Recommendations for fisheries management in FMAs number 711 and its relationship with regional fisheries programs in Batam City, Riau Islands Province

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Abstract. Ecosystem approach for Fisheries Management (EAFM) has been initiated by the Ministry of Marine Affairs and Fisheries (MMAF) since 2010. In 2014, there is a recommendation for fisheries management based on EAFM in the Fisheries Management Areas (FMAs) number 711. The relationship between recommendations and fisheries management programs in the regions is the focus of this study. This study aims to examine the relationship between fisheries management programs in Batam City and fisheries management recommendations in FMAs number 711. The research was conducted through a qualitative approach. Data collection was carried out through in-depth interviews with key informants from the Riau Islands Province Marine and Fisheries Department, Batam City and Tanjung Pinang Fisheries Department, MMAF representatif from fish quarantine quality control and safety of fishery products agency (BKIPM) and directorate general of supervision of marine and fishery resources (PSDKP). The data analysis was conducted in a descriptive qualitative. The study show that the fishing domain has a strong relationship between government programs and recommendations for improving capture fisheries management. Meanwhile, the domain of fish resources, habitat and ecosystem domain, social domain, economic domains and institutional domain show a weak relationship. Recommendations for improved management based on the ecosystem approach that have been formulated have not become the basis for developing fisheries management programs by regional management agencies.

1. Introduction
In the last two decades, the sustainable term has become a major issue in implementing development. In principle, the concept of sustainable development is development that integrates ecological, economic and social benefit. The development of the fisheries sector is one of the main sectors in the Indonesian economy, so that management is needed to ensure the sustainability of fishery resources and its people. The main objective of fisheries management is to provide benefits to the community in the future. Fishery management refers to two things, first, ensuring fishery activities provide direct benefits; second, ensure that there is no damage to the environment and fish resources so that the objectives can be achieved [1].

At the global level, fisheries management refers to the Code of Conduct for Responsible Fisheries (CCRF) Food and Agriculture Organization of the United Nations (FAO - PBB), states that fisheries management must guarantee of fish resources in sufficient quantities, quality and availability for...
current and future generations. The main principle is sustainable fisheries management by considering the dynamic interaction between the components of the abiotic and biotic ecosystem as a unitary function and process, utilization and policy formulation. Responsible fisheries management is one of the keys to addressing the challenges of sustainable fisheries development [2]. The application of responsible fisheries is carried out through an ecosystem approach. The ecosystem approach is a regime that has been agreed in the international community in implementing sustainable fisheries development. The ecosystem approach, in capture fisheries is known as the Ecosystem Approach to Fisheries (EAF).

Basic principle to implement EAF included; first, impact to fisheries; second, ecological protection; third, Fishery management tools must be compatible with all types of fisheries; fourth, cautiousness in decision making process and fifth, balance between human needs and fisheries resource capabilities [3]. The EAF framework has been developed for a long time, based on the concept of sustainable development that ensures human well-being and ecosystem health can collaborate [4].

In Indonesia, Ecosystem Approach for Fisheries Management (EAFM) is considered to be a fisheries management option by the government through Ministry of Marine Affairs and Fisheries (MMAF) [5]. Since 2010, EAFM has been adopted through development of indicator and assessment method. The capture fisheries management using EAFM is an alternative management model which is developed in MMAF.

Until 2014, EAFM development has been carried out related to indicators, parameters, methodologies, methods of assessment, pilot projects, developing regulations for implementation and management recommendation. In order to making EAFM operational, there are several step, included: (1) scoping the fishery, identifying the fishery characteristics, area and stakeholder; (2) Identifying the issues in the fishery; (3) Issues identification through risk assessment; (4) setting operational indicators and benchmarks; (5) selecting recommendation actions to meet the objective; and (6) Monitoring, assessment and review process [6]. This study focuses on point 5, whether the selecting management actions or recommendation that have been made are used in fisheries management program planning at the regional level. Studies related to the relationship between fisheries, environment, sustainable development and implementing an ecosystem approach have been widely studied [7,8]. However, studies related to the relationship between scientific-based recommendations and government program policies are rarely conducted.

This study aims to examine the relationship between fisheries management programs in Batam City and fisheries management recommendations in Fisheries Management Areas (FMAs) number 711.

2. Material and Methods

2.1. Research location and time study

The study was conducted in November 2019 at Batam City, Riau Islands Province. Batam City geographically has a very strategic location. Batam City is not only a producer of fishery production, but also as a gateway for fishery production in Indonesia. Total area of Batam City is 426,563.28 Ha, consisting of a land area 108,265 Ha and an area of sea water 318,298 Ha. Batam City covers more than 400 (four hundred) islands. Sea waters in Batam City are part of FMAs number 711.

2.2. Research method

The research method qualitative approach used in this study. In-depth interviews with five informants were used in this study. Informants came from institutions (1) Department of Marine and Fisheries, Riau Islands Province, (2) Batam City Fisheries Service (3) Tanjung Pinang City Fisheries Service, (4) Fish quarantine, quality control and safety of fishery products agency (BKIPM), and (5) Directorate general of monitoring of marine and fishery resources (PSDKP).

2.3. Collecting data method

Primary data collected through qualitative questionnare. The questionare consists of a number of recommendations for fisheries management in each EAFM domain. Assessment of the relationship
between programs and recommendations for management improvement was conducted by scoring from 1 – 3, with the following criteria:

Value 1 : indicates there is no program carried out at the institution.
Value 2 : indicates there is a program, but it is not running effectively,
Value 3 : indicates there is a program, running effectively.

2.4. Data analysis method
Primary data that has been collected is processed and analyzed using descriptive analysis method. Descriptive analysis was used to describe the value of relationship between recommendations for improvement of management and existing programs in the five institutions.

3. Result and Discussion

3.1. Potency of resources, status utilization and assessment result based EAFM in FMA number 711
FMAs number 711 covers Natuna Sea, South China Sea and Karimata Strait. Administratively, there are 7 provincial governments and 29 district governments that have authority and responsibility for fisheries management in FMAs 711. In 2017, the potential for fisheries resources in FMA 711 is 767.126 tons [9]. In general, the status of utilization of fishery resources in FMAs 711 shows over-exploited and fully-exploited of eight types of fish resources. This condition indicated that pressure to fish resources is very high. Since 2015, there have been recommendations to reduce fishing effort for purse seine fishing gear, danish seining (dogol), lobster and crab trap, and boat lift nets [10].

| Type       | Resource (Ton/year) |
|------------|---------------------|
|            | Small Pelagic       |
|            | Big Pelagic         |
|            | Demersal Fish       |
|            | Reef Fish           |
|            | Shrimp              |
|            | Lobster             |
|            | Crab                |
|            | Swimming Crab       |
|            | Squid               |
| Potency    | 330.28              |
|            | 185.85              |
|            | 131.07              |
|            | 20.625              |
|            | 62.342              |
|            | 1.421               |
|            | 2.318               |
|            | 9.711               |
|            | 23.499              |
| TACa       | 264.22              |
|            | 148.68              |
|            | 104.85              |
|            | 16.41               |
|            | 49.873              |
|            | 1.137               |
|            | 1.854               |
|            | 7.769               |
|            | 18.799              |
| Utility    | 1.41                |
|            | 0.93                |
|            | 0.61                |
|            | 1.53                |
|            | 0.53                |
|            | 0.54                |
|            | 1.09                |
|            | 1.18                |
|            | 1.80                |
| Status     | Fully-exploited     |
| utilisation| Fully-exploited     |
|            | Fully-exploited     |
|            | Fully-exploited     |
|            | Over-exploited      |
|            | Over-exploited      |

*a Total allowable catch

EAF at global level was initiated in 2003. Committee on Fisheries (COFI) was stated to adopt EAF framework to implement CCRF and the Convention on Biological Diversity [11]. The EAFM is holistic tools on fisheries management, deals with socio economic implication and ecological consequences [12, 13]. In Indonesia, national instruments also stated relevance to EAF concept, i.e. Law No. 45/ 2009 amending Law No. 31/2004 concerning Fishery, stated that fisheries management conducted to ensure optimizing fish resources and secure human welfare [14]. In 2010, EAFM framework was initiated by MMAF. During the period 2010 to 2014, indicators, parameters, methodology and methods of assessment based on the EAF concept have been formulated. There are six domains and 32 indicators that have been agreed upon in implementing EAF to fisheries management [15, 16]. These six domains include fish resource, ecosystem and ecology, fishing technology, social, economy and institution.

In 2015, an assessment was carried out using indicators in all fishery management areas. The indicator assessment serves to describe the results of the implementation of resource EAFM, which is useful for facilitating the central and local governments in planning sustainable fisheries management.
The assessment uses a value range from 1 to 3 where 1 shows a low value (red), 2 shows a medium value (yellow) and 3 shows a high value (green). The results of the assessment in FMAs 11 are shown in the following table. The evaluation results indicate that the status of ecosystem-based fisheries management in FMAs 711 is medium.

| Table 2. Domain, indicator and assessment result in FMAs 11 using EAFM |
|---------------------------------------------------------------|
| **Domain** | **Indicator code and assessment status** |
| A. Fish Resource | A1 Catch Per Unit Effort (CPUE) | A2 Trend of fish size | A3 Juvenile caught proportion | A4 Species composition caughted | A5 Range of fish resource collapse | A6 ETP\* species |
| | 2.0 | 2.0 | 2.0 | 3.0 | 1.5 | 1.0 |
| B. Ecosystem and Ecology | B1 Water quality | B2 Seagrass status | B3 Mangrove status | B4 Coral reef status | B5 Special habitat | B6 Climate change |
| | 2.7 | 2.0 | 2.0 | 2.0 | 3.0 | 1.5 |
| C. Fishing technology | C1 Illegal & destructive fishing | C2 Fishing gear modification | C3 Fishing capacity & effort | C4 Gear selectivity | C5 Suitability of the function and ship size | C6 Fishing boat crew certificatio |
| | 3.0 | 2.0 | 3.0 | 3.0 | 1.0 | 2.0 |
| D. Social | D1 Stakeholder participation | D2 Fisheries conflict | D3 Local knowledge |
| | 2.0 | 1.0 | 1.0 |
| E. Economy | E1 Asset ownership | E2 Household income | E3 Saving ratio |
| | 2.0 | 1.0 | 1.0 |
| F. Institution | F1. Compliance to responsible fisheries principle | F2 Fisheries management rule | F3 Decision making mechanism | F4 Fisheries management planning | F5 Synergy of policies & institutions | F6 Stakeholder capability |
| | 1.0 | 2.2 | 2.0 | 2.0 | 2.0 | 2.0 |

\* Endangered threatened and protected species

Fish resource domain is classified as good, because the target fish catch is greater than by catch. Meanwhile, the economic domain has the lowest value because fishermen earn below the minimum wage, plus the habit of saving is also low. The ecosystem and ecology domain can be said to be good. In the fishing technology domain, the size of the ship is often not in accordance with the actual conditions. Ship owners manipulate vessel sizes over 30 GT so that permits can be issued in the regions. In the social domain, conflict between local fishermen and foreign fishermen is one of the main problems. In the institution domain, compliance with responsible fisheries is a major problem.

3.2. Management recommendations and regional fisheries program

In implementing EAFM in Indonesia, an expert panel consisting of elements from the government, academia and the community has defined indicators, how to measure them, and provides management recommendations. Based on that, fisheries management plans (recommendation) based area and
species have been develop [15]. Based on the management improvement recommendation document, the strategy that can be used is a combination of conservation strategy and restoration strategy [17]. Technically, management improvement recommendations are made based on indicators in each domain. Ideally, these recommendations require attention not only from central stakeholders but also all stakeholders in the regions.

In this study, BKIPM and PSDKP are representatives of MMAF as the central government in the Batam City. One of the BKIPM's duties is to prevent fish pests and diseases from abroad and from within the country, or their exit from within Indonesia. Batam PSDKP's duties is to supervise marine and fishery resources based on the provisions of statutory regulations. PSDKP plays an important role in maintaining fisheries resources in FMAs 711 because there are many illegal Unreported Unregulated (IUU) activities [18]. Meanwhile, the local governments used as the study are the Riau Islands Provincial Marine and Fisheries Service and Batam City and Tanjung Pinang City Fisheries Services. The city government of Tanjung Pinang, was included in the analysis due to the geographical proximity factor.

Based on the following table, there are 33 recommendations for management improvements in FMA number 711. In general, the value of the relationship between the programs of the four institutions and recommendations for management improvement from the largest to the smallest is respectively provincial government, PSDKP, city government and BKIPM. The average score of the last three institutions is below the value of 2 means that the institution does not have a program related to specific recommendations or has a program related to recommendation but it is not running effectively. Different conditions in the provincial government which has a score of more than 2, means that it has programs related to recommendations that are either running effectively or not effectively. The provincial government is the main factor to implementing the recommendation, because accordance with Law 23/2014 concerning regional government, which states that the provincial government has the authority to manage of marine space below 12 miles.

**Table 3.** Management recommendations and it's relationship to regional fisheries programs in Batam

| Domain                | Management recommendations                                                                 | Value of relationship by institution |
|-----------------------|------------------------------------------------------------------------------------------|--------------------------------------|
| Fish resource         | (1) Maintaining number of vessel and fishing effort; (2) Maintaining of gear mesh size; (3) Socialization to fishery business actors; (4) Determination of the minimum size of the main target fish; (5) Socialization of protected fish species | BKIPM: 1.5  PSDKP: 2.1  Provincial government: 2.2  City government: 1.4 |
| Habitat and ecology   | (1) Coral reef transplantation and monitoring of destructive activities in conservation areas; (2) Research on climate change impact; (3) Control of household and industrial waste in coastal areas assessment | BKIPM: 1.0  PSDKP: 2.0  Provincial government: 2.0  City government: 1.7 |
| Fishing technology    | (1) Enforcement and control of destructive fishing in the Spermonde Islands; (2) Socialization of legal documents to fishermen, one-stop licensing, information technology applications; (3) Simplification of ankapin and atkapin certification, socialization of seafarers' | BKIPM: 1.0  PSDKP: 1.9  Provincial government: 1.9  City government: 1.3 |
certificates; (4) Increase the selectivity of fishing gear; (5) Fishing gear modification is allowed as long as it does not damage the ecosystem.

| Social                  | 1.4 | 1.7 | 2.3 | 2.0 |
|-------------------------|-----|-----|-----|-----|
| (1) law enforcement to prevent conflicts of people who use destructive fishing gear; (2) trying to stop community conflict; (3) Activating supervision based group community; (4) Involving stakeholders in decision making; (5) socialization of fisheries management policies; (6) building local consensus on ecosystem management and prohibition of fishing during the spawning season; (7) formation of a communication forum |

| Economy                 | 1.0 | 1.0 | 2.4 | 2.4 |
|-------------------------|-----|-----|-----|-----|
| (1) Provide cheap gasoline; (2) development of alternative livelihoods; (3) special training for women; (4) Socialization saving habit; (5) Savings system through cutting auction fisheries |

| Institutional           | 1.3 | 2.0 | 2.2 | 1.6 |
|-------------------------|-----|-----|-----|-----|
| (1) Law enforcement against violations in the fisheries sector; (2) enhance the role of community supervision; (3) regular meetings between the government and fishing communities; (4) Strengthening the capacity of stakeholders; (5) Designing a communication forum between stakeholders; (6) Monitoring implementation of Standard operation procedure; (7) formulate policies based on local rules; (8) Replication of local rules |

| Average value           | 1.2 | 1.8 | 2.2 | 1.7 |
|-------------------------|-----|-----|-----|-----|
| The low value of program relationships and recommendations can be seen in several ways. (1) Management improvement recommendation documents are not the main reference in laws and regulations. This means that local governments have no obligation to make programs in accordance with recommendations. (2) The recommendations made are basically general recommendations based on the main issues and problems in FMAs 711. The recommendations have not considered issues and problems in specific locations. In other words, fisheries issues and problems in Batam City cannot be resolved through these recommendations (3) there is no socialization related to these recommendations at the local government level. (4) Ecosystem approach for fisheries management involving all relevant stakeholder is neither cheap. This approach is very costly for its implementation. Unfortunately, the MMAF as an institution promoting EAFM implementation does not have sustainable financial resources that can be used for fisheries management programs in the regions. Inadequate institutional incentives to excessive monitoring cost, have plagued to these approach [19]. |

| a Fish Quarantine and Quality Development Agency (BKIPM) representative, MMAF |
| b Marine and Fishery Resources Supervision (PSDKP) representative, MMAF |
| c Department of Marine and Fisheries, Riau Islands Province |
| d Department of Fisheries, Tanjung Pinang and Batam City |
The table also shows that the relationship between the program and the recommendations in each domain is also different. The domain of fishery resources has a greater linkage between recommendations and programs than other domains. This occurs because resource-based management has become the main streaming of fisheries management in Indonesia. Meanwhile, the domain of fish resources, habitat and ecosystem domains, social domains, economic domains, and institutional domains show a low connection.

4. Conclusion

Fishery resources in FMAs 711 have great potential, but the status of their utilization has been over-exploited and fully-exploited. Ecosystem-based fisheries management is one of the instruments in improving the condition of existing fishery resources. However, recommendations for improved management based on the ecosystem approach that have been formulated have not become the basis for developing fisheries management programs by regional management agencies.

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