



Evaluating the Ecotourism-Conservation Nexus A Valuation of Coral Reef Ecosystem Services and Marine Protected Area Financing

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ABSTRACT

Background. Coral reef ecosystems provide essential ecological and socioeconomic services that support marine biodiversity, coastal livelihoods, and ecotourism development. Increasing environmental degradation and insufficient conservation financing mechanisms threaten the sustainability of Marine Protected Areas (MPAs), requiring integrated approaches that connect tourism benefits with ecosystem protection.

Purpose. This study aimed to evaluate the ecotourism-conservation nexus by assessing the economic value of coral reef ecosystem services and examining their potential contribution to sustainable MPA financing.

Method. A mixed-methods research design was applied by integrating ecosystem service valuation, stakeholder surveys, qualitative interviews, and governance assessments.

Results. The findings revealed that coral reef ecosystems generate substantial economic value through recreational tourism, coastal protection, biodiversity conservation, and livelihood support. Ecotourism activities contributed significantly to local economic development; however, existing conservation financing mechanisms remained insufficient to ensure long-term ecosystem management. Stakeholder participation, transparent governance, and tourism-based financial instruments emerged as critical factors supporting conservation sustainability.

Conclusion. The study concludes that ecosystem service valuation provides an important foundation for developing innovative financing strategies that transform ecotourism benefits into conservation investments. The research contributes an integrated framework for strengthening marine conservation, sustainable tourism management, and resilient blue economy development.

KEYWORDS

Coral Reef Ecosystem, Ecotourism, Ecosystem Services Valuation, Marine Protected Areas, Sustainable Financing

INTRODUCTION

Coral reef ecosystems represent one of the most valuable marine resources due to their exceptional biodiversity, ecological functions, and contribution to human well-being (Wu et al., 2025). These ecosystems provide a wide range of ecosystem services, including coastal protection, fisheries support, carbon regulation, biodiversity conservation, and recreational opportunities

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(Luisetti et al., 2024). Millions of coastal communities worldwide depend on coral reefs for food security, income generation, and cultural identity (Arkema, Cunningham, et al., 2024). The ecological and socioeconomic importance of coral reefs has positioned them as critical components of sustainable development strategies, particularly in regions where marine resources serve as the foundation of local economies.

Ecotourism has emerged as an important mechanism for connecting biodiversity conservation with economic development through the sustainable utilization of natural resources (Abdel Hamid et al., 2024). Marine-based ecotourism activities, including coral reef diving, snorkeling, and educational tourism, generate economic benefits while creating incentives for ecosystem protection. The relationship between ecotourism and conservation represents a potential pathway for achieving a balance between economic growth and environmental sustainability (Arkema, Field, et al., 2024). Effective management of this relationship requires a comprehensive understanding of the economic value of ecosystem services and the mechanisms needed to ensure that tourism revenues contribute directly to conservation efforts.

Marine Protected Areas (MPAs) have become widely recognized as essential conservation instruments for maintaining coral reef health and protecting marine biodiversity (Suggett et al., 2023). The effectiveness of MPAs, however, depends significantly on adequate and sustainable financing mechanisms. Many protected areas face challenges related to insufficient operational budgets, limited monitoring capacity, weak enforcement systems, and dependence on short-term funding sources (Habib et al., 2024). The integration of ecosystem service valuation and ecotourism-based financing provides an opportunity to strengthen conservation strategies by demonstrating the economic importance of coral reefs and creating sustainable financial pathways for marine protection.

The primary problem addressed in this research is the persistent gap between the economic benefits generated by marine ecotourism and the financial resources available for coral reef conservation (Dushani et al., 2021). Although coral reef ecosystems contribute substantial economic value through tourism and ecosystem services, these benefits are often not adequately translated into conservation investments. Tourism revenues frequently flow toward commercial activities without creating sufficient financial support for ecosystem restoration, monitoring, and long-term protection programs.

Coral reef ecosystems continue to experience increasing degradation caused by climate change, overfishing, pollution, coastal development, and unsustainable tourism practices. The decline of coral reef conditions threatens biodiversity, reduces ecosystem service availability, and weakens the economic foundation of marine tourism industries (Choudhary et al., 2024). The absence of effective valuation mechanisms makes it difficult for policymakers and stakeholders to recognize the true economic contribution of coral reefs and justify increased investments in marine conservation.

The management of Marine Protected Areas faces additional challenges due to limited financial sustainability and weak institutional coordination (Alongi, 2026). Traditional conservation financing approaches often depend on government budgets, international assistance, or temporary conservation projects that may not provide long-term stability. The development of sustainable financing models requires stronger evidence regarding the economic value of ecosystem services, tourism contributions, and potential revenue mechanisms that can support conservation objectives (Bazairi et al., 2023). Addressing these challenges requires an integrated assessment of the relationship between ecotourism activities, ecosystem service valuation, and MPA financing strategies.

This research aims to evaluate the relationship between marine ecotourism development and coral reef conservation by assessing the economic value of coral reef ecosystem services and their potential contribution to sustainable Marine Protected Area financing (Kumar, 2022). The study seeks to identify the monetary and non-monetary benefits generated by coral reef ecosystems while examining how these values can support conservation planning and financial decision-making.

The research further aims to analyze the contribution of ecotourism activities to conservation financing mechanisms within Marine Protected Areas. Specific attention is directed toward evaluating tourism-generated revenues, ecosystem service values, stakeholder participation, and institutional arrangements that influence conservation outcomes (Rangel-Buitrago, 2026). Through this assessment, the study intends to identify effective strategies for transforming ecotourism benefits into sustainable financial resources for coral reef protection.

The expected outcome of this research is the development of a comprehensive understanding of the ecotourism-conservation nexus through an ecosystem service valuation framework. The study aims to provide practical recommendations for policymakers, conservation organizations, tourism managers, and local communities in designing financing mechanisms that support both economic development and marine ecosystem sustainability (Wiese & Auad, 2022). The findings are expected to contribute to sustainable ocean governance by strengthening the connection between ecological conservation and economic valuation.

Existing research has extensively examined coral reef ecosystem services, marine biodiversity conservation, and the economic benefits of ecotourism. Previous studies have provided valuable information regarding the ecological importance of coral reefs and the contribution of tourism activities to coastal economies (Chakrabarty & Kumar, 2026). However, many studies continue to evaluate these components separately, resulting in limited understanding of how ecotourism-generated economic benefits can directly support conservation financing mechanisms.

Previous ecosystem service valuation studies have often focused on estimating the economic value of coral reefs without sufficiently examining how these valuations influence practical conservation management (Filz et al., 2025). Economic assessments frequently provide theoretical estimates of ecosystem benefits but lack integration with financial planning processes within Marine Protected Areas. This limitation reduces the practical application of valuation results for developing sustainable funding strategies and improving conservation effectiveness.

The literature gap is also evident in the limited exploration of institutional and governance factors influencing the transformation of tourism revenue into conservation investment. Existing research often emphasizes ecological and economic dimensions while providing insufficient attention to stakeholder coordination, financial mechanisms, policy implementation, and community involvement (Thompson, 2026). This research addresses these limitations by integrating ecosystem service valuation, ecotourism economics, and conservation financing within a unified analytical framework.

The novelty of this research lies in its integrated assessment of the relationship between ecotourism development, coral reef ecosystem service valuation, and Marine Protected Area financing. Unlike conventional approaches that examine tourism benefits and conservation needs separately, this study evaluates how economic valuation can serve as a foundation for developing sustainable financing strategies (Tallis et al., 2024). The research emphasizes the importance of recognizing coral reefs not only as ecological assets but also as valuable natural capital supporting long-term socioeconomic development.

The conceptual contribution of this study is reflected in the integration of ecosystem service valuation theory with marine conservation finance frameworks. This approach expands existing

knowledge by demonstrating how economic assessments can support evidence-based decision-making and strengthen institutional commitment toward coral reef protection (Samal & Dash, 2023). The research provides a broader perspective by connecting ecological value, tourism benefits, and financial sustainability within a comprehensive conservation framework.

The justification for this research is based on the urgent need to develop innovative financing solutions for coral reef conservation amid increasing environmental pressures and limited public funding capacity (Shokri & Mohammadi, 2021). Sustainable management of Marine Protected Areas requires financial mechanisms that are resilient, locally adaptable, and connected to economic activities benefiting from marine resources. This study contributes to global marine sustainability efforts by providing insights into how ecotourism can become not only an economic activity but also a strategic instrument for financing biodiversity conservation and ensuring the long-term protection of coral reef ecosystems.

RESEARCH METHODOLOGY

This study employed a mixed-methods research design to evaluate the relationship between ecotourism development, coral reef ecosystem service valuation, and Marine Protected Area (MPA) financing sustainability (Eales et al., 2021). The research design was developed to integrate ecological, economic, social, and institutional perspectives in understanding how marine tourism activities contribute to conservation outcomes. A mixed-methods approach was selected because the ecotourism-conservation nexus involves complex interactions between ecosystem conditions, economic benefits, stakeholder behavior, and governance mechanisms that cannot be adequately explained through a single analytical approach.

The research framework was structured around three interconnected analytical components: ecosystem service valuation, ecotourism contribution assessment, and conservation financing analysis. The ecosystem service valuation component focused on identifying and estimating the economic value of coral reef benefits, including recreational services, biodiversity support, coastal protection, and livelihood contributions. The ecotourism assessment component examined tourism activities, visitor preferences, economic contributions, and perceptions regarding conservation responsibilities. The financing analysis component evaluated existing MPA funding mechanisms, revenue allocation strategies, and opportunities for developing sustainable conservation finance models.

The analytical approach considered coral reef ecosystems as natural capital within a social-ecological system. The study assessed how ecological conditions influence tourism benefits, how tourism activities generate economic value, and how financial mechanisms can transform these benefits into conservation investments (Sheikh et al., 2025). The integration of quantitative valuation methods and qualitative stakeholder analysis provided a comprehensive understanding of the factors determining the effectiveness of ecotourism as a conservation-supporting strategy.

The population of this study consisted of stakeholders directly involved in coral reef ecotourism activities, Marine Protected Area management, and marine conservation initiatives. The target population included local communities, ecotourism operators, tourists, government agencies, conservation organizations, and MPA management authorities. These groups were selected because the sustainability of coral reef conservation depends on interactions among resource users, economic actors, institutional managers, and community-based conservation practices.

The research sample was selected using purposive sampling techniques to ensure that participants possessed relevant knowledge and experience regarding marine tourism, ecosystem management, and conservation financing. The sample included local residents whose livelihoods

depended on marine resources, tourism business operators involved in diving and snorkeling activities, visitors participating in marine ecotourism activities, government officials responsible for coastal management, and representatives of conservation organizations. Selection criteria included direct involvement in marine resource utilization, experience with ecotourism activities, participation in conservation programs, and understanding of MPA management practices.

The quantitative sample consisted of tourism visitors and local community members who provided data regarding willingness to pay, tourism expenditure patterns, perceptions of ecosystem value, and support for conservation financing mechanisms (Siddiqi et al., 2024). The qualitative sample consisted of key stakeholders involved in governance and management processes. The combination of different stakeholder groups enabled the study to capture diverse perspectives regarding the economic value of coral reef ecosystem services and the feasibility of ecotourism-based conservation financing.

The instruments used in this study consisted of ecosystem service valuation tools, structured questionnaires, stakeholder interview guides, and environmental assessment protocols. The ecosystem valuation instrument was designed to estimate the economic contribution of coral reef services through indicators such as recreational value, tourism revenue contribution, biodiversity importance, coastal protection benefits, and local livelihood dependence. These indicators were used to quantify the economic significance of coral reef ecosystems and demonstrate their contribution to sustainable development.

The questionnaire instrument was developed to collect data regarding tourism behavior, visitor preferences, willingness to pay for conservation activities, community perceptions of coral reef benefits, and attitudes toward Marine Protected Area financing (Brander et al., 2024). The questionnaire applied structured measurement scales to evaluate stakeholder awareness, economic dependence, conservation participation, and support for sustainable financing mechanisms. The instrument was tested to ensure clarity, reliability, and relevance before data collection.

The interview guide was designed to explore deeper information regarding governance structures, conservation financing challenges, institutional coordination, and stakeholder collaboration. Interviews were conducted with MPA managers, policymakers, conservation practitioners, and tourism stakeholders to understand existing management practices and opportunities for improving financial sustainability. Environmental assessment protocols were used to document coral reef conditions, ecosystem health indicators, tourism impacts, and conservation management practices. The integration of multiple instruments supported data triangulation and strengthened the validity of research findings.

The research procedure was conducted through several stages, including preliminary assessment, data collection, data analysis, and development of conservation financing recommendations. The preliminary stage involved identifying the research location, reviewing existing conservation programs, establishing assessment indicators, and preparing research instruments. The indicators were developed based on ecosystem service valuation frameworks, sustainable tourism principles, and Marine Protected Area management guidelines.

The data collection stage involved ecological observations, questionnaire distribution, stakeholder interviews, and secondary data collection from conservation reports and institutional records. Coral reef ecosystem assessments were conducted to evaluate environmental conditions and identify ecosystem services supporting tourism activities (Sidqi et al., 2026). Questionnaire surveys were distributed among tourists and local communities to measure economic contributions, conservation awareness, and willingness to participate in financing mechanisms. Stakeholder

interviews were conducted to obtain information regarding governance practices, funding challenges, and opportunities for sustainable conservation finance.

The data analysis stage involved quantitative and qualitative analytical procedures. Economic valuation data were analyzed using ecosystem service valuation techniques, including tourism expenditure analysis and willingness-to-pay estimation to determine the monetary value of coral reef services (Jamilah et al., 2025). Survey data were analyzed using descriptive statistics and relationship analysis to identify patterns in stakeholder perceptions and economic behavior. Qualitative interview data were analyzed through thematic analysis to identify key issues related to governance, financing mechanisms, and conservation strategies.

The final stage involved integrating ecological, economic, and social findings to evaluate the effectiveness of the ecotourism-conservation relationship. The analysis focused on identifying how tourism-generated benefits could support Marine Protected Area financing and improve coral reef conservation outcomes. The resulting framework provided recommendations for developing sustainable financing mechanisms that connect ecotourism activities with long-term ecosystem protection and adaptive marine governance.

RESULT AND DISCUSSION

The evaluation of the ecotourism-conservation nexus was conducted through an integrated analysis of coral reef ecosystem services, tourism economic contributions, and Marine Protected Area (MPA) financing mechanisms. The study collected data from 210 respondents consisting of tourists, local communities, ecotourism operators, MPA managers, government representatives, and conservation organizations. Secondary data were obtained from coral reef monitoring reports, tourism statistics, conservation management documents, and institutional financial records. The assessment focused on four major dimensions, including ecosystem service value, tourism contribution, stakeholder participation, and conservation financing capacity.

Table 1. Assessment of Coral Reef Ecosystem Services, Ecotourism Contribution, and Marine Protected Area Financing Indicators

Assessment Dimension	Indicators	Mean Score	Interpretation
Coral Reef Ecosystem Services	Biodiversity value, recreational benefits, coastal protection, livelihood support	4.12	High
Ecotourism Contribution	Visitor expenditure, tourism dependency, economic benefits	3.86	High
Conservation Participation	Community involvement, environmental awareness, conservation activities	3.74	Moderate-High
MPA Financing Capacity	Funding availability, revenue allocation, financial sustainability	3.21	Moderate
Overall Ecotourism-Conservation Nexus Index	Integrated ecosystem-tourism-financing assessment	3.73	Moderate-High

The data presented in Table 1 demonstrate that coral reef ecosystems generate substantial ecological and economic benefits that support both tourism activities and community livelihoods. Ecosystem service valuation obtained the highest score, indicating that stakeholders recognize coral reefs as valuable natural assets providing multiple benefits beyond recreational tourism. The

findings suggest that coral reef conservation has direct implications for maintaining ecological functions and sustaining local economic activities.

The secondary data analysis revealed that tourism activities generated significant economic value through visitor spending, marine recreational activities, and employment opportunities. Approximately 72% of local households reported direct or indirect dependence on marine tourism-related activities, demonstrating the strong relationship between coral reef conditions and community economic stability. The data also indicated that existing MPA financing mechanisms remained insufficient to fully support long-term conservation activities, particularly ecosystem monitoring, enforcement, and restoration programs.

The findings indicate that coral reef ecosystem services represent a critical foundation for sustainable marine ecotourism development. The high ecosystem service valuation reflects the importance of coral reefs as providers of recreational opportunities, biodiversity conservation, coastal protection, and livelihood support. These results demonstrate that ecological preservation is not only an environmental responsibility but also an economic necessity for maintaining tourism-based economies.

The moderate score of MPA financing capacity highlights a significant challenge in translating ecosystem and tourism values into effective conservation investments. Although ecotourism generates economic benefits, only a limited proportion of tourism revenue is consistently allocated toward ecosystem protection. The findings suggest that stronger financial mechanisms are required to ensure that economic benefits derived from coral reef resources contribute directly to conservation sustainability.

The economic valuation analysis demonstrated considerable monetary contributions generated by coral reef ecosystem services and marine tourism activities. The estimated annual economic value included recreational tourism benefits, ecosystem protection services, biodiversity benefits, and community livelihood contributions. The valuation results showed that tourism-related ecosystem services represented the largest economic component, followed by coastal protection and biodiversity-related values.

Table 2. Economic Valuation of Coral Reef Ecosystem Services and Conservation Financing Potential

Ecosystem Service Component	Estimated Annual Value Contribution (%)	Economic Importance
Recreational Tourism Services	45.6	Very High
Coastal Protection Services	24.3	High
Fisheries and Livelihood Support	18.7	Moderate-High
Biodiversity and Conservation Value	11.4	Moderate
Total Contribution	100	

The results presented in Table 2 indicate that recreational tourism represents the dominant economic value generated by coral reef ecosystems. The high contribution of tourism services demonstrates that marine tourism depends strongly on ecosystem quality and biodiversity conditions. The findings emphasize that degradation of coral reefs may result in significant economic losses for local communities and tourism industries.

The analysis further revealed that conservation financing mechanisms have not fully captured the economic value generated by coral reef ecosystems. Existing funding sources primarily relied on government allocations and conservation programs, while tourism-based financing mechanisms

such as conservation fees, visitor contributions, and private sector partnerships remained underdeveloped. These findings demonstrate the need to strengthen financial connections between tourism benefits and conservation investments.

The inferential analysis revealed significant relationships between ecosystem service valuation, ecotourism intensity, stakeholder participation, and conservation financing sustainability. Statistical testing demonstrated that higher recognition of coral reef ecosystem value was positively associated with stronger support for conservation initiatives ($p < 0.05$). The findings indicate that stakeholder awareness of ecosystem benefits influences willingness to participate in conservation financing mechanisms.

Regression analysis further showed that tourism contribution and community participation significantly predicted support for sustainable MPA financing. Tourism-generated economic benefits demonstrated the strongest relationship with conservation funding preferences, suggesting that stakeholders who benefit economically from marine resources are more likely to support investment in ecosystem protection. These findings confirm the importance of linking economic valuation with conservation decision-making.

The relationship analysis demonstrated that ecotourism and conservation form an interconnected system in which ecosystem quality influences tourism benefits, while tourism activities provide potential resources for conservation. Healthy coral reef conditions increased tourism attractiveness, visitor satisfaction, and economic opportunities for local communities. The findings indicate that conservation investments can generate long-term economic returns by maintaining ecosystem services that support tourism activities.

The analysis also revealed that governance mechanisms function as a critical link between tourism benefits and conservation outcomes. Effective financial management, stakeholder collaboration, and transparent revenue allocation strengthened the relationship between ecotourism development and ecosystem protection. The findings suggest that successful conservation financing depends not only on economic value generation but also on institutional capacity to manage and distribute resources effectively.

A representative case study was conducted in a Marine Protected Area characterized by high dependence on coral reef ecosystems for tourism and local livelihoods. The area experienced increasing tourism demand through diving and snorkeling activities while simultaneously facing challenges related to coral degradation, visitor pressure, and limited conservation funding. Data collection revealed that local communities recognized coral reefs as essential resources supporting both environmental stability and economic security.

Table 3. Case Study Assessment of Ecotourism-Conservation Integration in a Marine Protected Area

Assessment Aspect	Initial Condition	Current Development
Coral Reef Condition	Moderate degradation pressure	Conservation and restoration programs implemented
Tourism Activities	Increasing visitor demand	Sustainable tourism management strategies
Community Participation	Limited formal involvement	Increased participation in conservation activities
Financing Mechanism	Dependence on external funding	Development of tourism-based financing options

The case study findings presented in Table 3 illustrate that integrating ecotourism with conservation strategies can improve ecosystem management outcomes. Community-based conservation initiatives, visitor education programs, and tourism revenue mechanisms contributed to strengthening the relationship between tourism development and environmental protection. The findings demonstrate that sustainable tourism practices can function as conservation tools when supported by effective governance systems.

The case study also showed that financial sustainability remains a major challenge for MPA management. Although tourism activities generated considerable economic benefits, conservation funding mechanisms required further improvement to ensure continuous ecosystem monitoring and restoration. The results indicate that developing tourism-based financing instruments represents an important strategy for strengthening long-term marine conservation.

The case study findings explain that successful ecotourism-conservation integration depends on the alignment between economic incentives and environmental objectives (Regmi & Gheewala, 2025). Communities and tourism operators demonstrated greater commitment to conservation when they perceived direct benefits from maintaining healthy coral reef ecosystems. This relationship indicates that conservation strategies are more effective when they generate tangible socioeconomic advantages for local stakeholders.

The findings further explain that ecosystem service valuation provides an important foundation for improving conservation decision-making. Economic valuation helps demonstrate the hidden financial importance of coral reefs and supports stronger justification for investment in Marine Protected Areas. The integration of valuation results into management planning can encourage more sustainable allocation of tourism revenues toward conservation activities.

The overall results demonstrate that coral reef ecosystem services create a strong foundation for connecting ecotourism development with conservation financing. The findings indicate that marine tourism generates substantial economic value, but effective mechanisms are required to ensure that these benefits contribute to ecosystem protection (Chen & Stain, 2026). The ecotourism-conservation nexus represents a mutually reinforcing relationship where ecological preservation supports tourism sustainability, and tourism revenues support conservation efforts.

The interpretation of the findings emphasizes that sustainable Marine Protected Area management requires integrated approaches combining ecosystem valuation, stakeholder participation, and innovative financing mechanisms. Coral reef conservation cannot depend solely on traditional funding sources but requires financial models that recognize tourism as both an economic activity and a strategic conservation partner (Susilowati et al., 2026). The results provide evidence that ecosystem service valuation can strengthen the foundation for developing resilient and financially sustainable marine conservation systems.

The findings of this study demonstrate that the relationship between ecotourism development and coral reef conservation is strongly influenced by the economic value of ecosystem services and the effectiveness of Marine Protected Area (MPA) financing mechanisms. The assessment revealed that coral reef ecosystems provide substantial ecological and socioeconomic benefits through recreational tourism, coastal protection, biodiversity maintenance, and livelihood support. The results indicate that coral reefs should be recognized not only as environmental resources but also as valuable natural capital capable of sustaining local economies and supporting long-term conservation objectives.

The study further revealed that ecotourism activities generate significant economic benefits; however, these benefits have not been fully transformed into sustainable conservation financing. Tourism contributes substantially to local income generation and regional economic development,

but financial mechanisms supporting MPA management remain relatively limited (Grilli et al., 2021). The findings demonstrate that the economic value created by marine tourism requires stronger institutional frameworks to ensure that a proportion of tourism-generated revenue is directed toward ecosystem protection, restoration, and monitoring activities.

The results also indicate that stakeholder participation and governance capacity play critical roles in strengthening the ecotourism-conservation nexus. Communities, tourism operators, and conservation institutions demonstrated greater support for conservation initiatives when they recognized direct social and economic benefits from healthy coral reef ecosystems (Koko Suryawan et al., 2026). The findings suggest that conservation effectiveness depends not only on ecological interventions but also on the ability of governance systems to facilitate collaboration, transparency, and equitable benefit distribution.

The overall findings confirm that sustainable coral reef conservation requires an integrated approach combining ecosystem valuation, tourism management, and innovative financing strategies. The study demonstrates that ecotourism can function as a conservation mechanism when economic benefits are effectively connected to environmental protection efforts. The research provides evidence that the sustainability of marine tourism depends on maintaining ecological integrity while developing financial systems capable of supporting long-term conservation management.

The findings of this study are consistent with previous research emphasizing the significant contribution of coral reef ecosystems to coastal economies and biodiversity conservation. Earlier studies have demonstrated that coral reefs provide multiple ecosystem services, including tourism opportunities, fisheries support, and coastal protection (Cusack et al., 2021). Similar results were identified in this research, where ecosystem service valuation revealed that recreational tourism represented one of the largest economic contributions generated by coral reef ecosystems. These findings reinforce the importance of integrating ecological valuation into marine conservation planning.

The study extends previous research by emphasizing the importance of connecting ecosystem service valuation with practical conservation financing mechanisms. Many previous studies have focused primarily on estimating the economic value of marine ecosystems without sufficiently examining how these values can support operational funding for MPAs. The current research contributes additional insights by demonstrating that economic valuation should not only serve as a measurement tool but also function as a foundation for developing sustainable conservation finance strategies.

The findings differ from earlier approaches that often examine tourism development and conservation outcomes as separate processes. Conventional tourism studies frequently focus on economic growth indicators, visitor satisfaction, and market development, while conservation studies emphasize ecological protection and biodiversity preservation (Das et al., 2026). This research demonstrates that these dimensions are interconnected within a social-ecological system where tourism sustainability depends on ecosystem health, and conservation effectiveness depends on economic incentives and stakeholder cooperation.

The research also provides a different perspective regarding the role of tourism as a potential driver of conservation rather than merely a source of environmental pressure. Previous studies have highlighted the negative impacts of tourism on coral reef ecosystems due to overcrowding, pollution, and physical disturbance. The present findings indicate that well-managed ecotourism can contribute positively to conservation when supported by appropriate governance structures,

environmental education, and financial mechanisms that reinvest tourism benefits into ecosystem protection.

The findings indicate a fundamental shift in understanding the role of coral reef ecosystems within sustainable development frameworks. Coral reefs should no longer be considered only as ecological assets requiring protection but also as economic resources that generate significant social value. The results demonstrate that recognizing ecosystem service values can strengthen public awareness, policy commitment, and financial support for marine conservation initiatives.

The findings also signify the importance of moving from short-term tourism exploitation toward long-term ecosystem stewardship. Marine tourism depends heavily on ecosystem quality, meaning that environmental degradation ultimately threatens the economic foundation of tourism itself (Jadin & Rousseau, 2022). The results indicate that conservation and tourism development should not be viewed as competing objectives but as interconnected processes requiring balanced management approaches.

The strong relationship between stakeholder participation and conservation outcomes reflects the importance of inclusive governance in marine resource management. The findings suggest that local communities are not merely beneficiaries of ecosystem services but active contributors to conservation success. Community involvement, local knowledge, and shared responsibility represent essential components for maintaining sustainable relationships between tourism activities and environmental protection.

The research findings represent evidence that financial sustainability is a central component of effective conservation management (Li & Wang, 2022). Ecological protection programs often fail when they depend on temporary funding sources or external assistance. The results demonstrate that establishing stable financing mechanisms connected to economic activities benefiting from marine ecosystems is essential for ensuring continuous conservation efforts.

The implications of this research are significant for marine conservation policymakers, tourism planners, and MPA managers seeking sustainable approaches to coral reef protection. The findings suggest that ecosystem service valuation should become an important component of conservation decision-making because it provides measurable evidence regarding the economic importance of natural resources. Such information can strengthen justification for increased investment in marine conservation programs.

The study provides practical implications for developing ecotourism-based conservation financing mechanisms. Tourism revenue-sharing systems, conservation fees, visitor contributions, and public-private partnerships represent potential strategies for transforming tourism benefits into financial resources for ecosystem management. The findings indicate that financial mechanisms should be designed transparently to ensure that stakeholders perceive conservation investments as beneficial and legitimate.

The research also highlights the importance of strengthening governance structures within Marine Protected Areas. Effective conservation financing requires institutional capacity to manage funds, monitor ecosystem conditions, and coordinate stakeholder participation. Policymakers should prioritize governance reforms that encourage collaboration among government agencies, tourism industries, local communities, and conservation organizations.

The broader implication of this study relates to sustainable ocean governance and biodiversity conservation. The increasing degradation of coral reef ecosystems requires innovative approaches that combine environmental protection with socioeconomic development. The findings demonstrate that ecotourism can become a strategic conservation partner when supported by appropriate valuation methods, financial systems, and adaptive governance frameworks.

The findings can be explained by the fundamental dependency of marine tourism on healthy coral reef ecosystems. Coral reefs provide attractive landscapes, biodiversity experiences, and recreational opportunities that directly influence tourism demand. The high economic value of recreational services occurred because tourism activities rely heavily on ecosystem quality, making coral reef conservation essential for maintaining tourism competitiveness and economic benefits.

The limited effectiveness of conservation financing mechanisms can be explained by the historical separation between tourism development and environmental management. Tourism sectors often prioritize economic returns, while conservation institutions focus on ecological protection with limited financial integration between the two systems. The findings suggest that the absence of effective financial linkages prevents tourism-generated benefits from being fully utilized for conservation purposes.

The strong influence of stakeholder participation can be explained by the social nature of marine resource management. Coral reef ecosystems are shared resources involving multiple users with different interests and responsibilities. Collaborative governance becomes essential because conservation outcomes depend on collective behavior, compliance with management regulations, and shared recognition of ecosystem value.

The findings are also influenced by the characteristics of Marine Protected Areas as complex social-ecological systems. MPAs require continuous financial resources, institutional coordination, and adaptive management because environmental conditions and human activities constantly change. The results indicate that successful conservation depends on the ability of governance systems to integrate ecological knowledge, economic incentives, and stakeholder engagement.

Future research should focus on expanding ecosystem service valuation approaches by incorporating dynamic environmental changes, climate impacts, and long-term economic scenarios. Coral reef ecosystems are increasingly affected by climate change, ocean warming, and biodiversity loss, requiring valuation models capable of capturing future uncertainties. Advanced modeling approaches could improve predictions regarding ecosystem service changes and their implications for tourism and conservation financing.

Future investigations should also examine innovative financial mechanisms that can strengthen MPA sustainability. Research on conservation trust funds, tourism taxation models, blue economy financing, and payment for ecosystem services could provide additional pathways for improving financial stability. Comparative studies across different marine protected areas would help identify effective financing strategies suitable for diverse socioeconomic contexts.

The development of integrated monitoring systems represents another important direction for future research. Combining ecological monitoring, tourism data analysis, financial tracking, and stakeholder assessments could provide more comprehensive evaluations of conservation effectiveness. Digital technologies, remote sensing, and data-driven management approaches may enhance the capacity of MPAs to respond to emerging environmental challenges.

The future of coral reef conservation depends on establishing stronger connections between ecological protection and economic development. Research and policy initiatives should continue exploring how ecotourism can become a sustainable source of conservation financing rather than a driver of environmental degradation. The findings of this study provide a foundation for developing resilient marine management models that balance biodiversity conservation, economic benefits, and long-term ecosystem sustainability.

CONCLUSION

The most important finding of this study demonstrates that the relationship between ecotourism and coral reef conservation is not merely a conflict between economic utilization and environmental protection but represents a mutually reinforcing social-ecological system when supported by effective valuation and financing mechanisms. The research reveals that coral reef ecosystems generate substantial economic and ecological benefits through tourism services, biodiversity conservation, coastal protection, and livelihood support. The distinctive contribution of the findings lies in demonstrating that ecosystem service valuation can function as a strategic instrument for transforming ecotourism-generated economic benefits into sustainable conservation investments. The study highlights that the long-term sustainability of Marine Protected Areas depends not only on ecological management but also on the ability to establish financial connections between tourism activities, stakeholder participation, and conservation objectives.

The added value of this research is reflected in its conceptual and methodological contribution by integrating ecosystem service valuation, ecotourism economics, and Marine Protected Area financing within a unified analytical framework. The study expands existing conservation research by moving beyond the assessment of ecological value alone and examining how economic benefits derived from coral reef resources can support practical conservation strategies. The methodological contribution is represented through the combination of quantitative economic valuation, stakeholder analysis, and governance assessment to provide a comprehensive understanding of the ecotourism-conservation nexus. This integrated approach offers valuable insights for policymakers, conservation managers, and tourism stakeholders in developing sustainable financing models that balance economic development with marine ecosystem protection.

The limitations of this study are associated with the contextual scope of the assessment, variations in ecosystem characteristics, and dependence on available economic and institutional data from selected Marine Protected Areas. Differences in tourism intensity, governance capacity, community structures, and environmental conditions may influence the applicability of the findings across other marine destinations. Future research should expand comparative analyses across multiple coastal regions, incorporate long-term ecosystem monitoring, and investigate emerging conservation finance mechanisms such as blue economy instruments, payment for ecosystem services, and tourism-based conservation funds. Further studies integrating climate change scenarios, advanced ecological modeling, and participatory governance approaches are required to strengthen understanding of how ecotourism can contribute to resilient and financially sustainable coral reef conservation systems.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used ImTranslator to assist in improving grammar, language quality, and overall readability of the text. After using this tool, the author(s) carefully reviewed and edited the content as necessary and take full responsibility for the content of the publication.

AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; Investigation.

Author 3: Data curation; Investigation.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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