



Sustainable Traditional Fishing: Ecological Principles in the Use of *Tali Kor* Fishing Gear in Watubela Waters, Maluku-Indonesia

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ABSTRACT

Tali Kor is a traditional fishing gear based on local wisdom and designed with ecological principles, including species selectivity, fishing efficiency, and minimal impact on marine habitats. This study employed a qualitative approach through in-depth interviews, focus group discussions (FGDs), field observations, and document analysis. The results indicated that *Tali Kor* supports sustainable traditional fisheries by maintaining marine ecosystem balance and reducing bycatch. The gear does not damage benthic habitats such as coral reefs and seagrass beds, which are crucial for fish life cycles. By applying ecological principles, *Tali Kor* contributes to fish stock sustainability and the preservation of coastal ecosystems. Additionally, this study found that *Tali Kor*-based traditional fishing positively impacts the socioeconomic resilience of fishing communities by ensuring the long-term availability of fishery resources. The adoption of this gear by local fishers demonstrates an ecological adaptation relevant to sustainable fisheries management. This research concluded that *Tali Kor* not only preserves traditional fishing practices that align with marine ecology but also serves as an environmentally friendly fisheries model in Indonesia. These findings align with the Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water), by promoting responsible fisheries and marine conservation, and SDG 8 (Decent Work and Economic Growth) by enhancing the livelihoods and resilience of coastal fishing communities.

INTRODUCTION

Traditional fisheries play an important role in food security and the well-being of coastal communities, especially in archipelagos such as Watubela. The fishing system used by local fishermen generally relies on methods that have been inherited from generation to generation and are adapted to the conditions of the local aquatic ecosystem. One of the fishing tools that is still widely used is *Tali Kor*, an environmentally friendly fishing tool that prioritizes the principle of sustainability in the use of fish resources

(Pauly *et al.*, 2020). *Tali Kor* not only reflects fisheries practices that are adaptive to aquatic ecological dynamics but also shows how local knowledge can contribute to sustainable fisheries management.

In the global context, sustainable fisheries are a major issue in marine resource management. Overfishing and habitat destruction have threatened the sustainability of marine ecosystems and fish populations in various parts of the world (FAO, 2022). Therefore, fisheries practices that take into account ecological balance are becoming increasingly important. *Tali Kor* as a traditional fishing tool has characteristics that support the concept of sustainability, such as the selectivity of target species and the lack of impact on benthic ecosystems. Studies on fishing gear that maintains ecosystem balance are still limited, so this research contributes to further understanding of sustainable fishing gear alternatives in tropical waters.

The state of the art in fishing gear research has evolved from a conventional approach to an ecology-based approach. Previous studies have highlighted the destructive impact of modern fishing gear such as trawls and tiger trawls on seabed habitats (Hall *et al.*, 2021; Tuapetel & Rahman, 2025). Several studies also emphasize the importance of selective fishing gear in reducing bycatch and improving fisheries efficiency (Zhou *et al.*, 2019). However, studies on traditional fishing gear, such as *Tali Kor* in supporting fisheries sustainability, are still rarely found in the scientific literature, especially in the context of Indonesia's aquatic ecosystem.

This research has novelty in three main aspects. First, this study examines *Tali Kor* as a fishing tool that is ecologically designed and able to reduce negative impacts on the marine environment. Second, this study provides an analysis of how *Tali Kor* contributes to the sustainability of fish stocks and ecosystem balance in Watubela waters. Third, this study also considers the socio-economic aspect by exploring how the use of *Tali Kor* can improve the welfare of fishing communities through a community-based fisheries approach.

In this study, ecological principles are applied to evaluate the effectiveness of *Tali Kor* in maintaining the sustainability of fish resources. These principles include the selectivity of fishing gear, the efficiency of fishing, and their impact on marine ecosystems. This study also refers to the approach of fisheries ecology that emphasizes the importance of balancing resource exploitation and environmental carrying capacity (Cinner *et al.*, 2021). Thus, this research not only contributes to academic understanding, but also has practical implications in fisheries management at the local level.

In conclusion, this study aimed to fill the gaps in the literature on sustainable traditional fishing gear and to provide ecological-based policy recommendations for fisheries management in Indonesia. By understanding how *Tali Kor* functions in maintaining the balance of the marine ecosystem and improving the sustainability of fisheries, it is hoped that the results of this research can be the basis for the development of more environmentally friendly fisheries strategies in the future. This research supports

the achievement of several Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water), by promoting sustainable fisheries practices that preserve marine ecosystems, and SDG 8 (Decent Work and Economic Growth) by fostering socioeconomic resilience in coastal communities through the adoption of sustainable fishing techniques.

MATERIALS AND METHODS

Description of study area

This research was carried out in Eastern Seram Regency for 6 months from March - September 2024. The research location consists of three villages, namely Ilili, Effa, and Lahema villages (Fig. 1).

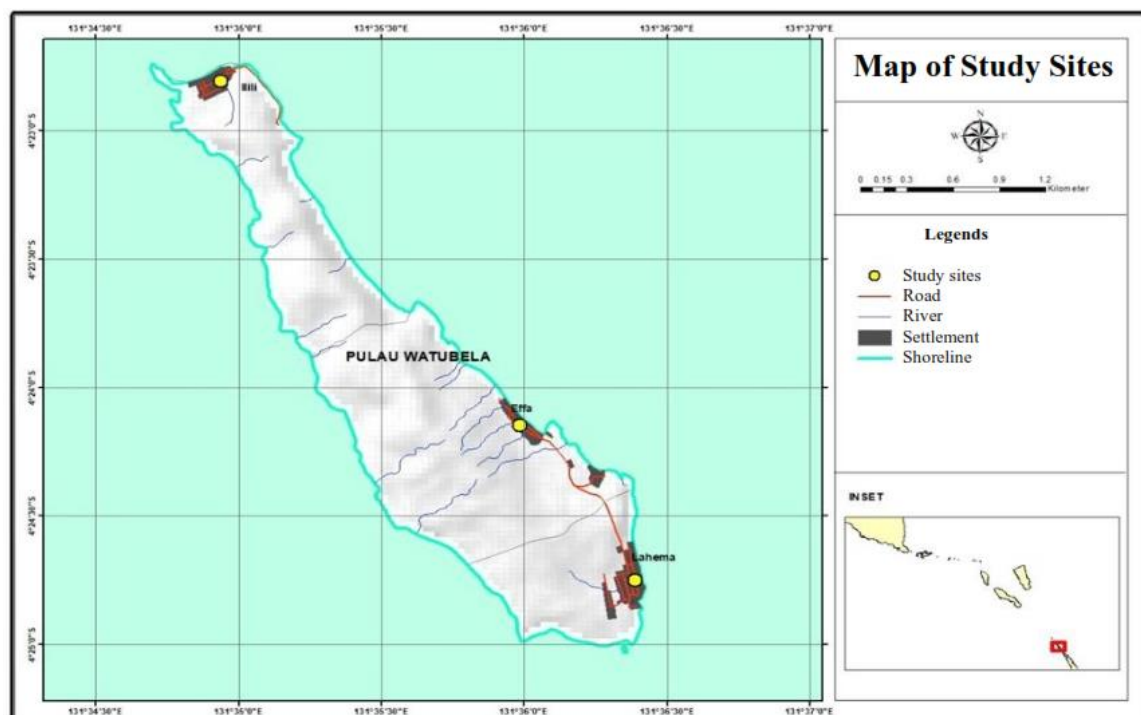


Fig. 1. Map of the study area

Watubela Island is located in the Eastern Seram region, Maluku Province, which is geographically in the group of tropical islands of Indonesia. This island is part of the eastern Indonesian marine ecoregion which has the characteristics of coastal ecosystems and waters rich in biodiversity (Tomascik *et al.*, 1997). Administratively, Eastern Seram is bordered by the Banda Sea to the north and the Arafura Sea to the south, making it a region with complex oceanographic dynamics due to the influence of currents from the Pacific Ocean and the Indian Ocean (Gordon & Fine, 1996).

Geomorphologically, Watubela Island and the Eastern Seram region are formed from geological processes influenced by tectonic activities in the Eurasian Plate and the

Indo-Australian Plate. The geological structure in this area is dominated by sedimentary and volcanic rocks formed due to subduction and tectonic uplift activities in the geological history of the Maluku region (PVMBG, 2020). The area also has a varied coastline, ranging from sandy beaches to rocky coasts and mangrove areas that play an important role in maintaining the balance of the coastal ecosystem.

In terms of climate, the Eastern Seram region is in a tropical climate zone with relatively high rainfall throughout the year. The average temperature ranges from 25–30°C, with high air humidity and monsoon patterns that affect the fishing season and local fishermen's activities (BPS Seram East, 2022). The pattern of ocean currents in this region is influenced by the Indonesian Cross Current system (Arlindo), which carries water masses from the Pacific Ocean to the Indian Ocean through the fissures of the Maluku archipelago, including the waters around Watubela Island (Gordon & Fine, 1996).

The aquatic ecosystem around Watubela Island is rich in fishery resources, which are the main livelihood for the local community. Marine biodiversity in this area includes various types of pelagic and demersal fish, as well as coral reef ecosystems that are the main habitat for various species of consumption fish and ornamental fish (KKP, 2021). In addition, seagrass beds and mangrove ecosystems along the coast have an important ecological role in the life cycle of fish and maintain the stability of coastal ecosystems (Bailey, 2018).

From an oceanographic perspective, the waters around Eastern Seram have a high level of fertility due to the mixing of water masses rich in nutrients from upwelling and strong current circulation (Verstappen, 1973). This makes this area one of the potential areas in the capture fisheries sector in eastern Indonesia. However, the sustainability of fishery resources in this region is highly dependent on the fishing methods used by the local community. Traditional fisheries practices such as the use of *Tali Kor* are one of the strategies that support the balance of marine ecosystems and the sustainable use of fish resources (Pauly *et al.*, 2020).

With unique geographical conditions, rich ecosystems, and complex oceanographic dynamics, Watubela Island and the Eastern Seram region have great potential in the fisheries and marine resource conservation sectors. Sustainable management based on ecology and local wisdom is the main key in maintaining the balance of the ecosystem and supporting the economic resilience of coastal communities in this region.

Data collection methods

This study used a qualitative approach with a data collection method consisting of in-depth interviews, focus group discussions, and field observations. In addition, secondary data were collected through the study of related documents relevant to the research topic.

In-depth interview

To deeply understand the practice of using *Tali Kor* as an environmentally friendly fishing tool, in-depth interviews were conducted with key stakeholders, including traditional fishermen, community leaders, and parties involved in the management of fishery resources on Watubela Island. These interviews were conducted in a structured manner with a pre-designed list of questions, as well as semi-structured interviews with key informants who had in-depth insights into the ecological, social, and economic aspects of the use of *Tali Kor*.

Focus group discussion – FGD

The focus group discussion was carried out to obtain a collective perspective from fisheries actors, including capture fishermen, boat owners, and other stakeholders such as village officials and related parties in local fisheries management. The FGD aims to explore understanding of the effectiveness of *Tali Kor*, the challenges in its implementation, and public perception of fisheries sustainability in the region. This discussion also helps identify potential policy development that can support environmentally friendly fisheries practices.

Observation

Direct observation was carried out to see the real condition of fisheries on Watubela Island, including the technique of using *Tali Kor*, the interaction of fishermen with the environment, and the impact of this fishing gear on the marine ecosystem. This observation also aimed to visually document fishery practices, record the socio-economic conditions of coastal communities, and understand environmental factors that affect the sustainability of fish resources

Desk study

The study of this document aims to provide historical and policy context relevant to this study, as well as comparing the results of field research with previously available data.

With this combination of methods, the study is expected to provide a comprehensive analysis of the role of *Tali Kor* in the sustainability of fisheries on Watubela Island, as well as the accompanying ecological, social, and economic implications.

Data analysis

The data obtained in this study were analyzed using a qualitative descriptive approach, which aims to deeply understand how the use of *Tali Kor* fishing gear contributes to sustainable fisheries on Watubela Island. This analysis was carried out by interpreting the results of in-depth interviews, focus group discussions, field observations, and secondary data collected from various sources.

RESULTS AND DISCUSSION

This study shows that the use of *Tali Kor* fishing gear is proof of the commitment of the Watubela community in maintaining the balance of the marine ecosystem. *Tali Kor* is included in the category of environmentally friendly fishing gear because it does not damage coral reefs or other fish habitats (Fig. 2). This practice reflects a deep understanding of aquatic ecology and is part of efforts to maintain the sustainability of fish resources in the waters around Watubela Island. Research by **Johannes and Yeeting (2021)** shows that traditional-based fishing gear tends to be more selective and has a lower impact on habitat than modern fishing gear that is not environmentally friendly.

The ecological principle in the design of fishing gear involves various aspects designed to catch fish efficiently, selectively, and environmentally friendly (**Pailin *et al.*, 2024**). Each fishing gear is designed for a specific species, fishing method, or specific environment. These principles help explain how life systems function, relate to each other, and react to change. The application of ecological principles can produce additional benefits for society. According to **Sumaila *et al.* (2016)** and **Tawari *et al.* (2020)**, the role of institutions and policies in fisheries and marine management is very important in maintaining the sustainability of marine ecosystems and the sustainable use of marine resources.



Fig. 2. (a) *Tali Kor* construction; (b) *Tali Kor* fishing gear operation

In addition to institutions, policies also play a crucial role in regulating fisheries and marine activities. Effective policies must be based on sustainability principles, including sustainable resource management, environmental protection, and improving the welfare of fishing communities (**Occhiali, 2023**). By maintaining the balance of marine ecosystems, fishery resources can be maintained in the long term, ensuring a stable food supply and livelihoods for communities that depend on the fisheries sector.

Ecological principles in the use of fishing gear refer to a sustainable and environmentally friendly approach to maintain the balance of marine ecosystems and the preservation of fishery resources. Here are some relevant principles:

1. **Selectivity of fishing gear:** Fishing gear should be designed to capture target species of appropriate size (Tawari, 2013), while minimizing bycatch such as small fish, juveniles, or protected species (such as turtles and marine mammals) (Zhou *et al.*, 2019). The observation results show that *Tali Kor* has a high selectivity for catches. The fish obtained are almost 100% dominated by target fish, primarily pelagic species such as *Decapterus* sp. Based on catch data, approximately 100% of the total catch consists of target species, with minimal bycatch of non-target species. This is also supported by the statements of the fishermen obtained during the FGD and in-depth interviews.
2. **Resource sustainability:** The use of *Tali Kor* considers the level of exploitation that does not exceed the environmental carrying capacity (Maximum Sustainable Yield). According to Pauly *et al.* (2020), the use of traditional fishing gear with high selectivity can maintain the availability and sustainability of fish resources.
3. **Minimize habitat damage:** The fishing gear used should not damage seabed habitats such as coral reefs, seagrass beds, and muddy bottoms. For example, the use of tiger trawls is often banned because it damages the seabed (Hall *et al.*, 2021). *Tali Kor* fishing gear is used on the surface of the water by herding fish towards the shore. This indicates a low risk of ecological damage to both coral reefs and seagrasses.
4. **Socio-economic impact:** The sustainability of fishing gear must also consider the socio-economic impact on fishing communities (Lopulalan & Rahman, 2024; Pical *et al.*, 2024; Pical & Rahman, 2025). *Tali Kor* as a fishing tool based on local wisdom has been proven to be able to improve the welfare of small-scale fishermen without threatening fish stocks.

In addition to adhering to ecological principles, the use of *Tali Kor* fishing gear aligns with the objectives of the Sustainable Development Goals (SDGs), particularly Goals 14 and 8. SDG 14 emphasizes the conservation and sustainable use of marine resources and ecosystems. *Tali Kor's* environmentally friendly design, high selectivity in capturing target fish species, and minimal impact on habitats contribute to preserving marine biodiversity and maintaining sustainable fish stocks. Furthermore, *Tali Kor* supports SDG 8, which focuses on fostering inclusive and sustainable economic growth and enhancing livelihoods. As a fishing method based on traditional knowledge, *Tali Kor* has proven effective in boosting the income of small-scale fishers without depleting fish resources or damaging marine environments. This integration of ecological sustainability and socio-economic resilience positions *Tali Kor* as a best practice in sustainable and community-based fisheries management.

CONCLUSION

Tali Kor reflects fisheries practices that not only respect the dynamics of local ecosystems but also become a solution to the growing threat of degradation of fish resources. The results show that *Tali Kor* can maintain the balance of marine ecosystems by minimizing bycatch and habitat damage such as coral reefs. In addition, this fishing gear provides socio-economic benefits for the local fishing community by maintaining the sustainability of fish stocks as their source of livelihood. The active role of the community in maintaining this fishing method proves the existence of local wisdom that can support more sustainable management of fishery resources. The study also emphasizes the importance of cross-stakeholder collaboration, including local governments, academics, and local fishers, to ensure that environmentally friendly fisheries practices can continue to be implemented. This effort needs to be supported by ecological-based policies and increasing public awareness about the importance of maintaining aquatic ecosystems. By providing a comprehensive analysis of the ecological and socio-economic benefits of using *Tali Kor*, this study is expected to be the foundation for the development of more sustainable fisheries strategies in Indonesia's coastal areas. The implementation of environmentally friendly fishing gear such as *Tali Kor* not only supports the balance of the marine ecosystem but also provides hope for a greener and more competitive future of the fisheries sector.

Furthermore, this study highlights the alignment of *Tali Kor* with Sustainable Development Goals (SDGs), particularly SDG 14 (Life Below Water) and SDG 8 (Decent Work and Economic Growth). Its ecological benefits support sustainable fisheries by minimizing habitat damage, while its socio-economic contributions enhance small-scale fishers' livelihoods, reinforcing its role in sustainable coastal resource management.

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