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MANAGEMENT PLAN OF TYRE COAST NATURE RESERVE (TCNR) : ASSESSMENT - DIAGNOSIS REPORT

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Table of Contents

List of figures

Lis of tables

List of Acronyms

APAC	Appointed Protected Area Committee
CNRS	National Councilfor Scientific Research
DPSIR	Driving Forces-Pressures-State-Impacts-Responses
EEZ	Exclusive Economic Zone
IUCN	International Union for Conservation of Nature
LU	Lebanese Universities
LRA	Litany River Authority
LPA	Lebanese Petroleum Administration
METT	Management Effectiveness Tracking Tool
MoA	Ministry of Agriculture
MoC	Ministry of Culture
MoE	Ministry of Environment
MoEW	Ministry of Energy and Water
MoF	Ministry of Finance
MoIM	Ministry of Interior and Municipalities
MoPWT	Ministry of Public Works and Transport
MoT	Ministry of Tourism
MPA	Marine Protected Area
NCMS	National Center for Marine Sciences
NGOs	Non-Governmental Organizations
NIS	Non-Indigenous Species
SLWE	South Lebanon Water Establishment
SPAMI	Specially Protected Area of Mediterranean Importance
SPA/RAC	Specially Protected Areas Regional Activity Centre
SWOT	Strengths, weaknesses, opportunities, and threats.
TCNR	Tyre Coast Nature Reserve
UN	United Nations
UNDP	United Nations Development Programme
UNEP/MAP	United Nations Environment Programme / Mediterranean Action Plan
UNESCO	United Nations Educational, Scientific and Cultural Organization

1 Background

The Specially Protected Areas Regional Activity Centre (SPA/RAC) of the Mediterranean Action Plan (UNEP/MAP) has been designated as co-executing agency in the framework of the regional project "Towards achieving the good environmental status (GES) of the Mediterranean Sea and coast through an ecologically representative and efficiently managed and monitored network of marine protected areas (MPAs)" ("IMAP-MPA Project").

The "IMAP-MPA" Project, funded by the European Union (EU) - Directorate General for Neighbourhood and Enlargement Negotiations (DG NEAR) and the European Financial Instrument of the 2018-2022 Green MED III: The European Neighbourhood Instrument (ENI) South, for Water and Environment, is coordinated and implemented by the UNEP/MAP Secretariat and executed through its Programme for Assessment and Control of Marine Pollution in the Mediterranean Region (MED POL) and SPA/RAC.

The beneficiary countries of the MPA component national activities of the IMAP-MPA project are Algeria, Egypt, Lebanon, Libya, Morocco and Tunisia.

Regarding Lebanon, SPA/RAC is jointly collaborating with theMinistry of Environment (MoE) and the Appointed Protected Area Committee (APAC) of Tyre Coast Nature Reserve (TCNR) to develop an updated Management Plan (MP) for Tyre Coast Nature Reserve (TCNR), a Specially Protected Area of Mediterranean Importance (SPAMI).

This collaboration, implemented with the technical support of a national team of experts and in close coordination with the International Union for Conservation of Nature Regional Office for West Asia (IUCN-ROWA), aims atupdating the 2004 management plan of TCNR in view of (i) preserving its ecological value either its terrestrial and marine ecosystems and biodiversity (ii) preserving the cultural heritage of the reserve and its socio-economic value, and (iii)improving the effective managementof the SPAMI

(i) preserving its ecological and socio-economic values, (ii) conserving the terrestrial and marine ecosytemsof the reserve, including its cultural and heritage importance,.

2 Introduction

2.1 Objectives of the assessment-diagnosis report

The currentreport is the outcome of the first phase of the assignmentand serves as a basis to updateand further develop the management plan for the coastal and marine zones of TCNR. It consists of a thorough analysis of the current state of TCNR including its ecological, cultural and socio-economic status, the current practices and its legal and organizational structure and framework. The report also provides an evaluation of the previous management plangoals, outputs, achievements, and gaps. It includes though (i) an analysis of the strengths, weaknesses, opportunities, and threats (SWOT analysis) of the reserve features, potentials and management framework, (ii) an evaluation of the

realchallenges for itsprotection and conservation, and (iii) a vision and a set of key objectives that will lay the ground for the preparation of the updated version of TCNR management plan.

2.2 Data Collection

The data used to prepare this diagnosis report (see table 1) is based on published studies and scientific reports previously conducted for TyreCoast Nature Reserve (TCNR) by the MoE, SPA/RAC, IUCN and other organizations as well as relevant information from the 2004 management plan of TCNR.

Table 1. List of Consulted data and bibliography

Year	Studies, reportsand project outputs/
2004	Biodiversity Assessment and Monitoring in the Protected Areas (Lebanon), MoE/UNEP/GEF/UL
2005	Mediterranean Action Plan (MAP) for the Conservation of Marine Turtles- Mediterranean Association to Save the Sea Turtles MEDASSET UNEP- MAP- RAC/SPA; MEDASSET; Project for the Conservation of Wetlands and Coastal Ecosystems in the Mediterranean Region (MEDWETCOAST)
2005-2006	Socio-economic development of the Fishing Community of Tyre, Lebanon: Commercial landing and fishing métiers within the artisanal fishery of Tyre, Lebanon. Italian Ministry of Foreign Affairs Italian NGO 'Ricerca e Cooperazione' in collaboration with Caritas Lebanon 2005-2006
1999-2006	MedWetCoast: Project for the Conservation of Wetlands and Coastal Ecosystems in the Mediterranean region French Global Environment Facility (FFEM) Project Coordination hosted by Tour du ValatMedWet ; United Nations Development Programme (UNDP); MoE Lebanon 1999-2006
2009-2012	Appui aux ReservesNaturelles du Liban (Support for Natural Reserves in Lebanon) FFEM and AFD TCNR
2010	Mare Nostrum projectEuropean Union Paralleli Institute
2010-2012	Programme for Monitoring and Exchange Visits MedPAN-TCNR
2011-2013	"Supporting the Management of Important Marine Habitats and Species in Lebanon" Project. Ministry of Environment and the IUCN - Centre Malaga, Spain (IUCN – MED)
2012	Lebanon Marine Protected Area Strategy (Developed within the Project "Supporting the Management of Important Marine Habitats and Species in Lebanon", IUCN/ Aecid/ MoE)
2012	Scientific and Institutional Cooperation to Support Responsible Fisheries in the Eastern Mediterranean - EastMed Greece, Italy and EC FAO 2012
2012	Satellite tracking of two Sea Turtles in South Lebanon Regional Action Centre of Specially Protected Areas (RAC/SPA) and Tyre Municipality TCNR
2013-2015	MEET Project EU-ENPI TCNR
2014	Ecological Characterization of Sites of Interest for Conservation in Lebanon, SPA-RAC/MoE
2014-2017	Sustainable Fisheries Management for Improved Livelihoods of the Coastal Fishing Community in Tyre, South Lebanon, IUCN-ADR funded by Drosos Foundation.
2015	MedMPAnet Project: Regional Project for the Development of a Mediterranean Marine and Coastal Protected

	Areas (MPAs) Network through the boosting of MPA creation and management EC, AECID and FFEM. Regional Activity Centre for Specially Protected Areas (RAC/SPA)
2015-2016	Develop and sustain Tyre's underwater natural and heritage snorkeling trails MedPAN, ARESMAR and Tyre Municipality TCNR
2017-2018	Master Plan for the Sustainable Development of the Lebanese Coast Italian Ministry of Foreign Affairs (MAECI/DGCS) through the Italian Agency for Development Cooperation (AICS) CIHEAM Bari and the Lebanese Council for Development and Reconstruction (CDR), in partnership with the Lebanese Ministry of Agriculture
2017	Design and Install Marah Tyre Coast Nature Reserve Hub to activate TCNR local activities American University of Beirut TCNR
2018-2019	NEMO project - Mediterranean Coastal Communities Italian Cooperation CIHEAM Bari in collaboration with the MoA and main local actors (TCNR. Municipality of Tyre, Union of Municipalities of Tyre province, LAG, TYROS, Mosan Centre, Syndicate and Cooperative of fishermen).
2018-2022	Monitoring the Marine Turtles Activities, SPA/RAC-MoE (**ONGOING PROJECT)**
2019	Action Plan for the conservation and protection of Marine Turtles- SPA/RAC-MoE
2020	1. Ecotourism Program Based on Sea Turtles for Tyre Coast Nature Reserve TCNR, SPA/RAC-MoE 2. Sustainable Monitoring Schemes in Tyre to Support Monitoring and Conservation, SPA/RAC-MoE 3. Ecological Characterization of the Coastal and Marine Habitats in Tyre, Lebanon, SPA/RAC-MoE 4. Establishment of a Socio-Economic Plan for TCNR, SPA/RAC-MoE 5. Strategic Environmental Assessment for Exploration and Production Activities Offshore Lebanon, Lebanese Petroleum Administration (LPA)
2021	Lebanon National strategy for monitoring IMAP Candidate Indicator 24-SPA/RAC-MoE
2021	Economic valuation report of Palm Islands Nature Reserve and Tyre Coast Nature Reserve (MoE/IUCN/UNEP/GEF)
2022	Baseline study for Marine Litter in Lebanon-MoE-World BANK Group-PROBLUE-BALAMAND UNIVERSITY-MORES under the framework of the project: Building capacity to prevent and Reduce pollution in Marine Environments in Lebanon.

Further to the previous data sources, the data collection was also based on ongoing projects information and outcomes (see Table 2). Those projects tackle emerging challenges including marine litter, climate change, and enhancing socio-ecological resilience within TCNR.

Table 2. Information (Project duration, Objectives, and outcomes) of the ongoing projects within TCNR

Projects	Project duration	Main objectives	Outcomes
COastal Management and MOnitoring Network for Tackling Marine Litter in Mediterranean Sea (COMMON Project) In cooperation with Lebanese Environement Forum (LEF)	Start date: 03 September 2019 End date: 02 September 2022	Apply the ICZM principles to the marine litter management in 5 pilot coastal areas through a local coordination and the Mediterranean networking among different stakeholders.	Develop monitoring tools dealing with the impacts of marine litter on marine organisms (sea turtles, fish, crustacean, Mollusca) Develop communication tools to reduce the use of plastics Propose solutions, and tools to reduce the use of plastic items
MEDiterranean Ecosystem Based Management (MED4EBM PROJECT)	Start Date: October 2019 End Date: October 2022	Incorporate the Ecosystem-Based management approach to ICZM into local development planning.	TCNR Thematic Scoping Data gathered from stakeholders (both experts and from the local community representing the different socio-economic activities related to the reserve) through workshops Primary System Diagram of the reserve's Ecosystems & Biodiversity Identification of indicators of status of each Component & Sub-Component at the reserve
ENhancing Socio-Ecological RESilience in Mediterranean coastal areas (ENSERES PROJECT)	Start date: October 2021 End date: September 2023	Ensure effective and integrated management of Mediterranean coastal areas and sustainable income-generation for local communities	Combine improvement of effective protection and conservation of coastal and marine environment (inside MPA) and management of pollution and human activities in coastal areas around Mediterranean cities (outside MPA), aiming at sustained livelihoods of local communities based on income- and labor-generating activities.
Blue Tyre Project	Start date: January 2022 End date: January 2024	Strengthening the governance capacities of the local authorities in Tyre Integrated services of environmental sustainable and participated management	Institutional and Technical capacity buildings Actions of research and environmental participated monitoring Waste management systems and innovative tools

STEPping uo Nature ReservesCapacity-STEP4Nature (MoE/UNDP/Italian Cooperation)	Start Date: October 2020 End Date: October 2022	Contibution to the enhancement and improvement of nature reserves in Lebanon from institutional, socio-economic and technical perspectives	1- Legal and institutional support 2- Tchnical research and policy support 1. 3-Enhancement of infrastructureal capacity

Last but not least, a consultation process has been engaged by the team of consultants, in cooperation with the MoE, the APAC,SPA/RAC and IUCN, with relevant stakeholders to getfurther feedbacks and informations on the current situation of the reserve with regards to the current ecological, socio-economic and environmental challenges (e.g. status of the terrestrial/marine habitats and biodiversity, livelihood issues, evidence of environmental degradation, threats and impacts of the natural resource of the reserve) as well as their perception and aspirations/expectations on the future state of the reserve.

2.3 Stakeholdersidentification and engagement

Stakeholders engagement is a fundamental activity to design an effective management plan that can be implemented and achieve tangible conservation outcomes. In particular, local communities and stakeholders are considered essential players in the protection and conservation of the nature reserve due to their role, proximity and direct influence on the MPA's ecological and biodiversity aspects (Niccolini*et al.*, 2019) (Annex 1). Figure 1[1] illustrates a non-exhaustive mapping of direct and indirect stakeholders, whereby the stakeholder's proximity to the center indicates their level of involvement/influence on TCNR. Stakeholders of various national organizations, local communities, social groups and individuals, institutions that have direct/ indirect significant interests in the management of coastal and marine natural resources of TCNR are considered in this analysis. Figure 2 shows the influence of the stakeholders on each other. Table 3 indicates the degree of risk, influence, interest, and engagement levels of each stakeholder.

[1] All the Photos, Figures, Maps, and diagramswere taken and developed by the National team experts. However, Photos, and Maps credits are mentioned for others taken from different sources.

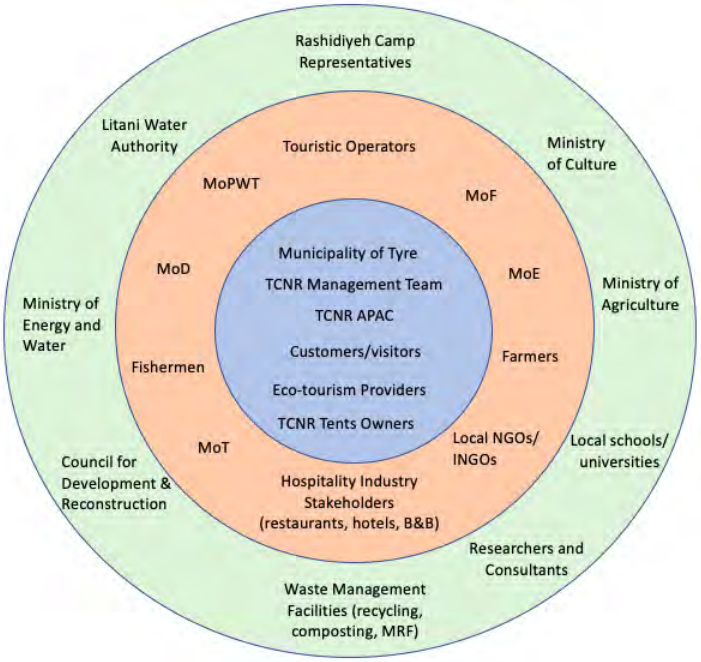


Figure 1. TCNR Stakeholders Mapping (Blue: Key Stakeholders, Orange: Relevant Stakeholders, Green: Other Stakeholders)

Key Stakeholders: Actors with strong influence on and frequent interactions with the human and natural components of the MPA.

Relevant Stakeholders: Actors that had some interaction with and influence on the MPA and its ecosystems.

Other Stakeholders: Actors with low influence on the ecosystems and limited interaction with the MPA.

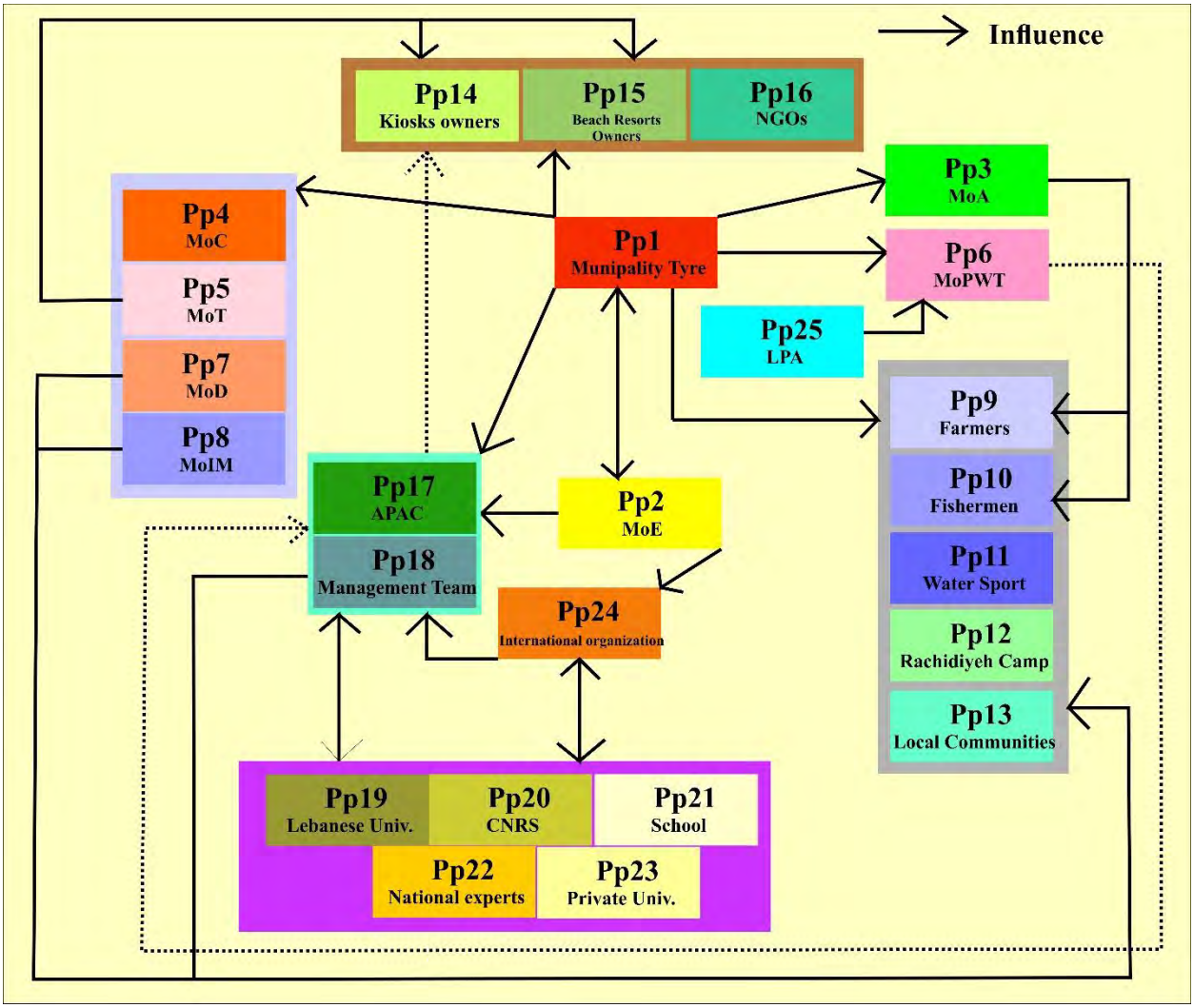


Figure 2. The stakeholders engaged in the management of TCNR and their influence on each other. The colors indicate the differents stakeholders. The narrow indicates the influence. For more information about symbols, see Annex 1.

A participatory approach that engages the identified stakeholders has then been designed to capture their concerns and needs, and highlight the reserve's main values from an ecological, social and economic perspective. This allows understanding the dynamics between the key stakeholders and the natural resources and assets of the reserve. Therefore, specific workshops and meetings will be organized to facilitate the work of engaging various stakeholders in the management plan design, .

Thesemeetings and workshops will help identifying the stakeholders' main concerns, perception and aspirations for the management plan of TCNR. They would also serve as platforms to initiate discussions to find collaborative grounds to resolve conflicts of interests between different stakeholders concerning TCNR's activities and resources, and propose efficient and integrated solutions to the current challenges and threats impacting the reserve. This exercise will allow the management plan to propose and develop co-management partnerships focused around Nature-based

Solutions.. Other stakeholders' engagement activities will be assessed through semi-structured interviews to gather additional relevant information.

Table 3. Stakeholders engagement matrix – Blue circle: low level; Red circle: high level-Orange circle: Medium level

	Stakeholders	Risk	Influence	Interest	Project phases					Engagement level
					Initiation	Planning	Execution	Control	Close	
1	MoE				Responsible	Consulted	Responsible	Informed	Responsible	
2	Mun.				Responsible	Responsible	Responsible	Responsible	Responsible	
3	MoA				Informed	Informed	Informed	Responsible	Informed	
4	MoT				Informed	Informed	Informed	Informed	Informed	
5	MoC				Informed	Informed	Informed	Informed	Informed	
6	MoPWT				Informed	Consulted	Responsible	Consulted	Informed	
7	MoD				Informed	Informed	Responsible	Responsible	Responsible	
8	MoIM				Informed	Informed	Responsible	Responsible	Responsible	
9	Farmers				Informed	Informed	Responsible	Informed	Informed	
10	Fishers				Informed	Informed	Responsible	Informed	Informed	
11	Water Sport				Informed	Informed	Responsible	Informed	Informed	
12	Rach.C.				Informed	Informed	Responsible	Informed	Informed	
13	Local Comm.				Informed	Informed	Responsible	Informed	Informed	
14	Kiosks				Informed	Informed	Responsible	Informed	Informed	
15	B. Resorts				Informed	Informed	Responsible	Informed	Informed	
16	NGOs				Responsible	Responsible	Responsible	Informed	Informed	
17	APAC				Responsible	Responsible	Responsible	Responsible	Responsible	
18	MT				Responsible	Responsible	Responsible	Responsible	Responsible	
19	LU				Responsible	Responsible	Responsible	Informed	Informed	

20	CNRS				Responsible	Responsible	Responsible	Informed	Informed	
21	Nat.Exp				Responsible	Responsible	Responsible	Informed	Informed	
22	Schools				Responsible	Responsible	Responsible	Informed	Informed	
23	Priv.Un.				Responsible	Responsible	Responsible	Informed	Informed	
24	Int. Org.				Consulted	Consulted	Consulted	Informed	Informed	
26	Litani Authority				Consulted	Responsible	Responsible	Responsible	Responsible	
26	MoEW				Consulted	Responsible	Consulted	Consulted	Consulted	
27	LPA				Informed	Consulted	Consulted	Consulted	Consulted	

3 Description of the Tyre Coast Nature Reserve

3.1 Location

Tyre Coast Nature Reserve (TCNR) is one of the three Marine Protected Areas (MPA) along the Lebanese coast (Table 4). It is situated between longitude 35º 12' East and Latitude 33º 17' North at c.1-15 m of altitude, south of Tyre city (Figure 3). TCNR was declared a Lebanese nature reserve, Law No. 708 (Annex 2)on the 5th ofNovember 1998. The terrestrial total surface of the TCNR is 3.883.253.00 m^2(three million and eight hundred eighty-three thousand and two hundred fifty square meters). However, and based on the Law No. 708 (Annex 2), the nature reserve includes the sandy beach and the correspondent territorial waters within a sea area of 113 km^2. Therefore, the total area (including the terrestrial and marine parts) of TCNR is 116.89 km^2.

Table 4. List of Declared Marine Protected Areas in Lebanon

Sites	Location	Date of declaration	Law
Palm Island Nature Reserve	North Lebanon	9 March 1992	121
Tyre Coast Nature Reserve	South Lebanon	5 November 1998	708
Abbasiyeh Coast Nature reserve	South Lebanon	5 May 2020	170

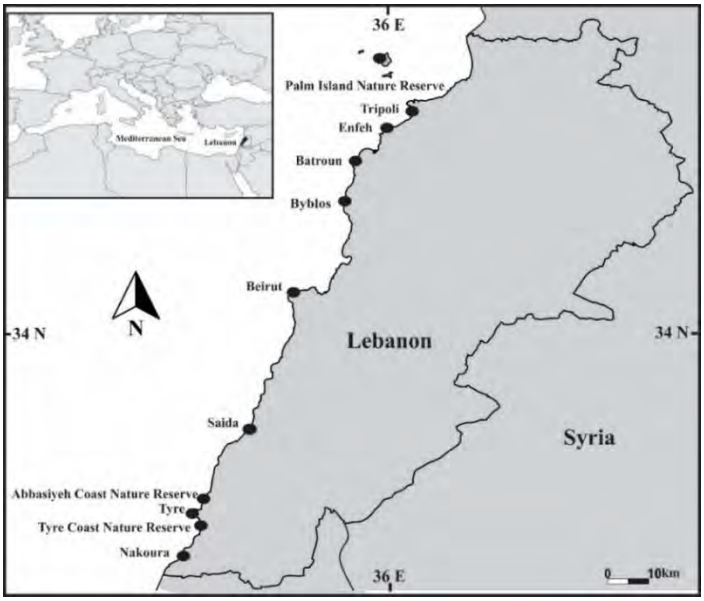


Figure 3. Map of Lebanon showing the location of the three Marine Protected Areas along the Lebanese coast

3.2 Zoning of the TCNR

Within an area of 380 hectares, the TCNR is divided into three zones: Touristic Zone, Conservation or Scientific Zone(Figure 4), and Agricultural Zone (Figure 5).

It is worth noting that TCNR is divided into two segments by the Rashidieh refugee campthat lies alongside the principal road and extends to the sandy beach. The northern part of the reserve is always open, especially during the summer season for recreation. It includes the public sandy beach and the Conservation Zone. While the southern part, including the beach facing theRashidieh refugee camp, Agricultural land and Ras Al Ain flowing artesian well, is controlled by the Lebanese Army (due to security purposes) (Figure 6).

Figure 4. The sandy beach of TCNR Touristic and Conservation Zones

Figure 5. The sandy beach of TCNR Agricultural Zone

Figure 6. Map sowing the division of the TCNR into three zones © Municipality of Tyre

3.3 Description of TCNR zones

1. Touristic Zone: it is a fine sand beach. This zone is used for:
    1. Touristic purposes for swimming with 49 removable kiosks being used within a beach length of 654 meters during the summer season (4 months) for food and beverage services. In addition to a parking lot with a capacity of more than 100 cars.
    2. Recreation within a beach length of 320 meters. This zone is not well defined until today.

It is worth noting that the touristic zone has:

1 – Park House offices including a Visitors'center(Figure 7)

2 – Permanent Exbhition of Sea Turtles' Life Cycle(16 m^2) (Figure 8)

3 – Recreation and swimming area: Parking lot + 49 Kiosks for food and beverage service (Figure 4)

4 – Beach extension of 320 meters

Figure 7. The visitor center within the Touristic Zone of TCNR


Figure 8. The sea turtle's museum within the Touristic Zone of TCNR

2.

Conservation Zone: it is a sandy beach with a length of 740 metersused for:

1. Monitoring, protection and conservation of the ecosystems and biodiversity (especially the sea turtles' activities during the nesting season)
2. Studies and research (currently very limited).

It is worth noting that the conservation zone has:

1 –Fenced and gated section

2 - An educational walking trail network (2 or 3 trails) with information panels, delineated with ropes on both sides, leading the visitor through the sand dunes to the beach, ending with an elevated wooden bridge (Figure 9).

3 –A bird watching hide.

All trails, their structure, equipment, panels, and access gates are in bad condition. (Figure 10).

Figure 9. Bird tower and some signs that need rehabilitation within the Conservation Zone

Figure 10. The educative trail and the wooden bridge that need rehabilitation within the Conservation Zone

2. Agricultural Zone (Figures 11, 12, 13, 14, and 15): within an area of 200 hectares, this zone is characterized by:

1. A sandy beach mixed with coarse and pebbels and gravels in a length of 2000 m
2. The presence of artesian aquifers dug by the Phoenicians(Figure 15)
3. Natural freshwaters springs (Ras-Al-Ain springs) with a flow of 1500 liter per second into four connected striking pools
4. Wetlands streams and marshes located only a few meters from the sea, creating a brackish interface

5. Agricultural lands used and cultivated by 200 Lebanese, Palestinians, and Syrians farmers

Figure 11. Houses for farmer and wooden kiosks (for touristic purposes) within the Agricultural Zone

Figure 13. Agricultural land within the agricultural zone

Figure 12. Freshwater ecosystem within the Agricultural zone

Figure 14. Gemmays trees around the ponds of Ras-Al-Ain

Figure 15. The artifial wells and ponf within the Agricultural Zone © Hasan Hamza

The agricultural zone has an inactive Ottoman era Water mill and a walking trail (delimitated by the streams and marshes) that reach the artificial freshwater pond. It also has a wooden esplanade and an information cabin. The wooden cabin (Figure 11) is currently closed and used sometimes by farmers, and the wooden esplanade is in bad conditions.

Table 5. The TCNR zones and characteristics (length-surfaces-objectives and Infrastructure/ equipment)

TCNR zones	Length of the beach	Surface (Hectares-Ha)	Infrastructure/ Equipment	Objectives
Touristic Zone (Open access)	974 m	200 ha	17. Visitor center with: 1. Very limited posters and signage (that need update and rehabilitation) 2. Snorkeling and diving gears 3. Compressor to fill diving bottle 4. Material for sea turtles nesting and monitoring sea turtles stranded 5. Under the MEET project the TCNR received a number of 10 bicycles, with helmets. Partial equipment (tanks and freezer) for the establishment of sea turtle rescue center Sea turtle Museum for awareness and educative activities (not well used).	Touristic and Recreation and camping (however no camping/ recreative areas were defined until now within the TCNR)
Conservation Zone (Open access)	740 m		An educative trail with many panels, that need rehabilitation, for education and awareness purposes. A wooden bridge that connect the sandy conservation zone to the educative trail and birds tower. It needs refurbishment. A bird watching hide cabin that is not used since 2004.	Protect and conserve marine turtles nests, especially during nesting season. Protect and conserve the sand dunes and associated biodiversity (especially flora and plants and mammals). Protect and conserve bird species

Agricultural zone (Access controlled by the Lebanese army)	2000 m (Including the beach front of Rachidiyeh camp)	180 ha	An inactive watermill Three deposits for stocking stuff A wooden esplanade and a wooden kiosk in bad condition for touristic purpose Some house for farmers	Protect and conserve the freshwaters and wetlands ecosystems and associated biodiversity (especially plant, mammals, reptiles, and birds) Protect and conserve the artesian wells, as a cultural heritage. Agriculture practices

***It is important to mention that TCNR include also a marine zone of 113 km^2 that need to be well demarcated**

3.4 The marine zone of TCNR

The marine zone of the reserve is very rich including important marine habitats and associated biodiversity. It does include also neighbor rocky islands (e.g., Al Jamal and Al-Fanar areas), where the submerged archaeological ruins of old Tyre and the feeding zone of sea turtles are located throughout the year (Nature Reserve Office, 2019). Therefore, it is necessary to have a zoning for TCNR's marine area along the different terrestrial zones in order to reducethe anthropogenic impacts in this area as much as possible.

Accordingly, and:

1. Due to the particular features of TyreSea (Cultural and historical values; Important marine habitats and associated fauna and flora of special interests; High human density; High littoral urbanization; High tourism pressure; Overexploitation of natural resources; Overfishing)
2. Based on the ecological characterization of Tyre areas, including important and sensitive marine habitats and associated biodiversity (especially fauna and flora with special interests), and different levels of human pressures and impacts (SPA/RAC-UNEP/MAP, 2014; SPA/RAC–UN Environment/MAP, 2020a).

A preliminary proposal of zoning of Tyre marine waters has been developed in 2013 based on the ecological characterization studies developed by the insistry of Environment and SPA/RAC in 2013 (Figure 16). This zoning proposal includes:

1. A core zone to protect and conserve freshwater springs as a natural resource;
2. A buffer zones to protect particular species or habitats represented by the lagoons, Inlets, Jamal, and Fanar areas.

3. A multiuse or peripheral zone to conserve ecosystems and associated cultural values and traditional natural resource management systems.

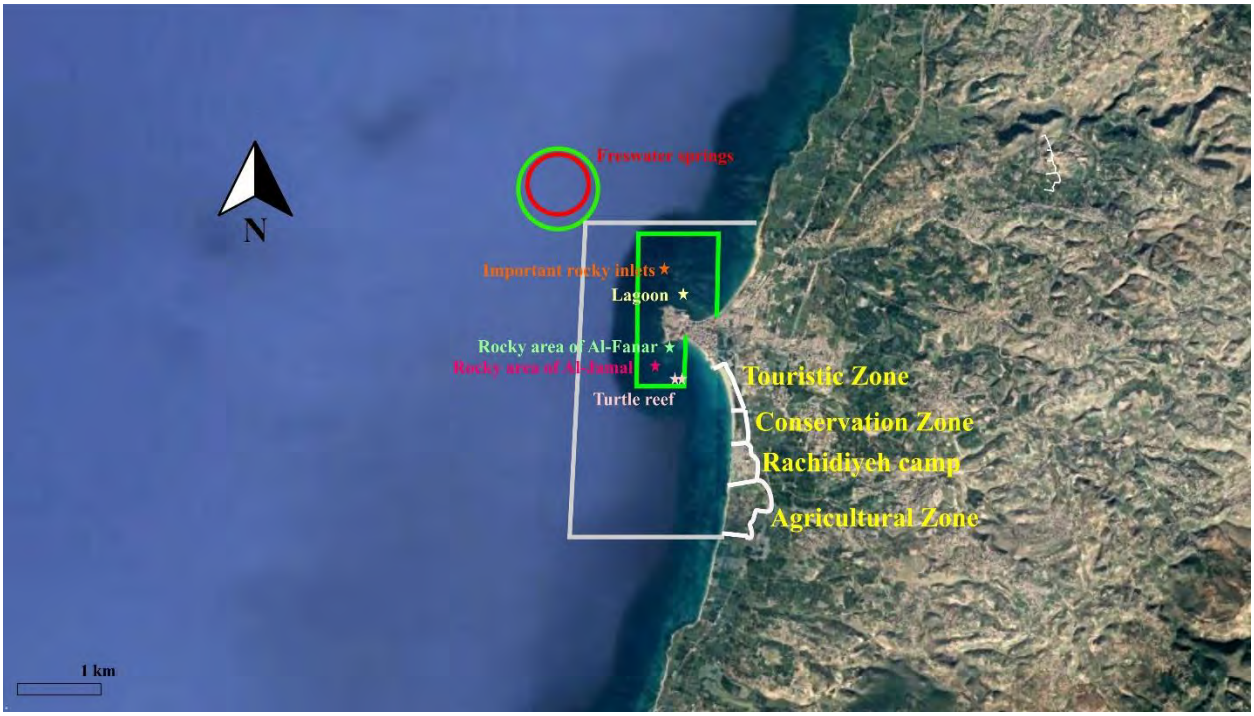


Figure 16. Proposed marine protected and/or managed area, and zoning: core zone (red lines), buffer zones (green lines) and multi-use zone (Grey lines). Reproduced from: RAC/SPA-UNEP/MAP, 2013; and SPA/RAC-UNEP/MAP, 2020

3.5 National and International designations of TCNR

Tyre Coast Nature Reserve was designated a RAMSAR site (or Wetland of Special International Importance under the Ramsar Convention) number 980 on 1999. . In addition, TCNR was listed on the "Specially Protected Area of Mediterranean Importance-SPAMI" in 2012 under the 1995 Barcelona Convention, in addition the whole city of Tyre including TCNR is classified as World Heritage Site by UNESCO in 1984 Nationally, in addition to law number 708 of 1998 establishing Tyre Coast Nature Reserve, Ras-Al-Ain springs within the TCNR was designated National Heritage by the Ministry of Culture in Lebanon (MoC).

3.6 Governance and Management

According to Lebanese law, public lands fall under the legal ownership of the Ministry of Finance (MoF). However, as a nature reserve, TCNR falls under the mandate and overall supervision and management of MoE. Furthermore, TCNR's land falls under the legal framework of different governmental administrations as per their mandate (TCNR Management Plan, 2002-2006):

1. Ministry of Agriculture (MoA) is responsible for regulating and controlling agricultural and fishing activities from the coast to the limit of territorial waters of Lebanon.
2. Ministry of Public Works and Transport (MoPWT) has mandates within overall beaches in Lebanon; and has a responsibility towards sea transport, boats registration and harbors management, including Tyre port. MoPWT has also to be consulted for any proposed zoning by MoE and APAC of the marine part of thec reserve as it is responsible for the management of territorial waters.
3. Ministry of Culture, through the Directorate General of Antiquities, is mandated over all archeological and historical sites of Tyre and TCNR.
4. Municipality of Tyre has the mandate to offer yearly funds to TCNR and to be represented in the reserve's committee (APAC). In addition, the municipality has the right to use the tourism zone in Section E1 throughout the summer season (According to the Law 708/1998 concerning the establishment of the TCNR), on the basis of a yearly agreement with the TCNR committee and the approval of the Minister of Environment and to grant a percentage of the investement fees to the APAC to be used to cover a part of the management fees of the reserve.
5. Ministry of Interior and Municipalities has the mandate to enforce the laws and regulations, through the Internal Security Forces.
6. Ministry of Defense and Lebanese Army are responsible for controlling the coastline and the sea for security reasons and illegal smuggling and human trafficking, in addition to patrolling the area and inhibiting illegal practices; they have also a role in emergency response.
7. The Ministry of Energy and Water (MoEW) is mandated to supervise and manage the use of the groundwater resources in TCNR;

8. The Lebanese Petroleum Administration (LPA) has mandates to promote exploration and production of hydrocarbons on the offshore blocks as per the Offshore Petroleum Resources Law (132/2010).
9. The Litani River Authority (LRA) is authorized to manage the water in Ras-Al-Ain for irrigation.

Many institutions are a fundamental part of TCNR management, since each has a different role and level of responsibility. Organizations that are mostly in charge of the direct management of the site, including the preparation and the approval of the management plan are:

1. Ministry of Environment: MoE is responsible for the supervision of the overall management of the reserve, including the appointement to its committee (APAC).
2. Appointed Protected Area Committee (APAC): Appointed through a decision by the Minister of Environment to ensure the local management of the reserve under the supervision of the Ministry of Environment. This committee comprises five volunteers representing the Municipality of Tyre, Governor of the Tyre district, two local NGOs, and the Ministry of Agriculture.
3. Tyre Municipality: Management of the touristic zone during the summer season through an annual contract with the TCNR committee after the approval by the MoE.
4. Ministry of Tourism (MoT) has the role to promote ecotourism in protected areas in Lebanon and puts the policies, laws and regulations of all tourism activities in general in Lebanon and is responsible of implementing the regulations and standards related to categorization of hotels, guesthouses and campings in addition to hygiene etc…MoT is also responsible of the good practice of the tourist guides and the tour operators in general and local ghuides and eco-tour operators in particular. Note: Laws are being revised currently to modernize the job of tourist guide and tour operator.

4 Legal framework

4.1 Regional Laws affecting TCNR

In addition to law number 708 of 1998 establishing Tyre Coast Nature Reserve, there are many relevant laws and decrees and initiatives allowing the protection and conservation of the marine habitats and associated biodiversity that relate to the TCNR legal framework:

18. Law number 444/02 (Code of Environment) specifies, under Chapter VIII, the protection, conservation and management of nature and biodiversity.

Article 30 strictly forbids all discharges, immersions or burning in the Lebanese territorial waters of every material that may directly or indirectly: (i) Affect the health of human beings or natural marine resources; (ii) Harm the activities and marine creatures, including shipping, fishing, flora and seaweed; (iii) Negatively affect the quality of marine water; (iv) Reduce the entertainment value and tourism possibilities of the sea and the Lebanese coast. Article 31 requires a permit for discharge to sea (application decree not issued yet). Article 44 requires a permit for the import, handling or disposal of dangerous/ hazardous chemicals (application decree not issued). In the absence of the detailed procedures for obtaining such permits, MoE provides these approvals through the EIA process. According to the law, MoE has the powers for monitoring, inspection and enforcement.

19. Law. issued as decision no. 2775 dated 1929, related to the control of marine and coastal fishing and its amendmentsHunting Law number 508/04: is the latest legislationregulating hunting practices in Lebanon in terms of season, amount and type of game birds/animals allowed during the hunting season, along with a permiting system based on hunting test. The hunting law prohibits also all year long the hunting of protected species and also the hunting practices in specific areas including protected areas and their surroundings.
20. Law No. 77/2018, Water Resources Law: The law aims to organize, develop, and protect water resources. It also aims to promote sustainability by strengthening water establishments.
21. Law No. 80/2018, Integrated Solid Waste Management: the law sets integrated solid waste management principles. It provides guidelines for the management of non-hazardous waste and hazardous waste.
22. Law 130/2019, Protected Areas Law: The Law classifies the categories of protected areas, sets the requirements for their establishment, includes supervision and management requirements and sets the conditions for allowing zoning within protected areas.
23. Decree Nº. 8213 dated 24/5/2012 relating to the “Strategic Environmental Assessment for Proposed Policies and Plans and Programs in the Public Sector” or SEA decree.
24. Decree Nº 8633 dated 7/8/2012 relating to the “Fundamentals of Environmental Impact Assessment” or EIA decree. According to this decree, all major development, infrastructure and industrial projects are subject to EIA or IEE studies which aims to assess the effects of these projects on the environment including their effects on biodiversity, in order to promote conservation activities and set mitigation measures to prevent the damage of the surrounding environment by these projects before receiving approval.

25. Decree No. 3989/2016, Environmental Police: Designation of an Environmental Police Department within the Ministry of Environment to regulate environmental crimes and enforce penalties; and specification of their organization and mandates

In addition, many Ministerial Decisions regulating fishing and fishing techniques are issued by the Ministry of Agriculture (MoA), mainly:

1. Decision of the Minister of AgricultureNº. 202/1 of 1997 amending Resolution Nº. 254/1 of 1995 on regulating fishing-diving sport.
2. Decision of the Minister of Agriculture Nº. 385/1, dated 26/1/1997, stating that fishing activities are prohibited in allestuaries all year round. The protected area involved extendsover 500 m on each side of the estuary, 500 m inside the riverand 2 km seawards. All human activities are bannedexcept for those of scientists and the Coast Guard.
3. Decision of the Minister of Agriculture Nº. 125/1 dated 23/9/1999 banning the fishing of marine turtles, monk seals and whales aswell as selling, use or trade of any derivatives from the mentionedspecies.
4. Decision of the Minister of Agriculture Nº. 93/1 dated 14/3/2008 regulating scuba-diving industry including permitting proceduresand safety measures and scuba-diving fishing.
5. Decision of the Minister of Agriculture Nº 346/1 dated 15/07/2010 regulating and defining some fishing types and equipment and prohibiting the use of nets with small mesh sizes, trawling nets and fishing with scuba diving equipment.
6. Decision of the Minister of Agriculture Nº. 8/1 dated f 04/01/2012 organizing and defining some fishing types, gears and equipment.
7. Decision of the Minister of Agriculture Nº. 1160/ 1 dated 10/12/2013setting general provisions of shark fishing.
8. Decision of the Minister of Agriculture Nº. 396/1 dated 12/5/2014 banning the catching of marine birds.
9. Decision of the Minister of Agriculture Nº.1044/1 dated 25/11/2014 setting general conditions to protect Cetaceans.
10. Decision of the Minister of Agriculture Nº.1045/1 dated 25/11/2014 setting general conditions to catch Sharks.
11. New Fishing law/Draft- Given that the existing fishing law in Lebanon is about 90 years old, a new draft law was prepared by the MoA taking into consideration the new challenges in fisheries management as well as the new scientific references and benchmarks for the sustainable management of marine resources.

4.2 International Conventions and Agreements affecting TCNR

National protection of the Marine Protected Areas in Lebanon, , is influenced by several multilateral environmental agreements, that have either been signed or ratified by the Government of Lebanon. Accordingly, TCNR meet the international criteria for the conservation of wetlands as defined by the RAMSAR convention. ,TCNR should therefore focus on (i) maintaining the reserve's ecological characteristics; (ii) using the site's resources in a sustainable

manner. Moreover, TCNR was designated a Specially Protected Area of Mediterranean Importance (SPAMI) in 2012 under the 1995 Barcelona Convention, and is a part of Tyre city which is classified as World Heritage Site by UNESCO in 1984.

On the other hand, TCNR management is influenced by several international conventions and agreements that have either been signed or ratified by the Lebanese government. They include:

1. The **Barcelona Convention** for the protection of the Mediterranean Sea against pollution, adopted in 1976 by the Conference of Plenipotentiaries of the Coastal States of the Mediterranean Region (signature by the GoL on 16/2/1976, accession in 30/6/1977 through legislative decree no. 126) and amended on 10 June 1995 and renamed Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Adhesion by the GoL on 16/10/2008 through law no. 34).
2. The UNESCO Convention on the Protection of Cultural and Natural Heritage (Adhesion by the GOL in 30/10/1990 through Law No 19).
3. The **Convention on Biological Diversity (CBD)** (signature by the GoL in 1992 and ratification on 11/8/1994 through Law no. 360).
4. The **United Nations Convention on the Law of the Sea** (UNCLOS) (signature and ratification by the GoL in 1995).
5. The **Ramsar Convention on Wetlands of International Importanc**e especially as Waterfowl Habitat (Adhesion by the GoL on 23/2/1999 through Law no. 23)
6. The **African-Eurasian Migratory Water Birds Agreement** (AEWA) (Ratification by the GoL on 13/6/2002 through Law no. 412).
7. The Agreement on Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic area (ACCOBAMS) (Adhesion by the GoL on 5/2/2004 through Law no. 571).
8. The **Protocols of the Barcelona Convention** specifically the Protocol on Specially Protected Areas (SPA Protocol) ratified in 22/02/1994 through the Law No.292, and its amendment the SPA and Biodiversity Protocol (The Law N°127 dated 30/04/2019 has approved the accession to the Protocol by the GoL but the process for the deposit of the instruments of accessionby the GoL is still ongoing)
9. **IMO MARPOL 73/78** and its annexes
10. Convention on the Protection of the **Underwater Cultural Heritage**, 2001
11. IMO International Convention on Civil Liability for oil pollution damage (CLC) (1969)
12. IMO International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)
13. IMO International Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKER)
14. The International Convention relating to the Limitation of the Liability of Owners of Sea-Going Ships, and Protocol (Brussels, 1957); this convention was replaced by The IMO Convention on Limitation of Liability for Maritime Claims (LLMC),1976, but the LLMC has not been ratified by Lebanon.
15. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) ratified by Lebanon through law No…. date…

16. Convention on Migratory Species (UNEP/CMS) ratified by Lebanon through law No. …. dated …

5 Physico-chemical and biological features of TCNR

5.1 Physical features

5.1.1 Geomorphology and geology

The reserve is situated in a sandy area of the Quaternary age. The sandy beach, including the sand dunes, an important ecosystem within the TCNR, comprises a mixture of quartz and carbonate sands within the conservation and touristic zones of the TCNR. Some of the dunes became sandstone, composed of mobile sands that even the fixed scattered vegetation cannot fix. The sandy beach is mixed with pebbles and limestones gravel in the agricultural zone. Accordingly, and within this zone, the underlying geology has a unique mixture of rock units. It is composed of a mix of rock layers consisting of porous and fissured Lower and Middle Cretaceous limestone, Late Cretaceous chalks and marls, and Lower Tertiary limestone. Subsequently, the entire rock sequence is slightly inclined and broken by local faults due to earthquakes (Gruvel, 1931; Sanlaville, 1977).

5.1.2 Hydrologyand hydrogeology

The hydrology and hydrogeology within the TCNR, especially within the agricultural zone, is of particular interest. The unique underlying geology composition controls the existence of the artesian wells. The porous Lower and Middle Cretaceous limestones and the upper Eocene sediments that absorb the waters form an aquifer as a source of freshwater. Subsequently, the Late Cretaceous rock, characterized by its large impermeability, allowed the construction of artesian wells where the freshwater rises under natural pressure. Later, and within this zone of TCNR (Ras-Al-Ain), the Phoenicians built three artesian wells and small springs (Gruvel, 1931; Sanlaville, 1977). The water rises to 5 m above ground level within the artesian wells, with a flow rate of 1500 liters per second, forming four big connected pools (Ras-Al-Ain pools). These springs provide ecosystem functions and services for the area. They serve and fulfill the need for water to irrigate the surrounding agricultural lands. In addition, they are an essential source of drinking water for ten villages within the Governate of Tyre.

5.1.3 Bathymetry and current

The bathymetry of the Lebanese coast is barely investigated. However, ultrasound probe bathymetry has been performed by Pfannenstiel (1960) and Emery *et al.* (1966). Their studies characterized the very narrow continental shelf (3-4 km) up to 200 m isobaths, situated at 8 to 10 km from the coast in the south of Lebanon (including Tyre coast), and up to 20 km in the north. The mean depth of the continental shelf is 20 to 40 m (Goedicke, 1972), and the slope is parallel to the coast, reaching the abyssal plain at 1100 to 1400 m depth and at a distance of 25 to 30 km from the coast. In addition, a bathymetric survey of the Lebanese Exclusive Economic Zone (EEZ) was conducted in 2003 by the SHALIMAR bathymetric cruise (MOPWT – DGLMT, 2017). According to the survey, the Lebanese

continental shelf, as for all continental shelves worldwide, is considered the most productive part of Lebanese waters, where most fishing activities are concentrated.The current circulation of the Lebanese sea is northwards following the counter-clockwise current gyre of the Eastern Mediterranean. This current is locally modified by the configuration of the coastline and the topography of the narrow continental shelf. A series of clockwise directed eddies and small gyres can be associated with bays, headlands, and submarine canyons (Goedicke, 1972). Water movements along the coast are also strongly related to surface currents and seasonal meteorological factors.

5.1.4 Tides and swells

On the Lebanese coast, the tidal range is very low. With a semi-diurnal rhythm, the tide has an amplitude of 0.40 m in syzygy and 0.20 m in quadrature. Wind or changes in pressure, for example, during the passage of a "khamsin", could however lead to accidental variations in level of tides, that can reach 0.8 m. Therefore, although it could be visible on the beaches, the tidal range is more sensitive on the rocky coast, where the vermetid platforms are emerged more or less depending on the time of the tide. The swell is characterized by a modest amplitude, a short period, and a low wavelength along the Lebanese coast (Sanlaville, 1977).

5.1.5 Temperature

Lebanese climate is a typical Mediterranean climate distinguished by four seasons: winter that is characterized by low temperatures and a high rate of humidity, and summer that is longer than winter, characterized by high temperatures and a low rate of humidity, are the two extreme seasons: Spring and autumn present intermediate and variable temperatures and humidity. Along the coast, winters are relatively mild and rainy, and the annual temperature is relatively low, around 13 to 15°C. In some cases, this temperature can reach exceptional extreme values of 3°C or 4°C, especially in December and January. On the other hand, during summer, temperatures are relatively high. They can reach 30ºC to 35°C (maximal values can reach 38ºC) in July and August (Abboud Abi Saab *et al.*, 2012).

The mean monthly air temperature variation ranges from a minimum of 12.4°C in January to a maximum of 27.6°C in August. The diurnal range remains close to 7°C throughout the year (Abboud Abi Saab, 1985).

According to Abboud-Abi Saab, M. (2008a), and Abboud Abi Saab *et al.* (2013), the mean monthly variation of sea surface temperature between 2000 and 2012 varied from a minimum of 17.8°C in March and a maximum of 27.7°C in August. However, and going deeper, the sea temperature decreases rapidly in summer, reaching around 16°C at a depth of 200m.

Within the TCNR, the sea surface temperature generally ranges between a minimum of 18.5°C during the winter season (February) to a maximum of 30.5 °C during the summer season (August).

5.1.6 Salinity and PH

The Eastern Mediterranean has the highest salinity within the Mediterranean Sea (Manninoet *al.*, 2017; Tanhuaet *al.*, 2013; Taupier-Letage, 2008). Indeed, the Levantine Sea waters have become saltier since the construction of the Aswan Dam, the regularization of the Nile waters, and the opening of the Suez Canal (Gruvel, 1931; Moraitou-Apostolopolou, 1983). Specific studies on the variation of water salinity are scarce in Lebanon. However, a four-month study on the salinity variation along with four sites along the Lebanese coast (Abboud-Abi Saab *et al.*, 2005) shows a significant increase of 0.700/oo in the salinity level. Accordingly, the salinity within TCNR sea waters ranges from a minimum of 38.0 (especially in February) to a maximum of 39.4 (especially in August). The PH varies between 8.17 - 8.23.

5.1.7 Chemical features

The sea concentrations of Nitrate (NO_3), Nitrite (NO_2), Phosphate (PO_4), and chlorophyll (Chl a), of a station located in the touristic zone of the TCNR show significant fluctuation during the years 2006, 2007, 2010, and 2011 (Pers.comm. Abboud Abi Saab). However, the minimum concentrations of the nutrients (NO_2 with 0.08 $\mu g.g^{-1}$; NO_3 with 0.52 $\mu g.g^{-1}$; PO_4 with 0.05 $\mu g.g^{-1}$; and Chl a with 0.1 $\mu g.g^{-1}$), especially during summer shows the good water quality of Tyre Coast Nature Reserve, as an important hotspot for tourism, especially during summer (Abboud-Abi Saab *et al.*, 2008b).

In addition, a study of sediments (as another indicator of the good environmental status), done in 2014 within the TCNR marine zone shows low levels of Phosphate (356 $\mu g.g^{-1}$), Codium (0.04 $\mu g.g^{-1}$), Plomb (4 $\mu g.g^{-1}$), and Copper (1.19 $\mu g.g^{-1}$)2.

It is worth noting that the sea water temperature, salinity, Ph, and Nutrients (Nitrate, Nitrite, Phosphate, and Chlorophyl) are annually measured by the CNRS/ NCMS along 25 stations of the Lebanese coast from the south (including a station located in the touristic zone of the TCNR) to the north of the Lebanese coast. However, data and analyzes are not yearly published for scientific purposes.

5.2 Biological and ecological values of Tyre Coast Nature Reserve

Tyre Coast Nature Reserve is unique by its biodiversity significance. TCNR hosts a mosaic of important marine and terrestrial ecosystems within 380 ha and the correspondent territorial waters. Accordingly, those ecosystems regroup a high diversity of fauna and flora species with special interests.

5.2.1 Marine habitats and biodiversity associated with Tyre Coast Nature Reserve

2CNRS, National Council for Scientific Research-Lebanon, 2014, The CANA-CNRS Research Vessel & Project.

The marine zone of the TCNR is poorly studied. Consequently, it has never been the subject of detailed monitoring. However, some stations located in the marine part of the Rachidiyeh camp, Touristic, Conservation, and Agricultural zones of the TCNR were monitored by the underwater visual census (hydroplane transects, snorkeling, and plot dives). Accordingly, ecological characterization and mapping of habitats and associated biocenosis were performed. In addition, Marine Turtles activities (e.g., nesting and hatchling), including monitoring stranded specimens, have been permanently monitored since 2013 by the Management team, in cooperation with national marine expert. In addition, TCNR water and sediment quality are usually evaluated, especially before and during the summer season, to guarantee a good environmental status by the CNRS/NCMS. Furthermore, threats, especially marine litter (including its impact on Marine Turtles), and Non-Indigenous Species (NIS), are monitored within TCNR. The list of marine habitats and flora and fauna associated with the TCNR have been established based on:

- An extensive review of published articles and campaign reports (Bitar, 2011; Kouyoumjian and Hamzé, 2012; RAC/SPA-UNEP/MAP, 2014; IUCN-SPA/RAC, 2017; Aguilar *et al.*, 2018; Badreddine, 2018; SPA/RAC- UN Environment/MAP, 2018a, 2018b; Badreddine *et al.*, 2018; Badreddine *et al.*, 2019; Badreddine *et al.*, 2020; Bariche & Fricke, 2020; Bitar & Badreddine, 2020; Badreddine & Bitar, 2020a, SPA/RAC- UN Environment/MAP, 2020a;SPA/RAC-UNEP/MAP, 2020a).
- Unpublished data of one of the consultancy teams (AB) based on many personal fieldworks, since 2013, regarding the marine habitats and associated biodiversity related to the TCNR.

As a result of all these studies, TCNR marine zones are characterized by important marine habitats: Rocky habitat, Sandy habitat, Coarse sands and gravels habitat, Vermetid reefs, Photophilic algae habitat, *Cystoseira* forests, Coralligenous assemblages, seagrass *Cymodocea nodosa*, and Rhodoliths/ Maërl beds.

In association with those habitats163marine species (Table 6), belonging to 15 zoological groups, were identified and confirmed present in the TCNR waters (Annex 4 for the detailed list of flora and fauna species). Among those species: 33 species are considered of special interests with high priority of conservation (Table 7) and 39Non-Indigenous Species (NIS), which many of them are considered invasive.

Table 6. The status of the marine biodiversity (fauna and flora) and Non-Indigenous Species in the TCNR

TAXA	NUMBER OF SPECIES (NON-INDIGENOUS SPECIES-NIS)
FUNGI	
VERRUCARIACEAE	1
PLANTEA	
CYMODOCEACEAE	1
HYDROCHARITACEAE	1 (1)
CHOLOROPHYTA	7 (4)

OCHROPHYTA	11 (3)
RHODOPHYTA	17 (3)
ANIMALIA	
ANNELIDA	2 (0)
ARTHROPODA	14 (2)
CHORDATA/ FISHES	44 (8)
CHORDATA/TUNICATA	2 (1)
CNIDARIA	10 (2)
CTENOPHORA	1 (1)
ECHINODERMATA	7 (3)
MOLLUSCA	37 (11)
PORIFERA	12
TOTAL	163 (39)

Table 7. Marine organisms of conservation interest observed within TCNR and related international conventions or directives. (MRB) Mediterranean Flora Red Book; (EU) Habitat Directive European Union (1992); (BaC) Barcelona Convention (1995); (BeC) Bern Convention;); (WC) CITES (2013) The listed species are either included in Annex II or III of the SPA/BD Protocol of the Barcelona Convention, and/or have been assessed by IUCN as threatened (i.e., Vulnerable (VU), Endangered (EN), or Critically Endangered (CR) or Near Threatened

Phylum	Species	MRB	EU	BaC	BeC	WC	IUCN	Listed on Annex II (SPA/ BD Protocol)	Listed on Annex III (SPA/ BD Protocol)
Arthropoda	*Ocypode cursor*			II	II	NE	NE	X	
Chordata	*Cetorhinus maximus*			II	II	EN	EN		
Chordata	*Epinephelus aeneus*								
Chordata	*Epinephelusmarginatus*			III	III	NE	VU		X
Chordata	*Glaucosteguscemiculus*			II		NE	CR		
Chordata	*Heptranchiasperlo*			II		NE	EN		X
Chordata	*Rhinobatosrhinobatos*			II		NE	EN	X	
Chordata	*Mobulamobular*			II	II	II	EN	X	
Chordata	*Sciaena umbra*			III	III	NE	NT		X
Chordata	*Squatina oculata*			II		NE	CR	X	
Chordata	*Umbrinacirrosa*			III	III	NE	NE		X
Chordata	*Xiphias gladius*			III		NE	EN		X
Cnidaria	*Dendrophylliaramea*						VU	X	
Cnidaria	*Madracispharensis*								
Cnidaria	*Phyllangia americana mouchezii*								

Cnidaria	*Dendrophylliaramea*						VU	X	
Mollusca	*Dendropomaanguliferum*							X	
Mollusca	*Luridalurida*			II	II	NE	NE	X	
Mollusca	*Octopus vulgaris*						LC		
Mollusca	*Stramonitahaemastoma*								
Mollusca	*Pinna nobilis*		IV	II		NE	NE	X	
Mollusca	*Tonna galea*			II	II	NE	NE	X	
Magniolophyta	*Cymodocea nodosa*							X	
Ochrophyta	*Cystoseira* genus (except *Cystoseira compressa*)	+	II	I		NE	LC	X	X
Porifera	*Axinellapolypoides*			II	II	NE	NE	X	
Porifera	*Sarcotragusfoetidus*			II		NE	NE	X	
Porifera	*Spongia (Spongia) officinalis*			III	III	NE	NE		X
Rhodophyta	*Neogognolithon brassica-florida*								
Rhodophyta	*Phymatolithoncalcareum*	+	IV			NE	NE		
Vertebrata	*Caretta caretta*		II,IV	II	I		VU	X	
Vertebrata	*Chelonia mydas*		II,IV	II	II	I	EN	X	
Vertebrata	*Trionyxtiunquis*			II	II	II	VU	X	

5.2.1.1 Marine habitats and associated biocenosis and biodiversity within the TCNR

TCNR marine zone is mainly characterized by a mix of soft and rocky bottom (Table 8). The characterization of the habitats has been done according to the "Handbook for interpreting the types of marine habitat for selecting sites to be included in the national inventories of natural sites of conservation interest" (UNEP/MAPRAC/SPA, 2015), and the "Updated Classification of Benthic Marine Habitat Types for the Mediterranean Region"(SPA/RAC–UN Environment/MAP, 2019) as follow:

5.2.1.1.1 Sandy habitat

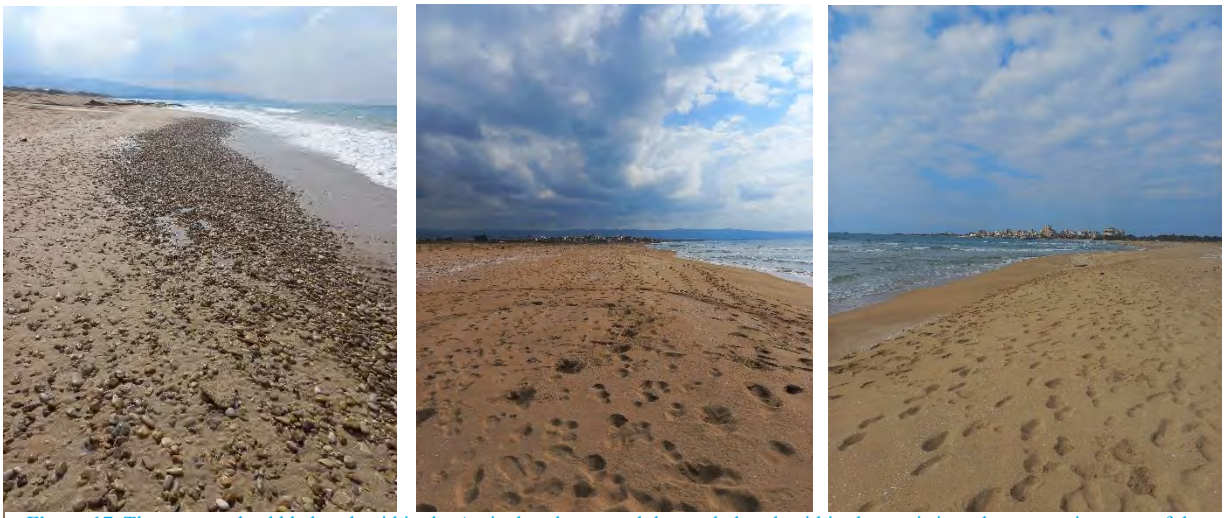


Figure 17. The stone and pebble beach within the Agricultural zone and the sandy beach within the touristic and conservation zone of the TCNR

1. The supralittoral stage is represented by sandy habitat (UMR I.2.1)(Figure 17). It is mainly hosting the tufted ghost crab Ocypode cursor.
2. The mediolittoral stage is represented by sandy habitat (UMR II.2), in the touristic and conservation zones of the TCNR, and stone and pebbles habitats (UMR III.3.1)(Figure 17), considered an important bird feeding area, especially in the agricultural zone of the TCNR. This stage mainly hosts:
    1. The non-indigenous common moon crab (*Matuta victor), and the slender swimcrab (Portumnuslatipes)
    2. Juveniles of seabreams (Diplodussargus, Lithognathusmormyrus) and the Non-Indigenous Species (NIS)suez whiting (*Sillagosuezensis), especially in the shallow waters.

In addition, and in association with those habitats, it can also be found:

1. Empty shells of various snails and bivalves (e.g. Acanthocardiatuberculata, Donaxtrunculus, *Gafrariumpectinatum[3], Glycymerisglycymeris, Glycymerisnummaria, Janthinajanthina, Peronaeaplanata, and Venus verrucosa), as an important source of feeding for some birds especially the yellow-legged gull Larus michahellis.
2. Several terrestrial halophytes, such as the Narrow-leaved bugloss (Echium angustifolium), the Sea holly (Eryngium maritimum), and the Sea daffodil (Pancratium maritimum) forming an association with halophytes (UMR II.1.1). The association with halophytes reflects a great diversity of station conditions linked to the nature of the substratum, the salinity, and the length of flooding. It is considered an important wintering and nesting area for many limicolous birds.
3. The infralittoral stage is mainly represented by:

1. Association with Cymodocea nodosa on fine sands (UMR: III.2.2.1).

[3] Symbol (*) mean a Non_Indigenous Species (NIS)

2. Association with Cymodocea nodosa on muddy sands (UMR: III.2.3.4).

Cymodocea nodosa meadow is among the most important habitats of the Mediterranean Sea. They offer food and shelter for a large number of marine species. It generally colonizes the sandy and muddy sandy bottoms. Likewise, it prevents coastal erosion by stabilizing sediments with their rhizomes. Therefore, its preservation is of high national and international priority, as Endangered or threatened species (Annex II, Barcelona Convention, Marrakech-2009 amendment); strictly protected flora species (Annex I, Bern Convention 1996-98). Also, the *Cymodocea* meadows are located in the natural habitats of community interest (Annex I, habitat Directive 92/43).

Within the TCNR, *Cymodocea nodosa*has been observed, in front of Rachidiye camp forming a small patch with isolated plants at 30-31 m depth (RAC/SPA - UNEP/MAP, 2014). Furthermore, a small zone has been spotted with irregular patches of *C. nodosa* in the marine area in front of the touristic zone of the TCNR (SPA/RAC-UN Environment/MAP, 2020a). Accordingly, in June 2021, small patches of *C. nodosa* were observed respectively at 15m in front of the conservation zone, and at 10m in front of the agricultural zone (pers.obs. Ali Badreddine).

Accordingly, *Cymodocea nodosa* habitat mainly regroups some Chordata fish species mainly *Gobius* spp., the Threespot wrasse**Pteragogustrispilus*, Pearly razorfish *Xyrichtysnovacula*, Echinodermata species heart urchin *Brissus unicolor*, Mollusca species mainly exotic snail **Conomurexpersicus*, as well as bivalves (*Acanthocardiatuberculata*, *Glycimerisinsubrica*, *Mactrastultorum*), the ragged sea hare * *Bursatellaleachii*and the NIS phanerogams **Halophila stipulacea* (becoming very rare along the Lebanese coast).

4. The biocenosis of coarse sands and gravels under the influence of bottom currents (UMR: III.3.2). Both on infralittoral and circalittoral bottoms (mainly, between 7 to 44m depth), it appears in rocky channels and pools, between blocks, around maërl beds and rock ridges.

26. The biocenosis of coarse sands and gravels is mainly characterized by the presence of some Macroalgae Rhodoliths and Ceramiales with Porifera Ciocalyptacarballoi and Cinachyrellalevantinensis. While, the invertebrate mobile fauna is represented by Annelida (serpulidaeDitrupaarietina,Hermodicecarunculata), Arthropoda hermit crab (Diogenes pugilator), Echinodermata sea urchins (Brissus unicolor) with an abundance of empty shells of B. unicolor, and Mollusca of Bittium sp. and *Conomurexpersicus, the holothurian *Synaptula reciprocans, the bivalves Mimachlamys varia, and Venus verrucosa. However, some fishesspecies in the rocky bottom can be observed in the TCNR sandy waters, due to the proximity of rocky and sandy bottoms. Therefore, the biocenosis of coarse sands and gravels is characterized by chordata fish speciesmainly represented by pearly razorfish (Xyrichthysnovacula), stingrays (Dasyatispastinaca, Taeniuragrabata), Boopsboops, Corisjulis, Diplodus vulgaris, Gobiusbucchichiwith high abundance, and the slender goby Gobiusgeniporus, Plotosuslineatus, *Sargocentron rubrum (c), Serranus cabrilla, Spicarasmaris, Thalassomapavo, *Torquigenerflavimaculosus.

The biocenosis of coarse sands and gravels is also associated with rhodoliths (UMR: III.3.2.2). The association with rhodoliths is an original and rare habitat in the Mediterranean that deserves to be considered separately. The substratum is formed by free-living rhodoliths (some of them ∅ = 7cm) of the Corallinacea (Melobesiae), mainly *Neogoniolithon*

brassica-florida and *Lithophyllumincrustans*, with small cobbles, shell gravel, and coarse sand. A complex community is associated with this habitat, between 6 to 9 m depth, mainly sessile fauna are bivalves (**Chama pacifica*, **Malleus regula*, **Pinctada radiata*, **Spondylus spinosus*), Cnidaria/ Hydroides (the toxic NIS invasive **Macrorhynchiaphilippina*, and the rare species indigenous *Pennariadisticha*), Porifera (*Crambecrambe*), Tunicata/ Ascidiidae (**Phallusia nigra*, *Rhodosoma* sp.) and macroalgae (*Cystoseira* spp., *Dictyota* sp., *Amphiroa*sp., *Lobophora* sp., *Lithophyllum* sp.). This biocenosis is characterized by the presence of juvenile fishes (*Mycteroperca rubra*), as a nursery area.

It is worth noting that the rhodoliths cover the coarse sand and gravel exceeded the 10 %, it is considered maërl bed (Steller *et al.*, 2003). This mainly occurs at the circalittoral stage at a depth of about 32-33 m.

However, this maërl bed has been located in northern Tyre, where the inlets and beach form a lagoon. Accordingly, maërl bed (generally found in the circalittoral zone) constitutes a significant part of the TCNR soft bottom, between 6 and 10 m depth. The most prominent marine organisms present there are seaweeds (e.g. *Cystoseira*, *Lithophyllum*, *Dictyota, Amphiroa, Lobophora*), Porifera (*Crambecrambe*), Cnidaria (**Macrorhynchiaphilippina*, *Pennariadisticha*), and scattered bivalves (e.g. **Pinctada radiata, *Spondylus spinosus, *Chama pacifica, Malleus regula*). Among the fish species encountered, **Siganusrivulatus*, **Torquigenerflavimaculosus*, and *Gobius*spp. were common. Other organisms that may be encountered are **Caulerpa scalpelliformis*, **Conomurexpersicus*, *Pinna nobilis* (dead), **Synaptula reciprocans* and empty shells of various snails and bivalves (e.g. *Acanthocardiatuberculata*). The region also represents a nursery area for some fish of commercial importance such as groupers (*Mycteroperca rubra*, *Epinephelusaenus, E. costae*).

5. The circalitoral zone is mainly characterized by:

1. Association with rhodoliths (UMR: III. 3. 2. 2).
2. Maërl beds formed by Phymatolitoncalcareum(UMR: IV.2.2.2).

The Rhodoliths/ maërl beds represents the most important communities on soft bottoms from the conservation point of view. It is protected by the Barcelona Convention and the European Union habitat Directive (annex V).

The deep maërl beds have appeared in Tyre, between 32-45 m depth (RAC/SPA - UNEP/MAP, 2014). The maërl beds are mainly represented by calcareous algae with special interest *Phymatolithoncalcareum*and *Mesophyllumcorallioides*. Accordingly, the substratum is formed by shell gravel and coarse sand, with the rhodolithes*Phymatolithoncalcareum*(c), *Mesophyllum* sp. (c) and *Spongitesfruticulosus* (c). The lessepsian chlorophyte **Caulerpa scapelliformis* is present. Epifauna is scarce in this region, as very few species have been reported (e.g. **Conomurexpersicus*, **Synaptula reciprocans*).

It is worth noting that sandy habitat within the TCNR regroup a meiofauna (species associated with sediment) composed of Cladocera, Copepodes, and nematode.

5.2.1.1.2 The rocky habitat, especially in front of the Rachidiyeh camp, and in the south of the agricultural zone

Figure 18. Rocky habitat within the Agricultural zone and Rachidiyeh camp

The seascape/biocenosis concepts have been applied to hard substrata, classifying them as a littoral rock (supra and mid littoral rock), infralittoral rock (upper, middle, and lower horizons) circalittoral rocky bottoms.

The rocky habitat along the TCNR coast is in very good ecological condition. It is mainly represented by:

1. Biocenosis ofthesupralittoralrock(UMR: I.4.1):The characteristic species are typically the lichen Verrucaria amphibia, the littorinids Melarhapheneritoides and Echinolittorina punctata, and the isopoda Ligia italica in the supralittoral zone.
2. Biocenosis ofthe upper midlittoralrock(UMR: II.4.1): The characteristic species are the sessile fauna mostly represented by stellate barnacle Chthamalusdepressus and C. montagui, whereas mobile species such as the knee-cap Patella ulyssiponensis, P. rustica, and the lessepsian*Cellanarota (very abundant and becoming invasive, and should be monitored to evaluate the status and the impact on the Indigenous species) and the intertidal crabs marbled rock crab Pachygrapsusmarmoratus and the mottled shore crab Pachygrapsus transversus.
3. Biocenosis ofthelowermidlittoral rock

The lower midlittoral rock is mainly characterized by *Vermetustriquetrus* occurring in the inner edge and *Dendropomaanguliferum* present in the outer edge; along with other mobile invertebrates like the gastropods *Patella ulyssiponensis* and turbinate monodont*Phorcusturbinatus*, and the crab *Pachygrapsusmarmoratus*, and *P. transversus*.

1. Importance of the two vermetids species Dendropomaanguliferum, and Vermetustriquetrus

Dendropomaanguliferum, in association with *Vermetustriquetrus*, the other solitary vermetid, and the crustose coralline alga *Neogoniolithon brassica-florida* which cements the tubular shells of the two vermetid gastropods, forming biogenic intertidal structure: the vermetid reefs/ or the vermetids platforms(Figure 18).

The vermetid reefs are important and distinctive coastal ecosystem in the Mediterranean Sea, and especially in the Levantine Sea, including the Lebanese coast (Badreddine *et al.*, 2019). Vermetid reefs provide key ecosystem functions and services by protecting the shoreline from wave erosion, sinking carbon, and being support, nursery and refuge habitats from predators for many diverse species assemblages, and fish of commercial interest. Vermetid reefs are also used as paleobathymetric markers and as potential bioindicators of global changes, particularly of rising sea-level and of surface seawater temperature changes (Badreddine *et al.*, 2019, and references therein). Following a precautionary approach, "*Dendropomapetraeum* complex" is included in Annex II of the Protocol for Specially Protected Areas and Biodiversity in the Mediterranean Sea (Barcelona Convention), and its reefs have been listed as threatened habitat in the Mediterranean Red Data Book of threatened biological assemblages. And, vermetid reefs are now listed as vulnerable habitats in the IUCN Red List, with many experts recognizing *Dendropoma* spp. (as D. petraeum) and *Neogoniolithon brassica-florida* as species deserving protection.

Accordingly, living individuals of *Dendropomaaguliferum* (as the main reef builder species, and in regional extinction along the Levantine coast), are still present along the TCNR reefs.

TCNR Vermetid reefs are also characterized by:

1. Shallow tidal pools or "cuvettes", considered an infralittoral enclave, mostly dominated by macroalgae (e.g., Fucales (as indicator of a good ecological status), Corallinales, Dictyotales, Sphacelariales and Ulvales).
2. The presence of the endemic species for the Levantine Sea, Treptacantharayssiae (as ex. Cystoseirarayssiae). T. rayssiae is forming an association in the cuvette of the vermetid reef TCNR. As well as, belt of T. rayssia can be observed in the inner and outer edge of TCNR vermetid reefs. Other Cystoseira species can also be found in the cuvette of the TCNR vermetid reefs.

Within the mediolittoral stage is important to monitor the invasion of the NIS **Brachidontespharaonis*. *B. pharaonis*may have an effect on the *Dendropomaanguliferum*(as the main reef buider) recruits.

4. Biocenosis of midlittoral caves (UMR: II.4.3) mainly associated with the presence of the two Rhodophyta Phymatolithonlenormandii and Hildenbrandia rubra (UMR: II. 4. 3. 1).
5. Infralittoral rock (UMR:III.6)Theinfralittoralrockrepresentsacomplexofhabitats depending on the natureandtopographyofthesubstratum,surfaceslope,waveexposure,illumination,sedimentcoverandscour,seasonaltemperaturechanges,thermoclinedepth,etc.

Accordingly, the infralittoral rock of the TCNR rocky coast are mainly characterized by:

1. Association of Cystoseira amentacea, Cystoseira compressa, Sargassum vulgare

27.  Species belonging to the Fucales, mainly Cystoseiragenus are the main habitat-forming macroalgae in the Mediterranean Sea, with 80% of the species that are endemic of this basin, and thrive from the littoral to the lower limit of the euphotic zone (Badreddine, 2018 and references therein). They are considered as "engineer species", because their three-dimensional structure dramatically alters the physical, chemical and biological environment. These forests provide shelter, food, habitat and nurseries for a multiplicity of species much as ecosystem functions and services (Badreddine et al., 2018 and references therein). From a conservation point of view, all the Mediterranean species of the genus Cystoseira, except C. compressa, have been protected under the Annex II of the Barcelona Convention (2010), and listed as endangered or threatened in the Annex II of the Barcelona Convention (1976, updated 2013). The presence of fucales species (mainly of the genus Cystoseira) along the Lebanese coast, including TCNR rocky coast, indicates a good ecological status (as well as a pristine environment). In addition, those species dominate the shallow waters, sometimes creates belts, mainly in the exposed rocky coastline of TCNR rocky, especially in association with the vermetid reefs. They are also abundant in the tidal pools of theTCNRvermetid reefs. This association includes many layers and high and rich species characterize it. It shelters epibiontic organisms and other nethic organisms, which mainly pertain to algae, polychaetes, mollusks and crustaceans. They are also abundant in the upper infralittoral zone within the TCNR rocky coast.

2. Association of the Infralittoral Photophilic algae mainly Ubiquitous photophilic algae (e.g., Padina pavonica, Dictyota spp., Dictyopterispolypodioides, Halopteris scoparia, Laurencia complex), Erect corallines Stands of articulated Corallinales, Tolerant photophilic algae Community dominated by Colpomeniasinuosa, Pterocladiellacapillacea, Hypneamusciformis, Green algae (Ulva spp. and Cladophora spp.).Those associations regroup a diversity of fauna and flora:

- Species with special interest Rhodophyta Mesophyllum sp., Cnidaria Cladocoracaespitosa, Pennariadisticha, Madracispharensis, Phyllangia americana mouchezii, Porifera Axinellapolypoides, Spongia officinalis
- The presence of many NIS species mainlyArthropoda *Charybdis helleriEchinodermata the dangerous *Diademasetosum (that should be urgently monitored), and *Synaptula reciprocans, Cnidaria the invasive and toxic *Macrorhynchiaphilippina, Mollusca mainly the invasive NIS lessepsian *Cerithiumscabridum, *Chama pacifica, *Conomurexpersicus, *Ergalataxjunionae, *Pinctada radiata, *Malleus regula, and Chordata/Fishes species with economical value (*Pterois miles, *Siganusluridus, *S. rivulatus, *Sargocentron rubrum), and the toxic *Lagocephalusscelleratus.
- Fish species with an economic value such as the Chordata (fishes species), Boopsboops, Diplodussargus, Diplodus vulgaris, Epinephelus costae, Epinephelusmarginatus, *Fistulariacommersonii, Lithognathusmormyrus, Mycteroperca rubra, Obladamelanura, *Pterois miles, Sarpa salpa, Scorpaena maderensis, Scorpaena porcus, *Siganusluridus, *Siganusrivulatus,

Sparisomacretense, Xyrichthysnovacula, and Mollusca *Chama pacifica, *Pinctada imbricata, *Spondylus spinosus, Sepia officinalis.

6. The circalittoral stage of the rocky coast is mainly characterized by:

Coralligenous assemblages that are considered among the most diverse habitats, and part of the biodiversity hotspots for the Mediterranean Sea: coralligenous assemblages are creating complex three-dimensional structures where a countless number of species, including those of high commercial value and endangered ones, refuge, live, settle, feed, or reproduce (SPA/RAC-UNEP/MAP, 2020a). Itpertains to circalittoral area, but can be particularly encountered as an enclave (overhangs, caves entrances) and caves in the biocenosis of infralittoral algae, which favor shadows/nuances. This habitat is encountered in various locations within the TCNR rocky coast between 20-60 m depth. It is mainly dominated by encrusting Rhodophyta (*Hildenbrandia rubra*, *Phymatolithonlenormandii*, *Peyssonelia*spp.), the Porifera *Axinellapolypoides*, *Spongia* (*spongia officinalis*), *Sarcotragusfoetidus*, and the Cnidaria *Phyllangia americana mouchezii*.

As conclusion, the marine biodiversity within TCNR waters is characterized by the presence of important habitas and associated species with special interests such as the presence of:

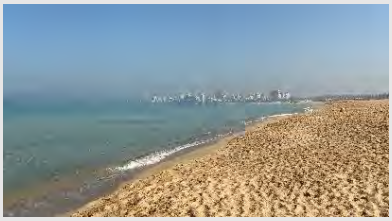
- The seagrass meadow Cymodocea nodosa
- The vermetid reefs, as an important coastal ecosystem
- The rare Rhodoliths species in the eastern Mediterranean Sea: Phymatolithoncalcareum, as the main former of the Maërl beds
- Coralligenousassemblage's habitat
- Brown Macroalage (Ochrophyta-Fucoids) species belonging to the genus Cystoseira
- Many shark species with high priority for conservation actions such as Common Guitarfish Rhinobatosrhinobatos (Linnaeus, 1758), the Sharpnosesevengill shark Heptranchiasperlo (Bonnaterre, 1788).
- The endangered species giant tun Mollusca Tonna galea rare in Lebanon and observed many times at 7 to 15 m of depth in Tyre Coast Nature Reserve waters. Tonna galea is classified as Endangered or threatened species (Barcelona Convention, Annex II); strictly protected fauna species (Annex II, Bern Convention 1996-98). European Union proposal (COM (2009) 585) to include it in the list of endangered or threatened species.
- The endangered tree coral Dendrophylliaramеareported around Tyre area (bycatch fishers of Rachidiyeh)

It is worth noting that the importance of TCNR marine zones is also related with the neighboring important rocky habitats, Al-Jamal, and Al-Fanar, in the north, and Nakoura in the south, characterized by a distinctive and particular ecological status, and regrouping a particular marina habitats and fauna and flora of special interest (Bitar, 2011; Badreddine, 2013; SPA/RAC-UNEP/MAP, 2014; IUCN-SPA/RAC, 2017; Badreddine, 2018; Badreddine *et al.*, 2018; Badreddine *et al.*, 2019; SPA/RAC-UN Environment/MAP, 2020).

Table 8. List of important marine habitats within the TCNR and their importance.

Marine Habitats	Importance

Sandy habitat



Habitat for *Ocypode cursor*

Habitat for meiofauna (species associated with sediments), mainly characterized by Cladocera sp., Copepoda, Nematoda

Habitat for several terrestrial halophytes

Vermetid reefs

Paleobathymetric markers

Potential bioindicators of global changes

Rising sea

Surface seawater temperature changes

Habitat formers

Support for many macroalgae specially fucoids

Protect from wave erosion

Nurdery and refuge for many species

Protect from wave erosion

Nurdery and refuge for many

Cystoseira forests

Habitat-forming species

Substrate for organisms

Nurseries for fishes

Export of organic matter

Oxygen

Food

Economic interest

Bioindicators

Cymodocea nodosa

Food and shelter for a large number of marine species

Nurseries for fish

Prevents coastal erosion by stabilizing sediments with their rhizomes

Bioindicator

Becoming rare along the Lebanese coast

Infralittoral Macroalgae

Food and shelter for a large number of marine species

Nurseries for fish

Habitat for a fauna and flora with special interest

Bioindicators

Coralligenous assemblages

Creating complex three-dimensional structures where a countless number of species, including those of high commercial value and endangered ones, refuge, live, settle, feed, or reproduce

Rhodoliths/ Maerl beds

Bioindicators

Shelter for a large number of marine species

5.2.2 TCNR as important site for the Mediterranean Marine Turtle species

28. The two marine turtles' species, the loggerheads (Caretta caretta) and the greens (Chelonia mydas), frequent the Lebanese waters, including TCNR waters. Accordingly, two stations are defined as turtle reefs within the TCNR, where both species breed forages. The first turtle reef is located between 5 to 10 m depth in the face of the touristic zone, and the second one is in the front of the conservation zone between 10 to 15 m. In 2012 and around the Tyre regions, one individual of both Caretta caretta and Chelonia mydas was monitored via satellite tracking by the Tyre Coast Nature Reserve (TCNR) group, and the SPA/RAC team. It showed that the loggerhead individual stayed close to the Tyre area in shallow waters of less than 10 m depth for seven months. The green turtle also stayed around the Tyre area only two months before moving further south of Lebanon (SPA/RAC–UN Environment/MAP, 2018a). This monitoring confirms that TCNR waters are an important area for sea turtles breeding, foraging, and nesting.
29. In 2019, a stranded network for Sea turtles and cetaceans has been developed and established along the Lebanese coast, including TCNR. As a result, marine turtles in the Lebanese sea, as is the entire Mediterranean, are under multiple anthropogenic pressures, especially fishing activities, boat traffic, and marine litter. As a result, the number of stranded marine turtles in Tyre waters varied from 4 to 18 dead ones from 2018 to 2022. The cause of death is mainly due to fishing activities (illegal fishing practices, catching accidentally by fishers' nets), collision with boats, and being entangled and suffocated by plastic bags, fishing nets, and especially the loss nets ((SPA/RAC- UNEP/MAP, 2020c, 2021b).
30. The Loggerheads, and Greens turtles are also nesting on many sites of the Lebanese coast, including the sand beach of the TCNR (SPA/RAC- UNEP/MAP, 2020b, 2021a).
31. From 2018 until 2021, within the framework of a project for the "Conservation of Marine Turtles in the Mediterranean Region", funded by the MAVA Foundation and executed by the Regional Activity Centre for Specially Protected Areas (SPA/RAC), in cooperation with the MoE (the project is still ongoing), a total number of 20 sites along the Lebanese coast were defined as marine turtles nesting sites, including the TCNR sandy beach (SPA/RAC- UNEP/MAP, 2021a). As a result of the extensive monitoring carried out along those sites, a maximum of 107 nests of Caretta caretta and 53 nests of Chelonia mydas were recorded during the marine turtles nesting seasons 2018-2021 (Badreddine in Casaleet al., 2020; SPA/RAC-UNEP/MAP, 2020b, 2021a). Within the TCNR sandy beach, the average number of marine turtles' nests varied from 9 nests in 2005 to a minimum of 4 and a maximum of 6 between 2018 and 2021 (Badreddine in Casaleet al., 2020; SPA/RAC-UNEP/MAP, 2020b, 2021a). However, the marine turtles' nests, and hatches are under a mix of natural and human pressures. The natural pressures are mainly represented by the presence of ghost crabs, macro insects, and foxes that eat marine turtles' eggs). Human pressure includes high tourism activities (light and noise disturbance and nest destruction) in summer, which coincide with the marine turtles nesting season.

From a conservation, and protection point of view, an action plan for the conservation of the Marine Turtles in Lebanon has been prepared for the next five years (2020-2025). In addition, a large awareness campaign has already been set up since 2019 on all the Lebanese coast (including TCNR) and is ongoing. This awareness campaign allows to motivate and encourage all the public at large and especially the fishermen, ecovolunteers, and Non-Governmental Organizations (NGOs) to help and participate in the monitoring program during nesting/hatching season and essentially share the information with the experts, allowing to obtain better results for the protection of the Lebanese Marine Turtles in Lebanon. Accordingly, many releases of sea turtles' hatchlings events have been organized within the TCNR. Gifts and brochures have been distributed for free during these events (Figure 19).

Within the TCNR, a sea turtle museum was established in 2019 for educational and awareness purposes within the touristic zone. In addition, an ecotourism plan based on sea turtles for TCNR has been developed and established in cooperation with the SPA/RAC and MoE in 2020 (SPA/RAC- UNEP/MAP, 2021c).

In the same year, a sustainable monitoring program for monitoring the sea turtles within TCNR has also been developed and established (SPA/RAC- UNEP/MAP, 2021d). A sea turtles rescue center will be established under the framework of the project Blue Tyre, in cooperation with the Municipality of Tricase, and University of Genoa, Italy.

32. Accordingly, in 2021, a national strategy for implementing the common indicator CI24 dealing with the impact of marine litter on sea turtles has been developed and its implementation is ongoing (SPA/RAC-

Figure 19. Awareness activities for the protection and conservation of the sea turtles within the TCNR

UNEP/MAP, 2021e).

5.2.3 Threats on the marine habitats and associated biodiversity within the TCNR

33. TCNR marine habitats and associated biodiversity are facing a mix of natural and human pressures (Table 10) represented by:

34. Domestic pollution (Figure 21) which comes from the beach kiosks and visitors (local community and tourists), especially during summer. It comes also from the farmers of the Agricultural zones.The main

component of this waste is plastic bags/bottles and other plastic debris (marine litter), which causes the entanglement of many flag marine species (Marine turtles, fish, cetaceans). In addition, floating plastic rubbish breaks down under the effect of the sun, and toxic molecules end up in the sediment or get ingested by marine organisms, particularly sessile filter-feeding species such as clams, tunicates, and sponges. The toxic molecules may affect their biology or accumulate in other organisms that consume them. It is worth noting that marine litter can also come with ocean currents carrying litter offshore (especially during winter). Marine litter comes also from the sea waves, carrying litter to the shores. However, a study of the impact of marine litter done in Tyre in 2021 (Worldbank Group-Problue-Mores-University of Balamand, 2022) shows:

35. 1- 3.2. kg/persons/year of uncollected waste leakage to the environment
36. 2- 1.1 kg/persons/year of uncontrolled waste leakage to water systems
37. 3- Lowest percentage (with 34%) of uncollected waste leakage to water systems in comparison with Beddaoui, Byblos, and Ghazir
38. 4- The majority of marine litter fragments are composed of Cigarette Butt
39. 5- Marine litter floating in seawater was the lowest in fragment number and percentage in Tyre, in comparison with Byblos, Litani River, Ibrahim River
40. 6- Microplastic in the sediment of Tyre (with 177 Fibre, 16 Rope and Filament, and 10 Pellet) was also low compared to Byblos, Litani River, Ibrahim River. However, a study done in 2021 (Sherif et al., 2021) shows a high quantity of macroplastic floating in many localities of Tyre areas with 23023 plastic fragments and 7.8 item/ m3 microplastics.

Figure 21. Fishing net stranded on the sandy beach of TCNR

Figure 20. Solid wastes, especially marine litter in the sandy beach of TCNR

41. Agriculture activities that use pesticides, herbicides and some heavy metals. Consequently, they are carried to the marine environment by the streams and marshes located a few meters from the sea within the Agricultural zone of the TCNR.

abandoned, lost, discarded fishing gear (ALDFG) nets (Ghost nets) or fishing lines (Figure 20) that may kill marine organisms (especially marine turtles and fish and crustaceans). In addition, it can cause the destruction of important habitat within TCNR waters (Coralligenous habitats, Rhodoliths/ Maërl beds, *Cystoseira* forests, and seagrass *Cymodocea nodosa*).

Fishing activities (Figure 22): it is represented by the use of illegal fishing methods such as scuba diving with a compressor to fish high price fish (e.g. groupers, and seabreams), fishing with entangling nets (e.g. trammel, gillnets, Lampara-used to fish "bizre" juveniles of sardine, anchovies, and bogue), and blast fishing and fishing with poisons.

Figure 22. Fishing of eight individuals of Rayswith high priority of conservation by a fisherman in 2012. © IsmaïlSabrawi

Illegal harvesting also includes the illegal collection of seashells (Figure 23) from the reserves for commercial business. This action destroys the food chain around the reserve and most probably within its boundary.

Figure 23. Shells of Mollusca along the sandy beach of TCNR

Shipping activity: the impact is related to anchoring (especially ship vessels and recreational boats) that damage the marine habitat (especially *Cymodocea nodosa*, *Cystoseira*forests, Coralligenous habitats, and Rhodliths/ Maërls beds). It is worth noting that shipping activity, mainly by collision, also can cause the death of some flag marine species within the TCNR, mainly marine turtles.Furthermore, shiping activity can contribute to the appearance of new NIS. Furthermore, unusal appearance of species can excavated from some ships (Figure 24).

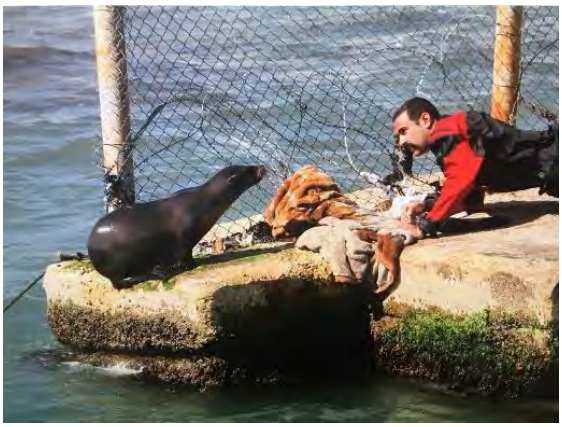


Figure 24. Unusual appearance of a Sea lion in Tyre in 2013 © Ziad Samaha

Local communities, Visitors and tourism activities: The high number of visitors during the summer season, generates pollution (solid wastes (mainly marine litter), light and noise disturbance, especially during the nesting season), and negatively affects the particular vegetation cover within the TCNR, especially those terrestrial plants that play a role in fixing the dunes. In addition, it is worth noting that TCNR is open all the year (including the nesting season of marine turtles), which may cause more pressures on the nesting and hatchling activities of the marine turtles. Furthermore, activities of local communities (mainly trampling on the vermetid reef) within the agricultural zone, especially from the Rachidiyeh camp, may affect vermetid survival and settlement success, as well as a degradation of the associated benthic assemblages. As a result, canopy-forming dominated assemblages tend to be lost as predicted to be replaced by less complex communities, characterized by stress tolerant, ubiquitous, opportunistic and ephemeral macroalgal species (Badreddine *et al.*, 2018).

Sea warming and acidification: Sea warming may cause the proliferation of toxic marine, harmful algae (e.g., *Ostreopsis* sp.) (Figure 25 and Figure 26) that may cause respiration problems (espcially by physical contatct) and being toxic for some organisms (Phyoplanton, Zooplancton, Mollusca, crustacean, fish larva). In addition, sea warming can also cause cyanobacteria/ or pathogen proliferation, causing the whiteness (Figure 27)of some incrusting macroalgae with specific interest (e.g., The busy coral *Cladocora caespitosa*, becoming rare in Lebanon), and Rhodoliths.

Figure 27. Effect of a Bacteria *Vibrio* sp. on the Cnidaria **Oculina patagonica*

Figure 25. Bloom of the toxic harmful macroalgae *Ostreopsis* sp. in the pools of Tyre vermetid reefs

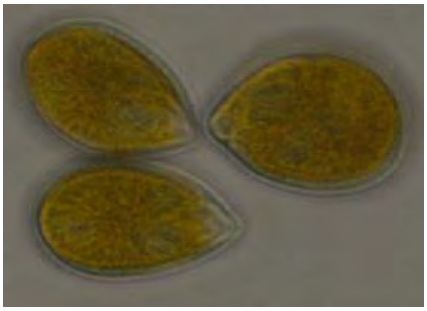


Figure 26. *Ostreopsis* sp. under microscope © Marie-Abboud AbiSaab

42. Non-Indigenous Species: TCNR waters, as the entire Lebanese waters, have not been spared the impact of non-indigenous marine species (e.g. especially from the Indo-Pacific). It is worth noting that marine non-indigenous species, , have significant effects on the environment (biodiversity loss, habitat modifications, and alterations in community structure), economy, and human health. TCNR waters are mainly affected by the Ochrophytatoxic laminar brown algae *Stypopodiumshimperi(Figure 31), fishes (e.g. the invasive toxic Silver-cheeked toadfish *Lagocephalussceleratus, Figure 28), Cnidaria (e.g., the white stinger *Macrorhynchiaphilippina, the nomad jellyfish *Rhopilemanomadica, Figure 31), Ctenophora the warty comb jelly *Mnemiopsisleidyi, Echinodermata (e.g. the lessepsian invasive porcupine sea urchin *Diademasetosum(Figure 32) that should be urgently monitored and evaluate its impacts), and Mollusca (e.g., the lessepsian invasive mussels *Brachidontespharaonis(Figure 29) that may affect the Dendropomaanguliferum (as the main reef builders) recruits. Furthermore, new records of NIS are still reported in Tyre waters, such as the Indo-Pacific jellyfish Cotylorhizaerythraea(Badreddine & Bitar, 2020).It is worth noting that the seawater temperature rise is often associated with a continuous income of invasive species from the Suez Channel.

Figure 28. The toxic **Logocephalus sceleratus* stranded on the sandy beach of TCNR

Figure 30. The two invasive NIS toxic Macroalgae *Stypopodium sgimperi* and *Galaxaura rugosa* in the tidal pool of TCNR vermetid reef

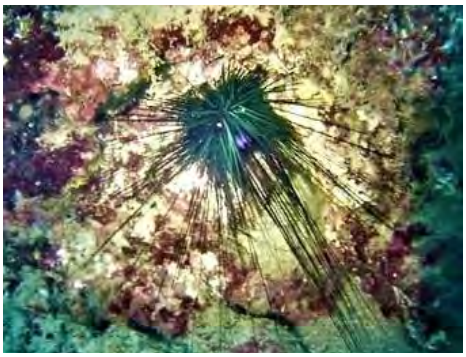


Figure 31. The NIS *Diadema setosum* in the infralittoral zone

Figure 29. The invasion of Brachidontes pharaonis of the vermetid reefs of TCNR

Figure 32. The invasion of the NIS *Rhopilema nomadica*

Oil spill affects key marine ecosystems and associated fauna and flora (Figure 33). Notably the oil spill of 2006 and the oil spill of 2021 from Israeli waters, have hit the Lebanese coast and formed tars in many areas of the TCNR.

Figure 33. The effect of oil spill 2021 on the sandy beach and associated biodiversity (Marine turtles) of TCNR

Potential future threats and environmental disturbance could also originate from offshore exploration and production activities, particularly within Block 10 that faces TCNR, but also surrounding blocks due to generation of underwater noise as well as being additional sources of possible spills.

5.2.4 Terrestrial ecosystems and associated biodiversity

43. TCNR is characterized by a mosaic of terrestrial ecosystems regrouping a fauna and flora with special interestsRamadan-Jaradi et al., 2004) (Table 9). Accordingly, TCNR comprises:

5.2.4.1 Sand dune ecosystems

TCNR is characterized by the presence of sand dunes (Figure 34) within its conservation zone. According to Corine classification, the dune formation of TCNR lies under “Sand dunes of the Mediterranean Coast” type and belongs to “White Sand dunes of the Mediterranean”. It is worth noting that natural sand dunes protect the beaches from erosion, coastal flooding and stormsdamages (mainly during winter and heavy rain season). In addition, they provide shelter from the wind and sea spray. Sand dunes also provide a future supply of sand to maintain the beach.

Figure 34. Sand dunes within the conservation zone of TCNR

The marram grass *Ammophilia arenaria* forms a habitat dominated by the prickly parsnip Echinophora spinosa, the sea holly *Eryngium maritimum*, the sea spurge *Euphorbia paralias*, and flowers *Cutandia maritime*, *Medicago marina*, and *Anthemis maritima*.

However, the main threats on this ecosystem are more related with the high tourism pressures, especially during summer, where beach visitors are trampling on these dunes and collects some plants and flowers, without understanding their importance. Fires that accidentally/ or intentionally occur (some local communities are burning garbages around this area), especially during summer, are also another threat to this ecosystem.

5.2.4.2 Fresh water ecosystems

The Ras-Al-Ain springs, present in the agricultural zone of TCNR, are natural artesian freshwaters springs (Figure 35). The fraction that is not used for domestic purposes flows out to the sea, creating a unique freshwater-marine ecosystem, formed by Ras-Al Ain wetlands as streams and marshes are located only a few meters from the sea. The high water table on the site creates freshwater ponds on the beach, which have a significant cover of reeds and are resting sites for several bird species.

Figure 35. Artifical ponds within the Agricultural zone of TCNR

5.2.4.3 Agricultural land

44. The agricultural land (Figure 36) is located near the Ras Al Ain springs. It is being utilized by local farmers as a source of livelihood.

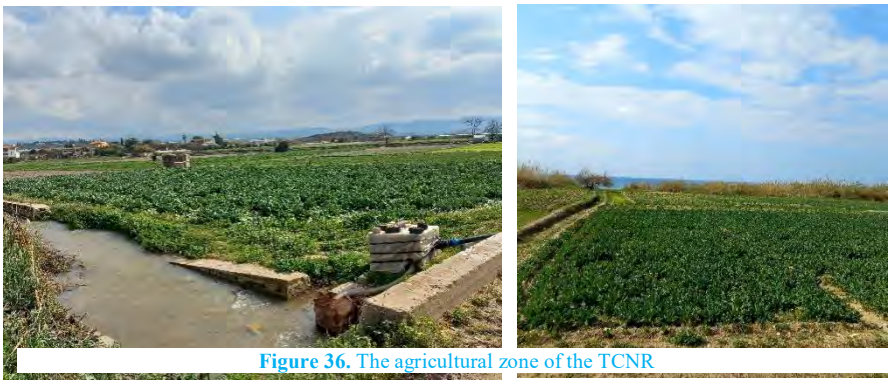


Figure 36. The agricultural zone of the TCNR

5.2.4.4 Terrestrial fauna and flora within the TCNR

5.2.4.4.1 Flora

TCNR regroup 275 plant species belonging to 50 families (Annex 5) associated with the different habitats: sandy shores, sand dunes, freshwaters, Ras-Al-Ain wetlands, and Agricultural lands. Accordingly, families represented by Gramineae, Fabaceae, Asteraceae, and Umbellifereae dominate the floristic resources. Among the species known to occur, six plant species are regionally and nationally threatened (e.g., the Egyptian fig tree/ or Gemmayz tree *Ficus sycomorus*, the butterfly orchid *Orchis papilionacea*, the Fan-lipped orchid *Orchis collina*, the Thick duckweed *Lemnagibba*, and the Few-ribbed duckweed *Lemnapaucicostata*), four endemics (e.g. the Beirut milk-vetch *Astragalus berytheus*), ten rare species (e.g. *Ficus sycomorus*). In addition, it is worth noting that some plant species have economic importance (e.g., *Hyparrheniahirta*, *Hordeum bulbosum*, used as fooder) and medical values (e.g., *Arundo donax*).

5.2.4.4.2 Terrestrial Mammals

TCNR is a habitat for 13 terrestrials'mammals' species belonging to 8 families (Annex 6). Among the species known to occur:

 Two species considered flying mammals (e.g., pipistrelle *Pipistrellus pipistrellus*, and the Mediterranean horseshoe bat *Rhinolophus Euryale judaicus*), considered as threatened at both global and regional level.

 The transcausian badger *Meles melescanescens*, the Ocellated skink *Chalcides ocellatus ocellatus*, and the Arabian spiny mouse *Acomyxdimidiatus* are considered globally threatened and susceptible to Lebanon.

 The red fox Vulpusvulpuspalestina, as an endemic species

 The domestic rat (*Rattus rattus*) and mouse (*Mus musculus*) are indicators of organic waste accumulation.

 Freshwaters and wetlands ecosystems within the agricultural zone of TCNR are also characterized by the presence of 14 microalgae species (Annex 12), including five rare species (*Gomphonematrunctatum*, *Merismopediatenuissima*, *Oscillatoria agardhü*, *Paracapsasiderophila*, *Wolleasaccata*), two threatened microalgae *Cymbellaminuta*, *Cymatopleurasolea*, and one introduced species *Hyphomorphaantillarum*. Furthermore, six species of invertebrates (Annex 9), including Gastropoda species *Succinea (Oxyloma) elegans*, *Theodoxusjordani*, *Melanopsispraemorsabuccinoida*, *Physella(physa) acuta* were also identified in association with the freshwaters ecosystems of TCNR. It is worth noting that the group of freshwater and sub-freswater invertebrates deserves special attention, especially at Ras-Al-Ain pomds that includes the wells that curve into the rocks and retain a natural character.

5.2.4.4.3 Amphibians and reptiles

 Minor herpetological work was conducted at TCNR before 1999. However, TCNR hosts seven species of Amphibians (Annex 7), including the two sea turtles (more details paragraph 6.2.2), and six regionally threatened species such as the nile soft-shell Turtle (*Trionuxtriumguis*), the Caspian turtle (*Mauremyscapicarivulata*), the levant water frog (*Pelophylaxbedriagae*), and the green toad (*Bufo viridis*).

 Ten species of reptiles (Annex 7), including eight species regionally threatened (e.g., Shreiber's lizard *Acanthodactylusshreiberi*, Small whipe snake *Coluber rubriceps*, use the freshwaters ecosystems of TCNR.

Moreover, it was noticed that in Tyre itself, there had been a significant decrease in the numbers of the Caspian terrapin *Mauremyscaspica*, which was once a widespread species. Furthermore, two more species of amphibians, the green toad *Bufo viridis* and the tree frog *Hylasavignyi*, have also shown a severe decline in the agricultural area of the reserve. In addition, two deserts species, shreiber's lizard *Acanthodactylusschreiberi* and ocellated skink *Chalcides ocellatus* were recorded inhabiting the sand of warm areas.

5.2.4.4.4 Birds

TCNR regroup 204 species of birds (Annex 8). Among the species known to occur:

 Four globally threatened species: the lesser kestrel *Falco naummani*, the corn crake *Crex crex*, *Phalacrocorax pygmeus*, and the Dalmatian pelican *Pelecanus crispus.*

 Twelve regionally threatened species: *Botaurus stellaris*, *Ciconia ciconia*, *Aythya nyroca*, *Elanus coeruleus*, *Pernis apivous*, *Neophron percnop-terus*, *Gyps fulcus*, *Accipiter brevipes*, *Aquila pomarina*, *Falco cherrug*, *Falco biarmicus*, and *Gallinago media*.

 Eight wholly partially restricted species in the Middle East: *Larus hemprichii*, *Glareolanord-manni*, *Pycnonotusxanthophygos*, *Iraniagutturalis*, *Hippolaislanguida, Sylvia mystacea* and *Serinussyriacus*.

5.2.4.4.5 Insects and butterflies

The insects and butterflies associated with TCNR have never been studied before. However, it has been identified (Annex 10 and Annex 11):

 25 species of insects, belonging to four families including eleven rare species (e.g. as *Pimelia sp.ChilicorusbipustulatusCoccinellaseptumpunctata*).

 32 butterflies, belonging to 5 families.

It is worth noting that the sandy shore and sand dunes of TCNR are also characterized by the presence of skeletons of marine benthic foraminifera, resulting in very light sand with an admixture of tiny gastropod shells and parts of skeletons and spines of echinoderms.Foraminfera species within the TCNR should be monitored and studied in the future.

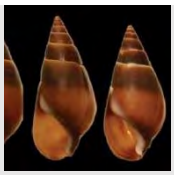
Table 9Some terrestrial fauna and flora with special interest associated with the TCNR

Species	Habitat	Ecology	Particular interest
Ficus sycomorus (Egyptian Fig Tree, Gemmayz tree 	Native to Africa of the Sahel and north of the Tropic of Capricorn. It also grows naturally in Lebanon, where the famous Gemmayzeh street is named after its Arabic name Gemmayz.	It requires considerable space as it is large, spreading, and very shady.	The leaves are used to treat snakebites, and aundice. Help in dune fixation, soil improvement and water retention. Effective for chest diseases, colds, and dysentery. Widely valued for spiritual and scared properties. It is rare and endangered.
Pancratium maritimum(Sea Daffodil, Sea Lily, Sand Lily) © Magda Abou Dagher 	Mediterranean Basin	Habitat for a hawk-moth named *Agrius convolvuli*. Sunny position and well drained Sandy oil	Rare and threatened Used for medical purposes as antifeedant, emetic, hypostensive, pugative. Used as Pesticide
Astragalus berytheus (Beirut Milk-vetch). © Magda Abou Dagher	Endemic to the Levantine Sea	Indicator of ecosystem health	Used for ornamentation and to preserve biodiversity

 *Alceasetosa palmate* (Bristly hollyhock)	Mediterranean Basin	Need rain and insects for reproduction	Treat injuries, burn, cough, and inflammation The flower buds can be used as medicine for sicknesses in the airways
 *Crithmummaritimum* (Rock samphire)	Mediterranean Basin- North Africa, Canary Island	Tolerate salinity Pebble and sands Rock types from chalk and limestone to granite	Rich in vitamin C Used as Aromatic pickle Digestive remedy The leave can be used to lose weight/ nad for kidney complaints and sluggishness Treatened species
 *Glaucium flavum* (sea poppy)	Native to north Africa Temperate zones	Like extreme high tide event	Bronchodilator and anti-inflammatory Medical purpose as antitussive Can have second effect such as hallucegenic
 *Trionyxtriunguis* (Nile soft-shell turtle) ©Ali BADREDDINE 	Endemic to the Levantine Sea	Tolerate salt water It has been found in the sea bottom in Tyre area sea water (Pers.comm.YoussefJundi)	Critically endangered in the IUCN Red List (1996-2000)

Meles melescanescens(Transcaucasian Badger) © SeaLife 	Europe Asia (Middle-east)	Feed with birds, insects, rats, fish Rarely drink Badgers are very fussy over the cleanliness of their burrow	Conflict with human Dig up and eat bulbs and other crops
Acomyxdimidiatus(Arabian Spiny Mouse) ©Klaus Rudoff 	Africa Middle eastern deserts	Spiny fur provides this tiny mouse with some form of protection against predators.	Nationally susceptible In Lebanon
Vulpusvulpus palestina (Red Fox) ©Mounir Abi Said 	Various habitat from sea level to 2000 m, and very abundant in Lebanon (especially in Shouf Nature reserve).	Habitats mainly forests, bushy areas, open areas and valleys	Significant impact on the biodiversity and the ecosystem of the reserve
Vormelaperegusnasyriaca(Marbled Polecat) ©WikiSPECIES 	It is first reported in Tyre by Tohmé&Tohmé (1999).	Eat squirrels' rats Shy and elusive	Regionally threatened
Acanthodactylusschreiberisyriacus(Fringe-toed lizard) ©RyadSadek 	Endemic to the Levantine Sea	Valuable for pest control	Threatened
Chalcides ocellatus ocellatusrs. (Ocellated Skink)	Mediterranean Sea North Africa	Land and gravel deserts	Valuable for pest control Regionally treatened

©RyadSadek  *Falco naumammi*(Lesser Kestrel) © Wildlife	Meditteranean	Surveys of lesser kestrels wintering January 2007	Threatened globally
 *Crex crex*(Corn Crake) ©Birdingplaces	Europe and central Asia	Hidden by vegetation	Threatened globally
 *Pycnonotusxanthopygos*(White-spectacled Bulbul or Yellow-vented Bulbul ©FinanHeritage	Central and southern Turkey to the Levant and Western, Central and Southern Arabia.	Lives in fruits plantations, gardens, cities and other places. Eats fruits also seeds and invertebrates	Threatened regionally
 *Platycnemis dealbata Sélys*(Damsly Ivory Feather-Leg) ©IUCN	Meditteranean, And African	Running waters Similar to dragonfly	Bioindicators for good freshwater quality
 *Melanopsispraemorsabuccinoida*(Fresh water Snail) ©AnimalBase	Mediterranea Region	Freshwaters	Sensitive against organic pollution

			
Cocconeisplacentula(Diatom)	Medyterranean region	Freshwaters Very common also in benthic habitat	Sensitive species. It is tolerant for a moderate organic poulltion

5.3 Threats related to the terrestrial ecosystems

Freshwaters ecosystems and associated biodiversity are mainly under pressure from agricultural activities (especially related to the use of herbicides and pesticides), deterioration of water quality (organic pollution), destruction of habitat (meadows), crop production, and domestic pollution represented by solid waste (especially plastic/ bottle caps), and from farmers' activities such as livehood (grazing, beekeeping or apiculture).

5.4 Summary of identified threats on the marine and terrestrial biodiversity of TCNR

TCNR marine and terrestrial habitats are under high human pressures. Anthropogenic activities, mainly represented by overexploitation of natural resources, overfishing, using illegal methods of fishing and agriculture activities, domestic pollution (including solid waste and plastics, mainly marine litter), high human pressures, especially during summer, are the most threats affected the biodiversity of the reserve, and causing the degradation of its ecosystems. However, the main causes of those threats can be more related to the users' lack of knowledge and interest in the importance of the reserve natural resources. In addition, it can also be attributed to the lack of awareness and education activities. Furthermore, the lack of law enforcement and studies attributed to this topic increase the impacts.Table 10 provides an analysis of the human threats on the marine and terrestrial habitats and biodiversity.

Table 10: Analysis of human threats on the main important marine and terrestrial habitat

Priority target resources	Priority threats	Priority causes	Priority impacts	Behaviors causing impacts	Stakeholders causing impacts	Objective (Ideal future state) In the next 5 years
	Light and noise disturbance	Lack of interest	Increase in the dead marine turtles	Beach kiosks and beach resorts (party, wedding, noise disturbance), especially during summer.	Owners of beach kioks	80 % of the local communities will know the importance of the protection and conservation of marine turtles. The conservation zone within the TCNR will be well
		Lack of knowledge	Loss of nesting habitats		Owners of beach resorts	
		Lack of awareness and	Decrease in number of sea turtles' nests			

Sea turtles	Solid wastes (e.g. plastic bags, and bottles) Illegal Fishing activities Sea turtles nest destruction Loss of fishing nets Maritime traffic	educative practices Lack of law enforcement Lack of sustainable sea turtles monitoring program Lack of patrolling Lack in the interaction with fishermen and local community Lack of application of law and regulations No demarcating zones, especially the conservation zone No signage	Increase of dead sea turtles' hatchlings Desequilibre in the marine ecosystems Increase in the number of jellyfish (especially the invasive nomade **Rhopilemanomadica*)	Beach visitors (local communities, tourists) by trampling, camping fire Fishers (fishing activities during night)	Local communities and visitors, especially during summer Fishers	demarcated and protected. 50% of local communities (especially fish, and volunteers) will be engaged in the marine turtles monitoring program 20 % of the marine turtle's population within TCNR will be tagged. 70 % of the population of marine turtles, including the marine turtle's nests, will be monitored protected and conserved. A sea turtles rescue center will be developed and established Most of the action proposed in the Action Plan of Marine turtles will be taken into consideration
Cymodocea nodosa seagrass *Cystoseira*species Vermetid reefs Rhodoliths/ Maërl beds Coralligenous assemblages	Anchoring coming from ship vessels and recreational boats Snorkelling and scuba diving, especially during summer Collecting *Cymodocea nodosa*, and Rhodoliths an *Cystoseira*species	Lack of interest and knowledge Lack of law enforcement Lack of data and mapping and monitoring Lack of expertize	Destruction of *Cymdocea nodosa* area Loss of *Cymodocea nodosa* habitat Loss of biodiversity (especially fish, Echinodermata) associated to the *Cymodocea nodosa* habitats Loss of *Dendropomaanguliferum*, as the main reef builder Lack of communication and coordination with fishermen and Universities and Research centers	Fishermen using their boat Beach visitors (especially local community and tourists) using their boat for recreation purpose Local communities trampling on	Local communities and visitors, especially during summer Fishers	60 % of the local communities (including fishermen) will know the importance of Vermetid reefs, Coralligenousasembl ages, Rhodoliths/ Maërl beds *Cystoseira*forests, and *Cymodocea nodosa* habitat Vermetid reefs, Coralligenous 0asemblages,*Cymodo cea nodosa*,*Cystoseira*sp

	Trampling on the vermetid reefs	Lack of patrolling Lack of awareness and education		the vermetid reefs		ecies, and Rhodoliths/ Maërl beds habitat will be mapped within the TCNR Vermetid reefs, Coralligenousasembl ages,*Cymodoceanod osa* ,and Rhodoliths/ Maërl beds habitat will be regularly monitored and evaluated
Fish species	Overfishing Illegal fishing methods	Lack of law enforcement and regulation Lack of monitoring and data related with fish assessment Lack of interaction with the fishers Lack of awareness and education	Decrease on the juveniles of species with special interest (e.g. groupers, and seabreams) Desequilibre on the fish stock assessment Increase in the number of Non-Indigenous Species Loss of fish habitat (Cystoseiraforests, CoralligenousasemblagesCoralligenous assemblages, *Cymodoceanodosa*)	Fishers that use illegal pratices such blast, poison, Lampara, spearfishing by scuba diving with a compressor)	Fishers Restaurants Local communities	Sustainable fishing activities will be well established within the TCNR The marine zone within TCNR will be well demarcating A good interaction with local fishers The law and regualtions allowing good fishing practices will be applied
Birds Sand dunes and associated biodiversity especially flora and fauna Freshwaters ecosystems, and associated biodiversity	Hunting Habitat destruction Habitats destruction especially fire Agricultural activities (Use of pesticides and herbicides) Solid wastes (especially plastic nags/ and bottles) coming from the farmers	Lack of knowledge and expertise and interest Lack of controls of the farmer's activities Lack of awareness and education Lack of environmental solutions	Decrease in number and species of birds Destruction of the habitat Loss of main biodiversity associated, especially plant with specisl interests Loss of important fauna associated Loss of nursery area for endemic species	Local communities from Rachidiyeh camp hunting important species, and overexploited the natural resources of the TCNR Farmers using non-environmental practices	Farmers Local communities of Rachidiyeh camp	Sand dunes and Freshwaters ecosystems will be monitored, protect, and conserved An update list of birds, fauna and flora species associated with sand dunes and freshwater ecosystems will be established Farmers will use environmental practices and will nknow the importance of the ecosystems

	Wildlife disturbance	Lack of law enforcement	
		Overexploitation of water resources	

6 Socio-economic Features

6.1 Demographic and Socio-EconomicContext

TCNR is located in Tyre, one of the most densely populated coastal cities in Lebanon with a national population density estimated in 2020 at 667 persons/km^2. The population of Tyre and its urban agglomeration was estimated at 135,204 residents (Nahnoo, 2019). This population is projected to increase by 48% in 2030 to reach 174,000 residents: 52,000 in Tyre city and 122,000 in the suburbs (DAR, IAURIF, 2005).

There are no residential settlements within TCNR, except for the Palestinian Rachidiyeh camp that is located between the conservation and agriculture zone, diving the reserve into two segments. According to UN-Habitat Lebanon 2017 report, the Rachidiyehcamp accommodates around 31,500 registered refugees. The main economic activity of residentsis seasonal work in agriculture, fishing and construction. Mainproblems include major need for shelter rehabilitation,lack of employment opportunities, and the absence ofa sewerage system (UN-Habitat, 2016).

Illiteracy rates in the district of Tyre are relatively high with 17% compared to the national level of 13%, with women representing higher rates reaching 23% (compared to 17% nationally). Additionally, around 7% of the Tyredistrict population have university degrees, and a total of 80,680 schoolstudents with half in private schools. South Lebanon governorate is still the second poorest governorate in Lebanon with 42% occurrence of overall poverty (IUCN-ADR, 2017).

The employingsectors are agriculture, construction, and services industries – often unskilled labor for little income andlow income security (UN Habitat, 2017). Nearly three years(3) into the crisis and with the current economic andpolitical instability in Lebanon, the situation got worse. The devaluation of the Lebanese currency made the price of basic commodities and the input costs in the different sectors sky-high. This not only affected the purchasing power of people, but also the continuity of businesses which ended up laying off manyworkers/employees, increasing with that the unemployment rate and natural resources as primary sources of food and needs (subsistence fishing, farming and grazing, etc.) (Figure 37).

6.2 Land-Use and Infrastructure

It is important to give an overview of the current land-use and infrastructure facilities that exist around TCNR given its location on the coast of Tyre near very populated areas. In fact, it will allow to assess the anthropogenic threats that surround the reserve and the infrastructure that exist.

6.2.1 Solid Waste Management Facilities

Thesolid waste sorting and composting plant of Ain Baal is not adequately equipped to deal with thedistrict's needs, which necessitated the continuous dumping in the Ras El Ain landfill site, as well asin other random dumpsites in and around the City. The dumping of solid waste in Ras El Ain and Rachidiyeh Camp is often practiced in an illegal and unregulated way without sanitary infrastructure measures for landfills. The lack of solid waste management facilities is negatively impacting the natural resources in TCNR including soil, groundwater and water (marine and freshwater), which in return is threatening the habitats and associated fauna and flora species.

6.2.2 Waste Water Facilities

The lack of funding and sound strategies addressing wastewater, is a major factor hampering the development of a strong wastewater infrastructure and management system in Tyre. In fact, wastewater is continuously discharged in the old city near the fishing port, affecting negatively the population in terms of health, aswell as two of the key income generating sectors: agriculture, tourism and fishing. Additionally, the Rachidiyeh Camp located in TCNR also lacks wastewater treatment facility and is not connected to any network, thus, wastewater is directly discharged into the sea causing serious health hazards, not only on the camp residents, but affecting the city as a whole, and the marine habitat and biodiversity (UNRWA 2011). Also, currently the wastewater system in Tyre serves as storm water drainage, especially during the heavy rainfall season causing coastal flooding.

6.2.3 Roads and Transportation

There is currently an existing under-maintained andoverburdened network of regional and local roads, which provides basic connections between Tyreand its neighborhoods. Tyre's low-quality/informal public transportation system lacks organizationand structure, and does not provide a reasonable alternative to private cars, restricting its use to onlya few passengers who have no other choice. Soft mobility is not catered for in the city, yet Tyre hasboth a favourable small size and flat terrain for this type of practice. Facilitated pedestrian routesand cycling would help, yet they are not well maintained or present in case of the latter. As for TCNR, it is located on the main coastal route of Tyre which allows visitors from other areas or regions to easily reach it. However, the major drawback in terms of infrastructure would be the lack of well-engineered and prepared parking space for tourists using their cars to visit TCNR. Currently, the parking lot managed by the Municipality of Tyre during the summer season is created on the sand dunes of the touristic zone of the reserve leading to the degradation and rifting of the land, resulting in a sort of wetland or pond ecosystem during the winter season.

6.3 Electricity

The city of Tyreas most of the cities in Lebanon secure their electricity supply from thermal power plants. The latter operate at high costs using conventional fuels such as diesel. Additionally, the Tyre urban area experiences electricity rationingand reliance on back-up private generators (SPA/RAC–UN Environment/MAP, 2020). In fact, during the

summer season, the kiosks in the touristic zone rely on diesel generators for electricity to operate (incl. fridge and electronics utensils, etc.). This applies for the conservation zone and the visitor center and museum.

6.4 Economic Sectors

The location of TCNR in the center of one of the most populated Lebanese coastal cities and the different ecosystems within the reserve presented opportunities for different social and economic activities to take place. Many of the resources or services that the reserve offers in a direct or indirect way to the local community are essential for the socio-economic development of the city. Moreover, the reserve's strategic location on the Mediterranean Sea and its different habitats allowed to host a diversity of marine and terrestrial habitats and species that use the reserve as feeding, nesting and resting grounds. This ecological feature of TCNR has given the reserve international recognitions and attracted the attention of many international NGOs, researchers, students and eco-lovers. gives an illustration of TCNR zones (touristic, conservation, agriculture and marine) and the socio-economic benefits from each zone; whereas, the next sub-sections briefly give an overview of the socio-economic activities and land-use importance of the reserve.

Figure 37. Socio-Economic Activities Offered by the 4 Zones of TCNR. Icons represent different types of activities offered by the different marine (bottom-right), touristic (bottom-left), agriculture (top-right), conservation (top-middle) zones, as well as the external sectors that benefit from the reserve (top-left)

6.4.1 Fishing Activities

TCNR falls in proximity to the main fishing port of Tyre city. The Tyre fishing harbor is the second largest in the southern coast of Lebanon after the harbor of Sidon. Fishing in Tyre has been an old profession practiced throughout the generations. For the past three years, there were around 243 fishing vessels registered with the MoA, but there are around 576 fishers in Tyre that practice fishing either as source of subsistence food or as a source of income generation (Majdalani, 2005). The average fishing days per year per fishermen is around 200 days per year. In Tyre, and there is no central fish market where fishermen can sell their catch, therefore they sell them directly to fishmongers causing financial disparities. It is important to note that currently with the economic crisis, the fishermen are earning in Lebanese Pounds and we can assume that despite the devaluation of the Lebanese Lira, the majority of the fisheries households spend more than what they earn with household debts amounting to USD 3,008.

Blast fishing and illegal fishing are still occurring in Tyre regardless of the efforts put by the Municipality and the Ministry of Agriculture to stop them. Based on our interview with the fishers syndicate in Tyre, fishing is practiced illegally within TCNR. There is a patrolling boat to prohibit fishing within the reserve however it only operates on specific schedules, therefore the fishers wait for it to finish patrolling to head to the sea and practice fishing within the marine boundaries of the reserve. The increasing number of fisherspracticing illegal fishing is putting pressure on the fish stocks in the area. Bureaucracy and political clashes play a big role in this region leading to the lack of control and proper law enforcement (SPA/RAC-UN Environment/MAP, 2020).

6.4.2 Agriculture and Grazing Activities

The Tyre District is considered one of the largest and most fertile coastal plains in the country and accounts for about 20% of employment in the District in comparison to 8% in Lebanon (CCA Coalition, 2019).

The TCNR agricultural zone is very fertile and has been cultivated since the Roman times. This zone extends over 170 hectares along the coastline, and is worked by both Lebanese and Palestinian famers mainly, and by Syrians. The agricultural lands of Ras Al Ain are considered as a source of livelihood for many families. The main production of these lands is open fields seasonal crops cultivation, mainly fodder culture and vegetable or legume culture such as tobacco, wheat, corn, and vegetables (tomatoes, cucumbers, lettuce, cabbages, eggplants, etc.). Citric and banana cultivation are not allowed within the agricultural lands annexed to TCNR. The farmers are divided equally between Lebanese and Palestinians. A limited percentage of livestock farming takes place, with 506 mainly small-scale farms functioning. Organic farming has also been initiated in the area (CRI, Debs, ECODIT & IAURIF, 2015). Most farmers sell their produce at the Tyre and/or Saida fruits and vegetable wholesale market, which in turn sells the produce to retails (supermarkets/mini markets, and restaurants) and consumers.

The Ras El Ain farmers use extensive and uncontrolled fertilizers and pesticides that negatively affect groundwater and marine water resources, and in return he whole food chain within the site causing a change in the water quality

and leading to habitat and biodiversity loss. The Litani Water Authority is authorized to manage the water in Ras el Ain for irrigation. The Litany Water Authority is in direct contact with the farmers, as they pay a yearly fee to receive the water. The farmer/reserve relationship is a neutral one. The problem is that the agricultural area of the reserve is being taken over by people - big farmers-who are sub- renting "their land" (reserve property) to smaller farmers. This means that there can be no control over the farming activities in that area unless the TCNR rights, rules and regulations are implemented first and foremost. There is a lack of agricultural advisory services or organized lobbying such as a farmers' union, or logistical/infrastructural support services such as refrigeration warehousing facilities. Also, there are no clear and organized ownership rights, as farmers or agriculture land owners do not pay any fees for the municipality or TCNR for using the lands that are initially not their properties.

6.4.3 Freshwater Supply

The agricultural zone of Ras Al Ain in TCNR has three artesian wells whose walls were built by the Phoenicians, as well as other small springs. The water at the wells rises up to 5 m above the ground level. The three freshwater springs in the agricultural zone which are known under the names of Safsaf spring, Israwi spring and Saydeh spring are the main sources of freshwater supply for irrigation and household consumption. The Israwi spring is managed by the South Lebanon Water Establishment (SLWE), responsible of supplying freshwater for domestic consumption to the city of Tyre and 10 other villages in Tyre. According to the SWLE, there are currently around 4,400 subscribers to the water grid. The supply of freshwater as an ecosystem service offered as part of the reserve has an important socio-economic value. The presence of freshwater enabled the agricultural practice which maintains the livelihood of many farmers and their families. Whereas the freshwater provides the households with water: a basic human need.

The third spring which is the Saydeh spring, it is relatively a small spring that forms a channel through the agricultural lands and drains directly into the sea, forming an estuary like ecosystem (Litani Water Authority, 2020). The freshwater springs of Ras Al Ain feed 1500 liter per second into three striking pools. The off-flow creates small areas of marshland attractive to amphibian and water birds such as ducks, crakes, coots, etc. (SPA/RAC - UNEP, 2012). Some nesting sites of sea turtles can be found in the agricultural zone. The agricultural zone has a walking trail that reaches the artificial fresh water pond in it.

6.4.4 Offshore Oil and Gas

Hydrocarbons, oil and natural gas, found offshore are formed by the remains of ancient marine organisms, such as plants, algae, and bacteria that decay over millions of years and transform into carbon-rich substances known as petroleum; a high valuable end-product (Turgeon & Morse, 2018).

The potential oil and gas reservoirs in Lebanon are located within 3 nautical miles facing the shore of TCNR (Block No.10). The offshore oil and gas extraction is a relatively new topic of discussion in Lebanon since the discovery of

hydrocarbon resources in the Levantine Basin. If such activities are possible in the near future, this will certainly have important economic and social implications for the country. Such activities are expected to boost the economy by creating a source of potentially large revenues, allowing for new investment capabilities and job creation. On the other hand, the oil and gas sector is still in its early stages of development where exploration activities are being conducted. Assessing the potential of this sector on the economy awaits the discovery of commercial fields in the exploration phase (Kanbar, 2015).

Despite the economic advantage of the offshore oil and gas exploitation, this activity has to be implemented with a contingency plan for spill accidents, as such incidents can have detrimental impacts on the marine and coastal biodiversity.Offshore oil and gas activities are also a source of numerous impacts that need to be properly managed to avoid causing significant environmental damage.

6.5 Recreation and tourism

Tyre beach remains one of the few public beaches in Lebanon, which comprise only 20% of the Lebanese shore – with 1068 violations recorded, according to the MoPWT (NAHNOO, 2019). There are many tourism offerings in Tyre, from private beaches (resorts) to public beaches, and each has a different impact on a city such as Tyre.

Furthermore, Tyre's beach is internationally renowned. National Geographic acclaimed it as one of the top 10 Middle Eastern beaches (NAHNOO, 2019). Moreover, Tyre city is the top local destination to be visited until the end of 2021 (Abou Arrage & Ghadban, 2020). In addition, an ecotourism plan based on sea turtles for TCNR has been developed and established in cooperation with the SPA/RAC and MoE in 2020 (SPA/RAC- UNEP/MAP, 2021c) (Figure 38).

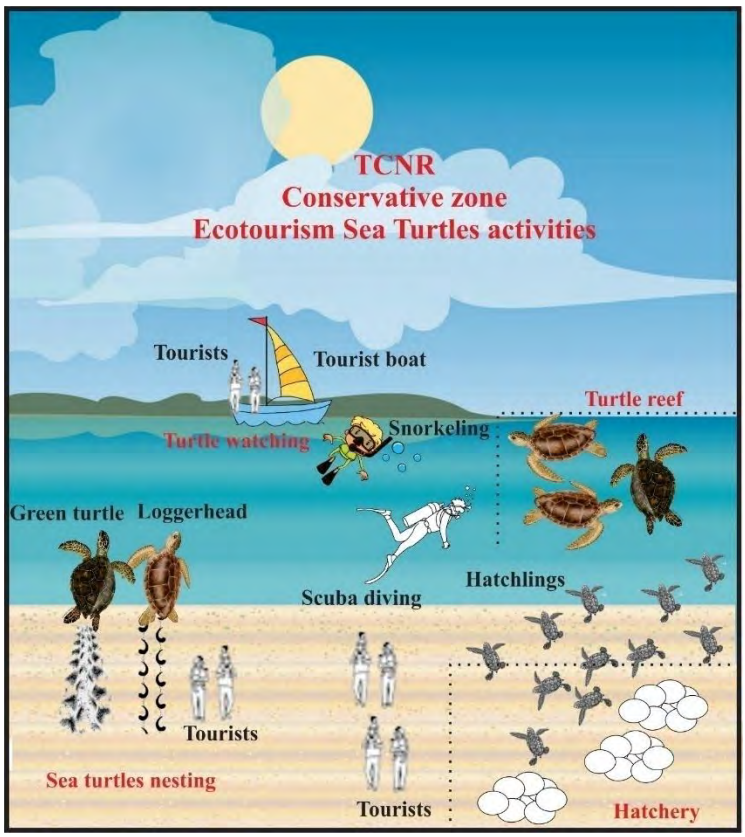


Figure 38. Ecotourism Plan Based on sea turtles for TCNR (SPA/RAC-UNEP/MAP, 2021c)

Tourism is an important economic activity as it represents one of the economic support sources to the environment conservation efforts in protected areas in general. Tourism in the TCNR is divided to two categories: 1- Mass tourism and, 2- Eco-tourism.

1. Mass tourism: Recreational and swimming are the main tourism activities that are taking place in the touristic zone of the TCNR, where a number of jet-ski engines are allowed here, with little control. According to the Tyre Mayor, during the summer season, 20,000 people visit the Tyre public beach on Sundays, around 15,000 visitors on Saturdays, and 10,000 on weekdays. The typical Tyre beach season extends over 18 weeks, with a monthly average of 375,000 people (NAHNOO, 2019). So nearly 1 million visitors use the sandy beach

north of the TCNR, or south of Tyre city yearly, with a concentration in the months of June, July and August, while shoulder seasons are May and September. The Integrated Touristic zone is managed by the municipality of Tyre in close coordination with the TCNR management team. The number of kiosks serving the visitors has been divided by two and decreased from 100 to nearly 50 kiosks, with additional but limited efforts deployed to make them more ecological in an attempt to reduce their impact on the environment. They have been pulled back away from the wave line, and shy initiatives of solid waste recycling activity has been promoted among the kiosks' owners, in addition to that the waste water is pumped away by trucks, but the impact is still considerable on the environment as the noise level and light level by night represent a disturbance to the sea turtle in nesting season,, not to mention the impact of the cars using the parking lot, with noise, CO2 pollution and oil leakage coupled with tires abrasive impact on sandy soil.

In high season, the return to TCNR generated from the parking fee and the kiosks rental fees which is paid back by the municipality is 45% of the total revenues, representing the amount of LBP 147,069,000 in 2019 (NAHNOO – 2019). Nevertheless, very little number of visitors knock the door of the Visitors' center or the turtles' permanent exhibition , which are located at the entrance of the beach access way. (more awareness is needed at this level, towards the mass tourists).

2. Ecotourism: In parallel, the TCNR receives another type of visitors (906 visitors on yearly average based on data provided by the TCNR management team for the period between years 2000 and 2019) ,who seek a more educational approach, in the 2a - scientific zone and 2b - - agricultural zone.

2a - - In the Concervation/ Scientific Zone, the visitor discovers the characteristics of the TCNR sand dunes landscape and its specific flora and fauna, by walking on the modest but sufficient network of trails (2 or 3 trails). The ecotourist learns about beach blond sand dunes and their importance to the ecosystem, the fresh water with reed patches near salty sea water, practices bird watching, turtles watching, marine crabs watch, snails, insects and reptiles' role in the chain. The trails wind through the different surfaces of dunes and reed spots, and offer, in addition to the wooden bridge, views on different marine type landscapes that are rare in Lebanon. The birds' wooden hide is another site that offers the opportunity to watch different coastal types of birds.

2b - - Inthe agricultural Zone, the visitors have the opportunity to discover the cultural heritage sites of Ras el-Aain (historical water sources and mane made ponds and aquaducts from antiquity, with ottoman period water mills) in addition to the fresh water ponds where the ecotourist discovers fresh water flora such as reed, offering shelter to a rich fresh water fauna such as crabs, turtles, fish, and snakes. It was a time when the management team of TCNR used to organize visits to the agriculture fields to discover locally grown water melon and thyme and arrange lunch meals on the wooden esplanade overlooking the fresh water lake, in the shade of the sycamore trees.

Table 11. Matrix of Types of tourists in the TCNR vs number of visitors in the different zones

	Touristic Zone	Conservation/ Scientific Zone	Agriculture Zone

Type of visitors	Recreationists – individuals – families – group of friends	Recreationists - Ecotourists – Researchers – Experiential tourists – individuals – families – group of friends – school groups – organized tours tourists	Recreationists - Ecotourists – Researchers – Experiential tourists – individuals – families – group of friends – school groups – organized tours tourists
Domestic or International market	Domestic (local Lebanese)	Domestic (locals and expatriates) - international	Domestic (locals and expatriates) - international
Number of visitors	Approx. 1Million per year	Approx. 900 per year in both areas together	
Seasonality	Summer	All year with spring and fall as peak seasons	All year
Type fo activity	Recreation – Swimming – Eat and suntanning	Hiking – Bird watching – Animal watch – Scientific or cultural discovery – Participation to conservation activities – snorkelling	Hiking – Bird watching – Animal watch – Scientific and cultural discovery – Participation to conservation activities – snorkelling - farming and agritourism activities – gastronomy – meal on the wooden esplanade - cycling
Current Involvment of local community	High	Very low	Low
Potential activities in combination with TCNR visit	Tyre old town and archeological sites visits	Tyre old town and archeological sites visits – neighboring villages visit – Boat tours with local fishermen	Tyre old town and archeological sites visits – neighboring villages visit – Boat tours with local fishermen

6.5.1 The tourism link between Tyre city and TCNR

Few tourists extend their visit to the TCNR while visiting the city of Tyre (this aspect shoul be studied). In parallel very few, nearly zero, tour operators combine Tyre archeological site or Tyre old city visit or even swimming in the touristic zone, with the TCNR, in an attempt to support the nature reserve and raise awareness among their visitors. In parallel we have to admit that the tourism services are available today in the city (hotels, guesthouses, restaurants), and they can be used by the eco-tourists, which wasn't the case a decade ago. So, there is room to stress on the diversity of the touristic offer and the availability of services while promoting tourism in Tyre region.

1- Diversifying the tourism activity offer:

The EU, ENPI - Mediterranean Experience of Ecotourism (MEET) project, which grouped many protected areas in 12 countries on both sides of the mediterranean sea, focused on the relation with the local community in the process

of ecotourism product development, or in other terms in constructing the ecotourism packages in and around the protected area. The TCNR was a beneficiary of the MEET project along with the leading partner, the Shouf Biosphere Reserve, and other protected areas in Lebanon such as the Jabal Moussa Biosphere Reserve, the Ehden Forest Nature Reserve and the Tannourine Cedars Nature Reserve. Only the Shouf Biosphere Reserve and Jabal Moussa passed the final test to the MEET Network Catalogue, which support the packages of the protected areas in the Mediterranean Sea. In TCNR, the management team with the ecotourism experts worked on diversifiying the ecotourism offer by involving the fishermen in the experiential activities; and different test tours have been operated and included boat tours, fishing methods demonstrations, snorkeling, lunch onboard of the boats or at local houses, breakfasts in the old souqs near the ottoman caravanserail (Khan); efforts has been made to develop activities with the boat builders and the craftsmen (local women associations) and small handicraft souvenirs, but this activity didn't reach any success.

Another activity under MEET project was investigated to be handled by a local micro enterprise from the local community: bicycles rental and tour in the area stretching from the touristic zone and the scientific zone, extending to the old part of the city. But at this level too, no marketing efforts were made and no return on investment was realized with this valuable equipment.

Today the MEET catalogue resumed its marketing activity after COVID19 pandemic, and the opportunity of featuring in it is still present. So, there is a need to rebuild the packages and send them to the MEET Network administration to get tested again and regain trust of the international tour operators, with the help of the Lebanese ecotourism MEET expert and tour operator.

2- Camping site:

Discussions were conducted with the late management team to create an ecological camping site near the touristic zone; some shy studies were presented but never implemented. But this activity, if well managed can add diversity to the ecotourism offer of the TCNR and generate additional income as it would include a slow food unit based on food prepared by the local community and made with local products of the region, and a souvenir shop where locally made handicraft is sold.

3- Decongestion plan:

The main income from ecotourism activity in the TCNR is generated by the "mass" tourism activity located in the touristic zone. With the late management team, there was an idea to reduce the congestion at the touristic zone beach by introducing another type of activities at the beach of the agricultural zone side, but with different approach and activities, targeting reduced numbers of high-end visitors, with highly priced entrance fees but with different ecological services in return and oriented towards culinary and gastronomy tourism based on the locally grown agricultural products. Another idea in this regard was to distribute the influx of visitors to the beach at the Aabbassiyyeh Nature Reserve North of Tyre city. The different parts of the plan were not further explored and were never implemented.

4- Snorkeling trail

A snorkeling trail plan was developed and proposed, under the framework of the MedWestCoast Project and in cooperation with the MoE. However, it has never seen the light, because of lack of planning and marketing and financial resources.

5- Rescue center for turtles

A Sea Turtle Rescue Center is under establishment under the framework of the ongoing project Blue Tyre. This step is highly important from a monitoring, educational, and ecotourism point of view.

6- Accessible tourism

According to the management team, one of the kiosks installed in the touristic zone, on the public beach, was equipped by toilets wheelchair friendly. But the overall approach in the TCNR to the accessibility for different types of invalid people is not up to the standards today.

The Lebanon Mountain Trail Association (LMTA) approached the TCNR lately to introduce an all-terrain wheelchair and create a specific accessible trail for it in the TCNR. It is currently under study as communication has been established between LMTA and TCNR management team to start implementation before spring 2022 season.

6.6 Education and research

TCNR with its ecological value, hosting key marine/ terrestrial habitats, and associated biodiversity, especially fauna and flora with special interest, can be considered a biodiversity hotspot in Lebanon.

Furthermore, TCNR conservation zone also attracts students from different universities and schools. Trips are organized to the conservation zone throughout the year. There are on average 906 visitors to the conservation zone based on the data from year 2000 to 2019 (Pers.Comm. Management Team). The educational activities of school and university students are mainly focusing on bird watching and sea turtle watching. This is supported by the fact that TCNR is an IBA and the sandy beach is wide enough to attract the endangered Green Turtles in addition to Loggerheads (EMC, 2005). In addition, many activities related with the protection and conservation of sea turtles were done with the participation of local communities.

Accordingly, TCNR ecological resources are interest for many national, regional, and international epxerts from many areas:

1. For herpetologist, the sand dune reptile species and the amphibians of the marshes constitute a protected community that is easy for monitoring away from human disturbance.
2. Also, the globally threatened marine turtles visiting the islands for breeding and foraging or its waters for wintering offer better research conditions than in any other sites of the continental disturbed beaches or its sandy beach for nesting activities.

3. For oceanologists, the study of the water quality and marine diversity, biocenoses and habitats, and also threats, and impacts will be made easier within the marine zone of the reserve where monitoring plots can be protected and maintained over the time when zoning of this area takes place.
4. For ornithologists, many waterfowls and waders use the reserve as a stopover- an opportunity to see aquatic and semi-aquatic birds in a freshwater wetland near the sea, where also sea birds are seen passing along the shore.
5. For botanists, the TCNR encompasses many plants, and flowers species with special interest.

In addition, TCNR ecological and natural values (especially, its sandy beach, freshwaters ecosystems, sand dunes, marine waters) attract differents experts dealing with freshwater/ marine phytoplankton, zooplankton, cyanobacteria, microflora, macroflora, macroinvertebrates, meiofauna, and macrofauna.

6.7 Cultural and archeological Sites

The Birak of Ras Al Ain, known also as the ponds of Ras Al Ain, are located in the agricultural and archaeological zone of TCNR. These ponds are artesian wells that date from more than 5000 years, back to the Phoenician era. According to Assyrian texts, Shalmaneser V ordered his soldiers to protect them during the blockade of Tyre in 725 B.C. Throughout the centuries the wells were rebuilt and connected to other channels or aqueducts, providing fresh water for consumption by people and domesticated animals and for irrigation (INMA*et al.*, 2005). The springs are a source of water supply for the city of Tyre and 25 other villages of Jabal Aamel and Tyre District, it is also an important freshwater source for irrigation. In Ras Al Ain there is also a historical water Mill that dates 600 years back which needs restoration and rehabilitation.

The TCNR reserve is located less than 1km away from the UNESCO cultural heritage sites of Tyre characterized by its imposing ruins from the Roman city and the mediaeval construction of the Crusades on the former island, and on the mainland, the necropolis monumental way, the aqueduct and hippodrome (UNESCO, n.d.).

7 TCNR Key Values

Based on the current ecological and socio-economic baseline assessment of TCNR, it prevails that the reserve plays a very important role in Tyre in specific and in the region in general. Accordingly, many features of TCNR are clearly of great conservation importance, both at the local, national level, and in some cases at the regional (Middle East and/or Mediterranean) and international levels. The key values of TCNR revolve around its biodiversity richness, cultural heritage significance and socio-economic importance, as highlighted in the sub-sections below. TCNR is characterized by its ecological, natural, and cultural values.

TCNR, especially its special sandy beach is the last remaining opened MPA free of charge along the Lebanese coast, especially during summer. Accordingly, it provides recreational values and opportunities for swimming, snorkeling, diving, kayaking, and enjoying the presence of beautiful biodiversity (e.g. many shells of Mollusca species, Marine Turtles, birds). In addition, TCNR marine zone is characterized by its shallow waters allowing the good practices of those activities.

7.1 Ecosystems/ biodiversity richness

Tyre coast Nature Reserve provide key ecosystems functions and services, and regroups important values represented by:

1. Large sandy beach with a considerable scenic and recreational value. It is also an important sea turtle nesting site for Mediterranean Loggerhead and the globally endangered Green sea turtles.
2. Streams and marshes located only a few meters from the sea, creating a brackish interface. It plays a significant role in the local community's livelihood, in terms of water resources used by local farmers to irrigate a vast agricultural area.
3. The presence of sand dunes acting as nature-based ecosystem for coastal erosion protection
4. Wetlands as habitat for endemic fauna and flora and resting sites for migratory birds
5. Low water table level and fertile lands enabling the cultivation of a variety of crops
6. The habitat and nursery for high diversity and number of fish species with commercial and economic values
7. The habitat of rare, threatened, and endemic marine species of Macroalgae Fucales, Rhodobiontes/ Rhodolithes, Mollusca, Sharks, and Cetaceans
8. The habitat of vermetid reefs, as an important coastal ecosystem in the Mediterranean Sea
9. The habitat of rare and endangered seagrass meadows species (Cymodocea nodosa)
10. The habitat of endangered Mediterranean marine turtles
11. The habitat of nationally and internationally significant birds
12. The habitat of endemic species of terrestrial mammals, amphibians and reptiles
13. The habitat of threatened, rare and endemic plants, including medicinal, culinary and aromatic plants

7.2 Cultural heritage significance

1. TCNR is located in the city of Tyre.Tyre (Sour in Arabic) is one of the main Lebanese city, situated in the south of Lebanon. It is a World Heritage Site designated by the UNESCO in 1984 and it is particular by its cultural heritage combining many civilizations, and traditions (e.g. Phoenician, Greek, Roman, Persian, Arab, Ottoman).
2. The Roman aqueducts and wells in the agriculture zone represent a historical water resource supply for the entire region of Tyre until today
3. TCNR is a highly desired area for ecotourism and education related to the ecological, natural and cultural values. And the important marine habitats, the rocky coast including the vermetid platforms and the rocky islands, surrounding TCNR.
4. Recreational and touristic landmark for local, regional and international visitors known for its clear blue water and long stretch of sandy beach
5. Submerged archeological ruins nearby TCNR (Al fanar and Al Jamal area) which represent an extension of Tyre old city and an attractive site for divers
6. The old water mill located in the agriculture land, although it is not functional nor well maintained, it still represents what is left of the cultural and traditional old practices in the area

45.

7.3 Socio-Economic Importance

1. The touristic zone promotes direct and indirect jobs creation and help sustain the livelihood of many households especially during the summer season (F&B kiosks, water sports activities providers, cleaners, parking staff, guides, etc.)
2. The location of TCNR in a renowned coastal area famous for its archeological sites and clean blue water attracts many regional and international visitors especially during the summer which boosts the local economy (hotels, B&Bs, local shops, etc.).
3. The richness of the marine fish species nearby the reserve as a result of decreasing illegal fishing activities imposed by the presence of the reserve, is indirectly resulting in the spill-over of fisheries where the abundance of fish species is creating favorable conditions for fishermen to enhance their catch and thus increase their revenues generation
4. The fertile lands are hosting around 170 farmers who depend on crops cultivation and selling for their living
5. Abundant freshwater resources from Ras El Ain springs that supply the city of Tyre and 10 other villages with water, thus offering a basic human need

Beside its ecological, cultural and socio-economic importance, TCNR's ecosystems present indirect benefits and contributions to the local community and national economy that go beyond its abovementioned direct values.

Highlighting the ecosystem services offered by the reserve and their benefits to the society is important for public education and awareness, by soliciting the attention of the local community to cooperate on safeguarding the ecosystems of the reserve, while sensitizing policy and decision-makers. Direct and indirect stakeholders should

comprehend the interrelation between the ecological environment and the economic activities of TCNR. For example, the conservation and protection of sea turtles can render an economic value to the local community through sustainable tourism. This can be translated in increased number of visitors and researchers, locally and internationally visiting the reserve with shared interest of studying or watching sea turtles, not to mention international donors. On the other hand, the rehabilitation and protection of TCNR's sand dunes can consist of a great natural defense solution to flooding and severe storms conditions as a result of climate change impacts. The latter can result in savings to the local community in terms of avoided damaged properties and infrastructure that can reachUSD 1.46 M per year (IUCN-MoE-UNEP-GEF-ECODIT, 2020).

In fact, an economic valuation study,conducted by ECODIT for MoE / IUCN and funded UNEP - GEF2020, have estimated a total economic benefit value of all the ecosystems of TCNR at USD 21.4 M per year. The valued ecosystem services included coastal protection and hazard mitigation, fisheries, recreation and ecotourism, education and research, agricultural productivity, freshwater provision, biodiversity and biological support, medicinal, culinary and ornamental products, cultural and archeological value, waste assimilation, and carbon sequestration and climate regulations, as well as the bequest value which was based on a survey that captured the willingness-to-pay of the local and national people towards the conservation and protection of TCNR regardless of their direct use or benefit from the reserve.

Therefore, the management plan should reflect the key ecosystem services of TCNR by setting clear and achievable short and long-term objectives to protect and conserve the natural resources, habitats and cultural sites of the reserve.

8 Previous TCNR Management Plan (2004) Analysis

The management plan of TCNR was developed in 2004 for five years (2004-2009) and has not been updated since this date. The management plan described the main natural resources and scientific values of Tyre Coast Nature Reserve (TCNR), including its socio-economic values. Furthermore, it provided a detailed analysis of the terrestrial part, presenting the main physical, chemical, and biological factors, including the list of terrestrial ecosystems, fauna, and flora species associated with TCNR. It also presented the main threats, mainly agricultural pressures, that affected TCNR and its associated biodiversity. Finally, based on a stakeholders' analysis, the management plan offered a vision and long-term objectives focused on conserving the terrestrial natural habitats within the TCNR, enhancing the natural and cultural values, and achieving sustainable management of the natural resources. Accordingly, it identified three levels of reviews related to the project achievement, an annual review of the operational objectives proposed in the MP and a five-year review of the long-term objectives. However, the 2004 management plan vision remains vague, including the proposed operational objectives and specific activities. There is a lack of prioritization of the proposed long-term objectives. As a result, it is unclear which long-term objectives and correspondent activities are the most important and contributes to conserving the main values of TCNR or the highest priority, particularly for ecosystems and species.

The most critical gap of the management plan adopted in 2004 isthe absence of the reserve's marine part into the management plan strategy and objectives. In fact, the previous management plan focused only on the coastal and terrestrial components of the reserve, while ignoring the 12 nautical miles which are also a significant part of the marine section. Additionally, there is a weak implementation of specific management components, particularly those related to socio-economic considerations of local communities and sustainable financing options.

It is important to document what has been achieved, partially achieved or not achieved since 2004 from the previously proposed objectives and correspondent projects and activities, in order to effectively address the gaps and needs in the design of the new management plan (Annex 13).

In fact, the previous management plan of TCNR (2004) had proposed 8 operational objectives which included 30 projects and subsequently a number of activities to enable the implementation of these projects. The main objectives that were included consisted of the following:

1. Conserve the faunal and floral biodiversity in Tyre Coast Nature Reserve
2. Reduce threats caused by users
3. Restore and rehabilitate the cultural value of Raas el Ain Area in TCNR
4. Improve the economic livelihood of the local population in and around TCNR
5. Ensure the economic viability of the nature reserve and surrounding area
6. Develop permanent management facilities
7. Raise environmental awareness on the benefits and function of Tyre Coast Nature Reserve

8. Involve stakeholders in the management of Tyre Coast Nature Reserve

Annex 2 provides a review of the previous management plan while indicating the achievements and challenges that haltered the implementation or attainment of proposed objectives.

8.1 Main Achievements of TCNR Previous Management Plan (2004)

The TCNR previous management plan has successfully achieved some of the activities that were proposed to conserve and protect the reserve such as:

1. Reducing impact on carrying capacity of the touristic zone by decreasing the number of kiosks from 100 to 49 with the help of the a Medwest Coast Project with the FFEM Fund and AFD
2. Monitoring the sea turtles' activities (especially during the nesting season)
3. Awareness activities in view of protecting and conserving marine turtles
4. Proposing a snorkeling trail within TCNR waters which is not yet established
5. Removing the invasive plan Heterotheceasubaxillaris from the conservation zone. The species is unfortunately still present in the Conservation Zone
6. Building a visitor center, and a sea turtles museum within the touristic zones
7. Building a wooden bridge within the conservation zone
8. Building capacity of the management team on monitoring and identification of marine habitats and associated biodiversity for instance.
9. Plantating Ficus sycomorus trees around the artificial pond in Ras Al Ain to enrich the biodiversity
10. Retrieving kiosks 110 m away from the shoreline
11. Reduceing light pollution by covering the lights at the kiosks with hay so it does not affect the nesting of sea turtles especially during nighttime (this idea is still also under implementation)
12. Placing around 30 trash bins along the conservation and touristic zone to reduce waste littering

Additionally, projects based on the old management plan proposed activities that are still on-going such as:

1. Demarcation of the conservation zone and development of an energy solor infrastructure
2. Plantation of Gemayz tree within the conservation zone
3. Development and establishment of a sea turtle rescue center
4. Elaboration of a law by the MoE to give the Management team an authorization to deal with financial on passing a law improving the legal status of nature reserves, providing them with Legal/Natural Status, entitling them the ability of ownership of facilities, equipment and tools, and the collection of fees from the public
5. Establishment of a wooden platform passage to facilitate the access for visitors with special needs to the touristic areas (i.e., blind people) which extends from the parking to the sea, as well as a tent with a food menu customized according to their needs

These accomplishments ensured the protection of the habitats and species and reduced the risk of certain species to be threatened, however these activities are not sufficient to guarantee short to long term protection measures in light of the current increasing anthropogenic activities and pressures.

8.2 Main Challenges in implementing TCNR previous management plan (2004)

The challenges that prevented the implementation of the previous management plan and the reach of its objectives of are mainly linked to an overall poor management.

In this regards, the study undertaken by IUCN to enhance management effectiveness of the Marine Protected Areas in Lebanon clearly outlined the key threats affecting TCNR and the main weaknesses of the previous management plan. The use of the Advanced METT tool on TCNR has revealed an overall management score of around 43% which reflects a basic management plan with major deficiencies.

Furthermore, the Ordinary Periodic Review undertaken by SPA/RAC in 2019, under the Barcelona Convention regarding the sites included the SPAMI List (UNEP/MAP, 2019), revealed that TCNR had achieved a low score of 38/60 which is below minimum required score to maintain its SPAMI designation. Therefore, TCNR was moved to a provisional nature reserve under SPAMI for 6 years which highlights the urgent need to update the management plan and take actions to improve its status.

The major gaps that were identified in the previous management plan of TCNR by both IUCN Advanced METT and SPAMI review reports are the following:

1. Lack of financial resources: Currently, financial resources to manage TCNR can only cover the most basic management requirements. During the past years, TCNR managed to secure some funding from the total revenues generated by the Municipality of Tyre from operating the touristic zone during the summer season. In fact, the Municipality is responsible for collecting concession fees from 49 seasonal beach kiosks (mainly selling food & beverage) within the touristic zone of TCNR. The municipality also charges parking fees and obtains fees from the recreational water sports activities (e.g., kayaks renting) offered by some of the providers on the beach. Around 45% of the total revenues collected during the summer season are funding the TCNR management, supporting only 50% of yearly core TCNR staff time. Additionally, TCNR receives financial support from some unsustainable projects, international grants and partnerships projects (e.g., RAC-SPA, ENI CBC MED projects, Italian Universities). The MoE also provides a financial contribution that is available upon submitting a fully documented financial report clearly depicting the financial sheets and previous budget allocations. However, TCNR did not acquire this contribution for seven years (2015-2021) due to a lack of capacity to submit the appropriate accounting and financial reports on time by the TCNR management team. Therefore, the financial resources of TCNR were primary secured through the revenues collected by the Muncipality of Tyre during the summer season, which remain insufficient to cover all the operational and management needs of the reserve.

2. Over-exploitation of the natural resources within the TCNR: TCNR, especially the agricultural zone, remains the last open land for local communities along the Lebanese coast. Currently, around 200 Lebanese, Palestinians, and Syrian farmers use the agricultural zone of TCNR (200 ha), without any control or without paying any contribution fees or taxes. In addition, the refugees of the Rashidieh camp are using the natural resources in TCNR (e.g., land for birds hunting and small-scale grazing activities, and the marine zone, especially for fishing), with limited control exercised by the municipality patrols.

3. Lack of management planning: The TCNR staff headed by the manager are not able to implement the activities mentioned in the management plan due to the lack of financial resources and insufficient number of staff with low capabilities to manage the daily activities within the reserve's zones. Currently, the TCNR team comprises a vice-director, an administrative officer, one cleaner, and three rangers. There has been no director of TCNR since 2021. Many staff positions are still absent such as an accountant, marine science expert, communication & outreach expert, trained rangers, as well as seasonal support crew for tourism control (e.g., beach cleaners, maintenance staff, etc.). Additionally, the current staff has inadequate capabilities mainly due to low educational level and language challenges especially among rangers resulting in a lack of communication between TCNR staff and ability to ensure an effective management. There is currently no capacity-building strategy to regularly enhance the skills of staff and support them with the required competences and tools. Moreover, the lack of management planning can also be related to the MP of 2004 that neither prioritized the activities nor identified the reserve's main values.

4. Lack of enforcement of existing laws and regulations: It is one of the main constraints of the successful management of TCNR. Today, the Municipality of Tyre and Internal Security Forcesare arranging marine patrols to reduce illegal fishing methods, especially from the Rashidieh camp. Additionally, the use of Jet Skis within the TCNR marine zone are prohibited by a Municipal Decision for safety, protection and conservation purposes, especially of sea turtles. However, other regulations are not enforced, such as Article 14 of the Law No.708 which states that any person who violates the rules and regulations identified by the reserve team committee is subject to a penalty ranging between 500.000 LL and 2.000.000 LL., and in cases where the damage is severe then a prison sentence is imposed from one week to a month, whereas in repeated violations the punishment can be doubled. The violation fees will be collected by the reserve's team and used to enhance the management of the reserve.

5. Lack of communication: TCNR is situated in a densely populated area, yet there is a low level of interaction with the local community, which is inconsistent with the need of the reserve, particularly given its location. There is no stakeholder outreach strategy implemented by the management team, as a result many visitors and people from the local community are unaware that the different zones of TCNR are part of a marine protected area. Furthermore, there are no synergies and sharing experience with other nature reserves managers.

6. Lack of research, educational, and awareness activities: The lack of education and outreach initiatives is a major obstacle to the effective management of TCNR. Accordingly, there are no long-term educational and awareness (outside the marine turtles) activities within the TCNR. Moreover, the communication with national experts, national institutes, universities, and research centers on the needs of the TCNR is weak, inhibiting their involvement in the activities programs of the TCNR.

7. Lack of infrastructure and maintenance: currently, the infrastructure of TCNR is limited to a visitor center, a sea turtles' museum within the touristic zone, and the presence of an educational trail, and bird towers within the conservation zone. Also, there is an inactive water mill within the agricultural zone of the TCNR. However, all the structures need major maintenance and rehabilitation work.

8. Lack of commitments and interests: Tourists have no guide signs, especially during the summer season. These guide signs will help inform the public of the reserve's natural resources and values and the environmental and ecological importance of TCNR. The absence of informative signs and clear demarcations are resulting in people trespassing to the conservation zones and other zones which is leading to the destruction or deterioration of habitats (e.g., sea turtles nesting sites).

9. Lack of equipment: The equipment of TCNR is limited to diving gears, snorkeling equipment, a SCUBA safe air compressor for filling diving cylinders, . In addition, TCNR has sea turtle monitoring equipment.

10. Absence of Database: Within TCNR, the data collected from the patrolling, monitoring activities, and training are not registered. There is also no digital or accurate tracking of the number of visitors to the reserve.

8.3 Recommendations to Consider in the New Management Plan

Based on the gaps analysis of the previous management plan, many recommendations have been proposed by the SPAMI and the METT evaluationto improve the management and protection plan of TCNR. Table 12 represents the main recommendations and the actions needed to be integrated in the design of the new management plan.

Table 12. Recommendations for the New Management Plan of TCNR[4]

Recommendations	Actions Needed
Updating and taking ownership of the management plan, while specifying and prioritizing management objectives	1. Define the critical biodiversity assets and key threats affecting TCNR 2. Develop more specific management objectives and set conservation targets and priorities for action 3. Identify and prioritize specific objectives by highlighting fundamental conservation values (beyond sea turtles) of the TCNR 4. Undertake consultation process with APAC and key stakeholders and partners 5. Revise and update the management plan priorities on a yearly basis
Demarcating boundaries	1. **Delineate boundaries of terrestrial and marine zones** 2. **Install adequate signs for the public** 3. Stop enlargement of parking lot which reduces beach area 4. Establish a buffer zone or transition zone to lower impacts on the core areas 5. Develop marine zoning plan including potential multiple-use, no-take, scientific zones, etc.
Strengthening staff capacity	1. Outline the staff needed for the reserve and ensure sustainable funding to recruit and maintain staff 2. Strengthen staff capacity through capacity building trainings, prioritizing the tasks needed on a day-to-day basis by the manager 3. Explore mechanisms to evaluate and enhance the performance of current staff 4. Recruit key expertise, including Conservation Planning, Marine Science, Accounting, and Communication and Outreach and park rangers and guards

[4]Based on the evaluation of TCNR 2004 Management Plan (SPAMI Ordinary Periodic Review (UNEP/MAP, 2019) and the METT Advanced Report

Educational communication and awareness	1. Focus on enhancing the awareness through educational ~~ve~~ activities 2. Invest in building ownership of the community and stakeholder over its management framework, enabling even small grass-root actions 3. Promote open communication and build mutual support and trust between the community and TCNR management through community participation and awareness raising efforts
Business Planning and Sustainable Financing	1. Develop pragmatic business and financing plan for the TCNR 2. Develop Tourism Management Plan with an income generating plan from ecotourism activities, based on diversification of activities 3. Secure the financial contribution of the Ministry of Environment (MoE) by submitting appropriate reports in a timely fashion 4. Define appropriate infringement penalties and authorize staff to enforce them adequately **5.** Develop a comprehensive monitoring plan that includes indicators and thresholds of management and biodiversity components in addition to carrying capacity of the sites

9 SWOT analysis

In order to identify the main challenges that TCNR's terrestrial and marine parts are facing and attempt to map the solutions that would help overcome these challenges, we determined the strengths, weaknesses, opportunities and threats of TCNR by conducting a SWOT analysis as indicated in Table 13.

Table 13.TCNR SWOT Analysis

Strengths	Weaknesses
1. Existing international recognitions (World Heritage Site, SPAMI, Ramsar site, etc.) 2. National commitment to protect TCNR while sustainably growing the local community and helping improve people's living conditions 3. Rich keymarine and terrestrial habitats (e.g., *Sand dunes*, Vermetid reefs, Coralligenous assemblages, Rhodoliths Maerl beds, *Cymodocea nodosa* seagras) 4. Rich endemic biodiversity including nesting and breeding site for globally endangered marine species (e.g., green sea turtles) and a resting and breeding site of migratory birds, and a habitat for plants, mammals, Amphibians, Reptiles, of special interests 5. Archeological ruins in both the terrestrial (agriculture zone) and adjacent marine area of Al Fanar and Al Jamal area (submerged historical ruins)	1. Poor management plan and lack of sustainable financing to enhance protection and enforce rules and regulations within the nature reserve 2. Located in a populated coastal city with poor infrastructure related to wastewater treatment and solid waste treatment facilities 3. Presence of an unregulated settlement camp which divides the reserve 4. There is zoning in the coastal area of the reserve but there is no clear land demarcation between the different zones, in addition there is no demarcation of the borders of the marine area of the reserve consisting of 12 nautical miles 5. High presence of local fishers in Tyre (80% of local Tyre population) 6. Insufficient number of qualified staff to manage the reserve and lack of capacity building for the management team 7. Weak community mobilization and engagement

Opportunities	Threats
1. Continuous international earmarked grants and donations received and research studies reflecting the international importance of the reserve 2. Increased demand for ecotourism on a national and global level 3. Potential self-sustaining income generating activities promoting inter-sectoral cooperation such as selling of certified organic farming and ecotourism (Bed Breakfast or camping site) 4. Create jobs as guides, rangers, eco-guides, as well as small businesses 5. Growing demand for organic products 6. Rich biodiversity and clear marine water 7. Enforced regulations to stop illegal fishing by the MoA 8. National and international awareness programs targeting fishermen to promote sustainable fishing practices and mitigate fishing impact on sea turtles 9. Large marine area (12NM) that can be demarcated into multiple-use zones (e.g., research marine zone, touristic zone, control zone, etc.) 10. Provision of control sites for research and ecological benchmarks against which to measure human-induced change 11. Presence of multiple local recycling companies that can handle	1. Increasing negative environmental impacts caused by solid waste and wastewater direct discharge from the Rashidiehcamp (and from the beach kiosks during summer) to the sea, with no jurisdiction for the reserve to exert 2. Overexploitation of fisheries in waters surrounding the reserve where fishers are bounded to a 6NMstrip from the shore of Tyre city 3. Bird hunting in Ras El Ain 4. Non-Indigenous Species which are affecting the sea biodiversity 5. Light and noise pollution from the touristic zone, and from the neighboor beach resorts, especially during summer 6. Surpassed carrying capacity in the touristic zone during summer season 7. Waste littering in the touristic zone by visitors, especially during summer 8. Conventional farming activities excessively using agriculture chemicals (fertilizers and pesticides) polluting freshwater and

10 Key Challengesand Concerns

10.1 Key Challenges

Based on the gap analysis of the previous management plan and the SPAMI and METT evaluations, we pinpointed different key challenges that TCNR is facing as such:

1. Unsustainable and/or mis-management of financial resources to: (1) sustainably and efficiently operate (e.g., staff resources, equipment and programs acquisitions, etc.)(2) implement activities to enhance the protection and conservation of natural resources and biodiversity, and (3) create services and activities that in return can regenerate substantial revenues for the reserve
2. No visibility of the reserve at a local and national level, mainly due to the absence of engagement and community outreach strategy, which resulted in the majority of the local stakeholders not being aware that the sandy beach is part of a protected area or even that the agriculture area is part of TCNR
3. Absence of clear land demarcation of the reserve's zones that showcases the values of the reserve, the uses of the different zones and their corresponding rules and regulations
4. Lack of trust between the reserve's management team and the local community, where the latter possesses a wrong perception of the reserve as a restricted zone thinking itwill negatively affect people's livelihood
5. Strong presence of political influence, corruption and favoritism impacting the different zones of the reserve and hindering its progress in the implementation of some of its intervention actions and plans
6. Weak governance ownership and capacity of the management team to perform, which poses a critical problem in prioritizing and implementing strategies and actions, as well as ensuring proper communication internally between the team and APAC, and externally with the stakeholders
7. Several conflicts of interests between the reserve and external stakeholders (local community incl. fishermen, farmers, tourists, etc.)5
8. Lack of regulations and laws enforcement from both the reserve's management team and governmental institutions
9. Increasing anthropogenic impacts on the reserve's ecosystems due to the lack of regulations and laws enforcement from both the reserve's management team and governmental institutions, such activities consist of: waste littering, illegal waste dumpsites and discharge of wastewater, illegal hunting of birds (especially in the agriculture zone), excessive use of chemicals (fertilizers and pesticides) in the agriculture zone, over exploitation of fisheries within the marine area of the reserve, poaching and vandalism activities, etc.

[5] Details elaborated in the next sub-section

10. Absence of a management information system i.e. database and/or digitalized management mechanisms, to facilitate the work of the management team, especially with regards to monitoring activities, as well as keeping track of the number of visitors in both the touristic zone and the conservation zone.

10.2 Stakeholders Conflicts of Interests

The location of TCNR in the middle of a populated coastal city and the different social and economic activities that are practiced around and within TCNR, are putting pressure on the reserve's natural ecosystems and are resulting in manyconflicts of interests between the stakeholders and the reserve. In fact, diverse conflicts mainly related to resource allocation may arise in relation to the MPA.

The socio-economic study of the "Coastal and Marine Area of TCNR" done by SPA/RAC in 2020, presents a Driving Forces-Pressures-State-Impacts-Responses (DPSIR) framework for Tyre which represents the existing environmental issues while establishing links between the socio-economic and cultural aspects and the environmental factors as represented in Annex 3. The DPSIR clearly reflects the complexity of interrelation between the different social actors and the existing environmental threats. It showcases how economic sectors and social drivers can impact the environmental and human state. The framework highlights the importance of including an integrated coastal zone management for the city of Tyre where TCNR will have an essential role.

The study also comprises a resource use and management conflict matrix for Tyre where strong conflict of interests between TCNR and stakeholders were highlighted based on key informants' interviews. The major conflicts presented where as such:

1. Fishing sector (artisanal and recreational fishing): TCNR is in strong conflict with the fishers that practice illegal and offseason fishing, dispose garbage (incl. plastics) within the reserve's marine area which is a major threat to marine species (e.g., sea turtles). Fishers on the other hand are in strong conflict with the reserve, as the latter forbids recreational fishing near the sea shore of the reserve and puts restrictions on the artisanal fishing practices within the marine area of the reserve.
2. Tourism services sector: the tourism sector has low to no conflict with the reserve, however the reserve is in strong conflict with visitors that trespass from the touristic to the conservation and agriculture zones and practice illegal camping and littering, with no respect to the habitats and species, resulting in harming nesting sites.
3. Farming activities (Ras El Ain): farmers have a negative perception of TCNR where they are worried that they will have to stop their activities because the reserve might take over their lands. Whereas TCNR opposes the use of farmers for excessive fertilizers and pesticides affecting the reserve's groundwater and seeping into the marine water.
4. Residential Areas (informal settlement-Rashidieh Camp): the reserve is in low conflict with the Rachidiyeh camp due to the haphazard disposal of solid waste and wastewater into the sea and illegal burning of dumped solid waste in the reserve. On the other hand, the Rashidieh camp is in direct

Highlighting these conflicts is essential in designing the new management plan and the need to rationalize the reserve's biodiversity objectives with its sustainable livelihood goals. It will allow to focus on creating cooperative framework and shared-values for the different stakeholders throughout proposed activities that will integrate environmental conservation and protection and social and economic development. Stakeholders will be able to meet their needs while minimizing the threats on the environment. Examples include cooperation between the fishers and tourism sectors, as well as the Ras El Ain farmers and local community through the reserve. Additionally, the management plan will account for the policy recommendations suggested in the SPA/RAC study with the aim to achieve socio-economic sustainability in TCNR. Policy recommendations include the following:

1. Local perception and awareness raising
2. Community engagement and mobilization
3. Fishers' livelihood improvement and fisheries sector development
4. Tourism sector development
5. Inter-sectorial work and engagement while encouraging women's and youth participation in TCNR
6. TCNR governance strengthening and law enforcement

11 New vision and bjectives of the new management plan

The new management plan will take into account the lessons learned from the previous MP including success and failures, the ecological and anthropogenic threats and the current environmental and socio-economic challenges in TCNR and surrounding environment. It will then reflect the key values and potentials of the reserve in the definition of the new vision, objectives and related programmes and activities to ensure:

1. Conservation and sustainable use of natural resources.
2. Sustainable initiation of revenue-generating activities.
3. Social collaboration for efficient operation.

The management plan will determine the management actions, interventions, and financing mechanisms. It will also design monitoring and evaluation protocols and include the acceptable mechanisms for enforcement and compliance. Additionally, the new management plan will look over the marine area of the reserve as a multi-use zone with activities that can boost the national economy and the livelihood of the local community while ensuring the sustainable use and consumption of marine resources and protection of species.

11.1 Vision

Based on the assessment of the natural resources and the threats and challenges associated within the TCNR, the vision for the elaboraltion and development of the new management plan is based on:

1. Define and valorization of the natural resources within TCNR
2. Towards achieving sustainable use of the natural resources, and the monitoring, and protection, and conservation of TCNR marine habitats and associated biodiversity, while creating socio-economic opportunities to support the livehood of the local community in Tyre

Based on the vision, the main mission is defined by Monitoring, Protecting, and Conserving TCNR marine habitats and associated biodiversity, especially species with special interest, while promoting the sustainable use of natural resources, and creating socio-economic opportunities to support the livehood of the social community and prosper the development of the TCNR, and Tyre.

11.2 Objectives

It is important to elaborate the new management plan of TCNR based on realistic, clear and precise formulated objectives that would be articulated to cover specific aspects summarized in Figure 39.

Figure 39. Main Criteria Covered in the MP Objectives

In light of the above baseline assessment and in order to achieve the vision of the future management plan, it is important to formulate specific objectives that will be later detailed into specific activities and actions. The key objectives are based on the themes mentioned in Figure 39, and are as follows:

1. Protect and conserve the marine and terrestrial habitats and associated species especially critical habitats, and threatened species
2. Protect attractive habitats and species on which sustainable tourism can be based (e.g., sea turtles, birds)
3. Protect, restore and rehabilitate cultural and historical sites (water mill, aqueducts)
4. Enhance and restore existing infrastructure and users' facilities in the reserve
5. Create short and long-term activities and services that would engage local stakeholders and generate sustainable income for the reserve
6. Spread awareness and promote conservation measures by enhancing the visibility of the reserve on a local and national level and incorporating the local stakeholders into the reserve's management activities
7. Enforce the rules and regulations within the reserve to reduce and minimize the anthropogenic impacts
8. Implement continuous monitoring, surveying and research studies to track conservation measures in terms of biodiversity protection and conservation
9. Enhance the performance of the management team by increasing the number of specialized staff and offering regular capacity building trainings
10. Implement a centralized database and reporting mechanisms within the reserve
11. Incentivize stakeholders to engage in the reserve's management and protection activities by creating shared-value for the local community including the fishermen, farmers, local shops, lodging facilities, eco-tourism services providers

12. Adopt an integrated management system that promotes blue economy activities e.g. circular economy (i.e., waste recycling, composting, biodegradable materials, use of arts and crafts selling from seashells)
13. Introduce an institutional framework that would enhance the cooperation between the different regulators and decision-makers such as the MoE, MoA, MoD, MoWT, MoT and MoC, while defining and distributing the roles and responsibilities for a successful and sustainable management of TCNR

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13 Annexes

13.1 Annex 1 The stakeholders directly and indirectly involved in the management and services of TCNR

Code	Organizations	Direct User of the MPA	Activities within the MPA	Conflicts/ Constraints	Opportunities for the MPA
			Government		
PP1	Ministry of Environment	Manager of the Nature Reserve	Responsible for the classification and supervision of the environmentally protected areas.	-	Support some activities within the MPA from a financial support
			Supervises the overall management of each Nature reserve		Support the studies within the MPA by engaging national expert
			Appoints the APAC		Support the establishment of some significant infrastructure
			Approve the Management team		Improvement of some law for the good management of the MPA
			Contribute to the financement of the APAC		
			Approve the Management Plan		
PP2	Municipality of Tyre	Yes	Responsible of water supply, sanitation, sewerage, drainage and irrigation, construction, rehabilitation and maintenance of local roads, public transport, waste	Law execution	Enforce the regulation of law

			management, planning in Tyre.	Conflict of interest with the fishermen	Help the MPA in the application of some activities by some regional projects
			Important role in the sustainable development of coastal area and protection of the marine environment	Conflict of interest with the farmers	Financial support
			Pay 50 % of the Management team rate	Conflict of interest with the local community of the Rachidiyeh camp	Capacity building
			Collect incomes from renting the beach kiosks and parking during summer		
			Patrolling to avoid any violation/ or illegal practices within the TCNR		
PP3	Ministry of Agriculture	No	Implementing legislations related to fisheries and fishing activities	Execution of law	Control the fishing methods
			Implement legislation related to the agriculture activities within TCNR	Conflict with the fishermen	Find a balance between the need of the fishermen and the protection and conservation of falg species
				Conflict with the farmer	
					Improvement of law prohibited the utilization of pesticides in the agriculture activities
PP4	Ministry of tourism	No	Regulates and Promotes tourism in Lebanon and ecotourism in protected areas	Conflict with kiosks and beach resorts owners	Promotes ecotourism activities
			Puts standards for service providers (accommodation, restaurants, activities handling		

			businesses, hygiene etc, prices, …) Helps in tourism project development		
PP5	Ministry of culture	No	Protects all archeological and historical sites, including that of Ras el Ain	No problem	Valorization of the cultural and heritage significance of TCNR
PP6	Ministry of Public Works and Transport (MoPWT)	No	46. Responsible for the entire coast 47. Provides permits for construction in public domain 48. 49. Responsible for the budget of rehabilitation activities. Control the implementation of the legislation and rules related to transport and marine public properties	Conflict with local community	Assure the zoning of the marine zones within the TCNR
PP7	Ministry of defense	No		Law execution	Protect and conserve the natural resources of the MPA

			Control and survey and protect natural resources in Tyre water area	Conflict with fishermen	
PP8	Ministry of Interior and Municipalities Lebanon (MoIM)	No			Prohibit illegal practices within the TCNR by respecting the laws proposed by the MoE and the MoA
					Help the municipality to apply the laws and regulations
PP26	Ministry of Energy and Water	Yes	Supervise and Manage the use of the ground water resources in TCNR	Conflict with farmers	Help the Municipality to regulate the irrigation
			Users Groups		
PP9	Farmers	Yes	Use the marine space for fishing and for tourism activities	No interest for environment and ecology	Promote ecotourism as a way to increase revenues and interest in the area.
PP10	Fishermen	Yes			
PP11	Water sports activity	Yes			
PP12	Local communities of Rachidiyeh Camp	Yes	Use the terrestrial space for agriculture	Lack of knowledge of the value of the TCNR	Help in the conservation and protection of the flag species within the TCNR
PP13	Local community of Tyre	Yes			
			Use the coastal space for recreational and tourism activities	No respect of legal practices and regulations	Increase environmental awareness acitivities
				Conflict with the municipality	
			Overexploitation of the natural resources within the TCNR	Conflict with the MoA	Help researchers to increase knowledge and anticipate the pollution
			Groups of interests		
PP14	Kioks owners	Yes	Overexploitation of the touristic zone of TCNR	Lack of environmental interest	Promote ecotourism as a way to increase revenues and interest in the area
PP15	Beach resorts owners	Yes			

PP16	NGOs	Yes			
			Management		
PP17	Management team (TCNR team)	Yes	Day to day management activities in the site under supervision of the APAC.	Lack of expertize Lack of coordination Lack in number and capacities Lack of initiative	Generates income for the reserve from different donors and through income-generating activities Financial support through regional/ or international projects
PP18	APAC	Yes	Prepare the Management plan in coordination with the MoE and concerned stakeholders Coordinate with the involved stakeholders Implement the activities of the Management Plan Administrative finance Supervises the work of the Management team and reports to MoE	Lack of initiative	Promote environmental activities Supervise, and Support the execution of regulations and laws
			Education and scientific community		
PP19 PP20 PP21	Lebanese University Research Centers National expert	No No No	Provides scientific data related with the water quality and sediments and terrestrial/ marine biodiversity.	Lack of coordination and communication with the Managemet team	Provite important scientific data

PP22	Schools (students)	No			Support and encourage the environmental and awreness activities
PP23	Private universities	No	Monitoring the marine and coastal environment	Lack of engagement of the MT in the project	
			Define the main threats on ecosystems and associated biodiversity	Lack of sharing data	
			Provides recommendations for a better protection and conservation of key species associated with the MPA	Lack of financial support for the reserve through proect	
Others					
PP24	International/ Regional organizations	No	Financial support through projects	No conflict	Development of the reserve
PP25	Lebanese Petroleum and Gaz	No			Capacity building
			Develop the reserve infrastructure and equipments		Finacial resources
			Training of the MT		
PP27	Litani River Aytority	Yes	Manage the water in Ras-Al-Ain	No Conflict	Control the water quality
					Assure the good practices and uses of the water

13.2 Annex 2: TCNR law

representative of: the municipal council and the Qaemmaqam (commissioner district) in Tyre (2 members), 2 NGO representatives, one of the Ministry of Agriculture.

Article Seven- In order to establish and manage the reserve, the appropriate finance shall be secured from the ministries and institutions mentioned in Article Four, as well as from the municipality, UNDP and other international agencies concerned with protected areas, donations and various activities.

Article Seven- the reserve will be subject to a reforestation programme based on the guidance of experts in botany, taxonomy and endemic plants in order to conserve the natural flora habitat and its sustainability.

Article Eight- the living organisms including inland and marine animals, birds, fishes, reptiles, etc. shall be proliferated to create a wealthy and sustainable natural environment.

Article Nine- to establish botanical gardens, aquarium and zoos.

Article ten- it is restricted to carry out any action/activity that is not mentioned in the Article three, and which might lead to damages in the reserve. The Committee has the right to assess this damage and persecute legally the responsible for this damage.

Article eleven- it is forbidden to access the parts (sections) of the strictly reserved area except by the management team, scientists, and researchers carrying out scientific studies.

Article twelve- the management team defines the entry and exit points of the reserve as well as the procedures adopted for the management of the reserve according to the requirements of the different parts (sections) mentioned in Article three.

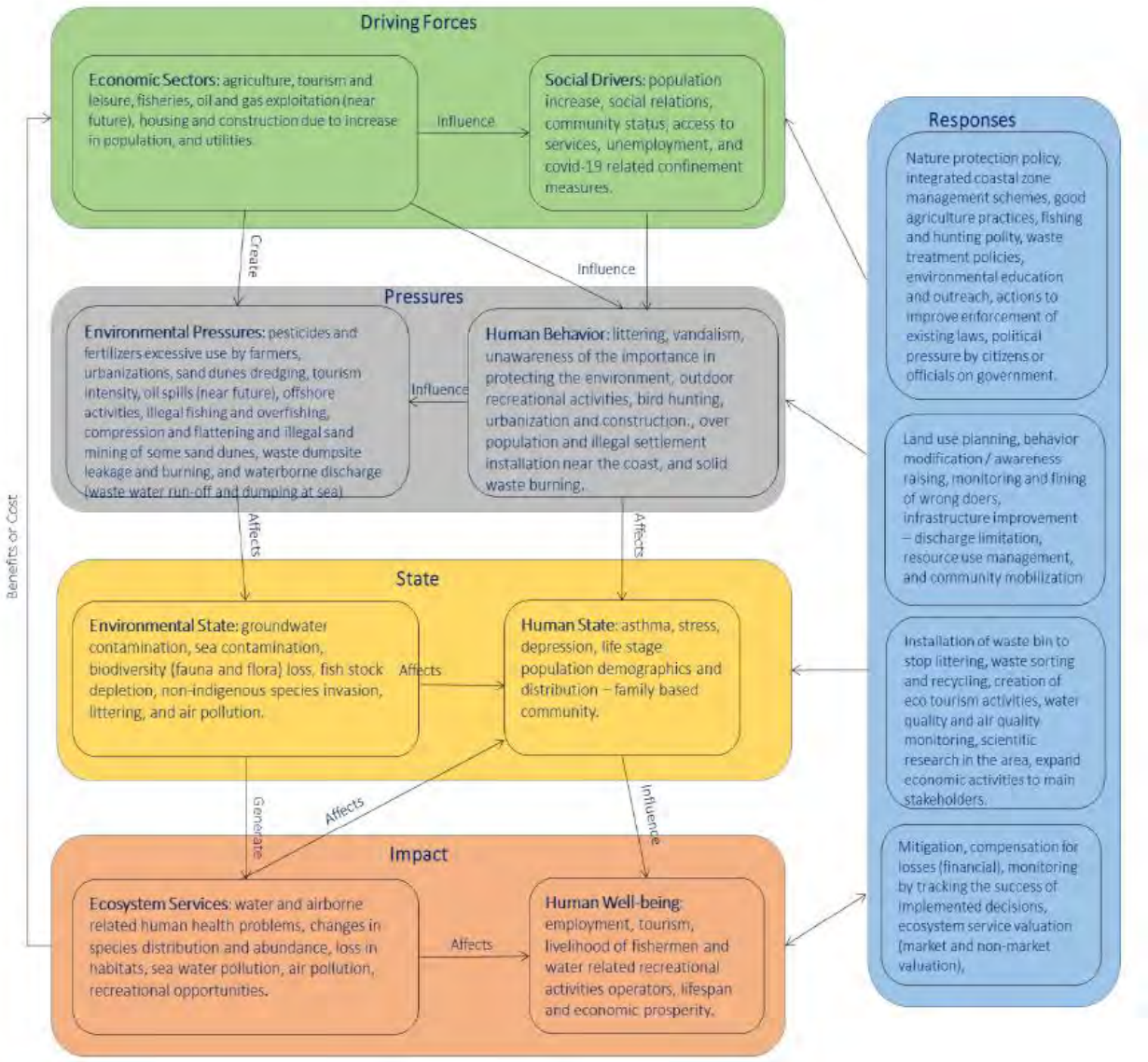
Article thirteen- the management team committee appoints the reserve guards and trains them on how to protect, maintain and apply the articles mentioned in this law.

Article Fourteen- any person who violates the rules and regulations identified by the reserve team committee is required to subject to a penalty ranging between 500.000 LL and 2.000.000 LL. If this violation leads to a serious damage in the reserve, then the person is subject to prison from one week to a month, and in case of repeated violations the punishment is doubled between two weeks to two months.
The returns from violations go to the benefit of the reserve team committee that shall use them to a better reserve management.

Article Fifteen- the operational laws and regulations of Lebanon are used to apply the protection of the reserve.

Baabda, 5-11-1998
Rafic El-Hariri

13.3 Annex 3: DPSIR Framework for TCNR



13.4 Annex 4 List of marine flora and fauna within TCNR waters

FUNGI
Verrucaria amphibia Clemente, 1814
PLANTEA
CYMODOCEACEAE
Cymodoceanodosa (Ucria) Asch.
HYDROCHARITACEAE
**Halophilastipulacea* (Forsskål) Ascherson, 1867
CHLOROPHYTA
**Anadyomene stellata* (Wulfen) C.Agardh, 1823
Bryopsis plumosa (Hudson) C.Agardh, 1823
**Caulerpascalpelliformis (R.Brown ex Turner) C.Agardh, 1817*
Cladophoropsismembranacea (Hofman Bang ex C.Agardh) Børgesen, 1905
**Codium parvulum* (Bory ex Audouin) P.C.Silva, 2003
*Ulvaintestinalis*Linnaeus, 1753
**Ulva lactuca* Linnaeus, 1753
OCHROPHYTA
Cystoseira spp.
Colpomenia sinuosa (Mertens ex Roth) Derbès & Solier, 1851
**Dictyotaacutiloba*J.Agardh, 1848
Dictyota implexa (Desfontaines) J.V.Lamouroux, 1809
Halopterisscoparia(Linnaeus) Sauvageau, 1904
Padina pavonica (Linnaeus) Thivy, 1960
**PadinaboergeseniiAllender& Kraft, 1983*
*SargassumvulgareC.Agardh, 1820
Scytosiphon lomentaria(Lyngbye) Link, 1833
**Stypopodiumschimperi*(Kützing) Verlaque&Boudouresque, 1991
Treptacantharayssiae(Ramon) Mulas, Neiva & Israel 2020
RHODOPHYTA
Amphiroa sp.
**Asparagopsistaxiformis*(Delile) Trevisan de Saint-Léon, 1845
Ellisolandiaelongata (J.Ellis&Solander) K.R.Hind&G.W.Saunders, 2013
**Galaxaura rugosa* (J.Ellis & Solander) J.V.Lamouroux, 1816

**Ganonema farinosum* (J.V.Lamouroux) K.-C.Fan & Y.-C.Wang, 1974
Hypnea musciformis (Wulfen) J.V.Lamouroux, 1813
Hildenbrandiarubra(Sommerfelt) Meneghini, 1841
Jania rubens (Linnaeus) J.V.Lamouroux, 1816
Janiavirgata (Zanardini) Montagne, 1846
*Laurenciachondrioides*Børgesen, 1918
Lithophyllum incrustans Philippi, 1837
Lobophora variegata (J.V.Lamouroux) Womersley ex E.C.Oliveira, 1977
Mesophyllumlichenoides(J.Ellis) Me.Lemoine, 1928
Neogoniolithon brassica-florida (Harvey) Setchell&L.R.Mason, 1943
Palisada perforata (Bory) K.W.Nam, 2007
Peyssonnelia squamaria (S.G.Gmelin) Decaisne ex J.Agardh, 1842
Phymatolithon calcareum (Pallas) W.H.Adey & D.L.McKibbin ex Woelkering & L.M.Irvine, 1986
ANIMALIA
ANNELIDA
Hermodicecarunculata (Pallas, 1766)
Ditrupaarietina (O. F. Müller, 1776)
ARTHROPODA
Clibanariuserythropus (Latreille, 1818)
**Charybdis (Charybdis) hellerii*(A. Milne-Edwards, 1867)
*Chthamalusmontagui*Southward, 1976
Chthamalusstellatus(Poli, 1791)
Diogenes pugilator (P. Roux, 1829)
Eriphiaverrucosa(Forskål, 1775)
*Ligiaitalica*Fabricius, 1798
Pachygrapsusmarmoratus(J.C. Fabricius, 1787)
Pachygrapsustransversus(Gibbes, 1850)
**Matuta victor* (JC Fabricius, 1781)
Ocypode cursor (Linnaeus, 1758)
Portumnuslatipes (Pennant, 1777)
CHORDATA
TUNICATA/ ASCIDIIDAE
**Phallusia nigra* Savigny, 1816
Rhodosoma sp.
VERTEBRATA

Boopsboops (Linnaeus, 1758)

Cetorhinus maximus (Gunnerus 1765)

Chromischromis (Linnaeus, 1758)

Corisjulis (Linnaeus, 1758)

Dasyatis pastinaca (Linnaeus, 1758)

Diplodussargus (Linnaeus, 1758)

Diplodus vulgaris (Geoffroy Saint-Hilaire, 1817)

Epinephelusmarginatus(Lowe 1834)

Epinepheluscostae (Steindachner, 1878)

Epinephelus aeneus (Geoffroy St. Hilaire 1817)

**Fistulariacommersonii*Rüppell, 1838

Glaucosteguscemiculus (Geoffroy St. Hilaire 1817)

*Gobiusbucchichi*Steindachner, 1870

Gobius spp.

Heptranchiasperlo (Bonnaterre 1788)

**Lagocephalussceleratus*(Gmelin 1789)

Lithognathusmormyrus (Linnaeus, 1758)

Mobulamobular (Bonnaterre 1788)

Mycteroperca rubra (Bloch, 1793)

Obladamelanura(Linnaeus, 1758)

Plotosuslineatus (Thunberg, 1787)

Pteragogustrispilus Randall, 2013

**Pterois miles* (Bennett, 1828)

Rhinobatosrhinobatos (Linnaeus 1758)

**Sargocentron rubrum* (Forsskål, 1775)

Scorpaena maderensis Valenciennes 1833

*Scorpaena porcus*Linnaeus 1758

Sciaena umbra Linnaeus 1758

Serranuscabrilla (Linnaeus, 1758)

Serranusscriba (Linnaeus, 1758)

**Siganusluridus* (Rüpell, 1829)

**Siganusrivulatus*Forsskål, 1775

Sparisomacretense (Linnaeus, 1758)

Spicara smaris (Linnaeus, 1758)

**Sillagosuezensis* Golani, Fricke &Tikochinski, 2013

Squatina oculata Bonaparte 1840
Symphodusroissali (Risso, 1810)
Symphodustinca (Linnaeus, 1758)
Thalassomapavo (Linnaeus, 1758)
Taeniuragrabata (Geoffroy Saint-Hilaire, 1817)
**Torquigenerflavimaculosus* Hardy & Randall, 1983
Umbrinacirrosa(Linnaeus 1758)
Xiphias gladius Linnaeus, 1758
Xyrichtysnovacula (Linnaeus, 1758)
CNIDARIA
Cladocoracaespitosa (Linnaeus, 1767)
*Cotylorhizaerythraea*Stiasny, 1920
Dendrophylliaramea(Linnaeus, 1758)
Eudendriumcarneum Clarke, 1882
Madracispharensis(Heller, 1868)
*Pennariadisticha*Goldfuss, 1820
Phyllangia americana mouchezii(Lacaze-Duthiers, 1897)
Phyllorhiza punctata von Lendenfeld, 1884
**Macrorhynchiaphilippina*Kirchenpauer, 1872
**Rhopilema nomadica* Galil, Spanier & Ferguson, 1990
CTENOPHORA
**Mnemiopsisleidyi* A. Agassiz, 1865
ECHINODERMATA
Brissus unicolor (Leske, 1778)
Echinocardiummediterraneum (Forbes, 1844)
**Holothuria (Panningothuria) forskali*Delle Chiaje, 1823
*Holothuria (Platyperona) sanctori*Delle Chiaje, 1823
*Holothuria (Holothuria) tubulosa*Gmelin, 1791
**Diademasetosum*(Leske, 1778)
**Synaptula reciprocans* (Forsskål, 1775)
MOLLUSCA
**Aplysiadactylomela* Rang, 1828
Aplysiafasciata Poiret, 1789
Acanthocardiatuberculata (Linnaeus, 1758)
Bittium sp.

Brachidontespharaonis(P. Fischer, 1870)

Bursatellaleachii Blainville, 1817

Cellana rota (Gmelin, 1791)

Cerithiumscabridum Philippi, 1848

*Chama pacifica*Broderip, 1835

Conomurexpersicus (Swainson, 1821)

Dendropomaanguliferum(Monterosato, 1878)

Echinolittorinapunctata(Gmelin, 1791)

*Elysiagrandifolia*Kelaart, 1858

*Ergalataxjunionae*Houart, 2008

Donaxtrunculus Linnaeus, 1758

Gafrariumpectinatum (Linnaeus, 1758)

Glycymerisglycymeris (Linnaeus, 1758)

Glycymerisnummaria (Linnaeus, 1758)

Goniobranchusannulatus(Eliot, 1904)

Luria lurida (Linnaeus, 1758)

Mactrastultorum (Linnaeus, 1758)

Malleus regula (Forsskål in Niebuhr, 1775)

Melarhapheneritoides(Linnaeus, 1758)

Mimachlamys varia (Linnaeus, 1758)

*Patella aspera*Röding, 1798

*Patella ulyssiponensis*Gmelin, 1791

*Petaloconchusglomeratus (*Linnaeus, 1758)

Phorcusturbinatus(Born, 1778)

Pisaniastriata(Gmelin, 1791)

Pinctada radiata (Leach, 1814)

Pinna nobilis Linnaeus, 1758

Peronaeaplanata (Linnaeus, 1758)

Sepia officinalis Linnaeus, 1758

*Spondylus spinosus*Schreibers, 1793

Stramonitahaemastoma(Linnaeus, 1767)

Tonna galea (Linnaeus, 1758)

Venus verrucosa Linnaeus, 1758

*Vermetustriquetrus*Bivona-Bernardi, 1832

PORIFERA

Axinellapolypoides Schmidt, 1862

Crambe crambe(Schmidt, 1862)

*Chondrillanuculas*Schmidt, 1862

*Chondrosiareniformis*Nardo, 1847

Cliona sp.

Octopus vulgaris Cuvier, 1797

Petrosia (Petrosia) ficiformis (Poiret, 1789)

Sarcotragusspinosulus Schmidt, 1862

Spongia (Spongia) officinalis Linnaeus, 1759

*Spongitesfruticulosa*Kützing, 1841

13.5 ANNEX 5 List of plants of Tyre Coast Reserve. Arabicnames are mainlyextractedfrom the "Dictionnaire étymologique de la flore du Liban".

(1) refers to nationally threatened species
(2) refers to endemic species
(3) refers to nationally rare species
(4) refers to wholly or partially restricted species to East Mediterranean area.

ZOSTERACEAE	Zosteraceae (Eel-grass)	زستيرية
Cymodocea major	Greater cymodocea	حامول البحر
POACEAE (GRAMINEAE)	Gramineae	النجيليات
Aegilops ligustica(4)	Ligurian goat-grass	دوسر
Aegilops peregrina	Foreign goat-grass	دوسر رحال
Alopecurus anthoxanthoides(4)	Fox-tail	ذيل الثعلب
Alopecurus myosuroides	Black-grass	ذيل الفأر
Ammochloapalaestina	Palestine ammochloa	شعيبة الرمل
Ammophila arenaria	Sandreed	سبط
Andropogon distachyus	Beard-grass	زلابية
Arundo donax	Cane	قصب
Bromus fasciculatus	Fascicled brome	عُرْغول حُزمي
Bromus madritensis	Madrid brome	عرغول مدريدي
Bromus scoparius	Twiggy brome	عرغول مكنسي
Catapodiumrigidum	Hard poa	القنبيوم
Cutandiamemphitica	Memphis cutandia	خلور
Cutandiaphilistaea(4)	Palestine cutandia	خلور فلسطيني
Dactylis glomerata	Orchard-grass	ثيل عمران
Hordeum bulbosum	Bulbous barley	شعير بصلي
Hyparrheniahirta(1)	Shaggy hyparrhenia	صفير صوف
Imperata cylindrica	Blady-grass	حلفاء
Lagurusovatus	Ovate hare's-tail	ذنب رنب
Lolium multiflorum	Many-flowered ray-grass	زوان متعدد الزهور
Lolium rigidum	Rigid ray-grass	زوان قاس
Lophochloaphleoides	Cat's-tail	ذنب القط
Paspalidiumgeminatum	Twin paspalidium	سنيلة
Phalaris minor	Lesser Canary-grass	شيت قصير زهرة
Phalaris paradoxa	Paradoxial Canary-grass	شيت، خفار
Saccharum spontaneum	Wild sugar-cane	غزار

Stipa capensis	Mediterranean needle-grass	حي ة
Vulpiamembranacea	Membranous fox-grass	فلجي ة غ ا ي ة
CYPERACEAE	**Cyperaceae**	**س ع ي ات**
Carex divisa	Bracteate marsh-sedge	س ع ادى ق ي وم
Carex extensa	Long-bracted sedge	س ع ادى م داد
Cyperus alopecuroides	Foxtail cyperus	س ع د الحصر
Cyperus kalli	Kalli cyperus	ق ل ي
Cyperus laevigatus	Smooth cyperus	س ع د أملس
ARACEAE	**Araceae**	**ل ق ي ات**
Biarumpyrami	Pyrame'sbiarum	ل و ف ب ي ر ام
LEMNACEAE	**Lemnaceae**	**د ع ي ات ل م اء**
Lemnagibba (1)	Gibbous duckweed	ل م ن ة ح ب اء
Lemnapaucicostata(1) (3)	Few-ribbed duckweed	خ ي ل
JUNCACEAE	**Juncacea**	**أ ل ي ات**
Juncus fontanesii	Fontanesi' rush	ل ل ف و ن ت ي ن
Juncus maritimus	Sea rush	ل ل ب ح ر ي
LILIACEAE	**Liliaceae**	**ذ ق ي ات**
Allium carmeli (2)	Carmel garlic	ث و م ك ر م ل
Allium neopolitanum	White garlic	ث و م ي ض
Asparagus stipularis	Thorny asparagus	ل ي ون
Asphodelusmicrocarpus	Common asphodel	ل ر اس
Muscarimaritimum	Sea muscari	ل ب و س ال ب ح ر
Ornithogalum densum	Dense star-of-Bethlehem	ص ا ص ل ه ف ي
Ornithogalum narbonensis	Narbonne star-of-Bethlehem	ص ا ص ل ن ب و ن
Urginea maritima	Sea-squill	ح ص ي ل ة
DIOSCOREACEAE	**Dioscoreaceae**	**ب ي و س ق و ي ات**
Tamus communis	Common black-bryony	ع ر ق ج
IRIDACEAE	**Iridaceae**	**س و س ن ي ات**
Crocus hyemalis (3) (4)	Winter crocus	ز ع ف ر ان ش ت و ي
ORCHIDACEAE	**Orchidaceae**	**س ح ل ي ات**
Ophrysattica	Attic ophrys	س ح ل ي ة ذ ك ا
Orchis collina(1)	Fan-lipped orchid	س ح ل ب ال ر ا ب ي
Orchis papilionacea(1)	Butterfly orchid	ز ر ل ا ع د ر ا
URTICACEAE	**Urticaceae**	**ق ر ص ل ي ات**
Parietariajudaica	Basil-leaved pellitory	ش ي ش ة ال ق ز ا ز

MORACEAE	Moraceae	التوتيات
Ficus sycomorus (1) (3)	Sycomore	جميز
POLYGONACEAE	**Polygonaceae**	**ضيلة العراعر**
Emex spinosa	Spiny dock	فجل الجبل
Polygonum maritimum	Sea knotweed	قرددبحري
Polygonum persicaria	Redleg	قرددرقني
Polygonum salicifolium	Willow-leaved knotweed	رفة
Rumex conglomeratus	Globular dock	حميض
CHENOPODIACEAE	**Chenopodiaceae**	**سرقيات**
Arthrocnemummacrostachyum(3)	Glasswort	شمام
Atriplex halimus	Sea-purslane	سرمقبحري
Chenopodium murale	Wall goosefoot	رمرام
Salsola kali	Prickly saltwort	القلي
AMARANTHACEAE	**Amaranthaceae**	**قطيات**
Alternanthera sessilis	Sessile globe-amaranthe	نكاب
Amaranthus albus	White amaranth	قطيفة بيضاء
Amaranthus graecizans silvestris(2)	Greek amaranth	قطيفة يونانية
Amaranthus hybridus chlorostachys	Hybrid amaranth	قطيفة هجينة
AIZOACEAE	**Aizoaceae**	**غسلويات**
Mesembryanthemum nodiflorum	Egyptian fig-marigold	غلول
CARYOPHYLLACEAE	**Caryophyllaceae**	**قرنفليات**
Minuartiadecipiensdamascena(4)	Deceptive sandwort	مزونية خادعة
Paronychia argentea	Silvery nailwort	حبقفضي
Silene coloratadecumbens	Cloven-petalled catchfly	سيلينة لونة
Silene macrodonta(4)	Large-toothed catchfly	سيلينة كبيرة سنان
Silene nocturna(4)	Night catchfly	سيلينة ليلية
Silene oliveriana(4)	Olivier's catchfly	سيلينة زيتية
Silene succulenta	Succulent catchfly	سيلينة لحمية
Spergularia bocconii	Boccone's spurrey	سبيرغلية بكون
Spergularia marina	Sea spurrey	سبيرغلية بحرية
Vaccaria pyramidata	Pyramidal cow-basil	بقية هرمية
Veleziarigida	Rigid velezia	بديقة
BERBERIDACEAE	**Berberidaceae**	**بربريات**
Bongardiachrysogonum	Golden rod	عرف الديك
RANUNCULACEAE	**Ranunculaceae**	**حوذيات**

Adonis annua	European pheasant's-eye	ناب الجمل
Nigellaciliaris(4)	Ciliatenigella	شونيز مهدب
Nigellaciliaris(4)	Ciliatenigella	شونيز مهدب
Ranunculuscornutus (4)	Horned buttercup	حوذان قرني
Ranunculusscandicinus(4)	Shepherd's- needle buttercup	حوذان شيطي
PAPAVERACEAE	**Papaveraceae**	**خشخاشيات**
Fumariajudaica(4)	Judean fumetory	شاهترج يهودية
Glauciumflavum	Seapoppy	ماميثا صفراء
Papaver dubium laevigatum	Pale-red poppy	خشخاش محمر
Papaver rhoeasstrigosum	Corn poppy	خشخاش منثور
Papaver syriacum(4)	Syrian poppy	خشخاش سوري
BRASSICACEAE (CRUCIFERAE)	Brassicaceae	صليبيات
Brassica rapa	Turnip	لفت
Cakileaegyptia	Egyptian sea-rocket	رشاد البحر
Enarthrocarpusarcuatus(4)	Curved enarthrocarpus	شلوة قوسة
Erucariahispanica	Pink mustard	سليح
Lobularia maritima	Sea lobularia	لبريا بحرية
Maresia nana (4)	Dwarf maresia	ماريزية مقزمة
Matthiolatricuspidata	Trifid stock	منثور ي
Nasturium officinale	Common water-cress	قرة
Raphanus raphanistrum	Wild radish	فجل بري
Raphanussativus	Garden radish	فجل زراعي
Ricotialunaria	Egyptian honesty	سي ن
Sinapis arvensis orientalis	Charlock	خردل الحقول
RESEDACEAE	Resedaceae	بليحاويات
Reseda alba	White mignonette	ذيل الخروف
Crassulaceae	Crassulaceae	**مخلدات**
Sedum schizolepis	Cut-scaled stonecrop	حيون
MIMOSACEAE	**Mimosaceae**	**أقاقيات**
Acacia cyanophylla	Cassia	أقاقيا
Lagonychiumfarctum	Stuffed lagonychium	قعيل
FABACEAE (PAPILIONACEAE)	**Fabaceae**	**فراشيات**
Astragalus baeticus	Andalusian milk-vetch	استراغالس أندلسي
Astragalus berytheus(4)	Beirut milk-vetch	استراغالس بيروت
Hippocrepismultisiliquosa	Many-podded horseshoe-vetch	متعدد الخرادل

Hippocrepisunisiliquosa	Common horseshoe-vetch	نمت احادي الخرنوبة
Lotus cytisoides	Downy birdsfoot-trefoil	لوطس لزاني
Lotus edulis	Edible lotus	لوطس مأكول
Lotus ornithopodioides	Claw-podded birdsfoot-trefoil	لوطس بويدني
Lotus villosus	Shaggy birdsfoot-trefoil	لوطس وبر
Medicago marina	Sea medick	فصة بحرية
Medicago minima	Least medick	فصة قزمة
Medicago scutellata	Snail medick	فصة قرصية
Medicago tuberculata	Tubercled medick	فصة عرقولية
Melilotus indicus	Indian melilot	حندقوق هندي
Melilotus siculus (3)	Sicilian melilot	حندقوق صقلية
Melilotus sulcatussulcatus	Grooved melilot	حندقوق مثلّم
Ononis hirta	Shaggy restharrow	شبرق
Ononis variegata	Variegated restharrow	شبرق مرقش
Ononis viscosabreviflora	Viscous restharrow	شبرق لزج
Pisum arvense	Field pea	بسلة الحقول
Psoralea bituminosa	Bitumen pea	حومان
Scorpiurussubvillosus	Hairy caterpillar	غيرية وبرة
Trifolium campestre	Hop trifoil	فل حقلي
Trifolium clusii	Cherler’s clover	فل كلوزي
Trifolium dichroanthum(4)	Two-colored clover	فل ذو لونين
Trifolium nigrescenspetrisavii(4)	Blackish clover	فل مسود
Trifolium purpureum	Purple clover	فل ارجواني
Trifolium resupinatum	Reversed clover	فل مقلوب
Trifolium scabrum	Rugged clover	فل أحرش
Trifolium spumosum	Bladder trifoil	فل زبد
Trifolium tomentosum	Tomentose clover	فل لبدي
Trifolium xerocephalum(4)	Dry-headed clover	فل جاف الراس
Trigonella cylindracea(4)	Cylindrical fenugreek	حلبة اسطوانية
Trigonella spinosa (4)	Spiny fenugreek	حلبة شائكة
Vicia galeata	Helmeted vetch	بيقية مخوذة
Vicia hybrida	Hairy yellow vetch	بيقية هجينة
Geraniaceae	**Geraniaceae**	**غرنوقيات**
Erodium laciniatumpulverulentum	Cut-leaved stork’s-bill	جزاب
Geranium molle	Dove’s-foot geranium	غرنوقي لين

Linaceae	**Linaceae**	**الكتانيات**
Linumpubescens(4)	Downy flax	كتان أزغب
Rutaceae	**Rutaceae**	**السذابيات**
Haplophyllumbuxbaumiistenophyllum(4)	Buxbaum's haplophyllum	سذاب بوم
Oxalidaceae	**Oxalidaceae**	**الحماضيات**
Oxalis pes-caprae	Bermuda buttercup	حماضة
Oxalis pes-caprae plenum	Red bermuda buttercup	حماضة سبكة
Euphorbiaceae	Euphorbiaceae	فربيونيات
Euphorbia aleppica	Aleppo spurge	فربيون حلب
Euphorbia arguta (4)	Toothed spurge	فربيون حاد
Euphorbia berythea(2)	Beirut spurge	فربيون بيروت
Euphorbia gaeniculata(3)	Knee-jointed spurge	لبن الحمار
Euphorbia paralias	Coast spurge	فربيون الحساسي
Euphorbia peplis	Purple spurge	زرق
Euphorbia peplus	Petty-spurge	فوخ
Euphorbia terracina	Terracina spurge	فربيون تيراسينا
Mercurialis annua	Annual mercury	حبوحبي
Ricinus communis	Common palma-christi	خروع
Malvaceae	**Malvaceae**	**الخبازيات**
Alceasetosepalmata	Bristly hollyhock	خبيثة
Lavatera cretica	Cretan tree-mallow	خيزران
Malvellasherardiana	Sherard's malvella	خبيزة شيرارد
Frankeniaceae	Frankenia	فرانكيات
Frankenia pulverulenta	Dusty sea-heath	حمرة
Cistaceae	**Cistaceae**	**القرنيات**
Fumana arabica	Arabian fumana	فومانا عربية
Helianthemum stipulatum	Stipulate sunrose	قرنين
Lythraceae	Lythracea	حرفيات
Lythrumhyssopifolia	Grass-poly	رجل الحمامة
Lythrumjunceum	Rushylythrum	فودنل
Onagraceae	Onagraceae	أخريات
Ludwigia stolonifera (3)	Stoloniferous ludwigia	لودجية
Oenothera drummondi	Drummond's oenothera	شب الليل أول مرة من نيسان في 03/2/6
Apiaceae (Umbelliferae)	**Apiaceae**	**الخيميات**
Ainsworthiatrachycarpa(4)	Common ainsworthia	أنسوثية شائعة

Ammi visnaga	Tooth pick	خلة بلدية
Apium graveolens	Celery	كرفس
Bupleurum fontanesii	Desfontaines' hare's-ear	بهيق
Bupleurum nodiflorum(4)	Sessile-flowered hare's-ear	لحب ب عقدي الزهر
Chaetosciadiumtrichospermum(4)	Hairy-seeded chervil	شيتسيديوم
Crithmummaritimum	Rock samphire	شمر البحر
Daucus aureus (3)	Golden carrot	الدوقو الذهبي
Daucus littoralis(4)	Coastal carrot	الدوقو الساحلي
Eryngium creticum(4)	Cretan eryngo	قرصعنة
Eryngium maritimum	Sea holly	شندابل البحر
Helosciadumnodiflorum	Marshwort	جزر عفواتي
Lagoeciacuminoides	Bastard cumin	قردمان
Pimpinella cretica(4)	Cretan burnet-saxifrage	سيباس
Pseudorlaya pumila	Dwarf false-orlaya	شومر الجبل
Tordyliumaegyptiacum(4)	Egyptian hartwort	شرعوب
Plumbaginaceae	Plumbaginaceae	رصاصيات
Limonium graecum (4)	Greek sea-lavander	ليمونيوم يوناني
Limonium sinuatum	Sinuate sea-lavender	ليمونيوم متعرج
Plumbago europea	Leadwort	لبهق
Convolvulaceae	**Convolvulaceae**	**محموديات**
Convolvulus arvensis	Field bindweed	لبلاب الحقول
Convolvulus betonicifolius	Betony-leaved bindweed	لبلاب بوقسطراني الورق
Convolvulus dorycniumoxysepalus(4)	Dorycnium bindweed	لبلاب دوركنيوم
Convolvulus pentapetaloides	Five-lobed bindweed	لبلاب خماسي الفصوص
Convolvulus secundus(4)	One-sided bindweed	لبلاب وحيد الجانب
Ipomoea palmata(3)	Palmate morning-glory	بنت الباشا
Ipomoea stolonifera	Coast morning-glory	أثمان
Boraginaceae	**Boraginaceae**	**حمحميات**
Echium angustifolium (4)	Narrow-leaved viper's-bugloss	خويض ضيق الورق
Hormuzakiaaggregata	Clustered hormuzakia	لسان العجة
Verbenaceae	**Verbenaceae**	**فصيلة رعي الحمام**
Phyla nodiflora	Sessile-flowered frog-fruit	بيلة عقيقية الزهر
Lamiaceae (Labiatae)	Lamiaceae	شفويات
Calaminthaincana(4)	Hoary calamint	كلمنتة بيضاء
Lamium amplexicaule	Great henbit	لميوم معانق

Marrubium vulgare	Common white- horehound	شحيشة الكلب
Mentha microphylla	Small-leaved mint	نعنع صغير الورق
Molucella spinosa	Spiny Molucca-balm	مصيص
Salvia hierosolymitana(4)	Jerusalem sage	قويسة القدس
Salvia pinnata (4)	Wing-leaved sage	قويسة ريشية
Salvia sclarea	Clary	كف الدب
Salvia verbenaca serotina	Wild clary	قويسة سارالثور
Satureiathymbra	Summer savory	ثمبرة
Stachys neurocalycina(4)	Nerved-calyxed woundwort	قرطوم معرق الكأس
Stachys obscura (4)	Dark woundwort	قرطوم داكن
Teucrium polium	Poley	جعدة
Solanaceae	**Solanaceae**	**باذنجانيات**
Datura metel	Hairy thorn-apple	بقم
˜Nicandra physalodes	Apple-of-Peru	نقين نفخي زلس
Physalis peruviana	Physalis of Peru	بيزالس بلي رو
Withaniasomnifera	Clustered withania	سم الفار
Scrophulariaceae	**Scrophulariaceae**	**خنزيريات**
Antirrhinum majus angustifolium	Lion's mouth	تم السمكة
Antirrhinum orontium	Lesser snapdragon	سيسم
Scrophulariaumbrosa	Shade figwort	خنزيرية الظل
Verbascum galilaeum(4)	Galilee mullein	بوصير الجليل
Verbascum orientale	Oriental mullein	بوصير شرقي
Verbascum tripolitanum(4)	Tripoli mullein	بوصير طرابلس
Veronica anagallis-aquatica	Water pimpernel	بيرونيكة حبق الماء
Veronica syriaca(4)	Syrian speedwell	بيرونيكة سورية
Orobanchaceae	**Orobanchaceae**	**هعيليات**
Orobancheaegyptiaca(4)	Egyptian broomrape	هعيل مصري
Orobanchecamptolepis(4)	Bent-scaled broomrape	هعيل منحني الحرشف
Orobanche crenata	Scalloped broomrape	ذكر الفول
Orobanchegrisebachii(4)	Grisbach's broomrape	هعيل غيبخ
Orobanche nana	Dwarf broomrape	هعيل قزم
Orobanchepubescens	Downy broomrape	هعيل أزغب
Plantaginaceae	**Plantaginaceae**	**حمليات**
Plantago afra	African plantain	بزرقطونا
Plantago albicans	Silvery plantain	سهيق

Plantago lagopus	Round-headed plantain	ودنة
Plantago major	Greater plantain	مصاصه
Plantago squarrosa(4)	Leafy-spiked plantain	زبد
Rubiaceae	**Rubiaceae**	**فوويات**
Galiumcassium	Cassius bedstraw	غاليوم قرع
Galiumdivaricatum	Spreading bedstraw	غاليوم متشعب
Galiumjudaicum	Judean bedstraw	غاليوم يهودية
Galiumsetaceum	Bristled bedstraw	دحريج
Galiumtricornutum	Tricornutum bedstraw	غاليوم مثلث الزوايا
Valantiahispida	Hispid valantia	فلنتية
Caprifoliaceae	**Caprifoliaceae**	**لسنايات**
Lonicera etrusca	Etruscan honeysuckle	لونيسيرا هتروريا
Dipsacaceae	**Dipsacaceae**	**دبساسيات**
Cephalariajoppensis	Jaffa cephalaria	سيوان يافا
Cephalariasyriacaphoeniciaca	Syrian scabious	سيوان سوري
Cucurbitaceae	Cucurbitaceae	قرعيات
Bryoniasyriaca(4)	Syrian bryony	فشرا سورية
Campanulaceae	**Campanulaceae**	**وقيات**
Campanula strigosa(4)	Strigose bellflower	جريس شائك الزغب
Asteraceae (Compositae)	**Asteraceae**	**مركبات**
Aetheorhiza bulbosa	Bulbous hawk's-beard	بيض ا رض
Ambrosia maritima (3)	Sea ambrosia	بغيرة
Anthemis palestina(4)	Palestine chamomile	بهار فلسطيني
Artemisia monosperma(4)	Sand wormwood	عاذر
Carduus argentatus(4)	Silvery plumed-thistle	خرفيش صغير
Carlina lanata	Purple carline	كلين صوفية
Centaurea ibericameryonis(4)	Iberian knapweed	قنطريون ايبيري
Centaurea procurrens(4)	Procumbent knapweed	قنطريون ممتد
Chrysanthemum myconis	Mico's chrysanthemum	قحوان ميكو
Crepis aculeata (4)	Prickly hawkwood	سراغ شائكة
Ecliptaprostrata(3)	Prostrate eclipta	سعد مفترشة
Erigeron bonariensis	Buenos Aires fleabane	رأي غارون بونس أيرس
Erigeron canadense	Canadian fleabane	راي غارون كندي
Eupatorium cannabinumsyriacum(2)	Syrian hemp-agrimony	بلوتوي سوري
Filago pyramidata	Pyramidal cotton-rose	قطنية هرمية

Hedypnoiscreticamonspeliensis	Cretan hedypnois	هيبنويسكريتيكا
Hedypnoisrhagadioloidestubiformis	Nipplewort hedypnois	هيبنويسرهاجاديولويدستوبيفورميس
Helichrysum sanguineum(4)	Blood-red everlasting	خلدة حمراء
Inula graveolens	Heavy-sented inula	عين طيون
Launaeatenuiloba(2)	Slender-lobed launaea	لونيا الجليلية
Notobasissyriaca	Syrian thistle	حرمل
Onopordumcarduiforme(4)	False plumed-thistle	خرشف الريش
Otanthus maritimus	Sea cottonweed	أوتانثوس البحري
Picris amalecitana(4)	Amalek ox-tongue	بيكريس العمالقة
Scolymus maculatus	Spotted golden-thistle	عقيصة مرقطة
Senecio gallicus	French groundsel	شرون فرنسية
Senecio leucanthemifolius	Oxeye groundsel	شرون أبيض
Senecio vernalis	Spring groundsel	شرون ربيعية
Silybum marianum	Lady's-thistle	شوك مريم
Varthemiaiphionoides(4)	Common varthemia	فارثيميا شائعة

13.6 ANNEX 6 List of mammals at Tyre Coast Reserve.

(1) refers to globally threatened species

(2) refers to locally threatened species

(3) refers to endemic species

(4) refers to wholly or partially restricted species to East Mediterranean area

(5) rare species

Scientific Name	English Name	Arabic Name
	ERINACEIDAE	
Erinaceus europaeus concolor (4)	Hedgehog	كلبلب القنفذ
	PTEROPODIDAE	
Rousettus aegyptiacusaegyptiacus	Egyptian Fruit-Bat	ردلس مصرية

	RHINOLOPHIDAE	
Rhinolophus euryale judaicus(1, 4)	MediterraneanHorseshoe	عم اشرص غير
Pipistrellus kuhliikhawanius (1, 4)	Kuhl's Pipistrelle	ڤ اشاكو لي
	CANIDAE	
Canis aureussyriacus (4)	Jackal	ابن اوى
Vulpusvulpuspalaestina (4)	Red Fox	لبغ ب
	MUSTELIDAE	
Vormelaperegusnasyriaca (1, 4)	Marbled Polecat	لظبان
Meles melescanescens (1)	Badger	لاغ ير
	SPALACIDAE	
Spalax leucodonehrenbergi(4)	**Mole-Rat**	لغ د
	MURIDAE	
Rattus norvegicusnorvegicus	Brown Rat	جرذون شائع
Mus musculuspraetextus	House Mouse	ڤأرة
Acomysdimidiatus(4) (5)	Spiny Mouse	فأرشوكي
	CRICETIDAE	
Merionestristramitristrami(4)	Jird	جرذ تستر ام

13.7 ANNEX 7 List of amphibians and reptiles at Tyre Coast Nature Reserve.

1. refers to globally threatened species
2. refers to regionally threatened species
3. refers to endemic species
4. refers to nationally rare species

	ANURA	
Bufo viridis (2)	Green toad	ر ض خ م و ج ي
Rana levantina*(2)*	Levant frog	ض ف د ع ش ر ق ي
Hyla savignyi*(2)*	Common tree-frog	ض ف د ع ل ش ر ج
	TRIONYCHIDAE	
Trionyxtriunguis (2)	Terrapin	س ل ح ف ا ت م ي ا ه ب ج ة
	CHELONIIDAE	
Carettacarettacaretta(1) (4)	Logger-head turtle	س ل ح ف ا ض خ م ة ل ر أ س
Cheloniamydasmydas(1)	Green turtle	س ل ح ف ا خ ض ر ا ء
	EMYDIDAE	
Mauremyscaspica(2)	Caspian mauremys	س ل ح ف ا أ م ي د
	GEKKONIDAE	
Hemidactylus turcicus (2)	Turkish gecko	أ ب و ب ر ي ص
	AGAMIDAE	
' Lacerta laevislaevis(2)	Wall lizard	س ل ح ي ة ج ي ط ا ن
Laudakiastelliostellio	Agama	ح ر ذ ون
	LACERTIDAE	
Acanthodactylusshreiberi(2) (3)	Shreiber's lizard	س ل ح ي ة ش ر ي ب ر

SCINCIDAE		
Mabuyavittata	Vital's skink	سقنقور عيوني
Chalcides ocellatus ocellatus(2)(4)	Ocellated skink	سقنقور زئمي
COLUBRIDAE		
Coluberrubriceps(2)	Small whipe snake	فلعى رشاي ه
Colubernajadum (2)	Dahl's whipe snake	فلعى أبجدي ة
Malpolonmonspessulana*(2)*	Montpellier snake	فلعى مونبلي ه
Natrix tessellatatessellata(2)	Dice snake	فلعى الزهر

13.8 ANNEX 8 List of bird species at Tyre Coast Reserve

Dates and names of observers are given for vagrants and species that were known in the past or recently discovered by the author of this ornithological section. The following abbreviations are used to indicate the species status. A question mark indicates uncertain status. Three stars (***) denote threatened species at global level, two stars (**) indicate threatened species at regional level and one star (*) indicates species that are wholly or largely restricted to the Middle East (after Evans 1994). Lower case abbreviations, e.g. r, sb, s, wv and pm indicate that the species is uncommon or rare at the relevant season at Tyre Coast Reserve.

R=**Resident with definite breeding records**

SB=Breeding summer visitor

S=Non-breeding summer visitor

WV=Winter visitor

PM=Passage migrant

FB=Formerly bred (no records within the last 20 years)

V=Vagrant

E=Extinct in Lebanon

Little Grebe*Tachybaptus ruficollis* **pm**

Black-necked Grebe*Podicepsnigricollis* **pm**

Mediterranean Shearwater *Puffinusyelkouan* **v**

Great Cormorant*Phalacrocorax carbo* **pm**

Pygmy Cormorant *Phalacrocorax pygmeus* *** **v**

White Pelican*Pelecanusonocrotalus***PM**

Dalmatian Pelican*Pelecanus crispus****?v**

Bittern *Botaurus stellaris*** **pm**

Little Bittern*Ixobrychusminutus***pm, wv**

Night Heron*Nycticoraxnycticorax***pm**

Squacco Heron*Ardeolaralloides***pm**

Cattle Egret*Bubulcus ibis***pm**

Little Egret*Egrettagarzetta***PM**

Great White Egret*Egretta alba* **PM**

Grey Heron*Ardea cinerea* **PM**

Purple Heron *Ardea purpurea* **pm**

Black Stork*Ciconia nigra***pm**

White Stork*Ciconiaciconia*** **PM**

Glossy Ibis*Plegadisfalcinellus***pm**

Spoonbill*Platalealeucorodia***pm**

Greater Flamingo*Phoenicopterus ruber* **pm**

Graylag Goose*Anseralbifrons***pm**

Shelduck*Tadornatadorna***pm**

European Wigeon *Anas penelope***pm**

Gadwall*Anas strepera* **pm**

Teal *Anas crecca***PM, WV**

Mallard *Anas platyrhynchos* **PM, WV**

Pintail *Anas acuta***pm**

Garganey *Anas querquedula***PM**

Shoveler *Anas clypeata***pm, wv**

First recorded by Flach (1959)

Red-crested Pochard*Nettarufina***v**

Pochard *Aythya ferina***pm**

Ferriginous Duck *Aythya nyroca* ** **v**

Tufted Duck *Aythyafuligula* **pm**

Honey Buzzard *Pernisapivorus*** **PM**

Black-winged Kite *Elanus coeruleus*** **v**

First recorded by Tristram in 1863

Black Kite *Milvusmigrans* **pm**

Red Kite *Milvusmilvus* **v**

Egyptian Vulture *Neophron percnopterus*** **pm**

Griffon Vulture *Gyps fulvus*** **v**

Short-toed Eagle *Circaetusgallicus* **PM**

Marsh Harrier *Circus aeruginosus***PM**

Hen Harrier *Circus cyaneus***pm**

Pallid Harrier *Circus macrourus***pm**

Montagu's Harrier *Circus pygargus***pm**

Goshawk *Accipitergentilis* **pm**

Sparrowhawk *Accipiter nisus* **pm**

Levant Sparrowhawk *Accipiterbrevipes*** **PM**

Common Buzzard & Steppe Buzzard *Buteobuteo* **pm**

Long-legged Buzzard *Buteorufinus* **pm, wv**

Lesser Spotted Eagle*Aquila pomarina***pm**

Steppe Eagle *Aquila nipalensis* **pm**

Golden Eagle *Aquila chrysaetos* **pm**

Verreaux's Eagle *Aquila verreauxii* **v**

Booted Eagle *Hieraaetuspennatus* **pm**

Bonelli'sEagle *Hieraaetus fasciatus* **pm**

Osprey *Pandion haliaetus* **pm**

Lesser Kestrel*Falconaumanni**** **sb, pm**

Kestrel *Falco tinnunculus* **pm, wv**

Red-footed Falcon *Falco vespertinus***pm**

Merlin *Falco columbarius* **pm**

Hobby Falco*subbuteo* **pm**

Lanner*Falco biarmicus*** **pm**

Eleonora's Falcon Falco*eleonorae***pm**

Saker Falcon*Falcocherrug*** **pm**

Peregrine Falcon*Falco peregrinus* **pm, wv**

Quail*Coturnix coturnix***PM**

Water Rail *Rallus aquaticus* **pm, wv**

Spotted Crake*Porzanaporzana***pm**

Little Crake *Porzana parva* **pm**

Baillon'sCrake *Porzanapusilla***pm**

Corncrake *Crex crex**** **pm**

Moorhen*Gallinula chloropus***pm, wv**

Coot *Fulica atra* **R, PM, WV**

Crane *Grus grus***pm**, **wv**

Black-winged Stilt *Himantopus himantopus***pm**

Stone Curlew*Burhinusoedicnemus***pm**

Collared Pratincole*Glareolapratincola***pm**

Black-winged Pratincole*Glareolanordmanni** **pm**

Little Ringed Plover *Charadrius dubius***pm**

Ringed Plover *Charadrius hiaticula***pm**

Kentish Plover *Charadrius alexandrinus***pm**

Greater Sand Plover *Charadrius leschenaulti***pm**

Dottrel*Charadriusmorinellus* **pm**

Golden Plover*Pluvialisapricaria***pm**

Grey Plover*Pluvialissquatarola***pm**

Spur-winged Plover*Hoplopterusspinosus***?sb, pm**

Lapwing*Vanellusvanellus***pm, wv**

Little Stint *Calidris minuta***pm**

Temminck's Stint *Calidris temminckii***pm**

Curlew Sandpiper *Calidris ferruginea***pm**

Dunlin *Calidris alpina***pm**

Ruff*Philomachus pugnax* **pm**

Jack Snipe*Lymnocryptesminimus***pm.wv**

Common Snipe*Gallinagogallinago***pm, wv**

Great Snipe*Gallinago media*** **pm**

Black-tailed Godwit*Limosalimosa***pm**

Whimbril*Numeniusphaeopus***pm**

Redshank*Tringatotanus***pm, wv**

Marsh Sandpiper*Tringastagnatilis***pm**

Greenshank*Tringanebularia***pm, wv**

Green Sandpiper*Tringaochropus***pm**

Wood Sandpiper*Tringaglareola***pm**

Common Sandpiper*Actitishypoleucos***pm**

Turnstone*Arenaria interpres***v**

Sooty Gull*Larus hemprichii** **v**

Great Black-headed Gull *Larus ichthyaetus***v**

Little Gull *Larus minutus***pm, wv**

Black-headed Gull *Larus ridibundus* **PM, WV**

Slender-billed Gull *Larus genei***v**

Great Black-backed Gull*Larus marinus***v**

Lesser Black-backed Gull *Larus fuscus***PM, WV, s**

Yellow-legged Gull *Larus cachinnans***PM,WV**

Armenian Gull*Larus armenicus***v**

Gull-billed Tern *Gelochelidonnilotica* **v**

Sandwich Tern *Sternasandvicensis***pm, wv**

Common Tern *Sternahirundo***PM**

Little Tern *Sterna albifrons***v**

Whiskered Tern*Chlidonias hybridus* **pm**

White-winged Black Tern*Chlidoniasleucopterus***pm**

Turtle Dove*Streptopelia turtur* **pm**

Palm Dove *Streptopelia senegalensis* **R**

Great Spotted Cuckoo*Clamatorglandarius***v**

Cuckoo *Cuculuscanorus***pm**

Barn Owl *Tyto alba* **r**

Little Owl *Athenenoctua* **r**

Short-eared Owl *Asioflammeus***wv**

Nightjar*Caprimulgus europaeus* **pm**

Swift*Apus apus***SB, PM**

Pallid Swift *Apus pallidus* **pm**

Alpine Swift *Apus melba* **PM**

Little Swift *Apusaffinis* **pm**

Kingfisher*Alcedoatthis*?r

Pied Kingfisher *Cerylerudis* **v**

European Bee-eater*Meropsaptaster***PM**

Roller *Coraciasgarrulus* **pm**

Hoopoe *Upupaepops***PM**

Wryneck*Jynxtorquilla***pm**

Calandra Lark*Melanocorypha calandra* **PM**

BimaculatedLark *Melanocoryphabimaculata* **pm**

Greater Short-toed Lark*Calandrellabrachydactyla***PM**

Lesser Short-toed Lark*Calandrellarufescens***pm**

Crested Lark *Galerida cristata* **r**

Wood Lark Lullula arborea**wv**

Skylark *Alauda arvensis* **PM**

Sand Martin *Ripariariparia* **PM**

Crag Martin*Ptyonoprognerupestris***pm**

Swallow*Hirundo rustica* **PM**

Red-rumped Swallow*Hirundodaurica***pm**

House Martin*Delichonurbica***PM**

Tawny Pipit*Anthus campestris* **pm**

Tree Pipit*Anthustrivialis***pm**

Yellow Wagtail*Motacilla flava* **PM**

Grey Wagtail*Motacilla cinerea* **pm, wv**

White Wagtail*Motacilla alba* **PM, wv, s**

Bulbul *Pycnonotusxanthopygos** **R**

Dunnock*Prunellamodularis* **pm**

Rufous Bush Robin *Cercotrichasgalactotes* **pm**

Robin *Erithacusrubecula* **WV**

Thrush Nightingale *Luscinia luscinia***pm**

Nightingale *Luscinia megarhynchos* **pm**

Bluethroat *Luscinia svecica***PM, wv**

White-throated Robin *Iraniagutturalis** **pm**

Black Redstart*Phoenicurusochruros***pm, WV**

First recorded by Macfarlane (1978)

Redstart*Phoenicurusphoenicurus***pm**

Whinchat *Saxicola rubetra* **pm**

Stonechat *Saxicolatorquata* **pm, wv**

Isabelline Wheatear *Oenanthe isabellina***pm**

Wheatear *Oenanthe oenanthe***PM, wv**

Desert Wheatear *Oenanthedeserti* **pm**

Fieldfare *Turdus pilaris* **pm, wv**

Song Thrush *Turdus philomelos* **pm**

Mistle Trush*Turdusviscivorus* **pm**

Graceful Warbler*Priniagracilis***R**

Grasshopper Warbler *Locustellanaevia* **v**

Savi's Warbler*Locustellaluscinioides***pm**

MoustachedWarbler *Acrocephalusmelanopogon* **pm**

Sedge Warbler *Acrocephalusschoenobaenus* **pm**

Marsh Warbler*Acrocephalus palustris* **pm**

European Reed Warbler *Acrocephalusscirpaceus* **pm**

Great Reed Warbler*Acrocephalusarundinaceus***PM**

Olivaceous Warbler*Hippolais pallida* **PM**

Upcher'sWarbler*Hippolaislanguida** **?sb, pm**

Ménétries'sWarbler*Sylviamystacea****pm**

SardinianWarbler *Sylvia melanocephala***?r, sb, PM, wv**

Rüppell's Warbler *Sylvia rueppelli* **pm**

Orphean Warbler *Sylvia hortensis* **PM**

Barred Warbler *Sylvianisoria* **pm**

Lesser Whitethroat *Sylvia curruca* **?sb, PM, ?wv**

Whitethroat *Sylvia communis* **?sb, PM**

Garden Warbler *Sylviaborin* **pm**

Blackcap *Sylvia atricapilla* **PM**

Bonelli'sWarbler *Phylloscopusbonelli* **pm**

Wood Warbler *Phylloscopussibilatrix* **pm**

Chiffchaff *Phylloscopuscollybita* **PM, wv**

Willow Warbler *Phylloscopus trochilus* **pm**

Spotted Flycatcher *Muscicapa striata* **PM**

Red-breasted Flycatcher *Ficedula parva* **pm**

Semi-collared Flycatcher *Ficedulasemitorquata* **pm**

Collared Flycatcher *Ficedulaalbicollis* **pm**

Pied Flycatcher *Ficedulahypoleuca* **pm**

Palestinian Sunbird *Nectarineaosea* **R**

Golden Oriole *Oriolusoriolus* **sb, pm**

Isabelline Shrike *Laniusisabellinus* **pm, wv**

Red-backed Shrike *Laniuscollurio* **PM**

Woodchat Shrike *Lanius senator* **PM**

Masked Shrike *Laniusnubicus* **sb, PM**

Hooded Crow *Corvuscoronecornix* **visitor**

Starling *Sturnus vulgaris* **wv**

Sparrow *Passerdomesticus* **R**

Spanish Sparrow *Passerhispaniolensis* **pm, wv**

Chaffinch *Fringilla coelebs* **pm**

Syrian Serin *Serinussyriacus* *** visitor**

Greenfinch *Carduelischloris* **r, PM, WV**

Goldfinch *Carduelis carduelis* **visitor**

Siskin *Carduelis spinus* **wv**

Yellowhammer *Emberiza citronella* **wv**

Ortolan Bunting *Emberizahortulana* **pm**

Reed Bunting *Emberizaschoeniclus* **wv**

Black-headed Bunting *Emberizamelanocephala* **PM**

Corn Bunting *Miliaria calandra* **pm**

13.9 ANNEX 9 List of invertebrates at Tyre Coast Nature Reserve

MOLLUSKS	ABUNDANCE	HABITAT
	GASTREPODS	
*Succinea (Oxyloma) elegans*Risso	(10 individus)	Marsh

Theodoxusjordani (Sow.)	(30 individus)	Spring tributary
Melanopsispraemorsabuccinoida Olivier	(10 individus)	Spring tributary
Physella(physa) acuta Drap.	(5 individus)	Stream
ODONATES		
*Platycnemis dealbata*Sélys	(2 mâles,2 femelles)	Stream
HIRUDINÉES		
Dina lineata concolor Ann.	(4 individus)	Stream

13.10 ANNEX 10 List and summary status of the observed insect specimens at Tyre Coast Reserve.

ORDER	FAMILY	SCIENTIFIC NAME	DENSITY	ABUNDANCE
Coleoptera	Tenebrionodae	*Pimelia sp.*	low	Rare
Coleoptera	Tenebrionodae		low	Rare
Coleoptera	Cantharidae		medium	common
Coleoptera	Bostrichidae		medium	uncommon
Coleoptera	Cicindellidae	Gen. *Cicindella*	Very high	uncommon
Coleoptera	Scarabeidae		low	Rare
Coleoptera	Scarabeidae	*Tropinotasqualida*(Pilosa,Bruille1832)	*	
Coleoptera	Scarabeidae	*Oxythyreaalbopicta*(Motchulsky1854)	*	
Coleoptera	Carabidae		low	Rare
Coleoptera	Coccinellidae	*Chilicorusbipustulatus*(Linnaeus1758)	low	Rare
Coleoptera	Cocinellidae	*Coccinellaseptumpunctata*	low	Rare
Coleoptera	Cerambycidae		low	Rare
Coleoptera	Cerambycidae	*Certallumebulinum* (Linnaeus1767)	medium	uncommon
Coleoptera	Curculionidae		low	Rare
Diptera	Tipulidae		low	uncommon
Diptera	Bibionidae		medium	common
Diptera	Ceratopogonidae		high	Common
Hemiptera	Lygaidae	*Spilostethuspandurus*(Scopoli11763)	low	common
Hemiptera	Lygaidae		low	Rare
Hemiptera	Coreidae		low	Rare
Hemiptera	Pentatomidae		medium	uncommon

Hemiptera	Pyrhocoridae	*Pyrrhocorisapterus*(Linnaeus1758)	medium	common
Hymenoptera	Apidae	*Apis mellifera*	Very high	common
Hymenoptera	Vespidae		low	Rare
Orthoptera	Acrididae		low	common

13.11 Annex 11 list of butterflies (32 species) of Tyre Coast Nature Reserve with mention to occurrence in other habitats or sites.

BUTTERFLIES OF TYRE COAST RESERVE

NO	SCIENTIFIC NAME	ENGLISH NAME	SUB-FAMILY	FAMILY	PLACE
1	*Papiliomachaonsyriacus*	Swallowtail	Papilioninae	PAPILIONIDAE	Hazmiye, Tyre, Aammiq
2	*Pieris brassicaecatoleuca*	Large White	Pierinae	PIERIDAE	Hazmiye, Tyre, Aammiq
3	*Pieris rapaeleucosoma*	Small White	Pierinae	PIERIDAE	Hasmiye ,Tyre , Terbol , Beqaa, Aammiq
4	*Pieris napidubiosa*	Green-veined White	Pierinae	PIERIDAE	Laklouk ,Hammana , Antelias , sea level, Jbeil, Cedar Mountain, Hazmiye, Tyre
5	*Pontiadaplidicedaplidice*	Bath White	Pierinae	PIERIDAE	Hazmiye, Tyre
6	*Colotisfaustafausta*	salmon Caper Butterfly	Pierinae	PIERIDAE	environs of Tyre, sea level, Tyre, Aammiq
7	*Anthocharis cardamines phoenissa*	Orange Tip	Pierinae	PIERIDAE	Hazmiye, Tyre, Aammiq
8	*Leptideasinapis ? Sinapis*	Wood White	Dismorphiinae	PIERIDAE	Jisr el-Qadi, Aabadiye, Yarze, Tyre
9	*Danaus chrysippuschrysippus*	Plain Tiger	Danainae	NYMPHALIDAE	Batroun, Tyre, Aammiq
10	*Limenitis reductareducta*	Southern White Admiral	Nymphalinae	NYMPHALIDAE	Hazmiye, Tyre, Aammiq
11	*Precis hiertacrebrene*	Yellow Pansy	Nymphalinae	NYMPHALIDAE	near Tyre
12	*Vanessa atalantaatalanta*	Red Admiral	Nymphalinae	NYMPHALIDAE	Tyre, Aammiq
13	*Aglaisurticae turcica*	Tortoiseshell	Nymphalinae	NYMPHALIDAE	Jabal Kesrouan, Tyre
14	*Melitaea phoebe telona*	Knapweed Fritillary	Nymphalinae	NYMPHALIDAE	Hazmiye, Tyre
15	*Melitaeadeserticolamacromaculata*	Desert Fritillary	Nymphalinae	NYMPHALIDAE	Bouarej, Hazmiye, Tyre, Aammiq
16	*Pseudotergumiapisidicepisidice*	Sinai Grayling	Satyrinae	NYMPHALIDAE	Tyre, sea level
17	*Maniolatelmessiatelmessia*	Eastern Meadow Brown	Satyrinae	NYMPHALIDAE	Hazmiye, Tyre, near Halba, Aammiq
18	*Ypthimaasteropeasterope*	African Ringlet	Satyrinae	NYMPHALIDAE	Hazmiye, Tyre
19	*Parargeaegeriaaegeria*	Speckled Wood	Satyrinae	NYMPHALIDAE	Hazmiye, Tyre, Aammiq
20	*Strymonidia (Satyrium) spinimelantho*	Blue-spot Hairstreak	Theclinae	LYCAENIDAE	near Damour, Aammiq, Tyre
21	*Deudorix (Virachola) livialivia*	Pomegranate Hairstreak	Theclinae	LYCAENIDAE	Tyre, sea level
22	*Lycaena (Thersamonia) thersamonkurdistanica*	Lesser Fiery Copper	Lycaeninae	LYCAENIDAE	Hazmiye, Tyre, Aammiq
23	*Apharitisacamasacamas*	Levantine Leopard Betterfly	Aphnaeinae	LYCAENIDAE	Tyre, sea level

24	*Lampidesboeticusboeticus*	Long-tailed Blue	Lampidinae	LYCAENIDAE	Tyre, Laklouk, Aammiq
25	*Azanusjesousgamra*	African Babul Blue	Everinae	LYCAENIDAE	AUB Campus, Tyre, sea level
26	*Chiladesgalbagalba*	Small Desert Blue	Plebejinae	LYCAENIDAE	Aarida, Sea Level, Aammiq
27	*Aricia agestisagestis*	Brown Argus	Plebejinae	LYCAENIDAE	Hazmiye, Tyre, Aammiq
28	*Spialiaorbiferhilaris*	Orbiferous Skipper	Pyrginae	HESPERIIDAE	15 km E. of Damour, Tyre
29	*Carcharodusalceaealceae*	Hollyhock Skipper	Pyrginae	HESPERIIDAE	Tyre , sea level
30	*Adopoaea hyrax hyrax*	Levantine Skipper	Hesperiinae	HESPERIIDAE	Hazmiye ,Tyre
31	*Gegenespumiliopumilio*	Pigmy Skipper	Hesperiinae	HESPERIIDAE	Hazmiye ,Tyre, Aammiq
32	*Borboborbonicazelleri*	Zeller's Skipper	Hesperiinae	HESPERIIDAE	Aarida , sea level, Tyre

Annex12 List of microalgae of Tyre Coast Nature Reserve

Rare
Merismopediatenuissima
Oscillatoria agardhü
Paracapsasiderophila
Wolleasaccata
Gomphonematrunctatum
Noteworthey
Microcystisflos- aquae
Achnanthesminutissima
Cocconeisplacentula
Cyclotella meneghiniana
Nitzschia palea
Surirella ovata
Introduced (1)
Hyphomorphaantillarum
Threatened (2)
Cymbellaminuta
Cymatopleurasolea

13.12 Annex 13Achievements and Gaps or Challenges facing the implementation of the previous management plan through the actions of its objectives

Operational objectives/ Projects/ Activities proposed on the MP 2004	Achievements	Gaps	Challenges
Operational Objective 1: Conserve the faunal and floral biodiversity in Tyre Coast Nature Reserve			
Project 1.1: Protect the floral species in TCNR			
Activity 1.1.1: Develop a manual to monitor selected flagship (threatened, endangered endemic) species. Activity 1.1.2: Develop a strategy to restore and rehabilitate threatened or degraded habitats. Activity 1.1.3: Reintroduce or propagate threatened key species in TCNR. Activity 1.1.4: Develop and implement a mitigation plan on the impact of present alien invasive species on native biota. Activity 1.1.5: Develop and implement a plan to control grazing in the reserve.	1. An informative booklet for Tyre Coast Nature Reserve have been developed in 2016 in collaboration with the MedWetCoast and MoE. 2. Gemmayz tree/ Ficus syconomorus trees were planted around the artificial pond in Ras-Al-Ain to enrich biodiversity. 3. The invasive plant Heterothecasubaxillaris has been eradicated from the conservation zone of TCNR in May 2015 in collaboration with USJ with the support of MoE, UNESCO, and ECOPLANTMED	1. No update of the list of terrestrial flora species since 2004 2. No sustainable monitoring program of threatened/ or endangered flora species. 3. Weak collaboration of the MT with educational institutes and researches 4. No clear removal program of non-indigenous flora species 5. Lack of initiative form the APAC and MT 6. Lack of financial resources 7. No control of the overexploitation, especially in the Argicultural zone 8. Apiculture and Grazing are still present in the Agriccultural Zone	1. Control the overexploitation in the Agricultural Zone 2. Enhance the coordination with the farmers and the Management Team 3. Enhance the coordination between the APAC and the MoA 4. Enhance the coordination with national experts, institues and Universities 5. Encourage studies related with this topic 6. Engagement of local communities (especially farmers in the monitoring program)
Project 1.2: Conserve the endangered sea turtles species nesting on site			

Activity 1.2.1: Develop a conservation strategy for Sea Turtles. Activity 1.2.2: Develop and implement a yearly monitoring plan during the nesting and hatching seasons. Activity 1.2.3: Reduce the negative impact of the touristic activities on the beach during nesting and hatching seasons. Activity 1.2.4: Develop awareness campaigns for the conservation of sea turtles. Activity 1.2.5: Ensure the provision of proper training and knowledge relating to Sea turtles in the Mediterranean.	1. The activities of the two marine turtles species (Caretta caretta and Chelonia mydas) were regularly monitored especially during the nesting and hatching season since 2013, in collaboration with SPA/RAC and the MoE. The monitoring process is ongoing in collaboration with national marine experts. 2. Two sea turtles were tracked in July 2012 via satellite in partnership with SPA/RAC and SZN revealing that Tyre coastline has a sustainable foraging ground of high biodiversity for both seaturtles species. 3. TCNR team has been trained on monitoring of the sea turtles activities, especially during the summer, and on rescuing injured sea turtles to limit their mortality caused mainly by fishing nets, boats collision. 4. An ecotourism plan based on sea turtles has been established for TCNR in cooperation with the SPA/RAC and the MoE	1. Weak in the interaction between the TCNR and fishermen 2. Light and noise pollution, especially during summer, coming from the beach resorts and the kiosks installed in the touristic zone of the TCNR. 3. Marine litter coming from beach visitors, especially during summer, and rejected by the sea during winter 4. Illegal fishing method, especially during the sea turtles mating and nesting seasons 5. Lack of the enforcement of law, especially the ones of the MoA decision to protect marine turtles and sea mamals 6. No sustainable cleaning program of the beach within TCNR 7. No demarcating zones 8. No signage	1. Apply the actions and recommendations proposed in the Action Plan for for the monitoring and protection of sea turtles along the Lebanese coast 2. More interaction with fishermen, and visitors (especially during summer) 3. Enhance the awareness activities to protect and conserve sea turtles 4. Establishment of the sea turtles rescue center 5. Guarantee a sustainable monitoring program for sea turtles 6. Demarcating the zones within TCNR, especially the conservation zone 7. Apply the actions and recommendation proposed in the ecotourism plan for sea turtles in Tyre 8. Apply the actions and

	5. A sustainable monitoring program for the protection and conservation of sea turtles have been established for TCNR in cooperation with the SPA/RAC and the MoE 6. An awareness campaign for the protection and conservation of the marine turtles along the Lebanese coast including TCNR, has been launched since 2018 (and it is ongoing) in cooperation with the SPA/RAC and the MoE 7. Stranded marine turtles along the Lebanese coast, including TCNR, is monitored under a sea turtles stranding network established in Lebanon since 2019 in cooperation with the SPA/RAC and the MoE 8. The impact of marine litter on sea turtles is also studied and monitored within the TCNR in cooperation with the SPA/RAC and the MoE. 9. Methods, such as the use of green LED lights and special hoos (barbless) for reduction the bycatch of marine turtles within Tyre area were used for one year		recommendation proposed in the sustainable monitoring program for sea turtles in TCNR 9. Apply the actions and recommendation proposed in the National monitoring program for the implementation of COMMON indicator dealing with the impact of marine litter on Sea turtles 10. Benefit from the sea turtles museum to guarantee incomes that can be used for the monitoring program

	in collaboration with Bari University-Italy 10. Action plan for the protection and conservation of marine turtles have been perdormed in 2019 in collaboration with SPA/RAC, and MoE		
Project 1.3: Conserve and protect the fresh water habitat			
Activity 1.3.1: Regularly monitor fresh water reptiles, invertebrate and amphibians. Activity 1.3.2: Regularly monitor and control reed beds to ensure the availability of open reed beds. Activity 1.3.3: Install proper infrastructure to promote conservation of TCNR and improve accessibility. Activity 1.3.4: Develop awareness campaigns for the conservation of fresh water habitats.	No significant achievements	1. No update of the list of fauna associated with the fresh water ecosystems since 2004 2. Lack of funding and capacities 3. Weak of expertize of the TCNR staff 4. Lack initiative from APAC and MT to deal with this topic 5. Weak collaboration of the MT with educational institutes and researches. 6. Lack control of the overexploitation in the Agricultural zone 7. No demarcating zone 8. No siganage 9. Lack application of laws and regulations	1. Update the list of fauna and flora 2. Valorization of natural resources 3. Enhance the awareness and education 4. Enforce the initiative to deal with this topic
Project 1.4: Conserve the bird population in TCNR			
Activity 1.4.1: Develop and implement a monitoring program for the bird species in TCNR.	1. TCNR have a bird watching tower in the		

Activity 1.4.2: Install proper infrastructure to promote conservation of TCNR and improve accessibility to the site Activity 1.4.3: Ban bird hunting and effectively monitor bird-hunting activities. Activity 1.4.4: Develop a strategy to restore and rehabilitate threatened or degraded habitats	conservation zone, that need rehabilitation. 2. Some educative signs/posters were present in the conservation zone of TCNR but they need rehabilitation, and updating.	1. Bird hunting, especially in Ras-Al-Ain zone 2. No sustainable monitoring for bird species 3. No follow up of the impact of non-indigenous bird species 4. Lack of financial resources	1. Maintenance and rehabilitation of the infrastructure 2. Update the list of birds species 3. Sustainable monitoring program for species with special interest 4. Demarcating the zones 5. Put signage 6. Define the needs in expertize and equipments
Project 1.5: Conserve the marine habitats and species			
Activity 1.5.1: Investigate the available laws on the sustainable use of fisheries resources in Lebanon. Activity 1.5.2: Implement a pilot project on sustainable fishing. Activity 1.5.3: Conduct a marine census study. Activity 1.5.4: Coordinate with institutions or organizations in the Mediterranean interested with Marine Habitats, Marine Pollution, etc... Activity 1.5.5: Develop awareness campaigns for the conservation of marine habitats and species.	1. SPA/RAC–UNEP/MAP, in cooperation with the Ministry of Environment (MoE), conducted an Ecological characterization of marine sites of interest for conservation in Enfeh Peninsula, Ras Chekaa cliffs, Raoucheh, Saida, Tyre (including some sites within the TCNR), and Nakoura (RAC/SPA–UNEP/MAP, 2014). 2. International Union for Conservation of Nature (IUCN) in cooperation with the SPA/RAC-UNEP/MAP conducted a marine survey in Tyre under the framework of the	1. Weak monitoring of the marine ecosystems and biodiversity within the TCNR 2. No list of marine ecosystems 3. No list of fauna and flora marine species 4. Pollution, (urban and agricultural) 5. Marine litter, and ghostnets 6. Climate change and acidification 7. Bloom of toxic algae 8. Illegal fishing methods	1. Zoning of the marine waters within the TCNR 2. Ecological characterization of marine habitats and associated species 3. Developp the list of fauna and lora 4. Developp a sustainable monitoring program for species with special interest 5. More communication and coordination with national experts and univeristies and research centers

project sustainable fisheries management for improved livelihoods of the coastal fishing community in Tyre, south Lebanon. 3. CNRS-NCMS conduct a study to evaluate the environmental quality of Tyre and Beirut area within a project of two years, 2019-2021. 4. SPA/RAC–UNEP/MAP, in cooperation with the Ministry of Environment (MoE), conducted an ecological characterization of the coastal and marine habitats in Tyre, Lebanon.	9. No sustainable monitoring program of some key species 10. Lack in the expertize of the MT to deal and work with those topics 11. Lack of participation in International/ and National training related with the marine topics 12. No references to book, and no application of the actions and recommendations proposed in National monitoring program for biodiversity in Lebanon-SPA/RAC-MoE; Action Plan for Non-Indigenous species- SPA/RAC-MoE; Action plan for the monitoring, protection, and conservation of coralligenous assemblages in Lebanon SPA/RAC-MoE-Lebanon's National Biodiversity Strategy and Action Plan-MoE.	6. Integrate fishermen on the activities of the Management plan 7. Train the reserve staff to deal with this important topic 8. Develop an ecotourism strategy based on the marine habitats and associated species 50.

Project 1.6: Conserve the sand dune habitat in TCNR			
Activity 1.6.1: Develop an action plan for sand dune protection. Activity 1.6.2: Install proper infrastructure to promote conservation of TCNR and improve accessibility to the site (cross-cutting-1.3.3). Activity 1.6.3: Develop and implement a plan to control grazing in the reserve (crosscutting-1.1.5). Activity 1.6.4: Reduce the negative impact of tourists' activities on the beach during the summer Action 1.6.5: Implement a methodology for sand dune stabilization and regeneration.	No significant achievement	1. No demarcating of the three zones of the TCNR 2. High tourism pressure 3. Weak communication, especially with relevant national experts 4. No educative signage within the TCNR 5. Lack of financial resources	1. Develop an action plan for the protection and conservation of sand dune protection 2. Demarcating the zones within the TCNR 3. Put educative signage
Project 1.7: Enhance the natural landscape of TCNR			
Activity 1.7.1: Reduce the obstructive visual impact of infrastructure on the beach. Activity 1.7.2: Reforest the agricultural roads in Raas el Ain with the suitable plant species. Activity 1.7.3: Develop a landscape master plan for the reserve including the ecological, archeological and environmental significance of the site. Activity 1.7.4: Implement the master plan. Activity 1.7.5: Install proper infrastructure to promote conservation of TCNR and improve accessibility to the site	Gemmayz tree/ *Ficus syconomorus* trees were planted around the artificial pond in Ras-Al-Ain to enrich biodiversity.	1. Lack of staff number and capacities 2. Lack of financial resources 3. Lack of expertize 4. Lack of initiative	1. More patrolling 2. More training of the TCNR staff 3. More coordination with local communicties (especially farmers 4. Involvemet of farmers in the management plan activities
Operational objective 2: Reduce threats caused by users			
Project 2.1. Reduce the negative impact of the users of the site.			
Activity 2.1.1: Develop and implement a plan to control grazing in the reserve. Activity 2.1.2: Reduce the impact of the tourists' activities on the beach during the summer.	1. Marine patrols to reduce illegal fishing methods in collaboration with the municipality of Tyre and	1. Lack in the enforcement of law 2. High tourism pressures	1. Control the aricultural zones

Activity 2.1.3: Conduct regular cleaning campaigns. Activity 2.1.4: Calculate the carrying capacity for the site.	the Internal Security Guards. 2. Stop the use Jet skis within the TCNR marine zone, by a decision of the Municipality of Tyre for protection and conservation purpose, especially for sea turtles protection.	3. High pressures coming from the Rachidiyeh camp 4. Low staff capacity	2. Dealing with the farmers within the Agricultural zone 3. Define priority 4. More patrolling 51.
Project 2.2: Reduce the impact of Tyre open solid waste dump			
Activity 2.2.1: Develop a proposal for funding an integrated solid waste management in Tyre. Activity 2.2.2: Implement awareness campaigns for the local community on solid waste management. Activity 2.2.3: Develop a household recycling program in Tyre City. Activity 2.2.4: Regular monitoring of ground water to detect leaching.	No significant achievements	1. No waste water management, especially for the kiosks placed during summer within the touristic zone of TCNR 2. No irrigation plan and strategy within the agricultural zone Of TCNR 3. Lack of financial resources	Develop a wate water and irrigation strategy and plan \ More coordination with the Litani River Autority Define the need
Project 2.3: Reduce the impact of wastewater discharge into the sea in Tyre.			
Activity: 2.3.1: Assist the municipality in developing proposals. Activity 2.3.2: Seek funds from international and multinational agency. Activity 2.3.3: Develop a collaboration mechanism with the CHUD project in this matter.	No significant achievements	1. Lack of initiative from the APAC and MT 2. Lack of financial resources 3. No control on the working farmers within the agricultural zone of TCNR	Develop a wate water and irrigation strategy and plan More coordination with the Litani River Autority Define the needs
Project 2.4: Promote Sustainable fishing			

Activity 2.4.1: Investigate the available laws on the sustainable use of fisheries resources in Lebanon Activity 2.4.2: Implement a pilot project on sustainable fishing (crosscutting-1.5.2). Activity 2.4.3: Conduct a marine census study (crosscutting-1.5.3). Activity 2.4.4: Implement an awareness campaign for fishermen on sustainable fishing practices and techniques.	1. Assessment study on governance framework for fisheries in the Casa of Tyre – South Lebanon have been performed by IUCN (2014-2017) 2. Same achievements as project 1.5	1. Weak communication and interation with fishermen 2. Law enforcement of MoA decision and regualations 3. Illegal fishing methods 4. Weak Application of the strategy proposed in Sustainable Fisheries Management for for Improved Livelihoods of the Coastal Fishing Community in Tyre, South Lebanon-IUCN 52.	Guarantee the establishment of the suatinable fisheries program developped
Project 2.5: Reduce the impact of agriculture pollution by promoting environmental friendly practices.			
53. Activity 2.5.1: Train local farmers to produce and package environmental friendly products.	No significant achievement	1. No control of the working farmers within the agricultural zone 2. No educative and awareness activities	More engament and coordination with local farmers
Project 2.6: Restore and rehabilitate the natural flow of Raas el Ain estuary to the sea			
Activity 2.6.1: Study the minimum flow required to maintain a healthy estuarine ecosystem.	No significant achievement	1. Lack of maintenance of the infrastructure	No challenges

Activity 2.6.2: Reduce the negative human impact on the estuary.		2. Lack of financial resources 3. Lack of staff number and capacities	
Project 2.7: Promote the sustainable use of resources derived from the wetlands.			
Activity 2.7.1: Develop a study to improve the efficiency of the irrigation system used in the vicinity. Activity 2.7.2: Promote and support environmental friendly or organic agriculture. Activity 2.7.3: Calculate the carrying capacity for the site (crosscutting-2.1.4). Activity 2.7.4: Develop and implement a plan to control grazing in the reserve (crosscutting-1.1.5). Activity 2.7.5: Promote the wise use of ground water according to Ramsar Guidelines. Activity 2.7.6: Conduct a water budgeting analysis for the Raas el Ain springs.	No significant achievement	1. Lack of initiative from APAC and MT 2. No irrigation strategy	Deal with the conflict with farmers about the exploitation of natural resources within the TCNR
Operational objective 3: To restore and rehabilitate the cultural value of Raas el Ain Area in TCNR			
Project 3.1: Restore and rehabilitate the artesian wells and the surrounding Area			
Activity 3.1.1: Develop a complete historical study and literature review of the site. Activity 3.1.2: Restore and rehabilitate the Mill house in Raas el Ain into a visitor center. Activity 3.1.3: Remove all illegal housing in the Area. Activity 3.1.4: Develop a landscape master plan for the reserve including the ecological, archeological and environmental significance of the site (crosscutting-1.7.3). Activity 3.1.5: Implement the master plan (crosscutting-1.7.3). Activity 3.1.6: Develop an administrative coordination mechanism among all the stakeholders concerned with Raas el Ain (i.e. Water	Most of the illegal housing aroud Ras-Al-Ain have been removed	1. Lack of coordination and communication 2. Lack of financial resources	No challenges

department of the South, department of Antiquities, Litani Water Authority, Council for Development and Reconstruction, Ministry of Environment and the APAC).			
Project 3.2: Create facilities to host tourists in Raas el Ain. (in close coordination with the ministry of culture's Directorate of General Antiquities)			
Activity 3.2.1: Install proper infrastructure to promote conservation of TCNR and improve accessibility Activity 3.2.2: Restore and rehabilitate the Mill house in Raas el Ain into a visitor center Activity 3.2.3: Develop an ecological museum highlighting the natural significance of the site. Activity 3.2.4: Initiate Agro-tourism activities in Raas el Ain Area.	No significant achievements	1. High tourism pressure 2. Lack of maintenance and rehabilitation of infrastructure 3. No control of the working farmers within the agricultural zone of TCNR	No challenges
Operational Objective 4: Improve the economic livelihood of the local population in and around TCNR			
Project 4.1: Revive traditional knowledge and indigenous practices of the local community in and around the site.			
Activity 4.1.1: Conduct a thorough survey to identify all traditional knowledge and indigenous practices of the local communities in the conservation of TCNR. Activity 4.1.2: Develop a proper marketing strategy to promote the identified practices and the knowledge for the purpose of income generation.	No significant achievement	Lack of expertize Lack of initiative	Valorization of the natural resources within the TCNR
Project 4.2: Improve the added-value of the agricultural practices through direct intervention with Raas el Ain farmers.			
Activity 4.2.1: Train local farmers to produce and package environmental friendly products Activity 4.2.2: Implement a pilot plan for organic farming in a demonstration plot. Activity 4.2.3: Develop integrated pest management strategy for the agricultural areas in the reserve Activity 4.2.4: Implement integrated pest management plan for the agricultural areas in the reserve	No significant achievement	1. No control of the working farmers within the agricultural zone of TCNR 2. No educative and awareness activities	1. Dealing with the confict with farmers and fishermen 2. More initiative to deal with this topic 3. Valorization of the natural resources within the TCNR

Activity 4.2.5: Create retail outlets for the agriculture produce of the site. Activity 4.2.6: Create a certification system to ensure that products reach reliably high standards. Activity 4.2.7: Construct a packaging center for all the products and crops in TCNR.		3. Lack of initiative from the APAC and MT	
Project 4.3: Promote sustainable fishing practices in Tyre City			
Activity 4.3.1: Implement an awareness campaign for fishermen on sustainable fishing practices and techniques (crosscutting-2.4.4). Activity 4.3.2: Conduct a feasibility study on sustainable fishing practices. Activity 4.3.3: Provide the fishermen with legal fishing nets and the proper fishing equipment.	Assessment study on governance framework for fisheries in the Casa of Tyre – South Lebanon have been performed by IUCN (2014-2017)	1. Weak communication and interaction with fishermen 2. Law enforcement of MoA decision and regulations 3. Illegal fishing methods 4. Weak Application of the strategy proposed in Sustainable Fisheries Management for for Improved Livelihoods of the Coastal Fishing Community in Tyre, South Lebanon-IUCN 54.	1. Enhance the coordination and communication with fishermen 2. More patrolling 3. Enhance the application of law and regulation 4. More awareness and education activities 5. Engagement of fishermen in the activities of the TCNR
Project 4.4: Promote income generation activities for the local community			
Activity 4.4.1: Create a revolving fund to finance Small and Medium Enterprises (SMEs) projects leading to the alleviation of stress on the site. Activity 4.4.2: Initiate and market Bed & Breakfast in the city of Tyre.	1. A socio-economic evaluation has been performed by the SPA/RAC in collaboration with MoE	1. No action taken to create a sustainable funding mechanism for the reserve such as a revolving fund	1. Valorize and benefit for the infrastructure within the TCNR 2. Entrance fees

Activity 4.4.3: Develop a community development plan. Activity 4.4.4: Develop a business plan for TCNR.	2. An economic valuation of ecosystem services has been conducted by the IUCN in collaboration with MoE	that would help the Management Team finance protection and conservation activities, as well as other revenues generating projects 2. Absence of a marketing and communication plan to involve and mobilize the local communities in the management and protection of the reserve by incentivizing them and showcasing the economic value that the ecosystems of TCNR are offering	3. The local community (example, boat makers and local fishermen), ask for high fees to coordinate activities with project activities 4. The TCNR itself did very shy efforts in propmotion and marketing for their products (packages) in and outside the TCNR 5. It is extremely difficult to organize an ecotourism day with lunch prepared by the local community in the surrounding villages of the TCNR; the team usually use to bring the food prepared by the local community to the pond with great difficulties. 6. Difficulty to develop the agriculture

			activities with visitors, it was only watching the crops and rarely vegetable picking.
			7. Difficulty to manage a catch-up with turtles watch activity for school groups.
Operational Objective 5: Ensure the economic viability of the nature reserve and surrounding area			
Project 5.1: Mobilize financial resources from private and public agencies			
Activity 5.1.1: Develop a business plan for TCNR (crosscutting-4.4.4). Activity 5.1.2: Mobilize international and national funding sources for wetland conservation and wise use. Activity 5.1.3: Organize a yearly donor tour. Activity 5.1.4: Prepare a feasibility study on organic farming in TCNR. Activity 5.1.5: Develop a strategy to diversify sources of funding for TCNR. Project 5.1.6: Propose and implement alternative socio-economic and cultural development plans based on local experiences Activity 5.1.7: Finance an alternative income-generating plan for the kiosk owners located in the tourism zone of the reserve.	1. A socio-economic evaluation has been performed by the SPA/RAC in collaboration with MoE 2. A socio-economic evaluation has been performed by the IUCN in collaboration with MoE	1. No ecotourism plan and strategy 2. No entrance fees 3. No control of farmer within the agricultural zone of the TCNR 4. Weak communication with local communities and beach visitors, especially during summer 5. No use of the TCNR infrastructure (e.g. Sea turtle museum) as an activity that could generate a sustainable revenue stream	1. Developp a communication strategy 2. Developp a financial syatem and strategy within the TCNR based on the socio-economic value 3. Valorize and benefit for the infrastructure within the TCNR 4. Lack of staff number 5. No control of the farmers 6. No clear contract with farmers 7. Lack of financial resources

Project 5.2: Develop a community development plan			
Activity 5.2.1: Finance an alternative income-generating plan for the kiosk owners located in the tourism zone of the reserve (crosscutting-5.1.7). Activity 5.2.2: Develop a community development plan (crosscutting-4.4.3) Activity 5.2.3: Develop a business plan for TCNR Activity 5.2.4: Conduct a feasibility study on sustainable fishing practices Activity 5.2.5: Prepare a feasibility study on organic farming in TCNR	1. TCNR managed to secure some funding from Tyre Municipality income generated by: the tourism activities on the beach (e.g. renting beach areas during summer, within the touristic zone of the TCNR, to 49 removable beach restaurants, as kiosks, summer activities, especially kayaks, and parking in the touristic zone of the TCNR). 2. A socio-econmic study have been developed in cooperation with the SPA/RAC and MoE	1. No ecotourism plan and strategy 2. No entrance fees 3. No valorization and benefit of the infrastructure 4. No control of farmer within the agricultural zone of the TCNR	1. Developp a communication strategy 2. Developp a financial syatem and strategy within the TCNR based on the socio-economic value 3. Valorize and benefit for the infrastructure within the TCNR
Project 5.3: Develop and promote eco-tourism activities			
Activity 5.3.1: Establish an operational tourist management system. Activity 5.3.2: Construct a fully equipped visitor information center to host all tourism. Activity 5.3.3: Develop a mechanism of cooperation with tour operator and eco-tour operators. Activity 5.3.4: Install proper infrastructure to promote conservation of TCNR and improve accessibility Activity 5.3.5: Create retail outlets for the agriculture produce of the site Activity 5.3.6: Initiate Agro-tourism activities in Raas el Ain Area	A friendly visitor center was opened in the reserve 2012 in the touristic zone	1. Lack of staff number 2. No control of the farmers 3. No clear contract with farmers 4. Lack of financial resources	Developp and establish a good tourism strategy 5.3.1: This should be part of the business plan and should be revised every 2 years. Packages based on the relation with the local communities should be developed with experts in ecotourism 5.3.2: a visitor center without local tour guides, park rangers and guards cannot be functional (without mention of course of the main administrative team); we need a wider visitor center which plays the following role: - hosting and welcoming - activities reservations, ticketing and operations - awareness area with multipurpose auditorium and

			- marine interactive area (different than a museum) - marine nursery and hospital - rest area - souvenir shop - transfer services (paid) for tourists without means of transport, reaching the reserve parts 5.3.4: There is a huge lack at this level, but - there is as well a huge lack of responsibility in maintenance of the equipment. - with lack of funds, we can introduce tourist involvement programs where a visitor may pay to help in maintenance instead of the TCNR paying labor for the same task. 5.3.5: sure, very important for tourism activity as well. 5.3.6: described above
Project 5.4: Develop visitor management plan			
Activity 5.4.1: Conduct a survey of visitors to the reserve specifically to the tourism zone. Activity 5.4.2: Establish a monitoring and control system for the management of tourism activities. Activity 5.4.3: Develop a zoning plan for tourist.	No achievement	1. Lack of financial resources 2. Lack of initiative 3. No control of the high number of tourist, during summer 4. Lack in staff number 5. Lack of expertize	Train the reserve staff to deal with this topic Demarcating the zones within the TCNR
Operational Objective 6: Establish appropriate administrative facilities and technical resource to achieve sustainability of the reserve.			
Project 6.1: Develop permanent management facilities			
Activity 6.1.1: Employ staff to properly manage and safeguard the site.	The staff of the TCNR is composed of a Manager (currently no manager for the	1. Lack of staff number and capacities	Establish a good Management team within the TCNR (including an

Activity 6.1.2: Provide the staff with proper equipment and material.	TCNR), deputy manager, administrative officer, one cleaner, and three rangers	2. Some of the MT staff have low education level and language challenges	agricultural expert, Marine expert, Finacial and administrative officer)
Project 6.2: Construct proper visitor infrastructure on site			
Activity 6.2.1: Install proper interpretive signs located within the visitor trail. Activity 6.2.2: Install a visitor trail in the reserve. Activity 6.2.3: Construct a bird hide to promote bird conservation of TCNR. Activity 6.2.4: Construct wooden bridges. Activity 6.2.5: Construct a fully equipped visitor information center to host all tourism Activity 6.2.6: Install garbage bins in appropriate locations on site.	1. A friendly visitor center was opened in the reserve 2012 in the touristic zone 2. An educative trail, a wooden bridge, and a bird tower were opened in the conservation zone of the TCNR 3. TCNR is equipped by material for sea turtle monitoring activities, diving gears, compressor for filling diving bottle. 4. A sea turtles' museum has been opened in 2019 within the touristic zone of TCNR	1. Lack of maintenance of the infrastructure 2. Lack of educative signage 3. No demarcating of the appropriate zones of TCNR 4. Weak expertize of MT to choose the appropriate equipment	1. Rehabilitation and maintenance of infrastructure 2. Establishment of a sea turtle rescue center 3. Establishment of a scientific laboratory within the TCNR 4. Demarcating of the zones 5. Signage 6. Define and update the educative trail within the TCNR
Project 6.3: Develop training program on capacity development for the conservation of Tyre Coast Nature Reserve.			
Activity 6.3.1: Identify training need for the management team and APAC. Activity 6.3.2: Develop a training program for the management team. Activity 6.3.3: Provide continuous training for the management team. Activity 6.3.4: Develop a volunteer training manual. Activity 6.3.5: Develop a cooperation mechanism with academia to include the research and monitoring requirements of TCNR in their research and internship programs.	1. The TCNR team have been trained on the monitoring (diving and techniques) and identification of marine species under the framework of the project "Market policy and legislative development for mainstreaming the sustainable management of marine and coastal ecosystems in Lebanon",	1. Lack of initiative from the APAC and MT to communicate with relevant national experts, institutes and research centers 2. Low educational level of the TCNR staff	1. Developp a plan to propose the needs in expertize for TCNR 2. More involvement and motivation coming from the TCNR staff 3. Involcement of young researchers in the activities of TCNR

Activity 6.3.6: Collaborate with external technical organization to provide the proper training for the Management Team.	executed by the International Union for the Conservation of Nature - Regional Office for West Asia IUCN-ROWA, and implemented in partnership with the Lebanese Ministry of Environment (MoE) and with a fund from the Global Environment Facility (GEF) and the United Nations Environment Programme (UNEP) as an implementing agency. 2. TCNR team has been trained on monitoring the activities of sea turtles, especially during the nesting seasons and also on rescuing injured sea turtles to limit their mortality caused mainly by fishing nets, boats collision.		4. Dealing with the conflict between the TCNR staff
Operational Objective 7: To raise environmental awareness on the benefits and function of Tyre Coast Nature Reserve			
Project 7.1: Develop an awareness campaign targeting behavioral change in the local community and stakeholders in Tyre.			
Activity 7.1.1: Implement environmental awareness campaigns for the general public regarding the values and functions of TCNR. Activity 7.1.2: Develop awareness campaigns for the conservation of sea turtles. Activity 7.1.3: Develop awareness campaigns for the	An awareness campaign to protect and conserve marine turtles along the Lebanese coast, including TCNR is launched since 2019 in collaboration with SPA/RAC and the MoE.	1. Lack initiatives from APAC and MT to initiate such trainings from international organizations/ project, and activities	1. Enhance the awareness and education activities 2. More communication and

conservation of fresh water habitats. Activity 7.1.4: Develop awareness campaigns for the conservation of marine habitats and species. Activity 7.1.5: Implement awareness campaigns for the local community on solid waste management. Activity 7.1.6: Implement awareness campaigns for fishermen on sustainable fishing practices and techniques. Activity 7.1.7: Train local farmers to produce and package environmental friendly products. Activity 7.1.8: Participate in exhibitions and yearly events such as (World Wetland day, National protected Area day, World Food day).		2. Low education level of the Management staff 3. Lack of financial resource	involvement of local communities
Project 7.2: Develop awareness material on the benefits and functions of TCNR (digital media, print media)			
Activity 7.2.1: Develop an interactive school manual about wetlands for children. Activity 7.2.2: Develop educational material for school children such as posters and educational tapes. Activity 7.2.3: Develop an information brochure for TCNR. Activity 7.2.4: Develop a bird guide for TCNR in Arabic and English. Activity 7.2.5: Produce a television spot to raise awareness and promote TCNR. Activity 7.2.6: Prepare material and complementary information packages to highlight the importance of TCNR.	An informative booklet for Tyre Coast Nature Reserve have been developed in 2016 in collaboration with the MedWetCoast and MoE. Many activities have been done with schools, local communities within the reserve. However, the activities were limited to a visit of the conservation zone Videos, posters, have been developed under the framework of some projects dealing with marine litter, socio-economic, and tourism. 55.	1. Lack of educative awareness within TCNR 2. Weak expertize of the MT 3. Lack of updated studies and research 4. Lack of intiative from the APAC 5. Lack of interest 6. Lack of management 7. Lack of financial resource	1. Develop brochures valorizing the importance of TCNR 2. And showing the important habitats and associated biodiversity. 3. Develop of communication strategy 4. Enhance the communication (especially more appearance on social media platforms)
Operational objective 8: To involve stakeholder in the management of Tyre Coast Nature Reserve.			
Project 8.1: Promote stakeholder involvement in decision-making and management strategies of Tyre Coast Nature Reserve			

Activity 8.1.1: Organize workshops with identified groups of users among the stakeholders to develop a strategy for achieving local involvement in TCNR management. Activity 8.1.2: Carry out participatory planning and negotiation among stakeholders to develop a strategy for achieving local involvement in TCNR management.	No significant achievements	1. Lack of interest and commitments 2. Low level of communication with local community 3. Lack of engagement of stakeholders 4. Confict with farmers, and fishermen realted to the exploitation of the reserve natural resources	1. Involvement of stakeholders (especially local communities, farmers, fishermen) 2. Sharing informations and data 3. Engagement of stakeholders on the monitoring and activities done within the TCNR
Project 8.2: Encourage and facilitates the collaboration with academia in the management of TCNR			
Activity 8.2.1: Develop a cooperation mechanism with academia to include the research and monitoring requirements of TCNR in their research and internship programs. Activity 8.2.2: Develop a yearly research agenda covering the research needs of Tyre Coast Nature Reserve.	The National Center for Marine Sciences (CNRS-NCMS) has integrated the reserve, especially the touristic zone, in its national programs of marine water quality monitoring.	1. Lack of assistance from relevant national institutes and research centers 2. Lack initiative from the APAC and MT to communicate with national institutes and research centers 3. Lack in the Management Planning 4. Lack of sharing data	1. Enhance the Mangement Planning 2. Day to day management 3. Enhance the coordination and communication with others institues and reseachers and universities 4. Define the need of the TCNR in researches

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