	563346	1533
2014	1999719	443	318440	1169
2015	1340087	267	250906	939
2016	553758	149	148992	502
2017	308350	115	175523	817
Jumlah	**5826609**	**1358**	**1457207**	**4960**

(Source: Processed Data 2019)

Table 2. Fishing Power Index (FPI)

Catching tool	Catch (kg)	Effort (trip)	CPUE (Catch per unit effort)	FPI (Fishing Power Index)
Longline	5826609	1358	4290,581001	14,60415834
Trolling	1457207	4960	293,7917339	1

(Source: Processed Data 2019)

Calculating the FPI of each tool using a longline tuna fishing gear as standard fishing gear, because its productivity (CPUE) is greater than the Trolling fishing gear, so the FPI value for longline tuna is 14,60415834. According to Sparre and Venema [9] that fishing gear that has a high CPUE value can be used as standard fishing gear (Table 2).

Table 3. Fishing Gear Standardization Results

Tahun	Longline		Trolling	
	Catch (kg)	*Effort* (trip)	*Catch* (kg)	*Effort* (trip)
2013	23727,303	5608	563346	1533
2014	29204,213	6469,64	318440	1169
2015	19570,843	3899,31	250906	939
2016	8087,170	2176,02	148992	502
2017	4503,192	1679,48	175523	817
Jumlah	**85092,720**	**6735680**	**1457207**	**4960**

(Source: Processed Data 2019)

In principle, the output of the fishing activity is the catch, while the input from the fishing activity is the effort (effort) needed from the fishing activity. Indicators of the level of technical efficiency of the effort can usually be known by using the amount of CPUE, in other words, the value or the amount of CPUE which is higher reflects the level of efficiency of using a better effort (Nahib 2008).

Catch Per Unit Effort (CPUE)

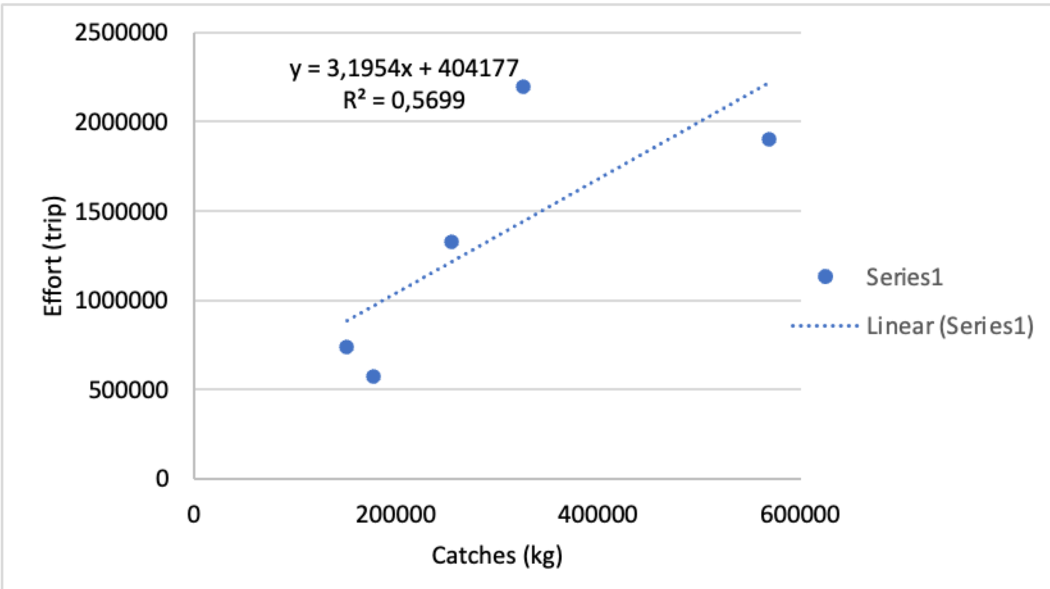

Fig-3. Relationship between Standard Efforts and Yields of Yellowfin tuna Tuna Per Year for 2013-2017

(Source: Processed Data 2019)

Based on the graph of the relationship between effort and CPUE of yellowfin tuna in PPN Palabuhanratu from 2013 to 2017 obtained a linear equation y = 3195,4x + 404177 with R2 = 0,5699. The equation shows that:

1. Regression coefficient (b) of 3195,4x, states a positive relationship between production and efforts that each addition (due to a positive sign) 1 trip effort will cause CPUE to rise by 0,5699 / trip. If the effort drops by 1, CPUE is also predicted to experience a decrease in production by 0,5699 kg/trip. If a positive sign (+) states the direction of the relationship is reversed then an increase in variable X will result in a decrease in variable Y and vice versa.

2. The coefficient of determination (R2) is 0.5699 or 56,99%. This means that variations or fluctuations in CPUE of 56,99% are caused by the value of effort, while the remaining 43,01% is caused by other variables.

According to Nahib (2008), the Schaefer model applies only if the parameter value (b) is negative, meaning that every additional capture effort the CPUE value will decrease. Based on the value of CPUE fluctuating from 2013 to 2017. The highest CPUE supply in the year of 2017 was 31,02 tons/trip and the lowest occurred in 2014 of 14,78 tons/trip. High and low CPUE values occur because during that period there were additions and reductions in both the use of fishing gear and trip capture (effort). The highest increase in CPUE value occurred in 2016-2017 with an increase of 10,58 tons/trip. In 2013-2014 the value of CPUE decreased quite high at 15,07 tons, this is because the fishing effort in the previous year was very high so that the resources of yellowfin tuna obtained decreased. According to Listiani (2016) that the level of exploitation of fish resources if left unchecked will lead to a condition called overfishing as indicated by a decrease in CPUE value. If the productivity of fish resources decreases, there must be emphasis or control of the amount of fishing effort (Damarjati 2006).

Maximum Sustainable Potential (MSY)

The purpose of using a production surplus model is to determine the optimum level of effort, that is, an effort that can produce a maximum sustainable catch without affecting long-term stock productivity or maximum sustainable catch (MSY) (Susilo 2010).

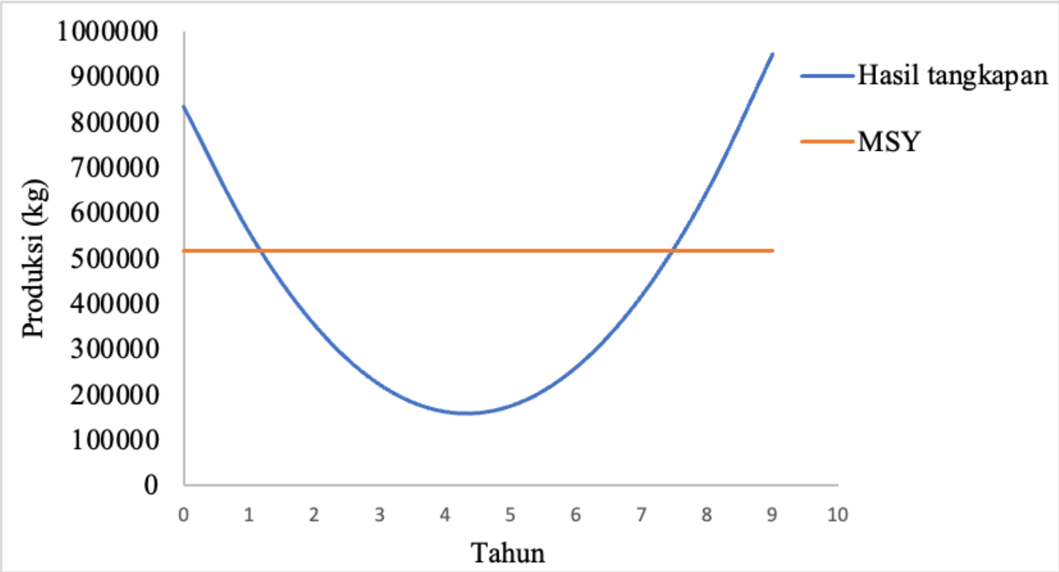

Fig-4. Relationship between Total Production and Efforts to Catch Yellowfin tuna in 2013-2017

(Source: Processed Data 2019)

Based on the Schaefer model, the maximum sustainable catch amount is 517.381 tons per year. When viewed based on the maximum sustainable catch value, the number of catches produced from 2013-2017 has decreased from the maximum catch value. The fishing effort that has been carried out also has not exceeded the optimum fishing effort, according to [10] that an increase in fishing effort in Palabuhanratu will result in a decrease in fish biomass and vice versa. In 2013-2017 there was a significant decrease, this was related to the reduction in the number of fishermen, boat fleets, production yields, the distance of fishing areas and the influence of changes in natural conditions such as rainfall, salinity and fishing season for tuna yellowfin tuna resources [10].

Based on the value of sustainable catches that have not exceeded the maximum catch value, it can be said that the yellowfin tuna resources landed at the Port of the Archipelago Fisheries in Palabuhanratu are still in the moderate category or not yet in overfishing conditions. This is also inversely proportional to research conducted by Nurdin [14] which states that the availability of stocks of both bigeye tuna and yellowfin tuna in Indonesian waters is estimated to be in a fully exploited condition, even in some fishing areas there have been overfished.

Utilization Level

The level of resource utilization can be seen by comparing the amount of fish production in a particular year with the amount of catch allowed or Total Allowable Catch. The amount of catch allowed is 80% of the maximum potential reserve [15], the level of resource utilization of tuna in Palabuhanratu can be seen in table 3.

Table 4. Level of Utilization of Yellowfin tuna Fish Resources in PPN Palabuhanratu

Year	Production (tons)	TAC (*Total Allowable Catch*) (ton)	Utilization Rate (%)	Explanation of Utilization Level
2013	568.954	413.904	137%	*Over exploited*
2014	324.909	413.904	78%	*Moderate*
2015	254.805	413.904	62%	*Moderate*
2016	151.168	413.904	37%	*Moderate*
2017	177.202	413.904	43%	*Moderate*
Rata-rata	295.408	413.904	71%	*Moderate*

(Source: Processed Data 2019)

Based on Table 3, the Total Allowable Catch or the number of catches allowed is 413.904 tons/year. The level of utilization from year-to-year decreases, this is because the production results also tend to decrease, but the utilization rate of yellowfin tuna is above 100%, meaning that the level of utilization of tuna resources has exceeded the threshold or has been in an overexploitation condition. The utilization rate in 2013 was 137%, which is categorized as being overexploited, but in the following years, the utilization rate of yellowfin tuna has not reached 80% of the amount of catch allowed or still in the moderate category.

The average utilization rate of yellowfin tuna landed in Palabuhanratu PPN over 5 years is 71% of the Total Allowable Catch, this indicates that the utilization of the resources of tuna moderate tuna landed in PPN Palabuhanratu is still in moderate condition. In 2014-2017 the catch has not reached or exceeded the estimated potential set due to the recovery of tuna yellowfin tuna resources, in addition to other factors caused by the farther location of fishing, fishing season, natural conditions also affect fishing operations [13].

4. CONCLUSIONS

Based on the results of this study can be concluded as follows,

1. CPUE (Catch per Unit Effort) shows that the average annual production of yellowfin tuna is 295.408 tons with an average fishing effort of 1348128 trips per year.
2. Based on the calculation using the Schaefer model, the estimated maximum sustainable potential or MSY of yellowfin tuna is 517.381 tons per year with a total allowable catch of 413.904 tons.
3. The average percentage value of the utilization rate of yellowfin tuna resources is 71%, so it is categorized as moderate. Based on the production of yellowfin tuna landed at the
4. Port of the Indonesian Fishery in Palabuhanratu in 2013-2017 which has not been overexploited, it is still possible to make additional fishing efforts but must be done in close monitoring to maintain the sustainability and sustainability of the yellowfin tuna resources to remain stable.

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