

Habitats and Endemic Species

Tyre scale, Lebanon





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

Habitats and Endemic Species

Tyre scale, Lebanon



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OVERVIEW

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REVIEW

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List of abbreviations

CNRS	Centre national de la recherche scientifique
TCNR	Tyre Coast Nature Reserve
RSIS	Ramsar Site Information Service
UNESCO	United Nations Educational, Scientific and Cultural Organization
MoE	Ministry of Environment
CDR	Council for development and reconstruction
APAC	Asia-Pacific

Abstract

This report aims to identify the different threats to habitats and endemic species in Tyre city, Lebanon, and the region. 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 biodiversity and their threats in the Tyre coast. Section 2 highlights the effect of tourism on endemic species. Section 3 focuses on reporting the plans and policies to manage tourism while protecting the environment.

I. Introduction

The coastal land and seascape are characterized by active fluvial exchanges which constantly sculpt coastal zones to create ecosystem structures and links between adjacent ecosystems (Ray, 1991). Coastal zones are among the most productive locations on the planet, providing a diverse range of important habitats and ecosystem services that have long drawn humans and human activity.

Lebanon, regarded as a biodiversity hotspot in the Mediterranean Basin (Médail and Quézel, 1997; Myers *et al.* 2000), is distinguished by the presence of plants with varied biogeographical origins and a substantial limited number of endemic species. At the national level, several laws and international agreements, and conventions govern the protection of the environment in Lebanon (Awwad and El Khoury, 2012). However, a wetland policy is still lacking (UNEP-RAC/SPA, 2011).

Among several protected wetlands and coastal areas in the country, Tyre Coast nature reserve is recognized as a unique site and a location worthy of conservation. It is an important nesting site for two globally endangered sea turtle species (*Caretta caretta* and *Chelonia mydas*), is the last remaining coastal agricultural land encompassing small family farms, and it is part of Tyre, a city designated as a World Heritage Site by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 1984 (UNEP-RAC/SPA, 2011).

This report aims to identify the different threats to habitats and endemic species in Tyre city. It is developed through the review of existing data at national and regional scales, and consultation of the experts.

II. Biodiversity and their threats in the Tyre coast

II.1. Overview of Habitat and Endemic Species

Tyre, located in southern Lebanon, is distinguished by its natural diversity and unique marine and coastal ecosystems, with the sandy beaches of Tyre Coast Nature Reserve (TCNR) being part of the best-preserved stretch of sandy coastline in Lebanon. According to the [CNRS report \(2021\)](#), Tyre waters are considered among the cleanest in the country. The variety of its aquatic life has also been shown through intertidal and offshore research ([RSIS, 2003](#)). In 1998, a well-preserved part of the city was prompted to be designated as a nature reserve. The TCNR was formed under Law No. 708, and it is regarded as a one-of-a-kind protected region in Lebanon due to its high natural heritage value ([Farajalla and El-Khoury, 2007](#)).

Tyre Coast Nature Reserve (TCNR) encompasses an area of 437.72 ha and a marine surface area of about 11,300 ha ([UNEP-RAC/SPA, 2011](#)). The nature reserve comprises freshwater estuaries and springs that run to the sea, forming a fresh/marine water interface, and is designated as an important heritage site. Both visitors and experts agree that it is one of Lebanon's most attractive and stunning beaches, with the greatest biodiversity ([RSIS, 2003](#)).

The beach and sand dunes of the Tyre Coast Nature Reserve (TCNR) are composed of quartz and carbonate sands that have been locally lithified to form beach rock. The underlying geology is critical since it governs the presence of artesian springs. The reserve incorporates five different habitats including sand dunes on the Mediterranean coast, coastal freshwater land, agricultural land, sandy beaches, and pebble and stony beaches.

Three artesian wells with Phoenician walls, are present at Ras Al Ain. Ras Al Ain's freshwater springs pump 1,500 L/s into three ponds. The runoff generates limited sections of wetlands that are appealing to amphibians and aquatic birds such as ducks, and coots ([UNEP-RAC/SPA, 2011](#)).

This diversified and rich geology contains a wide variety of ecosystems; marine, rocky, sandy, and agricultural, which are all refuges for many threatened and rare species. TCNR is an important nesting ground for migratory birds out of which 4 are rare, 5 are endemic and 7 are Threatened (globally: Lesser Kestrel (*Falco naumanni*); Corncrake (*Crex crex*). Regionally: Black-winged Pratincole (*Glareola nordmanni*); Bulbul (*Pycnonotus xanthopygos*); Bittern (*Botaurus stellaris*); White Stork (*Ciconia ciconia*); Syrian Serin (*Serinus syriacus*)) ([EB-ICZM report, 2020](#)). The survey conducted by [Ramadan-Jaradi et al. \(2004\)](#) showed a total of 222 recorded bird species in the TCNR. Seven of them *Neophron percnopterus*, *Falco biarmicus*, *Falco cherrug*, *Phalacrocorax pygmeus*, *Pelecanus crispus*, *Falco naumanni*, and *Serinus syriacus* are classified as globally threatened species according to IUCN Red List categories for 2007. Eight others are classified as regionally threatened species (*Ciconia ciconia*, *Aythya nyroca*, *Pernis apivorus*, *Elanus coeruleus*, *Gyps fulvus*, *Accipiter brevipes*, *Aquila pomarina*, and *Gallinago media*). The artesian wells there constitute an important water supply as well as a resting

place for these migrating birds (SPNL, 2018). All these characteristics allowed “BirdLife International” to recommend designating the TCNR reserve as an Important Bird Area (IBA).

Three sites in Tyre are considered attractive for sea turtles, TCNR where extensive conservation work occurs, El Abbassyeh beach which is situated on the northern coast of Tyre, in the municipality of El Abbassyeh and El Mansouri beaches which is the most important sea turtle nesting rookery identified in Lebanon, the bay located between the town of Tyre and the southern border, unfortunately, the site has no official protection (Cross *et al.* 2006).

Three sea turtle species occur in Tyre (*Chelonia mydas mydas*, *Caretta caretta caretta*, *Dermochelys coriacea coriacea*) (Figs 2 and 3), out of which 2 are considered endangered species. These endangered sea turtle species have chosen Tyre beaches as a nesting site: Green turtle (*Chelonia mydas*) and Loggerhead turtle (*Caretta caretta*). After mating, the Green Marine turtle and Logger-head marine turtle visit their nesting sites in Tyre to lay their eggs. The hatching of sea turtles takes around two months, during which extensive conservation effort should be given to protect the nests and the hatchling (SPA/RAC, 2016), taking 3 to 7 days to reach the sea. Another reptile species is the Schreiber’s Fringe-fingered Lizard (*Acanthodactylus shreiberi*) which is middle eastern endemic threatened species.

Moreover, according to Ramadan Jaradi *et al.* (2004) twenty-one per cent of the TCNR flora is restricted to the eastern Mediterranean area. Two rare species *Ficus sycomorus* and sea daffodil (*Pancratium maritimum*), depending on the dunes’ habitat, which is degrading on the national level, hence becoming a threatened species. An endemic species, *Astragalus berytheus* with habitat as dunes that aren’t found but in TCNR in Lebanon (EB-ICZM, 2020).



Figure 1. Loggerhead turtles (*Caretta caretta*) hatching in Tyre



Figure 2. Green turtle (*Chelonia mydas*) hatching in Tyre

Out of the 13 mammal species that inhabit TCNR, two bat species Mediterranean horseshoe bat (*Rhinolophus euryale judaicus*), Kuhl's pipistrelle (*Pipistrellus kuhli ikhawanius*) and one carnivore species the Eurasian badger (*Meles meles canescens*) are considered threatened at global levels. Similarly, the reserve hosts a very rare rodent species of Lebanon, the spiny mouse (*Acomys dimidiatus*; Fig. 5) and Marbled polecat (*Vormela peregusna syriaca*; Fig. 4; UNEP-RAC/SPA, 2011).



Figure 3. Marble polecat Lebanon



Figure 4. Spiny mouse (*Acomys dimidiatus*)

II.2. Main threats

With all efforts to protect the biodiversity of TCNR, a strong decrease in the numbers of many species such as the Caspian terrapin (*Mauremys caspica*), the green toad (*Bufo viridis*) and the tree frog (*Hyla savignyi*) can still be seen. The reserve has been also witnessing since the 2000s, an increasing number of invading species, such as the North American camphorweed (*Heterotheca subaxillaris*) which invaded TCNR from Haifa across the Blue Line (Yacoub *et al.* 2011).

Agriculture techniques are still prevalent in the TCNR's agricultural zone, with some farmers still utilizing fertilizers and pesticides. This unregulated and uncontrolled use of pesticides can have a severe impact on the entire food chain within the site, producing a change in water quality and biodiversity loss. Several local and national non-governmental organizations (NGOs) did, however, organize initiatives to promote the responsible use of organic farming, such as training, workshops, and demonstrations. The gathering of medicinal and other commercially valuable wild plant species is uncommon in TCNR and so has little influence on the site (SPA/RAC, 2016).

Many threats are imposed on nesting sea turtles in Tyre. Pregnant females are easily frightened, especially during the early stages of nest construction, and may return to the sea without laying eggs, severely threatening an already endangered species. During the inter-nesting period, females normally remain at sea, close to their nesting beaches (typically nests are laid at two-week intervals). Another source of harm is light pollution which has been shown to harm both adult females and hatchlings (Witherington and Martin, 1996). Local people's awareness must also be addressed, vehicles induce sand compaction over a nest, preventing newborns from reaching the beach surface.

According to the SOER report (2001), Two-thirds of fishing in Tyre is done using ineffective fishing equipment, namely trammels and dragnets, and one-third using long lines. These methods will undoubtedly influence sea life both outside and within the reserve.

More than 15 villages and three Palestinian refugee camps in Tyre caza dump their garbage in an open dumpsite near the coast south of Tyre, 200 meters south of the Ras el Ain springs, endangering the groundwater that supplies the wells and hence the reserve's freshwater resources. Because the maritime current movement along the Lebanese coastline is from south to north, landfill leachate also affects the reserve's shore.

Added to that, new hazards to the marine environment are predicted with the forthcoming oil and gas finding off the coast of Lebanon, from the building and operation of offshore infrastructure (oil and gas, accidents, and blow-outs) will put biodiversity under further strains (Badreddine, 2018).



Figure 5. Sea turtles killed by oil spill in Tyre

III. Effect of tourism on endemic sp. in Tyre

Coastal tourism can negatively impact the coastal ecosystem in many ways, either by polluting seawater, increasing beach and shoreline erosion, abusing and destructing coral reefs, destructing habitats of local flora and fauna, and accelerating the extinction rate of certain threatened species.

Tyre is an attractive destination for millions of visitors every year. Known for its spectacular sandy beaches and archaeological monuments, Tyre hosts vulnerable ecosystems as well, that cannot tolerate the increase in human presence which exceeds the carrying capacity of these sites, these ecosystems include sandy beaches, coastal wetlands, and the Tyre Coast Nature Reserve.

Seasonality of tourism causes a high concentration of human presence in the city during the summer season (Tyre beaches alone 3,000 visitors per weekend; RIS, 2009-2012), putting a strain on the city's infrastructures, the reserve's ecosystems, and, eventually, its biodiversity. Some tourism activities disrupt the biodiversity of TCNR.

Tourism increases human presence in the region, which increases solid waste and littering, and sewage, stepping, digging and umbrellas fixed on the sandy beach of the tourist zone TCNR threaten the breeding habitat of both Green and Loggerhead turtles and contribute to the decline of these globally threatened species.



Figure 6. Green Sea turtle found dead in Tyre after swallowing a plastic bag

Air pollution is exacerbated by increased automobile use, according to an EIA study done in Tyre, which revealed that Awqaf Square and Hamra (Hiram) Street both had PM10 concentrations that exceed the standards (CDR, 2009). This was linked to heavy traffic congestion in the square (two-way streets) at peak commercial activity times in the morning and noon, as well as at night. Similarly, the ambient noise level surpassed the highest permitted noise limits in Lebanon (UN-Habitat, 2017).

Visitors can generate further disruptions by trampling and harming turtle eggs, insular vegetation, freshwater vegetation, and plants that maintain dunes at the reserves. The Sand Dunes environment is in the reserve's protection zone and has well-established relative vegetation. *Astragalus berytheus* (Fig. 8), one of Lebanon's most vulnerable species, occurs in key tourist regions, such as Tyre's sandy beaches, which are being developed for resorts. Because of significant tourism throughout the Mediterranean, these ecosystems are classified as extremely.



Figure 7. *Astragalus berytheus*, Tyre

Moreover, 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.

The primary environmental damage in the maritime environment is also created by water recreational activities such as over-use by divers, jet skis, and recreational vessels. Uncontrolled recreational activities sites are the seashore places where most tourists go to, including unregulated recreational fishing, scuba diving, jet-skiing, and boating at the various coastal marinas and seafronts along the entire Lebanese coast.

The requirement for parking for visitors to the area was previously enforced by destructing and flattening certain dunes. This has devastated not just a portion of the reserve's vital dunes ecosystem, but also a portion of the reserve's attractive landscapes.



Figure 8. Diving in Tyre

IV. Protection of Maritime Tourism and ecosystem in Tyre

IV.1. Opportunities to integrate Habitat and Endemic species

Alternative forms of tourism and recreational activities have risen in Lebanon in recent years, such as ecotourism or environment tourism, which has seen a large increase in the number of ecotourism providers since 1991 (MoE/LEDO, 2001; MoE/UNDP/ELARD, 2010). Ecotourism is rising because of a better knowledge of the recreational value of natural assets and civil society engagement in their conservation. In 2004, 56,000 tourists accessed Lebanon's natural reserves (MoE/UNDP/ELARD, 2010), representing a 56% increase over the previous year. Ecotourism, on the other hand, is not limited to nature reserves and has expanded to span many parts of the nation as well as diverse topics to encompass cultural and traditional components of the Lebanese population.

Nonetheless, those activities are primarily concentrated in mountain regions and country sides, whereas coastal ecotourism activities are minimal and limited to summer seasons at the two coastal nature reserves, the Palm Island Nature Reserve in the north and the Tyre Coast Nature Reserve in the south, as well as scuba diving by enthusiasts. In this environment, the number of professional scuba diving clubs in Lebanon is growing, and scuba diving is one of the maritime sports that is drawing more enthusiasts. Divers regularly rent fishing boats for leisure diving, so there is already engagement with local fishermen.

At the same time, the recreational fishing industry is expanding and remains one of the most significant activities, particularly during the summer season. However, the partnership with fishermen for these activities is not formal and is done on an ad hoc basis. The ecotourism sector has not considered the possibility of incorporating the artisanal fisheries community into its plans, and this integration has not been a goal of community development projects in Lebanon, even though it has great potential for attracting people, improving fishermen's livelihoods, and conserving marine coastal resources if properly planned and marketed.

The coastal tourism industry is mostly centered on activities that take place within urban buildings such as beach resorts, hotels, restaurants, country clubs, and casinos. Tourism in Lebanon is divided into three primary categories, according to the Lebanese Ministry of Tourism (MoE/LEDO, 2001):

- Recreational tourism, including beach holidays, winter sports, summer holidays in the mountains, cultural tourism, religious tourism, adventure tourism and youth tourism.
- Business tourism, including individual businessmen, and passenger movement for the purpose of exhibitions and congresses.
- Other types of tourism, mainly comprising medical visits and travel for education and training.

The last type of tourism can be further enhanced in Tyre. For instance, eco-tourism is presently limited to some bird-watching activities and a few educational visits by students, mainly from the surrounding schools. The reserve is also implementing educational activities during sea turtle seasons, to make citizens and tourists aware of the importance of protecting sea turtles. These fascinating, rare, and important creatures are becoming increasingly an attraction for tourism.

Furthermore, the establishment of Bed and Breakfast in the city of Tyre using the accommodation of local communities has been an essential aspect of ecotourism and has shown to be effective in terms of generating cash for the local community as well social-cultural interchange with international tourists. Naturalists and eco-tour operators use this facility for lodging; hence, the location serves as a source of income for the local community.

IV.2. Managing tourism sustainably to protect endemic species

Several ecotourism enterprises and clubs have recently been founded around Lebanon, strengthening the tourist sector, and assisting local communities (MoE/LEDO, 2001; MoE/UNDP/ECODIT, 2011). Nonetheless, comparable ecologically responsible activities were restricted to the country's mountainous and rural areas, with coastal communities hardly represented in such projects.

Many initiatives have already been implemented since the creation of TCNR. The reserve was designated as Protected Area (MPA) to be 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.

Furthermore, conservation initiatives are being carried out in several sites on-site to promote and maintain significant species and ecosystems. The APAC, which has accomplished numerous tasks such as fencing, reducing human negative effects, infrastructure, and so on, is leading conservation efforts on-site. Furthermore, the MoE has undertaken several on-site initiatives like awareness, infrastructure, and biodiversity monitoring through the MedWetCoast Project, a regional project aimed at conserving wetlands around the Mediterranean.

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, species invasion (Mannino *et al.* 2017) ocean acidification (Gattuso *et al.* 2015) 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. The TCNR includes a conservation zone that is designated as a high conservation zone to prevent wildlife disturbance. This area has been preserved to safeguard and investigate wildlife and plants. The preservation of this area will allow endangered sea turtles to return and nest on the beach.

Other sites of importance in Tyre are El Abbassyeh (to the north) and El Mansouri beaches (to the south, which is the most important sea turtle nesting rookery identified in Lebanon). The El Mansouri bay is located between the town of Tyre and the southern border.

Stakeholders, particularly local communities, especially NGOs are frequently under-involved in the formulation, designation, and maintenance of area-based measures in a transparent, fair, and equitable manner, despite acknowledgement of the need to consider traditional and indigenous knowledge. When customary resources become unavailable to residents owing to the implementation of area-based management techniques, there is sometimes a lack of viable alternative livelihoods or (financial) incentives.

Furthermore, there has been a lack of coordination between the fisheries and aquaculture sectors, as well as the biodiversity and conservation sectors. This can be exacerbated by ineffective governance in key areas, such as insufficient policy and legislative alignment, poor enforcement, weak institutions, and insufficient civil society engagement. Resulting in knowledge and data gaps, poor information sharing, and redundancy in management efforts. There is also a lack of strong and coordinated governmental agencies to establish integrated coastal and marine management and planning, as well as a requirement for efficient national laws, administrative and technical frameworks, and enough technological, financial, and human skills.

Governance could be improved by increasing transparency, accountability, participation, coordination, legitimacy, and adaptability, while fairness or equity could be increased by developing ways to share conservation benefits locally, particularly by supporting local economic and tourism development, capacity-building programs, and hiring practices.

IV.3. Blue Economy and Coastal and Maritime Tourism

Sustainable development indicates that economic growth is carried out in a way that does not deplete the natural resources on which societies rely in the long term. A crucial component of the blue economy is the need to balance the economic, social, and environmental components of sustainable development with respect to oceans. It is also a challenging balance to achieve in practice, given that ocean resources are finite and ocean health has deteriorated dramatically because of human activity.

Biodiversity loss resulting from the reduction, fragmentation, or disturbance of a species in its managed ecosystem and can result in its extinction, will disturb the functioning of those ecosystems and ecological services they provide. The local services provided by normal functioning ecosystems are pure public benefits. Biological resources such as fish in marine coastal environments can provide new job opportunities if harvested sustainably. Other resources such as medicinal plants, and birds which are some of the richness of Tyre provide tourism opportunities, available for all people to enjoy (Perrings and Gadgil, 2003).

Dive tourism, marine archaeology, surfing, cruises, ecotourism, and recreational fishing activities are all examples of coastal and ocean-related tourism. Sustainable tourism can contribute to the blue economy by promoting conservation and sustainable use of marine environments and species, generating income for local communities (thereby alleviating poverty), and preserving and respecting local cultures, traditions, and heritage. It can also support fisheries management, other species management, integrated marine and coastal area management, marine spatial planning, marine protected areas, and carbon sequestration activities.

To promote the blue economy in Lebanon and protect our coastal species the focus on preventing plastic pollution and encouraging solutions for a healthy ocean is a must.

V. Conclusions

Tyre is known for its natural diversity and unique marine and coastal ecosystems, having the best-preserved stretch of sandy coastline, and the cleanest waters in the country. Its reserve constitutes a refuge for endemic or rare plants and animal species. Its major importance lies in being a nesting site for two endangered sea turtle species, which requires constant effort to protect the region.

Although many efforts have been already implemented in the reserve and many laws and conventions are ratified, further policies for the protection of other wetlands are required since many nesting sites for marine turtles are still unprotected by-law (El Mansouri beaches).

Herpetofauna (reptiles and amphibians) species are declining due to many anthropogenic or natural factors. An unmanaged solid waste system, pesticide uses in agriculture, and uncontrolled tourism activities added to the presence of the region near a corridor for invasive species are all reasons for such an observed decline in species.

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).

The findings suggest that Tyre has potential and requires the implementation of the Blue Economy concepts, however more research, strong political commitment, and societal awareness are required to achieve long-term sustainable prosperity. An in-depth study on the ecological environment within the various coastal zones of Tyre is needed, to be associated with a systematic scientific monitoring program for the fauna, flora, and their habitats. Beyond TCNR, the zones could include the stretch between the rest house and rocky coast of the Tyre peninsular, the area of the ports and along the coastal Cornish, and the sandy beaches beyond the Cornish to the north.

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