



Assessing the role of aquatic tourism in enhancing economic resilience and biodiversity conservation in marine protected areas

**Nilufar Rustamova^{1*}; Malika Saidmurodova²; Anvar Pardayev³;
Sarvinoz Zakirova⁴; Shakhnoza Shokirova⁵; Bahodir Akramov⁶;
Dusmurod Narkulov⁷; Xosiyatposhsho Akhmadaliyeva⁸**

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Abstract

In Marine Protected Areas (MPAs), aquatic tourism can contribute to economic resilience and biodiversity conservation. This research paper will evaluate the value of aquatic tourism in these regions, with specific respect to its contribution to the sustainable development of the economy and to the conservation of marine ecosystems. The study is based on the concept of a blue economy, which focuses on the sustainable use of marine resources to develop the economy. These goals will help to assess the economic effects of aquatic tourism on the local population in MPAs, analyze the opportunities of tourism to help in conservation activities and also to find out which issues and opportunities can be used to balance tourism and conservation objectives. The approaches will involve both economic analysis and ecological studies, as well as interviews with the stakeholders, to obtain data on both economic and environmental impacts. The findings indicate that properly developed aquatic tourism in MPAs may have a huge economic potential, such as creating employment opportunities, developing infrastructure, and leveraging on tourism activities to boost revenue. Also, as part of conservation, it can help achieve the better marine biodiversity by providing the funding to conservation initiatives and

1*- Termez State University, Termez, Uzbekistan; Surkhondaryo region, Termiz, Uzbekistan.

Email: rustamovan725@gmail.com, ORCID: <https://orcid.org/0000-0001-7115-0960>

2- Faculty of Economics, National Research University, Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, Tashkent, Uzbekistan. Email: saidmurodovamalika736@gmail.com, ORCID: <https://orcid.org/0009-0007-8697-6336>

3- Termez University of Economics and Service, Termez, Uzbekistan.

Email: anvarjon_pardayev@tues.uz, ORCID: <https://orcid.org/0009-0005-5101-8758>

4- Uzbekistan National Pedagogical University named after Nizami, Uzbekistan.

Email: sarvinoz.zakirova.80@mail.ru, ORCID: <https://orcid.org/0009-0003-7113-3505>

5- Nizami National Pedagogical University of Uzbekistan, Tashkent, Uzbekistan.

Email: aripova.shahnoza@mail.ru, ORCID: <https://orcid.org/0009-0006-3054-5943>

6- Samarkand State Medical University, Samarkand, Uzbekistan.

Email: baxodirbek.akramov@mail.ru, ORCID: <https://orcid.org/0000-0003-0103-7166>

7- Tashkent State Medical University, Tashkent, Uzbekistan.

Email: dostmurod.norqulov8195@gmail.com, ORCID: <https://orcid.org/0000-0003-2604-3159>

8- Banking and Finance Academy, Republic of Uzbekistan, Tashkent, Uzbekistan.

Email: xosiyatposhshoaxmadaliyeva@gmail.com, ORCID: <https://orcid.org/0009-0003-2757-2818>

*Corresponding author

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increasing awareness among the visitors. Nevertheless, the paper also emphasizes that there should be effective management measures in place to deter the occurrence of over-tourism and to counteract the possible negative consequences on the ecological conditions.

Keywords: Aquatic tourism, Marine protected areas, Economic resilience, Biodiversity conservation, Blue economy, Sustainable development

Introduction

Aquatic tourism, which includes scuba diving, snorkeling, boating, and ecotourism, is becoming a more significant issue in the global economies of coastal areas. The industry has grown considerably over the last several decades due to increased demand for nature-based experiences and the allure of colorful marine ecosystems. The Marine Protected Areas (MPAs) have taken centre stage in this development, as they ensure the ecological well-being of the coastal ecosystem and offer regulated tourism. Such locations, set aside to protect marine biodiversity, also attract millions of tourists each year, who come to enjoy the clean surroundings and the local biodiversity. Eli, Raimi and Amachree, 2025 explain the role played by MPAs in enhancing biodiversity and sustainable economic development in the context of the blue economy.

The idea of the blue economy is part of the conceptualization of the connection between tourism and conservation. It underscores that ocean resources should be used sustainably to enhance economic development, improve living conditions, and protect the ecosystem (Mehdizadeh and Ravanshadniya, 2017). The blue economy seeks a balance between economic activities, tourism, and fishing, and environmental protection. To integrate tourism into the blue economy,

it is important to recognize that marine ecosystems are not only a resource but also a treasure trove of economic opportunities, providing essential services such as carbon sequestration, water purification, and biodiversity preservation. (Hailu *et al.*, 2023) emphasize the contribution of the MPAs to the resilience and economic development, making these areas important parts of the blue economy.

This research aims to assess the economic and conservation effects of aquatic tourist activities in MPAs. In particular, the research will determine the role of tourism activities in local economies, focusing on job creation, revenue generation, and business development. It will also dive into the impacts of tourism on the health of marine ecosystems, examining both positive and negative effects (Rajan and Raja, 2025). The MPAs model presented by Sarker, Rahman and Wahab, 2023 is a valuable tool for evaluating the effects of tourism on marine ecosystems within conserved areas. The purpose of the research is to develop practical solutions for incorporating sustainable tourism practices into management strategies to make the MPA viable in the long run for both local communities and ecosystems.

It is necessary to pay attention to MPAs, which are among the most ecologically important and vulnerable ecosystems on the planet. The

development of sustainable tourism in MPAs is important to ensure that the economic gains from aquatic tourism do not compromise conservation efforts. (Karani and Failler, 2020) discuss the link between marine tourism and climate change, and the need to pursue a sustainable blue economy strategy in regions such as Africa's large marine ecosystems. This research will also help ensure sustainable tourism is promoted in marine parks by understanding the interplay among tourism, local communities, and marine ecosystems to serve the interests of both conservation and economic development (Hlushenkova *et al.*, 2024).

Adaptive capacity of local communities is important for implementing sustainable tourism practices, especially in ecotourism settings. According to (Suryawan, Gunawan and Lee, 2025), local capacity to respond to changes in environmental conditions is crucial to the success of marine ecotourism projects. Their findings will be integrated into this research to suggest community-based conservation and adaptive management strategies for the MPAs. Lastly, (Reddy and Sailesh, 2024) emphasize the role of marine tourism in the blue economy model, which proposes ways to harmonize the development of tourism with the safeguarding of marine ecosystems, offering economic and ecological sustainability.

Conceptual Framework

Aquatic tourism, which includes scuba diving, snorkeling, boating, and eco tourism, is becoming a more significant issue in the global economies of coastal

areas. The industry has grown considerably over the last several decades due to increased demand for nature-based experiences and the attractiveness of colorful marine ecosystems (Venkadeshwaran *et al.*, 2025). The Marine Protected Areas (MPAs) have taken centre stage in this development, as they ensure the ecological well-being of the coastal ecosystem and offer regulated tourism. Such locations, set aside to protect marine biodiversity, also attract millions of tourists each year, who come to enjoy the clean surroundings and the local biodiversity. (Le Gouvello *et al.*, 2017) propose synergies between MPAs and aquaculture to promote environmental and economic sustainability, demonstrating the potential of MPAs for tourism development.

The idea of the blue economy is part of the conceptualization of the connection between tourism and conservation. It underscores that ocean resources should be used sustainably to enhance economic development, improve living conditions, and protect the ecosystem. The blue economy seeks a balance between economic activities, tourism, and fishing, and environmental protection. To integrate tourism into the blue economy system, it is important to understand that marine ecosystems are not only a resource but also a treasure trove of economic opportunities, providing essential services such as carbon sequestration, water purification, and biodiversity preservation. As emphasized by (Camargo *et al.*, 2009), community participation in the management of MPAs is essential in the maintenance of coral reefs' resilience,

which is important in the sustenance of the local economy as well as the marine ecosystem.

This research aims to assess the economic and conservation effects of aquatic tourism activities in MPAs. In particular, the study will determine the role of tourism activities in local economies in terms of job creation, revenue generation, and business development. It will also dive into the impacts of tourism on the health of marine ecosystems, including both positive and negative effects. (Laffoley *et al.*, 2019) will provide an extensive review of MPAs and their theoretical use in the conservation of marine biodiversity, which will guide the study's assessment of how tourism can help conservation. The purpose of the research is to develop practical solutions for incorporating sustainable tourism practices into management strategies to make the MPA viable in the long run for both local communities and ecosystems.

It is necessary to pay attention to MPAs, which are among the most ecologically important and vulnerable ecosystems on the planet. The development of sustainable tourism in MPAs is important to ensure that the economic gains from aquatic tourism do not compromise conservation efforts. (Casimiro *et al.*, 2023) highlight the role of ecotourism in MPAs as a means of valuing natural capital, thereby facilitating improvements in marine governance and supporting sustainable tourism practices. This research will also help ensure sustainable tourism is promoted in marine parks by understanding the interplay among tourism, local communities, and marine

ecosystems to serve the interests of both conservation and economic development.

Adaptive capacity of local communities is important for the implementation of sustainable tourism practices, especially in ecotourism settings. (Uddin *et al.*, 2021) highlight the importance of fishery-based ecotourism as a means of promoting social-ecological resilience by supporting coastal communities that rely on marine resources for livelihoods. (Pedju, 2017) explores stakeholders' attitudes in Bali, Indonesia, towards the effects of MPAs on the resilience of social and ecological systems, and adds to the knowledge on how tourism can be managed in MPAs to enhance sustainability. The study will be based on these findings to suggest approaches for integrating tourism and conservation in MPAs in a balanced, sustainable way (Salehi and Nowrouzi, 2025).

Objectives of the Study

The main aim of this research is to determine the role of aquatic tourism in ensuring the economic sustainability of people living in Marine Protected Areas (MPAs). Through tourism-related revenue analysis, job creation, and support for local businesses, the study will assess the extent to which tourism has become a sustainable economic driver for the communities. It will also examine the effect of tourism expenditure on other economic sectors, such as hospitality, transport, and retail, and ensure that the local economy is diversified and can withstand external shocks.

The other important goal is to examine how aquatic tourism contributes to

biodiversity conservation. Aquatic tourism may promote marine conservation both directly and indirectly by educating people about the need to protect marine life, charging entrance fees to promote ecotourism, and accepting donations to fund conservation projects. The research will examine how tourism income is reinvested in protecting marine ecosystems, such as coral restoration, sustainable fisheries, and environmental education programs, thereby helping conserve biodiversity in the MPAs.

The study will also aim at establishing the possible synergies and contradictions between tourism development and conservation objectives. Although tourism can bring economic benefits, it can also pose dangers, including overtourism, pollution, and habitat destruction. The study will examine the areas where tourism and conservation activities have been integrated and those where there are conflicts by analyzing case studies of various MPAs, thereby providing a clearer idea of the balance that must be struck between growth and sustainability.

Lastly, the research will suggest management actions to involve tourism in the governance of the MPA to ensure maximum benefits for local people and the ecosystem. It will suggest policies that enable sustainable tourism development while ensuring effective marine conservation. The strategies will involve the stakeholders in decision-making, sustainable tourism certifications, and a set of ecotourism guidelines that focus on the environmental stewardship of tourism so that the tourism sector will add to the

long-term sustainability of both communities and ecosystems in MPAs.

Methodology

This paper aims to assess the economic and environmental effects of aquatic tourism in the Marine Protected Areas (MPAs), specifically Zanzibar, the primary field of analysis. Zanzibar, an offshore island of Tanzania, boasts several MPAs, including the Mnemba Atoll Marine Conservation Area, which is known for its high marine biodiversity and a flourishing tourist industry. Tourists who visit this area are interested in an ecotourism experience that includes scuba diving, snorkeling, boat tours, and more, making this the best place to discuss the synergies between economic development and the preservation of the sea.

Data Collection Methods

The mixed-methods approach is to be used for data collection, as it combines quantitative and qualitative methods to provide a comprehensive picture of the multidimensional effects of aquatic tourism on Zanzibar's local economy and marine ecosystems. The given approach will enable a thorough analysis of not only the economic benefits but also the environmental impacts of tourism in the Marine Protected Areas (MPAs), which will be useful in developing sustainable tourism.

The first part of the research is an economic analysis. The economic value of aquatic tourism will be evaluated through data on tourism revenue, employment creation, and investments made by local businesses. The main information will be collected on entrance fees to MPAs, spending on tourism

services (renting boats, diving gears, and lodging), and the number of tourism-specific jobs created by the local population. The economic impact will be quantified by obtaining secondary data from the Zanzibar Tourism Department and local businesses to establish the impact of the tourism industry on the city's economy. There will also be a surveys and interviews with tourism operators, local government agencies, and business owners to provide direct information on the economic impact of tourism in the area.

The second one is an ecological measurement, aimed at assessing the

environmental effects of tourism in MPAs. Indicators of biodiversity, such as the health of fish populations, the condition of coral reefs, and seagrass coverage, will be monitored over time. Regions with diverse tourist activity rates will be compared to identify potential adverse impacts. Marine biologists and conservation groups will conduct field surveys, underwater photography, and water-quality tests. This will be used to measure the immediate effects of tourism on the marine ecosystem, especially on the health of sensitive marine habitats such as coral reefs, which are vital to both biodiversity conservation and tourism.

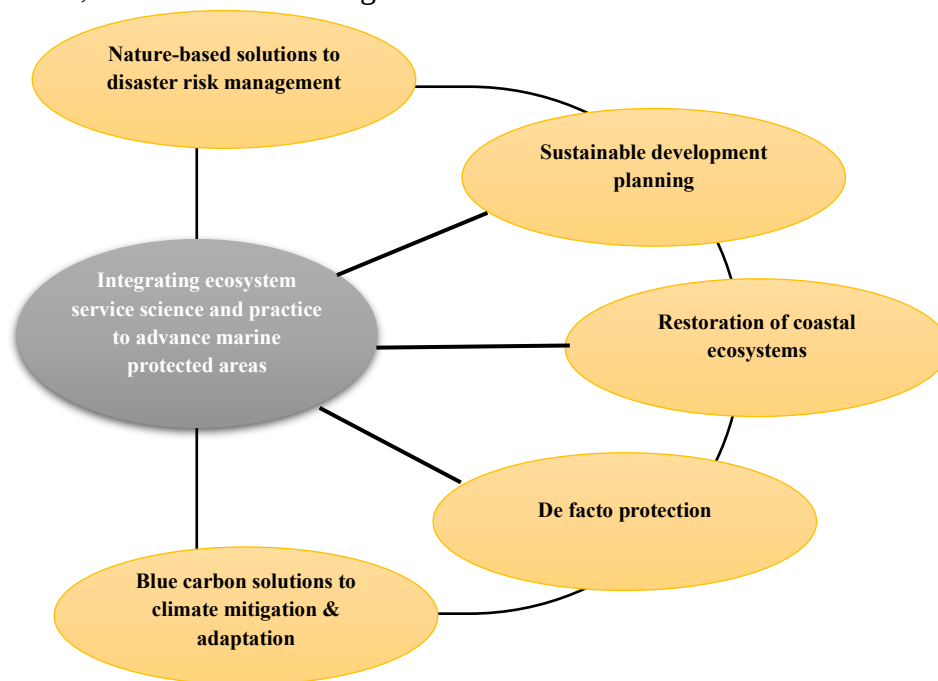


Figure 1: Strategies for enhancing resilience in coastal ecosystems and marine protected areas.

Figure 1 presents several important measures to enhance the resilience of coastal ecosystems and communities, with references to marine protected areas (MPAs). It focuses on integrating ecosystem service science to improve the management of MPAs and support biodiversity conservation. Such strategies as nature-based solutions to disaster risk management, sustainable

development planning, and recovery of coastal ecosystems help to achieve economic resilience, as well as environmental protection. Also, the use of blue carbon solutions contributes to mitigating climate change, whereas the de facto protection of marine resources improves the overall sustainability of marine resources, demonstrating the

relevance of these two features in promoting sustainable tourism.

Finally, stakeholder interviews will be carried out with wide variety of people, among them, the members of the local community, the operator of tourism activities, the manager of conservation, and the policy maker. These semi-structured interviews will give qualitative information on the perceived advantages and difficulty of aquatic tourism, will give insights into the local attitudes to conservation activities and how MPAs contribute to economic growth and environmental protection. This information will help understand the social dynamics of tourism, including the community's participation in conservation activities and the effects of tourism on local people and their cultures. Combined, the approaches will provide a solid framework for evaluating the economic and ecological impacts of aquatic tourism in Zanzibar's MPAs, enabling the ongoing development of sustainable tourism strategies.

Analytical Techniques

To determine the effects of tourism on economic resilience and biodiversity conservation, the research will employ a combination of analytical methods to provide both quantitative and qualitative insights into the relationships among tourism activities, economic growth, and environmental sustainability.

To start with, the economic Modeling will be based on input-output analysis, which measures the direct, indirect, and induced impacts of tourism expenditure on Zanzibar's economy. This model will approximate the contribution of tourism to local employment, income generation, and business development. It will

evaluate the value added by ecotourism activities such as diving and boat tours, and compare the amounts and costs related to environmental damage from tourism, such as habitat destruction and pollution. This analysis will focus on the economic benefits of tourism and the environmental costs it may entail, in relation to Zanzibar's long-term economic sustainability.

The ecological impact analysis will follow this, conducted through a comparative ecological evaluation of marine ecosystems in high- and low-tourism areas. Fish population density and coral reef health are among the main indicators of biodiversity that will be observed in the long term. The changes in these indicators will be analyzed using statistical methods, including the identification of the correlation between tourism activity levels and environmental degradation. This will be useful for quantifying the magnitude of the tourism effect on marine ecosystems, especially in MPAs, and for providing insights into the effectiveness of conservation strategies in ensuring the health of the ecosystem.

Lastly, a thematic analysis of information derived from interviews with local communities, tourism operators, conservation managers, and policymakers will be undertaken as a stakeholder analysis. This qualitative research method will help reveal general themes and views on the balance between the economic and potential environmental costs of tourism. Through stakeholders' perceptions, the research will be informed on how local communities perceive the role of tourism in economic development and

biodiversity conservation, and any trade-offs they may have between the two. These analytical tools, when combined, will provide a holistic evaluation of the

economic and ecological effects of tourism and also offer useful suggestions for promoting sustainable tourism in the MPAs in Zanzibar.

Table 1: Data table overview.

Method	Description	Purpose
Economic Analysis	Data collection on tourism revenue, job creation, and business investments.	To assess the economic contributions of tourism to the local economy, particularly in relation to MPAs.
Ecological Assessments	Monitoring biodiversity (e.g., fish population, coral reef health, water quality).	To evaluate the environmental impacts of tourism, focusing on biodiversity conservation and ecosystem health.
Stakeholder Interviews	Semi-structured interviews with local communities, tourism operators, and conservation managers.	To gather qualitative insights on the social, cultural, and economic impacts of tourism, and stakeholder attitudes towards conservation efforts.
Input-Output Modeling	Estimation of direct, indirect, and induced economic impacts of tourism spending.	To model the economic effects of tourism in Zanzibar, providing a comprehensive view of its contributions to the economy.

The Economic Analysis in Table 1 aims to collect information on tourism revenues, employment creation, and business investments to evaluate the economic effects of tourism on the local economy, particularly in the MPAs. Biodiversity indices are observed through ecological Assessments of fish populations, coral reef health, and water quality to assess the efficacy of tourism on the environment and its impact on biodiversity conservation. The Stakeholder Interviews provide qualitative information on local communities, tourism operators, and conservation management, discussing the social, cultural, and economic effects of tourism and the views of local people on conservation. To assess the overall impact of the tourism sector on Zanzibar's economy, the direct, indirect, and induced economic impacts of tourism spending are estimated using the input-output modeling tool.

Results and Discussion

The findings of this research indicate the economic effects of aquatic tourism on the local communities in Zanzibar, especially in the Marine Protected Areas (MPAs) setting. The role of aquatic tourism in income generation is immense, as tourism-related activities are a significant source of income for local businesses, such as hotels, restaurants, transport service providers, and tour operators. Tourism revenue is steadily increasing, as evidenced by recent statistics from Zanzibar's tourism department, which show that aquatic tourism activities generate an average of 30 million dollars for the local economy each year. Also, it is a significant boost to job creation, as tourism has proven to be a major employer, especially in the hospitality and ecotourism industries. Tourism has also spurred infrastructure development, such as roads, ports, and

hotels, improving access to MPAs and supporting broader community development along coastlines.

Regarding the role of aquatic tourism in biodiversity conservation, the paper outlines several ways in which tourism supports the conservation of marine ecosystems. Fees paid to MPAs, ecotourism activities, and tourism donations have generated significant funds for conservation projects. For example, in the Mnemba Atoll Marine Conservation Area in Zanzibar, tourism income has been invested in marine research, coral recovery, and sustainable fishing. Moreover, tourism has raised awareness, encouraging communities to support marine conservation efforts. Most of the tourists, who are also eco-conscious, attend environmental education programs and this also helps in the conservation of the marine biodiversity of Zanzibar. Statistics indicate that ecotourism activities contribute to more than 40 per cent of the budget allocated to local marine conservation through tourism.

The paper does not fail to note, however, that there are also very serious problems associated with overtourism, such as environmental degradation and pressure on natural resources. There has been documented degradation of coral reefs, water pollution, and loss of biodiversity in high-traffic areas of the MPAs, usually due to activities such as uncontrolled diving and boat traffic. These demands on the environment compromise the same ecosystems on which tourism relies, which is a challenge to long-term sustainability. Effective management of tourism activities is

important in order to reduce these effects. Specifically, the paper recommends more stringent rules on tourism activities, which include reducing the number of tourists visiting the sensitive field and promoting sustainable tourism activities.

This discussion shows that there is an urgent need for a balance between economic growth and environmental sustainability within MPAs. Although tourism plays a major role in the local economy, it should be conducted in a way that does not harm ecosystems. Green tourism practices, including environmentally friendly activities, educating tourists, and pursuing policies geared towards conservation, play a critical role in ensuring that the goals of economic and environmental sustainability are met. The results indicate that this balance can be achieved through the incorporation of ecosystem services into economic models and tourism management structures.

Figure 2 graphically illustrates the revenue the tourism sector will generate in five coastal areas between 2000 and 2030, scaled to 0-1. The intensity of the colors shows the different levels of tourism revenue, with darker colors indicating higher revenue. The heatmap helps identify trends in tourism revenue, showing which regions are better or worse off in terms of revenue in different years. It provides an understanding of the dynamics of economic resilience across regions and of how aquatic tourism supports marine protected areas (MPAs) and economic stability over time.

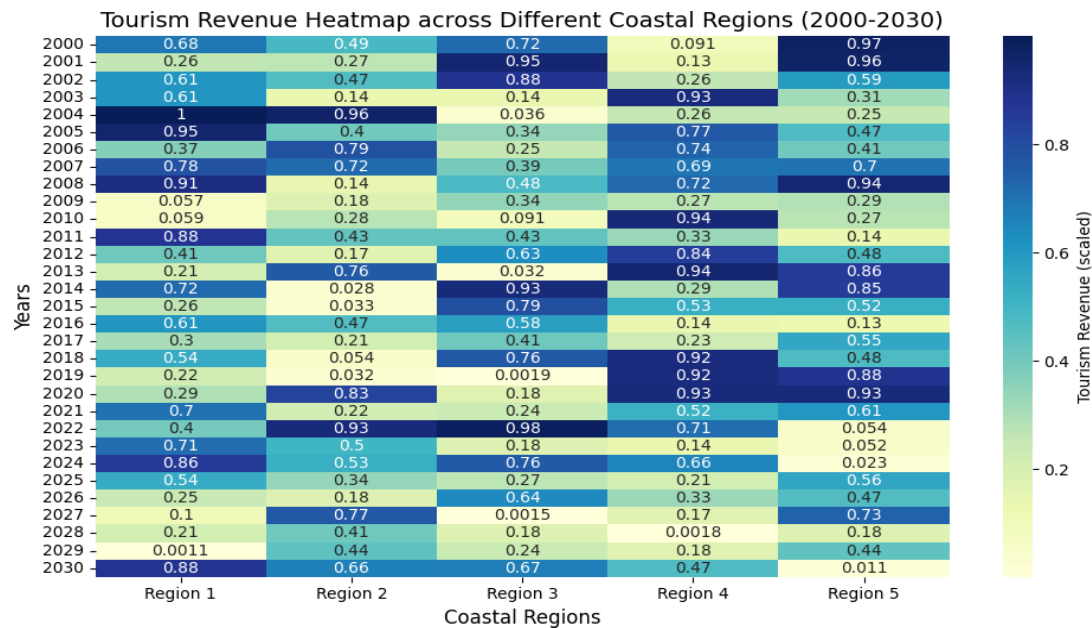


Figure 2: Tourism revenue heatmap across different coastal regions (2000-2030).

Table 2: Data table overview.

Impact Type	Economic Contribution	Challenges	Management Strategies
Income Generation	Aquatic tourism generates approximately \$30 million annually in Zanzibar.	Over-tourism leads to resource depletion and reduced biodiversity.	Implement sustainable tourism fees and ecotourism certifications.
Employment	Thousands of jobs are created in the hospitality and ecotourism sectors.	Pressure on local infrastructure due to high visitor numbers.	Limit the number of tourists in sensitive areas, and provide training for sustainable practices.
Infrastructure Development	Improvements in roads, ports, and tourist facilities are driven by tourism.	Infrastructure overload, leading to environmental impacts.	Develop sustainable infrastructure with low environmental footprints.
Biodiversity Conservation	Tourism revenue supports conservation projects (e.g., coral restoration, marine research).	Risk of environmental degradation from tourism activities.	Strict regulation on tourism activities in MPAs, and investment in marine restoration.

Table 2 outlines the main economic impacts, issues, and management measures associated with aquatic tourism in the Marine Protected Areas (MPAs) in Zanzibar. Tourism earnings are important to the local economy, though the approach to generating income also creates jobs in the hotel and ecotourism industries. Tourism also contributes to infrastructure development to enhance

the accessibility of MPAs. There are, however, major challenges such as over-tourism, environmental degradation, and infrastructure overburdening. To address them, the paper proposes sustainable tourism management systems, such as ecotourism certifications, visitor restrictions, and tourism activity regulations, to strike a balance between

economic development and environmental preservation.

The findings not only reveal the enormous economic role played by aquatic tourism but also highlight the environmental issues posed by it. Management is needed to ensure a fine balance between economic growth and conservation in the MPAs, so that tourism is sustainable for surrounding livelihoods and biodiversity.

Conclusion

This paper also emphasizes the great role of aquatic tourism in economic sustainability as well as the conservation of biodiversity within Marine Protected Areas (MPAs). Aquatic tourism offers significant economic advantages in terms of income, creation of employment, and development of infrastructures, as well as marine conservation due to employment and revenue as a result of tourism and heightened awareness. Nonetheless, the research also shows such problems as over-tourism, environmental deterioration, and pressure on the local infrastructure. In an effort to promote sustainable aquatic tourism activities, it is advisable that the policymakers should adopt ecotourism policies, visitor management policies and sustainable tourism accolades so that the negative effects on the environment can be reduced. The tourism operators are to emphasize on promoting sustainable activities, whereas conservationists need to emphasize on the community participation in decision-making and conservation programs. More studies should be conducted in order to streamline tourism and conservation policies, especially by the creation of

models that integrate the ecosystem services to the economic models. Also, it is necessary to adopt adaptive management strategies that would lead to the long-term sustainability of the marine ecosystem and local economies, which will make it possible to become flexible in response to changing conditions and ensure that both conservation objectives and economic growth can co-exist.

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