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ANALYSIS OF THE EFFECT OF FISHERMEN'S CHARACTERISTICS ON THE MANAGEMENT OF WEDGEFISH (*Rhynchobatus* sp.) AND GIANT GUITARFISH (*Glaucostegus* sp.) WITH PERCEPTION AS AN INTERVENING VARIABLE IN TASIKAGUNG FISHING PORT

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ABSTRACT

The endangered stingray species wedgefish (*Rhynchobatus* sp.) and giant guitarfish (*Glaucostegus* sp.) require good management, which must be implemented by examining the characteristics and perceptions of fishermen in Tasikagung Fishing Port, Rembang Regency. This study aims to know how the characteristics and perceptions of fishermen affected management support. The research method used in this study is a quantitative method and data analysis through linear regression and path analysis. Before being evaluated, the data were first validated with classical assumptions, including the multicollinearity test, linearity test, and normality test. The coefficient of determination (R^2), the F test, and the t-test are then used to analyze the data to see whether the model is accurate. The sample determination method used causal-comparative, and the sampling method used was accidental sampling with 44 respondents. Fishermen characteristics as variable X (independent) are divided into 2 variables, namely Education (X_1) and Knowledge (X_2), Perception as variable Y (intervening), and Management Support as variable Z (dependent). Education and knowledge positively influence perception with a constant X_1 = 0.177, and X_2 = 0.556. Education, Knowledge, and Perception positively affect support with a constant X_1 = 0.296; X_2 of 0.028, and Y = 0.655. Y does not mediate the effect of X_1 on Z, but does mediate the effect of X_2 on Z.

Keywords: wedgefish; giant guitarfish; characteristics; perception; support

INTRODUCTION

More than 118 species from 25 different shark and ray families can be found in Indonesian waters (Dharmadi *et al.*, 2015). Currently, it is known that a number of Indonesian Fisheries Management Areas (FMA) contribute significantly to the catch of sharks and rays. These FMAs include FMAs 572 (western Indian Ocean) and 573 (southern Indian Ocean), where pelagic and oceanic shark catches dominate (Fahmi & Dharmadi, 2013), as well as Java Sea waters (WPP 712) where sharks from the family Carcharhinid (Widodo & Mahisworo, 2007). Wedgefish (*Rhynchobatus* sp) and giant guitarfish (*Glaucostegus* sp.) are fish that have one of the habitats in Indonesia. There are at least 5 of the 8 species of Rhynchobatus in the world, namely *R. australiae, R. djiddensis, R. laevis, R. palpebratus*, and *R. springeri* which have habitats in Indonesia. As for the genus Glaucostegus, there are 5 of the 7 species in the world found in Indonesia, namely, *G. cemiculus*, *G. granulatus*, *G. halavi*, *G. thoiun*, and *G. typus*. Several species of wedgefish (*Rhynchobatus* sp.) and giant guitarfish (*Glaucostegus* sp.) are already endangered, namely *G. cemiculus*, and *G. typus* with critically endangered (CR) status, and *G. granulatus*, *G. halavi*, *G. thoiun*, *R. australiae*, *R. djiddensis*, *R. laevis* and *R. springeri* with vulnerable status (VU).

At this time, the populations of wedgefish and giant guitarfish continued to decline and were endangered, so both species were included in the red list of the International Union for Conservation of Nature and Natural Resources (IUCN). This is exacerbated by the problem of habitat destruction from stingrays. With the inclusion of these two types of rays into Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), stakeholders in Indonesia are led to manage wedgefish and giant guitarfish resources. This is intended to ensure the continuity of its population in the wild (Yuwandana *et al.*, 2020). This condition shows that the sustainability of wedgefish and giant guitarfish in the world (especially Indonesia) is already threatened. Studies on fishermen's perceptions of wedgefish and giant guitarfish management support need to be conducted to prevent extinction.

The distribution areas of the two groups of rays are centered on Fisheries Management Area (FMA) 711, 712, and 713 (DJPT, 2016). Central Java as a province with a fishing port located on the North Coast of Java is the right location for the study of these two rays (Yuwandana *et al.*, 2020). One of the fishing ports located on the North Coast of Central Java is Tasik Agung Fishing Port. Fishermen's catches in WPP 711, 712, and 713 are sold at both TPI in Tasikagung Fishing Port..

Wedgefish and giant guitarfish catches averaged 22 fish/trip at three landing sites (Tasikagung Fishing Port of 3.56 fish/trip, Bajomulyo Fishing Port of 9.13 fish/trip, and Tegalsari of 10.3 fish/trip) (Yuwandana *et al.*, 2020). Although the production of the two types of rays at Tasikagung Fishing Port is the smallest, it cannot be used as a reference in terms of the abundance of wedgefish and giant guitarfish. The abundance of the two stingrays is influenced by many factors, including the type of fishing gear, the area of operation, etc.

Wedgefish and giant guitarfish are bycatch of fishing activities using Danish seine or bottom longline. Wedgefish and giant guitarfish live at the bottom of muddy shallow waters. In one setting, Danish seine can capture more than one individual of homogeneous length. This indicates that wedgefish were caught in schooling. Giant guitarfish are also caught several times with homogeneous sizes, although there are not as many as wedgefish (Yuwandana *et al.*, 2020).

Populations of several types of wedgefish (*Rhynchobatus* sp.) and giant guitarfish (*Glaucostegus* sp.) in Indonesia have entered the status of critically endangered (CR) and vulnerable (VU). The limited habitat makes this stingray vulnerable to a by-catch trawl, and other fishing gear. This stingray is a target for fishing because of the high price of its fins and its meat consumed by coastal communities. Fishermen's perceptions are influenced by several factors including attention, expectations, needs, value systems, and personality traits (Sarwono, 2011).

Based on this background description, the purpose of this study are to determine the influence of personal characteristics on fishermen's perceptions, the influence of personal characteristics and fishermen's perceptions on management support, and the influence of intervening variables in mediating the influence of personal characteristics on the management support of wedgefish (*Rhynchobatus* sp.) and giant guitarfish (*Glaucostegus* sp.) in Tasikagung Fishing Port.

RESEARCH METHODS

This research was conducted at Tasikagung Fishing Port, Tasikagung Village, Rembang District, Rembang Regency on August 30, 2020, to September 20, 2020. Primary data was obtained from observations and interviews with questionnaires, while secondary data was obtained from data at TPI Tasikagung, PPP Tasikagung, Marine and Fisheries Service of Rembang Regency, WCS (Wildlife Conservation Society), and Rekam Nusantara Foundation. The data analysis method uses qualitative and quantitative approaches using linear regression and path analysis.

Data Analysis

The methods used in this study were qualitative and quantitative approaches. The population in this study were fishermen who had caught wedgefish (*Rhynchobatus* sp.) and giant guitarfish (*Glaucostegus* sp.). Based on the existing population, there were 44 respondents used in this study. The data is first tested using a classical assumption test consisting of a multicollinearity test, a linearity test, and a normality test. The next tests performed are the F test which serves to test simultaneously, the t-test to test partially, and the coefficient of determination (R^2).

Linear regression was performed using IBM SPSS Statistics 25. These variables are analyzed into two equations, consisting of equation 1 and equation 2. Equation 1 is a linear regression between the variable X as an independent variable, and the variable Y as a dependent variable. Equation 2 is a linear regression between variables X and Y as independent and variable Z as dependent. The functions Y and Z can be seen in the following equation:

$$Y = f(X) \quad \text{.....(1)}$$

$$Z = f(X,Y) \quad \text{.....(2)}$$

According to Katemba and Djoh (2017), simple linear regression is a statistical method that serves to test the extent of causal relationships between causal factor variables (x) to consequent variables. Causal factors are generally denoted by *x* or also known as predictors, while the consequent variable is denoted by *y* or also known as a response.

Path analysis was used to analyze the data for this study. Path analysis, according to Kadir (2015), is a statistical method used to examine the causal connection between two or more variables. Path analysis is fundamentally based on a set of linear equations. Regression analysis differs from path analysis in that path analysis permits testing with variable intervening. The authors used a path diagram to explain the causal connections between the variables they had studied. The relationship between dependent, intervening, and independent variables is shown using a path diagram (Figure 1).

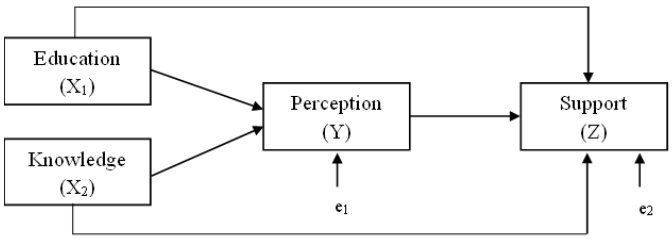

Figure 1. Path Analysis Concept

Path analysis in this study consists of personal characteristics as an independent variable (*x*), perception as an intervening variable (*y*), and management support as a dependent variable (*z*). The error value (*e*) is obtained from the adjusted R square value and entered into the formula:

$$e = \sqrt{1 - (adjusted\ R\ Square)} \quad \text{.....(3)}$$

RESULT AND DISCUSSION

Characteristics of Fishermen

The characteristics of fishermen are the characteristic of a person who works as a fisherman or other activities that support fishing operations, whether they live in coastal areas or not. The characteristics of fishermen are influenced by several factors. Based on research that has been conducted at Tasikagung Fishing Port, Rembang Regency obtained the latest education data from respondents presented in Table 1 below.

Table 1 shows that about 68% of respondents did not finish elementary school or did not attend school. This is due to economic and environmental factors. Becoming a fisherman does not require special skills and requirements, but only requires the will and ability of the person. Even though the level of education will affect their thinking, problem-solving, and decision-making abilities. Rokhmah *et al.* (2019), mentioned that education is one of the factors that determine a person's mindset or actions. The mindset in people with higher levels of education will consider many factors in deciding a problem, while the mindset in people with lower levels of education will tend to depend on the basic disposition of the person and not consider many factors in deciding a problem.

Table 1. The Respondent's Last Education

No	Last Education	Amount (person)
1	No School/Elementary School	30
2	Junior High School	9
3	Senior High School	5
	Total	**44**

Fishermen's knowledge of the rules for capturing and managing wedgefish (*Rhynchobatus* sp.) and giant guitarfish (Glaucostegus sp.) is presented in Table 2.

Table 2. Fishermen's Knowledge of the Rules

No	Kind of Knowledge	Amount (Person)	
		Knowing	Don't know
1	Protected Fish	43	1
2	Apendix CITES	0	44
3	Wedgefish	44	0
4	Giant Guitarfish	44	0
5	The population of Wedgefish and Giant Guitarfish	0	44
6	Stingray Fishing Regulations and Consequences	10	34
7	Socialization about the Rules of Wedgefish and Giant Guitarfish	15	29
8	Stingray's Regulations	14	30
9	Changes in Regulations regarding Marine Resources	40	4
10	Changes in the Catch of Wedgefish and Giant Guitarfish	2	42
11	Endangered Wedgefish and Giant Guitarfish	41	3

Based on Table 2, the majority of respondents know the types of protected fish (only 1 respondent does not know), such as hammerhead sharks, milk sharks, stingrays, and other types of mammals. But fishermen's knowledge related to the CITES Appendix is still very minimal. None of the respondents knew about the CITES Appendix, this was due to a lack of explanation regarding the CITES Appendix.

All survey participants had prior knowledge of the wedgefish and enormous guitarfish, the study's subjects. Due to its shark-like shape, though, fishermen mistake it for a shark. Furthermore, nothing is currently known about the fish population. Bycatch includes wedgefish (*Rhynchobatus* sp.) and giant guitarfish (*Glaucostegus* sp.), the majority of which are dead upon hauling. The fish may be sold at the Tasikagung Fish Auction, according to several respondents. According to Mohanraj *et al.* (2009), shark and guitarfish fins in India were reported to sell for USD 72/kg for small fins, USD 93/kg for medium fins, and USD 145/kg for large fins in 2009. Shark teeth were reported to sell for USD 21/kg, and ray gill rakers were reported to sell for USD 10/kg.

Regarding stingray fishing regulations, 77% of respondents do not know the regulations regarding stingray fishing and its consequences, so there are still many stingrays catches traded at Tasikagung Fish Auction. It is actually already known by fishermen that wedgefish and giant guitarfish are endangered. Fishermen's knowledge of some of the points in Table 2 may influence attitudes toward sustainable management of wedgefish and giant guitarfish.

Perception

Fishermen's perception of the existence of fishery resources is also needed in terms of fishing activities. The perception of fishermen who think that the stock of fishery resources is declining, fixed, or increasing will affect the policies to be taken. If the fisherman's perception is known, it will be easier to formulate the policy. In addition, the right management strategy can also improve fishermen's compliance with applicable regulations (Nababan *et al.*, 2017). Data on fishermen's perceptions of regulation are presented in Table 3.

Table 3. Perceptions of Regulations

No	Rules	Respondent's Answer*				
		VL	L	N	P	VP
1	Prohibition of fishing for certain species of sharks and rays	0	21	20	3	0
2	Feel advantaged / disadvantaged by the catch of Wedgefish and Giant Guitar Fish	0	6	37	1	0
3	Feel advantaged / disadvantaged from the inclusion of Wedgefish into protected fish	0	14	28	2	0
4	Feel advantaged / disadvantaged by the inclusion of Giant Guitarfish into protected fish	0	15	28	1	0

Table 3 gives the symbol captions as VL: Very Loss, L: Loss, N: Neutral, P: Profit, and VP: Very Profit. Table 3 shows that fishermen's perceptions of several regulatory plans are generally unfavorable. Some wedgefish and giant guitarfish rules are neither particularly helpful nor detrimental to responses. The majority of respondents believe that the only regulation that is harmful is the one that forbids the taking of certain species of sharks and rays. This is because the responders are unaware of the types of rays and sharks that are specifically forbidden from being caught under the regulation.

Due to their full exploitation, regulations regarding to the ban on the capture of giant guitarfish and wedgefish must be implemented. Rachmawati *et al.* (2021) claim that wedgefish has a very high rate of exploitation, which indicates that there has been an excessive amount of fishing pressure that will affect the population sustainability of the species. Wedgefish has a critical category in Appendix II of CITES. If it persists, it will have a detrimental effect on the sustainability of threatened resources.

Support

Respondents' support in fisheries management can be seen in Table 4. Table 4's symbol captions are VNP for "Very Not Support," NS for "Not Support," N for "Neutral," S for "Support," and VS for "Very Support." 84% of respondents agreed that wedgefish and giant guitarfish should be classified as species protected by law. The need of protecting this species of fish is already well understood by fishermen. Fishermen have become aware of the rarity of these two species, particularly of giant guitarfish, which are getting harder to find at Tasikagung Fish Auction.

Table 4. Support for Management

No	Rules	Respondent's Answer*				
		VNP	NS	N	S	VS
1	Prohibition of fishing for certain species of sharks and rays	0	8	8	28	0
2	Support the inclusion of Wedgefish into list of protected animals by law	0	0	7	37	0
3	Support the inclusion of Giant Guitar Fish into list of protected animals by law	0	0	7	37	0

The majority of respondents agreed that some sharks and rays should not be caught. This occurs because the presence of sharks and rays does not significantly affect fishermen's income. However, some people disapprove of the bans. Given the significant sales of such fish fins, the fact that they still have other income sources explains this.

According to Dulvy *et al.* (2014), along with the underappreciation of skates and rays in the commerce of Chondrichthyan meat, rays are also frequently disregarded in the trade of fins. Shark fin traders highly value the fins of sawfishes (Pristidae), guitarfishes (Rhinobatidae), and wedgefishes (Rhynchobatidae), and this has been a major contributing reason to the overexploitation of these species. Five of the seven most endangered chondrichthyan taxa (sawfishes, wedgefishes, sleeper rays, stingrays, and guitarfishes) are represented by rays, according to a recent analysis.

According to Safitri *et al.* (2022), rays of the *Rhynchobatus* sp. have a catch yield of more than 50% for immature. Based on the distribution of length size, the study's findings at Tasik Agung Fishing Port revealed that for *Rhynchobatus australiae*, up to 97.8% of male individuals and 98.8% of female individuals were captured in immature conditions, while for *Rhynchobatus springeri*, up to 93.9% male individuals and 74.1% female individuals, as well as for *Rhynchobatus laevis*.

The Classical Assumption Test

Classical assumption testing needs to be done so that the results of regression analysis meet the BLUE criteria (Best, Linear, Unbiased Estimator) (Irayanti and Tumbel, 2014). Based on the test of classical assumptions, the following results are obtained:

Multicollinearity test

The multicollinearity test aims to test whether there is a correlation between independent variables in the regression model. Multicollinearity can be seen from the tolerance value and VIF value (Setiawan and Indriani, 2016). The results of the multicollinearity test are presented in Table 5.

Table 5. Multicollinearity Test Results

No	Model	Collinearity Statistics	
		Tolerance	VIF
1	Education	0,896	1,116
2	Knowledge	0,637	1,570
3	Perception	0,611	1,636

The tolerance value in X_1 (Education), and X_2 (Knowledge) obtained results of more than 0.10 X_1, X_2 > 0,10. The VIF (Variance Inflation Factor) values on X_1 and X_2 obtained results of less than 10. The tolerance value at Y (Perception) above 0,10 or Y is more than 0,10. The VIF (Variance inflation factor) value at Y is below 10 or Y is less than 10. The results showed that there were no problems with the multicollinearity test. Setiawan and Indrani (2016) show that equation 1 and equation 2 have a tolerance value of more than 0.10 and a VIF of less than 10. This suggests that there is no problem of multicollinearity in either equation.

Normality test

The normality test serves to test whether the disruptive or residual variable regression model has a normal distribution (Gozali (2011), Santoso and Priantinah, (2016). The normality test used is the Kolmogorov-Smirnov test. The test results are presented in Table 6.

Table 6. Normality Test Results

No	One-Sample Kolmogorov-Smirnov Test		
	N (Sample)	Asymp sig.	Monte Carlo Sig
1	44	0,004	0,154

The data in table 6 shows that the significance value obtained is 0,154. The figure is above 0,05 or 0,154 less than 0,05, indicating that all study variables are normally distributed. The data is supported by Santoso and Priantinah (2016) who show that the significance level is more than 0.06. The conclusion is that all variables in this study are normally distributed.

Linear regression

This research uses multiple linear regression because there are 2 free variables (X_1 and X_2).

1. Equation 1

Linear regression in equation 1 is used to determine the influence of Education and knowledge on perception. The results of multiple linear regression analysis can be seen in Table 7

Table 7. Linear Regression Analysis Results of Equation 1

No	Coefficients		
	Model	Standardized Coefficients Beta	Sig.
1	Education	0,177	0,167
2	Knowledge	0,556	0,000

Based on the data in table 7, the regression equation can be formulated in the form of a standardized coefficient beta:

Perception = 0,177 (Education + 0,556 (Knowledge) + 3

2. Equation 2

Linear regression in equation 2 is used to determine the influence of Education, knowledge, as well as perception on support. The results can be seen in Table 8.

Table 8. Linear Regression Analysis Results of Equation 2

No	Coefficients		
	Model	Standardized Coefficients Beta	Sig.
1	Education	0,293	0,004
2	Knowledge	0,028	0,808
3	Perception	0,655	0,000

Based on the data in table 8, the regression equation can be formulated in the form of the following standardized coefficient beta:

Support = 0,293 (Education) + 0,028 (Knowledge) + 0,655 (Perception) + e

Model Accuracy Test

The results obtained from the model accuracy test can be seen in Table 9.

Table 9. Model Precision Test

No	Model	Test	Value	Sig.
1	Equation 1	Adjusted R Square value	0,359	-
		F value	13,042	0,000
		Education t value	1,408	0,167
		Knowledge t value	4,413	0,000
2	Equation 2	Adjusted R Square value	0,638	-
		F value	26,209	0,000
		Education t value	3,024	0,004
		Knowledge t value	0,245	0,808
		Perception t value	5,578	0,000

The coefficient of determination test is used to test the goodness fit of the regression model as seen from the adjusted value of R square (Setiawan and Indriani, 2016). In equation 1, the adjusted value of R square is 0.359. This means that the influence of independent variables (X1 and X2) on dependent variables (Y) is 35.9%, while the remaining 64.1% is influenced by other variables. In equation 2, the influence of the independent variable (X1, X2, Y) on the dependent variable (Z) is 63.8%, while the remaining 36.2% is influenced by other variables.

The F test is used to determine whether independent variables simultaneously affect the dependent variables (Setiawan and Indriani, 2016). Based on Table 9, the calculated F value in equation 1 has a value of 13.042 > F of table 3.220. The significance obtained is 0.000 (<0.05). This suggests that the independent variable (X) simultaneously affects the dependent variable (Y). At 2, the F value counts 26.209 > F table 3.220. The significance result is 0.00 (<0.05). This means that independent variables (X and Y) simultaneously affect the dependent variable (Z).

The t-test serves to show how much an individual independent variable will describe the dependent variable. The level of significance used is 5% (Setiawan and Indriani, 2016). Based on Table 9, the results obtained in the value of t equation 1 are as follows

- The calculated t value on X1 (Education) is smaller than the t-table (1.408 < 2.020) and the significance value is greater than 0.05 (0.167 > 0.05). This means that variable X1 has a partial no effect on variable Y (Perception). A positive value on the t-test means that variable X1 has no positive effect on variable Y
- The calculated t value on X2 (Knowledge) is greater than the t-table (4.412 > 2.020) and the significance value is less than 0.05 (0.00 < 0.05). This means that variable X2 partially has a significant effect on variable Y. A positive value on the t-test means that variable X2 has a positive effect on variable Y

In equation 2, the results of the t-test obtained are as follows

- The calculated t value on X1 (Education) is greater than the table t (3.024 > 2.020) and the significance value is less than 0.05. This means that it individually has a significant effect on the Z (Support) variable. A positive value on the t test means that variable X1 negatively affects variable Z.
- The calculated t value on X2 is smaller than the table t (0.245 < 2.020) and the significance value is greater than 0.05. This means that X2 (Knowledge) individually has no significant effect on the variable Z (Support). A positive value on the t test means that variable X2 has a positive effect on variable Z.
- The calculated t value at Y is greater than the table t (5.578 > 2.020) and the significance value is less than 0.05. This means that variable Y (Perception) has a significant effect on variable Z (Support). A positive value in the t test means that variable Y has a positive effect on variable Z.

Path Analysis

The Path Analysis method, created by Sewal Wright in 1934, is essentially a correlation development that is broken down into a number of interpretations of the effects it has. Wright used Path Analysis to create a fictitious examination of causal linkages utilizing correlations. This method is sometimes referred to as the causal model (causing modeling) (Hakam *et al*., 2015). Figure 3 depicts the path analysis plan created using linear regression.

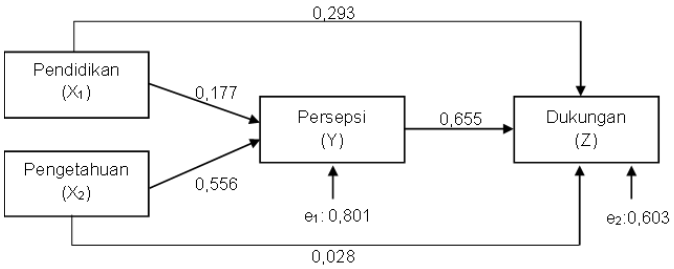

Figure 3. Path Analysis Scheme

Based on Figure 3, it can be known the magnitude of the direct and indirect influence of the variable X on the variable Z. Indirect influence is calculated by multiplication between the standardized coefficient beta values on variables X and Y as follows:

a. X_1 to Z (direct) = 0,293.....(4)
   X_1 by Y to Z (indirect) = 0,177×0,655=0,166.....(5)
   Total effect of X_1 on Z = 0,293+0,166=0,409.....(6)
b. X_2 to Z (direct) = 0,028.....(7)
   X_2 by Y to Z (indirect) = 0,556x0,655=0,364.....(8)
   Total effect of X_2 on Z = 0,028+0,364=0,392.....(9)

From formula (4), it is known that the value of the influence directly of the variable X1 on the variable Z is greater than the value of the indirect influence of the variable X_1 on Z (5). This indicates that variable Y does not mediate the influence between variable X_1 on variable Z. The value of the direct influence of variable X_2 on variable Z (7) is smaller than the value of the indirect influence of variable X2 on Z (8). This indicates that variable Y mediates the influence between variable X_2 and variable Z

CONCLUSION

Based on the research that has been carried out, several conclusions can be drawn. Personal characteristics (education/X_1, and knowledge/X_2) have a positive influence on the perception of (Y) wedgefish fishermen (*Rhynchobatus* sp.) and giant guitarfish (*Glaucostegus* sp.) at Tasikagung Fishing Port. The observed constant X_1 is 0,177; while X_1 is 0,556. Personal characteristics (education/ X_1, knowledge/ X_2, and perception/Y) have a positive influence on the support of (Z) the management of wedgefish (*Rhynchobatus* sp.) and giant guitarfish (*Glaucostegus* sp.) in Tasikagung Fishing Port. The constant X_1 is 0,293, X_2 is 0,028 and Y is 0,655. The perception of (Y) as an intervening variable does not mediate the influence between the education variable (X_1) on the support variable (Z), and the value of the direct influence constant (0,293) > the indirect influence (0,166). Perception (Y) mediates the influence between the knowledge variable (X_2) on the support variable (Z) and the value of the direct influence constant (0.028) < indirect influence (0,364).

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