Utilization of fish resources in the Indonesia’s Exclusive Economic Zone within the Fishery Management Area of 573: Case study in Rote Ndao Regency

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Abstract. The United Nations Convention on the Law of the Sea (UNCLOS 1982) affirms that the government has sovereign rights, jurisdiction, and obligations in Indonesia's EEZ. Indonesia has an interest in protecting sovereign rights and increasing state revenues in the waters of the Exclusive Economic Zone (EEZ). That sovereign right is to use fishery resources responsibly for the benefit of the nation and society as a whole. The sole purpose of this qualitative research is to optimize fisheries utilization in the Rote Ndao Regency whose waters include the Fisheries Management Area of 573 (FMA-573) in the EEZ. The analysis had been carried out with a case study approach and then descriptively elaborated. The results showed that: 1) the use of fisheries in FMA-573 was carried out by traditional fishermen (using vessels ≤10 Gross Tonnage/GT) and fishermen using vessels >29 GT; 2) supervision is still needed for the improvement of ships and human resources; 3) there are still violations of territorial waters by traditional Indonesian fishermen. The policy recommendations that must be carried out by the government are: 1) encouraging local fishermen to catch fish in the FMA-573 area by providing stimulus for ships and fishing gear; 2) allocate budget to purchase a new fleet of ships and add supervisors; 3) increase the number of fishery instructors to foster and socialize the boundaries of Indonesia’s EEZ with Australia.

1. Introduction

Indonesia is a country that has great strategic marine and fishery resources potential. Indonesia is geographically located at the heart of world economic growth and cannot be separated from the dynamics of globalization. The dynamics of globalization that occur today have made Indonesia determined to carry out transformation and economic growth to achieve the vision of a developed and prosperous country. High and sustainable economic growth is a must for sustainable development and prosperity. The greatest empowerment of fish resources is obtained from the waters of the Exclusive Economic Zone (EEZ) of Indonesia. It is estimated that 90% of the commercial fish catch is carried out in the EEZ [1].
The exclusive economic zone may not exceed 200 nautical miles measured from the baseline of the territorial sea breadth [2]. The authority to manage fishery resources in the EEZ region by Indonesia is bound by the provisions of the United Nations Convention on the Law of the Sea 1982 (UNCLOS 1982) and Law of the Republic of Indonesia Number 5/1983 on the Exclusive Economic Zone of Indonesia (LRI No. 5/1983). UNCLOS 1982 and LRI No. 5/1983, have a passion for realizing sustainable fisheries management. The protection of the marine environment that causes damage to fish resources has become an international concern [3]. Each country that has an EEZ is required to determine the total allowable catch for each fish species and estimate its fishing capacity.

The country is obliged to give access to other countries, especially neighboring countries and landlock states to the allowed surplus catch. Such access must be provided by the conservation efforts stipulated by the regulations of the EEZ owner country. UNCLOS 1982 gave impetus to ratifiers to obtain economic benefits from the resources in the waters of the state as their territory [4]. Indonesia has eleven fishing area authorities and one of them is the Fisheries Management Area of 573 (FMA-573). FMA-573 covers the Indian Ocean south of Java to the south of Nusa Tenggara, the Sawu Sea, and the West Timor Sea [5]. WPP-573 is dominated by large pelagic fish, while other resources are shrimp and demersal fish, the majority of which are in coastal waters.

Indonesia as the largest archipelagic country has tropical water ecosystems with high dynamic characteristics of fish resources. The high dynamics of fish resources is an integral part of tropical ecosystem complexities. In this context, fisheries management that aims to provide socio-economic benefits for the community becomes an inseparable unit as the dynamics of the fish resource ecosystem in FMA-573. Based on this, this study aims to examine the optimization of fisheries utilization in the EEZ area which became FMA-573 in Rote Ndao Regency.

2. Data and Methods
This research was conducted in 2020 with loci in Rote Ndao Regency. These loci were chosen because they represent the FMA-573 and fisheries-based regional development business. Primary data is focused on extracting information from people who have knowledge of FMA-573 in the Indonesian EEZ waters and fisheries management in the Rote Ndao Regency. Secondary data sources are obtained from written information (online news) and scientific research that supports answering the objectives of the study. Data collection techniques are carried out through:

In-depth interviews using the data topic were conducted to: 1) the head of the Department of Marine Affairs and Fisheries of Rote Ndao Regency; 2) secretary of the Marine and Fisheries Service of Kupang Province; 3) the head of Surveillance for Marine and Fisheries Resources-Ministry of Marine Affairs and Fisheries (MMAF), Kupang Province; 4) the extension worker of Rote Ndao Regency; 5) cross border fishermen of Rote Ndao Regency; 6) the chief of fisher’s cooperative of Rote Ndao Regency.

2.1. Focus Group Discussion (FGD)
FGD participants involved: 1) Artha Wacana University lecturer of Kupang Province; 2) the head of Surveillance for Marine and Fisheries Resources-MMAF, Kupang Province; 3) representative of the Department of Marine Affairs and Fisheries of Kupang Province; 4) representative of the Indonesian Fisher’s Association of Kupang Province; 5) cross border fishermen of Rote Ndao Regency.

2.2. Literature review
The literature review is a survey of books, scientific articles, and other sources relevant to a specific issue, area of study, or theory, which in doing so can provide a description, summary, and critical evaluation of these works concerning them with research problems that are being carried out.

The analysis of this research is discussed qualitatively with a case study approach and is described comprehensively to understand fishing activities in Rote Ndao District and WPP-573. The purpose of selecting this analytical method is to explain the current phenomenon of fisheries management in Rote Ndao Regency which is located in the waters of WPP-573 in the Indonesian EEZ.
3. Results and Discussions

3.1. Fisheries Utilization Activities in Rote Ndao Regency

Rote Ndao Regency is located in the province of East Nusa Tenggara and at the southern end of the territory of the Unitary State of the Republic of Indonesia (divided into 10 sub-districts, 112 villages, and 7 urban villages). The boundaries of this district are to the north: Sawu Sea, south: Indian Ocean, west: Sawu Sea, and east: Timor Sea. Rote Ndao Regency has a marine area of 376 km², with a total coastline length of approximately 330 km and a width of 7.2 km. The potential for sustainable capture of fish reaches 17,875 tons/year, while only 30-40% is used per year [6].

Utilization of management rights in wider water areas can lead to reduced fish resources, especially for small-scale fisheries. [7]. The head of the Department of Marine Affairs and Fisheries of Rote Ndao Regency, revealed that the supporting factors for fishery potential are still quite large, namely the level of industrial and household pollution is still low and the use of fishing gear is still simple. The structure of the fishing fleet is still dominated by traditional fleets, fishing organizations are still ineffective and limited sources of funds for fishing operations (interview, 28/08/2020). Small-scale capture fisheries are defined based on the characteristics of capture fisheries, technical attributes of fishing vessels, and socio-economic attributes of fishermen [8]. The type and number of fleets and fishing gear used by fishermen in the Rote Ndao Regency, are presented in Table 1. Table 1, explains that fisheries management in the waters of FMA-573 in the Indonesian EEZ cannot be separated from the social context and local wisdom of a community. This is because the development process is closely related to the life cycle of the community which is expressed in their culture, social, and economy.

Table 1. Type, Number of Fleet, and Fishing Equipment for Fishermen in Rote Ndao Regency [6]

| Fleet          | Number of Unit |
|----------------|----------------|
| Jukung         | 1.555          |
| Boat without engine | 122         |
| Motorboat      | 246            |
| Ketinting      | 383            |
| Sailboat       | 59             |
| Catching Tools |                |
| Liftnet vessel | 12 unit        |
| Liftnet        | 4 unit         |
| Hand fishing   | 407 unit       |
| Basic longline | 77 unit        |
| Gillnet        | 1.799 piece    |
| Scatter nets   | 897 unit       |
| Purseine       | 49 unit        |
| Fishing rod    | 203 unit       |

Table 2. Number of Fishermen in Rote Ndao Regency [6]

| Districts        | Full | Sideline Main | Sideline Additional | Total  |
|------------------|------|---------------|---------------------|--------|
| Southwest Rote   | 312  | 14            | 43                  | 369    |
| Northwest Rote   | 438  | 29            | 7                   | 474    |
| Lobalain         | 397  | 45            | 25                  | 467    |
| Central Rote     | 24   | 5             | 5                   | 34     |
| South Rote       | 15   | 5             | 5                   | 25     |
| Pantai Baru      | 198  | 13            | 27                  | 238    |
| East Rote        | 372  | 87            | 24                  | 483    |
| Landu Leko       | 285  | 51            | 14                  | 350    |
| West Rote        | 55   | 27            | 14                  | 96     |
| Ndao Nuse        | 339  | 44            | 72                  | 455    |
| **Total**        | 2435 | 320           | 236                 | 2991   |
The number of residents who make a living as fishermen in Rote Ndao Regency by district, can be seen in Table 2. Based on Table 2, it is known that fisheries management is carried out rationally and efficiently, in order to realize the welfare of fishermen who are professional, advanced, and independent. The sustainability of fishery products is highly dependent on the fishing method, location, and targeted species [9]. Management of fisheries to meet social, economic, and ecological goals is a fundamental strategy for achieving sustainable development goals [10].

### 3.2. Fishery Utilization of Rote Ndao Regency in FMA-573 in EEZ Waters

#### 3.2.1. Traditional Fisherman (Using ≤10 GT Boat)
Traditional fishermen in the subject of small-scale fisheries are considered important because they play a role in increasing the availability of food nutrients from fish for local, national, and international markets. Traditional fishermen are people who do fishing to meet their daily needs, both those who do not use fishing vessels and those who use fishing vessels with a maximum size of 10 Gross Tonnage/GT [11]. Secretary of the Marine and Fisheries Service of Kupang Province, said that traditional fishermen in Rote Ndao District searched for fish up to the EEZ waters (interview, 25/08/2020).

Indonesian fishermen enter Australian waters to catch sharks, reef fish, sea cucumbers, and trochus destined for the Asian market [12]. Fishing operations by taking a long and difficult journey to get these commodities are carried out by traditional Indonesian fishermen because their economic value is very profitable [13]. Cross border fishermen of Rote Ndao Regency revealed that the income obtained by selling the catch per trip to catch sharks is around 50 million rupiahs, while for sea cucumbers it is around 150 million rupiahs. Catching operations for sea cucumbers are carried out manually/taking by diving using diving goggles without a compressor. The fishing season for sea cucumbers is April-June and August-October (the average length per trip is 21 days), while the fishing season for sharks is September-January (interview, 26/08/2020).

The implementation of fishing rights carried out by Indonesian traditional fishermen has been enshrined in the 1982 UNCLOS Convention. The Indonesian and Australian governments have also accommodated the interests of these traditional fishermen in a memorandum of understanding, namely a Memorandum of Understanding between the Government of Australia and the Government of the Republic of Indonesia on Operation of Indonesian Traditional Fishermen in the area of the Australian Exclusive Fishing Zone and Continental Shelf, 1974 (MoU Box) [14].

#### 3.2.2. Fishermen Using Vessel >29 GT
The success of implementing and utilizing technology to access marine resources, can be used as a means of managing fisheries properly. An important step in fisheries management is to classify fishing vessels based on their technical capacity, strength, reach and impact. This can improve management for environmental, social, and economic objectives [16]. The abundant potential in the waters of the FMA-573 EEZ, must be utilized optimally and supported by a large fleet of ships. The types and numbers of vessels and fishing gear operated in FMA-573, are listed in Table 3.

| Catching Tools                  | Size of Vessel |
|--------------------------------|---------------|
|                                | 30-60 GT      | 60-100 GT | > 100 GT |
| Boating net                    | 1             | -         | -        |
| Pole and line                  | 1             | -         | -        |
| Liong bun net                  | 1             | -         | -        |
| Handline                       | 8             | 5         | -        |
| Large pelagic purseine with one ship | 6     | 52        | 388      |
| Set longline                   | 3             | -         | -        |
| Drifting longline              | 50            | 34        | 13       |
| **Total**                      | **70**        | **91**    | **401**  |

Table 3. Fleet of Ships and Fishing Gear on FMA-573 [17]
Table 3, explains that the main catch commodities of fishermen who use large vessels are Tuna. Tuna is one of the pillars of the Indonesian economy which has a very prospective development trend. Tuna in Indonesia is the country's most important fishery sector in terms of income [18].

The number of ships operating in the EEZ area in FMA-573 causes the utilization of fish resources to be quite high as well. Conditions of Tuna resources in the FMA 573 have already been fully exploited [19]. Fishery utilization in the waters of WPP-573 is currently categorized as overexploited [20]. Indonesia currently has limited capacity to manage Tuna fisheries operationally. Fishing control policy by Indonesia vessels must be carried out as an effort for economy increasing and fish resources sustainability [21]. Fishery production in FMA-573 is one of the important foreign exchange earners for the country which has a significant export value.

3.3. Overview of Fishery Management in the Waters of FMA-573 in EEZ

Supervision of the Indonesian EEZ in the waters of FMA-573 is carried out through surveillance vessels, the Vessel Monitoring System (VMS), and community monitoring groups (formulation results of the FGD in Kupang Province, 31/10/2020). Involving the community in the surveillance system is one solution to managing fisheries in a sustainable manner [22]. The size of the area that must be handled and the lack of infrastructure and facilities, have caused the activities of the security forces so far not to be carried out optimally. Based on this, to realize optimal and sustainable use in the waters of FMA-573 it is necessary to monitor fish resources and their environment which are managed with a measurable system.

The extension worker of Rote Ndao Regency, said the case of illegal refugees entering Australian territory using fishing boats that departed from Indonesia had previously become a concern for both countries. The issue of illegal refugees is now considered illegal fishing by the Australian side (interview, 27/08/2020). The chief of fisher’s cooperative in Rote Ndao Regency, said that the fishermen who cross the border actually know the rules and boundaries of Australian waters (interview, 26/08/2020). Dissemination of information and cooperation between local governments and fishermen, can reduce the occurrence of violations [23].

The head of Surveillance for Marine and Fisheries Resources-MMAF Kupang Province, revealed that knowledge about territorial boundaries was actually obtained from Australian supervisors through the provision of boundary maps and ship radio broadcasts (interview, 31/08/2020). The current description of fisheries management at WPP-573 in Indonesia's EEZ includes: 1) there are still few local fishermen operating; 2) large fishing operational costs; 3) local fishermen with small boats cannot operate far (limited fuel and food). The obstacle to fisheries management for fishermen with 10 GT boats in Rote Ndao Regency is the lack of fishery instructors. The constrains experienced by fishermen who use vessels >29 GT in the waters of WPP-573, are the large costs for operations to the fishing ground and the catch quota for Tuna species currently exceeds the limit.

The main objective of fisheries management is to maintain the socio-ecological system in a healthy and resilient state, including maintaining the capacity of fishing communities in a sustainable manner [24]. The political interests that surround the management of fisheries in FMA-573 in the EEZ waters must be able to be used wisely by the government as a form of national power. Devolution and decision on the use of fisheries to local fishermen can be an effective alternative approach for better fisheries management [25]. This is intended to emphasize that Indonesia is an archipelagic country that is advanced, prosperous, and sustainable in placing the management of marine and fisheries potentials for the prosperity of the people.

4. Conclusion

Fisheries management in the waters of FMA-573 in the EEZ must be managed properly by the government to take advantage of it optimally. This management requires the support of business actors, the community, law enforcement officers, and parties who have a central role in fisheries. The aim is to create integrated management of fisheries sustainably. The policy that must be carried out by the government in order to improve the management of fisheries utilization in FMA-573 in EEZ area, is by
providing fishing vessels size over 10 GT and fishing gear for fishermen in Rote Ndao Regency. The provision of assistance for vessels and fishing gear, must be accompanied by ways of managing and using them so that the assistance provided can be useful and can improve the economy of traditional fishermen. Budget allocations to increase the fleet and human resources must also be made to improve the monitoring system. The addition of a fleet of surveillance vessels suitable for the water characteristics of the FMA-573 should be considered. Guidance and socialization of territorial water boundaries can be done by increasing the number of fishery instructors. This is intended to prevent cases of catching Indonesian fishermen for violating territorial boundaries by the Australian side.

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References
[1] Steenis J V 2002 Pirate as Poachers: International Fisheries Law and the Bluefin Tuna (Colombus-Ohio: Capital University Law Review)
[2] United Nation Convention on the Law of the Sea 1982
[3] Loja M H 2014 Who Owns the Oil that Traverses a Boundary on the Continental Shelf in an Enclosed Sea? Seeking Answers in Natural Law through Grotius and Selden Leiden Journal of International Law 27 893-911
[4] Prerna R and Pandey D K 2018 The Shades of Grey Over Blue: a Maritime Delimitation Dogma Journal of Ocean dan Coastal Management 158 93-102
[5] Regulation of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia Number 18/Permen-KP/2014 on Fisheries Management Areas of the Republic of Indonesia
[6] Rote Ndao Regency Government 2019 Region Profile Rotendaokab
[7] Halim A, Loneragan N R, Wiriyawan B, Fujita R, Adhuri D S, Hordyk A R and Sondita F A 2020 Transforming Traditional Management into Contemporary Territorial-Based Fisheries Management Rights For Small-Scale Fisheries in Indonesia Journal of Marine Policy 116 103923
[8] Halim A, Wiriyawan B, Loneragan N R, Hordyk A, Sondita M F A, White A T, Koeshendrajana S, Ruchimat T, Pomeroy R S and Yuni C 2019 Developing a Functional Definition of Small-Scale Fisheries in Support of Marine Capture Fisheries Management in Indonesia Journal of Marine Policy 100 238-248
[9] West C D, Hobbs E, Croft S A, Green J M H, Schmidt S Y and Wood R 2019 Improving Consumption Based Accounting for Global Capture Fisheries Journal of Cleaner Production 212 1396-1408
[10] Wang Y, Hu J, Pan H and Failler P 2020 Ecosystem-Based Fisheries Management in the Pearl River Delta: Applying a Computable General Equilibrium Mode Journal of Marine Policy 112 103784
[11] Law of the Republic of Indonesia Number 7/2016 On Protection and Empowerment of Fishermen, Fish Cultivators, and Salt Farmers
[12] Vince J 2007 Policy Responses to IUU Fishing in Northern Australian Waters Journal of Ocean dan Coastal Management 50 683-698
[13] Prescott J, Riwu J, Prasetyo A P and Stacey N 2017 The Money Side of Livelihoods: Economics of an Unregulated Small-Scale Indonesian Sea Cucumber Fishery in the Timor Sea Journal of Marine Policy 89 197-205
[14] Minarro S, Forero GN, Reuter H and Putten I E V 2016 The Role of Patron-client Relations on the Fishing Behaviour of Artisanal Fishermen in the Spermonde Archipelago (Indonesia) Journal of Marine Policy 69 73-83
[15] Minas S 2018 Marine Technology Transfer under a BBNJ Treaty: A Case for Transnational Network Cooperation American Journal International Law 112 144-149
[16] Prestelo L, Oliveira R and Vianna M 2019 A New Proposal to Classify Small Fishing Vessels to Improve Tropical Estuarine Fishery Management *Journal of Fisheries Research* **211** 100-110

[17] Directorate General of Capture Fisheries 2020 Vessel Licensing Data in the Exclusive Economic Zone (Jakarta: Directorate General of Capture Fisheries-Ministry of Marine Affairs and Fisheries)

[18] Khan M A, Mill A C, Gray T S, Jiang M, Arief H, Brown A, Karman A, Polunin N V C 2020 Reliability of the Data on Tuna Catches Obtained from the Dockside in Indonesia: a Study of Stakeholders’ Perceptions *Journal of Marine Policy* **122** 104242

[19] Nurani T W, Wahyuningrum P I, Wisudo S H, Gigentika S and Arhatin R E 2018 Model Designs of Indonesian Tuna Fishery Management in the Indian Ocean (FMA 573) Using Soft System Methodology Approach *The Egyptian Journal of Aquatic Research* **44** 139-144

[20] Decree of the Minister of Maritime Affairs and Fisheries of the Republic of Indonesia Number 50/Kepmen-KP/2017 on Potential Estimation, Permitted Catch Amount, and Level of Utilization of Fish Resources in Fisheries Management Areas of the Republic of Indonesia

[21] Satria F, Sadiyah L, Widodo A A, Wilcox C, Ford J H and Hardesty B D 2018 Characterizing Transhipment at-Sea Activities by Longline and Purse Seine Fisheries in Response to Recent Policy Changes in Indonesia *Journal of Marine Policy* **95** 8-13

[22] Quynh C N T, Hailu A, Schilizzi S and Iftekhar S Fisher 2018 Participation in Monitoring: Does it Help Reduce Excessive Investment in Fishing Capacity? *Journal of Fisheries Research* **206** 138-149

[23] Chapsos I, Koning J and Noortmann M 2019 Involving Local Fishing Communities in Policy Making: Addressing Illegal Fishing in Indonesia *Journal of Marine Policy* **109** 103708

[24] Tam J, Chan K M A, Satterfield T, Singh G G and Gelcich S 2018 Gone Fishing? Intergenerational Cultural Shifts can Undermine Common Property Co-managed Fisheries *Journal of Marine Policy* **90** 1-5

[25] Domondon P R, Tirona R S, Box S, and Pomeroy R 2021 Pathways to Establishing managed Access and Networks of Reserves *Journal of Marine Policy* **109** 104580