

Socio-Economic Domain Assessment of the EAFM Approach in the Bullet Tuna Fishery at Prigi Nusantara Fishing Port (PPN), Trenggalek, East Java

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Abstract. The capture fisheries landed at the Nusantara Fishing Port (PPN) in Prigi, Trenggalek, East Java, play a strategic role in influencing the social and economic conditions of fishing households. The production of bullet tuna is highly volatile, which in turn impacts these socio-economic conditions. This study aims to analyze the assessment of the social and economic domains in the implementation of EAFM for the bullet tuna fishery at PPN Prigi. It employs a qualitative method using the Ecosystem Approach to Fisheries Management (EAFM), which integrates social and economic aspects as a potential solution to achieve sustainable fisheries management and improve fishers' welfare. Data collection techniques included field observations and interviews with 98 fishers who use purse seine and Danish seine gear. The findings indicate that the social domain is rated as 'good' with a composite score of 66. This rating is characterized by a low potential for conflict, which is crucial to maintain, although stakeholder participation and the utilization of local knowledge are not yet optimal. The economic domain was classified as "moderate" with a score of 53, attributed to low ownership of productive assets and highly vulnerable income levels, which limit fishers' capacity to save. It is recommended that the government address the socio-economic vulnerabilities of fishers in an integrated manner, by strengthening regulation and mediation to mitigate potential conflicts, while simultaneously initiating productive asset assistance and business diversification programs supported by financial literacy.

Keywords. Bullet tuna fishery; EAFM; fishers' welfare; PPN Prigi; sustainable

I. INTRODUCTION

East Java Province is one of the significant centers for capture fisheries in Indonesia, supported by numerous active fish landing bases [1]. The province's strategic location in Fisheries Management Area (WPP) 573 of the Indian Ocean, a seasonal upwelling area, results in periodic increases in fish catch abundance [2]. This upwelling process brings nutrient-rich water from deeper layers to the surface, stimulating plankton growth and ultimately increasing fish populations [3]. One of the main ports in this region is the Prigi Nusantara Fishing Port (PPN) in Trenggalek Regency [4].

The majority of fishermen at PPN Prigi, over 80%, are small-scale fishers with fleets under 10 GT, making them highly dependent on catch yields and vulnerable to production fluctuations and economic hardships, especially during the off-season [5]. Data indicate a significant decline in production at PPN Prigi, from 28.8 million kg in 2019 to only 13.3 million kg in 2022 [6]. Although fishing ports are expected to improve the welfare of fishermen, these benefits have not been fully realized for small-scale fishermen, who still face challenges such as middlemen's market control and limited access to capital [7].

To address these challenges, the Ecosystem Approach to Fisheries Management (EAFM) was introduced as an

integrated framework to balance human needs with environmental sustainability [8]. This study aims to assess the social and economic domains of the EAFM approach on the bullet tuna fishery at PPN Prigi, Trenggalek, East Java.

II. METHODS

Time and Location

This research was conducted at PPN Prigi, located in Tasikmadu Village, Watulimo District, Trenggalek Regency, East Java Province, from February to March 2025.

Research Methods

The research uses qualitative methods primarily through field observation. Qualitative methods are commonly utilized in the humanities, social sciences, and religious studies [9]. Data were collected through surveys, including interviews and questionnaires. Respondent sampling of fishermen was carried out using stratified random sampling, which ensures that every element of the population within each non-overlapping group has an equal chance of being selected into the sample [10]. The sampling strata were based on the type of fishing gear used by the fishermen. The sample size was determined using the Slovin formula with a 10% tolerance level [11] with the formula:

$$n = \frac{N}{1 + Ne^2} \quad (1)$$

with the following fisherman classification as shown in Table 1.

Table 1.

Classification of the Total Fisherman Samples based on Fishing Gear

Type of Fishing Gear	Total Fisherman	Total Sample
Purse seine one boat system	210	5
Purse seine two boats system	3.779	91
Payang	72	2
Total	4.061	98

Source: [12]

Interviews were conducted using in-depth interviews, which is a qualitative research technique for collecting subjective data from respondents. Respondents also included key informants, individuals from whom information related to the research was gathered to cross-check data [13]. Key informants were utilized in this research to validate the interview data collected from

fishermen and to obtain in-depth insights into the operational and environmental conditions at PPN Prigi, Trenggalek. Key informants in this study included the management of the purse seine one-boat system, the purse seine two-boat system, and the payang fishing groups, as well as officials from PPN Prigi and local village institutions.

Assessment of the social and economic domains is conducted using an Ordinal Likert Scale with scores of 1, 2, and 3, in accordance with the assessment criteria for each indicator. The index value is calculated by multiplying each indicator's score by its predetermined weight. The allocation of weights to each indicator is based on the indicator's level of influence (degree of importance) within the domain. Indicators that have a direct or significant influence within the domain are given a higher weight [14].

$$Cat - i = Sat - i \times Wat - i \quad (2)$$

Cat - i = Index value of attribute/indicator i

Sat - i = Score of attribute/indicator i

Wat - i = Weight of attribute/indicator i

The total index value obtained is analyzed using a simple composite analysis based on the arithmetic mean. The results of this analysis are then presented as a flag model, with the criteria described in Table 4.

Table 4
 Composite Assessment with Flag Modelling for the Social and Economic Domain

Lower Score Limit	Upper Score Limit	Flag Modeling	Description
1	20		Poor
21	40		Insufficient
41	60		Moderate
61	80		Good
81	100		Excellent

Source: [14]

This composite value is the sum of all indicators' values.

$$NK = \left(\frac{Cat}{Cat_{max}} \right) \times 100 \quad (3)$$

Cat = Total index value of all attributes or indicators

Cat_{max} = Maximum total index value

Data Analysis

Data analysis was carried out using the EAFM approach, which involves two domains: Social and Economic. Each indicator includes criteria, scores, and assessment weights, as stipulated in the Decree of the SK Direktorat Jenderal Perikanan Tangkap Nomor 18 Tahun 2014 concerning Technical Guidelines for Indicator Assessment for Fisheries Management with an Ecosystem

Approach. The social domain consists of three indicators: stakeholder participation, fisheries conflict, and the use of local knowledge in fisheries resource management. The

economic domain consists of three indicators: asset ownership, household income from fisheries (RTP), and the saving ratio.

Table 2.
 Criteria and Weights for Social Domain Indicators

Indicator	Monitoring	Criteria	Weight (%)
Stakeholder participation	Recording of participation is carried out continuously throughout the stages of fisheries management. The percentage of involvement is measured based on the number of stakeholder types, not individual stakeholders.	1 = < 50% 2 = 50-100% 3 = 100 %	40
Fisheries conflict	The guideline for conflict data collection is every semester (twice a year) or according to the season (assuming the level of competition varies by season).	1 = high frequency 2 = moderate 3 = low frequency	35
The use of local knowledge in fisheries resource management	Recording of the utilization of local knowledge is conducted continuously throughout the stages of fisheries management.	1 = none 2 = present, not effective 3 = present, effective	25

Source: [14]

Table 3.
 Criteria and Weights for Economic Domain Indicators

Indicator	Monitoring	Criteria	Weight (%)
Asset ownership	Guidelines for survey frequency and the collection of average fisheries household income (RTP) data are annual, taking into account seasonal variations over five years (data source: BPS Susenas).	1 = asset value decreases (more than 50%) 2 = asset value remains (less than 50%) 3 = asset value increases (more than 50%)	45
Fisheries household income	Fisheries household income surveys should use a sampling approach that adheres to scientific principles, in which the income measured and compared to the regional minimum wage (UMR) is the individual income derived from fisheries activities within the fisheries unit being studied.	1 = less than the average regional minimum wage (UMR) 2 = equal to the average UMR 3 = more than the average UMR	30
Saving Ratio	Guidelines for survey frequency and the collection of RTP income data are based on fishing seasons (primary data). Information on loan interest rates can be obtained from Bank Indonesia during the survey.	1 = less than the loan interest rate 2 = equal to the loan interest rate 3 = more than the loan interest rate	25

Source: [14]

III. RESULT AND DISCUSSION

Assessment of the Social Domain Status at PPN Prigi, Trenggalek

The assessment of the social domain yielded a composite score of 66, which falls into the good category, indicated by a light green flag in the modeling. This finding is consistent with research at PPN Palabuhan Ratu, West Java, which stated that the social domain's composite score in WPP 573 (Indian Ocean) was in the good category for EAFM implementation, with a total composite value of 79.69 [15].

The results of the indicator assessment in the social domain at PPN Prigi, Trenggalek, are presented in Table 4. The stakeholder participation indicator received a score of 1.8 and an index value of 72. This result shows that various institutions, such as the PPN Prigi Unit, the Department of Marine Affairs and Fisheries, PSDKP, POLAIR, and the Harbormaster, have been actively involved in management. However, 37% of respondents report that stakeholder involvement is still below 50%, and fishermen feel that outreach and aid have not been evenly distributed (Figure 1). Government-led activities should fully support the welfare of fishermen. Fisheries

management activities aim to ensure the sustainable conservation of fish resources [16].

The fishery conflict indicator obtained a score of 2.5 and an index value of 87.5. This condition is considered quite good, with 74% of respondents reporting no conflicts in the past year. Nevertheless, 18% of respondents reported frequent conflicts, including disputes over fishing grounds, fish theft, and competition with migrant fishermen (Figure 2). This situation is rated as fairly good, but there is potential for horizontal conflict that needs serious attention in resource management. Institutions like the Department of Marine Affairs and Fisheries, the PPN Prigi Unit, and the Harbormaster can tighten regulations at the port. Direct violations of fishing regulations, such as fishing outside designated zones, can be addressed through negotiation, conciliation, and mediation, in accordance with Law No. 45 of 2009 on Fisheries and Ministerial Regulation No. 59/PERMEN-KP/2020 [17].

The local knowledge indicator received a score of 1.5 and an index value of 37.5, indicating that its application remains very low. A total of 70.72% of respondents stated that local knowledge is not used in fish resource management. However, 21.21% acknowledged the effective use of local knowledge, such as using traditional seasonal calendars to determine fishing times (Figure 3). The majority of fishermen rely on habits and generational knowledge to know when fish are abundant and when they spawn [18].

Assessment of the Economic Domain Status at PPN Prigi, Trenggalek

The results of the economic domain indicator assessment at PPN Prigi, Trenggalek, are presented in Table 5. The economic domain received a composite score of 53, placing it in the moderate category, indicated by a yellow flag in the modeling. This result is due to the low ownership of productive assets and vulnerable income levels, which limit the fishermen’s ability to save. Based on this value, the fishermen at PPN Prigi, Trenggalek, cannot yet be considered prosperous but are in a sufficient yet highly vulnerable condition, limiting their long-term resilience.

The asset ownership indicator received a score of 1, corresponding to an index value of 45. This value was flagged with a yellow modeling indicator, signifying its position within the moderate index range of 41-60, showing that the value of fishermen’s assets tends to decrease or that most do not own productive assets. As many as 96% of respondents stated they do not own

productive assets in the fisheries sector, such as fleets or fishing gear (Figure 4). The decline in assets is often driven by economic pressures that force fishermen to sell their assets to meet urgent needs. This is in line with the research, which states that asset ownership may not be long-lasting due to economic demands that require fishermen to sell some assets to support their family’s economy [19].

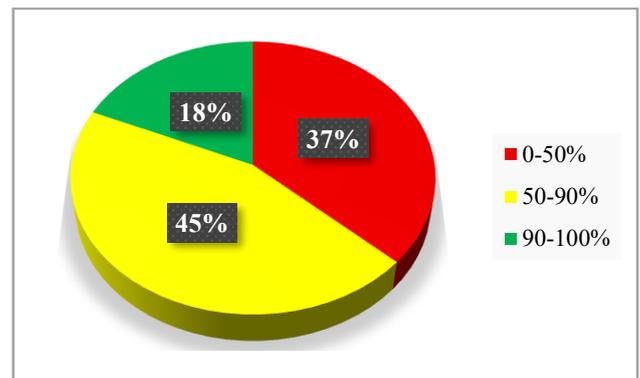


Figure 1. Stakeholder Participation Result

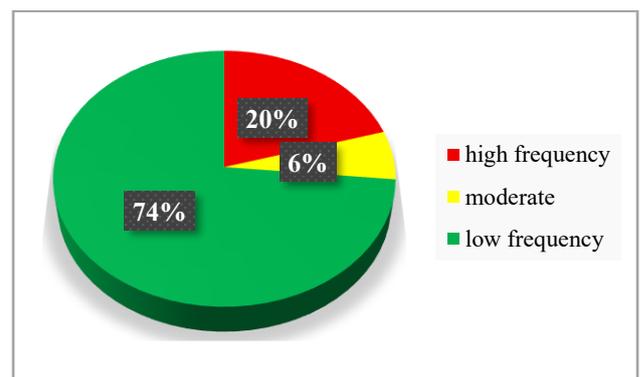


Figure 2. Fisheries Conflict Result

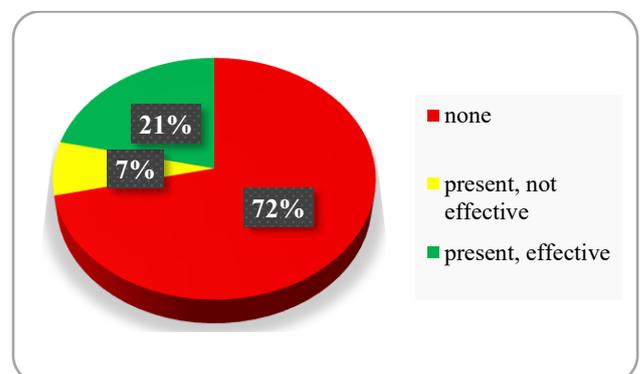


Figure 3. Local Knowledge in Fisheries Resource Management Result

Table 4.
 Results of Social Domain Indicator Assessment

Indicator	Criteria	Weight (%)	Score	Index Value	Flag
Stakeholder participation	1 = < 50%	40	1.8	72	Yellow
	2 = 50-100%				
	3 = 100 %				
Fisheries conflict	1 = high frequency	35	2.5	87.5	Green
	2 = moderate				
	3 = low frequency				
The use of local knowledge in fisheries resource management	1 = none	25	1.5	37.5	Yellow
	2 = present, non-effective				
	3 = present, effective				
Total		100	8	197	
Composite Value				66	Green

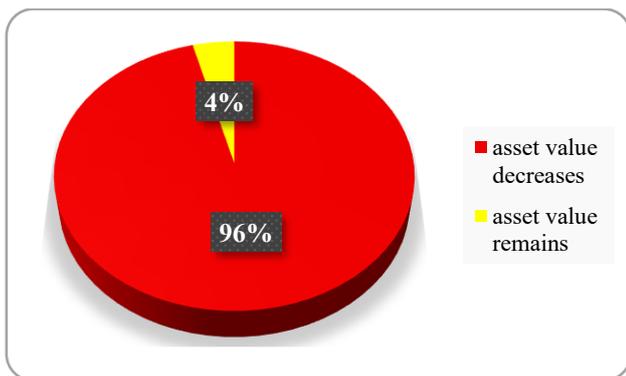


Figure 4. Asset Ownership Result

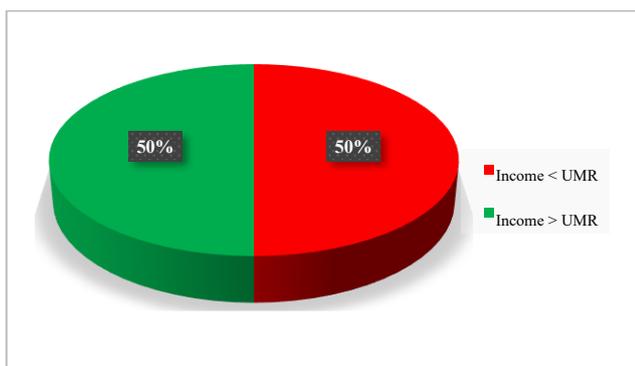


Figure 5. Fisheries Household Income Result

The fishery household income (RTP) indicator received a score of 2 and an index value of 60. This value was flagged with a yellow modeling indicator, signifying its position within the moderate index range of 41-60, indicating that the average income of fishermen is only equivalent to the Regional Minimum Wage (UMR) for Trenggalek Regency

in 2025, which is IDR 2,378,784 [20]. 50% of respondents have incomes below the UMR, with some earning as little as IDR 750,000 per month, placing them in the extreme poverty category (Figure 5). Poverty among fishermen is caused by complex structural issues. Fishermen's income is entirely dependent on seasons and weather, while their bargaining power is very weak against middlemen who control selling prices and serve as a source of loans [21].

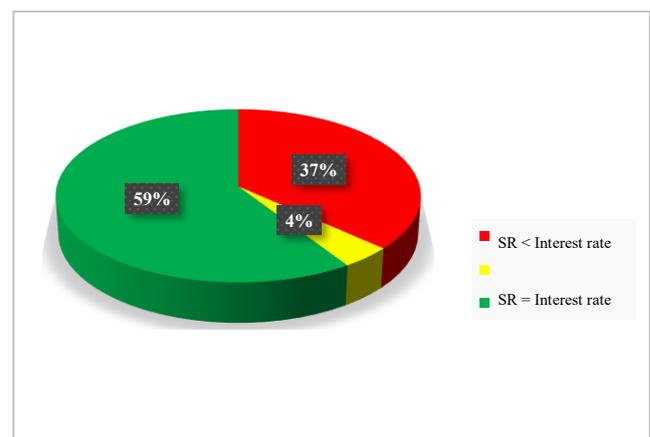


Figure 6. Saving Ratio Result

The saving ratio indicator scored 2.2 with an index value of 55. This value was flagged with a yellow modeling indicator, signifying its position within the moderate index range of 41-60, which shows that the average saving capacity of fishermen is only equivalent to the interest on credit loans (10.55%) [22]. Although 59% of respondents have a saving ratio higher than the credit interest rate, another 37% have a lower ratio, indicating low or even negative saving potential (Figure 6). This shows that while

most fishermen can meet their credit loan obligations, their ability to save remains limited, signaling the need for efforts

to improve financial capacity and income stability in the capture fisheries sector [23].

Table 5.
 Results of Economic Domain Indicator Assessment

Indicator	Criteria	Weight (%)	Score	Index Value	Flag
Asset ownership	1 = asset value decreases (more than 50%)	45	1	45	
	2 = asset value remains (less than 50%)				
	3 = asset value increases (more than 50%)				
Fisheries household income	1 = less than the average regional minimum wage (UMR)	30	2	60	
	2 = equal to the average UMR				
	3 = more than the average UMR				
Saving ratio	1 = less than the loan interest rate	25	2.2	55	
	2 = equal to the loan interest rate				
	3 = more than the loan interest rate				
Total		100	5	160	
Composite Value				53	

IV. CONCLUSION

Conclusion of the Socio-Economic Domain Assessment Using the EAFM Approach on Bullet Tuna Fisheries at Pelabuhan Perikanan Nusantara (PPN) Prigi, Trenggalek, East Java:

1. The EAFM social domain score for frigate tuna fishing households at PPN Prigi Trenggalek is 66, categorized as good. This is supported by stakeholder participation and low levels of conflict. However, the use of local knowledge in management is not yet optimal and needs improvement.
2. The EAFM economic domain score is 53, categorized as moderate. This condition is caused by the low ownership of productive assets and highly vulnerable income levels, which directly limit the fishermen's capacity to save and achieve sustainable welfare.

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