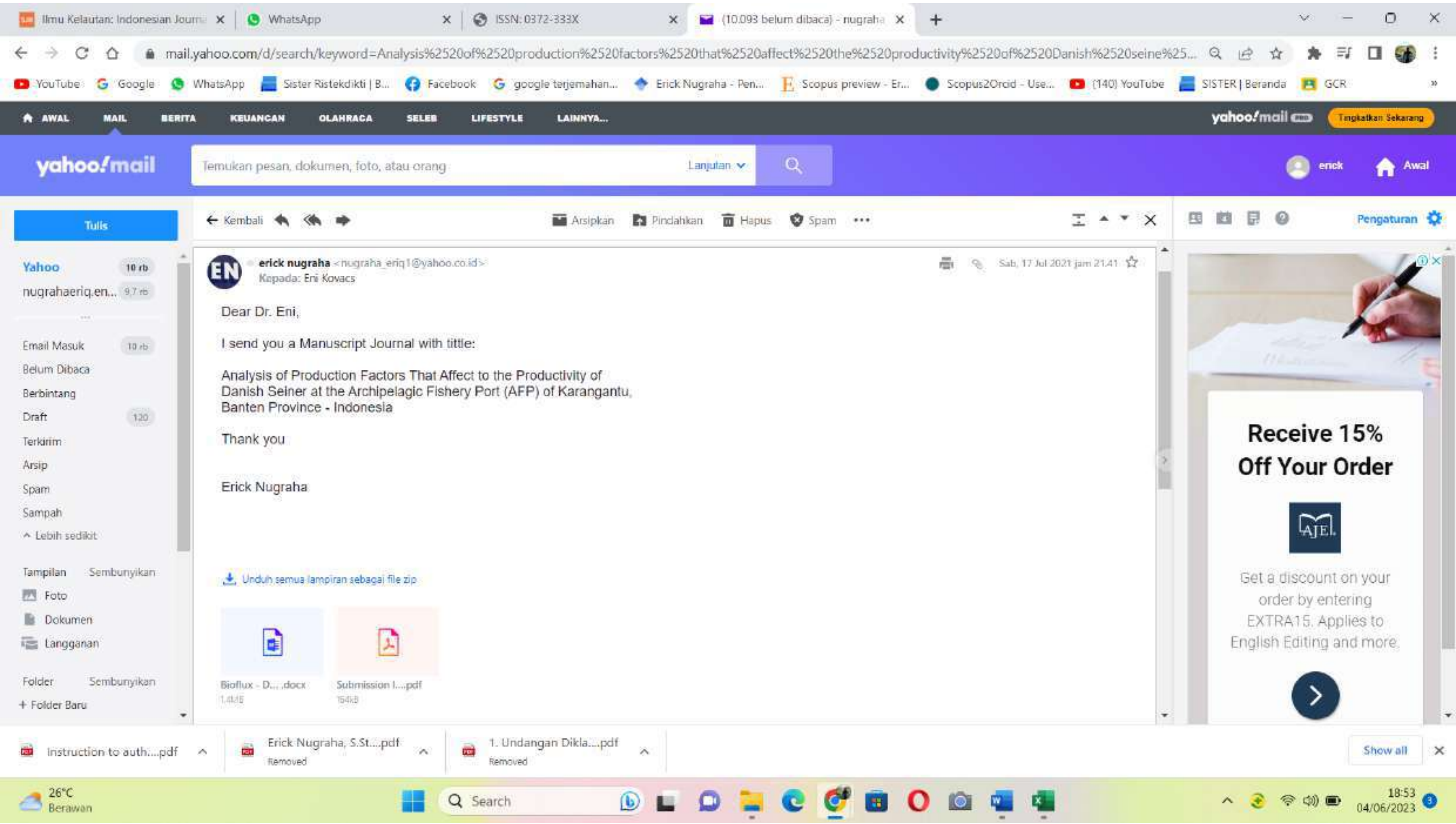

erick nugraha <nugraha_eriq1@yahoo.co.id>
Kepada: Eni Kovacs

Sab, 17 Jul 2021 jam 21.41

Dear Dr. Eni,

I send you a Manuscript Journal with tittle:

Analysis of Production Factors That Affect to the Productivity of Danish Seiner at the Archipelagic Fishery Port (AFP) of Karangantu, Banten Province - Indonesia

Thank you

Erick Nugraha

Unduh semua lampiran sebagai file zip

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Submission I....pdf

Submission letter

Article title:

Analysis of Production Factors That Affect to the Productivity of Danish Seiner at the Archipelagic Fishery Port (AFP) of Karangantu, Banten Province - Indonesia

Hereby I would like to submit the manuscript entitled "Analysis of Specific Shallow Water Current for Endemic Fish Conservation at Natuna Islands, Indonesia" to Aquaculture, Aquarium, Conservation & Legislation - International Journal of the Bioflux Society.

This manuscript was not submitted or published to any other journal. The authors declare that the manuscript is an original paper and contain no plagiarised text. All authors declare that they are not currently affiliated or sponsored by any organization with a direct economic interest in subject of the article. My co-authors have all contributed to this manuscript and approve of this submission.

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July 18, 2021

Analysis of production factors that affect to the productivity of Danish Seiner at the Archipelagic Fishery Port (AFP) of Karangantu, Banten Province - Indonesia

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ABSTRACT. The purpose of this study is to determine the productivity of the Danish seiner and to analyze the production factors that affect the productivity of the Danish seiner which includes: vessel length (x_1), vessel engine power (x_2), amount of fuel oil (x_3), number of days per trip (x_4), operational costs (x_5), and number of crew members (x_6). This final practice was carried out from February to May 2015, using a survey method. Primary data collected are the catch of the Danish seiner (y), the length of the vessel (x_1), the power of the vessel's engine (X_2), the amount of fuel oil (x_3), the number of days per trip (x_4), the operational costs (x_5), and number of crew (x_6), and the fishing ground of the Danish seiner. Meanwhile, secondary data are documents of the vessel and crew of the Danish seiner, literature on the Danish seiner, and the annual the AFP Karangantu report. To find out the production factors that affect the productivity of Danish Seiner through multiple linear regression analysis using computer software. The results of this study explain that the correlation between the productivity of the Danish seiner (y) and the variables x_3, x_4, x_5 is very strong and unidirectional. For the correlation between productivity (y) and the variable x_6 is moderate and unidirectional. While the correlation between productivity (y) with variables x_1 and x_2 is weak and unidirectional. Taken together the independent variables x_1, x_2, x_3, x_4, x_5, and x_6 have a significant effect on the increase in productivity of the Danish Seiner (y). However, individually (partially) only the variables x_4 and x_6 have a significant effect, while the other variables have no significant effect on the increase in productivity of the Danish Seiner (y).
Kata kunci: *CPUE,* Common ponyfish (*Leiognathus equulus*), FMA 712

Introduction. The Archipelago Fishing Port (AFP) of Karangantu has important strategic roles in the fishery and marine development (Puspitasari et al 2013; Suherman et al 2020). The potential of marine and fishery natural resources owned by Banten Province is spread across three areas of Banten waters, including the Indian Ocean, the Sunda Strait, and the Java Sea (Rizal 2013; Oktaviyani et al 2015). The types of fishing gear used include lift nets, purse seine, danish seiner, hand line and several other fishing gear (Rahmawati et al 2017; Diniah et al 2012).

Total production of fish caught in the AFP Karangantu in 2013 as many as 2,797 tons (Hamzah et al 2015). In 2014, AFP Karangantu recorded production of landed catches of 2,881 tons and the Danish seiner is the highest level of production among other fishing gears operating that reached 1,548 tons or 55.07% of the total catch (AFP Karangantu, 2015). Productivity is a measure that states how well resources are managed and utilized to achieve optimal results (Sarjono 2001). The production process can only run if the required requirements can be met and this requirement is better known as the production factor. In capture fisheries, the minimum required production factors consist of resources (sea), labor (fishermen) and capital (boats and fishing gear) (Suharso et al 2006).

Danish seiner. The Danish Seiner is similar to a trawler and the construction of the Danish seiner is relatively simple (Ardidja, 2010; Sudirman & Mallawa 2004). It is a fishing gear that is more likely to replace trawling as a means of utilizing demersal fishery resources (MMFA 2011). This condition allows herds of fish to enter the net (Antika et al 2014). The dimensions the main vessel is the main measure ones contained on the vessel, covering length, width and height vessel (Fyson 1985), this can be used as the main parameter in determine the vessel design (Tangke 2010; Purnama et al 2015).

The main catch of Danish seiner is shrimp and demersal fish like an Goldband goatfish (*Upeneus moluccensis*), Doublewhip threadfin bream (*Nemipterus nematophorus*), Sea catfishes (*Ariidae*), grouper (*Serranidae)* and Jarbua terapon (*Terapon jarbua)* (Sudirman et al 2008; Nedelec & Prado 1990). Fishing operations using the Danish seiner can be carried out in the morning before light conditions or in the late afternoon. The Danish seiner catching trip is usually one day fishing (Antika et al 2014). The advantage of the danish seiner operation are much cheaper because it is used on vessels that are much smaller than trawls (Semedi & Schneider 2021).

Production Factors. The production function is a mathematical relationship between production (output) and the factors of production (input) (Shephard 1970). This relationship is without regard to prices, both the prices of the factors of production and the production. Mathematically the production function can be expressed by y = (x_1, x_2, x_3, … x_n) while x_1, x_2, x_3, … x_n is the input factor used to produce output (y). The function above explains that the resulting output depends on input factors, but does not yet provide a quantitative relationship between input and output factors (Salvatore 1995; Nicholson 1999).

Material and Methods

The tools and materials used in this research are Danish seiner, fishing gear, calculator, meter, digital camera, GPS, stationery, computer and software. The data collected consists of primary data were obtained from interviews with fishermen and direct observations, and the secondary data obtained are vessel and crew documents, AFP statistics annual report, literature of Danish seiner productivity, and data of fishing ground.

Data analysis method. The Catch Per Unit Effort (CPUE) data is collected at the same time as fish landings. This shows that the relationship between catch and work is linear through the origin (Makwinja et al 2021). To calculate the value of the CPUE, each fishing gear is calculated the amount of production and the number of trips, using the following formula (Gulland 1983):

$$\boldsymbol{CPUE} = \frac{\mathbf{C}}{\mathbf{f}}$$

With :

CPUE = Production per Unit of Effort (kg trip)
C = Production (kg)
f = catch effort (trip)

To determine the factors that affect the productivity of the Danish seiner, a production function analysis is carried out using multiple linear regression analysis which is presented in tables and graphs. Parameter testing is carried out at the real level (α) 5% in order to obtain a linear regression equation (Sugiyono 2015):

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6$$

With:

y = Productivity of the Danish seiner (kg)
a = constant
b = multiple regression coefficient
x_1 = Length of vessel (m)
x_2 = Engine power (PS)
x_3 = Amount of fuel (ltr)
x_4 = Number of days per trip (days)
x_5 = Operational costs (Rp)
x_6 = Number of crew (people)

Result and Discussion

This research was conducted from February to May 2015 at the AFP Karangantu, Serang City, Banten Province, Indonesia. (figure 1).

Figure 1. The Archipelagic Fishery Port (AFP) of Karangantu (MMAF 2021).

Danish seiner. Danish seiner is very effective because its operation does not recognize the fishing season as is the case with other fishing gear so that it can be operated at any time. The shape of the Danish seiner can be seen in Figure 2.

Figure 2. Danish seiner

Danish seiner at The AFP Karangantu is made of wood with relatively the same length, rate from 10 - 15 m. The number was 46 units in 2014, of which in 2013 there were still 42 units. The development of this additional fleet positions as a type that has a dominant level of production, because the catch is much higher than other fishing gears, namely 1,548 tons or 55.07% of the total fish catch in 2014 of 2,811 tons (AFP Karangantu, 2015). In this research, sampling was carried out on 10 Danish seiner landed at The AFP of Karangantu. Data on these vessels can be presented in Table 1 below.

Table 1

Danish seiner research sample

Name of Fishing Vessel	Length (m)	Width (m)	GT	Engine power (PS)
FV. Putri Timbul	11.40	3.95	15	120
FV. Bunga Indah 01	12.20	4.34	14	120
FV. Bunga Indah 02	11.85	3.95	14	100
FV. Sari Jati Mulya	10.50	2.60	10	100
FV. Sari Jati Untung	13.20	4.05	18	120
FV. Sari Mulya	10.50	3.40	10	100
FV. Setia Jaya	14.50	4.42	19	120
FV. Setia Kawan	13.60	3.95	20	120
FV. Tirta Raya Mina 01	12.00	4.00	11	120
FV. Tirta Raya Mina 02	12.50	4.25	15	120

Fishing Ground. Danish seiner is operated in the bottom waters are sand, mud or a mixture of both. The Danish seiner that landed at The AFP of Karangantu has a fishing ground in the FMA-712, namely the North Jawa Sea, to be precise in the Sunda Strait around Tunda Island and Panjang Island. This can be seen in Figure 3 below.

Gambar 3. Danish seiner Fishing ground

Danish seiner Catches. From 10 samples of the Danish seiner, the types of production landed at AFP Karangantu during the period February 15 to April 15 2015 consisted of 4 types of dominant fish (Table 2).

Table 2

The type of catch of the Danish seiner at The AFP Karangantu for the period February - April 2015

No	Type of catch	Total production (kg)	Percentage (%)
1	Common ponyfish (*Leiognathus equulus*)	61,420	51.06
2	Goldband goatfish (*Upeneus moluccensis*)	20,298	16.87
3	Doublewhip threadfin bream (*Nemipterus nematophorus*)	6,234	5.18
4	Squid (*Loligo* spp)	5,680	4.72
5	Others	26,653	22.16
	Total	120,285	100.00

Source : MMAF 2006.

Danish Seiner Catch Rate (CPUE)

The catch rate of Danish seiner is the number of catches of a number of trips. From the 10 of Danish seiners were used as objects of observation, the catch rate per vessel can be described in Table 3 below.

Table 3

Catch rate of Danish seiner at The AFP of Karangantu

	Name of Fishing Vessel	Total production (kg)	Trip (times)	Average (kg/trip)
1	FV. Tirta Raya Mina 01	3,305	2	1,652.5
2	FV. Tirta Raya Mina 02	6,391	6	1,065.2
3	FV. Sari Jati Untung	17,872	19	940.6
4	FV. Sari Mulya	3,371	4	842.8
5	FV. Setia Kawan	7,387	13	568.2
6	FV. Bunga Indah 01	22,514	40	562.9
7	FV. Setia Jaya	18,372	34	540.4
8	FV. Putri Timbul	12,370	23	537.8
9	FV. Bunga Indah 02	20,300	42	483.3
10	FV. Sari Jati Mulya	8,403	18	466.8
	Average			766.1

From the table above it can be seen that FV. Tirta Raya Mina 01 has the highest catch rate, which is 1,652.5 kg/trip. Meanwhile, FV. Sari Jati Mulya is a lowest catch rate, which is 466.8 kg/trip.

Productivity of the Danish seine . The productivity of the Danish seiner is the average level of production per trip which is determined by a number of variables. Where these variables are grouped into 6 parts, namely the level of production according to vessel size, engine power, fuel consumption, number of days per trip, operational costs, and number of crew members.

Danish Seiner Production Rate According to Vessel length size. The Danish seiner sampled in the measurements were 10 vessels, where each vessel has its own size. However, among the 10 vessels, there are 2 vessels that have the same length, namely FV. Sari Jati Mulya and FV. Sari Mulya. Measurements are made on the length of the vessel with the assumption that the length of the vessel will determine the level of productivity. The level of production of Danish seiner according to vessel size can be presented in Table 4 below.

Table 4

Danish seiner production rate per trip according to the vessel length

Name of Fishing Vessel	Vessel Length (m)	Trip (times)	Production (kg)			
			Total	Average/trip	Minimum	Maximum
FV. Sari Jati Mulya	10.50	18	8,403	467	259	714
FV. Sari Mulya	10.50	4	3,371	843	420	1,167
FV. Putri Timbul	11.40	23	12,370	538	272	863
FV. Bunga Indah 02	11.85	42	20,300	483	244	793
FV. Tirta Raya Mina 01	12.00	2	3,305	1,653	1,171	2,134
FV. Bunga Indah 01	12.20	40	22,514	563	378	899
FV. Tirta Raya Mina 02	12.50	6	6,391	1,065	610	1,790
FV. Sari Jati Untung	13.20	19	17,872	941	509	1,763
FV. Setia Kawan	13.60	13	7,387	568	306	899
FV. Setia Jaya	14.50	34	18,372	540	228	823

Table 4 above shows that the average production of the Danish seiner for each trip is different according to the length of the vessel. The results of data processing from the 10 sample Danish seiner gave a difference in the value of landed fish production. However, this difference shows that the Danish seiner with a larger size has the ability to catch fish that is almost the same as compared to a smaller vessel. This is because the length of the vessel is not followed by the size of the fishing gear. The relationship between the independent variables, namely the length of the vessel and the dependent variable, namely production, can be illustrated in Figure 4 below.

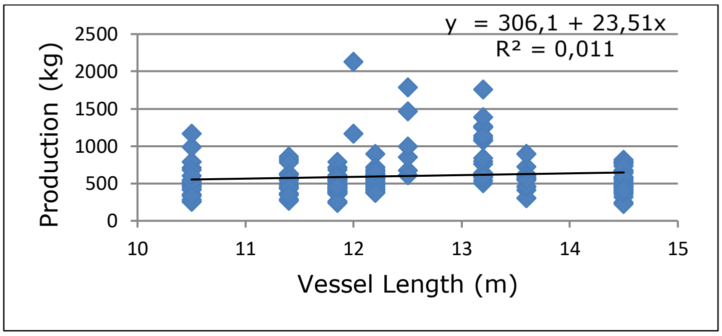

Figure 4. Graph of the relationship between production and vessel length.

From the graph above, the correlation coefficient (R) is 0.104. This value is obtained from the result of squaring the value of the coefficient of determination (R_2). From the correlation coefficient (R), it means that the correlation between production and vessel length is weak (unidirectional). Where the longer the length of the vessel increases, the production of the catch also increases.

The coefficient of determination (R_2) is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above, it is known that the coefficient of determination (R_2) between production (y) and vessel size (x_1) is 0.011 which means that every 1.1% of the production obtained is influenced by vessel size and the remaining 98.9% is influenced by another factor (Ghozali 2011).

Danish seiner production rate according to engine power vessels. According to the engine powers, the 10 sample vessels observed were divided into 2 categories, namely vessels with engine powers of 100 ps and 120 ps. There are 3 vessels with an engine powers of 100 ps while 7 vessels with an engine power of 120 ps. The level of Danish seiner production according to the vessel's engine powers can be presented in Table 5 and Figure 5 below.

Table 5

Danish seiner production rate per trip according to the size of the engine power

No	Engine power (ps)	Trip (times)	Production (kg)			
			Total	Average/Trip	Minimum	Maximum
1	100	64	32,074	501	244	1,167
2	120	137	88,211	644	228	2,134

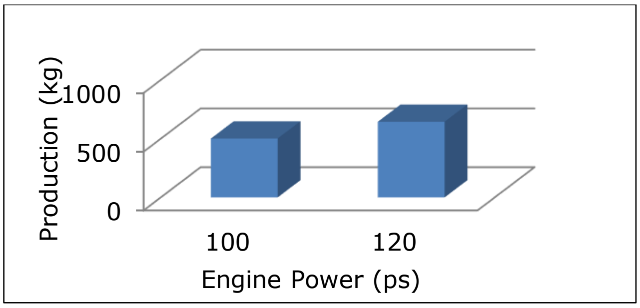

Figure 5. The average production rate according to engine power.

The table and graph above shows that the average production of a Danish seiner for each trip is different according to the size of the vessel's engine power. The average production of a vessel with an engine size of 100 ps is 501 kg/trip, while for the larger vessel size, 120 ps, it is 644 kg/trip. The results of data processing from the 10 sample Danish seiners gave a difference in the value of fish production. This difference illustrates that a Danish seiner with a larger engine power size has the ability to get a greater catch of fish compared to a vessel with a smaller engine power. It because vessels with larger engine power can accelerate the fishing gear operating process compared to vessels with smaller engine power.

Danish seiner production rate according to total fuel oil. In terms of fuel consumption, the 10 sample vessels are divided into 11 categories. The level of production can be shown in Table 6 and Figure 6 below.

Table 6

Danish seiner production rate per trip according to the amount of fuel

No	Fuel oil (liters)	Trips (times)	Production (kg)			
			Total	Minimum	Maximum	Average/trip
1	60	2	976	420	556	488
2	70	2	989	455	534	495
3	80	122	59,800	228	899	534
4	90	1	993	993	993	993
5	100	70	39,964	250	1,253	571
6	150	1	1,167	1,167	1,167	1,167
7	160	1	1,141	1,141	1,141	1,141
8	200	5	5,658	995	1,393	1,132
9	300	1	1,272	1,272	1,272	1,272
10	400	4	6,191	1,171	1,467	1,548
11	500	1	2,134	2,134	2,134	2,134

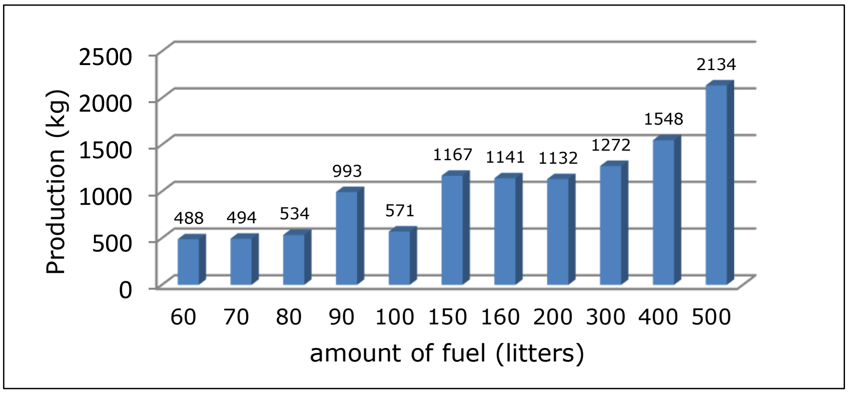

Figure 6. The average production rate according to the amount of fuel

The table above shows that the average production of the Danish seiner for each trip is different according to the amount of fuel. The average production of a Danish seiner with 60 liters of fuel is 488 kg/trip, 70 liters of fuel is 495 kg/trip, 80 liters of fuel is 534 kg/trip, 90 liters of fuel is 993 kg/trip. trip, the amount of fuel as much as 100 liters is 571 kg/trip, the amount of fuel as much as 150 liters is 1,167 kg/trip, the amount of fuel as much as 160 liters is 1,141 kg/trip, the amount of fuel as much as 200 liters is 1,132 kg/trip, the amount of fuel is 300 liters is 1,272 kg/trip, the amount of fuel as much as 400 liters is 1,548 kg/trip, and the amount of fuel as much as 500 liters is 2,134 kg/trip. These results illustrate that the higher the amount of fuel used, the higher the production of the catch obtained. This is presumably because the higher fuel consumption is followed by the higher the level of fishing gear operation and the duration of the fishing operation. The relationship between the independent variable, namely the amount of fuel and the dependent variable, namely production, can be illustrated in Figure 7 below.

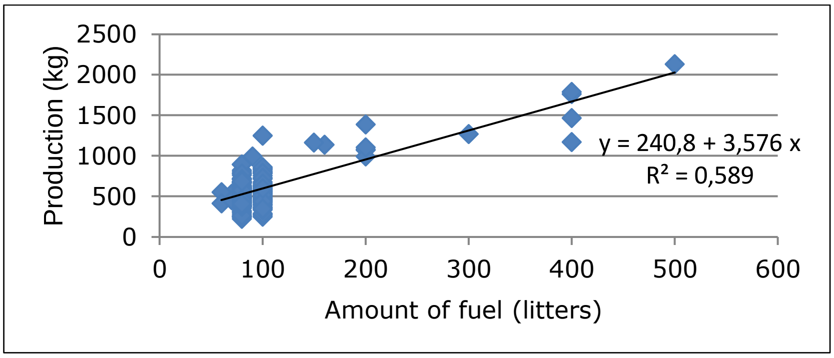

Figure 7. The relationship between production and amount of fuel

From the graph above, the correlation coefficient (R) is 0.767. This value comes from the result of squaring the value of the coefficient of determination (R_2). From the correlation coefficient (R), it means that the correlation between production and the amount of fuel is very strong/perfect (unidirectional). Where the increase in the amount of fuel, the more the production of the catch.

The coefficient of determination (R_2) is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above, it is known that the coefficient of determination (R_2) between production (y) and the amount of fuel (x_3) is 0.589 which means that 58.9% of the production obtained is influenced by the amount of fuel and the remaining 41.1% is influenced by factors other (Ghozali 2011).

Production Rate of Danish Seiner according to the number of days per trip. Danish seiner operating at AFP Karangantu generally have an average number of operating days, namely 1 day. However, of the 10 sample vessels, the number of days per trip was observed divided into 4 categories, namely the number of 1-day trips, 2-day trips, 3-day trips, and 4-day trips. The level of Danish seiner production according to the number of days per trip can be shown in Table 7 and Figure 8 below.

Table 7

Danish seiner production rate per trip according to the number of days per trip

Number of days/trip	Trips (times)	Production (kg)				
		Total	Avg./trip	Avg./day	Min.	Max.
1	180	95,719	532	532	228	899
2	16	16,019	1,001	501	505	1,272
3	4	6,413	1,603	534	1,393	1,790
4	1	2,134	2,134	534	2,134	2,134

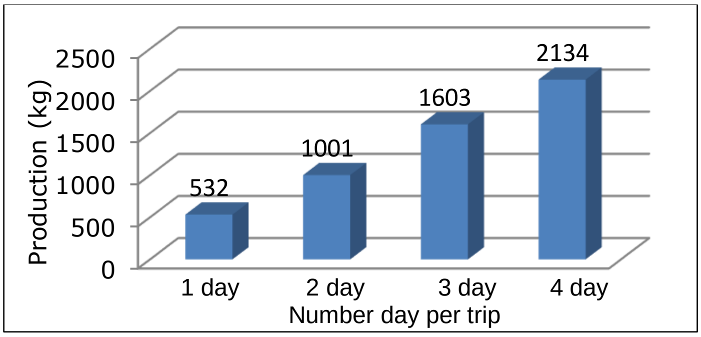

Figure 8. The average production rate according to the number of days per trip

From the table and graph above, the average production of the Danish seiner varies according to the number of days per trip. The average production of a Danish seiner, with the number of days per trip of 1 day is 532 kg/trip, the number of days per trip of 2 days is 1,001 kg/trip, the number of days per trip of 3 days is 1,603 kg/trip, and the number of days per trip of 4 days is 2,134 kg/trip. These values illustrate that a Danish seiner with more days per trip has the ability to get a larger catch of fish than the fewer days per trip. This is due to the increasing number of days per trip, the fishing gear operating activities will increase so that the catch will also increase. However, if averaged the production per day tends to be the same and there is no significant change.

The relationship between the independent variable, namely the number of days per trip and the dependent variable, namely production, can be seen in Figure 9 below.

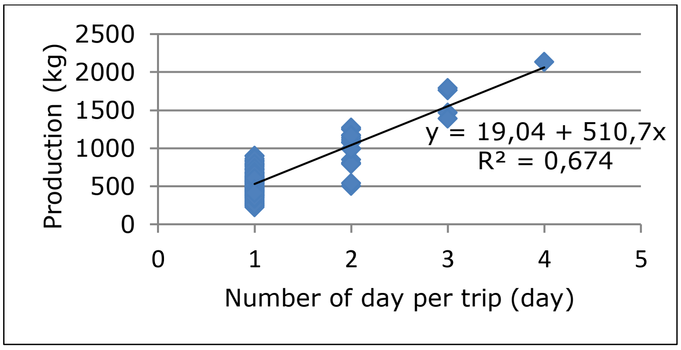

Figure 9. The relationship between production and the number of days per trip

From the graph above, the correlation coefficient (R) is 0.821. This value is obtained from the result of squaring the value of the coefficient of determination (R_2). From the correlation coefficient (R), it means that the correlation between production and the number of days per trip is very strong/perfect (unidirectional). Where the more the number of days per trip, the more the catch production will increase.

The coefficient of determination (R_2) is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above, it is known that the coefficient of determination (R_2) between production (y) and the number of days per trip (x_4) is 0.674 which means that 67.4% of the production obtained is influenced by the number of days per trip and the remaining is 32.6% influenced by other factors.

Danish seiner production level according to operational costs. The Danish seiner requires operational costs to meet its needs during fishing operations. The operational costs referred to consist of the cost of fuel, oil, clean water, net equipment, ice, foodstuffs, and others. The level of production of a Danish seiner according to the operational costs used can be presented in Table 8 and Figure 10 below.

Table 8

Danish seiner production rate per trip according to operational costs.

No	Operating Costs (USD)	Trip (times)	Production (kg)			
			Total	Average /trip	Minimum	Maximum
1	51.28	28	15,961	570	361	899
2	54.95	5	2,503	501	285	714
3	55.68	1	420	420	420	420
4	57.14	1	501	501	501	501
5	58.61	46	23,280	506	228	993
6	62.27	20	10,230	512	276	899
7	65.93	44	24,269	552	263	843
8	69.60	15	9,124	608	362	863
9	73.26	22	11,124	506	250	793
10	80.59	2	1,161	581	350	811
11	87.91	3	3,358	1,119	852	1,253
12	109.89	1	791	791	791	791
13	124.54	1	1,167	1,167	1,167	1,167
14	161.17	1	1,141	1,141	1,141	1,141
15	168.50	1	1,077	1,077	1,077	1,077
16	175.82	1	1,393	1,393	1,393	1,393
17	183.15	3	3,188	1,063	995	1,084
18	190.48	1	1,272	1,272	1,272	1,272
19	241.76	1	1,790	1,790	1,790	1,790
20	256.41	1	1,763	1,763	1,763	1,763
21	278.39	2	2,638	1,319	1,171	1,467
22	318.68	1	2,134	2,134	2,134	2,134

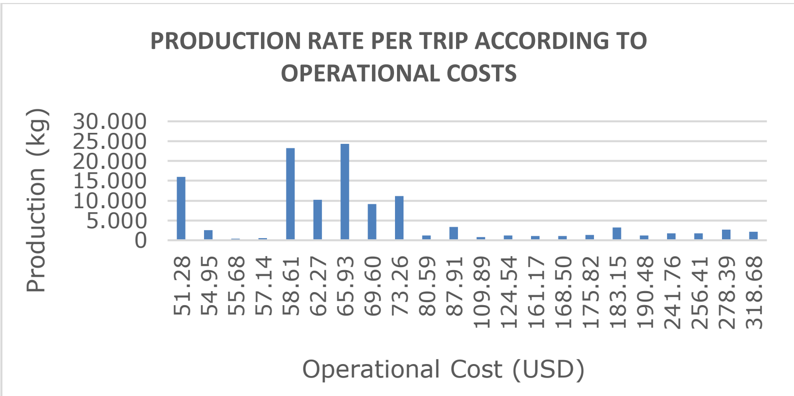

Figure 10. The average level of production according to operational costs.

The table and graph above shows that the average production of a trip differs according to operational costs. The results above also illustrate that a Danish seiner with a higher operating cost has the ability to get a larger catch of fish than a vessel with a lower operating cost. The relationship between the independent variables, namely operational costs and the dependent variable, namely production, can be seen in Figure 11 below.

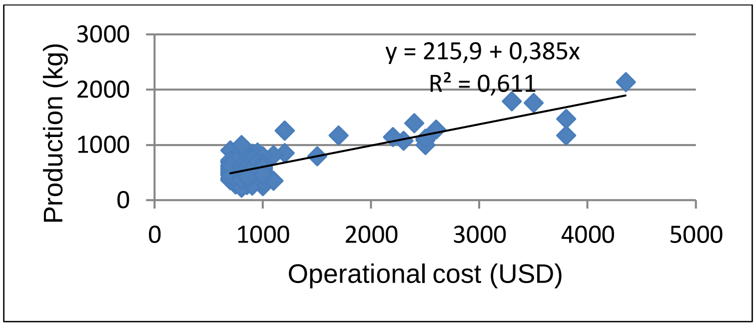

Figure 11. The relationship between production and operational costs

From the graph above, the correlation coefficient (R) is 0.782. This value is obtained from the result of squaring the value of the coefficient of determination (R_2). From the correlation coefficient (R), it means that the correlation between production and operational costs is very strong (unidirectional). Where the higher the operational cost, the higher the catch production.

The coefficient of determination (R_2) is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above, it is known that the coefficient of determination (R_2) between production (y) and operational costs (x_5) is 0.611 which means that 61.1% of the production obtained is influenced by operational costs and the remaining 38.9% is influenced by other factors.

Danish Seiner Production Level According to Number of Crew. The number of crew members is a factor that needs to be considered in the operation of the Danish seiner. Each crew member has their respective roles and functions. Of the 10 sample vessels that were observed, the number of crew per trip can be divided into 7 categories, namely the number of crew members of 4, 5 people, 6 people, 7 people, 8 people, 9 people, and 10 people. The level of production of the Danish seiner according to the number of crew members used can be presented in Table 9 and Figure 12 below.

Table 9

Danish seiner production rate per trip according to number of crew

No	Number of Crew (people)	Trips (times)	Production(kg)			
			Total	Average/trip	Minimum	Maximum
1	4	3	2.204	735	420	993
2	5	41	21.580	526	228	1.167
3	6	64	32.448	507	250	899
4	7	69	45.264	656	224	1.790
5	8	16	8.932	558	350	717
6	9	5	5.429	1.086	543	2.134
7	10	3	4.428	1.476	1.272	1.763

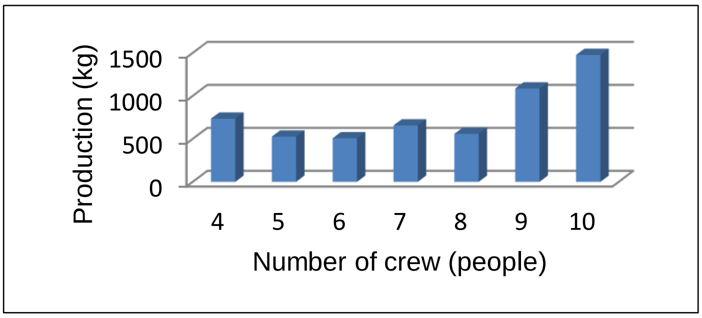

Figure 12. Average levels of production by number of crew

The table and graph above shows that the average production of the Danish seiner for each trip varies according to the size of the number of crew members used. The average production of a Danish seiner which uses a crew of 4 people is 735 kg/trip, the number of crew of 5 people is 526 kg/trip, the number of crew of 6 people is 507 kg/trip, the number of crew is 7 people. 656 kg/trip, the number of crew of 8 people is 558 kg/trip, the number of crew of 9 people is 1,086 kg/trip, and the number of crew of 10 people is 1,476 kg/trip. This difference illustrates that a Danish seiner with a larger crew has the ability to catch more fish than a vessel with a smaller crew. This is because more and more crew members will simplify and speed up the operation of fishing gear. So that the fish caught will be more and more.

The relationship between the independent variable, namely the number of crew members, and the dependent variable, namely production, can be described in Figure 13 below.

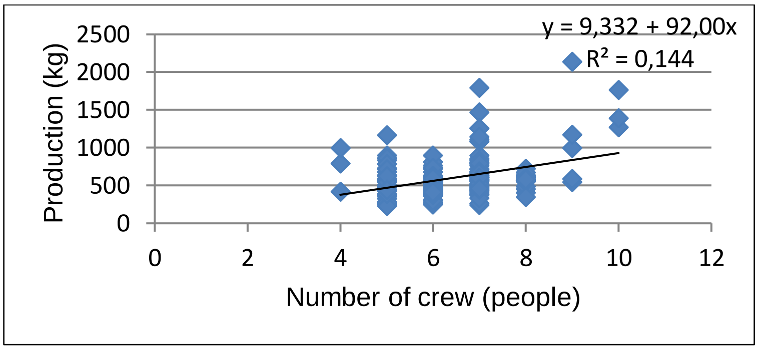

Figure 13. Relationship between production and number of crew

From the graph above, the correlation coefficient (R) is 0.379. This value is obtained from the result of squaring the value of the coefficient of determination (R_2). From the correlation coefficient (R), it means that the correlation between production and number of crew is moderate (unidirectional). Where the more the crew, the more the catch production increases.

The coefficient of determination (R_2) is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above it is also known that the coefficient of determination (R_2) between production (y) and the number of crew (x_6) is 0.144, which means that 14.4% of the production obtained is influenced by operational costs and the remaining 85.6% is influenced by another factor.

Factors affecting productivity of Danish seiner. To determine the factors that affect the productivity of the Danish seiner, multiple linear regression analysis is performed. Data processing using computer software program Microsoft Excel and Statistical Product and Service Solutions (SPSS) version 17 with parameter testing is carried out at the real level (α) 5%. SPSS is a software that functions to analyze data. perform statistical calculations on a windows basis. The results of the multiple regression analysis of variance can be seen in Table 10 below (Suharso et al 2006).

Table 10

Analysis of variance multiple linear regression analysis of factors which affects the productivity of the Danish seiner

No	Source	Degrees of freedom	Sum of squares (JK)	Middle Square (KT)	F_{count}	Probability > F
1	Regression	6	1.043	1738443.139	83.661[a]	0.000
	Residue	194	4031244,511	20779.611		
2	Total	200	1.446			
3	R^2	0.721				
	R	0.849				

Information: a = real at the 95% level (α = 0.05)

The results of the analysis in Table 19 above and Appendix 1 show that the coefficient of determination (R2) is 0.721, which means that 72.1% of the productivity of the Danish seiner (y) can be influenced by the variable x_1 = length of the vessel, x_2 = engine power, x_3 = Amount of fuel, x_4 = number of days/trip, x_5 = operational costs, x_6 = number of crew. While the remaining 27.9% is influenced by other variables that determine but are not included in the model.

The ANOVA or F_{test} test results obtained the calculated F_{count} of 83.661. While the results of the F_{table} calculation, the F_{table} value is 2.15. From these calculations, the value of $F_{count} > F_{table}$ so that it can be declared significant with a significant level or a probability of 0.000. Because the probability is smaller than 0.05, the change in Danish seiner production can be explained significantly with a 95% confidence level by the 6 predefined variables (Suharso et al 2006).

The correlation coefficient (R) is used to determine the degree of closeness of the relationship between the dependent variable (y) and the independent variables (x). The results of the analysis show that the coefficient (R) value is 0.849 with a positive sign and is close to the number one, so it means that the dependent variable (y) has a fairly strong or strong relationship with all independent variables (x).

Partial testing is used to test the effect of the independent variable (x) individually on the dependent variable (y) using the t_{test}. A summary of the results of multiple linear regression analysis on the productivity of the Danish seiner is presented in Table 11 below.

Table 11

Parameter Value Analysis of variance multiple linear regression analysis factors affecting the productivity of the Danish seiner

No.	Explanatory description (x)	Regression coefficient (b)	t count	Probability > t
1	Intercept	-514,355	-3,678	0,000
2	The length of the vessel (x_1)	13,069	1,251 [tn]	0,212
3	Engine power (x_2)	2,337	1,696 [tn]	0,092
4	Total fuel (x_3)	1,029	1,491 [tn]	0,138
5	Number of days per trip (x_4)	388,054	7,874 [a]	0,000
6	Operating costs (x_5)	-0,016	-0,199 [tn]	0,842
7	Number of Crew (x_6)	24,687	2,423 [a]	0,016
8	The coefficient of determination (R^2)	0,721		

Information: a = real at the 95% confidence level (α = 0.05)
tn = not significant at the 95% confidence level (α = 0.05)

After the data is analyzed, the following equation is obtained:

$$y = -514.355 + 13.069\, x_1 + 2.337\, x_2 + 1.029\, x_3 + 388.054\, x_4 - 0.016\, x_5 + 24.687\, x_6$$

Where :
y = Productivity of the Danish seiner (kg)
x1 = Length of vessel (m)
x2 = Engine power (ps)
x3 = fuel consumption (ltr)
x4 = Number of days/trip (days)
x5 = operational costs (Rp)
x6 = number of crew (people)

To determine the use of factors that affect productivity, it can be seen from the elasticity of each variable to production which is obtained as follows:

1. The variable size of the length of the vessel (x_1), because the probability is greater than 0.05, it does not have a significant or insignificant effect with a probability level of 0.212. The variable x_1 has a regression coefficient (b_1) of 13.069. This means that each additional 1 m of vessel length will increase the productivity of the Danish seiner by 13.069 kg (if other variables are constant). The length of the vessel has no significant effect on the catch because the length of the vessel does not determine the amount of the catch. This is due to the fact that the larger the length of the vessel is not

accompanied by an increase in the size of the fishing gear. The Danish seiner which landed at The AFP Karangantu has relatively the same size of fishing gear.

2. The machine power variable (x_2), because the probability is greater than 0.05, it does not have a significant or insignificant effect with a probability level of 0.092. The variable x_2 has a regression coefficient (b_2) of 2.337. This means that every addition of 1 PS of engine power will increase the productivity of the Danish seiner by 2.337 kg (if other variables remain).
   The power of the engine (x_2) will determine the speed of the vessel when the vessel is moving towards the fishing ground. Vessels with relatively high speeds can reach the fishing ground more quickly. With a large engine power, the fishing gear operating process will also be faster. However, this observation found that the magnitude of the engine power did not really determine the size of the catch.
3. The variable amount of fuel (x_3), because the probability is greater than 0.05, it does not have a significant or insignificant effect with the probability level of 0.138. The variable x_3 has a regression coefficient (b_3) of 1.029. This means that each additional 1 liter of total fuel will increase the productivity of the Danish seiner by 1.029 kg (if other variables are constant). The use of fuel for large engine power needs to be supported by a balanced amount of fuel. Indirectly, the amount of fuel used in the operation of the Danish seiner also affects the amount of catch because with the large amount of fuel, the number of operating days for the vessel will be longer. However, this observation found that the amount of fuel does not really determine the size of the catch.
4. The variable operating time per trip (x_4), because the probability is smaller than 0.05, it has a significant or significant effect with a probability level of 0.000. The variable x_4 has a regression coefficient (b_4) of 388.054. This means that each additional 1 day of operation will increase the productivity of the Danish seiner by 388.054 kg (if other variables remain). This positive relationship shows that productivity is directly proportional to the longer operating days of the Danish seiner. This is because the longer the day the vessel operates, the more production results will be obtained. Where the longer the fishing gear operating days allow the catch to increase as well.
5. Operational cost usage variable (x_5), because the probability is greater than 0.05, it has no significant or insignificant effect with a probability level of 0.842. The variable x_5 has a regression coefficient (b_5) of -0.016 and the effect is negative. This means that each additional USD 0.00007 of the operational costs will reduce the productivity of the Danish seiner by 0.016 kg (if other variables are constant). This negative relationship shows that the use of large operational costs does not have an impact on large production as well.
6. The variable number of crew (x_6), because the probability is smaller than 0.05, it has a significant or significant effect with a probability level of 0.016. The variable x_6 has a regression coefficient (b_6) of 24.687. This means that each additional 1 crew member will increase the productivity of the Danish seiner by 24,687 kg (if other variables remain). This positive relationship shows that the productivity of the Danish seiner is determined by the number of crew members. The number of crew members has a real effect because the large number of crew members also accelerates the operation of fishing gear.

Conclussion.

Based on the results and discussion previously described, it can be concluded as follows:

1. FV. Tirta Raya Mina 01 has the highest catch rate, which is 1,652.5 kg/trip with. Meanwhile, FV. Sari Jati Mulya is a Danish seiner with the lowest catch rate, which is 466.8 kg/trip. However, if averaged the rate of catch per day, there is no significant difference in catch rates or tend to be the same.
2. The correlation between the productivity of the Danish seiner with the variable amount of fuel (x_3), number of days per trip (x_4), and operational costs (x_5) is very strong and unidirectional. For the correlation between productivity and the variable number of crew (x_6) is moderate and unidirectional. Meanwhile, the correlation between productivity and vessel size variable (x_1) and engine power (x_2) is weak and unidirectional.

3. The independent variable (x) which consists of: variable length of vessel (x_1), engine power (x_2), fuel consumption (x_3), number of days per trip (x_4), operational costs (x_5) and number of crew (x_6) has a significant effect on the increase in productivity of the Danish seiner (y). However, individually (partially) only the variable number of days per trip (x_4) and the number of crew members (x_6) had a significant effect, while other variables had no significant effect on the increase in productivity of Danish seiners (y).

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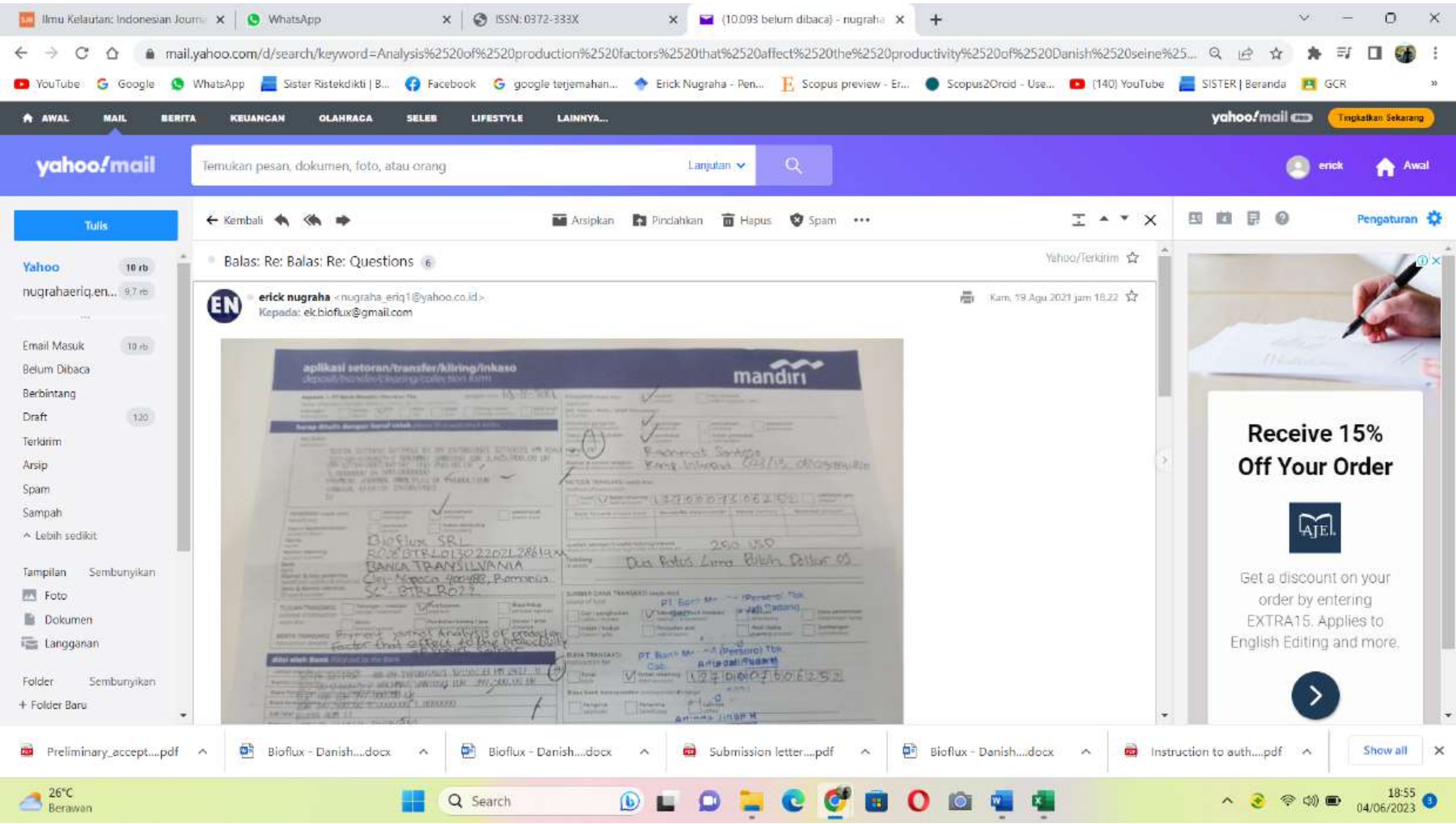
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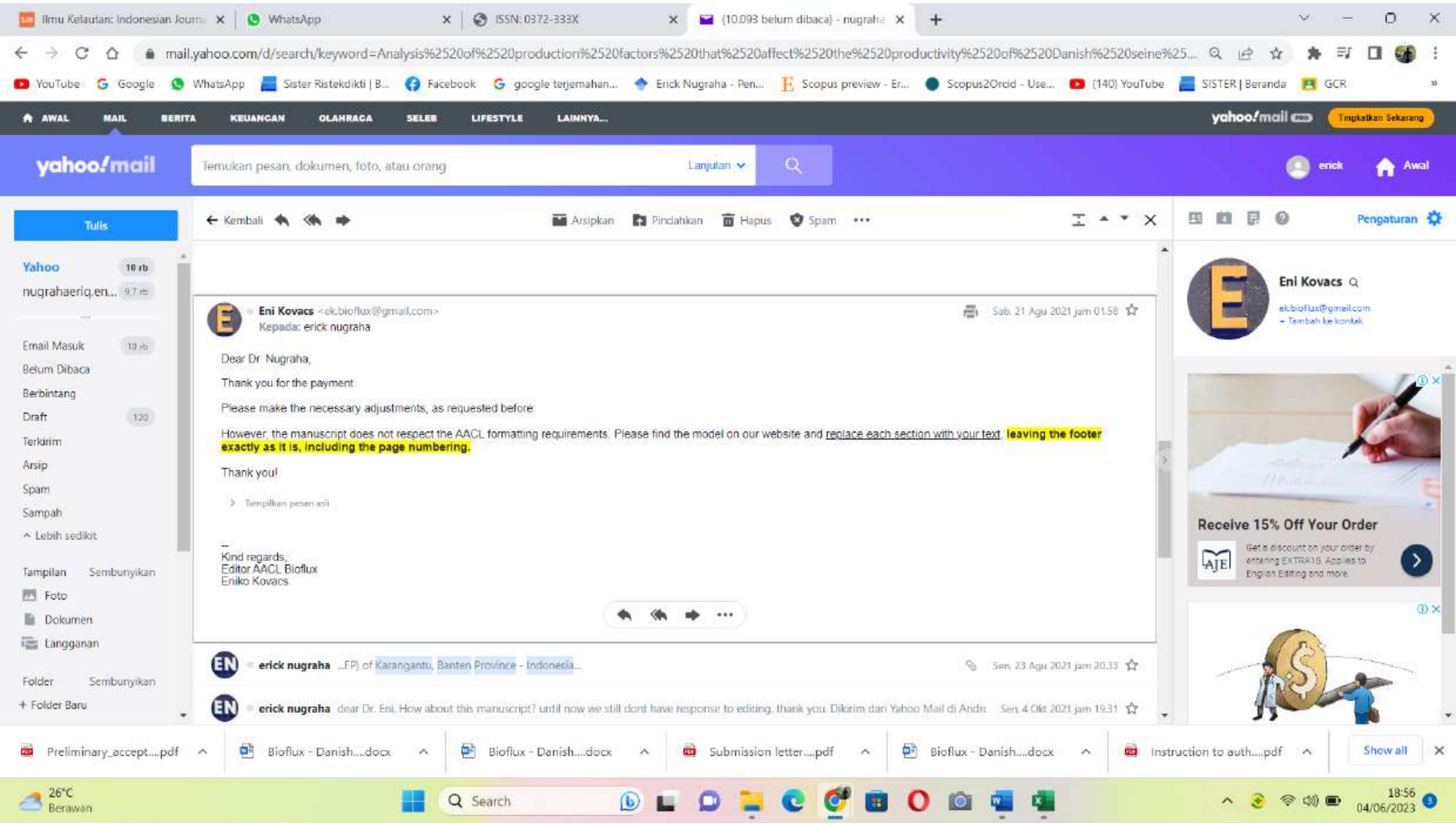
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Abstract. The purpose of this study is to determine the productivity of the Danish seine and to analyze the production factors that affect the productivity of the Danish seine which includes: vessel length (x1), vessel engine power (x2), amount of fuel oil (x3), number of days per trip (x4), operational costs (x5), and number of crew members (x6). This research was carried out using a survey method. The primary data collected are the catch volume of the Danish seine (y), the length of the vessel (x1), the power of the vessel's engine (X2), the amount of fuel oil (x3), the number of days per trip (x4), the operational costs (x5), the number of crew members (x6) and the fishing ground of the Danish seine. Meanwhile, thesecondary data are documents of the vessel and crew of the Danish seine, literature on the Danish seine and the annual the AFP Karangantu report. In order to determine the production factors that affect the productivity of the Danish Seine, a multiple linear regression analysis via computer software was used. The results of this study explain that the correlation between the productivity of the Danish seine (y) and the variables x3, x4, x5 is very strong and positive. The correlation between productivity (y) and the variable x6 is moderate and positive, while the correlation between the productivity (y) and the variables x1 and x2 is weak and positive. Taken together, the independent variables x1, x2, x3, x4, x5 and x6 have a significant effect on the increase of the Danish Seine productivity (y). However, individually (partially) only the variables x4 and x6 have a significant effect, while the other variables have no significant effect on the increase of the Danish Seine productivity (y).
Key Words: CPUE, *Leiognathus equulus*, FMA 712, AFP Karangantu.

Introduction. The Archipelago Fishing Port (AFP) of Karangantu has a strategic role in the fishery and marine development (Puspitasari et al 2013; Suherman et al 2020). The potential of marine and fishery natural resources of the Banten Province is spread across three water areas s:the Indian Ocean, the Sunda Strait and the Java Sea (Rizal 2013; Oktaviyani et al 2015). The types of fishing gear used include lift nets, purse seine, danish seine and hand line (Rahmawati et al 2017; Diniah et al 2012).

Total production of fish caught in the AFP Karangantu in 2013 as many as 2,797 tons (Hamzah et al 2015). In 2014, the AFP Karangantu recorded 2,881 tons of landed catches. The Danish seine has the highest contribution, among the other operating fishing gears, reaching 1,548 tons or 55.07% of the total catch (AFP 2015). Productivity is a measure that states how well resources are managed and utilized to achieve optimal results (Sarjono 2001).

The Danish seine is similar to a trawler, being seinerelatively simple (Ardidja 2010; Sudirman & Mallawa 2004). It is a fishing gear that is more likely to replace trawling in the exploitation of demersal fishery resources (MMFA 2011). This condition allows herds of fish to enter the net (Antika et al 2014). The dimensions the main vessel is the main parameter, covering the length, width and height (Fyson 1985), determining the vessel design (Tangke 2010; Purnama et al 2015).

The main catch of Danish seine is the shrimp and the demersal fish like: goldband goatfish (*Upeneus moluccensis*), doublewhip threadfin bream (*Nemipterus nematophorus*), sea catfishes (*Ariidae*), grouper (*Serranidae)* and Jarbua terapon (*Terapon jarbua)* (Sudirman et al 2008; Nedelec & Prado 1990). Fishing operations using the Danish seine can be carried out in the morning or in the late afternoon, in less intense light conditions. The Danish seine catching trip is usually one day fishing (Antika et al 2014) and it has the advantage of seinebeing much cheaper, since it is used on vessels that are much smaller than trawls (Semedi & Schneider 2021).

The production function is a mathematical relationship between production (output) and the factors of production (input) (Shephard 1970), independently of the prices. Mathematically the production function can be expressed by $y = (x_1, x_2, x_3, \ldots x_n)$ while $x_1, x_2, x_3, \ldots x_n$ is the input factor used to produce output (y). The function above explains that the resulting output depends on input factors, but does not yet provide a quantitative relationship between input and output factors (Salvatore 1995; Nicholson 1999).

According to Suharso (2006), the new production process can run if the requirements (factors of production) needed can be met. In capture fisheries, the minimum required production factors consist of resources (sea), labor (fishermen) and capital (vessels and fishing gear). The three factors of production must be available. Each factor of production has a different function and is interrelated with each other. If one of the factors of production is not available, the production process will not run. In addition to the three production factors mentioned above, the authors intend to examine six production factors that are thought to influence the productivity of dogol boats at AFP Karangantu, namely the vessel length, the strength of the vessel's engine, the amount of fuel oil, the number of days a fishing trip, operational costs and number of crew members. With a high level of Danish seine production, it is necessary to carry out research on the analysis of the factors that affect the productivity of this Danish seine.

Material and Method. The tools and materials used in this research were: Danish seine, fishing gear, calculator, meter, digital camera, GPS, stationery, computer and software. The data collected consists of primary data obtained from interviews with fishermen and direct observations, and the secondary data obtained from the vessel and crew specifications, the AFP statistics annual report, the literature on the Danish seine productivity and of the fishing ground maps.

Data analysis method. The Catch Per Unit Effort (CPUE) data was collected at the same time as the fish landings. The relationship between catch and work is linear through the origin (Makwinja et al 2021). The CPUE is calculated based on the total production and on the number of trips, using the following formula (Gulland 1983):

$$CPUE=C/f$$

Where:
CPUE - production per unit of effort (kg a trip);
C - production (kg);
f - catch effort (trip).

To determine the factors that affect the productivity of the Danish seine, a production function analysis is carried out using the multiple linear regression analysis which is presented in tables and graphs. A parameter testing is carried out at the significance level (α) of 5%, in order to obtain a linear regression equation (Sugiyono 2015):

$$y = a + b1x1 + b2x2 + b3x3 + b4x4 + b5x5 + b6x6$$

Where:
y - productivity of the Danish seine (kg);
a - constant;
b - multiple regression coefficient;
x1 - length of vessel (m);
x2 - engine power (PS);
x3 - amount of fuel (L);
x4 - number of days per trip (days);
x5 - operational costs (USD);
x6 - number of crew members (people).

Results and Discussion. This research was conducted at the AFP Karangantu, Serang City, Banten Province, Indonesia (Figure 1).

Figure 1. The Archipelagic Fishery Port (AFP) of Karangantu (MMAF 2021).

Danish seine. Danish seine is very effective because operating it does not depend onthe fishing season as it is the case with other fishing gear so that it can be operated at any time. The shape of the Danish seine can be seen in Figure 2.

Figure 2. Danish seine (original).

Danish seine at the AFP Karangantu is made of wood with relatively the same length, of 10-15 m. The number of units was 46 in 2014, while in 2013 there were only 42 units. The dominance and development of this gear is justified by its level of productivity, namely 1,548 tons or 55.07% of the total fish catch of 2,811 tons, in 2014 (AFP 2015). In this research, sampling was carried out among the 10 Danish seine landed at the AFP of Karangantu. Data on these vessels was presented in Table 1 below.

Table 1

Danish seine research sample

Name of fishing vessel (FV)	Length (m)	Width (m)	GT	Engine power (PS)
FV. Putri Timbul	11.40	3.95	15	120
FV. Bunga Indah 01	12.20	4.34	14	120
FV. Bunga Indah 02	11.85	3.95	14	100
FV. Sari Jati Mulya	10.50	2.60	10	100
FV. Sari Jati Untung	13.20	4.05	18	120
FV. Sari Mulya	10.50	3.40	10	100
FV. Setia Jaya	14.50	4.42	19	120
FV. Setia Kawan	13.60	3.95	20	120
FV. Tirta Raya Mina 01	12.00	4.00	11	120
FV. Tirta Raya Mina 02	12.50	4.25	15	120

Fishing ground. Danish seine is operated at the bottom waters, which consists of sand, mud or a mixture of both. The Danish seine landed at The AFP of Karangantu has a fishing ground in the FMA-712, namely the North Jawa Sea, in the Sunda Strait, around Tunda Island and Panjang Island. This can be seen in Figure 3 below.

Gambar 3. Danish seine Fishing ground.

Danish seine catches. From 10 samples of the Danish seine, the types of fish landed at AFP Karangantu during the period February 15 to April 15 2015 consisted of 4 types of dominant fish (Table 2).

Table 2

The type of catch of the Danish seine at The AFP Karangantu for the period February - April 2015

No	*Type of catch*	*Total production (kg)*	*Percentage (%)*
1	Common ponyfish (*Leiognathus equulus*)	61,420	51.06
2	Goldband goatfish (*Upeneus moluccensis*)	20,298	16.87
3	Doublewhip threadfin bream (*Nemipterus nematophorus*)	6,234	5.18
4	Squid (*Loligo* spp)	5,680	4.72
5	Others	26,653	22.16
	Total	120,285	100.00

Source: MMAF 2016.

Danish seine Catch Rate (CPUE). The catch rate of Danish seine is the number of catches divided by the number of trips. The 10 Danish seines were used as objects of observation and the catch rate per vessel was reported in Table 3 below.

Table 3

Catch rate of Danish seine at The AFP of Karangantu

No	Name of fishing vessel (FV)	Total production (kg)	Trip (times)	Average (kg $trip^{-1}$)
1	FV. Tirta Raya Mina 01	3,305	2	1,652.5
2	FV. Tirta Raya Mina 02	6,391	6	1,065.2
3	FV. Sari Jati Untung	17,872	19	940.6
4	FV. Sari Mulya	3,371	4	842.8
5	FV. Setia Kawan	7,387	13	568.2
6	FV. Bunga Indah 01	22,514	40	562.9
7	FV. Setia Jaya	18,372	34	540.4
8	FV. Putri Timbul	12,370	23	537.8
9	FV. Bunga Indah 02	20,300	42	483.3
10	FV. Sari Jati Mulya	8,403	18	466.8
	Average			766.1

From the table above it can be seen that FV. Tirta Raya Mina 01 has the highest catch rate, which is 1,652.5 kg $trip^{-1}$. Meanwhile, FV. Sari Jati Mulya is a lowest catch rate, which is 466.8 kg $trip^{-1}$.

Productivity of the Danish seine. The productivity of the Danish seine is the average level of production per trip, which is determined by a number of variables, grouped into 6 categories, namely: the level of production according to the vessel size, the engine power, fuel consumption, number of days per trip, operational costs, and the number of crew members.

Danish seine production rate according to vessel length size. The Danish seine units sampled in the measurements were installed on 10 vessels of variable sizes. However, among the 10 vessels, there are 2 vessels that have the same length, namely FV. Sari Jati Mulya and FV. Sari Mulya. It was assumed that the length of the vessel will determine the level of productivity. The level of production of the Danish seine according to the vessel size was presented in Table 4 below.

Table 4

Danish seine production rate per trip according to the vessel length

Name of fishing vessel (FV)	Vessel length (m)	Trip (times)	Production (kg)			
			Total	Average/trip	Min.	Max.
FV. Sari Jati Mulya	10.50	18	8,403	467	259	714
FV. Sari Mulya	10.50	4	3,371	843	420	1,167
FV. Putri Timbul	11.40	23	12,370	538	272	863
FV. Bunga Indah 02	11.85	42	20,300	483	244	793
FV. Tirta Raya Mina 01	12.00	2	3,305	1,653	1,171	2,134
FV. Bunga Indah 01	12.20	40	22,514	563	378	899
FV. Tirta Raya Mina 02	12.50	6	6,391	1,065	610	1,790
FV. Sari Jati Untung	13.20	19	17,872	941	509	1,763
FV. Setia Kawan	13.60	13	7,387	568	306	899
FV. Setia Jaya	14.50	34	18,372	540	228	823

Table 4 shows that the average production of the Danish seine for each trip is different according to the length of the vessel. The results from the 10 Danish seines gave a difference in the value of landed fish production. However, this difference shows that the Danish seine with a larger size has almost the same efficiency as a smaller vessel. This is because the length of the vessel is not consistent with the size of the fishing gear. The relationship between the length of the vessel and the dependent variable, namely the production, was illustrated in Figure 4.

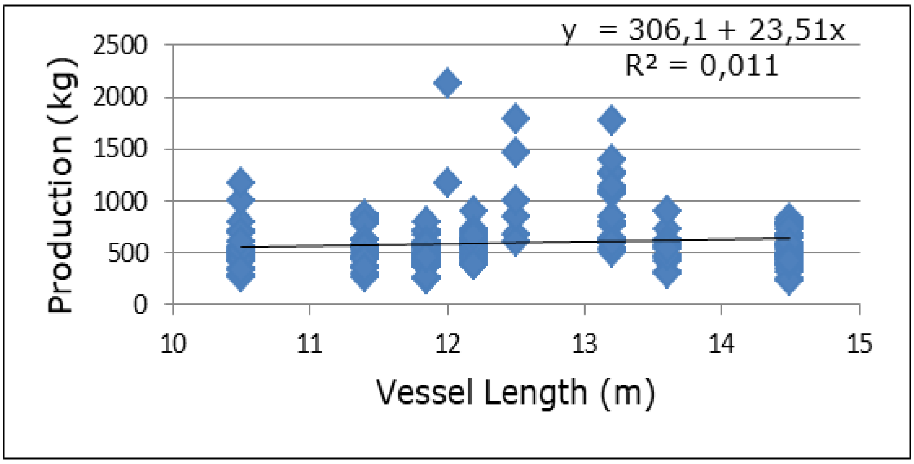

Figure 4. Graph of the relationship between production and vessel length.

In the equation described by the graph above, the correlation coefficient (R) is 0.104. In this case, the correlation between production and vessel length is weak and positive.

By squaring R, the coefficient of determination (R^2) can be obtained, which is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above, it is known that the coefficient of determination (R^2) between production (y) and vessel size (x_1) is 0.011 which means that 1.1% of the production obtained is influenced by the vessel size and the remaining 98.9% is influenced by other factors (Ghozali 2011).

Danish seine production rate according to engine power vessels. According to the engine powers, the 10 sample vessels observed were divided in 2 categories, namely vessels with engine powers of 100 ps and 120 ps. There are 3 vessels with an engine power of 100 ps and 7 vessels with an engine power of 120 ps. The level of Danish seine production according to the vessel's engine power can be presented in Table 5 and Figure 5 below.

Table 5

Danish seine production rate per trip according to the size of the engine power

Engine power (ps)	*Trip (times)*	*Production (kg)*			
		Total	*Average/Trip*	*Minimum*	*Maximum*
100	64	32,074	501	244	1,167
120	137	88,211	644	228	2,134

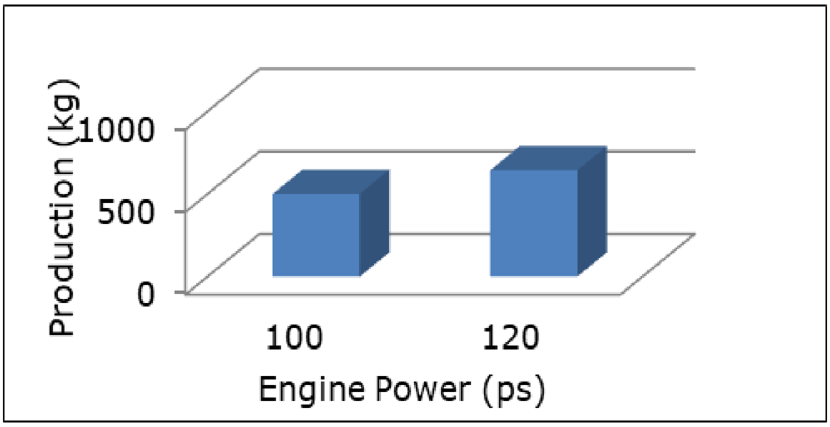

Figure 5. The average production rate according to engine power.

The table and graph above shows that the average production of a Danish seine for each trip is different according to the size of the vessel's engine power. The average production of a vessel with an engine size of 100 ps is 501 kg trip^{-1}, while for the larger vessel size, of 120 ps, it is of 644 kg trip^{-1}. The results of data processing from the 10 sample Danish seines gave a difference in the value of the fish production. This difference illustrates that a Danish seine with a larger engine power size has the ability to catch a larger volume of fish compared to a vessel with a smaller engine power, due to an accelerated fishing gear operating process.

Danish seine production rate according to total fuel oil. In terms of fuel consumption, the 10 sample vessels are divided into 11 categories. The level of production can be shown in Table 6 and Figure 6 below.

Table 6

Danish seine production rate per trip according to the amount of fuel

No	*Fuel oil (L)*	*Trips (times)*	*Production (kg)*			
			Total	*Minimum*	*Maximum*	*Average/trip*
1	60	2	976	420	556	488
2	70	2	989	455	534	495
3	80	122	59,800	228	899	534
4	90	1	993	993	993	993
5	100	70	39,964	250	1,253	571
6	150	1	1,167	1,167	1,167	1,167
7	160	1	1,141	1,141	1,141	1,141
8	200	5	5,658	995	1,393	1,132
9	300	1	1,272	1,272	1,272	1,272
10	400	4	6,191	1,171	1,467	1,548
11	500	1	2,134	2,134	2,134	2,134

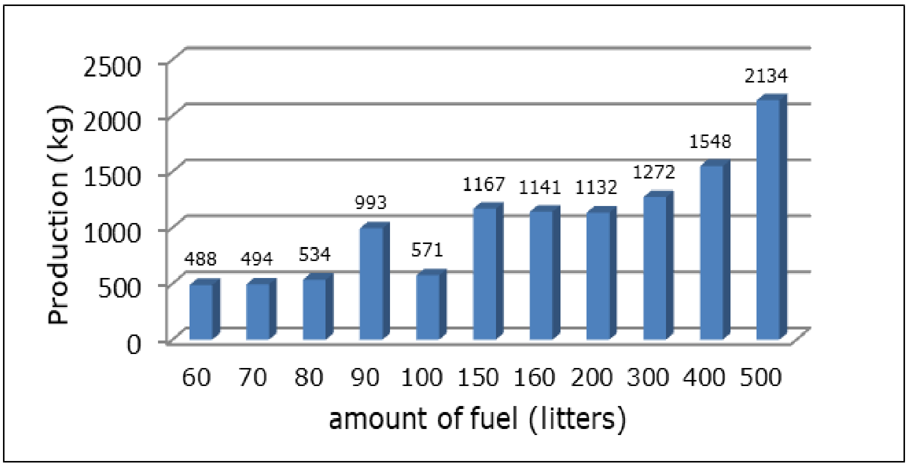

Figure 6. The average production rate according to the amount of fuel.

The table above shows that the average production of the Danish seine for each trip is different according to the amount of fuel. These results illustrate that the higher the amount of fuel, the higher the productivity of the catch. This is presumably because a higher fuel consumption is followed by a higher intensity and duration of the fishing gear operation. The relationship between the independent variable, namely the amount of fuel, and the dependent variable, namely the production, can be illustrated in Figure 7 below.

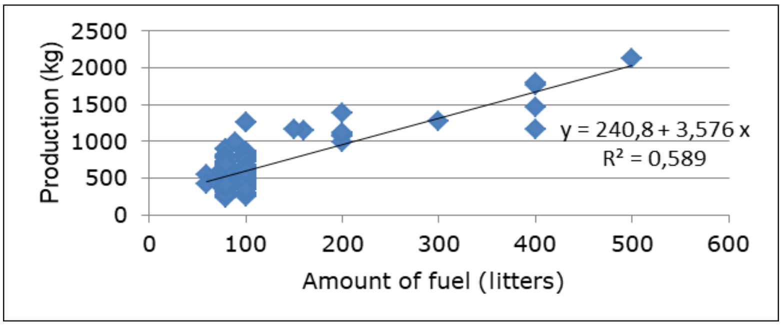

Figure 7. The relationship between production and amount of fuel.

In the equation described by the graph above, the correlation coefficient (R) is 0.767. From the correlation coefficient (R), it can be observed that the correlation between the production and the amount of fuel is strong and positive. The coefficient of determination (R^2) between production (y) and the amount of fuel (x_3) is 0.589, which means that 58.9% of the production obtained is influenced by the amount of fuel and the remaining 41.1% is influenced by other factors (Ghozali 2011).

Production rate of Danish Seine according to the number of days per trip. Danish seine operating at AFP Karangantu generally have an average number of operating days of 1 day. However, of the 10 sample vessels, the number of days per trip was observed divided into 4 categories, namely: the 1-day trips, 2-day trips, 3-day trips and 4-day trips. The level of Danish seine production according to the number of days per trip can be shown in Table 7 and Figure 8 below.

Table 7

Danish seine production rate per trip according to the number of days per trip

Number of days trip^{-1}	*Trips (times)*	*Production (kg)*				
		Total	*Avg. trip^{-1}*	*Avg. day^{-1}*	*Min.*	*Max.*
1	180	95,719	532	532	228	899
2	16	16,019	1,001	501	505	1,272
3	4	6,413	1,603	534	1,393	1,790
4	1	2,134	2,134	534	2,134	2,134

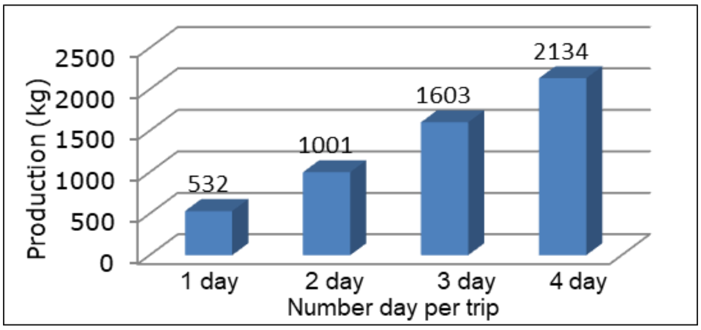

Figure 8. The average production rate according to the number of days per trip.

From the table and graph above, the average production of the Danish seine varies according to the number of days per trip. The average production of a Danish seine, with the number of days per trip of 1 day is 532 kg trip^{-1}, the number of days per trip of 2 days is 1,001 kg/trip, the number of days per trip of 3 days is 1,603 kg/trip, and the number of days per trip of 4 days is 2,134 kg/trip. These values illustrate that a Danish seine with more days per trip has the ability to get a larger catch of fish than for fewer days per trip. However, when averaged, the production per day tends to be the same and there is no significant change. The relationship between the independent variable, namely the number of days per trip, and the dependent variable, namely the production, can be seen in Figure 9 below.

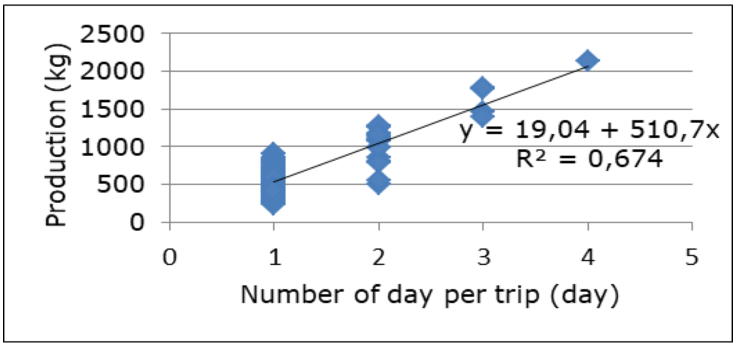

Figure 9. The relationship between production and the number of days $trip^{-1}$.

In the equation described by the graph above, the correlation coefficient (R) is 0.821. From the correlation coefficient (R), it can be observed that the correlation between the production and the number of days per trip is very strong and positive.

The coefficient of determination (R^2) between the production (y) and the number of days per trip (x_4) is 0.674 which means that 67.4% of the production obtained is influenced by the number of days per trip and the remaining is 32.6% influenced by other factors.

Danish seine production level according to operational costs. The Danish seine requires operational costs to meet its needs during fishing operations. The operational costs consist of the cost of fuel, engine oil, clean water, net equipment, ice, foodstuffs and others. The level of production of a Danish seine according to the operational costs used can be presented in Table 8 and Figure 10 below.

Table 8

Danish seine production rate per trip according to operational costs

No	*Operating costs (USD)*	*Trip (times)*	*Production (kg)*			
			Total	*Average /trip*	*Minimum*	*Maximum*
1	51.28	28	15,961	570	361	899
2	54.95	5	2,503	501	285	714
3	55.68	1	420	420	420	420
4	57.14	1	501	501	501	501
5	58.61	46	23,280	506	228	993
6	62.27	20	10,230	512	276	899
7	65.93	44	24,269	552	263	843
8	69.60	15	9,124	608	362	863
9	73.26	22	11,124	506	250	793
10	80.59	2	1,161	581	350	811
11	87.91	3	3,358	1,119	852	1,253
12	109.89	1	791	791	791	791
13	124.54	1	1,167	1,167	1,167	1,167
14	161.17	1	1,141	1,141	1,141	1,141
15	168.50	1	1,077	1,077	1,077	1,077
16	175.82	1	1,393	1,393	1,393	1,393
17	183.15	3	3,188	1,063	995	1,084
18	190.48	1	1,272	1,272	1,272	1,272
19	241.76	1	1,790	1,790	1,790	1,790
20	256.41	1	1,763	1,763	1,763	1,763
21	278.39	2	2,638	1,319	1,171	1,467
22	318.68	1	2,134	2,134	2,134	2,134

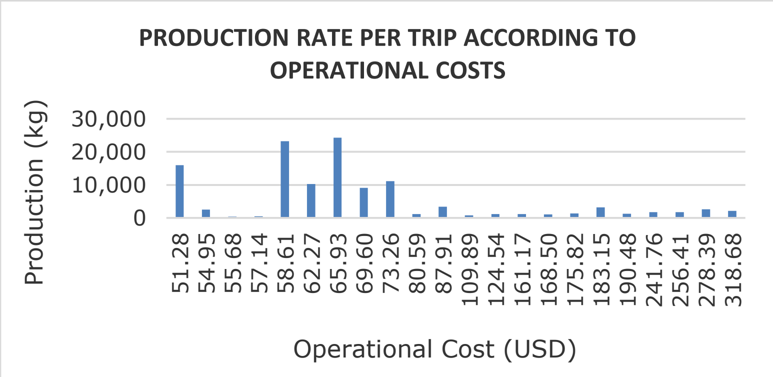

Figure 10. The average level of production according to the operational costs.

The table and graph above shows that the average production of a trip differs according to the operational costs. The results illustrate that a Danish seine with a higher operating cost has the ability to get a larger catch of fish than a vessel with a lower operating cost. The relationship between the independent variables, namely the operational costs and the dependent variable, namely the production, can be seen in Figure 11 below.

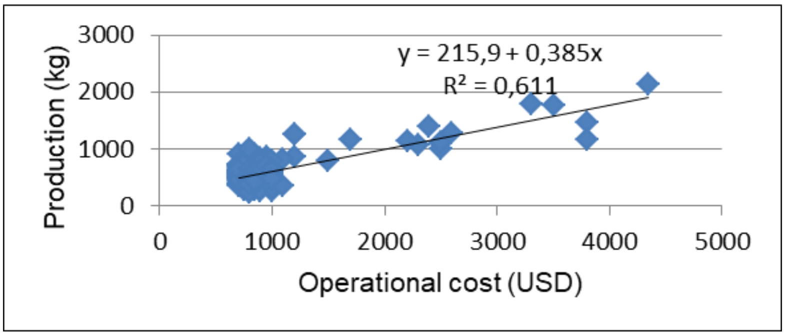

Figure 11. The relationship between production and operational costs.

In the equation described by the graph above, the correlation coefficient (R) is 0.782. The correlation between production and operational costs is strong and positive. The coefficient of determination (R^2) between production (y) and operational costs (x_5) is 0.611 which means that 61.1% of the production obtained is influenced by operational costs and the remaining 38.9% is influenced by other factors.

Danish seine production level according to number of crew members. The number of crew members is a factor that needs to be considered in the operation of the Danish seine. Each crew member has its respective role and function. Of the 10 sample vessels that were observed, the crews can be divided into 7 categories, namely with 4, 5, 6, 7, 8, 9 and 10 people. The level of production of the Danish seine according to the number of crew members used can be presented in Table 9 and Figure 12 below.

Table 9

Danish seine production rate per trip according to number of crew

No	*Number of crew (people)*	*Trips (times)*	*Production(kg)*			
			Total	*Aver. trip^{-1}*	*Minimum*	*Maximum*
1	4	3	2.204	735	420	993
2	5	41	21.580	526	228	1.167
3	6	64	32.448	507	250	899
4	7	69	45.264	656	224	1.790
5	8	16	8.932	558	350	717
6	9	5	5.429	1.086	543	2.134
7	10	3	4.428	1.476	1.272	1.763

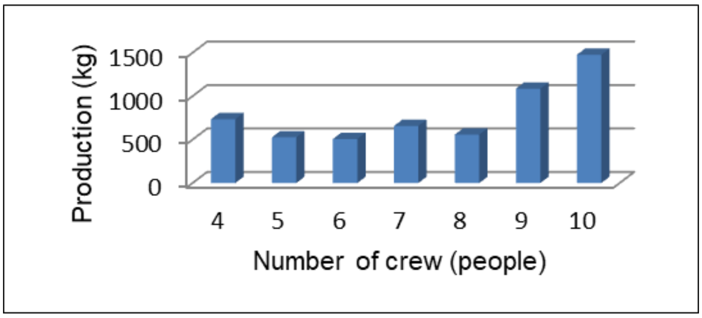

Figure 12. Average levels of production by number of crew.

The table and graph above shows that the average production of the Danish seine for each trip varies according to the size of the number of crew members used. seineThis difference illustrates that a Danish seine with a larger crew has the ability to catch more fish than a vessel with a smaller crew. This is because more and more crew members will simplify and speed up the fishing gear operation.

The relationship between the independent variable, namely the number of crew members, and the dependent variable, namely the production, is described in Figure 13.

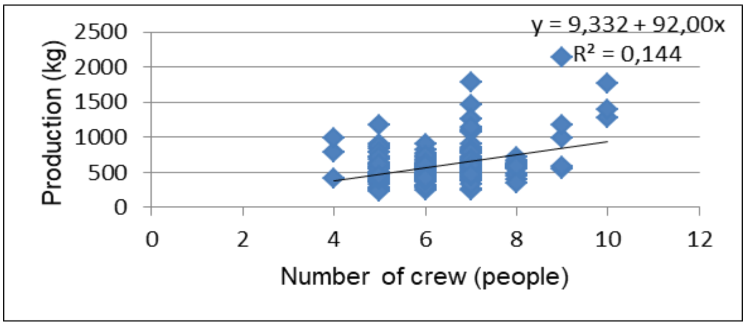

Figure 13. Relationship between production and number of crew members.

From the graph above, the correlation coefficient (R) is 0.379. The correlation between production and number of crew members is moderate and positive. The coefficient of determination (R^2) between production (y) and the number of crew members (x_6) is 0.144, which means that 14.4% of the production obtained is influenced by the number of crew members and the remaining 85.6% is influenced by other factors.

Combined factors affecting the productivity of Danish seine. To determine the influence of the linear combination of factors on the productivity of the Danish seine, a multiple linear regression analysis is performed. Data processing used the softwares Microsoft Excel and Statistical Product and Service Solutions (SPSS) version 17, with the parameter testing carried out at the significance level (α) of 5%. The results of the multiple regression analysis of variance can be seen in Table 10 (Suharso et al 2006).

Table 10

Analysis of variance multiple linear regression analysis of factors which affects the productivity of the Danish seine

No	*Source*	*Degrees of freedom*	*Sum of squares (JK)*	*Middle square (KT)*	F_{count}	*Probability > F*
1	Regression	6	1.043	1738443.139	83.661[a]	0.000
	Residue	194	4031244,511	20779.611		
2	Total	200	1.446			
3	R^2	0.721				
	R	0.849				

a = real at the 95% level (α = 0.05).

The results of the analysis in Table 10 above show that the coefficient of determination (R^2) is 0.721, which means that 72.1% of the productivity of the Danish seine (y) can be influenced by the variables: x_1 = length of the vessel, x_2 = engine power, x_3 = Amount of fuel, x_4 = number of days/trip, x_5 = operational costs, x_6 = number of crew, while the remaining 27.9% is influenced by other variables that are not included in the model.

The change in the Danish seine productivity can be explained with a 95% confidence level for all the 6 predefined variables (Suharso et al 2006).

The correlation coefficient (R) is used to determine the degree of closeness of the relationship between the dependent variable (y) and the independent variables (x). The results of the analysis showed that the coefficient (R) value is 0.849 with a positive sign, indicating that the dependent variable (y) has a strong relationship with the linear combination of independent variables (x).

Partial testing is used to test the effect of the independent variables individually on the dependent variable (y) using the t_{test}. A summary of the results of multiple linear regression analysis on the productivity of the Danish seine is presented in Table 11.

Table 11

Parameters value analysis of variance and multiple linear regression analysis of the factors affecting the productivity of the Danish seine

No.	*Explanatory description (x)*	*Regression coefficient (b)*	*t count*	*Probability > t*
1	Intercept	-514,355	-3,678	0,000
2	The length of the vessel (x_1)	13,069	1,251 [tn]	0,212
3	Engine power (x_2)	2,337	1,696 [tn]	0,092
4	Total fuel (x_3)	1,029	1,491 [tn]	0,138
5	Number of days per trip (x_4)	388,054	7,874 [a]	0,000
6	Operating costs (x_5)	-0,016	-0,199 [tn]	0,842
7	Number of crew (x_6)	24,687	2,423 [a]	0,016
8	The coefficient of determination (R^2)	0,721		

a-significant at the 95% confidence level (α=0.05); tn-not significant at the 95% confidence level (α=0.05).

After the data is analyzed, the following equation is obtained:

$$y = -514.355 + 13.069\ x_1 + 2.337\ x_2 + 1.029\ x_3 + 388.054\ x_4 - 0.016\ x_5 + 24.687\ x_6$$

Where:
y - Productivity of the Danish seine (kg);
x1 - Length of vessel (m);
x2 - Engine power (ps);
x3 - fuel consumption (ltr);
x4 - Number of days/trip (days);
x5 - operational costs (USD);
x6 - number of crew (people).

The appropriate use of factors that affect productivity, can be determined from the production elasticity to each variable change, as follows:

1. The length of the vessel variable (x_1) does not have a significant effect (a probability level of 0.212). The variable x_1 has a regression coefficient (b_1) of 13.069. This means that each additional 1 m of vessel length will increase the productivity of the Danish seine by 13.069 kg (if the other variables are constant). The length of the vessel does not significantly determine the amount of the catch, since its increase is not necessarily accompanied by an increase in the size of the fishing gear. seine
2. The machine power variable (x_2) does not have a significant effect (a probability level of 0.092). The variable x_2 has a regression coefficient (b_2) of 2.337. This means that every addition of 1 PS of engine power will increase the productivity of the Danish seine by 2.337 kg (if the other variables remain constant).

The power of the engine (x_2) will determine the speed of the vessel when the vessel is moving towards the fishing ground. Vessels with relatively high speeds can reach the fishing ground more quickly. With a large engine power, the fishing gear operating process will also be faster.

3. The amount of fuel variable (x_3) does not have a significant effect (a probability level of 0.138). The variable x_3 has a regression coefficient (b_3) of 1.029. This means that each additional 1 liter of total fuel will increase the productivity of the Danish seine by 1.029 kg (if the other variables are constant). seineThe larger the amount of fuel, the longer the catching trip (and the gear's operating period)
4. The operating time per trip variable (x_4) has a significant effect (a probability level of 0.000, smaller than 0.05). The variable x_4 has a regression coefficient (b_4) of 388.054. This means that each additional 1 day of operation will increase the productivity of the Danish seine by 388.054 kg (if the other variables remain constant). This positive relationship shows that productivity is directly proportional to the loength of the operating days of the Danish seine.
5. The operational cost variable (x_5) has no significant or insignificant effect (a probability level of 0.842). The variable x_5 has a regression coefficient (b_5) of -0.016 and the effect is negative. This means that each additional USD 0.00007 of the operational costs will reduce the productivity of the Danish seine by 0.016 kg (if the other variables are constant).
6. The variable number of crew (x_6) has a significant effect with (a probability level of 0.016, smaller than 0.05). The variable x_6 has a regression coefficient (b_6) of 24.687. This means that each additional 1 crew member will increase the productivity of the Danish seine by 24,687 kg (if the other variables remain constant). This positive relationship shows that the productivity of the Danish seine is determined by the number of crew members. The number of crew members has a real effect because a larger number of crew members accelerates the operation of the fishing gear.

Conclusions. Based on the results and discussion previously described, it can be concluded that:

1. The FV. Tirta Raya Mina 01 has the highest catch rate, which is 1,652.5 kg a trip, while the FV. Sari Jati Mulya is the Danish seine carrier with the lowest catch rate, which is 466.8 kg/trip. However, if the rate of catch per day is averaged, there is no significant difference in the catch rates.
2. The correlation between the productivity of the Danish seine with the variable amount of fuel (x_3), number of days per trip (x_4), and operational costs (x_5) is very strong and positive. while the correlation between productivity and the variable number of crew members (x_6) is moderate and positive. Meanwhile, the correlation between productivity and vessel size variable (x_1) or engine power (x_2) is weak and positive.
3. The linear combination of the independent variables (x) which consists of: variable length of vessel (x_1), engine power (x_2), fuel consumption (x_3), number of days per trip (x_4), operational costs (x_5) and number of crew members (x_6) has a significant effect on the increase in the productivity of the Danish seine (y). However, individually (partially) only the variable number of days per trip (x_4) and the number of crew members (x_6) had a significant effect, while the other variables had no significant effect on the Danish seines' productivity increase seine(y).

Conflict of interest. The authors declare no conflict of interest.

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Questions

Eni Kovacs <ek.bioflux@gmail.com>
Kepada: erick nugraha
Sel, 20 Jul 2021 jam 02.13

Dear Dr. Nugraha,

The editorial team assessed your manuscript and concluded that data were collected or reported and simulations were performed at least 6 years ago. More recent data and consistent time series (i.e. same or close periods for the collected and reported data) are required.

Please clarify: why do you say that the considered period is the period February - April 2015, while you indicate the source of the data presented in the table as follows: "Source : MMAF 2006." ? You need to solve all the contradictions related to the time series. (comment to the Table 2)

Thank you!

Kind regards,
Editor AACL Bioflux
Eniko Kovacs

Bioflux - D....docx
1.4MB

erick nugraha <nugraha_eriq1@yahoo.co.id>
Sel, 20 Jul 2021 jam 06.43

Analysis of production factors that affect ~~to~~ the productivity of Danish ~~Seiner~~ seine at the Archipelagic Fishery Port (AFP) of Karangantu, Banten Province - Indonesia

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Abstract. The purpose of this study is to determine the productivity of the Danish ~~seiner~~seine and to analyze the production factors that affect the productivity of the Danish ~~seiner~~seine which includes: vessel length (x1), vessel engine power (x2), amount of fuel oil (x3), number of days per trip (x4), operational costs (x5), and number of crew members (x6). This research was carried out using a survey method. ~~Primary~~ The primary data collected are the catch volume of the Danish ~~seiner~~seine (y), the length of the vessel (x1), the power of the vessel's engine (X2), the amount of fuel oil (x3), the number of days per trip (x4), the operational costs (x5), ~~and~~ the number of crew members (x6)~~,~~ and the fishing ground of the Danish ~~seiner~~seine. Meanwhile, the secondary data are documents of the vessel and crew of the Danish ~~seiner~~seine, literature on the Danish ~~seiner~~seine~~,~~ and the annual the AFP Karangantu report. ~~To~~ In order to ~~find out~~determine the production factors that affect the productivity of the Danish ~~Seiner~~Seine, ~~through~~ a multiple linear regression analysis ~~using~~ via computer software was used. The results of this study explain that the correlation between the productivity of the Danish ~~seiner~~seine (y) and the variables x3, x4, x5 is very strong and ~~unidirectional~~positive. ~~For~~ T~~t~~he correlation between productivity (y) and the variable x6 is moderate and ~~unidirectional~~positive, ~~. W~~while the correlation between the productivity (y) ~~with~~ and the variables x1 and x2 is weak and ~~unidirectional~~positive. Taken together, the independent variables x1, x2, x3, x4, x5~~,~~ and x6 have a significant effect on the increase ~~in~~ of ~~productivity of~~ the Danish ~~Seiner~~Seine productivity (y). However, individually (partially) only the variables x4 and x6 have a significant effect, while the other variables have no significant effect on the increase ~~in productivity~~ of the Danish ~~Seiner~~Seine productivity (y).

Key Words: CPUE, *Leiognathus equulus*, FMA 712, ...

Introduction. The Archipelago Fishing Port (AFP) of Karangantu has a~~important~~ strategic role~~s~~ in the fishery and marine development (Puspitasari et al 2013; Suherman et al 2020). The potential of marine and fishery natural resources ~~owned by~~of the Banten Province is spread across three water areas ~~of Banten waters~~:~~, including~~ the Indian Ocean, the Sunda Strait~~,~~ and the Java Sea (Rizal 2013; Oktaviyani et al 2015). The types of fishing gear used include lift nets, purse seine, danish ~~seiner~~seine~~,~~ and hand line ~~and several other fishing gear~~ (Rahmawati et al 2017; Diniah et al 2012).

Total production of fish caught in the AFP Karangantu in 2013 as many as 2,797 tons (Hamzah et al 2015). In 2014, the AFP Karangantu recorded 2,881 tons ~~production~~ of landed catches. ~~of 2,881 tons and t~~The Danish ~~seiner~~seine ~~is~~ has the highest ~~level of production~~contribution, among the other operating fishing gears~~ operating~~, ~~that reached~~ reaching 1,548 tons or 55.07% of the total catch (AFP Karangantu, 2015). Productivity is a measure that states how well resources are managed and utilized to achieve optimal results (Sarjono 2001). The production process can only run if the ~~required requirements~~

~~can be met and this requirement is better known as~~ the production factor requirements can be met. In capture fisheries, the minimum required production factors consist of resources (sea), labor (fishermen) and capital (boats and fishing gear) (Suharso et al 2006).

The Danish ~~Seiner~~seine is similar to a trawler, being ~~and the construction of the Danish seiner~~seine ~~is~~ relatively simple (Ardidja~~,~~ 2010; Sudirman & Mallawa 2004). It is a fishing gear that is more likely to replace trawling ~~as a means of utilizing~~in the exploitation of demersal fishery resources (MMFA 2011). This condition allows herds of fish to enter the net (Antika et al 2014). The dimensions the main vessel is the main ~~measure ones contained on the vessel~~parameter, covering the length, width and height ~~vessel~~ (Fyson 1985), ~~this can be used as the main parameter in determine~~ determining the vessel design (Tangke 2010; Purnama et al 2015).

The main catch of Danish ~~seiner~~seine is the shrimp and the demersal fish like: ~~an~~ goldband goatfish (*Upeneus moluccensis*), doublewhip threadfin bream (*Nemipterus nematophorus*), sea catfishes (*Ariidae*), grouper (*Serranidae)* and Jarbua terapon (*Terapon jarbua)* (Sudirman et al 2008; Nedelec & Prado 1990). Fishing operations using the Danish ~~seiner~~seine can be carried out in the morning or in the late afternoon, in ~~before~~ less intense light conditions ~~or in the late afternoon~~. The Danish ~~seiner~~seine catching trip is usually one day fishing (Antika et al 2014~~).~~) and it has t~~T~~he advantage of ~~the danish seiner~~seine ~~operation are~~being much cheaper, ~~because~~ since it is used on vessels that are much smaller than trawls (Semedi & Schneider 2021).

The production function is a mathematical relationship between production (output) and the factors of production (input) (Shephard 1970~~).~~), ~~This relationship is without regard to~~independently of the prices~~, both the prices of the factors of production and the production~~. Mathematically the production function can be expressed by y = (x_1, x_2, x_3, … x_n) while x_1, x_2, x_3, … x_n is the input factor used to produce output (y). The function above explains that the resulting output depends on input factors, but does not yet provide a quantitative relationship between input and output factors (Salvatore 1995; Nicholson 1999).

(...)

Commented [A1]: The aim of the study is required.

Material and Method. The tools and materials used in this research ~~are~~were: Danish ~~seiner~~seine, fishing gear, calculator, meter, digital camera, GPS, stationery, computer and software. The data collected consists of primary data ~~were~~ obtained from interviews with fishermen and direct observations, and the secondary data obtained ~~are~~ from the vessel and crew ~~documents~~specifications, the AFP statistics annual report, the literature ~~of~~ on the Danish ~~seiner~~seine productivity~~,~~ and ~~data of~~of the fishing ground maps.

Data analysis method. The Catch Per Unit Effort (CPUE) data ~~is~~ was collected at the same time as the fish landings. T~~his shows that t~~he relationship between catch and work is linear through the origin (Makwinja et al 2021). ~~To calculate the value of~~ T~~t~~he CPUE is calculated~~,~~ ~~each fishing gear is calculated~~based on the total ~~amount of~~ production and on the number of trips, using the following formula (Gulland 1983):

$$CPUE = C/f$$

~~With~~Where:
CPUE ~~=~~ - production per Unit of Effort (kg trip);
C ~~=~~ - production (kg);
f ~~=~~ - catch effort (trip).
To determine the factors that affect the productivity of the Danish ~~seiner~~seine, a production function analysis is carried out using the multiple linear regression analysis which is presented in tables and graphs. ~~Parameter~~ A parameter testing is carried out at the ~~real~~ significance level (α) of 5%, in order to obtain a linear regression equation (Sugiyono 2015):

$$y = a + b1x1 + b2x2 + b3x3 + b4x4 + b5x5 + b6x6$$

~~With~~Where:
~~–~~y ~~=~~- productivity of the Danish ~~seiner~~seine (kg);
~~–~~a ~~=~~- constant;
~~–~~b ~~=~~- multiple regression coefficient;
x1 ~~=~~- length of vessel (m);
x2 ~~=~~- engine power (PS);
x3 ~~=~~- amount of fuel (~~ltr~~L);
x4 ~~=~~- number of days per trip (days);
x5 ~~=~~- operational costs (~~Rp~~USD);
x6 ~~=~~- number of crew members (people).

Results and Discussion. This research was conducted at the AFP Karangantu, Serang City, Banten Province, Indonesia (Figure 1).

Figure 1. The Archipelagic Fishery Port (AFP) of Karangantu (MMAF 2021).

Danish ~~seiner~~seine. Danish ~~seiner~~seine is very effective because ~~its operation~~ operating it does not ~~recognize~~ depend on the fishing season as it is the case with other fishing gear so that it can be operated at any time. The shape of the Danish ~~seiner~~seine can be seen in Figure 2.

Figure 2. Danish ~~seiner~~seine (original).

Danish ~~seiner~~seine at the AFP Karangantu is made of wood with relatively the same length, ~~rate from~~ of 10–15 m. The number of units was 46 ~~units~~ in 2014, ~~of which~~while in 2013 there were ~~still~~ only 42 units. The ~~development of this additional fleet positions as a type that has a dominant~~ dominance and development of this gear is justified by its level of producti~~vity~~on, because the catch is much higher than other fishing gears, namely 1,548 tons or 55.07% of the total fish catch ~~in 2014~~ of 2,811 tons, in 2014 (AFP Karangantu, 2015). In this research, sampling was carried out ~~on~~ among the 10 Danish ~~seiner~~seine landed at ~~The~~ the AFP of Karangantu. Data on these vessels ~~can be~~was presented in Table 1 below.

Table 1

Danish ~~seiner~~seine research sample

Name of fishing vessel	Length (m)	Width (m)	GT	Engine power (PS)
FV. Putri Timbul	11.40	3.95	15	120
FV. Bunga Indah 01	12.20	4.34	14	120
FV. Bunga Indah 02	11.85	3.95	14	100
FV. Sari Jati Mulya	10.50	2.60	10	100
FV. Sari Jati Untung	13.20	4.05	18	120
FV. Sari Mulya	10.50	3.40	10	100
FV. Setia Jaya	14.50	4.42	19	120
FV. Setia Kawan	13.60	3.95	20	120
FV. Tirta Raya Mina 01	12.00	4.00	11	120
FV. Tirta Raya Mina 02	12.50	4.25	15	120

Fishing ground. Danish ~~seiner~~seine is operated ~~in~~ at the bottom waters, which ~~are~~ consists of sand, mud or a mixture of both. The Danish ~~seiner~~seine ~~that~~ landed at The AFP of Karangantu has a fishing ground in the FMA-712, namely the North Jawa Sea, ~~to be precise~~ in the Sunda Strait, around Tunda Island and Panjang Island. This can be seen in Figure 3 below.

Gambar 3. Danish ~~seiner~~seine Fishing ground.

Danish ~~seiner~~seine catches. From 10 samples of the Danish ~~seiner~~seine, the types of ~~production~~ fish landed at AFP Karangantu during the period February 15 to April 15 2015 consisted of 4 types of dominant fish (Table 2).

Table 2

The type of catch of the Danish ~~seiner~~seine at The AFP Karangantu for the period February - April 2015

No	Type of catch	Total production (kg)	Percentage (%)
1	Common ponyfish (*Leiognathus equulus*)	61,420	51.06
2	Goldband goatfish (*Upeneus moluccensis*)	20,298	16.87
3	Doublewhip threadfin bream (*Nemipterus nematophorus*)	6,234	5.18
4	Squid (*Loligo* spp)	5,680	4.72
5	Others	26,653	22.16
	Total	120,285	100.00

Source : MMAF 2016.

Danish ~~Seiner~~seine Catch Rate (CPUE). The catch rate of Danish ~~seiner~~seine is the number of catches ~~of a~~dividided by the number of trips. ~~T~~From ~~t~~he 10 ~~of~~ Danish ~~seiner~~seines were used as objects of observation~~,~~ and the catch rate per vessel ~~can be described~~was reported in Table 3 below.

Table 3

Catch rate of Danish ~~seiner~~seine at The AFP of Karangantu

	Name of fishing vessel	Total production (kg)	Trip (times)	Average (kg trip^{-1})
1	FV. Tirta Raya Mina 01	3,305	2	1,652.5
2	FV. Tirta Raya Mina 02	6,391	6	1,065.2
3	FV. Sari Jati Untung	17,872	19	940.6
4	FV. Sari Mulya	3,371	4	842.8
5	FV. Setia Kawan	7,387	13	568.2
6	FV. Bunga Indah 01	22,514	40	562.9
7	FV. Setia Jaya	18,372	34	540.4
8	FV. Putri Timbul	12,370	23	537.8
9	FV. Bunga Indah 02	20,300	42	483.3
10	FV. Sari Jati Mulya	8,403	18	466.8
		Average		766.1

Commented [A2]: Required: at the first occurrence, the abbreviated words must be written in full letters.

From the table above it can be seen that FV. Tirta Raya Mina 01 has the highest catch rate, which is 1,652.5 kg trip^{-1}. Meanwhile, FV. Sari Jati Mulya is a lowest catch rate, which is 466.8 kg trip^{-1}.

Productivity of the Danish seine. The productivity of the Danish ~~seiner~~seine is the average level of production per trip, which is determined by a number of variables,~~.~~ ~~Where these variables are~~ grouped into 6 ~~parts~~categories, namely: the level of production according to the vessel size, the engine power, fuel consumption, number of days per trip, operational costs, and the number of crew members.

Danish ~~seiner~~seine production rate according to vessel length size. The Danish ~~seiner~~seine units sampled in the measurements were installed on 10 vessels of variable ~~, where each vessel has its own~~ sizes. However, among the 10 vessels, there are 2 vessels that have the same length, namely FV. Sari Jati Mulya and FV. Sari Mulya. ~~Measurements are made on the length of the vessel with the~~It was ~~assumption~~ assumed that the length of the vessel will determine the level of productivity. The level of production of the Danish ~~seiner~~seine according to the vessel size ~~can be~~was presented in Table 4 below.

Table 4

Danish ~~seiner~~seine production rate per trip according to the vessel length

Name of fishing vessel	Vessel length (m)	Trip (times)	Production (kg)			
			Total	Average/trip	Minimum	Maximum
FV. Sari Jati Mulya	10.50	18	8,403	467	259	714
FV. Sari Mulya	10.50	4	3,371	843	420	1,167
FV. Putri Timbul	11.40	23	12,370	538	272	863
FV. Bunga Indah 02	11.85	42	20,300	483	244	793
FV. Tirta Raya Mina 01	12.00	2	3,305	1,653	1,171	2,134
FV. Bunga Indah 01	12.20	40	22,514	563	378	899
FV. Tirta Raya Mina 02	12.50	6	6,391	1,065	610	1,790
FV. Sari Jati Untung	13.20	19	17,872	941	509	1,763
FV. Setia Kawan	13.60	13	7,387	568	306	899
FV. Setia Jaya	14.50	34	18,372	540	228	823

Table 4 shows that the average production of the Danish ~~seiner~~seine for each trip is different according to the length of the vessel. The results ~~of data processing~~ from the 10 ~~sample~~ Danish ~~seiner~~seines gave a difference in the value of landed fish production. However, this difference shows that the Danish ~~seiner~~seine with a larger size has ~~the ability to catch fish that is~~ almost the same efficiency as ~~compared to~~ a smaller vessel.

This is because the length of the vessel is not ~~followed by~~consistent with the size of the fishing gear. The relationship between ~~the independent variables, namely~~ the length of the vessel and the dependent variable, namely the production, ~~can be~~was illustrated in Figure 4.

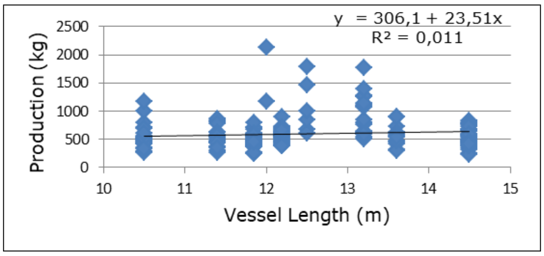

Figure 4. Graph of the relationship between production and vessel length.

In the equation described by~~From~~ the graph above, the correlation coefficient (R) is 0.104. ~~This value is obtained from the result of squaring the value of the coefficient of determination (R^2). From the correlation coefficient (R), it means that~~In this case, the correlation between production and vessel length is weak and ~~(unidirectional~~positive~~)~~. ~~Where the longer the length of the vessel increases, the production of the catch also increases~~.

By squaring R, the coefficient of determination (R^2) can be obtained, which~~The coefficient of determination (R_2)~~ is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above, it is known that the coefficient of determination (R^2) between production (y) and vessel size (x_1) is 0.011 which means that ~~every~~ 1.1% of the production obtained is influenced by the vessel size and the remaining 98.9% is influenced by ~~an~~other factors (Ghozali 2011).

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Danish ~~seiner~~seine production rate according to engine power vessels. According to the engine powers, the 10 sample vessels observed were divided in~~to~~ 2 categories, namely vessels with engine powers of 100 ps and 120 ps. There are 3 vessels with an engine power~~s~~ of 100 ps ~~while~~ and 7 vessels with an engine power of 120 ps. The level of Danish ~~seiner~~seine production according to the vessel's engine power~~s~~ can be presented in Table 5 and Figure 5 below.

Table 5

Danish ~~seiner~~seine production rate per trip according to the size of the engine power

Engine power	Trip	Production (kg)			
(ps)	(times)	Total	Average/Trip	Minimum	Maximum
100	64	32,074	501	244	1,167
120	137	88,211	644	228	2,134

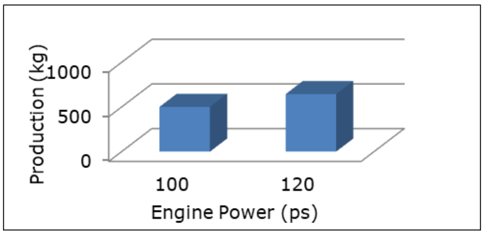

Figure 5. The average production rate according to engine power.

The table and graph above shows that the average production of a Danish ~~seiner~~seine for each trip is different according to the size of the vessel's engine power. The average production of a vessel with an engine size of 100 ps is 501 kg/trip, while for the larger vessel size, of 120 ps, it is of 644 kg/trip. The results of data processing from the 10 sample Danish ~~seiner~~seines gave a difference in the value of the fish production. This difference illustrates that a Danish ~~seiner~~seine with a larger engine power size has the ability to ~~get a greater~~ catch a larger volume of fish compared to a vessel with a smaller engine power, due to an~~.~~ ~~It because vessels with larger engine power can~~ accelerated ~~the~~ fishing gear operating process. ~~compared to vessels with smaller engine power.~~

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Danish ~~seiner~~seine production rate according to total fuel oil. In terms of fuel consumption, the 10 sample vessels are divided into 11 categories. The level of production can be shown in Table 6 and Figure 6 below.

Table 6

Danish ~~seiner~~seine production rate per trip according to the amount of fuel

No	Fuel oil (L)	Trips (times)	Production (kg)			
			Total	Minimum	Maximum	Average/trip
1	60	2	976	420	556	488
2	70	2	989	455	534	495
3	80	122	59,800	228	899	534
4	90	1	993	993	993	993
5	100	70	39,964	250	1,253	571
6	150	1	1,167	1,167	1,167	1,167
7	160	1	1,141	1,141	1,141	1,141
8	200	5	5,658	995	1,393	1,132
9	300	1	1,272	1,272	1,272	1,272
10	400	4	6,191	1,171	1,467	1,548
11	500	1	2,134	2,134	2,134	2,134

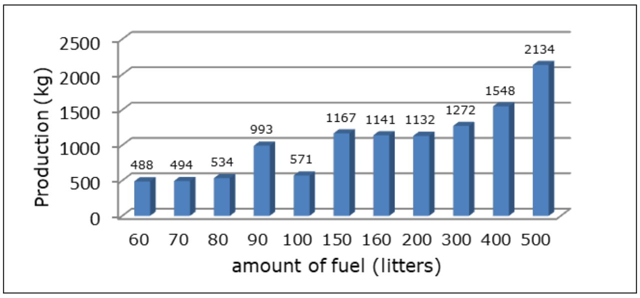

Figure 6. The average production rate according to the amount of fuel.

The table above shows that the average production of the Danish ~~seiner~~seine for each trip is different according to the amount of fuel. ~~The average production of a Danish seiner~~seine ~~with 60 liters of fuel is 488 kg/trip, 70 liters of fuel is 495 kg/trip, 80 liters of fuel is 534 kg/trip, 90 liters of fuel is 993 kg/trip. trip, the amount of fuel as much as 100 liters is 571 kg/trip, the amount of fuel as much as 150 liters is 1,167 kg/trip, the amount of fuel as much as 160 liters is 1,141 kg/trip, the amount of fuel as much as 200 liters is 1,132 kg/trip, the amount of fuel is 300 liters is 1,272 kg/trip, the amount of fuel as much as 400 liters is 1,548 kg/trip, and the amount of fuel as much as 500 liters is 2,134 kg/trip.~~ These results illustrate that the higher the amount of fuel ~~used~~, the higher the ~~production~~ productivity of the catch ~~obtained~~. This is presumably because ~~the~~ a higher fuel consumption is followed by ~~the~~ a higher intensity and duration ~~the level~~ of the

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fishing gear operation~~ and the duration of the fishing operation~~. The relationship between the independent variable, namely the amount of fuel, and the dependent variable, namely the production, can be illustrated in Figure 7 below.

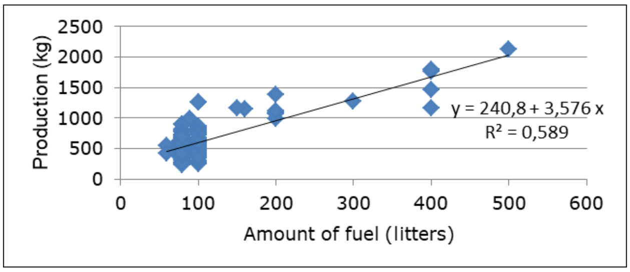

Figure 7. The relationship between production and amount of fuel.

~~From~~ In the equation described by the graph above, the correlation coefficient (R) is 0.767. ~~This value comes from the result of squaring the value of the coefficient of determination (R_2).~~ From the correlation coefficient (R), it can be observed ~~it means~~ that the correlation between the production and the amount of fuel is ~~very~~ strong~~/perfect~~ and ~~(unidirectional~~positive~~)~~. ~~Where the increase in the amount of fuel, the more the production of the catch.~~

The ~~coefficient of determination (R_2) is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above, it is known that the~~ coefficient of determination (R^2) between production (y) and the amount of fuel (x_3) is 0.589, which means that 58.9% of the production obtained is influenced by the amount of fuel and the remaining 41.1% is influenced by other factors ~~other~~ (Ghozali 2011).

Production rate of Danish ~~Seiner~~Seine according to the number of days per trip. Danish ~~seiner~~seine operating at AFP Karangantu generally have an average number of operating days~~, namely~~ of 1 day. However, of the 10 sample vessels, the number of days per trip was observed divided into 4 categories, namely: the ~~number of~~ 1-day trips, 2-day trips, 3-day trips~~,~~ and 4-day trips. The level of Danish ~~seiner~~seine production according to the number of days per trip can be shown in Table 7 and Figure 8 below.

Table 7

Danish ~~seiner~~seine production rate per trip according to the number of days per trip

Number of days trip^{-1}	Trips (times)	Production (kg)				
		Total	Avg. trip^{-1}	Avg. day^{-1}	Min.	Max.
1	180	95,719	532	532	228	899
2	16	16,019	1,001	501	505	1,272
3	4	6,413	1,603	534	1,393	1,790
4	1	2,134	2,134	534	2,134	2,134

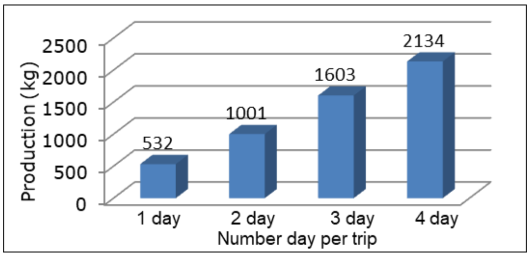

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Figure 8. The average production rate according to the number of days per trip.

From the table and graph above, the average production of the Danish ~~seiner~~seine varies according to the number of days per trip. The average production of a Danish ~~seiner~~seine, with the number of days per trip of 1 day is 532 kg/trip, the number of days per trip of 2 days is 1,001 kg/trip, the number of days per trip of 3 days is 1,603 kg/trip, and the number of days per trip of 4 days is 2,134 kg/trip. These values illustrate that a Danish ~~seiner~~seine with more days per trip has the ability to get a larger catch of fish than ~~the~~ for fewer days per trip. ~~This is due to the increasing number of days per trip, the fishing gear operating activities will increase so that the catch will also increase.~~ However, ~~if~~ when averaged, the production per day tends to be the same and there is no significant change.

The relationship between the independent variable, namely the number of days per trip, and the dependent variable, namely the production, can be seen in Figure 9 below.

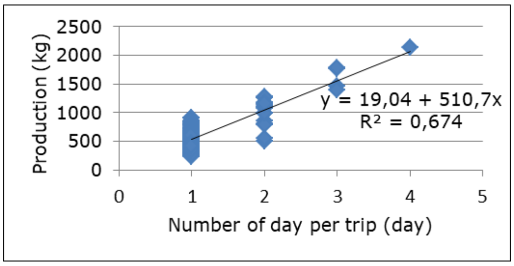

Figure 9. The relationship between production and the number of days trip^{-1}.

In the equation described by the ~~From the~~ graph above, the correlation coefficient (R) is 0.821. ~~This value is obtained from the result of squaring the value of the coefficient of determination (R_2).~~ From the correlation coefficient (R), it ~~means~~ can be observed that the correlation between the production and the number of days per trip is very strong and ~~/perfect (unidirectional~~positive). ~~Where the more the number of days per trip, the more the catch production will increase.~~.

The ~~coefficient of determination (R^2) is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above, it is known that the~~ coefficient of determination (R^2) between the production (y) and the number of days per trip (x_4) is 0.674 which means that 67.4% of the production obtained is influenced by the number of days per trip and the remaining is 32.6% influenced by other factors.

Danish ~~seiner~~seine production level according to operational costs. The Danish ~~seiner~~seine requires operational costs to meet its needs during fishing operations. The operational costs ~~referred to~~ consist of the cost of fuel, engine oil, clean water, net equipment, ice, foodstuffs~~,~~ and others. The level of production of a Danish ~~seiner~~seine according to the operational costs used can be presented in Table 8 and Figure 10 below.

Table 8

Danish ~~seiner~~seine production rate per trip according to operational costs

No	Operating Costs (USD)	Trip (times)	Production (kg)			
			Total	Average /trip	Minimum	Maximum
1	51.28	28	15,961	570	361	899
2	54.95	5	2,503	501	285	714
3	55.68	1	420	420	420	420
4	57.14	1	501	501	501	501
5	58.61	46	23,280	506	228	993

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6	62.27	20	10,230	512	276	899
7	65.93	44	24,269	552	263	843
8	69.60	15	9,124	608	362	863
9	73.26	22	11,124	506	250	793
10	80.59	2	1,161	581	350	811
11	87.91	3	3,358	1,119	852	1,253
12	109.89	1	791	791	791	791
13	124.54	1	1,167	1,167	1,167	1,167
14	161.17	1	1,141	1,141	1,141	1,141
15	168.50	1	1,077	1,077	1,077	1,077
16	175.82	1	1,393	1,393	1,393	1,393
17	183.15	3	3,188	1,063	995	1,084
18	190.48	1	1,272	1,272	1,272	1,272
19	241.76	1	1,790	1,790	1,790	1,790
20	256.41	1	1,763	1,763	1,763	1,763
21	278.39	2	2,638	1,319	1,171	1,467
22	318.68	1	2,134	2,134	2,134	2,134

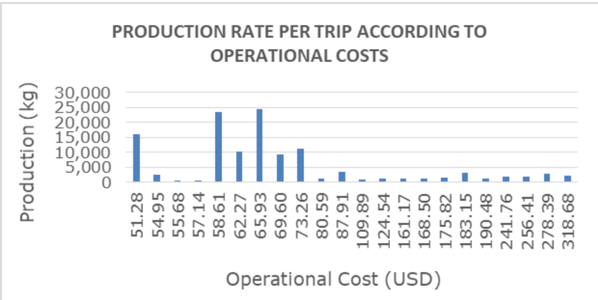

Figure 10. The average level of production according to the operational costs.

The table and graph above shows that the average production of a trip differs according to the operational costs. The results above also illustrate that a Danish ~~seiner~~seine with a higher operating cost has the ability to get a larger catch of fish than a vessel with a lower operating cost. The relationship between the independent variables, namely the operational costs and the dependent variable, namely the production, can be seen in Figure 11 below.

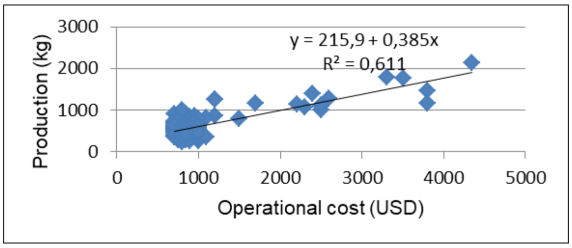

Figure 11. The relationship between production and operational costs.

In the equation described by the ~~From the~~ graph above, the correlation coefficient (R) is 0.782. ~~This value is obtained from the result of squaring the value of the coefficient of determination (R_2). From the correlation coefficient (R), it means that the~~ The correlation between production and operational costs is ~~very~~ strong ~~–~~ and ~~(unidirectional~~positive~~)~~. ~~Where the higher the operational cost, the higher the catch production.~~

~~The coefficient of determination (R_2) is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above, it is known~~

~~that~~ ~~T~~the coefficient of determination (R^2) between production (y) and operational costs (x_5) is 0.611 which means that 61.1% of the production obtained is influenced by operational costs and the remaining 38.9% is influenced by other factors.

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Danish ~~seiner~~seine production level according to number of crew members. The number of crew members is a factor that needs to be considered in the operation of the Danish ~~seiner~~seine. Each crew member has ~~their~~ its respective roles and function~~s~~. Of the 10 sample vessels that were observed, the ~~number of~~ crews ~~per trip~~ can be divided into 7 categories, namely with ~~the number of crew members of~~ 4, 5 ~~people~~, 6 ~~people~~, 7 ~~people~~, 8 ~~people~~, 9 ~~people,~~ and 10 people. The level of production of the Danish ~~seiner~~seine according to the number of crew members used can be presented in Table 9 and Figure 12 below.

Table 9

Danish ~~seiner~~seine production rate per trip according to number of crew

No	Number of crew (people)	Trips (times)	Production(kg)			
			Total	Average trip^{-1}	Minimum	Maximum
1	4	3	2.204	735	420	993
2	5	41	21.580	526	228	1.167
3	6	64	32.448	507	250	899
4	7	69	45.264	656	224	1.790
5	8	16	8.932	558	350	717
6	9	5	5.429	1.086	543	2.134
7	10	3	4.428	1.476	1.272	1.763

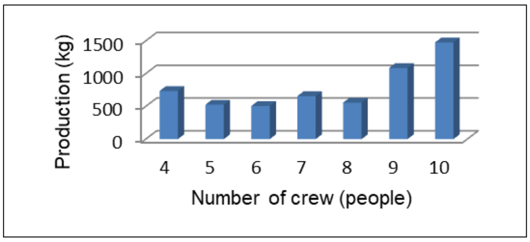

Figure 12. Average levels of production by number of crew.

The table and graph above shows that the average production of the Danish ~~seiner~~seine for each trip varies according to the size of the number of crew members used. ~~The average production of a Danish seiner~~seine ~~which uses a crew of 4 people is 735 kg/trip, the number of crew of 5 people is 526 kg/trip, the number of crew of 6 people is 507 kg/trip, the number of crew is 7 people. 656 kg/trip, the number of crew of 8 people is 558 kg/trip, the number of crew of 9 people is 1,086 kg/trip, and the number of crew of 10 people is 1,476 kg/trip.~~ This difference illustrates that a Danish ~~seiner~~seine with a larger crew has the ability to catch more fish than a vessel with a smaller crew. This is because ~~more and~~ more crew members will simplify and speed up the fishing gear operation ~~of fishing gear~~. ~~So that the fish caught will be more and more.~~

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The relationship between the independent variable, namely the number of crew members, and the dependent variable, namely the production, can be described in Figure 13 below.

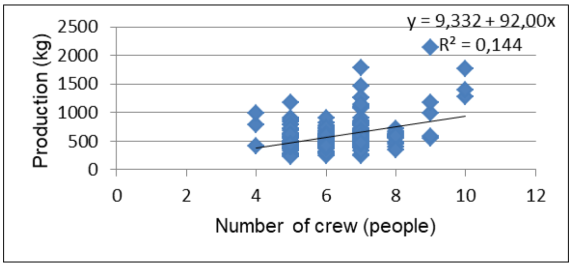

Figure 13. Relationship between production and number of crew members.

From the graph above, the correlation coefficient (R) is 0.379. ~~This value is obtained from the result of squaring the value of the coefficient of determination (R_2). From the correlation coefficient (R), it means that t~~The correlation between production and number of crew members is moderate~~ (unidirectional~~ and positive~~)~~. ~~Where the more the crew, the more the catch production increases.~~

~~The coefficient of determination (R_2) is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above it is also known that the~~ The coefficient of determination (R^2) between production (y) and the number of crew members (x_6) is 0.144, which means that 14.4% of the production obtained is influenced by the number of crew members ~~operational costs~~ and the remaining 85.6% is influenced by ~~an~~other factors.

Combined ~~f~~Factors affecting the productivity of Danish ~~seiner~~seine. To determine the influence of the linear combination of factors ~~that affect~~on the productivity of the Danish ~~seiner~~seine, a multiple linear regression analysis is performed. Data processing ~~using~~ used ~~computer~~ the softwares ~~program~~ Microsoft Excel and Statistical Product and Service Solutions (SPSS) version 17, with the parameter testing ~~is~~ carried out at the ~~real~~ significance level (α) of 5%. ~~SPSS is a software that functions to analyze data. perform statistical calculations on a windows basis.~~ The results of the multiple regression analysis of variance can be seen in Table 10 below (Suharso et al 2006).

Table 10

Analysis of variance multiple linear regression analysis of factors which affects the productivity of the Danish ~~seiner~~seine

No	Source	Degrees of freedom	Sum of squares (JK)	Middle Square (KT)	F_{count}	Probability > F
1	Regression	6	1.043	1738443.139	83.661[a]	0.000
	Residue	194	4031244,511	20779.611		
2	Total	200	1.446			
3	R^2	0.721				
	R	0.849				

Information: a = real at the 95% level (α = 0.05)

he results of the analysis in Table 19 above and Appendix 1 show that the coefficient of determination (R^2) is 0.721, which means that 72.1% of the productivity of the Danish ~~seiner~~seine (y) can be influenced by the variables: x_1 = length of the vessel, x_2 = engine power, x_3 = Amount of fuel, x_4 = number of days/trip, x_5 = operational costs, x_6 = number of crew~~.~~, ~~While~~ while the remaining 27.9% is influenced by other variables that ~~determine but~~ are not included in the model.

~~The ANOVA or F_{test} test results obtained the calculated F_{count} of 83.661. While the results of the F_{table} calculation, the F_{table} value is 2.15. From these calculations, the value of F_{count} > F_{table} so that it can be declared significant with a significant level or a probability of 0.000. Because the probability is smaller than 0.05, the~~ The change in the

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Danish ~~seiner~~seine ~~production~~ productivity can be explained ~~significantly~~ with a 95% confidence level ~~by~~ for all the 6 predefined variables (Suharso et al 2006).

The correlation coefficient (R) is used to determine the degree of closeness of the relationship between the dependent variable (y) and the independent variables (x). The results of the analysis showed that the coefficient (R) value is 0.849 with a positive sign ~~and is close to the number one~~, ~~so it means~~indicating that the dependent variable (y) has a ~~fairly strong or~~ strong relationship with ~~all~~ the linear combination of independent variables (x).

Partial testing is used to test the effect of the independent variables ~~(x)~~ individually on the dependent variable (y) using the t_{test}. A summary of the results of multiple linear regression analysis on the productivity of the Danish ~~seiner~~seine is presented in Table 11 below.

Table 11

Parameters ~~v~~Value ~~Analysis~~ analysis of variance and multiple linear regression analysis of the factors affecting the productivity of the Danish ~~seiner~~seine

No.	Explanatory description (x)	Regression coefficient (b)	t count	Probability > t
1	Intercept	-514,355	-3,678	0,000
2	The length of the vessel (x_1)	13,069	1,251 [tn]	0,212
3	Engine power (x_2)	2,337	1,696 [tn]	0,092
4	Total fuel (x_3)	1,029	1,491 [tn]	0,138
5	Number of days per trip (x_4)	388,054	7,874 [a]	0,000
6	Operating costs (x_5)	-0,016	-0,199 [tn]	0,842
7	Number of Crew (x_6)	24,687	2,423 [a]	0,016
8	The coefficient of determination (R^2)	0,721		

Information: a = ~~real~~ significant at the 95% confidence level (α = 0.05)
tn = not significant at the 95% confidence level (α = 0.05)

After the data is analyzed, the following equation is obtained:

$$y = -514.355 + 13.069\ x_1 + 2.337\ x_2 + 1.029\ x_3 + 388.054\ x_4 - 0.016\ x_5 + 24.687\ x_6$$

Where :
y - Productivity of the Danish ~~seiner~~seine (kg);
x1 - Length of vessel (m);
x2 - Engine power (ps);
x3 - fuel consumption (ltr);
x4 - Number of days/trip (days);
x5 - operational costs (Rp);
x6 - number of crew (people).

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T~~o determine t~~he appropriate use of factors that affect productivity, ~~it~~ can be ~~seen~~ determined from the production elasticity ~~of~~ to each variable ~~to~~ change, ~~production which is obtained~~ as follows:

1. The ~~variable size of the~~ length of the vessel variable (x_1)~~,~~ ~~because the probability is greater than 0.05, it~~ does not have a significant ~~or insignificant~~ effect ~~with~~ (a probability level of 0.212). The variable x_1 has a regression coefficient (b_1) of 13.069. This means that each additional 1 m of vessel length will increase the productivity of the Danish ~~seiner~~seine by 13.069 kg (if the other variables are constant). ~~The length of the vessel has no significant effect on the catch because t~~The length of the vessel does not significantly determine the amount of the catch~~.~~, since its ~~This is due to the fact that the larger the length of the vessel~~increase is not necessarily accompanied by an increase in the size of the fishing gear. ~~The Danish seiner~~seine ~~which landed at The AFP Karangantu has relatively the same size of fishing gear.~~
2. The machine power variable (x_2)~~,~~ ~~because the probability is greater than 0.05, it~~ does not have a significant ~~or insignificant~~ effect ~~with~~ (a probability level of 0.092). The variable x_2 has a regression coefficient (b_2) of 2.337. This means that every addition of

1 PS of engine power will increase the productivity of the Danish ~~seiner~~seine by 2.337 kg (if the other variables remain constant).
The power of the engine (x_2) will determine the speed of the vessel when the vessel is moving towards the fishing ground. Vessels with relatively high speeds can reach the fishing ground more quickly. With a large engine power, the fishing gear operating process will also be faster. ~~However, this observation found that the magnitude of the engine power did not really determine the size of the catch.~~

3. The ~~variable~~ amount of fuel variable (x_3)~~, because the probability is greater than 0.05, it~~ does not have a significant ~~or insignificant~~ effect ~~with the~~(a probability level of 0.138). The variable x_3 has a regression coefficient (b_3) of 1.029. This means that each additional 1 liter of total fuel will increase the productivity of the Danish ~~seiner~~seine by 1.029 kg (if the other variables are constant). ~~The use of fuel for large engine power needs to be supported by a balanced amount of fuel. Indirectly, the amount of fuel used in the operation of the Danish seiner~~seine ~~also affects the amount of catch because with t~~The larger the amount of fuel, the longer ~~number of~~the catching trip (and the gear's operating period)~~days for the vessel will be longer. However, this observation found that the amount of fuel does not really determine the size of the catch.~~
4. The ~~variable~~ operating time per trip variable (x_4)~~, because the probability is smaller than 0.05, it~~ has a significant ~~or significant~~ effect ~~with~~ (a probability level of 0.000, smaller than 0.05). The variable x_4 has a regression coefficient (b_4) of 388.054. This means that each additional 1 day of operation will increase the productivity of the Danish ~~seiner~~seine by 388.054 kg (if the other variables remain constant). This positive relationship shows that productivity is directly proportional to the ~~longer~~ loength of the operating days of the Danish ~~seiner~~seine. ~~This is because the longer the day the vessel operates, the more production results will be obtained. Where the longer the fishing gear operating days allow the catch to increase as well.~~
5. The ~~O~~operational cost ~~usage~~ variable (x_5)~~, because the probability is greater than 0.05, it~~ has no significant or insignificant effect ~~with~~ (a probability level of 0.842). The variable x_5 has a regression coefficient (b_5) of -0.016 and the effect is negative. This means that each additional USD 0.00007 of the operational costs will reduce the productivity of the Danish ~~seiner~~seine by 0.016 kg (if the other variables are constant). ~~This negative relationship shows that the use of large operational costs does not have an impact on large production as well.~~
6. The variable number of crew (x_6)~~, because the probability is smaller than 0.05, it~~ has a ~~significant or~~ significant effect with (a probability level of 0.016, smaller than 0.05). The variable x_6 has a regression coefficient (b_6) of 24.687. This means that each additional 1 crew member will increase the productivity of the Danish ~~seiner~~seine by 24,687 kg (if the other variables remain constant). This positive relationship shows that the productivity of the Danish ~~seiner~~seine is determined by the number of crew members. The number of crew members has a real effect because ~~the~~ a larger number of crew members ~~also~~ accelerates the operation of the fishing gear.

Conclusions. Based on the results and discussion previously described, it can be concluded ~~as follows~~that:

1. The FV. Tirta Raya Mina 01 has the highest catch rate, which is 1,652.5 kg/trip~~ with~~,~~.~~ ~~Mean~~while~~,~~ the FV. Sari Jati Mulya is ~~a~~ the Danish ~~seiner~~seine carrier with the lowest catch rate, which is 466.8 kg/trip. However, if ~~averaged~~ the rate of catch per day is averaged, there is no significant difference in the catch rates~~ or tend to be the same~~.
2. The correlation between the productivity of the Danish ~~seiner~~seine with the variable amount of fuel (x_3), number of days per trip (x_4), and operational costs (x_5) is very strong and ~~unidirectional~~positive. ~~For the~~while the correlation between productivity and the variable number of crew members (x_6) is moderate and ~~unidirectional~~positive. Meanwhile, the correlation between productivity and vessel size variable (x_1) ~~and~~ or engine power (x_2) is weak and ~~unidirectional~~positive.
3. The linear combination of the independent variables (x) which consists of: variable length of vessel (x_1), engine power (x_2), fuel consumption (x_3), number of days per

trip (x_4), operational costs (x_5) and number of crew members (x_6) has a significant effect on the increase in the productivity of the Danish seinerseine (y). However, individually (partially) only the variable number of days per trip (x_4) and the number of crew members (x_6) had a significant effect, while the other variables had no significant effect on the Danish seines' productivity increase in productivity of Danish seinerseines (y).

Conflict of interest. The authors declare no conflict of interest.

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Analysis of production factors that affect the productivity of Danish seine at the Archipelagic Fishery Port (AFP) of Karangantu, Banten Province - Indonesia

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Abstract. The purpose of this study is to determine the productivity of the Danish seine and to analyze the production factors that affect the productivity of the Danish seine which includes: vessel length (x1), vessel engine power (x2), amount of fuel oil (x3), number of days per trip (x4), operational costs (x5), and number of crew members (x6). This research was carried out using a survey method. The primary data collected are the catch volume of the Danish seine (y), the length of the vessel (x1), the power of the vessel's engine (X2), the amount of fuel oil (x3), the number of days per trip (x4), the operational costs (x5), the number of crew members (x6) and the fishing ground of the Danish seine. Meanwhile, thesecondary data are documents of the vessel and crew of the Danish seine, literature on the Danish seine and the annual the AFP Karangantu report. In order to determine the production factors that affect the productivity of the Danish Seine, a multiple linear regression analysis via computer software was used. The results of this study explain that the correlation between the productivity of the Danish seine (y) and the variables x3, x4, x5 is very strong and positive. The correlation between productivity (y) and the variable x6 is moderate and positive, while the correlation between the productivity (y) and the variables x1 and x2 is weak and positive. Taken together, the independent variables x1, x2, x3, x4, x5 and x6 have a significant effect on the increase of the Danish Seine productivity (y). However, individually (partially) only the variables x4 and x6 have a significant effect, while the other variables have no significant effect on the increase of the Danish Seine productivity (y).

Key Words: CPUE, *Leiognathus equulus*, FMA 712, AFP Karangantu.

Introduction. The Archipelago Fishing Port (AFP) of Karangantu has a strategic role in the fishery and marine development (Puspitasari et al 2013; Suherman et al 2020). The potential of marine and fishery natural resources of the Banten Province is spread across three water areas s:the Indian Ocean, the Sunda Strait and the Java Sea (Rizal 2013; Oktaviyani et al 2015). The types of fishing gear used include lift nets, purse seine, danish seine and hand line (Rahmawati et al 2017; Diniah et al 2012).

Total production of fish caught in the AFP Karangantu in 2013 as many as 2,797 tons (Hamzah et al 2015). In 2014, the AFP Karangantu recorded 2,881 tons of landed catches. The Danish seine has the highest contribution, among the other operating fishing gears, reaching 1,548 tons or 55.07% of the total catch (AFP Karangantu, 2015). Productivity is a measure that states how well resources are managed and utilized to achieve optimal results (Sarjono 2001). The production process can only run if the the production factor requirements can be met. In capture fisheries, the minimum required

~~production factors consist of resources (sea), labor (fishermen) and capital (boats and fishing gear) (Suharso et al 2006).~~

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The Danish seine is similar to a trawler, being seinerelatively simple (Ardidja 2010; Sudirman & Mallawa 2004). It is a fishing gear that is more likely to replace trawling in the exploitation of demersal fishery resources (MMFA 2011). This condition allows herds of fish to enter the net (Antika et al 2014). The dimensions the main vessel is the main parameter, covering the length, width and height (Fyson 1985), determining the vessel design (Tangke 2010; Purnama et al 2015).

The main catch of Danish seine is the shrimp and the demersal fish like: goldband goatfish (*Upeneus moluccensis*), doublewhip threadfin bream (*Nemipterus nematophorus*), sea catfishes (*Ariidae*), grouper (*Serranidae)* and Jarbua terapon (*Terapon jarbua)* (Sudirman et al 2008; Nedelec & Prado 1990). Fishing operations using the Danish seine can be carried out in the morning or in the late afternoon, in less intense light conditions. The Danish seine catching trip is usually one day fishing (Antika et al 2014) and it has the advantage of seinebeing much cheaper, since it is used on vessels that are much smaller than trawls (Semedi & Schneider 2021).

The production function is a mathematical relationship between production (output) and the factors of production (input) (Shephard 1970), independently of the prices. Mathematically the production function can be expressed by y = (x_1, x_2, x_3, … x_n) while x_1, x_2, x_3, … x_n is the input factor used to produce output (y). The function above explains that the resulting output depends on input factors, but does not yet provide a quantitative relationship between input and output factors (Salvatore 1995; Nicholson 1999).

(…)

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According to Suharso (2006) that the new production process can run if the requirements (factors of production) needed can be met. In capture fisheries, the minimum required production factors consist of resources (sea), labor (fishermen) and capital (vessels and fishing gear). The three factors of production are something that absolutely must be available. Each factor of production has a different function and is interrelated with each other. If one of the factors of production is not available, the production process will not run.

In addition to the three production factors mentioned above, the author intends to examine six production factors that are thought to have influenced the productivity of dogol boats at AFP Karangantu, namely the vessel length, the strength of the vessel's engine, the amount of fuel oil, the number of days a fishing trip, operational costs and number of crew members. With a high level of Danish seine production, it is necessary to do research on the analysis of the factors that affect the productivity of this Danish seine.

Material and Method. The tools and materials used in this research were: Danish seine, fishing gear, calculator, meter, digital camera, GPS, stationery, computer and software. The data collected consists of primary data obtained from interviews with fishermen and direct observations, and the secondary data obtained from the vessel and crew specifications, the AFP statistics annual report, the literature on the Danish seine productivity and of the fishing ground maps.

Data analysis method. The Catch Per Unit Effort (CPUE) data was collected at the same time as the fish landings. The relationship between catch and work is linear through the origin (Makwinja et al 2021). The CPUE is calculated based on the total production and on the number of trips, using the following formula (Gulland 1983):

$$CPUE=C/f$$

Where:
CPUE - production per Unit of Effort (kg a trip);
C - production (kg);
f - catch effort (trip).

To determine the factors that affect the productivity of the Danish seine, a production function analysis is carried out using the multiple linear regression analysis which is presented in tables and graphs. A parameter testing is carried out at the significance level (ɑ) of 5%, in order to obtain a linear regression equation (Sugiyono 2015):

$$y = a + b1x1 + b2x2 + b3x3 + b4x4 + b5x5 + b6x6$$

Where:
y - productivity of the Danish seine (kg);
a - constant;
b - multiple regression coefficient;
x1 - length of vessel (m);
x2 - engine power (PS);
x3 - amount of fuel (L);
x4 - number of days per trip (days);
x5 - operational costs (USD);
x6 - number of crew members (people).

Results and Discussion. This research was conducted at the AFP Karangantu, Serang City, Banten Province, Indonesia (Figure 1).

Figure 1. The Archipelagic Fishery Port (AFP) of Karangantu (MMAF 2021).

Danish seine. Danish seine is very effective because operating it does not depend onthe fishing season as it is the case with other fishing gear so that it can be operated at any time. The shape of the Danish seine can be seen in Figure 2.

Figure 2. Danish seine (original).

Danish seine at the AFP Karangantu is made of wood with relatively the same length, of 10-15 m. The number of units was 46 in 2014, while in 2013 there were only 42 units. The dominance and development of this gear is justified by its level of productivity, namely 1,548 tons or 55.07% of the total fish catch of 2,811 tons, in 2014 (AFP Karangantu, 2015). In this research, sampling was carried out among the 10 Danish seine landed at the AFP of Karangantu. Data on these vessels was presented in Table 1 below.

Table 1

Danish seine research sample

Name of fishing Vessel (FV.)	Length (m)	Width (m)	GT	Engine power (PS)
FV. Putri Timbul	11.40	3.95	15	120
FV. Bunga Indah 01	12.20	4.34	14	120
FV. Bunga Indah 02	11.85	3.95	14	100
FV. Sari Jati Mulya	10.50	2.60	10	100
FV. Sari Jati Untung	13.20	4.05	18	120
FV. Sari Mulya	10.50	3.40	10	100
FV. Setia Jaya	14.50	4.42	19	120
FV. Setia Kawan	13.60	3.95	20	120
FV. Tirta Raya Mina 01	12.00	4.00	11	120
FV. Tirta Raya Mina 02	12.50	4.25	15	120

Fishing ground. Danish seine is operated at the bottom waters, which consists of sand, mud or a mixture of both. The Danish seine landed at The AFP of Karangantu has a fishing ground in the FMA-712, namely the North Jawa Sea, in the Sunda Strait, around Tunda Island and Panjang Island. This can be seen in Figure 3 below.

Gambar 3. Danish seine Fishing ground.

Danish seine catches. From 10 samples of the Danish seine, the types of fish landed at AFP Karangantu during the period February 15 to April 15 2015 consisted of 4 types of dominant fish (Table 2).

Table 2

The type of catch of the Danish seine at The AFP Karangantu
for the period February - April 2015

No	Type of catch	Total production (kg)	Percentage (%)
1	Common ponyfish (*Leiognathus equulus*)	61,420	51.06
2	Goldband goatfish (*Upeneus moluccensis*)	20,298	16.87
3	Doublewhip threadfin bream (*Nemipterus nematophorus*)	6,234	5.18
4	Squid (*Loligo* spp)	5,680	4.72
5	Others	26,653	22.16
	Total	120,285	100.00

Source : MMAF 2016.

Danish seine Catch Rate (CPUE). The catch rate of Danish seine is the number of catches divided by the number of trips. The 10 Danish seines were used as objects of observation and the catch rate per vessel was reported in Table 3 below.

Table 3

Catch rate of Danish seine at The AFP of Karangantu

	Name of Fishing Vessel (FV.)	Total production (kg)	Trip (times)	Average (kg trip^{-1})
1	FV. Tirta Raya Mina 01	3,305	2	1,652.5
2	FV. Tirta Raya Mina 02	6,391	6	1,065.2
3	FV. Sari Jati Untung	17,872	19	940.6
4	FV. Sari Mulya	3,371	4	842.8
5	FV. Setia Kawan	7,387	13	568.2
6	FV. Bunga Indah 01	22,514	40	562.9
7	FV. Setia Jaya	18,372	34	540.4
8	FV. Putri Timbul	12,370	23	537.8
9	FV. Bunga Indah 02	20,300	42	483.3
10	FV. Sari Jati Mulya	8,403	18	466.8
	Average			766.1

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From the table above it can be seen that FV. Tirta Raya Mina 01 has the highest catch rate, which is 1,652.5 kg trip^{-1}. Meanwhile, FV. Sari Jati Mulya is a lowest catch rate, which is 466.8 kg trip^{-1}.

Productivity of the Danish seine. The productivity of the Danish seine is the average level of production per trip, which is determined by a number of variables, grouped into 6 categories, namely: the level of production according to the vessel size, the engine power, fuel consumption, number of days per trip, operational costs, and the number of crew members.

Danish seine production rate according to vessel length size. The Danish seine units sampled in the measurements were installed on 10 vessels of variable sizes. However, among the 10 vessels, there are 2 vessels that have the same length, namely FV. Sari Jati Mulya and FV. Sari Mulya. It was assumed that the length of the vessel will determine the level of productivity. The level of production of the Danish seine according to the vessel size was presented in Table 4 below.

Table 4

Danish seine production rate per trip according to the vessel length

Name of fishing vessel (FV.)	Vessel length (m)	Trip (times)	Production (kg)			
			Total	Average /trip	Minimum	Maximum
FV. Sari Jati Mulya	10.50	18	8,403	467	259	714
FV. Sari Mulya	10.50	4	3,371	843	420	1,167
FV. Putri Timbul	11.40	23	12,370	538	272	863
FV. Bunga Indah 02	11.85	42	20,300	483	244	793
FV. Tirta Raya Mina 01	12.00	2	3,305	1,653	1,171	2,134
FV. Bunga Indah 01	12.20	40	22,514	563	378	899
FV. Tirta Raya Mina 02	12.50	6	6,391	1,065	610	1,790
FV. Sari Jati Untung	13.20	19	17,872	941	509	1,763
FV. Setia Kawan	13.60	13	7,387	568	306	899
FV. Setia Jaya	14.50	34	18,372	540	228	823

Table 4 shows that the average production of the Danish seine for each trip is different according to the length of the vessel. The results from the 10 Danish seines gave a difference in the value of landed fish production. However, this difference shows that the Danish seine with a larger size has almost the same efficiency as a smaller vessel. This is because the length of the vessel is not consistent with the size of the fishing gear. The relationship between the length of the vessel and the dependent variable, namely the production, was illustrated in Figure 4.

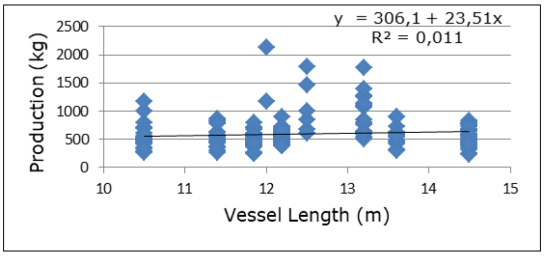

Figure 4. Graph of the relationship between production and vessel length.

In the equation described by the graph above, the correlation coefficient (R) is 0.104. In this case, the correlation between production and vessel length is weak and positive.

By squaring R, the coefficient of determination (R^2) can be obtained, which is useful for knowing how far the independent variable (x) can predict the dependent variable (y). From the graph above, it is known that the coefficient of determination (R^2) between production (y) and vessel size (x_1) is 0.011 which means that 1.1% of the production obtained is influenced by the vessel size and the remaining 98.9% is influenced by other factors (Ghozali 2011).

Danish seine production rate according to engine power vessels. According to the engine powers, the 10 sample vessels observed were divided in 2 categories, namely vessels with engine powers of 100 ps and 120 ps. There are 3 vessels with an engine power of 100 ps and 7 vessels with an engine power of 120 ps. The level of Danish seine production according to the vessel's engine power can be presented in Table 5 and Figure 5 below.

Table 5

Danish seine production rate per trip according to the size of the engine power

Engine power (ps)	Trip (times)	Production (kg)			
		Total	Average/Trip	Minimum	Maximum
100	64	32,074	501	244	1,167
120	137	88,211	644	228	2,134

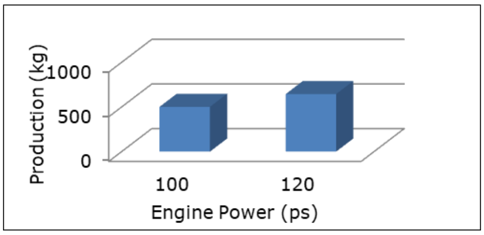

Figure 5. The average production rate according to engine power.

The table and graph above shows that the average production of a Danish seine for each trip is different according to the size of the vessel's engine power. The average production of a vessel with an engine size of 100 ps is 501 kg a/trip, while for the larger vessel size, of 120 ps, it is of 644 kg/ a trip. The results of data processing from the 10 sample Danish seines gave a difference in the value of the fish production. This difference

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Danish seine production rate according to total fuel oil. In terms of fuel consumption, the 10 sample vessels are divided into 11 categories. The level of production can be shown in Table 6 and Figure 6 below.

Table 6

Danish seine production rate per trip according to the amount of fuel

No	Fuel oil (L)	Trips (times)	Production (kg)			
			Total	Minimum	Maximum	Average/trip
1	60	2	976	420	556	488
2	70	2	989	455	534	495
3	80	122	59,800	228	899	534
4	90	1	993	993	993	993
5	100	70	39,964	250	1,253	571
6	150	1	1,167	1,167	1,167	1,167
7	160	1	1,141	1,141	1,141	1,141
8	200	5	5,658	995	1,393	1,132
9	300	1	1,272	1,272	1,272	1,272
10	400	4	6,191	1,171	1,467	1,548
11	500	1	2,134	2,134	2,134	2,134

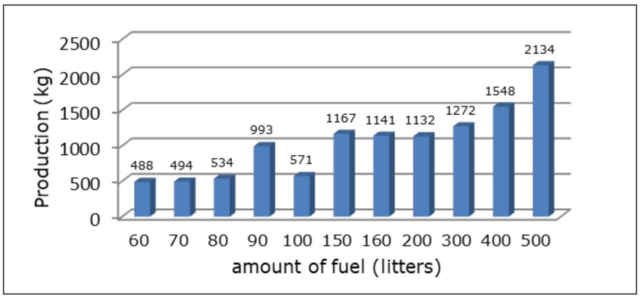

Figure 6. The average production rate according to the amount of fuel.

The table above shows that the average production of the Danish seine for each trip is different according to the amount of fuel. These results illustrate that the higher the amount of fuel, the higher the productivity of the catch. This is presumably because a higher fuel consumption is followed by a higher intensity and duration of the fishing gear operation. The relationship between the independent variable, namely the amount of fuel, and the dependent variable, namely the production, can be illustrated in Figure 7 below.

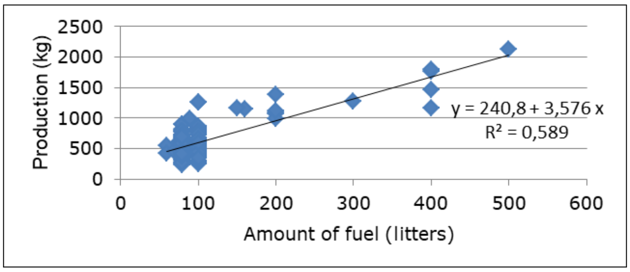

Figure 7. The relationship between production and amount of fuel.

In the equation described by the graph above, the correlation coefficient (R) is 0.767. From the correlation coefficient (R), it can be observed that the correlation between the production and the amount of fuel is strong and positive.

The coefficient of determination (R^2) between production (y) and the amount of fuel (x_3) is 0.589, which means that 58.9% of the production obtained is influenced by the amount of fuel and the remaining 41.1% is influenced by other factors (Ghozali 2011).

Production rate of Danish Seine according to the number of days per trip. Danish seine operating at AFP Karangantu generally have an average number of operating days of 1 day. However, of the 10 sample vessels, the number of days per trip was observed divided into 4 categories, namely: the 1-day trips, 2-day trips, 3-day trips and 4-day trips. The level of Danish seine production according to the number of days per trip can be shown in Table 7 and Figure 8 below.

Table 7

Danish seine production rate per trip according to the number of days per trip

Number of days trip^{-1}	Trips (times)	Production (kg)				
		Total	Avg. trip^{-1}	Avg. day^{-1}	Min.	Max.
1	180	95,719	532	532	228	899
2	16	16,019	1,001	501	505	1,272
3	4	6,413	1,603	534	1,393	1,790
4	1	2,134	2,134	534	2,134	2,134

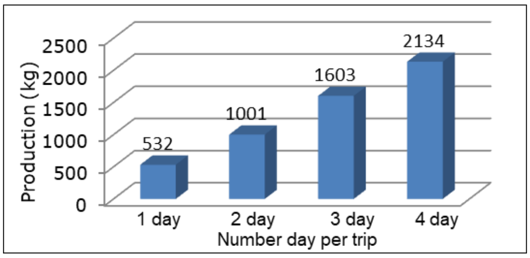

Figure 8. The average production rate according to the number of days per trip.

From the table and graph above, the average production of the Danish seine varies according to the number of days per trip. The average production of a Danish seine, with the number of days per trip of 1 day is 532 kg a/ trip, the number of days per trip of 2 days is 1,001 kg/trip, the number of days per trip of 3 days is 1,603 kg/trip, and the number of days per trip of 4 days is 2,134 kg/trip. These values illustrate that a Danish seine with more days per trip has the ability to get a larger catch of fish than for fewer

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days per trip. However, when averaged, the production per day tends to be the same and there is no significant change.

The relationship between the independent variable, namely the number of days per trip, and the dependent variable, namely the production, can be seen in Figure 9 below.

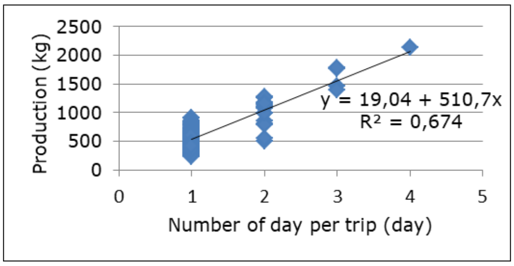

Figure 9. The relationship between production and the number of days trip^{-1}.

In the equation described by the graph above, the correlation coefficient (R) is 0.821. From the correlation coefficient (R), it can be observed that the correlation between the production and the number of days per trip is very strong and positive.

The coefficient of determination (R^2) between the production (y) and the number of days per trip (x_4) is 0.674 which means that 67.4% of the production obtained is influenced by the number of days per trip and the remaining is 32.6% influenced by other factors.

Danish seine production level according to operational costs. The Danish seine requires operational costs to meet its needs during fishing operations. The operational costs consist of the cost of fuel, engine oil, clean water, net equipment, ice, foodstuffs and others. The level of production of a Danish seine according to the operational costs used can be presented in Table 8 and Figure 10 below.

Table 8

Danish seine production rate per trip according to operational costs

No	Operating Costs (USD)	Trip (times)	Production (kg)			
			Total	Average /trip	Minimum	Maximum
1	51.28	28	15,961	570	361	899
2	54.95	5	2,503	501	285	714
3	55.68	1	420	420	420	420
4	57.14	1	501	501	501	501
5	58.61	46	23,280	506	228	993
6	62.27	20	10,230	512	276	899
7	65.93	44	24,269	552	263	843
8	69.60	15	9,124	608	362	863
9	73.26	22	11,124	506	250	793
10	80.59	2	1,161	581	350	811
11	87.91	3	3,358	1,119	852	1,253
12	109.89	1	791	791	791	791
13	124.54	1	1,167	1,167	1,167	1,167
14	161.17	1	1,141	1,141	1,141	1,141
15	168.50	1	1,077	1,077	1,077	1,077
16	175.82	1	1,393	1,393	1,393	1,393
17	183.15	3	3,188	1,063	995	1,084
18	190.48	1	1,272	1,272	1,272	1,272
19	241.76	1	1,790	1,790	1,790	1,790
20	256.41	1	1,763	1,763	1,763	1,763
21	278.39	2	2,638	1,319	1,171	1,467
22	318.68	1	2,134	2,134	2,134	2,134

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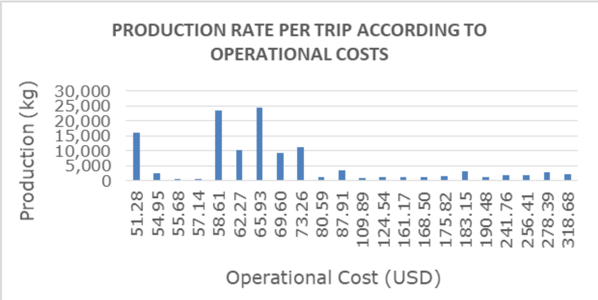

Figure 10. The average level of production according to the operational costs.

The table and graph above shows that the average production of a trip differs according to the operational costs. The results above also illustrate that a Danish seine with a higher operating cost has the ability to get a larger catch of fish than a vessel with a lower operating cost. The relationship between the independent variables, namely the operational costs and the dependent variable, namely the production, can be seen in Figure 11 below.

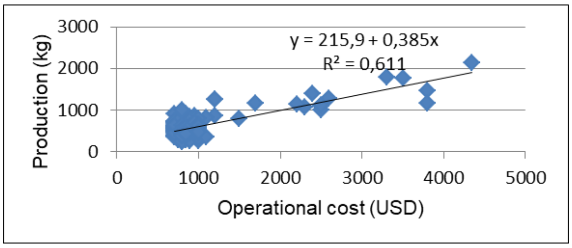

Figure 11. The relationship between production and operational costs.

In the equation described by the graph above, the correlation coefficient (R) is 0.782. The correlation between production and operational costs is strong and positive.

The coefficient of determination (R^2) between production (y) and operational costs (x_5) is 0.611 which means that 61.1% of the production obtained is influenced by operational costs and the remaining 38.9% is influenced by other factors.

Danish seine production level according to number of crew members. The number of crew members is a factor that needs to be considered in the operation of the Danish seine. Each crew member has its respective role and function. Of the 10 sample vessels that were observed, the crews can be divided into 7 categories, namely with 4, 5, 6, 7, 8, 9 and 10 people. The level of production of the Danish seine according to the number of crew members used can be presented in Table 9 and Figure 12 below.

Table 9

Danish seine production rate per trip according to number of crew

No	Number of crew (people)	Trips (times)	Production(kg)			
			Total	Average trip^{-1}	Minimum	Maximum
1	4	3	2.204	735	420	993
2	5	41	21.580	526	228	1.167
3	6	64	32.448	507	250	899
4	7	69	45.264	656	224	1.790
5	8	16	8.932	558	350	717
6	9	5	5.429	1.086	543	2.134
7	10	3	4.428	1.476	1.272	1.763

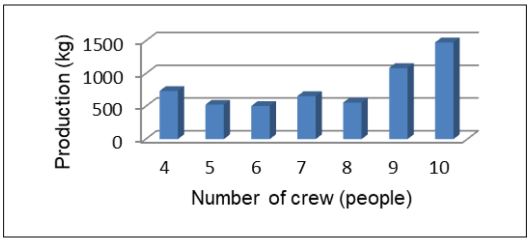

Figure 12. Average levels of production by number of crew.

The table and graph above shows that the average production of the Danish seine for each trip varies according to the size of the number of crew members used. seineThis difference illustrates that a Danish seine with a larger crew has the ability to catch more fish than a vessel with a smaller crew. This is because more and more crew members will simplify and speed up the fishing gear operation.

The relationship between the independent variable, namely the number of crew members, and the dependent variable, namely the production, can be described in Figure 13 below.

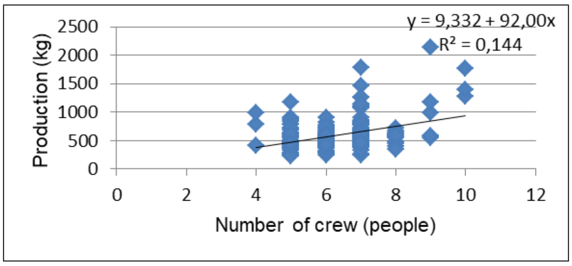

Figure 13. Relationship between production and number of crew members.

From the graph above, the correlation coefficient (R) is 0.379. The correlation between production and number of crew members is moderate and positive.

The coefficient of determination (R^2) between production (y) and the number of crew members (x_6) is 0.144, which means that 14.4% of the production obtained is influenced by the number of crew members and the remaining 85.6% is influenced by other factors.

Combined factors affecting the productivity of Danish seine. To determine the influence of the linear combination of factors on the productivity of the Danish seine, a multiple linear regression analysis is performed. Data processing used the softwares Microsoft Excel and Statistical Product and Service Solutions (SPSS) version 17, with the parameter testing carried out at the significance level (α) of 5%. The results of the multiple regression analysis of variance can be seen in Table 10 below (Suharso et al 2006).

Table 10

Analysis of variance multiple linear regression analysis of factors which affects the productivity of the Danish seine

No	Source	Degrees of freedom	Sum of squares (JK)	Middle Square (KT)	F_{count}	Probability > F
1	Regression	6	1.043	1738443.139	83.661[a]	0.000
	Residue	194	4031244,511	20779.611		
2	Total	200	1.446			

3	R^2	0.721
	R	0.849

Information: a = real at the 95% level (α = 0.05)

he results of the analysis in Table 19 above and Appendix 1 show that the coefficient of determination (R^2) is 0.721, which means that 72.1% of the productivity of the Danish seine (y) can be influenced by the variables: x_1 = length of the vessel, x_2 = engine power, x_3 = Amount of fuel, x_4 = number of days/trip, x_5 = operational costs, x_6 = number of crew, while the remaining 27.9% is influenced by other variables that are not included in the model.

The change in the Danish seine productivity can be explained with a 95% confidence level for all the 6 predefined variables (Suharso et al 2006).

The correlation coefficient (R) is used to determine the degree of closeness of the relationship between the dependent variable (y) and the independent variables (x). The results of the analysis showed that the coefficient (R) value is 0.849 with a positive sign, indicating that the dependent variable (y) has a strong relationship with the linear combination of independent variables (x).

Partial testing is used to test the effect of the independent variables individually on the dependent variable (y) using the t_{test}. A summary of the results of multiple linear regression analysis on the productivity of the Danish seine is presented in Table 11 below.

Table 11

Parameters value analysis of variance and multiple linear regression analysis of the factors affecting the productivity of the Danish seine

No.	Explanatory description (x)	Regression coefficient (b)	t count	Probability > t
1	Intercept	-514,355	-3,678	0,000
2	The length of the vessel (x_1)	13,069	1,251 [tn]	0,212
3	Engine power (x_2)	2,337	1,696 [tn]	0,092
4	Total fuel (x_3)	1,029	1,491 [tn]	0,138
5	Number of days per trip (x_4)	388,054	7,874 [a]	0,000
6	Operating costs (x_5)	-0,016	-0,199 [tn]	0,842
7	Number of Crew (x_6)	24,687	2,423 [a]	0,016
8	The coefficient of determination (R^2)	0,721		

Information: a = significant at the 95% confidence level (α = 0.05)
tn = not significant at the 95% confidence level (α = 0.05)

After the data is analyzed, the following equation is obtained:

$$y = -514.355 + 13.069 x_1 + 2.337 x_2 + 1.029 x_3 + 388.054 x_4 - 0.016 x_5 + 24.687 x_6$$

Where :
y - Productivity of the Danish seine (kg);
x1 - Length of vessel (m);
x2 - Engine power (ps);
x3 - fuel consumption (ltr);
x4 - Number of days/trip (days);
x5 - operational costs (~~Rp~~USD);
x6 - number of crew (people).

The appropriate use of factors that affect productivity, can be determined from the production elasticity to each variable change, as follows:

1. The length of the vessel variable (x_1) does not have a significant effect (a probability level of 0.212). The variable x_1 has a regression coefficient (b_1) of 13.069. This means that each additional 1 m of vessel length will increase the productivity of the Danish seine by 13.069 kg (if the other variables are constant). The length of the vessel does not significantly determine the amount of the catch, since its increase is not necessarily accompanied by an increase in the size of the fishing gear. seine

2. The machine power variable (x_2) does not have a significant effect (a probability level of 0.092). The variable x_2 has a regression coefficient (b_2) of 2.337. This means that every addition of 1 PS of engine power will increase the productivity of the Danish seine by 2.337 kg (if the other variables remain constant).
   The power of the engine (x_2) will determine the speed of the vessel when the vessel is moving towards the fishing ground. Vessels with relatively high speeds can reach the fishing ground more quickly. With a large engine power, the fishing gear operating process will also be faster.
3. The amount of fuel variable (x_3) does not have a significant effect (a probability level of 0.138). The variable x_3 has a regression coefficient (b_3) of 1.029. This means that each additional 1 liter of total fuel will increase the productivity of the Danish seine by 1.029 kg (if the other variables are constant). seineThe larger the amount of fuel, the longer the catching trip (and the gear's operating period)
4. The operating time per trip variable (x_4) has a significant effect (a probability level of 0.000, smaller than 0.05). The variable x_4 has a regression coefficient (b_4) of 388.054. This means that each additional 1 day of operation will increase the productivity of the Danish seine by 388.054 kg (if the other variables remain constant). This positive relationship shows that productivity is directly proportional to the loength of the operating days of the Danish seine.
5. The operational cost variable (x_5) has no significant or insignificant effect (a probability level of 0.842). The variable x_5 has a regression coefficient (b_5) of -0.016 and the effect is negative. This means that each additional USD 0.00007 of the operational costs will reduce the productivity of the Danish seine by 0.016 kg (if the other variables are constant).
6. The variable number of crew (x_6) has a significant effect with (a probability level of 0.016, smaller than 0.05). The variable x_6 has a regression coefficient (b_6) of 24.687. This means that each additional 1 crew member will increase the productivity of the Danish seine by 24,687 kg (if the other variables remain constant). This positive relationship shows that the productivity of the Danish seine is determined by the number of crew members. The number of crew members has a real effect because a larger number of crew members accelerates the operation of the fishing gear.

Conclusions. Based on the results and discussion previously described, it can be concluded that:
1. The FV. Tirta Raya Mina 01 has the highest catch rate, which is 1,652.5 kg/ a trip, while the FV. Sari Jati Mulya is the Danish seine carrier with the lowest catch rate, which is 466.8 kg/trip. However, if the rate of catch per day is averaged, there is no significant difference in the catch rates.
2. The correlation between the productivity of the Danish seine with the variable amount of fuel (x_3), number of days per trip (x_4), and operational costs (x_5) is very strong and positive. while the correlation between productivity and the variable number of crew members (x_6) is moderate and positive. Meanwhile, the correlation between productivity and vessel size variable (x_1) or engine power (x_2) is weak and positive.
3. The linear combination of the independent variables (x) which consists of: variable length of vessel (x_1), engine power (x_2), fuel consumption (x_3), number of days per trip (x_4), operational costs (x_5) and number of crew members (x_6) has a significant effect on the increase in the productivity of the Danish seine (y). However, individually (partially) only the variable number of days per trip (x_4) and the number of crew members (x_6) had a significant effect, while the other variables had no significant effect on the Danish seines' productivity increase seine(y).

Conflict of interest. The authors declare no conflict of interest.

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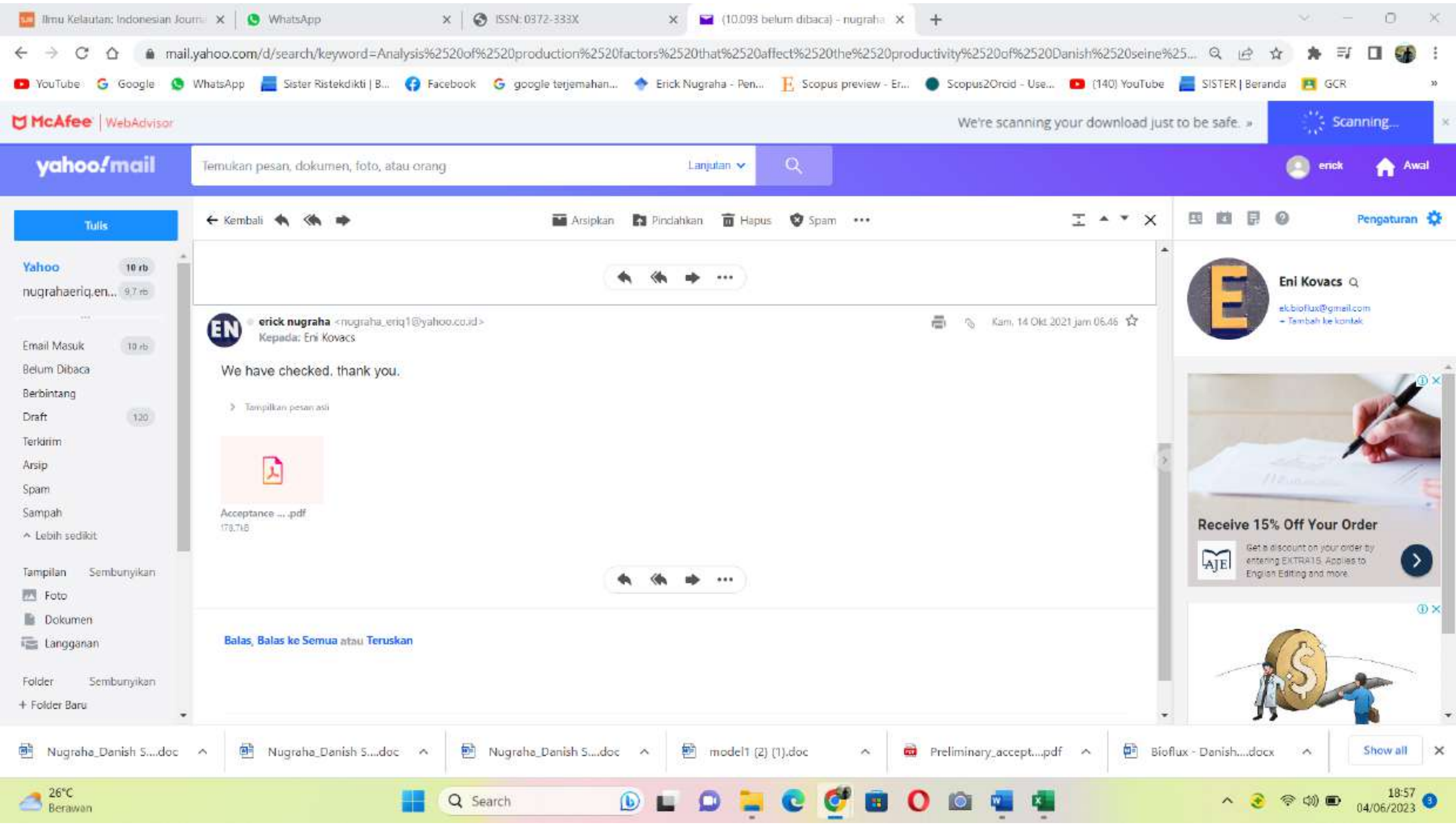
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Thank you.

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