

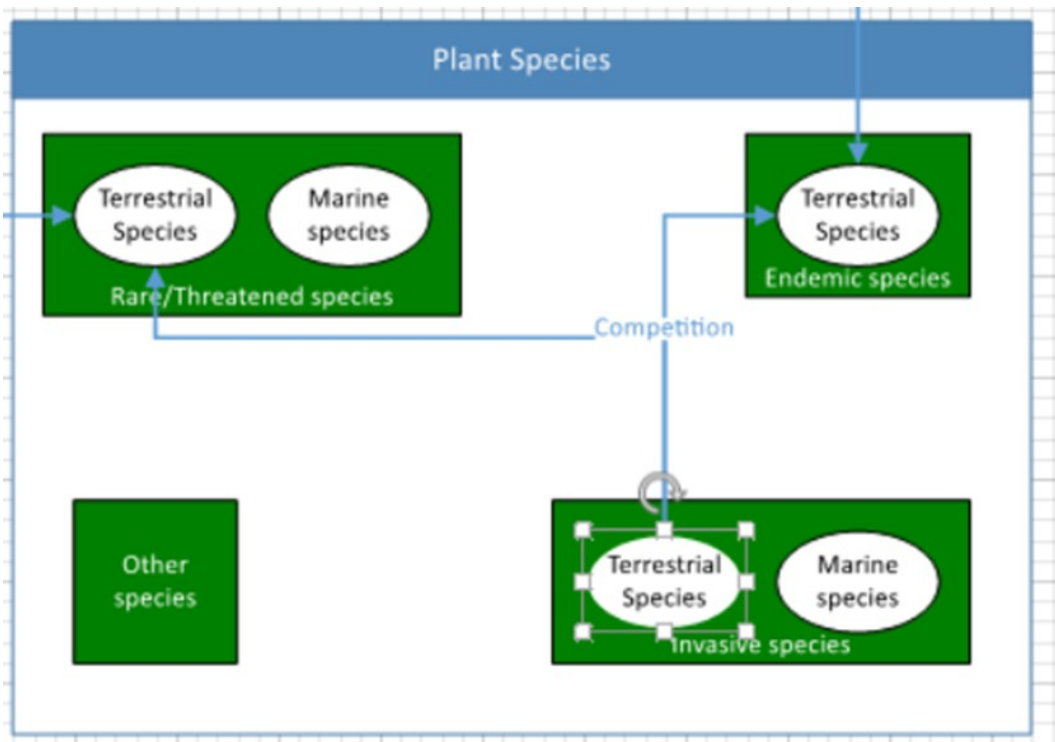
#### 4- APPLICATION CASE: FLORA (INVASIVE SPECIES)

##### Introduction

The Tyre Coast Nature Reserve (TCNR) boasts a diverse plant ecosystem, housing both rare, endemic and invasive species. *A. berytheus*, a plant species exclusive to the eastern Mediterranean coastline, faces significant endangerment within Lebanon. Initially documented in five locations across the country, rampant urban expansion along the Beirut coastal zone has led to the extinction of this plant in four locations. Consequently, only a singular remaining population exists within the TCNR. Endemic plants are well-suited to the coastal conditions and play a crucial role in stabilizing the ecosystem and providing homes for wildlife. However, these unique species face threats from human activities like trampling, overexploitation, grazing, potentially leading to overexposure. On the other hand, invasive species, introduced from outside regions, aggressively compete with native vegetation. The proliferation of this plant (*Heterheca subaxillaris*) within the scientific zone of TCNR has profoundly impacted the local ecosystem.

This invasive plant aggressively competes for vital resources such as sunlight, water, and nutrients, disturbing the growth patterns of native and endemic vegetation. Its swift expansion can disrupt the ecosystem's structure, ultimately diminishing biodiversity and native fauna habitats. Additionally, this invasive species alters the soil composition, further impeding the growth of indigenous plants. Hence, it is crucial to exert efforts in controlling and managing its spread to maintain the natural balance and diversity within the TCNR coastal ecosystem. Furthermore, safeguarding endangered and endemic species from human intervention is equally vital.

**Figure 4.1:** Components of Plant Species Container



Within the cause-and-effect analysis system and as identified by stakeholders in the ISP system, a variety of components constitute a plant species (figure 4.1). These components encompass Rare and Threatened species (both Marine and Terrestrial), Endemic Species (Terrestrial), as well as Invasive Species (both Marine and Terrestrial).

#### 4.1 – Terrestrial species (Id 28) (Container Plant Species, Component, Rare/Threatened species) -> Local Community in TCNR Biosphere.

##### 4.1.1 - Process explanation: diagram + components + relations

For botanists, TCNR holds a distinct plant, **Astragalus berytheus**, exclusive to this area. It also hosts two scarce and at-risk species, **Ficus sycomorus** and **Panocratum maritimum**, alongside numerous notable plant varieties, some of which have vanished from much of Lebanon's coast. Additionally, the introduced plant, **Physalis peruviana**, deserves careful monitoring (Bauer, 2020).

Depending on TCNR, **Salsola Kali**, is facing **threats** due to the influence of the **local community in the biosphere** (Over exploitation for export). Noticing that there is no data upload in ISP explain this fact (Table 4.1)

Regarding the local community, there has been a noticeable rise in population, including both Lebanese residents and refugees (Syrian and Palestinian). This population increase has led to alterations in the vegetation cover within TCNR due to trampling and grazing. Addressing this issue necessitates proper legal management to curb these detrimental practices.

#### [Terrestrial Species (Id=28)]



**Table 4.1:** Indicators of Terrestrial Species (Descriptive data)

Indicators attached to component: Terrestrial Species (Id=28)				
Name	Description (Sand dune plant)	DataSource	UpdateFrequency	Notes
Presence of Salsola kali	Over exploitation for export		Occasional	
Cover of Salsola kali				

**[Local Community in TCNR Biosphere (Id=1121)]**



Table 4.2 displays data regarding the local community within the Biosphere, encompassing Indigenous people and refugees during both 1997 and 2011. The tabulated information (table 4.3 and 4.4) and accompanying diagrams (figure 4.2 and 4.3) depict the growth of the local community in the Biosphere from 1997 to 2011, highlighting the escalating human impact on coastal resources and the coastal ecosystem. This clarifies the excessive utilization of uncommon plant species (*Salsola kali*).

**Table 4.2:** Indicators of Local Community in Biosphere

<b>Indicators attached to component: Local Community in TCNR Biosphere (Id=1121)</b>				
<b>Name</b>	<b>Description</b>	<b>DataSource</b>	<b>UpdateFrequency</b>	<b>Notes</b>
Sour Population	population of Tyre	UN	Tyre City Population (Indigenous People and Refugees) - Extracted from United Nations 2017 (Tyre City Profile)	

**Table 4.3:** Tabular for the local community in Biosphere during the year of 1997

<b>Local Community in TCNR Biosphere (Id=1121) =&gt; Population of Tyre =&gt; Population =&gt; Population</b>						
<b>Year</b>	<b>Municipality</b>	<b>Leb_PRL_Outside Camps</b>	<b>Syrian_Refugees</b>	<b>PRL_Camps</b>	<b>PRS_Ali</b>	<b>Total Population</b>
1997	Aabbassiyet Sour	11925				11925
1997	Aain Baal	4338				4338
1997	Borj Ech-Chemali	22311				22311
1997	Sour	47479				47479

7						
1997	Tyre District	86053				86053

Figure 4.2: Local community Population in Tyre during the year of 1997

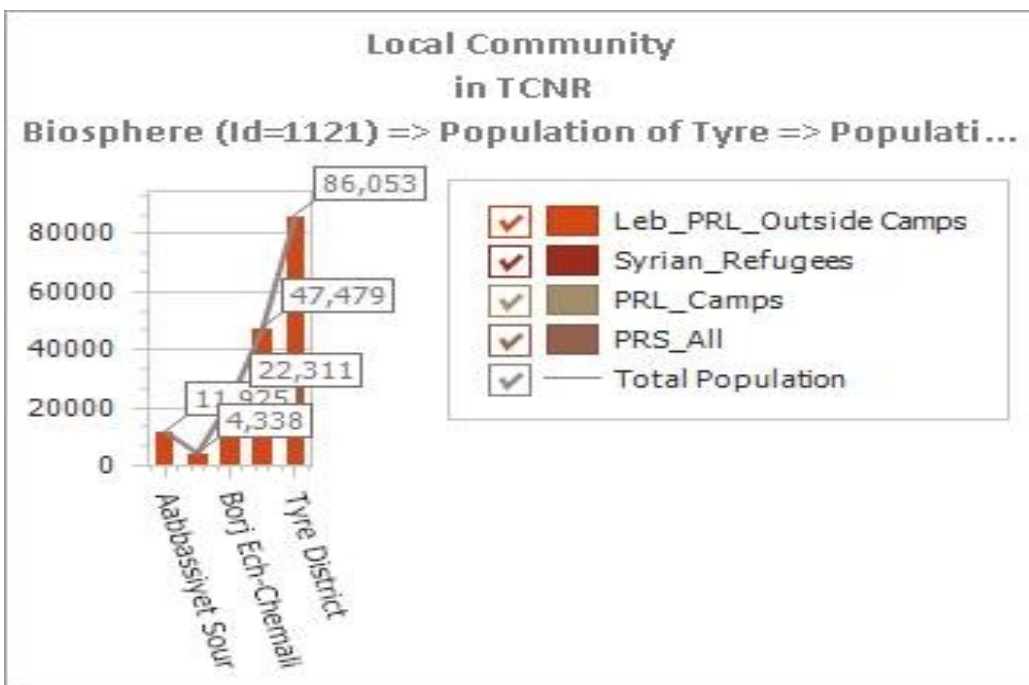
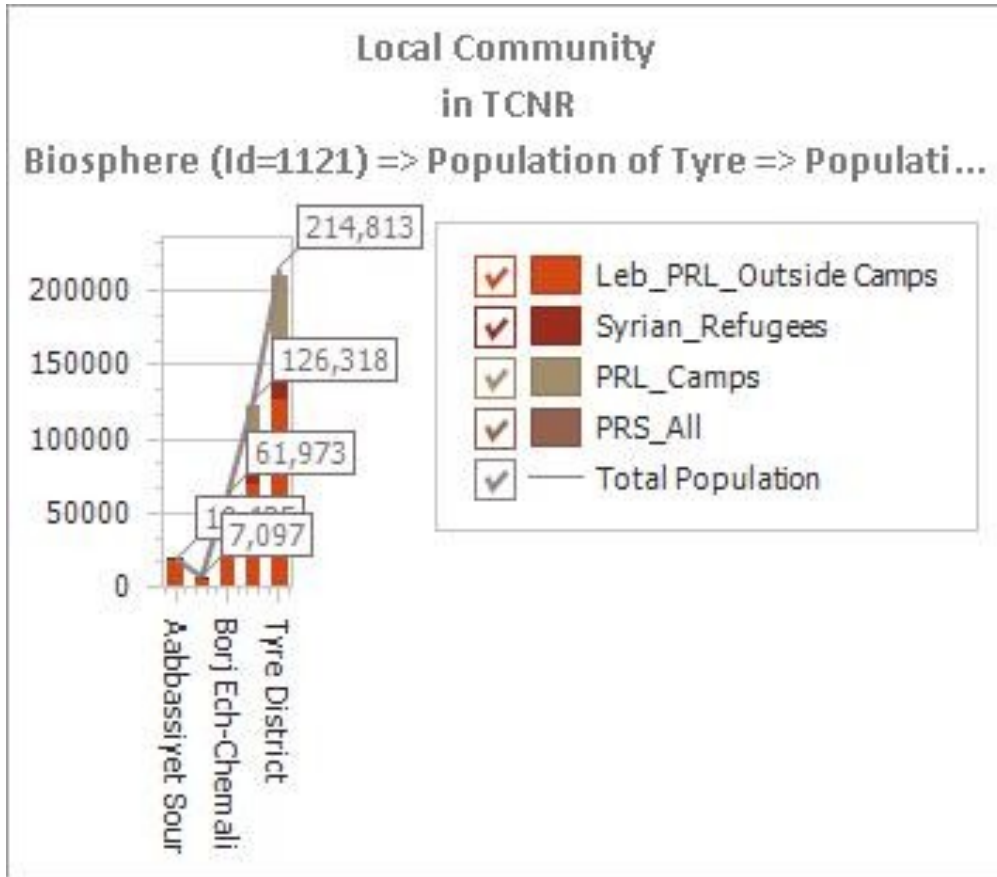


Table 4.4: Tabular for the local community in Biosphere during the year of 2011.

Local Community in TCNR Biosphere (Id=1121) => Population of Tyre => Population => Population						
Year	Municipality	Leb_PRL_Outside Camps	Syrian_Refugees	PRL_Camps	PRS_All	Total Population
2011	Aabbassiyet Sour	17556	1869			19425
2011	Aain Baal	6386	711			7097
2011	Borj Ech-Chemali	32886	2498	24173	2416	61973
2011	Sour	69984	8147	45551	2636	126318

1						
201	Tyre District	126812	13225	69724	5052	214813
1						

**Figure 4.3:** Local community Population in Tyre during the year of 2011.



#### 4.1.2 – From the gap analysis to the identification of options and opportunities

The limited availability of data concerning rare and at-risk plant species, including *Salsola Kali* and related species, emphasizes the importance of conducting thorough field visits. These visits are fundamental for accurately determining the entire population of these plants within the designated scientific zone of TCNR. The assessment, ideally extended over about two years, provides a valuable window for a comprehensive monitoring process, allowing us to carefully observe and understand the alterations these plants undergo over time (such as comparing data from two distinct years). These shifts are influenced by a combination of natural elements and human-induced pressures.

By adopting this systematic approach, we can compile a comprehensive and reliable database specifically focused on these unique plant species. This database will serve as a critical foundation for further research, conservation efforts, and informed decision-making aimed at preserving the delicate balance of this ecological system.

This comprehensive approach entails daily monitoring of the scientific zone to promptly identify any illegal activities like grazing or trampling. This proactive surveillance is vital for maintaining the zone's integrity and safeguarding the plant species under study. It allows for swift intervention should any unauthorized human activities be detected, thereby ensuring the conservation of the natural habitat.

Moreover, we are profound on launching an "anti-illegal practices" initiative, commencing with issuing warnings and advancing to enforce penalties like fines and imprisonment. This proactive step aims to deter unlawful activities that could disrupt the ecological balance of TCNR. Education and awareness campaigns targeting the local community will be integrated into this approach, enlightening them about the critical importance of preserving this natural habitat. However, the effectiveness of this plan depends greatly on strong collaboration and backing from significant stakeholders, particularly the Ministry of Environment and APAC (Agency for the Protection and Conservation of the Environment). Their engaged participation is vital for creating and enforcing rules and instating policies that prioritize the safeguarding and responsible administration of TCNR.

#### **4.2 – Terrestrial species (Id 28) (Container Plant Species, Component Rare/Threatened species) -> Terrestrial Species (Id 33), Container Plant Species (Id 1029), Invasive species (Id 32).**

##### **4.2.1 – Process explanation: diagram + components + relations**

Based on the indicators and graphical representations, we have been able to observe the invasion of *Heterotheca subaxillaris*, an invasive species, within the scientific zone of TCNR. An extensive field survey was conducted in August 2023 (table 4.5). This field survey is a result of collaboration between Lebanese university students and TCNR, bringing to light this invasive presence. The survey's outcomes provided valuable insights, revealing a substantial total of approximately 1270 species (table 4.6 and figure 4.4). This data serves as a testament to the rich biodiversity and complexity of the ecosystem thriving within TCNR during the specific period under study.

Moreover, to this survey there is a study done by collaboration between Saint Joseph University of Beirut and TCNR revealed the existence of this species with different density in the Scientific zone (Figure 4.5). The recognition of *Heterotheca subaxillaris* as an invasive species underscores the critical need for proactive strategies aimed at effectively managing and mitigating its adverse effects on the indigenous flora and fauna.

[Terrestrial Species (Id=33)], INVASIVE SPECIES

Terrestrial Species (Id 33) Container [Plant Species (Id=1029)] -> [Invasive species (Id=32)]



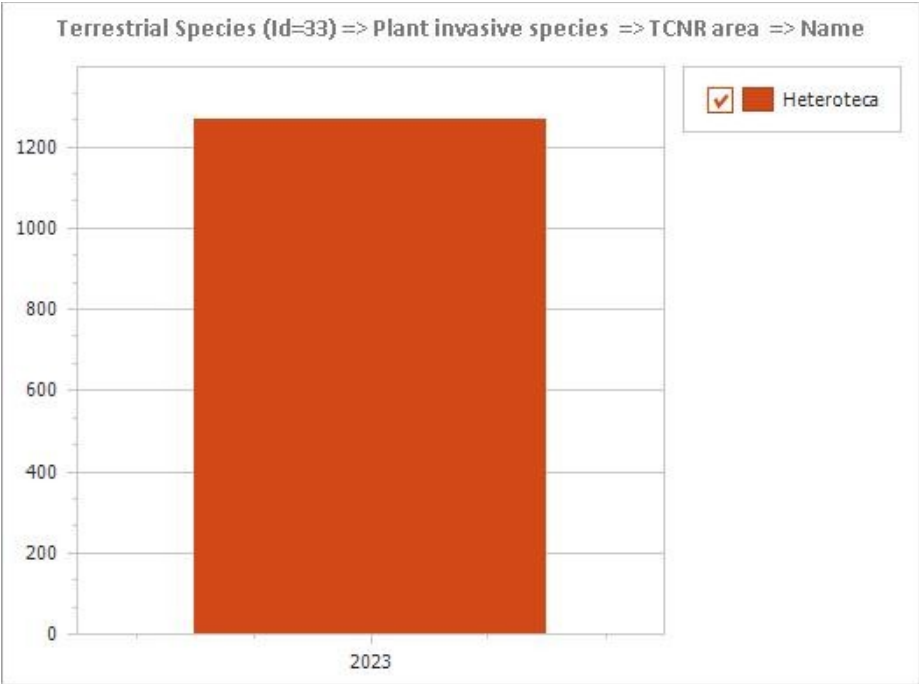
**Table 4.5:** Indicators of Terrestrial Species (invasive species)

Indicators attached to component: Terrestrial Species (Id=33)				
Name	Description	DataSource	UpdateFrequency	Notes
Presence of Heterotheca subaxillaris	Presence and distribution. Estimation about the extension in surface of removed plants		Annual	Removed every year by hand
Plant invasive species	Field survey for plant invasive species	Field survey has done by Lebanese university student under supervision of TCNR project Manager		

**Table 4.6:** Tabular data for the number of Heterotheca Subaxillaris at the year of 2023.

Terrestrial Species (Id=33) => Plant invasive species => TCNR area => Name		
Year	Locality	Heterotheca subaxillaris
2023	Scientific	1270

**Figure 4.4:** *Heterotheca subaxillaris* total number during August 2023



**Figure 4.5:** Density of *Heterotheca subaxillaris* (Map from: Bou Dagher Kharrat et al 2016)



#### **4.2.2 - Options and opportunities already identified**

The options are identified within the protocol (chapter 6): INVASIVE PLANTS MANAGEMENT PLAN IN TCNR.

The primary objective of this management plan is to effectively eradicate invasive plant species through manual extraction. This collaborative effort will involve the participation of various stakeholders, including NGOs, as well as students from Lebanese universities and schools. Engaging the community in this extraction process is not only educational but also essential in mitigating the growth of these invasive species and limitation the competition they pose to endemic plants.

By actively removing these invasive plants, we can directly limit their expansion and protect the ecological balance of the TCNR. This initiative not only aids in preserving the unique endemic flora but also helps in fostering a deeper understanding of conservation principles among the participating individuals.

Furthermore, this management plan emphasizes the importance of establishing a network between TCNR and Abbasieh Nature Reserve. This collaboration is critical for an integrated coastal management approach. Sharing knowledge, experiences, and strategies with neighboring reserves enhances the overall efficacy of invasive species control and contributes to a broader, more sustainable coastal ecosystem management. Through such coordinated efforts, we can work towards safeguarding the coastal biodiversity and maintaining the ecological integrity of these significant natural reserves.

#### **4.3 – Terrestrial Species (Id 31) (Container Plant Species (Id=1029), Component Endemic species (Id 30) -> Local Community in TCNR Biosphere**

##### **4.3.1 – Process explanation: diagram + components + relations**

Depending on report of united Nation program 2011 there are several Type of endemic species, the sand plants species are various : primarily with *Cakile aegyptiaca*, *Cyperus kalli*, *Matthiola tricuspidata*, *Muscari maritimum*, *Pancratium maritimum*, *Salsola kali*, *Silene colorata decumbens*; and secondarily with *Astragalus berytheus*, *Cakile aegyptiaca*, *Cyperus kalli*, *Daucus aureus*, *Daucus littoralis*, *Echium angustifolium*, *Emex spinosa*, *Eryngium maritimum*, *Hypocrepis multisiliquosa*, *Lagonychium farctum* etc (United Nation, 2020).

Table 4.8 and Figure 4.5 illustrate a significant diversity of endemic species within the scientific zone of TCNR. This data stems from a field survey conducted in August 2023. This particular species is vulnerable to unlawful activities due to the influence of the local community on the biosphere, known as anthropogenic pressure. The actions primarily involve unauthorized collection and extraction, significantly impacting the natural habitat and vegetation cover of this species. These detrimental human interventions have a profound and adverse effect on the overall well-being and survival of this specific plant. The unregulated activities conducted by the community not only disrupt the delicate balance of the ecosystem but also pose a serious threat to the sustainability and conservation of this valuable species.

**Terrestrial Species (Id 31) (Container Plant Species (Id=1029), Component Endemic species (Id 30))**

[Endemic species (Id=30)]



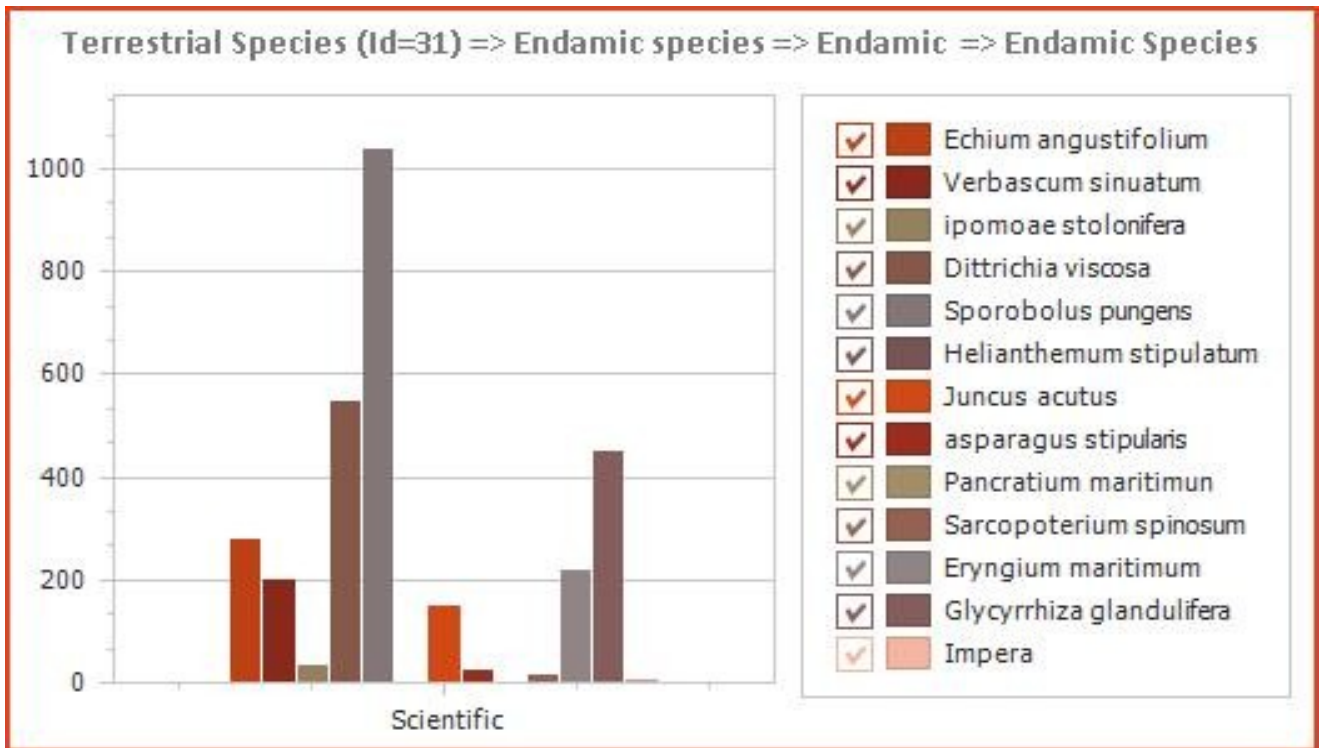
**Table 4.7:** Indicator of Terrestrial Species (Endemic)

Indicators attached to component: Terrestrial Species (Id=31)				
Name	Description	DataSource	UpdateFrequency	Notes
Endemic species	Endemic species for the year of 2023	Field Survey August 2023 (Scientific zone)	Yearly	

**Table 4.8:** Tabular data indicates the total number of each endemic species during August 2023.

Terrestrial Species (Id=31) => Endamic species => Endamic => Endamic Species														
Year	Locality	Echium angustifolium	Verbascum sinuatum	Ipomoea stolonifera	Diatrichocoma viscosa	Sporobolus pungens	Helianthemum stipulatum	Juncus acutus	Asparagus stipularis	Panicum maritimum	Sarcopodium spinosum	Eryngium maritimum	Glycyrrhiza glandulifera	Impatiens cylindrica
2023	Scientific	279	201	33	550	1040	3	150	24	2	15	220	450	9

**Figure 4.5:** The total number of each endemic species that resulted in field survey at August 2023



**[Local Community in TCNR Biosphere (Id=1121)]**



The above-mentioned community within the Biosphere (refer to 4.1.1).

#### **4.3.2 - Options and opportunities already identified**

Addressing illegal practices requires a thorough and well-rounded management approach. This initiative should commence with extensive awareness campaigns, which can be organized by the TCNR team in collaboration with NGOs such as ADR, AMWAJ, SPNL, and others. These campaigns play a crucial role in elevating societal awareness regarding the significance of this particular species and its contribution to the environment. Educating the public about the value of preserving this species is vital for fostering a sense of responsibility and encouraging sustainable practices.

Moreover, effective law enforcement is essential, and this entails close cooperation between Tyre municipality and the Ministry of Environment. Enforcing existing laws and regulations pertaining to the protection of this species ensures a legal framework that discourages illegal activities and bolsters conservation efforts. By combining these strategies—raising awareness and reinforcing legal measures—we can significantly reduce the illegal practices that endanger this important species and promote a culture of responsible environmental stewardship.

#### **4.4 – Terrestrial Species (Id 31) (Container Plant Species (Id=1029), Component Endemic species (Id 30) -> Terrestrial Species (Id 33), Container Plant Species (Id 1029), Component Invasive species (Id 32)**

##### **4.4.1 – Process explanation: diagram + components + relations**

#### **Terrestrial Species (Id 31) (Container Plant Species (Id=1029), Component Endemic species (Id 30) -> Terrestrial Species (Id 33), Container Plant Species (Id 1029), Component Invasive species (Id 32)**

The elements and diagram featuring invasive species *Heterotheca submaxillary* with Id 32 have been discussed earlier in section 4.2, whereas the endemic species with Id 30 was addressed in section 4.3.

Depending on the comparison between table (4.8 and 4.6) we can deduce that the ecological survey conducted in August 2023, focusing on both invasive and endemic species, brought to light a significant finding. The count of *Heterotheca submaxillary*, an invasive plant species, stood at a notable 1270, surpassing the combined total of various other endemic species within the TCNR. Specifically, *Echium angustifolium* was found to be 279, *Verbascum sinuatum* at 201, *ipomoae stolonifera* at 33, *Helianthemum stipulatum* at 3, *Juncus acutus* at 150, *asparagus stipularis* at 24, *Pancratium maritimum* at 2, *Sarcopoterium spinosum* at 15, and *Imperata cylendrica* at 9.

The results of this survey distinctly demonstrate the ongoing rivalry between the two categories of species in TCNR. The significant abundance of *Heterotheca submaxillary* accentuates the urgent requirement for well-planned tactics to manage and alleviate the invasive species' influence. Safeguarding the fragile equilibrium and varied life forms of TCNR demands a collaborative endeavor, implementing specific

approaches to restrain the overpowering presence of invasive species and encourage the thriving of the distinct endemic vegetation.

#### **4.4.2 - Options and opportunities already identified**

The management plan for this competition has already identified in 4.2 and within the protocol chapter 6.

### **5 - APPLICATION CASE: FAUNA (MARINE REPTILES).**

#### **Introduction**

According to the IUCN report in 2015, the primary player in the MPA, which is the fishing sector in Tyre, faces a significant challenge of depleting resources due to excessive fishing and the adoption of unregulated and illegal fishing practices. These unauthorized methods include the use of small fishing nets, surface supplied diving for spearfishing, and blast fishing. The absence of effective law enforcement and alternative initiatives for fishermen to generate income has become a substantial obstacle to achieving sustainability in the fishing sector in the southern region of Lebanon.

As reported by SPA/RAC and MedPAN in 2019, Lebanon has implemented national legislation aimed at safeguarding marine zones. Nonetheless, the majority of these legal provisions primarily center around regulations related to fishing and the preservation of marine biodiversity. Some examples of these legislations include:

- The legislation implemented on 23/9/1999 by the Minister of Agriculture, known as Decision no. 125/1, prohibits the hunting of marine turtles, monk seals, and whales, and also bans the sale, utilization, or commerce of any products sourced from these particular species.
- Article 25 of the Lebanese Coastal Fishing Control Law from 1929 expressly forbids the use of explosives, drugs, or any toxic substances for fishing purposes. This signifies a clear acknowledgment within Lebanese legislation of the hazards associated with such fishing practices.

Despite the laws enforced by the Ministry of Agriculture to oversee and regulate illegal fishing practices, they are unable to effectively assume responsibility due to various challenges, notably financial constraints. This was conveyed by Ministry of Agriculture representatives during the workshop held on 29/9/2023 regarding FIHS MED NET, which involved TCNR, fishermen, Tyre Fish Syndicate, representatives from the Ministry of Agriculture, Tyre municipality and Lebanese diving center. These circumstances have posed a threat to marine turtles, leading to issues like bycatch and turtle mortality. This information was conveyed by fishermen, the Tyre Fish Syndicate, and also the Lebanon Diving Center.

#### **5.1 – Marine Reptiles -> Sandy Beach**

##### **5.1.1 - Process explanation: diagram + components + relations**

[Marine

## Reptiles (Id=1095]

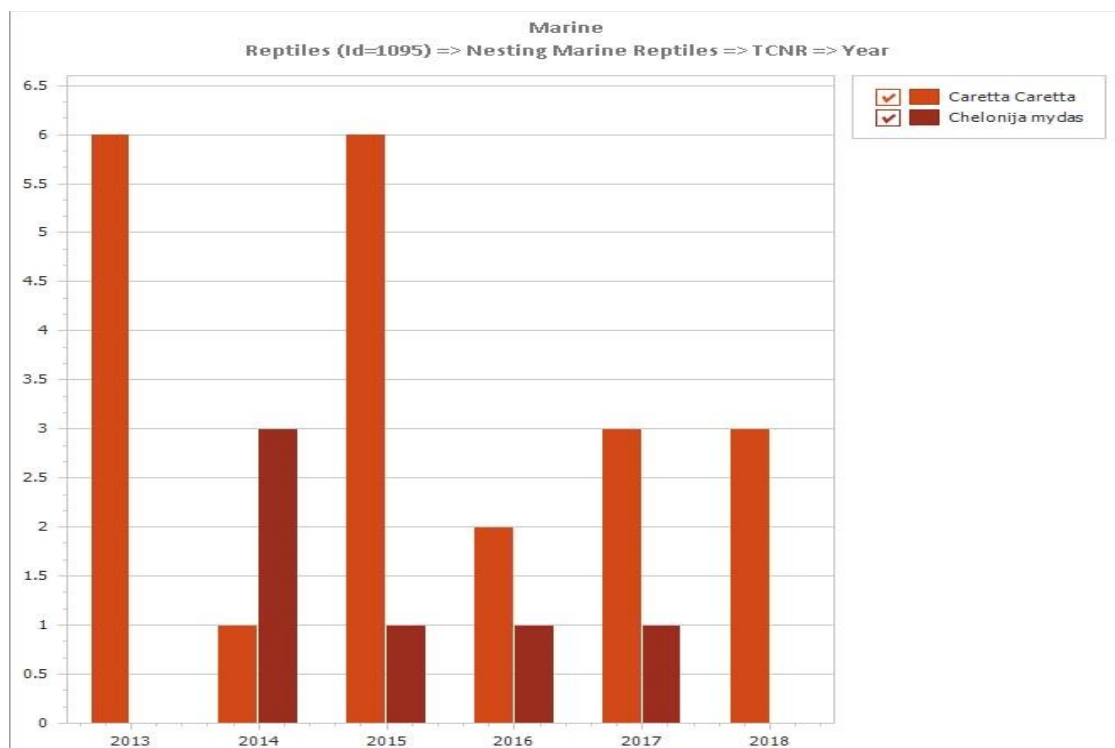


Referring to table 5.1, there are three indicators related to Marine Reptiles. The first indicator correlates with figure (5.1), illustrating the documented nesting of Marine Reptiles (Caretta Carretta and Cheloni Mydas) between 2013 and 2018. The chart visually presents the trend of marine turtle nesting during this

**Table 5.1:** Indicators of Marine Reptile (Turtles: Caretta Caretta and Cheloni Mydas).

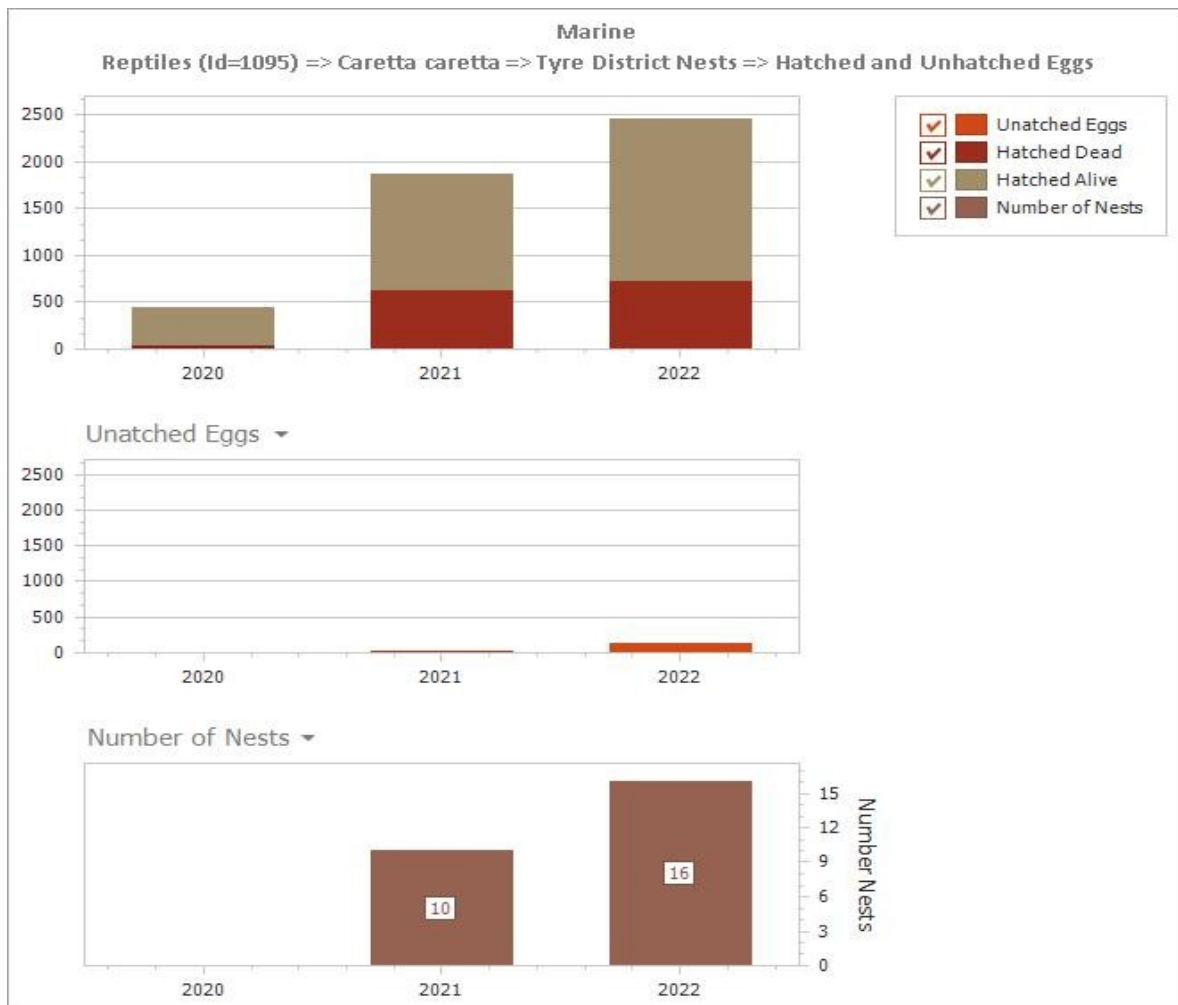
Indicators attached to component: Marine Reptiles (Id=1095)				
Name	Description	DataSource	UpdateFrequency	Notes
Nesting Marine Reptiles	Number of nests of turtles	TCNR	Yearly	
Caretta caretta	Number of nests and hatched eggs	TCNR	Yearly	
Chelonia mydas	Number of nests and hatched eggs	TCNR	Yearly	

**Figure 5. 1:** Recording of Nesting Marine Reptile (Caretta Carretta and Cheloni Mydas) from 2013 to 2018 (TCNR survey).

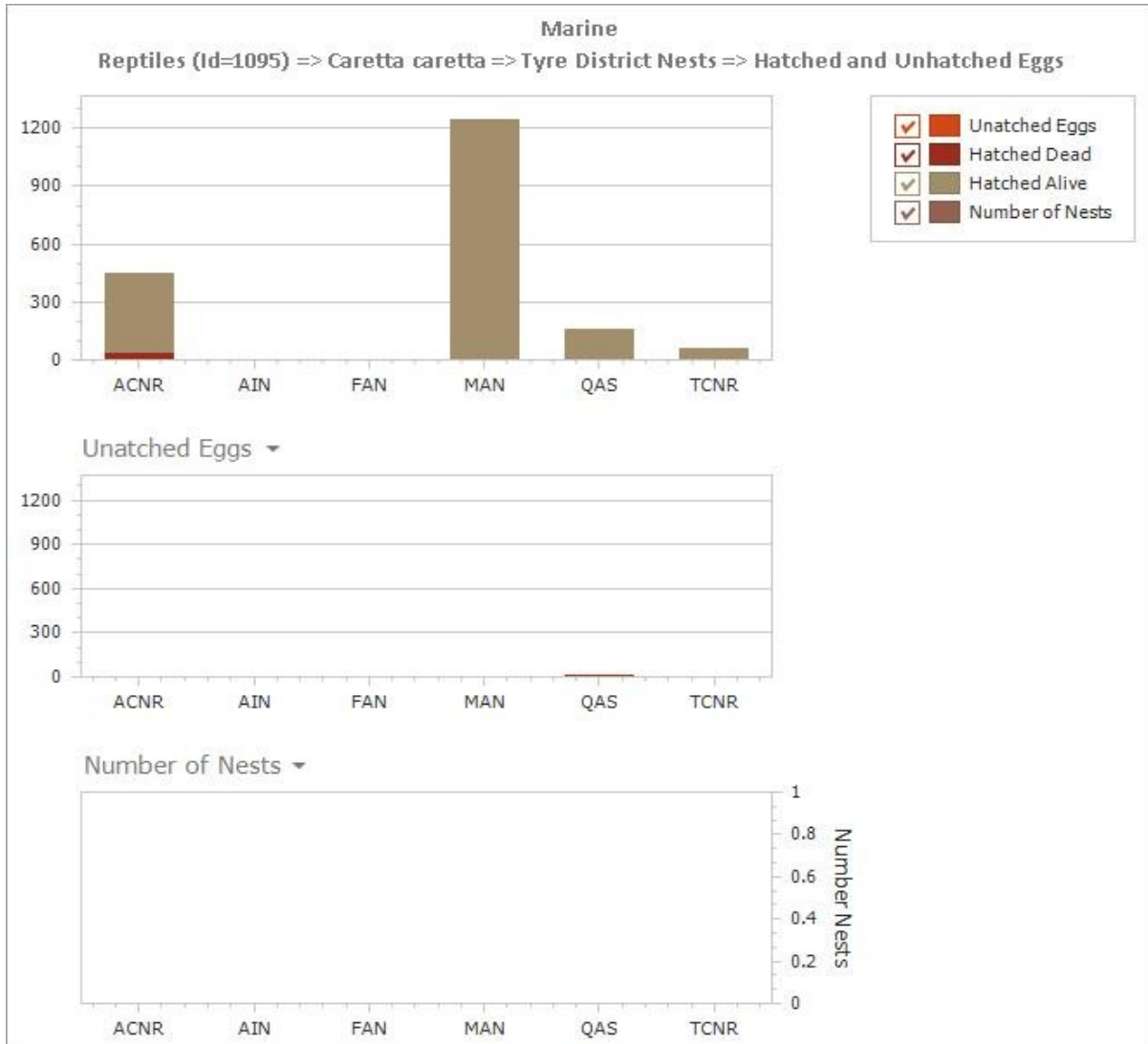


The second measurement provided in table 5.1 displays the total of nests and hatched eggs belonging to *Caretta Caretta* within the Tyre District, encompassing six specific areas. The data for this analysis is derived from the years 2020, 2021, and 2022. Figure (5.2) illustrates the rise in the number of hatched dead from 2020 to 2022, while depicting a decline in hatched alive during the same period. Figures (5.3, 5.4, and 5.5) demonstrate that TCNR recorded a decrease in hatched alive, zero unhatched eggs, and no nesting sites in the year 2020. Subsequently, in 2021, there were only two nesting sites, which remained the same in 2022. Conversely, other locations like AL Mansouri exhibited an increase in the number of nesting sites from 2020 to 2022.

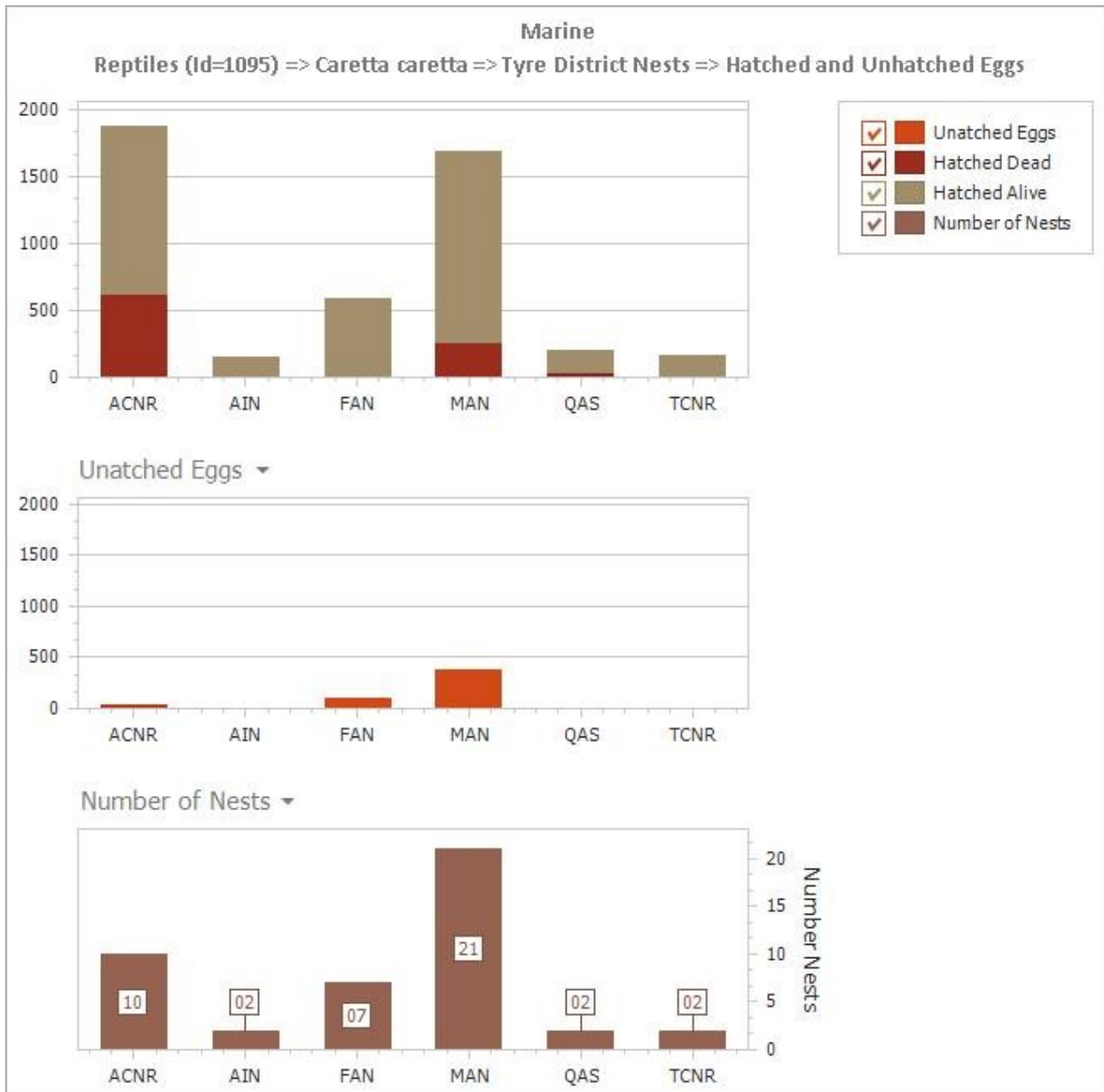
**Figure 5.2:** Carretta Caretta Nests (Hatched and Unhatched Eggs) from 2020 to 2022



**Figure 5.3** Carretta Caretta Nests (comprising hatched and unhatched eggs) across the six regions in the year 2020.



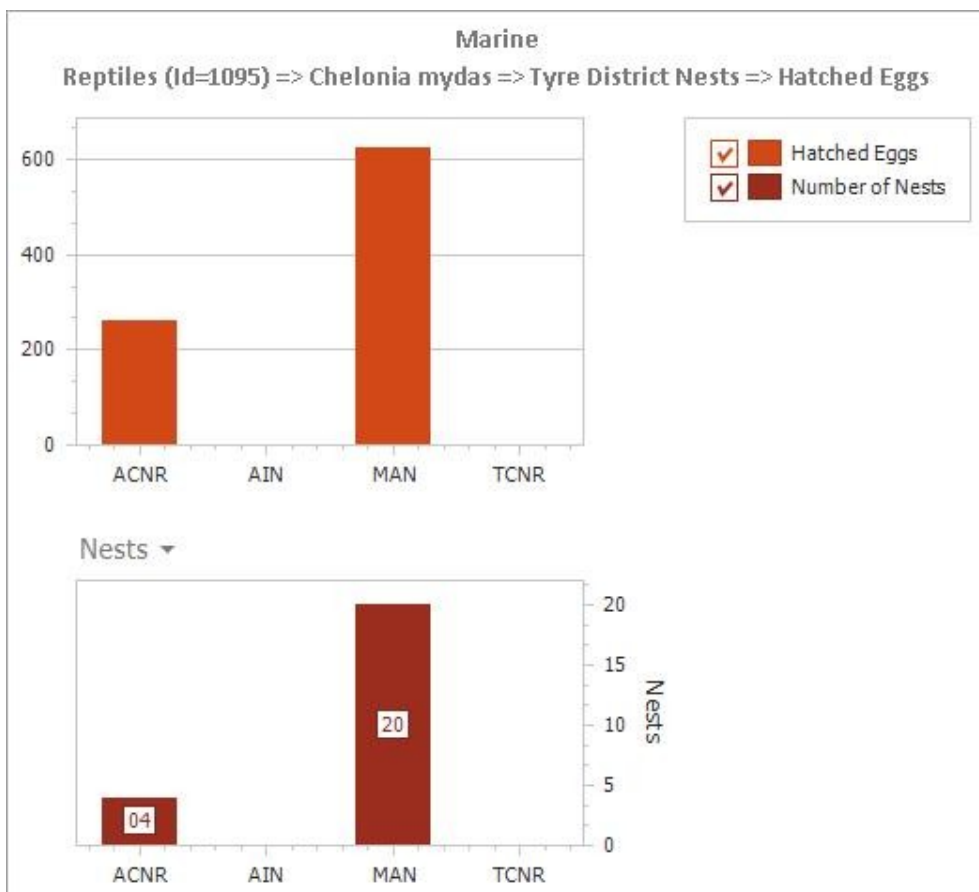
**Figure 5.4:** Carretta Caretta Nests (comprising hatched and unhatched eggs) across the six regions in the year 2021.



**Figure 5.5:** Carretta Caretta Nests (comprising hatched and unhatched eggs) across the six regions in the year 2022.

The third indicator, as presented in Table 5.1, showcases the combined count of nests and hatched eggs attributed to CHELONIA MYDAS in the Tyre District, spanning across four distinct areas. Upon analyzing Tables 5.2, 5.3, and 5.4, as well as the diagrams in 5.6, 5.7, and 5.8, it is evident that there was a noticeable decrease in the number of nests, reducing to only 1 in both 2021 and 2022. Furthermore, there was a decline in the number of hatchlings from 100 to 85 when comparing the years 2021 and 2022, with no recorded data for the year 2020.

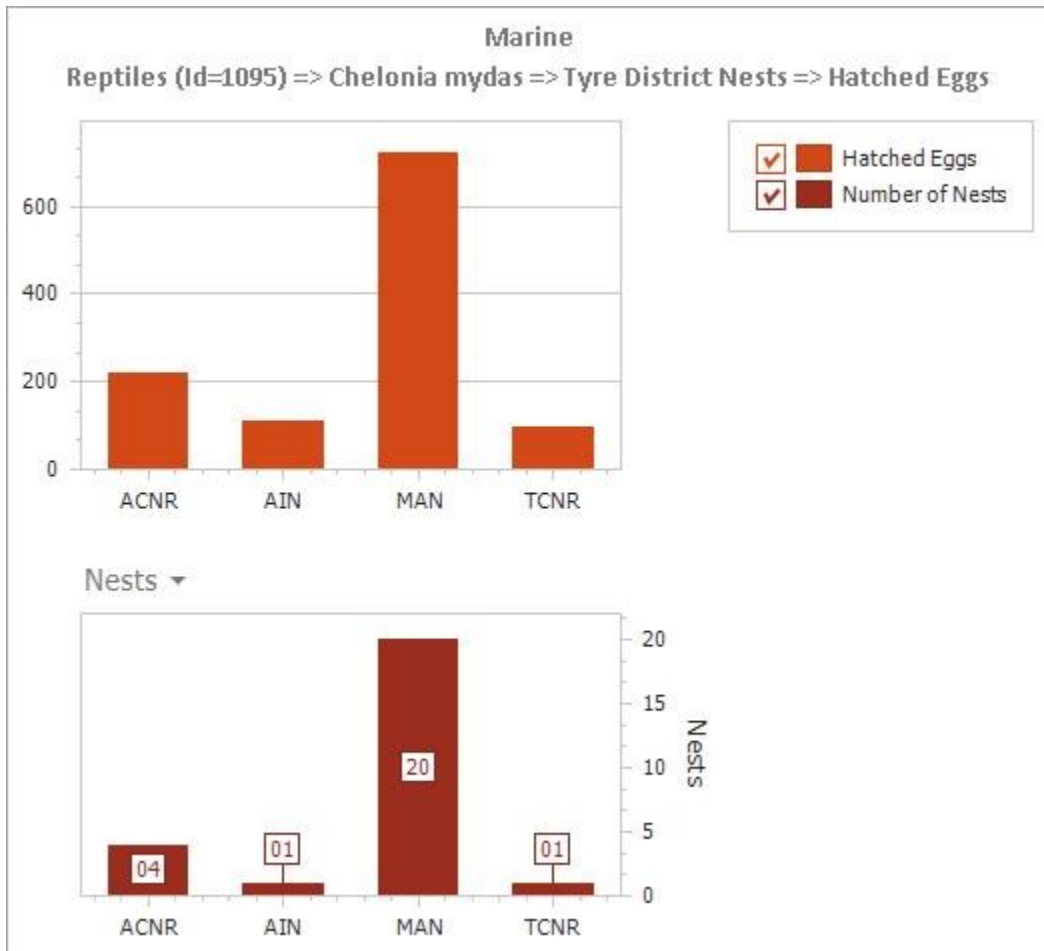
**Figure 5.6:** Chelonia Mydas Nests (comprising hatched and unhatched eggs) across the four regions in the year 2020



**Table 5.2:** Nesting Hatchlings and Nest Counts for Chelonia Mydas during the year 2020.

Marine Reptiles (Id=1095) => Chelonia mydas => Tyre District Nests => Hatched Eggs			
Year	Site	N_Hatched	N_Nests
2020	ACNR	264	4
2020	AIN		
2020	MAN	624	20
2020	TCNR		

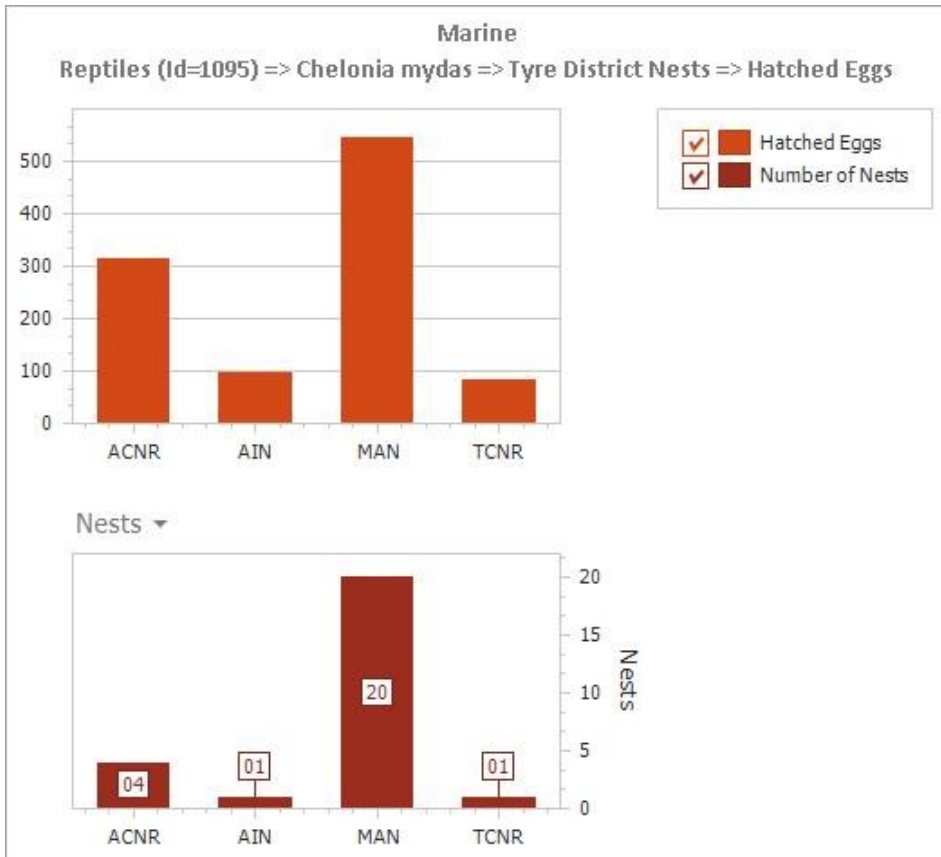
**Figure 5.7:** Chelonia Mydas Nests (comprising hatched and unhatched eggs) across the four regions in the year 2021



**Table 5.3:** Nesting Hatchlings and Nest Counts for Chelonia Mydas during the year 2021

Marine Reptiles (Id=1095) => Chelonia mydas => Tyre District Nests => Hatched Eggs			
Year	Site	N_Hatched	N_Nests
2021	ACNR	223	4
2021	AIN	112	1
2021	MAN	723	20
2021	TCNR	100	1

**Figure 5.8:** Chelonia Mydas Nests (comprising hatched and unhatched eggs) across the four regions in the year 2022



**Table 5.4:** Nesting Hatchlings and Nest Counts for Chelonia Mydas during the year 2022

<b>Marine Reptiles (Id=1095) =&gt; Chelonia mydas =&gt; Tyre District Nests =&gt; Hatched Eggs</b>			
<b>Year</b>	<b>Site</b>	<b>N_Hatched</b>	<b>N_Nests</b>
2022	ACNR	314	4
2022	AIN	98	1
2022	MAN	545	20
2022	TCNR	85	1

The data and analysis provided highlight the danger to nesting turtles, suggesting adverse incidents occurring within the sandy beach area (Scientific zone). Despite visible indications stressing the significance of nest protection and TCNR monitoring, this site is confronted with several threats, including issues like light pollution and trampling.

**[Sandy Beach (Id=13)]**

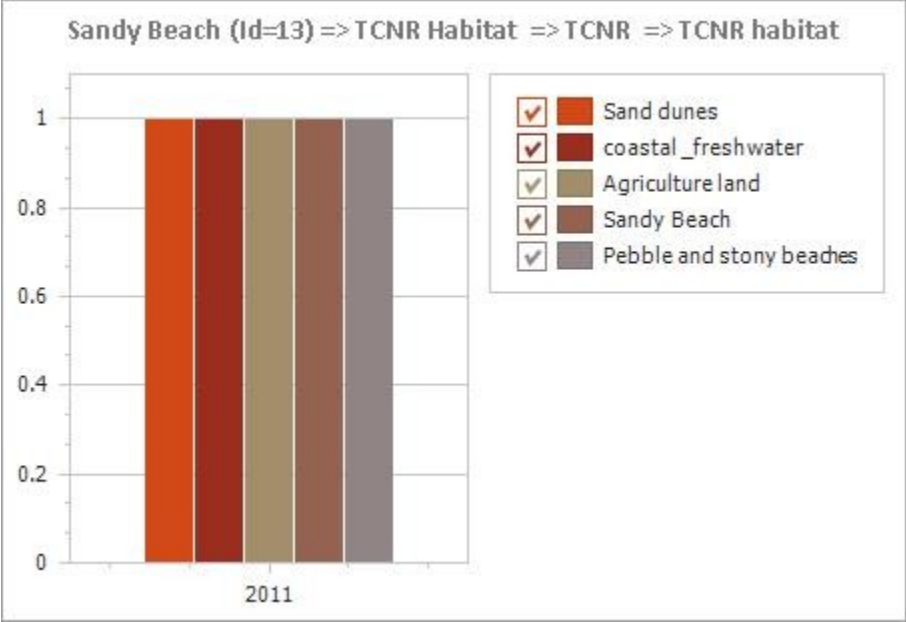


**Table 5.5:** Indicators of Sandy Beach

<b>Indicators attached to component: Sandy Beach (Id=13)</b>				
<b>Name</b>	<b>Description</b>	<b>DataSource</b>	<b>UpdateFrequency</b>	<b>Notes</b>
Litter presence transported by sea	Litter transported by the sea <a href="https://plasticbustersmpas.interreg-med.eu/">https://plasticbustersmpas.interreg-med.eu/</a> Kg Classification per each item Based on manual Beach litter monitoring		Twice per year, in two different seasons	Marine litter on the surface, followed by the satellites. University of Siena
Presence of litter left by tourists	Collection of rubbish for 4 months, summer season. On the public beach, carried out by the owners of the huts and transported away by the municipality service.		Service twice per week.	

TCNR Habitat	Habitat at TCNR	United Nations Environment Programme, Proposal for inclusion in the SPAMI List: Tyre Coast Nature Reserve, UNEP RAC/SPA - Tunis, 2011		
TCNR Species	Species	United Nations Environment Programme, Proposal for inclusion in the SPAMI List: Tyre Coast Nature Reserve, UNEP RAC/SPA - Tunis, 2011		

Depending on ISP there is land cover map, the surface of this habitat (Turtle) and related relevant information, such as protection regime, presence of facilities, fences, and other. So the indicator of sandy beach (table 5.5), represent different topic without any statistical data. The first two indicators are mentioned the issue of litter and the las two indicators issue the habitat (figure 5.9 and table 5.6) and the Species (figure 5.10 and table 5.7) on TCNR.

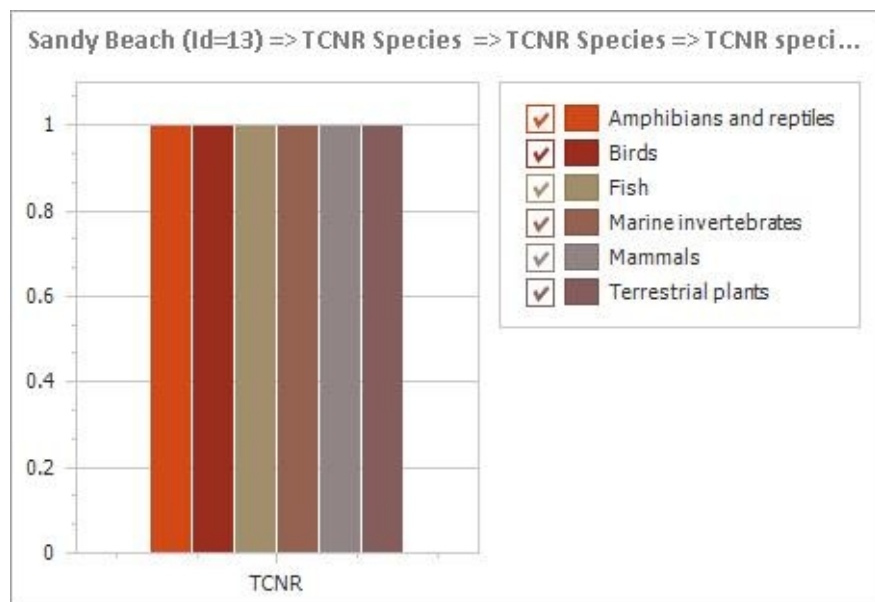


**Figure 5.9:** TCNR habitat

Sandy Beach (Id=13) => TCNR Habitat => TCNR => TCNR habitat						
Year	Locality	Sand Dunes	Coastal_Freshwater	Agricultural Land	Sandy Beach	Pebble and stony beach
2011	TCNR	1	1	1	1	1

**Table 5.6:** TCNR habitat

**Figure 5.10:** TCNR species



**Table 5.7:** TCNR species

<b>Sandy Beach (Id=13) =&gt; TCNR Species =&gt; TCNR Species =&gt; TCNR species</b>								
<b>Year</b>	<b>Locality</b>	<b>Amphibians and reptiles</b>	<b>Birds</b>	<b>Fish</b>	<b>Marine invertebrates</b>	<b>Mammals</b>	<b>Terrestrial plants</b>	<b>Marine plants</b>
2011	TCNR	1	1	1	1	1	1	1

### **5.1.2 – From the gap analysis to the identification of options and opportunities**

Understanding land use and land cover within the Tyre Coast Nature Reserve (TCNR) is crucial for assessing the territory used by turtles and evaluating various features that impact these marine creatures. Moreover, comprehending land use and cover allows for an assessment of environmental and anthropogenic stressors affecting turtles, encompassing elements like vegetation types and density, migration routes, conservation of zone (barrier etc). These aspects collectively shed light on the intricate relationship between the habitat structure and the well-being of turtle populations.

Addressing the anthropogenic threat of trampling within the scientific zone of TCNR demands vigilant monitoring to mitigate detrimental human interventions. It is imperative to implement proactive measures to safeguard these areas, given the adverse consequences of human foot traffic. Notably, a collaborative effort involving the Bio Connect project in collaboration with SHOUF CEDR SOCIETY, ACE, ADR, and SPN has set the foundation for a protective barrier around the scientific zone. This barrier is instrumental in securing critical nesting locations and preserving the integrity of the essential ecological environment.

Regarding lighting, both TCNR and the Tyre Municipality have enforced regulations for kiosk owners in tourist zones and the local community entering other areas, urging them to avoid using detrimental lighting for turtles. They emphasize the use of gentle and subdued lighting with low intensity and brightness. Additionally, a vigilant monitoring system is in place to ensure strict compliance and deter any legal violations.

## **5.2 – Marine Reptiles -> Fisheries**

### **5.2.1 - Process explanation: diagram + components + relation**

Marine Reptile with Id=1095 has mentioned above in 5.1

[Fisheries (Id=1104)]

Indicators attached to component: Fisheries (Id=1104)				
Name	Description	DataSource	UpdateFrequency	Notes
Economic value (\$/125 m2) of local fish	For each fish species			
Catch (tons)				
Economic value (\$/Kg) of imported fish	For each species			
Bycatch	Occurrence of unintentional catch of marine turtles during the fishing activities	Several reports (newspaper, social media like Facebook etc.) has indicated the that turtle in Tyre beach exposed to unhurt due to the fishing practices like hang of Turtle in the nets of fishermen.		



**Table 5.8:** Fisheries indicators (descriptive data).

According to reports in newspapers, observations from fishermen, and information shared on social media, marine turtles in Tyre are facing the adverse effects of both bycatch and illegal fishing methods. This situation likely contributes to the decline in the nesting and hatching numbers of both Carrreta Carreta and Chelonia Mydas turtle species.

### 5.2.2 – From the gap analysis to the identification of options and opportunities

There is a noticeable absence of data on fish landing and bycatch within the ISP. Furthermore, this critical data has not been publicly disclosed by the Ministry of Agriculture, researchers, or any relevant entities, underscoring a significant gap in the availability of such information. Specifically, the bycatch of turtles and their mortality resulting from fishing nets, dynamite, or illegal fishing practices have only been reported in social media videos, newspapers, and IUCN reports. However, these reports have not delved deeply into comprehending the degrees of this phenomenon.

For this reason we have adopted an protocol which mentioned on chapter 6: STRATEGIC BLUEPRINT FOR SAFEGUARDING MARINE TURTLES IN TCNR. This protocol relies on establishing trust with fishermen and closely monitoring the fishing industry, including catch levels and equipment. Its primary aim is to examine the primary risks faced by *Caretta caretta* and *Chelonia mydas* in the marine and coastal regions of TCNR. The goal is to assess the extent of impact from each of these threats, facilitating collaboration with stakeholders to develop strategies, mitigation measures, and coordinate efforts with related ongoing projects.

## 6 Protcols

### 6.1 FAUNA

#### Management protocol

<b>SECTOR/ TOPIC: FAUNA</b>	
<b>COMPONENTS: MARINE REPTILES, CARETTA CARETTA AND CHELONIA MYDAS</b>	
<b>TITLE: STRATEGIC BLUEPRINT FOR SAFEGUARDING MARINE TURTLES IN TCNR</b>	
<b>TARGET AREA (GEOGRAPHICAL POSITION): TCNR AND TYRE COASTAL ZONE</b>	
<b>FREQUENCY: DAILY</b>	
<b>MONITORING RATIONALE (System Component)</b>	<p>Loggerhead turtles (<i>Caretta caretta</i>, Linnaeus 1758) in the Mediterranean primarily choose nesting sites in Turkey, Greece, Cyprus, and Libya, as documented by Margaritoulis et al. (2003) and Laurent (1998). In contrast, there are significantly fewer nesting occurrences on the coasts of Lebanon, Palestine, Israel, Egypt, and Tunisia.</p> <p>Nesting sea turtles in the Eastern Mediterranean face increasing threats from human intervention. Coastal development, beachfront tourism, and fishing activities have all contributed to the degradation of crucial nesting habitats for these endangered species (Margaritoulis, D., &amp; Panagopoulou, A. 2018).</p>

The Mediterranean hosts the prevalent sea turtle species, the loggerhead turtle (*Caretta caretta*), facing a significant threat to its preservation primarily from accidental captures during fishing activities. Italian waters alone witness an alarming estimate of over 50,000 capture incidents, resulting in a potential 10,000 fatalities. Unfortunately, our understanding of sea turtle interactions with fishing gear and the effective application of measures to reduce these incidents remains limited. This knowledge gap hampers efforts to mitigate the decline in sea turtle populations across the Mediterranean. (Lucchetti et al., 2019).

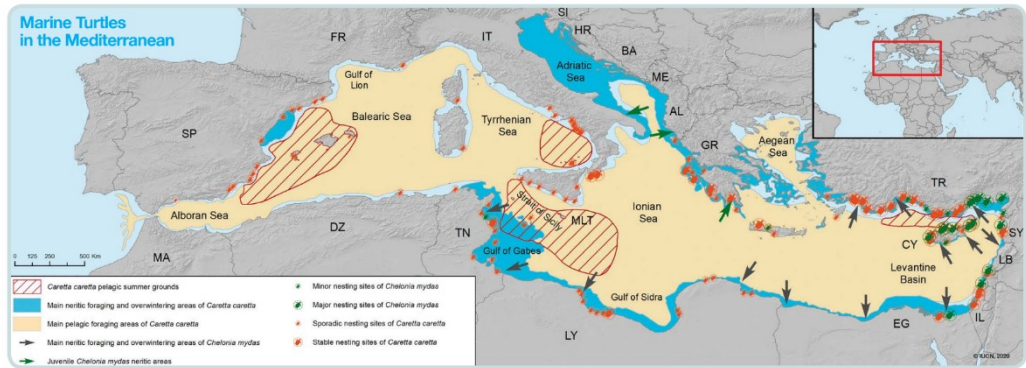
The species is classified as LC in the Mediterranean Sea basin (IUCN 2022), and as VU at the global level (IUCN 2015). Compared to *Caretta caretta*, much less is known about green turtles (*Chelonia mydas*), for which only a general overview of the ecology and conservation status exists. The Mediterranean subpopulation of loggerhead turtles was downgraded in 2015 to Least Concern (LC) from Endangered (EN) according to the IUCN red list criteria. The species belongs to the same IUCN red list category at the global level.

The turtles' survival is threatened by intentional and unintentional human actions presents both intentional and unintentional. Intentional threats include continued hunting, poaching and egg harvesting. Unintentional threats include boat strikes, fishermen's nets that lack turtle excluder devices, pollution and habitat destruction. Light pollution may disorient hatchlings.

Surveys conducted along the entire coastline of Lebanon revealed that nesting activities were not evenly distributed. In some sections of the northern coast, nesting was sparse, and on several developed beaches, it was scattered. However, the nesting sites in the southern region were found to be of greater significance both at a national and regional level. Loggerhead turtles are prevalent along the Lebanese coast, and there is specific sites with moderate nesting densities across the coastal belt of Lebanon. On the other hand, the green turtle is less common, and their nesting is limited to the less developed areas in the south of the country (Cross et al., 2006).

Figure 1, that south Lebanon represent the major nesting site of *Chelonia mydas* and stable nesting site of *Caretta caretta*.

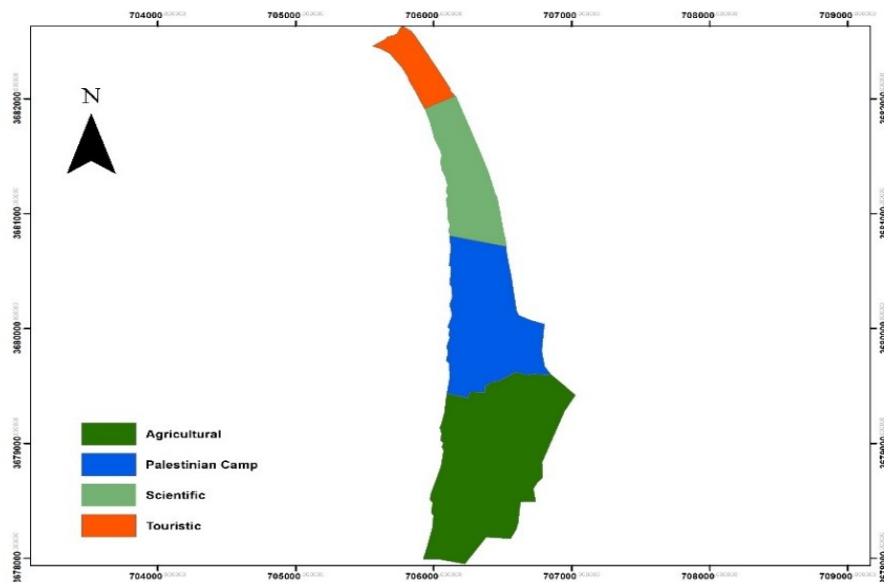
Figure 1 Species nesting in the Mediterranean, IUCN 2020



The nesting locations in southern Lebanon are found initially in Al Mansouri, classified as first-rate, and then in TCNR. The nesting sites of marine turtles in TCNR are located in scientific zone (protected zone) more than other zones (Figure 2). This nesting sites are vulnerable to harm due to human activities (Light pollution, divers pollution, bycatch and boat strike).

Consequently, there is an urgent need for a robust framework to safeguard this nesting area.

Figure 2 TCNR Nature Reserve with its zonation.



**MONITORING GOAL**

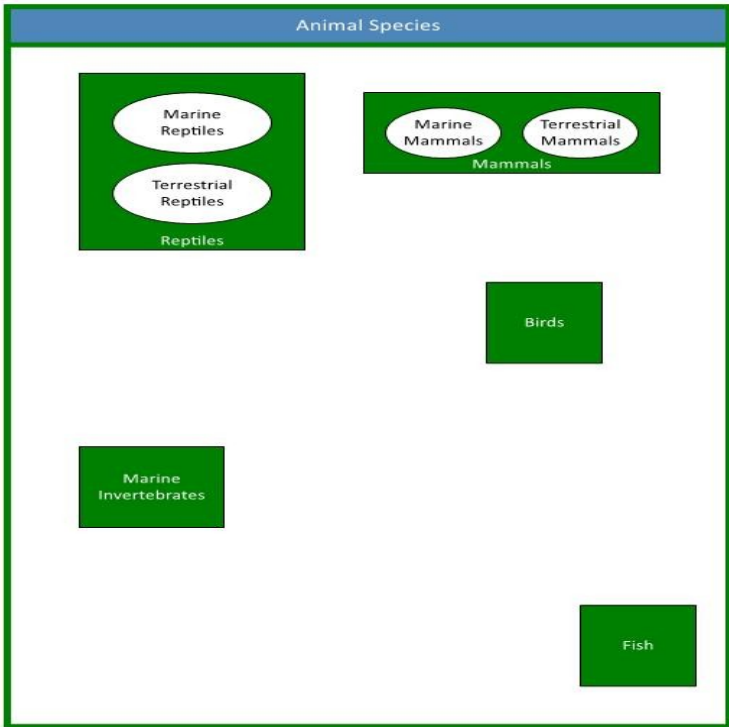
The main objective of this protocol is to investigate the main threats for *Caretta caretta* and *Chelonia mydas* along the TCNR marine and coastal areas and evaluate the level of impacts for each of the threats, in order to elaborate – with the stakeholders –

	<p>strategies, mitigation initiatives and synergies with similar and ongoing projects.</p> <p>This protocol will contribute to:</p> <p>A) detect the most effective management plan for the turtles' nesting sites of TCNR.</p> <p>B) collecting functional information to better detect and quantify unintentional turtle captures (bycatch) in fishing gear.</p>
<p><b>LABORATORY ANALYSIS NEEDS</b></p>	
<p><b>DATA ANALYSIS AND INTERPRETATION PROTOCOLS</b></p>	<p>Data will be entered into the ISP system after daily monitoring to the fishing ground by TCNR, with responsibility shared between the Project Manager and the Technical team. The table will contain the following variables: locality, year, month, day, boat registration, fishermen's name, fishing gear, Total catch (Kg), classification of landed species caught, records of accidents, such as turtle's bycatch.</p> <p>The outcome of this data will spread and communicate on the website of TCNR and with publish an informative publications and scientific articles.</p>

**DSS SYSTEM DIAGRAM & INDICATORS**

**DIAGRAM ELEMENT:**

Animal Species (Id=10)



[MarineReptiles (Id=1095)]



**Indicators attached to component: Marine Reptiles (Id=1095)**

Name	Description	DataSource	UpdateFrequency	Notes
Nesting Marine Reptiles	Number of nests of turtles	TCNR	Yearly	
Caretta caretta	Number of nests and hatched eggs	TCNR	Yearly	
Chelonia mydas	Number of nests and hatched eggs	TCNR	Yearly	

[Fisheries (Id=1104)]



**Indicators attached to component: Fisheries (Id=1104)**

Name	Description	DataSource	UpdateFrequency	Notes
Economic value (\$/125 m2) of local fish	For each fish species			
Catch (tons)				
Economic value (\$/Kg) of imported fish	For each species			
Bycatch	Occurrence of unintentional catch of marine turtles during the fishing activities			

**DATA COLLECTION PROCEDURE**

<b>STAFF</b>	TCNR Team, Tyre Municipality and Tyre Fish syndicate, Monitors (5)
<b>EQUIPMENT</b>	Record Sheet (field monitoring sheet)
<b>PROTOCOL</b>	<p>This protocol is founded upon a structured methodology that encompasses several crucial phases, each playing a fundamental role in ensuring successful engagement with fishermen. The process entails establishing trust, enhancing awareness and education, providing training on effective bycatch identification and reporting, and maintaining regular feedback and communication loops.</p> <p>The TCNR team, in collaboration with Tyre municipality, is arranging a series of meetings with fishermen. The objective is to showcase the project's objectives, highlight the criticality of safeguarding turtles, and emphasize the value of collaborative efforts. These gatherings are set to occur over the coming two months, targeting the participation of 400 fishermen. In each weekly meeting (Three hours), 50 fishermen will be engaged to facilitate an open dialogue regarding the significance of marine conservation and how their proactive engagement can have a meaningful impact. This consistent transparency week after week will play a crucial role in establishing a foundation of trust between all parties involved.</p> <p>During our planned meetings, we will present a variety of informative materials to engage the fishermen and shed light on crucial aspects of sea turtle conservation:</p> <ul style="list-style-type: none"> <li>• Statistics and video'</li> </ul> <p>We will showcase extensive data and statistics derived from a comprehensive survey conducted by TCNR regarding turtle nesting. This data will illustrate the discernible decline in nesting activity from 2013 to 2016, providing a factual basis for understanding the urgency of conservation efforts. Furthermore, we will present videos sourced from Facebook illustrating the adverse effects of fishing gear on turtles, highlighting the negative impacts caused by such equipment.</p> <ul style="list-style-type: none"> <li>• Illustrative Narratives and Noteworthy Cases (Videos and Images)</li> </ul> <p>We will feature compelling success stories and case studies that exemplify the active involvement of fishermen in the sea turtle conservation process. Notable examples include the inspiring roles played by fishermen as Sea Turtle Guardians in Bahia Magdalena (Mexico), their instrumental engagement in Bycatch Mitigation in Costa Rica, and their proactive implementation of Turtle Excluder Devices (TEDs) in the USA.</p> <ul style="list-style-type: none"> <li>• Exploring Economic Benefits through Eco-Tourism</li> </ul>

We intend to engage in a meaningful dialogue with the fishermen, focusing on how the conservation of marine turtles directly influences their financial prospects through eco-tourism. By drawing examples from successful eco-tourism models in various countries, we aim to emphasize the potential economic gains that can be achieved by responsibly promoting turtle-related tourism activities.

At the end of every meeting, we will inform participants that subsequent to these discussions, a joint survey will be launched in collaboration with fishermen, Tyre Municipality, and Tyre Fish Syndicate. This survey aims to collaboratively work towards the preservation of marine turtles in Tyre, while also assisting fishermen in exploring opportunities for eco-tourism investment and environmental conservation.

Following meetings with the fishermen, TCNR will organize training sessions for designated monitors from Tyre Municipality and the Fishing Syndicate in Tyre. These sessions will emphasize precise completion of the data sheet, and they will be conducted in a single day. The monitors will begin their daily duties early in the morning as fishermen return to the fishing port (for one year).

**Fishery Landings Monitoring Sheet by TCNR, Tyre Municipality, and Tyre Fish Syndicate**

Locality	
Year	
Month	
Day	
Boat Registration	
fishermen's name	
fishing gear	
Total catch (Kg)	
Classification of landed species caught	
Records of accidents (Turtle bycatch)	

This sheet and protocol serve various purposes for Tyre and TCNR. Initially, they aid in identifying if bycatch significantly impacts turtles and quantifying the overall catch, vital for marine research and species categorization. Based on outcomes, we can formulate protocols to mitigate turtle bycatch or address other contributing factors such as lighting and human activities (e.g., trampling).

<b>QUOTATIONS</b>	<ul style="list-style-type: none"> <li>• Meetings with fishermen weekly: 400\$*8= 3200\$</li> <li>• Monthly salary for monitor's: 500\$*5= 2500\$</li> </ul>
<p><b>References:</b></p> <p>Cross, H., Khalil, M. Rizk, C. Venizelos, L. 2010. Marine Turtle Conservation in the Mediterranean Population Status and Conservation Activities on Sea Turtle Nesting Beaches in South Lebanon, 2005.</p> <p><i>Lucchetti, A., Bargione, G., Petetta, A., Vasapollo, C., &amp; Virgili, M. (2019). Reducing sea turtle bycatch in the Mediterranean mixed demersal fisheries. Frontiers in Marine Science, 6(JUL), 1–12.</i>  <a href="https://doi.org/10.3389/fmars.2019.00387">https://doi.org/10.3389/fmars.2019.00387</a></p> <p>Margaritoulis, D., and Panagopoulou, A. 2018. Sea turtles in the Mediterranean: Distribution, threats, conservation priorities, and challenges. In <i>The Biology of Sea Turtles</i> (Vol. III, pp. 435-464). CRC Press.</p> <p>Margaritoulis, D., Argano, R., Baran, I., Bentivegna, F., Bradai, M.N., Caminas, J.A., Casale, P., De Metrio, G., Demetropoulos, A., Gerosa, G., Godley, B.J., Haddoud, D.A., Houghton, J., Laurent, L., and Lazar, B. (2003) Loggerhead turtles in the Mediterranean Sea: present knowledge and conservation perspectives. In, A.B. Bolten, B.E. Witherington (eds). <i>Loggerhead Marine turtles</i>. Smithsonian Institution Press, Washington D.C., pp175-198</p>	

## 6.2 Flora

### Management protocol

<b>SECTOR/ TOPIC: FLORA</b> <b>COMPONENTS: PLANT (TERRESTRIAL INVASIVE SPECIES)</b>	
<b>TITLE OF THE PROTOCOL: INVASIVE PLANTS MANAGEMENT PLAN IN TCNR</b>	
<b>TARGET AREA: TCNR (SCIENTIFIC ZONE) AND ABBASIEH (NATURE RESERVE ZONE)</b>	
<b>FREQUENCY: YEARLY</b>	
<b>MONITORING RATIONALE (System Component)</b>	One of the increasing threat for the ecosystems, in particular the dunes along the coastal areas, is the biological invasion. The Non-native plant species, when become invasive, can outcompete and replace native vegetation. Their aggressive growth can alter the composition and structure of these fragile ecosystems, affecting wildlife

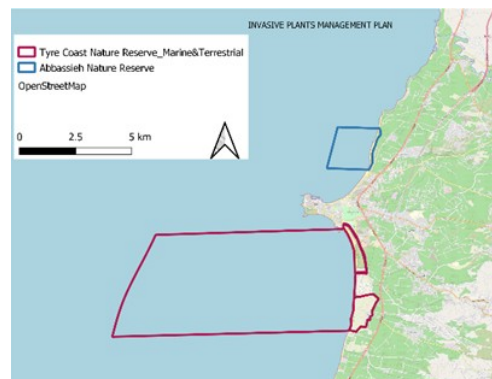
habitats and disrupting the natural balance (Kozhoridze et al 2022).

*Heterotheca subaxillaris*, known by the common name camphorweed, is a member of the Asteraceae family. Its classification indicates it as an annual plant, although it can occasionally exhibit biennial or perennial characteristics (Halvorson and Guertin 2003). It engages in competition with indigenous vegetation, vying for essential resources like water, nutrients, and sunlight. Its flower heads typically remain closed for about ten days, during which time the fruits reach maturity. Seed maturation and dispersion typically take place in autumn. This plant yields two kinds of seeds: the initial type originates from the disc floret and can germinate promptly under both light and dark conditions. The second seed type arises from ray florets, necessitating a one-year period of dormancy before germination, which occurs in well-lit conditions. As *Heterotheca subaxillaris* matures, it may potentially exhibit the capacity for rootstock resprouting. These characteristics, among others, render this species highly invasive, posing a significant threat to native and endangered species, including *Astragalus berytheus*, endemic for Tyre (Bou et al., 2016).


The Camphorweed's native place of origin can be traced to the southern regions of the United State (USDA, 2016) . In 1975, an initial introduction of this plant took place in the Middle East, specifically south of the Lebanese border, with the aim of stabilizing mobile sand dunes. Between the end of October 2008 and the beginning of the following year, a limited number of camphorweed plants were first spotted in Lebanon, near TCNR (Tohmé and Tohmé 2009).

Invasive terrestrial plants have established themselves in various parts of the Tyre coastal area, including the terrestrial parts of the protected areas Abbasieh (Nature Reserve) and Hema Al Mansouri (Figure 1).

Figure 1



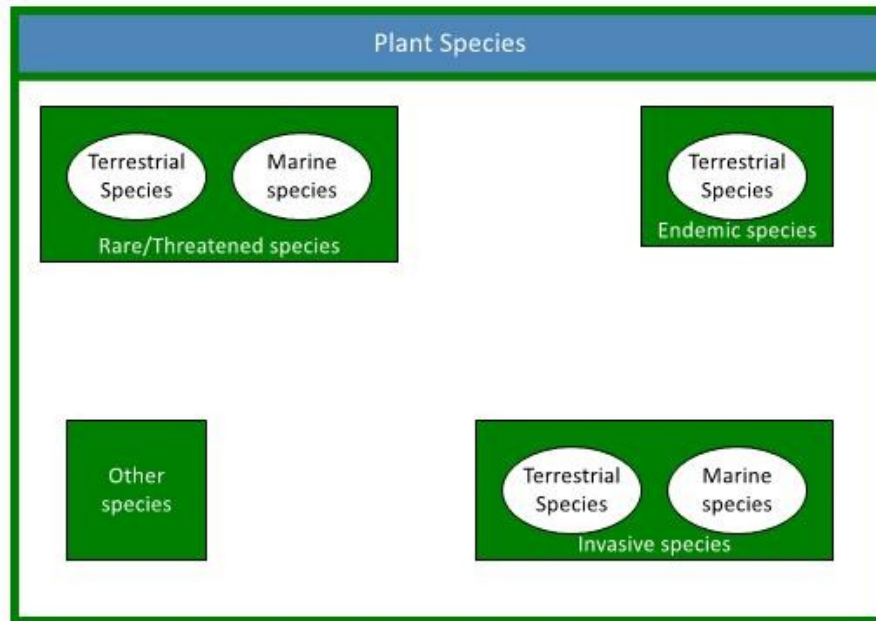
Ongoing research is being conducted in Abbasieh and is projected to conclude by the end of

	<p>summer, under the supervision of the Southern Green Association. However, research on Hema Al Mansouri has not started yet. Acknowledging the significant role played by MPA networks and analogous coastal areas in promoting sustainability goals through comprehensive coastal management, we can consolidate these endeavors in collaboration with Abbasieh Nature Reserve.</p>
<p><b>MONITORING GOAL</b></p>	<p>The primary goal of this management strategy is twofold: first, it strives to conserve native biodiversity by preventing invasive plants from overtaking and replace indigenous plant species. By eliminating invasive plants within a specific area, the aim is to prevent their dissemination to surrounding areas.</p> <p>Moreover, the attempts to control and eliminate invasive plants open doors for scientific exploration. This involves in-depth examinations of how invasive species impact native flora, fauna, and ecosystems, while also evaluating the efficiency of eradication approaches. Additionally, these efforts create educational prospects, especially for school student (particularly, this pertains to those individuals who will be actively involved or take part.), to understand relevant impacts of invasive species on the ecosystem.</p> <p>In conclusion, collaborative efforts and harmonization between the two marine protected areas will assist us in organizing actions, sharing expertise, promoting the conservation of a diverse range of marine species and habitats, and exchanging vital data crucial for informed decision-making.</p>
<p><b>LABORATORY ANALYSIS NEEDS</b></p>	
<p><b>DATA ANALYSIS AND INTERPRETATION PROTOCOLS</b></p>	<p>Data will be entered into the ISP system by TCNR, with responsibility shared between the Project Manager and the Technical team. The table will contain the following metrics: locality, year, month, day, coordinates, area (square meter), and biomass. Data insertion will occur on a daily basis throughout the duration of this project.</p> <p>The cause-effect analysis for this protocol analysed the potential impacts of invasive species on the endemic plants. To explore better the relations between these two plants' categories and collect information aimed to explore and quantify this dynamic, it is essential to monitor the endemic plants presence and distribution both before and after the eradication process. The outcome of this data will spread and communicate on the website of TCNR, Green Southerners, and with publish informative and scientific articles.</p>

## DSS SYSTEM DIAGRAM & INDICATORS

DIAGRAM ELEMENT:

[Plant Species (Id=1029)]



Indicators attached to component: [Invasive species (Id=32)] -> Terrestrial Species (Id=33)				
Name	Description	Data Source	Update Frequency	Notes
Presence of <i>Heterotheca subaxillaris</i>	Estimation about the extension in surface of removed plants		Annual	Removed every year by hand
Terrestrial Invasive Species	Field survey for plant species (invasive and endemic species).	Field survey has done by Lebanese university student under supervision of TCNR project Manager on August 2023 (Scientific zone)	Annual	Scheduled to remove by hands

Indicators attached to component: Terrestrial Species (Id=31)				
Name	Description	DataSource	UpdateFrequency	Notes
Endamic species	Endemic species for the year of 2023	Field Survey August 2023 (Scientific zone)	Yearly	

DATA COLLECTION PROCEDURE	
<b>STAFF</b>	<p>TCNR team and Volunteer (Five students from Lebanese University), NGO's (Fekr w Insan, ADR, AMWAJ), Tyre II Official School, DSC Lebanon, Al Afaaq Institute of Imam Sadr Foundation.</p> <p>The exact staff count remains uncertain as the contact process has commenced but is still ongoing. However, it is anticipated to reach approximately 100 individuals.</p>
<b>EQUIPMENT</b>	Gloves, Root puller, Pruning Shears, Hand Pruners, Bags, Rakes, Disinfectant for shoes.
<b>PROTOCOL</b>	<p>The individuals involved in this protocol will receive training through a workshop organized by TCNR prior to field engagement. The training will cover essential topics, including how to step carefully to safeguard delicate species, identification of invasive species for removal, proper extraction techniques, and appropriate procedures for collecting and storing the removed plants in designated bags (figure 2).</p> <p>The expected number of respondents could reach max 100 people; the all zone will require a duration of five days. It's important to note that all plants collected in each zone will be</p>

burned after the extraction process is completed, noting that the location of burning in each zone should be in the open areas (locations devoid of animal and plant species).

We strongly recommend disinfecting the soles of your footwear using a spray bottle filled with an appropriate disinfectant before entering or exiting any location. You can use methylated spirits (70-100%), diluted bleach (25%), or F10 solution. Simply spray the disinfectant and wait for one minute before moving forward to prevent recontamination of your footwear

Figure 2 illustrates the approach for eradicating invasive plant species

The Invasive Plants Management Protocol at TCNR is scheduled for implementation either during the upcoming spring season or in the midst of winter, strategically chosen to take advantage of moist soil conditions that facilitate the efficient removal of these invasive plants, emphasizing root extraction. This protocol is designed to be applicable not only to the management of *Heterotheca Subaxillaries* also to address various types of invasive plant species encountered within the reserve.

The success of this management approach hinges on collaboration and active participation from multiple stakeholders, including NGOs, dedicated volunteers, and the TCNR team. By engaging this collective effort, we aim to tackle invasive species comprehensively, protect the integrity of the natural ecosystem, and ensure the long-term preservation of the TCNR's unique biodiversity.

<b>QUOTATIONS</b>	Hand Pruners: 68\$ (approximately 50 piece)  Gardeners gloves: 25\$ (approximately 50 piece)
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	<p>Pruning Shears: 40\$ (approximately 50 piece)</p> <p>Root Puller: 45\$ (approximately 50 piece)</p> <p>Bags: 5\$ (approximately 70 piece)</p> <p>Rakes: 6\$ (approximately 70 piece)</p> <p>Disinfectant for shoes: 6\$ (approximately piece 70)</p>
<p><b>References:</b></p> <p>Bou, M., Kharrat, D., Farhat, P., Dakik, N., Kahale, R., and Potash, L. 2016. Invasion and management of <i>Heterotheca subaxillaris</i> in Tyre Coast Nature Reserve, Lebanon. January 2017.  <a href="https://doi.org/10.13140/RG.2.2.21409.40808">https://doi.org/10.13140/RG.2.2.21409.40808</a></p> <p>Daehyun Ki., Jung-Yun L., Jongcheol S. and Insang S. 2019. Recolonization of native and invasive plants after large-scale clearance of a temperate coastal dunefield. <i>Applied Geography</i>, Volume 109. ISSN 0143-6228.</p> <p>Halvorson, W. L. 2003. Verification of plant specimens from Sonoran Desert parks. Report to the Desert Southwest Cooperative Ecosystems Studies Unit, University of Arizona, Tucson, AZ.</p> <p>Kozhoridze, G.; Dor, E.B.; Sternberg, M. 2022. Assessing the Dynamics of Plant Species Invasion in Eastern-Mediterranean Coastal Dunes Using Cellular Automata Modelling and Satellite Time-Series Analyses. <i>Remote Sens</i>: 14, 1014: 20 pp. <a href="https://doi.org/10.3390/rs14041014">https://doi.org/10.3390/rs14041014</a></p> <p>Stenberg M. 2016. From America to the Holy Land: disentangling plant traits of the invasive <i>Heterotheca subaxillaris</i> (Lam.) Britton &amp; Rusby. <i>Plant Ecol</i> (2016) 217:1307–1314. DOI 10.1007/s11258-016-0656-z</p> <p>Suarez and Estelrich 2018. <i>Heterotheca subaxillaris</i>. en: <i>Malezas e invasoras de la Argentina</i>. Tomo III <i>Historia y Biología</i>. Ed.: Fernandez, Leguizamon y Acciaresi: 435 – 448.</p> <p>Tohmé, G. et Tohmé, H. 2009. Espèces nouvelles du Liban et redescription d'espèces endémiques. <i>Lebanese Science Journal</i>, 10;125–130</p>	

## 7. Synergies

The current collaboration involves fishermen and farmers with TCNR at the initial stages of the project, but synergies will be implemented in the future, aligning with the requirements outlined in the fauna and flora protocols.

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## **2) Report**

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