

Sustainability status analysis of shrimp production management at Cilacap Regency, Central Java, Indonesia

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Abstract. Shrimp is one of the main export commodities of the Indonesian fishery, which is produced from various regions. One of the areas that become the center of shrimp production is Cilacap Regency. The main type of shrimp commodity in Cilacap is banana shrimp (*Fenneropenaeus merguensis* de Man) which has high economic value. The production of banana shrimp in Cilacap is declining. This study aimed to analyze the sustainability status of banana shrimp management in Cilacap waters in a multidimensional base (Multidimensional Scaling/MDS) which is seen through the ecological, social, economic, ethical, technological, and institutional dimensions. The tool used to analyze the sustainability status is the Rapid Appraisal for Fisheries (Rapfish). This research shows that the sustainability value of banana shrimp management reaches 49.68 or is in the Less Sustainable status. Referring to the sustainability analysis results on each dimension, it can be seen that the economic dimension is the dimension with the lowest sustainability status. This is due to the low income of the fishermen on the results of the shrimp catch. From the sustainability status of shrimp management, it is necessary to take strategic steps to improve the sustainability status of shrimp management in Cilacap Regency.

1 Introduction

Shrimp is one of the commodities with large market opportunities. In 2020, it was noted that the main export commodity from the export of fishery products was shrimp (Ministry of Marine Affairs and Fisheries, 2020). One area that is a center for shrimp production is Cilacap Regency, Central Java Province. The fishery product of shrimp commodities in Cilacap waters is mostly Penaeid shrimp. The shrimp resources in Cilacap waters are mostly banana shrimp (*Fenneropenaeus merguensis* de Man), a type of penaeid shrimp with high economic value [1].

The utilization of shrimp resources in Indonesian Fisheries Management Areas, in general, has exceeded its sustainable potential [2]. It also occurs in the waters of the Cilacap Regency. As stated in several conducted studies, the utilization of banana shrimp in Cilacap has already been at the overfishing level and impacts the sustainability status of shrimp resources. The status of the utilization of shrimp resources has already been at the overfishing

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status [3]. The condition of the utilization of banana shrimp commodities that tends to exceed the catch limit will impact its sustainability status. The commodity of penaeid shrimp (including banana shrimp) in the Cilacap Regency had undergone biological degradation of shrimp resources [4].

According to sources from the Cilacap Regency Fishery Office, the production value of banana shrimp from 2017 to 2020 has decreased. The production of banana shrimp in 2017 was 342.3 tons, and it was 315.7 tons in 2018, 171.9 tons in 2019, and 100.2 tons in 2020. It indicates a management and utilization system that needs improvement to be further analyzed regarding the condition of sustainability of banana shrimp resources in the Cilacap waters.

2 Materials and methods

The research was carried out from March to April 2021 in the Cilacap Ocean Fishing Port area, Central Java. The research was conducted using the multidimensional analysis method (Multidimensional Scaling/MDS) using software in the Rapfish (Rapid Appraisal for Fisheries) application. This application is based on Microsoft Excel. Rapfish analysis was carried out on several dimensions, i.e., the ecological, social, economic, ethical, technological, and institutional dimensions. The main dimensions of Rapfish analysis consist of ecological, social, economic, ethical, and technological dimensions [5]. The institutional dimension in Rapfish analysis is an additional dimension [6].

Data was collected using interviews using a questionnaire tool containing several questions about the attributes of each dimension. The number of respondents was determined by as many as 50 fishermen and related parties by the purposive sampling method. The value generated from Rapfish is analyzed using the sustainability status index [1]. The value of the sustainability status index is presented in Table 1.

Table 1. Sustainability status index.

No.	Sustainability Index Interval	Sustainability Status
1.	0 – 25	Poor
2.	> 25 – 50	Less
3.	> 50 – 75	Sufficient
4.	> 75 – 100	Good

3 Results

3.1 Ecological dimension

From the analysis results, it can be viewed that the value of the ecological dimension index is 53.69 or is included in the Sufficient Sustainable category. The sustainability value of the ecological dimension is presented in Figure 1. Furthermore, from the leverage analysis results, the leverage attribute is the exploitation status attribute. These attributes need improvement so that the level of sustainability is getting better. The exploitation status attribute is the condition of shrimp resource utilization at the time of data collection. From observations in the field, data and information were obtained that the level of exploitation of shrimp resources in Cilacap waters is in the over-exploited condition.

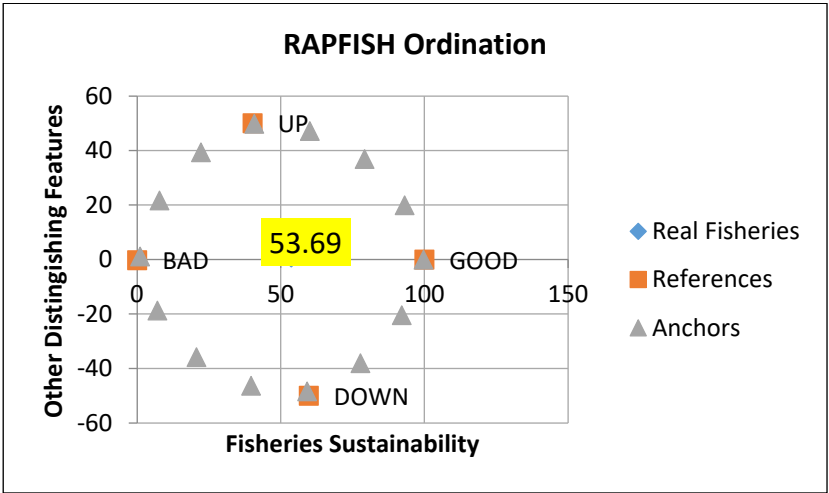


Fig. 1. Rapfish ordination results on the ecological dimension.

3.2 Social dimension

Rapfish analysis on the social dimension resulted in a value of 41.52. The value is included in the Less Sustainable category. The sustainability value of the social dimension is presented in Figure 2. Furthermore, from the leverage analysis results, the attributes of leverage are fishermen's knowledge of the environment and the influence of fishermen. These attributes need improvement so that the level of sustainability is getting better.

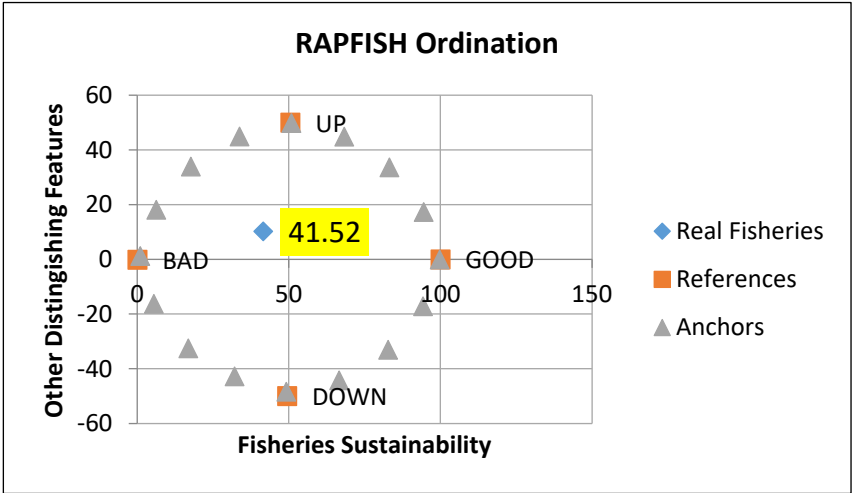


Fig. 2. Rapfish ordination results on the social dimension.

3.3 Economic dimension

The economic dimension sustainability index value is 37.17 or is included in the Less Sustainable category. The sustainability value of the economic dimension is presented in Figure 3. Furthermore, from the leverage analysis results, leverage attributes are subsidies,

restrictions on fishing effort, and resource ownership rights. These attributes need improvement so that the level of sustainability is getting better.

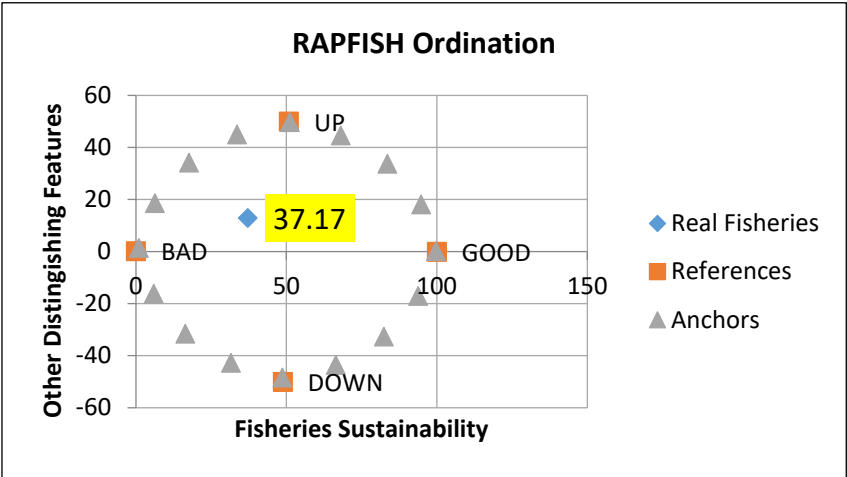


Fig. 3. Rapfish ordination results on the economic dimension.

3.4 Ethical dimension

The results of Rapfish’s analysis on the ethical dimension show a sustainability value of 56.64. The value is included in the Sufficient Sustainable category. The sustainability value of the ethical dimension is presented in Figure 4. Furthermore, from the leverage analysis results, leverage attributes are fairness in utilizing resources and mitigating ecosystem decline. These attributes need improvement so that the level of sustainability is getting better.

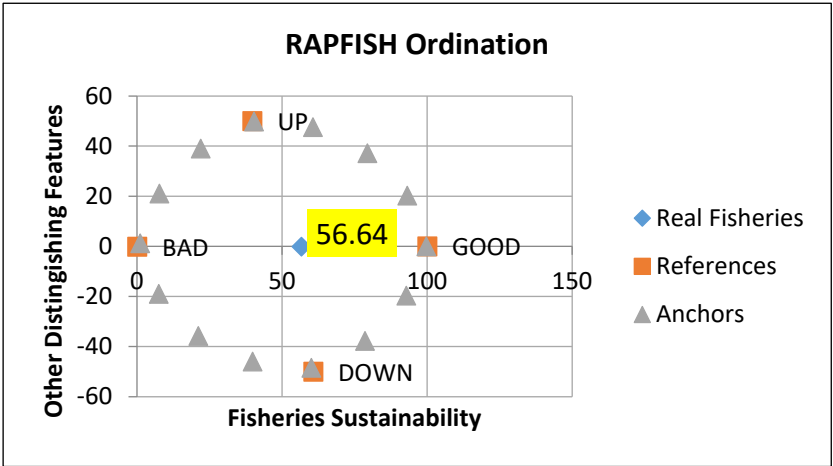


Fig. 4. Rapfish ordination results on the ethical dimension.

3.5 Technological dimension

Rapfish analysis shows that the value on the technology dimension is 84.80 or is in a Good category (Sustainable). The sustainability value of the technology dimension is presented in Figure 5. Furthermore, from the leverage analysis results, the leverage attribute is shrimp

processing before selling. These attributes need improvement so that the level of sustainability is getting better. From observations in the field, shrimp processing before selling is not carried out. The caught shrimp are sold directly to buyers through an auction process or directly sold to middlemen (tradesmen).

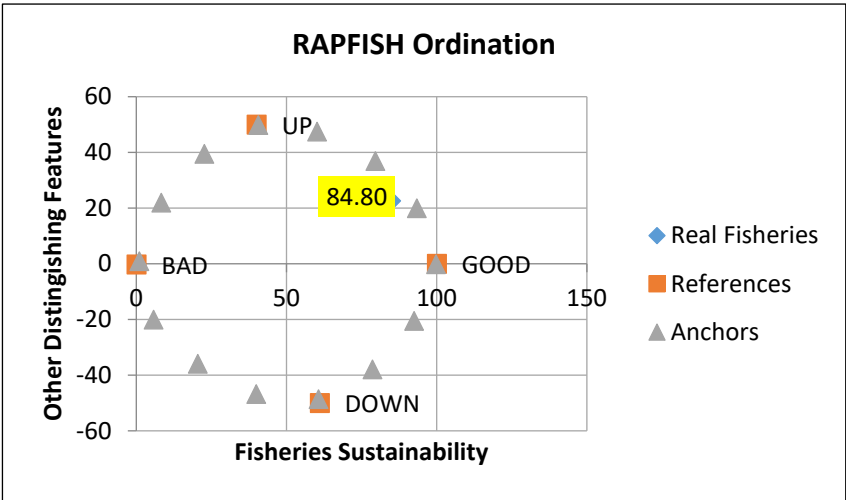


Fig. 5. Rapfish Ordination results on the technological dimension.

3.6 Institutional dimension

The value of the sustainability index on the institutional dimension is 48.32 or is included in the Less Sustainable category. The sustainability value of the institutional dimensions is presented in Figure 6. Furthermore, from the leverage analysis results, leverage is the attribute of shrimp management rules. These attributes need improvement so that the level of sustainability is getting better. Shrimp management rules are one of the institutional instruments so that shrimp catching activities can run well and still adhere to environmental sustainability and carrying capacity. From observations in the field, it can be viewed that related to the management of shrimp resources, and there have been no management regulations. It is also in line with the results of interviews with the Cilacap Regency Fishery Office and the Cilacap Fishing Port, stating that there were no regulations for shrimp management in Cilacap waters.

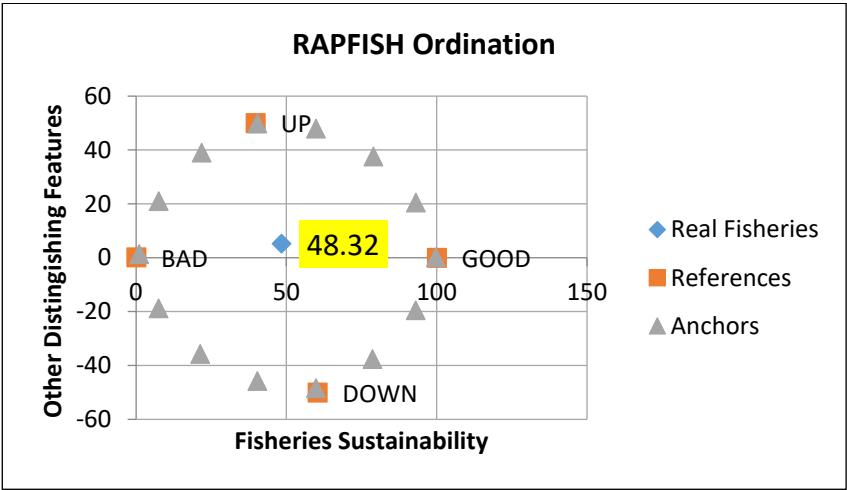


Fig. 6. Rapfish ordination results on the institutional dimension.

The results of the RAPFISH analysis of the six dimensions indicate that the analysis of the attributes in each dimension is quite accurate. It can be viewed from the stress value, and the degree value of the coefficient of determination (R^2) is relatively large. From the results of the stress value and coefficient of determination, it can be viewed that the attributes used in each dimension to assess the sustainability status are adequate, as presented in Table 2.

Table 2. Stress value and coefficient of determination of RAPFISH analysis results on each sustainability dimension.

No.	Dimension	Sustainability Index Value	Category (Sustainability Status)	Stress	R^2
1.	Ecology	53,69	Sufficient Sustainable	0,15	0,94
2.	Social	41,52	Less Sustainable	0,13	0,94
3.	Economy	37,17	Less Sustainable	0,15	0,95
4.	Ethics	56,64	Sufficient Sustainable	0,15	0,94
5.	Technology	84,80	Sustainable	0,14	0,95
6.	Institutional	48,32	Less Sustainable	0,15	0,94

4 Discussions

The analysis results of RAPFISH ordination of ecological, social, economic, ethical, technological, and institutional dimensions can describe the condition of sustainability status of each dimension. Referring to each of these sustainability status, it can be viewed that there are three dimensions in the Less Sustainable status, i.e., social, economic, and institutional dimensions. There are two dimensions in the Sufficient Sustainable status, i.e., ecological and ethical dimensions, and only one dimension, i.e., technological dimension in the Sustainable status (Good). It is schematically presented in Figure 7.

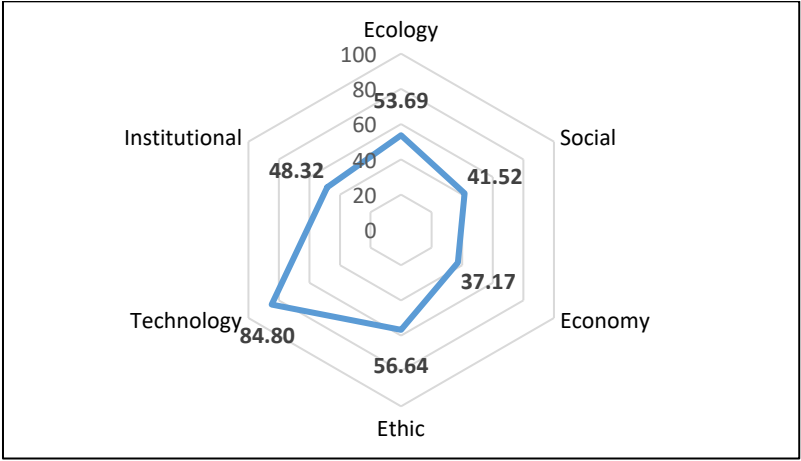


Fig. 7. Diagram of the sustainability status of shrimp management in Cilacap Waters.

The sustainability status of shrimp management in Cilacap waters can be determined by multiplying the sustainability value by the weight of each dimension. The weights were obtained by using the pairwise comparison matrix analysis method. In the detail of Table 3, the combined index value of the sustainability status of shrimp management in Cilacap waters is presented.

Table 3. Combined sustainability index value.

No.	Dimension	Sustainability Index Value	Scaled Weight of Pairwise Comparison Test Results	Amount of Weighted MDS
1.	Ecology	53,69	0,43	23,09
2.	Social	41,52	0,26	10,80
3.	Economy	37,17	0,15	5,58
4.	Ethics	56,64	0,08	4,53
5.	Technology	84,80	0,05	4,24
6.	Institutional	48,32	0,03	1,45
Total Amount (General Sustainability Status Value)				49,68 (Less Sustainable)

5 Conclusions

The status of shrimp management in Cilacap is Less Sustainable, with a value of 49.68. The results of the MDS analysis show that the economic dimension lies at the lowest status and the technology dimension lies at the highest status. The status on the economic dimension is the lowest one as the income and profits of fishermen from catching shrimp are still insufficient, even though it is the main income in fishermen's families. With these conditions, it is necessary to take strategic steps to improve status to increase the welfare of fishermen while still paying attention to the conditions of carrying capacity and environmental sustainability.

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