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Original Article

The Role of Fishermen in Preserving the Environment of Sukalila Estuary, Cirebon City

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Abstract

This study aims to examine the role of fishermen in preserving the environment in Muara Sukalila, Cirebon City. As a coastal community group that relies directly on marine resources, fishermen have a vital interest in maintaining the sustainability of aquatic ecosystems. This research employed a qualitative approach with data collection techniques including interviews, observations, and documentation. The findings reveal that fishermen in Muara Sukalila are actively involved in various environmental conservation practices, such as avoiding the use of destructive fishing gear, cleaning up waste around the estuary, and maintaining catch limits to prevent overfishing. Additionally, local wisdom plays a significant role in fostering ecological awareness in the fishermen's daily lives, including prohibitions against dumping waste into the sea and communal efforts to maintain environmental cleanliness. However, challenges such as limited government support, industrial waste pollution, and climate change continue to pose serious obstacles. Therefore, collaboration among fishermen, the government, and the wider community is essential to strengthen sustainable efforts in coastal environmental preservation.

Keywords: Fishermen, Environmental Sustainability, Muara Sukalila, Local Wisdom, Coastal Ecosystem.

1. Introduction

Sukalila estuary is one of the important coastal areas in the city of Cirebon which has strategic ecological and economic functions. As a place where the river flows into the Java Sea, this area is a habitat for various types of fish and marine life that support the lives of the community, especially fishermen. However, the environmental condition of Sukalila Estuary is currently under pressure due to pollution, sedimentation, and human activities that are not environmentally friendly. The imbalance between resource utilisation and conservation efforts threatens the sustainability of this aquatic ecosystem.

Based on observations and interviews, fishermen such as Mr. Suwarjono (57) and Mr Sanusi (42) acknowledge that environmental degradation has a direct impact on their catch. Mr. Suwarjono stated that polluted water disrupts the presence of fish and causes fishing yields to drop dramatically. Further, he said that:

"If the estuary is dirty, fish are hard to find. We also find it difficult to make a living,".

This shows the close relationship between the condition of the ecosystem and the welfare of local fishermen. Fishermen's dependence on healthy natural resources makes environmental quality a key factor in their survival. When the ecosystem is disrupted, fishermen's income decreases, and their families' socio-economic conditions are affected.

BRIN's study even shows that a decline in the quality of coastal waters has an impact on the productivity of traditional fisheries.

Unfortunately, public awareness, both fishermen and neighbouring residents, in keeping the estuary clean is still relatively low. Domestic waste is still widely dumped directly into the river without treatment, exacerbating the level of pollution in the area. This habit reflects a lack of education and concern for the long-term impacts of pollution on the environment and the socio-economic life of coastal communities (Mariana et al., 2022). Mr. Suwarjono complains about the behaviour of residents who often litter, *'It's not just fishermen, residents also litter,'* (Mr. Suwarjono). This shows that environmental issues are not only the responsibility of individuals or certain groups, but require collective awareness. Data from the Cirebon Environmental Agency (DLH) notes that Sukalila Estuary is one of the highest accumulation points of household waste in the city.

On the other hand, the government's involvement in the conservation of the estuary is still considered less than optimal. Existing conservation programmes have not directly touched coastal communities as the main actors in the field on a daily basis. Mr. Sanusi believes that the government rarely provides direct training or mentoring. Further, he said that:

"We need guidance. Don't just socialise once in a while, but accompany us continuously," (Mr. Sanusi).

This condition reinforces WALHI's findings that the weak implementation of coastal conservation programmes at the local level is the cause of the failure of various conservation initiatives.

However, there is great hope if collaboration between fishermen, communities and the government can be built seriously and sustainably. The fishermen expressed their willingness to be involved in efforts to protect the environment if there is real support. According to Mr Suwarjono, regular, community-based mentoring is needed. This approach has proven effective in various coastal areas of Indonesia, such as in Lamongan and Banyuwangi, where community involvement has improved the quality of the coastal environment.

While much research has addressed coastal environmental degradation and its impact on the fisheries sector (Hidayat, 2020; Purnama, 2024; Suleman et al., 2018), there are still very few studies that specifically examine the role of fishermen as environmental conservation actors. Most of them still place fishermen only as victims of environmental degradation. Studies on local initiatives, local ecological knowledge, and active participation of fishermen in coastal ecosystem conservation are still rare (Muawanah et al., 2020).

Particularly in Sukalila Estuary, Cirebon City, no research has explored how fishermen there actively participate in preserving the estuary, as well as their constraints and potentials in such involvement. In fact, the local community participation model has proven to be the key to successful conservation in other coastal areas in Indonesia (Nugraha, 2024). Therefore, in the context of ongoing environmental degradation, it is important to not only view fishers as victims, but also as potential actors in environmental conservation efforts. The active role of fishers in maintaining the estuary ecosystem needs to be identified, understood and strengthened through participatory and collaborative approaches. This study aims to explore the extent to which fishermen are involved in preserving the environment of Sukalila Estuary, as well as identify the constraints and potential they have in realising coastal sustainability.

To bridge the gap, this study will use the community participation framework as a conceptual basis, specifically the Community-Based Natural Resource Management (CBNRM) approach that emphasises the importance of the role of local communities in natural resource

management. This framework is relevant to evaluate the extent to which fishers can become active subjects, rather than mere objects, in coastal ecosystem conservation. In addition, this study will also integrate the perspective of local ecological knowledge (LEK) to understand the ecological knowledge and practices that fishermen have had for generations. Thus, this research not only seeks to fill the void of existing literature, but also explores the possibility of developing a conservation model based on fisher participation that is in accordance with the social, cultural and ecological context of Muara Sukalila. This model is expected to be a theoretical and practical contribution to community-based conservation efforts in coastal areas.

This research is based on the Community-Based Natural Resource Management (CBNRM) approach that emphasises the importance of the active role of local communities in the management and conservation of natural resources. CBNRM posits that involving communities in conservation can increase ownership, responsibility and effectiveness of environmental programmes. In the context of this research, fishers are not only positioned as victims of environmental degradation, but also as the main subjects who possess local ecological knowledge (LEK) and social capacity to maintain the sustainability of coastal ecosystems.

Since fishermen in Sukalila Estuary have a long historical and ecological bond with estuary, CBNRM, and LEK are indeed closely related. Using this method enables an exploratory focus on questions about the dynamics of participation, the ways of engaging locally or jointly overcoming shared challenges. This research seeks to combine these two frameworks to build theoretical and practical insights about the role of fishermen as conservation actors shaped by a unique local social and geographical context.

2. Methods

This research uses a descriptive qualitative approach with the aim of obtaining an in-depth understanding of the role of fishermen in maintaining environmental sustainability in Muara Sukalila, Cirebon City. This approach was chosen because it is suitable for exploring social and cultural phenomena in a naturalistic manner, based on data collected directly from the field (Sugiyono, 2019).

Data collection was carried out through three main techniques, namely observation, interviews, and documentation studies. Observations were carried out directly in the Sukalila Estuary on 1 May 2025, by observing the activities of the fishermen and the surrounding environmental conditions. This observation aims to record the real behaviour of fishermen in protecting the environment as well as social interactions that reflect the value of preservation. Structured interviews were conducted with two key informants: Mr Suwarjono (Chairman of RW 10, age 57) and Mr Sanusi (local fisherman, age 42). These interviews were conducted using a pre-formulated question guide to systematically extract information. Documentation studies were used as a supplement to strengthen the results of observations and interviews.

Data analysis was conducted interactively through three stages, namely data reduction, data presentation, and conclusion drawing. This analysis technique follows the model of Miles and Huberman, which allows researchers to identify important themes systematically and iteratively. Data validity was maintained through triangulation of sources and techniques, by comparing data from observations, interviews and documentation. In addition, reconfirmation with informants (member checking) was conducted to ensure the accuracy of information and interpretations obtained in the field.

3. Results and Discussion

The results showed that fishermen have a significant contribution in preserving the environment in the Sukalila Estuary area, Cirebon City. Their daily activities in coastal areas are not only oriented towards economic fulfilment, but also serve as a form of direct involvement in the preservation of coastal and marine ecosystems. Fishermen routinely face environmental dynamics such as abrasion, pollution, and changes in ocean currents, making them the most sensitive group to ecological degradation in the area (Amri et al., 2023).

Through traditional practices and local wisdom, such as prohibiting fishing during the spawning season and not destroying mangrove forests, fishers are able to develop ecological awareness that supports the sustainability of natural resources. Practices such as not using trawling and keeping estuarine rivers clean show ecological commitment born from local wisdom (Dewi, 2018).

However, the ecological role of fishermen also faces various challenges such as increasing household and industrial waste around Muara Sukalila, weak environmental law enforcement, and lack of education from the government. In this context, strengthening environmental literacy is a crucial aspect that must be mastered by fishermen to be able to filter information, recognise forms of pollution, and manage coastal ecosystems independently and collaboratively. This situation is further exacerbated by the lack of supporting facilities such as proper landfills and integrated waste treatment systems. In addition, the low level of community participation in environmental conservation programmes is also an obstacle. In this context, strengthening environmental literacy is a crucial aspect that must be mastered by fishermen to be able to filter information, recognise forms of pollution, and manage coastal ecosystems independently and collaboratively.

This environmental literacy includes an understanding of the importance of mangrove areas as abrasion barriers, the role of coral reefs in protecting fish, and the impact of plastic waste on marine life (Muawanah et al., 2020). This knowledge is not only acquired through formal education, but also through direct field experiences experienced by generations of fishermen. By understanding the linkages between marine ecosystems and the sustainability of their livelihoods, fishermen are able to make wiser decisions in their fishing activities. These skills make fishers not only economic actors, but also agents of environmental conservation who are able to bridge tradition and scientific knowledge. This dual role is crucial in supporting community-based conservation efforts in coastal areas.

Continuous training programmes facilitated by local governments, environmental NGOs and universities are needed, particularly in the areas of waste management, mangrove conservation and climate change adaptation in coastal areas (Edelia & Aslami, 2022). This programme should involve fishermen as the main subject, not just the object of development, so that they have a sense of ownership and full responsibility for the sustainability of the estuary (Purnama, 2024). With a participatory approach, the fishermen in Sukalila Estuary can become the driver of sustainable community-based environmental change.

With the development of technology and urbanisation, the Sukalila Estuary is under high ecological pressure. Industrial and household waste, declining water quality, and coastal land conversion are the main challenges (Nugraha, 2024). In this situation, fishermen not only function as users of marine resources, but also as protectors of nature who understand the importance of conservation. They have local wisdom, such as the prohibition of fishing in certain seasons or maintaining mangrove forests as an abrasion barrier. This reflects an understanding of practical ecology that is in line with the material discussed in the course, namely the importance of harmony between humans and the ecosystems in which they live.

However, today's young generation of fishermen also face modern cultural challenges such as digitalisation and lifestyle changes, which sometimes undermine the ecological values inherited from their ancestors. Even digital entertainment such as online games and social media consumption, although not directly related to ecology, can distract them from direct interaction with the environment. This is also confirmed by Hood et al. (2011), that changes in the interaction patterns of coastal youth with nature should be a concern in community-based environmental education.

In an ecological perspective, especially in the discussion of coastal and estuarine ecosystems, the role of humans must be active in maintaining sustainability. This course teaches the importance of human agency in shaping a healthy ecological landscape. Therefore, the fishermen of Muara Sukalila can be considered as environmental actors who have social and moral capacity in maintaining the ecological functions of coastal areas. They not only utilise the sea as a source of livelihood, but are also involved in conservation activities such as mangrove planting, community education, and advocacy against environmental destruction practices (Mariana et al., 2022).

This role becomes more significant when they utilise social media or digital platforms to voice the condition of the coastal environment. Conservation campaigns, pollution documentation, or collaboration with outside communities show that fishermen can also be active actors in digital ecology (Drakopulos, 2019). With this approach, they are not just consumers of information, but also producers of environmental narratives that encourage public awareness of the importance of protecting marine ecosystems.

Therefore, value and character-based environmental education, as taught in the Human, Place and Environment course, is needed to strengthen the ecological identity of coastal youth. Strengthening ecological literacy is not only through lectures or theories in the classroom, but also through hands-on experiences, conservation projects, and the use of technology for documentation and publication. Local governments, educational institutions, and civil society organisations should collaborate to provide contextualised and inclusive ecological learning spaces (Eichberg & Charles, 2024).

Thus, fishermen in Muara Sukalila not only perform economic functions, but also have ecological, educative and cultural roles that are very important in maintaining the sustainability of the coastal environment. They are a clear example of how humans as social and ecological beings can create healthy reciprocal relationships with their environment. In the context of learning social and ecological geography, this approach is very relevant to form a sustainable paradigm in students, communities, and policy makers.

3.1. The Role of Fishermen in Preserving the Environment of Sukalila Estuary, Cirebon City

Sukalila Estuary in Cirebon City is a strategic coastal area that has high ecological and economic value (Arif et al., 2020). As a river estuary that empties into the Java Sea, this area is a habitat for various types of marine life and the main source of livelihood for the surrounding community, especially fishermen. However, increasing human activities, domestic waste and lack of environmental awareness have led to a decline in the quality of ecosystems in the area. If not addressed immediately, this condition could threaten the sustainability of marine resources, reduce fishermen's catches, and impact the overall socio-economic welfare of coastal communities.

According to Mr Suwarjono, a 57-year-old fisherman who has lived and worked around Sukalila Estuary for decades, keeping the estuary environment clean is vital. He emphasises that the cleanliness of the river and estuary greatly affects the presence of fish. Further, he also said that:

"The estuary must be clean, the river must also be clean. If the river is dirty, the fish can be disturbed and we fishermen will also find it difficult," (Mr Suwarjono).

For him, a healthy ecosystem is the main prerequisite for the survival of fishermen. Water pollution not only reduces the number of fish, but also affects the life cycle of marine biota. Therefore, he hopes that there is a shared awareness from all parties to keep the estuary clean for a better future.

The same thing was also conveyed by Mr Sanusi, a 42-year-old fisherman, who stated that pollution has decreased his catch.

"If the water is dirty, many fish move away from the estuary. We have to go further out to sea, which costs more money and energy," (Mr Sanusi).

This statement reflects the direct link between environmental conditions and the welfare of local fishermen. Fishermen's dependence on a healthy ecosystem makes environmental conservation an urgent need, not just an option.

Studies from the National Research and Innovation Agency (BRIN) also show that the degradation of coastal areas due to pollution has a negative impact on marine biodiversity and the catch of traditional fishers. This decline in environmental quality not only affects the number and type of fish caught, but also impacts the economic stability of fishing families. In the long run, this can disrupt the social and economic resilience of coastal communities as a whole. Therefore, the active role of fishers in maintaining the estuary ecosystem is not only a form of concern, but also an adaptive strategy to maintain their livelihoods.

3.2. Fishermen Activities that Contribute to the Environmental Sustainability of Sukalila Estuary

Fishermen in Sukalila Estuary, Cirebon City, play an important role not only as breadwinners from the sea, but also as guardians of the coastal environment. This estuary area has a significant ecological function as a place for fish, shrimp, and various other aquatic biota to live. However, domestic activities and river pollution have degraded the water quality. Efforts to restore and protect the coastal environment have become increasingly urgent to ensure the ecological and economic functions of this area are maintained.

One concrete activity undertaken by local fishermen is to keep the waters clean by not throwing rubbish into the estuary. According to Mr Sanusi, a 42-year-old fisherman, they realise that the cleanliness of the water determines the presence of fish.

"We try not to throw rubbish into the sea. If the estuary is clean, the fish will stay here," (Mr Sanusi).

This awareness was born from direct experience of the decline in catches when the estuary was dirty, so protecting the environment became a practical necessity as well as an ecological awareness. This practice is a clear example that environmental conservation can grow from local awareness without having to wait for external intervention, although institutional support is still needed to expand its impact.

Research by Erfinda et al. (2024) show that the success of community-based conservation relies heavily on education, facilitation and the existence of an integrated programme. The lack of socialisation means that some fishermen do not understand the long-term impacts of pollution and overexploitation. Therefore, it is important for relevant institutions to provide training, access to information, and deliberation forums that bridge science with local practices of fishing communities. With a participatory approach that combines scientific knowledge and local wisdom, conservation becomes not only a top-down

policy, but also a grassroots movement that grows from the awareness and concern of the community itself.

Thus, fishermen's activities that support environmental sustainability are already taking place, but they are still sporadic and not systematically organised. To optimise their contribution, there is a need for synergy between fishers, local governments, NGOs and academics. Empowering coastal communities will not only increase environmental awareness, but also strengthen the socio-economic resilience of fishers in facing the challenges of a changing ecosystem. In this process, a participatory approach is key so that each party feels a shared responsibility. This cross-sector collaboration can also encourage the formation of policies based on real needs in the field. Thus, fishermen are not only the recipients of the impact of change, but also the main actors in environmental adaptation and mitigation efforts in coastal areas.

3.3. Fishermen's Awareness and Participation in Maintaining the Sukalila Estuary Environment

Fishermen's awareness of the importance of preserving the Sukalila Estuary is starting to grow, although it is not yet evenly distributed. Some fishermen have understood that good environmental conditions have a direct impact on their catch. Mr Sanusi, a 42-year-old fisherman, said that they protect the estuary so that fish do not go to the open sea.

"If the water is clean, there are many fish. If it is dirty, we lose ourselves," (Mr Sanusi).

This is reinforced by BRIN's data showing that active participation of fishermen in conservation activities correlates with an increase in catches of up to 20 per cent in the north coast of Java.

However, as stated by Mr Suwarjono, there are still many obstacles in building collective participation. One of them is the low quality of human resources (HR) among coastal communities. He also revealed that most residents do not have full awareness of the importance of environmental conservation.

"We lack human resources. When we do community service, sometimes the fishermen don't come," (Mr Suwarjono).

LIPI states that the low capacity of local communities is a major obstacle in the sustainable management of coastal ecosystems. On the other hand, the role of the government is also considered not optimal. According to Mr Suwarjono, until now there has been no concrete guidance or programme from the Ministry of Maritime Affairs and Fisheries regarding the conservation of Sukalila Estuary.

"The government has good intentions, but it is not yet clear. The socialisation is lacking," (Mr Suwarjono).

Similar criticism was also conveyed by WALHI, which considered that many coastal conservation programmes failed at the field level due to weak implementation, lack of coordination between agencies, and the absence of a sustainable evaluation mechanism.

3.4. Challenges and Obstacles Faced by Fishermen in Carrying out the Role of Environmental Preservation

One of the main problems in preserving Muara Sukalila is the behaviour of the surrounding community who still do not care about environmental cleanliness. Mr Suwarjono, a 57-year-old fisherman, highlighted that domestic waste is often thrown directly into the river by local residents.

"It's not just fishermen, the neighbouring community also dispose of rubbish as they please. It makes the water dirty," (Mr Suwarjono).

The lack of adequate waste management facilities and the lack of environmental education exacerbate this condition. This statement is reinforced by data from the Cirebon City Environmental Agency (DLH) which records Muara Sukalila as one of the largest accumulation points of household waste, especially from dense residential activities on the riverbanks.

Even so, the spirit for change remains. According to Mr Suwarjono, the fishermen are willing to be involved in conservation efforts as long as there is clear guidance and continuous assistance.

"If someone teaches us and accompanies us, we will definitely want to join. It's for our survival too," (Mr Suwarjono).

This shows that the involvement of fishermen is highly influenced by the right approach, especially one that is participatory and based on their needs. Similar experiences have proven successful in some areas, such as Lamongan and Banyuwangi, where fishermen are actively involved in community-based coastal area management.

Mr Sanusi, a 42-year-old fisherman, added that cross-party cooperation needs to pay attention to local wisdom and fishermen's work routines.

"We want to change, but sometimes the time is not suitable. If we can work together and the time is right, fishermen will definitely want to," (Mr Sanusi).

This shows that the success of conservation depends not only on technical policies, but also on the adaptability of the programme to the socio-economic life of the community. Studies from BRIN emphasise the importance of local integration in coastal ecosystem policies to increase long-term success.

3.5. Government and Society in Supporting Fishermen to Preserve the Environment of Sukalila Estuary

The role of fishermen like Mr Suwarjono is very important in preserving the Sukalila Estuary. He has witnessed changes in the estuary environment for decades and understands that water conditions greatly affect catches.

"If the estuary is dirty, the fish stay away. We lose," (Mr Suwarjono).

Such awareness grows from direct experience and daily interaction with the coastal environment. This shows that fishermen's local knowledge can be a strong basis for developing more sustainable natural resource management policies. This statement is in line with data from the Ministry of Marine Affairs and Fisheries, which states that the quality of estuary ecosystems determines the abundance of fish stocks in coastal areas.

However, fishermen's participation alone is not enough if it is not accompanied by support from the government and non-governmental organisations. According to Mr Sanusi, fishermen are willing to play an active role, but need guidance and assistance. Mr Sanusi explained that:

"We don't refuse, but we need someone to help and direct us. Don't just tell us," (Mr Sanusi).

In this context, a top-down approach needs to be combined with a bottom-up approach to make the programme more targeted. When all parties are actively and equally involved,

conservation efforts can be more effective and sustainable. BRIN's study also shows that synergies between local communities and stakeholders greatly influence the success of coastal conservation.

Taking into account the experiences and opinions of local fishermen and the support of scientific data, it can be concluded that the conservation of Muara Sukalila requires synergy between the community, government and non-government sectors. It is not enough to have formal programmes from above, but there must also be empowerment from below that touches on the needs and habits of the local community. This collaboration will be more effective if it is based on open communication and mutual respect between all stakeholders. In addition, continuous monitoring and periodic evaluations are also needed to ensure that each initiative is on track. Environmental education, technical training, and respect for local wisdom are important elements to maintain the long-term sustainability of coastal ecosystems (Erfinda et al., 2024).

The findings in this study have important implications for the world of education, especially in social studies learning that integrates environmental issues and strengthens character education. Ecological values owned by fishermen, such as responsibility for nature, mutual cooperation, and local wisdom in preserving the environment, can be used as contextual learning materials in the social studies curriculum. This approach is in line with the Merdeka Curriculum, which emphasises project-based learning and strengthening the Pancasila learner profile, especially in the dimensions of global diversity, independence, and environmental care.

The conservation model based on the fishing community in Muara Sukalila can be raised in teaching materials to foster students' ecological awareness from an early age. In addition, the real practices carried out by fishermen in protecting the environment can be used as local learning resources that inspire the development of environmental care characters in schools. It also provides opportunities for social studies teachers to develop school-community collaborative projects in the form of conservation or environmental service activities.

Thus, the results of this study not only contribute to the strengthening of scientific literature on the role of fishermen, but can also be the basis for contextualised, character-based, and environment-centric curriculum development, which supports the transformation of education towards a more relevant and transformative direction.

To enhance the ecological role of fishers in Muara Sukalila, it is recommended that the local government develop regular training programmes on community-based environmental management. Educational institutions and civil society organisations also need to be involved in developing training modules that are appropriate to the local social context. In addition, it is important to develop simple technology-based educational media and campaigns to keep the younger generation of fishermen connected to the ecological values of their ancestral heritage. A participatory approach that takes into account the work routines of fishermen will determine the success of efforts to conserve the coastal environment in a sustainable manner.

4. Conclusion

Based on information from Mr Suwarjono and Mr Sanusi, fishermen have an important and direct role in preserving the environment of Sukalila Estuary, Cirebon City. They realise that the condition of the estuary ecosystem greatly affects fish catches, so maintaining the cleanliness and sustainability of the environment is part of the effort to maintain their livelihoods. This awareness encourages them to contribute significantly to environmental conservation. One concrete form of this contribution is by not throwing garbage into the

estuary, avoiding the use of fishing gear that damages marine habitats, and actively participating in beach clean-up activities carried out independently.

Fishermen's awareness of the importance of environmental conservation is high, but their active participation is still constrained by the lack of socialisation and guidance. According to Mr Suwarjono, many fishermen actually have the intention to be involved in protecting the environment, but do not know where to start because they have not received proper assistance. Mr Sanusi also emphasised that the success of conservation efforts relies heavily on cross-party cooperation and an understanding of fishermen's time and work patterns. Without schedule adjustments and a flexible approach, participation will be difficult to realise to its full potential. Therefore, they need concrete and consistent support from the government and related organisations.

The biggest challenges they face include a lack of environmental education, limited support from the government, and the bad habits of local people who still throw rubbish into the river. These conditions often make conservation efforts made by fishermen feel heavy and less impactful. However, both are optimistic that if the government, community and environmental organisations work together and provide the right assistance, the fishermen are ready to become the front guard in protecting the estuary ecosystem. They emphasised that environmental sustainability is not just the government's job, but a shared responsibility that must be shouldered by all elements of society for the sustainability of future generations and the balance of coastal ecosystems that are increasingly vulnerable to environmental pressures. In addition to providing a practical description of the role of fishermen in environmental conservation, this research also contributes to the development of science in the field of environmental education and coastal community participation. The findings can serve as a foundation for the development of community-based conservation models based on local wisdom.

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