frontiers | Frontiers in Marine Science

TYPE Original Research
PUBLISHED 04 August 2025
DOI 10.3389/fmars.2025.1618637

OPEN ACCESS

EDITED BY
Renato Mamede,
University of Aveiro, Portugal

REVIEWED BY
Felicity Picken,
Western Sydney University, Australia
Agustin Santana-Talavera,
University of La Laguna, Spain

*CORRESPONDENCE
Nada Mallah Boustani
nada.mallahboustany@usj.edu.lb

RECEIVED 26 April 2025
ACCEPTED 14 July 2025
PUBLISHED 04 August 2025

CITATION
Msayleb N, Boustani NM, Abidib S, Athiman K and Bejaoui B (2025) Stakeholder participation and crisis- responsive strategies in the Mediterranean blue bioeconomy-insights from Lebanon under Co-Evolve4BG project.
Front. Mar. Sci. 12:1618637.
doi: 10.3389/fmars.2025.1618637

Stakeholder participation and crisis- responsive strategies in the Mediterranean blue bioeconomy-insights from Lebanon under Co-Evolve4BG project

Nahed Msayleb[1], Nada Mallah Boustani[2]*, Sana Abidib[3], Khouloud Athiman[4] and Béchir Bejaoui[4]

[1]Department of Environmental Engineering, Faculty of Agronomy, Lebanese University, Beirut, Lebanon, [2]Faculty of Business and Management, Saint Joseph University, Beirut, Lebanon, [3]Department of Geography, Faculty of Literature and Human Sciences, Lebanese University, Tripoli, Lebanon, [4]Marine Environment Laboratory (LMM), National Institute of Marine Sciences and Technologies (INSTM), Tunis, Tunisia

Introduction: This study investigates the long-term impacts of health emergencies—specifically the COVID-19 pandemic—on coastal tourism systems across the Mediterranean, with a particular focus on the Batroun pilot site in Lebanon. Coastal areas are especially vulnerable to systemic disruptions due to their dependence on tourism, ecological fragility, and governance fragmentation. Understanding how crises like COVID-19 reshape tourism dynamics is critical for advancing sustainable and resilient development within the blue bioeconomy framework.

Methods: We adopted a participatory research approach involving multi-stakeholder workshops, focus groups, and SWOT analyses. The Co-Evolve4BG Toolkit, a participatory evaluation instrument, was applied to assess the sustainability performance of Batroun's coastal tourism sector across environmental, economic, and governance dimensions. Thresholds and indicator scoring were co-developed with local actors and experts to reflect contextual realities.

Results: Findings revealed both systemic vulnerabilities and adaptive capacities. Batroun demonstrated relative strengths in public engagement, wastewater infrastructure, and cultural asset preservation. However, significant weaknesses emerged in pollution management, marine habitat protection, and institutional coordination. The COVID-19 pandemic acted as a stress test, highlighting the fragility of current systems but also catalyzing shifts toward digital tourism, circular economy initiatives, and decentralized decision-making.

Discussion: The Co-Evolve4BG Toolkit proved to be an effective mechanism for benchmarking sustainability and co-developing locally grounded action plans. Insights from the Batroun case emphasize the importance of participatory governance and integrated coastal management in building long-term resilience. We recommend the adoption of standardized health protocols,

diversification of tourism models, and improved inter-institutional coordination at the regional level. These findings contribute to a replicable model for aligning ecological preservation with crisis-responsive tourism planning in Mediterranean coastal areas.

KEYWORDS

blue bioeconomy, COVID-19, ecosystem services, Mediterranean tourism, participatory governance, stakeholder participation, sustainable coastal development, SWOT analysis

1 Introduction

In recent years the urgency for sustainable development has put the blue bioeconomy in the spotlight – a multifaceted field that focuses on the responsible and innovative use of marine and aquatic resources. This aligns with the broader sustainability goals of the United Nations Sustainable Development Goals (SDGs) especially those related to climate action (SDG 13), life below water (SDG 14) and decent work and economic growth (SDG 8). The blue bioeconomy encompasses sectors such as fisheries, aquaculture, marine biotechnology and coastal tourism and aims to harmonize economic productivity with marine ecosystem preservation and offers ecological and socio-economic benefits.

The Mediterranean is a key area to explore the blue bioeconomy due to its biodiversity richness, dense coastal populations and economic dependence on maritime sectors especially tourism. Coastal areas in countries like Lebanon are demographic and GDP drivers but also suffer from intense human pressures such as illegal fishing, habitat degradation, pollution and unregulated tourism (Rizk and Vartanian, 2018). These pressures undermine ecosystem services and risk pushing coastal economies into a grey economy – where informal or illicit practices reduce long term value and equity (Gormsen, 1997).

Moreover, the COVID-19 pandemic presented an unprecedented stress test for coastal tourism systems, particularly in the Mediterranean. While it is globally acknowledged that tourism, public health, and local economies are interconnected, this study leverages the pandemic as a pivotal moment to examine how crisis events can catalyze shifts toward more resilient and sustainable tourism governance. In the context of Batroun, Lebanon, COVID-19 served as both a disruptor and an inflection point, prompting stakeholders to rethink tourism planning within the broader scope of the blue bioeconomy. By applying participatory tools in a localized setting, this paper highlights how health crises can trigger adaptive governance innovations transferable to other Mediterranean destinations.

Amid these systemic threats to socio-ecological resilience and building on this contextual foundation, the Co-Evolve4BG project funded by the ENI CBC Med Program provides a framework to understand how participatory governance and stakeholder engagement can address these sustainability challenges.

This paper presents findings from a Mediterranean pilot site located in Lebanon, showing how collaborative tools such as SWOT analyses can guide integrated coastal zone management (ICZM) and contribute to the development of a resilient and inclusive blue bioeconomy. It bridges academic research with on the ground policy action and provides practical pathways to enhance socio-ecological resilience.

Building on this contextual foundation, it is essential to examine the scholarly landscape that has informed the evolution of the blue bioeconomy and stakeholder engagement across Mediterranean coastal systems.

The blue bioeconomy has become a key driver for coastal sustainable development especially in regions heavily dependent on marine resources. Defined as the sustainable use of ocean and aquatic resources for economic growth, improved livelihoods and ecosystem health it encompasses a wide range of sectors such as fisheries, aquaculture, marine biotechnology and coastal tourism (Araújo et al., 2021). The Mediterranean, with its unique socio-ecological systems and heritage-rich coastlines, is especially relevant to blue bioeconomy transitions. But the success of these initiatives depends heavily on good governance, stakeholder inclusion and pollution mitigation strategies. Several authors have emphasized that stakeholder engagement is key to long term sustainability in coastal and marine systems. Berkes (2009, 2010) introduced the concept of co-management where local stakeholders and government institutions share decision making responsibilities to increase legitimacy and compliance. This is especially relevant in Mediterranean contexts where informal economies and decentralized governance often hinder environmental enforcement. Similarly, Reed (2008) stated that early and inclusive stakeholder participation improves decision quality, manages conflicts and promotes social learning – principles that underpin the participatory approach of the Co-Evolve4BG project.

The integration of local knowledge through participatory methods such as SWOT analyses and workshops has been proven in previous studies. For example, Tompkins et al. (2008) showed how scenario-based stakeholder engagement fosters adaptive management in the face of climate uncertainty. These participatory tools are particularly suited to the Mediterranean where cultural values and governance systems intersect. Moreover, the inclusion of youth, diaspora and civil society in environmental action as seen in one of the pilot regions of Lebanon,

Batroun reflects the "sense of place" model by Ardoin et al. (2015) where emotional and cultural ties to a landscape promote pro-environmental behavior (Pahl-Wostl, 2015).

In parallel, environmental pressures continue to challenge blue economy growth. Human induced impacts – from unregulated tourism and pollution to IUU (Illegal, Unreported and Unregulated) fishing – have been shown to degrade marine ecosystems and erode local economies (Halpern et al., 2015; Islam and Tanaka, 2004). Pauly and Zeller (2016) argue that global fish catches are underreported and increasingly unsustainable, exacerbating ecological decline and reducing returns for coastal communities. The Batroun SWOT analysis reflects these challenges pointing to wastewater leakage, chemical pollution and invasive species as key threats to ecosystem integrity.

To counteract these trends integrated policy frameworks such as Integrated Coastal Zone Management (ICZM) have been recommended. ICZM emphasizes cross sectoral planning, participatory governance and ecosystem-based management, all of which align with the Co-Evolve4BG approach. However, Shipman and Stojanovic (2007) argue that ICZM has struggled in Europe due to poor institutional coordination and implementation gaps – challenges also reflected in Batroun's fragmented regulatory environment and lack of enforcement capacity. Meanwhile, sustainable tourism is evolving as a tool for economic diversification and environmental stewardship. McLeod et al., (2022) argue that top-down tourism policies in mass destinations fail due to lack of local input. But when tourism is integrated with cultural heritage, marine protection and circular economy models, it can support a regenerative blue economy. Practices such as reusing fishing nets, promoting eco-tourism and enhancing fishermen's cooperatives, reflect the vision of Olesen et al. (2023) who argues that circular economy strategies in fisheries can reduce marine waste and increase value-added production.

Innovation is also key. Marine biotechnology as highlighted by Rudovica et al. (2021) and nature-based solutions for beach restoration and pollution control (OECD, 2018) offer opportunities for sustainable coastal development. These innovations require investment in capacity building and governance which the FAO (2021) calls the "Blue Transformation".

According to the Araújo et al. (2021) this sector supports employment and innovation and plays a crucial role in mitigating climate change and environmental degradation. Nonetheless, the blue bioeconomy success is highly dependent on the integration of science-based management and stakeholder involvement.

Several studies have emphasized that stakeholder engagement is the cornerstone for sustainability in marine and coastal contexts. Berkes (2010) stresses the value of co-management systems, where local actors are empowered to make decisions alongside government authorities to increase legitimacy and compliance. Tompkins et al. (2008) highlight the effectiveness of scenario-based participatory methods in reducing conflicts and integrating local knowledge into environmental governance. These participatory models are especially relevant in the Mediterranean context where the socio-political landscape is fragmented, and communities have deep historical ties to coastal ecosystems. In sustainable tourism, which is a key component of the blue bioeconomy, Ardoin et al. (2019) introduced the concept of "sense of place" to explain how emotional and cultural ties to coastal areas influence environmental behavior. This complements ecosystem services approaches that assess the tangible and intangible benefits from healthy marine environments (Crossman et al., 2018; Barbier et al., 2011). Moreover, integrating heritage preservation into sustainable tourism has been shown to promote economic diversification and community resilience as seen in case studies of Tyre (Lebanon) and Djerba (Tunisia) (French Ministry of Culture, 2025; Ayadi and Forouheshfar, 2023).

Despite these frameworks the literature also warns of significant threats that can undermine blue bioeconomic progress. Illegal, unreported and unregulated (IUU) fishing, pollution and uncontrolled urbanization erode marine biodiversity and reduce the long-term viability of coastal industries (Cambridge Prisms, 2025). These issues are exacerbated by weak regulatory enforcement and the proliferation of informal economies that siphon resources away from sustainable channels. Prokopiou et al. (2019) and Rangwala (2024) advocate for dynamic and adaptive planning models including SWOT analyses to better capture context specific challenges and opportunities.

The Co-Evolve4BG project builds on these insights by applying participatory methods across pilot sites in Lebanon, Tunisia, Spain and Greece. Its methodology integrates ICZM principles with locally tailored action plans to provide empirical evidence on how stakeholder participation can improve ecosystem governance and support blue growth. Therefore, it contributes to an evolving discourse that seeks to balance ecological integrity with economic development through inclusive, innovative, and place-based approaches.

In summary, the Co-Evolve4BG project aligns with a growing body of research that advocates for inclusive, adaptive, and cross-sectoral approaches to sustain the blue bioeconomy. The Batroun case provides empirical evidence on how participatory processes and environmental innovation can be scaled up across Mediterranean coastal communities to address ecological degradation and socio-economic fragility.

2 Theoretical framework: from integrated coastal zone management to adaptive and socio-ecological governance

Integrated Coastal Zone Management (ICZM) has been the prevailing framework guiding sustainable planning and resource coordination in coastal areas since the 1990s. Rooted in ecosystem-based management and intersectoral governance, ICZM promotes participatory approaches and long-term strategic planning to harmonize economic development with environmental protection (Shipman and Stojanovic, 2007). It has been particularly influential in the Mediterranean context, where diverse pressures such as tourism, urbanization, and biodiversity loss converge. However, despite its conceptual strength, ICZM has faced increasing criticism regarding its practical implementation. Scholars highlight several structural limitations, including fragmented legal frameworks, lack of vertical coordination between governance levels, and inflexibility

in responding to emerging crises such as health emergencies or extreme climate events (Jones and Carpenter, 2009; Fraschetti et al., 2018). In many Mediterranean coastal areas, including Lebanon, these limitations are further exacerbated by institutional instability and limited enforcement capacities.

In response to these shortcomings, alternative frameworks have emerged to better address the dynamic and uncertain nature of socio-environmental systems. One such framework is adaptive governance, which emphasizes institutional flexibility, polycentric governance, social learning, and stakeholder inclusion (Folke et al., 2005; Chaffin et al., 2014). Adaptive governance diverges from ICZM's top-down, planning-oriented structure by promoting iterative decision-making, local experimentation, and responsiveness to change. These characteristics are particularly relevant in the wake of the COVID-19 pandemic, which exposed the need for decentralized, rapid, and locally-informed responses to system-wide shocks in the tourism sector. In this sense, the Co-Evolve4BG project's participatory methodology—centered on stakeholder workshops, SWOT analyses, and action planning—reflects principles of adaptive governance by fostering co-production of knowledge and feedback-driven strategy formulation.

Complementary to adaptive governance is the socio-ecological systems (SES) framework, which views human and natural systems as deeply intertwined and co-evolving. The SES perspective emphasizes resilience, feedback mechanisms, and cross-scale interactions, and has been widely applied in the study of marine and coastal resource management (Ostrom, 2009; Berkes, 2000). In this view, tourism-dependent coastal zones are not just economic spaces, but complex systems where environmental degradation, social vulnerability, and governance capacities interact. The COVID-19 pandemic, framed through an SES lens, constitutes a systemic disturbance that tests the resilience of these interconnected systems. Evaluating Mediterranean tourism responses to the pandemic therefore requires not only an understanding of tourism flows or environmental quality, but also of the institutional, cultural, and ecological feedbacks that shape adaptation.

The integration of ICZM, adaptive governance, and SES frameworks offers a more holistic lens for analyzing the governance of Mediterranean coastal tourism in the face of overlapping health and environmental crises. While ICZM provides a foundational structure for intersectoral coordination, adaptive governance and SES contribute the necessary flexibility and systems thinking required to navigate uncertainty and support transformation. This theoretical triangulation is particularly useful for interpreting the Co-Evolve4BG project outcomes, which highlight the role of participatory processes, local innovation, and cross-scale collaboration in fostering resilience. It also provides a conceptual bridge between the operational goals of the blue bioeconomy and the broader challenges of socio-ecological sustainability in coastal regions.

3 Methods

This study uses a qualitative, participatory action research (PAR) approach based on Integrated Coastal Zone Management (ICZM) and blue bioeconomy governance frameworks. The methodology was applied within the context of the EU-funded Co-Evolve4BG project in Batroun pilot area in Lebanon. The overall objective was to assess how stakeholder participation contributes to identifying challenges and co-developing solutions for coastal ecosystem management and tourism development. Ethical approval for stakeholder engagement was obtained under the Co-Evolve4BG Project framework.

3.1 Methodology

The study is a multi-actor participatory process involving local authorities, civil society, environmental NGOs, tourism stakeholders and technical experts. This is in line with the stakeholder co-management model (Berkes, 2009) that emphasizes inclusiveness, collective decision making and local empowerment in the planning and implementation of coastal sustainability measures.

The research is structured in three phases:

Diagnostic phase: Baseline analysis of environmental and socio-economic conditions in Batroun using secondary data (literature, municipal reports) and stakeholder perceptions.

SWOT analysis workshops: Participatory sessions to identify local Strengths, Weaknesses, Opportunities and Threats (SWOT) for pollution management, sustainable tourism and blue economy practices.

Action planning and validation: Co-development of site-specific action plans and strategic recommendations for local implementation followed by feedback and consensus building activities.

3.2 Data collection tools

The primary data collection tools were:

Participatory Workshops (December 28-29, 2021 & April 18-19, 2023): Over 30 stakeholders including Batroun municipality, Ministry of Environment, Ministry of Agriculture, local NGOs, academia and community members.

A Co-Evolve4BG Toolkit was used as part of the pilot actions to assess and monitor sustainable coastal/maritime tourism in the Mediterranean, with Batroun (Lebanon) as a case study. The Toolkit is a practical Excel-based instrument (Annex 1) that provides local stakeholders (municipal authorities, environmental agencies, community actors) with a framework to evaluate the tourism sector's performance in environmental, social and economic dimensions.

Through a participatory process with local actors, a selection of compulsory and non-compulsory indicators was made, reflecting the specific environmental and socioeconomic characteristics of Batroun. The 32 compulsory indicators in bold in the toolkit allow for standardization and benchmarking with other Mediterranean destinations, while the 46 non-compulsory indicators offer flexibility to address local realities such as groundwater pollution, cultural heritage and marine litter.

the Toolkit's implementation process and participatory definition of sustainability thresholds

The thresholds for sustainability indicators, including those related to tourism carrying capacity, were defined through a

participatory process involving workshops and focus group discussions with local stakeholders and experts. These exchanges relied on contextual knowledge, available data, and practical experience in managing tourism impacts. This bottom-up method ensured thresholds reflected both scientific judgment and local realities. The same process was applied across all selected indicators, which enhances the toolkit's contextual validity and increases its potential replicability in other coastal destinations.

Key steps in the Toolkit's implementation were:

Indicator selection: Local stakeholders selected the indicators most relevant to Batroun's tourism and environmental profile. The selection process was guided by participatory workshops and expert consultation. In Batroun, the toolkit was initially completed by experts in Integrated Coastal Zone Management (ICZM) and Maritime Spatial Planning (MSP). These initial responses were validated through consultations with diverse local stakeholders, including municipal officials, businesses in the coastal and maritime tourism sectors (hotels, restaurants, water sports providers), academic institutions (e.g., MARSATI and universities), and representatives from national ministries (Environment, Public Works and Transport, and Tourism). While this multi-stakeholder approach aimed at ensuring broad representation, limitations such as stakeholder availability, potential biases, and uneven participation levels are acknowledged.

Data entry and sustainability thresholds: For each selected indicator, values were assigned to represent the lower and upper thresholds of sustainability, based on expert judgment and regional benchmarks. These thresholds were compared to the current values from municipal records, field observations and stakeholder reports.

Sustainability level scoring: Each indicator was rated using a standardized qualitative scale ("Very Bad" to "Very Good") generating a weighted performance assessment.

SWOT Matrices: Facilitators guided participants to identify internal (strengths/weaknesses) and external (opportunities/threats) factors impacting pollution control and sustainable tourism.

Field observations and expert input: Supplementary information was gathered from field visits, stakeholder interviews and technical briefings from municipal and sectoral actors (e.g., fisheries cooperatives, waste management staff).

Secondary Data: National reports, EU project documentation and academic sources were used to triangulate stakeholder insights and provide context for SWOT themes (e.g., marine pollution, ICZM gaps, circular economy practices).

3.3 Analysis procedure

Workshop data were transcribed, synthesized and coded using a thematic content analysis framework, grouping entries by thematic pillars (e.g., governance, infrastructure, environmental pressure, tourism). Each SWOT matrix was examined to identify:

Cross-cutting patterns (e.g., institutional gaps across sectors),

Context-specific drivers (e.g., refugee-related wastewater issues),

Strategic leverage points (e.g., existing infrastructure, diaspora networks).

A comparative lens was used to align Batroun's findings with blue bioeconomy priorities as outlined in recent European Commission and FAO frameworks. The action plan was developed with stakeholders and further validated through expert consultation.

4 Results

The application of the Co-Evolve4BG Toolkit in Batroun, Lebanon, yielded a comprehensive performance assessment of the pilot area across environmental, economic, and governance dimensions of coastal tourism sustainability. The participatory evaluation process, informed by local expertise and stakeholder input, revealed areas of relative strength and concern.

4.1 COVID-19 impact on Mediterranean tourism and tourist well-being

The SWOT analysis (Table 1) showed that the COVID-19 pandemic had far reaching and multiple impacts on tourism sectors across the Mediterranean region. Data from Mediterranean riparian country Lebanon revealed a severe contraction in tourist arrivals ranging from 60% to 90% in 2020-2021. The most affected tourism segments are:

Beach and Maritime Tourism: Public health measures such as social distancing and beach closures led to a drastic decline in coastal tourism activities. Local economies that heavily depend on seasonal beach tourism suffered significant income losses particularly in coastal towns like Batroun.

Urban and Cultural Tourism: Lockdowns and travel bans led to the closure of museums, heritage sites and city-based festivals. Destinations such as Beirut reported severe economic damage affecting local artisans, transport providers and cultural service workers.

Recreational Boating: With restricted mobility and maritime border controls, the chartering and leisure boating sectors also declined sharply. Small businesses involved in boat rental and marina services were especially vulnerable due to their limited operational reserves.

Nature and Eco-tourism: While nature-based tourism was initially seen as a resilient alternative, limited access to protected areas, mobility restrictions and public safety concerns reduced this sector's ability to absorb displaced demand.

This further highlighted the vulnerability of community-based and conservation-linked tourism initiatives. Also, the pandemic increased mental health and well-being concerns for both tourists and tourism workers. Surveys from regional tourism boards showed rising anxiety levels among travelers, reluctance to participate in group activities and higher expectations for safety, hygiene and flexible booking policies.

The SWOT Table 1 in the Batroun workshop report primarily addresses pollution and waste management. However, the broader claim about the COVID-19 pandemic's wide-reaching impact on Mediterranean tourism is substantiated in the project's national-scale health and tourism analysis (Deliverable 3.1.1.7). This report

10.3389/fmars.2025.1618637

TABLE 1 SWOT analysis of pollution management in Batroun (April 2023).

Strengths	Weaknesses
• Presence of a complete wastewater network infrastructure system	• Violations on coastal public property
• Presence of a wastewater treatment plant	• Failure to inform the local population about development projects and financing schemes
• Strong environmental guidance	• Inadequate solid waste management plan, including lack of sorting from the source
• Public involvement in environmental activities (cleaning campaigns, individual initiatives, etc.)	• Insufficient awareness and environmental guidance
• Personal initiatives in sorting waste from the source	• Inaccessible coastal areas and beaches for the public
• Regular and consistent collection of solid waste from residential areas and public spaces.	• Groundwater pollution caused by sewage
• Banning the use of dynamite in the fishing sector	• Nonfully operational wastewater treatment plant
• Digitalized archaeological sites	• Chemical pollution from the Selaata chemical plant
• Existence of a landfill and a sorting facility for solid, organic, and nylon waste	• Aesthetic pollution is present
• Attempt to reduce noise pollution and switch to alternative energy sources such as solar energy and hydroelectric cars	• High number of displaced populations impacting the area
• Some beaches are safeguarded by official decree	• Risk of waste being brought to the sea by the El Jawz river
	• Increasing waste disposal due to growing tourism
	• Waste generated by maritime transport activities
	• Overreliance on nonbiodegradable packaging
	• Inadequate number of waste collection bins
	• Noncompliance with environmental standards
	• Beach erosion occurring
	• Lack of specific guidelines and regulations for tourists
Opportunities	**Threats**
• Initiate the process of enacting laws	• Decrease in the fishing sector
• Advocate for the establishment of environmental police officers	• Existence of invasive species
• Reactivate aquaculture practices	• Native marine species such as sponges, murex, and sea urchins are becoming extinct or scarce
• Restore coastal habitats	• High amount of marine litter and microplastics present
• Establish a program for monitoring health and the environment	• Insufficient ability to manage tourist numbers
	• Unsustainable financing methods for operating the wastewater treatment plant

(Continued)

TABLE 1 Continued

details how Lebanon's tourism sector experienced dramatic declines in tourist arrivals, hotel occupancy, and hospitality employment during the pandemic, alongside compounded crises such as the economic downturn and Beirut Port explosion.

4.2 Co-Evolve4BG toolkit implementation

Result visualization: The toolkit's built-in dashboard generated an aggregate sustainability profile for Batroun's coastal tourism sector (Figure 1), showing areas of progress and concern. Initial results showed that Batroun performs well in public engagement, wastewater network availability and cultural asset preservation. However, significant weaknesses were found in pollution management, marine habitat degradation and solid waste sorting. For example, despite the presence of a wastewater treatment plant, it was found to be not operational, so water quality indicators were rated "Bad". Marine litter and non-biodegradable packaging were identified as critical environmental threats. The results reflected in Figure 1 are derived from the application of the Co-Evolve4BG Toolkit, a participatory Excel-based evaluation instrument tailored for assessing sustainability in coastal tourism. Local stakeholders collaboratively selected a set of compulsory and non-compulsory indicators aligned with Batroun's specific socio-environmental context. Each indicator was evaluated against predefined sustainability thresholds using available local data (e.g., municipal records, stakeholder input, field observations). For instance, high scores in "public engagement" stemmed from strong local participation in ICZM and blue economy initiatives, while positive scoring in "wastewater network" was based on relatively widespread infrastructure coverage. Conversely, "pollution management" and "marine habitat condition" scored poorly due to identified issues such as wastewater leakage and biodiversity decline, as further elaborated in the Pollution and Community ID documents: ID-LB-04-Pollution and ID-LB-16-Community. These figures helped local actors to prioritize specific interventions such as waste sorting infrastructure, enforcement at polluting industrial sites, and eco-tourism alternatives as outlined in the Action Plan (Table 2) discussed during the Batroun workshops.

The participatory evaluation process revealed areas of relative strength and concern:

Batroun showed strong performance in public engagement, wastewater infrastructure availability, and cultural heritage

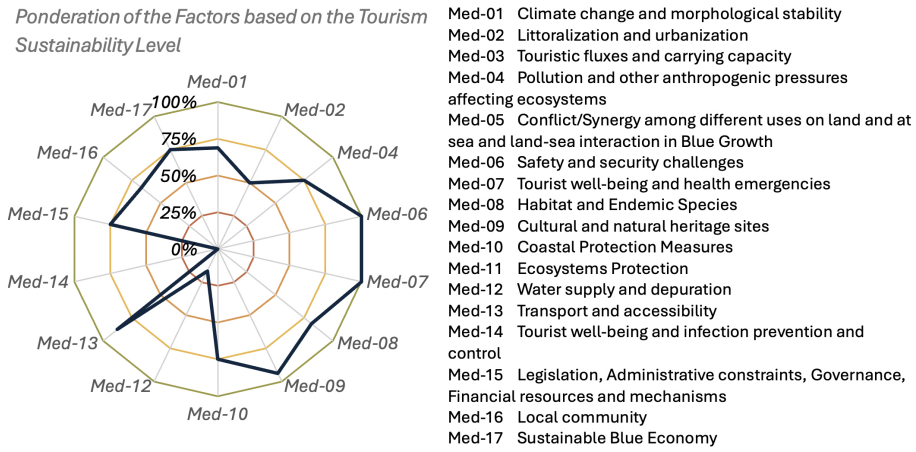

FIGURE 1
Radar chart showing sustainability scores across environmental, social, and economic indicators, with marine habitat degradation rated lowest.

preservation. Local initiatives such as citizen-led coastal clean-ups, stakeholder involvement in tourism planning, and municipal investments in wastewater networks reflected high community ownership and institutional awareness. The preservation of cultural sites, supported by diaspora networks and local NGOs, further contributed to Batroun's sustainability profile.

Conversely, several systemic weaknesses were identified. Pollution management remained a critical challenge, exacerbated by limited solid waste sorting at source, non-operational segments of the wastewater treatment plant, and contamination risks linked to the Selaata chemical facility. Marine habitat degradation was also noted, with threats including invasive species, beach erosion, and unregulated coastal development. Additionally, the growing volume of waste linked to seasonal tourism, insufficient waste collection infrastructure, and non-compliance with environmental regulations weakened Batroun's ecological resilience.

The participatory SWOT analysis emphasized institutional fragmentation and coordination gaps across the ministries and local authorities, particularly in enforcing ICZM principles. Moreover, public health vulnerabilities—exacerbated during the COVID-19 pandemic—underscored the fragility of current coastal tourism systems and the need for integrated recovery strategies.

5 Discussion

The findings from Batroun contribute significantly to the literature on blue economy transitions and stakeholder-led governance in coastal Mediterranean settings. In contrast to broader global observations on the pandemic's impact on tourism, this study demonstrates how localized participatory methods—particularly the Co-Evolve4BG Toolkit—can diagnose site-specific vulnerabilities and mobilize community-driven responses.

By anchoring the assessment in ICZM and blue bioeconomy frameworks, the study underscores the importance of inclusiveness and co-management in achieving sustainable outcomes. As emphasized by Berkes (2009) and Reed (2008), stakeholder participation enhances legitimacy, knowledge integration, and long-term engagement—elements that were clearly evident in Batroun's process. For example, the incorporation of civil society actors, local businesses, and academic institutions into the action planning phase supported a shared vision of sustainability rooted in place-based knowledge.

Importantly, the COVID-19 pandemic served as a disruptive yet catalytic force, prompting local actors to re-evaluate tourism dependencies and propose alternatives that align more closely with ecological preservation and circular economy principles. This reflects global trends yet adds value through context-specific insights. In Batroun, the pandemic highlighted the urgency of improving waste management systems, restoring coastal habitats, and integrating health preparedness into tourism planning—findings that hold relevance for similarly structured coastal towns across the Mediterranean.

The study advances conceptual linkages between crisis response, participatory governance, and blue economy pathways. It shows how combining top-down frameworks (like ICZM) with bottom-up engagement can bridge implementation gaps—an issue flagged by Shipman and Stojanovic (2007) as central to Mediterranean coastal governance. Finally, the approach adopted here offers a replicable model for other coastal areas seeking to align post-crisis recovery with long-term sustainability goals.

5.1 SWOT analysis

The SWOT analysis in Batroun highlights the complex interplay between environmental vulnerabilities and opportunities within the blue bioeconomy framework. As a coastal city with rich cultural heritage and growing tourism demand, Batroun faces both the potential and peril of unbalanced development. The results align with broader Mediterranean challenges—pollution, infrastructure deficits, governance gaps, and pressure on marine ecosystems—while also showing context-specific pathways for sustainable transformation through stakeholder engagement (Sobhani et al., 2023).

10.3389/fmars.2025.1618637

TABLE 2 Action plan for sustainable tourism in Batroun (April 2023).

Thematic	Objectives	Actions	Key players
Environment	Solid waste management	• Update of waste management plan	Local authority Local community
		• Repurpose of reusable materials	
		• Carry out the implementation of the solid waste management plan, especially sorting from source	
	Habitat degradation	• Eliminate violations along the coastline, particularly in protected areas, and implementing taxes on constructions that cannot be removed	Local authority
			Ministry of Environment (MoE)
	Infrastructure	• Enhance the capacity of the wastewater treatment facility in Batroun by upgrading the pumping system to deal with the overflows	Local authority
		• Collaborate closely with displaced populations to prevent the discharge of their wastewater into the El-Jaouz River and monitor their waste that causes blockages in the pumping system	Local community
		• Install public restroom facilities in tourist spots and beaches	
	Pollution	• Imposing and levying taxes on plastic waste disposal in the environment	Local authority
		• Activate the sorting from the source process, and increasing the number of bins in streets, beaches, and public areas	
	Regulations	• Need to enforce the environmental regulations at the Selaata plant to prevent water, air, and beach pollution. This can be achieved by putting more pressure on the union of municipalities to comply with the standards	Local authority
			Ministry of Agriculture (MoA)
			MoE
		• Commence the operations of the nearest coast guard station, located in Chekka (11 km north Batroun)	
		• Have environmental inspectors/officers operating within the municipal boundaries, preferably recruited from outside the city to avoid conflicts of interest	
		• Implement environmentally friendly solutions to restore eroded beaches and areas, such as planting vegetation, conducting beach nourishment, etc.	
		• Provide unrestricted access to the beaches and some areas	
Awareness	Local community	• Activate the networking community	Local authority
		• Increase awareness through school programs and community events	Local community
		• Establish closer collaboration and work alongside Lebanese diaspora donors to further environmental and developmental projects in Batroun.	

(Continued)

TABLE 2 Continued

Thematic	Objectives	Actions	Key players
Sustainable tourism	Blue economy	• Inclusion of circular economy to minimize waste, such as repurposing discarded fishing nets by recycling them into sponges for cleaning dishes, etc.	Local authority
		• Expand the municipal police force to enhance monitoring capacity in relation to the tourism influx	Local community
		• Promote the adoption of sustainable and eco-friendly substitutes for plastic use in the hospitality industry (hotels, resorts, public beaches, etc.), such as aluminum bottles, cloth bags, etc.	
		• Establish a marketplace where diving equipment can be rented out	
		• Enable fishermen to discover and adopt new methods for selling their catch, such as producing fish pickles, etc.	
	Fisheries	• Activation and enforcement of the marine fishing law.	Local authority
		• Develop a strategy for revitalizing and overseeing eco-tourism activities that can benefit local fishermen and small enterprises	MoE
		• Collaboration among fish sellers in the market to standardize prices and regulations and generating QR code for this purpose	MoA
		• Provide support to fishermen by arranging fishing expeditions in deep sea waters and introducing aquaculture	Ministry of Public Works and Transport (MPWT)
		• Support and empower the fishermen cooperative to thrive and establish a local marketplace for their catch	
		• Have a well-equipped boat for deep-sea fishing, managed either by the fishermen cooperative or MARSATI, in order to assist and support fishermen	
	Archaeology	• Modify the current master plan for the archaeological area to accommodate the current population needs	Local authority
		• Finish up the cultural and heritage projects	
Transport		• Impose and levy a tax on road violators and infractions	Local authority
Energy		• Implement alternative energy sources, such as solar power, to provide electricity for the wastewater treatment plant and electric vehicles	Local authority

5.1.1 Environmental pressures and anthropogenic threats

The weaknesses and threats identified, particularly related to pollution and habitat degradation, are anthropogenic pressures that can undermine blue economy sectors. Pollution from the Selaata chemical plant, groundwater contamination, marine litter, and the non-operational wastewater treatment plant reveal systemic governance failures (Cambridge Prisms, 2025; UN Environment Programme, 2022). Invasive species, decline of native marine species, and beach erosion indicate a weakened marine ecosystem unable to sustain long-term economic activity, especially in fisheries and eco-tourism.

5.1.2 Regulatory and infrastructure gaps

Institutional capacity gaps—such as lack of enforcement at industrial pollution sites, absence of environmental inspectors, and limited municipal coordination—further exacerbate environmental risks (Prokopiou et al., 2019). Unsustainable financing models for critical infrastructure like the wastewater treatment plant threaten long-term viability. This mirrors findings across the Mediterranean where participatory processes, without robust institutional support, fail to achieve full impact.

5.1.3 Towards a blue economy model

Opportunities identified in Batroun's action plan reveal readiness for a blue economy transition: enforcing marine and eco-tourism laws, establishing environmental police, introducing solar energy solutions, and leveraging waste taxation mechanisms. The Action Plan specifically outlines measures such as repurposing discarded fishing nets into cleaning sponges, incentivizing sustainable alternatives to single-use plastics, promoting circular economy models within hospitality sectors, and supporting fishermen cooperatives through innovations like fish pickling and local markets. These initiatives align with EU Blue Bioeconomy principles (Olesen et al., 2023).

Batroun's strengths—its engaged community, environmental initiatives, and cultural capital—provide a foundation for inclusive governance and eco-innovation. However, political will, cross-agency collaboration, and sustainable financing remain critical for success.

5.2 Toolkit implications for blue bioeconomy governance: stakeholder engagement

Batroun's public engagement, existing waste management networks, and environmental activism demonstrate substantial potential for co-created governance. In line with Berkes' (2010) co-management framework, decentralizing environmental decision-making improves legitimacy and outcomes.

The Co-Evolve4BG Toolkit supported evidence-based action planning by translating complex sustainability assessments into accessible indicators, fostering local ownership and stakeholder-driven governance. As a strategic planning tool, it enabled the development of a comprehensive Action Plan addressing key areas such as:

- Solid Waste Management: Implementing updated waste management plans focusing on source separation, increasing recycling capacity, and introducing plastic waste taxes.
- Infrastructure Enhancements: Upgrading Batroun's wastewater pumping systems and installing public restrooms at tourist hotspots.
- Pollution Control: Strengthening regulatory enforcement at the Selaata plant and activating coast guard and municipal environmental inspectorate services.
- Sustainable Tourism Development: Promoting eco-tourism alternatives, establishing diving equipment rental points, and expanding municipal policing to manage tourist influx.
- Fisheries and Blue Economy: Encouraging innovations in fishery products, promoting aquaculture, and empowering fishing cooperatives to strengthen income diversification.

These action points reflect an integrated ICZM approach, promoting both ecological resilience and socio-economic development (Araújo et al., 2021).

While Toolkit implementation was largely successful, challenges such as data availability, local capacity limitations, and potential subjectivity in threshold settings require continued attention.

5.3 Reimagining Mediterranean tourism amid health emergencies

COVID-19 exposed systemic vulnerabilities in Mediterranean tourism. Key lessons include the need for embedding health resilience into tourism planning, diversifying tourism portfolios beyond mass maritime and cruise sectors, and reinforcing local, community-based tourism models. Sustainable transitions—through digital innovation, sanitation upgrades, and eco-tourism promotion—are now critical.

Regional cooperation remains vital to manage health risks and support tourism recovery (Barcelona Convention, 2021; Union for the Mediterranean, 2022). The Co-Evolve4BG model provides an adaptable governance framework for future crisis resilience.

When it comes to evaluating transferability and replicability of this research findings. Compared to other Co-Evolve4BG pilot areas, Batroun benefits from relatively advanced infrastructure—such as its wastewater network and waste sorting facilities—and visible community involvement in environmental initiatives. However, common challenges such as weak enforcement and increasing tourism pressure were also observed in Tyre and Samothraki. The specific solutions developed in Batroun—such as digitalizing archaeological sites, involving diaspora communities, and enforcing localized tourism regulations—may offer transferable value to similarly structured locations like Djerba or Murcia, though contextual adaptation remains essential, particularly in less developed or politically distinct settings.

5.4 Limitations

While the toolkit was applied through expert judgment and validation with local actors, several limitations emerged. First, data availability was uneven, with some indicators relying on estimates or proxies due to limited official statistics. Second, institutional fragmentation occasionally impeded data access and coordination, and politically sensitive issues—such as pollution sources or refugee pressures—may have influenced stakeholder openness. Nevertheless, validation efforts through inclusive stakeholder engagement, spanning municipal officials, tourism businesses, academic institutions, and

government representatives, helped mitigate potential biases and increase the overall representativeness of the results.

6 Conclusion and recommendations

This study underscores the necessity of integrated, stakeholder-driven governance to achieve sustainable tourism and blue bioeconomy transitions in Mediterranean coastal cities. Implementing Batroun's action plan could serve as a model, demonstrating how locally grounded, evidence-based strategies can mitigate vulnerabilities and promote long-term resilience. Future efforts must prioritize community empowerment, institutional capacity building, diversified economic models, and regional collaboration to secure a sustainable and inclusive post-pandemic Mediterranean tourism sector.

The link between tourism, public health systems and local economies became more apparent during the crisis. Coastal and island destinations with underdeveloped health infrastructure struggled to adapt to emergency needs and tourists perceived greater risk. Nature-based and eco-tourism were initially seen as safer alternatives, but their development was hindered by lack of digital preparedness, insufficient infrastructure and lack of crisis attentiveness. This means while eco-tourism has long-term potential for sustainable tourism development it needs strategic investment and policy support to fulfil this role during future health-related disruptions.

This study contributes novel empirical insights into how participatory governance and diagnostic tools can guide tourism resilience in Mediterranean coastal areas, using the Batroun pilot site as a case study. Unlike generic accounts of COVID-19's impact, our findings demonstrate how a health crisis catalyzed a community-led transition toward blue economy principles—integrating public health, circular economy, and marine sustainability. The application of the Co-Evolve4BG Toolkit and SWOT analyses revealed context-specific vulnerabilities and actionable pathways for recovery. These include localized health protocols, digital innovation, and sustainable tourism diversification. The study offers a transferable model for crisis-responsive tourism development, bridging health resilience with blue economy goals through stakeholder co-creation.

Given the scale and depth of the impact of COVID-19 on Mediterranean tourism, a multi-faceted approach is needed to build resilience and recovery. At policy level Mediterranean countries should work together to develop harmonized health protocols and crisis management frameworks. Coordinated regional health measures can facilitate safer cross-border travel and a more united response to future health emergencies. National governments should support destination-level strategies to diversify tourism offerings and reduce dependence on a single type of tourism (maritime or cruise-based). Strengthening healthcare infrastructure in high-traffic tourism areas, particularly in rural and island regions, is crucial to ensure safety and reassure domestic and international tourists. Tour operators and DMOs should put more emphasis on health and well-being in the tourist experience. This means not only implementing hygiene protocols but also creating tourism products that promote physical and psychological wellness such as nature retreats and wellness-oriented accommodations. Digital transformation is another key area to focus on, technology can play a central role in disseminating health information, contactless services and customer engagement. Local sourcing and community-based tourism can also contribute to building more inclusive and resilient tourism economies that can absorb external shocks.

From a research perspective, the pandemic requires more interdisciplinary research. Future studies should investigate the link between public health, tourism behavior and economic resilience drawing from fields such as epidemiology, behavioral science and environmental economics. Longitudinal studies on post-pandemic tourist behavior are needed to inform future marketing strategies and infrastructure development. Academic institutions can also design early warning systems and decision-support tools for tourism stakeholders using real-time data analytics and predictive modelling.

The COVID-19 pandemic is a turning point for the Mediterranean tourism sector, it forces stakeholders to re-evaluate long-standing practices and adopt more sustainable and resilient models of tourism development. The crisis showed that health emergencies are not isolated incidents but recurring challenges in an increasingly interconnected world. In this context, safeguarding tourist well-being must be repositioned as a strategic imperative deeply embedded in the governance, planning and promotion of tourism across the region.

The pandemic has highlighted the need for regional cooperation, investment in healthcare and digital infrastructure and diversification of tourism offerings. It has also shown the potential of underutilized sectors such as eco-tourism and wellness tourism to act as buffers during global crises. By taking proactive steps to integrate health preparedness into tourism systems, Mediterranean countries can improve their ability to respond to future emergencies and the quality and inclusiveness of their tourism industries. Resilience, adaptability and a renewed focus on human well-being, will be the key to long-term sustainability and competitiveness of Mediterranean tourism in the post-pandemic era.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Ethics statement

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study

Author contributions

NM: Resources, Validation, Conceptualization, Writing – original draft, Software, Project administration, Visualization, Methodology. NMB: Writing – review & editing, Supervision, Investigation, Conceptualization, Writing – original draft, Validation, Project administration. SA: Methodology, Investigation, Data curation, Writing – original draft, Visualization. KA: Software, Data curation, Writing – original draft, Resources, Conceptualization, Formal analysis.

BB: Validation, Investigation, Resources, Writing – original draft, Formal analysis.

Funding

The author(s) declare that no financial support was received for the research and/or publication of this article.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Araújo, R., Vázquez Calderón, F., Sánchez López, J., Azevedo, I. C., Bruhn, A., Fluch, S., et al. (2021). Current status of the algae production industry in Europe: an emerging sector of the blue bioeconomy. *Front. Mar. Sci.* 7. doi: 10.3389/fmars.2020.626389

Ardoin, N. M., Gould, R. K., Lukacs, H., Sponarski, C. C., and Schuh, J. S. (2019). Scale and sense of place among urban dwellers. *Ecosphere* 10, e02871. doi: 10.1002/ecs2.2871

Ardoin, N. M., Wheaton, M., Bowers, A. W., Hunt, C. A., and Durham, W. H. (2015). Nature-based tourism's impact on environmental knowledge, attitudes, and behavior: a review and analysis of the literature and potential future research. *J. Sustain. Tourism* 23, 838–858. doi: 10.1080/09669582.2015.1024258

Ayadi, R., and Forouheshfar, Y. (2023). Blue economy within the mediterranean region: the role of regional collaboration. *EMEA Policy Paper, Under INVESTMED.*

Barbier, E. B. (2011). *Capitalizing on nature: ecosystems as natural assets*. Cambridge University Press.

Barcelona Convention (2021). *Protocol on Integrated Coastal Zone Management in the Mediterranean* (Barcelona: UNEP/MAP). Available online at: https://www.unep.org/unepmap/resources/protocol-integrated-coastal-zone-management (Accessed May 8, 2024).

Berkes, F. (2009). Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. *J. Environ. Manage.* 90, 1692–1702. doi: 10.1016/j.jenvman.2008.12.001

Berkes, F. (2010). Devolution of environment and resources governance: trends and future. *Environ. Conserv.* 37, 489–500. doi: 10.1017/S037689291000086X

Berkes, F. (2000). *Linking social and ecological systems*. Cambridge University Press, United Kingdom.

Cambridge Prisms (2025). Unchecked tourism and environmental degradation in Mediterranean coastal zones. *Cambridge Prisms: Coast. Futures* 1, e10. doi: 10.1017/cft.2025.10

Chaffin, B. C., Gosnell, H., and Cosens, B. A. (2014). A decade of adaptive governance scholarship: Synthesis and future directions. *Ecol. Soc.* 19, 56. doi: 10.5751/ES-06824-190356

Crossman, N., Stoeckl, N., Sangha, K., and Costanza, R. (2018). Economic values of the northern territory marine and coastal environments.

FAO. (2021). *The FAO action plan on antimicrobial resistance 2021–2025*. Available at: https://www.fao.org/documents/card/en/c/cb5545en/4.

Folke, C., Hahn, T., Olsson, P., and Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annu. Rev. Environ. Resour.* 30, 441–473. doi: 10.1146/annurev.energy.30.050504.144511

Fraschetti, S., Pipitone, C., Mazaris, A. D., Rilov, G., Badalamenti, F., Bevilacqua, S., et al (2018). Light and shade in marine conservation across European and contiguous seas. *Front. Mar. Sci.* 5, 420.

Gormsen, E. (1997). The impact of tourism on coastal areas. *GeoJournal* 42, 39–54. doi: 10.1023/A:1006840622450

Halpern, B. S., Frazier, M., Potapenko, J., Casey, K. S., Koenig, K., Longo, C., et al. (2015). Spatial and temporal changes in cumulative human impacts on the world's ocean. *Nat. Commun.* 6, 7615. doi: 10.1038/ncomms8615

Islam, M. S., and Tanaka, M. (2004). Impacts of pollution on coastal and marine ecosystems including coastal and marine fisheries and approach for management: a review and synthesis. *Mar. pollut. Bull.* 48, 624–649. doi: 10.1016/j.marpolbul.2003.12.004

Jones, P. J. S., and Carpenter, A. (2009). Crossing the divide: The challenges of integrating the ecosystem approach to marine spatial planning. *Mar. Policy* 33, 260–270. doi: 10.1016/j.marpol.2009.02.006

McLeod, M. T., Dodds, R., and Butler, R. (Eds.). (2022). *Island tourism sustainability and resiliency*. New York: Routledge. 4.

Olesen, I., Bonaldo, A., Farina, R., Gonera, A., Hughes, A. D., Navrud, S., et al. (2023). Moving beyond agriculture and aquaculture to integrated sustainable food systems as part of a circular bioeconomy. *Front. Mar. Sci.* 10. doi: 10.3389/fmars.2023.1178014

Organisation for Economic Co-operation and Development. (2018). *Cost-benefit analysis and the environment: further developments and policy use*. (OECD Publishing).

Ostrom, E. (2009). A general framework for analyzing sustainability of social-ecological systems. *Science* 325, 419–422. doi: 10.1126/science.1172133

Pahl-Wostl, C. (2015). *Water governance in the face of global change* (Cham, Switzerland: Springer).

Pauly, D., and Zeller, D. (2016). Catch reconstructions reveal that global marine fisheries catches are higher than reported and declining. *Nat. Commun.* 7, 10244. doi: 10.1038/ncomms10244

Prokopiou, D., Giannopoulos, K., Anagnostellos, K., Tselentis, B., and Mavridoglou, G. (2019). SWOT analysis of the tourist sector on Paros Island, Greece. *WIT Trans. Built Environ.* 188, 165–176. doi: 10.2495/UT190141

Rangwala, T. (2024). Literature review: adaptive planning practices. *Water* 16 (12), 1657.

Reed, M. S. (2008). Stakeholder participation for environmental management: a literature review. *Biol. Conserv.* 141, 2417–2431. doi: 10.1016/j.biocon.2008.07.014

Rizk, R., and Vartanian, R. D. (2018). Lebanon and tourism: coastal encroachment: case of Byblos beaches. *EuroMed J. Manage.* 2, 315–328. doi: 10.1504/EMJM.2018.096138

Rudovica, V., Rotter, A., Gaudêncio, S. P., Novoveská, L., Akgül, F., Akslen-Hoel, L. K., et al. (2021). Valorization of marine waste: use of industrial by-products and beach wrack towards the production of high added-value products. *Front. Mar. Sci.* 8. doi: 10.3389/fmars.2021.723333

Shipman, B., and Stojanovic, T. (2007). Facts, fictions, and failures of integrated coastal zone management in Europe. *Coast. Manage.* 35, 375–398. doi: 10.1080/08920750601169684

Sobhani, P., Esmaeilzadeh, H., Wolf, I. D., Marcu, M. V., Lück, M., and Sadeghi, S. M. M. (2023). Strategies to manage ecotourism sustainably: insights from a SWOT-ANP analysis and IUCN guidelines. *Sustainability* 15, 11013. doi: 10.3390/su151411013

Tompkins, E. L., Few, R., and Brown, K. (2008). Scenario-based stakeholder engagement: incorporating stakeholders' preferences into coastal planning for climate change. *J. Environ. Manage.* 88, 1580–1592. doi: 10.1016/j.jenvman.2007.07.025

UN Environment Programme (2022). *Mediterranean coastal resilience: A strategic assessment* (Nairobi: United Nations Environment Programme). Available online at: https://www.unep.org/resources/report/mediterranean-coastal-resilience-2022 (Accessed April 17, 2023).

Union for the Mediterranean (2022). *Regional policy framework for sustainable tourism recovery*. Available online at: https://ufmsecretariat.org/sustainable-tourism-ufm-2022/ (Accessed October 05, 2023).