

Ecosystem Protection

Tyre scale, Lebanon





Analysis of Threats and Enabling Factors for Sustainable Tourism at Pilot Scale

Ecosystem Protection Tyre scale, Lebanon



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OVERVIEW

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REVIEW

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Abstract

This report aims to identify the different threats to the ecosystem stability of the Tyrian coastal zones. It is developed through the review of existing data at national and regional scales. The document is structured in three sections. Section 1 provides an overview of the present and the future possible trends of natural and coastal changes. Section 2 highlights the morphological characteristics of Tyrian coastal zones. Section 3 focuses on reporting the services to protect the coastal ecosystem in Tyre.

I. Introduction

The Mediterranean marine coastal ecosystems are suffering from well-established and growing pressures of anthropogenic activities. Coastal habitats in the Levantine basin have been significantly impacted by urbanization, resulting in biodiversity loss (Doxa *et al.* 2017). Coastal vegetation has a diverse range of species that have adapted to the peculiar requirements of this area (Vorontkova *et al.* 2008). As a result, significant Mediterranean ecosystems, notably vermetid reefs (Fig. 1) and *Cystoseira* forests have been severely impacted, and their local disappearance has been documented in several locations.



Figure 1. Tyre vermetid reef

Lebanon is part of this degrading ecosystem and is one of the region's ten biodiversity hotspots (Médail and Myers, 2004). It hosts a diverse range of important Mediterranean ecosystems (*e.g.*, *Cystoseira* forest, vermetid reefs, and coralligenous assemblages), but is undergoing a rapid and dramatic coastline transformation. The heavy effect of anthropogenic activities such as coastal development (MOE/UNDP/ECODIT, 2011), fisheries, pollution, and ocean warming, influx of invasive species, has already destroyed one-third of the 220 km coastline (MOE, 2004). Its location is a vulnerable zone of the Eastern Mediterranean Sea, nearly 450 kilometers north of the Suez Canal, which is the main vector for alien species introduced into the Mediterranean Sea (Mannino *et al.* 2017).

The fact that the Lebanese coastline is under many stresses is now well recognized, resulting in a greater understanding of the importance of including coastal zone management programs in future activities. With the forthcoming oil and gas finding off the coast of Lebanon, new hazards to the marine environment are predicted from the building and operation of offshore infrastructure (oil and gas, accidents, and blow-outs). It is expected that this degraded reef state will gradually advance westward. Alleviating human pressures with marine reserves might make the reefs more resilient to global pressures, but other conservation actions, such as ecological restoration, may be necessary to reduce the erosion of vermetid reefs.



Figure 2. Tires and glass bottles on detritic seabed in Lebanon

II. Trends of natural and coastal changes

II.1. Characteristics and dynamics

Tyre located on the southern coastal borders of Lebanon hosts rich biodiversity. It is an important nesting site for migratory birds, two types of sea turtles which are endangered internationally: the loggerheads (*Caretta caretta*) and the green sea turtle (*Chelonia mydas*). Tyre hosts remarkable plant species such as the *Astragalus berytheus* which is a coastal plant species endemic to Lebanon and Palestine, and one of the most threatened taxa in Lebanon (MOE, 2004).



Figure 3. Hatching Sea turtles in Tyre

Many rare species of corals and cephalopods that are considered globally endangered are also present in these reefs, such as *Verongia aerophoba*, *Axinella polypoides* (Fig. 4), and *Hircinia foetida*, *Cladocora caespitosa* (Fig. 5), and many others.



Figure 4. *Axinella polypoides* on vertical surface of the rocky outcrop in front of Tyre



Figure 5. The Mediterranean hermatypic coral *Cladocora coespitosa* in Tyre

Although it has the widest point of sandy beaches in Lebanon, it is only about a few kilometers, and a few meters deep, which is considered very limited globally, making many ecosystems and species threatened due to restricted geographical distribution. Moreover, Tyre's sandy beaches and dunes are prone to erosion which increases the vulnerability of the ecosystems. Land appropriation and coastal sand extraction for construction are further threatening this ecosystem. Consequently, the resulting loss of vegetation from dunes destabilizes them and causes a shift in their geography.

Along Lebanese coasts, particularly in Tyre, *Cystoseira* forests and vermetid reefs (Fig. 1) are threatened, as already observed along the Palestinian coast concerning vermetid reefs (Rilov, 2016) and in Kos reefs (at the south-eastern end of the Aegean Sea, just outside the area defined as the Levantine basin) concerning *Cystoseira* forests. This deteriorated reef state is expected to crawl westward over time.

Threats to the great potential offered by the coast already exist in Tyre, such as uncontrolled urban sprawl, increased privatization of the shorefront, reduced public access to the beach, solid waste dumping, wastewater discharges, sea filling, and sand extraction. Furthermore, the increased interest in the use of the coastal zone and its resources has led to conflicting interests among different coastal users.

Despite the existence of legal texts to manage coastal and marine ecosystems, the current situation is still marked by a lack of transparency in policymaking, allocative and productive inefficiencies, ineffective management, insufficient laws, misinterpretation of legal texts, and poor compliance, as well as weak governance and corruption.

The Lebanese coastline is under great stress, which has resulted in significant ecosystem degradation. With the upcoming oil and gas drilling off Lebanon's coast, additional risks to the marine environment are expected because of the construction and operation of offshore infrastructure (oil and gas, accidents, and blow-outs).



Figure 6. Tyre beaches in Summer

II.2. Impact of tourism

Tyre's spectacular sandy beaches and archaeological monuments are popular tourist destinations (Fig. 6), attracting thousands of visitors each year. However, several of these attractive places, including sandy beaches, coastal wetlands, and the Tyre Coast Nature Reserve, are deemed vulnerable (TCNR). Because these locations are regularly frequented, particularly during the summer, uncontrolled recreational activities such as unregulated fishing, jet skiing, and boating exist.

More disturbances can be caused by visitors trampling and damaging turtle nests, the insular vegetation, the freshwater vegetation, and the plants that stabilize dunes at the reserve. Another main concern is the disturbance of vermetid platforms across the Lebanese coast by the tourism sector. Another possible danger is the trampling of visitors and fishermen, which may impair vermetid recruits' survival and settlement success, as well as the associated benthic ecosystems.

Sand Dunes ecosystem is in the conservation zone of the reserve, with well-established relative vegetation. *Astragalus berytheus* which is one of the most threatened taxa in Lebanon (MOE, 2004) occurs in prime tourist areas, such as the sandy beaches of Tyre, which are targeted for the establishment of resorts. These habitats are categorized as highly threatened because of extensive tourism throughout the Mediterranean.



Figure 7. Tyre beaches in Summer

The main roads connecting the tourist destination areas host many restaurants, nightclubs, and coffee shops that are sources of impact through noise, solid and liquid waste, and lights at night. Night lights lead to a considerable decrease in the potential of marine turtles nesting on sandy beaches and pollution debilitates marine organisms and reduces survival capacity. In the marine environment, the main problems are also caused by water activities such as over-frequentation by divers, jet skis, and recreational boats.

Tourism increases human presence in the region, and this will increase the pollution resulting from any other industry noise, increased solid waste and littering, releases of sewage, oil, and chemicals; Air emissions from increased cars usage increase air pollution, an EIA study conducted in Tyre showed that Awqaf square and Hamra (Hiram) Street, both suffer from PM10 concentrations exceeding the limits (CDR, 2009). This was attributed to the high traffic congestion on the square (two-way streets) during peak commercial activity time in the morning and noontime and during night-time. Similarly, the ambient noise level exceeded the Lebanese maximum allowable noise limit standards (UN-Habitat, 2017).

Seasonality of tourism makes the city very concentrated in human presence during the summer season, exerting high pressure on the city's infrastructures, the reserve's ecosystems, and eventually its biodiversity. Some touristic activities cause wildlife disturbance to the biodiversity of TCNR.

The number of visitors during the beach season exceeds the carrying capacity of the touristic zone in the reserve. It extends beyond the area covered by the Ministry of Environment's 50 permitted kiosks (temporary hut-restaurants) to both sides (northern and southern sides of the beach uncovered by the kiosks' services) by independent tourists who do not follow the eco-rules imposed on the kiosk owners exploiting the beach during the summer.

Uncontrolled Recreational Activities Seashore destinations witness the largest mass of tourism. They are often frequented by visitors during the summer season (mainly May-September) resulting in uncontrolled recreational activities, including unregulated recreational fishing, scuba diving, jet-skiing, and boating that are located on the various coastal marinas and seafronts along the entire Lebanese coast. Furthermore, sensitive ecosystems such as sandy beaches and coastal wetlands are attractive to tourists, developers, and residents. Increasing numbers of tourists to natural, well-conserved sites such as the Tyre Coast Nature Reserve (TCNR) constitutes a major concern. The disturbances caused by visitors include trampling, noise and littering, damaging turtle nests, the unique insular vegetation, the unique freshwater vegetation, and the special plants that stabilize dunes at the reserves.

The growing tourism sector also causes intensive urban development along the coast. It is mainly based on activities within urban structures such as beach resorts, hotels, restaurants, and country clubs. This traditional trend of Lebanese tourism has a destructive impact on the environment. The unregulated construction of coastal resorts and the violation of the Maritime Public Domain have resulted in coastal privatization, beach erosion, and land and ecosystem degradation.



Figure 8. Tourism in Tyre old city

III. Morphological characteristics of Tyrian coastal zones

Tons of trash wind up in Lebanon's ocean every year. Marine litter damages both terrestrial and marine ecosystems, decreasing their regeneration capacity and diminishing the blue natural capital and its ability to provide important ecosystem services. Marine pollution jeopardizes the marine environment's health. Indeed, pollution is a major contributor to the decline of marine biodiversity.

Furthermore, the litter and dumping on the beach and dune regions detract significantly from the aesthetic value of the area and pose a pollution hazard to public health and ecology. One of the primary priorities of active conservation management in Tyre should be to address this issue. It would provide a message to the public that the place is being actively cared for, making it simpler for people to understand and respect the area's natural resources.

Lebanon's wetlands have been subjected to natural and anthropogenic stresses, including changing climatic conditions, notably a reduction in the water allocation needed to maintain their water-saturated terrain.

All the variables will have a significant influence on tourism, making the place unappealing to visitors.

IV. Protection of the coastal ecosystems in Tyre

IV.1. Policies, plans and programs

The fact that the Lebanese coastline is under different stresses is now well recognized, resulting in a greater understanding of the importance of including coastal zone management programs in future activities. With the forthcoming oil and gas finding off the coast of Lebanon, new hazards to the marine environment are predicted from the building and operation of offshore infrastructure (oil and gas, accidents, and blow-outs). It is expected that this degraded reef state will gradually advance westward. Alleviating human pressures with marine reserves might make the reefs more resilient to global pressures, but other conservation actions, such as ecological restoration, may be necessary to reduce the erosion of vermetid reefs.

Some of these management plans are stated below:

Lebanon's Marine Protected Area Strategy

Tyre nature reserve is a marine protected area MPAs, meaning it is protected by multiple national and international statuses. The country can thus activate international aid and mechanisms for its effective management.

A Marine Protected Area (MPA) is a clearly defined coastal or/and marine geographical space, recognized, dedicated, and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values. International law does not provide a universal definition or legal framework for MPAs. However, several international agreements encourage States to establish such areas, as their existence is considered the most effective way to protect the ocean and marine natural resources.

MPAs contribute to healthy oceans, to the good management of fisheries resources, to ensuring fishers' livelihoods, and they also stimulate the local economy and create sustainable tourism opportunities. These are the reasons why the establishment of new MPAs constitutes an international goal, according to the most important environmental policy documents.

Establishing marine protected areas help to reach Aichi objectives, adopted in 2010 by the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD) for the period 2011-2020, as well as the 17 Sustainable Development Goals (SDGs), adopted by the United Nations Assembly in 2015. The implementation of global environmental policies requires the adoption of a legal framework at the regional and national levels. At the regional level, the Barcelona Convention, through the Specially Protected Areas Regional Activity Centre (SPA/RAC), coordinates the efforts of the States. Following the provisions and recommendations of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol), Mediterranean States are called upon to create SPAs in the marine and coastal areas under their sovereignty. National legislation is also needed to regulate the establishment and effective management of marine and coastal protected areas.

Ratified conventions by Tyre MPA:

- Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean of the Barcelona Convention, Ratified in 2019 Specially Protected Areas of Mediterranean Importance (SPAMI)
- Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat (1971), Adhesion in 1999
- The African-Eurasian Migratory Water Birds Agreement, Ratified in 2002
- The UNESCO Convention on the Protection of Cultural and Natural Heritage (1972), Adhesion in 1990

The MoE and IUCN implemented with OAPN, AECID, and MAVA funding the project “Supporting Management of Important Marine Habitats and Species in Lebanon” (2010-2012) to support the development of a network of Marine Protected Areas (MPAs) and an associated monitoring program to evaluate their management effectiveness.

However, MPAs alone are not sufficient to guarantee the protection of important coastal ecosystems since regional or global physical and climatic factors, such as global warming (Lejeusne *et al.* 2010), species invasion (Mannino *et al.* 2017) ocean acidification and increased water turbidity, cannot be prevented by the implementation of individual MPAs or other small-scale protection measures. Hence continuous long-term monitoring should be a priority for a better assessment of the effects of human impacts on the evolution of marine ecosystems. In this context, it is necessary to maintain the good ES of the existing coastal ecosystems (*e.g.*, large brown algae forests, vermetid reefs) allowing for conserving the current population, including restoration programs.

Tyre Coast Nature Reserve:

Nature Reserves defined by law are as a terrestrial or marine zone where nature conservation measures are established to protect ecosystems, habitats, or organisms of particular importance. The Tyre Coast Nature Reserve (TCNR) was established in 1998 (Act no. 708, issued November 5, 1998) as a nature reserve. These wetlands have national legal protection, and the Ministry of Environment is the national administrative authority over them (being nature reserves). The Ministry of Environment is responsible for the protection and management of the site under the overall supervision of a management team responsible for the implementation of daily management activities, and a management plan. Accordingly, the national legal protection of these Ramsar sites in Lebanon as well as the provisions of their management plans contribute toward fulfilling the requirements of the Ramsar Convention by the Government of Lebanon.

Tyre Beach Nature Reserve is also a Ramsar site. It is one of the three identified coastal wetlands in Lebanon. It is located along the southern Lebanese coast and represents a saturated clayey terrain where several springs and seeps exist. A five-year Management Plan was developed for the TCNR by the MedWetCoast Project, an initiative under the Ramsar Convention, and funded by the “Fonds Francais pour l’Environnement Mondial” (FFEM) with national contributions. It was executed by the Ministry of Environment

(MoE) and managed by the United Nations Development Program (UNDP) from 2002 to 2006. A management plan was developed to protect biodiversity at global and regional levels, with little focus on the conservation of marine biota and habitats. The plan was endorsed by the MoE and by the Council of Ministries (Decree 8044, dated 25/4/2012).

The archaeological and historical sites in the region, and this includes that of Ras el Ain (part of the TCNR) is designated a World Heritage Site by UNESCO in 1984. The UNESCO world heritage site will facilitate protection and monitoring. The presence of endemic plants on archaeological sites is an opportunity to raise the conservation awareness of visitors. The Lebanese Ministry of Culture (MoC), through the Directorate General of Antiquities (DGA), is mandated overall archaeological and historical sites in the region, and this includes that of Ras el Ain (part of the TCNR), which was designated as a national heritage through a governmental decree.

“BirdLife International” specialists recommended designating the TCNR as an Important Bird Area (IBA), as found qualified for this designation through a two-year (2019-2020) monitoring program (Msayleb, 2022).

Proposed strategies for the protection of the environment in Tyre, according to the SSRDP report (2015; as included in the report):

GREEN 1

Establish the “Parc Naturel Regional du Littoral Sud de Tyr” recommended by the National Land Use Master Plan for Sour (COM Decree No.2366/2009) The “Parc Naturel Regional du Littoral Sud de Tyr” was recommended by the National Land Use Master Plan for Lebanon in 2005 and endorsed by the COM in 2009 (by Decree No. 2366/2009). The proposed park will help promote the conservation of Sour’s pristine coastline. Such a park project would require the participation and collaboration of multiple stakeholders including municipalities (Naqoura, Iskandarona, Mansouri, Qleile, Aaziye, Sour, *etc.*), business groups, farmer groups, and water and energy utilities. The park would have its own set of management objectives, and it would develop and promote environmental guidelines to influence urban construction, economic activities, and the protection of the natural environment. The park could also design a coastal trail that would showcase Sour’s coastline and heritage; such a trail would require detailed reconnaissance, delineation, testing, and signage and could attract thousands of visitors each year. The park would help reconcile Sour’s development and conservation goals.

GREEN 3

Classify two sites Ras Al Bayyada Cliff and Ras El Ain Springs & Reservoirs in the cadaster of Tyre as Natural Sites protected by MOE. The Ministry can protect outstanding natural sites by ministerial Decisions, stipulating that MOE and DGUP will jointly develop permitting standards for the construction and operation of facilities within a 500-meter protection radius (buffer zone) from the protected site.

IV.2. Ecosystem services for Coastal/Maritime tourism in Tyre

The southern part of Tyre remains a more natural and less populated territory. It is mainly characterized by the preponderance of natural areas (Mediterranean forest or herbaceous vegetation). Preserved until the withdrawal of the occupying forces in 2000, this part of the territory was subject to much slower development than the rest of the cadaster.

Tyre Coast Nature Reserve (TCNR) is located immediately south of the city of Tyre. The Reserve is the biggest and most beautiful remaining sandy beach in Lebanon. It is characterized by its ecological, marine, and coastal ecosystem. In addition, it is an important nesting site for migratory birds and threatened sea turtles. To sustainably manage the coast, the Tyre Coast Nature Reserve is divided into three main zones from north to south:

Conservation zone: Human access is strictly prohibited. This zone is conserved to protect and research the fauna and the flora. Its protection will allow endangered sea turtles to come back and nest on the shore.

Agricultural and Archeological zone: This section includes the Phoenician springs of Ras el-Ain and a large area where agriculture remains an economic livelihood from many small family farms.

The tourism zone: Encompasses a sandy beach that opens to the public for swimming and sunbathing during the summer season that stretches from May to October.

IV.3. Blue Economy and Ecosystems

Since the country is already going through an economic crisis, the blue economy concept seems a promising plan for the country and especially for Tyre. The blue economy concept seeks to effectively manage water resources, especially seas and oceans, to preserve them as significant natural resources for current and future generations. The blue economy includes all the economic activities that directly correlate with the oceans, such as fishing, shipbuilding, maritime transport, coastal tourism, *etc.* Although the blue economy term seems to be new, the water resources and the awareness of their importance have been around since prehistoric times. The importance of water resources on the Earth's surface (oceans, seas, rivers, *etc.*) cannot be denied.

The concept of the blue economy has presented a new perspective of sustainable economic development in different countries or geographical areas such as coastal areas by using the oceans and marine resources at the various levels of development, regional, national, and international. The blue economy depends on the growth of industries and activities based on marine and ocean resources, such as fisheries, shipping, ports, marine logistics, coastal, and recreational tourism. Furthermore, there are many emerging sectors in a blue economy such as renewable ocean and seas

energy (wind, tides, waves, etc.), extraction of gas and oil from the seas and oceans, mining, aquaculture and marine, blue biotechnology, monitoring and controlling seas and oceans, conducting marine research, and others that are characterized using cutting-edge technologies.

Coastal tourism is at the forefront of the blue economy economic sectors, offering job opportunities or sharing in the gross value added. A study reviewing the seven main sectors that formed the blue economy approach found that coastal tourism was the most active blue economy sector participating in providing job opportunities or sharing in the gross value added (GVA).

The Blue Economic Concept provides an opportunity to develop more economically and environmentally sound investments and businesses, utilize natural resources more efficiently and less environmentally, produce more efficient and cleaner systems to produce greater products and economic value, increase labor absorption, and provide an opportunity to benefit each contributor more fairly. The Blue Economic Concept was developed to answer the challenge that the world economic system tends to be exploitative and environmentally destructive. So far, the principles of resource efficiency, low carbon, and social inclusiveness have grown but still have not been able to overcome human greed to exploit more natural resources.

Although the conservation of nature should be considered the fundamental objective of MPAs, neglecting their social, cultural, and economic impacts has at times led to poor local consensus, if not hostility.

Fishermen and other stakeholders suffer from resource depletion due to overfishing and the use of illegal, unregulated fishing methods such as small fishing nets, use of surface supplied diving for spearfishing, and blast fishing. The lack of law enforcement and alternative schemes to generate income for fishermen has resulted in major impediments to sustainability in the fishing sector in the South of Lebanon.

V. Conclusions

Multiple stressors are affecting marine ecosystems along the Lebanese coast: community surveys and experiments along the Palestinian (Rilov, 2016) and Turkish (Sala *et al.* 2012) coasts suggest that the entire Levant has experienced profound coastal ecosystem phase shifts. The need of incorporating coastal zone management programs into future activities is becoming more widely recognized, with the top priority being to prevent further deterioration of critical coastal ecosystems to maintain ecosystem function and services.

Given the upcoming oil and gas discovery offshore Lebanon, new threats to the marine environment are expected to arise related to the construction and operation of offshore installations (oil spills, accidents, and blow-outs). In case of an oil spill accident (from platforms or tankers), it is important to know the distribution of such sensitive ecosystems, plan coastal protection actions, or manage the emergency (move the tanker, install floating protections).

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