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Valuation of fisheries management status based on ecosystem approach (EA) in East Simeulue, Aceh

Ratna Mutia Aprilla[1,2], Celli Dirgantini[1], Edy Miswar[1,2,*], Thaib Rizwan[1], Rianjuanda Djamani[1,2], Salmarika Salmarika[3], Alvi Rahmah[1,2], Imelda Agustina[1,2], Ratu Sari Mardiah[4].

[1] Department of Fisheries Resources Utilization, Faculty of Marine and Fisheries, Universitas Syiah Kuala, Banda Aceh, 23111, Indonesia
[2] Research Center for Marine Sciences and Fisheries, Universitas Syiah Kuala, Banda Aceh, 23111, Indonesia
[3] Department of Marine Sciences Faculty of Agriculture, Malikussaleh University, Aceh utara, Indonesia
[4] Department of Capture Fisheries, Marine and Fisheries Polytechnic of Dumai, Dumai City, Riau Province, 96127, Indonesia

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ABSTRACT

Fishery management is an activity that must be carried out to achieve sustainable fisheries. Fisheries management using the Ecosystem Approach to Fisheries Management (EAFM) approach is the sustainable use of fishery resources and protection of fish stocks in nature. One of the objectives of fisheries management in social and economic aspects is how fisheries can ensure the socio-economic welfare of the fishing community. Using fishing gear that is not environmentally friendly is one of the triggers for social conflict between fishermen and the uncertain selling price when the peak season of fish impacted the fishermen's economy. Therefore, the purpose of this research is to examine the socio-economic domain indicators from the aspect of EAFM-based coastal and marine resource ecosystem management. This research was conducted from January to February 2021, located in Simeulue District, Sub-District East Simeulue. The data collection method used in the study was interviews and field surveys. The determination of respondents is done by using a gradual sampling technique or stratified random sampling. Data analysis uses an ordinal-based Likert score of 1,2,3 for each indicator, namely the economic domain, fishery household income (RTP), savings ratio, asset ownership, and the social domain, namely stakeholder participation fisheries conflict and the use of local knowledge in fish resource management. Management status in East Simeulue District assessed the aggregate value of the economic domain in the medium category with a score of 48.3. Fishermen still earn less than the minimum wage, while in the social domain, it is in the excellent category with a score of 100 because fishermen, institutions, and related agencies work with each other.

Introduction

Simeulue Regency is an archipelago consisting of 147 large and small islands. The total area of Simeulue Regency is 1,838.09 Km² or 183,809 Ha. As an archipelago surrounded by a long coastline, Simeulue is potentially rich in fisheries and marine (BPS, 2020). The total capture fisheries production of Simeulu Regency in 2020 is 19,239,389 tons (DKP Aceh, 2021). The rich marine resources make the area in Simeulue a conservation area. The area is often used as a place for fishermen in East Simeulue to do fishing using prohibited tools, like compressors which can cause conflict between fishermen. East Simeulue fishermen generally live as middle-low

Society economic class families, their economy only depends on the catch, therefore sustainable fisheries management shall be put in place including planned, structured, and effective, to prevent actions that cause damage to these resources. Common problems faced by coastal communities include the level of poverty (economic uncertainty), damage to coastal resources, and environmental health, as well as the use of sea areas for fishermen (open access and limited open access) (Firdaus et al., 2016).

Fishery management is an activity that must be carried out to achieve sustainable fisheries. The ecosystem approach to fisheries management (EAFM) is a management approach with the concept

of how to balance the social, economic, and health goals of fisheries ecosystems in an integrated, comprehensive, and sustainable manner (FAO, 2003). The EAFM approach in this study uses 2 domains/aspects, involving aspects/domains of social and economic conditions.

The study of the socio-economic is one of the important aspects of fisheries management in East Simeulue which cannot be denied because one of the goals of fisheries management in the social and economic aspects is how fisheries can ensure the socioeconomic welfare of the fishing community such as the lack of fisheries conflicts, utilization of local knowledge, increasing Fishery Household income or Rumah Tangga Perikanan (RTP) and fishermen's saving ratio as well as increased asset ownership (Gazali *et al.*, 2017; Perumal *et al.*, 2017; Mulyana, 2018). Therefore, this research needs to be done to determine the level of social and economic conditions of fishermen on the coast of East Simeulue.

Materials and Methods
Location and time of research

This research was conducted from January to February 2021, located in East Simeulue District, Simeulue Regency, Aceh Province.
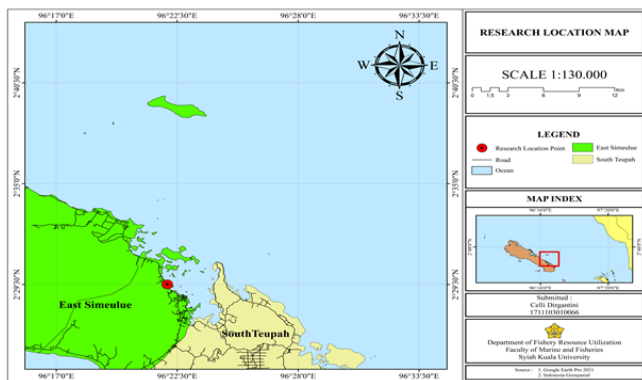

Figure 1. Maps of East Simeulue District, the site of this study

Data retrieval method

The data collection method used in the study was interviews and field surveys. The method of this study is stratified random sampling, in which the total sample is 54 respondents. This number is taken from the amount of captured fisheries households or *Rumah Tangga Perikanan* (RTP) in every village located on the East Simeulue Coast Sub-District. The determination of respondents is done by using a gradual sampling technique or stratified random sampling. The assessment of the EAFM was divided into two subjects, it's called social and economic

domains. Primary data was obtained from data sources "respondents or informants" and also from field observations. While secondary data is obtained from relevant agencies and other agencies through books, reports, internet sites, and other written sources that are relevant to the problem being studied (object of research) like panglima laot regulation data and the number of Simeulu fishing households.

Data analysis

An ecosystem approach to sustainable fisheries management of EAFM analysis is a management plan that focuses on better activity and action plans including stakeholder activities, control plans, utilization, and enforcement of the rules of the game that have been established in the strategic plan, including the economic and social domains. This economic and social aspects-focused research used a simple scoring system with an ordinal-based Likert score of 1,2,3 which means the greater the score, the better status. An assessment of each indicator of the economic and social domains was used as a method in this study. The collected and processed data were analyzed to answer the questions posed in the research. The data processing technique was carried out based on the assessed indicators and then analyzed using simple composite analysis. The classification of coastal and marine resource management is determined on a scale of 1-100 (KKP, 2014) as follows (Table 1):

Table 1. Limitation of the domain and aggregate value scores.

Composite score	Flag Model	Description
1-20		Bad
21-40		Not good
41-60		Medium
61-80		Good
81-100		Very well

Results
EAFM economic and social domain indicator assessment

The results of the research from data collection and data detailing economic domain indicators are (1) fishery household income, (2) asset ownership, and (3) savings ratio. Data collection was obtained from questionnaires and interviews with fishermen, the *Panglima laot* of Lhok East Simeulue District, and related agencies. The scoring results of each economic domain indicator in the table below show a poor condition of the fishery household or *Rumah*

Tangga Perikanan (RTP) income indicator seen from the minimum wage or UMR that has been determined and the savings ratio indicator which is displayed with a red flag while asset ownership which indicates a poor condition this is shown with a yellow flag (Table 1).

Table 2. Analysis of the economic domain of fishermen.

Indicator	1*	2*	3*	Total
Results	1 = less than the minimum wage or UMR	2 = value of fixed assets (less than 50%)	1 = less than the loan interest	
Score	🟥	🟨	🟥	
Weight	30	45	25	
Score	30	90	25	145

The results of the research from data collection and details on social domain indicators are (1) indicators of stakeholder participation, (2) fisheries conflicts, and (3) utilization of local knowledge in fish resource management. The scoring results of each social domain attribute, based on the table below, produce good conditions for each indicator, which are indicators of stakeholder participation, fisheries conflicts, and utilization of local knowledge in fish resource management which can be seen with the flag displayed in green (Table 3).

Table 3. Composite analysis of social domains on fishermen.

Indicator	1*	2*	3*	Total
Results	3 = > 100%	3 = less than 2 times/year	3 = exists and is effectively used	
Score	🟩			
Weight	40	35	25	
Score	120	105	75	300

Economic and social domain EAFM aggregate value

The result of Economic and social domain EAFM aggregate values showed in Table 4.

Table 4. Economic and social domain EAFM aggregate values.

Domain	Composite Value	Flag Model	Description
Economy	48.3	🟨	Medium
Social	100	🟩	Very well

Discussion

EAFM Economic and Social Domain Indicator Details

1) Fishery Household Income Indicator

The average result of fishery household income in East Simeulue District was obtained with a low score, seen from the government's regional minimum wage, These results were obtained based on interviews with fishermen in Simeulue Timur District as measured by gross income per fishing trip where the gross income of hand line fishermen, net fishermen, and shooting fishermen averaged ± Rp. 500,000 per fishing trip. The minimum caught can only meet their daily needs. Generally, handline, net, and shoot fishermen only make daily catches, for lift net fishermen who are generally located in Suka Maju Village have an average income of ± Rp. 3,000,000 in 22 trips for one month, this income is obtained when the fishing season is stable and when the fish is in a bad season, the fishermen even owe their fishing capital and owe it to the owner for their daily needs, this is in line with research by Harahap (2003), which states that the value of fishermen's household income is influenced mainly by fishing time, length of time at sea and number of family members. In addition, each fisherman has different catches per month depending on how many times they go to sea, and each time they go to sea the average results obtained are also different (Chandriyanti and Eny, 2020).

Types of fish caught by fishermen are generally fish with high selling prices, such as leopard coral grouper, giant trevally fish, camouflage grouper, octopus, and sea cucumbers where the price of the fish ranges from Rp. 25,000/kg to Rp. 130,000/kg with a stable selling price or infrequent price declines. Meanwhile, there are also fish with fluctuating selling prices such as tuna and sardines, with prices ranging from Rp. 8,000/kg to Rp. 10,000/kg when it is sold outside the region and Rp. 5,000 /kg when sold to an agent. Fishermen who sell tuna directly can reach Rp. 100,000/bucket during peak fish season. The cause of the low selling price

of fish is that the price of fish is determined by the toke or agent already at TPI (Sinaga *et al.*, 2020). The higher the selling price of fish, the higher the income received (Firdaus and Cornelia, 2014).

2) Asset Ownership and Savings Ratio (Saving Rate)

Ownership of fishermen's assets in East Simeulue District shows the results of unfavorable conditions where the value of fixed assets (less than 50%), from some fishermen, interviewed only 1-3 fishermen who increase the number of boats because the previous boats can no longer be used, one of these ships is aid from the Department of Marine Affairs and Fisheries of Simeulue Regency. Fishermen do not increase the number of fishing gear except for adding some materials such as rubber for shooting fish, adding fishing lines, and other fishing aids. According to Meidiana dan Marhaeni (2019), asset ownership has a positive but not significant effect on income. However, this is different from Agunggunanto (2015); Primyastanto (2018), which states that fishermen's assets have a positive and significant influence on fishermen's income. This condition is caused by the larger the boat used by fishermen, the more sophisticated the fishing gear used to catch fish.

The value of the savings ratio indicator obtained is bad. This value indicates that the ratio of savings obtained from fishing activities is less than the loan interest rate. From the results of interviews with several fishermen, the household expenditure of fishermen in East Simeulue District on average spends Rp. 100,000/day for only kitchen needs and many other needs that must be spent on a daily basis, causing none of the fishermen to have savings in the Bank. In research (Budiarto *et al.*, 2015; Edwardsyah, 2017), a negative SR number is obtained because the average monthly income is smaller than the average monthly expenditure spent for daily living needs/necessities (potential debt).

3) Stakeholder Participation

This measurement of stakeholder participation aims to see the activity of stakeholders in all fish resource management activities. The level of stakeholder activity will determine the success of fish resource management activities (Budiarto *et al.*, 2015). The results of interviews with stakeholder participation in East Simeulue District obtained a score of 3 where more than 50% took part in handling fishing activities. This is because all the existing stakeholders participate in the management and utilization of fishery resources.

The stakeholders in question include the panglima laot of Laot Lhok, the community surveillance group or Kelompok Masyarakat

Pengawas (POKMASWAS), the Department of Marine Affairs and Fisheries or Dinas Kelautan dan Perikanan (DKP), together with POL AIR, TNI AL, and Syabandar of Simeulue Regency who routinely carries out surveillance 10 days a year as well as Flora and Fauna International institutions (FFI) Simeulue which assists the Simeulue community, especially the fishermen to unite perceptions in establishing the rules in the customary law of the sea, especially in the Regional Marine Conservation area Pulau Pinang, Siumat and Simanaha or Konservasi Laut Daerah Pulau Pinang, Siumat dan Simanaha (KKLD PISISI), and other parties. The level of activity of stakeholders will affect the success of fisheries management, where the more active the stakeholder participation, the higher the success rate of fisheries management (Adrianto, 2013). Duggan *et al.* (2013), stated that involving various stakeholders of marine resources in the management system can help resolve conflicts more effectively than if only a few stakeholders were involved.

4) Fisheries Conflict

Fishery conflict is one indicator that is quite influential in capturing fisheries activities in the waters of East Simeulue District, especially for the long term. The assessment of the conflict indicators that occurred in East Sumeulue District resulted in a value of 3 or in 1 year it was estimated that there were less than 2 times/year violations between fishermen who use fishing gear that is not environmentally friendly, which is compressors used in conservation areas. Fisheries conflicts only occur in two villages, Air Pinang Village and Pulau Siumat Village where the area is a Regional Marine Conservation Area or Kawasan Konservasi Laut Daerah (KKLD) according to the Simeulue Regent's Decree No. 523.1/104/SK/2006 issued on April 9, 2006. The Regional Marine Protected Area or Kawasan Konservasi Laut Daerah (KKLD) is designated for marine protected areas and marine/maritime tourism parks.

The mission of establishing this KKLD is as an area for conservation, tourism, education/research, and community economic activities. Conflicts that often occur in the area are the use of fishing aids that are not environmentally friendly, namely compressors used to catch octopus, sea cucumbers, and other marine products. Based on the results of interviews, fishermen from other sub-districts committed these violations more often. Triggers for conflict include the concern of a community group about the availability of natural resources and discomfort about the form of relationships and forms of cheating in the level of experience (Anwar,

2015). Capture fisheries conflicts generally occur due to diminishing fish resources resulting in unhealthy competition fighting over resources in the same fishing area (Purnama *et al.*, 2015; Kobesi *et al.*, 2019; Karisma, 2018).

5) Utilization of Local Knowledge in Fish Resource Management

The results of the indicators of the use of local knowledge in the management of fish resources, exist and are effectively used given the rules prohibiting fishing on Fridays, Islamic holidays, tsunami memorials, and others which are always carried out and obeyed by fishermen. The use of local knowledge in fish resource management affects the activities of fishing communities, the presence or absence of local knowledge in fisheries resource management activities is followed by the effectiveness of the application of local knowledge which will determine the success of coastal and marine resource management activities (Miswar *et al.*, 2018; Widarmanto, 2018).

Economic and social domain EAFM aggregate value

Based on table 4 above about the study of social and economic aspects of the management of coastal and marine resource ecosystems based on EAFM in East Simeulue District, Simeulue Regency, the aggregate value of EAFM in the economic domain is 48.3 so that the flag modeling visualization is yellow or still in the medium category, while in the social domain, it is 100 or categorized very well so that it is visualized with the green flag model. Strategies for solving socio-economic problems can be carried out through efforts to increase socio-economic capital by strengthening institutions (community groups and fishermen) and local wisdom, environmental and cultural sustainability, and community empowerment (Firdaus *et al.*, 2016). According to Stefansson *et al.* (2019), participatory planning and decision support tools such as EAFM enable stakeholders to learn about the social and economic impacts of decisions made for fisheries management. In the marine and fisheries sector, the fisherman's exchange rate approach has been defined as the main performance indicator of the Ministry of Marine and Fisheries (KKP) to measure the high welfare of a fishing community (Saptanto dan Apriliani, 2012). Management of ecosystems that are closely related to fisheries must be supported by every stakeholder and fishing community so that they can continue to improve fisheries management more optimally (Miswar *et al.*, 2018).

The key to the successful implementation of EAFM is the commitment among stakeholders about their perceptions of managing fish resources to ensure livelihoods (Prasetyo *et al.*, 2014). One of the challenges of EAFM is to establish ways to ensure that the actions of coastal and fisheries agencies at every level of government are aligned with one another and with agreed EAFM objectives and policies (Pomeroy *et al.*, 2019). The management function is carried out to make things better than before. Sustainable fisheries management is something that can be considered in realizing a better fishery status (Rahmah *et al.*, 2021).

Conclusion

The research result showed that the management status in the East Simeulue District on the assessment of the aggregate value of the economic domain in the medium category with a score of 48.3 where fishermen still earn less than the minimum wage or UMR, while in the social domain, it is in the very good category with a score of 100 because fishermen, institutions and related agencies cooperate in fisheries management. The results of this study can be used as a recommendation in fisheries management, such as having fishermen's groups that have technology and machines for processing fisherman's products, including providing training and counseling on an effective marketing system for fisherman's products.

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