



Study of Small-Scale Capture Fisheries in West Sulawesi Waters “Case Study of Large Pelagic Fishing Rod in Mamuju Regency”

Roswati^{1,*}, Najamuddin², Alfa Filep Petrus Nelwan³

¹Student of Integrated Coastal Resources Management, Postgraduate Program of Hasanuddin University, Makassar

^{2,3}Lecturer of Integrated Coastal Resources Management, Postgraduate Program of Hasanuddin University, Makassar

*Corresponding Author

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Abstract— Mamuju Regency, West Sulawesi Province, has the potential for pelagic fish, especially large pelagic fish, namely tuna, skipjack and cob, which are very prospective. The majority of fishermen in Mamuju Regency use fishing rods to catch large pelagic fish. Fishing rod fishermen with a large pelagic catch target are in Mamuju Regency, Simboro District, precisely in Sumare Village but currently it is known that there has been a decrease in the number of fishing rod fishermen in Mamuju Regency since the last 5 years experiencing a decrease in production. This study aims to determine the status of small-scale capture fisheries in a sustainability perspective according to ecological, technological, social and economic dimensions for small-scale fisheries in Mamuju Regency, and recommendations for sustainable capture fisheries. The study was conducted using qualitative methods using Rapfish analysis to determine the sustainability of fishing efforts. The results showed the highest dimensions in fish resources (70.13) and fishing technology (50.06) which means quite sustainable (good) while in the social dimension (38.47) and economic dimension (28.75) in the bad category which means there needs to be special attention in handling.

Keywords— Sustainability Status, Small-scale capture fisheries, Rapfish Analysis

I. INTRODUCTION

Geographically, Mamuju Regency is located on the western edge of Sulawesi Island. In the north of Mamuju Regency there is Mamuju Bay and in the south there is Lebani Bay. The resources of coastal areas and small islands of West Sulawesi Province, are assets to be developed on the basis of economic activities on the aim of prospering coastal communities and increasing local native income generation (BPS Sulbar, 2022).

According to (Halim et al, 2020) said that small-scale fisheries are defined as fishing activities that occur within the scope of households and vessel sizes ≤ 5 GT. This type of fishing vessel is dominated by fishing gear, fishing rods, and gill nets. Hand Line is one type of

fishing gear used by fishermen of Mamuju Regency to catch large pelagic fish.

The rate of production in capture fisheries activities is determined by how much fishing effort in utilizing fish resources. Fishing effort is determined based on the dimensions of the fishing gear, vessel, number of days of operation, and fishing technology used. Thus fishing efforts will determine the amount of fish production in a fishery area, so that fishing efforts will affect the biological conditions of fish resources (Nelwan et al, 2015).

When the rate of fishing effort is lower than the available fish stock, the remaining fish stock can still grow and develop. However, if the level of fishing effort exceeds the availability of fish stocks, then the availability

of fish for fisheries will decrease. Thus fish production will increase proportional to fishing efforts.

Small-scale capture fisheries in Mamuju Regency need to be studied considering the decline in production of large pelagic fish catches in various areas in Mamuju Regency. Based on data from the Marine and Fisheries Service of West Sulawesi Province, it was recorded that capture fisheries production in Mamuju Regency decreased in 2019 (21,468 tons), then decreased in 2020 (19,333 tons) and increased only 167 tons in 2021 (19,500 tons). The decrease in the production of large pelagic fish catches has resulted in a shift in fishing areas, considering the smaller size of the fish and the farther fishing ground so that some large pelagic fish fishermen switch to catching bottom fish and switch fishing bases.

Problems faced in the sustainability of small-scale capture fisheries in the waters of Mamuju Regency include various things including the condition of densely fished waters so that fish resources (SDI) are increasingly limited, fishing efforts continue to increase but productivity decreases so that fishermen's income decreases, conflicts over the use of SDI are increasing which results in an increase in the intensity of social conflicts between fishermen.

The majority of fishermen in Mamuju Regency use fishing rods to catch large pelagic fish such as tuna, skipjack and cob. However, some fishermen use tonda fishing gear to catch swordfish. Fishing rod fishermen with a large pelagic catch target are in Mamuju Regency, Simboro District, precisely in Sumare Village but currently it is known that there has been a decrease in the number of fishing rod fishermen in Mamuju Regency since the last 5 years experiencing a decrease in production. The data is confirmed by data from DKP Mamuju Regency.

Based on the background described above, the objectives of this study are: (1). Determining the status of small-scale capture fisheries in a sustainability perspective according to ecological, technological, social and economic dimensions for small-scale fisheries in Mamuju Regency, (2). Recommendations for sustainable capture fisheries.

II. METHODOLOGY

2.1. Location and Time of Research

This research was conducted from September 2021 to February 2022, with the research location in Sumare Village, Simboro District, Mamuju Regency, West Sulawesi Province. The selection of the research site was carried out purposively with the consideration that Mamuju Regency is one of the areas in West Sulawesi

Province that has the prospect of large pelagic fishing, namely tuna, skipjack, and cob using fishing gear. Mamuju Regency is also one of the areas with the most pelagic fish catches in West Sulawesi Province.

2.2 Sampling Method

The population in this study is all fishing rod fishermen in Sumare Village with large pelagic fish catches namely tuna, skipjack and cob. The information on the number of fishermen obtained from Fisheries Extension in Sumare Village in 2021, namely with a total of 710 fishermen with each criterion including 300 mixed fishermen and 410 pure fishermen. Of the 410 genuine fishermen, 160 of them are large pelagic fishing rods (DKP Mamuju Regency, 2021).

Sampling for research according to Masri Singarimbun (2014), if the subject is less than 100 people then all should be taken, and if the subject is large or more than 100 people should be taken 10-15% or 20-25% depending on the size of the risk borne by the researcher. The total number of fishing rods in Sumare Village is 160 people, which is more than 100 samples, so the researchers took 15% of the population, so the number of samples in this study was 24 fishermen. In addition to sampling, researchers used a snowball sampling system in determining informants, namely interviews with the Head of DKP, Fisheries Extension of Mamuju Regency and interviews with the manager of the TPI cooperative in Sumare Village.

2.3 Data Retrieval Method

This research uses the case study method by interviewing fishermen who use fishing rods with the criteria of having 10 years of experience using fishing gear located in Simboro District, Sumare Village. However, in addition, data collection was also carried out by filling out questionnaires on 24 respondents by Selected Experts with the aim of obtaining professional consideration from the expertise of the respondents in determining the level of importance of several variables in formulating priority programs for the development of integrated capture fisheries resource management.

The relatively same size of fishing rods and boats provide the same fishing opportunities, so that fishing units with the aim of catching large pelagic fish species found in Sumare Village will provide the same fishing opportunities. In addition, the entire fishing unit uses rumpon as tool technology Help arrest. Clearly the source and type of data used in this study are presented in the table below:

Table 1. Needs and Data Sources Used

Dimension	Required data	Data Sources
Fish Resource Dimension Data	· Production of Yellowfin Tuna, Skipjack, Tongkol, 2017-2021 · Caught species	· DKP Mamuju Regency · DKP Mamuju Regency
Ecological Dimensions	· Fish size · Fishing season · Fish production in each rumpon	Primary data from interviews/questionnaires
Dimensions of Fishing Technology	· The amount of fishing effort in Sumare Village · Personal data of fishermen, fishing rods and boats in Sumare Village	Fisherman's logbook fishing rod
Social Dimension	· Stakeholder participation	Primary data from interviews/questionnaires
Economic Dimension	· Asset ownership · Fishermen's household income	Secondary data

2.4. Data Analysis

The management and analysis of data used in this study consists of several analyses that refer to solving the problem formulation in this study. The following data analysis is used:

2.4.1. Catch Analysis Per Unit Effort (CPUE)

CPUE analysis is used in assessing the domain of large pelagic fish resources on the Standard CPUE indicator. In determining the optimum effort for large pelagic fishing in Sumare Village, Mamuju Regency uses the Catch per Unit Effort (CPUE) analysis which is a value reflecting the productivity of fishing gear used to capture large pelagic fish resources, namely tuna, skipjack and cob. The CPUE value is obtained by adjusting the production value and *effort* for 2017-2021. The CPUE value can be formulated as follows (Fauzi and Anna, 2005).

$$CPUE_t = \frac{Catch_1}{Effort_1}$$

$$1. \quad t = 1, 2, \dots, n$$

Where :

CPUE_t = catch per catch in_{t-year}

Catch₁ = catch in the t-year

2.4.2. Data Analysis Method (Rapfish Analysis)

Each fisher has different preferences about the use of resources, depending on personal goals or the intended target group. Rapfish is one method in analyzing fisheries sustainability and is new in application in the field of fisheries. The procedure for analyzing rapfish techniques

applied in this study as explained by Fauzi and Anna (2005) is through stages:

1. Analysis of fisheries data of the study location through statistical data.
2. Analysis of field observation data and literature studies.
3. Fisheries Resources Assessment.

The Rapfish method basically uses a Multi Dimensional Scaling (MDS) approach. All attributes obtained from the results of this study were analyzed in a multidimensional manner. This multidimensional analysis is to determine the points in the Rapfish studied relative to the two points of reference. The reference points are good and bad in the interval 0 - 100, where there are good extremes and bad extremes. The sustainability index intervals are intervals 0-25 in bad status, hoses 26-50 in less status, hoses 51-75 in sufficient status and lapses 76-100 in good status.

In the assessment of fishery resources, the most important thing to know is the estimated value of catches from fish stocks. To determine the status of small-scale capture fisheries in a sustainability perspective according to ecological, technological, social and economic dimensions for small-scale fisheries in Mamuju Regency, the estimated value of the catch first needs to know the productivity of fish stocks, which is usually estimated with quantitative models. In this study the technique for estimating biological parameters of surplus production models is through estimating coefficients developed by Clarke, Yoshimoto, and Polley (1992) or often known as the CYP method. With this analysis, the value of *r*, *q*, *K*, *MSY*, *JTB* (Number of Catches allowed) and exploitation rate are obtained.

The general criterion for determining the attributes of each dimension is the ease with which it can be objectively scored, and the extreme point of its sustainability can be simply expressed as good or bad.

The scoring criteria for each attribute are determined using the Likert scale. The following dimensional indicators are used in this study in the table below:

Table 2. EAFM Indicators

No.	Dimensions	Indicator	Criteria	Data analysis
1.	Dimensions of Fish Resources	Raw CPUE	1. Sharp decline (> 20%/year) 2. Slightly decreased (<20%/year)	CPUE analysis (secondary data)
		Fish Size Trends	1. The size of the tuna is getting smaller (<15kg) 2. Fixed relative size (15-45kg)	Fish weight measurement (Primary data)
		Catch Species Composition	1. Lower proportion of target fish (<50%) 2. The proportion of target fish is the same as non target	Frequency Analysis (Primary data)
		Range Collapse	1. Fishing ground fixed distance 2. Far fishing grounds 3. Fishing ground very far	Descriptive analysis based on interview results
2	Dimensions of Fishing Technology	Gear selectivity	1. Not Environmentally Friendly 2. Environmentally friendly	Descriptive data analysis
		Vessel Capacity and Arrest Efforts	1. $R < 1$ 2. $R = 1$ 3. $R > 1$	CPUE analysis (secondary data)
		Certification of fishing boat crew in accordance with regulations	1. Low < 50% 2. Moderate 50-75% 3. High >75%	Class Range Interval Analysis (secondary data)
		The size of the fishing vessel	1. There are changes to increase production capacity 2. There is no change in ship size	Descriptive data analysis
3	Social Dimension	Stakeholder participation	1. Low (<3 stakeholders involved) 2. Moderate (3-5 stakeholders involved) 3. High (>5 stakeholders involved)	Class Range Interval Analysis (Primary data)
		Fishermen's working relationship	1. Semimodern 2. Traditional	Class Range Interval Analysis (Primary data)
		Stakeholder interaction	1. Stakeholder meeting (> 10x in 1 year) 2. Stakeholder meetings (5 – 10 times in 1 year) 3. Stakeholder meetings (< 5 times)	Class Range Interval Analysis (Primary data)
		Fisheries Conflict	1. >5 times/year 2. 2-5 times/year	Class Range Interval Analysis (Primary data)
4	Economic Dimension	Asset ownership	1. Asset value reduced, <50% 2. Fixed asset value, 50%	Class Range Interval Analysis (secondary data)

No.	Dimensions	Indicator	Criteria	Data analysis
		Working capital	1. Personal 2. Others 3. Personal and other people	Class Range Interval Analysis (secondary data)
		Profit-sharing system	1. Traditional 2. wage system 3. Salary system	
		Fisherman Household Income	1. < average UMR 2. = average UMR 3. > average UMR	Revenue Analysis (secondary data)

III. RESULTS AND DISCUSSION

Mamuju Regency, West Sulawesi Province, has the potential for pelagic fish, especially large pelagic fish, namely tuna, skipjack and cob, which are very prospective. The production of capture fisheries in Mamuju Regency fluctuates every year. Based on data from the Marine and Fisheries Service of Mamuju Regency, the highest production value between 2017-2021 experienced peak production in 2019, which was 21,468 tons (BPS Sulbar, 2022) for tuna, skipjack and cob catches.

Capture fisheries production in Mamuju Regency from 2017 to 2019 always increased, but there was a decrease in catches in 2020. In 2019, capture fisheries products for large pelagic fish were 21,468 tons but decreased in 2020 by 19,333 tons or decreased by 2,135 tons in 1 year.

The most dominating types of fish in the sea of Mamuju Regency are Tongkol fish, skipjack fish and the lowest number of tuna catches. This can be seen in the catch in 2021 based on data from West Sulawesi Province in Numbers (2022) with a total catch of 4,222 tons of swordfish, 1,997 tons of skipjack fish and 727 tons of tuna catch.

In order to determine the status of small-scale capture fisheries in Mamuju Regency in a sustainability perspective, it is very important to conduct an analysis of four dimensions such as resource, technological, social and economic dimensions using Rapfish analysis as follows:

3.1 Dimensions of Fish Resources

Sustainable capture fisheries management requires information and patterns of distribution of fish resources that are utilized. Large pelagic fish resources are related to efforts that are allowed for sustainable fishing management. The data used is data on the production of large pelagic fish in Mamuju Regency using hand line fishing gear for a vulnerable time of 5 years 2017-2021.

The CPUE value of large pelagic fish in Mamuju Regency has fluctuated in the five years 2017-2021. The highest CPUE value was found in 2019 with a value of 0.22 tons/trip while the lowest CPUE value in 2017 only reached 0.11 tons/trip. The relationship between CPUE and Effort values is presented in Figure 12. The equation is: $Y = -0.000001x + 0.3816$ with $R^2 = 0.7333$, which means that if the effort increases by 1 trip, CPUE will decrease by 0.000001 ton/trip. In the research results of Novitasari, F., et al (2022) stated that the catch per unit effort (CPUE) reflects the comparison between the catch and the unit effort devoted.

The number of attributes used in the dimensions of fish resources in this study consisted of (1) CPUE, (2) Fish Size Trend, (3) Fish Composition, (4) Range Collapse. The following is the value of the rapfish analysis in the Figure.1.

Based on Figure 1 it shows that the value of the dimension of fish resources in the management of large pelagic fish in Mamuju District, Sumare Village is at a value of 70.13% or in the good category (good). In the analysis of each attribute used in the fish resource indicator that has the highest sensitivity (leverage) is the trend attribute of fish size. In fishing activities for large pelagic fish by fishermen in Sumare Village, fish sizes are still below average. This is because the location of the fishing ground is not too far (fixed) which causes the size of the catch to be relatively small. The fishermen of Sumare Village are included in the small-scale capture fisheries group using hand line fishing gear and a fleet of vessels with a size of <10 m. This is what makes the fish size trend attribute the highest attribute.

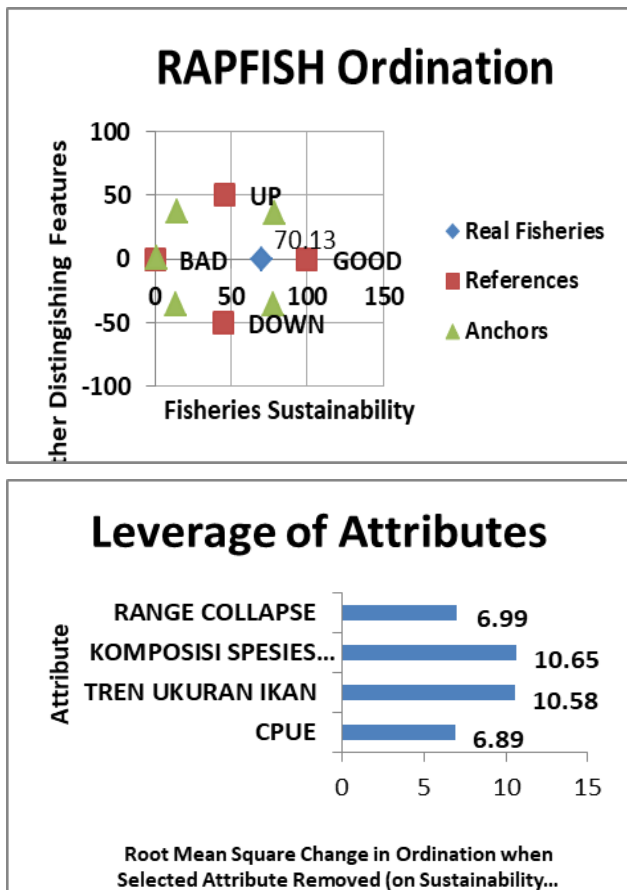


Fig.1. RapFish Analysis of Fish Resource Dimensions and Leverage of Attributes Analysis of Fish Resource Dimensions

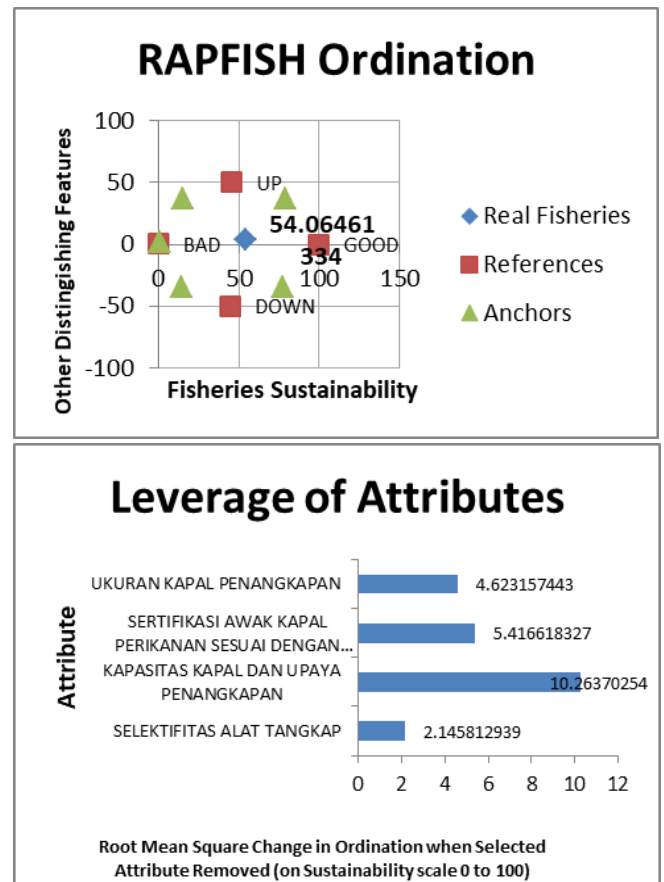


Fig.2. Analysis of Leverages Attributes Dimence of Fishing Technology and Analysis of RapFish Dimence of Fishing Technology

3.2 Dimensions of Fishing Technology

Fishermen in Sumare Village, Mamuju Regency target large pelagic fish in their fishing production by working in groups. Most of the fishermen in Sumare Village use handline fishing gear in the fishing process and are carried out in a semi-modern manner. This can be seen from the use of technology which is combined with traditional knowledge patterns of fishermen with the use of technology such as GPS or ecosonder in determining a better fishing ground.

The number of attribute uses on the dimensions of fishing technology in this study consists of (1). Gear selectivity, (2). Fisheries Capacity and Catching Effort, (3). Certification of Fishing Vessel Crew in Accordance with Regulations, (4). Catching Vessel Size. The following are the rapfish analysis values in the table below:

Based on Figure 2 shows that the dimension of fishing technology is at a value of 54.06 or is in the good category. The sensitivity analysis (leverages) on each attribute shows that the highest value is in the capacity of the vessel and the fishing effort with a value of 10.26. The use of fishing gear used by Sumare village fishermen, namely fishing rods, is included in traditional fishing gear so that the fishing results are more selective but the results are not optimal. Technological limitations in the fishing process using fishing rods make maximum fishing efforts but catches are still relatively minimal. This needs special attention for fishermen so that small-scale fisheries of large pelagic fish types can produce maximum catches and are economically and ecologically sustainable.

3.3 Social Dimension

The social aspect is part of guaranteeing the social welfare of fishermen or coastal communities in improving the economy and fishing productivity of these fishery commodities. Some things that are included in the benchmark of social aspects in fishing communities are working relationships between fishermen, stakeholder

participation, interactions between stakeholders, and conflicts between fishermen.

Sumare Village, Simboro District, Mamuju Regency is a coastal area where the majority of the population is a fishing community. The social construction of people in coastal areas is these fishermen, although not all villages in coastal areas have residents who make a living as fishermen. The real life of fishing communities that can be done by means or through business that can be influenced by the fishing season (Hasmah, 2018).

Residents in Sumare Village who work as fishermen partly have good-looking houses with adequate facilities, they are boat owners or commonly referred to as ponggawa. In these conditions it has been shown that there is one system that makes fishermen increasingly economically marginalized. This situation requires the role of the government and stakeholders in helping the fishermen's economy, especially mustard fishermen. Mustard fishermen are fishermen who do not have fishing gear such as boats and other equipment.

Mustard fishermen only participate in helping the fishing process.

The role of the government at both the district and provincial levels has not had a real impact on small-scale fishing fishermen in Sumare Village. The existence of a government program regarding fishermen insurance premium assistance carried out by the Director of Fish Resources Management has not been carried out evenly. Fishermen in Sumare Village do not get real assistance from the government. Supposedly, the assistance provided by the government must be right on target by providing assistance to villagers who are left behind and still use simple (traditional) fishing gear.

The number of uses of attributes in the social dimension in this study consists of (1). Stakeholder participation, (2). Working relations between fishermen, (3) Stakeholder interaction, (4) Conflict between fishermen.

Based on Figure 3 in rapfish analysis shows that the social dimension in the management of small-scale fisheries of large pelagic fish in Sumare Village is at a value of 38.47 or in the bad category. The sensitivity analysis (leverages) on each attribute shows that the highest value is in the attribute of modification of fishermen's labor relations with a value of 20.58. This indicates that fishing activities that work in groups and are still traditional in nature are the most important aspects that need to be considered in the management of small-scale businesses in large pelagic fish in Sumare Village.

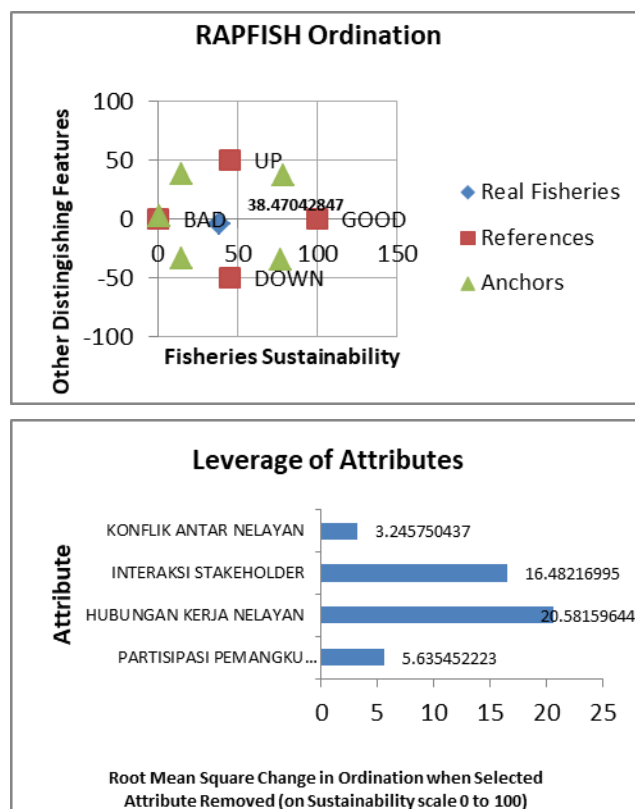


Fig.3. Leverage Analysis of Social Dimension Attributes and Rapfish Analysis Social Dimension Ordination

3.4 Economic Dimension

The small-scale capture fisheries business in Sumare Village that catches large pelagic fish, namely tuna, skipjack and tuna, provides distinct benefits for fishermen. Fishing activities in Sumare Village are carried out in groups. This directly has an impact on the ownership of production assets owned by these fishermen. Some fishermen serve as retainers, namely owners of boats and fishing gear, some become mustard fishermen or crew members who assist in the fishing process.

Fishing equipment such as boats and other supporting tools cannot be owned by small fishermen like mustard greens because some of them do not have enough capital to start a business. The average value of investment in small-scale fishing for large pelagic fish in Sumare Village is in the range of Rp. 50,000,000, and only collectors or retainers own the fishing production assets. The catch sharing system by boat owners is usually a percent distribution of 40% for owners and 15% each for crew members who assist in the process of catching large pelagic fish in Sumare Village.

Fishing production activities for large pelagic fish using handline fishing gear have an average total cost of Rp. 137,947,550 per year for fixed costs and variable costs with a total cost of IDR 11,495,629 per month. The

revenue value that can be generated in large pelagic fishing activities can reach an average of Rp. 201,729,375 per year or as much as IDR 16,810,781 per month. The amount of net income received by fishermen with an average of Rp. 63,781,825 per year or as much as IDR 5,315,152 per month.

The profit-sharing system is based on one of the fishermen respondents who own large pelagic fishing boats in Sumare Village. If it is based on the number of crew members used in fishing activities, it can be concluded that the wages received by those who are members of the fishermen working group are at an average level below the standard minimum wage for the province of West Sulawesi. In table 9 it can be seen the results of the distribution of pelagic fishing, where the retainer gets a share of 40% or Rp. 5,283,100 while the crew only get 15% of each income or Rp. 1,981,162, which is below the standard minimum wage of Rp. 2,678,863 in West Sulawesi Province.

The number of attributes used in the economic dimension in this study consists of (1) Asset Ownership, (2) Working Capital, (3) Profit Sharing System, (4) Fisherman Household Income, can be seen in the picture below:

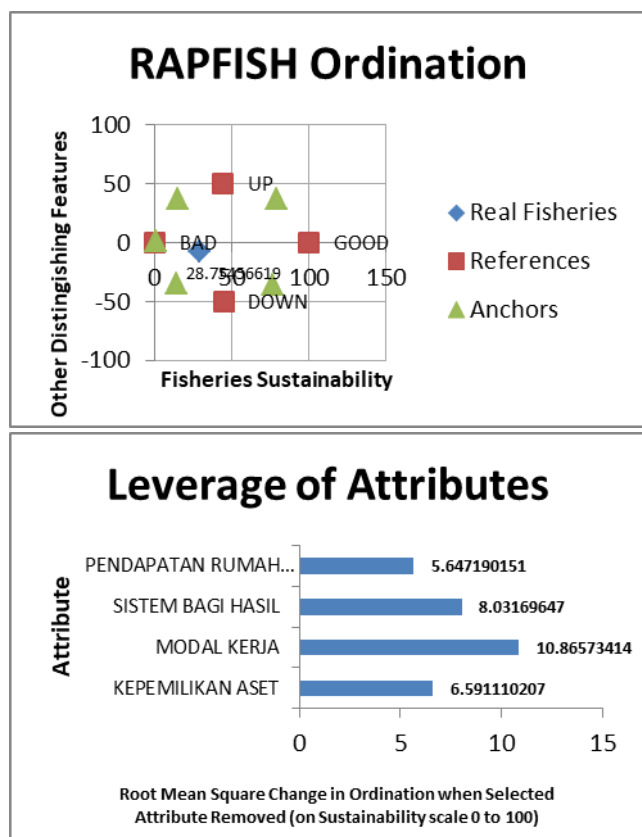


Fig.4. Leverage Analysis of Economic Dimensions Attributes and Economic Dimension Rapfish Ordination Analysis

Based on Figure 3 in rapfish analysis shows that the social dimension in the management of small-scale fisheries of large pelagic fish in Sumare Village is at a value of 38.47 or in the bad category. The sensitivity analysis (leverages) on each attribute shows that the highest value is in the attribute of modification of fishermen's labor relations with a value of 20.58. This indicates that fishing activities that work in groups and are still traditional in nature are the most important aspects that need to be considered in the management of small-scale businesses in large pelagic fish in Sumare Village.

3.5 Status of Management of Large Pelagic Fish Resources in Mamuju Regency

Management of fish resources, especially large pelagic fish, namely tuna, skipjack and cob in Mamuju Regency is a very important aspect in the fisheries sector as a determinant of the sustainability of large pelagic fishing activities. The following is a laying diagram for each dimension used in the management of large pelagic fish in Mamuju Regency, Sumare Village according to the results of this study:

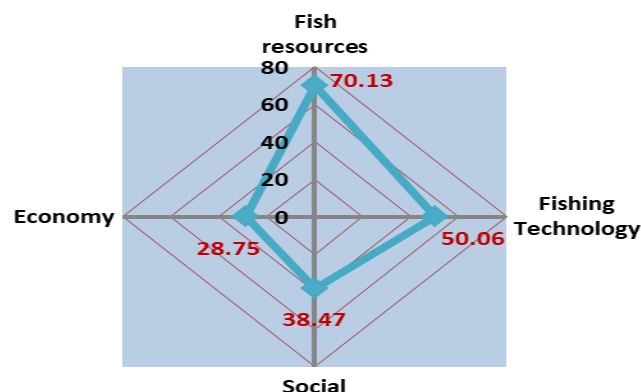


Fig.5. Overlay diagram of all EAFM dimensions in the management of large pelagic fish

Figure 5 shows a flyover diagram that illustrates the interrelationships between the four dimensions at once. The fly chart depicts a score of 0% -100% with an interval of 25%, namely bad, poor, adequate and good. The more the index goes out, the better the sustainability status and vice versa. In the flyover diagram, it can be seen that overall the index of small-scale fisheries for large pelagic fish in Sumare Village, Mamuju Regency is in the range of 28% -70%, the sustainability of fishing effort is in the status of less and quite sustainable. The dimensions of fish resources and fishing technology are in a fairly sustainable status with values of 70.13 and 50.06, this can be used as an alternative by looking at the sustainability value in the rapfish analysis which is quite high. The use of more selective fishing gear can have an impact on the

sustainability status of small-scale fishing activities from a technological dimension. In addition, it is necessary to increase the selectivity of fishing gear because by using selective fishing gear, fish sizes will be obtained according to market needs.

The social and economic dimensions are in a less sustainable status with a social dimension value of 38.47 and an economic dimension value of 28.75 which are in the bad category (bad). In this case, there needs to be special attention from the local government of Mamuju Regency as well as the provincial and central levels in raising the economic level of small-scale fishing communities. Small-scale fishermen dominate capture fisheries in Sumare Village, but this business does not provide much profit and is not sufficient for decent needs because fishermen's income is still below the regional minimum wage (UMR). The main problem for small-scale fishing businesses is meeting operational costs, inadequate marketing and TPI systems, these factors have triggered the ineffectiveness of the government's role in fishing businesses in Sumare Village.

The role of the government is very important in establishing policies and providing innovation and assistance or providing alternative livelihoods and managing fish catches which can have a significant impact on improving the welfare of fishing communities in Mamuju Regency.

In the dimensions that have been analyzed based on the EAFM approach, it shows that the fish resources available in the waters of Sumare Village based on CPUE analysis show that there is no exploitation. One of the causes of no exploitation in the waters around Sumare Village is because fishermen still use traditional fishing gear, namely hand lines which are classified as environmentally friendly. However, this cannot help fishermen in increasing their business, especially for small fishermen (sawi) due to limited capital. There is a need to strengthen capacity in the institutional aspect in assisting and guiding small fishermen to develop their business so that it is sustainable and economically profitable.

Based on the results of research conducted by (Andi Eka Ratu, 2019), namely measuring the sustainability index using rapfish analysis of each dimension of tuna management in Bulukumba Regency, the results of the fishing technology dimension and the economic dimension are in the bad category (bad). This requires special attention from the regional government of Bulukumba Regency, as well as at the provincial and central levels in raising the economic level of fishing communities who work in tuna fishing. There is a need for government policies and innovations in providing

assistance and providing alternative livelihoods and processing tuna which can have a significant impact on improving the welfare of fishing communities in Bulukumba Regency.

IV. CONCLUSION

A. Conclusion

1. Rapfish analysis is used as an initial analysis in obtaining a general and comprehensive picture of the sustainability status of small-scale capture fisheries businesses in Sumare Village, Mamuju Regency. Based on the sustainability index of each dimension, the highest index on the dimension of fish resources and fishing technology is in the good category so that fishing effort can be continued and improved in its management, while the lowest index is on the economic and social dimensions which are in the bad category so that it is necessary to improve the system to create ecologically and economically sustainable management.
2. Based on the assessment of the four dimensions, important attributes that have high sensitivity values can be used to identify efforts (recommendations) that can be made to improve the sustainability of fisheries at the research location, where the attributes with the highest values are trends in fish size, vessel capacity and fishing effort, fishermen's working relationship and working capital.

B. Suggestion

1. The results of the analysis on the economic and social dimensions that are in the bad category need to be improved through synchronization of the system for each small-scale fisheries management actor for large pelagic fish consisting of fishermen as fishing actors, government officials and private parties in developing their businesses. fishermen to get capital so that small fishermen (sawi) are no longer dependent on retainers, so they can maintain business continuity and improve the welfare of large pelagic fish fishermen in Sumare Village, Mamuju Regency.
2. Family participation in the utilization of SDI needs to be carried out by the family so that fishermen do not only rely on family income sources from catching fish but from other forms such as added value from catch products, this can be done in various ways including efforts to improve skills and insight in processing the catch, namely tuna, skipjack and tuna so that fishermen's families are able to be competent in finding other alternatives in improving their welfare.

REFERENCES

- [1] Central Bureau of Statistics, 2022. Central Bureau of Statistics for West Sulawesi Province. Retrieved December 10, 2022. <https://sulbar.bps.go.id>. Bangun, W. (2010). *Microeconomic Theory*. Bandung: Publisher: Refika Aditama.
- [2] Bangun, w. (2010). *Microeconomic Theory*. Bandung: Publisher: Refika Aditama
- [3] Maritime Affairs and Fisheries Service, 2021. Fisheries Statistics Report for West Sulawesi Province. Ministry of Maritime Affairs and Fisheries.
- [4] DKP West Sulawesi Province. 2022. Capture Fisheries Statistics Report for West Sulawesi Province. Mamuju. Department of Maritime Affairs and Fisheries of West Sulawesi Province.
- [5] Eka Ratu, A., 2019. Analysis of Sustainable Management of Tuna Resources (*Thunnus sp*) on Fish Landing in Bontotiro District, Bulukumba Regency. Postgraduate Faculty of Marine Science and Fisheries. Hasanuddin University. Macassar.
- [6] Fauzi, A and Anna, S. 2005. *Modeling of Fisheries and Marine Resources*. Jakarta : PT. Main Library Gramedia.
- [7] Halim, Abdul. Wiryawan B., Loneragan NR, et al. 2020. Developing A Functional Definition of Small-Scale Fisheries In Support of Marine Capture Fisheries Management In Indonesia. Manuscript_fcc968199c8451bd53dfafb7c6e10677. (accessed 3 Feb 2023).
- [8] Hasmah, 2018. Adaptation Strategy for Traditional Fishermen in Sumare Village, Mamuju Regency, West Sulawesi Province. *WALASUJI* Vol 9, No.2, December 2018:403-413.
- [9] Nelwan, Alfa FP., Sudirman., Zainuddin. M., Kurnia. M., 2015. Productivity of Catching Large Pelagic Fish Using Hand Lines Based in Majene Regency. *Marine Fisheries* Vol. 6, No.2. Pages: 129-142.
- [10] Novitasari, F., et al. 2022. Catching season for Yellowfin Tuna (*Thunus albacares*) using hand line fishing gear in the waters of Bone Bay landed in Luwu Regency. *Indonesian Fisheries Research Journal*. Volume 28 No. 1 March 2022. Pages 1-6.
- [11] West Sulawesi Province in Figures, 2022. West Sulawesi Central Bureau of Statistics. <https://sulbar.bps.go.id/provinsi-sulawesi-west-in-figures-2022.html>
- [12] Singarimbun, Masri. Sofian Effendi. 2017. *Survey Research Methods*. Second Printing (revised). PT. LP3ES library, member of IKAPI. Jakarta.