Asian Journal of Aquatic Sciences, April 2025. Vol 8, Issue (1) 110-118
e-issn: 2716-4608
p-issn: 2655-366X

ANALYSIS OF SUSTAINABILITY OF SMALL-SCALE CAPTURE FISHERIES IN BANGKO DISTRICT, ROKAN HILIR DISTRICT

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ABSTRACT

This research was conducted in Bangko District, Rokan Hilir Regency, Riau Province. This research aims to analyse the sustainability status of small-scale capture fisheries and leverage attributes that support their sustainability in the future. The method used in this research is a survey method with a quantitative approach and the determination of respondents is carried out randomly purposive sampling with the consideration that the respondents taken were two fishermen group leaders, one community leader, one fisheries instructor, one academic, one village official, two people from the Fisheries and Maritime Service, and one fishermen cooperative. The public criteria selected in this study to collect the primary data were seven people, namely, fishermen. The number of public respondents selected came from villages/districts, so the total number of respondents was 16. Based on research results sustainability status small-scale capture fisheries show a sustainability index with an average value of 51.65 or in the range 50-75 which is classified as quite sustainable and the leverage attributes from the five dimensions that are the most sensitive and have high leverage in influencing the sustainability status of capture fisheries include fishing time, nature ownership of fishing facilities, type or nature of fishing gear, fishermen's education level, and fisheries management plan (RPP).

Keywords: Sustainability, Capture Fisheries, Small Scale

1. INTRODUCTION

Rokan Hilir Regency has marine fishing businesses as well as public water fishing businesses. Fishing media in public waters in this area are still traditional and straightforward, both in technology and capital. One is small-scale fishing, which has limitations, so its sustainability is threatened. Small-scale fishing is a fishing effort at the fishery household level at the research location, carrying out fishing activities using fishing fleets or fishing vessels measuring < 5 GT without using fleets, such as operating them using human power. Small-scale fishing activities are carried out in the fishery zone with a depth of ±0-200 m.

Fisheries production according to the Fisheries Service, LAKIP, Rokan Hilir Regency in 2021 shows the production of captured fisheries at sea is 53,987.96 tons. Capture fisheries production still supplies total fisheries production of around 80.67% and has experienced an increase of around 1.19% from the final target of the Rokan Hilir Regency Strategic Plan in 2017. The production data in the 2021 Annual Report of the Rokan Hilir Regency Fisheries Service in Bangko District is 11,174.07 tons[1]. Fisheries production in Bangko District comes from two activities, namely sea fishing and pond cultivation.

In this research, to determine the sustainability of capture fisheries, it is carried out comprehensively which includes

Received: 16 March 2025
Accepted: 16 April 2025

several crucial dimensions consisting of several dimensions, namely: 1) ecological dimension; 2) economic dimension; 3) social dimension; 4) technological dimension; 5) institutional dimension. Some of these aspects can be used as a basis for looking at the sustainability status of a fisheries water area so that it can be used as a reference for developing the sustainability of capture fisheries, especially in Bangko District, Rokan Hilir Regency, in the future. According to Denny et al.[2], sustainable management of captured fisheries resources will essentially look for appropriate management actions, both ecologically (maintaining environmental sustainability) and economically (fishing that can provide profits).

2. RESEARCH METHOD

Multidimensional Scaling (MDS) Analysis

Sustainability analysis uses the Rapfish analysis tool with the multidimensional scaling (MDS) approach in this research to determine the sustainability status of small-scale capture fisheries in Bangko District, Rokan Hilir Regency. According to Walundungo et al.[3], to carry out data analysis using Multidimensional Scaling (MDS), values describe the level of similarity or level of dissimilarity between objects, called proximity, which is divided into similarity and dissimilarity.

Index Preparation and Sustainability Status

The sustainability index value for small-scale fisheries using the Rapfish method is known to be bad to good in the range of 0-100. To make it easier to determine the sustainability status of small-scale capture fisheries in Bangko District, the interval from bad (0) to good (100) is divided into several categories or statuses, divided into four intervals from 0 to 100. The sustainability index interval is the interval 0-25, which is in poor or bad status; interval 25.01-50 is in less status; interval 50.01-75 is in adequate status; interval 75.01-100 is in good status[4]. In this research, there are four categories of sustainability status in determining the sustainability status of capture fisheries (Table 1).

Table 1. Value index and sustainability status of small-scale capture fisheries

No	Index Value	Category
1	0.00-25.00	Bad (not sustainable)
2	25.01-50.00	Less (Less sustainable)
3	50.01-75.00	Sufficient (Sufficiently sustainable)
4	75.01-100.00	Good (Very sustainable)

Source: Marlian et al. [4]

Monte Carlo Analysis

According to Kavanagh & Pitcher[5,] in Monte Carlo Analysis at a 95% confidence interval. This analysis estimates the influence of error (random error) in the statistical analysis process. The results of the Monte Carlo analysis were compared with the results of the MDS analysis to determine the differences between the two. The small difference between MDS and Monte Carlo indicates the condition of the effects of determination errors. Analyze the stress value to determine the analysis results' goodness of fit (accuracy) using MDS and recommend that the acceptable stress value is less than 0.25.

Accuracy Assessment (goodness of fit)

The accuracy of MDS (goodness of fit) analysis, according to Suwanto[6], is determined by the S-Stress value resulting from calculating the S value. A low stress value indicates high accuracy (goodness of fit), and vice versa. In Rapfish, a good model is indicated by a Stress value smaller than 0.25, and if the Stress is higher than 0.25, then the MDS results have low accuracy.

Measuring the level of suitability or condition of fit (goodness of fit), the distance of the estimation point from the origin is critical. Goodness of fit in MDS measures the accuracy (how well) a point can reflect the original data. Goodness of fit in MDS is

determined by the S-Stress value resulting from calculating the S value. A low stress value indicates goodness of fit, while a high S value indicates the opposite. In Rapfish, a good model is indicated by a stress value smaller than 0.25 (S<0.25)[7].

Leverage Attributes

To determine the lever attributes to support the sustainability of small-scale capture fisheries in the future in Bangko District, Rokan Hilir Regency, the following analysis was carried out:

Assessment of Sustainability Attributes. Determining the attributes of the sustainability analysis of small-scale capture fisheries in Bangko District includes ecological, economic, technological, social and institutional dimensions. The selected attributes are used as sustainability indicators of these dimensions[8].

The research dimensions and attributes used in assessing the sustainability criteria for capture fisheries in Bangko District are modifications of the Ecosystem Approach to Fisheries Management (EAFM) module manual from the Ministry of Maritime Affairs and Fisheries (KKP), the World Wildlife Fund (WWF) and the Center for Coastal and Marine Resources Studies (PKSPL) Bogor Agricultural Institute (IPB) and initial observations at the research location, the lever attributes can be seen in Table (2,3,4,5,6) [8].

Table 2. Attributes and scoring criteria for ecological dimensions

No	Attribute	Score Options	Condition		Scoring Criteria
			Good	Bad	
1	Recruitment diversity (types of fish caught)	0,1,2,3	3	0	Diversity coefficient[7]: (0) < 20% (1) 20 - 60% (2) 60- 100% (3) > 100%
2	Changes in the type of fish caught	0,1,2	0	2	Abdullah[7]; (0) low < 20% (1) medium 20-60% (2) high 60-100%
3	Coverage of the fishing area	0,1,2,3	0	3	Abdullah[7]; (0) far, > 7 miles (1) a little further, < 7 miles (2) still, 5 miles (3) getting closer, 1 mile
4	Percentage of fish discarded	0,1,2	0	2	(0) low 0-25% (1) moderate >25-50% (2) high >50%
5	Arrest time	0,1,2	2	0	Change in arrest time; (0) >12 hours, longer (1) 12 hours, fixed (2) <12 hours, faster
6	Collapse rate (decrease in the number of fish caught)	0,1,2	0	2	Decrease in the number of fish[7], (0) No (1) A little (2) Lots

Table 3. Attributes and scoring criteria for the economic dimension

No	Attribute	Score Options	Condition		Scoring Criteria
			Good	Bad	
1	Employment	0,1,2	2	0	(0) low (1) currently (2) tall

2	Profit	0,1,2,3,4	0	4	(0) very profitable (1) profitable (2) close to breakeven or return (3) slightly profitable (4) unfavourable
3	Alternative jobs and income	0,1,2,3	3	0	(0) There isn't any (1) There is, but it is not easy (2) a lot but difficult (3) lots and easy
4	The average income of fishermen	0,1,2	2	0	(0) low the UMR ≤ IDR 1-2,000,000 (1) the same or close to the UMR = IDR 2,996,539.00 (2) high or above UMR ≥ IDR 3,009,416.00
5	The level of subsidies from the government	0,1,2,3	3	0	(0) There isn't any (1) A little (2) Enough (3) big
6	Nature of ownership of fishing facilities (fishing gear, vessels, etc.)	0,1,2	0	2	(0) local owner (1) local and non-local owners (2) non-local owner
7	Capture fisheries production	0,1,2	2	0	(0) decreased (<50%) (1) still (2) increased (>50%)

Table 4. Attributes and scoring criteria for the technology dimension

No	Attribute	Score Options	Condition		Scoring Criteria
			Good	Bad	
1	Size of the fishing vessel	0,1,2,3	3	0	(0) ≥ 5 GT (1) 4 GT (2) 2-3 GT (3) 0-1.5 GT
2	Post-harvest handling	0,1,2	0	2	(0) Yes, okay (1) Yes, not good (2) There isn't any
3	Selectivity of fishing gear	0,1,2	2	0	(0) Low selectivity (1) quite selective (2) High selectivity
4	Type/nature of fishing gear used	0,1,2	2	0	(0) 1-2 types of tools catch (1) 3-4 types of fishing gear (2) > four types of fishing gear
5	Use of destructive fishing aids	0,1,2	2	0	(0) quite a lot > three kinds (1) Yes, < 2 Types (2) There isn't any
6	Fish landing place	0,1,2	2	0	(0) very spread out (1) somewhat centralized (2) centralized
7	Knowledge of technology	0,1,2	2	0	(0) There isn't any (1) don't know enough (2) enough to know

Table 5. Attributes and scoring criteria for the social dimension

No	Attribute	Score Options	Condition		Scoring Criteria
			Good	Bad	
1	Growth of workers/RTP in the last 5-10 years	0,1,2,3	3	0	(0) not good,< 5 % (1) not good,< 25 % (2) pretty good (3) Very good> 50 %
2	Work experience	0,1,2,3	3	0	(0) < 2 years (1) 3-5 years (2) 6-10 years (3) > 10 years
3	The fisherman's education level	0,1,2	2	0	(0) There isn't any (1) Elementary-middle school (2) SMA-PT
4	Status and Frequency of Conflict	0,1,2	0	2	(0) There isn't any (1) many (2) Lots
5	Participation of local communities in the use of SDI	0,1,2	2	0	(0) low (1) currently (2) tall
6	Fisherman welfare program	0,1,2	2	0	(0) There isn't any (1) quite influential (2) very influential

Table 6. Attributes and scoring criteria for institutional dimensions

No	Attribute	Score Options	Condition		Scoring Criteria
			Good	Bad	
1	Illegal fishing	0,1,2	0	2	Wild catching (0) There isn't any (1) some (2) Lots
2	Availability of law enforcement personnel	0,1,2	2	0	(0) There isn't any (1) Yes, <5 people (2) Yes, >5 people
3	Fisheries management plan	0,1,2	2	0	(0) There isn't any (1) Yes, it's not effective (2) Yes, effective
4	The role of formal institutions that support HR management	0,1,2	2	0	(0) There isn't any (1) exists & is ineffective (2) exists & is effective
5	Justice in law	0,1,2	2	0	(0) There isn't any (1) exists but is not effective (2) exists and is effective
6	Benefits of fisheries regulations for the welfare of fishermen	0,1,2	2	0	(0) There isn't any (1) less useful and inefficient (2) quite useful and efficient

Sensitivity Analysis (Leverage analysis)

Sensitivity analysis was carried out to achieve the second objective in this research, namely to determine the leveraging attributes in supporting sustainability at the research location and to look further at the role of each attribute in the sustainability value studied; for this reason, an attribute leveraging analysis was carried out. Leverage attributes are attributes that are

sensitive to increasing or decreasing sustainability status. According to Kavanagh & Pitcher[5], determining the leverage attribute is based on the order of the percentage change in the Root Mean Square (RMS) ordination on the X axis. The greater the value of the RMS change, the greater the role of this attribute. Towards increasing/decreasing sustainability status. The influence of each attribute is seen in the form of changes in the root mean square (RMS) ordination, especially on the x-source or sustainability scale. The greater the RMS change value due to the loss of a particular attribute, the greater the role of that attribute in forming sustainability values on the sustainability scale, or in other words, the more sensitive the attribute is in sustainable development (management)[9].

3. RESULT AND DISCUSSION

Sustainability Status of Small-Scale Capture Fisheries

The results of the analysis of the five dimensions using Rap-Analysis show that the sustainability index value for the ecological, economic, technological, social and institutional dimensions, namely the sustainability index value for the ecological dimension is 50.00, meaning it is not sustainable, the economic dimension is 50.51, meaning it is quite sustainable, the technological dimension is 66.87 means quite sustainable, social dimension 44.95 means less sustainable, institutional dimension 61.34 means quite sustainable. According to Marlian et al.[4], the point of ordination of less sustainable dimensions is in the negative (down) quadrant because the average of the key scoring attributes is low.

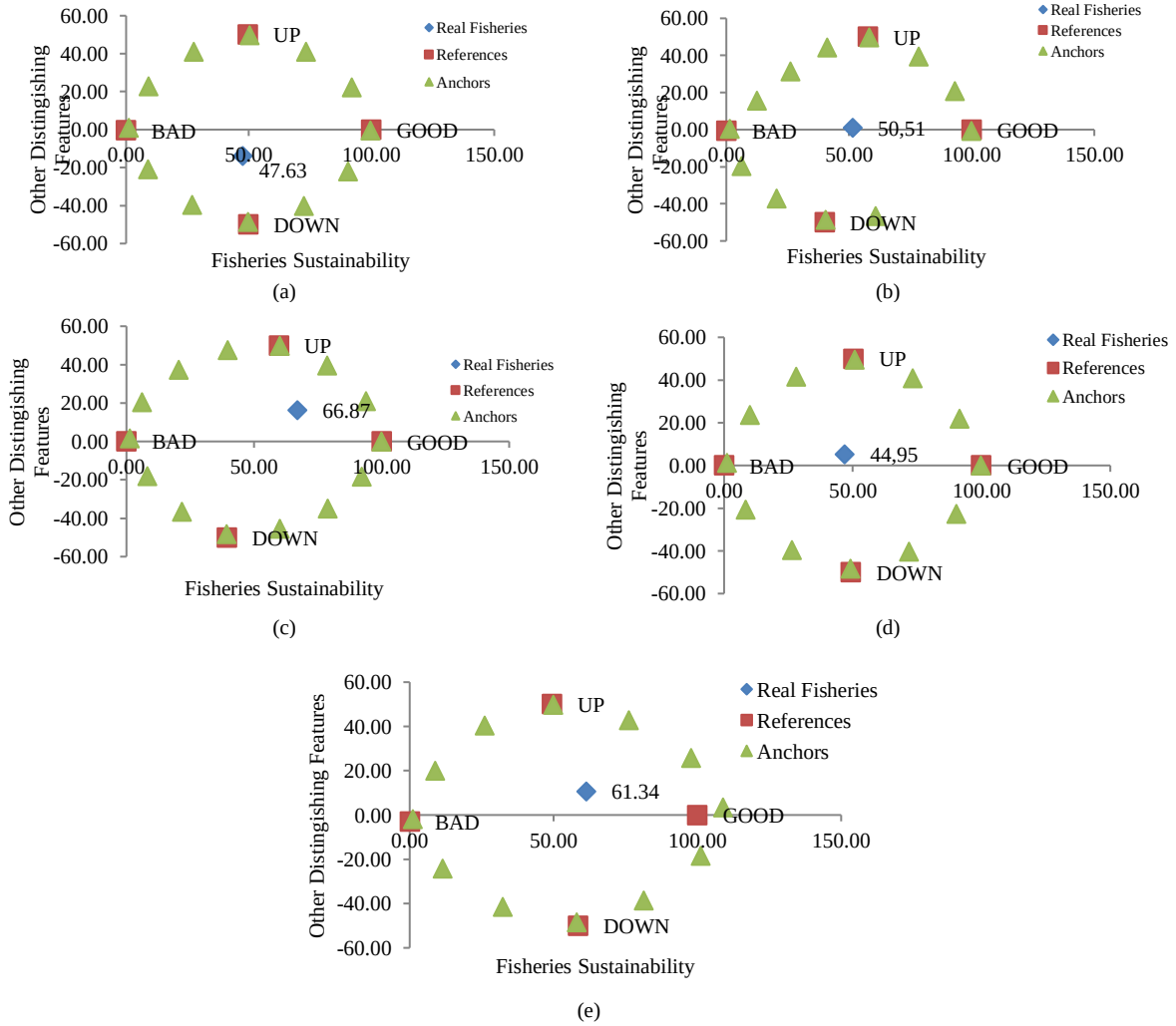


Figure 1. Sustainability status of small-scale capture fisheries; a) ecology, b) economy, c) technology, d) social, and e) institutional dimension

Table 7. Categorization of sustainability status assessment against five dimensions

No	Index Value	Category
1	0.00-25.00	Bad (unsustainable)
2	25.01-50.00	Less (Less sustainable)
3	50.01-75.00	Sufficient (Sufficiently sustainable)
4	75.01-100.00	Good (very sustainable)

Source: Thamrin et al.[10]; Nurmalina[11]; Suyitman et al.[12]

Multidimensional Small-Scale Capture Fisheries Sustainability Status

The layout diagram shows the differences in sustainability status values from the five dimensions at the research location. Rapfish's analysis of these five dimensions shows a sustainability index with an average value of 54.26, or 50-75 sustainability status in the quite sustainable category.

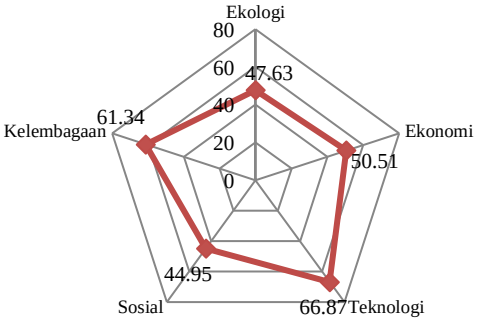
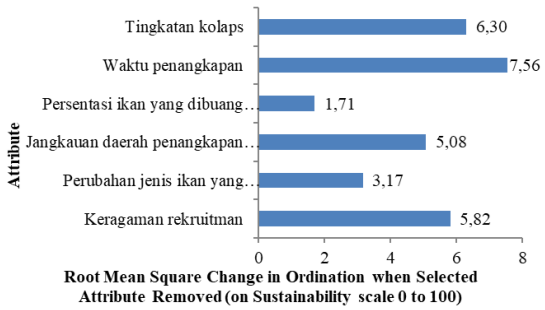


Figure 2. The kite diagrams

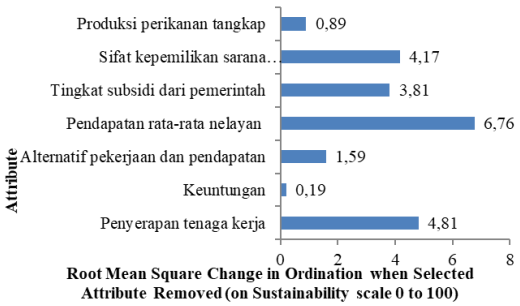
A value or index that is increasingly outward (approaching the value of 100) indicates a better sustainability status, but conversely, if it is increasingly inward (approaching the value of 0), it indicates a poor sustainability status. This condition will be very detrimental because it can threaten resource sustainability[13]. Based on the analysis using Rapfish for each dimension, it is shown that among the five dimensions, there are 2 dimensions, social and ecological, that are the worst dimensions for sustainability status, with IKP <50, namely 44.95 and 47.63 (less sustainable).

Attributes of Sustainability Leverage for Small-Scale Capture Fisheries

Based on the sensitivity analysis results on the catch time attribute, it shows a value of 7.56 or a bad score (bad). It can be seen that this attribute is an attribute in a good category that does not need to be considered, but still maintains its value. In this research, fishermen carried out fishing trips in one day (one day fishing) or less than one day with 12 hours less time. With longer fishing times, more and more fish will be caught, and then overfishing will occur, or the sustainability of fish resources (SDI) will decrease. Abdullah[7] explained that the attribute of the level of decline in the number of fish shows that there are no symptoms of a decline in the number of fish caught in a specific geographical area or coverage area, indicating a good ecosystem.



(a)



(b)

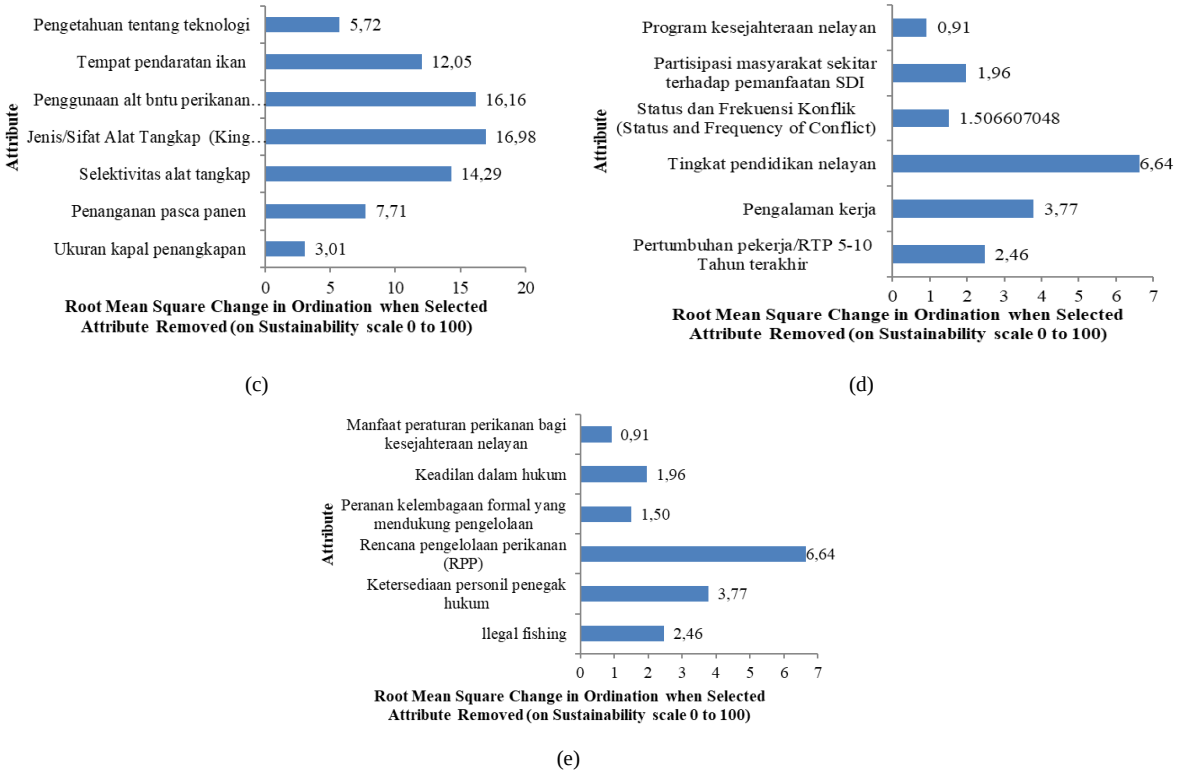


Figure 3. Attributes of sustainability leverage for small-scale capture fisheries: a) ecology, b) economy, c) technology, d) social, and e) institutional dimension

The average income attribute of fishermen with a value of 6.76 or a bad score can indicate a value that requires policy. Seeing that the need for clothing and food is quite high, and the need for ship maintenance and the fishing equipment used can cause catches to be limited due to inadequate equipment, based on this explanation, the welfare level of fishermen has decreased. According to Hendra[14], fishermen's income, which is supported by capital and seasons, will not run well if good technology does not support it. The attribute of the type or nature of fishing gear is the attribute with the highest score, with a value of 16.98 or a bad score (bad), indicating that this attribute requires special policies and attention, considering traditional fishing gear. The use of fishing gear in terms of operation can be categorized as active looking at the fishing process carried out by fishermen daily around the research location.

The education level attribute is an attribute that needs to be highlighted because the level of education is one of the most critical factors in community welfare, with a sensitivity analysis result value of 6.64 or a poor score. According to Julianto[15] the level of education has a strong relationship with the quality of life and the welfare of the family and community, especially in coastal communities. Therefore, educational development is critical to produce a generation with superior abilities and qualities for the progress of a nation.

The attribute with the first highest score is the fisheries management plan (RPP) with a score of 6.64, or a bad score (bad). Some fisheries' community empowerment programs have been partially implemented, and some are still waiting for decisions. A fisheries management plan (RPP) is necessary to continue the program, which will be provided to the community to support the sustainability of fisheries in the future.

4. CONCLUSION

The sustainability status of small-scale capture fisheries in Bangko District, Rokan Hilir Regency, shows a sustainability index

with an average value of 51.65 or in the range 50-75, which is classified as quite sustainable. Leverage attributes from the five most sensitive dimensions and have high leverage in influencing the sustainability status of captured fisheries include time of capture, ownership of fishing facilities, type/nature of fishing gear, fishermen's education level, and fisheries management plan.

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