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The potential for developing a sustainable fishing sector in Sukamara

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ABSTRACT

This research explores the potential of a sustainable fisheries sector in Sukamara Regency, Central Kalimantan, which is rich in fisheries resources, both freshwater and marine. This study identified the potential for freshwater fish production of 10,000 tons annually and marine fish of 8,000 tons yearly, with superior species such as snakehead fish, baung, catfish, snapper, grouper, and tuna. Although the fishing sector has an essential role in the local economy, unsustainable fishing practices have led to overfishing, environmental degradation, infrastructure problems, and limited technological knowledge. This research emphasizes the importance of sustainable fisheries practices through ecosystem-based management, the use of environmentally friendly technology, and education and training programs to increase the capacity of fishermen. The economic impact shows an increase in the average income of fishermen by 25%, while the social impact includes an increase in the welfare of coastal communities by 20%. Environmental impacts include the restoration of mangrove and coral reef ecosystems with increased area and cover of live coral. The main challenges include overfishing, environmental degradation, lack of infrastructure, and limited technological knowledge. Proposed strategies to overcome these challenges include strengthening policies and regulations, improving infrastructure, education and training, multi-stakeholder collaboration, and research and development. By implementing this strategy, the potential of the sustainable fisheries sector in Sukamara can be optimized, providing significant economic, social, and environmental benefits and becoming a model for other regions in sustainable natural resource management.

Keywords: sustainable fisheries, Sukamara, fisheries potential, ecosystem, environmentally friendly, fisherman

I. INTRODUCTION

The fishing sector plays a significant role in the economic development of coastal communities, such as Sukamara Regency in Central Kalimantan. Due to its abundant aquatic resources, Sukamara has substantial potential for developing a sustainable fisheries industry. Sustainable fisheries encompass not only the augmentation of fish output but also the preservation of ecological equilibrium and the guarantee of the perpetuity of fish resources for forthcoming generations (Van Dyke et al., 2020).

Nevertheless, the fisheries industry in Sukamara encounters many obstacles, including excessive fishing, the utilization of harmful fishing equipment, and the deterioration of aquatic environments. Based on statistics from the Sukamara District Fisheries Service, the yearly fish

production exhibits notable volatility, primarily attributed to unsustainable fishing methods. Hence, this study aims to ascertain the capacity for establishing sustainable fisheries in Sukamara and offer suggestions for the advancement of this industry.

Sukamara Regency, situated in Central Kalimantan, possesses substantial fisheries potential due to its proximity to abundant fish supplies in nearby waterways. Fisheries play a significant role in the local economy as a primary economic sector, providing employment for numerous fishermen and fish farmers and supporting the fish processing industry in the region (Warren & Steenbergen, 2021). According to data from the Sukamara Regency Fisheries Service, the fisheries industry significantly contributes to the Gross Regional Domestic Product (GRDP) of Sukamara Regency. However, there is still room for improvement in increasing the contribution of this sector by implementing more sustainable techniques.

Although the fisheries sector in Sukamara possesses significant potential, it encounters various obstacles that impede its progress toward achieving sustainability. Overfishing, also known as excessive fishing, poses a substantial danger to the long-term viability of fish populations in this region. Utilizing harmful fishing gear is a significant issue that can lead to the deterioration of aquatic environments and a substantial decline in fish populations (Gilman et al., 2023). Furthermore, water contamination by both household and industrial waste exerts additional strain on water quality, potentially diminishing the productivity of fish resources and the overall well-being of aquatic ecosystems (AbuQamar et al., 2024).

Sustainable fisheries encompass a comprehensive approach to managing fisheries resources, considering economic, ecological, and social dimensions (Elliott et al., 2020). Adopting sustainable fisheries methods is crucial for preserving fish resources, the local economy's long-term viability, and the coastal people's well-being (Monteiro & de Noronha, 2020). By employing a technique grounded on scientific principles and guided by sustainability principles, the aim is for the fisheries industry in Sukamara to yield long-term advantages for future generations sustainably.

This research is crucial for gaining a more profound comprehension of the potential of fisheries resources in Sukamara and the obstacles encountered in establishing a sustainable fisheries industry. This research aims to use the obtained results as a foundation for developing more efficient policies in fisheries management. Additionally, it seeks to enhance public understanding of the significance of sustainable fisheries practices and offer strategic suggestions for stakeholders to actively engage in conserving fisheries resources in this region.

II. LITERATURE REVIEW

Sustainable fisheries refer to the deliberate management of fisheries resources to satisfy present demands while safeguarding the capacity of future generations to fulfill their own requirements (Gogoi et al., 2020). This notion encompasses three primary pillars: ecological sustainability, economic sustainability, and social sustainability (Gomes Silva et al., 2022). The fundamental tenets of sustainable fisheries as follows (Arreguín-Sánchez, 2022):

1. Ecosystem-based management considers the interplay between fish species and the aquatic ecosystem.
2. Precautionary Approach: Implementing suitable conservation measures even without comprehensive scientific data.
3. Community Engagement: Engage fishermen and local communities in making decisions.

The Ministry of Maritime Affairs and Fisheries identifies overfishing, the utilization of damaging fishing equipment, water pollution, and climate change as the primary obstacles to achieving sustainable fisheries management in Indonesia (Hutajulu et al., 2024). The Food and

Agriculture Organization (FAO) in 2010 proposed several methods to promote fisheries' sustainable development. These initiatives include:

1. Enhancing Regulations: Rigorous enforcement of laws to combat harmful fishing activities.
2. Promote the adoption of fishing equipment that is ecologically harmless to foster the development of environmentally friendly technology.
3. Education and Training: Deliver comprehensive training programs to fishermen, focusing on implementing sustainable fishing techniques.

Sustainable fisheries refers to a method of managing fisheries resources to satisfy present demands while safeguarding future generations' ability to fulfill their own requirements (Chen & Zhou, 2020). This idea highlights the significance of preserving the equilibrium of aquatic ecosystems while considering the social and economic factors involved in managing fishery resources. Sustainable fisheries require the application of scientifically derived management measures, including establishing fishing quotas, determining minimum catch sizes, and creating marine conservation zones (Hilborn et al., 2022). This strategy is specifically formulated to maintain equilibrium and enhance the productivity of fish populations in the long run while limiting any detrimental effects on the aquatic ecosystem.

III. METHODS

This study employs a descriptive qualitative methodology, with case studies as the primary framework. This strategy was selected based on its pertinence in acquiring a comprehensive comprehension of the capacity of fisheries resources and the obstacles encountered in establishing sustainable fisheries in the Sukamara region. The study was conducted in Sukamara Regency, located in Central Kalimantan. The selection of this district was based on its abundant fisheries resources and crucial role in fisheries management in Central Kalimantan. This study focuses on the Fisheries Service and local government, responsible for formulating fisheries management plans and enforcing rules. The employed methodologies for data collecting include:

1. They conducted comprehensive interviews with fishermen, fisheries entrepreneurs, local governments, and representatives from non-governmental organizations. This interview aims to get their perspectives on the potential of fishery resources, the obstacles they encounter, and their thoughts on potential remedies.
2. Participatory observation entails researchers actively engaging in the everyday activities of fishermen to gain a first-hand understanding of fishing techniques and assess the state of infrastructure and fishing facilities in Sukamara.
3. Document Study: Analyzing authoritative documents, including fisheries data reports, government regulations about fisheries, and literature about the sustainability of fishing in Central Kalimantan.

IV. RESULTS AND DISCUSSION

Potential Fisheries Resources in Sukamara

Sukamara Regency boasts diverse freshwater and marine fish species with significant commercial worth. The fish species mentioned are tilapia, catfish, mackerel, and snapper. According to data provided by the Sukamara Regency Fisheries Service, the annual fish production in this area, including freshwater and marine species, amounts to 2,000 tons. Sukamara Regency boasts a diverse ecosystem teeming with many freshwater and marine fish species. According to the Sukamara Maritime Affairs and Fisheries Service (2023), the freshwater fish production potential in Sukamara is estimated to be 10,000 tons annually. The primary

species contributing to this output include snakehead fish, baung fish, and catfish. The projected marine fisheries production is approximately 8,000 tons annually, primarily consisting of snapper, grouper, and tuna. Regarding the Featured Species data:

1. The annual production of Snakehead Fish (Channa striata) is approximately 3,000 tons.
2. The Baung Fish (Hemibagrus nemurus) has an annual yield of approximately 2,500 tons.
3. The annual production of Patin fish (Pangasius hypophthalmus) is approximately 4,500 tons.
4. The annual production of Snapper (Lutjanus sp.) is approximately 3,000 tons.
5. The annual production of Grouper (Epinephelus sp.) is approximately 2,000 tons.
6. The annual production of Tunafish (Euthynnus affinis) is approximately 3,000 tons.

Capture Infrastructure & Technology

In Sukamara, fishermen predominantly employ conventional fishing equipment, such as nets and fishing rods. Additionally, several fishermen have adopted contemporary fishing equipment like traps and fish traps, which are seen as more ecologically sustainable. Sukamara Regency possesses commendable infrastructure and amenities to facilitate the fisheries sector, encompassing a fish port, fish auction site, and fish processing unit. The local government has also offered aid in the form of watercraft and fishing gear to enhance the productivity of local fishermen.

Sustainable Fishing Practices

The research has identified sustainable fisheries practices, which are:

1. Ecosystem-Based Resource Management involves safeguarding crucial ecosystems, such as mangrove forests and coral reefs (Sunkur et al., 2023). Research conducted by WWF Indonesia in 2023 has demonstrated that applying this strategy in several regions of Indonesia has resulted in a significant 40% improvement in the sustainability of fish stocks.
2. Implementation of Environmentally Sustainable Technology: Using fishing equipment that minimizes environmental harm, such as gill nets and hand lines, and adopting efficient fish farming techniques like bio floc and aquaponic systems (Lakra & Krishnani, 2022). According to a report conducted by the Sukamara Fisheries Service in 2023, the utilization of this technology has the potential to enhance output by as much as 30%.
3. Education and Training: Enhancing the proficiency of fishermen and fish producers by implementing sustainable training initiatives (Nauen & Arraes Treffner, 2022). According to data from the NGO Pesisir Mandiri, this training program can enhance fishermen's understanding and proficiency in sustainable fishing techniques by as much as 60%. Illustrative Training Program:
    a) Training in Fisheries Resource Management: Provides instruction on the principles of ecosystem-based management.
    b) Training in Fish Cultivation Technology: Provides instruction on utilizing bio floc and aquaponic systems.
    c) Training on Fishery Product Marketing and Processing: Enhancing the value of fishery goods by diversifying the range of products.

Economic, Social and Environmental Impact

1. Financial Consequences
   The use of sustainable practices in the fisheries sector has the potential to enhance the financial earnings of both fishermen and fish growers (March & Failler, 2022). According to the data obtained from BPS Sukamara in 2023, adopting sustainable fishing practices leads

to a 25% rise in the average income of fishermen compared to those who continue to rely on conventional tactics. In addition, the diversification of fisheries goods, such as the production of processed fish products, can generate additional value and create new market prospects. Some examples of processed fish goods are fish nuggets, floss, and crackers.

2. Societal Influence
   They are enhancing the well-being of coastal communities by augmenting their income and facilitating their access to natural resources. Education and training initiatives additionally improve the quality of life for coastal communities (Elwell et al., 2020). According to a survey conducted by the Pesisir Sejahtera Foundation in 2023, the welfare of communities participating in sustainable fishing initiatives has experienced a 20% increase.
3. Ecological Consequences
   Conserving aquatic environments by implementing sustainable fishing methods ensures the preservation of biodiversity and the ecosystem's overall health (Ahmed et al., 2022). A study by the Sukamara Environmental Agency in 2023 reveals that the size of protected mangrove forest areas has grown by 15%. Additionally, repaired coral reefs have displayed notable signs of recovery within a two-year timeframe. The Mangrove Forest Ecosystem Rehabilitation Data area has grown from 500 hectares to 575 hectares. In addition, there was a rise in the proportion of live coral on coral reefs, increasing from 30% to 45%.

Challenges and Problems

1. Overfishing: According to the Sukamara Maritime Affairs and Fisheries Service (2023) study, the employment of excessive fishing methods has led to a 25% decrease in fish populations over the past 5 years. This reduction is worsened by the utilization of fishing equipment that is not ecologically sustainable, such as trawls that devastate the habitat on the seabed.
2. Environmental Degradation: According to the Sukamara Environmental Agency's data from 2023, around 30% of mangrove forests and 20% of coral reefs in this region have suffered harm from human activities, specifically illegal logging and mining.
3. Insufficient Infrastructure: The fishing infrastructure in Sukamara is currently inadequate. Based on a report conducted by the Sukamara Fisheries Service in 2023, approximately 15% of the catch cannot be effectively marketed due to insufficient fish processing and storage facilities.
4. Insufficient Knowledge and technologies: Numerous traditional fishermen lack the necessary understanding and means to employ sustainable fishing technologies.

According to a poll conducted by the Pesisir Sejahtera Foundation in 2022, around 70% of fishermen continue to employ traditional and less effective fishing techniques.

Sustainable Fisheries Sector Development Strategy

1. Enhancing rules and Regulations: The government should formulate rules and regulations that promote sustainable fishing methods, such as restricting harmful fishing equipment and safeguarding vital habitats. Enhanced surveillance and enforcement measures are crucial in mitigating overfishing and minimizing environmental deterioration (Cochrane, 2021).
2. Enhanced Infrastructure: Allocating resources towards sufficient fisheries infrastructure, such as fish processing and storage facilities, will enable fishermen to promote and sell their products more effectively. It is essential to consider the growth of both local and

international markets to enhance the value of fishery products (Arthur et al., 2022).

3. Education and Training: Continuous education and training programs are vital for fishermen and fish farmers. Enhancing their ability to employ eco-friendly technology and sustainable fishing practices will bolster the productivity and sustainability of the fisheries sector (Andersen et al., 2014).
4. Enhanced multi-stakeholder engagement: It is imperative to foster more collaboration among government, civil society, academia, and the commercial sector. This collaboration will facilitate the creation of efficient plans and the execution of comprehensive sustainable fisheries initiatives (Horan, 2022).
5. Research and Development: Additional investigation is required to oversee and assess the execution of sustainable fishing methods to guarantee their long-term viability. Promoting the advancement of new technology and innovation in crops and fishery management is imperative (Penca et al., 2021).

V. CONCLUSION

The Sukamara Regency possesses significant potential for establishing a sustainable fishing industry that can yield economic, social, and environmental advantages. The keys to achieving sustainability in fisheries resources lie in implementing ecosystem-based management, adopting environmentally friendly technologies, and enhancing the capacity of fishermen. Government support and coordination with several stakeholders are essential to actualize this potential.

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