Management of Sustainable Hemiramphus robustus Fishery in Boalemo District

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Abstract

This study aims to examine the sustainability status of the julung-julung fish catch fisheries in Boalemo District based on the five aspects of ecology, economic, social, technological and ethical dimensions, and provide recommendations for strategies to support sustainability. This research was conducted in Boalemo District from March to August 2016. The method used in this research is survey method. As for the sustainability status analysis using Rapid Appraisal for Fisheries (RAPFISH), and for preparing strategy priorities using SWOT analysis (Strenght, Weaknesess, Opportunities, and Threath). The results showed that the status of sustainable fisheries cultivation of julung-julung dimension of ecology 80,63 (continuous), economics 35,80 (less sustainable), social 73,85 (sustainable enough), technology 55,51 (sustainable enough), and ethics 52.56 (fairly sustainable). When viewed in a multidimensional manner, the fishing activities of the julung-julung fish catch in Boalemo Regency are in sustainable condition with the value of IKP (Fishery Sustainability Index) 59.67. Strategies that need to be done in the management of capture fisheries are 1) Arrangement of fishing effort of the julung-julung, 2) Arrangement of catching season, 3) Protection of place to lay eggs, 4) Determination of fishing zone, 5) Related to capital, utilization of technology, and management assistance, 6) socialization of environmentally friendly fishing, 7) Improving fisherman's access to education, 8) integrated fishery management, 9) increasing fishermen's role in formulation of fishery policy, 10) And 11) Establish a group of independent fishery resource supervisor (POKWASMAN).

Keywords: Julung-Julung, sustainability, RAPFISH, SWOT, Boalemo

Introduction

Indonesia as the largest maritime country in the world, has a very large and diverse natural wealth. The sustainable potential of Indonesia's marine fish resources is estimated at 7.3 million tons per year spread over Indonesian territorial waters and the waters of the Indonesian Exclusive Economic Zone (ZEEI). Of all potential fish resources, the number of allowable catch (JTB) of 5.8 million tons per year or about 80 percent of sustainable potential, and newly used 5.4 million tons in 2013 or just 93% of JTB, while Total production of capture fisheries (at sea and lake) is 5,863 million tons (Ministry of Marine Affairs and Fisheries, 2015). This fact illustrates that the potential of Indonesian fishery is very large, so that if managed well and responsible for its activities can be sustainable, it can be one of the main sources of capital development in the present and the future. In this regard, the development of capture fisheries essentially leads to optimal and rational utilization of fish resources for the welfare of the community in general and fishermen in particular, without causing damage to the fish resources themselves and the environment. Law Number 45/2009 on fisheries also mandates that fisheries management, including capture fisheries activities should be conducted on the basis of fairness, equity, partnership, equity, integrity, transparency, efficiency and sustainability.

Boalemo regency is one of the districts in Gorontalo Province that directly faces tomini bay. As a region located in the tomini bay, has the same marine potential with other districts located on the coastline. One of the potentials is the resources of the julung-julung fish. Rolled-up fish are caught by means of purse seine fishing gear in local language called roa trawl or trawling. The fish in Boalemo Regency become an important commodity, some people especially hereditary do catching and processing curing of roa by local people called sagela fish, as the main livelihood so that their livelihood depends on the fish commodity.

Smoked roa is in great demand by the market because of its distinctive and savory taste, so the price remains stable and tends to rise. This encourages fishermen to continue to rely on livelihoods from the use of julung-julung fish so that in his capture always try to get the maximum catch, although often ignore the biological aspect and the

sustainable potential of the julung-julung fish. Wuaten et al (2011) mentioned the presence of julung-julung fish in the coastal waters to do the spawning then catching using roa trawl gives a very serious impact on the availability of julung-julung fish in nature. Considering the situation, it is necessary to endeavor the right and wise management of sustainable fishing on the right, so it is hoped that the resource will be sustainable without reducing its economic value for the society at present and in the future.

Research Methodology

The research was conducted in Boalemo district, fishing base research in coastal area of PaguyamanPantaisubdistrict and Tilamuta sub district. The study was conducted for 5 months from April to August 2016.

The method used in this research is survey method with Rapfish technique analysis tool supported by SWOT analysis to formulate strategy and policy priority. Rapfish (Rapid Appraisal for Fisheries) is developed by the University of British Columbia Canada, which is an analysis to evaluate the sustainability of a multidisciplinary fishery. Rapfish is based on an ordination technique that places something of value (score) on a measured attribute using Multi-Dimensional Scaling (MDS). Aspects in Rapfish concern aspects of ecological, economic, technological, social and legal-institutional. The determination of recommendation of fishery strategy and policy of fishery is done by SWOT analysis (Rangkuti, 2015).

The data to be collected in this study consists of primary and secondary data. Primary data were collected intensively by using structured interviews with roa trawl fishermen, the staff of the Boalemo Fisheries and Fisheries Office, experts related to capture fisheries, and documentation at selected locations. Secondary data were obtained by conducting literature study. The data can be obtained from related agencies, institutions or institutions in the management of capture fisheries such as the Ministry of Marine Affairs and Fisheries, Fisheries and Marine Office, Fish Auction Place (TPI), and Central Bureau of Statistics.

In this study the subject is all the fishermen roa trawl in coastal Boalemo Regency. The sampling technique used was purposive sampling, where the study was not performed on the entire population, but focused on the sample with some consideration (Sugiono, 2014),

Data obtained from observations and interviews with subsequent respondents processed with microsoftexel software, and applications RAPFISH in tempel excel. The results of the processed data are displayed in the form of tables, graphs and diagrams to be analyzed descriptively. Rapfish analysis in this case using ALSCAL algorithm (Fauzi and Anna, 2002) which in principle make the smallest error value in the iteration process. The iteration process is a repetition of the count to see the effect of scoring errors on each attribute. In detail the analytical procedure with Rapfish technique will go through several stages as follows:

1. Fish data collection of study locations through statistical data.
2. Analysis of field observation data with literature study.
3. Define attributes and scores
4. Scoring aspects of fisheries sustainability with structured interviews (questionnaire filling) on respondents.
5. Perform Multi-Dimensional Scaling (MDS) analysis with excel templates to determine ordination and ALSCAL algorithm to determine stress value.
6. Conducting sensitivity analysis (Leverage analysis) and Monte Carlo analysis to take into account aspects of uncertainty.

To determine strategies and policy recommendations for sustainable management of sustainable fish fisheries in Boalemo District is done by SWOT analysis. This analysis is based on logic that maximizes strengths and opportunites, but can simultaneously minimize weaknesses and threats.

All attributes obtained from the results of this study were analyzed multidimensi. The point of reference is good and bad (bad), where the extremes are good (100) and the extremes are bad (0). Then divided into four categories or status hoses. The sustainability index hover is 0-25 in non-sustainable status, hose> 26- = 50 in sustainability, hose> 50- = 75 in sustainability and hose> 75-100 in sustainable status (Hamdan, 2007).

Results and Discussion

The fishing communities of roa net in Boalemo Regency are found only in the coastal district of PaguyamanPantai and Tilamuta sub-district. The type of fishing gear used for catching the julung-julung fish is a mini-seine trawl, the local fishermen usually call trawl roa or trawling. Overall the gear of the same is

the same as the mini-seine trawl is only smaller in size. The specifications of roa trawl in Boalemo District generally are as follows: length of upper ris is 160 m, length of lower ris is 200 m, height / in mesh 22 m, mesh size 1.15 inch net mesh, wing mesh 1.5 inch, 1.25 inches, and mesh pockets of 1 inch pouch. The distance between the buoys on the wings 40 cm, the distance between the buoy body section 15 cm, while the distance between the ring 2.5 m. Production of julung-julung fish catches for the last 5 years is 126 tons in 2012, 121 tons in 2013, 116 tons in 2013, 2014 in 2014 and 127.8 tons in 2015. The largest catching season of the julung-julung fish is from November to April, each vessel usually makes 12 fishing trips per month, while in May to October the average fishing effort is 7 trips per month. Based on the description of the fishermen, the most-breeding season of julung-julung fish lay eggs is in December to January or for two months. This is indicated by the number of julung-julung fish caught laying eggs. Based on observations at the study sites, the fishing conditions of julung-julung fish catches are currently experiencing a decrease in catch and even fishermen tend to often get no catch on any catching effort.

To determine the sustainability status of the fishing fisheries in Boalemo Regency, conducted by RAPFISH analysis technique on five dimensions of sustainability namely ecology, technological, economic, social, and ethical dimension. The initial stage of RAPFISH analysis is to determine the attributes in each dimension that correspond to the unit of analysis. This research uses five aspects (dimensions) of sustainability namely ecological, economic, social, technological and ethical dimensions. The dimensions and attributes used refer to T.J. Pitcher and D. Preikshot (2001) and modified according to the area of analysis.

The results of the fifth-dimensional Rapfish analysis can be seen in Figures 1 through 5, while the sensitive attributes of each dimension can be seen in Figures 1a through 5a. The value of stress and r-squared (squared correlation) of each dimension. Static stress requirements must be less than 25% whereas r-squared is close to 100%.

Tabel1 Percentage of Stress and r-squared value

No	Dimensi	Stress(%)	r-squared(%)
1	Ekologi	13, 30	95,21
2	Ekonomi	13,38	95,20
3	Sosial	13,06	94,91
4	Teknologi	13,88	94,88
5	Etika	13,30	95,20

For example stress value obtained from the research on ecology dimension of 13.30% This according to Multidimensional Scaling (MDS) procedure has met the goodness of fit because the stress value is less than 25% and the confidence interval given is quite high ie 95, 21%.

Ecology dimension

Figure 1 shows the social dimension index value is 73.85 that value is in the range of> 50- = 75, the condition thus illustrates that the ecological status of the fisheries catching fish in the Boalemojulung-julung in the category quite sustainable.

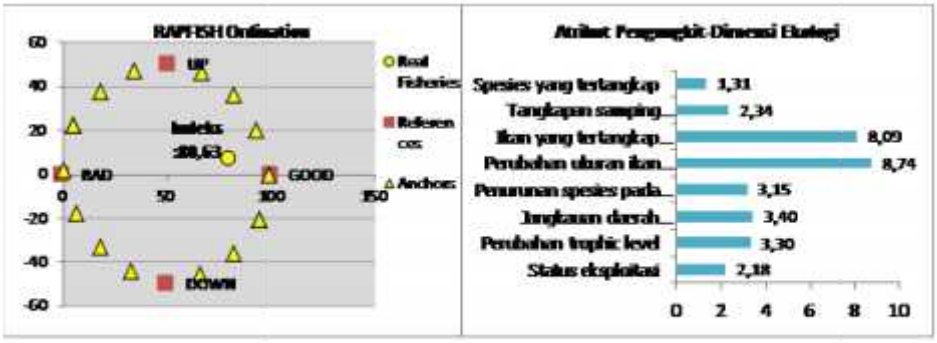

Figure 1. **(a)** RAPFISH Ordination of Dimension of Ecology **(b)** Leverage Analysis on Dimension of Ecology

The leverage analysis (Figure 1a) shows that attributes of fish size and fish sizes caught in the mature state of gonads are the most significant attributes to the sustainability of the julung-julung fish catch fisheries. This is very basic considering the decrease in fish size is one important indication that there has been a decline in fish stocks. If this is allowed then the damage to resources will not be prevented because it could be the fish caught are the fish that have not had time to spawn so that the

process of adding stock through spawning stalled. Based on that, it is necessary to arrange restrictions on fishing effort, arrange fishing season and zonation of fishing area, so that the existence of julung-julung fish in nature can be maintained so that the economic benefit is not reduced for the society today and in the future.

Economy dimension

Figure 2 shows that the economic dimension index value is 35.80. The value is in the range of> 25- = 50, this condition illustrates that the economic status of the julung-julung fish catch fishery in Boalemo Regency is in a less sustainable category.

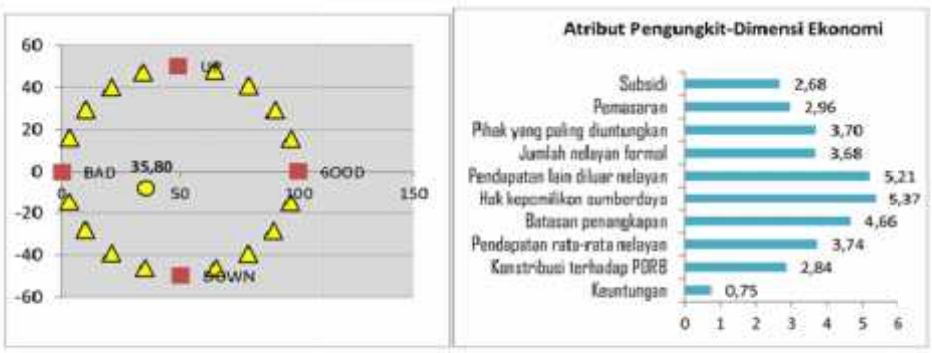

Figure 2 (a) Hasil Ordinasi RAPFISH Dimensi Ekonomi **(b)** Analisis *Leverage* Dimensi Ekonomi

Analysis of leverage attributes (Figure 2b) shows three attributes sensitive to the sustainability of the economic dimension namely; 1) The right of resource ownership, the catching of julung-julung fish with trawl roa in the waters of Boalemo Regency is done by the nature of common property, where every fisherman is entitled to make maximal catch so as to cause unlimited catching and will eventually drain the resource. Open acces fishing activities will result in the absence of responsible parties in maintaining the sustainability of fish resources. 2) Other income outside of fishermen, alternative fishing gear of roa trawl other than sea is very limited. Fishermen usually increase incomes by farming corn, but the land for agriculture is limited due to its location of more limestone and barren soil, so more fishermen rely on livelihood from the sea. Alternative jobs other than fishermen is needed, as an effort to reduce the pressure on the resources of fish julung-julung 3) Limitations of fishing, fisheries management fisheries in the district of Boalemo up to date have not applied efforts to limit the catch, it is in fear will affect To the sustainability of fisheries business catching fish in the julung-julung due to over fishing. The effort to limit the catch is done by estimating the optimum catch and the factors that influence the kelulahan fisheries resources can be done by applying several restrictive measures, namely; Restrictions on julung-julung fish catching, catchment season constraints, and limits on catchment areas.

Social dimension

The result of RAPFISH ordination of social dimension is 73,85 (Figure 3) the value is at hose> 50- = 75, this condition illustrates that social status of fishery fisheries in the Boalemo Regency is in sustainable category.

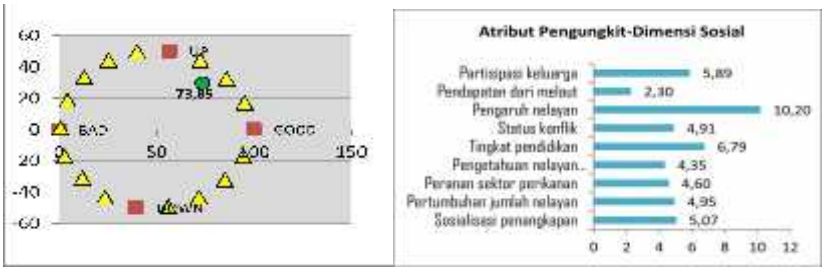

Figure 3 RAPFISH Ordinatior Figure 3 Analysis of leverage attributes ial Dimension

Analysis of leverage attributes (Figure 3a) shows two attributes sensitive to the sustainability of social dimensions ie; 1) The influence of fishermen in the formulation of fisheries policy, the government in this case as the policy maker.

Capture fishery in Boalemo Regency in making the policy has not involved fishermen. The involvement of fishermen in sustainable capture fisheries development is needed, fishermen as an accurate source of information will describe the current fishery condition in terms of social, technological and fish resources, so that the policies taken will be more targeted, 2) the level of education, the level of fisherman education in general Lower when compared with other communities. The low level of education leads to a lack of knowledge of fishermen on the sustainable use of fisheries potential.

Tecnology dimension

The result of RAPFISH analysis of technological dimension, got index value that is 55,51 the value is in the range> 50- = 75 (Figure 4). This condition illustrates that the sustainability status of technological dimension of fisheries catching fish in the julung-julung category is quite sustainable.

Figure 4. RAFFISH Ordination on Technology Dimension **Figure 4a**. Leverage Analysis on Technology Dimension

Analysis of leverage attributes (Figure 4a) shows the most sensitive attribute to the sustainability of technology dimension is the selectivity of the fishing gear. Roa seine fishing gear is a fishing gear with target species of julung-julung fish (Hemiramphus robustus) but with specification of roa trawl which consists of three different mesh size with mesh size on 1.5 inch wings, 1.25 Inchi and the center (bag) 1 inch. The size of the eye of the net of roa net has the potential of catching other species besides julung-julung / roa (Hemiramphus robustus). It can be seen from the catch of the fishermen of roa trawl.

Based on the observation of the catches of roa seine, the average fish caught more than one species with different sizes, so the roa trawl belonging to the category of fishing gear is rather selective.

Ethics dimension

The result of analysis with RAPFISH software shows that index of ethical dimension is 52,56. This value is in the range of> 50- = 75, the condition explaining that the status of sustainability of fishing fisheries in the julung-julung category is quite sustainable.

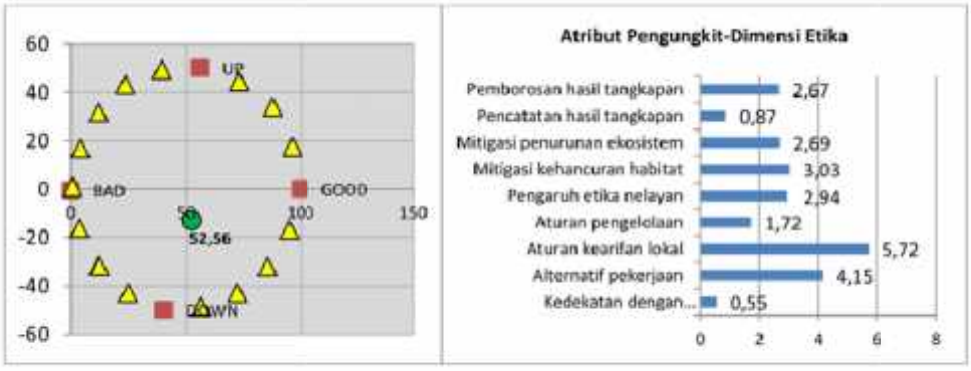

Figure 5 RAP FISH Ordination on Ethics Dimension **Figure 4a**. Leverage Analysis on Ethics Dimension

Analysis of leverage attributes (Figure 5a) shows two attributes sensitive to the sustainability of social dimensions namely; 1) The rules of local wisdom. Fishery management based on local tradition or wisdom is essential for sustainable fisheries management in the future. The development of ethics of coastal communities in the utilization of local resources based on local traditions or wisdom will further increase community participation in monitoring the utilization of their resources. 2) Alternative work. Limited work becomes a problem in itself that will put pressure on the resources of the julung-julung fish increasing.

Monte Carlo simulation

Monte Carlo simulations in RAPFISH are required to address the uncertain aspects. According to Fauzi and Anna (2005), this uncertainty is caused by several factors such as the impact of scoring error due to the lack of information, the impact of diversity in scoring due to the difference in valuation, the error in data entry and the high value of stress obtained. The Monte Carlo simulation results with 25 replicates in each dimension can be seen in Figures 6a, 6b, 6c, 6d and 6e. The Monte Carlo simulation results show that the index of sustainability of the fish fisheries in the Boalemo Regency collects at one point, that is, by 25 repetitions, some of the uncertainty factors of Rapfish analysis above can still be used in determining the sustainability status according to the MDS (multidimentional) Scaling).

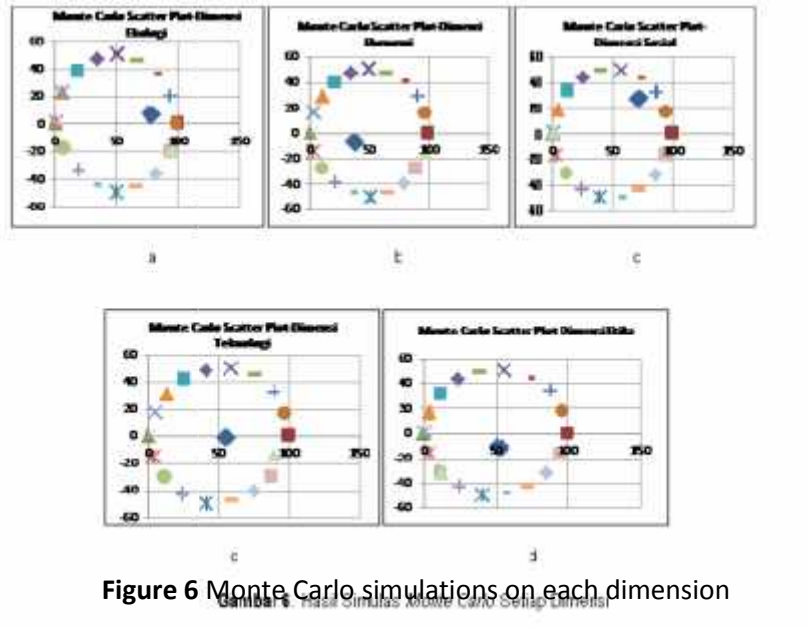

Figure 6 Monte Carlo simulations on each dimension

Multidimension status of sustainable fishery

The differences in the sustainability status values of the five dimensions in the research area are shown in the overlay diagrams below.

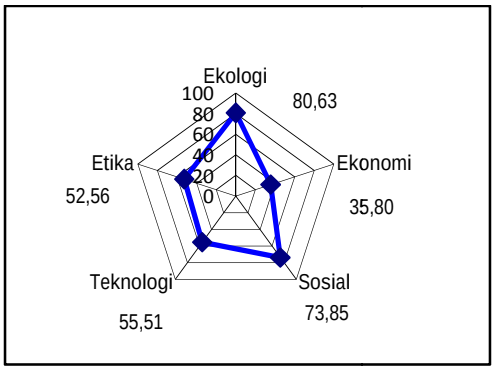

Figure 7 Kite diagram on multi dimensions

Rapfish analysis on five dimensions showed that the index of sustainability of the fisheries fisheries in Boalemo District was quite sustainable, with an average value of IKP of 59.67 or at hoses> 50- = 75. The value or index getting out (close to 100) indicates a better sustainability status, on the contrary if getting deeper (near point 0) shows worsening sustainability status. Rapfish analysis in each dimension showed that among the five dimensions in this study, the economic dimension was the worst dimension of its sustainability status, with the IKP <50 being 35.80 (less sustainable).

SWOT analysis for strategy and policy recommendations

The result of RAPFISH analysis explains the sustainability status of each dimension along with

attribute of lever which influences to the sustainability of capture fisheries of julung-julung fish. These attributes become one of the considerations in formulating alternative strategies that can improve the management of aquaculture fisheries in the district of Boalemo. The formulation of a policy strategy was made using SWOT analysis, and 11 policy recommendations were obtained with the following priorities:

1) Arrangement of long-rolling fishing effort.
2) Arrangement of catch season.
3) Protection of spawning place of fish of the julung-julung.
4) Determination of fishing zones.
5) Establishing partnerships related to capital.
6) Socialization of environmentally friendly fishing capture.
7) Increased access of fishermen to education.
8) Integrated fisheries management.
9) Increasing the role of fishermen in the formulation of fisheries policy.
10) Improvement of fishing skills in other fields.
11) Establish a resource watch group

Conclusion and Suggestion

The current condition of capture fisheries of julung-julung fish has decreased production of catch from year to year.

The sustainability status of multi-dimensional fish catching fish in multidimensional category is quite sustainable. The sustainability status for each dimension is the ecological dimension of the sustainable category, the social, technological, and ethical dimensions are in a fairly sustainable category, while the economic dimension is in a less sustainable category.

The strategy for managing aquaculture fisheries recommends eleven policies, with the main priority of catching the julung-julung fish catch.

Seriousness is required in the application of the julung-julung fishing arrangement as an effort to maintain and improve the catch of fishermen.

There is a need for a thorough improvement of attributes in every dimension, especially in the economic dimension, so that the fishing fisheries of the julung-julung are still profitable.

Improve communication with various parties; Fishermen, academicians, religious leaders, customary figures, and community leaders, to disseminate the recommendations of strategies for sustainable management of fisheries fisheries in a sustainable manner that has been formulated so that the implications can be felt by the community.

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