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Availability of fish catch production yellowfin tuna (*Thunnus albacares*) landed in the Bungus Ocean Fishery Port of West Sumatra Province

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Abstract

This research aims to determine predictions of yellowfin tuna catch production and conditions of catch production in 2021-2025 and the factors influencing yellowfin tuna catches. This research was conducted in September 2021 at the Bungus Marine Fisheries Harbor. The data taken is primary and secondary. The analysis used is Catch Production Projection Analysis and quadratic (Polynomial) Regression Analysis. The research results show that in catch projections, there is data on fish catch production for 2021-2025, where predictions for the next five years will fluctuate, or yellowfin tuna production will increase yearly. In the results of quadratic (polynomial) regression research, the factors that most influence the output of yellowfin tuna catches using quadratic regression are the number of fishing gear with a coefficient of determination or R^2 value of 0.9934 and the number of fishermen with a coefficient of determination or R^2 value of 0. 9934. The coefficient of determination or R^2 value is 0.9599.

1. INTRODUCTION

Bungus Ocean Fishing Harbour is located in Bungus Bay, Labuhan Tarok Village, Bungus Teluk Kabung Sub-district, Padang, West Sumatra. This fishing port has a strategic location 42 km from Minangkabau International Airport. The history of PPS Bungus begins with the oceanic fisheries development and development project, better known as the "Sumatra Development Project", SFDP finding a suitable place to collect fish caught by fishermen. The area chosen was Bungus Teluk Kabung because it has a wide enough seabed.

Lubis (2006) argues that whether or not the functions of a fishing port are carried out optimally indicates the success or failure of managing a fishing port. Furthermore, it is said that the type and capacity of the facility will develop by the operational needs of the port or, in other words, that the development of the production of landed catches should be balanced with the development of the type of capacity of the facility.

One type of tuna landed at PPS Bungus is yellowfin tuna (*Thunnus albacores*). Yellowfin tuna is a pelagic fish that inhabits the upper layers of oceanic waters, spreading into the water column to the top of the thermocline. This type of fish mostly wades through the water column layer and relatively rarely penetrates the thermocline layer, but this fish can dive deep into the sea in the Indian Ocean, spending 85% of its time at a depth of less than 75 m (Sumadhiharga, 2009).

The production of catches landed at fishing harbors' is often abundant during the peak fishing season, which is often detrimental to fishermen due to the decline in selling prices. Some cases occur where fishermen throw their catches out to sea during the peak season due to the lack of port facilities that can accommodate both cold storage and fishing industry businesses (Minister of Marine Affairs and Fisheries Regulation Number PER.16 / MEN / 2006 concerning Fishing Ports ignored by DKP 2018).

2. RESEARCH METHODS

Time and Place

This research was conducted in September 2021 at Bungus Ocean Fishing Port, West Sumatra Province.

Materials and Tools

The material used in this research is the fish production data of Bungus Ocean Fishing Port Fisheries statistics for 2016-2020. The tools used in this research are stationery, camera, computer, and Ms.Excel application.

Research method

The method used in this research is the survey method by directly knowing the aspects of catch production at PPS Bungus. The data collected is primary data, namely data obtained directly from field conditions, about how the production activities of fish catches landed at the Bungus Ocean Fishing Port. While secondary data is data obtained from relevant agencies, namely the Bungus Ocean Fishing Port of West Sumatra Province.

Research Procedures

Data Collection

The data collected is secondary data, secondary data is data obtained from relevant agencies, namely the Bungus Ocean Fishing Port of West Sumatra Province, such as: number of boats/motorboats operating in PPS Bungus, the dominant fishing gear at PPS Bungus, development of the number of fishermen in PPS Bungus, and production of the dominant catch of fish at PPS Bungus

Data analysis used in this research is Catch Production Projection Analysis, Quadratic Regression Analysis (Polynomial) using the SPSS application and Normality Test Method. The data that has been processed is then tabulated in the form of tables and graphs and then analyzed descriptively.

Catch Production Projection Analysis (HT)

The projection of the amount of catch landed at the Bungus Ocean Fishing Port of West Sumatra in the next five years was carried out using the multiplicative decomposition model forecasting method (Gasperz, 1992). The equation model used is:

$$Yt = It \times Tt \times Ct \times Et$$

Description:

Yt = Time series value (actual data) in period t
It = Seasonal component or index in period t
Ct = Cyclic component in period t
Et = error component in period t

The steps to solve the above function based on the model. The multiplicative decomposition is (Gazper, 1992).

From the actual time series data (Yt), determine the moving average of 12 monthly, four quarterly, or seven daily, according to the nature of the time series data, whether in monthly, quarterly, or daily form. The purpose is to estimate the trend (Tt) and cyclic (Ct) effects. Thus, the following will be obtained:

$$Mt = Tt \times Ct$$

Where it can be explained that:

$$M1=\frac{Yt+Y2+\ldots+Y12}{12} \qquad M2=\frac{Yt+Y2+\ldots+Y12}{12}$$

In the formula above, it can be explained that M1 was placed in the middle of 2016, namely in July, and M2 was placed after July, namely in August and so on in M3 to M12. In August and so on from M3 to M12.

To influence the season (It). Then, divide the actual data (Yt) by the moving average value (Mt). The result of this division is called the ratio of real data to moving average. This will obtain:

$$\frac{Yt}{Mt}=It \times Et\ 100\%$$

The third stage removes the influence of errors (Et) from the equation and averages the values for the same month. Decomposition The decomposition of the ratio of the actual data to the moving average uses an approach called the medial mean. This will obtain:

$$R2\ (\%)\ \frac{Y2}{M2}\ X\ 100\%$$

Determine the effect of the trend (Tt) according to the existing time series data pattern. The total data in the raw data of Madidihang Tuna fish catch production fluctuates yearly. This indicates that a suitable model for this data is a linear trend. The linear trend estimation model used is :

$$Tt = a + bt$$

Where

Tt = Trend

T = Time index (Month)

a,b = Values to be sought as estimators of model parameters

To obtain the cyclic component (Ct), determine the value of the ratio between Mt and Tt so as to obtain:

$$\frac{Mt}{Tt} = Ct$$

Regression Analysis

The relationship of factors affecting fish landing time (number of unloads, unloading speed, ship cargo, catch, and wasted time) to time efficiency can be known by conducting a quadratic regression analysis.

Quadratic regression is a relationship between two variables consisting of the dependent variable (Y) and the independent variable (X) so that a curve will be obtained that forms an ascending or descending curved line. The general form of the quadratic regression mathematical equation is as follows:

$$Y = ax^2 + bx + c$$

Description:

Y = Independent variable (time efficiency).

c = Constant

a and b = regression coefficient value

x = Independent variable (influencing factors)

The function form of this regression is where the independent variable Y functions as a power (exponent) and the independent variable X has the form of a power.

3. RESULTS AND DISCUSSION

Production and Production Value of Fish Catches

Fish production landed at Bungus Ocean Fishing Port comes from the catch of fishing vessels in the waters of Bungus Ocean Fishing Port. The production and value of fish landed at Bungus Ocean Harbour from 2016-2020 can be seen in the Table 1.

Table 1. Production and value of fish landed at Bungus Ocean Harbour 2016-2020

Year	Production	Value(Rp)	Progress (%)
2016	562.116	25.616.155.550	-
2017	960.615	42.837.168.090	41,48
2018	1.112.997	36.445.072.239	13,69
2019	4.174.509	107.960.689.500	73,33
2020	4.425.779	111.028.457.000	5,67
Average	**2.247.203**	**64.777.508.476**	**-**

Source: PPS Bungus Logbook Data 2016-2020

Based on this table, it can be seen that from 2016-2020 the fish production and value of fish production landed at Bungus Ocean Fishing Port has increased. The most significant fish production landed at Bungus Ocean Fishing Port in 2020, namely 4,425,779 kg with a fish production value of Rp.111.028.457.000, -. While the minor fish production landed at Bungus Ocean Fishing Port in 2016, namely 562,116 kg with a fish production value of Rp.25.616.155.550,-.

Yellowfin Tuna Catch Production 2016-2020

Based on statistical data from Bungus Ocean Fishing Port in 2016-2020, the production of yellowfin tuna landed at Bungus Ocean Fishing Port can be seen in the Table 2.

Table2. Production of yellowfin tuna landed at Bungus Ocean Fishing Port 2016-2020.

Month	Catch Production (kg)				
	2016	**2017**	**2018**	**2019**	**2020**
January	18.038	179.848	45.570	101.869	315.587
February	26.726	43.170	57.067	219.095	258.058
March	53.620	164.337	41.983	747.294	230.982
April	29.895	29.360	72.492	562.217	457.122
May	48.741	72.656	165.277	315.617	482.895
June	35.879	29.564	26.730	283.133	492.125
July	14.041	54.330	77.869	311.222	443.771
August	15.232	58.354	113.517	234.044	507.738
September	22.515	40.561	112.162	424.114	500.801
October	80.207	76.692	162.978	384.271	281.174
November	15.,195	132.668	118.387	248.937	455.526
December	63.027	79.075	118.965	342.696	350.361
Total	562.116	960.615	1.112.997	4.174.509	4.425.779

Based on the table above, it can be concluded that the production of fish catches landed at the highest fishing port occurred in 2020, where the yields fluctuated or increased every year. Based on statistical data of Bungus Ocean Fishing Port 2016-2024.

Projection of yellowfin Tuna Catch Production in 2021-2025.

Based on the Table 3, it can be concluded that the prediction of the data that has been processed in Appendix 5 for the next five years on yellowfin tuna fishing production in 2021-2025 in the table above can be seen that this production has increased every year. It can be seen that based on the data processed, the highest prediction of yellowfin tuna production was obtained in 2025, which was 2,612,763.94 kg, and the lowest in 2021 was 1.442.637.57 kg.

Table 3. Production of yellowfin tuna landed at Bungus Ocean Fishing 2021-2025

Month	Catch Production (kg)				
	2021	**2022**	**2023**	**2024**	**2025**
January	163.257,19	199.443,42	235.629,64	271.815,87	308.002,09
February	157.319,35	191.557,03	225.794,72	260.032,41	294.270,10
March	32.676,41	39.661,15	46.645,90	53.630,65	60.615,40
April	22.003,14	27.831,18	32.661,65	37.492,12	42.332,59
May	27.571,37	33.262,16	42.206,64	44.643,72	50.334,50
June	140.828,20	169.403,90	197.979,60	226.555,29	255.130,99
July	318.018,26	381.474,90	444.931,53	508.388,17	571.844,80
August	237.610,90	284.247,75	330.884,60	377.521,45	424.158,30
September	244.177,28	291.331,67	338.486,07	385.640,46	432.794,85
October	30.616,40	36.459,06	42.281,72	48.104,38	53.927,03
November	26.872,48	31.900,15	36.927,82	41.995,49	46.983,16
December	41.666,59	49.342,47	57.018,35	64,694,23	72.370,11
Total	**1.442.637,57**	**1.735.914,83**	**2.031.448,24**	**2.320.474,23**	**2.612.763,94**

Source: Data Processing of Fish Catch Production in 2021-2025

Relationship between Yellowfin Tuna Catch Production and Influencing Factors

Relationship between Number of Vessels and yellowfin Tuna Catch Production. Fishing vessels, also called fisheries fleets, are ships, boats or other floating devices used to conduct fisheries surveys or exploration activities. Fisheries are essential capital in fisheries and aquaculture. Besides being used to catch fish, ships are used to maintain fisheries in Indonesia (Fauzi *in* Tawakal, 2015). The number of vessels (Units) can be seen in Table 4.

Table 4. Number of ships (unit)

Years	Number of ship units					
	< 10GT	**11-20 GT**	**21-30 GT**	**>30 GT**	**Quantity (unit)**	**Progress (%)**
2016	36	2	28	2	68	-
2017	99	9	18	6	132	48.48
2018	34	56	51	48	189	30.16
2019	34	98	99	76	307	38.44
2020	32	84	116	64	296	-3.72

Source: PPS Bungus Logbook Data 2016-2020

To analyses the data on the relationship between the number of fishermen and the production of yellowfin tuna catch, quadratic regression analysis was used, the results can be seen in Figure 1.

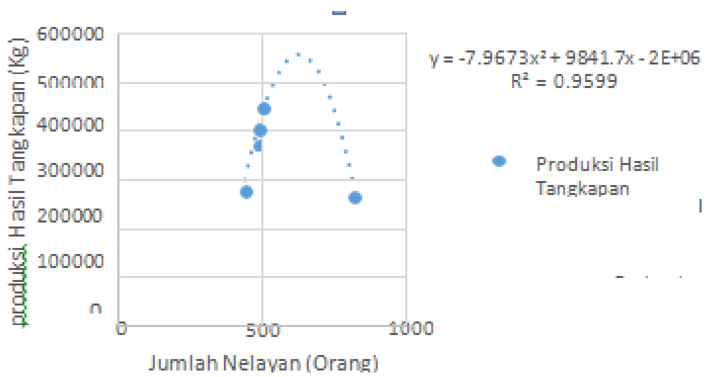

Figure 1. Relationship between the number of fishermen and fish catch production

From the graph, it can be seen that the equation obtained from the regression analysis regression analysis is $y = -7.9673x_2 + 9841.7x_1 - 20000$. The R^2 value of 0.9599 is the determination value which shows that the conjecture model presented can represent the observation model by 95.99%. The correlation value can be obtained by multiplying the determination value. Thus, the correlation value of the equation is 0.97, which indicates that the relationship between the number of fishermen and the production of yellowfin tuna catch is close and interconnected.

From the quadratic regression analysis, the equation obtained from the R^2 value to determine the factors that most affect the production of yellowfin tuna catch can be seen in the Table 5.

Table 5. Regression analysis

Factors affecting the Coefficient of	Equation	Coefficient of determination (R^2)	Correlation coefficient (R)
Number of Vessels	y = -26,44x+5202.3x-21525	0,5131	0,72
Number of Fishing Gear	y = 0,815x–683,52+ 541291	0,9934	0,99
Number of Fishermen	y=-15,9346x+9841,7- 20000	0,9599	0,97

From the Table 5, it can be concluded that the factor that most influence the production of yellowfin tuna catches using quadratic regression is the number of fishing gear with a coefficient of determination or R2 value of 0.9599. This shows that the amount of fishing gear used to conduct fishing is more efficient, so this factor has more influence on the production of yellowfin tuna catches at PPS Bungus.

In addition, other factors, namely the number of fishermen, have a coefficient of determination or R^2 of 0.9599. This shows that the number of fishermen can affect the production capacity of the catch obtained and landed at the Bungus PPS port. The number of vessels factor has a coefficient of determination or R^2 value of 0.5131. This shows that the number of boats can affect the production capacity of the catch landed at PPS Bungus.

4. CONCLUSIONS

Based on the results of the study, it can be concluded that the catch of yellowfin tuna at Bungus Ocean Fishing Port in 2021-2025 experienced fluctuations in fish catches in the next 5 years. From this projection and forecast, it can be concluded that the catch of yellowfin tuna in the next 5 years will be in a reasonably good position in the catch which is explained by the data generated that the projection of yellowfin tuna fish experienced the highest increase in 2025 and experienced a decline in 2021 which in this decline in catches did not experience a drastic decline so that the author can conclude that this catch is experiencing the best results for the future. Factors that affect the production of fish catches include the number of boats, the number of fishing gear and the number of fishermen. Based on data analysis using quadratic regression to determine the factors that influence the production of yellowfin tuna catches, the R^2 result on the number of boats is 0.5131, the number of fishing gear is 0.9934, and the number of fishermen is 0.9599. The factors that most influences the production of yellowfin tuna catches are the number of fishing gear. At the same time, other factors, such as the number of boats and the number of fishermen, are also sufficient to influence the production of yellowfin tuna catch. This is due to the need for more tools and labor in the fishing process.

There is a need for similar research with a more significant number of samples so that there can be a comparison between one sample and another. There is a need for similar research on projections of things related to and supporting the production of catches, such as projections of port pond area requirements, projections of TPI area requirements, and others.

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