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Development of a Community-Based Sustainable Coral Reef Ecosystem Conservation Model through the Integration of Local Wisdom and Scientific Approaches in North Lombok Regency

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ABSTRACT

Coral reef ecosystems in North Lombok Regency are increasingly threatened by overfishing, destructive practices, pollution, and climate change, despite their vital role in supporting biodiversity and coastal livelihoods. This study aims to identify and analyze the ecological, socio-economic conditions, and local wisdom of coastal communities in the development of a community-based sustainable marine conservation model in North Lombok Regency. Sampling was conducted using purposive sampling on 50 respondents consisting of fishermen, marine tourism operators, and coastal communities involved in the utilization of marine resources. Data collection methods included field surveys, coral reef condition observations, water quality parameter measurements, and the distribution of questionnaires and in-depth interviews. Data analysis used a quantitative and qualitative descriptive approach integrated into the formulation of a conceptual model. The results showed that (1) live coral cover was in the good category, ranging from 60 to 70%, and was supported by relatively stable water quality parameters, (2) the community had a high level of economic dependence on marine resources, (3) local wisdom such as Awig-awig still plays a role in regulating resource use, but has not been systematically integrated with a scientific approach, and (4) the development of a conservation

model that integrates quantitative biophysical data with social legitimacy based on local wisdom within the village institutional framework is considered feasible to implement. This model emphasizes the importance of community participation, regional policy support, technical assistance, and conservation-based economic incentives to ensure ecosystem sustainability and the welfare of coastal communities.

INTRODUCTION

Coral reef ecosystems are important assets for human survival because they provide vital ecosystem services such as food sources, climate regulation, and economic and recreational value. More than 70% of the earth's surface consists of marine areas with an estimated biodiversity of more than 2.2 million species, so their existence plays a central role in maintaining global ecological balance. However, rapid development and overexploitation in recent decades have caused the degradation of coral reef ecosystems in various parts of the world. Indonesia, as the largest archipelagic country in the world, which is home to around 23% of the world's coral reefs and more than 2,500 species of reef fish, is also experiencing serious ecological pressure (Setiawan, 2022). A 2022 report by the Indonesian Institute of Sciences (LIPI) shows that only about 6.39% of Indonesian coral reefs are in very good condition, while 35.15% are damaged to severely damaged due to anthropogenic activities such as destructive fishing, pollution, sedimentation, and the impacts of global climate change (Hadi & Giyanto, 2018).

One region experiencing significant ecological pressure is West Nusa Tenggara, a province with high marine potential located in the world's coral triangle, a center of global marine biodiversity. With a coastline of more than 2,300 km and ecosystems that include coral reefs, seagrass beds, and mangrove forests, this region faces ecosystem degradation due to increased human activity. Data from the West Nusa Tenggara Province Marine and Fisheries Service shows that coral reef degradation has reached 40% in the last ten years, which has had a direct impact on declining fish catches and the income of coastal communities (Rafandi *et al*., 2025). This situation highlights the need for sustainable management and conservation to preserve the ecosystem and ensure the socio-economic sustainability of coastal communities.

North Lombok Regency, located in the northern part of Lombok Island, has a coastline of more than 100 km and a coral reef ecosystem that supports the community's economy and is a major attraction for marine tourism (Badan Pusat Statistik Kabupaten Lombok Utara, 2024). However, the condition of the coral reef ecosystem in this region shows an alarming trend, with low coral health indices and high mortality rates due to destructive fishing practices, coral harvesting, pollution from tourism and settlement activities, and coral bleaching caused by rising sea temperatures. These ecological impacts have directly resulted in a 27% decline in fish catches over the past five years and a decrease in fishermen's incomes, prompting some communities to switch to unsustainable fishing practices or change their livelihoods (Badan Pusat Statistik Kabupaten Lombok Utara, 2024). Meanwhile, various conservation efforts have been undertaken, but the approaches applied remain top-down and lack community involvement, thus failing to achieve sustainability. In fact, local wisdom such as Awig-awig has great potential in supporting sustainable marine resource management, but

it has not been optimally integrated into modern conservation programs. Thus, a conservation approach that combines ecological and social dimensions is needed to achieve sustainable management of the Coral Reef Ecosystem.

Coral Reef Ecosystem Conservation has received significant attention over the past two decades, with approaches such as Ecosystem-Based Management (EBM), Marine Protected Areas (MPAs), and Integrated Coastal Management (ICM) becoming crucial in promoting biodiversity and ecological balance. According to Judijanto (2025) and Tseliou & Tselepides (2020), science-based conservation approaches aim to reduce exploitation and improve ecosystem health through long-term planning and scientific monitoring. Lois (2025) shows that conservation success in Palau and the Caribbean can be achieved when local communities are involved in management. However, Lois (2025) and Munir (2024) emphasize that compliance with conservation programs in coastal areas is often low when communities are not involved as key actors. Therefore, Tseliou & Tselepides (2020) and Palmer (2017) emphasize the importance of integrating ecological, economic, and social factors so that conservation goals can be aligned with the livelihoods of coastal communities.

Recent research highlights the important role of community participation and local wisdom in the success of marine conservation efforts in Indonesia. Helmi (2024) and Damayanti et al. (2025) show that community-based conservation (CBC) is effective because it involves the community as both managers and beneficiaries of marine resources. Examples in Maluku and Bali show that integrating traditional practices such as Awig-awig with modern conservation techniques increases compliance and management effectiveness. Hasim et al. (2025) and Zalukhu (2025) found that economic dependence, cultural values, and local identity influence conservation outcomes, necessitating a holistic approach that combines ecological and socio-cultural aspects. Furthermore, (Sakti, 2023) emphasize that Traditional Ecological Knowledge (TEK) can increase ecosystem resilience to environmental change, making community involvement and recognition of local knowledge key to achieving sustainable marine conservation.

Although various conservation efforts have been carried out in North Lombok Regency by the government and non-governmental organizations, most of them are still top-down and do not involve the community as the main stakeholders of marine resources. In fact, the local community has local wisdom such as Awig-awig, which regulates sustainable use of the sea, but it has not been optimally integrated with modern scientific-based conservation approaches. Previous studies have also generally examined the biophysical aspects of ecosystems or social empowerment separately, so there is no integrated conservation model that combines ecological, social, economic, and cultural dimensions. This situation indicates a research gap in developing a sustainable Coral Reef Ecosystem conservation model that is based on science and rooted in local knowledge, as well as implementation strategies that are effective and acceptable to the community in North Lombok Regency.

Based on research gap, this study aims to develop a sustainable community-based coral reef ecosystem conservation model through the integration of local wisdom and scientific approaches, including ecological foundations and implementation mechanisms in North Lombok Regency.

METHODS

Research Approach

This study uses a mixed-method approach that integrates quantitative and qualitative methods for collecting, analyzing, and mixing both quantitative and qualitative methods in a single study to understand a research problem (Creswell, 2012). This study is in line with comprehensive understanding of the ecological, social, economic, and cultural aspects of developing a sustainable Coral Reef Ecosystem conservation model. A participatory approach is applied by involving local communities as key actors in the research process, from problem identification, data collection, and validation of findings to the formulation of conservation recommendations. Specifically, this study adopted a Participatory Action Research (PAR) framework that emphasized collaboration between researchers, coastal communities, and relevant stakeholders in formulating solutions based on local needs and realities. Through this approach, the study not only produced academic outputs but also encouraged community empowerment in sustainable marine resource management.

Location and Time

The study conducts in the coastal area of North Lombok Regency, West Nusa Tenggara Province from May to December 2025. Based on the results of a preliminary study, one representative coastal village will be selected based on the following criteria: (1) coral reef ecosystem conditions, (2) community dependence on marine resources, (3) the existence of local wisdom practices, and (4) geographical representation.

The research activities are projected to run for eight months, starting from the preparation stage, data collection, analysis, model development, to evaluation and reporting. The implementation time will take into account seasonal conditions to ensure that the Coral Reef Ecosystem survey can be carried out optimally.

Population and Sample

The population of this study includes two categories, namely biophysical and social. In terms of biophysics, the population includes the entire Coral Reef Ecosystem in North Lombok Regency, which consists of coral reefs, seagrass beds, and other coastal ecosystems. In terms of social aspects, the population includes all coastal communities that utilize marine resources as a source of livelihood or economic activity in the study area. Thus, the research population reflects the relationship between the condition of the Coral Reef Ecosystem and the social dynamics of the community as the basis for community-based conservation development.

The research sample was determined purposively according to data collection needs. In terms of biophysics, the sample consisted of coral reef ecosystems at selected locations, measured using the Line Intercept Transect (LIT) and Quadrant Transect methods to obtain ecosystem health indicators. In the social aspect, purposive sampling was used to select key informants such as community leaders, fishermen, traditional leaders, and other stakeholders, with a total of 50 people. The selection of this technique allowed for the exploration of relevant information regarding conservation, local wisdom, and marine resource utilization practices.

Data Collection Techniques

1. Ecological Data

Ecological data were collected through direct field observations using standardized coral reef assessment methods. The Line Intercept Transect (LIT) method was applied to measure the percentage of live coral cover and to determine substrate composition at the three selected observation sites. Reef fish composition and dominant families were identified using

the Underwater Visual Census (UVC) technique to describe the ecological structure of reef-associated fish communities. In addition, water quality parameters were measured in situ, including temperature, salinity, pH, dissolved oxygen (DO), and water transparency, to assess environmental suitability for coral reef ecosystems. Underwater photographic documentation was also conducted to visually confirm reef conditions and to support field observations.

2. Socio-Economic and Cultural Data

Socio-economic and cultural data were collected through structured questionnaires administered to selected respondents to obtain demographic characteristics, including gender, age, education level, and occupation. In-depth interviews were conducted with key informants to explore community perceptions, participation patterns, and marine resource management practices. Focus Group Discussions (FGDs) were organized to validate findings and to gather collective perspectives regarding conservation strategies. Documentation of local wisdom practices, particularly Awig-awig, was carried out to understand traditional regulatory systems governing marine resource utilization.

Data Analysis Techniques

Ecological Data Analysis

Ecological data were analyzed descriptively by calculating the percentage of live coral cover and comparing coral conditions across the three observation sites. Dominant coral genera and reef fish families were identified to describe ecosystem structure. Water quality parameters were evaluated against suitability standards for marine life. Coral reef conditions were then classified based on national coral reef condition standards as stipulated in the Minister of Environment Decree No. 4 of 2001.

Socio-Economic Data Analysis

Socio-economic data were analyzed using descriptive statistical methods, including frequency distributions and percentage calculations. This analysis was used to describe demographic characteristics, livelihood patterns, and the level of economic dependence on marine resources among respondents.

Qualitative Data Analysis

Qualitative data obtained from interviews and FGDs were analyzed using thematic analysis to identify major themes related to forms of local wisdom, community participation patterns, and institutional mechanisms in marine resource management.

Model Formulation

All ecological and socio-cultural findings were integrated descriptively to formulate a conceptual framework for a community-based sustainable coral reef conservation model. The model was constructed based on empirical ecological conditions, socio-economic dependence patterns, and existing local institutional and cultural systems to ensure ecological relevance and social acceptability.

RESULTS

This study presents a comprehensive overview of the ecological, socioeconomic, and cultural conditions of coastal communities in North Lombok Regency as a basis for developing a sustainable coral reef ecosystem conservation model. The results of the study show that the coral reef ecosystem in the study area is still in relatively good condition, although there are indications of pressure due to the intensity of marine resource utilization. On the other hand, coastal communities still maintain various forms of local wisdom in marine management, but these practices have not been systematically integrated with the scientific-based conservation

approach that has been applied so far. The findings obtained through ecological measurements, socio-economic surveys, and documentation of local wisdom are presented to explain the two main focuses of the research, namely the development of a coral reef ecosystem conservation model that integrates local wisdom with a scientific approach and the formulation of effective and sustainable community-based conservation implementation strategies in North Lombok Regency.

1. Characteristics of Coastal Communities in North Lombok Regency

The characteristics of the respondents in this study describe the socio-demographic conditions of coastal communities as a basis for developing community-based conservation models.

Table 1. Gender of Respondents

Gender	Respondents	Percentage (%)
Male	31	62
Female	19	38
Total	50	100

Source: Primary Data Processed (2025)

Based on Table 1, most respondents in this study were male (62%), while females accounted for 38%. This shows that marine resource utilization activities in North Lombok Regency are still dominated by males, particularly in fishing and other marine activities.

Table 2. Age Distribution of Respondents

Age (Years)	Respondents	Percentage (%)
26-32	5	10
33–39	17	34
40–46	13	26
47-53	8	16
54-60	6	12
61-67	1	5
Total	50	100

Source: Primary Data Processed (2025)

Based on table 2, the majority of respondents were in the 33–39 age group, with 17 people (34%), followed by the 40–46 age group with 13 people (26%). The 47–53 age group numbered 8 people (16%), while the 54–60 age group numbered 6 people (12%). Younger respondents, aged 26–32, numbered 5 people (10%), and the smallest group was the 61–67 age group with 1 person (5%). In general, these data show that most respondents were in the middle productive age group (33–46 years old), so the sample characteristics were dominated by a relatively mature age group that was socially and economically active.

Table 3. Respondents' Education Level

Education Level	Respondents	Percentage (%)
Elementary School	27	54
Junior High School	8	16
Senior High School	15	30
Total	50	100

Source: Primary Data Processed (2025)

Based on Table 3, the respondents' education levels were dominated by elementary school graduates (54%) and high school graduates (30%). This shows that the community's formal literacy capacity is at an intermediate level, so that in implementing the conservation model, a participatory approach that is communicative and easy to understand is needed.

Table 4. Patterns of Natural Resource Utilization by Respondents

Main Livelihood	Respondents	Percentage (%)
Fishermen	25	50
Aquaculture Farmers	0	0
Marine Tourism Operators	22	44
Fish Traders/Processors	3	6
Others	0	0
Total	50	100

Source: Primary Data Processed (2025)

Based on Table 4, the majority of respondents work as fishermen (50%), followed by aquaculture farmers and marine tourism operators. Dependence on marine resources is relatively high, both as a primary and supplementary source of income. This condition shows that the sustainability of coral reef ecosystems is directly related to the economic stability of coastal communities.

2. Ecological and Socio-Cultural Foundations for a Community-Based Marine Conservation Model

Based on the results of the ecological survey, the live coral cover at the three research sites showed good conditions, as shown in Figure 1 below.

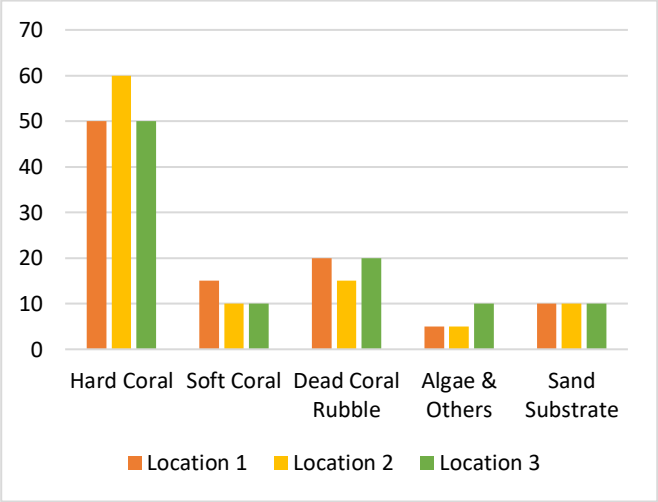

Figure 1. Coral Cover Comparison by Category Across the Three Observation Sites in North Lombok

Figure 1 shows the results of an ecological survey of coral reef ecosystem conditions at three research sites in North Lombok Regency, indicating a relatively good status suitable as a basis for developing a conservation model. Live coral cover ranged from 60 to 70%, with values of 65% at Location I, 70% at Location II, and 60% at Location III, which according to Minister of Environment Decree No. 4 of 2001 is classified as good. A comparison of coral cover based

on substrate categories in Figure 1 shows the dominance of hard corals at all observation sites, particularly the genera Acropora, Porites, Platygyra, and Montipora, which play an important role in maintaining the stability of the reef structure. Soft corals, especially Sinularia and Lobophytum, are evenly distributed with a proportion of 10–15%, while dead coral debris ranges from 15–20%, algae and other organisms 5–10%, and sand substrate is relatively consistent at around 10%.

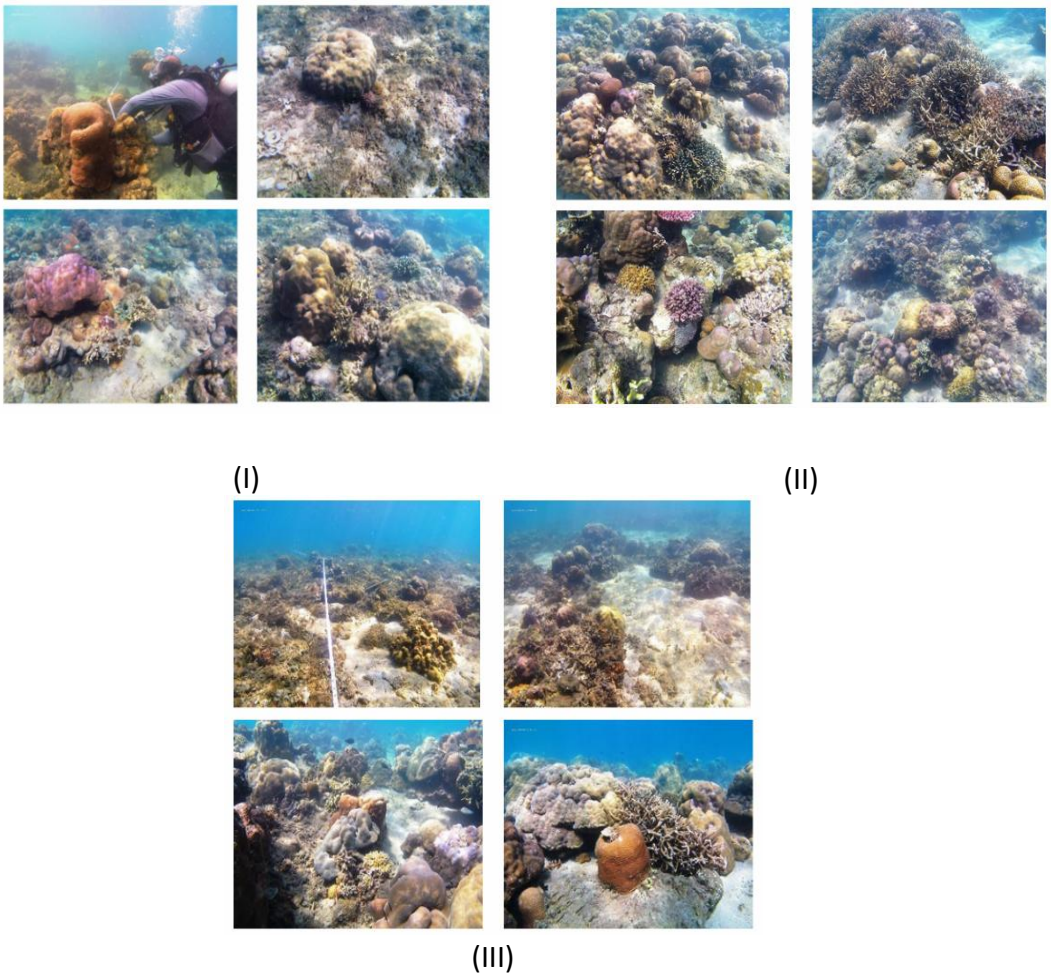

Figure 2. Condition of Coral Reef Ecosystems at Locations I, II, and III
Source: Field Documentation (2025)

Figure 2 shows the physical condition of coral reef ecosystems at three research sites in North Lombok Regency, observed visually through underwater documentation. Site I shows a relatively complex reef structure dominated by massive and branching hard coral colonies, interspersed with soft corals and other attached biota. The substrate surface is still dominated by living corals, although in some parts there are dead coral debris and open areas that indicate local pressure due to human activities or natural factors. Location II shows a denser and more homogeneous reef condition, with hard coral colonies growing close together and a relatively low level of sedimentation. The reef structure at this location appears to be more physically stable, with coral cover forming a complex habitat for associated organisms. Meanwhile, Location III shows considerable variation in coral growth forms, but is accompanied by more visible open substrate areas and coral debris compared to Location II. Nevertheless, the presence of growing live coral colonies indicates that the ecosystem at this

location still has natural recovery capacity. Overall, this visual documentation confirms that the three research locations still maintain functional coral reef structures, despite varying levels of pressure and microhabitat conditions between locations. Next, consider the following image.

Table 5. Results of Physical and Chemical Parameter Measurements of Water in the Coral Reef Ecosystem of Impos Beach

No	Observation Date	Time	Location & Coordinates	Temperature (°C)	Salinity (ppt)	pH	DO (mg/L)	Water Transparency (m)	Remarks
1	23-07-2025	10:00	Location I (8°21'40.8" S 116°08'08.1 "E)	29.5	33	8.1	6.4	5.2	Sunny weather
2	23-07-2025	11:00	Location II (8°21'36.4" S 116°08'07.3 "E)	29.7	33	8.0	6.2	5.0	Sunny weather
3	23-07-2025	11:45	Location III (8°21'33.3" S 116°08'07.1 "E)	29.6	33	8.2	6.6	4.4	Sunny weather

Table 5. The ecological conditions are also supported by water quality parameters that are within the optimal range for marine life, with a temperature of 29.5–29.7°C, salinity of 33 ppt, pH of 8.0–8.2, dissolved oxygen of 6.2–6.6 mg/L, and water clarity of 4.4–5.2 m. These stable physical-chemical conditions contribute to supporting coral growth and maintaining reef ecosystem function. In addition, the reef fish community shows a relatively stable structure with 11 species from various families identified, dominated by Pomacentridae, as well as the presence of herbivorous fish such as *Acanthurus triostegus*, *Zebrasoma scopas*, and *Naso lituratus*, which play an important role in controlling algae growth and maintaining the balance of the reef ecosystem.

On the socio-cultural side, the results of the study show that local wisdom still plays a significant role in marine resource management. As many as 62% of the community stated that customary rules and traditional practices are still consistently implemented, especially in the form of taboos or temporary marine closures at certain times, as well as rituals before going to sea. The community's traditional ecological knowledge is largely acquired through personal experience (64%) and hereditary inheritance (52%), which demonstrates the strong social legitimacy of culture-based management systems at the community level.

Based on the integration of these ecological and socio-cultural findings, this study produced a community-based sustainable coral reef ecosystem conservation model built on five main components, namely: (1) data-driven coastal zone management and zoning, (2) strengthening Awig-awig as a customary regulatory system with high social legitimacy, (3) monitoring of ecosystem conditions through community-based participatory mechanisms, (4)

increasing the capacity and scientific literacy of coastal communities to support adaptive decision-making, and (5) multi-stakeholder collaboration between local communities, customary institutions, academics, and local government. These five components form a conservation model framework that is empirically supported by local ecological conditions and is socially acceptable and sustainably implementable in North Lombok Regency.

3. Development of the Sustainable Marine Conservation Model

Based on the results of ecological, socio-economic, and cultural analyses, this study produced a community-based sustainable coral reef ecosystem conservation model that is designed in an integrative and contextual manner in accordance with the characteristics of the coastal area of North Lombok Regency. This model is based on empirical findings regarding the condition of the coral reef ecosystem, which is still in the moderate to good category, but shows local pressure due to the intensity of resource use and coastal activities.

Table 6. Components of the Sustainable Marine Conservation Model

Component	Empirical Basis	Implementation Mechanism	Expected Output
Ecological Foundation	Coral cover condition, seagrass and mangrove status	Zonation system	Ecosystem protection
Local Wisdom Integration	Traditional fishing regulation, seasonal control	Community-based monitoring	Social legitimacy
Institutional Mechanism	Pokmaswas strengthening	Village regulation & collaboration	Sustainable governance

To provide a clearer structural representation of the developed model, the conceptual framework is presented in Figure 3.

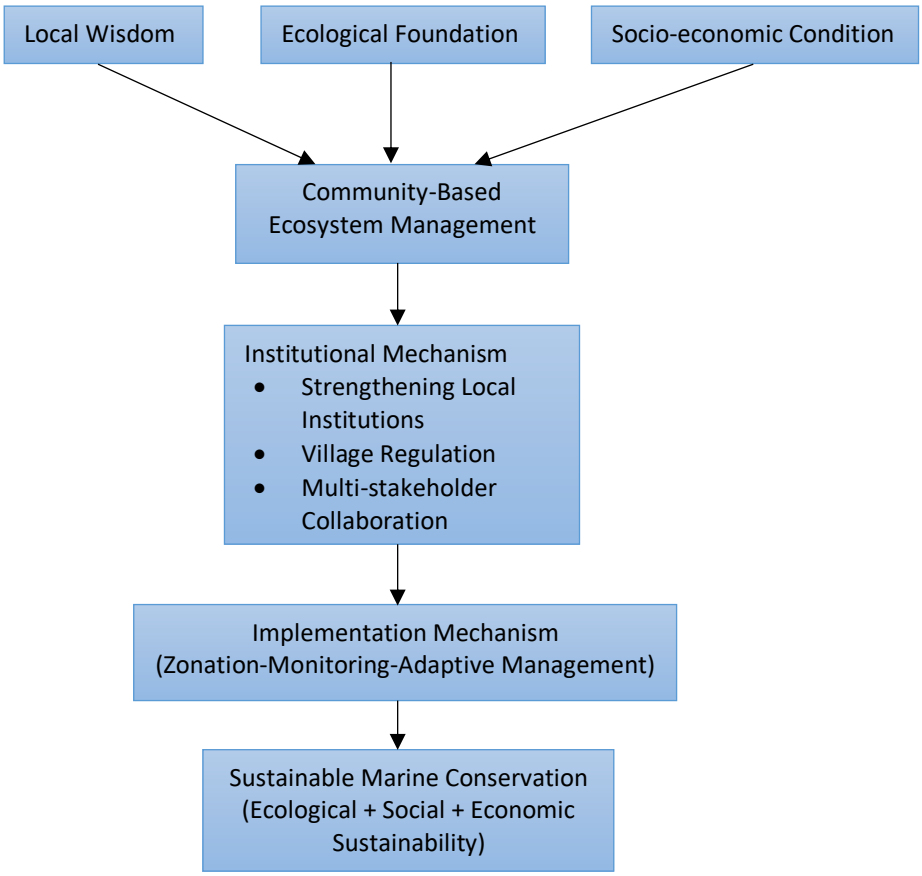

Figure 3. Conceptual Framework of the Community-Based Sustainable Marine Conservation Model

1. Ecological Basis

The conservation model was developed based on the actual condition of the ecosystem. Field measurements show that coral reef cover is still moderate with relatively stable coral fish diversity, although there are indications of biomass decline in locations with high fishing pressure. Seagrass ecosystems still function as spawning and nursery grounds, while mangroves play an important role in coastal protection and coastal ecosystem buffering.

Based on these findings, the conservation model integrates an ecological condition-based zoning approach, which includes core protection zones, limited use zones, and sustainable use zones. Zoning is determined by considering the level of ecosystem vulnerability and the intensity of community activities.

2. Integration of Local Wisdom and Scientific Approaches

This study found that coastal communities still maintain local wisdom practices in marine resource management, such as regulating fishing seasons, restricting certain types of fishing gear, and implementing social mechanisms based on mutual cooperation to protect coastal areas. However, these practices have not been formally documented and have not been systematically integrated with scientific-based conservation policies.

The model developed integrates local wisdom with an ecosystem-based management approach through a participatory monitoring system, the development of simple ecological indicators that can be understood by the community, and the strengthening of local regulations based on village regulations. This integration aims to increase social legitimacy and ecological effectiveness in conservation implementation.

3. Local Institutional-Based Implementation Mechanisms

The success of conservation is highly dependent on local institutional capacity. Therefore, this model emphasizes the strengthening of community monitoring groups (Pokmaswas), capacity building through technical training in conservation and ecosystem monitoring, and multi-stakeholder collaboration between communities, local governments, and academic institutions.

The implementation model is structured in operational stages that include:

(1) identification of initial ecological and social conditions,
(2) formulation of village-based joint regulations,
(3) strengthening of community institutions and capacity,
(4) implementation of zoning-based conservation, and
(5) periodic adaptive monitoring and evaluation.

This approach ensures that conservation is not only normative but also has a structured and sustainable implementation mechanism.

Feasibility and Implementation Strategy Model

The analysis shows that the feasibility of implementing the conservation model in North Lombok Regency is supported by three main factors, namely ecological conditions that still have adequate carrying capacity, the existence of local wisdom that is still alive in community social practices, and a relatively high level of community participation in marine resource-based activities.

1. The success of the model's implementation is influenced by several key factors, namely:
2. The level of community participation and ownership of conservation programs;
3. Support for regional policies and regulations that are in line with the principles of sustainable management;
4. The availability of technical assistance and capacity building;
5. Development of conservation-based economic incentives, such as ecotourism and sustainable fishing practices.

Overall, the developed model is considered feasible for implementation as a community-based marine conservation management framework in North Lombok Regency. This model is adaptive, participatory, and contextual, and is able to bridge scientific approaches with the socio-cultural practices of local communities. Thus, this model is not only oriented towards ecosystem protection, but also towards the social and economic sustainability of coastal communities. This model differs from previous conservation approaches because it simultaneously integrates quantitative biophysical data with social legitimacy based on local wisdom within a village institutional framework.

DISCUSSION

Findings Research findings indicate that live coral cover in North Lombok Regency is still in the good category (60–70%) with relatively stable water quality parameters. This condition indicates that ecologically, the area still has adequate carrying capacity for sustainable management. These findings are consistent with a study (Harvey et al., 2018) showing that areas with moderate anthropogenic pressure are still able to maintain coral community structure if local management systems are effective. Similarly, study (Darwin, 2025) confirms that local monitoring and restrictions on destructive activities contribute significantly to the stability of fish biomass and coral cover in the medium term. In the national context, these results are in line with research (Juliani & Ningsih, 2025) in the Thousand Islands, which found

that community-based conservation models can increase live coral cover and fish biomass compared to areas without community management. This shows that a combination of relatively good ecological conditions and strengthened local management are important factors in maintaining ecosystem resilience.

From a socio-economic perspective, the dominance of respondents of productive age and the high dependence on the fisheries and marine tourism sectors show a close relationship between ecological conditions and the welfare of coastal communities. Mufakkirah, (2025) ; (Rosmiza *et al*., 2025); (Dermawan & Mujib, 2025) emphasize that the success of marine conservation is greatly influenced by the integration of ecosystem resilience and community economic resilience. Without conservation-based economic alternatives, pressure on marine resources tends to increase. This finding is reinforced by (Larasati *et al*., 2025) in Nipah Hamlet, North Lombok, which shows that community empowerment through coral reef conservation not only increases fish populations but also has an impact on increasing local income. Thus, a conservation approach integrated with economic incentives such as ecotourism and sustainable fisheries becomes a strategic element in ensuring long-term sustainability.

In the socio-cultural dimension, the sustainability of local wisdom practices such as Awig-awig shows that customary norms still have social legitimacy in regulating the use of marine resources. This phenomenon is in line with the theory of local institutions in the management of common-pool resources proposed by Indriani (2025); (Utomo & Nadriana, 2025), where community-based rules can increase compliance and the effectiveness of supervision. However, this study found that the local system has not been fully integrated with quantitative ecological indicators. This condition is similar to the findings of Alamsyah (2025), which emphasize the need for technical assistance to strengthen the community's capacity to understand and monitor coral reef conditions scientifically. Ngaisah *et al*., (2025) and (Faradina, 2025) also shows that integrating local values with scientific data through multi-stakeholder collaboration can strengthen social legitimacy and the effectiveness of conservation implementation.

Conceptually, the developed model is related to the Ecosystem-Based Management (EBM) and Community-Based Conservation (CBC) approaches. In line with EBM principles, this model uses biophysical data as the basis for zoning and conservation priorities (Van Dyke & Lamb, 2020). However, unlike the EBM approach, which tends to be technocratic and top-down, this model places village institutions as the main actors in its implementation. Within the CBC framework, strengthening community participation and local institutions such as Pokmaswas is in line with the community-based conservation approach (Carpio *et al*., 2021). However, the developed model goes beyond conventional CBC by incorporating a monitoring mechanism based on quantitative ecological indicators as a structured adaptive evaluation system.

Thus, the novelty of this model lies in the simultaneous integration of social legitimacy based on local wisdom and quantitative scientific basis within a single operational village institutional framework. This model does not merely adopt EBM or CBC partially, but synthesizes both in an adaptive, participatory, and measurable community-based implementation system.

Feasibility analysis shows that the level of community participation, regional policy support, technical assistance, and conservation-based economic incentives are determining factors for the success of the model. These findings reinforce the argument (Presta *et al*., 2025) that effective marine conservation requires a collaborative (co-management)

governance approach that synergistically connects local actors and the government. Without consistent institutional and policy support, the effectiveness of the model has the potential to stagnate in the long term.

Overall, this study contributes empirically and conceptually to the literature on marine conservation governance by offering an integrative community-based model that simultaneously strengthens ecological, social, and institutional dimensions, and is relevant for replication in coastal areas with similar socio-ecological characteristics.

CONCLUSION

This study concludes that the sustainable marine conservation model developed in North Lombok Regency is feasible in ecological, social, and institutional terms. The relatively good condition of live coral cover and stable water quality parameters indicate that the ecosystem has sufficient carrying capacity for adaptive and preventive management. The integration of local wisdom, such as Awig-awig, with quantitative biophysical indicators strengthens the social legitimacy and ecological effectiveness of the model. The success of implementation is greatly influenced by community participation, local policy support, technical assistance, and conservation-based economic incentives. Conceptually, this model offers a synthesis between the Ecosystem-Based Management and Community-Based Conservation approaches within an adaptive, participatory, and measurable village institutional framework, making it potentially replicable in coastal areas with similar socio-ecological characteristics.

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