

# Economic Potentials and Sustainability Challenges in Marine Resource Management in the Ionian and Adriatic Region: An Empirical Analysis of the Tourism, Fisheries, and Maritime Transport Sectors

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This study analysed the economic potentials and sustainability challenges in marine resource management across the Ionian and Adriatic region, focusing on the tourism, fisheries, and maritime transport sectors. The research used a mixed-methods approach combining quantitative economic analysis with sustainability assessment frameworks to examine the complex interrelationships between economic development and environmental conservation. Data from 2019 to 2024 were collected from international databases, regional reports, and field studies across eight countries bordering these seas. Results revealed significant economic dependence on marine resources, with tourism contributing 18 – 24% to coastal economies, fisheries supporting many livelihoods despite declining stocks, and maritime transport experiencing 7.3% annual growth. Identified sustainability challenges included tourism seasonality, overfishing, and transport-related pollution. Countries showed varying management effectiveness, with governance integration scores ranging from 0.34 to 0.81, directly correlating with both economic and environmental performance. Integrated coastal zone management achieved 34% better environmental outcomes while maintaining economic benefits. Maritime Spatial Planning emerged as the most effective integration tool, improving economic performance by 18.4% and environmental indicators by 23.6% compared to areas lacking such frameworks. Multi-sectoral cooperation initiatives reduced resource conflicts by 27%, highlighting the importance of stakeholder engagement. The research confirmed that balancing economic growth and environmental protection requires region-specific governance frameworks tailored to local conditions. These findings contribute to understanding the complexities of marine resource management in semi-enclosed seas by identifying governance mechanisms that effectively balance economic needs with ecological limits while reducing cross-sectoral conflicts in spatially constrained marine environments, informing stakeholder decisions toward sustainable blue economy development.

## KEY WORDS

- ~ Integrated governance
- ~ Cross-sectoral conflicts
- ~ Maritime spatial planning
- ~ Ecosystem services
- ~ Stakeholder engagement
- ~ Blue growth

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## 1. INTRODUCTION

The Adriatic and Ionian Seas are among Europe's most valuable yet vulnerable marine ecosystems, distinguished by rich biodiversity, historical shipping routes, and coastal tourism destinations that together constitute a critical economic asset for neighbouring countries. These semi-enclosed seas face increasing pressures from human activities, creating an urgent need to balance economic development with environmental sustainability across various sectors. The economic significance of marine resources in this region is considerable, with estimates indicating that sea-related economic activities contribute between 13 and 28 per cent of the gross domestic product in coastal countries (Salvador, 2019). However, this economic reliance creates complex sustainability challenges as resource exploitation approaches or exceeds ecological limits.

The interconnected use of marine resources generates both synergies and conflicts among key economic sectors. Tourism competes with fisheries and port activities for limited coastal space and clean waters, while also benefiting from the cultural landscapes and gastronomic traditions maintained by small-scale fishing communities. Fisheries are affected by the spatial impact of tourism infrastructure and shipping routes, yet they supply high-value products to hospitality and catering sectors, enhancing the appeal of coastal destinations (Zhansagimova et al., 2022; Ostapenko and Bryantsev, 2023). Maritime transport supports regional trade and connectivity but produces emissions, noise, and pollution that can compromise water quality, ecosystem integrity, and the reputation of destinations marketed as pristine and sustainable (Dreus et al., 2024; Carlucci et al., 2020). This interdependence necessitates integrated management approaches, which remain underdeveloped in the region. Kies et al. (2020) note that fragmented governance systems and inadequate cross-sectoral coordination have impeded progress towards sustainable marine management, with the Integrated Coastal Zone Management (ICZM) framework and ecosystem approach offering potential routes for more coherent governance.

Previous research has examined specific aspects of marine resource management in the Adriatic-Ionian region. Piroddi et al. (2022) investigated Mediterranean Sea ecosystem modelling at high spatial resolution to inform ecosystem-based management, highlighting spatial and temporal changes in biodiversity and marine resource distribution, and emphasising the need for regional and sub-regional management approaches. Furlan et al. (2020) developed geographic information system (GIS) models to support maritime spatial planning in the Adriatic, although their approach was primarily focused on environmental rather than economic aspects.

The governance framework for marine management has developed through initiatives such as the EU Strategy for the Adriatic and Ionian Region (2014), which aims to promote economic prosperity through blue growth while preserving ecological balance. Despite these efforts, Petrosillo et al. (2023) identified ongoing gaps between policy intentions and implementation, particularly regarding coordinated approaches to managing competing economic interests. Kelly et al. (2019) also noted that transformative marine governance approaches are required to address persistent barriers to sustainable development across marine sectors, including disconnected policy frameworks and power imbalances in decision-making processes.

A significant gap remains in understanding how the three key sectors – tourism, fisheries, and maritime transport – interact within shared marine spaces and how their combined economic potential can be optimised while addressing sustainability challenges. While sectoral studies provide valuable insights, they often fail to capture the complex interdependencies that characterise actual marine resource management. Moreover, empirical analyses of successful mechanisms for balancing economic development and environmental protection remain limited, especially in the context of the Adriatic-Ionian region.

This research addresses these gaps by conducting a comprehensive empirical analysis of the economic potentials and sustainability challenges across tourism, fisheries, and maritime transport sectors in the Adriatic-Ionian region. Through this integrated assessment, the research aims to contribute to the development of more coherent and effective marine resource management frameworks tailored to the unique characteristics of the Adriatic-Ionian region.

The study seeks to identify patterns of resource use, document successful management practices, and evaluate governance approaches that effectively balance economic benefits with environmental sustainability. It addresses three central research tasks: analysing the economic contributions and growth trajectories of marine-based tourism, fisheries, and maritime transport across the Adriatic-Ionian region; identifying critical sustainability challenges facing each sector and assessing their environmental impacts using standardised indicators; and evaluating the effectiveness of existing management approaches in balancing economic development with environmental protection across different governance contexts.

## 2. MATERIALS AND METHODS

The methodological framework used a comparative mixed-methods approach to analyse economic potential and sustainability challenges in marine resource management across the Ionian and Adriatic region (Figure 1). The research covered the period 2019–2024, examining tourism, fisheries, and maritime transport sectors in eight bordering countries: Albania, Bosnia and Herzegovina, Croatia, Greece, Italy, Montenegro, Slovenia, and North Macedonia. These coastal economies are highly dependent on marine resources and are subject to both EU and regional blue-economy initiatives. This region was chosen because it combines significant economic reliance on marine sectors, intense spatial competition among uses, and diverse governance capacities, providing a critical setting for examining how institutional arrangements influence the balance between economic development and environmental protection.



Figure 1. A map of the Ionian and Adriatic Region (Source: compiled by the authors based on Blue Growth (2025)).

Quantitative data were compiled from Eurostat regional statistics (Eurostat, 2024), national statistical offices, sectoral reports, and policy documents for the three focal sectors from national ministries responsible for maritime affairs, tourism, and environmental protection. Selection criteria included publication within the 2019–2024 timeframe, relevance to the target sectors, quantifiable indicators, and geographical coverage of the study countries. Descriptive statistics characterised sectoral structures and temporal trends, while Pearson correlation analysis and multiple linear regression examined relationships between governance integration scores, sectoral economic indicators, and sustainability indices. Composite indices (Governance Integration Score, Policy Implementation Effectiveness, sector-specific Sustainability Indices, Coastal-Inland Economic Integration Index) were constructed through normalisation and weighting procedures and validated using a Delphi process.

Qualitative material from interviews, focus groups, and field surveys was coded thematically and triangulated with the quantitative results to interpret stakeholder perceptions of cross-sectoral interactions and management effectiveness. Field surveys were conducted in 18 coastal communities across six countries (Albania: 2, Croatia: 4, Greece: 3, Italy: 4, Montenegro: 3, Slovenia: 2), involving 324 respondents, including local officials ( $n = 42$ ), business operators ( $n = 137$ ), and community residents ( $n = 145$ ). Bosnia and Herzegovina and North Macedonia were excluded from field surveys due to limited coastal access but included in documentary analysis. Although North Macedonia is a landlocked country, its inclusion in the regional assessment is justified by its institutional, economic, and policy linkages to the Ionian-Adriatic macro-region. As a member of the EU Strategy for the Adriatic and Ionian Region, North Macedonia participates in coordinated governance frameworks, transport connectivity planning, and blue-economy initiatives that shape regional development trajectories. Its inland transport corridors, tourism flows, and supply-chain connections influence demand for coastal services and maritime transport within neighbouring coastal states. Communities were selected using stratified random sampling based on population size, economic dependency on marine resources, and governance structure. Communities with populations under 5,000 were excluded to ensure sufficient economic activity across sectors.

Primary data included interviews (n=78), focus groups (n=14), and questionnaires (n=246). Analysis was conducted using NVivo and SPSS. A validated matrix generated governance scores. The research complied with the ICC/ESOMAR International Code and received approval from the Research Ethics Committee of the European Institute for Marine Studies (approval number: EIMS-2023-417). Participation was voluntary, informed consent was obtained, and personal data were anonymised in accordance with GDPR regulations.

Economic assessment used sector-specific frameworks: tourism analysis used the Tourism Satellite Account methodology following UNWTO guidelines; fisheries applied the Total Economic Value framework with biological reference points from the General Fisheries Commission for the Mediterranean; maritime transport utilised input-output analysis to capture supply chain interconnections.

The sustainability assessment used a modified Driver-Pressure-State-Impact-Response framework adapted for semi-enclosed seas, incorporating region-specific elements such as transboundary drivers, seasonal tourism pressures, endemic species indicators, impacts on traditional livelihoods, and multi-level governance responses. Environmental indicators included pollution levels, biodiversity metrics, and coastal development intensity, while governance indicators measured policy coherence and stakeholder engagement. Additional governance indicators comprised the Governance Integration Score, Policy Implementation Effectiveness, and sector-specific Sustainability Indices, developed using frameworks from Petrosillo et al. (2023). The Coastal-Inland Economic Integration Index was calculated according to Mediterranean regional development methodologies.

Data integration combined empirical findings using a Delphi-validated matrix (87% agreement), producing governance effectiveness scores and sustainability assessments, which are presented directly in the results section.

### 3. RESULTS

#### 3.1. Economic Contributions and Sectoral Performance

Drawing on regional economic accounts, sectoral performance indicators, and composite indices compiled for 2019–2024, the empirical analysis reveals substantial but uneven contributions of tourism, fisheries, and maritime transport to coastal economies in the Ionian–Adriatic region. Using harmonised regional data and sector-specific frameworks, tourism, fisheries, and maritime transport were assessed for their direct contribution to coastal GDP, employment, and recent growth trajectories. These indicators were then linked, through correlation and regression analysis, to governance integration scores and sectoral sustainability indices to evaluate how differences in institutional arrangements affect economic outcomes and environmental performance. The economic significance of these sectors, individually and collectively, underscores their importance to regional development and highlights the need for sustainable management approaches.

Marine tourism emerged as the dominant economic contributor among the three sectors examined, with particularly strong performance in Croatia, Greece, and Italy. As shown in Table 1, tourism directly contributed between 18% and 24% to the GDP of coastal regions, with even higher total contributions when accounting for indirect and induced effects. The sector also demonstrated the highest employment generation capacity, supporting approximately 2.4 million jobs across the region. According to Selvaduray et al. (2023), tourism growth has been particularly pronounced in specialised segments such as cruise tourism, nautical tourism, and eco-tourism, which collectively grew by 32% between 2019 and 2024 despite pandemic-related disruptions.

Sector	Direct GDP contribution (%)	Total employment	Annual growth rate (%)	Regional Economic Disparity Index
Coastal Tourism	19-25	2,513,800	9.1	0.71
Fisheries and Aquaculture	3-7	108,450	1.8	0.41
Maritime Transport	6-10	351,200	7.9	0.54
Combined Blue Economy	28-42	2,973,450	6.7	0.56

Table 1. Economic contributions of marine-based sectors in the Adriatic-Ionian region (2024) (Note: GDP contribution percentages refer to coastal regions only. Regional Economic Disparity Index ranges from 0 (highest disparity) to 1 (complete equality)).

The fisheries sector, although accounting for a smaller proportion of the regional economy compared to tourism, remains highly significant for local economies, particularly in Albania, Montenegro, and certain coastal communities in Italy

and Greece. The sector contributed between 3% and 7% to coastal GDP and supported approximately 108,450 jobs. However, as Manea et al. (2020) observed, the economic resilience of fisheries has been undermined by declining stocks and ecosystem changes, underscoring the need for ecosystem-based marine spatial planning, especially in areas such as the deep Mediterranean Sea, where economic activities and conservation requirements must be carefully balanced. Fisheries are closely integrated with local food systems, cultural identity, and territorial branding (Li et al., 2025; Akyzbekova et al., 2024). Fish and seafood from local fleets supply restaurants, hotels, and small food businesses, enhancing the distinctiveness of regional cuisine and supporting higher-value tourism products based on “fresh and local” narratives. Small-scale fisheries also contribute to food security by providing affordable protein and protecting households from price shocks in imported food (Kazhymurat et al., 2021; Alexyuk et al., 2021). Meanwhile, spatial competition with marinas, tourist infrastructure, and port expansion restricts traditional landing sites and access to fishing grounds, demonstrating that the sector’s broader significance can only be understood in relation to its interactions with tourism and maritime transport.

Maritime transport occupied an intermediate position, with a direct contribution of 6–10% to coastal GDP and employment of approximately 351,200 people. The sector exhibited strong growth momentum at 7.9% annually, driven mainly by the expansion of container shipping and increased port development. This growth was unevenly distributed, with northern Adriatic ports in Italy, Slovenia, and Croatia experiencing more substantial gains than Ionian destinations. Hidalgo-Gallego and Núñez-Sánchez (2023) noted that maritime transport’s economic multiplier effect is particularly pronounced in port regions, generating urban employment that extends beyond direct port activities into related service industries and urban centres.

Sectoral composition also varied considerably between countries, as shown in Table 2. Croatia and Greece had the strongest tourism orientation, while Italy maintained the most balanced sectoral distribution. Albania and Montenegro exhibited greater dependence on fisheries relative to their overall economic structure. These differences reflect distinct development trajectories and natural resource endowments among countries in the region.

Country	Tourism contribution to coastal GDP (%)	Fisheries contribution to coastal GDP (%)	Maritime transport contribution to coastal GDP (%)	Coastal-Inland Economic Integration Index
Albania	17.2	6.5	4.7	0.41
Bosnia and Herzegovina	8.5	1.8	2.3	0.29
Croatia	24.9	3.0	6.1	0.65
Greece	22.5	3.9	7.4	0.59
Italy	20.3	3.6	9.3	0.76
Montenegro	19.4	5.6	3.8	0.47
Slovenia	12.0	1.6	6.7	0.71
North Macedonia	8.3	0.7	3.1	0.34

Table 2. Country-level sectoral distribution and economic impacts in the Adriatic-Ionian region (2024) (Note: Coastal-Inland Economic Integration Index measures the degree of economic connectivity between coastal and inland regions (0=low integration, 1=high integration)).

The analysis revealed significant temporal trends in the economic performance of these sectors. After the severe disruption caused by the COVID-19 pandemic in 2020, tourism demonstrated notable recovery capacity, reaching pre-pandemic economic contribution levels by 2022 and exceeding them by 14.7% in 2024. This recovery was spatially uneven, with smaller destinations recovering faster than mass tourism areas.

Stakeholder interviews strongly corroborated these recovery patterns and underlying mechanisms. Croatian small-destination operators confirmed faster recovery rates, with one noting: “We were fully booked by summer 2022 while Dubrovnik still struggled.” Tourism entrepreneurs consistently linked recovery success to environmental quality, as expressed by a Slovenian eco-tourism operator: “Guests specifically choose us for clean nature – they pay 40% more for pristine environments.” Greek island tourism representatives validated the preference shift: “Post-COVID tourists avoid crowds and seek authentic, clean destinations.”

Focus group discussions revealed the economic-environmental connection mechanism. Italian coastal communities reported that destinations maintaining higher environmental standards attracted “higher-spending, longer-staying visitors” compared to mass tourism areas. Albanian operators noted: “Tourists now research water quality and waste management

before booking – environmental reputation directly affects our revenue.” These stakeholder insights explain the quantitative finding that areas with higher environmental sustainability scores experienced 34% higher average visitor spending.

According to Wang et al. (2023), this pattern suggests increasing tourist preference for less crowded destinations with perceived higher environmental quality, highlighting the economic premium associated with environmental sustainability. This trend is quantitatively demonstrated by the positive correlation ( $r=0.76$ ,  $p<0.01$ ) between environmental quality indicators and tourism growth rates across the region's destinations. Areas with higher environmental sustainability scores experienced 27% faster recovery and 34% higher average visitor spending, indicating that ecological preservation now represents a significant economic advantage rather than merely a regulatory constraint. This situation may be partially caused by a response to overtourism, heightened post-pandemic risk perceptions, and growing awareness of ecological degradation in mass tourism resorts. In the Ionian-Adriatic context, this shift translates into an economic premium for destinations that successfully reduce environmental pressures, maintain water quality, and visibly invest in sustainable practices.

Questionnaire data from tourism operators ( $n=67$ ) validated this economic-environmental nexus, with 89% reporting that environmental quality directly influenced their business performance. Operators in high-environmental-quality areas rated their economic prospects significantly higher (mean=4.3/5) compared to those in degraded environments (mean=2.7/5). This stakeholder validation demonstrates that the quantitative correlation between environmental sustainability and economic performance reflects actual business experiences and market dynamics across the region.

Overall, the analysis suggests that tourism, fisheries, and maritime transport jointly sustain a substantial share of coastal economic activity, yet their operations are fundamentally interdependent. Tourism relies on environmental quality and the cultural value generated by fisheries, while fisheries depend on port infrastructure and market access shaped by maritime transport. Shipping activity supports regional connectivity but also introduces emissions and habitat pressures that directly affect both fisheries and tourism. These cross-sectoral linkages show that isolated, sector-specific measures cannot secure long-term sustainability; effective outcomes require integrated governance that explicitly manages spatial overlaps, shared resources, and mutual externalities.

### 3.2. Sustainability Challenges and Environmental Impacts

The assessment of sustainability challenges in the tourism, fisheries, and maritime transport sectors identified significant environmental pressures throughout the Adriatic-Ionian region. Although economic benefits were substantial, as documented in the previous section, these were accompanied by considerable environmental costs that varied in nature and intensity across different activities and geographical areas.

Tourism exhibited the highest spatial concentration of environmental impacts, with seasonal peak pressures significantly exceeding carrying capacity in several coastal hotspots. As shown in Table 3, tourism activities generated substantial waste volumes, water consumption, and habitat disturbance, particularly during the summer months when visitor numbers were at their highest. Seasonal waste generation from tourism exceeded local management capacity by 37–142% during the high season, creating significant environmental pressures. Marine plastic litter from tourism activities accounted for approximately 32% of total coastal waste volume, with particularly high concentrations in beach areas with intensive recreational use.

Sustainability indicator	Tourism	Fisheries	Maritime transport	Combined Pressure Index
Carbon Footprint (Mt CO <sub>2</sub> e/year)	18.4	5.7	27.3	51.4
Marine Litter Generation (kt/year)	213.6	84.2	41.8	339.6
Habitat Disturbance (km <sup>2</sup> )	3,865	12,740	2,187	18,792
Water Consumption (million m <sup>3</sup> )	872	136	58	1,066
Seasonal Pressure Variation (%)	+418	+47	+29	+164

Table 3. Environmental sustainability indicators by sector in the Adriatic-Ionian region (2019-2024 average) (Note: Seasonal Pressure Variation indicates percentage increase in environmental pressure during peak season compared to annual average. Combined Pressure Index represents aggregate environmental impact across sectors.)

The Combined Pressure Index (CPI), calculated as a weighted composite of normalised sectoral impacts ( $0.3 \times \text{carbon emissions} + 0.25 \times \text{marine litter} + 0.25 \times \text{habitat disturbance} + 0.2 \times \text{water consumption}$ ), provides a standardised measure of aggregate environmental pressure.

Fisheries generated the most extensive spatial impact through habitat disturbance, affecting approximately 12,740 km<sup>2</sup> via bottom trawling and other extractive practices. Assessment of fish stock status revealed that 72% of commercially targeted stocks in the region were either fully exploited or overexploited, indicating significant sustainability challenges. Fishing community interviews directly confirmed these habitat disturbance patterns, with an Italian trawler captain noting: “We must go deeper and further each year – the shallow areas are empty now”. Albanian small-scale fishers corroborated stock depletion concerns: “My father caught twice as much fish in the same areas 20 years ago”. Focus group discussions with 14 fishing communities consistently identified overfishing as the primary threat, with participants mapping specific areas where “fish populations collapsed in the last decade”.

Small-scale fishing communities demonstrated more sustainable practices than industrial operations, with 43% lower bycatch rates and 27% higher selectivity in harvesting. Questionnaire data from fishing operators (n=45) validated these sustainability differences, with small-scale fishers reporting significantly higher environmental concern scores (mean=4.4/5) compared to industrial operators (mean=2.8/5). Traditional fishers emphasised their conservation practices during interviews: “We use selective gear and respect spawning seasons – it’s our future at stake”, contrasted with industrial operator concerns about “economic pressure to maximise catches regardless of sustainability”.

Maritime transport produced the highest carbon emissions among the three sectors, contributing approximately 27.3 Mt CO<sub>2</sub>e annually to the region’s carbon footprint. While spatial impacts were more concentrated along shipping lanes and port areas, pollution incidents had far-reaching consequences for marine ecosystems. Port authority representatives confirmed these emission patterns during interviews, with a Croatian port manager stating: “Large container ships produce more emissions in one day than our entire city”. Local communities near major shipping routes consistently reported air quality concerns, as noted by a Slovenian coastal resident: “Ship exhaust clouds are visible daily - children cannot play outside during peak traffic”.

The analysis identified 84 significant pollution incidents between 2019-2023, with impacts affecting approximately 2,187 km<sup>2</sup> of marine habitat. Maritime accidents and pollution incidents were strongly correlated with traffic density and regulatory enforcement levels, with highest risk areas concentrated at navigational chokepoints. Stakeholder interviews revealed enforcement challenges underlying these incident patterns. Greek coast guard officials noted: “We lack vessels to monitor all shipping lanes effectively”, while Italian environmental inspectors emphasised: “Penalties are too low to deter violations”. Community focus groups near navigational chokepoints identified specific incident locations that matched quantitative hotspot analysis, with Montenegro fishing representatives reporting: “Oil spills happen monthly near the main shipping channel – we lose fishing days cleaning our nets and areas”.

The sustainability assessment also examined management effectiveness across countries and sectors, revealing significant variations in both policy approaches and implementation outcomes (Gissi et al., 2021; Tanasiichuk et al., 2024). Table 4 presents governance effectiveness scores and corresponding environmental performance indicators, demonstrating the link between management capacity and sustainability outcomes. Countries implementing integrated coastal zone management frameworks achieved significantly better environmental performance across all sectors compared to those with fragmented governance approaches.

Country	Governance integration score	Policy implementation effectiveness	Tourism Sustainability Index	Fisheries Sustainability Index	Transport Sustainability Index
Albania	0.47	0.41	0.38	0.44	0.52
Bosnia and Herzegovina	0.34	0.29	0.31	0.37	0.43
Croatia	0.76	0.72	0.67	0.59	0.73
Greece	0.68	0.63	0.62	0.54	0.65
Italy	0.81	0.75	0.71	0.63	0.78
Montenegro	0.52	0.48	0.43	0.51	0.54
Slovenia	0.79	0.77	0.74	0.68	0.81
North Macedonia	0.38	0.32	0.35	0.29	0.41

Table 4. Governance effectiveness and environmental performance by country (2024) (Note: all indices range from 0 (lowest/poorest) to 1 (highest/best). Governance Integration Score measures the degree of cross-sectoral policy coordination. Policy Implementation Effectiveness measures practical application of regulatory frameworks. Sustainability Indices measure environmental performance in each sector.)

The analysis of sustainability challenges also identified significant inter-sectoral conflicts and synergies. The most pronounced conflicts were between tourism and fisheries, with 78% of surveyed fishing communities reporting negative interactions with recreational maritime activities. Similarly, 63% of tourism operators expressed concerns about port expansion and increased maritime traffic affecting destination attractiveness. Multi-use approaches to maritime spatial planning demonstrated considerable potential for reducing conflicts while enhancing economic and environmental performance, particularly when supported by effective stakeholder engagement processes.

The temporal analysis of environmental indicators showed mixed trends across the region. Water quality metrics improved in 57% of monitored locations between 2019-2024, reflecting investments in wastewater treatment infrastructure. However, marine litter volumes increased by 23% region-wide during the same period, with particularly sharp rises in plastic waste. Areas implementing comprehensive coastal management plans experienced 34% better environmental outcomes while maintaining economic benefits, suggesting that integrated approaches can effectively balance economic development with environmental protection.

The governance scores presented in Table 4 reflect a composite assessment of management effectiveness across multiple dimensions. Governance Integration Scores measure the degree of cross-sectoral coordination within national policy frameworks, with higher values indicating better harmonisation between economic, environmental, and social objectives. Policy Implementation Effectiveness quantifies the translation of formal policies into concrete actions, highlighting the implementation gap that exists in several countries. The sector-specific Sustainability Indices evaluate environmental performance outcomes, revealing that countries with higher governance scores consistently achieve better sustainability results (Bilan et al., 2017). This relationship is particularly evident in Slovenia and Italy, where strong governance frameworks (scores >0.75) correspond with superior environmental performance, demonstrating that administrative capacity and policy coherence are critical determinants of successful marine resource management.

### 3.3. Integration Mechanisms and Management Effectiveness

Cross-border and cross-sectoral integration mechanisms have played a pivotal role in enhancing governance effectiveness across the Ionian-Adriatic region. Empirical results indicate that countries combining maritime spatial planning with ecosystem-based management and regional cooperation platforms achieved the highest combined scores in economic performance, environmental outcomes, and conflict reduction. The coordinated implementation of maritime spatial planning frameworks in Italy and Slovenia demonstrates how joint zoning of shipping lanes, tourism uses, and fisheries areas can simultaneously improve environmental status and strengthen blue-economy performance. In these cases, close coordination between national ministries, regional authorities, and local stakeholders was essential for aligning spatial plans with development strategies, reducing overlaps and conflicts among sectors, and enabling adaptive management based on regular monitoring of ecological indicators and socio-economic impacts.

Maritime Spatial Planning (MSP) emerged as the most comprehensive integration tool, with varied implementation levels across the region. As shown in Table 5, countries with fully implemented MSP frameworks demonstrated significantly higher performance across economic and environmental indicators, suggesting that spatial planning provides an effective framework for resolving inter-sectoral conflicts. Italy and Slovenia, with the most developed MSP implementation, achieved integrated management effectiveness scores of 0.84 and 0.81 respectively, compared to the regional average of 0.59.

Integration Mechanism	Implementation level (regional average)	Economic performance effect	Environmental performance effect	Conflict resolution effectiveness	Cross-border coordination
Maritime spatial planning	0.62	+18.4%	+23.6%	0.76	0.57
Ecosystem-based management	0.47	+7.2%	+31.8%	0.65	0.42
Blue growth strategies	0.73	+24.5%	+9.3%	0.58	0.63
Stakeholder engagement platforms	0.54	+12.8%	+16.7%	0.81	0.69
Regional cooperation mechanisms	0.58	+15.1%	+19.2%	0.67	0.78

Table 5. Integration mechanisms and effectiveness indicators across the Adriatic-Ionian region (2024) (Note: Implementation Level ranges from 0 (not implemented) to 1 (fully implemented). Economic and Environmental Performance Effects indicate percentage improvement compared to areas without implementation. Effectiveness scores range from 0 (ineffective) to 1 (highly effective). Source: compiled by the authors based on Petrosillo et al. (2023).

The comprehensive assessment identified that multi-sectoral management approaches yielded superior outcomes compared to single-sector strategies. Areas implementing ecosystem-based management approaches demonstrated the strongest environmental performance improvements, though with more modest economic gains. Conversely, areas prioritizing Blue Growth strategies achieved the highest economic performance effect but relatively smaller environmental improvements. This pattern indicates the existence of trade-offs between short-term economic gains and long-term environmental sustainability.

Stakeholder engagement platforms demonstrated particularly strong conflict resolution effectiveness (0.81), highlighting the importance of participatory approaches in managing complex marine socio-ecological systems. These platforms proved especially effective in addressing conflicts between small-scale fisheries and tourism activities, with documented reductions in reported conflicts of 38-52% in areas with established engagement mechanisms.

Cross-border coordination varied in effectiveness across different integration mechanisms, with regional cooperation frameworks showing the strongest performance in this area (0.78). The analysis indicated that effective governance structures must operate at multiple scales to address both local specificities and transboundary challenges.

Temporal analysis of integration mechanisms revealed progressive improvement across the region during 2019–2023, with the average implementation level of all mechanisms rising from 0.43 in 2019 to 0.59 in 2023. This improvement coincided with enhanced economic and environmental performance, supporting the conclusion that integrated approaches contribute positively to sustainable development outcomes. Croatia and Greece showed the most significant implementation improvements during this period, largely driven by EU policy frameworks and funding support.

Economic sectors responded differently to integration mechanisms (Bashtannyk et al., 2020). Tourism demonstrated the highest positive response to stakeholder engagement platforms and spatial planning, with documented improvements in destination quality and visitor satisfaction in areas with effective implementation. Fisheries showed strongest positive response to ecosystem-based management approaches, with fish stock recovery observed in areas implementing comprehensive management plans. Maritime transport benefited most from regional cooperation mechanisms that standardised operational procedures and environmental regulations across borders (Bagoulla and Guillotreau, 2020; Adamkulova et al., 2025).

The practical implementation of integration mechanisms faced several consistent challenges across the region. Administrative capacity limitations were reported by 72% of surveyed management authorities, while funding constraints affected 68% of implementation efforts. Political commitment varied significantly, with national-level support averaging 0.64 on the implementation scale compared to local-level support at 0.46, indicating vertical governance challenges. The most successful implementations occurred where national policy frameworks were effectively translated into local action through multi-level governance arrangements supported by adequate resources and capacity development (Eero et al., 2020; Tyukhtenko, 2017).

Comparative analysis of management approaches indicated that the most effective model incorporated three key elements: comprehensive spatial planning frameworks, robust stakeholder engagement processes, and adaptive management mechanisms responsive to monitoring results (Manfra et al., 2020; Musayeva et al., 2025). Areas implementing this integrated approach achieved 27% better economic outcomes and 34% better environmental performance compared to areas with fragmented management approaches, demonstrating that economic development and environmental protection can be effectively balanced through appropriate governance arrangements.

This integrated approach produced sector-specific benefits that addressed each sector's unique challenges. In tourism, spatial planning frameworks successfully managed seasonal congestion, reducing peak environmental pressures by 46% while maintaining visitor numbers and increasing average expenditure by 11%. Stakeholder engagement processes proved particularly effective for fisheries management, enabling small-scale fishing communities to secure dedicated access zones and increase catches by 18% while maintaining stock sustainability through traditional knowledge integration. For maritime transport, adaptive management mechanisms facilitated efficiency improvements that reduced environmental impacts (emissions decreased by 23%) while accommodating 32% increased cargo volume through better route planning and port coordination. Across all sectors, the highest economic-environmental performance balance was achieved in regions where governance integration scores exceeded 0.70 (particularly evident in Italy, Slovenia, and Croatia), with performance gaps widening when comparing areas that integrated multiple sectors versus those managing each sector independently. These findings confirm that sector-specific solutions embedded within coherent regional frameworks represent the optimal approach for sustainable marine resource management throughout the Adriatic-Ionian region.

The empirical findings indicate the need for coordinated, actor-specific measures to operationalise integrated marine governance in the Ionian-Adriatic region. Governments should strengthen and harmonise Maritime Spatial Planning

through legally binding, cross-sectoral plans and establish shared environmental performance standards for ports, marinas, and tourism areas, supported by consistent monitoring and multi-level coordination platforms (Moura et al., 2012). Tourism operators and maritime businesses can contribute by adopting certified environmental management systems and investing in cleaner technologies and circular waste solutions that reduce ecological pressures while improving competitiveness in sustainability-oriented markets. Local communities should be included in co-management arrangements and advisory bodies, enabling them to provide traditional ecological knowledge, participate in monitoring, and co-design spatial or seasonal management measures that balance conservation objectives with livelihood needs.

#### 4. DISCUSSION

The comprehensive empirical analysis conducted in this study has quantified the economic-environmental relationships across multiple sectors and governance systems in the Ionian and Adriatic region, revealing previously undocumented patterns in resource use and management effectiveness. By systematically evaluating eight countries, three economic sectors, and five integration mechanisms through standardised metrics, the research has produced evidence-based insights into the complex dynamics between economic development and environmental sustainability. The findings reveal both opportunities and challenges in achieving balanced management approaches that support economic prosperity while ensuring long-term ecological health.

The economic contribution of marine-based sectors to regional economies confirms the central importance of blue economy activities for coastal communities throughout the Adriatic-Ionian region. The dominance of tourism as an economic driver aligns with findings by Mylonopoulos et al. (2022), who emphasised the pivotal role of cultural routes and sustainable tourism approaches in creating economic resilience for coastal communities. This study extends that understanding by quantifying the economic relationships between tourism and other marine sectors, demonstrating both complementarities and conflicts that must be addressed through integrated management.

The environmental pressures documented across all three sectors present substantial management challenges that require integrated approaches addressing both sectoral and cumulative impacts. The marked seasonality of tourism impacts, with peak pressures far exceeding carrying capacity in many areas, confirms findings by Chin (2022), who identified similar patterns in rural tourism destinations. The present research contributes additional insights by quantifying these seasonal variations across the Adriatic-Ionian region and documenting their specific manifestations in the marine environment.

The status of fisheries resources, with 72% of stocks either fully exploited or overexploited, mirrors global trends identified by Alsaleh et al. (2023) in their framework for blue growth. The current study advances this understanding by identifying specific governance approaches that have demonstrated effectiveness in addressing these challenges within the Adriatic-Ionian context, particularly highlighting the value of small-scale fisheries management models that incorporate traditional knowledge and practices.

Maritime transport emissions and pollution incidents represent significant environmental challenges that align with concerns raised by Wang and Wang (2018) regarding the environmental footprint of marine industries. The present research provides a more nuanced understanding of these impacts by mapping their spatial distribution across the Adriatic-Ionian region and identifying specific governance mechanisms that have proven effective in mitigating them while maintaining economic benefits.

The effectiveness of integrated management approaches documented in this study, particularly Maritime Spatial Planning and ecosystem-based management, supports the findings of Tao et al. (2021) on the importance of comprehensive ecological-economic accounting frameworks. This research extends that understanding by demonstrating the practical implementation challenges and successes of these approaches within the Adriatic-Ionian region, highlighting best practices and persistent barriers. For example, Slovenia and Italy achieved the highest integrated management effectiveness scores (0.81 and 0.84, respectively) through fully implemented MSP frameworks, which improved economic performance by 18.4% and environmental indicators by 23.6% compared to areas without such frameworks. The Gulf of Trieste initiative, spanning both countries, exemplifies successful integration, as coordinated Maritime Spatial Planning reduced stakeholder conflicts by 68% and increased economic outputs in aquaculture and tourism sectors. Further analysis by Depellegrin et al. (2018) confirms that multi-use maritime spatial planning consistently delivers superior outcomes when supported by robust stakeholder engagement and cross-border coordination mechanisms.

The correlation between governance effectiveness and environmental outcomes identified across countries aligns with observations by Zhao and Lv (2020) regarding the importance of institutional frameworks in sustainable marine development. This study adds depth by quantifying these relationships across multiple governance dimensions and identifying specific integration mechanisms that have proven effective in the regional context.

Cross-border coordination emerges as a critical factor in effective marine resource management, consistent with findings by Grbec et al. (2023) on legal aspects of marine protected areas in the Mediterranean. This research contributes further insights by evaluating the effectiveness of various cross-border mechanisms and identifying factors that support successful transboundary cooperation in the Adriatic-Ionian region.

The challenges faced by countries with less developed governance systems, particularly Albania, Bosnia and Herzegovina, and North Macedonia, reflect broader development patterns identified by Xiao and Guo (2020) in their analysis of marine industry development capacity. This research provides additional insights by documenting specific capacity constraints and identifying potential pathways for addressing these limitations through regional cooperation and targeted capacity building.

The empirical findings support the conclusion that economic development and environmental protection are not mutually exclusive when appropriate management frameworks are implemented. This aligns with arguments by Tian et al. (2020) regarding the importance of carrying capacity considerations in marine development. This research extends that understanding by identifying specific integration mechanisms and management approaches that effectively balance these objectives within the Adriatic-Ionian region.

The documented success of stakeholder engagement platforms in conflict resolution supports Loske's (2020) findings on the importance of collaborative approaches in managing complex socio-economic systems. The present research provides further insights by evaluating the effectiveness of various engagement mechanisms across different sectoral contexts and identifying factors that facilitate successful stakeholder participation in marine resource governance.

The progressive improvement in integration mechanisms observed between 2019 and 2023 indicates positive momentum towards more sustainable marine resource management. This trend is consistent with Wang and Wang's (2018) observations regarding the evolving role of marine industries in national economies. The present study advances this understanding by documenting specific policy innovations and implementation improvements that have contributed to this positive trajectory within the Adriatic-Ionian region.

Beyond sectoral performance, the findings underscore the critical importance of integrating coastal economic activities with broader regional development strategies. This integration is necessary not only to maximise economic benefits but also to distribute those benefits more equitably across coastal and inland communities. As demonstrated by Zhao and Lv (2020) in their study of marine sports tourism in Northern China, successful integration relies on establishing economic linkages that connect coastal activities with inland supply chains and service networks. This research extends that understanding to the Adriatic-Ionian context, identifying specific regional development patterns that support balanced economic growth.

The Coastal-Inland Economic Integration Index in Table 2 shows substantial variation across countries, with Italy (0.73) and Slovenia (0.68) exhibiting the strongest integration. This pattern is consistent with Zhao and Lv's (2020) findings that regions with stronger infrastructure connections and diversified economic linkages achieve more sustainable development outcomes. The present study adds further insights by documenting how these integration patterns affect both economic resilience and environmental management capacity in the Adriatic-Ionian region.

The growth in specialised tourism segments, particularly cultural and eco-tourism, reflects changing consumer preferences identified by Albasri and Sammut (2022) in their comparative study of sustainability profiles. This research builds on that understanding by mapping these trends across the Adriatic-Ionian region and identifying governance approaches that effectively support sustainable tourism development while preserving cultural authenticity and environmental integrity.

Although this research focused primarily on current economic and environmental conditions, the findings have significant implications for climate change vulnerability and adaptation strategies. Maragno et al. (2020) emphasised the importance of integrating climate adaptation planning with maritime spatial planning in the North Adriatic Basin. The present study complements this work by identifying governance arrangements that enhance adaptive capacity and documenting specific integration mechanisms that support climate-resilient development across the Adriatic-Ionian region.

The varying levels of governance effectiveness documented across countries indicate differing vulnerability to climate change impacts. Alsaleh et al. (2023) identified similar patterns in their analysis of tourism sustainability, noting that governance capacity significantly influences adaptive responses to environmental change. The present research extends that understanding by evaluating specific governance dimensions contributing to adaptive capacity in the Adriatic-Ionian context and identifying priority areas for capacity development.

The findings point to several important directions for future research on marine resource management in the Adriatic-Ionian region. Wang et al. (2023) emphasised the need for more integrated approaches to analysing resource constraints and economic growth. Building on this, future research should focus on developing more sophisticated models of the interactions between economic activities and environmental conditions, particularly incorporating climate change projections and adaptation scenarios.

The documented effectiveness of stakeholder engagement platforms suggests the need for more detailed investigation of participation mechanisms and their outcomes. Tian et al. (2020) emphasised the importance of participatory approaches in forecasting marine carrying capacity. As evidenced, stakeholder engagement platforms demonstrated strong conflict resolution effectiveness (0.81), improved economic performance by 12.8%, and enhanced environmental outcomes by 16.7% across the region. These platforms were especially effective in addressing conflicts between small-scale fisheries and tourism activities, with reductions in reported conflicts of 38–52% in areas with established engagement mechanisms. Future research should examine the specific dynamics of stakeholder engagement in different country contexts and evaluate the factors supporting effective participation in marine resource governance.

The varying implementation levels of integration mechanisms across countries highlight the need for more focused analysis of implementation barriers and enabling factors. Salvador (2019) highlighted the challenges of creating effective macro-regional strategies across EU borders. Future research should investigate the specific institutional, political, and capacity factors influencing implementation success in different country contexts and identify transferable lessons for improving integration across the region.

This research contributes significant scientific and practical value through its novel integration of economic, environmental, and governance indicators across the Adriatic-Ionian region. Scientifically, it establishes quantitative relationships between governance mechanisms and sustainable outcomes, with governance integration scores directly correlating with both economic and environmental performance, filling critical gaps in understanding cross-sectoral interactions in semi-enclosed seas. The study's methodological innovation lies in its standardised assessment framework, enabling systematic comparison across diverse governance contexts. From a practical perspective, the findings provide policymakers and stakeholders with evidence-based guidance for marine resource management, identifying specific integration mechanisms that effectively balance economic needs with ecological limits while reducing cross-sectoral conflicts in spatially constrained environments. These insights are particularly valuable for developing coherent blue economy frameworks that support regional cooperation while respecting local socio-ecological conditions.

## 5. CONCLUSIONS

This research offers a distinctive empirical integration of economic, environmental, and governance indicators across the Ionian and Adriatic region, demonstrating that effective marine resource management requires tailored governance mechanisms which balance sector-specific needs with ecosystem health.

The economic assessment revealed substantial contributions of marine-based sectors to regional economies, with tourism accounting for 18–24% of coastal GDP, followed by maritime transport (5–9%) and fisheries (3–7%). Croatia and Greece exhibited the strongest tourism orientation (23.8% and 21.6% of coastal GDP respectively), while Italy maintained the most balanced sectoral distribution, with a significant maritime transport contribution (8.7%). Albania and Montenegro showed greater dependence on fisheries (6.8% and 5.9% respectively) relative to their overall economic structure. This economic configuration presents both opportunities and challenges, as each sector generates distinct environmental pressures while relying on ecosystem health for long-term viability.

The sustainability assessment identified considerable environmental pressures across all sectors, with tourism causing highly concentrated seasonal impacts, fisheries resulting in extensive habitat disturbance, and maritime transport producing the largest carbon footprint. Notable environmental hotspots included the Croatian coastal tourism corridor, where seasonal waste generation exceeded local management capacity by 142% during the high season; the North Adriatic trawling grounds, where fisheries affected approximately 12,740 km<sup>2</sup> of seabed habitat; and major shipping lanes between the Ionian Sea and Northern Adriatic ports, where maritime accidents and pollution incidents were concentrated.

The evaluation of integration mechanisms found that Maritime Spatial Planning, ecosystem-based management, and stakeholder engagement platforms delivered the strongest performance in balancing economic and environmental objectives. Countries with well-developed integration frameworks, particularly Italy and Slovenia, achieved superior outcomes, with Maritime Spatial Planning improving economic performance by 18.4% and environmental indicators by 23.6% compared to areas without such frameworks.

The findings provide practical value by offering evidence-based guidelines for policymakers developing blue economy strategies, especially by quantifying the economic and environmental benefits of different governance mechanisms. Despite the comprehensive nature of this research, several limitations should be noted. The cross-sectional design captures only a snapshot of rapidly evolving socio-ecological systems, potentially missing important temporal dynamics. Data availability varied significantly across countries, with some regions having limited monitoring capabilities, particularly for environmental indicators in Albania, Bosnia and Herzegovina, and Montenegro. The relatively small sample size in certain communities ( $n < 30$ ) may also restrict the generalisability of some findings to broader contexts. The construction of composite governance and sustainability indices, despite expert validation, involves subjective weighting choices. Qualitative material, though valuable for interpretation, may not represent all regional contexts. Moreover, the absence of explicit climate-change and future-policy scenarios limits the study's ability to anticipate how evolving environmental and regulatory conditions may alter sectoral interactions. Future research should focus on developing more advanced forecasting models that incorporate climate change projections, examining cross-border governance arrangements to overcome political fragmentation, and designing stakeholder engagement platforms that effectively balance competing sectoral interests while supporting equitable distribution of marine resource benefits.

## CONFLICT OF INTEREST

Authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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