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Mitigating Destructive Fishing through the Optimization of Community-Based Coastal Surveillance as an Effort to Safeguard Maritime Security

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A B S T R A C T

This study aims to enhance coastal community involvement in marine surveillance to prevent such practices, focusing on issue identification, analysis, and strategy development for sustainable maritime security. Through a qualitative approach and literature review, the research examines community participation in marine resource surveillance, identifies challenges and opportunities, and suggests ways to optimize coastal community surveillance. Findings emphasize the importance of community-based surveillance in combating destructive fishing. A participatory framework that integrates communities into surveillance, decision-making, and implementation of sustainable marine management marks a shift from top-down to inclusive bottom-up models, recognizing local knowledge as vital. The study concludes that optimizing community-based coastal surveillance is crucial for addressing destructive fishing and supporting sustainable maritime security in Indonesia, recommending further research to explore its implementation across various regions and socio-economic conditions.

INTRODUCTION

Indonesia, as the world's largest archipelagic country, offers abundant and significant marine and fisheries resources crucial for economic growth and national development. The extensive maritime area, covering approximately 6.4 million km², includes territorial waters, archipelagic waters, and the Exclusive Economic Zone, which play a vital role in supporting the livelihoods and well-being of its population (Dao, 2023; Saefudin, 2023). However, this vast potential is accompanied by complex challenges, notably destructive fishing practices that threaten the sustainability of marine ecosystems and national sovereignty. These practices, including the use of explosives, cyanide, and electrofishing, cause significant damage to marine habitats and reduce biodiversity, such as vital coral reefs that maintain the balance of marine ecosystems (Abdurrahim, 2022), while also inflicting economic harm on local communities (Albasri & Sammut, 2021; Oktivana, 2023). Furthermore, the prevalence of destructive fishing highlights gaps in policy implementation and enforcement by relevant institutions, indicating an urgent need for more comprehensive and participatory approaches to effectively address this issue. In the context of Indonesia's maritime security, destructive fishing is a multifaceted problem that not only degrades marine ecosystems but also leads to significant economic losses and threatens national sovereignty.

Community involvement in the surveillance and mitigation of destructive fishing activities, although strategic, faces significant challenges such as lack of awareness, limited access to training and resources, and ineffective coordination mechanisms between communities and regulatory agencies (Albasri & Sammut, 2021; Ramenzoni, 2021). Therefore, this study focuses on identifying and analyzing the existing issues in combating destructive fishing through community-based coastal surveillance, aiming to develop more effective and sustainable strategies for safeguarding Indonesia's maritime security.

This research aims to optimize coastal community involvement in marine surveillance to prevent destructive fishing. Through a qualitative approach and literature review, the study examines community participation in marine and fisheries resource surveillance, identifies challenges and opportunities, and formulates efforts to enhance the capacity of coastal community surveillance. Strengthening the role of coastal communities in marine resource conservation is expected to contribute to maritime security and sustainable marine management in Indonesia. The study proposes a participatory framework that integrates communities into the surveillance, decision-making, and implementation of sustainable marine management strategies. This approach marks a shift from top-down to more inclusive bottom-up models, recognizing local knowledge as a key asset. The innovation of this research lies in actively integrating communities as primary overseers, addressing resource pressures and surveillance challenges. Empowering communities is expected to form an adaptive and resilient marine management system. The findings not only contribute to academic literature but also provide practical insights for policymakers, practitioners, and coastal communities, supporting the sustainability of marine resources and maritime security.

LITERATURE REVIEW

Maritime Security Theory

This theory is based on Buerger's (2015) view of three main aspects in examining the concept of maritime security. First is the maritime security matrix, which serves to identify and analyze various potential threats and vulnerabilities that may affect maritime security. The second is the "securitization" framework, which helps to understand how certain threats and issues are perceived as security concerns and how the international community responds to them. Third is the theory of security practices, which focuses on understanding actions taken in the context of maritime security and their influence on existing maritime security practices. This approach provides a framework for understanding and responding to maritime security challenges. The use of these theories allows this research to examine and identify threats to the sustainability of marine resources as maritime security threats, as well as examine countermeasures to these threats through community-based optimization in coastal areas.

Optimization Theory

The basic definition of optimization is the best, the highest, the most profitable, making the best, making the highest, optimization process, way, act of optimization (making the best, the highest, and so on). Optimization is the result achieved in the desired way, so optimization is about achieving the expected results effectively and efficiently. According to Liringoringo (2015), optimization is the process of finding the best solution. Optimization is also widely interpreted as a measure by which all needs can be met from the activities performed. According to Winardi (2015), optimization is a measure that causes the achievement of goals. In general, optimization is the search for the best available value from several functions given in a context. The use of this theory is to examine the optimization of the role of coastal communities in conducting surveillance in the context of overcoming destructive fishing as a threat to maritime security.

METHODOLOGY

This study employs a qualitative approach to gain an in-depth understanding of community-based coastal surveillance in the context of combating destructive fishing and strengthening maritime security. According to Sugiono (2017), "qualitative research methods are based on post-positivist philosophy, meaning they are used to study natural objects where the researcher is the key instrument, with data collection techniques carried out in triangulation (combination), and data analysis is inductive, emphasizing meaning rather than generalization." This research design is exploratory and descriptive, aimed at uncovering and describing the dynamics, perceptions, and practices of community-based coastal surveillance in addressing destructive fishing.

The study utilizes text analysis from various secondary data sources to build a comprehensive understanding of community participation in surveillance activities and how it contributes to maritime security efforts. Data collection involves a literature review of selected scholarly journal articles, research reports, policy documents, and publications from relevant

organizations. These sources are chosen based on their relevance and contribution to the research theme. In collecting and analyzing data, the study adopts content analysis methods to identify key themes, patterns, and insights emerging from the secondary data. Furthermore, the research seeks to validate findings through source and perspective triangulation, comparing data from various sources to enhance the reliability and validity of the findings. This approach allows the study to provide evidence-based and practical recommendations to support policies and practices in marine and fisheries resource surveillance, as well as broader maritime security.

RESULT AND DISCUSSION

Destructive Fishing as a Maritime Security Threat

One of the factors contributing to the depletion of marine fisheries resources is the use of destructive fishing gear. The use of environmentally unfriendly fishing gear is essentially illegal fishing. The use of cyanide fishing, the use of bombs (dynamite fishing), electrofishing, and other non-selective fishing gear has threatened the sustainability of marine biological resources due to the damage to marine biota habitats and the death of fish resources (Asri et al., 2019; Ernawati, 2023). According to FAO, destructive fishing is a term that refers to the use of fishing gear in such a way or in such places that one or more key components of an ecosystem are eliminated, destroyed, or can no longer provide important ecosystem functions (Willer et al., 2022).

Cases of destructive fishing in Indonesia reflect a serious problem affecting marine ecosystems and the sustainability of marine resources. For the period of 2013 to 2019, the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia, in cooperation with related agencies, has handled at least 653 (six hundred and fifty-three) cases of destructive fishing in various water areas in Indonesia. Based on data from the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia, fishing activities using explosives occur in almost all provinces in Indonesia, but the most vulnerable conditions occur in South Sulawesi, East Nusa Tenggara, West Nusa Tenggara, Southeast Sulawesi and Gorontalo. Meanwhile, fish poisoning activities are rampant in South Sulawesi, East Nusa Tenggara, West Sumatra, Gorontalo and Riau Islands. Meanwhile, fish shocking activities are mostly carried out in lakes or river estuaries in South Kalimantan, West Java, Lampung, and West Kalimantan.

Table 1. Detection and Handling of Destructive Fishing Cases in Indonesia in 2013-2019

No.	Province	Destructive fishing				Total
		Dynamite fishing	Cyanide fishing	Electro fishing	Other Destructive Fishing Gear	
1	South Sulawesi	451	19	0	1	471
2	South Kalimantan	0	0	57	0	57
3	Lampung	19	1	7	3	30

4	East Nusa Tenggara	14	4	0	0	18
5	Gorontalo	8	3	0	1	12
6	Southeast Sulawesi	8	1	1	0	10
7	West Nusa Tenggara	8	1	1	0	10
8	West Sumatra	3	4	1	0	8
9	West Java	0	0	8	0	8
10	Riau Islands	3	2	0	0	5
11	North Sumatera	4	0	1	0	5
12	North Sulawesi	2	1	0	0	3
13	Central Sulawesi	2	1	0	0	3
14	Papua	3	0	0	0	3
15	West Kalimantan	0	1	2	0	3
16	East Kalimantan	2	0	0	0	2
17	East Java	1	0	0	1	2
18	South Sumatera	0	0	0	1	1
19	Maluku	1	0	0	0	1
20	Bali	0	1	0	0	1
Total		**529**	**39**	**78**	**7**	**653**

Source: Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia (Processed by the author)

Destructive fishing causes significant damage to marine habitats, reduces biodiversity, and threatens the economic sustainability of coastal communities dependent on fishing. Damage to coral reefs from fish bombs can reach 0.5 - 2 meters per 1 kg bomb, according to the World Bank and other studies. In addition to the physical damage, the use of poisons in fishing has more severe effects, especially on ornamental fish that require more intensive stunning, affecting more parts of the coral body and the surrounding ecosystem. A specific case study is the damage in Malang district, where approximately 75% of the coral reefs were damaged by bomb fishing (Tempo, 2014). In addition, in the Sawu Sea National Park in East Nusa Tenggara, 990,000 hectares of coral reefs were severely damaged by the use of fish bombs and potassium cyanide (Kompas, 2014).

Maritime security is a state in which the maritime environment is protected from threats that can interfere with territorial sovereignty and law enforcement, both nationally and internationally. The aim is to ensure the realization of Indonesia's national interests. Buerger (2020) and Li (2023) stated that this threat is in the form of threats of violence, threats to marine resources and the environment, threats of lawlessness, and threats to navigation hazards. Given the complex and dynamic nature of threats at sea, maritime security refers to Buerger's (2015) view of three main aspects in examining the concept of maritime security. First is the maritime security matrix, which plays a role in identifying and analyzing the various potential threats and vulnerabilities that

may affect maritime security. The second is the "securitization" framework, which helps to understand how certain threats and issues are perceived as security concerns and how the international community responds to them. Third is the theory of security practices, which focuses on understanding the actions taken in the context of maritime security and their influence on existing maritime security practices. This approach provides a framework for understanding and responding to maritime security challenges.

In this context, maritime security is not only about protecting against physical threats, but also about maintaining the sustainability of marine natural resources (Pratson, 2023). Maritime security threats are rooted in lawless acts that negatively impact marine ecosystems and the people who depend on them (Gatto et al., 2023). Maritime security threats are generally problems that often occur in marine waters. Destructive fishing activities pose a significant threat to maritime security, affecting the blue economy, maritime power, and environmental resilience (Apriantara et al., 2023; Bila et al., 2023). The impacts of these practices are not only economically detrimental, but also result in massive environmental degradation, food security, affect marine food chains, and reduce biodiversity (Rizky et al., 2023). In addition, declining fish populations have a direct impact on local economies by increasing the operational costs of fishing and potentially leading to poverty among fishers. As a result, destructive fishing is recognized as one of the major forms of illegal fishing and is under the spotlight due to its huge losses to economies, ecosystems, resource sustainability, and even national security.

Factors Contributing to Destructive Fishing

Destructive fishing practices in Indonesia, typically carried out by small-scale coastal fishermen, are driven by a complex interplay of interrelated factors. Poverty and urgent economic needs often compel small-scale fishermen to adopt harmful fishing methods. These methods, seen as shortcuts to achieving larger catches in a shorter time, become a choice due to the economic pressures faced. This poverty is exacerbated by the low educational levels among fishermen, contributing to a lack of awareness regarding the long-term impacts of these practices on marine ecosystems and fishery resources. Additionally, limitations in the oversight of marine resources by government institutions result in uncontrolled and widespread destructive fishing activities.

Referring to studies by Nurdin & Grydehøj (2014), Asri et al. (2019), and Hampton-Smith et al. (2021), as well as interviews conducted with several fishermen, the authors summarize the factors contributing to destructive fishing, detailed in the table below.

Table 2. Factors Contributing to Destructive Fishing By Coastal Fishermen

No.	Contributing Factors	Issues
1.	Easy Access to Fish Bomb and Cyanide Materials;	The presence of trade in destructive fishing materials without proper oversight;
2.	Poverty and Low Education Levels Among Fishermen;	Restricted access to education in small island coastal regions coupled with low income levels among fishermen;
3.	Insufficient Oversight and Law Enforcement by Government Institutions;	The lack of adequate personnel, facilities, infrastructure, and budget for effective marine and fisheries resource oversight;
4.	Increasing Market Demand for Consumable Fish;	Insufficient fisheries extension services, habitual destructive fishing practices among fishermen, and the desire to quickly increase income;
5.	Fishermen's Perception that Destructive Fishing is an Efficient Method;	The lack of access to financing for fishermen to improve their operations and the absence of uniform compensation for price increases;
6.	High Operational Costs: The rise in fuel prices and the reliance on traditional fishing infrastructure significantly increase operational costs;	A lack of education and outreach regarding the conservation of natural resources;
7.	Low Public Awareness of Marine Resource Conservation;	Insufficient Education and Outreach on Natural Resource Conservation;
8.	Limited Alternative Livelihood Options in Remote Coastal Areas.	Reliance Solely on Marine Resources as an Economic Source

Source: Processed by the author

The case study conducted in this research, based on the data collected, demonstrates that substantial economic losses and sustained environmental degradation are direct results of destructive fishing. This practice, which constitutes a legal violation, highlights significant challenges in law enforcement and effective supervision. It underscores the urgent need for inclusive and participatory mitigation strategies that actively involve coastal communities in monitoring and conservation efforts. The vulnerability of coastal communities and fishermen, who heavily rely on marine resources, to destructive fishing practices emphasizes the importance of concrete measures to halt these activities. Such strategies must not only be reactive but also include preventive approaches that foster awareness and empower small-scale fishermen.

Optimizing Community-Based Coastal Monitoring

Optimizing community-based coastal monitoring plays a crucial role in safeguarding Indonesia's maritime security. The national legal framework, highlighted by Law No. 31 of 2004 as amended by Law No. 45 of 2009 on Fisheries, and Law No. 27 of 2007 on the Management of Coastal Areas and Small Islands, emphasizes the importance of active community participation in the supervision and management of marine resources and coastal areas. The implementation of this monitoring is manifested through the formation of Community Surveillance Groups (Pokmaswas), comprising various community elements including community leaders, religious figures, traditional leaders, NGOs, and fishermen. However, Law No. 23 of 2014 on Regional Government, which shifted monitoring responsibilities from districts/municipalities to provinces, has created new challenges in monitoring effectiveness. This is due to the expanded monitoring areas without proportional increases in necessary resources.

This study finds that community-based coastal monitoring can play a significant role in combating destructive fishing. Coastal communities, with their knowledge and close relationship with the sea, are in a prime position to detect and report destructive fishing practices. Community monitoring initiatives, when supported by training, adequate resources, and good cooperation with government agencies, have the potential to enhance monitoring effectiveness and compliance with fishing regulations. This directly contributes to maritime security and the sustainability of marine resources. This research supports Prasetyo et al. (2023), who emphasize the importance of integrating coastal communities into marine resource monitoring strategies and highlight the need for a more holistic approach to marine resource management, focusing not only on technical and regulatory aspects but also on community empowerment and active participation.

Optimization, according to Liringoringo (2015), is the process of finding the best solution. In the context of community-based surveillance, optimization refers to achieving the most effective and efficient surveillance outcomes. Winardi (2015) adds that optimization is a measure that leads to the attainment of goals, namely maritime security and the preservation of marine ecosystems. Therefore, community-based coastal surveillance must be optimized to achieve these objectives in the most effective and efficient manner. Based on this analysis, as a key supporting aspect in combating destructive fishing, efforts to optimize the strategic role of community-based coastal surveillance in addressing this practice and its efforts to maintain maritime security can be implemented through:

A. Empowerment of Coastal Communities

Empowerment of coastal communities is a fundamental pillar in optimizing the role of community-based monitoring against destructive fishing (Nurmianto, 2023). Empowerment initiatives should be designed to enhance the community's ability to identify, analyze, and address issues related to destructive fishing and marine resource management more effectively. This approach involves increasing the capacity of individuals and groups to act proactively in the management and conservation of marine resources. The

empowerment process must be inclusive and participatory, ensuring that all community members, including vulnerable and marginalized groups, have equal opportunities to participate and benefit from monitoring activities. Thus, in line with Prasetyo et al. (2023), community empowerment not only strengthens the community's capacity in marine resource monitoring but also fosters a sense of ownership and collective responsibility for the sustainability of the marine environment. This can be achieved through the increased formation of community surveillance groups, particularly in coastal and small island areas that are not reached by official monitoring institutions, and fostering active community involvement in these groups. Additionally, the use of technology, such as mobile applications or online reporting systems, can facilitate the reporting and monitoring process, providing ease for Pokmaswas in collecting data and information in real-time.

b. Integration of Local Knowledge and Wisdom

In optimizing the strategic role of community-based coastal monitoring in the context of addressing destructive fishing, the integration of local knowledge and wisdom is an essential component that cannot be overlooked. According to Ullah et al. (2023), local knowledge, accumulated over generations through direct experience with the marine environment, provides deep insights into marine ecosystems, including fish migration patterns, spawning seasons, and sustainable fishing areas. Integrating this knowledge into monitoring strategies not only enhances the effectiveness of detecting and preventing destructive fishing practices but also strengthens the sovereignty of marine resource management by valuing and utilizing local wisdom. As noted by Church et al. (2023), involving coastal communities in monitoring based on local knowledge promotes the strengthening of community capacity in managing their own resources, ensuring sustainable and equitable marine resource management. Therefore, integrating local knowledge into formal monitoring systems requires a collaborative approach between coastal communities, scientists, and policymakers, ensuring that monitoring and conservation policies are grounded in a comprehensive ecological understanding and are sensitive to local socio-cultural contexts.

c. Enhancement of Coordination and Cooperation

Enhancing coordination and cooperation among various stakeholders is critical in optimizing community-based coastal monitoring to address the issue of destructive fishing. A multidisciplinary approach involving the government, coastal communities, research institutions, and non-governmental organizations is imperative in developing and implementing effective monitoring strategies (Church et al., 2023; Druon et al., 2023). This cooperation enables the smooth flow of information, knowledge exchange, and efficient resource allocation, collectively enhancing the capacity and scope of monitoring activities. Good coordination facilitates the implementation of evidence-based policies and regulations tailored to local conditions and community needs while ensuring consistency with national and international marine resource conservation goals. Moreover, inter-

agency cooperation can enhance advocacy and support for conservation initiatives, strengthen law enforcement actions against violations, and promote sustainable marine resource management practices. Thus, enhancing coordination and cooperation not only strengthens monitoring effectiveness but also builds consensus and shared commitment towards the sustainability of marine and fisheries resources.

d. Advocacy and Outreach

Advocacy and outreach play crucial roles in strengthening community-based coastal monitoring efforts to combat destructive fishing, with the primary goal of increasing awareness and understanding among the broader community, especially coastal communities, about the negative consequences of destructive fishing practices and the importance of marine resource conservation. Structured and strategic advocacy campaigns should be designed to convey evidence-based information on the ecological, economic, and social impacts of destructive fishing, and to promote alternative sustainable marine resource management practices (Lanni, 2023). Additionally, effective outreach involves the use of various communication media, including community meetings, mass media, and digital platforms, to reach a wide and diverse audience. In this context, environmental education targeting schools and other educational institutions can be a vital means of building a future generation that is aware of and committed to marine conservation (Buana & Barlian, 2023). The active participation of community leaders, marine practitioners, and scientists is also crucial in delivering advocacy messages, providing real-life examples, and best practices in marine resource management and monitoring. Through comprehensive advocacy and outreach, coastal communities and the broader public can be equipped with the knowledge and motivation to support marine and fisheries resource conservation efforts, thereby strengthening the foundation of community-based monitoring and their contribution to sustainable maritime security.

Community-Based Coastal Monitoring Analysis

In the context of common resource management theories and community participation, the formulation of strategic optimization efforts underscores that community-based coastal monitoring is not only complementary but essential for effective surveillance strategies. Institutional and collective action theories have long discussed the importance of involving local stakeholders in natural resource management (Yuhandra et al., 2023). This study enriches that discourse by showing how coastal communities, with their local knowledge and strong environmental ties, can be powerful agents of change in combating destructive fishing. Furthermore, these findings illustrate the concept of "human security" within the framework of maritime security. According to Evans et al. (2023), the sustainability of marine resources and the livelihoods of coastal communities are interconnected and inseparable. Thus, this study not only validates but also extends our theoretical understanding of marine resource monitoring, emphasizing the need for more inclusive and participatory approaches.

The results indicate that, despite surveillance efforts by the government and international bodies, significant success in combating destructive fishing heavily relies on active participation and collaboration from coastal communities. This differs from the more top-down approaches commonly found in literature, which tend to emphasize law enforcement and sanctions. This study offers a new perspective on existing theories of marine resource management and conservation, particularly in the context of addressing destructive fishing. Based on the reviews and analyses conducted, this study asserts that empowering coastal communities through the optimization of community-based monitoring can be an effective strategy for combating destructive fishing. This aligns with the theory proposed by Nikijuluw (2002), which emphasizes the importance of community involvement in the monitoring and conservation of marine resources. Additionally, this study adds new insights regarding the importance of supporting infrastructure and institutional capacity in supporting community-based monitoring. Challenges such as the transfer of surveillance authority from local governments to the provincial level, as noted by Bailey & Sumaila (2015), highlight the need for better coordination among various levels of government and communities in marine resource monitoring.

This effort underscores the importance of a holistic approach in maritime security theory that integrates social, economic, and environmental aspects. Empowering coastal communities through community-based monitoring, as demonstrated in this study, is an effective strategy that contributes to the human security aspect of maritime security theory. This is in line with Bueger's (2015) perspective, which emphasizes that maritime security encompasses various dimensions including naval power, maritime safety, blue economy, and human security. By emphasizing the role of communities in marine resource monitoring, the findings of this study support the view that maritime security can be strengthened through the active involvement of local stakeholders, including coastal communities, in marine resource conservation efforts.

Therefore, optimizing community-based coastal monitoring is a strategic effort that should be pursued by local governments to combat destructive fishing. This effort requires synergy between the government, communities, and related institutions to build an effective surveillance system that can not only address destructive fishing practices but also support the sustainability of Indonesia's marine and fisheries resources. This indirectly enhances food security, reduces resource use conflicts, and strengthens the nation's sovereignty over its waters. Maintaining maritime security supports the socio-economic stability of coastal communities and ensures the sustainability of marine ecosystems for future generations.

CONCLUSIONS AND RECOMMENDATIONS

This research comprehensively highlights the significance of coastal community empowerment in strengthening marine resource stewardship to address destructive fishing practices, which substantially threaten the sustainability of Indonesia's maritime ecosystem and maritime security. By adopting a bottom-up approach that recognizes and integrates local knowledge as an important asset, this study offers new insights into more inclusive and sustainable marine resource management. The research findings show that a participatory framework, which actively involves coastal communities in decision-making and monitoring processes, not only improves the effectiveness of efforts to tackle destructive fishing but also supports the long-term sustainability of Indonesia's marine resources and maritime security.

Recommendations include the need for greater support from government and relevant agencies for coastal community monitoring capacity, improved inter-agency coordination, and broader advocacy and socialization of the impacts of destructive fishing and the importance of sustainable marine resource management. Further research is needed to test the effectiveness of this approach across different regional and socio-economic contexts in Indonesia, to enrich academic understanding and policy practice in support of marine resource sustainability and maritime security. This research makes a significant contribution to the literature in maritime security and marine resource management, highlighting the importance of community-oriented and participatory approaches.

ADVANCED RESEARCH

Still conducting further research to find out more about Mitigating Destructive Fishing through the Optimization of Community-Based Coastal Surveillance as an Effort to Safeguard Maritime Security

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