

DEVELOPMENT OF A MANAGEMENT PLAN FOR THE JOUNIEH PROPOSED MARINE PROTECTED AREA

*Development of a Management Plan relevant
to the sustainable conservation of marine resources
in a deep-sea area in Lebanon*

Financé par :



With the partnership of

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Study required and financed by:

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CTD profiles of JNMR

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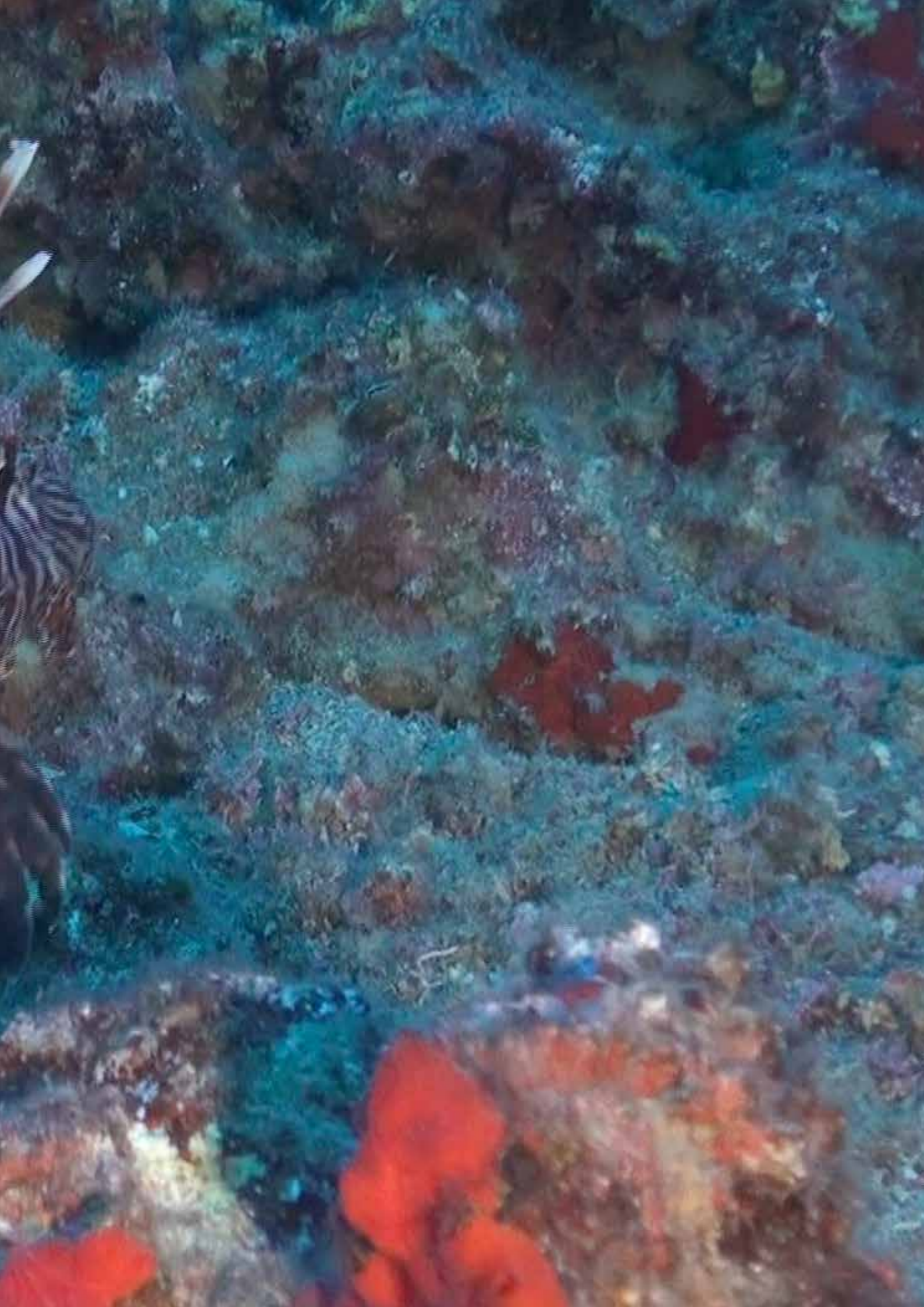
APPENDIX D



LIST OF ACRONYMS AND ABBREVIATIONS

ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area
ACI	Area of Conservation Interest
CBNRM	Community Based Natural Resources Management
CNRS	The National Council for Scientific Research
CNSM	National Centre for Marine Sciences
CSO	Civil Society Organization
CTD	Conductivity, Temperature and Depth
EEA	European Environment Agency
EEZ	Exclusive Economic Zone
EMDW	Eastern Mediterranean Deep Water
EUNIS	European Nature Information System
FRA	Fishery Restricted Area
GFCM	General Fisheries Commission for the Mediterranean
IUCN	International Union for Conservation of Nature
JNMR	Jounieh Nature Marine Reserve
LIW	Levantine Intermediate Water
LPA	Lebanese Petroleum Administration
MAP	Mediterranean Action Plan Barcelona Convention
MAW	Modified Atlantic Water
MoE	Ministry of Environment
MPA	Marine Protected Area
O&G	Oil and Gas
SPA/RAC	Regional Activity Centre for Specially Protected Areas
ROV	Remotely Operated Underwater Vehicle
SEA	Strategic Environmental Assessment
SPAMI	Specially Protected Areas of Mediterranean Importance
SST	Sea Surface Temperature
UNEP	United Nations Environment Program
UNU-INWEH	Sustainable Livelihood, Resources Conservation, and Environmental Protection for the human wellbeing





FOREWORD

This document represents the proposed management Plan of the Jounieh Nature Marine Reserve (JNMR). It aims at providing, in addition to the description of the status of the nature marine reserve and of its main challenges, a clear vision and operational objectives of the proposed management measures, taking into account the general objectives of the JNMR as stated in the draft declaration Law.

The orientations presented in this document stem from the results of a field survey conducted, based on the official request of the Lebanese Ministry of the Environment, in 2016 within the framework of the "Deep-sea of Lebanon" Project being implemented since 2016 thanks to the financial support of the MAVA Foundation and with the participation of the Lebanese Ministry of the Environment in partnership with Oceana, SPA/RAC and IUCN. The survey focused on the collection of biological and ecological data in deep marine areas covering the main submarine canyons in Lebanese waters.

As a follow-up to the survey, SPA/RAC, in close consultation with the other project partners, appointed a team of marine protected area management experts to identify the sites of conservation interest and to propose the declaration of Marine Protected Areas (MPAs) based on ecological, technical and administrative feasibility criteria and taking into account existing or planned uses of the marine environment in Lebanon.

The current management plan proposal includes the following elements:

- Main components of the natural heritage of the area and the rationale for its conservation;
- Socio-economic context prevailing in the area, including present and potential uses;
- Current and potential threats and other sources of pressure to the natural reserve;
- Zoning of the Nature Marine Reserve based on different level of protection with detailed description of the regulation applicable to each zone (prohibited, regulated and permitted activities in different sections of the reserve);
- Monitoring activity and required field surveys to improve the scientific knowledge about the habitats, species and human activities undertaken in the area and its surrounding zones;
- Governance structure, in line with the provisions of the draft declaration and the requirement of the identified management measures;
- Detailed workplan providing guidance for the methodology and the planning of the management measures;
- Evaluation indicators to assess the implementation of management measures and of their effectiveness in achieving the objectives of the Natural Marine Reserve.

The proposed management plan covers an implementation period of five years, after which an evaluation of the achievements as well as of the effectiveness of conservation and management measures will be undertaken.

1 INTRODUCTION AND BACKGROUND INFORMATION

The “Deep-Sea Lebanon” Project was launched in 2016 with the overall aim to increase the surface of Marine Protected Areas (MPAs) in Lebanon and the consequent intention of generating suitable management plans to maintain those protected zones. Following the adoption by the Lebanese Government of the Lebanon’s Marine Protected Areas Strategy in 2012, the Country identified some sites in the territorial deep-sea waters as potential MPAs and needing further scientific studies for their declaration.

Deep-sea environments are recognized as among the most sensitive features of oceans. However, information and data about these ecosystems are rare and scarce, but evidence regarding their richness in terms of biodiversity as well as their fragility has been demonstrated and highlighted by many scientific exploration surveys.

Based on the official request of the Lebanese Ministry of the Environment, Oceana concluded, in October 2016, a one-month expedition in previously unstudied deep-sea areas of Lebanon (Aguilar, et al., 2018). Five canyon areas were surveyed:

- Tarablus/Batroun;
- Jounieh;
- St. George;
- Beirut escarpment;
- Sayniq.

Submarine canyons are known to enhance the abundance and diversity of marine life by their effect on local circulation, by funnelling sediment transport and by providing more varied and complex physical habitats than surrounding slope areas. Indeed, canyons often have steep slopes, rocky outcrops, and faster currents that can support fauna with diverse habitat requirements (Würtz, 2012).

Most of the submarine canyons covered by the exploration campaign hold physical and biological features that deserve protection as heritage of special importance not only for Lebanon, but also at regional level. Many of the species and assemblages recorded are considered threatened, are protected under international agreements or play significant ecosystem roles, either by building habitat or providing other ecosystem services.

Starting from the data of the Oceana’s report, nine Areas of Conservation Interest (ACIs) were identified along the Libanese coast, named from ACI02 to ACI09 from North to South (Figure 1).

In the scope of the Phase 1 of the present Project, Golder carried out a GoldSET® Spatial Analysis and a GoldSET® Option Analysis in order to provide the Authorities an objective ranking of the nine ACIs to be used in the decision-making for the design of a new MPA. Indicators taken into account for the analyses are reported in the following table.

Table 1: Indicators used for the GoldSET Spatial Analysis and the Option Analysis

GOLDSET SPATIAL ANALYSIS INDICATORS	GOLDSET OPTION ANALYSIS INDICATORS
Distance from the closest Navy harbor	Variety of endangered species
Availability of data (data coverage)	Abundances of endangered specimens
Distance from the coast	High conservation interest
Distance from main navigation routes	Presence of Oil and Gas Blocks
Distance from Oil and Gas Blocks	Interest of National Authorities and stakeholders to designate a MPA
Distance from Fishery grounds	Number of Administrations potentially involved
Distance from major river mouth	Quantity of marine litter
	Presence of alien species (potential invasive species)
	Proximity of the main coastal cities

By combining the two analyses results, the final ranking (Figure 1) was elaborated and delivered to the Authorities (Table 2).

Table 2: Results of the GoldSET Spatial Analysis and the GoldSET Option Analysis and final ranking

ID	Canyon area	Final ranking	Spatial Analysis ranking	Option Analysis ranking
AC07	Beirut escarpment	1	1	2
ACI06	St. George	2	2	3
ACI04	Jounieh	3	3	5
ACI08	Beirut escarpment	4	6	1
ACI05	St. George	5	4	6
ACI09	Sayniq	6	8	4
ACI03	Jounieh	7	5	7
ACI02	Tarablus/Batroun	8	7	8

ACI04 (the Jounieh canyon), one of the top ranked sites by the ecological assessment, was selected, in the light of feasibility criteria, as the area for the designation of the first MPA covering deep-sea environment in Lebanon.

The infographic presented in Figure 2 is a summary of the methodology applied to support the decision-making process to identify the new MPA. It explains the steps of the Multicriteria Decision Analysis that allowed to provide the Local Authorities with a ranking of the ACIs in terms of their suitability to be designated as MPA.

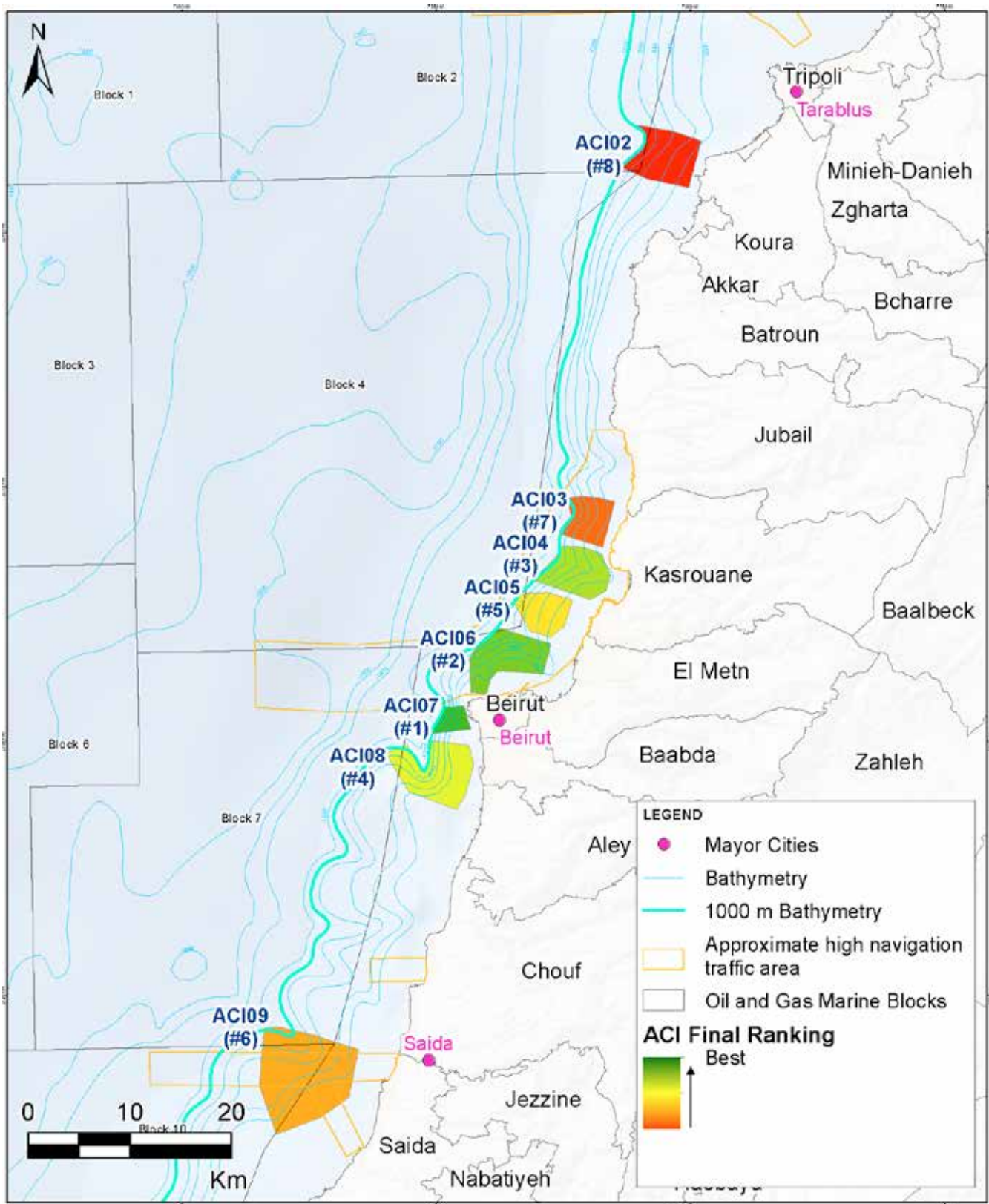


Figure 1: Location of the ACIs along the Lebanese coasts and their final GoldSET ranking

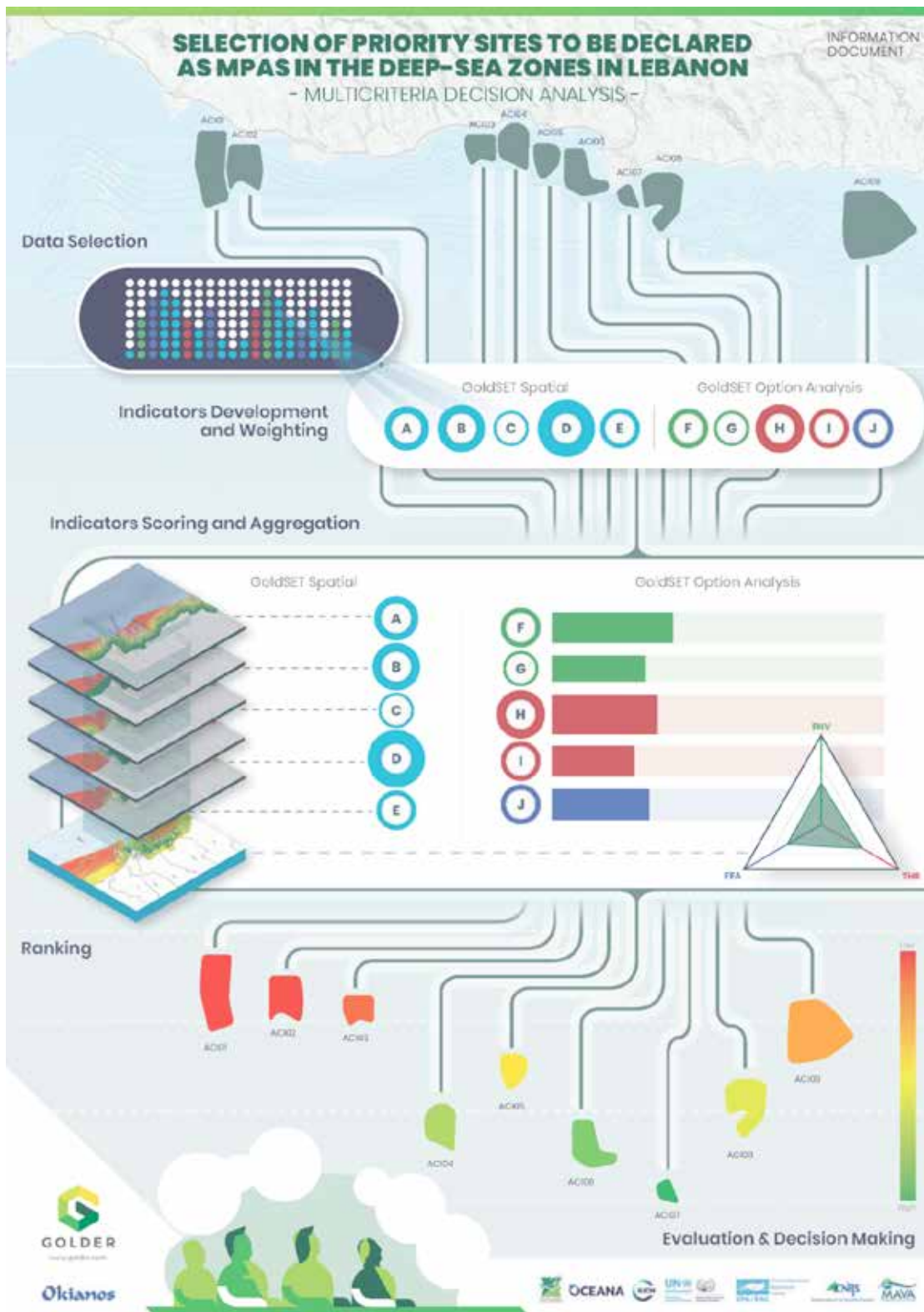


Figure 2: infographic showing the methodology applied for the site selection

The draft contents of the present Management Plan were presented and discussed at a Workshop organized in Beirut, December 11th, and attended by local authorities, local academics and stakeholders.

The discussion was really productive and prepositive. Pointers and suggestions raised during the Workshop were considered for finalizing and completing the present document.



2 DESCRIPTION OF THE NATURAL CONTEXT

This chapter provides a description of the marine environment within the JNMR. The borders of the

JNMR are shown in the figure below. The rationale for the zoning of the area is described in chapter 4.

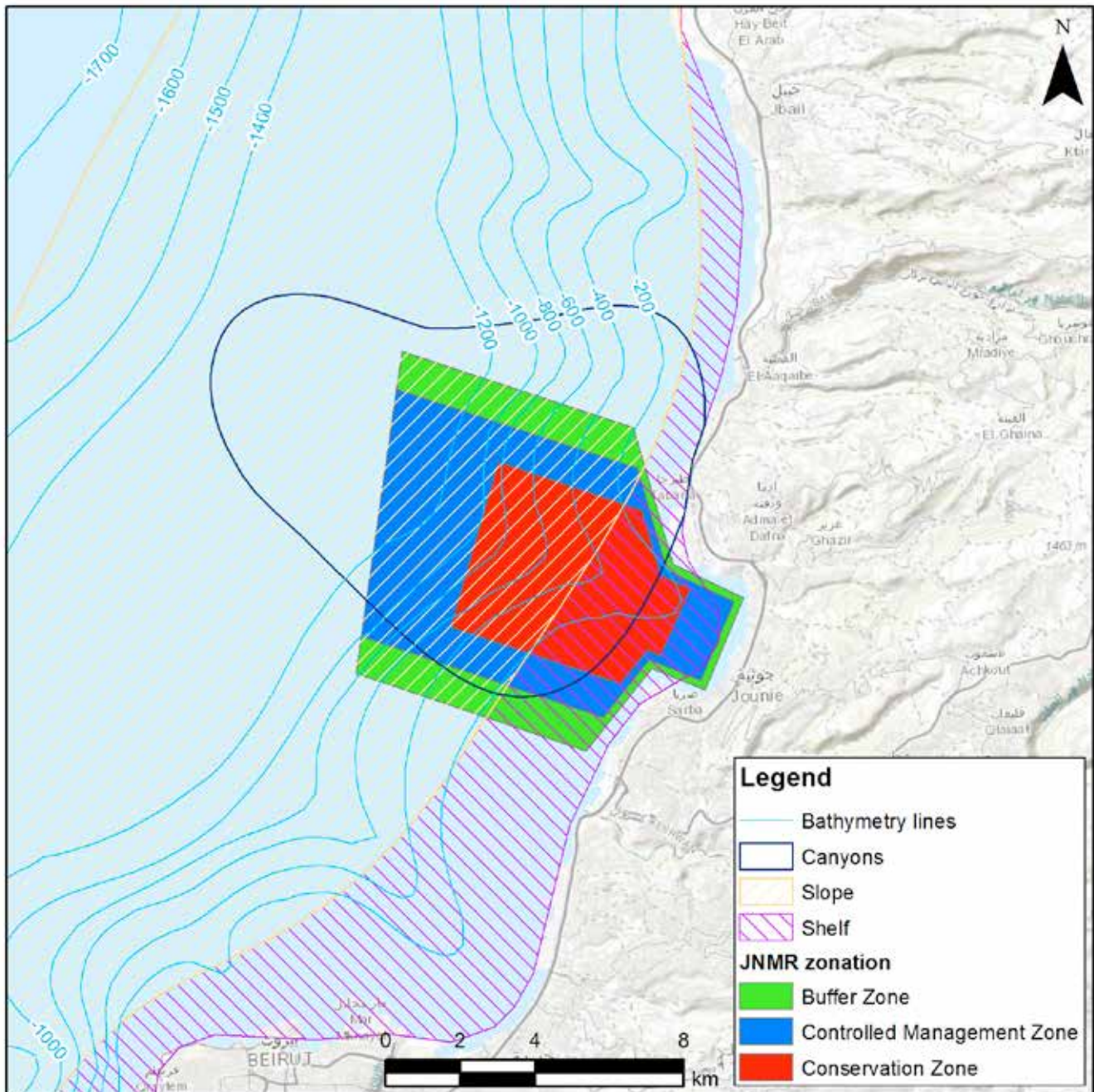


Figure 3: Borders of the Jounieh Nature Marine Reserve

2.1 Bathymetry

Lebanon is known to be characterized by rugged seafloors; the continental slope is located very close to the coastline. Lebanese waters are hence relatively deep, considering that the -1,000 m isobath line is averagely located about 7 km offshore. However, detailed data about bathymetry off the Lebanese coasts is limited⁽¹⁾.

Focusing on the Jounieh canyon area, the bathymetry of the JNMR ranges about from 10 m to 1,300 m depth (Figure 3). In the area water depth gently increases on the continental shelf (www.bluehabitats.org) up to the isobath of 200 m (located about 2 km from the coast). Starting from the isobath of -200 m, slope rapidly increases in the transition between the continental shelf and the slope. In the Jounieh area, the -1,000 m isobath line is located 8 km offshore. Bathymetric lines evidence the presence of a canyon to the open sea. The head of the canyon is positioned

at about 1,800 m from the coast. According to the available data, the extension of the canyon interests an area of about 102 km² (www.bluehabitats.org). The canyon continues beyond the bathymetry of the 1,200 m and out of the border of the JNMR.

According to the information collected from local authorities, the Army has recent and very accurate bathymetric data of the area (multibeam survey). The availability of these bathymetric data is essential for the implementation of the present Management Plan.

2.2 Hydrography

Lebanon is bathed by the Levantine Sea, the easternmost part of the Mediterranean Sea, which is also characterized by the highest Sea Surface Temperature (SST) and salinity values: respectively 22 °C (Figure 4) and 39.5 PSU (Figure 5) on average.

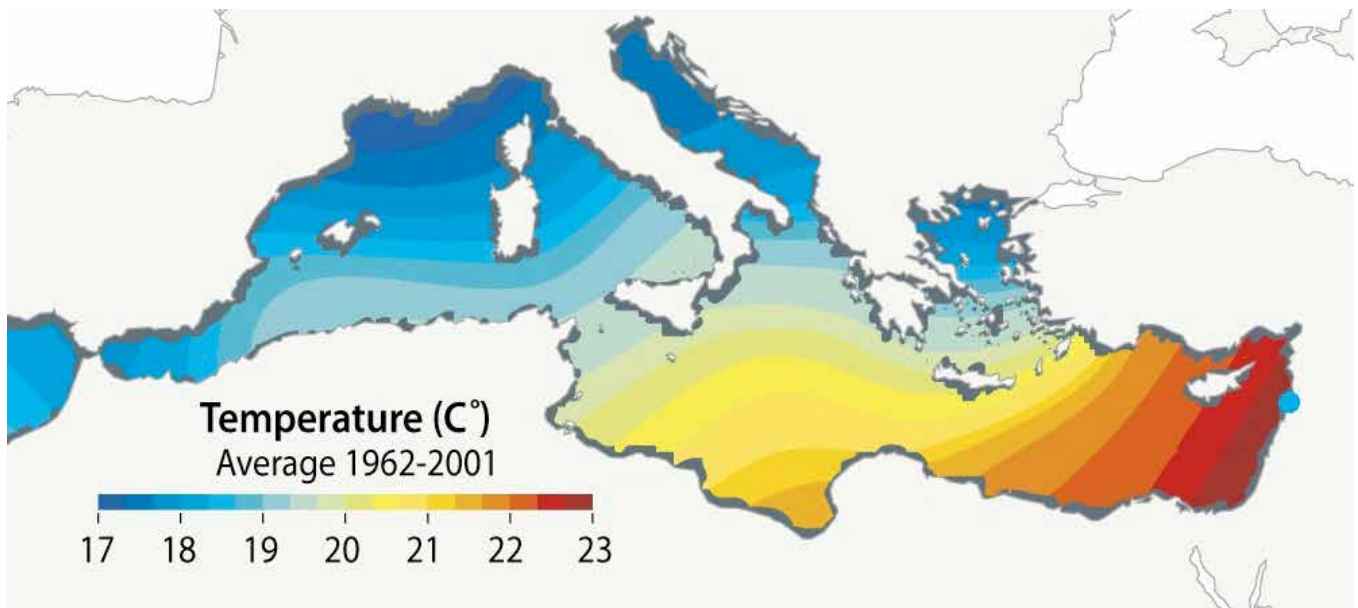


Figure 4: Mean annual SST values of the Mediterranean Sea (source: Vidal-Vijande, et al., 2011). The blue point indicates Jounieh Nature Marine Reserve location

(1) GEBCO bathymetric chart (<https://www.gebco.net/>) reports data at different resolution, depending on the site assessed and the availability of data.

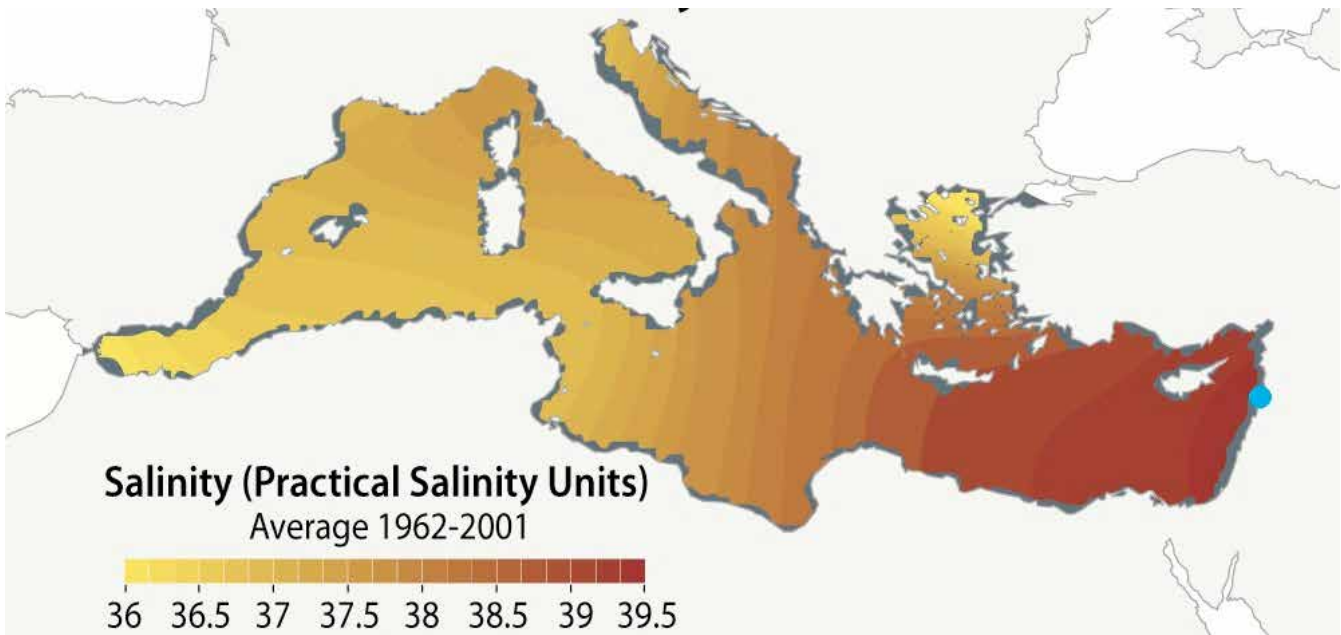


Figure 5: Mean surface salinity values of the Mediterranean Sea (source: Vidal-Vijande, et al., 2011).
The blue point indicates Jounieh Nature Marine Reserve location

A detail of the seasonal fluctuations of the SST in Jounieh Bay is provided in graph below.

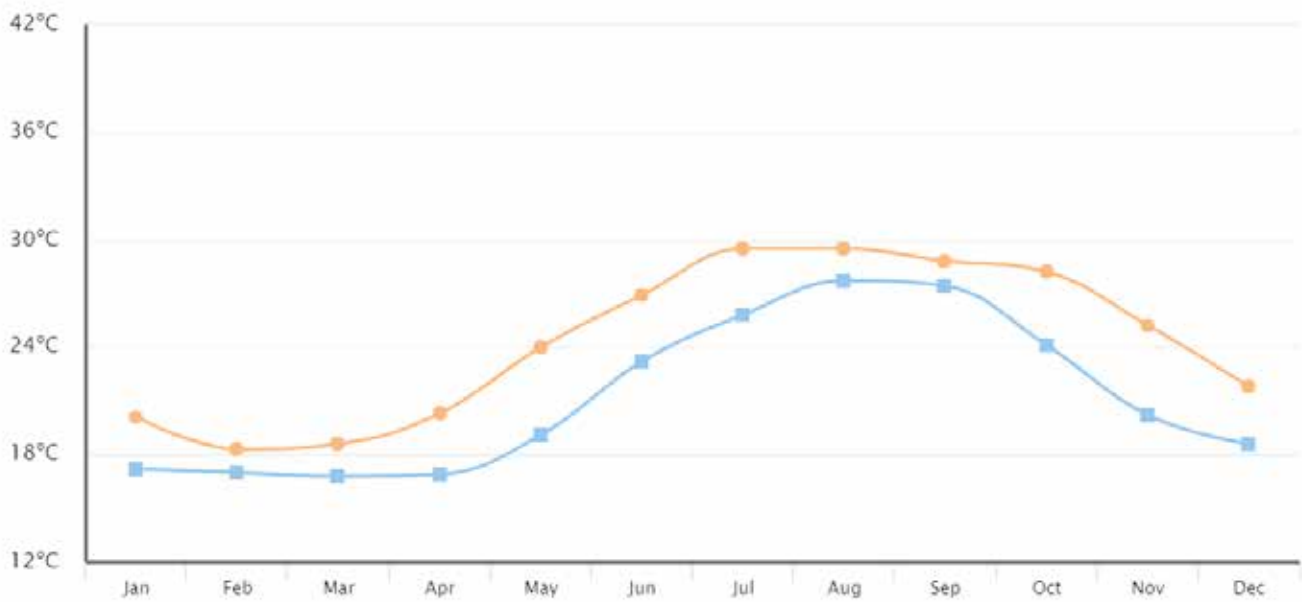


Figure 6: Monthly SSTs in Jounieh bay (source: <https://www.seatemperature.org/>)

Sea water is naturally poor in nutrients, being ultra-oligotrophic, when compared to other parts of the Mediterranean. This is also due to the lack of

significant rivers, that can provide a high supply of nutrients, flowing into the Levantine Sea.

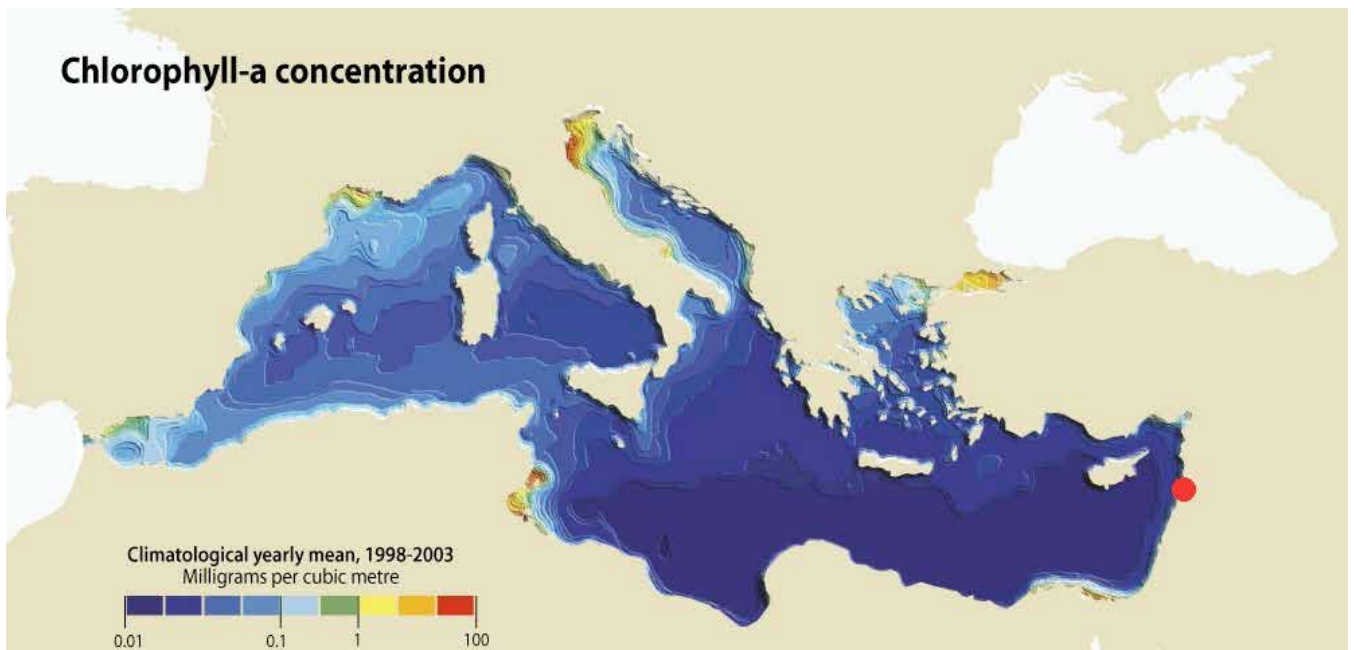


Figure 7: Mean annual nutrient concentration in the Mediterranean Sea (source: Barale, et al., 2008).
The red point indicates Jounieh Nature Marine Reserve location

2.2.1 CTD profile of the area

The CTD (Conductivity, Temperature and Depth) profile of the area was acquired by Oceana in 2016 in different measuring stations (Figure 8).

Data were gathered in October 2016 with a multiparametric probe. At both stations, measurements were taken from the surface to the sea bottom, showing a SST of about 26.0 °C and a sea bottom temperature of 13.8 °C at 1,076 m depth (CTD13) and 17.7 °C at 108 m depth (CTD12). A thermocline was found between 50 and 350 m depth

at CTD13 and between 30 and 55 m depth at CTD12. At CTD13, a peak of fluorescence was observed around 70 m of depth, coinciding with the upper zone of the thermocline. Nutrients probably concentrate at these depth range as a consequence of the density change. No anoxic layers were recorded. However, it must be noted that CTD profiles tend to change seasonally and according to significant meteorological changes. All CTD graphics are reported in APPENDIX A.

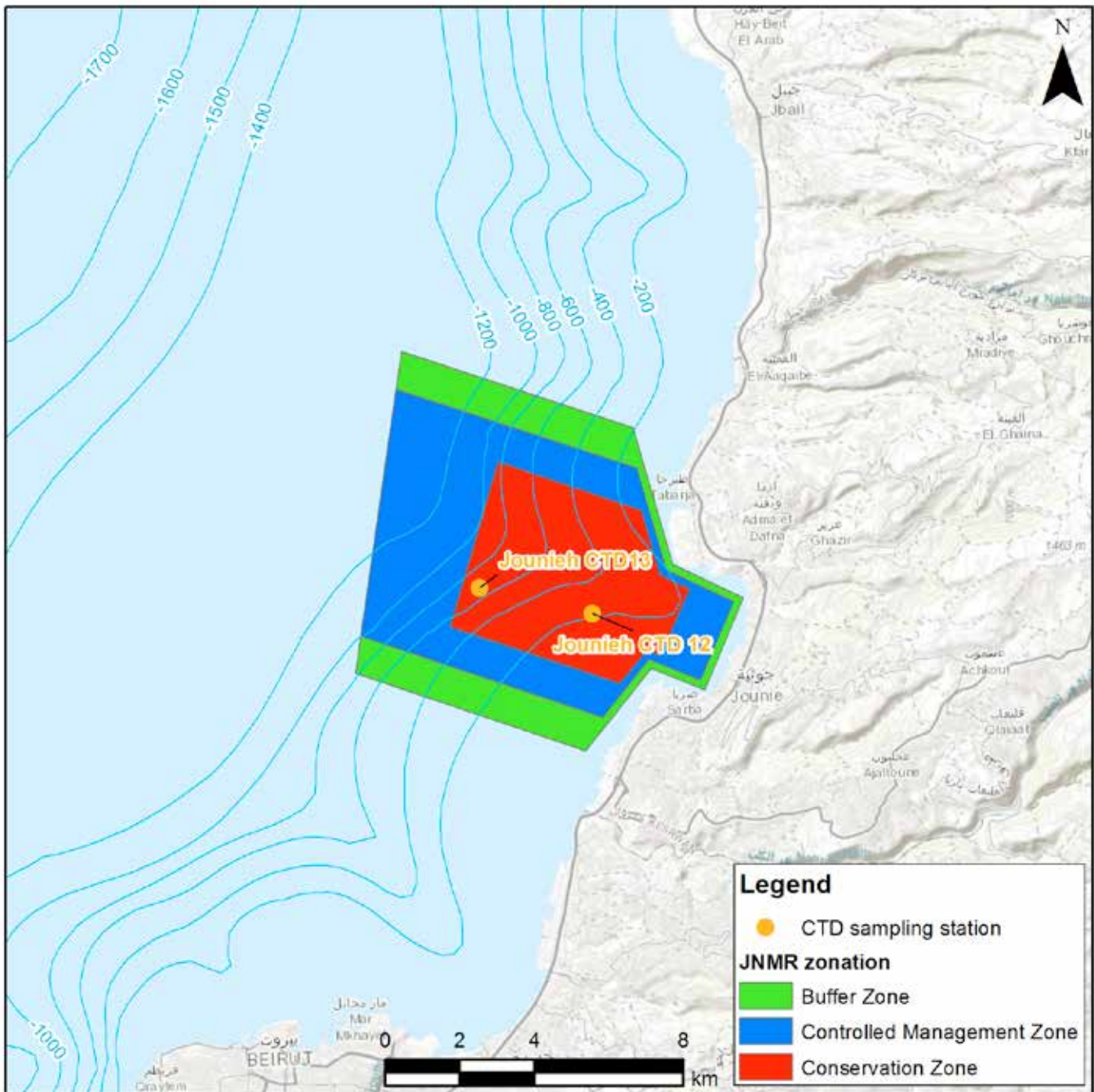


Figure 8: Measuring stations for the CTD profile

2.2.2 Currents

Currents offshore Lebanon are quite coastal and superficial (Gerin, et al., 2009). Indeed, water circulation off Lebanese shores is almost completely caused by currents in the Modified Atlantic Water (MAW; about 0-100 depth), the Mediterranean most superficial layer. Water movements in the deeper layers, the Levantine Intermediate Water (LIW; about 100-400 m depth) and in the Eastern Mediterranean

Deep Water (EMDW; approximately beyond 400 m depth), are weak and they hardly influence the marine circulation of the area (El-Geziry & Bryden, 2010). Noteworthy is the presence of a cyclonic gyre between Lebanon and Cyprus' South-eastern coasts (Figure 9 and Figure 10).

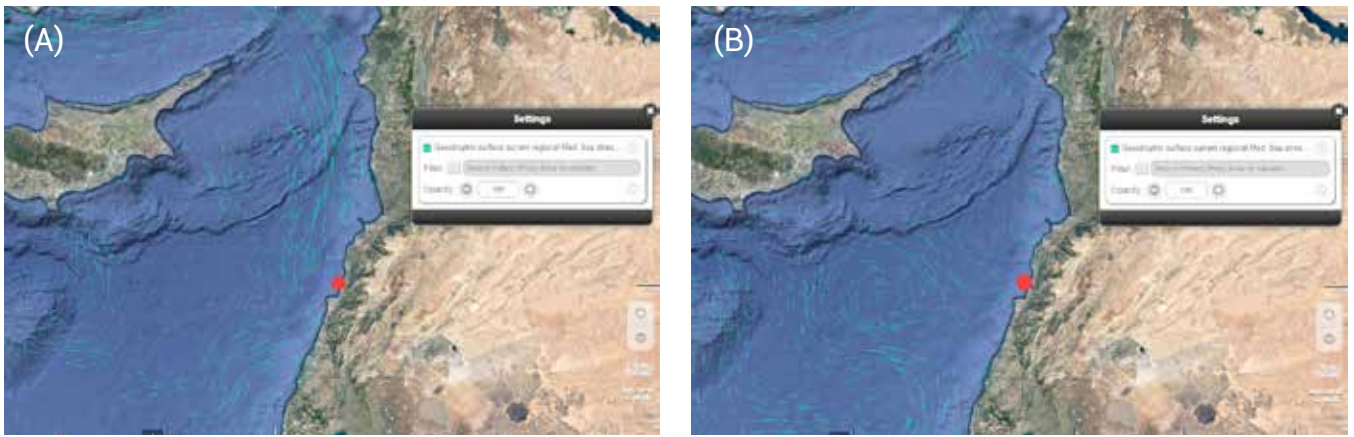


Figure 9: Currents offshore Lebanon in (A) January and (B) April 2015 (source: www.globcurrent.org). The red point indicates Jounieh Nature Marine Reserve location



Figure 10: Currents offshore Lebanon in (A) July and (B) October 2015 (source: www.globcurrent.org). The red point indicates JNMR location

Surface currents in a wide area around the JNMR are predominantly directed northwards. The average speed calculated along the Lebanon's coast is 6 cm/s (Emery & George, 1963). However, currents are

strongly influenced by the seasonality, being stronger in spring and summer very weak in summer and very weak during autumn and winter. A seasonal pattern for 2015 is provided in the figures below.

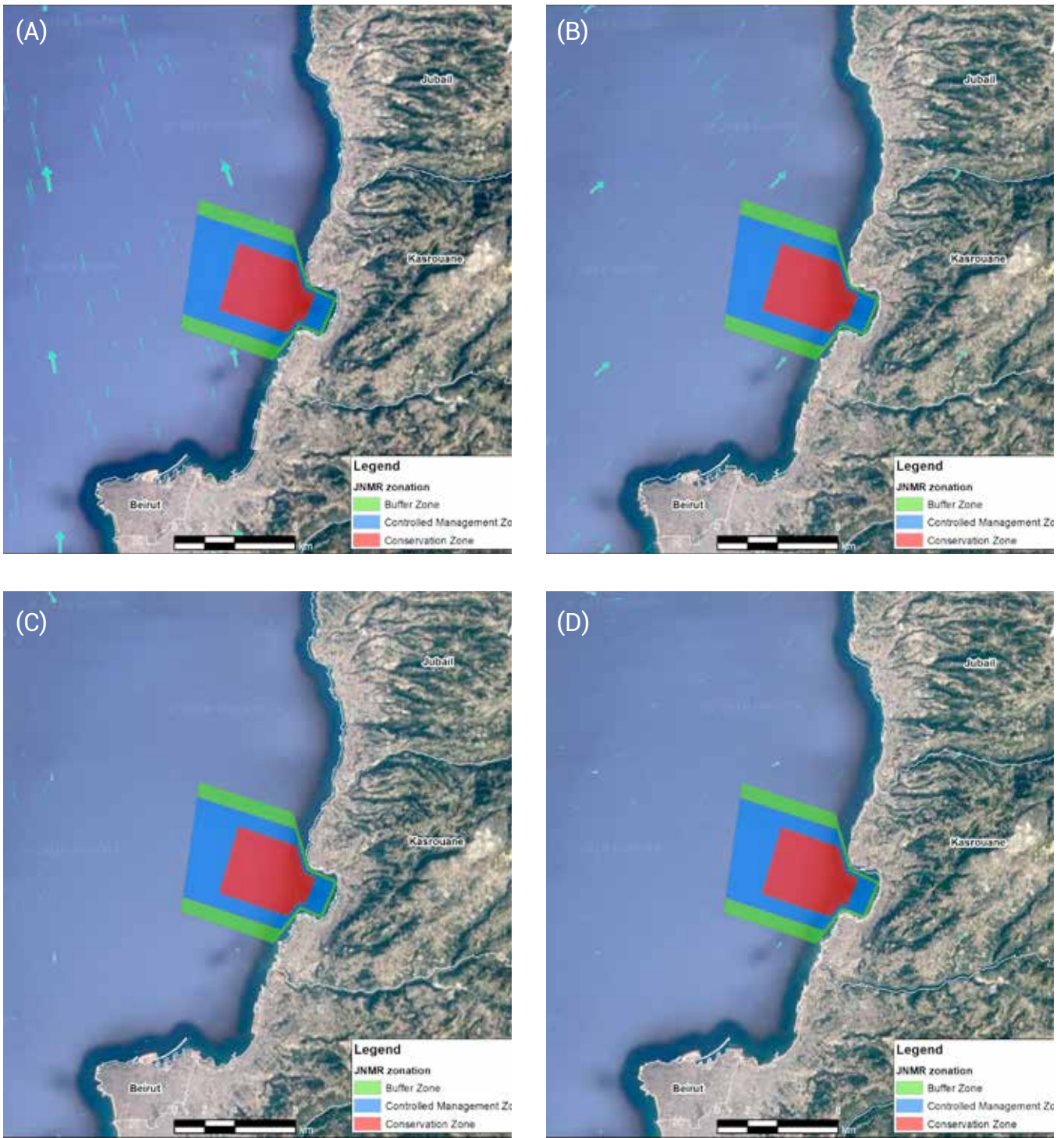


Figure 11: Currents in a wide area around Jounieh Nature Marine Reserve in (A) January, (B) April, (C) July and (D) October 2015 (source: www.globcurrent.org)

2.2.3 Marine pollution

Lebanese coast is highly anthropized and Lebanon itself has known critical issues linked to marine litter and sea pollution (Saab, et al., 2008). According to Shaban (2008), the Jounieh area appears to be

polluted mainly by wastewater disposal – due to many marine outfalls located in Jounieh Bay – and warm water, probably discharged by a power plant located on the southern coast of the Bay (Figure 12).

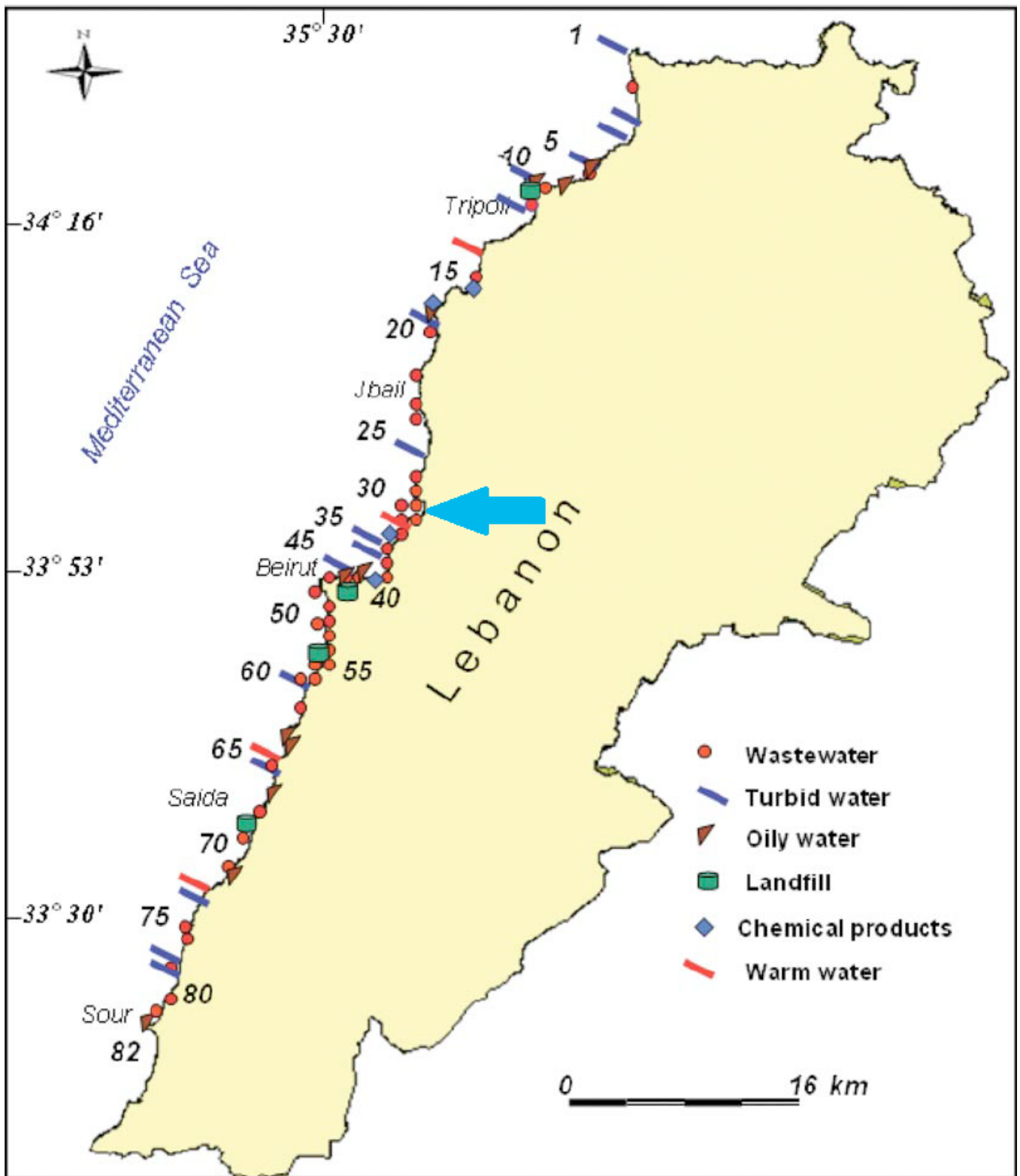


Figure 12: Map of the distribution of different aspects of marine pollution along the Lebanese coast (source: Shaban, 2008). The blue arrow indicates the JNMR location

2.3 Habitats

The Levantine Sea has one of the highest biodiversity indexes within the Mediterranean basin (Figure 13). The Lebanese coast itself, according to EEA (2006), shows a quite relevant presence of biodiversity

hotspots (Figure 14). This is mainly due to the peculiar geomorphic features of the seafloor and the presence of numerous canyons (Bariche, 2010).

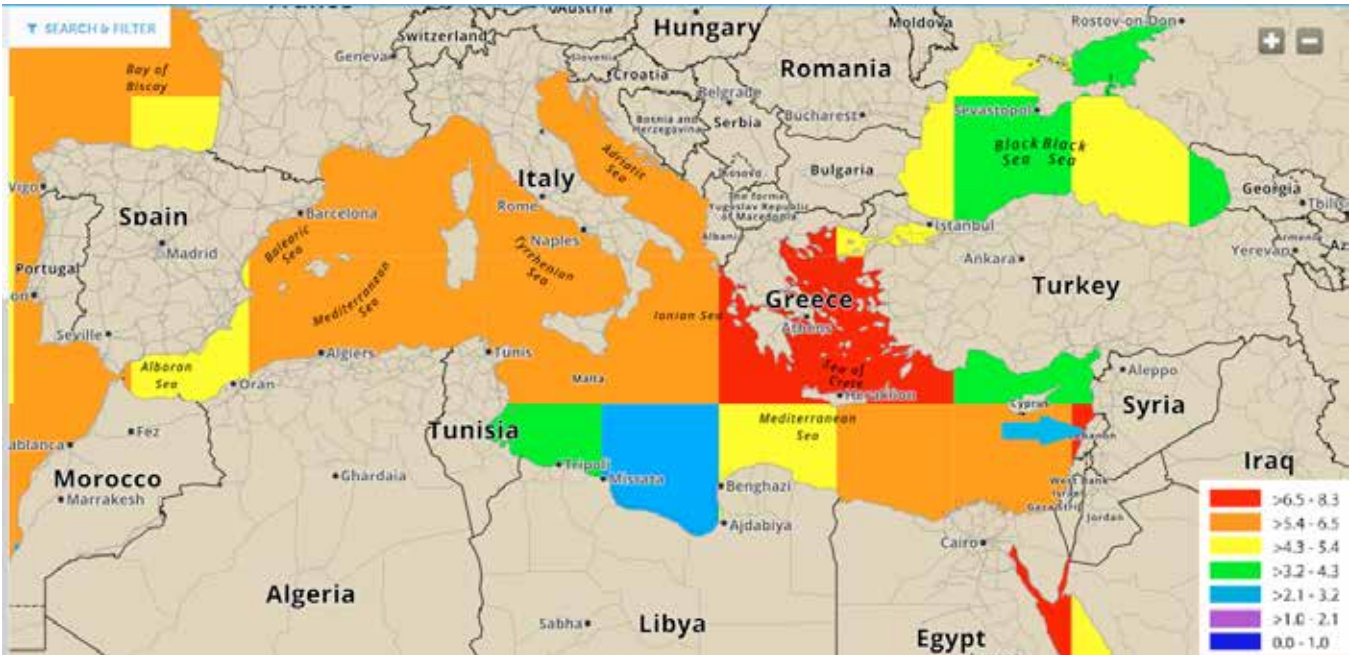


Figure 13: Map of Shannon's Index of Biodiversity in the Mediterranean Sea (source: Ocean Data Viewer, 2014). The blue arrow indicates the JNMR location



Figure 14: Biodiversity hotspot distribution in the Mediterranean Sea (source: EEA, 2006). The red arrow indicates the JNMR location

However, numerous alien species have been recorded in the Lebanese waters, due to several factors

including the particularly warm waters facilitating the settlement of non-indigenous species (Figure 15).

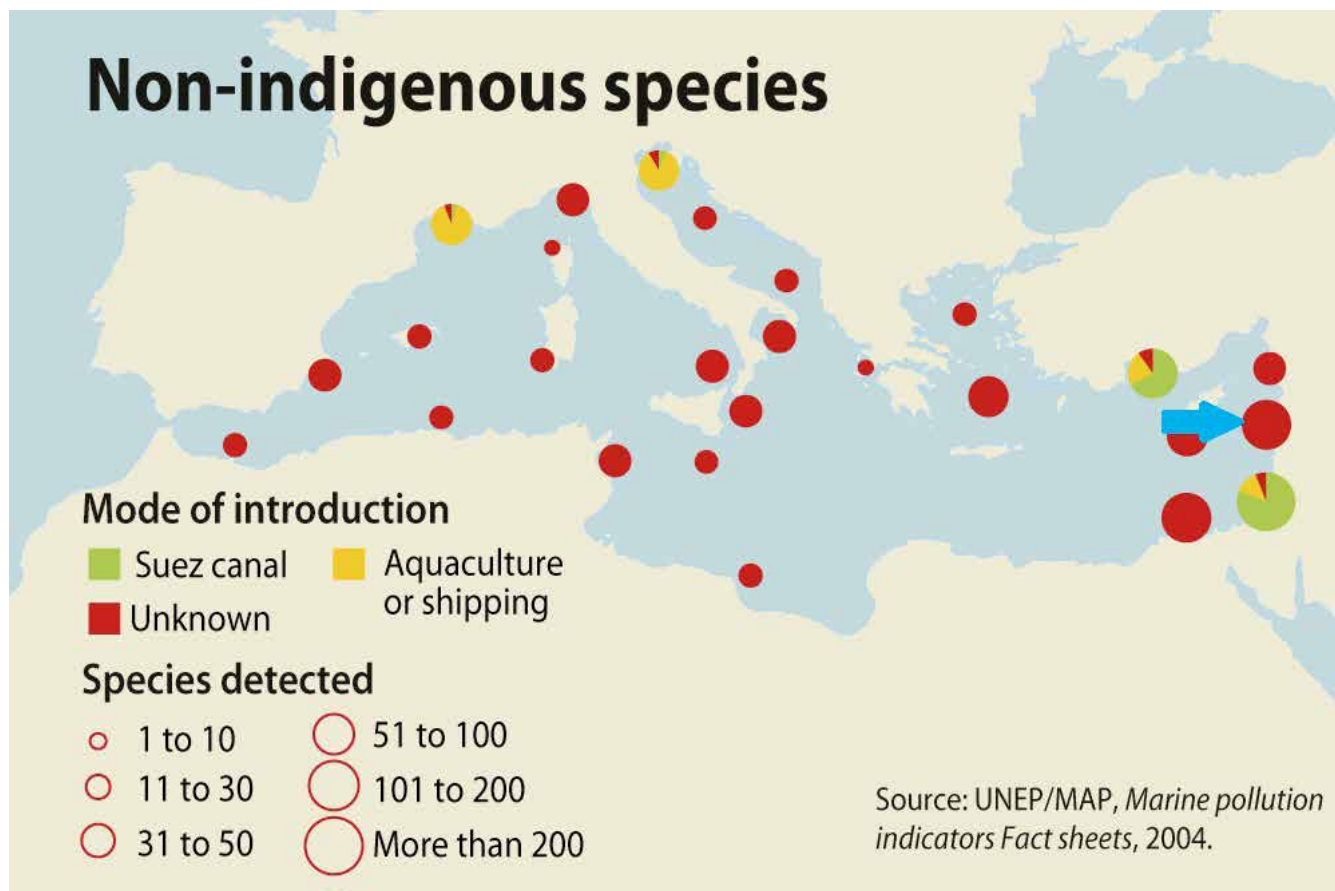


Figure 15: Allochthonous marine species recorded in the Mediterranean Sea. The blue arrow indicates the JNMR location

The inventory and distribution of marine habitats is a fundamental tool to plan and manage the natural resources. The marine habitat classification and cartography is essential and is considered the best tool to characterize and evaluate the marine environment (Bianchi, et al., 2012). Marine habitats are classified according to their importance for conservation. According to the Barcelona Convention benthonic habitats have been classified and 61 have been chosen as priorities for protection. Based on their vulnerability, heritage value, distribution, aesthetic and economic value, the document UNEP(OCA)MED WG. 149/5 classifies the marine habitats into three main categories:

- **Priority habitats**, the conservation of which is mandatory;
- **Remarkable habitats**, that deserve specific attention or management;
- **Other habitats**, that have no rarity or vulnerability features and limited heritage, aesthetic and economic importance.

Jounieh Nature Marine Reserve borders were designed in order to encompass the Jounieh submarine canyon. Submarine canyons are typical features of the continental slopes deeply incising the continental shelf. Their upper ends are termed "canyon heads", whereas the canyon's continuation seaward is named "canyon mouth" (Figure 16). The boundary between the continental shelf and the submarine canyon is known as "canyon rim".

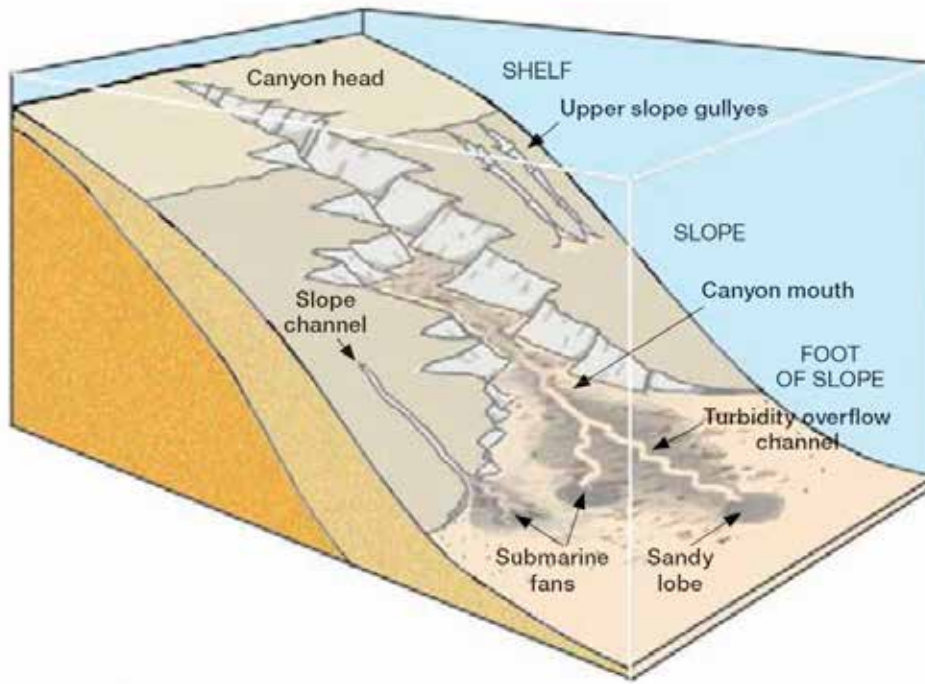


Figure 16: Schematic representation of a submarine canyon (source: Würtz, 2012)

The heads of some submarine canyons terminate on the slope, making so-called "blind" or "headless" canyons. However, Lebanese submarine canyons

are usually self-incising canyons with no clear bathymetric connection to a major river system (Figure 17).

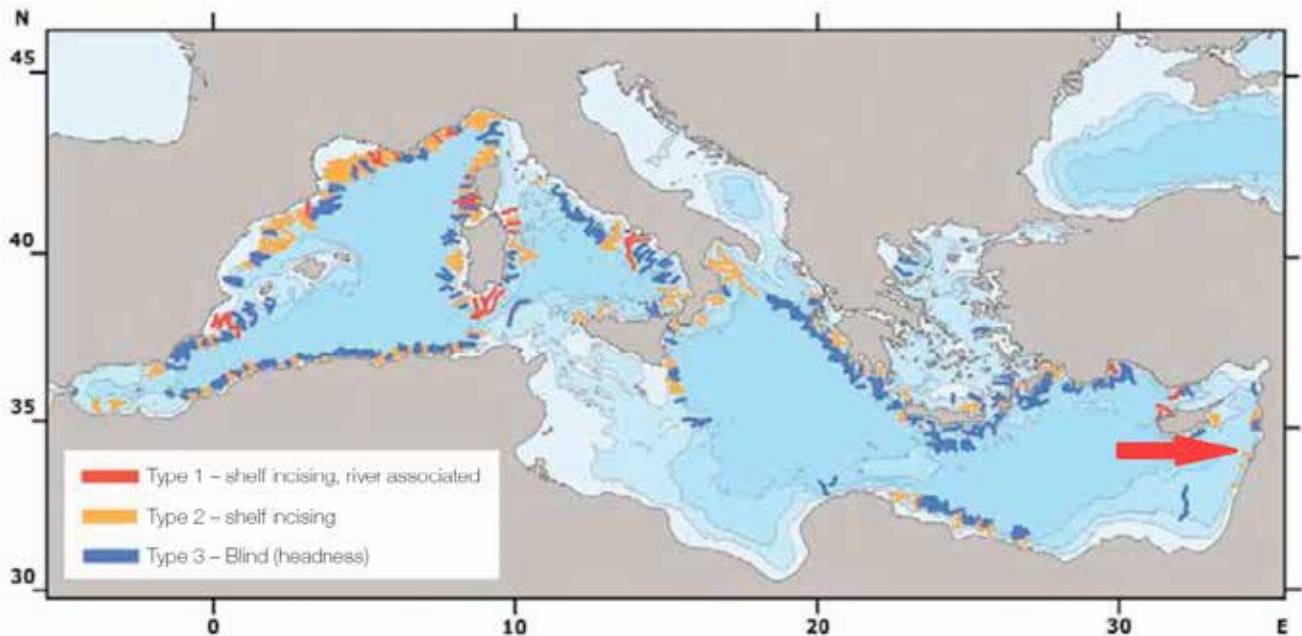


Figure 17: Types of submarine canyons and their distribution in the Mediterranean Sea (source: Würtz, 2012). The red arrow indicates the JNMR location

Habitat typologies within the JNMR were investigated by Oceana in October 2016 by benthic samplings through grab and ROV surveys (Figure 17). According to the distribution of the bathymetric lines, Jounieh's canyon head is located within Jounieh Bay, at about

100 m depth. The canyon mouth is expected to be located at about 1,000 m depth seawards. According to the available data, the canyon shows an east-west evolution with an expected total length of about 5.5 km.

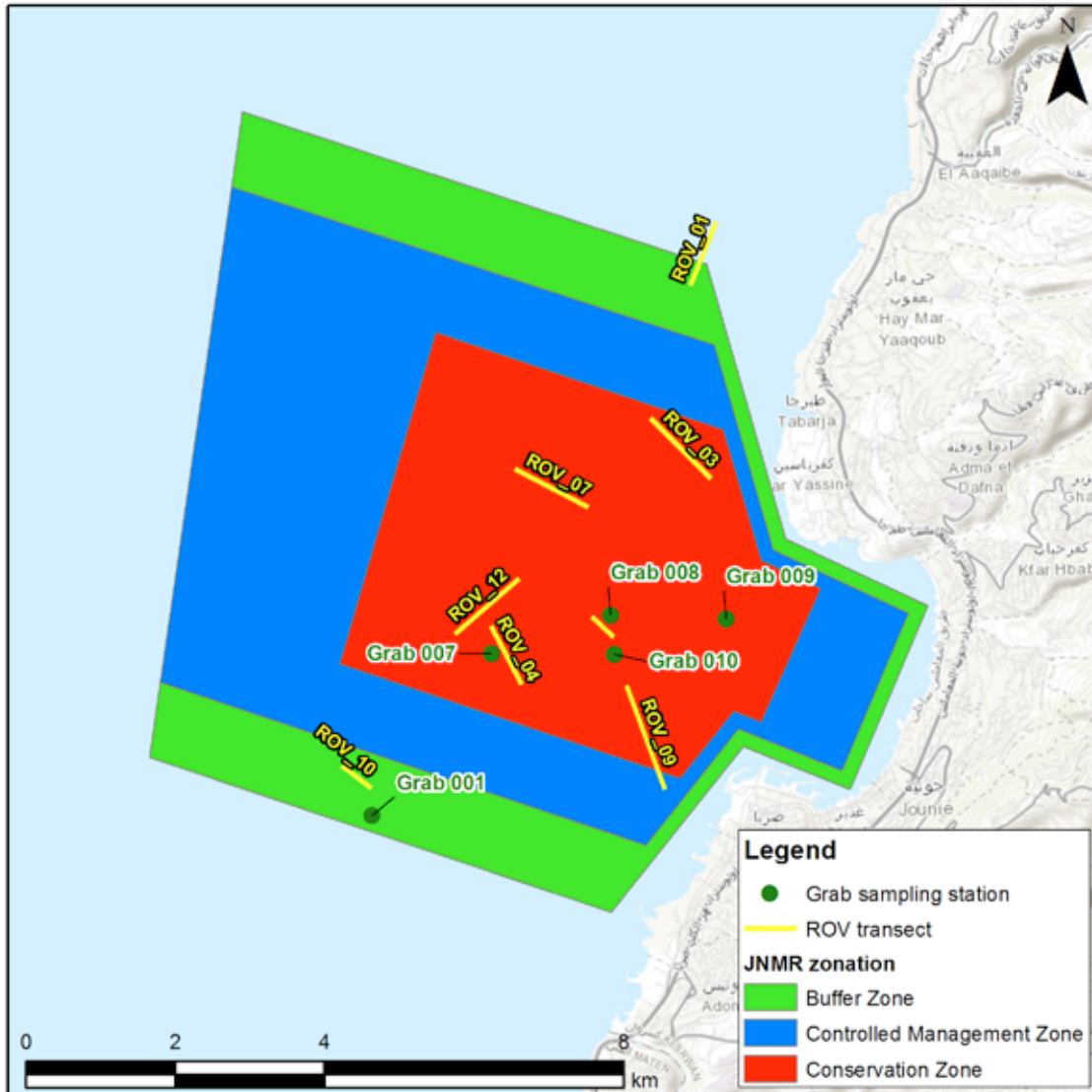


Figure 18: Grab sampling stations and ROV transects' location in JNMR

The sea bottom on the top of the canyon is prevalently sandy or sandy-muddy, with elements likely to be attributable respectively to the Biocoenosis of the coastal detritic bottom and the Biocoenosis of the muddy detritic bottom. Both habitats were found as mixed with some rocky outcrops and, in shallower waters (~60-70 m depth), associations

with rhodoliths and maërl facies were also recorded. Soft bottoms appeared to be widely bioturbed, index of a relatively abundant infauna presence. Rocky outcrops are widely distributed on both tops of the canyon with differences in the size: in the southern top, many emergent boulders were recorded.





The **Biocoenosis of the coastal detritic bottom** is formed by sediments coming from infralittoral or circalittoral formations and it is formed by gravels and sands with debris (Relini & Giaccone, 2009). According to UNEP(OCA)MED WG. 149/5, it is a not remarkable habitat, since it shows medium vulnerability, medium heritage value, very scattered distribution, low aesthetic value and medium economic value.

The **association with rhodoliths** is characterized by masses of calcareous encrusting algae which occur on coastal detritic bottoms (EUNIS database). According to UNEP(OCA)MED WG. 149/5, in the circalittoral zone, the habitat is classified as not remarkable, with medium vulnerability, medium heritage value, very scattered distribution, low aesthetic value and low economic value. However, when the habitat occurs in the infralittoral zone, it is classified as priority habitat.

Maërl facies are branched rhodoliths exposed to strong tidal currents (Relini & Giaccone, 2009). According to UNEP(OCA)MED WG. 149/5, in the circalittoral zone, the habitat is classified as remarkable, with high vulnerability, medium heritage value, very scattered distribution, medium aesthetic value and low economic value.

A species of Scleractinia new to science was found in the sandy bottoms of the southern top of the canyon: its identification is pending, but it potentially belongs to the genus *Anomocora*. The muddy portions of the seabed appeared to be dominated by the foraminifer *Pelosina* sp.

The canyon walls appeared to be both sedimented and rocky. Many portions of the walls showed high spatial complexity in their rocky parts. The sedimented portions of the northern wall (exposed southwards) were covered by the bivalve *Neopycnodonte cochlear*. The Coralligenous biocoenosis was found on the rocky portions of the wall. **Fossil reefs** were recorded at very deep (~900 m) areas of the southern wall (exposed northwards).

The **Coralligenous biocoenosis** is characterized by

very low luminosity and by vegetal dominance. It is found on rocky bottoms where calcareous algae can build biogenic constructions (Relini & Giaccone, 2009). According to the UNEP(OCA)/MED, it is a priority habitat, since it shows high vulnerability, high heritage value, very scattered distribution, high aesthetic value and medium economic value.

The bottom of the canyon and the canyon mouth are located on the continental slope. Muddy bottoms were recorded in both areas, most likely attributable to the Biocoenosis of bathyal muds. Many holes and mounds were found, probably caused by the particular sedimentation rate of canyons (Würtz, 2012). Some portions of the continental slope showed rocky substrata, however heavily covered by sediments.

The **Biocoenosis of bathyal muds** is formed by bottoms of more or less compacted clayey, yellowish or bluish grey mud. Sometimes it is only a film that covers both sides of the canyons. Light is almost absent (Relini & Giaccone, 2009). According to the UNEP(OCA)/MED, it is a remarkable habitat, since it shows medium vulnerability, low heritage value, no rarity, low aesthetic value, and high economic value. In addition, it should be mentioned that submarine canyons are known to be important habitats for a variety of cetacean species, including deep-diver species, such as the sperm whale, *Physeter macrocephalus*, and the Cuvier's beaked whale, *Ziphius cavirostris*. Hence, the potential presence of those species within the JNMR borders cannot be excluded.

A list of species recorded during Oceana's campaign within the JNMR and their potential conservation interest value is provided in APPENDIX B.

The benthic habitats of the JNMR are not pristine. Many signs of anthropic activities were recorded during 2016 Oceana's campaign, mainly on soft bottoms. The presence of wastes and litter, such as abandoned fishing gears (lines, nets and traps), tires, barrels, etc. was documented. Different levels of colonization were found on these wastes, suggesting that this is an ongoing impact.

2.4 Other relevant features

Marine archaeological remains were found within JNMR borders, including an intact amphora in

shallow waters on the southern top of the canyon, along the transect "ROV_09".



Figure 19: Intact amphora recorded at 88 m depth (source: Aguilar, et al., 2018)



3 Analysis of the Legal, Institutional and socioeconomic contexts

3.1 Legal context

In Lebanon, the regulation of marine resources dates back to the beginning of the previous century through the legislation relating to the control of marine and coastal fisheries. Since then, many texts have been promulgated concerning the protection of the environment in general, including the marine environment. In this context, the Code of Environment (Law 444/02) is the basic legal text for the protection of the environment. It is an overarching legal instrument for environmental protection and management based on 11 environmental principles, most of them, while applicable for the environment at large, are of particular relevance for the preservation of the marine environment. These environmental principles, as set in Article 4 of Law 444/2002, are listed below.

- Precaution Principle: it advocates the use of cleaner production techniques, based on most recent available scientific information.
- Prevention from all damages to the environment: through the use of best available technologies.
- Polluter-Pays Principle: The polluters should pay for combatting pollution, control and mitigation.
- Biodiversity conservation: All activities should avoid causing damages to the components of biodiversity.
- Prevention of natural resources degradation: Human activities should avoid any irreversible degradation of natural resources: water, air, soil, forests, sea, rivers, etc.
- Public participation: Free access to environmental information and citizen contribution and responsibility in preserving the environment.
- Cooperation at all levels between central government, local authorities, and citizens.
- Recognition of customary reference in rural zone, in case of non-existence of legal texts.
- Environmental monitoring covering pollution sources. Pollution control systems should not transfer pollutants from one environment to another).
- Economic incentives approach to encourage compliance and pollution control.
- Use of the Environmental Impact Assessment as a tool to control and mitigate environmental degradation.

The protection, conservation and management of nature and biodiversity are addressed in Chapter VIII of Law 444/2002 that includes a series of measures, including the declaration of protected areas to ensure the management of natural resources and conservation of biodiversity.

In addition to the Code of Environment, a series of Laws, Decrees, and Ministerial Decisions were promulgated in Lebanon in relation to the conservation and sustainable use of biodiversity.

- Law no. 708/98: Declaration of the Tyre Coast Nature Reserve.
- Law no. 121/92: Declaration of the Palm Islands Nature Reserve.
- Law no. 508/04: Hunting law, regulating wild fauna hunting in Lebanon: season, protected species forbidden for hunting, permitting procedures, etc.
- Decree no. 8213 of 24/05/2012: Strategic Environmental Assessment for Proposed Policies and Plans and Programs in the Public Sector.
- Decree no. 8633 of 07/08/2012: Introducing the obligation of Environmental Impact Assessment for major industrial and infrastructure projects.
- Ministerial decision N° 69/2004 of 02/07/ 2004: Establishment of a permanent inter-ministerial committee to implement the ACCOBAMS Agreement in Lebanon.
- Decision N° 524 of the General Secretary of Ministers Council of May 10th 2005. "Designation of the National Centre for Marine Sciences - CNRS as the focal point of the ACCOBAMS agreement".
- Decision n° 125/1 of the Minister of Agriculture of 23/09/1999 banning the taking selling, use or trade of marine turtles, monk seals and whales, including any derivatives from these species.
- Decision no. 202/1 of the Minister of Agriculture of 14/04/1997 organizing underwater spearfishing.
- Decision no. 93/1 of the Minister of Agriculture of 14/03/2008 regulating scuba-diving including permitting procedures and safety measures.
- Decision no. 346/1 of the Minister of Agriculture of 15/07/2010 about fishing types and equipment and prohibiting the use of nets with small mesh sizes, trawling nets and fishing with scuba diving equipment.
- Decision no. 676/1 of the Minister of Agriculture of 27/07/2011 forbid the fishing, transportation, selling and consumption of some types of fish.
- Decision no. 8/1 of the Minister of Agriculture of 04/01/2012 organizing and defining some fishing gears and equipment.

- Decision no. 1160/1 of the Minister of Agriculture of 25/11/2014 setting general provisions for shark fishing.

The preservation of the marine environment is also addressed under the Offshore Petroleum Resources Law (Law 132 of 24/8/2010) that regulates petroleum activities within territorial waters and the Exclusive Economic Zone (EEZ) of Lebanon. This Law provides for a framework for environmental safety and protection in relation to oil and gas activities (exploration, drilling, transport as well as decommissioning of facilities).

Although the regulations listed above are not specific to MPAs, their provisions may have direct impact on the conservation of the natural heritage of the JNMR as well as on the control and management of the human activities undertaken in the Nature Marine Reserve and in its surrounding zones. A draft Law for protected areas was elaborated in 2002 by the Lebanese Ministry of Environment. It was amended in 2012 and then submitted to the Parliament. Once officially endorsed it is expected to serve as the Protected Areas Framework Legislation. The latest amendments to the draft law, as approved by the relevant Parliamentary Committees, provides for the following 5 categories of Protected Areas¹.

1) Nature Reserve, which is defined as a terrestrial or marine zone in which ecosystems, habitats and species of specific importance must be protected because they are either endemic, or rare or endangered. The conservation of those species and ecosystems may require maintenance or rehabilitation activities if needed, in a way that suits with the protection objectives, and that are described in a management plan; in order to ensure the conservation of those habitats and the species that they harbour.

2) Natural Park, which is defined as a vast rural territory, partially inhabited, with exceptional natural and cultural heritage, recognized nationally and deserving protection on the long term. A Natural Park can include one or more PAs or areas that might eventually become protected.

3) Natural Site and Monument, which corresponds to an area containing one or more natural features of exceptional importance which deserve protection

¹ Extracts from the Fifth National Report of Lebanon to CBD (2015)

because of their rarity, representativeness or beauty.

4) Hima, which is defined as a Community Based Natural Resources Management (CBNRM) System that promotes Sustainable Livelihood, Resources Conservation, and Environmental Protection for the human wellbeing (UNU-INWEH). A Hima is under the supervision of the municipality, the union of municipalities or the Qaimaqam.

Given its objectives the JNMR would fall under the Category of "Nature Reserve".

3.2 Institutional context

The wide range of legislation and policy tools, applicable in Lebanon for the conservation and sustainable use of the marine environment and biodiversity, implies that many institutions hold prerogatives that may interfere with the declaration and the management of marine protected areas. However, the Ministry of Environment (MoE) is of most relevance to the development of the national network of MPAs since it has specific mandate in this regard as stated in the Law no. 690 of 26/8/2005 organising the Ministry of Environment and defining its mandate. This Law stipulates that the Ministry of Environment is responsible for the establishment, protection and management of protected areas. In 2012, the MoE developed, with the support of IUCN and SPA/RAC, the Lebanon's Marine Protected Area Strategy whose aim is to Support the management of important marine habitats and species in Lebanon.

In this context, the Ministry of Environment initiated the process for the declaration of the JNMR that shall be conducted in close consultation with other ministries and Governmental bodies. These include in particular the bodies listed below.

- **The Ministry of Transport** is mandated to control the implementation of the legislation and rules related to transport and marine public properties (Law no. 214 of 2/4/1993);
- **The Ministry of Agriculture** is responsible for implementing the legislation related to fisheries and fishing activities (Legislative decree no. 31 of 18/01/1955);
- **The Naval Forces** in the Army: their mandate includes, inter alia (decree no. 22 of 22/01/1981 about the Organization of the Lebanese Army):
 - assisting ministries and agencies in their duties at sea like (Fire fighting, fighting pollution, search and rescue operations);

- protecting natural resources and national interests along the coast and the regional waters.
- **The Lebanese Petroleum Administration (LPA):** this independent public institution operates under the tutelage of the Minister of Energy and Water. The LPA is mandated to manage the upstream offshore petroleum sector in Lebanon. It endeavours to ensure a successful development of the petroleum industry while protecting the environment.
- **The Municipality of Jounieh:** In Lebanon, municipalities constitute units of territorial decentralization. They may play an important role in the sustainable development of coastal areas and in the protection of the marine environment. There are examples of highly positive involvement and contribution of Municipalities in the management of Lebanese protected areas.
- **The Ministry of Tourism:** Besides promoting tourism in Lebanon, this Ministry has also mandate, coordinate and monitor tourism professions and companies and associations working in the tourism sector. It also facilitates tourism project development. The Jounieh being one of the most important touristic zones in Lebanon, the Ministry of Tourism shall be among the main stakeholders in JNMR.
- **The National Council for Scientific Research (CNRS):** CNRS is a public body with administrative and financial autonomy and operating under the authority of the Prime Minister. Its functions include defining the orientations for and implementing the country's science policy.
- **The National Centre of Marine Sciences (CNSM):** It is one of the scientific centres of CNRS, its mandate is to maintain a permanent watch on the coastal zone and the marine environment of the country through a national observation network (monitoring of water and sediment quality as well as the study of species and habitats). The CNSM has laboratories in Jounieh and Batroun, as well two research vessels equipped for sampling in the water column and in the sediment and also for conducting surveys (diving, ROV, multibeam, double beam, side scan sonar, sediment sounder).
- **Universities and Scientific Research Institutions:** In addition to CNSM, there are in Lebanon university departments and Institutes with experience and skills in the monitoring of the marine and coastal environments and could provide support in the management of the JNMR, in particular regarding the scientific data collection and the monitoring of species and habitats(e.g. Faculty of Sciences of the

Lebanese University, the University of Balamend and its Environment Institute, the American University of Beirut, etc.).

- **Civil Society Organisations:** Lebanon has a great number of CSOs, however most of them have low capacity in the conservation and management of marine environment. Enabling CSOs through their involvement and capacity building should be among the priority activities of the JNMR team and Committee.

The central role of the Jounieh municipality in the institution and management of the MPA is a key element to assure the success of the initiative.

3.3 Socioeconomic contexts

The Lebanese economy is based on the tertiary sector including tourism. Agriculture and fishing generate only 3% of jobs compared to 20% for industry, while services and mainly tourism remain the largest providers of jobs.

The main economic sectors using the marine environment in Lebanon have for a long time been tourism, transport and fishing. The industrial activity is present in some coastal areas of the country, and some units use marine waters for the cooling of their facilities with also discharges at sea.

In recent years, the **energy sector** has been central to the Lebanon's economic development challenges given the revealed potential of some of the country's marine areas for the development of oil and gas exploitation activities. In addition to its economic and political implications, the development of these activities is of environmental importance because of the pollution risks it involves. In this context the Lebanese Petroleum Administration (LPA) had carried out a Strategic Environmental Assessment (SEA) with the view of integrating environmental, cultural and socio-economic aspects in the exploration and exploitation of the country's offshore oil and gas resources. The SEA addressed a series of issues such as oil spill scenarios and their predicted impacts on the marine and coastal environment. It proposed recommendations including the development of a National Contingency Plan covering oil spills in Lebanese waters and other measures related to environmental awareness, cumulative impacts, transboundary issues, etc.

The Petroleum Activities Regulations for Lebanon stipulate that the areas available for the purpose of awarding Petroleum Rights to conduct Petroleum

Activities are divided into blocks. Ten blocks were defined over the waters under the jurisdiction of Lebanon. All of them are located beyond a 3 nautical miles zone from the coast to keep this area reserved primarily for the professional fishing activities and non-commercial uses. The proposed marine nature reserve is adjacent to Block 4 and it extends over 8,7 Km along the eastern limit of the Block.

The **maritime transport** sector plays a relatively important role in Lebanon with four main commercial ports (Beirut, Tripoli, Saida and Tyr). In terms of tonnage, the main maritime transport activity is for the import of petroleum products. This activity as well as cruising and pleasure boating may have negative impacts on the marine environment, mainly through chemical pollution and underwater marine noise. The development of harbours and marinas is another source of disturbance linked to maritime transport in the coastal zone.

The maritime transport sector plays an important role through the services it provides for many Lebanese economic sectors, such as tourism, one of the pillars of the country economy. Besides its support to many economic sectors, maritime transport has also a significant social role through the direct and indirect employments in ports, marinas and maintenance of leisure boats.

Tourism is an important economic sector in Lebanon and is considered among the main drivers for the country's economy. The coastal zone hosts about 70% of the total number of hotels and resorts, with the highest density in Beirut and Jounieh. The shoreline of the Jounieh Bay is occupied by tourist resorts, except a small portion of sandy beaches, the longest of them (about 600m) is located in the northern part of the bay. It is used for recreational beach activities (swimming and sunbathing).

The **fishing sector** in Lebanon includes coastal artisanal fishing and recreational fishing. However, the boundary between these two activities is unclear as many recreational craft are actually commercially exploited. Since the Lebanese fishermen's range of activity is essentially coastal, these actors will not have, in the short and medium terms, significant interference with conservation measures in the deep marine areas of the country.

The Lebanese fishing fleet does not have trawlers or purse seiners for bluefin tuna (purse seine) or other

types of industrial fishing. Problems of respect for gear meshes, catch sizes and the persistence of destructive practices (fishing dynamics) are noted in Lebanon. The fisheries legislation in Lebanon is based on old texts, however a new Law is under preparation and is expected to include conservation measures aimed at ensuring the sustainability of the fishing sector in Lebanon. The lack of human and material means of control and surveillance does not allow effective control of illegal fishing practices. This is a factor that must be taken into account when monitoring fisheries in the MPA.

Aquaculture cages are known to generate adverse impacts on the marine environment when located over a sea bed with sensitive habitats. For the time being, **marine aquaculture** is not developed in Lebanon and only a small experimental facility exists in Batroun. However, the importance to define aquaculture development as a priority was recommended by the Concerted Action for Lebanon supported by General Fishery Commission for the Mediterranean. The related recommendations included the rehabilitation of the Batroun Aquaculture Centre and the necessity to set up a legal framework for aquaculture in order to establish a clear strategy. Given the rapid development of marine aquaculture being registered in many Mediterranean countries, marine farms may be created in a near future in the coastal areas of Lebanon.

The network of **submarine cables and pipelines** is expected to increase in Lebanon in the coming years. The area covered by the JNMR may be affected in particular by the installation and the operation of pipelines in relation to the petroleum activity, although the information is not available yet about the location and size of coastal facilities that might be installed in support to the offshore petroleum activities in Lebanon. The Block 4, adjacent to the Western limits of the Nature Marine Reserve is one of the blocks open in the first licensing round launched by LPA.

The coastal zone of Jounieh is **essentially urbanised** with the presence of a tourism activity, particularly of a seaside nature. Agricultural activity is absent and the industrial activity is located in the southern part of the area. As in the case of several Lebanese coastal areas, the Jounieh area has a relatively high population density. The sea shores are heavily used by buildings and many developments (small harbors, marinas, beach protection structures, etc.).

The existing or planned human activities in the area of Jounieh that could potentially negatively interfere with the objectives of the JNMR are mainly linked to:

- Tourism, including beach tourism and leisure boating (about 300 boats were recorded in 2018 in the ports of the area);
- Petroleum activities, mainly in Block 4;
- Maritime transport, in particular the planned development of cruise shipping.

Secondly, also marine litter, sewage, liquid and solid waste disposal and fishery can negatively interfere with the objectives of the MPA if not appropriately managed.



Major identified potential threats and sources of nuisance

Due to the high level of anthropization of the coast, many human activities can threaten marine life along the Lebanese coast. As for the JNMR, the main potential sources of nuisance can be identified as:

- Marine litter, sewage, liquid waste disposal and dumping (including dredged sediments);
- O&G activities;
- Spread of alien and invasive species;
- Artisanal, recreational fisheries and collection of living organisms;
- Navigation.

In addition, the following potential sources of nuisance, even if at the moment are not documented in the area, can potentially impact the JNMR:

- Aquaculture;
- Live ammunition drills;
- Coastal/marine works (Harbors, piers, marinas, dredging);
- Mooring.

4.1 Marine litter, sewage disposal dumping (including dredged sediments)

Marine pollution is a major environmental issue known in Lebanon, as already described in section 2.2.3. Solid wastes were recorded in all canyon areas surveyed by Oceana in 2016. Among those, barrels, tyres and fishing nets were the most abundant. Non-toxic solid wastes are in some cases reported to represent a source of environmental enrichment in homogenous soft-bottomed seascapes, by providing a hard substratum which sessile species can settle on. Indeed, wastes in Jounieh Nature Marine Reserve showed different levels of colonization. However, this does not mean that the solid waste disposal into the sea can be considered a good practice. Marine debris can lead to loss of biodiversity and ecosystem functions and services and it is a reason of concern due to its abundance, durability and persistence in the marine environment. It is known to be harmful to organisms and to human health, and it has potential to increase the transport of organic and inorganic contaminants: the direct ingestion of litter by animals could be even lethal for them, besides many materials are known to release toxic substances or particles (e.g. heavy metals, micro- and nano-plastics) with negative consequences to marine life (e.g. ingestion of toxic particles, biomagnification

up the food chain, etc). Debris has also been shown to foster the transport of non-native species (Gall & Thompson, 2015).

Liquid wastes are also known to be disposed in the area, as shown in Figure 12. In particular, the sea area facing Jounieh is interested by various wastewater discharges (mainly civil sewage) from outfalls and seeping and cooling waters discharged from the Zouk Thermal Power Plant, located in the proximity of the city.

The discharge of sewage into coastal waters represents a major cause of marine pollution. The common dumping of sewage without primary treatment is of great concern, as these effluents not only contain high concentrations of suspended solids and nutrients, but often also carry substantial amounts of human organic waste products (Roth, et al., 2016). When untreated waters are discharged into shallow coastal waters there are dramatic consequences on water quality, sediments (Martinez & Adarraga, 2003) and biotic communities (Terlizzi, et al., 2005). The discharge of untreated sewage alters the physico-chemical properties of coastal waters and may cause severe contamination of the marine environment, often characterized by high microbial loads, including human pathogens (Roth, et al., 2016).

The discharge of cooling water from a power plant, dissipating significant quantities of heat in the water, may change physico-chemical parameters of water column and could impact marine life.

Therefore, those liquid disposals can significantly threaten marine habitats by causing potential changes in the seawater parameters. Those changes could eventually lead to a shift in the composition of the communities inhabiting the area.

The practice of dumping dredged sediment in offshore areas can also impact the sensitive canyons habitats and potentially also cause contamination of marine environment.

4.2 O&G activities

JNMR's border will be adjacent to an O&G Block (Figure 20). Hence, explorative activities and

theoretically also production activities are expected to take place off the MPA.

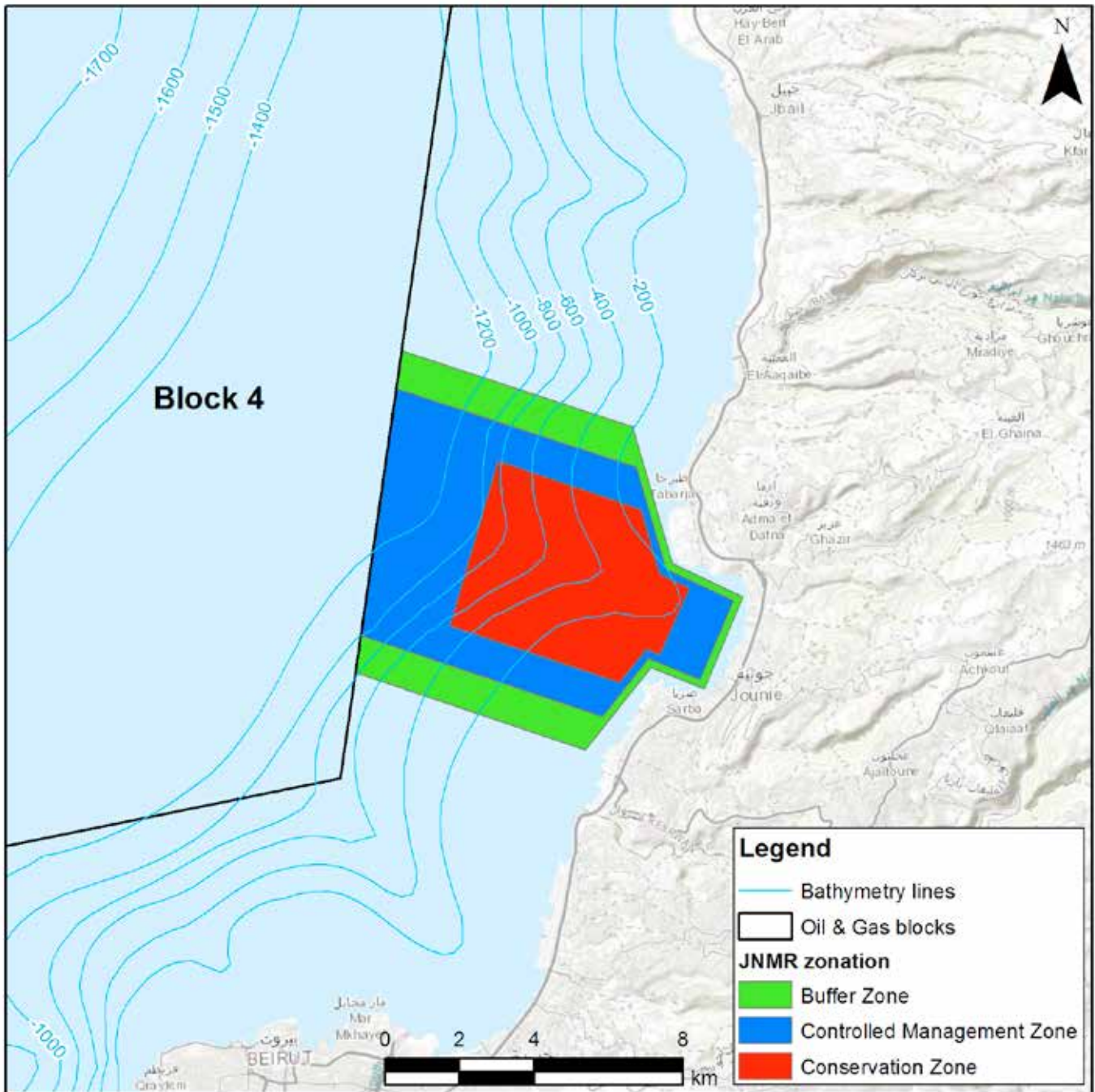


Figure 20: Jounieh Nature Marine Reserve location in relation to Lebanese O&G offshore Blocks

O&G exploration activities are known to potentially highly affect marine life if not properly managed with the implementation of appropriate mitigation measures. Main impacts are linked to the emission of high-levelled impulsive underwater noise (i.e. seismic surveys) and eventual accidental spills (i.e. oil, cement and sediments for the drilling activities). Underwater noise is known to affect mainly marine mammals, whereas cement and sediment disposal as result of the drilling activities may cause impacts to the benthic communities. Oil spills are reported to highly affect marine life at all levels.

This is not reported as a current threat for the MPA, but it may become in the future. In that case, O&G activities should be carefully managed.

4.3 Spread of alien and invasive species

The spread of invasive species is known to have huge impacts in marine environments. Lebanese waters, due to their physico-chemical features (see section 2.3) are known to facilitate the settlement and possibly the spread of alien species.

Non-indigenous species were recorded by Oceana in Jounieh Nature Marine Reserve (see APPENDIX B). However, none of them is reported to have reached the status of invasive. Hence, at the current time, this is expected to be a minor threat. However, it should be regularly monitored.

4.4 Artisanal, recreational fisheries and collection of living organisms

Lebanese waters are not on the main industrial fisheries' courses, as shown in Figure 21.

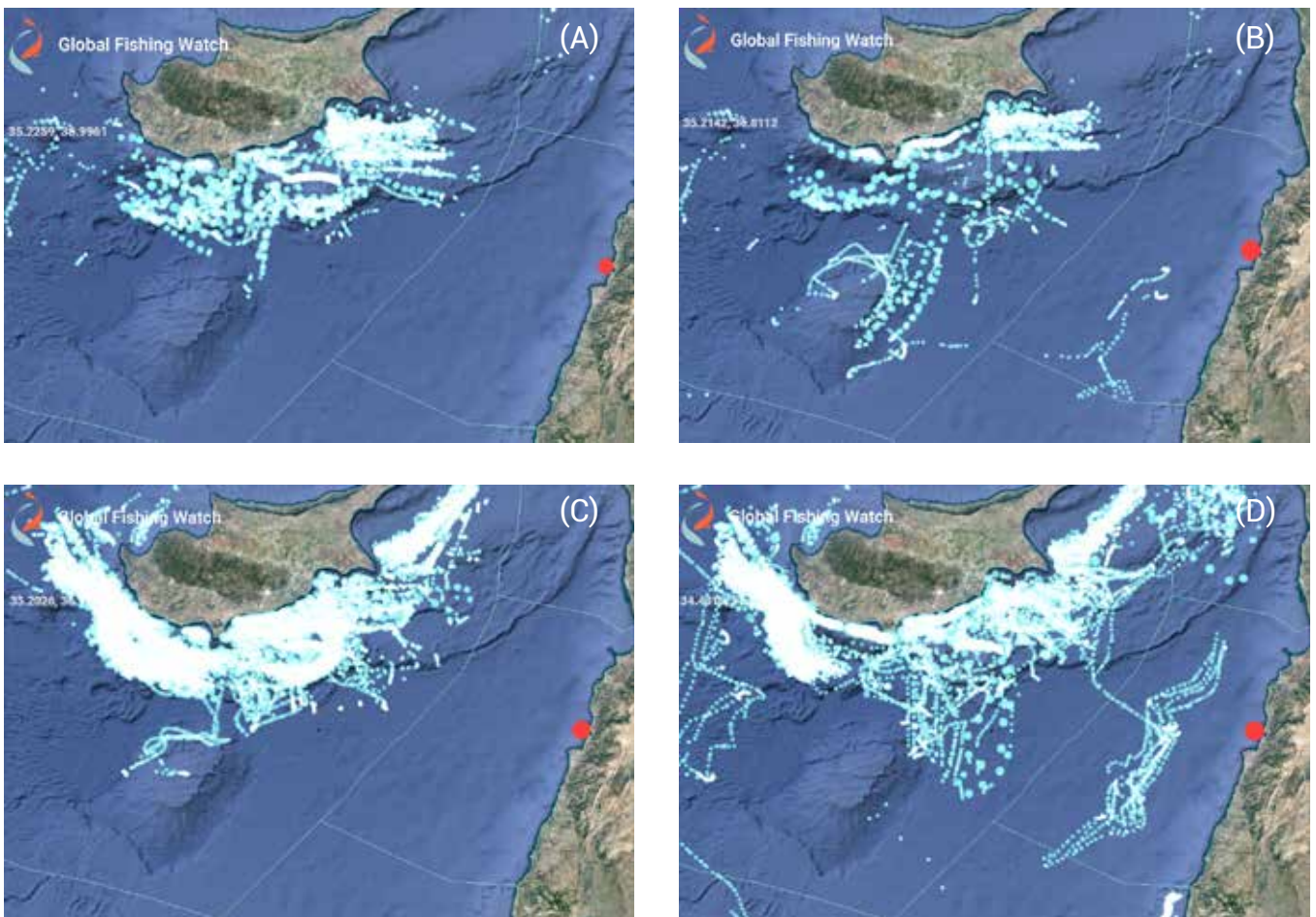


Figure 21: Industrial fisheries' location in the Lebanese water in the last 2 years (source: globalfishingwatch.org/map). Points on the map indicate the registered locations of industrial fishing vessels. (A) 2018, Semester 2 (updated to November); (B) 2018, Semester 1; (C) 2017, S2; (D) 2017, S1. The red point indicates JNMR location

The artisanal fishery sector is the dominant one in the country. However, a decrease in fish size and abundance due to overfishing is documented (Alajlan, et al., 2013). Main gears used along the Lebanese coast include trammel nets, gill nets, longlines and purse seines. Bottom trawl nets, which are known to be one of the most impacting fishing practices, are not used in Lebanon.

Jounieh Nature Marine Reserve is a fishing ground as documented by the presence of abandoned fishing nets recorded by Oceana in 2016. On the contrary, the presence of the MPA, together with the planned artificial reef², could potentially increase the fish

stock of the neighboring areas, playing the role of spill over, fostering the presence of breeding, protecting juveniles and therefore supporting the local fisheries, if properly managed.

Sport fishing constitutes another potential source of threats for the JNMR.

4.5 Navigation

Jounieh Nature Marine Reserve is not located on the main Lebanese marine courses (Figure 22). However, many ports are located in Jounieh Bay and Beirut is a very congested area for the marine traffic.

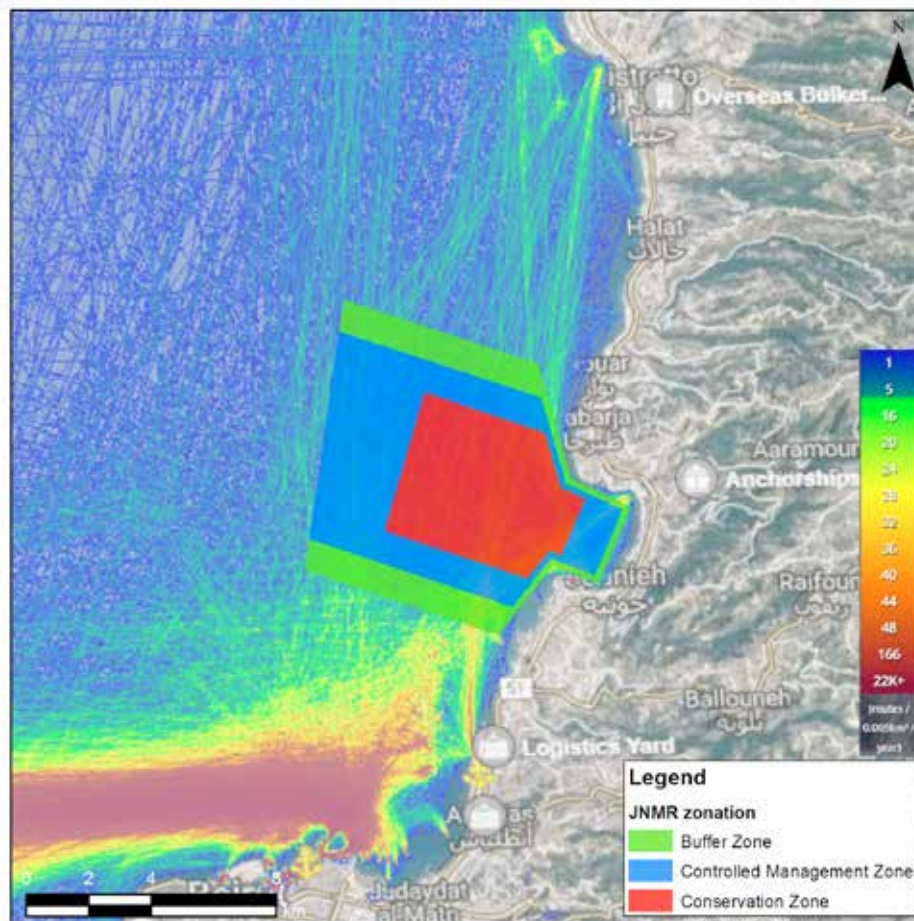


Figure 22: Main marine courses in a wide area around the JNMR

Impacts caused by the marine traffic are mainly linked to the emission of underwater noise and the risks of collision that could potentially affect cetaceans and marine turtle inhabiting the area. In addition, the presence of marine traffic increases the

risk of incident with consequent pollution. This threat could possibly increase in the future because of the new planned terminal located on the southern coast of Jounieh Bay.

² According to the available information, the construction of an artificial reef is planned in Jounieh Bay. The reef should be located in the Controlled Management zone. Site location and reef design are the key elements to assure the success of the initiative. Only if properly positioned and planned, the reef could foster biodiversity and artisanal fishing.



5 The Management vision and objectives

As stated in its declaration Law, the Jounieh Nature Marine Reserve has dual objective.

1) The conservation of the following elements of the natural heritage:

- marine canyons and their ecosystems;
- marine natural resources from the risks of all forms of pollution as well as the ecosystems and their environmental balance;
- plant and animal species, in particular endangered and / or rare and / or unique species and their habitats (listed in the IUCN Red List of the Barcelona Convention);
- biological balances, ecosystems and biodiversity from all causes of degradation.

2) The promotion of the sustainable use of natural resources for scientific research, with a view to preserving them for future generations in the interest of the public.

All the management activities should be developed according to these objectives taking also into account the general orientations and the priorities defined by the relevant national frameworks, in particular the "Strategy for Lebanon's Marine Protected Areas", elaborated in 2012 by the Lebanese Ministry of Environment in collaboration with IUCN and SPA/RAC and whose vision is to "achieve an effective marine protected area that contributes to sustainable development by enhancing natural and cultural diversity". Considering this vision and taking into account also the relevant guidelines and recommendations issued by International Organisations, the management orientations of the JNMR were defined according to the following vision:

"The deep-sea ecosystems of Lebanon are preserved, adequately managed and where necessary recovered using adequate scientific knowledge about their composition and functioning and ensuring their sustainable use and the equitable sharing of goods and services they generate".

To reach the desired vision, it is proposed to translate the objectives set in the Law establishing the JNMR into operational management objectives defined to address the issues at stake and the challenges faced, most of which relate mainly to existing or expected

threats to the habitats and species and the need for conciliating the conservation of biodiversity with the requirements of the socioeconomic development at local and national levels.

The defined Operational Objectives are:

• Operational Objective 1:

Ensure harmonisation of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.

• Operational Objective 2:

Achieve full involvement of stakeholders in the management of the declared MPA and in the regular revision of the conservation and management measures.

• Operational Objective 3:

Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems targeting the most critical issues, in particular pollution, Invasive non-indigenous species and climate change.

• Operational Objective 4:

Improve the scientific knowledge about the biodiversity and the functioning of deep-sea ecosystems, in particular in the zones covered by the JNMR and in the neighbouring areas beyond 1000 meters depth.

5.1 The Management Operational Objectives

Operational Objective 1: Ensure harmonisation of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.

Harmonization between JNMR conservation objectives and existing and potential uses requires three different approaches that need to be implemented simultaneously as they are complementary.

- The approach based on regular surveillance through patrolling at sea and along the coast as well as using available advanced technologies to identify infringements by users of the marine environment and ensure the enforcement of regulations, including through verbalization according to the legal procedures applicable in the area.

- The approach using information, awareness raising and capacity building activities targeting the local population at large as well as specific groups such as fishermen, users of leisure boats, tourism resort operators, school students, etc.
- Consultation with the specific categories of users of the JNMR space and resources: Operators of tourism activities, Oil & Gas industry, fishermen (including professional and recreational fishing), etc.

Operational Objective 2: Achieve full involvement of stakeholders in the management of the declared MPA and in the regular revision of the conservation and management measures

As for most of the Mediterranean coastal zones, the Bay of Jounieh is highly coveted by various types of human activities that generate adverse impacts on the environment and create challenges in terms of usage conflicts. The Nature Marine Reserve has the potential to provide a platform for consultation and conciliation among users while promoting the sustainability of their activities and the preservation of the marine environment. To this end, the JNMR Committee, with the support of the Management Team, should liaise with the stakeholders and endeavour to engage them in decision making and implementation of required measures. Indeed, the engagement of stakeholders in the management of marine protected areas is particularly crucial for the achievement of the conservation and management objectives. Their involvement since the very early stages of the management planning and implementation will contribute in building trust and confidence and will help preventing conflicts and fostering a climate of collaboration. This is, however, a long and progressive process that requires extensive knowledge about the key players in the area. These include Governmental and Non-Governmental Organisations as well as professional groups, groups of users or individuals that could contribute in the planning and management process or whose interests could be affected by the implementation of the Nature Marine Reserve regulation and management measures.

Actually, the process of consultation has already started with a number of stakeholders that were identified as directly concerned with the process of declaration and management of the JNMR with the view of building a shared vision about the declaration

of MPAs in the deep-sea zones of Lebanon. The Committee of the Nature Reserve as well as the Management Team should pursue the consultation process and extend it to involve all the stakeholders. They should be open to learning from stakeholders and to take into consideration their ideas and concerns. They should also endeavour to inform them about the main decisions taken and provide them with feedback showing how their inputs or concerns were taken into consideration. Stakeholder engagement requires a series of activities including in particular:

- Continual mapping of the stakeholders, analysis of their concerns or needs, identification of barriers to participation;
- Organization of information meetings and events;
- Capacity building (training, technical manuals);
- Meetings for consultation or arbitration, where needed.

Operational Objective 3: Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems targeting the most critical issues, in particular pollution, invasive non-indigenous species and climate change.

Given the changes in the ecological and socioeconomic features that occur over time within each MPA, the implementation and the regular adjustment of conservation and management measures require monitoring programmes to timely feed the decision-making processes with accurate data and information about the status of the MPA and its components as well as about the threats presenting conservation concerns and their trends.

Concerning the JNMR, monitoring is needed for most of the Nature Marine Reserve components, but the monitoring periodicity would vary according to the elements to be monitored. The frequency of monitoring would depend also on the monitoring means and the related costs. Although the deep-sea zones of the JNMR contain fragile habitats and species deserving special attention, the frequency of monitoring in these areas must take into account the relatively high costs that might involve the surveying tools required at such depths. Furthermore, monitoring effort may need to be adjusted according to the seasonality of natural processes or of the threats that have the potential to affect the ecosystems and

their functioning. It is therefore recommended to follow adaptive monitoring approaches in the design and development of the monitoring programmes to be implemented in the JNMR.

Considering the data and information currently available in relation to the biological and ecological assets in the JNMR as well as to the existing or planned human activities, the priority topics to be covered by monitoring programmes to be developed and implemented for the Nature Marine Reserve are as follows:

- Tourism (Leisure boating, recreational beach activities);
- Fishing activities (fishing effort, quantity and species composition of catches, recreational fishing, etc.);
- Land-based Sources of pollution (wastewater discharge, urban runoff, solid wastes, etc.);
- The arrival of non-indigenous species and the evolution of habitats and indigenous populations in relation to these arrivals;
- The impacts of possible Oil & Gas activities, particularly those carried out in Block 4;
- The benthic habitats identified in the submarine canyons;
- The benthic habitats that will be identified in the areas not yet surveyed in the JNMR, and in particular those located in Jounieh Bay and / or near the coast.

The monitoring of these elements is to be carried out according to the indications presented in the Work Plan section of this Management Plan.

Operational Objective 4:
Improve the scientific knowledge about the biodiversity and the functioning of deep-sea ecosystems, in particular in the zones covered by the JNMR and in the neighbouring areas beyond 1000 meters depth.

The survey conducted in 2016 in the deep areas of the Lebanese marine waters provided valuable scientific data that were very useful in identifying the sites of conservation interest. It should be noted, however, that the management of habitats and species in these environments requires a higher level of information. In particular, accurate bathymetry data, complete habitat maps and detailed information about the human activities undertaken in the area of the JNMR are needed to further adapt the management and conservation measures and to monitor their effectiveness.

The management measures proposed in the Work Plan to achieve "Operational Objective 1" aim at providing the needed additional data within the Nature Marine Reserve and in its surrounding zones. They include mainly:

- Bathymetric survey to elaborate accurate bathymetry maps in the Conservation zone, the Controlled management Zone and in the Buffer zone;
- Mapping of the key habitats in the Conservation zone, the Controlled management Zone and in the Buffer zone.

Furthermore, collecting additional data on species and habitats in deep zones beyond 1000 meters outside the area covered by the JNMR will also be very useful to complete information on these areas in order to refine the network of MPAs in Lebanon either through the extension of the JNMR or through the declaration of new MPAs.

In this context, the collaboration with and/or the full involvement of the National Centre of Marine Sciences (CNSM) as well as other University and Scientific Research Institutions, would be particularly useful.



6 The zoning

6.1 Zoning approach and rationale

The zoning of the area was carried out according to the criteria listed below.

- Establishing a core zone to be managed with the highest level of protection ("Conservation zone") containing the greatest number possible of items considered suitable for the protection according to the Oceana's data and the Golder's Phase 1 Report. The suitability for protection was defined according to the natural specificities, the uses and the existing/potential threats.
- Establishing around the "Strict Conservation zone" a "Controlled Management zone" that plays the role of a transition zone. The objective is to have a compromise between the conservation imperatives and the requirements of the sustainable development of important socioeconomic activities based on the use of marine environment.
- Establishing a potential multi-use zone that could buffer the potential impacts coming from the surrounding areas that threaten the protected area ("Buffer zone").

The delimitation of JNMR is based on the modified borders of the Jounieh Area of Conservation Interest (ACI04) showed in the Golder's Phase 1 Report. These previous borders were modified to improve their effectiveness. In particular:

- Applying a precautionary approach, the borders of the Controlled Management zone were enlarged towards offshore, up to the borders of Oil & Gas approved Block, avoiding overlapping with the Block. This enlargement to the open water enable the inclusion in the Controlled Management zone

of areas potentially interested by the presence of the continuation of the of canyon toward offshore. At the moment, the information on the habitats of this zone is limited.

- According to the abovementioned criteria, subdividing the whole area in three zones with different conservation objectives and different levels of protection, namely the "Conservation zone", the "Controlled Management zone" and the "Buffer zone".
- Since many potential impacts could come from the coastal area (as described in the section 2.5), the borders of the Controlled Management Zone and of the Buffer zone were enlarged towards the coast, maintaining a minimum distance of at least 100 m from it³.

The zoning was hence delineated according to the following main principles:

- Covering the most important features of the Jounieh Area of Conservation Interest (ACI04) based on the suitability classification reported in the Golder's Phase 1 Report and Oceana's report (Aguilar, et al., 2018).
- Avoiding/limiting the impacts of the main threats present in the area (e.g. marine litter, oil exploration, erosion, fishing, pollution, navigation, etc.) (see section 3).
- The borders of each zone were drawn reducing as much as possible the vertexes of the polygons in order to simplify the delimitation of the zones and therefore the management of these areas.

³ At a later stage, once verified the absence of interactions with coastal on-shore activities and regulations/competences dealing with costal infrastructures, the Buffer zone could also be furtherly enlarged up to the shoreline

6.2 Zoning categories

JNMR zoning was elaborated according to a decreasing gradient of protection as described in previous section 4.1 – Zoning approach and

rationale. The boundaries of each zone are reported in Figure 23; the coordinates of the vertexes of each zone's polygon are indicated in Table 3.

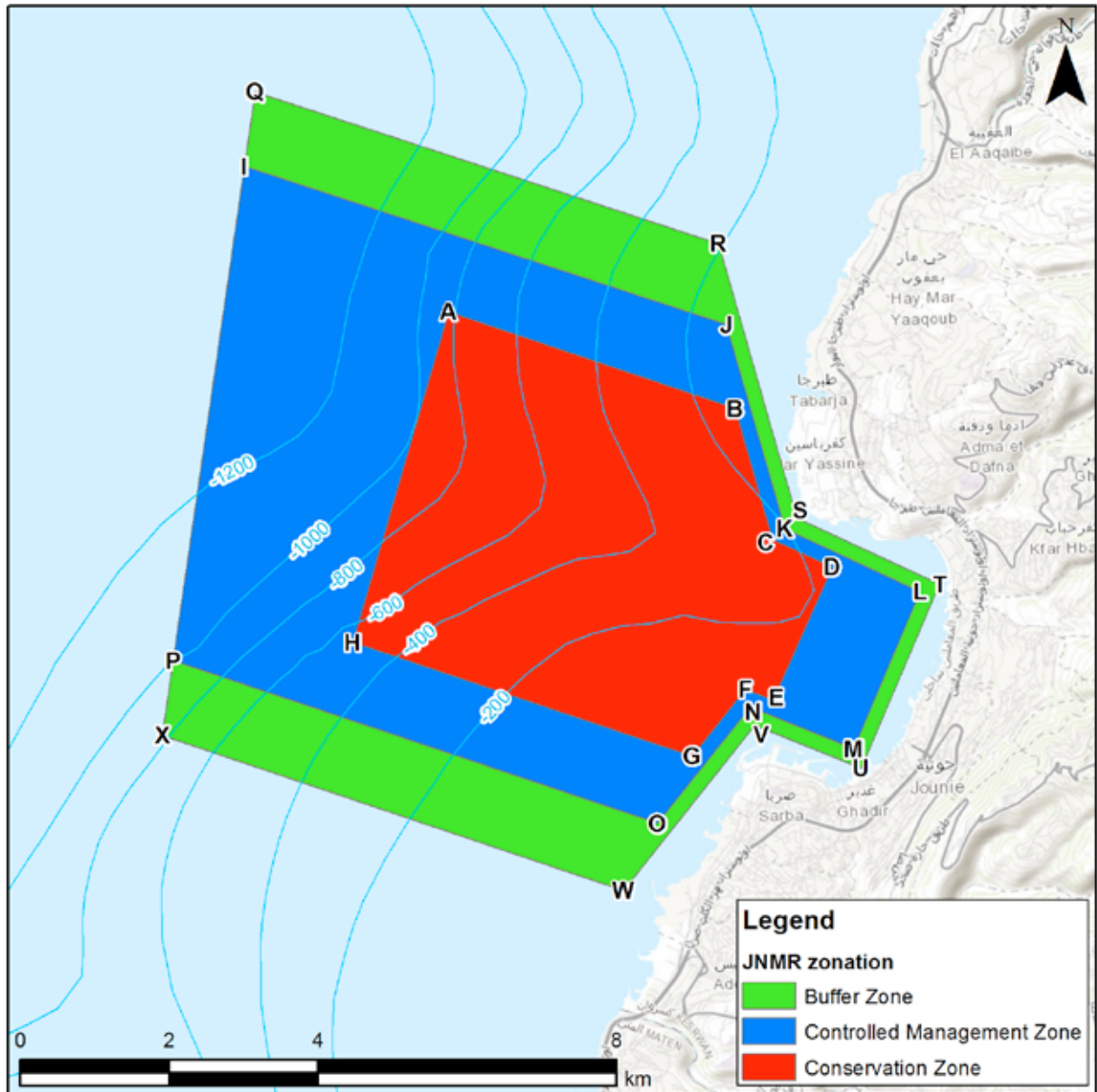


Figure 23: Zoning of the MPA: Conservation zone in red, Controlled Management zone in blue, Buffer zone in green. The numbered items are the vertexes of each zone's polygon. Source: Google Earth.

Table 3: Coordinates of the vertexes of the three zones (WGS 84). The number of the vertex (vertex ID) is reported in Figure 23.

	Vertex ID	Latitude	Longitude
Conservation zone	A	34° 2'30.23"N	35°34'22.40"E
	B	34° 1'44.87"N	35°36'50.89"E
	C	34° 0'47.61"N	35°37'8.76"E
	D	34° 0'34.82"N	35°37'39.51"E
	E	33°59'37.44"N	35°37'6.72"E
	F	33°59'42.51"N	35°36'52.65"E
	G	33°59'13.93"N	35°36'23.78"E
	H	34° 0'7.31"N	35°33'27.98"E
Controlled Management zone	A	34° 2'30.23"N	35°34'22.40"E
	B	34° 1'44.87"N	35°36'50.89"E
	C	34° 0'47.61"N	35°37'8.76"E
	D	34° 0'34.82"N	35°37'39.51"E
	E	33°59'37.44"N	35°37'6.72"E
	F	33°59'42.51"N	35°36'52.65"E
	G	33°59'13.93"N	35°36'23.78"E
	H	34° 0'7.31"N	35°33'27.98"E
	I	34° 3'35.70"N	35°32'37.57"E
	J	34° 2'21.56"N	35°36'47.39"E
	K	34° 0'52.10"N	35°37'15.31"E
	L	34° 0'23.04"N	35°38'25.16"E
	M	33°59'15.37"N	35°37'48.27"E
	N	33°59'34.64"N	35°36'54.79"E
	O	33°58'45.11"N	35°36'4.95"E
	P	34° 0'1.26"N	35°31'54.03"E
Buffer zone	I	34° 3'35.70"N	35°32'37.57"E
	J	34° 2'21.56"N	35°36'47.39"E
	K	34° 0'52.10"N	35°37'15.31"E
	L	34° 0'23.04"N	35°38'25.16"E
	M	33°59'15.37"N	35°37'48.27"E
	N	33°59'34.64"N	35°36'54.79"E
	O	33°58'45.11"N	35°36'4.95"E
	P	34° 0'1.26"N	35°31'54.03"E
	Q	34° 4'8.17"N	35°32'44.17"E
	R	34° 2'56.85"N	35°36'44.48"E
	S	34° 0'56.59"N	35°37'21.96"E
	T	34° 0'26.05"N	35°38'35.36"E
U	33°59'6.89"N	35°37'52.20"E	
V	33°59'26.76"N	35°36'57.02"E	
W	33°58'16.31"N	35°35'46.16"E	
X	33°59'28.76"N	35°31'47.43"E	

The JNMR totally covers an area of 70.05 km² as follows:

- 23.94 km² of Conservation zone;
- 30.39 km² of Controlled Management zone;
- 15.72 km² of Buffer zone.

For each zone the forbidden and regulated activities are listed in the following sections (4.2.1, 4.2.2, 4.2.3). As defined in Chapter 7, the Ministry of Environment may change zones to a higher level of protection.

6.2.1 Conservation zone

The Conservation zone, shown in red in Figure 23, will be the core area of the MPA where the highest level of protection will be applied. It falls mainly in the Jounieh canyon and presents a variety of different habitats and the highest biodiversity richness.

The objectives of the Conservation zone are:

- to preserve the natural integrity and values of the area in terms of biodiversity and geological/geomorphological features;
- to minimize the disturbance through careful planning and implementation of research and other approved activities;
- to improve the scientific knowledge about the biodiversity and the functioning of deep-sea ecosystems (as described in the section 5.1);
- to enhance the contribution of Lebanon in the efforts for the conservation of the marine environment and in particular the deep-sea ecosystems (as described in the section 5.1).

In the Conservation zone, the following activities are banned:

- Offshore Oil & Gas structures setting and exploitation and preliminary associated activities (e.g. seismic survey, exploratory drilling);
- Laying of Oil & Gas pipelines (gas and/or oil);
- Offshore mining;
- Dumping/discharge of solid, including sediments, and liquid waste, chemical and dead animals;
- Renewable energy generation;

- Extraction of sand;
- Offshore powerboat racings;
- Extraction or removal of living organisms, apart from commercial artisanal fishery, with the limitation indicated below for the fishing activities;
- Transportation of dangerous goods that may cause marine pollution⁴;
- Live ammunition drills;
- Restoration/enhancement for uses different from conservation (e.g. beach replenishment, fish aggregation, artificial reefs);
- Aquaculture facilities.

In the Conservation zone, the following activities are permitted only with MPA authority approval:

- Laying of cables;
- Restoration/enhancement for conservation (e.g., invasive species control).

In the Conservation zone, the following activities are subjected to specific limitations/regulation:

- Fishing:
 - Artisanal fishing is permitted subject to the regulations of the Ministry of Agriculture (e.g. fishing nets must have a mesh size larger than 50 mm; use of nylon net is forbidden, use of explosives and poisons is forbidden);
 - Limited number of authorized vessels⁵;
 - If necessary, according to the number of fishermen working in the area, turnover of the authorizations⁶;
 - Recreational fishing is forbidden;
 - Industrial fishing, including driftnet fishing, bottom fishing with towed gear, is forbidden;
 - Aquaculture activities are forbidden;
- Shipping is allowed according to regulation:
 - Motorized vehicles will be subject to reduced speed limits - Maximum speed 10 knots;
 - As indicated in the list of banned activities, the transportation of dangerous goods, that may cause the risk of marine pollution, is forbidden.

⁴ This includes substances indicated as marine pollutants and severe marine pollutants and N.O.S. (Not Otherwise Specified) in the Maritime Dangerous Goods (IMDG) Codes list.

⁵ The limitations of artisanal fishing activities will be applied with a different degree of severity in the Strict Conservation Zone and in Management Zone (from more severe to less severe).





6.2.2 Controlled Management zone

The Controlled Management zone surrounds the Conservation zone, as shown in Figure 23 (blue area). The Controlled Management zone is protected in such a way that it complements and ensures the protection of the biodiversity of the Conservation zone, however mediating with the requirements of the sustainable development of important socioeconomic activities based on the use of marine environment. It contains important suitable areas for conservation, according to the Golder's Phase 1 Report and the Oceana's report.

The main objective of this area is to ensure the harmonization of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.

In the Controlled Management zone, the following activities are banned:

- Offshore Oil & Gas structures setting and exploitation and preliminary associated activities (e.g. seismic survey, exploratory drilling);
- Laying of Oil & Gas pipelines (gas and/or oil);
- Offshore mining;
- Dumping/discharge of solid, including sediments, and liquid waste, chemical and dead animals;
- Renewable energy generation;
- Offshore powerboat racings;
- Extraction or removal of living organisms, apart from commercial artisanal fishery, with the limitation indicated below for the fishing activities;
- Transportation of dangerous goods that may cause the risk of marine pollution⁶;
- Live ammunition drills;
- Aquaculture facilities.

In the Controlled Management zone, the following activities are permitted only with MPA authority approval:

- Laying of cables;
- Extraction of sand;
- Diving (non-extractive recreation);
- Coastal/marine works (Harbors, piers, marinas, dredging), applying special limitation measures according to mitigation hierarchy (avoidance, minimization, rehabilitation/restoration, offset);

⁶ This includes substances indicated as marine pollutants and severe marine pollutants and N.O.S. (Not Otherwise Specified) in the Maritime Dangerous Goods (IMDG) Codes list.

- Restoration/enhancement for conservation (e.g., invasive species control);
- Restoration/enhancement for other uses (e.g. beach replenishment, fish aggregation, artificial reefs).

In the Controlled Management zone, the following activities are subjected to specific limitations/regulation:

- Fishing:
 - Artisanal fishing is permitted subject to the regulations of the Ministry of Agriculture (e.g. fishing nets must have a mesh size larger than 50 mm; use of nylon net is forbidden, use of explosives and poisons is forbidden);
 - Limited number of authorized vessels⁷;
 - If necessary, according to the number of fishermen working in the area, turnover of the authorizations⁸;
 - Recreational fishing is forbidden;
 - Industrial fishing, including driftnet fishing, bottom fishing with towed gear, is forbidden;
 - Aquaculture activities are forbidden;
- Mooring is permitted, according to regulation:
 - using dedicated mooring buoys (to be set-up);
 - free in specific zones to be identified based on detailed habitat mapping (to be defined);
- Shipping is allowed according to regulation:
 - Motorized vehicles will be subject to reduced speed limits - Maximum speed 10 knots;
 - As indicated in the list of banned activities, the transportation of dangerous goods that may cause the risk of marine pollution is forbidden.

6.2.3 Buffer zone

The Buffer zone, shown in green in Figure 23, is a potential multi-use zone set around the Controlled Management zone, with the exception of the West side of the MPA to the open sea. Its boundaries were defined with the following purposes:

- due to the proximity of the MPA to the coast, to create a zone that could act as a cushion between the protected area and coastal area from which a large part of the threats may come;
- to buffer other threats not coming from the coast, linked to various socioeconomic activities based on the use of marine environment.

⁷ The limitations of fishing activities will be applied with a different degree of severity in the Strict Conservation Zone and in Management Zone (from more severe to less severe).

Other than limiting and regulating some potentially dangerous activities, the Buffer zone could promote the value of the coastal area in terms of tourism and heritage.

In the Buffer zone, the following activities are banned:

- Offshore Oil & Gas structures setting and exploitation and preliminary associated activities (e.g. seismic survey, exploratory drilling);
- Laying of Oil & Gas pipelines (gas and/or oil);
- Offshore mining;
- Dumping/discharge of solid, including sediments, and liquid waste, chemical and dead animals;
- Renewable energy generation;
- Offshore powerboat racings;
- Transportation of dangerous goods that may cause the risk of marine pollution⁸;
- Live ammunition drills;
- Aquaculture facilities.

In the Buffer zone, the following activities are permitted only with MPA authority approval:

- Extraction of sand;
- Coastal/marine works (Harbors, piers, marinas, dredging), applying special limitation measures according to mitigation hierarchy (avoidance, minimization, rehabilitation/restoration, offset);
- Restoration/enhancement for conservation (e.g., invasive species control);
- Restoration/enhancement for other uses (e.g. beach replenishment, fish aggregation, artificial reefs);

In the Buffer zone the following activities are subjected to specific limitations/regulation:

- Fishing:
 - Artisanal fishing is permitted subject to the regulations of the Ministry of Agriculture (e.g. fishing nets must have a mesh size larger than 50mm; use of nylon net is forbidden, use of explosives and poisons is forbidden);
 - Limited number of authorized vessels;
 - If necessary, according to the number of fishermen working in the area, turnover of the authorizations;
 - Recreational fishing is forbidden;
 - Industrial fishing, including driftnet fishing, bottom fishing with towed gear, is forbidden;
 - Aquaculture activities are forbidden;
- Extraction or removal of living organisms is permitted, according to approval issued by Ministries of Environment and Agriculture upon request submitted to them, taking into account the

opinion of the MPA authority;

- Shipping is permitted, the only limit is the transportation of dangerous goods that may cause the risk of marine pollution which is forbidden (as indicated in the list of forbidden activities);
- Mooring is permitted, according to regulation:
 - using dedicated mooring buoys (to be set-up);
 - free in specific zones to be identified based on detailed habitat mapping (to be defined).

6.2.4 Exceptions and general rules for all the three zones

Exceptions to the prohibitions and regulations listed above for the three zones:

- Activities undertaken for justified purposes of archaeological research, exploration and recovery pursuant to a valid permit issued by the Minister of Culture (Directorate of Antiquities) and the Minister of Environment, taking into consideration the recommendation of the MPA authority;
- Activities undertaken by the Management body of the MPA (including its partners or subcontractors) for the purpose of conservation of natural resources and the implementation of the management plan;
- Activities undertaken in response to imminent and serious threat to conservation objectives or human life or health and authorized by the Minister of Environment on the proposal of the MPA authority.

General rules for all the three zones:

- Scientific research shall require a valid permit issued by the Ministry of the Environment, taking into consideration the recommendation of the MPA authority and the National Council of Scientific Research;
- The environmental impact assessment shall be carried out pursuant to the provisions of the Environmental Law and its applicable decrees;
- The Minister of the Environment may prohibit the carrying out of non-observable activities or activities requiring a permit within the protected areas, as necessary and in order to preserve the objectives of the establishment of the reserve;
- The Minister of the Environment may make regulations on additional activities prohibited or requiring a permit within the MPA, as necessary and in accordance with the conservation objectives of the site;
- Solid waste accumulation along the coast facing the JNMR that could be dispersed in the sea by atmospheric events/phenomena and coastal erosion should be avoided.

⁸ This includes substances indicated as marine pollutants and severe marine pollutants and N.O.S. (Not Otherwise Specified) in the Maritime Dangerous Goods (IMDG) Codes list.



7 The MPA Governance structure

The arrangements for the Governance of the Jounieh Nature Marine Reserve (JNMR) were defined on accordance with the relevant legal and institutional contexts in Lebanon and taking into account the specificity of the area of Jounieh and the marine zone covered by the Nature Marine Reserve. The Governance system of the JNMR is made of the following bodies:

- Committee of the Nature Marine Reserve;
- Management Team.

7.1 The committee of the Nature Marine Reserve

The Committee of the JNMR is made of seven members acting as volunteers on behalf of the institutions they are representing in the Committee. They shall be nominated, for a period of 3 years, by a decision of the Minister of Environment within a maximum period of six months from the official declaration of the Nature Marine Reserve (Publication of the declaration Law in the Lebanon's Official Gazette).

The JNMR Committee will be endowed with administrative and financial autonomy. It will supervise the management of the Nature Marine Reserve, liaise with the stakeholders and propose the annual autonomous budget of the JNMR. The details of its functions will be defined by Decision of the Ministry of Environment.

7.2 The Management team

The committee of the JNMR will appoint a management team composed of three categories of staff members:

- Director of the JNMR;
- Technical, Scientific and Administrative Officers;
- Rangers.

The appointment of the staff members of the JNMR will be according to the Terms of reference annexed to the present Management Plan (APPENDIX D).



8. Financial analysis

Table 4: Preliminary cost estimation

Main Cost items	Cost estimate (to be revised and updated if the adoption of the management plan is delayed)	Notes
Staffing Costs:		
Director of the JNMR		
Rangers		
Scientific, Technical and Administrative staff		
Office Premises costs		
Office Equipment		
Vehicles:		
Cars		
Patrolling boats (2)		2 boats: one semi-rigid boat 6 meters, 80 HP to be used in the coastal zone one 12 m boat with 2x100 HP motors to patrol in the deep zones
Installation and maintenance of demarcation buoys		The cost will be defined by the master plan to be elaborated under Activity B-3 (for the demarcation buoys) and B5 (for the mooring system) of the work plan
Installation and maintenance of Mooring system		
Bathymetric survey	25,000 US\$	Only for the depths between 0 and 200 m
Mapping of the key habitats in the Conservation Zone and deep-sea sections (> 80 m depth) of the Controlled Management zone	100,000 US\$	
Mapping of the key habitats in the shallow water (max 60-80 m depth) of the Controlled Management zone and of the Buffer	50,000 US\$	
Monitoring of habitats and species	30,000 US\$	
Awareness raising, information and education activities: Website development and other related costs Printed material Organisation of awareness and education event Installation of the underwater trail (if any)	55,000 US\$	
Consumable office supply		
Functioning and maintenance of patrolling boats, including fuel, insurance costs and home port fees		25% of the boat cost/year
Other costs (Travel, hiring of services, Miscellaneous expenses, etc.)		



9. The Management Work plan

The achievement of the Management Operational Objectives requires a series of actions that should be undertaken during the five-year period of the Management Plan. The actions could be grouped in the following clusters of actions:

- A) Consultation and engagement of stakeholders;
- B) Control and enforcement of the regulation;
- C) Monitoring;
- D) Research and knowledge improvement;

- E) Awareness raising, information and education activities;
- F) Reporting and evaluation;
- G) Cooperation and collaboration.

The following tables provide a summary of the proposed actions. For each of them a detailed sheet presenting the rationale, the methodology, the expected results and the timing is available annexed to the present Management Plan (APPENDIX C).

A- Consultation and engagement of stakeholders

Action Code	Management Action	Related Operational Objective	Actor(s)	Expected result	Periodicity
A-1	Consultation meetings & arbitration	1	The president of the JNMR Committee, assisted by the Director	Involvement of the stockholders in decision making process User Conflict Resolution	Continuous and Ongoing Activity according to an agreed calendar
A-2	Consultation meetings with the specific categories of users of the JNMR space and resources: Operators of tourism activities, Oil & Gas industry, fishermen (including professional and recreational fishing), etc.	2	The president of the JNMR Committee, assisted by the Director	Understand user concerns and needs Identify and overcome barriers to participation	Continuous and Ongoing Activity according to an agreed calendar
A-3	Stakeholder mapping	2	The Director of JNMR	Up-to-date information the stakeholders, analysis of their concerns or needs, identification of barriers to participation	Continuous and Ongoing Activity
A-4	Training of specific categories of users	2	The JNMR Staff Scientific partners Contracted experts	Capacity building of users	According to a calendar agreed with the targeted groups

B- Control and enforcement of the regulation

Action Code	Management Action	Related Operational Objective	Actor(s)	Expected result	Periodicity
B-1	Solid waste management	1	JNMR Rangers Relevant partners	Ensuring a proper management of the sources of Solid wastes within the JNMR and its surrounding zones	Continuous and Ongoing Activity
B-2	Regular surveillance through patrolling at sea and along the coast as well as using available advanced technologies	1	JNMR Rangers Relevant Authorities	Enforcement of regulation	Daily according to random timing
B-3	Installation and maintenance of demarcation buoys	1	JNMR Rangers with the help of subcontractors when needed	Inform the sea users about the borders of the JNMR and its zoning	Once installed the demarcation buoys and their sinkers should be regularly controlled and after stormy weather days
B-4	Elaboration of mooring system	1	The JNMR Staff in collaboration with relevant administrations	Conservation of key habitats	Year 3 of the management Plan
B-5	Elaboration of an Emergency Plan	1	The JNMR Committee in collaboration with relevant administrations	Preparedness to face arising emergency situations and management of their consequences	Year 3 of the management Plan

C- Monitoring

Action Code	Management Action	Related Operational Objective	Actor(s)	Expected result	Periodicity
C-1	Elaboration of a Directory of boats	1	JNMR Staff	Detailed knowledge of the fleet operating in the JNMR area and/or using its facilities	To be started on Year 1 of the Management Plan, Annual updating
C-2	Inventory of fishermen	1	JNMR Staff	Detailed information about the fishing effort deployed in the JNMR	To be started on Year 1 of the Management Plan, Annual updating
C-3	Monitoring of fishing activity	3, 1	JNMR Rangers	Information about halieutic resources status and over-fishing signals (if any)	Daily reporting through selected fishermen authorized to operate in the area
C-4	Benthic Habitat monitoring	3	Scientific partners	Regular assessment of the Habitat status	1 per year in the low depths (<30m) Every 4 Years for the deeper zones

Action Code	Management Action	Related Operational Objective	Actor(s)	Expected result	Periodicity
C-5	Monitoring of Birds, Turtles and cetaceans	3	JNMR Rangers	Regular assessment of the population of Bird, Turtle and cetacean species present or frequenting JNMR	Daily reporting of sightings
C-6	Visual census of fish species	3	Scientific partners	Regular assessment of fish population size and composition in defined key zones to be identified according to the Habitat mapping (D-2)	1 per year
C-7	Marine litter monitoring	3	JNMR Rangers	Ensure cleanliness and safety	Continuous and Ongoing Activity,
C-8	Monitoring of non-indigenous species	3	JNMR Rangers and Scientific partners	Early detection of new arriving species Identification of invasive species	In connection with key habitat and species monitoring, Daily reporting of sightings
C-9	Monitoring of beach users	3	JNMR Rangers	Detailed information about the actual level of beach use (number of users, timing, duration, etc.)	Seasonally
C-10	Monitoring of sea water quality	3	Scientific partners	Information about the marine environment health and indirect indication about the main sources of pollution, including land based sources of pollution	Seasonally for biological parameters Annually for pollution parameters
C-11	Inventory of land based sources of pollution	3, 1	JNMR Rangers	Identification of pollution sources and control for compliance with applicable regulation	To be started on Year 1 of the Management Plan, Annual updating
C-12	Geographic Information System	1, 2, 3	JNMR Staff	Support for the evaluation and assessment processes and decision-making	To be started on Year 1 of the Management Plan, Continuous updating and feeding with information from monitoring
C-13	Monitoring of climate change effects	3	JNMR Rangers and Scientific partners	Eventual signals of climate change	To be started on Year 2, Continuous updating and feeding with information from monitoring

D- Research and knowledge improvement

Action Code	Management Action	Related Operational Objective	Actor(s)	Expected result	Periodicity
D-1	Official request of bathymetric data to Lebanese Navy	4, 1, 2	The Ministry of Environment	Accurate bathymetry maps	To be done not later than the first 6 months of the Management Plan
D-2	Optional -Bathymetric survey	4, 1, 2	Subcontractors	Accurate bathymetry maps	TBD after D-1 but to be done not later than the first half of year 2 of the Management Plan
D-3	Mapping of the key habitats in the Controlled management zone and in the Buffer zone	4	Scientific partners and subcontractors	Baseline knowledge about the distribution of the benthic habitats Accurate habitat map (resolution between 1:5,000 and 1:10,000) GIS layers	To be done not later than year 2 of the Management Plan
D-4	Mapping of the key habitats in the Conservation zone	4	Scientific partners and subcontractors	Baseline knowledge about the distribution of the benthic habitats Accurate habitat map (resolution between 1:2,000 and 1:5,000) GIS layers	To be done as soon as possible according to the availability of financial resources

E- Awareness raising, information and education activities

Action Code	Management Action	Related Operational Objective	Actor(s)	Expected result	Periodicity
E-1	Information meetings and Awareness raising campaign targeting leisure boaters, professional and recreational fishing communities, tourism operators and beach users	2	The JNMR Staff	Enhanced community stewardship and understanding of marine values.	Continuous and Ongoing Activity according to a calendar taking into account the relevant local events agendas
E-2	Web site and Elaboration of brochures	2	The JNMR Staff	Enhanced Visibility of the JNMR Dissemination of information about the objectives and achievements	To be started on Year 1 of the Management Plan and continuous updating

Action Code	Management Action	Related Operational Objective	Actor(s)	Expected result	Periodicity
E-3	Education events targeting youth and at local school students	2	Communication staff of the JNMR Partner NGOs	Increased awareness about the natural values of the JNMR and the need for preserving its natural heritage	To be started on Year 2 of the Management Plan according to a calendar in consultation with schools
E-4	Sign posting	1	Communication staff of the JNMR with help of subcontractors when needed	Information of the general public about the regulation and the value of the JNMR	To be started on Year 1 of the Management Plan
E-5	Underwater trail	1	This activity is to be undertaken only of the Action D-2 (Mapping of the key habitats in the Controlled management Zone and in the Buffer zone) reveals the existence of suitable zone for the underwater trail		

F- Reporting and evaluation

Action Code	Management Action	Related Operational Objective	Actor(s)	Expected result	Periodicity
F-1	Reporting	1, 2	The JNMR Staff	Accurate and timely Information of the decision-makers Records about the status of the habitats, species and socio-economic activities	Monthly reports by the Director to the JNMR Committee Half-yearly reports by the JNMR Committee to the Ministry of Environment
F-2	Evaluation and assessment	1, 2	The JNMR Staff Independent evaluator(s)	Assessment of the implementation of the management measures and of their effectiveness	Yearly assessment by the JNMR Staff Year 4 of the Management Plan





G- Cooperation and collaboration

The JNMR Director should investigate possibilities of networking and partnership and make proposals to the Committee regarding:

- establishment of collaboration with relevant partners using where appropriate Memorandum of collaboration/partnership;
- participation in relevant networks of marine protected areas;
- inscription of the JNMR in relevant regionally and/or internationally recognised Lists of MPAs (eg: SPAMI under the Barcelona Convention, FRA under GFCM).



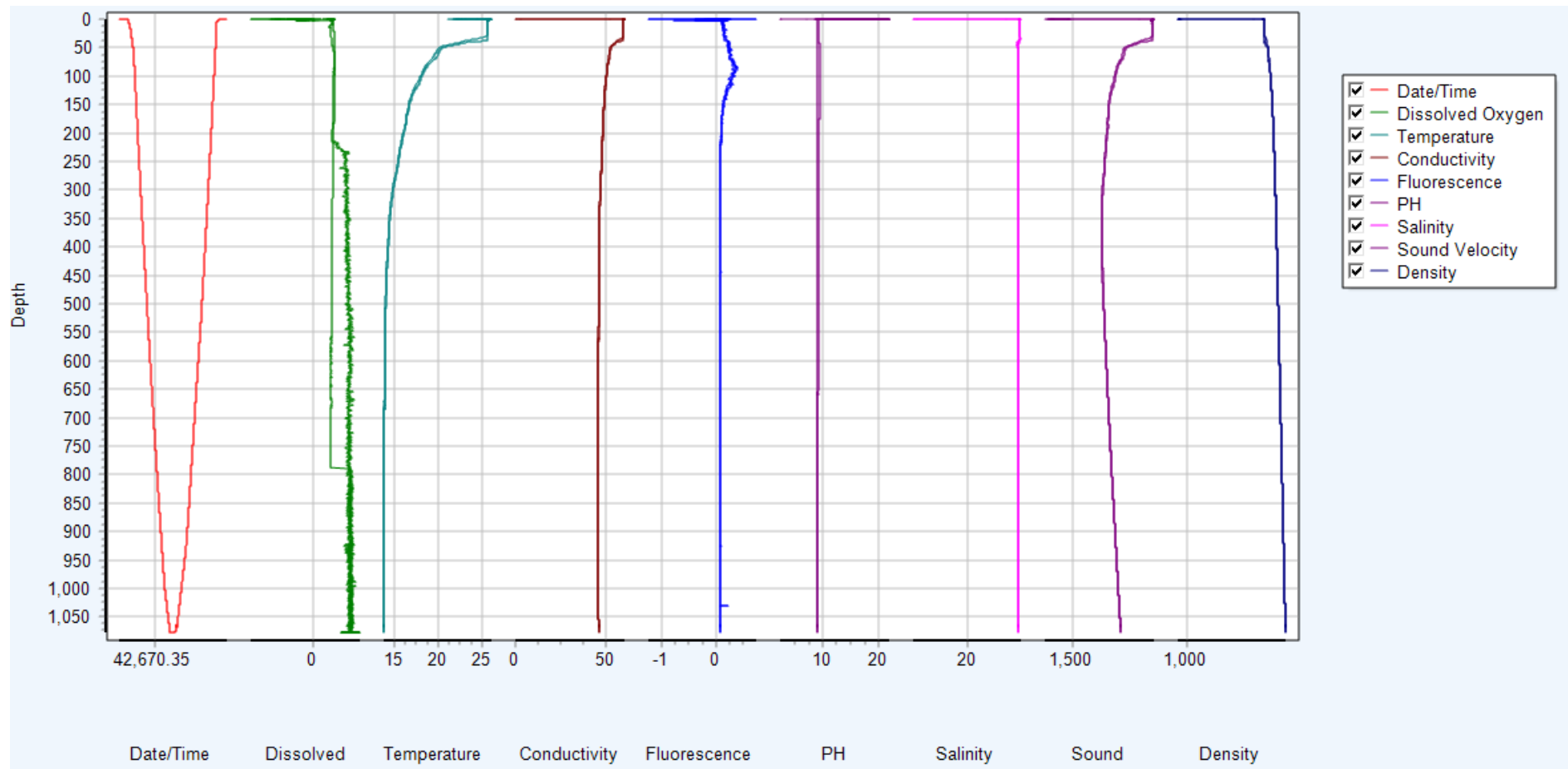
REFERENCES

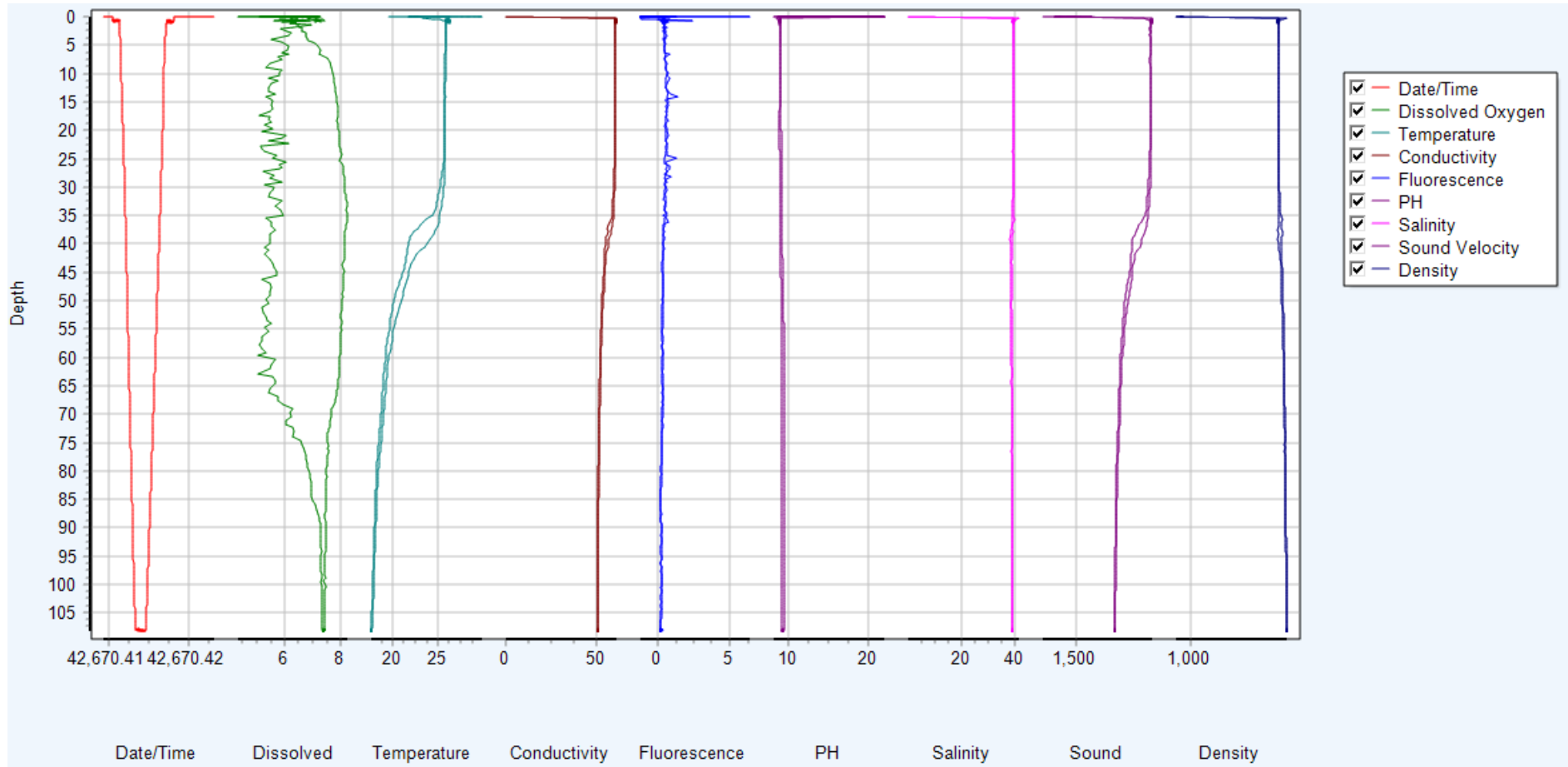
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APPENDIX A

CTD profiles of JNMR







APPENDIX B

**Species recorded within Jounieh
National Marine Reserve**



Table 1: Species collected through grab within JNMR (source: Aguilar et al., 2018)

Group	Species	Grab 01	Grab 07	Grab 08	Grab 09	Grab 10	Ecological considerations
Polychaetes	Polychaeta n.i.			x		x	
Polychaetes	Sabellidae n.i.						
Polychaetes	Serpulidae n.i.				x		
Gastropods	Cephalaspidea n.i.	x					
Gastropods	<i>Clanculus corallinus</i>					x	
Gastropods	<i>Clio pyramidata</i>					x	
Gastropods	<i>Nassarius</i> sp.	x		x		x	
Gastropods	<i>Pagodula echinata</i>	x					
Gastropods	<i>Taranis moerchi</i>					x	
Gastropods	Unidentified Gastropoda					x	
Bivalves	<i>Abra alba</i>				x		
Bivalves	<i>Abra longicallus</i>	x					Characterizing species of the Biocoenosis of bathyal muds ¹
Bivalves	<i>Cuspidaria cuspidata</i>				x		
Bivalves	<i>Nucula nitidosa</i>					x	

Group	Species	Grab 01	Grab 07	Grab 08	Grab 09	Grab 10	Ecological considerations
Bivalves	<i>Nucula sulcata</i>	x		x	x		Lives on muddy or clay bottoms
Bivalves	<i>Saccella commutata</i>				x		Prefers sandy-muddy bottoms rich in coarse material
Bivalves	<i>Thyasira flexuosa</i>					x	
Bivalves	Unidentified bivalvia					x	
Crustaceans	<i>Ebalia deshayesi</i>		x				
Brachiopods	<i>Megathiris detruncata</i>				x		
Brachiopods	<i>Megerlia truncata</i>				x		
Echinoderms	Rest of sea urchins	x					

¹ Relini & Giaccone (2009)

Group	Species	ROV_01	ROV_03	ROV_04	ROV_07	ROV_09	ROV_10	ROV_11	ROV_12	IUCN Med	Protection	Ecological considerations	Origin	Commercial Use ²
Sponges	<i>Haliclona</i> sp.		x											
Sponges	<i>Ircinia</i> sp.		x											
Sponges	<i>Ircinia variabilis</i>		x											
Sponges	<i>Pleraplysilla spinifera</i>		x											
Sponges	Porifera n.i.		x											
Sponges	<i>Sarcotragus</i> cf. <i>foetidus</i>		x											
Sponges	<i>Sarcotragus</i> cf. <i>spinulosum</i>		x											
Sponges	<i>Sarcotragus foetidus</i>		x								SPA/BD Ann.II			
Sponges	<i>Sarcotragus</i> sp.		x											
Sponges	<i>Sarcotragus</i> sp. damaged		x											
Sponges	<i>Spongia officinalis</i>		x								SPA/BD Ann. III	Characterizing species of the Coralligenous biocoenosis ¹		x
Hexacorals	<i>Alcyonium palmatum</i>		x							LC				
Hexacorals	<i>Arachnanthus</i> sp.								x					

Group	Species	ROV_01	ROV_03	ROV_04	ROV_07	ROV_09	ROV_10	ROV_11	ROV_12	IUCN Med	Protection	Ecological considerations	Origin	Commercial Use ²
Hexacorals	<i>Cerianthus cf. lloydii</i>				x									
Hexacorals	<i>Cerianthus cf. membranaceus</i>				x	x		x		LC				
Hexacorals	<i>Cerianthus mediterraneus</i>				x									
Hexacorals	<i>Cerianthus membranaceus</i>		x		x	x	x		x	LC				
Hexacorals	<i>Cerianthus</i> sp.			x					x					
Hexacorals	cf. <i>Edwardsiella</i> sp.						x							
Hexacorals	cf. <i>Pachycerianthus</i> sp.		x											
Hexacorals	<i>Epizoanthus</i> sp.				x			x						
Hexacorals	<i>Hormathia alba</i>								x	DD				
Octocorals	<i>Pennatula rubra</i>					x				VU				
Octocorals	<i>Swiftia pallida</i>			x						DD				
Octocorals	<i>Virgularia mirabilis</i>		x							LC				
Scleractinians	<i>Anomocora</i> sp.		x			x					CITES Ann. II			

Group	Species	ROV_01	ROV_03	ROV_04	ROV_07	ROV_09	ROV_10	ROV_11	ROV_12	IUCN Med	Protection	Ecological considerations	Origin	Commercial Use ²
	<i>infundibulum</i>													
Polychaetes	Polychaeta		x	x				x						
Polychaetes	<i>Protula cf. tubularia</i>							x						
Polychaetes	<i>Protula tubicola</i>			x										
Polychaetes	<i>Protula tubularia</i>		x											
Polychaetes	<i>Sabella pavonina</i>		x											
Polychaetes	Sabellidae		x	x										
Polychaetes	<i>Serpula vermicularis</i>		x	x	x			x				Characterizing species of the Coralligenous biocoenosis ¹		
Polychaetes	Serpulidae		x				x	x						
Polychaetes	Serpulidae covering the rock						x							
Polychaetes	Terebellidae n.i.		x											
Chelicerates	Pycnogonida (Uncertain)						x							
Crustaceans	<i>Aristeus antennatus</i>			x				x	x			Characterizing species of the Biocoenosis of bathyal muds ¹		x

Group	Species	ROV_01	ROV_03	ROV_04	ROV_07	ROV_09	ROV_10	ROV_11	ROV_12	IUCN Med	Protection	Ecological considerations	Origin	Commercial Use ²
Crustaceans	<i>Pagurus variabilis</i>								x					
Crustaceans	<i>Parapenaeus cf. longirostris</i>						x							
Crustaceans	<i>Parapenaeus longirostris</i>		x	x			x					Characterizing species of the Biocoenosis of bathyal muds ¹		x
Crustaceans	<i>Plesionika cf. edwardsii</i>				x									
Crustaceans	<i>Plesionika edwardsii</i>			x	x		x	x						x
Crustaceans	<i>Plesionika giglioli</i>			x										
Crustaceans	<i>Plesionika heterocarpus</i>		x											
Crustaceans	<i>Plesionika narval</i>		x											
Crustaceans	<i>Plesionika sp.</i>		x	x				x						
Gastropods	Gasteropoda n.i.		x											
Gastropods	<i>Tonna galea</i>		x								SPA/BD Ann. II			
Bivalves	<i>Neopycnodonte cochlear</i>		x			x								
Bivalves	Tellinidae n.i.						x							

Group	Species	ROV_01	ROV_03	ROV_04	ROV_07	ROV_09	ROV_10	ROV_11	ROV_12	IUCN Med	Protection	Ecological considerations	Origin	Commercial Use ²
Bryozoans	<i>Hornera frondiculata</i>		x									Characterizing species of the Coralligenous biocoenosis ¹		
Bryozoans	<i>Reteporella grimaldii</i>		x									Characterizing species of the Coralligenous biocoenosis ¹		
Bryozoans	<i>Reteporella</i> sp.		x									Characterizing species of the Coralligenous biocoenosis ¹		
Bryozoans	<i>Schizomavella</i> sp.					x								
Brachiopods	<i>Megerlia truncata</i>		x											
Echinoderms	Echinodermata dead					x								
Echinoderms	Asteroidea buried					x								
Echinoderms	<i>Chaetaster longipes</i>		x											
Echinoderms	<i>Coscinasterias tenuispina</i>					x								
Echinoderms	<i>Hacelia attenuata</i>		x									Characterizing species of the Coralligenous biocoenosis ¹		
Echinoderms	<i>Hacelia</i> sp.		x											
Echinoderms	<i>Hacelia superba</i>		x										Non indigenous	
Echinoderms	<i>Leptasterias</i> sp.			x									Non indigenous	

Group	Species	ROV_01	ROV_03	ROV_04	ROV_07	ROV_09	ROV_10	ROV_11	ROV_12	IUCN Med	Protection	Ecological considerations	Origin	Commercial Use ²
Echinoderms	<i>Antedon mediterranea</i>					x						Characterizing species of the Coralligenous biocoenosis ¹		
Echinoderms	<i>Ophiopsila aranea</i>					x								
Echinoderms	<i>Centrostephanus longispinus</i>					x					SPA/BD Ann. II	Characterizing species of the Coralligenous biocoenosis ¹		
Echinoderms	<i>Cidaris cidaris</i>	x	x	x	x	x		x						
Echinoderms	<i>Cidaris cidaris facies</i>					x								
Echinoderms	<i>Cidaris</i> sp.		x											
Echinoderms	Echinoidea dead					x								
Echinoderms	<i>Gracilechinus acutus</i>								x					
Echinoderms	<i>Hymenodiscus coronata</i>								x					
Echinoderms	sea urchin dead		x											
Echinoderms	cf. <i>Stylocidaris</i> sp.			x										
Echinoderms	<i>Stylocidaris affinis</i>		x											
Echinoderms	<i>Mesothuria intestinalis</i>				x							Characterizing species of the Biocoenosis of bathyal muds ¹		

Group	Species	ROV_01	ROV_03	ROV_04	ROV_07	ROV_09	ROV_10	ROV_11	ROV_12	IUCN Med	Protection	Ecological considerations	Origin	Commercial Use ²
Echinoderms	<i>Mesothuria</i> sp.								x					
Ascidians	<i>Ascidia conchilega</i>		x											
Ascidians	Ascidiacea n.i.				x									
Ascidians	<i>Didemnum</i> cf. <i>vulgare</i>		x											
Ascidians	<i>Halocynthia papillosa</i>		x									Characterizing species of the Coralligenous biocoenosis ¹		
Bony fish	<i>Anthias anthias</i>		x							LC		Characterizing species of the Coralligenous biocoenosis ¹		
Bony fish	<i>Arnoglossus rueppelii</i>		x							LC				
Bony fish	<i>Aulopus filamentosus</i>		x							LC				
Bony fish	<i>Bathypterois dubius</i>								x					
Bony fish	<i>Chauliodus sloani</i>						x		x	LC				
Bony fish	<i>Chelidonichthys cuculus</i>					x								
Bony fish	<i>Chlorophthalmus agassizi</i>	x	x		x		x			LC				x
Bony fish	<i>Citharus linguatula</i>					x				LC				x

Group	Species	ROV_01	ROV_03	ROV_04	ROV_07	ROV_09	ROV_10	ROV_11	ROV_12	IUCN Med	Protection	Ecological considerations	Origin	Commercial Use ²
Bony fish	cf. <i>Coelorhynchus</i> sp.								x					
Bony fish	<i>Coelorhynchus caelorhincus</i>			x										
Bony fish	<i>Coelorhynchus</i> cf. <i>caelorhincus</i>						x							
Bony fish	<i>Coelorhynchus</i> sp.								x					
Bony fish	<i>Coris julis</i>		x							LC				
Bony fish	<i>Dalophis imberbis</i>								x	LC				
Bony fish	<i>Dentex macrophthalmus</i>	x	x							DD				x
Bony fish	<i>Electrona rissoi</i>						x							
Bony fish	<i>Epigonus constanciae</i>		x							DD				
Bony fish	Gobiidae n.i.		x											x
Bony fish	<i>Helicolenus dactylopterus</i>		x	x	x		x	x	x	LC				x
Bony fish	<i>Hoplostethus mediterraneus</i>			x	x		x	x	x	LC				

Group	Species	ROV_01	ROV_03	ROV_04	ROV_07	ROV_09	ROV_10	ROV_11	ROV_12	IUCN Med	Protection	Ecological considerations	Origin	Commercial Use ²
Bony fish	<i>Serranus cabrilla</i>		x			x				LC				x
Bony fish	<i>Serranus hepatus</i>		x			x				LC				
Bony fish	<i>Stomias boa</i>				x			x		LC				
Bony fish	<i>Symphurus ligulatus</i>								x	LC				
Bony Fish	Unidentified fish		x			x	x	x						

¹ Relini & Giaccone, 2009

² FAO Yearbook. Fishery and Aquaculture Statistics 2016 (http://www.fao.org/fishery/static/Yearbook/YB2016_USBcard/index.htm)

APPENDIX C

Management Action Sheets



JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

A-1 and A-2

Operational Objective

Operational Objective 2: Achieve full involvement of stakeholders in the management of the declared MPA and in the regular revision of the conservation and management measures.
Operational Objective 1: Ensure harmonisation of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.

Consultation meetings & arbitration Consultation meetings with the specific categories of users of the JNMR

Rationale:

Achieving an adequate engagement of stakeholders in the decision making process and the management of the NJMR requires that regular consultation meetings be convened to inform the stakeholders on the main decisions to be made and collect their views and concerns regarding the relevant issues.

Actors:

The President of the JNMR Committee, assisted by the Director

Methodology:

Based on the list of the main stakeholders already identified and those to be identifies and considered in the future by the Action A-3 (Stakeholder mapping), the President of the JNMR Committee shall convene a series of consultation meetings according to a calendar established with the assistance of the Director. Some of the consultation meetings will be with specific categories of users of the JNMR space and resources in particular the Operators of tourism activities, Oil & Gas industry, fishermen (including professional and recreational fishing), etc.

As for arbitration meetings, they must be decided when the President of the committee thinks he can resolve conflicts of use or when it is necessary to reach consensus concerning governance or management decisions or measures.

It is important to solicit stakeholders only when necessary to avoid trivializing the meetings of the NJMR and instead try to keep them as important events that stakeholders value and avoid risks of weariness. It is also important to record the conclusions and recommendations of the meetings in minutes disseminated to all participants and to keep the stakeholders informed of the follow-up given to the recommendations of these meetings through adequate feedback.

Expected results

- High level involvement of stakeholders in the governance and management of the JNMR
- Identify and overcome barriers to participation
- Mitigation of the impacts of conflicts between users

Associated Actions:

- Stakeholder mapping (A-3)
- Training of specific categories of users (A-4)
- Elaboration of a Directory of boats (C-1)

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity
					(*)

* According to a calendar to be established by the President of the NJMR Committee with the assistance of the Director

Reporting

Minutes of the meeting shall be recorded and disseminated to participants

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

A-3

Operational Objective

Operational Objective 2: Achieve full involvement of stakeholders in the management of the declared MPA and in the regular revision of the conservation and management measures.

Stakeholder mapping

Rationale:

Underestimating the role of stakeholders in the planning, decision making and management of the MPA will have adverse impacts on the achievement of the objectives of the NJMR. The stakeholder mapping aims at identifying the individuals or groups that might be affected by the NJMR regulation and/or that might influence the implementation of the protection and management measures. It allows also to identify the possible support or opposition to the NJMR objectives and to monitor the changes of their expectations and concerns in relation to the MPA

Actors:

The Director of JNMR

Methodology:

The stakeholder mapping should be oriented to build robust and extensive knowledge about the key players in the area. These include Governmental and Non-Governmental Organisations as well as professional groups, groups of users or individuals that could contribute in the planning and management process or whose interests could be affected by the implementation of the Nature Marine Reserve regulation and management measures.

As a first step in the stakeholder mapping, the NJMR Director may start by elaborating a directory of key players in the area focusing in priority on governmental organizations and institutions, opinion leaders in local communities and relevant business, media, and scientific/academic community. The Directory should include contact details and where possible a preferential contact person for the organisations listed.

The second steps, shall be the identification of the role each identified stakeholder may play in favour or against the objectives of the NJMR, assessing where possible the related power influence.

The stakeholder mapping is a continuous process that keeps a watch and monitors any change in the stakeholder composition as well as changes in relative power or position towards the MPA, its regulation and objectives.

Expected results

- High level involvement of stakeholders in the governance and management of the JNMR
- Identification of barriers to participation
- Mitigation of the impacts of conflicts between users

Associated Actions:

- Training of specific categories of users (A-4)
- Elaboration of a Directory of boats (C-1)

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity
					(*)

* The stakeholder mapping is a continuous process that has been started during the elaboration of the management plan and shall be continued to identify any change in relation to stakeholders.

Reporting

A section on the status of stakeholders should be included in the annual reports of the NJMR

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref **A-4**

Operational Objective Operational Objective 2: Achieve full involvement of stakeholders in the management of the declared MPA and in the regular revision of the conservation and management measures.

Training of specific categories of users

Rationale:

The implementation of the conservation and management measures of the MPA require that some categories of users be trained in best practices. It would be also very useful to improve their knowledge in topics of special relevance for the objectives of the MPA. Improving the skills of the users of the JNMR environment will facilitate their collaboration with the MPA staff and would improve their readiness to comply with the regulation.

Actors:

The JNMR Staff
Scientific partners
Contracted experts

Methodology:

The first step should be the identification of categories of users to be targeted by the training activities. The fishermen and the users of leisure boats frequenting the JNMR area are among the users to target in priority. The MPA staff should ensure that the right conditions for learning are in place. They should in particular assess the training needs and the level of acceptability taking into account the most appropriate timing, duration and training methods (field training, training by doing Modules, manuals, etc.). The following training topics are recommended:

- Regulation of the JNMR
- Impact of anchoring on habitats
- Best practices for anchor dropping and hoisting
- Identification and early warning in relation to invasive species
- Handling of endangered species entangled in fishing gear

The stakeholder mapping exercise (A-3) could help in identifying other categories of users to consider for training as well as other topics.

Expected results

- Capacity building of the users of the JNMR environment
- Improved enforcement of regulation

Associated Actions:

- Stakeholder mapping (A-3)
- Elaboration of a Directory of boats (C-1)

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity
					(*)

(*) according to a calendar established in consultation with the targeted users and approved by the JNMR Committee.

Reporting

Reports on the training activities supported by evaluation forms filled in by the participants

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

B-1

Operational Objective

Operational Objective 1: Ensure harmonisation of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.

Solid waste management

Rationale:

Solid waste management is one of the main environmental issue in Lebanon. For the marine environment, in addition to the land based sources of solid waste, the oceanographic conditions along the Lebanese coast play a significant role in the accumulation of marine debris, including on the seabed. The survey conducted in 2016 in the deep sea zones of Lebanon revealed the existence of a wide variety of solid wastes in the surveyed canyons. Marine litter is therefore among the priorities to be addressed by the NJMR staff and Committee.

Actors:

JNMR Rangers
Relevant partners

Methodology:

The issue of solid wastes should be addressed through a coherent approach based on the knowledge of the main sources, zones of accumulation, composition of solid wastes and accurate estimates of quantities. To build the approach the following activities are recommended:

- Inventory of land based sources of solid wastes (rivers, coastal human activities, etc.)
- Seasonal surveys to assess the quantities of solid waste reaching the JNMR zone
- Elaboration of the solid waste management strategy in the area of JNMR in close collaboration with the relevant actors

Expected results

- Ensuring a proper management of the sources of Solid wastes within the JNMR and its surrounding zones

Associated Actions:

- Stakeholder mapping (A-3)

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5

Periodicity

Continuous and Ongoing Activity

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

B-2/ B-3/B-4

Operational Objective

Operational Objective 1: Ensure harmonisation of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.

- Regular surveillance through patrolling at sea and along the coast as well as using available advanced technologies (B-2)
- Installation and maintenance of demarcation buoys (B-3)
- Elaboration of mooring system (B-4)

Rationale:

According to a survey coordinated by SPA/RAC and MedPAN in 2013, weak surveillance (particularly for fishermen) and weak enforcement (particularly for polluters) represented 55% of the main causes for the offences committed in the Mediterranean MPAs.

The enforcement of the regulation set for the JNMR is to be ensured through frequent control using patrolling team as well as available technologies, in particular in the most remote areas of the MPA. Where the bathymetry allows, demarcation buoys indicating the limits of the HNMR and its zoning will help the sea users to conform to the regulation and the patrolling rangers to enforce it.

In the areas where the seabed has fragile biological formation, the setting of mooring system that could be used by boaters instead of anchoring their boats is among the recommended measures allowing to conciliate boating activities and conservation. In some Mediterranean MPAs mooring system contributed in reducing the patrolling workload.

Actors:

JNMR Rangers (surveillance)
Subcontractors when needed (demarcation buoys)
Relevant authorities

Methodology:

The surveillance for the enforcement of the regulation within the JNMR area is to be ensured by the rangers of the MPA. To this end, appropriate boats should be made available and maintained in operational status. Many guidelines provide best practices for the surveillance of MPAs. The practical Guide for Surveillance and enforcement of regulations in Mediterranean MPAs published by MedPAN in collaboration with SPA/RAC and other partners in 2015 is particularly relevant.

In addition to boat patrolling, the use of advanced technologies could significantly contribute in implementing more systematic surveillance, in particular for the remote zone of the JNMR. In this contexts, the JNMR Committee should liaise with the relevant authorities using such technologies (radar systems) in Lebanon and where possible establish agreements with them for the surveillance of the MPA.

The installation of the demarcation buoys and of the mooring system must be the subject of an in-depth study by specialized firms taking into account bathymetry, hydrographic and meteorological conditions and the distribution of habitats.

<p>Expected results</p> <ul style="list-style-type: none"> - Enforcement of regulation - Inform the sea users about the borders of the JNMR and its zoning - Conservation of key habitats 	<p>Associated Actions:</p> <ul style="list-style-type: none"> - Benthic Habitat monitoring (C-4) - Official request of bathymetric data to Lebanese Navy (D-2) - Optional -Bathymetric survey (D-3)
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Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity
					(*)

(*) Once installed the demarcation buoys and their sinkers should be regularly controlled and after stormy weather days

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-1

Operational Objective

1- Ensure harmonisation of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.

Elaboration of a Directory of boats

Rationale:

Information about the fleet frequenting the JNMR area and its surrounding zones is of particular importance for the monitoring, control and surveillance of boat activities in the Nature Marine Reserve. The elaboration of a Directory of boats is very useful since it allows to (i) control the number of active vessels, (ii) perform a follow-up of the fishing effort of the fleets by statistics surveys and (iii) detect illegal fishing activities and assess their importance.

Actors:

The JNMR Staff

Methodology:

Monitoring, Control and Surveillance activities will be carried out through:

- Dockside inspections of boats landing at the fishing port,
- Maritime Patrol Inspections in collaboration with the Navy,
- Air patrols to fly over, photograph and identify vessels that are present in waters under Lebanese jurisdiction,
- The Vessel Monitoring System (VMS) to provide data to the fisheries authorities on the position, course and speed of vessels fishing in Lebanese waters to check their areas of activity,
- Boarding observers aboard fishing vessels.

Expected results

- Detailed knowledge of the fleet operating in the JNMR area and/or using its facilities

Associated Actions:

- Evaluate the implementation of VMS
- Coordination with different actors: Ship-owners, the Lebanese Ministry of Agriculture and the company that provides installation and maintenance of VMS equipment in Lebanon) and the Fisheries Monitoring Centre.

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5

Periodicity(*)
Annual

(*) To be started on Year 1 of the Management Plan, Annual updating

Reporting

Production of reports for statistic exploitation and number of active vessels; identification and mapping the fishing activity of the majority of all industrial-sized commercial fishing vessels; GIS layers, position data reports

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-2

Operational Objective

1- Ensure harmonisation of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.

Inventory of fishermen

Rationale:

Fishery censuses are an effective tool for monitoring the quality of fishing in the area. The overall objective of the inventory is to provide reference information on the fisheries sector and to collect information on economic and livelihood conditions of these fishermen communities to identify key issues that might be considered in sustaining their livelihood and ensure their participation in conservation of fish biodiversity.

Actors:

The JNMR Staff

Methodology:

Data collection operations are based on surveys with fishermen. The Questionnaire survey is used to characterize the fishing activity as well as to determine its impact on the study area. For this, a questionnaire template must consist essentially of three main axes:

- Socio - economic aspect: population status of fishermen, number and types of houses, involvement of men and women in fishing and non-fishing activities, distance covered for fishing and total number fishermen involved in fishing, annual income/average income from fishing and non-fishing source, level of education of the population.
- The type of boat: Characteristics of the boat, types and number of crafts and gears, types of fish species caught during fishing and its marketing, fishing season, fishing effort, and the marketing circuit.
- Fisher's knowledge of fisheries legislation and preservation of endangered species.

Survey of fishermen can be integrated with Survey for the elaboration of a Directory of boats and fishing activity to get an overview of some particular issues such as fish catching, crafts and gears used for fishing, marketing, employment, income, evaluating the social acceptability of the future Marine Reserve, etc.

Expected results

- Detailed information about the fishing effort deployed in the JNMR

Associated Actions:

- Monitoring of fishing activity
- Elaboration of a Directory of boats
- Regular surveillance through patrolling at sea and along the coast as well as using available advanced technologies

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity *
					Annual

* To be started on Year 1 of the Management Plan, Annual updating

Reporting

Production of reports for statistic exploitation and number of fishermen

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-3

Operational Objective

1- Ensure harmonisation of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.
3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems.

Monitoring of fishing activity

Rationale:

Monitoring, control and surveillance of marine fisheries are critical issues for the sustainable management of marine fisheries and conservation of halieutic resources and the marine ecosystem. The monitoring of fishing activity is central to ensuring sustainable fisheries since it allows to (i) control the number of active vessels, (ii) perform a follow-up of the fishing effort of the fleets by statistics surveys, (iii) find out the types and quantity of fish being caught, (vi) detect illegal fishing activities and assess their importance, (v) monitor by-catch, and (vi) ensure that regulations are followed by fishers.

Actors:

JNMR Rangers

Methodology:

Monitoring, Control and Surveillance activities will be carried out by employing human observers (at sea and dockside) and through:

- Dockside inspections of boats landing at the fishing port,
- Maritime Patrol Inspections in collaboration with the Navy,
- photograph and identify vessels that are present in waters under Lebanese jurisdiction,
- The Vessel Monitoring System (VMS) to provide data to the fisheries authorities on the position, course and speed of vessels fishing in Lebanese waters to check their areas of activity,
- Boarding observers aboard fishing vessels.
- Observers on board commercial fishing vessels, who record what is caught (including by-catch impact on seabirds and marine mammals).

Expected results

- Information about halieutic resources status and overfishing signals (if any)

Associated Actions:

- Inventory of fishermen
- Monitoring of fishing activity
- Regular surveillance through patrolling at sea and along the coast as well as using available advanced technologies

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity *
					Daily

* Daily reporting through selected fishermen authorized to operate in the area

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-4

Operational Objective

3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems targeting the most critical issues, in particular pollution, Invasive non-indigenous species and climate change.

Benthic Habitat monitoring

Rationale:

Monitoring benthic habitat is used to record changes in physical conditions, in distribution or abundance of organisms, in the structure and composition of marine habitats or changes caused by human actions or natural events. Benthic habitat monitoring can give further information about the condition of species features that may prove useful for formulating management options for the site.

Actors:

Scientific partners

Methodology:

Existing appropriate standard survey methods for Marine Key Habitats can be used such as:

- Standard methods for inventorying and monitoring coralligenous and rhodoliths assemblages
- Guidelines for Standardization of Mapping and Monitoring Methods of Marine Magnoliophyta in the Mediterranean

For evaluation of long-term fluctuations in biotopes, either through natural changes or from anthropic impacts, monitoring of permanent quadrats and transects and photo-sampling (photo-quadrats) are necessary.

Collected data (snapshots) will be compared against the baseline data. This information will help managers evaluate trends (regular changes over time) or perturbations (sudden changes).

Expected results

- Regular assessment of the Habitat status

Associated Actions:

- Mapping of the key habitats in the Controlled management zone and in the Buffer zone
- Mapping of the key habitats in the Conservation zone
- Underwater trail
- Bathymetric survey
- Monitoring of birds, turtles and cetaceans

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity *
					Annual

* 1 per year in the low depths (<30m); Every 4 Years for the deeper zones

Reporting

Periodic reports

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-5

Operational Objective

3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems.

Monitoring of Birds, Turtles and cetaceans

Rationale:

Birds, turtles and cetaceans species face a conservation crisis due to human pressure on their habitats. They depend wholly or mainly on the marine environment for their survival. They spend the “majority” of their lives at sea, exploiting its surface and the water column to varying depths for food. Some species of turtles and birds come ashore only to breed. Monitoring of birds, turtles and cetaceans is useful tool to assess the ecological health of the site. Monitoring of these group of species, in line with the Ecosystem Approach, is an essential component of resource management by providing science-based information to guide key management decisions like crafting management options to overturn or prevent negative trends, prioritizing conservation strategies and whether or not this marine reserve is meeting its projected objectives.

Actors:

JNMR Rangers
Lebanese scientific community

Methodology:

The regular monitoring of selected species can identify changes, if any, in population numbers, but it can also perceive changes in the threats or detect any possible new threats.

Data collection operations are based on :

- Physical monitoring activities (such as counting, checking nest-sites, collecting biological data, etc), these activities should be carried out preferably in good weather conditions
- New technologies such as satellite tracking and geo-referenced data loggers, at least for the larger species, these operations allow direct sampling at sea of the most used migratory and/or feeding routes, as well as very relevant information of the species' behavior.

Expected results

- Regular assessment of the population of Bird, Turtle and cetacean species present or frequenting JNMR

Associated Actions:

- Mapping of the key habitats in the Controlled management zone and in the Buffer zone
- Mapping of the key habitats in the Conservation zone
- Underwater trail
- Bathymetric survey
- Monitoring of benthic habitats

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity *
					Annual surveys

* Daily reporting of sightings

Reporting

Periodic reports on trends, changes in population levels and on the causes of those changes

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-6

Operational Objective

3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems targeting the most critical issues, in particular pollution, Invasive non-indigenous species and climate change.

Visual census of fish species

Rationale:

Fish visual census can be used to estimate the variety, numbers, and even sizes of common, easily-seen, easily-identified fishes in areas of good visibility. This information may reflect the health of the fish stocks within the surveyed

Monitoring fish assemblages is needed to assess whether Marine Protected Areas (MPAs) are meeting their conservation and fisheries management goals, as it allows one to track the progress of recovery of exploited species and associated communities.

Actors:

Scientific partners

Methodology:

Underwater Visual Census techniques to monitor fish assemblages is based on identification and counting of fishes observed within a defined area on a constant depth along a transect line.

For cryptic or sparse fishes combining baited censuses of cryptic species with traditional censuses of mobile species can be applied to avoid underestimation of the number of cryptic species or overestimation of the abundance of mobile species.

Expected results

- Regular assessment of fish population size and composition in defined key zones to be identified according to the Habitat mapping (D-2)

Associated Actions:

- Monitoring of fishing activity
- Mapping of the key habitats

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity *
					Annual

* 1 per year

Reporting

Fish Abundance Data Reporting

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-7

Operational Objective

3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems.

Marine litter monitoring

Rationale:

The proliferation of debris and solid waste on the seabed and on the beach is a real threat to biodiversity, aesthetics, but also to public health. Monitoring the presence of marine litter within the NJMR will provide useful qualitative and quantitative data for the management of this issue, in particular to identify and manage the major land-based sources of marine litter, to establish beach and seabed cleaning programmes and to identify the most effective mitigation measures.

Actors:

JNMR Rangers
In collaboration with partner NGOs and volunteers

Methodology:

Various methods/protocols for monitoring marine litter exist and depend on the type and location of litter. The NJMR staff should keep a watch on the used protocols in Lebanon as well as in other Mediterranean countries and where possible use standardized methodologies that allow to compare the monitoring data with the other relevant initiatives undertaken at national and international level.

The data collected during the first year of monitoring shall be used as baseline and will help to establish a first master list of the most frequent items in the NJMR area.

For beach and rocky shore:

- Visual census along beach strandlines and following transect survey schemes is among the most cost effective monitoring methods that provide detailed information on composition and amount of litter. Litter should be categorized and collected. A Litter datasheets must be fulfilled out at each survey event;
- Weigh the litter items by litter data sheet category (e.g., plastic, metal, rubber), Units: number of items / kg weight per m length of beach
- Sand/Sediment samples could be collected from the top 50 mm of the sediment surface in a minimum 50 cm x 50 cm quadrat.

For water surface,

- Monitoring by visual observation from boats for floating litter,
- All items observed on the survey area should be noted in the 'Floating Litter Monitoring Sheet'

Monitoring of litter on the water surface could be possible to integrate this with hydrographic/plankton monitoring programmes.

Furthermore, monitoring solid wastes ingested by threatened species (turtles, sea birds, etc.) should be considered

For shallow waters, information can be obtained :

- from on-going monitoring of benthic species in protected areas,
- during pipeline camera surveys,
- during cleaning of harbors,

- through diving activities,
- by using video techniques.

For deep seafloor: by Sea-Floor Video (video imagery) for litter in deep areas.

Monitoring of litter on deep seafloor can be integrated with trawling for monitoring fish stocks. Both sampling and analysis can be made by the personnel doing the fish monitoring

For litter in biota, monitoring of litter in biota to determine

- trends in the amount and composition of litter ingested by marine birds, turtles, benthic and pelagic fish
- the incidence of entanglement of beached birds and marine mammals.

Expected results

- Ensure cleanliness and safety

Associated Actions:

- Solid waste management
- Regular surveillance through patrolling at sea and along the coast as well as using available advanced technologies
- Monitoring of sea water quality
- Information meetings and awareness raising campaign targeting leisure boaters, professional and recreational fishing communities, tourism operators and beach users

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity *
					Continuous

* Continuous activity starting from Year 2

Reporting

- Setting up a periodic cleaning program/ Cleaning campaigns
- Development of a waste management plan

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-8

Operational Objective

3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems targeting the most critical issues, in particular pollution, Invasive non-indigenous species and climate change.

Monitoring of non-indigenous species

Rationale:

Non-indigenous species (NIS) pose a major threat to biodiversity. In marine ecosystems, non-indigenous or alien marine species may become invasive and displace native species, cause the loss of native genotypes, increase the risk of genetic pollution, modify habitats, change community structure, affect food web properties and ecosystem processes, impact human health, and cause significant economic losses. Monitoring of non-indigenous species is essential to prevent, control and monitor the effects of species introduction that can cause irreversible damage to the receiving ecosystem.

Actors:

JNMR Rangers and Scientific partners

Methodology:

The following steps should be carried out continuously all along the year :

- Implement an early detection monitoring through a sample target areas using inventory/survey methods or using information from predictive models based on ecosystem attributes, species establishment characteristics, and vectors and pathways,
- Regular data collection through sampling, careful visual inspections of artificial hard structures, sediment surfaces or vegetation. Harvested species are listed and if possible the frequency of their relative occurrence is roughly estimated to 'dominant', 'abundant', 'rare' or 'present'. If the taxonomic status of a species is certain, none or only few individuals are collected. A chronological order of the sampling stations should be maintained each year for comparable results,
- Establishing a relevant identification methods by morphology (dependent on life stage, taxonomic expertise and quality of specimens), DNA target markers or DNA barcoding,
- Measuring the current status, the trend or change in population parameters such as abundance, temporal occurrence and spatial distribution, particularly for invasive alien species,
- Periodic sampling of fouling communities on the surface of floating pontoons and the docks from different sites off the substrates are taken for identification in the lab,
- Setting up a group of experts who will be responsible for assessing all relevant issues; regarding introduction, spatial distribution, pathways of introduction, and impacts of alien species, and analyzing risks and possible consequences, in close consultation with the other Parties and relevant International Organizations,
- Developing training and raising awareness programs on risks, legal issues, best practices, and management actions for prevention and mitigation of impacts for the general public, actors and decision-makers,
- Strengthening of the national institutional framework that governs the controlling of species introduction by enforcing the laws to prevent the introduction of non-native species,
- Assessing the effectiveness of control treatments if exist (e.g., eradication campaigns) in suppressing, containing or eradicating target non indigenous species.

Expected results

- Early detection of new arriving species

Associated Actions:

- Monitoring of sea water quality

- Identification of invasive species	- Monitoring of climate change effects - Information meetings and awareness raising campaign targeting leisure boaters, professional and recreational fishing communities, tourism operators and beach users
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Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity *
					Semi-annually

* In connection with key habitat and species monitoring, daily reporting of sightings

Reporting

- Updated list of Non-indigenous species reported in the national territory, the pathways of their introduction, and the state of their population trends. - National Action Plan concerning species introductions and invasive species in the Lebanese waters.
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JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-9

Operational Objective

3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems targeting the most critical issues, in particular pollution, Invasive non-indigenous species and climate change.

Monitoring of beach users

Rationale:

Monitoring of beach users via video and image observations provide a suitable method for counting people on the beach that could be useful for a number of coastal management applications including tourist attendance. Evolution of beach users can be compared with morphological beach changes caused by natural processes and human action.

Actors:

JNMR Rangers

Methodology:

In addition to visual census automated cameras can be installed at a remote site and programmed to take photos. The number and density of beach users will be calculated and stored in a database.

Expected results

- Detailed information about the actual level of beach use (number of users, timing, duration, etc.)

Associated Actions:

- Sign posting
- Regular surveillance through patrolling at sea and along the coast as well as using available advanced technologies

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity
					Seasonally

Reporting

- Annual beach attendance

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-10

Operational Objective

3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems

Monitoring of sea water quality

Rationale:

Facing the impact of human activities on the marine environment, monitoring of sea water is crucial to protect the environment, use sustainably marine resources. The parameters of sea water quality are used as indicators for the assessment of the environment health.

Actors:

Scientific partners

Methodology:

The parameters analysed to assess the water quality are broadly divided into:

- Physical parameters: Colour, Temperature, Transparency, Turbidity and Odour.
- Chemical parameters: pH, Electrical Conductivity, Total Solids, Total Dissolved Solids, Total Suspended Solids, Total Hardness, Calcium Hardness, Magnesium Hardness, Nitrates, Phosphates, Sulphates, Chlorides, Dissolved Oxygen, Biological Oxygen Demand, Chemical Oxygen Demand, Fluorides, Free Carbon-di-oxide, Potassium and Sodium.
- Heavy metals: Lead, Copper, Nickel, Iron, Chromium, Cadmium and Zinc.
- Biological parameters: The biological parameters involved the qualitative analyses of planktons (zooplankton and phytoplankton).
- Field measurement: The field parameters measured include pH, conductivity, dissolved oxygen, temperature and transparency.

It is highly recommended to harmonize the monitoring of the sea water quality in the JNMR with the national network of sea water monitoring implemented by the National centre for Marine Sciences of the Lebanese CNRS

Expected results

- Information about the marine environment health and indirect indication about the main sources of pollution, including land based sources of pollution

Associated Actions:

- Benthic Habitat monitoring
- Marine litter monitoring
- Monitoring of Birds, Turtles and cetaceans

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity *
					Seasonally/annually

* Seasonally for biological parameters; annually for pollution parameters

Reporting

- Establishment of a comprehensive database concerning the quality of seawater by application of European Standards

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-11

Operational Objective

1- Ensure harmonisation of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.
3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems

Inventory of land based sources of pollution

Rationale:

Domestic sewage, industrial wastewaters, river discharges were the largest sources of pollution affecting the environment. In order to achieve good water status, to identify the type and magnitude of pressures and to reduce the emissions of substances classified as priority and to eliminate those of the so-called priority hazardous substances on the environment as well as on human health, inventory of land based sources of pollution is a necessary step.

Actors:

JNMR Rangers

Methodology:

1. Collection of information by exploiting existing inventories relating to industrial sites,
2. Inventory of industries with treatment or pre-treatment plants
3. Analysis of available aerial photos and satellite images of different dates

Expected results

- Identification of pollution sources (detailed map, type of pollution, season, etc.)
- Enforcement of the applicable regulation

Associated Actions:

- Solid waste management
- Monitoring of sea water quality
- Monitoring of beach users

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity *
					Annual

* To be started on Year 1 of the Management Plan, Annual updating

Reporting

Production of reports for land based sources of pollution; GIS layers; Pollutant Emission Register/cadastre

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-12

Operational Objective

- 1- Ensure harmonisation of the conservation objectives with the existing, planned or potential uses of the marine environment and its natural resources.
- 2- Achieve full involvement of stakeholders in the management of the declared MPA and in the regular revision of the conservation and management measures
- 3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems

Geographic Information System

Rationale:

Geographic Information Systems (GIS) are powerful decision support tools, especially for space management. The integration of the spatial dimension, thanks to GIS makes it possible to locate the information, organize the data in a more user-friendly way and propose management options. The integration and use of GIS is an effective tool for ensuring optimal and sustainable management of the site by supporting evaluation and assessment processes and decision-making.

Actors:

JNMR staff

Methodology:

The GIS developed within the framework of the management plan could be used and regularly updated by:

- Georeferentiation of the bibliographic data;
- Organisation of the geodatabase;
- Fieldwork activities to complete and verify some missing information on available maps;
- Import of data, images and videos from the field work activities.

Expected results

- Support for the evaluation and assessment processes and decision-making

Associated Actions:

All management actions associated to:

- Consultation and engagement of stakeholders;
- Control and enforcement of the regulation;
- Monitoring;
- Research and knowledge improvement;
- Awareness raising, information and education activities;
- Reporting and evaluation.

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity *
					Continuous

* To be started on Year 1 of the Management Plan, Continuous updating and feeding with information from monitoring

Reporting

A geographic information systems (GIS) database available also as WebGIS

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

C-13

Operational Objective

3- Establish regular scientific monitoring of the MPAs with the view of providing accurate and up-to-date data to feed the assessment of the management effectiveness and early warning systems targeting the most critical issues, in particular pollution, Invasive non indigenous species and climate change.

Monitoring of climate change effects

Rationale:

Climate change is creating multiple threats to coastal and marine habitats. Changes to atmospheric and oceanographic conditions, including increased air and water temperatures, ocean acidification, sea level rise, altered ocean currents and extreme weather events, may affect marine ecosystems with numerous side-effects (e.g., biological, phenological, or community shifts, coral bleaching, spread of invasive alien species, etc.). Networks of MPAs could be used as sentinels of climate changes: the continuous monitoring of specific physical-chemical parameter, coupled with ecological monitoring, will be key to detect early responses to climate change. A specific action addressed to climate change monitoring is included in the JNMR Management Plan

Actors:

JNMR Rangers and Scientific partners

Methodology:

The following physical-chemical parameters will be monitored continuously: water temperature; pH.

The sensors or probes or other appropriate devices will be located at one of the demarcation buoys, at three depth level (superficial, intermediate and bottom) and will transmit the data in real time to a station for recording. Other relevant information (e.g., biological, phenological, or community shifts, spread of invasive alien species, mass mortality, jellyfish blooms) will be extrapolated from the following actions of the Management Plan: Monitoring of fishing activity; Benthic Habitat monitoring; Monitoring of Birds, Turtles and cetaceans; Visual Census of fish species; Monitoring of non-indigenous species.

Expected results

- Eventual signals of climate change

Associated Actions:

- Installation and maintenance of demarcation buoys
- Other biological monitoring

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
*	*	*

* To be defined according to technical feasibility

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity
To be defined after the installation of the demarcation buoys					Continuous

Reporting

A report will be produced once a year. The report will analyse the recorded water temperature and pH data as well as relevant biological parameters possibly linked to climate change.

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

D-1

Operational Objective

4- Improve the scientific knowledge about the biodiversity and the functioning of deep-sea ecosystems, in particular in the zones covered by the JNMR and in the neighbouring areas beyond 1000 meters depth.

Official request of bathymetric data to Lebanese Navy

Rationale:

Bathymetry is one of the parameters that influence marine biodiversity since it is a key element for the distribution of habitats and species. It is also important for defining the zoning of MPAs as well as the intervention approaches of the manager who must adapt the techniques and equipment used to the depths and the morphology of the zones. Accurate bathymetry maps are also useful for many users of the marine environment as well as for the design of coastal development and the assessment of their impacts.

Actors:

The Ministry of Environment

Methodology:

The most recent bathymetric survey, obtained with a multi beam echo sounder, is available from the Lebanese Navy. An official request should be done by the Ministry of Environment to acquire the bathymetry of the area comprised within the JNMR including the Conservation zone, the Controlled Management zone and the Buffer zone.

The bathymetry should be requested in appropriate formats (e.g.: Shapefile, CAD) with the most precise definition and, if possible, also the raw data (in .xyz format) should be asked to be attached. Technical specifications of the equipment should be attached to the bathymetry with information on when the survey has been performed and the parameters used to set the instruments.

Lastly, the cover of the bathymetry in the study area should be compared with the extension of the MPA and, if a part of the MPA was not comprised (e.g.: coastal zones), the D-2 Action should be performed.

Expected results

- Accurate bathymetry maps
- 3-D bathymetric maps showing the underwater relief, in particular the canyon shape

Associated Actions:

- Habitat mapping
- Installation boundary marking buoys
- Bathymetric survey

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity
					N/A

Reporting

Methodological reporting; printed and digital version of the maps; GIS layers

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

D-2

Operational Objective

4- Improve the scientific knowledge about the biodiversity and the functioning of deep-sea ecosystems, in particular in the zones covered by the JNMR and in the neighbouring areas beyond 1000 meters depth.

Optional - Bathymetric Survey of uncovered zones (if any)

Rationale:

Bathymetry is one of the parameters that influence marine biodiversity since it is a key element for the distribution of habitats and species. It is also important for defining the zoning of MPAs as well as the intervention approaches of the manager who must adapt the techniques and equipment used to the depths and the morphology of the zones. Accurate bathymetry maps are also useful for many users of the marine environment as well as for the design of coastal development and the assessment of their impacts.

Actors:

The management team (in collaboration with specialized agencies or subcontracting firms)

Methodology:

If the bathymetry obtained from the Lebanon Navy (reference to D-1) did not cover all the MPA a bathymetric survey of the uncovered zones should be performed.

Many methods are available for bathymetric surveys, most of them use single beam and/or multibeam echosounders coupled with the use of Differential Global Positioning Systems (D-GPS) and dedicated software.

Given the seabed features in the area of the JNMR it is recommended to carry out the bathymetry survey along survey lines orthogonal to the coast and take into account the wide range of depth. The equipment required to perform the survey should be, at minimum, a digital single beam echo-sounder operating at dual frequency (200 and 30 kHz) and compliant with the IHO Standards for Hydrographic Surveys. In case a single beam echo-sounder is used, the total coverage can't be assured and to limit the extension of the interpolation a survey design including an appropriate line spacing should be defined. In case a multibeam is used the total coverage of the area can be assured.

Expected results

- Accurate bathymetry maps
- 3-D bathymetric maps showing the underwater relief, in particular the canyon shape

Associated Actions:

- Habitat mapping
- Installation boundary marking buoys

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity
					N/A

Reporting

Methodological reporting; printed and digital version of the maps; GIS layers

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

D-3

Operational Objective

4- Improve the scientific knowledge about the biodiversity and the functioning of deep-sea ecosystems, in particular in the zones covered by the JNMR and in the neighbouring areas beyond 1000 meters depth.

Mapping of the key habitats in the Controlled management zone and in the Buffer zone

Rationale:

The map of marine habitats is the most important and powerful tool to foster the conservation and the spatial planning of marine areas. It is a key element for defining the zoning of MPAs as well as the management of the MPAs that must be compliant with different habitat typologies and sensitivity.

Actors:

The scientific partners (in collaboration with specialized agencies or subcontracting firms)

Methodology:

The whole Action is subdivided in two phases. During the **first phase** geophysical surveys should be performed (or collected if already available) to draw up a full coverage preliminary map based on:

- Bathymetric data (see Actions D1 and D2) and/or
- Side scan sonar (SSS) investigations especially in the areas characterized by flat bottom with presence of outcrops¹.

For bathymetric data acquisition see Actions D1 and D2, the SSS methodology is explained below.

Given the seabed features in the area of the JNMR it is recommended to carry out the SSS investigations along survey lines parallel to the coast. In order to obtain the full coverage of the investigated area and enough resolution for the habitat mapping, a standard maximum lateral range no larger than 150 m for each channel is recommended, and the data should be recorded in double frequency (e.g. about 100 kHz and 400 kHz). In the identified high valuable zones an in-deep SSS survey with a smaller range could be carried out. The different grey levels and textures of the preliminary map will be related to different types of substrates and the preliminary sonar data interpretation will provide several information, as well as uncertain points, that will be checked during the second phase (ground-truthing).

During the **second phase** direct verifications of the data provided by the SSS should be carried out on the field (**ground-truthing**). The data collected will allow to assess the correct interpretation of acoustic data and will resolve eventual doubts concerning the characteristics of the seabed in the study areas. Depending on the habitat and seabed substrate, different techniques should be adopted:

- The hard substrates should be studied by using an underwater towed camera, ROV and scuba diving (in the shallower zones);
- A Van Veen grab is suggested to sample and characterize the soft bottoms communities.

It is expected the production of a final habitat map with a resolution between 1:5.000 and 1:10.000 according to the data quality and the available budget. Moreover, it is recommended the preparation of a GIS and a WebGIS project, producing geographical layers (e.g., habitat map, geomorphological maps, eventual detailed maps of the ecological communities / Facies / Associations in areas of particular importance, etc).

¹ SSS surveys performed on vertical walls or zones characterized only by hard substrata are critical: they usually give poor results and the risk to lose the towfish is high.

Expected results

- Baseline knowledge about the distribution of benthic habitats
- Accurate habitat map (resolution between 1:5.000 and 1:10.000)
- GIS layers

Associated Actions:

- Official request of bathymetric data to Lebanese Navy and /or bathymetric Survey
- Geographic Information System

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
	X	X

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity
					N/A

Reporting

Methodological reporting; printed and digital version of the maps; GIS layers

JOUNIEH NATURE MARINE RESERVE (JNMR) MANAGEMENT WORK PLAN

Action Ref

D-4

**Operational
Objective**

4- Improve the scientific knowledge about the biodiversity and the functioning of deep-sea ecosystems, in particular in the zones covered by the JNMR and in the neighbouring areas beyond 1000 meters depth.

Mapping of the key habitats in the Conservation Zone

Rationale:

The map of marine habitats is the most important and powerful tool to foster the conservation and the spatial planning of marine areas. It is a key element for defining the zoning of MPAs as well as the management of the MPAs that must be compliant with different habitat typologies and sensitivity.

Actors:

The scientific partners (in collaboration with specialized agencies or subcontracting firms)

Methodology:

The whole Action is subdivided in two phases. During the **first phase** geophysical surveys should be performed (or collected if already available) to draw up a full coverage preliminary map based on:

- Bathymetric data (see Actions D1 and D2) and/or
- Side scan sonar (SSS) investigations especially in the areas characterized by flat bottom with presence of outcrops².

For bathymetric data acquisition see Actions D1 and D2, the SSS methodology is explained below.

Given the seabed features in the area of the JNMR it is recommended to carry out the SSS investigations along survey lines parallel to the coast. In order to obtain the full coverage of the investigated area and enough resolution for the habitat mapping, a standard maximum lateral range no larger than 100 m for each channel is recommended, and the data should be recorded in double frequency (e.g. about 100 kHz and 400 kHz). In the identified high valuable zones an in-deep SSS survey with a smaller range could be carried out. The different grey levels and textures of the preliminary map will be related to different types of substrates and the preliminary sonar data interpretation will provide several information, as well as uncertain points, that will be checked during the second phase (ground-truthing).

During the **second phase** direct verifications of the data provided by the SSS should be carried out on the field (**ground-truthing**). The data collected will allow to assess the correct interpretation of acoustic data and will resolve eventual doubts concerning the characteristics of the seabed in the study areas. Depending on the habitat and seabed substrate, different techniques should be adopted:

- The hard substrates should be studied by using an underwater towed camera, ROV and scuba diving (in the shallower zones);
- A Van Veen grab is suggested to sample and characterize the soft bottoms communities.

It is expected the production of a final habitat map with a resolution between 1:2.000 and 1:5.000 according to the data quality and the available budget. Moreover, it is recommended the preparation of a GIS and a WebGIS project, producing geographical layers (e.g., habitat map, geomorphological maps, eventual detailed maps of the ecological communities / Facies / Associations in areas of particular importance, etc).

² SSS surveys performed on vertical walls or zones characterized only by hard substrata are critical: they usually give poor results and the risk to lose the towfish is high.

Expected results

- Baseline knowledge about the distribution of the benthic habitats in the Conservation Zone
- Accurate habitat map (resolution between 1:2.000 and 1:5.000)
- GIS layers

Associated Actions:

- Official request of bathymetric data to Lebanese Navy and /or bathymetric Survey
- Geographic Information System

Application zone(s)

Conservation area	Controlled management zone	Buffer zone
X		

Timing

Year 1	Year 2	Year 3	Year 4	Year 5	Periodicity
To be done as soon as possible according to the availability of financial resources.					N/A

Reporting

Methodological reporting; printed and digital version of the maps; GIS layers

APPENDIX D

**Terms of reference and job
description of key staff members
of the Management Team of the
JNMR**

Terms of Reference for the Director of JNMR

Duties and Responsibilities

Under the authority of the President of the JNMR Committee, the Director supervises the MPA team to carry out the activities needed for the implementation of the management plan. Its main functions are:

- Design, planning and implementation of the work program of the JNMR team
- Ensure the management of the JNMR budget in accordance with the relevant regulation in force
- Take the necessary measures to ensure the legality and consistency of all actions undertaken by the MPA team as well as the security of the staff
- Ensure the maintenance of the equipment and materials of the reserve
- Assist the JNMR committee in defining the strategies and main orientations of the MPA and in particular in the periodic review of the management plan
- Elaborate the reports required by the JNMR Law for submission to the Committee for approval
- Develop funding requests as decided by the Reserve Committee
- Liaise, in coordination with the President of the JNMR Committee, with the partners of the MPA and stakeholders

Required skills and experience

The minimum key skills and expertise required for the post of the JNMR Director shall cover the following:

Education: Minimum University degree in relation to Integrated Coastal Zone Management, Administration management, Environmental Law, Marine biology or a related subject

Professional Experience: At least 5 years' experience in environmental fields, natural site conservation

Languages: Fluency in Arabic and English, fluency or working level in French is an asset.

Computer skill: Basic proficiency with office software is a requirement. Proficiency with GIS and database software is an asset.

Other qualifications:

Experience in liaising with stakeholders

Experience in project formulation and design of projects and funding requests

Knowledge of the approaches used for the management of protected areas



United Nations
Environment Programme



Mediterranean Action Plan
Barcelona Convention



*The Mediterranean
Biodiversity
Centre*

Specially Protected Areas Regional Activity Centre (SPA/RAC)
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