Global Journal of Marine Science
Vol. 1 No.1 2026 Page 36-48
E-ISSN: XXXX-XXXX, DOI: 10.XXXXX/XXXX

Social and Ecological Dynamics in Sustainable Coastal Resource Management

Ayu Firmansyah[1]*, Reza Setiawan[2], Nurul Hakim[3]
[1,2] Department of Marine Science, Faculty of Fisheries and Marine Science, Universitas Diponegoro, Semarang, Indonesia; [3] Department of Coastal Resource Management, Faculty of Fisheries and Marine Science, Universitas Brawijaya, Malang, Indonesia

Article Info

Received : 10 January 2026
Revised : 11 March 2026
Accepted : 30 March 2026

Keyword:

Coastal Resource Management;
Social-Ecological Systems;
Small-Scale Fisheries;
Local Knowledge;
Community Participation;
Sustainable Coastal Governance.

ABSTRACT

This study aims to analyze the social and ecological dynamics that shape sustainable coastal resource management in Tanjung Bira and Ara coastal villages, Bulukumba Regency, South Sulawesi, Indonesia. The study addresses the gap between formal coastal management programs and the lived experiences of coastal communities who face ecological change, livelihood uncertainty, unequal access, and tourism pressure. A qualitative case study design was used to explore the meanings, practices, and adaptive strategies of local actors. Data were collected through semi-structured interviews, participatory observation, and documentation involving small-scale fishers, fish traders, women from coastal households, tourism workers, village officers, community leaders, youth representatives, and local conservation actors. The data were analyzed using thematic analysis supported by data condensation, data display, and conclusion drawing. The findings reveal seven main themes: coastal resources as a shared livelihood system, ecological change and livelihood uncertainty, local knowledge as an adaptive resource, unequal access and social tension, community participation and local governance, livelihood diversification, and the social meaning of sustainability. The study shows that sustainable coastal resource management depends not only on ecological conservation, but also on fair access, local knowledge, livelihood resilience, and inclusive governance. These findings contribute to social-ecological systems theory and provide practical insights for participatory coastal policy, community-based management, and future research on coastal adaptation.

***) Corresponding Author:**

Ayu Firmansyah,
Department of Marine Science, Faculty of Fisheries and Marine Science, Universitas Diponegoro, Semarang, Indonesia
Email: ayu.firmansyah115@gmail.com

1. Introduction

Coastal areas are complex social and ecological spaces where livelihoods, local culture, marine ecosystems, and governance systems interact every day. They are not only physical zones between land and sea, but also living systems shaped by fishing practices, household economies, local institutions, ecological change, and policy interventions. Hossain et al. (2020) explain that coastal social-ecological systems need to be understood through the connection between human communities and ecological processes. This perspective is relevant because resource degradation in coastal areas rarely occurs as a purely environmental problem. It usually emerges from the interaction between ecological pressure, livelihood dependence, unequal access, and weak coordination among actors. Refulio-Coronado et al. (2021) also show that coastal social-

ecological systems are increasingly studied through the concepts of resilience, vulnerability, adaptive capacity, and governance.

Globally, coastal communities face growing pressure from climate change, declining fish stocks, habitat degradation, coastal erosion, market uncertainty, and competing uses of marine space. Kanan and Giupponi (2024) show that research on coastal social-ecological systems has grown because coastal regions are highly exposed to sea-level rise, salinity, storms, and ecosystem disruption. These changes affect the daily lives of small-scale fishers, women in coastal households, fish traders, tourism workers, and community-based conservation groups. Roberts et al. (2024) argue that fisheries sustainability must move beyond catch control and include ecological regeneration, community well-being, and long-term adaptation. This argument is important because many coastal management programs still focus on technical regulation, while the social meaning of resource use, local knowledge, and community negotiation often receives less attention.

In Indonesia, coastal resource management has a strong social and ecological urgency because many coastal households depend on small-scale fisheries, mangrove ecosystems, coral reefs, seaweed farming, coastal tourism, and informal fish markets. Halim et al. (2020) show that Indonesian small-scale fisheries need management systems that recognize local access rights and community-based practices. This issue is also visible in South Sulawesi, where coastal communities depend on marine resources while also facing pressure from tourism growth, seasonal uncertainty, habitat change, and market fluctuation. Basurto et al. (2025) emphasize that small-scale fisheries contribute to food security, nutrition, employment, and local economies. Therefore, sustainable coastal resource management in Indonesia cannot only rely on formal policy. It must also account for local experience, social relations, ecological knowledge, and the everyday strategies used by communities to maintain their livelihoods.

The field problem that underlies this study is the gap between formal coastal management programs and the lived realities of coastal communities. In many coastal villages, fishers and local residents do not experience environmental change as an abstract issue. They experience it through shorter fishing seasons, declining catch predictability, changing fishing grounds, conflict over access, damage to mangrove areas, and uncertainty in household income. Gómez Murciano et al. (2021) show that fisher vulnerability to climate change cannot be understood only through technical indicators because social perception and lived experience shape how communities define risk. Salgueiro-Otero et al. (2022) also find that adaptation pathways in small-scale fisheries depend on social networks, community relations, and the capacity to respond to ecological change. These findings support the need for a qualitative study that explores how coastal actors interpret change, negotiate access, and build adaptive practices in specific local contexts.

The social dynamics of coastal resource management are also shaped by power relations, customary norms, trust, leadership, gendered roles, and local institutions. Frawley et al. (2024) show that self-governance can influence fishing strategies, vulnerability, and adaptive responses among small-scale fishers. This means that community capacity cannot be separated from local rules, social organization, and the ability of actors to coordinate collective action. Mozumder et al. (2024) further show that debt relations and economic dependency can weaken socio-ecological resilience among small-scale fishers. In coastal settings, these conditions may appear through dependence on boat owners, middlemen, tourism investors, or informal credit systems. Dahlet et al. (2025) show that access to fisheries is often negotiated through social relationships, economic control, and governance gaps. This study therefore views coastal management as a social process that involves cooperation, contestation, adaptation, and unequal access to resources.

Ecological dynamics are equally important because the sustainability of coastal livelihoods depends on the condition of mangroves, coral reefs, fish habitats, water quality, and marine biodiversity. Micheli et al. (2024) explain that small-scale fisheries are vulnerable to

environmental extremes when ecological exposure combines with weak rights, limited infrastructure, and low adaptive capacity. Ojea et al. (2021) show that fisheries resilience depends on ecological, socioeconomic, and institutional dimensions. This confirms that ecological degradation cannot be solved only through conservation rules if communities lack access, voice, and livelihood security. Widiarti et al. (2025) also stress the importance of community perception and participation in sustainable coral reef management. These studies indicate that sustainable coastal management requires a balanced reading of ecological change and social response.

Although recent studies have discussed coastal vulnerability, small-scale fisheries, adaptive capacity, and community-based management, several gaps remain. Many studies still emphasize measurement, resilience indicators, policy models, or vulnerability mapping. Fewer studies explore how coastal communities make sense of ecological change, how local actors negotiate resource access, and how social meanings influence conservation practices. Refulio-Coronado et al. (2021) note that coastal and marine social-ecological research has advanced, but more contextual work is needed to explain feedback between human behavior and ecological change. Stelzenmüller et al. (2024) also highlight the importance of adaptive capacity in fisheries social-ecological systems. Based on this gap, this study aims to analyze the social and ecological dynamics that shape sustainable coastal resource management in Tanjung Bira and Ara coastal villages, Bulukumba Regency, South Sulawesi, Indonesia. The study contributes theoretically to social-ecological systems literature and practically to participatory, adaptive, and locally grounded coastal governance.

2. Materials and Methods

This study used a qualitative case study design. The design was selected because the research aimed to understand social and ecological dynamics in coastal resource management within a specific local context. A case study is suitable for examining complex processes, actor relations, and contextual meanings that cannot be separated from real-life settings. Lim (2025) states that qualitative research helps researchers explore meanings, practices, and experiences in depth. This study therefore did not aim to measure the level of sustainability statistically. It aimed to interpret how coastal actors understand ecological change, organize resource use, negotiate access, and participate in coastal management. Wiesner (2022) also argues that interpretive qualitative research is useful when the researcher needs to connect empirical experience with social meaning and contextual explanation.

The research was conducted in Tanjung Bira and Ara coastal villages, Bulukumba Regency, South Sulawesi, Indonesia. These locations were selected because they represent coastal communities where small-scale fisheries, tourism, mangrove areas, boat-related livelihoods, and marine resource use interact in one social-ecological setting. The study was carried out from June to August 2025. The first month focused on preliminary observation, community mapping, and identification of key informants. The second month focused on interviews, participatory observation, and collection of local documents. The third month focused on data confirmation, follow-up interviews, transcription, and initial coding. This time frame allowed the researcher to observe daily coastal activities, local interactions, and community responses to ecological and economic pressures.

Participants were selected through purposive sampling. The main criteria were direct involvement in coastal resource use, experience with ecological change, knowledge of local management practices, and participation in community or institutional activities related to coastal resources. The participants included small-scale fishers, fish traders, seaweed farmers, tourism workers, village officers, community leaders, women from coastal households, local conservation actors, and representatives of youth groups. After key informants were identified, snowball sampling was used to reach additional participants who had relevant knowledge but were not visible during the early stage of fieldwork. Sebele-Mpofu (2020) explains that saturation in qualitative research should be understood as the point at which the data provide enough depth,

variation, and conceptual clarity. In this study, interviews continued until new data no longer produced substantially different themes.

Data were collected through semi-structured interviews, participatory observation, and documentation. Semi-structured interviews were used to explore participants' experiences of coastal change, livelihood pressure, resource access, conflict, conservation practice, and adaptation strategy. Hughes (2020) explains that qualitative interviews allow participants to express experience and interpretation in their own words. Participatory observation was conducted by observing fishing preparation, fish landing activities, informal market interactions, coastal tourism activities, community discussions, mangrove-related activities, and everyday interactions among coastal actors. Documentation was used to examine village records, local regulations, coastal program documents, activity photos, maps, community reports, and related institutional archives. These three techniques supported triangulation and helped the researcher compare spoken narratives with observed practices and written records.

Data validation was carried out through source triangulation, method triangulation, member checking, and audit trail. Source triangulation was conducted by comparing information from fishers, village officers, women in coastal households, tourism actors, conservation groups, and community leaders. Method triangulation was conducted by comparing interview data, observation notes, and documents. Member checking was carried out by returning selected summaries of interview results and preliminary interpretations to key participants. Ahmed (2024) explains that credibility, transferability, dependability, and confirmability are key pillars of trustworthiness in qualitative research. To strengthen dependability, the researcher maintained an audit trail that included interview guides, field notes, consent records, coding decisions, analytic memos, and documentation of theme development.

Data were analyzed using thematic analysis supported by the interactive model of Miles, Huberman, and Saldaña. The analysis followed three connected stages: data condensation, data display, and conclusion drawing. Braun and Clarke (2025) emphasize that qualitative reporting should show a clear relationship between research values, analytic choices, and interpretation. In this study, data condensation began with verbatim transcription, repeated reading, initial coding, and selection of meaningful data segments. Data display was conducted through thematic matrices that grouped participants' statements, field observations, and document findings. Conclusion drawing was conducted by identifying patterns, contradictions, and relationships among themes. The main themes included ecological change, livelihood adaptation, resource access, local governance, social conflict, community participation, and sustainability meanings.

Research ethics were applied throughout the fieldwork and reporting process. Each participant received information about the study purpose, type of data collected, voluntary participation, confidentiality, and the right to stop the interview. Verbal or written consent was obtained before interviews and observations. Participant identities were anonymized using codes such as Fisher 1, Village Officer 1, Tourism Actor 1, and Community Leader 1. The researcher also used reflexive notes to record possible bias, assumptions, emotional responses, and field relations that could influence interpretation. This procedure made the research process transparent and allowed limited replication in other coastal communities with similar social-ecological characteristics. The methodology was designed to produce context-rich findings while maintaining rigor, ethical clarity, and consistency between research questions, field data, analysis, and interpretation.

3. Results and Discussions

Coastal Resources as a Shared Livelihood System

The findings show that coastal resources in Tanjung Bira and Ara are understood by local communities as a shared livelihood system. Participants did not describe the coast only as a physical environment or an economic resource. They described it as a living space that connects work, family, local identity, social relations, and ecological knowledge. Small-scale fishers

depended on the sea for daily income, while women in coastal households contributed through fish processing, informal trade, tourism-related activities, and household financial management. This pattern shows that coastal livelihoods are distributed across household members and are not limited to fishing activities alone.

Participants also viewed the sea as part of their social and cultural identity. One fisher stated, "The sea is not only where we work. It is where our family life begins every day" (Fisher 3). This statement illustrates that marine space carries emotional and social meaning. For many participants, coastal resources were closely linked to family continuity, social memory, and the ability to maintain life in the village. Observations at fish landing sites also showed that fishing activities created social interaction among fishers, traders, boat owners, and household members. These interactions formed a local economic network that supported daily survival.

The data indicate that coastal resource use operates through interdependence among actors. Fishers depend on traders to sell catches. Traders depend on fishers for supply. Women depend on fish availability for processing and selling. Tourism workers depend on coastal cleanliness, beach access, and visitor flow. This interdependence shows that coastal resource management cannot be reduced to environmental regulation. It involves livelihood relations, local markets, family roles, and community cooperation.

Ecological Change and Livelihood Uncertainty

Participants described ecological change through direct experiences in daily work. They did not commonly use scientific terms such as climate vulnerability, ecosystem degradation, or biodiversity loss. Instead, they referred to unstable weather, unpredictable winds, changing fishing seasons, declining catch certainty, shifting fishing grounds, and damage to coastal vegetation. One fisher explained, "Before, we could guess the season. Now the wind changes quickly, and sometimes we return with almost nothing" (Fisher 1). This statement shows that ecological change is experienced as uncertainty in income, time, and household planning.

Field observations supported this finding. Fish landing activities were not always stable. Some days showed active movement of fishers and traders, while other days were quiet because strong winds limited fishing activity. Several fishers waited longer before going to sea because they were unsure about weather conditions. This uncertainty affected household income, debt repayment, fuel costs, and market supply. It also affected emotional well-being because fishers had to decide whether going to sea was worth the risk.

The findings also show that ecological change does not affect all actors in the same way. Fishers with larger boats and better equipment had more flexibility to reach farther fishing grounds. Small fishers with limited capital faced greater constraints because they depended on nearby waters and daily income. Women in coastal households also felt the impact when fish supply declined, because their processing and trading activities depended on regular catches. This shows that ecological uncertainty becomes a social and economic problem when it interacts with unequal livelihood capacity.

Local Knowledge as an Adaptive Resource

Local knowledge emerged as an important adaptive resource in coastal life. Fishers used wind direction, wave movement, moon phases, water color, bird movement, and seasonal memory to decide when and where to fish. Older fishers were often viewed as key knowledge holders because they had long experience reading coastal signs. One community leader stated, "Young people use phones to see the weather, but old fishers still read the sea from signs that they have known since childhood" (Community Leader 1). This statement shows that traditional knowledge remains relevant even when digital tools become more available.

The findings suggest that local knowledge is not static. Fishers combined inherited ecological knowledge with mobile weather information, market information, and peer communication.

Younger fishers tended to use digital weather forecasts, while older fishers trusted direct observation and past experience. In practice, both forms of knowledge were often combined before decisions were made. This combination helped fishers reduce risk, although it did not fully remove uncertainty.

Local knowledge also influenced conservation awareness. Some participants linked mangrove condition, water quality, and fish habitat to long-term livelihood security. They understood that damage to coastal ecosystems could affect future income. However, this awareness did not always lead to consistent conservation behavior. Economic pressure sometimes pushed people to prioritize short-term income over long-term ecological protection. This finding shows that knowledge alone is not enough. It must be supported by fair access, livelihood security, and collective rules.

Unequal Access and Social Tension

The findings reveal unequal access to coastal resources and coastal space. Participants explained that actors with stronger capital, better boats, wider market networks, and closer links to decision-making structures had greater control over livelihood opportunities. Small fishers had fewer options when fishing conditions became difficult. Some participants also described tension between fishing activities and tourism development. A small-scale fisher said, “Sometimes the beach is more for tourists now. We must adjust where to place our boats” (Fisher 5). This indicates that coastal space is increasingly contested.

Tourism growth created both opportunity and pressure. Some residents benefited from boat services, food stalls, homestays, and beach-related work. Others felt that tourism changed access to traditional fishing spaces. The beach became not only a work space for fishers, but also a commercial space for visitors, businesses, and tourism operators. This created a new pattern of negotiation over where boats could land, where fishers could work, and how coastal areas should be used.

The data also show that economic dependency shaped social relations. Some fishers depended on boat owners, traders, or informal lenders to finance fishing operations. This dependency affected bargaining power. Fishers with debt or limited capital had less freedom to choose buyers or adjust livelihood strategies. This condition made their adaptive capacity weaker, especially during bad weather or low catch periods. Therefore, unequal access was not only a spatial issue. It was also linked to capital, market power, credit relations, and participation in local governance.

Community Participation and Local Governance

Community participation appeared as a major factor in coastal management. Participants were more willing to support conservation activities, waste control, mangrove protection, and coastal clean-up programs when they understood the purpose and saw clear benefits. A village officer stated, “People will join if they understand the purpose and if they see benefits for the village” (Village Officer 1). This statement shows that participation depends on trust, communication, and perceived relevance.

Observation showed that community meetings were more active when the topic was directly connected to livelihood, safety, tourism income, or visible environmental problems. Participants were less responsive when programs were introduced in technical language or when decisions were perceived as coming from outside the community. This indicates that participation is not only about attendance. It requires meaningful involvement, shared understanding, and local ownership.

The findings also reveal uneven participation among community groups. Men, village officials, and community leaders were more visible in formal discussions. Women, youth, and poorer fishers had less influence, although they experienced coastal change in direct ways. Women managed household resilience during income instability, while youth were active in

tourism and informal coastal work. Their limited influence in formal decision-making shows that local governance still needs stronger inclusion.

Livelihood Diversification as an Adaptation Strategy

Livelihood diversification became a key response to ecological and economic uncertainty. Some fishers shifted temporarily to tourism work during low fishing periods. Women sold processed fish, snacks, and small goods to visitors. Youth participated in boat services, homestay support, guiding, and informal tourism activities. One tourism worker stated, "When fishing is not good, tourism helps, but tourism is also not always stable" (Tourism Actor 2). This statement reflects the double character of diversification. It provides additional income, but it also creates new uncertainty.

Diversification helped households reduce dependence on fishing. It allowed families to survive when catches declined or weather prevented fishing. However, tourism-based income depended on season, visitor numbers, infrastructure, and market demand. This means that diversification did not fully solve livelihood insecurity. It changed the source of risk from ecological uncertainty to combined ecological and market uncertainty.

The findings also show that livelihood identities became more flexible. Some participants did not identify only as fishers, traders, or tourism workers. They moved between roles depending on season, income opportunity, and family need. This hybrid livelihood pattern shows the adaptive capacity of coastal communities. However, it can also create pressure on coastal ecosystems if tourism and resource use are not managed carefully.

Social Meaning of Sustainability

Participants understood sustainability in practical and everyday terms. They rarely used formal policy language. They associated sustainability with being able to fish in the future, maintaining clean beaches, protecting fish habitats, avoiding conflict, and ensuring that children could still live from coastal resources. A woman from a coastal household stated, "For us, sustainability means our children can still eat from the sea and the village is not damaged" (Woman Participant 2). This statement shows that sustainability is understood through family continuity, livelihood security, and environmental care.

The findings show that sustainability has moral, social, and ecological dimensions. It is moral because participants linked it to responsibility for future generations. It is social because it depends on cooperation, fairness, and conflict prevention. It is ecological because it requires healthy coastal ecosystems. This meaning differs from formal sustainability frameworks that often focus on policy targets or environmental indicators. For participants, sustainability becomes meaningful when it protects daily life and future livelihood.

This finding indicates that coastal management programs need to translate sustainability into local language and practical benefits. Programs that only use technical terms may fail to connect with community concerns. In contrast, programs that link ecological protection with family welfare, livelihood security, and village continuity may gain stronger support.

Discussion

Interpreting Coastal Resource Management Through Social-Ecological Systems Theory

The findings confirm that coastal resource management in Tanjung Bira and Ara must be understood as a social-ecological process. Coastal resources are not only ecological objects that need regulation. They are embedded in social relations, household economies, local meanings, and community institutions. This supports Hossain et al. (2020), who argue that coastal systems should be understood through the interaction between human communities and ecological processes. The present study strengthens this view by showing that the sea functions as a livelihood space, cultural space, and social space at the same time.

The findings also align with Refulio-Coronado et al. (2021), who explain that coastal and marine social-ecological systems involve feedback between ecological conditions and social behavior. In this study, ecological change affected fishing decisions, household income, and livelihood diversification. At the same time, social behavior affected coastal conditions through fishing practices, tourism activities, waste management, and participation in conservation. This two-way relationship confirms that coastal sustainability cannot be achieved through ecological protection alone.

The study offers a specific qualitative contribution. It shows how coastal actors interpret sustainability through lived experience. Instead of defining sustainability through abstract indicators, participants connected it to daily income, food security, family continuity, and village well-being. This local interpretation is important because policies that ignore community meaning may face weak participation and low compliance.

Ecological Change as Lived Uncertainty

The findings show that ecological change is experienced mainly as livelihood uncertainty. Participants described changing winds, unstable seasons, and declining catch predictability as direct disruptions to daily life. This supports Gómez Murciano et al. (2021), who argue that fisher vulnerability cannot be fully understood through technical indicators because perception and experience shape how risk is interpreted. The present study confirms this argument by showing that fishers define ecological risk through work routines, income instability, and household pressure.

The findings are also consistent with Salgueiro-Otero et al. (2022), who found that adaptation pathways in small-scale fisheries depend on social networks and community relations. In Tanjung Bira and Ara, fishers responded to uncertainty by changing fishing time, moving fishing areas, relying on local knowledge, and combining fishing with tourism work. These responses show that adaptation is not a single action. It is a series of practical adjustments shaped by household capacity, available networks, and access to resources.

However, this study also shows that adaptation capacity is unequal. Fishers with better boats and stronger capital adapted more easily than small fishers with limited equipment. This finding adds a critical point to previous studies. Adaptation should not be treated as a general community capacity. It must be examined through differences in class, capital, gender, and access to decision-making.

Local Knowledge and Hybrid Adaptation

The study found that local ecological knowledge remains important, but it now works together with digital information and modern livelihood demands. This finding supports Halim et al. (2020), who emphasize the importance of recognizing local access rights and community-based practices in Indonesian small-scale fisheries. Local knowledge helped fishers read ecological signs, avoid risk, and decide when to fish. It also shaped how communities understood environmental change.

At the same time, the findings show that local knowledge is adaptive rather than fixed. Older fishers relied on long-term experience, while younger fishers combined traditional knowledge with mobile weather forecasts and peer communication. This hybrid knowledge system offers a practical response to uncertainty. It allows communities to maintain inherited ecological understanding while adapting to new risks and technologies.

This finding offers a different perspective from studies that treat traditional knowledge as a cultural object that needs preservation. In this study, local knowledge appears as a working tool for decision-making. It changes, adjusts, and interacts with new information. Therefore, coastal management should not only document local knowledge. It should create spaces where local

knowledge can inform planning, risk communication, conservation, and community-based monitoring.

Unequal Access, Tourism Pressure, and Coastal Justice

The findings show that coastal sustainability is closely linked to access and justice. Small fishers, women, and poorer households faced greater vulnerability because they had weaker access to capital, coastal space, and decision-making. This supports Mozumder et al. (2024), who show that economic dependency can weaken socio-ecological resilience among small-scale fishers. In this study, dependency appeared through informal credit, market relations, and unequal bargaining power.

The findings also align with Dahlet et al. (2025), who argue that access to fisheries is shaped by governance, social relations, and economic control. In Tanjung Bira and Ara, access was shaped not only by fishing rights, but also by tourism development and spatial competition. As beaches became more valuable for tourism, traditional fishing spaces became contested. This shows that coastal resource management must address conflicts between livelihood groups and commercial development.

This study adds that tourism should not be viewed only as an alternative livelihood. Tourism can reduce fishing pressure and provide income. However, it can also create exclusion if coastal space is reorganized without protecting small-scale fishers. Therefore, coastal governance must integrate tourism planning, fisher access, conservation rules, and community participation. Sustainable coastal development needs to include coastal justice as a core principle.

Participation, Governance, and the Quality of Inclusion

The findings show that community participation becomes meaningful when people understand the purpose of programs and see clear local benefits. This supports Widiarti et al. (2025), who emphasize that community perception and participation are important for sustainable coral reef management. Participation in this study was not only influenced by formal invitation. It depended on trust, communication, relevance, and perceived fairness.

The findings also support Ojea et al. (2021), who explain that fisheries resilience depends on ecological, socioeconomic, and institutional dimensions. Local governance in Tanjung Bira and Ara worked better when village actors, fishers, youth groups, women, and conservation actors communicated across roles. However, formal participation remained uneven. Women and poorer fishers were less visible in decision-making, even though they were directly affected by livelihood uncertainty and environmental change.

This creates an important implication for participatory coastal governance. Participation should not be measured only by the number of people attending meetings. It should be assessed through the quality of inclusion, the diversity of voices, and the influence of community input on decisions. Without this, participation may become procedural rather than substantive.

Livelihood Diversification and Adaptive Capacity

The findings show that livelihood diversification is a major adaptation strategy in coastal communities. This aligns with Micheli et al. (2024), who explain that adaptation pathways in small-scale fisheries are shaped by exposure, rights, infrastructure, and social capacity. In this study, diversification appeared through tourism work, fish processing, small trade, boat services, and informal services. These activities helped households manage uncertainty when fishing income declined.

The findings also support Basurto et al. (2025), who emphasize the multidimensional contribution of small-scale fisheries to food, nutrition, employment, and local economies. The present study adds that small-scale fisheries in tourism areas are increasingly connected with non-

fishing activities. Coastal households do not depend on one livelihood source. They build flexible combinations of work to survive.

However, diversification has limits. Tourism income is seasonal and vulnerable to market change. It may also increase pressure on coastal space, waste management, and local inequality. This means diversification should not be treated as an automatic solution. It needs policy support, skills training, fair access to tourism benefits, and environmental safeguards.

Practical Implications for Sustainable Coastal Management

The findings suggest that sustainable coastal resource management in Tanjung Bira and Ara requires integrated and locally grounded strategies. First, local government should strengthen inclusive village forums that involve fishers, women, youth, tourism actors, conservation groups, and informal economic actors. These forums should not only discuss conservation targets. They should also address access, livelihood security, tourism pressure, and conflict prevention.

Second, coastal planning should protect small-scale fisher access to landing sites, fishing routes, and coastal work spaces. Tourism development needs clear spatial arrangements so that commercial use does not remove traditional livelihood spaces. Third, coastal conservation programs should use local knowledge as part of planning and monitoring. Fishers' knowledge of seasonal change, habitat conditions, and fishing grounds can support more responsive management.

Fourth, livelihood diversification should be supported through training, small business assistance, market access, and environmental standards. Fuchs et al. (2025) argue that marine conservation and climate adaptation need stronger integration. This study supports that view and adds that integration must happen through community-level institutions that connect ecological goals with household realities.

Theoretical Implications and Research Contribution

Theoretically, this study contributes to social-ecological systems literature by showing that sustainability is shaped by the interaction between ecological pressure and social meaning. The findings demonstrate that community responses to coastal change are not only driven by material conditions. They are also shaped by trust, identity, fairness, knowledge, and perceived future security.

This study also contributes to qualitative coastal research by showing the importance of lived experience in understanding sustainability. Lim (2025) argues that qualitative research is useful for exploring meanings and practices in context. The present study demonstrates that coastal actors interpret ecological change through daily work, household survival, spatial negotiation, and local responsibility. These meanings are important because they influence participation, adaptation, and acceptance of management rules.

The study also strengthens the argument of Stelzenmüller et al. (2024), who emphasize adaptive capacity in fisheries social-ecological systems. However, this study adds that adaptive capacity must be examined through social inequality. Communities may appear adaptive at the surface, but not all members have equal resources to adapt. This insight is important for designing fair and effective coastal governance.

Critical Reflection and Future Research

The findings show that coastal communities are active actors in responding to ecological and economic change. They interpret risk, adjust livelihood strategies, maintain local knowledge, and participate in management when they see relevance and fairness. However, their adaptive capacity is constrained by unequal access, weak bargaining power, unstable income, and uneven participation. This means that sustainability cannot depend only on community willingness. It also requires institutional support, fair policy, and protection of vulnerable groups.

Future research can compare several coastal villages with different economic characteristics, such as fishing-dominant villages, tourism-dominant villages, and conservation-based villages. Comparative research would help explain how different local economies shape adaptation and coastal governance. Further studies should also examine gender roles in coastal adaptation because women often manage household resilience but remain underrepresented in formal decision-making.

Mixed-method research can also extend this study by combining qualitative findings with livelihood surveys, spatial mapping, ecological monitoring, or climate risk data. Such studies can provide a more complete explanation of how social meaning, economic pressure, governance quality, and ecological condition interact in coastal areas. This direction would strengthen both academic understanding and practical policy design for sustainable coastal resource management.

4. Conclusions

This study concludes that sustainable coastal resource management in Tanjung Bira and Ara is shaped by the interaction between ecological change, livelihood dependence, local knowledge, unequal access, community participation, and adaptive livelihood strategies. The findings show that coastal resources are not only economic assets, but also social and cultural spaces that support family survival, local identity, and community continuity. Ecological change is experienced by coastal actors through unstable weather, shifting fishing grounds, uncertain catches, and declining livelihood security. Local communities respond through practical adaptation, including the use of local ecological knowledge, livelihood diversification, and participation in conservation activities. However, these responses remain uneven because access to capital, coastal space, market networks, and decision-making is not equally distributed among fishers, women, youth, tourism actors, and other local groups.

Theoretically, this study contributes to social-ecological systems literature by showing that coastal sustainability must be understood through the meanings, experiences, and negotiations of local actors. Practically, the findings highlight the need for coastal management that integrates ecological protection with livelihood security, inclusive participation, and recognition of local knowledge. From a policy perspective, local governments should strengthen participatory village forums, protect small-scale fisher access, regulate tourism development fairly, and support livelihood diversification that does not harm coastal ecosystems. Future research can compare coastal villages with different economic structures, examine gender roles in coastal adaptation, and combine qualitative findings with spatial, ecological, or livelihood data to deepen the understanding of social and ecological dynamics in coastal resource management.

References

Ahmed, S. K. (2024). The pillars of trustworthiness in qualitative research. *Journal of Medicine, Surgery, and Public Health, 2*, 100051. https://doi.org/10.1016/j.glmedi.2024.100051

Basurto, X., Gutierrez, N. L., Franz, N., Mancha-Cisneros, M. D. M., Gorelli, G., Aguión, A., Funge-Smith, S., Harper, S., Mills, D. J., Nico, G., Tilley, A., Vannuccini, S., Virdin, J., Westlund, L., Allison, E. H., Anderson, C. M., Baio, A., Cinner, J., Fabinyi, M., & Thilsted, S. H. (2025). Illuminating the multidimensional contributions of small-scale fisheries. *Nature, 637*, 875–884. https://doi.org/10.1038/s41586-024-08448-z

Braun, V., & Clarke, V. (2025). Reporting guidelines for qualitative research: A values-based approach. *Qualitative Research in Psychology*. https://doi.org/10.1080/14780887.2024.2382244

Chen, M., Xu, Z., & Wang, Y. (2025). Spatiotemporal distribution and influencing factors of Chinese marine protected areas under a social-ecological system framework. *Frontiers in Marine Science, 12*, 1513307. https://doi.org/10.3389/fmars.2025.1513307

Dahlet, L., Barboza, R. S. L., van Putten, I. E., Akpan, A., Siriwardane-de Zoysa, R., & Glaser, M. (2025). Perceptions of governance and access in artisanal marine fisheries in northern Brazil. *Ecology and Society, 30*(3), 30. https://doi.org/10.5751/ES-16389-300330

Frawley, T. H., González-Mon, B., Nenadovic, M., Gladstone, F., Nomura, K., Zepeda-Domínguez, J. A., Rodriguez-Van Dyck, S., Ferrer, E. M., Torre, J., Micheli, F., Leslie, H. M., & Basurto, X. (2024). Self-governance mediates small-scale fishing strategies, vulnerability and adaptive response. *Global Environmental Change, 84*, 102805. https://doi.org/10.1016/j.gloenvcha.2024.102805

Fuchs, G., Kroos, F., Scherer, C., Seifert, M., & Stelljes, N. (2025). Exploring marine conservation and climate adaptation synergies and strategies in European seas as an emerging nexus: A review. *Frontiers in Marine Science, 12*, 1542705. https://doi.org/10.3389/fmars.2025.1542705

Gómez Murciano, M., Liu, Y., Ünal, V., & Sánchez Lizaso, J. L. (2021). Comparative analysis of the social vulnerability assessment to climate change applied to fisheries from Spain and Turkey. *Scientific Reports, 11*, 13949. https://doi.org/10.1038/s41598-021-93165-0

Halim, A., Loneragan, N. R., Wiryawan, B., Fujita, R., Adhuri, D. S., Hordyk, A. R., & Sondita, M. F. A. (2020). Transforming traditional management into contemporary territorial-based fisheries management rights for small-scale fisheries in Indonesia. *Marine Policy, 116*, 103923. https://doi.org/10.1016/j.marpol.2020.103923

Hossain, M. S., Gain, A. K., & Rogers, K. G. (2020). Sustainable coastal social-ecological systems: How do we define "coastal"? *International Journal of Sustainable Development & World Ecology, 27*(7), 577–582. https://doi.org/10.1080/13504509.2020.1789775

Hughes, K. (2020). Introduction: Making the case for qualitative interviews. *International Journal of Social Research Methodology, 23*(5), 541–545. https://doi.org/10.1080/13645579.2020.1766756

Kanan, A. H., & Giupponi, C. (2024). Coastal socio-ecological systems adapting to climate change: A global overview. *Sustainability, 16*(22), 10000. https://doi.org/10.3390/su162210000

Kleisner, K. M., Free, C. M., Thorson, J. T., Ojea, E., Thomas-Smyth, A., Liu, O. R., Pinsky, M. L., & Gaines, S. D. (2022). Identifying policy approaches to build social-ecological resilience in marine fisheries with differing capacities and contexts. *ICES Journal of Marine Science, 79*(2), 552–572. https://doi.org/10.1093/icesjms/fsab080

Lim, W. M. (2025). What is qualitative research? An overview and guidelines. *Australasian Marketing Journal, 33*(2), 199–229. https://doi.org/10.1177/14413582241264619

Micheli, F., Saenz-Arroyo, A., Aalto, E. A., Beas-Luna, R., Boch, C. A., Cardenas, J. C., De Leo, G. A., Diaz, E., Espinoza-Montes, A., Finkbeiner, E., Freiwald, J., Fulton, S., Hernández, A., Lejbowicz, A., Low, N. H. N., Martinez, R., McCay, B., Monismith, S., Precoma-de la Mora, M., & Woodson, C. B. (2024). Social-ecological vulnerability to environmental extremes and adaptation pathways in small-scale fisheries of the southern California Current. *Frontiers in Marine Science, 11*, 1322108. https://doi.org/10.3389/fmars.2024.1322108

Mozumder, M. M. H., Schneider, P., Islam, M. M., Deb, D., Acharjee, M. R., & Washi, A. M. J. (2024). Bridging the gap: Enhancing socio-ecological resilience by breaking the debt cycle among small-scale hilsa fishers in Bangladesh. *Maritime Studies, 23*, 10. https://doi.org/10.1007/s40152-024-00355-3

Ojea, E., Fontán, E., Fuentes-Santos, I., & Bueno-Pardo, J. (2021). Assessing countries' social-ecological resilience to shifting marine commercial species. *Scientific Reports, 11*, 22926. https://doi.org/10.1038/s41598-021-02328-6

Refulio-Coronado, S., Lacasse, K., Dalton, T., Humphries, A., Basu, S., Uchida, H., & Uchida, E. (2021). Coastal and marine socio-ecological systems: A systematic review of the literature. *Frontiers in Marine Science, 8*, 648006. https://doi.org/10.3389/fmars.2021.648006

Roberts, C., Béné, C., Bennett, N., Boon, J. S., Cheung, W. W. L., Cury, P., Defeo, O., De Jong Cleyndert, G., Froese, R., Gascuel, D., Golden, C. D., Hawkins, J., Hobday, A. J., Jacquet, J., Kemp, P., Lam, M. E., Le Manach, F., Meeuwig, J. J., Micheli, F., & O'Leary, B. C. (2024). Rethinking sustainability of marine fisheries for a fast-changing planet. *npj Ocean Sustainability, 3*, 41. https://doi.org/10.1038/s44183-024-00078-2

Salgueiro-Otero, D., Barnes, M. L., & Ojea, E. (2022). Climate adaptation pathways and the role of social-ecological networks in small-scale fisheries. *Scientific Reports, 12*, 15526. https://doi.org/10.1038/s41598-022-18668-w

Sebele-Mpofu, F. Y. (2020). Saturation controversy in qualitative research: Complexities and underlying assumptions. *Cogent Social Sciences, 6*(1), 1838706. https://doi.org/10.1080/23311886.2020.1838706

Widiarti, R., Kusumawardhani, A. D., Burhanuddin, E., Susiloningtyas, D., Takarina, N. D., Patria, M. P., & Fadhilah, M. F. (2025). The enhancement of community perception and participation in gaining sustainable coral reef management models. *Frontiers in Marine Science, 12*, 1577199. https://doi.org/10.3389/fmars.2025.1577199