Habitat and Endemic Species-Pilot area

Batroun, Lebanon

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Co-Evolve4BG

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

Habitat and Endemic Species- Pilot area

Batroun scale, Lebanon

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OVERVIEW

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REVIEW

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Abstract

The coastal area of Batroun is a touristic area, whose marine ecosystem is facing a plethora of pressures. These pressures are adversely affecting the native biodiversity and habitats. This report aims to assess the habitats and endemic species in the pilot area of Batroun, focusing on the tourism aspect. Field observations covering four sites along the coast of Batroun were implemented for two days in March 2022. Several native floral and faunal species were observed, including the algae *Saragassum vulgare* and *Padina pavonica*, as well as the commercial fish species *Diplodus sargus*. Several non-indigenous floral and faunal species were also detected, including the invasive seaweed *Caulerpa taxifolia*, and the colonizing herbivorous fish *Siganus rivulatus*. Furthermore, the coast of Batroun was shown to be majorly rocky in nature with characteristic vermetid reefs, and a small sandy beach in the southernmost part of it. Finally, water discharge pipelines and marine litter were also observed at several sites along the coast. Several recommendations were also issued at the end of this report aiming to improve the conservation of the habitat and native species in Batroun coastal area considering touristic activities through promoting sustainable tourism and emphasizing blue economy.

I. Introduction

This report represents "Deliverable ID-PA6-08-Threats to co-evolution in touristic areas at the pilot area scale: Habitat and endemic species in tourism areas in Batroun". It will assess the natural habitats located in the coastal region of Batroun using various technical reports and field visits. It will also describe the biodiversity of the area mentioning the main native species in the region. In addition, this document will also reflect the threats affecting the natural habitats and native species along the coast. Moreover, the report will also assess several policies, plans and programs followed to sustain the coastal environment in the area considering touristic activities. Finally, it will also focus on sustainable tourism and the blue economy in Batroun, as well as issue several recommendations regarding this subject.

Batroun is a coastal city located in the North Governorate of Lebanon (34°15'3.54"N, 35°39'20.45"E), 55 km from the capital Beirut. The city of more than 20 000 residents, is considered a popular tourist destination hosting natural, historical, and archaeological sites, namely the renowned historical Phoenician wall, a mediaeval castle, arcaded Ottoman souks, and Byzantine-style churches (Kadi, 2017). The Batroun coastal area is also a popular attraction and characterized by an important and diverse ecosystem mainly consisting of rocky areas with a few sandy beaches and several distinctive vermetid reefs. However, the Batroun coastal zone also faces a lot of anthropogenic pressures making it a vulnerable region (El Shaer *et al.*, 2012). This beautiful and diverse biotope is jeopardized by industrial expansion. Therefore, managing and ensuring the conservation of its coastal area is indispensable for the growth of the region and improvement of its tourism sector (MOE/UNDP, 2011). The area was also added to the tentative list for inclusion in the World Heritage List.

In addition to the environmental aspect of the coast, the area is also known for its various beach resorts, nightlife, and seafood restaurants hosting a lot of tourists every year, especially during the summer season. Being a widely known touristic destination, all investments in Batroun are oriented towards the tourism sector (Kadi, 2017).

Despite the economic crisis and COVID-19 pandemic in addition to the pressures, the coastal city of Batroun is flourishing as a tourist destination especially for the Lebanese during summer.

II. Materials and methods

The information and data for this study covering habitat and native species in the coastal areas of Batroun, are based on published reports and articles that concern the Batroun coastal ecosystem, and available data and information from different technical reports (MoE/GEF/UNDP, 2015; Ramos-Esplá *et al.*, 2017). In addition, field visits were conducted on the 20th and 21st of March 2022 to collect real-time data and photographs on biodiversity (native and invasive flora and fauna), as well as characteristic coastal habitats. Four sites were chosen to cover the whole Batroun coastal area (Figure 1). The coordinates and descriptions are presented in Table 1.

Figure 1. Location of the observation sites along the Batroun coast.

Table 1. Coordinates and description of the observation sites.

Site	Coordinates (starting & end point of site)		Description
Site 1	34°14'43.0"N 34°14'48.9"N	35°39'38.0"E 35°39'36.0"E	**Sandy beach near Sawari**
Site 2	34°14'57.5" N 34°15'11.1" N	35°39'26.1"E 35°39'27.5"E	**Bahsa Bay**
Site 3	34°15'26.4"N 34°15'18.8"N	35°39'23.2"E 35°39'20.4"E	**Phoenician wall**
Site 4	34°15'43.8"N 34°15'39.0"N	35°39'28.0"E 35°39'27.7"E	**Near the Maritime Sciences and Technology Institute (MARSATI), north of the Batroun port**

The main native and non-indigenous species (NIS) species observed in the Batroun coastal area were recorded through several diving operations performed in the stations during the sampling days. Dives were performed up to 5 m depths. In addition, the coastal area was also surveyed to describe the diverse habitats observed in the region (*e.g.*, vermetid reefs, sandy and rocky beaches, *etc.*).

Furthermore, the effects of touristic activities on native biodiversity and habitats along the Lebanese coast were assessed using reports and case studies, as well as field visits to the municipality and meetings with several involved stakeholders.

III. Habitats and native species

III.1. Geomorphology

The Batroun coast is dominated by low rocky and wide littoral platforms (Figure 2), as well as small caves. The seabed of the low rock is characterized by the presence of coarse sand and gravel. Between 40 and 50 m deep, some rocky outcrops are observed (Ramos-Esplá *et al.,* 2017).

Figure 2. A wide vermetid platform observed around site 2: Bahsa Bay.

III.2.1. Habitats

The Batroun coastal area is also characterized by a high Species Habitat Index (SHI 0.96). The habitats of high interest observed by (Ramos-Esplá *et al.,* 2017)[1] are:

- *Cystoseira sp*.: between 19 and 27 m depth,
- Small block communities,
- Coralligenous and maërl: between 40 and 50 m deep,
- Semi-dark and dark cave communities.

Besides, according to Aguilar *et al.,* (2018) - deep-sea fieldwork conducted along the Lebanese coastline in 2016 by the organization of OCEANA in cooperation with the Regional Activity Centre for Specially Protected Areas (SPA/RAC), the Lebanese Ministry

[1] The authors in Ramo-Espla et al., 2017) have calculated the habitat index as follows:
Habitat Index (HI = MVZ/1,05) with: Medium Habitat Value/Zone (MVZ = ΣVZ/HZ) ; (ΣHV): Total Value/Zone; (HZ) N° Habitats/Zone. The habitat value (HV) of the habitats represents the sum of the different criterion values divided by 6 (number of criteria). Habitat value (HV) = (Σ S+V+P +R+A+E / 6) -1.
We have calculated a value (relative value of habitats), considering the sum of the values of the habitats in each zone divided by the number of habitats by zone, which gives us an average of the value of the habitat/zone (MHVZ: medium habitat value per zone). And in order to homogenize the values, each MHVZ was divided by the average value of all habitats / zones, obtaining the relative value of the habitats by zone.

of Environment (MoE) and the National Center for Marine Sciences (NCMS), Batroun coastal area is characterized by the presence of different types of substrates:

- *Rocky bottoms,*
- *Rhodolith/maërl beds,*
- *Detritic sand,*
- *Coralligenous formations.*

Moreover, this area is characterized by a high abundance of vulnerable endemic Mediterranean habitat-forming species, such as, *Vermetus triquetrus* and *Dendropoma anguliferum* which are the sessile gastropods constituting the main builders of vermetid reefs.

The coast is also considered a rocky area that hosts important vermetid reefs. Most of the area is dominated by shallow hard underwater bottoms while soft bottoms are observed at a greater depth (Aguilar *et al.,* 2018).

Furthermore, according to El Shaer *et al.,* (2012), Batroun coastal area is of high ecological importance as may act as nurseries, spawning and feeding grounds. It also constitutes a habitat for hard and soft bottom communities, as well as seagrass meadow communities.

On the other hand, the field visits and observation campaigns conducted, allowed the construction of the preliminary distribution of habitats along the Batroun coastal area (Figure 3). In general, the coastal area is mainly rocky in nature (Figure 4), with vermetid reefs occupying a good part of it located at the southern edge of Bahsa Bay and along the length of the historical Phoenician wall. Site 2 (south of Bahsa Bay) is characterized by a large vermetid reef of 170 m in length (Figure 5). The outer edge is wide, flattened with some crevices. The inner edge is irregular with many tidal pools. An approximately 550 m sandy beach is also observed in the southernmost part of the coast near the Sawari Resort (Figure 6).

Figure 3. Habitat distribution along with the four observed sites (Adapted from Google Earth by the authors).

Figure 4. The rocky nature of the Batroun coastal area.

Figure 5. The wide vermetid reef in the southern edge of Bahsa Bay (Photos by the authors).

Figure 6. The sandy beach in the southernmost part of the Batroun coast.

III.2.2. Habitats

Batroun coastal waters are characterized by the presence of an important number of native species ranging from algae to marine turtles and marine mammals. For instance, Ramos-Esplá *et al.,* (2017) emphasize the occurrence of an important commercial fish biomass (≈ 18 kg/125 m^2) featuring:

- *Diplodus vulgaris (≈ 9 kg/125 m2),*
- *Sargocentrum rubrum (1.2 kg/125 m2).*
- *The authors also reported the occurrence of several species of interest:*
- *Cystoseira sp.,*
- *Aplysinaaerophoba,*
- *Axinellapolypoides,*
- *Spongia officinalis,*
- *Phyllangia americana mouchezii.*

Moreover, Aguilar *et al.,* (2018) reported the presence of tall sea pen (*Funiculina quadrangulari*s) and the brachiopod *Gryphus vitreus.*

During the field visits, several floral and faunal species were observed. The distribution of several observed species is presented in Figure 7. Sites 1 and 2 were characterized by the predominance of several algal species, namely, *Janiarubens*, *Corallina elongata*, and *Ulva lactuca*. In addition, the non-indigenous species *Caulerpa taxifolia* and *Codium parvulum* were observed in site 1. On the other hand, a characteristic sea anemone,

Actinia equina, and the invasive alga *Colpomenia sinuosa* were also observed near the vermetid reef in site 2. Sites 3 and 4 comprised the same predominant species as sites 1 and 2, in addition to the native species *Sargassum vulgare* and the non-indigenous *Laurencia allamarilzae* observed in site 3. Site 4 was characterized by a predominance of the non-indigenous *Ulva lactuca* (Figure 8). Several species of *Patella* were detected in all observed sites; nevertheless, the native *Patella caerulea* was the predominant.

A detailed description of the native and non-indigenous species observed during the field visits is presented in Table 2 and Table 3, respectively.

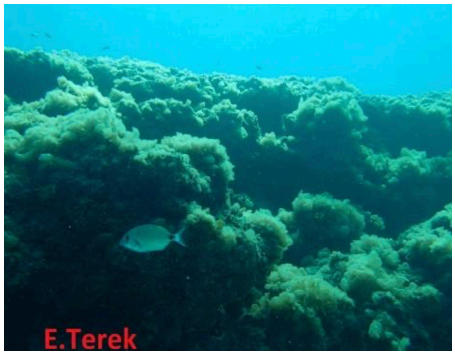
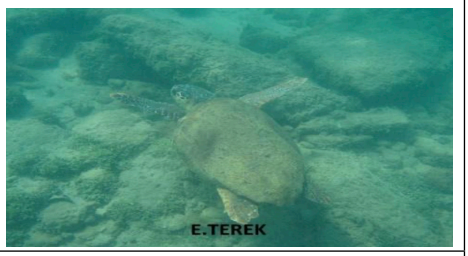
Figure 7. Observed species in the four sites along Batroun coastal area.

Figure 8. The non-indigenous *Ulva lactuca* as observed in site 4.

Table 2. Native species.

Phylum	Species and description	Photos
Ochrophyta	***Sargassum vulgare*** A brown seaweed, lithophytic preferring to grow on coral reefs, rocks, and stones It is observed in many areas along the Lebanese coast (Burkill, 1985).	
	Padina pavonica It is a ubiquitous distinctive small funnel-shaped brown alga growing to a diameter of up to 10 cm. It is also observed along all the Lebanese coast, especially in rocky areas (Guiry, 2015).	 

Rhodophyta	***Janiarubens*** This red algal species is also ubiquitous. It is also known as *Corallina rubens*. It is a rose-pink, epiphytic species with slender, articulated, and calcified fronds arranged in rounded bunches reaching a 5 cm height (Guiry, 2014a).	 
Porifera	***Aplysina aerophoba*** A yellow tubular sponge native to the eastern Atlantic Ocean and the Mediterranean Sea. This species can form colonies up to 1 m across. The photograph on the right is from the recruited diver's archives. It was taken in Bahsa Bay (Boury-Esnault, 2020).	
Mollusca	***Patella caerulea*** It is an endemic limpet species occupying Mediterranean coasts. It is commonly observed on rocky shores of the infra and mid littoral zones (Bannister, 1975).	
	Melarha pheneritoides This small species has a shell size varying between 4 and 9 mm. It inhabits rocky shores in cracks and crevices. It is often associated with the vermetid reefs along the Lebanese. This species was commonly found in the sandy beach (site 1) and Bahsa Bay (site 2).	

Chordata	***Diplodus sargus*** This is a native, commercial species that is commonly observed in the catches of fishermen in Lebanon. It inhabits rocky bottoms and sandy ones in proximity to rocks up to a depth of 50 m. The specimen in the adjacent photograph was observed at 2 m depth in Bahsa Bay (Bauchot, 1987).	
	Caretta caretta Loggerhead turtles are regularly observed in the Batroun area. This species belongs to the family Cheloniidae and has an exceptionally large head. It has a carapace of an average length of 90 cm in a fully grown individual. The photographs on the right are from the recruited diver's archives. They were taken on two different occasions at depths between 5 to 10 m in Bahsa Bay.	 
	Pagrus auriga The Red banded Seabream is also observed in Lebanese waters, inhabiting hard bottoms. The photograph on the right is from the recruited diver's archives. It was taken in Bahsa Bay (Bauchot, 1987).	
	Mureana helena The moray eel is a nocturnal carnivorous species. It is benthic and inhabits rocky bottoms. It is often discarded from catches. The photograph on the right is from the recruited diver's archives. It was taken in Bahsa Bay (Smith and Böhlke, 1990).	

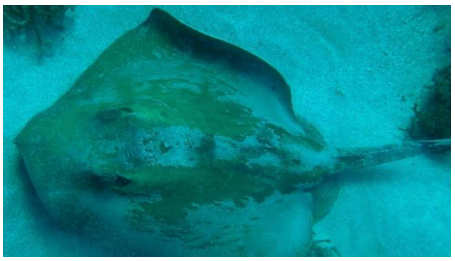
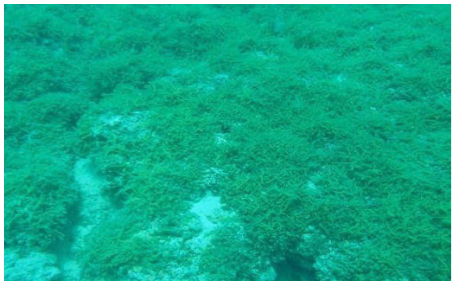
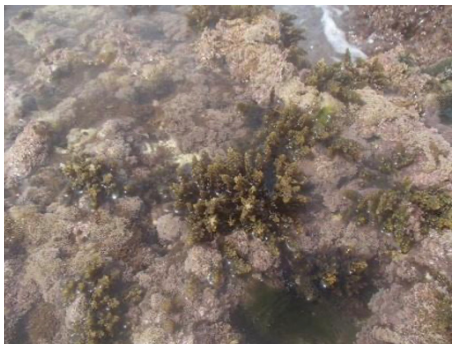
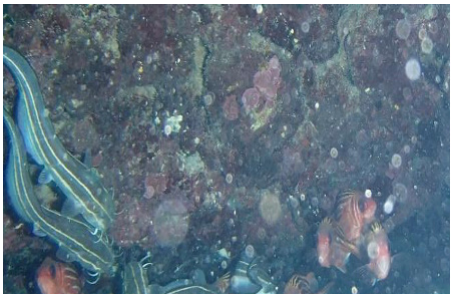
	Aetomylaeus bovinus It is an elasmobranch, commonly known as the bull ray, a species of large stingrays. It is often caught as a bycatch. The photograph on the right is from the recruited diver's archives. It was taken in Bahsa Bay (White, 2014).	
	Dasyatis pastinaca This elasmobranch belongs to the stingray family. It is known as the Common Stingray. It is found in the eastern Atlantic Ocean and the Mediterranean Sea. It inhabits sandy to muddy habitats, and it is often caught as bycatch by Lebanese fishermen (Lteif, 2015) The photograph on the right is from the recruited diver's archives. It was taken in Bahsa Bay.	
Arthropoda	***Clibanarius erythropus*** This species is the Mediterranean intertidal hermit crab. This species is a marine crustacean species that uses gastropod mollusks' shells. The specimen in the photograph is the hermit crab inhabiting the shell of the non-indigenous *Ergatalax junionae*. The specimen was observed at the southern edge of Bahsa Bay.	
	Balanus perforatus It is a large barnacle species that looks like a volcano with steep slopes growing up to 3 cm in both height and diameter. It is commonly seen on the rocky shores of Lebanon.	
	Scyllarides latus It is also known as the Mediterranean slipper lobster. It is highly considered edible and currently rare due to overfishing. The photograph on the right is from the recruited diver's archives. It was taken in Bahsa Bay (Holthuis, 1991).	

Table 3. Non-indigenous species (Photos by the authors).

Phylum	Species and description	Photos
Chlorophyta	***Codium parvulum*** It is a green seaweed found in infralittoral habitats, originally described from the Red Sea. It is found at 1-30 m depths in Lebanon (Bitar *et al.,* 2017).	 
	Ulva lactuca It is known as sea lettuce. It has a light green sheet-like thallus, which is delicate, translucent, and can grow up to 25 cm. It can be observed during all seasons. This alga inhabits rocks, lower-shore rock pools, and shallow subtidal zones (Guiry, 2014b).	
	Caulerpa taxifolia This dark to light green alga is an invasive species which was accidentally introduced to the Mediterranean Sea. It has flat, straight, and feather-like branches reaching 10 cm of length and up to 2 mm of diameter (Meinesz, *et al.,* 1993).	

Rhodophyta	***Laurenciella marilzae*** This species is often found with other macroalgae growing epilithically in the lower intertidal zone, specifically on moderately exposed rocky areas (Machín-Sánchez *et al.,* 2014).	
Ochrophyta	***Colpomenia sinuosa*** This light or golden brown to greenish-brown algae is lobed or irregularly expanded to 10–30 cm in diameter. It is commonly named the oyster thief or sinuous ball weed. It is widespread in tropical to temperate zones around the world (Nelson, 2013).	
Cnidaria	***Actinia equina*** This red-colored sea anemone is non-indigenous to the Lebanese coastal waters. It inhabits subtidal areas by attaching to rocks or any hard substrates. It can be observed up to 20 m depth (Ager, 2001).	
	Rhopilemano madica It is a light blue neritic epipelagic planktotrophic jellyfish capable of reaching a diameter of 90 cm. It is an invasive species that entered the Mediterranean in the late 1970s through the Suez Canal. It is characterized by its painful sting.	

Mollusca	***Ergalatax junionae*** This species is a marine gastropod mollusk that is non-indigenous. The specimen in the photograph is dead and constitutes a shelter for the native hermit crab (*e.g., Clibanarius erythropus*). The specimen was observed in the southern edge of Bahsa Bay.	
Chordata	***Siganus rivulatus*** This species is a demersal herbivorous Lessepsian migrant native to the Red Sea and introduced to the Mediterranean via the Suez Canal. The favorable environmental conditions favored the dispersal of this fish along the Lebanese coast. The specimen in the adjacent photograph was observed at 4 m depth in Bahsa Bay (Bariche, 2003).	
	Fistularia commersoni This species is also a Lessepsian one and is commonly observed in fishermen catches, as well as fish markets along the Lebanese coast. It has a vertically flattened body with a long whiplike tail filament. The specimen in the adjacent photograph was detected at 5 m depths in Bahsa Bay (Myers, 1991).	
	The adjacent photograph was taken in the Batroun area. It was also obtained from the archives of our recruited diver. It shows two Lessepsian species. - ***Plotosuslineatus*** This eel-tail catfish species is non-indigenous and has a single highly venomous serrate spine. It is commonly observed in Lebanese waters. It is inedible (Allen, 2000). - ***Sargocentron rubrum*** The redcoat is a red-colored fish with white stripes. It was introduced in the eastern Mediterranean via the Suez Canal. It is commonly detected in fish catches along the Lebanese coast; however, it has a low commercial value (Randall, 1998).	

It is noteworthy to mention that the bottlenose dolphin (*Tursiops truncatus*) is also frequently observed in the coastal waters facing Batroun by local fishermen and people, in addition to occasional stranding occurrences (Figure 9) in the Lebanese coastal waters. Furthermore, one sighting of the Mediterranean monk seal (*Monachus monachus*) was also recorded in the area.

Figure 9. A stranded bottlenose dolphin in Batroun area in 2013 (Photo by the authors).

IV. Main threats to the habitats and native species

Batroun is a highly populated village and a touristic attraction inducing urbanization and privatization of the coastline, not to mention the notorious chemical plant in Sel'aata (Ramos-Esplá *et al.,* 2017). As a result, the coast of Batroun is under major anthropogenic threats, such as coast degradation, soil erosion and loss of biodiversity. Furthermore, marine litter is also observed due to the various activities in the area (*e.g.,* recreational, touristic, domestic, *etc*.), in addition to domestic and industrial discharges to the sea. In addition, threats other than pollution include invasive species, urban expansion, and the effects of climate change as in all the Lebanese coastal area (MOE/UNDP, 2011).

IV.1. Anthropogenic pressures

The Batroun coastal area is subject to many anthropogenic pressures leading to a naturalness index as low as 0.21 (Ramos-Esplá *et al.,* 2017). This is calculated after the evaluation of the uses and impacts index (industry, commercial, traditional, and recreational fisheries, tourism, littoral urbanization, local population) in the given area by Ramos-Esplá *et al.,* 2017, where the naturalness index is estimated by subtracting the latter index from 1. Some of the threats observed in the Batroun coastal area in addition to their impact evaluation are represented in Table 4.
The field observations implemented showed different types of threats risking the sustainability of the coastal area in the region. Figure 10 shows the distribution of some observed discharge pipelines and marine litter along the surveyed area.

Table 4. A summary and an impact evaluation of the threats observed in the Batroun coastal area according to (Ramos-Esplá *et al.,* 2017). The relative evaluation of the use/Impact: (3) very important; (2) important; (1) not important.

Uses-Impacts	Relative evaluation of the use/Impact
Commercial fishing	3
Shore angling	3
Spearfishing	3
Lost nets (ghost fishing)	2
Trampling	3
Bait and shellfish collecting	3
Mooring	2
Ports, marinas, cove fishing	2
Solid waste	2
Domestic sewage discard	2
Industrial sewage discard	1
Beach/bathing	2
Urbanization	3

Figure 10. Some observed threats along the Batroun coast (Adapted from Google Earth).

IV.1.1. Habitat degradation

Habitats are crucial to maintain the biodiversity of any area as they provide inhabitant species with all the needs of their ecological niches (MoE/GEF/UNDP, 2015). The main causes of coastal habitat degradation in Batroun are:

- *The significant presence beach resorts, seasonal bungalows, and restaurants/bars especially in the proximity of the sandy beach (sites 1) and Bahsa Bay, including the vermetid platform at its edge (site 2)*
- *Land reclamation observed in the proximity of the port and MARSATI (Figure 11).*
- *Beach activities leading to marine litter, which was evident in the sandy beach (site 1) (Figure 12)*
- *Lack of awareness*

Figure 11. Land reclamation evidence near MARSATI in the coastal area of Batroun (Photo by the authors).

Figure 12. Marine litter on the sandy beach in site 1 (Photo by the authors).

IV.1.2. Pollution

Besides the marine litter, many sources of pollution were evident in the coastal area surveyed including:

- Municipal and industrial wastes (liquid and solid) are caused by the absence of waste management, infrastructure, and wastewater treatment. Water discharge pipelines were detected in sites 1 and 4 (Figures 13 and 14). Furthermore, the presence of the Sel'aata chemical plant is also adversely affecting the marine ecosystem in the region.
- Agricultural runoff is often observed in Bahsa Bay and its proximal vermetid reef (site 2). This runoff is sometimes represented by the smell of waste.

Figure 13. The discharge pipeline detected in the southern part (top) and the northern part (bottom) of site 1 (Photos by the authors)

Figure 14. The discharge pipeline detected in site 4 (Photo by the authors).

IV.1.3. Port activities

Port activities can also have a significant impact on coastal ecosystems. The Batroun area is characterized by a traditional fishing port, used for artisanal fishing and recreational activities. Site 3 represented the fishermen port of Batroun, where several ecosystem damaging activities might occur. For example, uncontrollably discarded litter from fishing vessels, use of anti-fouling paints, and potential oil leakage damage marine life and water quality (Abboud Abi-Saab, 2012).

IV.2 Climate change and invasive species

Climate change is a global event that is exerting an effect on the Batroun coastal area, as on any other area in the world. Biodiversity at all its levels has started to be affected by climate change (Ramos-Esplá *et al.,* 2017). During the past four decades, the Eastern Mediterranean, including Lebanese waters, has witnessed an increase in seawater temperature (0.09 °C/yr.) and salinity leading to the shift in sea characteristics towards a more tropical level (Ouba, 2015). Therefore, several ecological changes, especially biodiversity-related issues, were observed. The introduction of several Indo-Pacific species into the Levantine Sea and their establishment were facilitated by these new environmental conditions (Badreddine, 2018). For instance, the Lebanese coast has witnessed the disappearance of several engineering species, such as, *Posidonia oceanica* and the sea fans *Paramuricea clavata* and *Eunicella spp.* (Harmelin *et al.,* 2009; Harmelin *et al.,* 2016). Besides, the invasive seaweed *Caulerpa taxifolia* has been introduced from the Red Sea via the Suez Canal, and the increasing seawater temperatures induced by climate change have facilitated the colonization and invasion of this seaweed, as well as its competition with the endemic *Posidonia oceania* (Pergent *et al.,* 2008). The evidence of this introduction was evident in the Batroun coastal area, where the invasive *Caulerpa taxifolia* was observed in site 1. Furthermore, Siganids, namely *Siganus rivulatus* that was observed in Batroun waters during the field visits, have also colonized Lebanese waters. These species have succeeded to outcompete native herbivorous species, such as, *Boops boops* and *Sarpa salpa* for space and food, thus, altering native habitats, decreasing native species biodiversity in the area, and altering the trophic levels (Guy-Haim *et al.,* 2017).

IV.3. Unregulated fisheries

Unregulated fishing practices, the use of destructive and unsustainable fishing methods, spearfishing, blast fishing and the use of poisons also negatively impact the coastal ecosystem in Lebanon (Abboud Abi-Saab, 2012). The Batroun coastal area is facing an overexploitation of fish resources due to recreational spearfishing activities that target large individuals. In addition, artisanal fishing and harvesting activities are affecting nursery habitats on the inshore rocks.

IV.4. Lack of governance and data

There are gaps and issues concerning the status of biodiversity and ecosystems in Lebanon. Lack of data and governance can affect issuing policies and mitigation measures. This case is observed at the country scale, as well as at Batroun coastal area scale. Moreover, there is no efficient management of the marine environment and its resources in the Batroun coastal area. The development of resorts is inadequately managed due to the lack of construction regulations and the lack of awareness (Abboud Abi-Saab, 2012).

V. Impact of coastal/maritime tourism on habitats and native species

The Batroun coastal area has become a touristic and local attraction in the past couple of years, noting the financial crisis in Lebanon and COVID-19 pandemic that enhanced local tourism. In addition, Batroun is characterized by its natural beaches and coastal resorts which increased the number of visitors. An increase of local and foreign tourism in the area has affected the habitat and native species in many ways (Table 5).

Table 5. The positive and negative contribution of tourism to habitat and native species in Batroun coastal area.

Positive	Negative
An economic, financial, and political justification for conservation.	Touristic recreational activities (spearfishing and boat renting), urban expansion, and resort construction in the Batroun coastal area can contribute to overexploitation of marine resources and habitat degradation.
Provides the opportunity for the development of ecotourism (hiking trails, wildlife watching, snorkeling, *etc*.)	Any tourism action that releases greenhouse gases contributes to climate change, thus exacerbating the effects of climate change, such as, the introduction and colonization of non-indigenous species.
Provide the opportunity to promote citizen science through education and awareness to involve citizens in the conservation process.	Tourism activities in Batroun coastal area usually generate beach and marine litter that can be washed to the sea causing devastating effects on nursery habitats, as well as marine flora and fauna. For example, the sea turtle *Caretta caretta* can choke on plastic bags while mistaking it for jellyfish

VI. Promoting sustainable coastal/maritime tourism and Blue Economy

Nowadays, the practice of blue economy and sustainable tourism is on the rise. Current challenges demand a comprehensive sustainable plan for a better protection of the environment and resources through science, services, observations, data exchange and capacity development.
Several recommendations should be followed and implemented in Batroun coastal area to ensure the sustainability and the protection of the habitat and native species:

- Awareness and spread of a comprehensive idea highlighting the importance of habitats and native species, as well as their functions.
- Efficient dissemination through official platforms
- Improvement of the collaboration between the Ministry of the Environment, the Ministry of Telecommunication, the Ministry of Tourism, media platforms and tour operators to promote sustainable tourism in Batroun.
- Promotion of sustainable fishing methods through regulating the mesh sizes of the gear used and assigning seasonal closure periods during breeding and nursing seasons in collaboration with the ministry of agriculture.
- Devising education strategies for users (fishermen, tourists, ...) in the area.
- Spreading information that shows sources of harm to the coastal environment. This information should target fishermen, tourists, sea bathers, ...
- Promote blue economy friendly activities related to regulating artisanal fisheries.
- Planning sustainable port activities in the context of blue economy, as well as habitat and native species conservation.
- Plan eco-touristic activities and features: *i*) identification and training local eco-guides and *ii*) advertisements of eco-guides through the MoE and MoT.
- Involve local community into using eco-friendly products especially through encouraging local handicrafts related to sustainable tourism.
- Plan coastal clean-up campaigns implemented by the local community, especially youths every season.
- Establishing regulations of urban expansion and activities in Batroun.
- Spread brochures in Batroun resorts and tourist offices to encourage tourists' sense of environmental respect and conservation.
- Develop the related infrastructure to promote ecotourism.
- Enhance the value of coastal habitats to encourage their restoration and preserve ecological balance.

VII. Conclusions

The coastal city of Batroun is an important historical and touristic area comprising a small-scale fishing port, a mediaeval city, and an archaeological Phoenician wall. It comprises a variety of natural marine habitats of high ecological importance and hosts a wide diversity of threatened and native species. For this purpose, recommendations should be addressed, and action plans should be implemented to preserve this diverse environment in the context of a blue economy and sustainable tourism.

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