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APPLICATION OF THE SIMPLE MOVING AVERAGE METHOD FOR FARMING FISH PRICE FORECASTING SYSTEMS

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ABSTRACT

Price is one of the important things that needs to be considered as a determining factor for profit or loss on product sales as a result of price fluctuations which are very difficult to control. Price fluctuations are caused by many factors including weather, stock availability, demand and others. One of the steps to overcome the problem of price fluctuations is to forecast the entry price of fish. Forecasting is the art or science of predicting future events using past data. The purpose of this study is to apply the simple moving average method to estimate the price of farmed fish. The simple moving average method uses a number of actual demand data to generate forecast values for future requests. This method has two special properties, namely to make forecasts that require historical data over a certain period of time, the longer the moving average, the smoother the moving average will be. This study uses data on fish prices (milkfish and tilapia) daily for January 2023. The results show that the Simple moving average produces a very accurate forecast with a MAPE percentage for milkfish of 2% and tilapia of 1.97%.

Keywords – *Forecasting, Price, Simple Moving Average*

I. INTRODUCTION

Lamongan Regency is one of the largest fish producers in East Java, both in the capture fisheries and aquaculture sectors to meet industrial needs (Handoyo et al., 2014). The fisheries sector is able to move the wheels of the economy and is part of the food security sector in Indonesia (Shodiq and Saputra, 2022)(Aprillya et al., 2019). Aquaculture in Lamongan Regency has various types of commodities, including milkfish, tilapia,

catfish, vanami shrimp and others with various production which of course has an impact on the economy in Lamongan Regency.

The large number of fresh fish cultivation is in line with high consumer demand and also the needs of the fish processing industry. The amount of cultivated fish (stock) will affect the price of fish. If there is a lot of stock, the price of fish will decrease, conversely, if the stock is small, the price of fish will increase. This is due to the relatively same harvest time in some areas. Falling prices can cause farmers to lose because they are not balanced with the capital spent (Saputra, 2019). Therefore, it is necessary to collect and record the price of fish every day so that it can be used as a reference in determining the price of fish in the next period.

Forecasting is the art or science of predicting future events. This can be done by involving taking historical data and projecting it into the future with a form of systematic modeling, or it can also be done by using a combination of mathematical models that are adapted to the good judgment of a manager (Rachman 2018). Several approaches that can be used for forecasting include exponential smoothing, naïve bayes (Bianto et al., 2020), weighted moving average and simple moving average (Shodiq and Saputra, 2022) and neural networks (Ardiansyah et al., 2018). The simple moving average method uses a number of actual new demand data to generate forecast values for future demand. This method has two special properties, namely it requires historical data for a certain period of time, the longer the moving average will produce a smoother moving average (Maricar, 2019).

Based on these problems, a price forecasting system is needed to find out information about the price of cultivated fish. One of the methods used is the simple moving average. In this study the application of the simple moving average method will produce information on the price of cultivated fish that can be used as a reference in decision making by policy makers.

II. METHOD

A. Definition of Forecasting

Forecasting is defined as a tool used to make policies using past data and projecting it into the future with mathematical models so that it can be used to find solutions to problems in various fields (Shodiq and Saputra, 2022).

B. Simple Moving Averages

The single moving average method (Simple Moving Average) uses a number of actual new demand data to generate forecast values for future demand. Systematically moving averages can be calculated with the following equation (Andriana and Susanto, 2017).

$$S_{t+1} = \frac{x_t + x_{t-1} + \cdots + x_{t-n+1}}{n} \quad (1)$$

Information :

S_{t+1} = Forecasting for the period to *t+1*.
x_t = Data on period t.
n = Time period *Moving Averages*

C. Mean Absolute Percentage Error

Mean Absolute Percentage Error (MAPE) calculated using the absolute error for each period divided by the actual observed value for that period. Then, average the absolute percentage errors. This approach is useful when the size or magnitude of the forecast variable is important in evaluating the accuracy of the forecast. MAPE indicates how big the error in forecasting is compared to the real value (Sinaga et al., 2018).

$$E(t) = xt - st \quad (2)$$

$$APE\ (t) = \frac{|E(t)|}{xt} x\ 100\% \quad (3)$$

$$MAPE = \frac{1}{n} \sum_{t=1}^{n} APE(t) \quad (4)$$

Information :

Xt = original data
St = forecasting data
$|E(t)|$ = absolute residual value

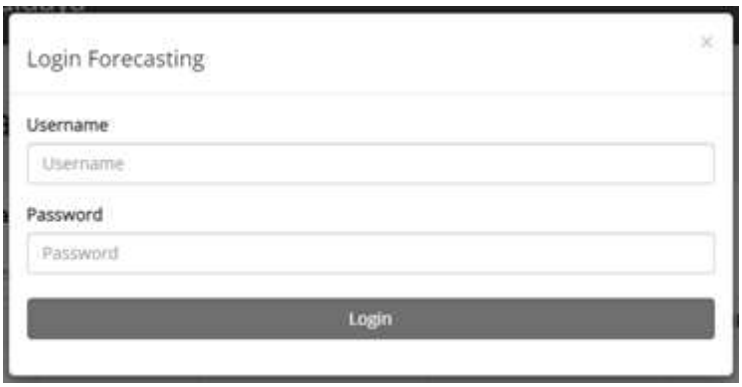

Figure 1. Login Page

Figure 2. Home page

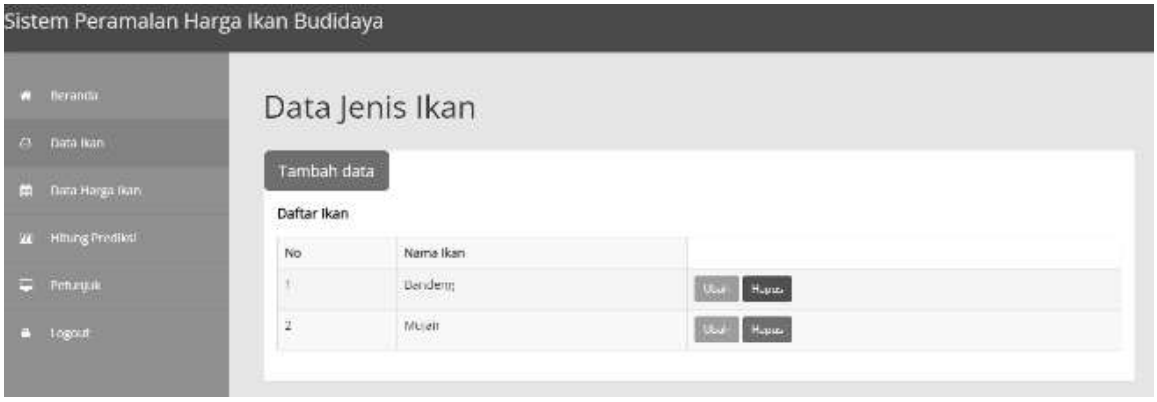

Figure 3. Page Types of fish

Figure 4 Page Price of fish

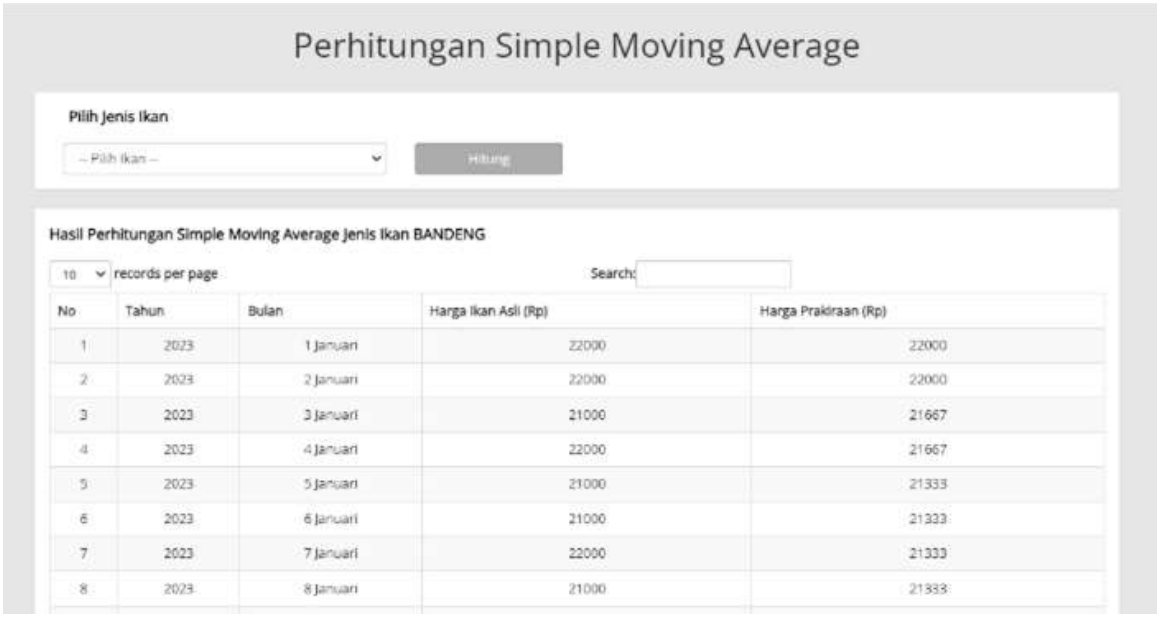

Figure 5 SMA calculation page

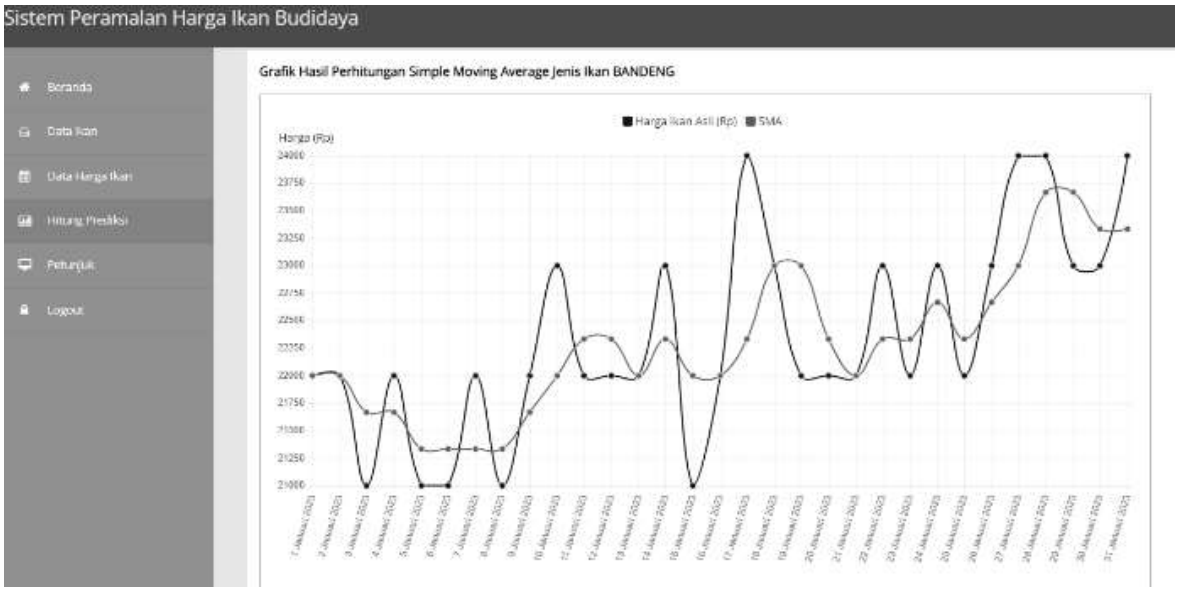

Figure 6 Page Displays Graph

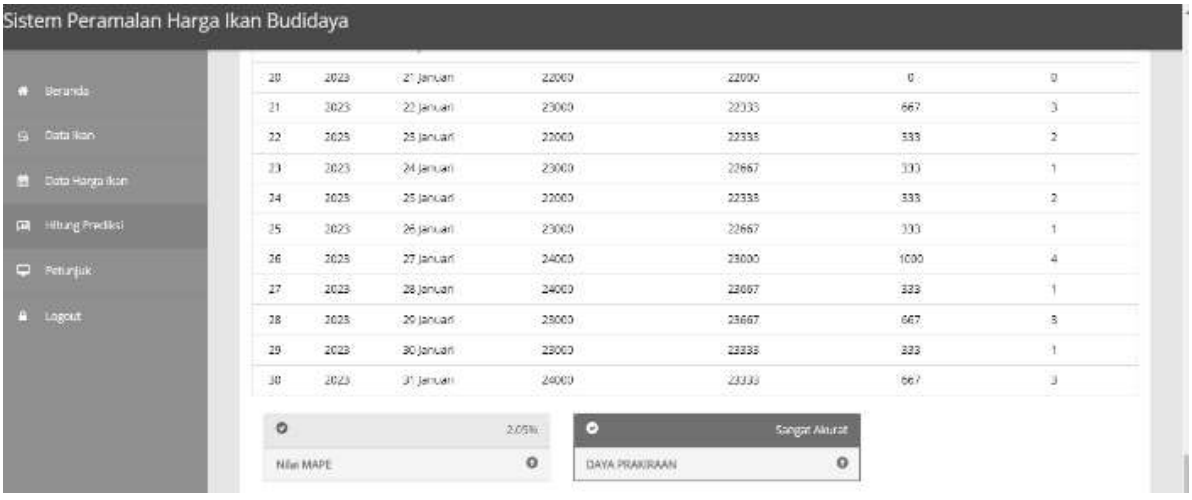

Figure 7 Page Displays accuracy

The following measures the level of accuracy of a forecasting model as shown in Table 1.

Tabel 1 Forecasting Data Patterns

MAPE	Forecasting Power
<10%	Very accurate
10-20%	Accurate
>20-50%	Enough
>50%	Not accurate

(Lusiana and Yuliarty, 2020).

III. RESULT AND DISCUSSION

1. Results of implementation

The login page is an interface for the admin to access the system for the process of entering data or changing data. This page is also used to limit user access to the system as a safeguard against parties who do not have access to the system. The login page is shown in Figure 1.

The main page of the system is the page that appears after the login process. System page views are made the same between admins and users. The difference between the two pages is shown that the user page only presents data entered by the admin while the admin page can be used to manage data to be entered. This page contains forecasting system information and sidebar menus that can be used to manage data entered into the system, as shown in Figure 2.

Fish type data page, admin can add, change and delete fish type data. In addition, this page displays data on fish species, as shown in Figure 3.

Fish price data page, admin can add, change and delete data on the amount of fish data. In addition, this page displays fish price data as shown in Figure 4.

After selecting the type of fish, 3 tables will appear on the forecasting page. The first table displays the calculation results from the model as shown in Figure 5.

Furthermore, the second table displays a comparison graph of actual data with data calculated from the simple moving average as shown in Figure 6.

Furthermore, the third table displays the accuracy of the simple moving average forecasting results for milkfish and tilapia species shown in Figure 7.

2. Simple Moving Average Calculation Results

In this study, a 3-day simple moving average is used to forecast the price of cultivated fish. The steps taken are to determine the initial data used for forecasting in the form of prices for milkfish and tilapia for the January 2023 period. The data taken is in the form of daily data so that a total of 31 data were obtained from the Lamongan Regency fish market as presented in Table 2.

TABLE 2 Fish Price Data

No	Period	Price of fish (Rp/kg)	
		Milkfish	Mujair
1	January 1, 2023	22.000	19.000
2	January 2, 2023	22.000	20.000
3	January 3, 2023	21.000	18.000
4	January 4, 2023	22.000	19.000
5	January 5, 2023	21.000	18.000
6	January 6, 2023	21.000	19.000
7	January 7, 2023	22.000	20.000
8	January 8, 2023	21.000	20.000
9	January 9, 2023	22.000	20.500
10	January 10, 2023	23.000	21.000
…	…..	……	…..
31	31 Januari 2023	24.000	21.000

Based on Table 2. If calculated using the simple moving average for milkfish as shown in table 3.

Table 3 Milk Fish Price Forecasting

Period	Original price	*Simple moving average*
January 1, 2023	22.000	22000,00
January 2, 2023	22.000	22000,00
January 3, 2023	21.000	21666,67
January 4, 2023	22.000	21666,67
January 5, 2023	21.000	21333,33
January 6, 2023	21.000	21333,33
January 7, 2023	22.000	21333,33
January 8, 2023	21.000	21333,33
January 9, 2023	22.000	21666,67
January 10, 2023	23.000	22000,00
…	…	….
January 31, 2023	24000	23333,33

Based on Table 3 if it is visualized in graphical form as shown in Figure 8.

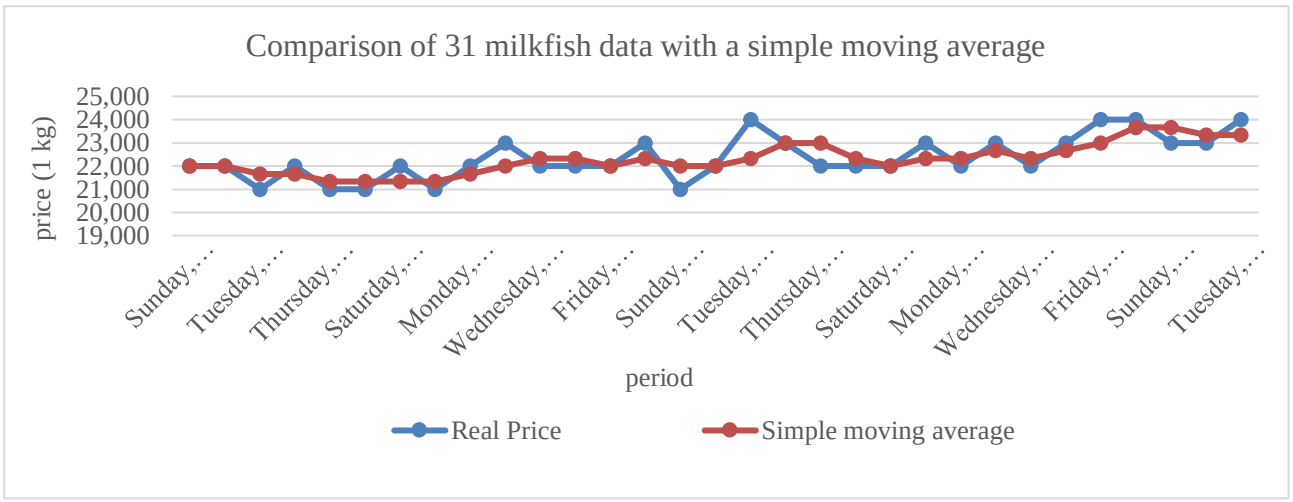

Figure 8 Graph Comparison of milkfish

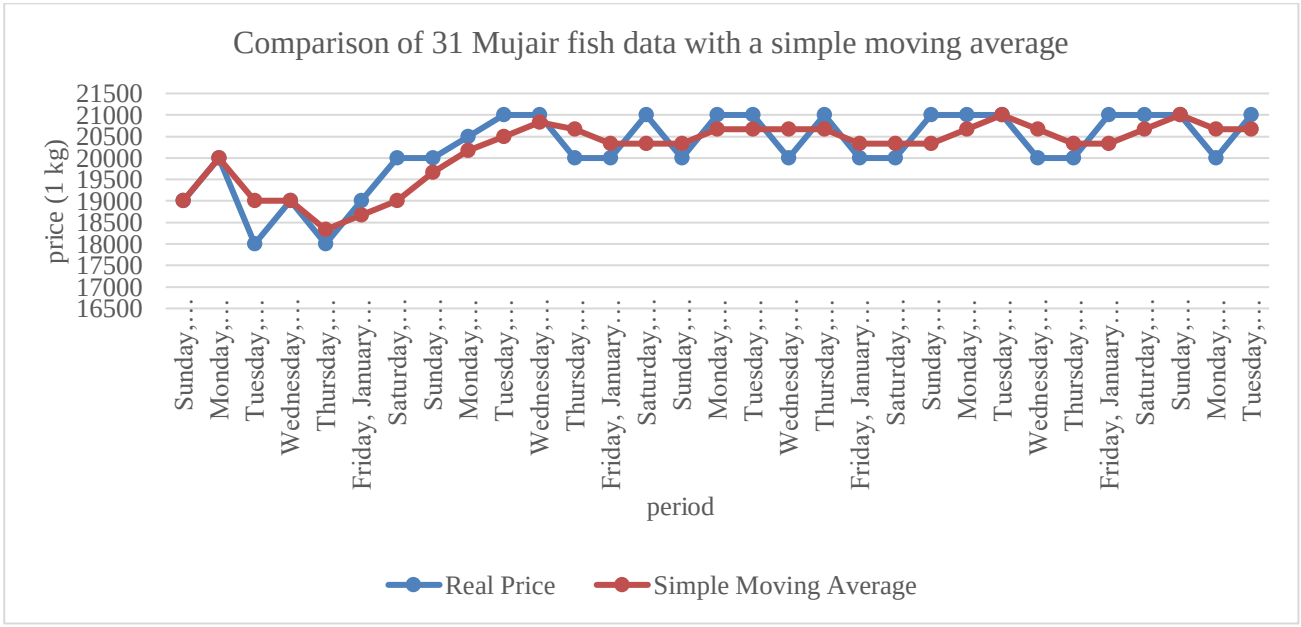

Figure 9 Graph of comparison of Mujair fish

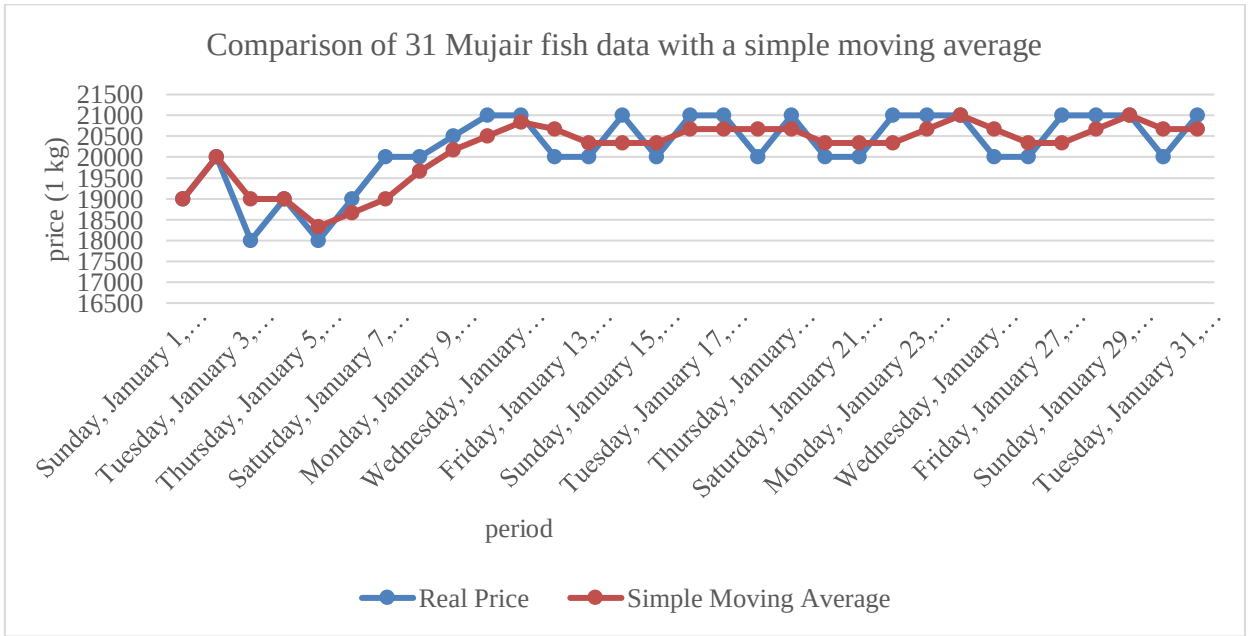

Figure 9 Graph of comparison of Mujair fish

Furthermore, accuracy measurements were carried out using MAPE as shown in Table 4.

TABLE 4 Milk Fish Price Forecasting Accuracy

Period	Original Price	*Simple moving average*	APE
January 1, 2023	22.000	22000,00	0,00
January 2, 2023	22.000	22000,00	0,00
January 3, 2023	21.000	21666,67	3,17
January 4, 2023	22.000	21666,67	1,52
January 5, 2023	21.000	21333,33	1,59
January 6, 2023	22.000	21333,33	1,59
January 7, 2023	21.000	21333,33	3,03
January 8, 2023	21.000	21333,33	1,59
January 9, 2023	22.000	21666,67	1,52
January 10, 2023	23.000	22000,00	4,35
……..	……..	…….	……..
January 31, 2023	24000	23333,33	2,89
		∑APE	19,83
		MAPE	1,98

Based on Table 4, it can be concluded that the forecasting results for milkfish are in the very accurate forecasting category referring to table 1.

TABLE 5 Price Forecasting Of Mujair Fish

No	Period	Original price	*Simple moving average*
1	January 1, 2023	19000	19000,00
2	January 2, 2023	20000	20000,00
3	January 3, 2023	18000	19000,00
4	January 4, 2023	19000	19000,00
5	January 5, 2023	18000	18333,33
6	January 6, 2023	19000	18666,66
7	January 7, 2023	20000	19000,00
8	January 8, 2023	20000	19666,66
9	January 9, 2023	20500	20166,66
10	January 10, 2023	21000	20500,00
	…	…	…
31	January 31, 2023	21000	20666,66

Based on Table 5 if it is visualized in graphical form as shown in Figure 9.

Furthermore, accuracy measurements were carried out using MAPE as shown in Table 4.

Table 6 Price Forecasting Accuracy Of Mujair Fish

Period	Fish Prices	*Simple Moving Average*	Ape
January 1, 2023	19000	19000,00	0,00
January 2, 2023	20000	20000,00	0,00
January 3, 2023	18000	19000,00	5,55
January 4, 2023	19000	19000,00	0,00
January 5, 2023	18000	18333,33	1,85
January 6, 2023	19000	18666,66	1,75
January 7, 2023	20000	19000,00	5,00
January 8, 2023	20000	19666,66	1,66
January 9, 2023	20500	20166,66	1,62
January10, 2023	21000	20500,00	2,38
…	…	…	…
31 Januari 2023	21000	20666,66	
		∑APE	61,34
		MAPE	1,97

Based on Table 6, it can be concluded that the forecasting results for Mujair fish are in the very accurate forecasting category referring to table 1.

IV. CONCLUSION

Based on the results and discussion of the research conducted, it can be concluded that:

1. A forecasting system built using the simple moving average method for forecasting the price of cultivated fish can produce very accurate forecasts.
2. The simple moving average method for forecasting prices for milkfish and tilapia with a scenario of 10 data, 20 data and 31 data gets a MAPE value of less than 10% which means the forecast is "Very Accurate"
3. Alternative optimal data lengths that can be used for forecasting are data lengths of 10 and 31 data

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