

Pollution and Anthropogenic Pressures Affecting Ecosystems

Tyre scale, Lebanon





Co-Evolve4BG

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

Pollution and Other Anthropogenic Pressures Affecting Ecosystems

Tyre scale, Lebanon



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OVERVIEW

The present document was produced in the framework of **Co-Evolve4BG** project “*Co-evolution of coastal human activities & Med natural systems for sustainable tourism & Blue Growth in the Mediterranean*” in relation to Threats and Enabling Factors for maritime and coastal tourism development on a national scale” Co-funded by ENI CBC Med Program (Grant Agreement A_B.4.4_0075).

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REVIEW

Contributors

Rebecca BAISSARI, Engineer

📍 Agricultural Vocational School of Batroun, Lebanon

Raji MAASRI

📍 MORES, Lebanon

Soumaya AYADI, PhD

📍 Association for the Community and the Environment, Lebanon

Reviewers

Josefa VELASCO GARCIA

📍 University of Murcia, Spain

Nahed MSAYLEB, PhD

📍 Lebanese University, Faculty of Agriculture and Veterinary Sciences, Lebanon

Supervisors

Bechir BEJAOU, PhD

📍 National Institute of Marine Sciences and Technologies, Tunisia

Malek GHANDOUR, Engineer

📍 AMWAJ of the Environment, NGO, Lebanon

LAYOUT

Khouloud ATHIMEN, Engineer, Technical Coordinator

📍 National Institute of Marine Sciences and Technologies, Tunisia

Houaida BOUALI, Engineer

📍 National Institute of Marine Sciences and Technologies, Tunisia

Mohamed Ali BRIKI, Engineer

📍 Coastal Protection and Planning Agency, Tunisia

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Abstract

The purpose of this report is to identify the many causes of pollution on the Tyrian coast that are generating tourist instability. It is created by reviewing available data at the national and regional levels. The document is divided into three sections. Section 1 presents a summary of the current pollution sources impacting tourism in Tyre, as well as potential developments. Section 2 focuses on the ecological and social sectors most vulnerable to coastal pollution. Section 3 reports on potential initiatives to minimize pollution on the Tyre Coast in the context of promoting tourism.

I. Introduction

Tyre is one of the oldest cities in the world. It has been known for its mercantile activity throughout the Mediterranean since ancient Phoenician times and is characterized by its archaeological and natural wealth. Tyre is in the South Governorate of Lebanon and is considered the fourth-largest coastal city in the country. It juts out from the coast of the Mediterranean Sea.

There are 4 municipalities in Tyre:

Table 1. Municipalities/cadasters of Tyre urban area by km²

Municipality / Cadaster	The area within Tyre urban boundary (km ²)
SOUR (Tyre)	5.4
Aabbassyeh Tyre	3.3
Burj El-Shamali	6.7
Ain Baal	1.3
Tyre Urban Area	16.7

Besides the trading activity, agricultural practices are highly encouraged by Tyre's fertile soil. In 2017, agriculture constituted the most dominant land use cover (44% of the territory), followed by 40% of built-up land (UN-habitat, 2017). Tyre is also characterized by its topography features such as the littoral sandstone reefs with a wide abrasion platform, with a remarkable presence of littoral caves on the shore of Ras El Bayada.

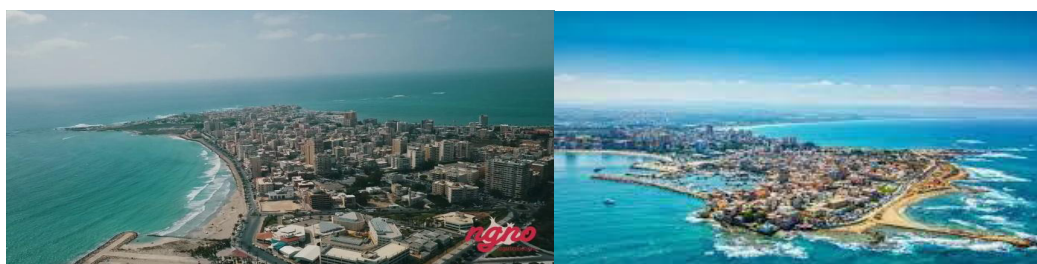


Figure 1. Tyre, south Lebanon

Table 2. Tyre Urban area land cover breakdown (UN-Habitat, 2017)

Land use/Land Cover	Area m ²	Tyre Urban Area %
Agricultural	7,309,194	44.2
Built-up area	6,332,028	38.3
Mixed residential and commercial	5,219,592	31.5
Cemetery	54,746	0.3
Commercial	174,732	1.1
Cultural	24,590	0.1
Education	200,809	1.2
Harbor	27,221	0.2
Health	1,128	0.0
Industrial	220,391	1.3
Military	152,200	0.9
Parking	34,508	0.2
Playground	42,573	0.3
Touristic	179,539	1.1
Gardens	169,056	1.0
Heritage	439,785	2.7
Roads	1,038,731	6.3
Sea shore	642,070	3.9
Unused land	616,942	3.7
Total	16,547,807	

The CNRS studies classify Tyre as having some of the cleanest beaches and waters in Lebanon. Due to its diverse flora and fauna, a reserve was declared in Tyre in 1998 by the Ministry of Public Works. Tyre Coast Nature Reserve (TCNR) is considered the best-preserved stretch of sandy coastline in southern Lebanon. The reserve was designated as well, a Ramsar Site in 1999 according to the international treaty for the conservation and sustainable use of Wetlands since it is considered “the last bio-geographic ecosystem in Lebanon”. It is an important nesting site for migratory birds, the endangered Loggerhead and green sea turtle, the Arabian spiny mouse, and many other creatures (including wall lizards, common pipistrelle, and European badger). Dolphins were also sighted near the waters of Tyre (RSIS, 2003).

However, neglect and absence of enforced regulations have resulted in different anthropogenic polluting activities, such as the haphazard dumping of wastes either directly into the sea or indirectly by being washed into the sea from rivers and underground aquifers. The sewage system dates to the 1960s and is in poor condition. Most of the wastewater is discharged on the coast of the old town (UN-Habitat, 2017).

To worsen the situation, external factors are increasing pollution in Tyre. There are three official Palestinian refugee camps in the Tyre urban area: El-Buss, Burj El-Chamali, and Rasheedyeh. During the 2006 conflict, the “Israeli” troops destroyed conservation sites, and turtle breeding locations (ERML, 2012). More recently, an oil leak from an “Israeli” boat, which wreaked havoc on Tyre beaches in February 2021, also resulted in important pollution in Tyre.



Figure 2. Tar removal after “Israeli” boat oil spil

II. Current pollution sources impacting tourism in Tyre

II.1. Main sources of pollution

II.1.1. Solid waste

Tyre caza generates approximately 100,000 metric tons of solid waste per year. The collected solid wastes are mainly disposed of in dumpsites, however, less than 10% of the wastes will be directed to Ain Baal Solid Waste Treatment Facility (Ain Baal SWTF) to be processed and recycled (Estimation of Waste Sector Greenhouse Gas Emissions in Tyre Caza, Lebanon (SCS Engineers, 2020).

Due to the lack of the implementation of a solid waste management program and the financial shortage, no sanitary landfills currently exist in Tyre Caza. On the contrary, open dumping and burning of solid waste outside landfills is widespread (MoE/UNDP/ECODIT, 2011).

Solid waste is polluting the water resources in the region. Solid wastes produce noxious leakage of effluents that seep into rivers and aquifers, harmful odor, and gas releases in addition to visual pollution (MOE/UNEP/MAP, 2005).

It is worth noting that marine litter is present in different nesting sites of sea turtles. This litter comes from ocean currents carrying litter offshore while in other cases it was obvious that large objects came from tourists and people. In this context, it is important to improve the disposal and management of solid waste.



Figure 3. Solid waste cleaning on Tyre shores

II.1.2. Wastewater

In Tyre the dominant source of pollution is wastewater. The discharge of unconnected households is disposed of haphazardly into open sewers, water streams, and other forms of disposal in the environment, as well as septic tank connections (World Bank, 2015).

Pollution caused by tanks that further leak into the environment is common, either as households cannot afford tank desludging or repair/ maintenance.

Estimates show that less than 8% of the wastewater generated at the national level is being treated (SOER report, 2020).

II.1.3. Organic waste

Slaughterhouses are common in Tyre. The problem is in releasing their wastes to open dumps without prior treatment. Blood is filtered on-site and then discharged into the sewer system (ERML, 2012).

In Tyre, there are poultry farms and olive pressing factories. Their organic wastes are decomposed upon reaching the sea, utilizing the dissolved oxygen. An increase in the anaerobic species is the result and foul-smelling and toxic end products such as methane, hydrogen sulfide and ammonia will occur. Foul odors were smelt around the Rasheedeh camp (RSIS, 2003).

Table 3. CNRS Report - Marine Pollution

Region	Coordinates	Location and nature of the beach	Fecal Streptococci/100ml	Fecal Coliforms/100ml	Classification of the beach
Tyre (SOUR-1)	33.26471°N 35.20414°E	Restaurants sandy beach (Sandy)	46	17	Very good/ suitable for swimming
Tyre (SOUR-2)	33.25990°N 35.20890°E	Tyre reserve beach (Sandy)	63	13	Very good/ suitable for swimming

II.1.4. Fishing pollution

The fisheries sector in Lebanon is artisanal and traditional with regulations dating back to 1929 (Decision 2775/29). Fishermen are considered amongst the poorest communities in the country. In the absence of an updated fisheries law coupled with the quasi absence of law enforcement, they heavily exploit the potential offered by the actual fishing zones (Majdalani, 2004; MOE/UNEP/MAP, 2005; IMAC, 2007).



Figure 4. Fishing Port in Tyre

II.1.5. Oil spill

Land-based oil containing discharges and diffuse sources of pollution continuously creates relatively low but persistent chronic contamination over large areas.

Tyre coast is issued for shipping or commercial harbors, where loading and unloading terminals for oil and other products are located and constitute a major pollution hotspot (MOE/UNDP/ECODIT, 2011).

In addition, the oil leaked by human activities, such as oil runoff from cars and trucks, is increasing in coastal areas where the population is growing, and roads are expanding. In addition to street run-off, industrial waste, municipal wastewater, and wastewater from refineries are a considerable part of marine oil pollution. Rivers polluted by oil in wastewater, or the improper disposal of petroleum products are also significant sources of oil in the sea (GPA/UNEP, 2012).

Lebanon's coastal environment has suffered from repeated wars and conflicts. During the 2006 war, turtle breeding areas were affected when the "Israeli" Troops bombed the conservation site. More recently, the oil spill which devastated the coast north of Ashkelon in February 2021 also contaminated Tyre beaches.

The thermal power plants located near the coastline of Tyre are causing additional pollution of coastal waters (ERML, 2012).

II.1.6. Air pollution

The dependency on private power generation is increasing to compensate for the weakness in the Lebanese electricity grid, unable to provide enough hours of electricity (GoL-UN, 2017). This will have negative consequences on the air quality, as the private generators emit heavy carbon dioxide emissions, carcinogen exposure, and air pollution, because private generators run on diesel fuel and are generally located in dense urban areas close to human settlements.

II.1.7. Sand extraction and narrowing of the sandy beaches of Tyre

The uncontrolled spreading of populated zones and the high market value of sand due to the extensive building taking place led to its illegal mining from sandy dunes of the beaches, sediment dredging offshore, gravel quarrying in riverbeds, sea embankments near the shore, and urban encroachment on agricultural lands. There are now tighter controls on illegal mining, but there are still signs that it is taking place on a small scale. The natural recharge of sand by longshore drifting northwards along the coast from the south of Tyre is now probably minimal.

A study conducted by the Marine and Coastal Resources Program at the IoE-UoB (MCR-IoE-UoB) compared historical aerial photographs of 1962 and a satellite image of 2010 by using photointerpretation based on the Geographic Information System (GIS) showed that sand and pebble beaches have retreated due to extensive erosion while more than 8 km² of land were added along the Lebanese shores by sea-filling. These changes are attributed mainly to illegal activities like sand extraction and chaotic coastal development due to the inability of the Government to enforce applicable laws especially during and after the civil war (1975-1990) and beyond.

However, these practices have an irreversible harmful impact on sandy coasts, especially on marine flora and fauna, seriously altering their habitats. For example, fish and shrimp spawning grounds may have been destroyed. Sand withdrawal also leads to the occurrence of valleys in the sea which is dangerous to swimmers because of the tides that are generated (CDR/DAR/IAURIF, 2005; MOE/UNDP/ECODIT, 2011).

Furthermore, the urbanization close to the coastline disturbs the natural processes and dynamics of sand replenishment and dissipation of wave energy. Dunes have the function of replenishing beach sand lost during catastrophic storm events and preventing coastal erosion. The loss of dune sand impedes this important beach-dune interaction.

II.1.8. Uncontrolled rural development

Tyre has been subject to an ongoing rural exodus since the 1960s, superimposing on natural population increase in the city. This rural-to-urban movement not only influenced the Lebanese population but also the movement of Palestinian refugees from Bekaa to the city's refugee camps.

During the civil war, Tyre's urban development progressed both horizontally and vertically in an uncontrolled manner. This has included haphazard development within proximity to major archaeological sites and historical properties.

Although some rural populations are still surviving from agriculture, increased revenues of constructed properties in comparison to agricultural production revenues are diminishing the value of agricultural lands. This fact increases the risks of continued urban encroachment.



Figure 5. Rural development in Tyre near the coast

II.1.9. Palestinian camps

The city hosts a dense Palestinian population present within its three Palestine Refugee Camps. And after This has caused huge pressure on the city in various sectors, especially on basic services. Further, the Syrian refugee crisis and its subsequent implications, caused a mass displacement of Syrian refugees, in an uncontrolled manner into the city placing further pressure on already strained infrastructure (UN-Habitat, 2017).

The Palestinian refugee camp of Al Bass: The French originally built the Al Bass refugee camp during the 1930s for Armenian refugees. Then, it was used by the Palestinians

from the early 1950s onwards before the initiation of any excavation. Over the years, this camp became a poor cramped urban settlement, and it forms a border limit for the city from the west.



Figure 6. Palestinian and Syrian refugee camps in Tyre

II.2. Evolution of Pollutants

The entire Levantine Sea, especially Lebanon is suffering from a fast and dramatic coastal transformation, because of different anthropogenic activities, fishery, pollution, ocean warming and the invasion of foreign species from the Suez Canal.

Tyre is facing a population growth exuberated by the large influx of Syrian refugees since 2011, this will contribute to exacerbating all anthropogenic pollution sources, which are already present due to haphazard dumping practices, the lack of sound strategies and funding and the weak wastewater infrastructure and management system in Tyre (CDR, 2015). Studies in 2014 have shown an increase in wastewater generation to reach 26 and 43 MCM (Million cubic meter) in May 2014, expected to reach 34 and 56 MCM by the end of the year. The study estimated that, at that rate, wastewater generated by the Syrian refugee influx would add 40,000 tons of BOD5 (five-day biochemical oxygen demand) per year, causing a significant negative effect on the environment. At the national level, the BOD5 load will increase by 34% (UN Habitat, 2017).

Further to the challenges of wastewater management, we add the challenge of managing solid waste. Several factors are contributing to such a steady rise of solid waste, namely the rapid growth of urban areas, the absence of a legal framework, and poor enforcement of the law that manages solid waste, the contradiction in environmental policies, social habits that do not encourage waste minimization, and lastly social keenness to use new materials rather than recycled ones (Sweep-net, 2014).

The rapid urbanization combined with a rural unplanned construction resulted in altering the natural flow of two rivers in the northern part of the district coming through the valleys of Wadi Al Izziye and Wadi Abou Zeble meet. Consequently, during the winter season, the ground floors of houses in the area suffer from flooding because of excessive stormwater. Other reasons attributed to flooding include blocked channels because of

an accumulation of garbage and waste, thus threatening coastal ecosystems and existing infrastructure (UN-Habitat, 2017).

The nature reserve of Tyre suffers from an increasing number of visitors which increases in correlation with demographic development. After this, the quantity of waste left behind by them, the sea bottom area that is damaged by anchors and the impact of stepping on the Euphorbia that plays a role in fixing the sand of the upper beach increase and threaten the ecological function of the reserve's ecosystems. The tour operators started exerting some pressure, through politicians, on the management team to obtain more permits for visits even when the reserve is busy with delicate research or with training activities. Thus, a specific visitor management plan is crucial to remedy this situation.

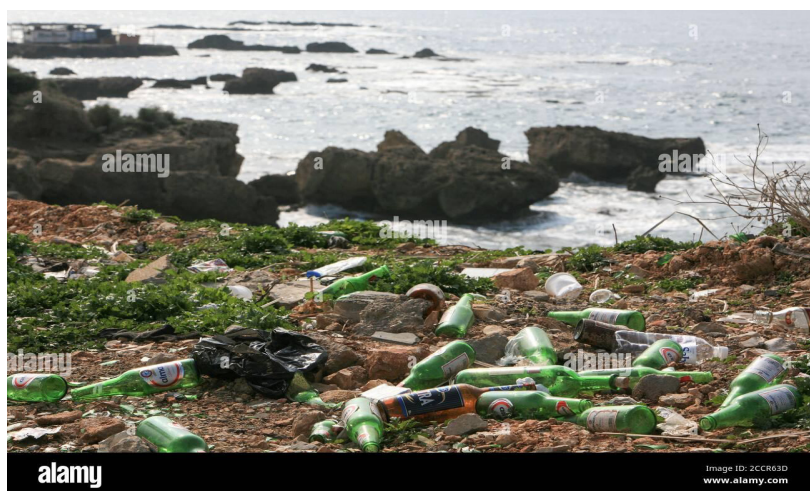


Figure 7. Glass bottles on Tyre shores

III. Pollution vulnerable ecological and social sectors

III.1. Identification of the coastal hotspots

Although Tyre enjoys a reputation for having some of the cleanest beaches in Lebanon, many vulnerable hotspots are in urgent need of protection.

Tyre sandy beaches and dunes that are prone to erosion are vulnerable ecosystems. Land appropriation and coastal sand extraction for construction are further threatening this ecosystem. Furthermore, the resulting loss of vegetation causes a shift in their geography.

Another vulnerable hotspot is The Tyre Coast Nature Reserve (TCNR). The reserve is a Wetland of international importance or Ramsar Site under the Ramsar Convention in 1999, it is located on major migratory routes, where internationally important bird species have been identified, and is designated in 1984 by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as a World Heritage Site.

The reserve is divided into two zones: one for tourism, which includes a 900-meter public beach and restaurant tents that can accommodate up to 20,000 visitors on a busy day during the summer season, and another 900-meter conservation zone that serves as a sanctuary for sea turtles and migrating birds. 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 hosts a diverse range of important Mediterranean ecosystems (e.g., *Cystoseira* forest, vermetid reefs, and coralligenous assemblages), but 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 (Boudouresque *et al.* 2017; 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; Badreddine, 2018).

III.2. Impact of pollution

The previously detailed sources of pollution, mainly solid and water wastes will pose equally a health risk to humans and the environment, and critical livelihood sectors such as farmland, groundwater resources as well as marine life. Unmanaged waste is a source of noxious leakage of effluent that seeps into rivers and aquifers, producing harmful odors and gas releases in addition to visual pollution (MOE/UNEP/MAP, 2005). This will have a subsequent impact on economic activities by reducing fishery and tourism (ERML, 2012).

Tyre beaches are known to be among the cleanest shores in the country, this is reflected by the rising number of visitors who are most frequently foreign tourists rather than locals. Tyre beaches are prized as bathing beaches in the summer. Many people fill the stretch nearest to the town. Disturbance to any wildlife is therefore great during this period.



Figure 8. Tourism activities in Tyre



Figure 9. Archeological sites in Tyre

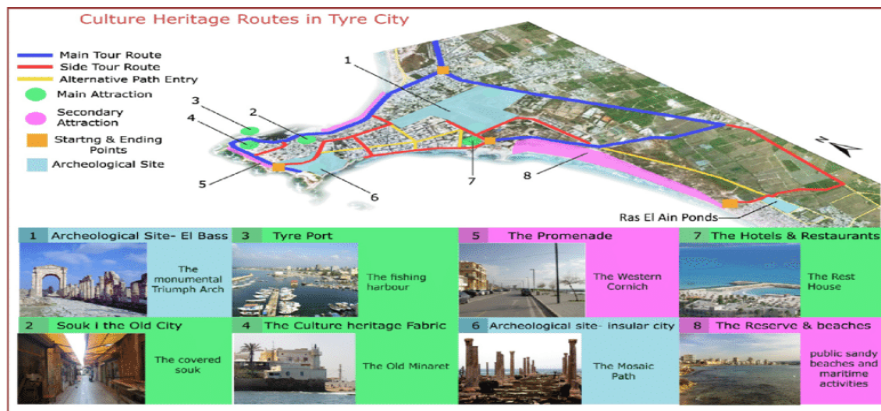


Figure 10. Cultural Heritage in Tyre City

III.3. Tourism pollution impact on the environment

III.3.1. Overview

The beautiful sandy beaches and archaeological sites of Tyre are an attractive hotspot for tourism, drawing thousands of visitors per year. However, many of these attractive sites are considered vulnerable, such as the sandy beaches, coastal wetlands, and the Tyre Coast Nature Reserve (TCNR). The fact that these sites are frequently visited, especially during the summer season results in uncontrolled recreational activities such as unregulated recreational fishing, jet-skiing, and boating.

More disturbances that can be caused by visitors include trampling, damaging turtle nests, insular vegetation, freshwater vegetation, and the plants that stabilize dunes at the reserves (MoE/UNEP/ UNDP, 2013). Another main concern is the disturbance of vermetid platforms across the Lebanese coast (Badreddine *et al.* 2018; Badreddine *et al.* 2019) by the tourism sector.



Figure 11. 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 the noise, solid and liquid waste, and lights at night (MoE/UNEP/UNDP 2013). 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 (Particulate Matter) concentrations exceeding the limits (CDR, 2009). This was attributed to the high traffic congestion at the square (two-way streets) during peak commercial activity time in the morning and noontime, and during night-time along Hamra Street. Similarly, the ambient noise level exceeded the Lebanese maximum allowable noise limit standards (UN-Habitat, 2017).

III.3.2. Type of pollution

Tyre Guest House witnessed illegal dumping in the back dunes of the beach area. Plastic, metal, and paper litter is strewn, including some materials hazardous- to wildlife (e.g., fine fishing nets) and potentially toxic materials (e.g., used syringes) can be seen everywhere. Although most of the litter has a local source, it is worth mentioning that some of the litter on the beaches has been washed up from the sea, probably from Israel.

In the summer, with the absence of waste treatment strategies, restaurant owners near the beach take the initiative to clean the beach but erect the rubbish removed in the sea.

IV. Minimizing tourism pollution in Tyre Coast

IV.1. Policies and efforts made to manage pollution

- **T**he Ministry of Environment (MoE) is the tutelage authority over TCNR and is responsible for its protection and management.
- The Ministry of Agriculture (MoA) is responsible for managing the agricultural land. However, currently, the MoA is not exercising an active role in TCNR. The MoA is also the national authority responsible for controlling fisheries activities.
- Ministry of Transport and Public Works and Transport (MoPWT) is mandated over all beaches in Lebanon; and has parallel jurisdiction with the Ministry of Environment (MoE),
- Ministry of Culture (MoC), through the Directorate General of Antiquities, is mandated over all archaeological and historical sites, including that of Ras el Ain,
- Elaboration of a Strategic Sustainable Regional Development Plan (SSRDP) for the Caza of Tyre: This plan developed an Integrated Solid Waste Management Plan for the Tyre district that can be aligned with future Government of Lebanon policies for solid waste management and programs; protect landscapes and notable green spaces and promote/sustain eco-tourism services in the district.
- Launching a Tyre Environment & Development Observatory (SEDO). This would serve as a tool for collecting information.
- Sustainable fisheries project marine survey in Tyre (2017)
- Plans, Strategies, Policies (incl. financial instruments) & National Objectives: Aimed at improving waste management in general. As part of its technical assistance project, OMSAR has prepared an Integrated Regional Waste Management Plan for waste generation in the entire District of Tyre. The aim was to:
 - Reduce the environmental and health impacts of waste management.
 - Enhance the resource recovery activities.
 - Increase the efficiency and the cost-effectiveness of the existing system.
 - Strengthen institutional development and the coast recovery.
- Estimation of Waste Sector Greenhouse Gas Emissions in Tyre Caza, Lebanon, using SWEET.
- Proposed Integrated Waste Management Plan: Which aims at providing a separate collection of organic waste from main restaurants and hotels using 120 or 240-liter plastic bins. Work with the tourism industry to increase source separation and curbside collection of recyclables and organics generated by hotels. Gradually expand the organic source-separation program into selected neighborhoods.

- **Formal Waste Sector:** Regarding the formal waste management sector in the District of Tyre, each municipality within the Union of Tyre Municipalities is responsible for the collection of waste from their jurisdiction.
- **Informal Waste Sector:** Informal recyclers are active in the Tyre District, although their role is underestimated, and sometimes ignored, by the public authorities. However, they are not ignored at all by the recycling companies, which work with them to acquire high-quality recyclables at good prices. Some other times, scavengers sell these to dealers and thus indirectly provide local industries with recycled feedstock. The informal recyclers in Tyre manage about 10% of the waste stream and are responsible for 83% of the material.
- **Waste Management Practice:** MSW collected by individual municipalities is mainly taken to a mechanical biological treatment (MBT) facility located in Ain Baal. There is no sorting at the source system in Tyre and there is no infrastructure available to support such a scheme currently. The MBT plant, therefore, treats mixed waste, which ultimately reduces the quality of the recovered material with a high contamination rate. Organic material is composted in trenches and matured in a covered hangar. The resulting bio-stabilized product can be classified as “compost-like output”, with lower quality and high contamination and is only suitable as a soil improver for landscaping at best, and frequently ends up in open dumps if it is not used for this purpose.

Table 4. Tyre Spatial Development Policies (UN-Habitat, 2017)

Project/ Study	Topic	Policies	Initiator/ Author	Start	Status	Law/ Decree	Governance
Cultural Heritage and Urban Development Project (CHUD)	Cultural preservation & urban planning	-Increase local economic development & enhance quality of life in the historic centers -To improve the conservation & management of Lebanon's built cultural heritage	CDR (Lebanese Council for Development & Reconstruction)	2002	Expected to be complete in Dec. 2016		Baalbeck, Byblos, Saida, Tripoli, & Tyre
National Physical Master Plan for Lebanon [SDATL/NPMLT]	National strategic spatial planning	-Structuring the territory -National economic development -Efficient Transportation network urban development -Sustainable development	Lebanese Council for Development & Reconstruction (CDR)	2005	Completed in 2005, implemented in 2009	Decreed	National
Strengthening Disaster Risk Management Capacities in Lebanon	Disaster risk management	-The process was divided into two phases including setting the framework of DRM and implementation components	UNDP & Swiss Confederation	2009	Ongoing		National
T-Net Territorial Project Historical & Cultural Sites in the Region	Historical preservation & conversation	-Restoration & Preservation of protected areas and archaeological sites -Tourism	Jeanine Abdul Massih, Zeina Haddad, and Claudine Abdul Massih (individual initiative)	2015	Ongoing		Selected sites within the Union of Tyre
Elaboration of a Strategic Development Plan for the Caza of Tyre (SSRDP)	Sustainable Urban Development	-Strategic Development Plan -Strategic Environmental Assessment	Consultation & Research Institute Habib Debs, ECODIT, LAURIF	2015	Ongoing		Tyre Caza

Table 5. Environmental SWOT analysis of Tyre

STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Exceptional beach stretch (ca. 30 km) Distinct natural landscapes	“Master Plan of South Coastal Areas” is poorly enforced.	Expand and improve the operation of the Ain Baal solid waste facility; opportunities for replication?	Lack of solid waste management and planning and widespread dumping and littering
Tyre Coast Nature Reserve since 1998 (Law no. 708)	The absence of preventive measures to protect coastal beaches.	Conservation of Sour’s green belt and agricultural production.	Linear/ribbon construction in coastal zone and in agricultural lands
Large (ca. 42 km²) and fertile coastal plain.	Lack of environmental / tourism and entertainment services	Potential to transform Sour’s littoral and beaches into a tourism gateway/ attraction (e.g., coastal trail along railway track)	Tectonic/earthquake risk Illegal quarrying
Extensive shrubland and garrigue cover (ca. 124 km²).	Lack of environmental awareness and responsibility.	“South Coastal Regional Park” (recommended by the National Land Use Master Plan) was endorsed by the COM (Decree No. 2366/2009); Sour can learn from Higher Metn Regional Parc (Charte du territoire).	Further encroachment of refugee settlements on natural/cultural areas/ heritage Likelihood of future encroachments on the public maritime domain in case of peace and stability in Lebanon.
		Classify Al Bayada Cliff as a natural site under the protection of the Ministry of Environment	Oil spill and pollution from future exploration and drilling works in Lebanese territorial waters.

IV.2. Environmental practice within the tourism sector

Tourism regulations are only applied within TCNR. The management plan stated the need to organize tourism activities within the reserve to protect it from pollution and to benefit from recreational activities with the least damage.

Thus, the reserve was divided into three zones:

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.

If no studies of carrying capacity are done to control the number of visitors to the TCNR, the current visitor numbers may have a negative impact on the reserve. This number may rise and compete with turtles for the limited sandy beach surface area required by both human summer visitors and nesting turtles (UNEP/MED, 2011).

In the summer, the reserve is a popular tourist destination, particularly for swimmers. The constant flattening of the dunes and turning off the sand by bulldozers for kiosk construction over selected regions as an infrastructure for visiting, as well as the waste left by visitors, are all regarded as a threat to the reserve.

However, the Ministry of the Environment analyzed the reserve's carrying capacity through the MedWetCoast project. The goal of the evaluation was to advise the Tyre municipality on how to manage the public beach while protecting endangered Mediterranean Sea turtles. The municipality decided to decrease the number of kiosks from 100 to 49 (they get thousands of visitors throughout the summer) and to move these kiosks back 60 meters from the wave level during high tide based on the evaluation and subsequent negotiations. Marine turtle nesting and hatching are projected to rise because of these interventions. Furthermore, the Ministry of the Environment is now working to limit the number of these kiosks to 40.

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

IV.3. Blue Economy and pollution

Understanding and properly managing the numerous components of marine sustainability, from managed fisheries to ecosystem health to pollution prevention, is a major challenge for the blue economy. For many individuals, the recreational value of the Tyre beaches is a worthwhile beginning point for conservation. A clean environment has clear benefits for people, and it also has apparent benefits for wildlife and geological features. With Tyre being a World Heritage Site, the potential exists to see that the region is appreciated for its natural heritage and recognized as an important local asset.

However, despite its obvious economic value, the marine ecology severely deteriorates because of both human and natural causes, including unregulated tourist development, fast population increase, and climate change. The blue economy idea is recognized to follow up after such destruction to rehabilitate our ocean. Moreover, it appears to provide a hopeful existence for the inhabitants of Tyre. To accomplish all of this, however, strong political will, commitment, thorough study, and raising societal awareness are required (EU, 2021).

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, in addition to revealing that an economy is unsustainable and resource inefficient. As a result, the blue economy suffers, with wide-ranging socioeconomic and health effects. Marine pollution jeopardizes the marine environment's health as well as the utilization of the seas for economic and recreational purposes. 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. Conservation research and management would be able to go forward more effectively because of this groundwork.

Applying the blue economy leads to a reduction of greenhouse gas emissions from maritime transport, decarbonizing maritime transport (as well as fishing operations) will decrease greenhouse gas emissions, as well as air and water pollution and underwater noise.

Minimizing the environmental impacts of fishing on marine habitats with measures such as specifications for fishing gear and mesh sizes, closed areas, and seasons.

The developing and promoting of low-impact aquaculture (such as low-trophic, multi-trophic and organic aquaculture) as well as expanding offshore renewable energy contributes to the transition towards a sustainable economic system in Tyre.

Most importantly, water scarcity in Lebanon is mostly concentrated in the coastal zone, which is home to more than 70% of the country's population. As a result, water demand/supply has become a critical geo-environmental issue, and water conservation has become a priority. Tyre is one of the Lebanese wetlands which are changing under rapid physical and anthropogenic stresses. These stresses must be addressed and management approaches to conserve these wetlands (Camacho *et al.* 2020).

V. Conclusions

The ecological characterization of the Tyre marine environment in 2013 showed a marine zone with high ecological interest (Mitrut and Constantin, 2008; Shunnaq *et al.* 2008). In addition, the history and potential touristic importance of the Tyrian coast make protection and efficient management crucial for the preservation of biodiversity and the fishery, to enhance human economic activity (RAC/SPA and UNEP/MAP, 2013).

Sustainable tourism development in Tyre is contingent due to the presence of all necessary resources. However, Tyre lacks proper administrative management and organization of its scarce resources. All results emphasized the importance of human capital in the development of any tourist destination.

The lack of conservation policies and proper planning of development threatens the prosperity of Tyre as a major coastal city and tourist destination.

VI. References

Badreddine A., 2018. Coastal ecosystems of the Lebanese coast: ecological status, conservation, evolution (THESIS).

Badreddine A., Abboud Abi-Saab M., Gianni F., Ballesteros E., Mangialajo L., 2018. First assessment of the ecological status in the Levant Basin: Application of the CARLIT index along the Lebanese coastline. *Ecological Indicators*. 85: 37-47.

Badreddine A., Milazzo M., Abboud-Abi Saab M., Bitar G., Mangialajo L., 2019. Threatened biogenic formations of the Mediterranean: Current status and assessment of the vermetid reefs along the Lebanese coastline (Levant basin). *Ocean and Coastal Management*. 169: 137-146.

Boudouresque C.F., Blanfuné, A., Fernandez C., Lejeusne C., Pérez T., 2017. Marine Biodiversity - Warming vs. Biological Invasions and overfishing in the Mediterranean Sea: Take care, 'One Train can hide another'. *MOJ Ecology & Environmental Sciences*. 2: 00031.

Camacho A., Custodio E., De la Hera-Portillo A., *et al.* 2020. Management and Protection of Mediterranean Groundwater-Related Coastal Wetlands and their Services.

CDR, 2009. National Physical Masterplan of the Lebanese Territory

CDR, 2015. Progress Report. Available at: http://www.cdr.gov.lb/eng/progress_reports/pr102015/Eroad.pdf

CDR/DAR/IAURIF, 2005. National Physical Master Plan of the Lebanese Territory (NPMP LT) – Final Report.

ERML, 2012. Environmental Resources Monitoring in Lebanon. Project - Marine Resources and Coastal Zone Management Program Institute of the Environment. University of Balamand.

EU, 2021. The blue economy report.

GoL-UN, 2017. Lebanon Crisis Response Plan (2017-2020).

GPA/UNEP, 2012. Global Marine Oil Pollution Information Gate. Land-based Sources of Marine Oil Pollution Retrieved from <http://oils.gpa.unep.org/facts/landbasedsources.htm> July, 05, 2012.

IMAC (Integrated Management of East Mediterranean Coastlines), 2007. Assessment Report. Institute of the Environment – University of Balamand.

Majdalani S., 2004. The present status of fishery and information system in Lebanon. GCP/INT/918/EC - TCP/INT/2904/TD-4.1. MedFisis Technical Document. 4.1: 45.

Mannino A.M., Balistreri P., Deidun A., 2017. The Marine Biodiversity of the Mediterranean

Sea in a Changing Climate: The Impact of Biological Invasions. <http://dx.doi.org/10.5772/intechopen.69214>.

Mitrut C., Constantin D., 2008. Quantitative and Qualitative Dimensions of Tourism contribution to Regional Development in Romania. The Case of Cultural Tourism presented at the 48th Congress of the European Regional Science Association, University of Liverpool, U.K. 27 – 31 August 2008.

MoE/UNDP, 2013. Structuring the Environmental Strategy. Arabic Version.

MOE/UNDP/ECODIT, 2011. State and Trends of the Lebanese Environment (SOER) 2010.

MOE/UNEP/MAP, 2005. Coastal Area Management Programme (CAMP) – Lebanon. Final Report.

RAC/SPA - UNEP/MAP, 2013. Synthesis report of the ecological characterization of the marine areas of Nakoura, Tyre and Saida in Lebanon. By Ramos-Espla A.A., Bitar G., El-Shaer H., Forcada A., Limam A., Oscra O., Sghaier Y.R., Valle C. Ed. RAC/SPA - MedMPAnet Project, Tunis: 38

RSIS, 2003. Tyre beaches report. <https://rsis Ramsar.org> › LB980_RISformer170704

SCS Engineers, 2020. Estimation of Waste Sector Greenhouse Gas Emissions in Tyre Caza, Lebanon, using SWEET. FINAL REPORT.

Shunnaq M., Schwab W.A., Reid M.F., 2008. Community development using a sustainable tourism strategy: a case study of the Jordan River Valley tourist way. International Journal of Tourism Research. 10: 1-14.

SOER report, 2020. Lebanon state of the environment and future outlook: turning the crises into opportunities.

Sweep-net, 2014 - SWEEP-Net (2014) Country Report on the Solid Waste Management in Lebanon. [https://www.scirp.org/\(S\(351jmbntvnsjt1aadkposzje\)\)/reference/ReferencesPapers.aspx?ReferenceID=1754325](https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=1754325).

UN habitat, 2017. TYRE CITY PROFILE

UNEP/MED, 2011. Proposal for inclusion in the SPAMI List: Tyre Coast Nature Reserve. UNEP RAC/SPA - Tunis, 2011

World Bank, 2015. 'Systematic Country Diagnostic' [http:// www.worldbank.org/en/country/lebanon/publication/lebanon-systematic-country-diagnostic-2015](http://www.worldbank.org/en/country/lebanon/publication/lebanon-systematic-country-diagnostic-2015).

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