International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/

Vol. 57 No. 2 June 2026, pp. 112-129

Fisheries Management of Blue Swimming Crab (Portunus Pelagicus) in the Northern Coast of Java Island

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Abstract - Overexploitation-induced stock depletion represents a major challenge in the fisheries management of blue swimming crab (Portunus pelagicus) in Fisheries Management Area of the Republic of Indonesia 712 (FMA RI 712). This study aimed to assess the current management status and to formulate strategic management measures through an approach Ecosystem Approach to Fisheries Management (EAFM) on the northern coast of Java Island. Evaluation of the six EAFM domains resulted in composite scores ranging from 1.45 to 1.90, indicating that the management status falls within the poor to moderate category. The results showed that fish resource, fishing practices, economics, and institutional dimensions exhibit the lowest performance. In contrast, the social dimension, along with habitat and ecosystem aspects, falls within the moderate (yellow) category. As part of recovery efforts, four integrated intervention strategies are proposed: (1) strengthening regulations on minimum legal carapace width (>100 mm for males and >110 mm for females); (2) ensuring full protection of ovigerous females through mandatory release mechanisms; (3) rationalizing fishing effort by reducing fleet capacity to 40%; and (4) implementing stock recovery programs through restocking and habitat protection measures, such as the establishment of sanctuary areas or habitat rehabilitation.

Keywords: Blue Swimming Crab, Ecosystem Approach to Fisheries Management (EAFM), Management Strategy, Overfishing, Sustainability

I. INTRODUCTION

Indonesian waters are a habitat for various types of crabs family Portunidae, like Portunus sanguinolentus, Charybdis feriatus, Podophthalmus vigil, and Charybdis natator. However, the blue swimming crab (Portunus pelagicus) plays a crucial ecological and economic role, particularly in the northern coast of Java Island within the Fisheries Management Area of the Republic of Indonesia 712 (FMA RI 712). As the main export commodity which is widespread in coastal areas, seagrass beds and mangrove forests, P. pelagicus has a vital role in the food chain as a benthic predator (Ernawati et al, 2014)

P. pelagicus is a coastal fishing commodity with high economic value, which is driven by the growing demand in export markets every year. Data shows that increasing demand for P. pelagicus markets has made this commodity one of Indonesia's key foreign exchange earners (Huda et al, 2021). Indonesia's blue swimming crab export volume reached 25,955.96 tons, equivalent to approximately USD 390 million (KKP, 2024). This high market demand has intensified fishing pressure, thereby threatening the sustainability of blue swimming crab resources. In response, the government has established regulatory measures, including

the Regulation of Minister of Marine Affairs and Fisheries Number 17 of 2021 concerning the Management of Lobster (Panulirus spp.), Mud Crab (Scylla spp.), and Blue Swimming Crab (Portunus spp.).

The fisheries management of blue swimming crab in the northern coastal region of Java faces complex challenges, characterized by declining resource availability alongside a continuous increase in fishing effort. This imbalance has the potential to trigger overfishing. This phenomenon is not only driven by high fishing capacity but also by practices that disregard biological considerations, including the use of non-selective fishing gear. These issues are further exacerbated by limited awareness among fishers regarding sustainable fishing practices, resulting in the continued use of environmentally unsustainable harvesting and handling methods (Budiarto et al., 2015).

In addition to overfishing, blue swimming crab fisheries in the northern coastal areas of Java—particularly in Cirebon, Rembang, and Lamongan Regencies—are also affected by habitat degradation. The use of destructive fishing gear, combined with pollution from industrial and domestic sources, has led to the deterioration of essential aquatic ecosystems. The degradation of seagrass meadows and coral reefs, which serve as critical spawning and feeding grounds for blue swimming crabs, directly affects the productivity and survival of blue swimming crab populations (Mustofa et al., 2021).

The Ecosystem Approach to Fisheries Management (EAFM) provides a comprehensive and relevant framework for addressing these multifaceted challenges. EAFM extends beyond catch regulation by incorporating ecosystem interactions as well as social, economic, and institutional dimensions (Sari et al., 2025). Its implementation in blue swimming crab fisheries management along the northern coast of Java can support ecological conservation of habitats and stocks, ensure economic viability, and enhance stakeholder participation in decision-making processes, while strengthening governance systems (Nasrul et al., 2019).

This study is expected to provide practical insights for policymakers and stakeholders in FMA-NRI 712, particularly in Cirebon (West Java), Rembang (Central Java), and Lamongan (East Java), in developing sustainable, EAFM-based fisheries management action plans for blue swimming crab. By applying EAFM analysis, this research aims to shift fisheries management from exploitative practices toward more responsible and sustainable approaches, thereby ensuring both fisher livelihoods and ecosystem sustainability.

II. RESEARCH METHODS

2.1 Study Site and Time Frame

This study was conducted in three major blue swimming crab-producing provinces on the island of Java, namely West Java, Central Java, and East Java. Specifically, the research focused on key landing sites in Cirebon Regency (Martasinga and Grogol Villages, Gunung Jati District), Rembang Regency (Gededungmulyo and Layur Villages, Lasem District), and Lamongan Regency (Paciran and Kandangsemangkon Villages, Paciran District). These locations were selected because they are situated within the same Fisheries Management Area of the Republic of Indonesia (FMA RI 712), which represents one of the primary centers of national blue swimming crab production. This indicates that blue swimming crab fisheries along the northern coast of Java are part of a connected ecosystem, thereby requiring coordinated management across provinces (Dita, 2022). The study was conducted from October 2025 to January 2026.

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
Vol. 57 No. 2 June 2026, pp. 112-129

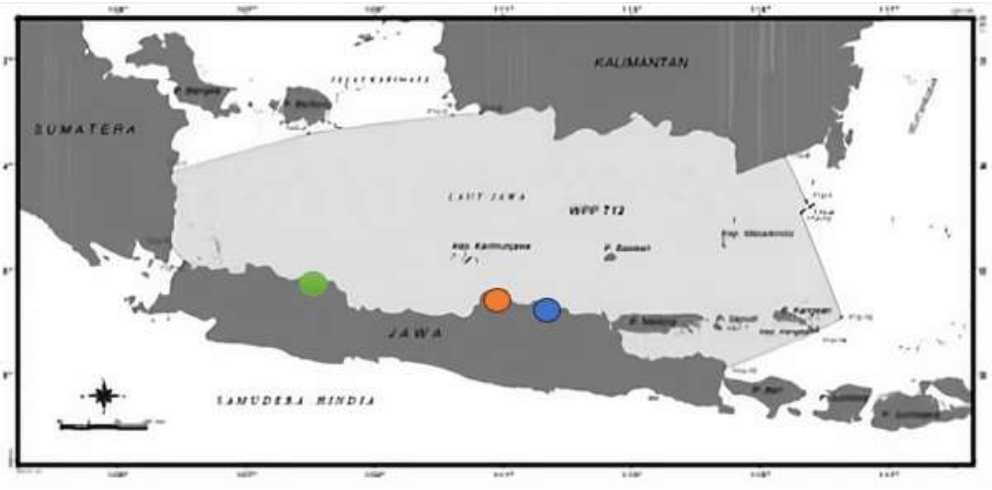

Figure 1 Map of the Northern Coastal Area of Java Island

(Source: Decree of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia Number 79 of 2016 concerning the Fisheries Management Plan for the State Fisheries Management Area of the Republic of Indonesia 712)

2.2 Data Types and Sources

This study employs a comprehensive bioeconomic approach to formulate sustainable fisheries management strategies for blue swimming crab in FMA RI 712, particularly in the Cirebon, Rembang, and Lamongan regions. By integrating primary and secondary data, the study evaluates 30 indicators encompassing fish resources, ecosystem conditions, fishing technology, and social, economic, and institutional dimensions. All analyses are conducted within the framework of the Ecosystem Approach to Fisheries Management (EAFM) to generate holistic and actionable policy recommendations for stakeholders.

Table 1. Indicators by Domain and Data Collection Methods

Scope and Data Sources	Data Types	Data Collection Methods
1) Fish Resources Domain		
Trap catchability (blue swimming crab)	Primary	Interviews and field observations (sampling)
Carapace width size structure	Primary	Interviews and field observations (sampling)
Exploitation rate	Secondary	Literature review (Ernawati et al., 2014)
Catch composition	Primary	Interviews and field observations (sampling)
Endangered, Threatened, and Protected (ETP) species	Primary	Interviews and field observations (sampling)
Stock range collapse	Primary	Interviews and field observations (sampling)

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Scope and Data Sources	Data Types	Data Collection Methods
2) Habitat and Ecosystem Domain		
Water quality parameters		
Knowledge of BSC distribution and life cycle	Primary	Direct measurement
BSC abundance	Secondary	Literature review (Ernawati et al., 2014)
Seagrass ecosystem status	Primary	Field observation (sampling)
Mangrove ecosystem status	Secondary	Literature review (Ernawati et al., 2014)
Climate change impacts on habitats	Secondary	Literature review (Ernawati et al., 2014)
Water quality parameters	Secondary	Literature review (Ernawati et al., 2014)
3) Fishing Practices Domain		
Destructive/illegal fishing practices	Primary	Interviews and direct observations
Gear modification	Primary	Interviews and direct observations
Fishing capacity and effort	Secondary	Literature review (Ernawati et al., 2014)
Gear selectivity	Secondary	Literature review (Ernawati et al., 2014)
Vessel compliance with legal requirements	Primary	Interviews and direct observations
Crew certification	Primary	Interviews and direct observations
4) Economic Domain		
Asset ownership	Primary	Interviews and field observations
Fisher household income	Primary	Interviews and field observations
Proportion of catch sold (%)	Primary	Interviews and field observations
5) Social Domain		
Stakeholder participation	Primary	Interviews and field observations
Blue swimming crab resource-use conflicts	Primary	Interviews and field observations
Fishers' perceptions and knowledge (management and sustainability)	Primary	Interviews and field observations
6) Institutional Domain		
Compliance with responsible fisheries principles	Primary	Interviews and field observations
Regulatory framework adequacy	Primary	Interviews and field observations
Fisheries management plan (RPP)	Primary	Interviews and field observations
Policy and institutional synergy	Primary	Interviews and field observations
Role of BSC fisheries association	Primary	Interviews and field observations

Scope and Data Sources	Data Types	Data Collection Methods
Role of BSC forums	Primary	Interviews and field observations

(Modified: Nugraheni, 2016)

2.3 Data Analysis

Data analysis was conducted using a Multi-Criteria Analysis (MCA) approach, in which a set of criteria was established to assess regional variations in fisheries management based on the Ecosystem Approach to Fisheries Management (EAFM). A composite index was developed through the following steps:

1) Defining criteria for each indicator within the EAFM domains (habitat, fish resources, socio-economic, and institutional);
2) Assessing the performance of each FMA for each indicator;
3) Assigning scores (n) to each indicator using an ordinal Likert scale (1–3);
4) Determining indicator weights (br) based on ranking;
5) Calculating domain scores (sd) based on cognitive mapping of indicators;
6) Constructing composite indices for each domain in each FMA using the function:
7) $CA_i = f(CA_{ni}; n = 1, 2, 3, \ldots, m)$;
8) Developing an overall composite index for EAFM performance in each FMA using the function:
9) $C\text{-}FMA_i = f(CA_i^y; y = 1, 2, 3, \ldots, z)$, where z represents the number of domains.

In this study, the status of indicators within the habitat domain was determined using a simple scoring approach based on an ordinal Likert scale (1–3). Higher scores indicate better indicator status, reflecting a greater contribution to the achievement of the Ecosystem Approach to Fisheries Management (EAFM) objectives. The index value was calculated using the following formula:

$$\textbf{Index Value} = \textbf{Score Value} \times \textbf{100} \times \textbf{Weight Value}$$

The index values for each indicator were aggregated to obtain a composite index for each domain. The resulting composite index was then classified into five categories and visualized using a flag model.

Table 2. Flag Model Visualization for EAFM Indicators

Score	Composite Index	Flag Model	Description
1.00 – 1.50	1.00 - 39.99		Poor
1.51 – 2.50	40.00 - 59.99		Moderate
2.51 – 3.00	60.00 - 100.00		Good

Source: Adrianto et al. (2014)

III. RESULTS AND DISCUSSION

3.1 Fish Resources Domain

Fisheries management in the Fisheries Management Area of the Republic of Indonesia 712 (FMA RI 712) was evaluated using the Ecosystem Approach to Fisheries Management (EAFM) indicator framework, which integrates six key domains as benchmarks for management performance. These domains encompass fish resources, habitat and ecosystem conditions, fishing practices, as well as social, economic, and institutional dimensions. The application of these indicators is particularly critical in the Java Sea to ensure that fisheries activities not only pursue production targets but also maintain ecological integrity and support the welfare of coastal communities across the eight provinces within the management area.

Table 3. Composite Index Results of Fish Resources Domain Indicators

Indicators	Score
Standardized catch per unit effort (CPUE)	1
Size structure of blue swimming crab	2
Proportion of juvenile blue swimming crab in the catch	2
Species composition	2
Stock range collapse	1
Endangered, Threatened, and Protected (ETP) species	1

The condition of the blue swimming crab population in the Java Sea FMA RI 712 is currently at an alarming level due to excessive fishing pressure (overfishing). Based on catch data, the quantity of blue swimming crab harvested by fishers has declined significantly, accompanied by a contraction in habitat distribution (range collapse). This situation has forced fishers to travel farther and spend more time at sea to obtain relatively lower catches compared to previous years.

In addition to declining abundance, the quality of the catch also indicates symptoms of growth overfishing, as reflected by the decreasing average size of captured blue swimming crab. A substantial proportion of the catch consists of juvenile individuals that have not yet reproduced, thereby hindering natural stock replenishment. This condition is further exacerbated by ecosystem degradation, evidenced by shifts in species composition and the reduced dominance of blue swimming crab in their traditional fishing grounds.

Another critical environmental concern is the increasing risk to endangered, threatened, and protected (ETP) species. Unregulated blue swimming crab fishing activities pose significant threats to vulnerable marine biota in the Java Sea. Therefore, improvements in data collection systems, along with stricter conservation measures, are essential to prevent further ecological degradation and ensure the long-term sustainability of blue swimming crab resources.

3.2 Habitat and Ecosystem Domain

The water quality indicator obtained a score of 2. The distribution of observations indicates considerable variability, with 23% categorized as score 1, 46% as score 2, and 32% as score 3. The predominance of score 2 (46%) suggests that water quality is generally within acceptable limits but approaching a threshold of concern. This condition is likely associated with increasing pollution levels and emerging changes in physicochemical parameters in the northern Java Sea (FMA RI 712).

Ecosystem conditions in FMA RI 712 indicate a high level of vulnerability, particularly in seagrass meadow condition and climate change impact indicators, both of which received the lowest scores (red category). The degradation of seagrass meadows poses a serious threat to their ecological functions as nursery and feeding grounds for marine organisms, including blue swimming crab. In addition, large-scale environmental changes, such as rising sea surface temperatures and altered current patterns, have contributed to ecosystem instability, further exacerbating the vulnerability of fisheries habitats in the Java Sea.

Meanwhile, mangrove ecosystems, coral reefs, and other critical habitats are classified as moderate, with a score of 2 (yellow category). Although these ecosystems continue to provide essential ecological functions—such as coastal protection and spawning habitats—their current status indicates increasing pressure. Anthropogenic activities, including land-use change, pollution, and intensive fishing, are beginning to compromise the resilience of these sensitive ecosystems. Therefore, timely mitigation measures are required to prevent further degradation.

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
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Table 4. Composite Index Results for the Habitat and Ecosystem Domain

Indicators	Score
Water quality	2
Seagrass ecosystem status	1
Mangrove ecosystem status	2
Coral reef ecosystems status	2
Unique or specific habitat	2
Climate change in water and habitat conditions	1

3.3 Fishing Practices Domain

The indicator of destructive or illegal fishing practices refers to the use of fishing gear or methods that damage habitats and undermine resource sustainability, such as the use of explosives, poisons, or prohibited fishing gear. This indicator received a score of 1 (poor). The statistical distribution shows a highly critical condition, with 88% of observations (50 data points) classified under score 1. This indicates that environmentally harmful fishing practices remain dominant and pose a major threat to ecosystem sustainability in the study area.

Indicators related to vessel compliance with regulatory requirements and fishers' adherence to licensing administration (or called SIPI) achieved the highest score (green/good). This reflects a relatively high level of compliance in administrative and legal aspects of fisheries operations. However, fishing gear modification was assessed at a moderate level, suggesting that efforts to improve efficiency have not yet been fully aligned with environmentally sustainable technological standards.

In contrast, operational capacity and human resource competence were classified as poor. Fishing effort has exceeded the natural recovery capacity of fish resources, indicating overfishing, while the selectivity of fishing gear remains low, as evidenced by high levels of bycatch and the capture of juvenile individuals. The most critical condition was observed in crew certification, which received the lowest possible score (100% in the poor category), indicating the absence of formal competency certification. This highlights a substantial gap between administrative compliance and the practical implementation of professional and sustainable fishing practices in the field.

Table 5. Composite Index Results for the Fishing Practices Domain

Indicators	Score
Destructive and/or illegal fishing methods	1
Modification of fishing gear and fishing aids	2
Fishing capacity and efforts	1
Fishing gear selectivity	1
Compliance of vessel function and size with legal requirements	3
Crew certification in accordance with regulatory requirements	1

3.4 Social Domain

An analysis of the social dimension of fisheries management in the study area reveals varying conditions across stakeholder participation, conflict dynamics, and the utilization of local knowledge. Overall, this domain highlights the significant potential of traditional ecological knowledge (TEK), although its effectiveness is constrained by underlying conflicts among

fishers. This assessment is essential for understanding how social dynamics influence the effectiveness of fisheries management and conservation policies in practice.

A more detailed examination of the indicators shows that stakeholder participation achieved a score of 2 (yellow category), indicating that involvement in decision-making processes exists but remains limited and uneven. More critical conditions are observed in the fisheries conflict indicator, which received a score of 1 (red category), reflecting a high frequency of disputes over fishing grounds that remain inadequately resolved. In contrast, the utilization of local knowledge achieved the highest score of 3 (green category), indicating that local wisdom is well recognized and has been effectively integrated into fisheries management practices.

The strong performance of traditional ecological knowledge should serve as a foundation for strengthening other social indicators that remain weak. The red status of fisheries conflicts signals an urgent need for formal mediation mechanisms and the strengthening of governance frameworks to reduce tensions among fishers. Furthermore, enhancing stakeholder participation from a moderate to a more active and inclusive level is expected to support participatory conflict resolution, thereby fostering a more conducive social environment for the long-term sustainability of fisheries ecosystems.

Table 6. Composite Index Results for the Social Domain

Indicators	Score
Stakeholder participation	2
Fisheries-related conflict	1
Use of local knowledge (including TEK) in fisheries management	3

3.5 Economic Domain

An analysis of the economic dimension of fishers in the study area indicates generally low levels of welfare. Overall, this domain is dominated by red-category scores, reflecting the limited capacity of fishing activities to provide adequate and stable financial returns. This economic pressure is closely associated with declining resource conditions, where increasing operational costs are no longer proportional to the income generated from fishing.

A detailed assessment of the indicators shows that asset ownership achieved a score of 2 (yellow category), indicating moderate levels of ownership of productive and household assets among fishers. In contrast, the household income indicator was classified as critical, with a score of 1 (red category), suggesting that income from fishing activities often falls below minimum living standards. This condition is further exacerbated by the savings ratio indicator, which also received a score of 1 (red category), indicating the absence of surplus income that could be saved as financial reserves or future capital, as most earnings are allocated to daily consumption.

This economic vulnerability poses a significant threat to both social and environmental sustainability. Financially constrained fishers are more likely to prioritize short-term gains over environmentally responsible practices. The low scores for income and savings indicators highlight the urgent need for alternative livelihood programs and economic diversification to reduce dependence on increasingly depleted resources. In addition, policy interventions aimed at improving access to capital and stabilizing market prices are essential to enhance fishers' welfare and support a transition toward more sustainable fisheries management.

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
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Table 7. Composite Index Results for the Economic Domain

Indicators	Score
Asset ownership	2
Household income	1
Savings ratio	1

3.6 Institutional Domain

An analysis of the institutional dimension of fisheries management in the study area reveals significant challenges in translating regulatory frameworks into effective implementation on the ground. Overall, this domain is characterized by moderate conditions, with critical weaknesses in policy enforcement and inter-agency coordination. A robust institutional framework is essential as a foundation to support the performance of other domains and to ensure the effective implementation of sustainable fisheries management.

Current governance conditions indicate low compliance with the principles of responsible fisheries, reflected by a score of 1 (poor), with 77% of respondents falling within this category. This suggests that violations of existing regulations remain widespread. The decision-making mechanism indicator achieved a score of 2 (moderate), with 88% of respondents in this category, indicating that formal mechanisms are in place but stakeholder participation—particularly among fishers—remains limited and largely procedural. Similarly, the fisheries management plan indicator also scored 2 (moderate), with a relatively balanced distribution between score 1 (53%) and score 2 (47%), suggesting that management plans developed at the administrative level have not been fully disseminated or adopted by stakeholders in practice.

In contrast, the level of policy and institutional synergy was assessed as poor (score 1), reflecting weak coordination and sectoral fragmentation among agencies, which often results in overlapping programs. Meanwhile, stakeholder capacity was categorized as moderate (score 2), with 67% of respondents in this category, highlighting the need for strengthened technical and managerial competencies.

Table 8. Composite Index Results for the Institutional Domain

Indicators	Score
Compliance with responsible fisheries principles in both formal and informal management frameworks	1
Completeness of regulatory frameworks in fisheries management	2
Decision-making mechanisms	2
Fisheries management plan	2
Level of policy and institutional synergy in fisheries management	1
Stakeholder capacity	2

To address these challenges, capacity-building initiatives should be prioritized to enhance stakeholder knowledge and skills, particularly among fishers and local institutions. Strengthening compliance mechanisms, improving inter-agency coordination, and promoting more inclusive and participatory governance processes are essential to developing a cohesive management system. Such improvements are expected to support the long-term sustainability of fishery resources and ensure more effective institutional performance.

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3.7 Composite Index Assessment of EAFM Domains

The management status of blue swimming crab fisheries in Fisheries Management Area (FMA) 712 was determined by aggregating the average values of all parameters at each sampling location into EAFM indicator scores, with a rating scale ranging from 1 to 3. In addition to indicator-based evaluation, a density analysis was conducted to assess the degree of interconnectivity among attributes within the EAFM domains. The results yielded an average composite value of 1.59. The integration of indicator scores and density analysis provides a comprehensive assessment of domain performance, forming a basis for the formulation of sustainable fisheries management strategies in the region.

Overall, the status of fisheries management in FMA 712 indicates a concerning condition. The aggregate score of 1.59 places the management status in the "low" category (red), suggesting that pressure on fishery resources and the aquatic environment in the Java Sea is high. This highlights the need for immediate and effective management interventions to prevent further degradation.

A domain-level analysis shows that the economic (1.40), fish resources (1.45), and fishing practices (1.45) domains represent the primary areas of concern, all falling within the low category. The low score in the fish resources domain reflects the occurrence of overfishing, where exploitation rates exceed the natural regeneration capacity of the stock. Meanwhile, the low performance in fishing practices indicates the continued use of non-selective or environmentally harmful fishing gear, which not only degrades ecosystem quality but also reduces the economic efficiency of fishing activities.

In contrast, the social (1.90) and habitat and ecosystem (1.75) domains fall within the moderate category (yellow), indicating existing resilience that can still be strengthened. Although the institutional domain remains relatively weak (1.60), improving coordination among stakeholders and strengthening regulatory enforcement are critical to enhancing overall management performance in FMA 712. Therefore, a comprehensive recovery strategy is required, including the regulation of fishing effort (input control), protection of critical habitats, and strengthening of governance systems, in order to restore ecosystem balance and improve the livelihoods of coastal communities.

Table 9. EAFM Domain Indicator Scores

Domain	Score	Description
Fish Resources Domain	1.45	Poor
Habitat and Ecosystem Domain	1.75	Moderate
Fishing Practices Domain	1.45	Poor
Social Domain	1.90	Moderate
Economic Domain	1.40	Poor
Institutional Domain	1.60	Poor
Aggregate	1.59	Poor

3.8 Tactical Decisions and Sustainable Fisheries Management Strategies

Efforts to improve fisheries management in Fisheries Management Area (FMA) 712 are implemented through tactical decision-making based on the availability of empirical field data. In line with the framework proposed by Bentley and Stokes (2014), this approach involves evaluating composite indices across multiple domains to ensure that sustainability principles are upheld. The planning process includes the establishment of clear targets, the definition of reference points, and the development of measurable strategies to achieve management objectives effectively.

Tactical interventions are prioritized for indicators that remain below the EAFM assessment threshold. These actions aim to enhance fisheries performance in FMA 712 by improving indicators from poor to moderate categories, as well as from moderate to good categories. Currently, 22 indicators require targeted intervention, of which eleven are classified as poor and the remainder as moderate. Through these improvements, all indicators are expected to achieve more optimal and sustainable management standards, as detailed in Annexes 1 and 2.

IV. CONCLUSION

The current management status of blue swimming crab fisheries in Fisheries Management Area (FMA) RI 712, as assessed using the Ecosystem Approach to Fisheries Management (EAFM), indicates a generally poor condition, with a composite score of 1.59. This finding reflects significant pressure on fishery resources and highlights the need for immediate management intervention. Among the six EAFM domains, the fish resources, fishing practices, economic, and institutional domains fall below the reference point, indicating critical weaknesses in both ecological and governance aspects. These conditions are largely driven by the continued use of non-selective and environmentally harmful fishing gear, which contributes to resource degradation and declining fishery performance. To address these challenges, a set of strategic management actions is required, including the regulation of minimum legal catch size, implementation of seasonal fishing controls, stricter management of fishing gear and fishing areas, protection and rehabilitation of critical habitats, and the implementation of stock enhancement programs such as restocking. These measures should be supported by strengthened monitoring, control, and surveillance systems to ensure compliance with existing regulations. The results of the EAFM-based assessment provide a valuable foundation for the development of a Fisheries Management Plan (RPP) for blue swimming crab fisheries in FMA RI 712. The recommended actions should be implemented in a phased manner, encompassing short-, medium-, and long-term priorities. Through the integration of ecological, economic, social, and institutional considerations, these strategies are expected to support the transition toward more sustainable fisheries management while improving the livelihoods of coastal communities.

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International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
Vol. 57 No. 2 June 2026, pp. 112-129

Annex 1. Improvement Strategies for Fisheries Management of Blue Swimming Crab in FMA RI 712

INDICATOR	BASELINE	REFERENCES	MANAGEMENT ACTION
Fish Resources Domain			
Standardized catch per unit effort (CPUE)	1 Sharp decline	2 Sightly decreased	Establish a standardized data collection system for the blue swimming crab (Portunus pelagicus) fishery at all landing sites, implemented by trained enumerators or relevant institutions, to monitor fishing effort, catch rates (CPUE), and stock condition in support of sustainable management.
Size trend of blue swimming crab	2 Declining size of blue swimming crab	3 Crab size tends to remain stable	Establishment and dissemination of minimum legal catch size regulations Lm (size at first maturity)
Proportion of juvenile blue swimming crab in the catch	2 (30%- 60%)	3 Harvesting above Lm (size at first maturity)	Awareness programs should be conducted to encourage fishers to target individuals above the size at first maturity (Lm), thereby minimizing the proportion of juveniles in the catch
Species composition	2 The target proportion accounts for 31% of the total volume.	3 Target proportion in accordance with applicable regulations	Strengthening monitoring and control of target-oriented fishing activities and catch outcomes
Stock range collapse	1 Fishing grounds are relatively fixed	2 Fishing ground is relatively near and fix	Regulation of the spacing between Fish Aggregating Devices (FADs) in the waters
Endangered, Threatened, and Protected (ETP) species	1 ETP individuals caught but not released	2 ETP individuals must be released if caught	Educate fishers on ETP species and raise awareness among collectors not to purchase ETP species
Habitat and Ecosystem Domain			

Water quality	2 Polluted category; light turbidity (>5 NTU)	3 Unpolluted; turbidity < 5 NTU	Related to socialization on household waste management (including domestic and hazardous waste)
Seagrass ecosystem status	1 Low seagrass cover with low species diversity	2 High cover (>50%) with high diversity	Seagrass rehabilitation and community awareness on ecosystem importance
Mangrove ecosystem status	2 Medium density (1,000–1,500 trees/ha), moderate diversity, moderate IVI	3 High density (>1,500 trees/ha), high diversity, high IVI	Mangrove rehabilitation and community awareness enhancement
Coral reef ecosystems status	2 Medium coral cover (25%–50%)	3 Good coral cover (>50%)	Prohibition of coral extraction, coral reef rehabilitation through transplantation and coral garden development
Unique or specific habitat	2 Known but not well managed	3 Well identified and well managed	Further studies required on spawning grounds, nursery grounds, and feeding grounds
Climate change in water and habitat conditions	1 Impacts known but without adaptation/mitigation strategies; coral bleaching observed (<5%)	2 Impacts known and accompanied by adaptation and mitigation strategies	Need for studies on climate change impacts and ecosystem adaptation strategies
Fishing Practices Domain			
Destructive and/or illegal fishing methods	1 Violation frequency >5 cases/year	2 Violation frequency <5 cases/year	Capacity building and strengthening surveillance/enforcement
Modification of fishing gear and fishing aids	2 25–50% of catch consists of target species below Lm	3 >50% compliance with target size above Lm	Training on environmentally friendly fishing gear and practices
Fishing capacity and efforts	1	2	Control of fishing effort and

	Fishing fleet size increases annually	Fishing effort controlled through reduction of trips, especially during spawning season	seasonal fishing restrictions
Fishing gear selectivity	1 Low selectivity (>75% non-target/bycatch)	2 Moderate selectivity (50–75%)	Enforcement of gear and fishing ground regulations (Ministerial Regulation No. 71/2016)
Compliance of vessel function and size with legal requirements	3 100% compliance with vessel function, size, and legal documents	3 100% compliance with vessel function, size, and legal documents	Strong compliance facilitated by legal documentation system
Crew certification in accordance with regulatory requirements	1 <50% crew certified	2 50–75% crew certified	Training and certification programs for fishers and crew members
Social Domain			
Stakeholder participation	2 ~50% stakeholder participation	3 up to 100% stakeholder participation	Socialization and capacity-building/training on fisheries management policies
Fisheries-related conflict	1 Conflict occurrence >5 times/year	2 Conflict occurrence <5 times/year	Regular outreach and stakeholder consultation to prevent conflicts
Use of local knowledge (including TEK) in fisheries management	3 Local knowledge exists and is effective	3 Local knowledge exists and is effective	Strengthening local institutions in rights-based fisheries management
Economic Domain			
Asset ownership	2 fixed assets <50%	3 assets increased >50%	Training on maintenance of fisheries-related assets
Household income	1 income < minimum standard	2 income ≥ minimum standard	Expansion of market access and partnerships for fishery products
Savings ratio	1 high dependence on loans/credit (low savings capacity)	2 improved savings capacity with reduced reliance on credit interest loans	Financial literacy training and cooperative-based financial access for fishers

Institutional Domain			
Compliance with responsible fisheries principles	1 Information on violations exists (formal and informal law violations are present)	1 Limited enforcement and incomplete compliance information	Strengthening surveillance and revitalization of community-based monitoring groups
Completeness of fisheries management regulations	2 Regulations exist but are incomplete and weakly enforced	3 Complete regulatory framework with effective enforcement mechanisms	Development of formal rules for conflict resolution and fisheries conservation
Decision-making mechanisms	2 Decision-making mechanisms exist but are not fully effective	3 Standard operating procedures (SOPs) for monitoring, enforcement, and stakeholder coordination are well established	Development of SOPs for enforcement, monitoring, and multi-stakeholder coordination
Fisheries management plan	2 Management plans exist but are not fully implemented	3 Fisheries management plans are fully developed and implemented in accordance with FMA 712 framework	Strengthening implementation of fisheries management plans at the regional level (FMA 712)
Level of policy and institutional synergy in fisheries management	1 Weak institutional synergy with overlapping policies	2 Moderate synergy with improving coordination between institutions	Strengthening inter-agency coordination through formal communication forums (central and regional levels)
Stakeholder capacity	2 Capacity exists but limited effectiveness	3 Effective capacity-building through training, extension services, and participatory approaches	Fisher capacity development through training, extension services, and persuasive engagement approaches

International Journal of Progressive Sciences and Technologies (IJPSAT)
ISSN: 2509-0119.

https://ijpsat.org/
Vol. 57 No. 2 June 2026, pp. 112-129

Annex 2. Aggregate Values of Indicators by Domain

Domain	**Value**			
	Composite Value	Calculation Value	Domain Value	Domain Classification
	(Scale 1-3)	(Scale 8,700)	(Scale 100)	
Fish Resources	1.45	1,957	22.5	Moderate
Habitats & Ecosystems	1.75	3,262	37.5	Moderate
Fishing Practices	1.45	1,957	22.5	Moderate
Social	1.90	3,915	45.0	Moderate
Economy	1.40	1,740	20.0	Poor
Institutional	1.60	2,610	30.0	Moderate
Average Aggregate	1.59	2,573	29.6	Moderate