Mainstreaming biodiversity conservation in Lebanon

Guidelines for environmental impact assessment for projects affecting marine and coastal areas

Ricardo Khoury, Perla Atiyah, Dima Alhaj, Manal Nader, Dania Ismail

International Union for Conservation of Nature - Regional Office for West Asia

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ACCOBAMS	The Agreement on the Conservation of Cetaceans of the Black Sea Mediterranean Sea and contiguous Atlantic area
AEWA	Agreement on the Conservation of African-Eurasian Migratory
AGDS	Water Birds Acoustic Ground Discrimination Systems
BOP	Blowout Preventer
BTU	A British Thermal Unit
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNRS	Centre National de la Recherche Scientifique
CoM	Council of Ministers
CTD	Conductivity, Temperature and Depth
dB	Decibel
ECC	Environmental Compliance Certificate
EIA	Environmental Impact Assessment
ELARD	Earth Link and Advanced Resources Development
ELCA	East Levantine Canyon Area
EMP	Environmental Management Plan
ERP	Emergency Response Plan
ES	Environmental Statement
EU	European Union
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GFCM	General Fisheries Commission for the Mediterranean
GHG	Greenhouse Gases
GPS	Geographic Positioning System

HAZID	The Hazard Identification
HAZOP	The Hazard Operability
HPWBDF	High-Performance Water-Based Drilling Fluid
HSI	Habitat Suitability Index
ICZM	Integrated Coastal Zone Management
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IFC PS6	International Finance Corporation Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living
IMDG	Natural Resources International Maritime Dangerous Goods
IMO	International Maritime Organization
ISO	International Organization for Standardization
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unreported and Unregulated
LBS	Land-Based Sources
LiDAR	Light Detection and Ranging
MAP	Mediterranean Action Plan
MARPOL	The International Convention for the Prevention of Pollution from Ships
MBES	Multi-beam Echo-Sounder
MedMPA	Mediterranean Marine Protected Areas
MOA	Ministry of Agriculture
MODU	Mobile Offshore Drilling Unit
MoE	Ministry of Environment
MoEW	Minister of Energy and Water
MoPWT	Ministry of Public Works and Transport
MoT	Ministry of Tourism
MPA	Marine Protected Areas

NBSAP	National Biodiversity Strategy and Action Plan
NCMS	National Center for Marine Sciences
NEBA	Net Environmental Benefit Analysis
NEL	Noise Emission Labels
NERC	National Emergency Response Committee
NG	Net Gain
NGO	Non-Governmental Organization
NIS	Non-indigenous Species
NMBAQC	Northeast Atlantic Marine Biological Analytical Quality Control
NNL	No Net Loss
NOSCP	National Oil Spill Contingency Plan
NPI	Net Positive Impact (net gain)
NSEQ	National Standards for Environmental Quality
OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation
PINR	Palm Island Nature Reserve
POPs	Persistent Organic Pollutants
PSA	Particle Size Analysis
RAC/ SPA	Regional Activity Centre for Specially Protected Areas
SAR	Synthetic Aperture Radar
SDGs	Sustainable Development Goals
SISPAM	Stable Institutional Structure for protected Areas Management
SOER	State and Trends of the Lebanese Environment
SOPEP	Shipboard Oil Pollution Emergency Plan
SPA/BD	Specially Protected Areas and Biological Diversity
SPAMIs	Specially Protected Areas of Mediterranean Importance
SR	Scoping Report

SS	Suspended Solids
SSC	Suspended Sediment Concentrations
TCNR	Tyre Coast Nature Reserve
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization Vertical
VSP	Vertical Seismic Profile
WBDF	Water-Based Drilling Fluid

Abstract

There is wide recognition that biological diversity is a major component of our natural environment. Despite this consensus, biodiversity is being lost globally at an alarming rate. One of the most important drivers of this trend is habitat loss, fragmentation, and degradation caused primarily by poorly-planned development, in combination with other stressors (i.e. unsustainable extraction practices, pollution, non-indigenous species, and climate change). In light of these conditions, there is a need to track, predict, minimize or prevent further negative changes to biodiversity.

Environmental Impact Assessment (EIA), a tool best suited for integrating environmental considerations into the planning of developments, provides opportunities for generating biodiversity data at a site, integrating biodiversity components with development objectives, and preventing biodiversity loss. In this context, IUCN, in partnership with the Ministry of Environment (MoE) of Lebanon and with the support of the United Nations Environment Programme (UNEP) and the Global Environment Facility (GEF), has carried out this activity aiming at the formulation of EIA guidelines designed to strengthen the mainstreaming of biodiversity conservation in the EIA process for development projects affecting marine and coastal ecosystems in Lebanon in order to prevent biodiversity loss along the coastal zone and marine areas of Lebanon.

Although all coastal development projects in Lebanon typically require an EIA, biodiversity has rarely been given specific or appropriate consideration in the EIA process. The objective of this report is to present guidelines that specifically address biodiversity inclusion in EIA studies. For each phase of the EIA process (screening, scoping, and impact assessment), the report outlines current procedures and recommends new steps to be integrated, if/when a biodiversity-inclusive EIA is required. The report also includes a checklist to serve as a tool for the MoE site inspections of coastal establishments. The checklist specifically addresses (direct and indirect) impacts to biodiversity, as well as relevant mitigation and monitoring practices.

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01.

Introduction

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1. Introduction

1.1 Defining biodiversity

Biodiversity is "the variability among living organisms, from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species (genetic biodiversity), between species (species biodiversity) and of ecosystems (ecosystem biodiversity)" [Convention on Biological Diversity (CBD); United Nations, 1992]. More broadly, biodiversity refers to the variety of all species and habitats within an ecosystem, rather than simply the number of taxa present.
There is a clear relationship between the degree of biodiversity and the overall productivity and health of an ecosystem. Hence, protecting biodiversity has positive environmental and economic implications.

1.2 Main threats to marine biodiversity

This report focuses entirely on Lebanon's marine and coastal areas, where biodiversity of aquatic species and habitats is considered rich, but highly vulnerable to anthropogenic activity (NCRS, 2016).

The main threats to Lebanon's biodiversity are the following:

1. Habitat loss, fragmentation, and degradation

Changes to habitats are the main causes for ecosystem and species decline, given that habitats provide species with all the required elements of their ecological niches. Habitats can be:

- Completely destroyed/eliminated (Habitat loss);
- Restructured in a way that interferes with a species' access to food, shelter, and reproduction (Habitat fragmentation); or
- Degraded to sub-optimal conditions (i.e. the selective removal or alteration of a critical habitat component, hydrological changes of the natural flow regimes, changes in water temperature, etc.).

Examples of development activities that impact habitats along coastal and marine zones include the construction of beach resorts, ports, marinas, industries, pipeline installations, and seafilling/land reclamation activities.

2. The exploitation of natural resources

Overfishing, or the practice of extracting marine resources faster than their replenishment rate, is a major driver in the population decline of several marine species.
This not only affects specific species by pushing them to their biological limits, but also disrupts their complex food chains within an ecosystem. Overfishing can also lead to the loss of species not intended for commercial use (bycatch). Fishing methods can also contribute to species loss. While most of Lebanon's fisheries are small-scale and based on artisanal fishing techniques, illegal and destructive practices (i.e. illegal mesh size, blast fishing) still exist.

3. Pollution

Pollution of marine waters causes serious harm to both species and their habitats. Potential sources of contamination include:

- Illegal dumping of municipal and industrial solid waste
- Release of untreated municipal and industrial waste water
- Oil spills
- Discharge of ballast water from ships
- Agricultural runoff leading to eutrophication
- Air Pollution leading to acidification
- Noise pollution
- Light pollution
- Plastics and other marine debris
- Abandoned, discarded, or lost fishing gear
- Ports and marinas

4. Non-indigenous species

Non-indigenous species (NIS) are non-native species, introduced either intentionally or accidentally (i.e. through the discharge of ballast waters) into local waters. They can threaten biodiversity by displacing native, endemic species, disrupting ecosystem structures and food webs (increased predation and competition for resources). NIS can quickly dominate the area where they have been introduced, making their removal difficult.

5. Climate change

There is clear evidence that the concentration of greenhouse gases (GHGs) in the atmosphere has been increasing exponentially, resulting in global climate change. In Lebanon, the industrial sector, electricity supply chains (i.e. generators), and high concentration of transportation vehicles have contributed to the release of these GHGs.

Climate change can have serious implications on the feeding, breeding, and development of marine species. These include:

- Rising sea levels that drown intertidal habitats, increase water depth, and lead to erosion;
- Rising water temperatures resulting in some species- those unable to adapt - to either migrate or die off (i.e.coral bleaching);
- Higher temperatures also mean a higher absorption rate of atmospheric carbon,leading to ocean acidification; and
- Extreme weather events along coastal zones causing flooding, erosion, and disturbances to habitats important for reproduction and growth (i.e. seagrassbeds).

1.3 Marine biodiversity in Lebanon: current status

1.3.1 General overview

Lebanese waters represent less than 1% of the world's ocean surface, but almost 6% of all global marine species (SOER, 2010). Due to their significance, marine ecosystems and associated biodiversity are relatively well studied in Lebanon. Within the framework of the UNEP Mediterranean Action Plan (MAP) under the Barcelona Convention for the Protection of the Mediterranean Sea against Pollution and specifically within the context of the "Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean, "the Government of Lebanon (GoL) and the Ministry of Environment (MoE) prepared the National Report on Coastal &Marine Biodiversity, under the SAP-BIO Programme executed by UNEP/ MAP/ SPA/ RAC (2002, and currently in the process of updating in 2020). The 2002 Report highlights five targeted action plans:

1. Permanent monitoring of coastal and marine biodiversity
2. Determination of the physical parameters of the Lebanese marine environment
3. Organizing awareness campaigns for the Lebanese coastal communities and the public sector
4. Legislation related to coastal and marine biodiversity
5. Establishment of conservation strategies for coastal habitats

1.3.2 Important biodiversity areas

Lebanon continues to conduct marine studies in an effort to better understand the status of its waters. A first step is the identification of important biodiversity areas. There are currently three coastal and marine protected areas (MPAs) in the country: the Palm Islands Nature Reserve (PINR), the Tyre Coast Nature Reserve (TCNR) and recently the Abbassieh Coast Nature Reserve. The PINR was established under Law no. 121 of 9/3/1992; the TCNR was established by Law no. 708 of 5/11/1998. It should be mentioned that Law 708/1998 defines the TCNR borders till the territorial waters parallel to the beach. As for the Abbassieh Coast Nature Reserve, it was established by Law no. 170 of 8/5/2020.

Alternatively, the Ramsar Convention listed four Lebanese sites as wetlands of international importance, of which three are coastal, namely: Promontory cape and cliffs of Ras Chekaa, PINR and TCNR, including Ras El Ain springs.

The Ministry of the Environment (MoE), along with the IUCN, and UNEP/MAP/SPA/RAC, has prepared "Lebanon's Marine Protected Areas Strategy" (2012) which recommends the establishment of 14 MPAs, in addition to four MPAs in the deep-sea and a programme to evaluate their management. Figure 1-1 presents existing and proposed marine protected areas in Lebanon. Table 1-1 lists the proposed sites as reported in the MPA strategy.

Table 1-1 Proposed MPAs as per the MPA strategy (MoE/IUCN, 2012)

#	Site	Quality and importance
1	Nakoura	The Nakoura site is unique for vermetid platforms of relatively small size; rocks and coralligeneous concretions at shallow depths; crevices and overhangs common; soft bottom areas of small sizes occasionally present in patches. The site provides nurseries, spawning and feeding grounds.
2	Sidon Rocks	Islets of rocks and vermetid reefs in the vicinity of Saida. A beach composed of gravel found nearby as well as the estuary of the Awali River. Hard bottom in shallow areas and surrounded by a sandy soft bottom. Saida (Sidon) includes an archaeological and historic features site that was nominated (1984) as a UNESCO World Heritage Site. Very low biodiversity, dominated by introduced species.
3	Raoucheh Cliffs and Caves	Beautiful limestone cliffs area with two large standing rock formations (Pigeons' Rocks). Shallow hard underwater bottoms extending over most of the area. Soft bottoms found at greater depths. Archaeological and historic site and a popular tourist destination (scale bar 250m).
4	Beirut Port Outer Platform	Artificial site composed of a long jetty (>2km) that protects the port of Beirut. Concrete structures as well as rocks and boulders of various sizes create artificial caves and crevices which act as an artificial reef.
5	Byblos	Large vermetid reefs with significant ponds. A beach composed of gravel is found north of the area and the Byblos historic port lies to the south. Hard bottom found in shallow areas and soft bottom with a seagrass meadow dominates deeper waters. Archaeological and historic features.
6	Medfoun Rocky Area	Rocky area with moderate cliffs. Hard underwater bottoms with occasional soft bottom patches. This area could be considered as partly protected since it lies within a military area.
7	Batroun Phoenician Wall	Rocky area with important vermetid reefs and hard underwater bottoms. Shallow hard underwater bottoms extend over most of the area. Soft bottoms found at greater depths. Archaeological and historic site and a popular tourist destination. A historic wall is believed to have been erected by the Phoenicians for protection from waves.
8	Ras El Chekaa Cliffs	Limestone cliffs area with hard underwater bottoms and caves. Landscape and seascape with cultural and religious importance.
9	Enfeh Peninsula	Limestone rocks and vermetid reefs forming a peninsula. Shallow hard underwater bottoms; soft bottom in deeper waters. Archaeological and historical site.
10	Litani Estuary	The Litani River is an important water resource in southern Lebanon. Exceeding 140 km in length, it is the longest river in Lebanon and provides an average annual flow estimated at 920 million cubic meters. The waters of the Litani both originate and flow entirely within the borders of Lebanon. The site is important for fisheries, and in relation to the presence of marine turtles and seagrass meadows. The habitat, a combination of physical features and living organisms that provide food, nesting, resting and shelter for fish and wildlife, has recently experienced significant changes in benthic community structure, possibly as a result of anthropogenic activity. The potential of the site for restoration is therefore apparent. Being a distinct topographic entity, identification of the Litani estuary as a protected area with defined boundaries is relatively straightforward.

#	Site	Quality and Importance
11	**Awali Estuary**	The Awali is a perennial river flowing in Southern Lebanon. It is 48 kilometers long, originating from the Barouk Mountain at a height of 1,492 meters and the Niha Mountain. The Awali is supplemented by two tributaries, the Barouk and Aaray Rivers. The Awali is also known as the Bisri River in its upper section; it flows through the western face of Mount Lebanon and into the Mediterranean. The Awali River has a discharge of 10.1625 m3/s , it forms a watershed with an area of about 294 km2. The Awali river estuary is important in terms of fisheries and seagrass meadows. Habitat is a combination of physical features and living organisms that provide food, nesting and resting areas, and shelter for fish and wildlife.
12	**Damour Estuary**	The site is characterized by a sandy bottom area with seagrass meadow in patches. The estuary is a nursery, spawning and feeding ground for numerous species. The green turtle *(Chelonia mydas)* has been recorded in this site.
13	**Nahr Ibrahim Estuary**	The site is characterized by a sandy bottom area with seagrass meadow in patches. The estuary is a nursery, spawning and feeding ground for numerous species. The green turtle *(Chelonia mydas)* has been recorded here.
14	**Areeda Estuary**	The site is characterized by a sandy bottom area with seagrass meadow in patches. The estuary is a nursery, spawning and feeding ground for numerous species. The green turtle *(Chelonia mydas)* has been recorded here.

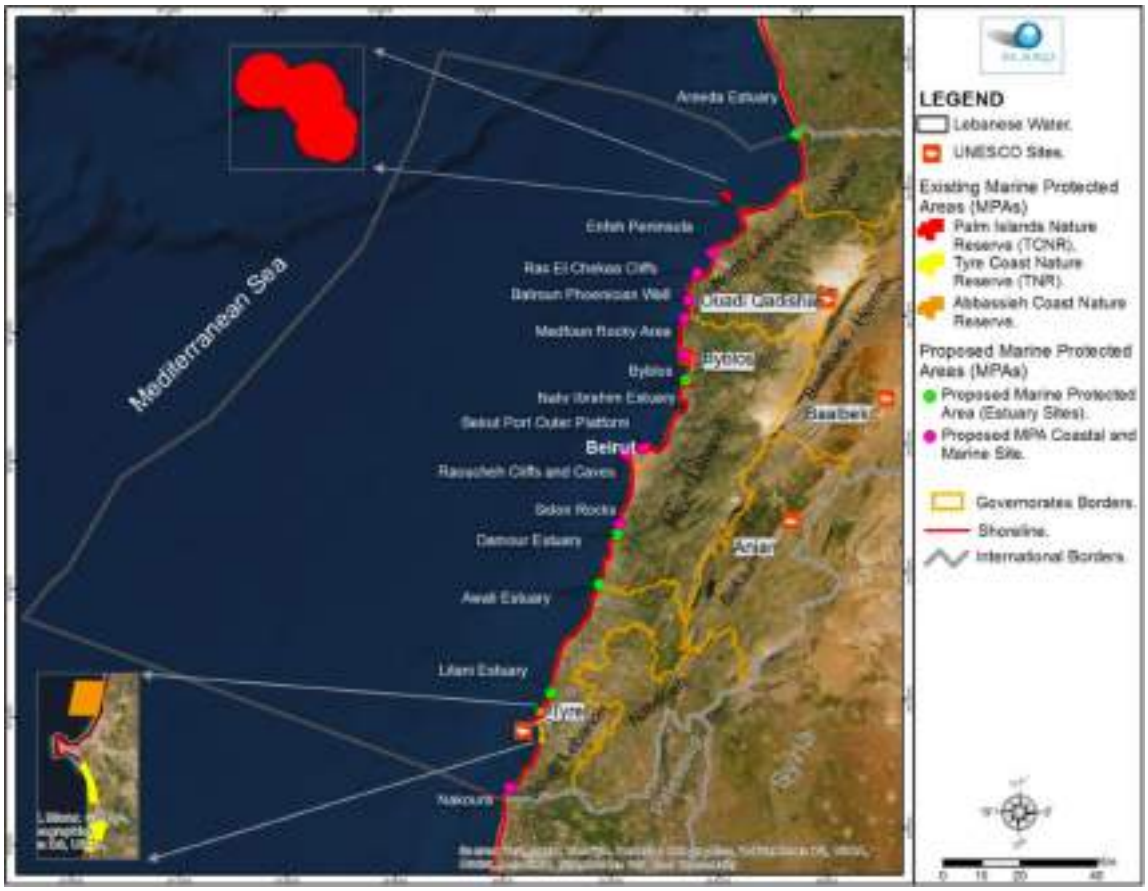

Figure 1-1 Existing and proposed Marine Protected Areas (MPAs)
Source: MoE/IUCN, 2012

As part of the Environmental Resources Monitoring Project in Lebanon (ERML) (MoE/UNEP/ UOB, 2013), the status of Coastal Sensitive Areas in Lebanon was assessed. The assessment aimed at preparing a database of natural and cultural heritage sites. Geographical, biological and cultural features, the existing and potential stresses, and current conservation status were all considered as parameters for the identification of the main coastal and marine sensitive sites. The most sensitive were then evaluated based on the criteria developed by the CBD and UNESCO-World Heritage Center (WHC). Consequently, priority ranking from the most to the least sensitive was given. Figure 1-2 presents the high priority sites[1,2].

Recommendations concerning the high priority sites emphasized the need for their immediate protection and management through a precautionary approach. In addition, high and medium priority sites were identified as hotspots for preservation and restoration whenever possible or feasible.

[1]Priority was designated based on the ranking and weighing of ecological criteria (representativeness, importance for threatened/ endangered species and/or habitats, high diversity, uniqueness, importance for life history stages of species or for migratory species, naturalness, connectivity, high biological productivity, vulnerability, international/national importance, scientific and aesthetic importance, threats/risk, resilience, etc.) and cultural criteria (cultural and traditional uses, ingenuity, heritage, indirect cultural value, etc.)

[2]This map has been adapted by ELARD from the ERML document.

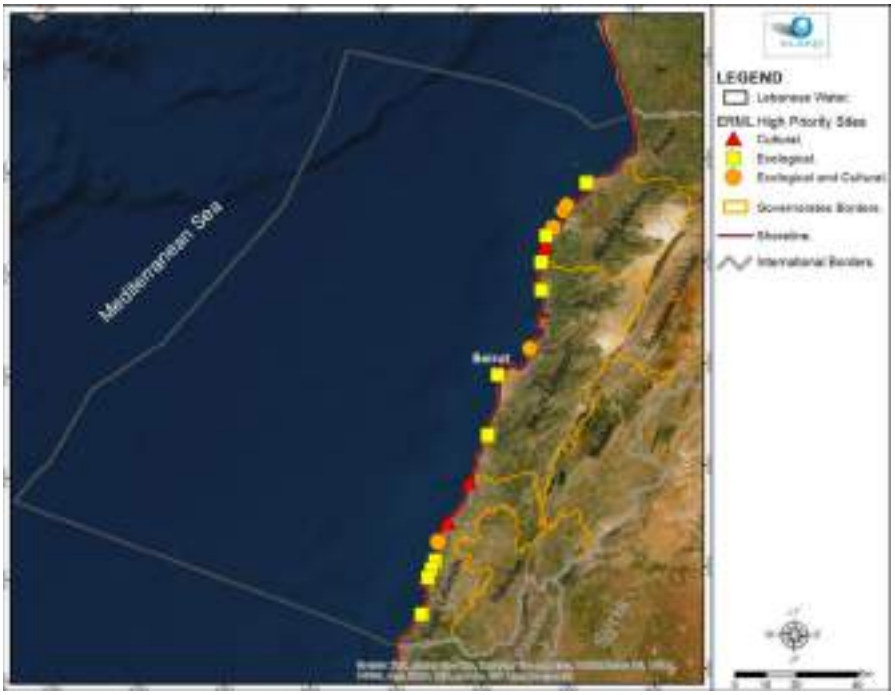

Figure 1-2 ERML high priority sites map
Source: MoE/UNEP/UOB, 2013

Through the MedMPAnet Project implemented by UNEP/MAP/SPA/RAC, the following proposed MPAs in Lebanon were assessed (through field surveys) for conservation purposes in terms of biodiversity, habitats, interesting species, fish populations and naturalness: Enfeh, Ras Chekaa, and Raoucheh (2012), followed by Saida, Tyre and Nakoura (2013).A 2014 report issued the results of these field surveys and determined the following:

- Ras Chekaa has some pristine areas which merit an integral protection.

- The underwater rocky outcrops from northern Tyre, between 30-50m depth, due to the rarity and the presence of interesting habitats (cold and hot freshwater springs, coralligenous, maerl beds), must be protected.

- The Nakoura zone, Ras El Bayada represents a pristine area which merits an integral protection (littoral cave, cold freshwater springs, and relatively high fish biomass).

- Raoucheh shows an impressive landscape with important marine caves and tunnels. This area is small and rounded by the city of Beirut; the adequate protection figure would be Natural Monument.

- Due to the high human presence in Enfeh and Tyre, an integral protection area would be inoperative. In these cases, the buffer zone could be operative, permitting some regulated uses (fishing, tourism) and applying mitigation measures to the human impacts (i.e. sewage treatment, selective fishing methods, no marinas). In the case of the Tyre Coast Nature Reserve, a buffer zone could reinforce the protection of this important area for turtle nesting.

- Despite the important cultural value, Saida is a very densely populated area, the establishment of a MPA would not be feasible here. Nevertheless, the multi-use zone could be applied with an integrated coastal zone management.

Based on another project conducted by UNEP/ MAP/SPA/RA-C under the MedMPA Network in 2016, sites in Batroun, Medfoun and Byblos were assessed for conservation through field surveys. The study proposed the establishment of two management areas in the North (see Figure 1-3):

- Batroun-Medfoun (together with Kfar Abida): Between Ras Selaata (north) and Ras Barbara

- Byblos: Between Ras Amchit (north) and Fidar (south)

Figure 1-3 Proposed zones for protection: (A) Batroun-Medfoun and (B) Byblos
Source: SPA/RAC, 2016

Proposed deep sea sites

Deep canyons characterize the continental slope of the Lebanese coast. Almost 518 large submarine canyons have been identified in the Mediterranean Sea and are considered as key structures for its ecosystem functioning. Submarine canyons are steep-walled, sinuous valleys, with V-shaped cross sections and relief comparable even to the largest of land canyons. Because they play a fundamental role in "Deep Oceans-Shelf Exchanges," submarine canyons can be defined as "super highways," allowing the energy turnover to speed up by reducing the time and the distances covered by water masses, organic and inorganic sediments, benthonic and nektonic organisms during their active or passive movements from shallow to deeper waters and vice-versa.

Within this context, a workshop was organized by the Convention on Biological Diversity (CBD) in Spain (2014) to define Ecologically and Biologically Significant Areas (EBSAs) for the Mediterranean. At the workshop, Lebanon suggested the establishment of an EBSA for the East Mediterranean under the title of East Levantine Canyon Area (ELCA).

The criteria for site selection included:

- C1: Uniqueness or rarity
- C2: Special importance for life-history stages of species
- C3: Importance for threatened, endangered or declining species and/or habitats
- C4: Vulnerability, fragility, sensitivity, or slow recovery
- C5: Biological productivity
- C6: Biological diversity
- C7: Naturalness

In addition to its biological importance, the ELCA is featured by its deep canyons all along the Lebanese and Syrian coasts, several hydrothermal vents, and submarine freshwater springs (IUCN 2012; Nader, 2012; Bariche, 2006).For example, the Turgut Reis Seamount that lies between Turkey, Syria, Lebanon and Cyprus, is still a host for virgin stocks of deep sea shrimps such as *Palaemon longirostris, Plesionika martia, Aristaeomorpha foliacea, Aristeus antennatus* (Würtz M. (ed.), 2012). This area is also on the migration routes of bluefin tuna and other tuna species.

The ELCA met the criteria as presented below.

Location and brief description of area	C1	C2	C3	C4	C5	C6	C7
The East Levantine Canyons is located all along the Lebanese and Syrian coastline. The East Levantine Canyons is a system composed of deep canyons, as well as hydrothermal vents and submarine freshwater springs, and is of particular biological importance. The coastal areas of the eastern Mediterranean host one of the largest areas of Opistho branch formations, and its waters experience the highest winter temperatures, allowing it to act as a refuge and spawning ground for many biologically important species of chondrichthyes, marine mammals, reptiles, and teleosts (many of which are listed as vulnerable/endangered on the IUCN Red List).	H	H	H	H	-	H	M

According to the declaration by the GFCM (in agreement with all Mediterranean countries), a Fishery Restricted Area has been declared, banning trawling activities for all the Mediterranean in depths superior to 1,000 m. Inside Lebanon's territorial waters, this area represents about 1,240 km2, including four specific features, as described by Oceana (2010) (further validating the importance of the ELCA), namely:

- Beirut Escarpment
- Saint Georges Canyon
- Jounieh Canyon
- Sayniq Canyon

Based on the Oceana study, and upon request by the MoE, a deep-sea expedition was undertaken in 2016 as part of the "The Deep-Sea Lebanon Project," funded by MAVA Foundation, a partnership between Oceana, IUCN and UNEP/MAP-SPA/RAC, on behalf of the MoE with the support of CNRS-L, GFCM and ACCOBAMS. Through this expedition the following five canyons were surveyed: Beirut Escarpment (Ouzai), Saint Georges Canyon, Jounieh Canyon, Sayniq (Saida) Canyon, and Chekka- Batroun Canyon.

The expedition documented more than 200 species, including new records for the Mediterranean Sea. It confirmed the presence of "a superb belt of coralligenous gardens discovered at 80 meters depth, beautiful corals, and a huge variety of sponges." The long-nosed skate (*Dipturus oxyrinchus*) was seen for the first time in the Levantine Sea, and observations of lantern shark (*Etmopterus pusillus*) marked the first record of this species in the Mediterranean. These findings should help in the declaration of the four identified deep-sea sites as MPAs.

The areas of conservation interest based on Oceana 2016 expedition are presented in Figure 1-4.

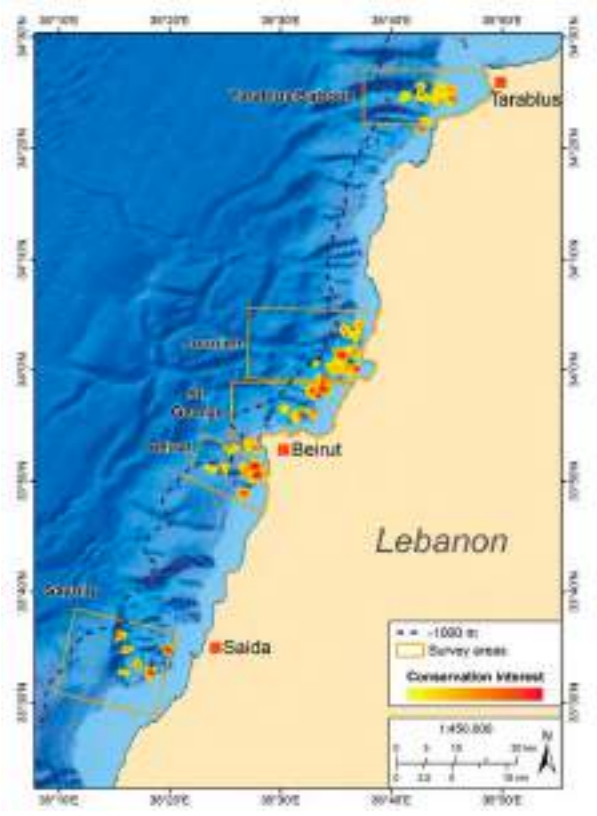

Figure 1-4 Areas of conservation interest based on Oceana 2016 expedition in Lebanese waters
Source: Aguilar et al. (2018)

Figure 1-5 presents areas of conservation interest and their ranking based on the different surveys and studies conducted as part of by Deep-Sea Lebanon Project (2016).

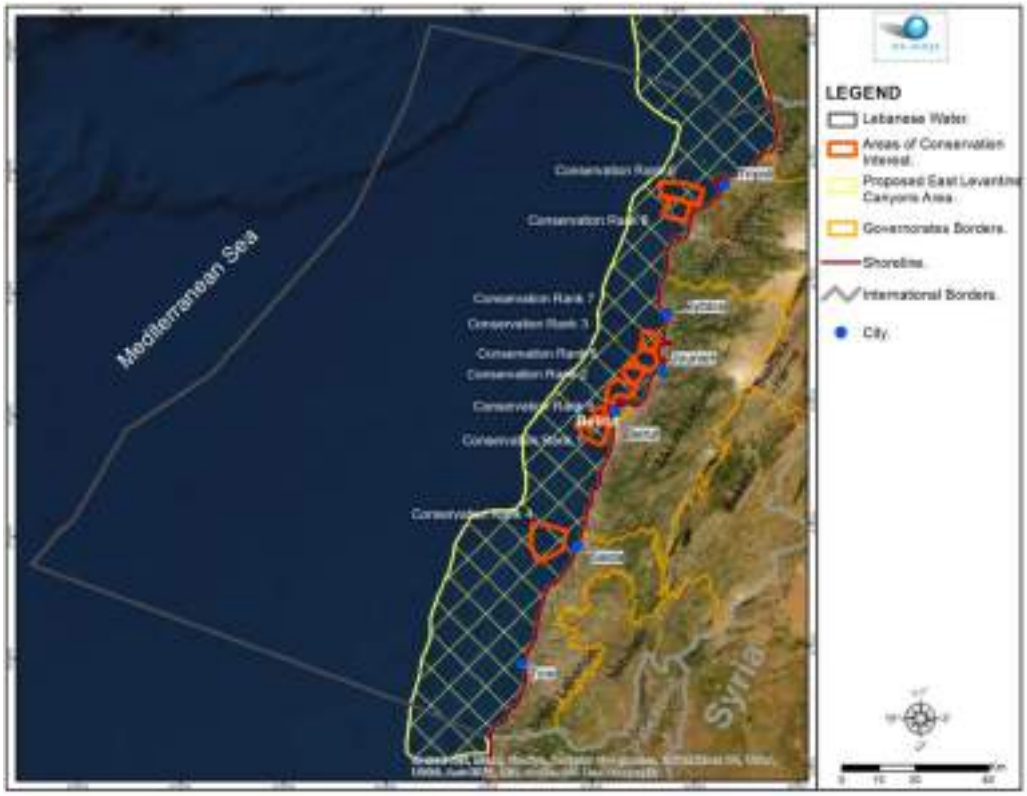

Figure 1-5 Areas of conservation interest
Source: Deep-Sea Lebanon Project (MoE, Oceana, CNRS, IUCN, SPA/RAC)

1.4 Project need and justification

The International Union for the Conservation of Nature, and in collaboration with the Ministry of Environment (MoE) is executing the project "Market policy and legislative development for mainstreaming sustainable management of marine and coastal ecosystems in Lebanon". The project, which is funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Program (UNEP), aims at creating an enabling integrated framework for sustainable management and conservation of coastal and marine biodiversity and at mainstreaming biodiversity priorities into national plans and coastal zone management plans.

The main activities of this project include: identification of threats to marine and coastal biodiversity in Lebanon, reviewing the existing policy and legislative tools, assessing the non-compliance causes, developing recommendations for legal reforms and law enforcement mechanisms, developing capacity building programs, as well as the identification of climate change impacts and adaptation measures. The Environmental Impact Assessment is one of the tools that aim at enhancing the biodiversity governance and provides an important entry point for biodiversity mainstreaming in development planning.

The project is working towards the development of these guidelines to enhance the capacity to mainstream biodiversity and sustainable management in EIA related to projects with potential impacts on coastal and marine biodiversity.

1.5 Purpose of the guidelines and checklist

All coastal development projects in Lebanon require an EIA. However, biodiversity has rarely been given specific or appropriate consideration in the EIA process. The inclusion of biodiversity in EIA studies is a critical step forward in ensuring that necessary measures needed to protect biodiversity are applied in the process of development planning. The objective of this report is to create guidelines to specifically address marine biodiversity inclusion, if/when applicable. This will strengthen the mechanisms for preventing biodiversity loss along the coastal zone through a more biodiversity-inclusive EIA process and an inspection checklist for monitoring implementation of the mitigation measures designed to prevent this loss.

This report will provide fit-for-purpose guidelines to support EIA consultants in the development of robust biodiversity impact assessment and mitigation plans as part of coastal and marine developments, and MoE staff in reviewing the EIA studies and monitoring implementation of mitigation measures.

02.

Relevant legal framework

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2. Relevant legal framework

2.1 Introduction

This section presents an overview of main applicable legislation, standards and international treaties and agreements, national plans and strategies related to biodiversity. Further details can be found in Annex 1.

2.2 Relevant Lebanese regulations and standards

2.2.1 Synopsis of the legislative framework for Environmental Protection

An overview of the main environmental legislations in Lebanon applicable to development projects affecting coastal and marine ecosystems is presented below.

1. Law No. 216/1993 (Establishment of the MoE) amended by the Law No. 690/2005, Organization of the MoE: The MoE is responsible for all matters related to the environment sector.

2. Law No.121/1992, Establishment of two nature reserves in some of the islands in front of Tripoli Beach.

3. Law No. 708/1998, Establishment of Tyr Coast Nature Reserve in Jaftlak Ras Al Ain – Tyr Real Estate Zone.

4. Law No. 444/2002, Environmental Protection Law: It is the environmental protection framework law. Includes
the general provisions for the protection of the environment.

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

5. Law No. 77/2018, Water Resources Law: The law aims to organize, develop, and protect water resources. It also aims to promote sustainability by strengthening water establishments.

6. Law No. 78/ 2018, Law for the Protection of Air Quality: The law aims to protect ambient air quality by identifying, monitoring and assessing, preventing and controlling air pollution resulting from anthropogenic activities. This excludes air pollution caused by physical hazards, natural disasters, and occupational and indoor air pollution.

7. Law No. 80/2018, Integrated Solid Waste Management: the law sets integrated solid waste management principles. It provides guidelines for the management of non-hazardous waste and hazardous waste.

8. Law 115/2019, Paris Agreement ratification that mandates countries to submit Nationally Determined Contributions (NDCs) that reduces greenhouse gas emissions and increase resilience in order to fulfill the goal of the Agreement which is to keep a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

9. Law No. 127/ 2019, The law is issued for approving joining the Protocol of Barcelona Convention concerning Specially Protected Areas and Biological Diversity in the Mediterranean.

10. Law 130/2019, Protected Areas Law: The Law classifies the categories of protected areas, sets the requirements for their establishment, includes supervision and management requirements and sets the conditions for allowing zoning within protected areas.

11. Law No. 170/2020, Establishment of Abbassieh Coast Nature Reserve.

12. Decree No. 2275/2009, Organization and mandates of the MoE, its divisions and departments.

13. Decree No. 2366/2009, National Land Use Master Plan: It classifies lands and organizes the territory.

14. Decree No. 8633/2012, Environmental Impact Assessment: This decree sets forth the rules that shall be considered in the EIA of public and private projects to avoid potential adverse environmental impacts during the construction, operation and decommissioning of these projects.

15. Decree No. 8213/2012, Strategic Environmental Assessment in the public sector: This Decree aims at determining mandatory procedures to be followed for the assessment of potential environmental impacts of any policy, plan, programme, study, investment or organization proposal that tackles an entire Lebanese region or an activity sector, in order to ensure that these activities are compliant with conditions related to health, public safety, the protection of the environment and the sustainability of natural resources.

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

17. MoE Decision 260/1 dated 2015, related to defining the procedures for the review of IEE Reports.

18. MoE Decision 261/1dated 2015, related to defining the procedures for the review of Scoping Reports (SRs) and EIA Reports.

19. MoE Decision 262/1/2015, related to defining the procedures for filing and review of an objection on MoE Decisions related to EIAs.

20. MoE Decision No. 589/2015, related to defining the procedures for the review of Strategic Environmental Assessment scoping reports (SEA scoping) and Strategic Environmental Assessment reports (SEA)

21. MoE Decision No. 189/2016, Review procedure for environmental audit studies.

2.2.2 Relevant national environmental standards

The main legislative texts that stipulate environmental standards in Lebanon are listed in Table 2-1.National emission and discharge standards were established by the MoE in Decision 52/1 dated 1996 and later updated and complemented in the Ministerial Decision 8/1 dated 2001.

Table 2-1 Relevant national environmental standards

Standard	Year	Relevent Provisions
MoE Decision No. 8/1	2001	National Standards for Environmental Quality (NSEQ) related to air contaminants and liquid waste emitted from classified establishments into receiving water bodies. Amends Decision 52-1/1996
Ministerial Decision No. 52/1, MoE	1996	National standards for environmental quality and environmental limit values for air, noise, water and soil, Amended by MoE Decision 8/1/2001.

These standards are currently being updated by MoE. Once this update is complete, these standards will replace Decisions 52/1 and 8/1 as the go-to reference.

2.3 International conventions, treaties and agreements

Lebanon has ratified several conventions related to the protection of the environment and marine environmental resources. The conventions that are most relevant to development projects affecting coastal and marine ecosystems are listed below.

- The United Nations Convention on the Law of the Sea (UNCLOS)

- Barcelona convention and its following protocols:

    1. 1976 Dumping Protocol
    2. 1976 Emergency Protocol
    3. 1980 Land-Based Sources Protocol
    4. 1982 Specially Protected Areas Protocol (SPA) and 1994 SPA and Biodiversity Protocol
    5. 2002 Emergency Protocol
    6. 1995 Integrated Coastal Zone Management in the Mediterranean

- IMO MARPOL 73/78 and its annexes:

    1. Annex I: Regulations for the prevention of pollution by oil
    2. Annex II: Regulations for the control of pollution by noxious liquid substances in bulk
    3. Annex III: Prevention of pollution by harmful substances carried by sea in packaged form
    4. Annex IV: Prevention of pollution by sewage from ships
    5. Annex V: Prevention of pollution by garbage from ships

- The Convention on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and Contiguous Atlantic-ACCOBAMS
- The Agreement on the conservation of African-Eurasian Migratory Water Birds (AEWA)
- The International Convention on the control of harmful anti-fouling systems on ships, 2001
- IMO Ballast Water Management Convention
- Basel convention on the control of trans-boundary movements of hazardous wastes and their disposal
- Rotterdam convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade
- Paris Agreement - Paris Climate Conference (COP21), part of the UNFCCC 2015
- United Nations Framework Convention on Climate Change (UNFCCC) treaty and the Kyoto Protocol
- Vienna convention for the protection of the ozone layer
- Montreal Protocol on substances that deplete the ozone layer and Copenhagen amendment
- UNESCO convention on the Protection of Cultural & Natural Heritage, 1972
- Convention on the Protection of the Underwater Cultural Heritage, 2001
- The Convention on Wetlands of International Importance (Ramsar)
- Convention on Biological Diversity (CBD)
- The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) to the Convention on Biological Diversity (CBD)
- Cartagena Protocol on biosafety
- Stockholm Convention on Persistent Organic Pollutants
- Sendai Framework of Action for Disaster Risk Reduction
- Minamata Convention on Mercury
- IMO International Convention on Civil Liability for oil pollution damage (CLC) (1969)
- IMO International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC)
- IMO International Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKER)
- The International Convention relating to the Limitation of the Liability of Owners of Sea-Going Ships, and Protocol (Brussels, 1957); this convention was replaced by The IMO Convention on Limitation of Liability for Maritime Claims (LLMC),1976, but the LLMC has not been ratified by Lebanon.
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention on Migratory Species (UNEP/CMS)

2.4 Plans, programmes and strategies

Main national plans, programmes or strategies that could have implications on development projects affecting coastal and marine ecosystems are presented in Table 2-2. It should be mentioned that this table is not exhaustive. It only includes the most relevant plans, programmes and strategies.

Table 2-2 Plans and strategies relevant to the development projects affecting coastal and marine ecosystems

#	Title	Year	Key requirements
1.	Lebanon's commitment to the UN sustainable development goals 2030	2017	In September 2015, the UN General Assembly adopted the 2030 Agenda for Sustainable Development that includes 17 Sustainable Development Goals (SDGs). Building on the principle of "leaving no one behind", the new Agenda emphasizes a holistic approach to achieving sustainable development for all. SDG 14 on "Life Below Water" focused on the protection of the marine and coastal biodiversity.
2.	Lebanon's Marine Protected Area Strategy(MoE)	2012	The document proposes new MPAs in addition to the two existing sites and sets the MPAs management strategy which aims to fulfil the following objectives: • To establish a more systematic approach to marine protected areas planning and establishment; • To enhance collaboration for management and monitoring of marine protected areas; • To increase awareness, understanding and participation of the local community in the marine • To link Lebanon's network of marine protected areas to Mediterranean networks.
3.	Lebanon's 5th National Report to the Convention on Biological Diversity(MoE)	2015	It provides an update on biodiversity status, trends, and threats and implications for human well-being and provides the national biodiversity strategy and action plan.
4.	Lebanon's National Biodiversity Strategy and Action Plan (MoE)	2016	It addresses Lebanon's obligations under Article 6a of the Convention on Biological Diversity (CBD) and is an update of the country's first NBSAP issued in 1998. The revised NBSAP was aligned with the new CBD strategic goals and integrated the 2020 Aichi Biodiversity Targets while taking into consideration both global and local needs and aspirations, as well as reflecting Lebanon's specific realm and the current existing professional capacities and awareness levels. One of the main objectives of the NBSAP is to mainstream biodiversity into sectorial and cross-sectorial strategies, plans and programmes.
5.	Palm Islands Nature Reserve Management Plan 2000-2005	2020	Management plan for Palm Islands nature reserve
6.	Ministry of Agriculture Strategy 2015- 2019 (MoA)	2014	The strategy sets three objectives, eight main courses of action including 30 components and 104 areas of intervention. Fisheries related actions include: • Improve the contribution of agriculture to the economic and social development of the country • Support investment in the fisheries and aquaculture and improving sustainable management of the sector
7.	National Oil Spill Contingency Plan in the Lebanese Waters (MoEW)	2017	The objectives of the NOSCP match and amplify the International Maritime Organization (IMO) objectives for a NOSCP, and as such it: • Establishes a viable operational organization with representation from all concerned agencies. • Identifies the national high risk areas. • Identifies priority coastal areas for protection and clean-up. • Provides a minimum level and appropriate types of pre-positioned pollution response equipment in accordance with article 6(2) of the OPRC Convention. • Prevents the spread of further pollution from identified oil spills. • Controls the spill source and clean-up existing pollution. • Employs Net Environmental Benefit Analysis (NEBA) to ensure that the chosen recovery strategies do not cause further damage to the environment.
8.	Integrated Solid Waste Management Policy (MoE)	2018	Sets the overall guiding principles and requirements for Solid waste management in Lebanon. Regarding Hazardous Wastes, MoE shall prepare a feasibility study and shall take the necessary steps to build there interim hazardous wastes storage sites and build needed treatment facilities.
9.	Lebanon Rural Tourism Strategy (MoT)	2015	The goal of the five-year strategy is to enhance economic opportunities in Lebanese rural areas through improving the competitiveness of specific value chains, including rural tourism and another set of agriculture sectors and food products. The Strategy identified main rural tourism stakeholders, dynamic trends in rural tourism and the different segments and sub-segments. The development of the rural tourism strategy is in line with the identified need to strategize and advocate for the development of the rural tourism sector through cooperation and common action among stakeholders.

03.

Guidelines on mainstreaming biodiversity conservation in the EIA process

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3. Guidelines on mainstreaming biodiversity conservation in the EIA process

3.1 EIA process

The guidelines in this report are specific to marine and coastal development and follow the EIA structure as specified in Decree 8633/2012.The main steps of the EIA Implementation process in Lebanon are summarized in and discussed in following sub-sections.A summary of the biodiversity-inclusive EIA process described in these guidelines is provided in Figure 3-2.

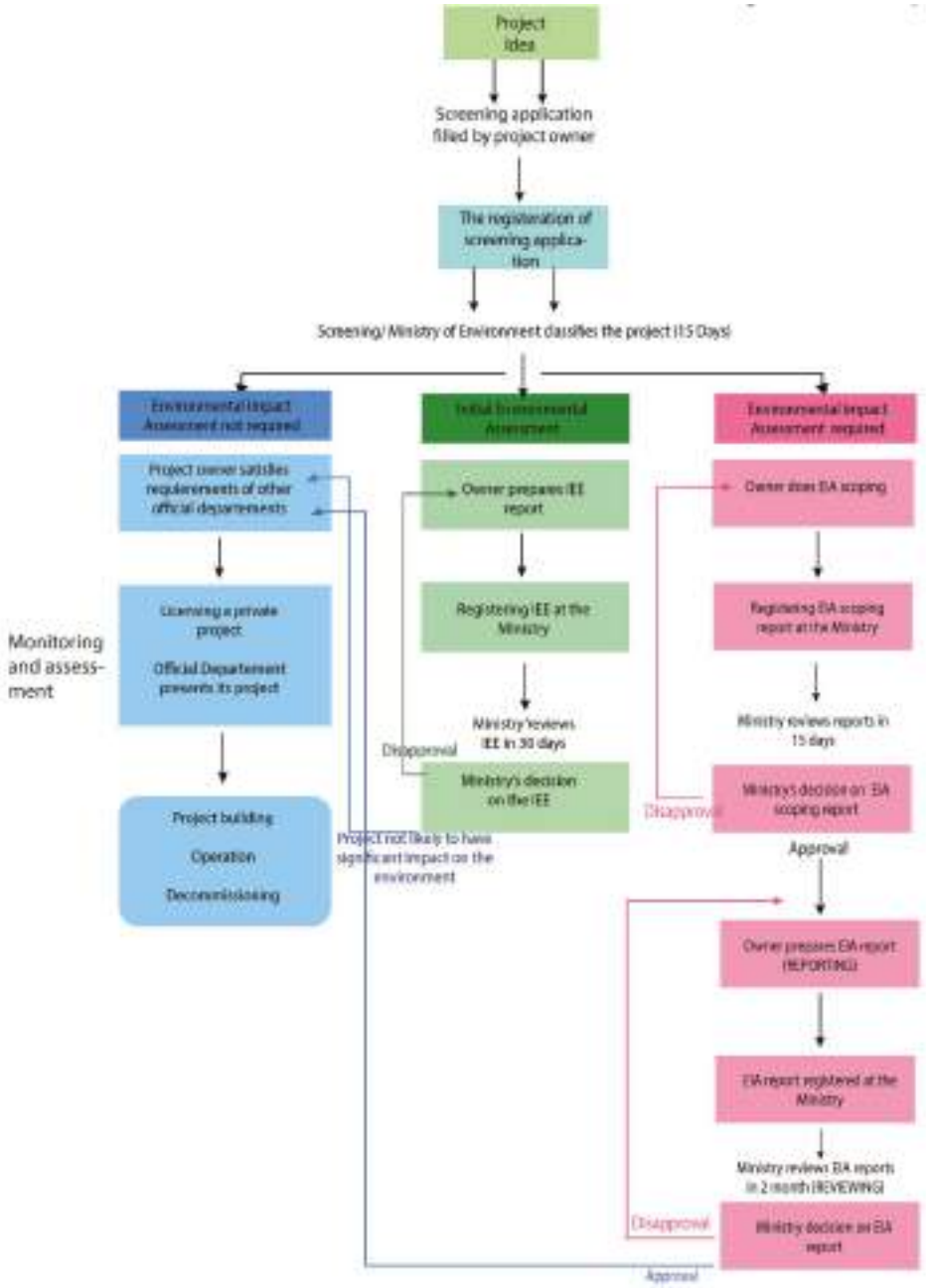


Figure 3-1 Environmental Impact Assessment (EIA) process in Lebanon

Source: IUCN/CER, 2020

Biodiversity-inclusive screening phase

During the review of the screening form, MoE addresses a series of pertinent questions related to biodiversity:

If the answer to all of these questions is "No" → Biodiversity inclusion is not required

If the answer to at least one of these questions is "Yes" → Biodiversity inclusion is required

Biodiversity-inclusive scoping phase

If a biodiversity-inclusive EIA is required based on the screening phase decision above, the following sections shall be included in the scoping report:

- Biodiversity-inclusive project description
- Biodiversity baseline survey plan
  - Desk-based Assessment
  - Field reconnaissance
- Biodiversity-inclusive Impact Assessment Methodology
- Biodiversity-inclusive Stakeholder Engagement/Public Participation

Biodiversity-inclusive EIA phase

- Biodiversity baseline study
  - Field-based Assessment (habitat maps, surveys)
    - Baseline Biological Environment
    - Baseline Physical Environment
  - Stakeholder Engagement/Public Participation
  - Biodiversity-inclusive Impact Assessment
  - Analysis of Project Alternatives
  - Environmental Management Plan
    - Avoidance
    - Minimization
    - Rehabilitation & restoration
    - Biodiversity offsets
    - No net loss
  - Monitoring

Figure 3-2 Summary of biodiversity-inclusive EIA process

3.2 Screening phase

3.2.1 General requirements: current procedure

The first step of the EIA process is submitting the screening application by the project owner or a chosen consultancy firm from the CDR list directly to the MoE. In addition to the application, the owner has to write a cover letter addressing MoE, in case the consultancy firm is tasked with submitting the screening, the owner has to include in his cover letter the fact that he has assigned this consultancy firm to deal with the screening process, and the letter should be signed by an official notary.

The MoE verifies whether a project falls under Annex 1 or Annex 2 of the EIA Decree or is located in an area listed in Annex 3 and has a potential for causing significant impact on that area. The MoE tells the project owner/ consultancy firm of the classification decision typically within 15 days of the registration date of the screening application. However, deadlines for all the mentioned phases from screening to project approval could be put on hold and considered nonbinding in case of major events. Subsequently, project owners should wait for MoE's replies even past the official deadlines. For projects requiring an environmental study, classification is based on the following criteria:

- If the proposed project falls under Annex 1,it will be subject to an EIA;
- If the proposed project falls under Annex 2, it will be subject to an IEE;
- If the proposed project falls under Annex 2 and is located in an area listed in Annex 3 (Environmentally Sensitive Areas), or it may have a significant environmental impact on such areas, the project will be subject to an EIA study; or
- If the proposed project does not fall under Annex 1 or Annex 2, but is located in an area listed in Annex 3, or it may have a significant environmental impact on such areas, it will be subject to either an IEE or EIA.

Environmentally Sensitive Areas as per Annex 3 of Decree 8633/2012 include:

1. Areas classified, by virtue of laws or decrees,as specifically protected areas, or natural environment protected areas, or natural forests or wetlands or important areas of birds or public gardens or natural scenery sites or touristic and historic sites and/or archaeological locations or river banks or springs or holy places;
2. Areas that are home to endangered species (animal and plants);
3. Watersheds;
4. Sea beaches, river waterways, and springs;
5. Emiri land.

Additionally, the MoE, based on an informed review, may request an IEE or EIA study for the project, regardless of its classification.

According to the Lebanese EIA Decree (Decree No. 8633/2012), all coastal and marine projects require an EIA or IEE if located in Annex 3 Areas. The objective of these guidelines, especially during the screening phase, is to determine if the biodiversity-inclusion is also required.

3.2.2 Biodiversity-inclusive screening phase: recommendations

The screening mechanism seeks to identify the projects with potentially significant adverse effects on biodiversity components and ecosystem services. The outcome of the screening process is the development of a screening criteria and decision (whether or not the biodiversity inclusion is required in the EIA/IEE).

The screening criteria for biodiversity can be based on the following pertinent questions. If the answer to at least one of these questions is "yes," then biodiversity inclusion is required:

- Will the proposed project adversely affect any of the following: protected areas or proposed MPAs; threatened ecosystems outside protected areas; migration corridors identified as being important for ecological or evolutionary processes; areas known to provide important ecosystem services; or areas known to be habitats for threatened species? (Refer to section 1.3 for information on important biodiversity areas)
- Is the project dependent on ecosystem services or will it directly or indirectly lead to serious damage or total loss of ecosystem, thus leading to a loss of ecosystem services?
- Will it affect the exploitation of ecosystems so that the exploitation becomes destructive or unsustainable?
- Will the proposed project cause a direct or indirect loss of a population of a species identified as threatened, endangered, rare,or endemic?
- Will the proposed project change the food chain and interactions that shape the flow of energy and the distribution of biomass within the ecosystem?
- Will the proposed project change the food chain and interactions that shape the flow of energy and the distribution of biomass within the ecosystem?
- Will the proposed project result in the fragmentation of an existing population leading to (genetic) isolation?
- Will the proposed project alter the species richness or species composition of habitats in the study area?
- Will the proposed project significantly increase the risk of invasion by a non-indigenous species?

If necessary, the Ministry of Environment can request that additional information regarding project activities be provided at this preliminary stage in order to address these questions and assess the need for a biodiversity-inclusive EIA.

3.3 Scoping phase

3.3.1 General requirements: current procedure

If the project requires an EIA study, then a scoping report must be prepared according to the requirements provided in Decree 8633/2012. The EIA scoping report shall be submitted to MoE.

The MoE shall provide its feedback within 15 days, which could either be: 1) approval of the scoping report without comments (in which case the client moves to stage 2: presentation of the EIA report); 2) approval with comments to be addressed in the EIA report; or 3) request for an addendum scoping report. The MoE shall declare its position regarding any submitted additional information within 15 days from the date of receipt. If the MoE does not respond within 15 days, the project proponent can consider the scoping report approved and begin the EIA study.

Stakeholder consultation is required BEFORE the scoping study has been submitted to MoE for review. All pertinent information related to that public participation meeting shall be included in the EIA scoping report for review including:

- A list of all attendees;
- Proof of invitation letters/emails sent to relevant authorities within the regulated timeframe (15 working days prior to the consultation). In the event that main relevant authority(ies) did not attend the Public Participation, the reason given by them for their lack of presence should be provided when possible;
- Proof of posting the public participation invitation in the identified media in Annex 4 of Decree 8633;
- Minutes of meeting (including all questions and replies);
- Presentation slides used during the consultation: and
- Online meetings should be offered as an additional platform during the public participation sessions, with the names of theonline attendees added to the list.

3.3.2 Biodiversity-inclusive scoping phase: Recommendations

In addition to the requirements provided in Decree 8633/2012, if a biodiversity-inclusive EIA is required based on the screening phase decision, the following sections shall be included in the scoping report.

3.3.2.1 Project description

This section shall include the following additional information about the project:

- Activities likely to cause biophysical changes (i.e. changes to the biotic and abiotic components of an ecosystem) during construction, operation and decommissioning, and their timing, frequency, duration, location, extent and magnitude of these changes
- Zone(s) of influence of the proposed activities on biodiversity, including activities located off site that may be relevant (i.e. construction of access roads)
- Activities likely to cause biophysical changes (i.e. changes to the biotic and abiotic components of an ecosystem) during construction, operation and decommissioning, and their timing, frequency, duration, location, extent and magnitude of these changes
- Zone(s) of influence of the proposed activities on biodiversity, including activities located off site that may be relevant (i.e. construction of access roads)
- Pathway for emissions (e.g. water, soil or air) and the receiving environment with a focus on biological receptors
- Best and worst case operating conditions including construction practices that could affect biodiversity

  Proposed measures designed to deliver biodiversity enhancements

3.3.2.2 Baseline description

During the scoping stage, a Biodiversity Baseline Survey Plan shall be developed to describe the scope of the baseline study to be conducted and to collect information on baseline conditions and any anticipated trends in biodiversity in the absence of the project.

All development projects should be managed with the expectations of surprising outcomes and therefore baselines should be developed with pre and post-construction monitoring objectives in mind. Two major types of monitoring are usually considered:

- Strategic monitoring is retrospective or hindsight monitoring with the aim to compare measurements of certain key characteristics of the environment before and after project works. This will allow for an environmental audit of the project's effects and requires baseline/ benchmark information for comparison.
- Tactical monitoring on the other hand is real time or oversight monitoring and is conducted in conjunction of the environmental management programme.The purpose is to monitor the construction detection of major negative impacts that may be occurring. If problems are detected, construction is halted until the situationis corrected.

For both, choice of evaluation parameters must consider space & time limits. Space mostly relates to the geographical location of the project and the surrounding habitats while time relates to the period of time the project will operate over.

It is highly recommended, if not required that monitoring of the project site starts at least one year before project construction to cover one full set of seasons and continue for three years after project completion. This will allow proper evaluation of project impacts and ecosystem response to the introduced stress (the project).

For pollution, impact indicators on flora & fauna should be devised. Plants and shellfish are usually chosen as biological indicators for being sedentary and for their ability to bio-concentrate chemicals. Defining and index organism is very useful as it offers the observer measurable signs of change.

Accordingly a thorough assessment of the impacted ecosystem is essential for environmental management plans to be effective.

Baseline marine ecological surveys for all habitats should include:

1. Habitat mapping
2. Benthic sampling for biota
3. Marine floral and faunal communities and their classification as per IUCN categories
4. Physical oceanography parameters
   - A. Bathymetry
   - B. Currents, waves, turbulence and mixing
   - C. Seawater sampling and testing:
     - Temperature, salinity, total suspended solids, pH, DO, BOD,COD, chlorophyll, turbidity
     - Microplastics
     - Ammonia, nitrates, and phosphates
     - Intestinal enterococci: fecal indicator parameters
     - Metals: lead, cadmium, chromium, mercury
     - Total petroleum hydrocarbons (TPH)
     - Polycyclic Aromatic Hydrocarbons (PAHs)
     - Other parameters as required and necessary (site dependent)
5. Sediment sampling:
   - Granulometry
   - Organic carbon
   - Calcium carbonate
   - Nitrogen
   - Microplastics
   - Phosphate
   - Intestinal enterococci: fecal indicator parameters
   - Metals: lead, cadmium, chromium, mercury
   - Total petroleum hydrocarbons (TPH)
   - Polycyclic Aromatic Hydrocarbons (PAHs)

Categories of biodiversity components that may be included are:

1. Habitats

As stated, the above parameters should be assessed for all habitat types. Nevertheless, more focused attention in the baseline must be paid to:

- Highly threatened or unique habitats;
- Habitats of significant importance to endangered or critically endangered species;
- Habitats of significant importance to endemic or geographically restricted species;
- Habitats supporting globally significant pelagic or demersal species; and
- Areas associated with key evolutionary processes.

For such habitat types, assessment of additional parameters may be assessed like climate variability, heat flux, sea-level rise, trophic level interactions, trophic state and nutritive value of sediments, plankton communities, biological description of species (spawning periods, recruitment rates, mortality, growth, etc...), carrying capacity of the natural environment to absorb and process wastes amongst others. It is important to note that such evaluations are quite demanding in time
and resources.

2. Protected areas and proposed MPAs

It is good practice to consider protected areas and MPAs as important biodiversity values that fall within the scope of a biodiversity baseline study, particularly those protected areas and MPAs that have been established to fulfil objectives related to biodiversity conservation.

Marine and coastal protected areas are presented in Section 1.3.

3. Species

In a biodiversity baseline study, project proponents should conduct general marine ecological surveys of all main groups both terrestrial and marine intertidal and sub-tidal species as applicable including mammals, birds, amphibians, fish, macro-algae, and macro-invertebrates including shellfishes.

The baseline should include any studies conducted on the individual species identified as conservation and or economic priorities by experts and stakeholders, including those species of special interest, protected by regulation, and with the highest conservation status accorded to them by IUCN. Examples of the types of species that may require focused studies for both terrestrial and marine organisms include:

- Nationally or globally threatened species (e.g., IUCN Red List of Threatened Species)
- Species with restricted ranges (e.g., km2; expert advice should be sought to identify range-restricted plant species)
- Pelagic and/or demersal species that utilize the site
- Other species that are considered a conservation priority by experts and stakeholders

4. Ecosystem services

The baseline study should also identify the ecosystem services being provided within the proposed site and zones of influence. These services should be classified as:

- Provisioning services (i.e. the products people obtain from marine ecosystems such as fish, shellfish, salt, minerals, oil and gas);
- Regulating services (i.e. the benefits people obtain from the regulation of ecosystem processes such as carbon sequestration, erosion prevention, floods and the moderation of extreme events like tsunamis);
- Cultural services(i.e. the non-material benefits people obtain from ecosystems such as recreational, spiritual, aesthetic and other non-material benefits); or
- Supporting services (i.e. natural processes that maintain the other services such as nutrient cycling and life-cycle maintenance for fauna and flora).

5. Biodiversity components based on specific criteria

MoE may emphasize specific biodiversity components that are not captured by the preceding categories. One example is ecological function in areas adjacent to the project site that are vital to maintaining the viability of biodiversity components occurring at the site.

Methodology to develop the Biodiversity Baseline Survey Plan

Some factors influencing the design of a methodology to develop the Biodiversity Baseline Survey Plan:

- The significance of expected impacts of the project on biodiversity;
- The sensitivity of the project's area of influence;
- The sufficiency of existing information to describe existing baseline conditions in the project's area of influence;

- Period of time provided to carry-out the survey; and
- Availability of funds and associated human resources

1. Desk-based assessment

Desk-based assessment of existing information is a cost-effective means of developing an understanding of the marine ecology components including biodiversity components that fall within the required scope of the baseline studies.

Desk-based assessment serves as a scoping exercise to define and plan field-based assessments. It is important to note that desk-based assessment should not replace actual field work that should be intensified particularly where sensitive species and/or habitats are expected to be present.

In order to conduct the desk-based assessment, the project proponent should compile and evaluate available marine ecological information, including information on the distribution and abundance of biodiversity components identified in the scoping phase described above.

Annex 2 provides a list of some available sources for marine and coastal baseline data in Lebanon, however, it shall be emphasized that the list is not exhaustive.

2. Field Reconnaissance

A reconnaissance visit to the study area shall be conducted during the scoping stage. Field reconnaissance is best suited for coastal (rather than marine) projects. The ways in which field reconnaissance can support the baseline study include:

- Verifying the presence of biodiversity components that have been identified from possibly outdated desktop information;
- Refining the baseline study area;
- Conducting preliminary meetings with local stakeholders to understand their priorities and concerns.

The earlier that potentially important biodiversity components can be identified and integrated into the baseline study, the better. Late detection of important biodiversity components can threaten the project schedule and reduce the effectiveness of mitigation planning.

It should be emphasized that the desk-based assessment and field reconnaissance are tools to help develop the Baseline Survey Plan and do not replace the field-based assessment. Table 3-1 provides a matrix for identification and preliminary assessment of project's impacts on biodiversity to help determine the level of baseline surveys required. It should be noted that the impact significance should consider the sensitivity of the biodiversity component expected to be affected.

Table 3-1 Impact identification as a tool to help determine the methodology for the biodiversity baseline survey plan

Project activities	Physical environment					Biological environment												
						Marine / Coastal								Terrestrial				
	Seawater quality	Sediments quality	Sediments composition	Underwater noise	Above water noise	Phyto & zoo benthos	Nekton	Phyto & zoo plankton	Seabirds	Cetaceans, turtles and seals	Sensitive marine habitats	Protected areas	Ecosystem services	Flora	Fauna	Sensitive habitats	Protected areas	Ecosystem services
Project activity #1																		
Project activity #2																		
Project activity #3																		

Key:	Expected Impact Significance:
	0: No impact 1: Negligible 2: Minor 3: Moderate 4: Major

Identifying the baseline study area

The Biodiversity Baseline Survey Plan should clearly establish the baseline study area. The baseline study area should encompass the project's area of influence, or geographic area of anticipated project activities and impacts. It is good practice to expand the study area based on the distribution of biodiversity components across the landscape.

The first step in identifying the project's area of influence is to overlaying the project's footprint with spatial information of the landscape within which the project will be located. Sources of spatial information include Google Earth and other types of satellite imagery, aerial photos, and existing mapping products from government sources and elsewhere.

It should be noted that the baseline study area may change during the EIA process if additional information is needed to support impact assessment and mitigation planning, or to include control and benchmark sites to support long-term monitoring.

1. Project's area of influence

It is good practice to take a comprehensive, precautionary approach (i.e. the maximum zone of influence for the physical baseline environment should be anticipated) to defining a project's area of influence. The project area of influence is generally larger than the physical footprint of the project, and includes the area within which a project may directly, indirectly, and cumulatively cause impacts to biodiversity.

The area of influence may include the following, as appropriate:

- The area affected by the project activities and facilities that are directly owned and managed by the project. Examples include the physical project footprint, areas adjacent to the project site that are affected by emissions and effluents, solid wastes, power transmission corridors, pipelines, borrow and disposal areas, etc.

- The area affected by associated facilities that, although not part of the project that is being assessed by the EIA, would not have been constructed in the absence of the project.

- The physical footprint of non-project activities in the surrounding area that are caused or stimulated by the project plus the area affected by their solid wastes (i.e. microplastics),effluents, and emissions, as indicated through emission modelling. These so-called indirect impacts to biodiversity are generally the result of changing economic or social patterns catalyzed by the project's presence, such as human settlement near a project site resulting in the destruction of natural habitat or increased pressure on biological resources (e.g., increased access to sensitive areas as a result of new roads, rights-of way, etc.). In some cases, a project's indirect impacts can greatly exceed its direct impacts.

- Cumulative impacts are the incremental impacts of a project on biodiversity, when also considering existing and reasonably foreseeable future stressors affecting a biodiversity component in the landscape. Cumulative impacts can be similar in type (e.g., emissions to air from multiple projects) or distinct (e.g., the cumulative effect of habitat loss, and habitat fragmentation).

2. Perceived project impacts

Stakeholder consultation may reveal perceived impacts from a project that are different than those indicated by science, or by similar experience elsewhere. It is good practice to document perceived impacts, even if they appear technically unfounded. Maintaining a discipline of respectfully acknowledging and analyzing these concerns will contribute towards building trust with stakeholders and ensuring a complete analysis. It may be appropriate that the baseline study area includes areas of stakeholder concern in order to confirm predictions of no impacts.

3. Spatial scales relevant to biodiversity

In some circumstances increasing the baseline study area will help to better understand the biodiversity context of the project. Following are cases where this may be useful:

- Distribution of biodiversity components: when the project may affect a biodiversity component that has a very limited distribution, it may be appropriate to include the entire occurrence of the component in the baseline assessment,particularly if the occurrence is very small, and/or if cumulative impacts are a concern.
- Proximity to areas of interest: when a project is near a nature reserve, spawning and nursery grounds, or threatened habitats (i.e. terraces hosting dendropoma species), these areas should be included in the baseline study area.
- Ecological function: it may be appropriate to expand the boundaries of the analysis to encompass a functionally defined landscape.
- Migratory routes: for migratory species, it may be appropriate for the baseline study to consider other sites utilized by the species along its migratory route. In particular, understanding whether there are functionally equivalent sites outsideof the project area of influence (for example, alternative stopover or staging sites for a migratory bird species) can help in impact assessment.
- In regions with poor existing knowledge: where little is known about biodiversity, wider landscape-scale surveys may be needed to help assess the significance of project impacts.

3.3.2.3 Impact Assessment Methodology

[Source: Total E&P Liban Sal, Block 4 (Lebanon) offshore exploration drilling EIA Report]

Based on the sensitivity of the environmental receptors and the intensity of the impact, the significance of the impacts can be assessed.

Definitions for scoring intensity and sensitivity are provided below.

- Impact Magnitude or Intensity

For each source of impact, the intensity of the effect shall be defined according to the following criteria:

- The nature of the change (what is affected and how)
- Its size and scale
- Its geographical extent and distribution
- Its duration, frequency and reversibility
- Possible cumulative effects from other activities
- Outputs from modelling exercises

Although the scales and their description are predefined, the assigned rating for each impact will be based on the judgment of a group of experts in the field.

The intensity is then scored from 1 (very low) to 4 (high) based on definitions of negative effects. A rating of 0 is also provided for beneficial
(positive) effects.

An example of a low magnitude impact to species biodiversity would be the disturbance of a local population or individuals of a species resulting in a decline in abundance or distribution over one or more generations, but that does not change the overall longevity or viability of the population of the species or populations of other dependent species.

Alternatively, a high magnitude impact would disturb a sufficient portion of the biogeographic population of a species and may cause a decline in abundance, distribution or size of the genetic pool such that natural recruitment could not return the population of the species, and other species dependent on it, to former levels.

Table 3-2 Definitions to assist with scoring the intensity of the impact

Score	Geographical extent	Duration	Environmental (physical and biological)
0 Positive			• Beneficial impacts on habitats and species
1 Very Low	Immediate: within the project footprint	Negligible: impact likely to be mitigated through natural processes (or project mitigation measures) immediately(within one month of impact occurring)	• Disturbance to the environment limited to the immediate area, with rapid recovery without intervention • Planned activity or accident causes disturbance to individuals of a species that is similar in effect to the random changes in population due to normal environmental variation • No discernible effect due to disruption of behaviour or species interactions of nationally/internationally important species of conservation concern • No protected areas affected Emissions and effluent discharges do not breach licence limits, or national/international standards and have negligible impact due to rapid dilution and dispersion • Noise from project site is audible at receptor locations but would not contribute to an exceedance of project criteria • Spill or accidental event (onshore or marine) that causes immediate area damage only and can be restored to an equivalent capability in a period of days up to one month
2 Low	Local: within the project footprint and up to 3 km from site	Short: impact likely to be mitigated through natural processes (or mitigation measures) within a year of cessation of activities	• Impacts on a unique habitat, or national scale, resulting in long-term damage and a restoration time of more than five years and requiring substantial intervention • Activity or event disturbing a sufficient portion of the biogeographic population of a species to cause a change in abundance, distribution or size of genetic pool such that natural recruitment would not return the population of the species, and several species dependent on it, to former levels within several generations • Potential for large-scale pathological damage of nationally/internationally important species of conservation concern • Numerous non-compliances with emission and effluent discharge licence limits, or national/international standards • Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in- country or international response resources • Noise levels from the proposed project site at receptors may contribute to an exceedance of project criteria dependent on cumulative noise levels, but does not exceed project criteria alone • Spill or accidental event (onshore or marine) leading to immediate area or localised damage to water resources or soil that may take up to six months to restore to pre- existing capability/ function • Environmental incident typically resolved with on-site response equipment

Score	Geographical extent	Duration	Environmental (physical and biological)
3 Medium	Regional: effects of impact experienced 3–50 km from site	Medium: impact likely to be mitigated through natural processes (or mitigation measures) within a few years of cessation of activities	• Impacts on a unique habitat, or regional scale, resulting in medium term damage and a restoration time of several years that may require intervention • Disturbance of a population of species resulting in a change of abundance over one or more generations, but that does not change the integrity of the population of the species, or populations of dependent species • Potential for small-scale pathological damage of nationally/internationally important species of conservation concern • Occasional non-compliances with emission and effluent discharge licence limits or national/ international standards. • Predicted noise levels from site plant at receptor locations exceed project criteria by up to 5 dB Spill or accidental event (onshore or marine) leading to damage to water resources, soil or habitat over a larger geographical area (not localised), or that cannot be restored to pre-existing capability/ function within one year • Environmental incident typically requiring mobilisation of in-country response resources
4 High	Widespread: Impact experienced >50 km from site	Long term: impact and its effects will continue for up to five years or more following cessation of activities, potentially irreversible	• Impacts on a unique habitat, or national scale, resulting in long-term damage and a restoration time of more than five years and requiring substantial intervention • Activity or event disturbing a sufficient portion of the biogeographic population of a species to cause a change in abundance, distribution or size of genetic pool such that natural recruitment would not return the population of the species, and several species dependent on it, to former levels within several generations • Potential for large-scale pathological damage of nationally/internationally important species of conservation concern • Numerous non-compliances with emission and effluent discharge licence limits, or national/ international standards • Environmental incident with potential for extensive ecological damage typically requiring mobilisation of in- country or international response resources

- **Receptor sensitivity**

The sensitivity of receptors will be defined taking into account such factors as the presence of protected areas or species of conservation concern, sensitive habitats, presence of spawning and nursery grounds, and ecosystem function. Sensitivity is scored from 1 (very low) to 4 (high) (Table 3-3).

Examples of environmental receptors that would be determined to have very low sensitivity would include commonly occurring habitats, ecosystem services, and species that are not subject to significant decline, or habitats that are already significantly disturbed and/or modified with little biodiversity value. High-sensitivity examples would include species listed as critically endangered or endangered on the IUCN Red List, and habitats that are difficult to restore to natural conditions, such as coral reefs.

Table 3-3 Definitions to assist with scoring of receptor sensitivity

Score	Biological receptor sensitivity
1 Negligible	Commonly occurring habitats, ecosystem services, and species not subject to significant decline. Habitats that are already disturbed or are periodically subject to natural disturbance. Fauna and flora not susceptible to emissions or discharges, fauna not susceptible to noise emissions.
2 Low	Low sensitivity or local ecosystem value. Sites of local biodiversity value but not intact, fragile or unique. Habitats that recover quickly following disturbance (e.g., habitats comprising species that rapidly re-colonise disturbed areas). Widespread common species with low biodiversity value. Fauna and flora with low susceptibly to air emissions and discharges, fauna with low susceptibly to noise emissions.
3 Medium	Medium sensitivity or regional/national ecosystem value. Sites of regional importance, or designated for protection at national level. Habitats of high species density or habitat diversity or 'naturalness', or recognized as intact or unique, or areas recognized by nongovernmental organizations as having high environmental value. Regionally or nationally important population of a species, either because of population size or distributional context. Species listed as near threatened on the IUCN Red List or species in significant decline at national or regional level. Habitats that are unlikely to return to natural conditions without some intervention, but which are capable of assisted recovery. Flora and fauna with moderate susceptibility to air emissions and discharges, fauna with moderate susceptibly to noise emissions.
4 High	High sensitivity or international ecosystem value. Sites of international importance/designated for protection at international level. High densities of species that are vulnerable, endangered or critically endangered or at an international level (i.e. listed on IUCN Red List, CITES). Critical habitats as defined by IFC P-S6'Biodiversity Conservation & Sustainable Natural Resource Management" Habitats that are very difficult to restore to natural conditions. Flora and fauna with high susceptibility/very low tolerance of air emissions or discharges, fauna with very low tolerance to noise emissions.

- **Impact Significance**

The significance of the impact will then be calculated as follows: **Significance = Intensity × Sensitivity**

The significance of impacts will be determined using the matrix presented in Table 3-4. It is based on a scale that ranges from Negligible to Major, with an additional category for Positive impacts (Table 3-5).

Table 3-4 Impact significance matrix

Significance			Sensitivity Rating			
			Very low	Low	Medium	High
		0 positive	1	2	3	4
Magnitude Rating	Very low	1	1 Negligible	2 Negligible	3 Minor	4 Minor
	Low	2	2 Negligible	4 Minor	6 Moderate	8 Moderate
	Medium	3	3 Minor	6 Moderate	9 Moderate	12 Major
	High	4	4 Minor	8 Moderate	12 Major	16 Major

Table 3-5 Impact severity scale

0	Positive	The positive impact should be welcomed by key stakeholders and measures should be taken to maximize the benefit
1-2	Negligible	Negligible impacts that are unlikely to warrant additional mitigation measures or monitoring
3-4	Minor	The potential negative impact is likely to be acceptable to key stakeholders without additional mitigation measures. Monitoring should check that the baseline conditions are not affected beyond predicted levels.
5-9	Moderate	Additional mitigation measures should be developed to control the potential negative impact so that changes to baseline conditions are kept 'as low as reasonably practicable'
> 9	Major	The possible negative impact is too significant to be acceptable. Controls must be implemented to reduce either the likelihood or the impact severity, or provide compensation/offset if this cannot be achieved.

3.3.2.4 Stakeholder consultation and engagement

Involving relevant authorities and stakeholders at an early stage of the EIA will make it possible to capture the most important issues and establish a consistent approach to assessing impact and looking for solutions.

Engaging stakeholders allows a project to better characterize biodiversity components including ecosystem services in the baseline study area. Similarly, experts familiar with the study area can be of tremendous help in identifying biodiversity components that should be included in the scope of the biodiversity baseline study, ruling out others that are not likely to be present.

Making use of the knowledge and opinions of environmental authorities and stakeholders can also help to:

- Highlight potential areas of contention and areas of improvement in a timely andeffective way;
- Provide information on relevant forthcoming projects, policies and legislative or regulatoryreforms, other types of assessment that should be considered when analyzing evolving baseline trends;
- Collect suggestions for building biodiversity enhancement schemes into the proposed project from the very beginning.
- Draw a clearer picture of all the prospective projects in the area of influence that could have a cumulative impact on the biodiversity

The project can reduce the risk of non-compliance by regularly consulting with key stakeholders. Best practice risk management involves ensuring that there is consensus among project stakeholders on biodiversity priorities and proposed survey methods.

With respect to biodiversity, relevant stakeholders (public institutions, research centers, academic institutions, private sector, NGOs, etc.) in the process are:

- Beneficiaries of the project – target groups making use of or putting a value to known ecosystem services which are purposely enhanced by the project;
- Affected people – those people who experience, as a result of the project, intended or unintended changes in ecosystem services that they value;

- Draw a clearer picture of all the prospective projects in the area of influence that could have a cumulative impact on the biodiversity

The project can reduce the risk of non-compliance by regularly consulting with key stakeholders. Best practice risk management involves ensuring that there is consensus among project stakeholders on biodiversity priorities and proposed survey methods.

With respect to biodiversity, relevant stakeholders (public institutions, research centers, academic institutions, private sector, NGOs, etc.) in the process are:

- Beneficiaries of the project – target groups making use of or putting a value to known ecosystem services which are purposely enhanced by the project;
- Affected people – those people who experience, as a result of the project, intendedor unintended changes in ecosystem services that they value;
- General stakeholders – formal or informal institutions and groups representing either affected people or biodiversity itself.

3.3.2.5 Qualifications of biodiversity experts

The scoping report should include the profiles and CVs of the biodiversity experts who will be conducting the field surveys and impact assessment. The team's qualifications should cover all biodiversity components scoped in the assessment.

3.4 Enviromental impact assessment phase

3.4.1 General Requirements: Current Procedure

- **EIA report**

The EIA Report shall comply with the Scoping Report approved by the MoE and shall consider any other impact not mentioned in the Scoping Report but noted during the EIA stage.

The EIA Report shall be submitted to the MoE. The MoE shall review the EIA Report and check its conformity with the approved Scoping Report within two months from the date of registration at MoE. Comments submitted from the MoE on the EIA Report must be addressed and the revised report must be submitted to the MoE for approval.

If the Ministry does not respond within the time limit prescribed above (two months), the project proponent may consider the EIA Report approved. Unless there are major events that might cause delays with the MoE replies, as mentioned before, then the client should wait for the MoE's replies past the official deadlines.

The position of the MoE on the EIA Report could be an approval, a conditional approval or a rejection with explanation. The Ministry's position shall be communicated to the project proponent and will be made available to the public and the concerned stakeholders.

The public and the concerned stakeholders have the right to access the summaries and the EMP- mitigation chapters in the approved EIA Report in addition to MoE related reports, except for any information pertaining to patent or confidential information for the project proponent.

3.4.2 Biodiversity-inclusive impact assessment phase: Recommendations

If a biodiversity-inclusive EIA is required based on the screening phase, the following shall be included in its relevant subsection of the EIA Report.

3.4.2.1 Biodiversity baseline study

Following the approval of the Biodiversity Baseline Survey Plan developed during the scoping phase, the implementation of the Biodiversity Baseline Study is completed during the EIA phase.

Figure 3-3 describes the steps involved in a biodiversity baseline study. Whether a project must follow all these steps will depend on the biodiversity components present at the project site, the sensitivity of these components to potential project impacts, as well as regulatory requirements.

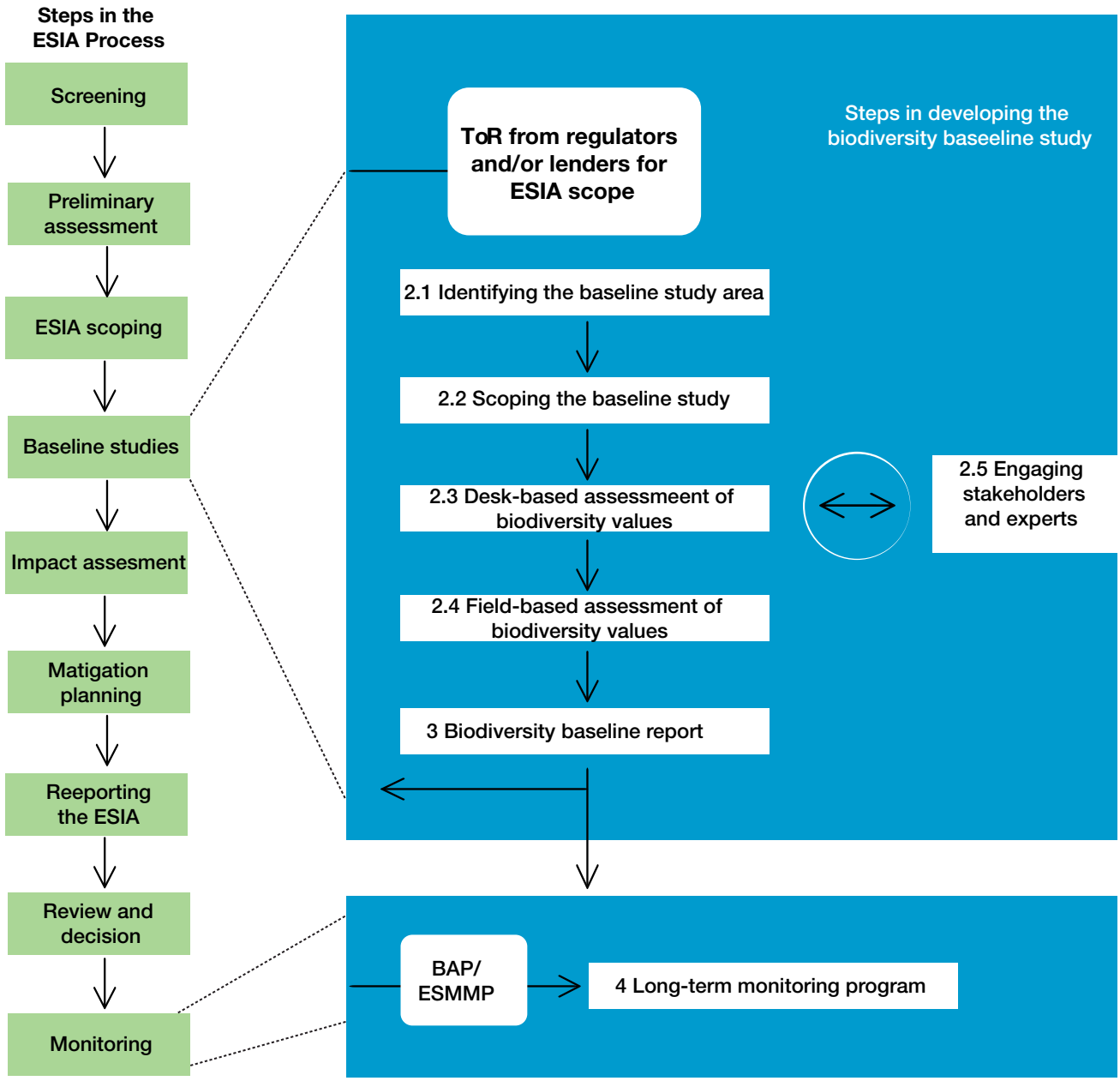


Figure 3-3 Basic steps involved in a biodiversity baseline study
Source: Hardner et al., 2015

3.4.2.1.1 Field-based assessment

The following is an overview of some key issues associated with the design of field-based assessments and choices of methodologies. It is worth emphasizing the importance of engaging appropriate experts throughout the field-based assessment, either through direct participation or through reviewing the work that has been conducted.

1. Factors influencing field-based assessments

Field-based assessments will employ a variety of methodologies to understand the distribution, abundance, and conservation status of biodiversity components within the baseline study area. It should be noted that this requires significant time to complete (i.e. a longer timeframe than the typical three months allocated for most EIAs). The design of the assessment and choice of methodology will be influenced by a number of considerations, including:

- Regulatory requirements: project proponents should ensure that the design of the field assessments meets relevant government regulatory requirements with regard to methodologies or other aspects of survey design (e.g., sampling intensity, or inclusion of taxonomic groups). However, projects should be aware that simply satisfying regulatory requirements may not be sufficient to comply with good practices or lender and corporate standards and that it may be desirable to supplement or improve on the methods required by regulators.

- Experience of contractors: baseline contractors may have a particular method or methods with which they have experience.This experience should be taken into consideration, but should not override other considerations of appropriateness,and scientific rigor when selecting the best methodologies.

- Credibility/established good practices: in all cases, the design of the assessment and the choice of methodologies should represent good practice and be credible in the eyes of the scientific community and other key stakeholder groups, as indicated by the use of similar approaches in the scientific literature and by recognized experts.

- Comparability with available data from reference sites and potential offset sites: in some cases, it will be beneficial for baseline information to be collected in a manner that is consistent and comparable with information collected on the same biodiversity components in other locations,or previous information from the same site.For example, a project proponent may wish to compare data from the project site with publicly available information at other sites, or, a project proponent may anticipate supporting protected areas as part of the project's strategy to achieve a net gain fora biodiversity-sensitive habitat. In these examples, it would be advantageous for the project's impacts in the study area to be measured in a manner consistent withthe way biodiversity monitoring is carried out at the benchmark or offset site.

- Ability to provide information on required metrics: the chosen methodology must be able to deliver data on the metrics chosen to reflect the viability and/or function of the biodiversity components.

2. Design of field-based assessments

This section describes general good practices for the design of field-based assessments.

2.1. Developing a habitat map

Preparing a habitat map as early as possible in the baseline schedule is good practice, and it is strongly recommended that its preparation precede the design of field assessments for other types of biodiversity components. The habitat map can play the following roles:

- Design of sampling strategy: the map provides a basis for designing sampling strategies for the various biodiversity components tobe surveyed.

- Use of habitat surrogates: by basing sampling for other types of biodiversity components on the habitat map, the likelihood that habitats can be used as a surrogate or proxy measure for other biodiversity components is greatly increased.

- Impact measurement: the map provides a basis for determining the area and quality of aquatic habitats impacted by a project, and thus plays a key role in supporting any loss-gain accounting that may be required to demonstrate achievement of performance targets such as “no net loss” of biodiversity.

This initial map shall be refined and improved in an iterative fashion as information becomes available from fieldwork. Three main categories should be considered for habitat mapping: terrestrial, intertidal and subtidal. The habitat map should be overlaid on a bathymetry map.

2.2. Determining where to survey

The scoping report and the baseline survey plan may identify information gaps for specific types of biodiversity components. To address these gaps, assessments of the baseline study area can be conducted to understand the distribution and ideally the abundance of these biodiversity components within the baseline study area. As it is usually impractical to survey the entire baseline study area for each of the biodiversity components, a balance must be found that ensures the area is adequately covered.

Surveys can be divided into general surveys and focal surveys. General surveys are used to characterize biodiversity components such as communities of species, or habitat types. The data obtained would allow a comparison of the number of species present in each of the habitat types and provide estimates of the relative abundance of at least the most common species.

There are various ways in which general surveys can allocate their sampling effort over the baseline study area. Four approaches to locating sampling sites for general surveys, in increasing order of preference, are:

- **Systematic:** An evenly spaced grid of sampling points can be laid out over the study area, with the location of the first point randomly located. This approach may be relatively easy to implement in the field, but may not achieve the goal of adequately sampling all of the biodiversity components that occur on the landscape. It may also bias results if some biodiversity components occur with the same systematic distribution as the sampling points, or if there are small localized patches of specialized or distinctive habitat.
- **Random:** Sampling points can be located in a completely random manner, but for low sampling intensities, some types of biodiversity components may not be adequately sampled.
- **Transect:** Establish a line that spans the gradient of interest and select sample plots along that line, or transect, either randomly or in a uniform manner (i.e. every 50, 100 or 150 meters).
- **Quadrat:** This method measures change in marine communities anticipated by a disturbance. Quadrats with replicates (the size of the quadrat will be determined by the EIA consultant), precisely located so that the exact area can be sampled in the future to detect change, if any. Data/records are converted into % live cover, dominant species,etc. Photos should be taken for identification of species in addition to collected samples.

2.3. Determining when to survey

The detectability and abundance of biodiversity components may vary temporally, including time of day, time of month, time of year (e.g., local or large-scale movements or migration), seasonally, annually, and over periods of multiple years. Variation on longer scales is also possible.

It is good practice for baseline surveys to be structured in such a way as to help understand regular large changes in detectability and abundance of biodiversity components that may occur in the baseline study area over time.

Focal surveys for priority components should target times when those components are most easily detected. Because detectability will vary among species, multiple field campaigns may be required if focal surveys are required for more than one species.

The importance of documenting temporal variation in biodiversity components in the baseline study will vary depending on the size of the project and the anticipated impacts to sensitive biodiversity components.

3.4.2.1.2 Methodologies, metrics and reporting results of field-based assessments

This section provides a brief overview of appropriate methodologies for surveying different types of biodiversity components. As mentioned above, there are many different ways in which biodiversity can be measured and the selection of the most appropriate methodology is based on many factors.

Baseline biological environment

1) Habitats

In addition to producing a habitat map, projects should measure the quality or condition of aquatic habitats within the baseline study area. Measures of condition typically consider some combination of information on the structure, composition, seasonality and ecological function of habitats, and assess the condition of the habitat at a particular site in relation to benchmark sites. Measures of conditions may also incorporate landscape considerations, for example, the size of the habitat patch, or degree of habitat fragmentation in the vicinity of the survey site. Approaches may be qualitative, using expert judgment to assign habitat to broad categories of condition (e.g., intact, somewhat degraded, severely degraded), or quantitative, for example, using transects to produce a numeric score of the condition of a habitat.

Metrics and reporting results:

Baseline information on habitats is typically presented in the baseline report both in gross terms, as well as area adjusted for condition of habitat (i.e. the number of hectares of habitat in each condition category should be presented). If habitat condition has been assessed quantitatively, then the area can be adjusted for habitat quality by multiplying area by the condition coefficient to obtain the number of habitat units for each habitat type. The occurrence of habitats may be broken down by project footprint, area of influence, and baseline study area.

2) Species

The scoping report and the baseline survey plan may identify gaps that require filling with respect to species occurring in the baseline study area. For example, if the species that occur within the project area of influence are not well documented, general surveys that aim to identify as many of the species as possible and to characterize the communities of each taxonomic group in terms of species richness and diversity might be required. If a certain species has been identified through scoping as being of particular conservation concern, targeted or focal surveys of that species may be required to support impact assessment and mitigation planning.

More complete mapping of some species or habitats within the project footprint may be required to support the impact assessment, as well as additional off-footprint work to understand its distribution within the larger study area. Survey methods will likely occur when detectability of the focal species is greatest. It is good practice to record the location of all occurrences of priority species with a geographic positioning system (GPS).

Table 3-6 illustrates different parameters in the marine biological baseline study of different species and related investigation methods. It should be noted that methodologies are constantly improving or new ones being developed. These methods are presently valid, but others might be used in the future depending on the advancement in assessment techniques.

Table 3-6 Parameters in the baseline study of different species and related investigation methods

Species		Parameters	Optional investigation methods
Pelagic communities	Phytoplankton	- Species composition - Species distribution - Species abundance - Biomass	• Manual sampling with plankton nets and samplers from ship/boat • Ship-of-opportunity sampling (unattended recording and sampling on ferries and other commercial ships with regular schedules) • Remote sensing
	Zooplankton, pelagic fishes, cephalopods, marine mammals		
Benthic communities	Infauna	- Species' number and composition - Species' abundancee - Biomass	• Grab sampling • Quantitative and qualitative sampling by scuba divers • Statistical analyses (community analysis, spatial analysis)
	Epifauna		• Video survey • Sampling by scuba divers • Statistical analyses (communityanalysis, spatial analysis) • Modelling
	Phytobenthos	- Species' number and composition - Coverage - Biomass	• Video survey • Quantitative and qualitative sampling by scuba divers • Community analysis, spatial analysis,modelling
	Benthic habitats	- Distribution and main characteristics of habitats	• Video survey • Sampling by scuba divers • Spatial modelling
Fish	Demersal fish	- Observed species and abundance - Biomass - Dominance ratios	• Bottom-set gill net fishing • Otter trawl fishing • Stomach analyses of predatory fish (to identify small fish species that cannot be caught with gill nets)
	Pelagic fish		• Hydro acoustics • Pelagic (mid-water) trawling • Vertical gillnets • Fish counts through remote operated vehicles or autonomous underwater vehicles, video and/or divers.
	Recruitment processes	Spawning migration routes - Spawning grounds and related biological processes - Nursery areas and related biological processes	• Video tracking • Telemetry • For fish eggs: diving surveys, surveys using artificial spawning substrates
		- Fish larvae	• Manual sampling with planktonnets and samplers from ship/boat
Birds	Sea birds	- Distribution and abundance in the project area and vicinity - Numbers of all flying and swimming individuals - Age and sex distribution	• Ship transect surveys • Aerial transect surveys • Aerial photography
	Migratory birds	- Flight direction and intensities at various altitude gradients (100 m steps) up to 1,000 m	• Radar surveys • Visual observations
Marine mammals	Seals, whales, dolphins	- Habitat use	• Remote sensing: tagging and tracking seals with telemetry devices that enable to obtain information on dive profiles and foraging trips of marine mammals as well as oceanographic data
		- Abundance and distribution	• Aerial surveys during breeding and moulting season • Aerial photography

Baseline physical environment

hydrodynamics and sediment transport regime at each site and the identified impact pathways. However, the following general considerations are relevant to all sites:

- The data should provide appropriate spatial and temporal (i.e. at least one year covering all seasons before works begin and three years after completion of works) coverage and resolution;
- The data should be collected and analyzed in accordance with recognized standards;
- The type of data collected should be appropriate for EIA and for the objectives of data requirements;
- The data should be accompanied by sufficient metadata (descriptions of the data source, location, date, time, time-step, instrument used, etc.) such that their context and limitations are understood;
- Quality Control procedures should be undertaken on any data used (an assessment of the data quality, checking whether the data conform to the expected ranges of values; non-conforming data are flagged or excluded)to reduce uncertainty;
- The data must also be of sufficiently high accuracy that potential inherent error in the field data is small in comparison to the absolute values (e.g. the tidal range) and the natural range of the parameter in question(e.g. spring-neap variability in tidal range); and
- The distance between the location(s) of the measurement(s) and the location(s) of interest should be minimized: the greater the offset distance and the greater the spatial complexity, the less representative the data will be of the key site of interest.

More specific considerations to help determine the suitability of hydrodynamic, sediments/geology topographic data for informing marine and coastal physical development projects is provided in Table 3-7 .

Table 3-7 Suitability data for informing marine, coastal and estuarine physical processes investigations

Parameter	Requirement
Hydrodynamics	
Salinity and temperature	Observations should cover annual variation (spring, summer, autumn and winter) and should be separately analyzed in locations where vertical stratification or variation in longitudinal structure is anticipated.
	Observations should cover times of high/ low freshwater flow.
Sediments and geology	
Sediment grain properties and bulk geotechnical properties	Maps of seabed sediment type may already be available (typically based on a limited number of historical sediment samples). New acoustic seabed and sub-seabed surveys should ideally be used to update and supplement such regional scale information with greater resolution within the development area and other areas of interest. Both historical and newly created maps of seabed type should be verified through direct observation (i.e. using seabed grab samples and cores).
	For side-scan sonar data acquisition, the height of the towfish above the seabed should be between 5 and 10% of the horizontal range setting (this usually allows a good level of seabed feature discrimination. The overlap between tracks should be at least 50% and include appropriate cross tracks. Where complete seabed coverage is required for detailed feature or habitat mapping, 200% coverage is recommended.
	A sufficient number and suitable distribution of grab sampling locations should be used in order to characterize areas with notably different sediment types. This sampling resolution should increase in areas of known seabed complexity (Pye et al. 2017) and where potential for relevant variation in sediment type occurs.
	The collected [sediment] samples should be large enough to be representative (a 1 liter pot, or approximately 1.5 kg as a minimum for predominantly sandy sediments, 0.5 liter pot, or 0.75 kg for predominantly muddy samples, and much larger samples (>5 kg for predominantly gravel sediments) (Pye et al. 2017).

Parameter	Requirement
	Sediment sample distributions should be reported at a minimum of half phi intervals.
	Particle Size Analysis (PSA) should be undertaken by laboratories which operate through recognized Quality Control schemes (e.g. the NMBAQC; Mason, 2016) Dry sieving should be performed in accordance with recognized technical requirements and testing e.g. ISO 3310 (2000).
Suspended sediment properties	SSC measurements should be collected throughout the full water column over of a range of representative tidal (flood / ebb, neap / spring), seasonal and wave conditions. Where possible, the aim should be to have simultaneous records of SSC, water levels, currents and waves.
	Where SSC is inferred from optical/ acoustic methods, the equipment should be calibrated using locally sourced seabed/ water column samples (collected immediately adjacent to the sensor and over a spring tidal cycle) analyzed for both concentration and sediment characteristics. The collection of cohesive sediment samples is especially important in estuarine environments in order to determine particle fall velocities, where flocculation is a major contributing factor.
Sediment transport	Where bed load movement predominates, consideration should be given to undertaking sediment tracer studies, sediment trend analysis (e.g. McLaren, 1999)

Metrics and reporting results:

The way in which results of general surveys are presented in the baseline study should include the following:

- Lists of species found within the baseline
- Study area, usually broken down by taxonomic group and by habitat type
- Comparisons of species richness, composition and diversity by taxonomic group and habitat type

For individual species that have been prioritized in the baseline scope, it is good practice for the baseline report to present a habitat map for each species indicating where the species was surveyed in the study area, the locations of individuals documented, and some measure of abundance of the species in the different habitat types, such as relative density.

Measures of relative density are based on variables that vary in a relatively constant but unknown way with absolute density. As a result, they do not provide an estimate of absolute density. Instead, they provide an index of abundance that is (hopefully) a reliable means to compare the relative density of a species among sites or over time. Some examples of measures of relative density include number of individuals trapped over a given period of time, number of fecal pellets encountered in quadrats or along transects, number of individuals detected during a fixed period of searching, or Habitat Suitability Indices (HSI) that represent the capacity of a given habitat to support a species.

For species with low population numbers, or that have a small distribution, it can be very helpful for the impact assessment to portray the numbers of individuals or area of habitat encountered in the baseline study in relation to the overall population or distribution of the species.

3.4.2.2 Biodiversity-inclusive public participation

As previously mentioned during the scoping stage, biodiversity-relevant stakeholders to be consulted in the process include:

- Beneficiaries of the project – target groups making use of or putting a value to known ecosystem services which are purposefully enhanced by the project;
- Affected people – those people who experience, as a result of the project, intended or unintended changes in ecosystem services that they value;
- General stakeholders – formal or informal institutions, ministries and groups representing either affected people or biodiversity itself.

It is good practice to consult project stakeholders in all steps of planning. In particular, entities that are potentially affected by impacts to biodiversity, as well as those who are knowledgeable about local biodiversity (i.e. traditional knowledge), should be consulted about plans to manage biodiversity impacts. Furthermore, where management includes off-site offsets, stakeholders may be affected positively by enhancing biodiversity values, or negatively by altering land use practices and/or restricting use of biodiversity values. Targeted stakeholder consultation will be very important to ensure the success of offsets. Finally, as stated earlier, management planning should acknowledge perceived impacts and the necessity to recognize them appropriately in the management planning process.

3.4.2.3 Biodiversity-inclusive impacts assessment

The EIA should assess impacts of project activities during construction, operations, and decommission phases. This should be inclusive of the infrastructure and the incremental transportation and energy infrastructure required to support the project. The main marine biodiversity impacts (either directly caused by the project or indirectly caused by activities linked to the project) could include:

Impact type	Impact
Habitat loss/degradation	- Benthic habitat degradation - Benthic habitat loss - Pelagic habitat degradation - Pelagic habitat loss - Seabed erosion - Coastal erosion - Reduction in productivity, anaerobic/azoic conditions - Intertidal habitat destruction/degradation - Dune system habitat destruction/degradation
Habitat disturbance	- Habitat disturbance/turbulence - Disturbance of current, sediment and temperature regimes - Disturbance in wave patterns and distribution of wave energy - Electromagnetic disturbance - Increased vessel activity
Habitat avoidance	- Habitat displacement - Migration interference - Spawning, nursery and feeding grounds
Species mortality	- Displacement of fishing effort and conflict with fishing - Bycatch/entanglement - Submergence - Extinction rare/endemic species - Climate Change - Pollution
Non-indigenous species	- Introduction of alien species from ballast and biofouling - pests, pathogens, competitors, predators - Genetic dilution
Contaminants	- Contamination from seabed sediment disturbance - Water pollution and bioaccumulation - oil, chemical, rubbish, waste, heavy metals, antibiotics - Air pollution - Eutrophication
Noise	- Noise - above water - Noise - below water
Light	- Light pollution - artificial lights - Water turbidity
Collisions	- Collisions (sea birds) - Collisions (marine mammals)
Positive impacts	- Habitat creation - Shelter - Knowledge of poorly studied ecosystems - Increasing productivity of nutrient poor area

A list of potential environmental impacts/aspects to marine biodiversity from different types of marine and coastal projects is provided in Table 3-12. Potential impacts are those that could occur in the absence of management within the project's area of influence. It should be noted that other impacts may arise depending on the project's activities and location.

Table 3-8 Environmental aspects identification matrix for marine and coastal projects

Activities/ Sources of Impact	Potential effects
Shipping & transportation	
Shipping noise	- Low-intensity sounds can cause masking and behavioural disruptions - May cause hearing loss and reduce animals' ability to rely on hearing for locating and capturing prey, and for detecting and avoiding predators
Anchoring	- Damaging the benthic environment by uprooting plants, leading to reduced shoot density and bed cover - Anchoring on rocky bottoms poses a threat to assemblages of infralittoral algae and sensitive species that are associated with such habitat types
Ships navigating in shallow water areas	- Stir up sediments from soft bottoms - Alteration in the physical and chemical characteristics of the water column and, ultimately, to potential adverse impacts
Antifouling biocides	- Affecting non-target biota, especially in harbours and marinas with high vessel density and restricted water circulation
Collisions	- Collisions and damaging seabirds and marine mammals
Accidental oil spills	- Damaging the marine habitats and reduce water quality
Landfills in the coastal area	
Construction works	- Increasing turbidity, total suspended solids and other water quality values - Burying of habitats - Changes in current and wave regimes - Disturbance of nutrient flow - Erosion of beaches
Operation of the landfill	- Degrading the coastal marine ecosystem and the marine water quality
	- Decreasing in the population of planktons, benthic flora and fauna
	- Less oxygen for the macro-benthic fauna
Wastewater treatment plant in the coastal area	
Construction works and pipeline installations	- Habitat loss or destruction
Clearance activities and vehicular transport during construction	- Habitat loss or destruction and vegetation loss
Destruction of terrestrial vegetation	- Mortality of individuals - Loss of individuals through emigration
Habitat removal and/or introduction of barriers	- Habitat fragmentation
Oil spills and solid waste generation	- Altered abiotic/site factors - Decrease of water quality
Wastewater leakages	- Altered abiotic/site factors - Decrease of water quality
Reduction of uncontrolled wastewater discharges	- Positive impact
Construction /maintenance of ports and terminals	
Physical removal of sea bed material	- Removal of benthic animals living in/on sediments leading to their entrainment. - Reversibility of impact depends on type of marine species and communities - The recovery of disturbed habitats following dredging depends upon the nature of the new sediment at the dredge site, sources and types of re-colonizing animals, and the extent of the disturbance - Conversion of shallow subtidal to deeper subtidal habitats as a cumulative effect resulting from maintenance dredging
Disposal of dredged materials, Sediment suspension and increased turbidity level	- Disposal of non-contaminated fine material leads to sediment suspension and increase in turbidity level. This would impact filter feeding organisms, such as shellfish, through clogging of gills and damaging feeding and breathing equipment, leading to fish fatalities. The severity increases with release of organic nutrients attracting larger fish, which ultimately would suffer the same fate - Increases in turbidity also lead to decreases in rates of photosynthesis (absence of light penetrating the water column)

Activities/ Sources of Impact	Potential effects
Release of organic matter, nutrients and contaminated sediments	- Release of organic rich sediments during dredging or disposal/re- suspension would result in localized oxygen (O2) removal from the surrounding water leading to short-term suffocation of marine animals and plants within the localized area, or may even deter migratory fish or mammals from passing through Severity increases if O2 depletion occurs during sensitive periods (peak spring migration, mating) - Releases of organic matter and nutrients are also associated with high risk of Eutrophication given the induced anaerobic conditions (O2 removal)
Release of dredged material during disposal	- Heavy metals, oil, and Polychlorinated Byphenyls locked into the seabed sediments in ports and harbours are released into the water column. Contaminants are taken up by animals and plants (if any), with the potential to cause contamination and/or poisoning. Secondary impacts are also anticipated by the re-uptake of these contaminants in the food chain to fishand sea mammals and ultimately local consumers, thus jeopardizing public health. - Repercussions on marine fauna include morphological andreproductive disorders. - Resulting contamination also causes increases in siltation, hence smothering benthic animals and plants. This in turns causes stress, reduced rates of growth and/or reproduction and even fatalities
Operation of ports and terminals	
Discharges from ships	- Water pollution
Spills of oils, lubricants, fuels and other oily liquids	- Water pollution - Damaging to fishery resources, aquatic biota and coastal habitat - Damaging to bottom biota and habitat
Cargo handling and storage	- Water pollution and bottom contamination resulting from these effluents lead to deterioration of aquatic biota and fishery resources
Discharge from waterfront industries	- Water pollution. - Deterioration of aquatic biota
Aquaculture	
Shellfish Culture	
Deposition/ accumulation of organic matter	- Potential loss or reduced diversity through smothering of benthic habitats and through oxygen depletion and hydrogen sulphide production during bacterial de-composition of organic matter; community domination by a small number of pollution indicator species, such as Capitellidae worms and other scavengers and deposit feeding species - Avoidance/attraction responses to additional/altered food source, with associated changes to population distribution, species composition and abundance - Loss or reduction in seagrass cover through the deposition of organic matter and the associated effects of light reduction and physical smothering
Inorganic deposition	- Alteration of physical structure of the sediment and the effects of smothering
Altered water column nutrient and suspended solid concentrations	- Altered species composition and abundance - Reduction in cover/growth through increased competition for essential growth nutrients - Reduced food supply/habitat loss
Farm structures and the use of heavy machinery and boats	- Altered communities through habitat modification, compaction of sediments,and smothering near structures that act as accumulation points for wrack and sediments - Removal of seagrass beds and habitat; reduction in beds caused by altered flows and habitats; impacts through shading effects of structures and machinery; effects of compaction from heavy machinery; and increased turbidity from farm boats
Introduction of non-endemic species and exotic pathogens	- Reductions in native stocks

Activities/ Sources of Impact	Potential effects
Translocation of exotic pathogens	- Potential reduction in species abundance and diversity resulting from intolerance of endemic species to exotic pathogens
Chemicals	- Potential bio-accumulation of contaminants, particularly for filter feeding organisms
Marine Debris	- Local smothering and loss of benthic habitat - Mortality or impacts on health through ingestion of, or entanglement in, debris
Finfish Culture	
Organic deposition (i.e. faeces and excess fish food)	- Smothering and light reduction - Altered sediment chemistry, including oxygen depletion and production of toxic gases
Nutrient discharge	- Potential contamination with micro-algal biotoxins during bloom events caused by increased nutrient levels - Loss or reduced coverage due to growth of epiphytic algae and phytoplankton blooms - Smothering through growth of nuisance algae, resulting in reduced diversity and loss of some native species - Altered species composition and abundance of microalgae due to blooms - Avoidance and attraction responses, a result of modified food sources, leading to altered population distribution
Antibiotics	- Antibiotic resistance in sediment bacteria and non-target organisms
Disease	- Spread of disease, potential loss of diversity and abundance
Chemicals	- Bio-accumulation and possible mortality through toxic effects - Lethal and sub-lethal effects resulting in alterations to species diversity and composition - Bio-accumulation, avoidance responses and changes in distribution patterns - Bio-accumulation in tissues
Introduction of exotic species	- Reductions in native stocks - Genetic contamination of wild stocks
Marine Debris	- Impact of debris through ingestion or entanglement
Predator control	- Entanglement, resulting in injury and potentially death - Entanglement and injury or death, and behavioural changes - Resulting from non-lethal methods of predator control
Disposal of dead fish to landfill	- Oiling of feathers of sea birds and ingestion of oil, leading to poor health or death
Farm infrastructure and machinery	- Altered communities through habitat modification and disturbance - Physical disturbance of sediment and shading effects of structures - Possible behavioural responses to farm disturbance resulting in altered distributions
Farm structure and operations	- Alteration of the benthic communities through habitat modification and disturbance such as through the effects of increased turbidity, shading and sedimentation.
Construction of power plants	
Land clearing, earthmoving, terrain shaping	- Modification of drainage patterns - Increased run-off due to soil compaction and changes in vegetation cover - Modification of stream and rivers due to crossings - Run-off carrying sediments and associate contaminants - Wetland destruction - Run-off carrying sediments and associated contaminants - Poisoning via contamination of waste and spills and leaks of hazardous materials - Reductions in species and habitats
Construction and landscaping of onsite facilities, structures and buildings	- Increased run-off due to soil compaction and changes in vegetable cover - Run-off carrying sediments and associated contaminants
Construction and/or upgrade of access roads. Construction of power line connections	- Increased use of natural resources and to invasion of previously inaccessible areas
Camp operation	- Increased collecting, hunting and fishing (food for workers)

Activities/ Sources of Impact	Potential effects
Solid and human waste disposal	- Water quality degradation from discharges and leaching - Run-off carrying associated contaminants
Fuel and chemical storage and handling	- Contamination from spills and leaks
Transportation	- Contamination from spills and leaks
Existence of structures	- Accidental releases of insulating fluids
Operation/maintenance of power plants	
Dams for cooling ponds	- Individuals killed, damaged or entrapped by intake structures, cooling systems or turbines
Cooling systems	- Disposal of material dredged from ponds or removed from cooling towers - Discharges of cooling tower - Habitat alteration from discharges of cooling tower
On-site equipment	- Disruption and dislocation of local and/or migratory wildlife, including disturbance of migratory corridors and breeding, spawning, nesting and calving areas
Maintenance	- Contamination from disposal of material dredged from cooling ponds, reservoirs or other structures - Habitat alteration from water contamination from disposal of dredged or removed material
Fuel washing and preparation	- Habitat alteration from water contamination from residue disposal
Fuel combustion	- Ash and sludge disposal (from the combustion chamber and air control devices) - Destruction or degradation of ecosystems downwind from stack emissions - Habitat alteration from water contamination from ash and sludge disposal
Solid and human waste disposal	- Water quality degradation from discharges and leaching - Run-off carrying associated contaminants
Fuel and chemical storage and handling	- Poisoning via spill and leaks - Contamination from spill and leaks
Existence of structures	- Accidental releases of insulating fluids
Decommissioning of power plants	
Removal or decommissioning of structures and buildings	- Increased run-off due to soil compaction and changes in vegetative cover - Run-off carrying sediments and associated contaminants - Contamination from spill and leaks - Disruption and dislocation of local and/or migratory wildlife, including disturbance of migratory corridors and breeding, spawning, nesting and calving areas - Wildfire
Touristic estbalishment in the coastal area (contruction &operation)	
Release of waste water to the sea	- Reduction in water quality
Soil compaction, erosion	- Altered abiotic/site factors
Destruction of vegetation	- Mortality of individuals
Disturbance or loss of habitat	- Loss of individuals through emigration
Habitat removal and/or introduction of barriers like roads	- Habitat loss or destruction - Habitat fragmentation
Construction noise, traffic, or presence of people	- Disturbance
Soil contamination due to disposal of oils and hazardous material	- Vegetation loss

Activities/ Sources of Impact	Potential effects
Physical removal of sea bed	- Removal of material from sea bed: this causes the removal of benthic animals living in/on sediments leading to their entrainment - Reversibility of impact depends on type of marine species and communities - The recovery of disturbed habitats following dredging depends upon the nature of the new sediment at the dredge site, sources and types of re-colonizing animals, and the extent of the disturbance - Conversion of shallow subtidal to deeper subtidal habitats as a cumulative effect resulting from maintenance dredging
Sedimentation and turbidity	- Suspension/re-suspension of non-contaminated fine material leads to sediment suspension and increase in turbidity level. This would impact all marine organisms including filter feeding organisms, such as shellfish, through clogging of gills and damaging feeding and breathing organs, leading to fatalities. The severity increases with release of organic nutrients attracting large fish, which ultimately would suffer the same fate. - Increases in turbidity also lead to decreases in rates of photosynthesis (absence of light penetrating the water column)
Contaminated sediments	- Heavy metals, oil, and Polychlorinated Byphenyls locked into the seabed sediments in ports and harbors are released into the water column. - Contaminants are taken up by animals and plants (if any), with the potential to cause contamination and/or poisoning. Repercussions on marine fauna include morphological and reproductive disorders. - Bioaccumulation of heavy metals and other petroleum-based contamination released from contaminated sediments - Resulting contamination also causes increases in siltation, hence damaging benthic animals and plants. This in turns causes stress, reduced rates of growth and/or reproduction and even fatalities.
Solid and liquid waste generation	- Direct contamination (i.e. improper disposal)
Discharge of cooling water	- The differences in temperature between the discharge water and seawater may cause localized thermal changes that may negatively affect marine ecology.
Accidental spills of fuels, oil and chemicals	- Anticipation on sediment and water quality
Offshore exploration drilling	
Mobilisation, installation, plug and abandonment and demobilisation	- Physical disturbance of sediments, benthic communities and sensitive seabed habitats.
Well Drilling - discharge of cuttings and fluids (Water based drilling fluid)	- Burial or smothering of benthic communities - Oxygen depletion in sediments - Changes to sediment structure and quality - Changes to water quality - Potential for toxicity or bioaccumulation effects - Potential for indirect effects on fish - Potential for direct and indirect effects on sensitive seabed habitats
Discharge of waste and wastewater from MODU (Mobile offshore drilling unit) and support / supply vessels	- Reduction in water quality - Effects on plankton and fish
Uplift and discharge of cooling water and produced water	- Reduction in water quality/ temperature effects - Potential impacts on plankton and fish
Discharge of ballast from MODU and support/ supply vessels	- Potential for introduction of non-indigenous species in ballast water and fouling, with knock-on effects to rest of marine ecosystem (secondary impacts)
Underwater noise from vertical seismic profile (VSP) activities	- Potential for injury / hearing loss, alteration of behaviour, auditory masking, effects on zone of audibility (Cetaceans turtles and seals and Nekton (fish))
Underwater noise from MODU and support / supply vessel operations	- Potential for injury / hearing loss, alteration of behaviour, auditory masking, effects on zone of audibility (Cetaceans turtles and seals and Nekton (fish))

Activities/ Sources of Impact	Potential effects
Light from MODU	- Attraction of seabirds, turtles and larger marine fauna to night time lighting - Potential for disorientation, collision with structures - Positive impacts associated with temporary refuge effects for migratory birds
Logistics base operation - discharge of drainage water	- Local effect on water quality
Logistics base operation – noise generation	- Disturbance of fauna in vicinity of logistics base
Helicopter transfers to Airport	- Airborne noise may disturb fauna (Sensitive coastal habitats,Terrestrial ecology, and Seabirds)
Accidental events	
Dropped Object from MODU (lifting)	- Physical disturbance of seabed sediments and benthos from dropped object
Loss of chemical containment on- board MODU	- Reduction in water quality and sediment quality - Potential indirect effects on benthos plankton, fish and fisheries
Radioactive source lost in hole	- Potential radiation impact on sediments and geology
Riser rupture, release of drilling fluid to sea	- Reduction in water quality and sediment quality - Potential indirect impacts on benthos, plankton, fish and fisheries
Shallow gas blowout, release of gas into water column during riserless operations	- Reduction in water quality and sediment quality - Potential indirect impacts on benthos, plankton, fish and fisheries - Potential for gas in water column to affect shipping
Blowout – release of condensate and gas	- Transboundary impacts also predicted in offshore waters and shoreline of Syria - Potential condensate spill impacts on plankton, fish, seabirds, cetaceans, turtles and seals and coastal habitats
Collision of third-party ship with MODU – release of third-party fuel inventory, possible damage to MODU and riser	- Reduction in water quality - Potential indirect impacts on plankton, fish, seabirds, cetacean,turtle and seals, marine habitats and fisheries
Helicopter crash on MODU deck – release of aviation fuel to sea	- Reduction in water quality - Potential indirect impacts on plankton
Loss of containment during offshore materials transfer to MODU – release of drilling fluids or marine diesel to sea	- Reduction in sediment and water quality - Potential indirect impacts on benthos, plankton, fish and fisheries
Loss of rig stability (rig capsize) with release of fuel inventory	- Offshore waters and shoreline of Lebanon likely to be affected - Transboundary impacts also predicted in offshore waters and shoreline - Potential condensate spill impacts on plankton, fish, seabirds,cetaceans, turtles and seals and coastal habitats
Earthquake resulting in loss of well integrity and release of hydrocarbons to sea	- Offshore waters and shoreline of Lebanon likely to be affected - Transboundary impacts also predicted in offshore waters and shoreline - Potential condensate spill impacts on plankton, fish, seabirds,cetaceans,turtles and seals and coastal habitats

3.4.2.4 Biodiversity-inclusive analysis of project alternatives phase

Alternatives related to biodiversity that should be considered, as applicable, in the EIA include:

- Change the physical layout/design of the project's facilities to avoid impacting certain biodiversity components, such as irreplaceable habitats;
- Restore degraded ecosystems on the site to enhance ecosystem services;
- Use an ecosystem services approach and green infrastructure;
- Introduce design alternatives to avoid adverse effects on marine species;
- Consider timing of construction, maintenance and decommissioning; or
- Deliver smart conservation that can contribute to species diversity.

3.4.2.5 Biodiversity-inclusive environmental management plan phase

3.4.2.5.1 Biodiversity mitigation measures

The purpose of this section is to describe the process for developing a management plan for biodiversity impacts. Here management is defined as any action that corresponds to the four elements of the mitigation hierarchy, as described below and shown in Figure 3-4.

The mitigation hierarchy can be viewed as a prioritized set of possible management responses to anticipated impacts. Where feasible, avoidance and minimization are preferable to rehabilitation/restoration and offsets because they maintain biodiversity components that may be difficult or costly to replace, or in some cases cannot withstand impacts and remain viable in the project area of influence or beyond. Avoiding or minimizing an impact can reduce the project's biological, social, and financial liabilities.

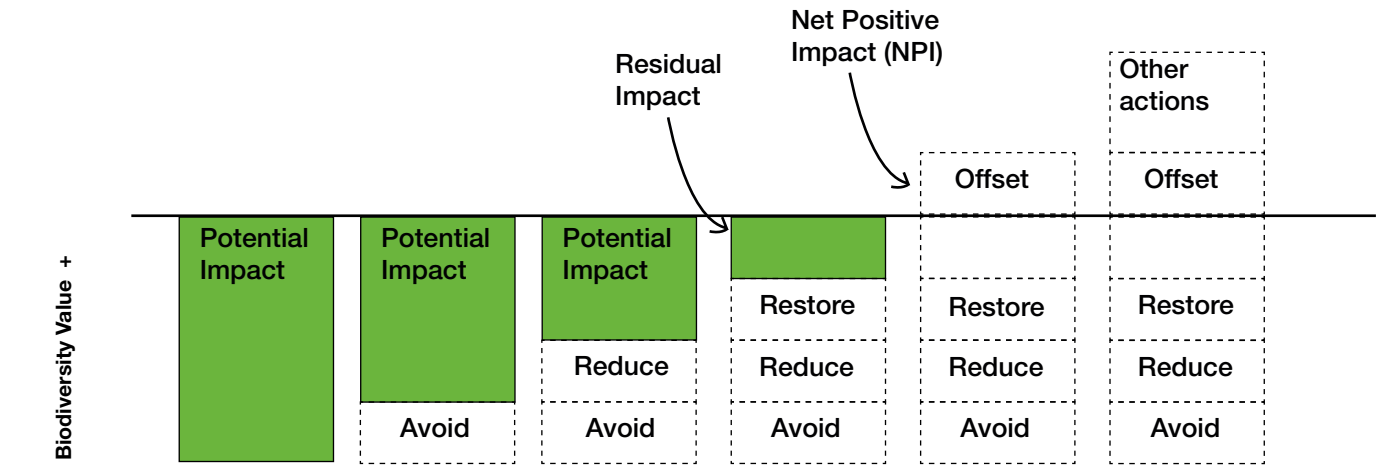


Figure 3-4 Graphical depiction of the mitigation hierarchy[3]

Source: Hardner et al., 2015

1. Avoidance:

"Avoidance" prevents damaging actions before they take place. Avoidance often involves a decision to deviate from the business-as-usual project development path, and should be taken into consideration during the analysis of alternatives as mentioned in Section 3.4.2.4.

The rationale for employing avoidance may include ecological, economic, regulatory and reputational reasons. Avoidance should be considered where there are biodiversity components that are: especially vulnerable and irreplaceable; of particular concern to stakeholders; or where a cautious approach is warranted due to uncertainty in impact assessment or the efficacy of management measures.

[3] The x-axis does not represent time in the project lifecycle, but rather the sequence in which categories of mitigation are considered when planning management. The metric used to measure change in biodiversity value (e.g., hectares of habitat) is shown on the y-axis.

Some environmental challenges have no technical solution. If the biodiversity components are likely to be influenced by the project's design, location and dimension, the project proposal must aim to avoid significant impacts through one or more of the following options:

- Site Selection: Locate the entire project away from areas recognized for important biodiversity components.
- Project Design: Configure infrastructure to preserve areas at the project site with important biodiversity components.
- Sensitive design: Impacts can be sometimes avoided by selecting relatively least impacting design alternatives.
- Opting for superior technology: Appropriate technological choices can be very effective in reducing the physical disturbance and prevent spatial impacts.
- Nature engineering solutions: Collaborative partnerships between environmental experts and engineers have generated practical solutions to many technical problems related to use of developed areas by organisms. Relatively greater levels of success in nature engineering initiatives have been achieved in planning of transportation projects through sensitive habitats to avoid impacts.
- Development choices: This involves making choices between development alternatives that can avoid impacts on biodiversity rich areas or the scarce and important resources.
- Siting considerations: For avoidance of impacts on areas that are not able to withstand the pressure from development activities, practitioners should exercise one or more of the following options:
    - Avoid adverse impacts on designated sites and protected species;
    - Avoid adverse impacts to priority habitats and species based on national priorities; or
    - Timing of project activities (to avoid fawning, breeding period).

2. Minimization:

"Minimization" reduces the extent, intensity, and duration of impacts on biodiversity that are not prevented by avoidance.

This step is usually applied during impact identification and prediction to limit or reduce the degree, extent, magnitude, or duration of adverse impacts.

Examples of minimization actions include practices such as implementing procedures for reducing the occurrence of environmental contamination from hydrocarbon spills, and maintaining environmental flows at dams. Minimization may require significant project investment if avoidance options are overlooked or not possible.

There are many different ways in which project impacts can be minimized:

- Decreasing the spatial/temporal scale of the impact: The spatial and temporal impacts can be decreased by controlling or regulating access to biodiversity rich areas duringconstruction or operation; using existing infrastructure and route corridors for new developments to the extent possible.This strategy can avoid vegetation clearing and greatly reduce the demands on land for right of use in sensitive areas.
- Promoting bio-friendly technologies: Many innovative trials are improving the technological products that can significantly avert threats to biodiversity.
- Timing of work and reducing duration of construction related activities in marine environments: Many of the impacts can be minimized by timing of in-stream work to avoid disturbance to the aquatic species sensitive to siltation or reducing considerably the duration of activities involving earth work and other construction related operations to a minimum.
- Rescue (relocation, translocation) of impacted species and habitat components.

3. Rehabilitation and restoration:

In cases where a project's activities occur for only a specific period of time, there may be an opportunity to rehabilitate or even restore biodiversity components on the impacted site.

There may also be situations where some damage to biodiversity is unavoidable, making restoration or remediation necessary. The objective of ecological restoration is to re-establish a functional ecosystem of a designated type that contains sufficient biodiversity to continue its maturation by natural processes. The two attributes of biodiversity that are most readily attained by restoration are species richness and community structure.

The requirement to perform rehabilitation and restoration may be tightly related to the desired outcome of biodiversity management (e.g., no net loss, net gain). In either case, both rehabilitation and restoration programmes should consider several important guidelines:

1. The biodiversity baseline should provide information on all species types at the site. In the best- case scenario, baseline information will include species composition and density estimates, and any information possible about ecological function. The baseline can serve as a reference against which restoration plans are developed.

2. Experimental trials should be started as soon as possible. In those cases where the conservation of biodiversity components at the site depends significantly on restoration, the project proponent should demonstrate that it can successfully performthe necessary restoration prior to impacting the ecosystem.

3. Where possible, rehabilitation/restoration should be progressive, as areas at a site become available for rehabilitation.

4. Biodiversity offsets:

Biodiversity offsets are defined as measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity.

According to Figure 3-4, an estimate of residual impact to biodiversity components will be needed once avoidance, minimization, and restoration actions have been designed. Offsets should be designed to make up for that residual loss if it represents a significant shortfall relative to mitigation targets.

Following are a set of general principles for offset design:

1. Follow the mitigation hierarchy: Offsets are not intended to relieve project developers of performing other types of mitigation.

2. Offsets should support marine landscape-level conservation: Offsets should be designed considering the ecological processes and functions of the marine landscape (i.e. coral relocation).

3. Offsets must provide additionally: Only the gains in biodiversity that would not have occurred in the absence of a conservation project qualify as a "biodiversity offset". The offset must not duplicate or replace an existing and adequately functioning restoration or conservation project.

4. Achieving no net loss or net gain requires adequate scale: Offsets should generate biodiversity gains (additionally) commensurate with the impacts of the project.In some cases, the scale of the offset may be expanded in size to accommodate uncertainties in design and expected effectiveness.

5. In-kind (like-for-like) vs. out-of-kind (trading up): An offset typically seeks to generate benefits for the biodiversity value(s) impacted by a project. Offsets with these characteristics are known as "in- kind" or "like-for-like" offsets. Sometimes, however, it may be desirable to implement an offset that restores or conserves a biodiversity value of greater conservation value than that which is to be impacted by the project. For example,if a project impacts very common natural habitat in the marine landscape, it may be desirable to "trade up" to an offset that conserves a more rare and/or threatened habitat that has been identified as a priority for conservation. Such an "out-of-kind" offset should only be implemented after appropriate consultation with conservationstakeholders to ensure both its technical validity (i.e. that the offset is genuinely of greater conservation value), and its public acceptance (i.e. that stakeholders view the offset as greater in perceived value).

6. Stakeholder participation fortifies offset design: Entities with responsibilities and interests related to biodiversity conservation and the human welfare impacts (both positive and negative) of decisions should be engaged in the biodiversity offset planning process. A sample list of stakeholders might include:environmental regulators; conservation organizations operating in the area; and local communities that may be affected by either losses of biodiversity that the offset seeks to replace, or loss of resources due to the implementation of the offset.

7. The benefits of offsets should endure as long as project impacts: Offsets require sustained management to ensure that thebenefits endure over time. To achieve such continuity, it is recommended to ensure legal protection of offset areas and secure funding to manage the offset for its entire design life.

3.4.2.5.2 No net loss

- **No net loss definition:**

No net loss of biodiversity is inextricably linked with both net positive impact (NPI), sometimes referred to as 'net gain', and the often-controversial idea of biodiversity offsetting.

Both no net loss and NPI are biodiversity status goals for development projects, where biodiversity gains either negate (no net loss) or outweigh (NPI) negative project impacts.

The International Finance Corporation's Performance Standard 6 (PS6) defines it as follows: "The point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration and finally to offset significant residual impacts, if any, on an appropriate geographic scale (e.g., local, national, regional)" (IFC, 2012).

IFC PS6 requires that all projects in natural habitats implement mitigation measures that are designed to achieve no net loss of biodiversity, and those projects in critical habitats to achieve net gains for the biodiversity components for which the critical habitat was designated.

There should be no further loss of biodiversity, both in quantitative and qualitative terms. This implies that loss of irreplaceable biodiversity must be avoided, and loss of other biodiversity has to be compensated (in term of quality and quantity). For example, loss of an ecosystem service may be irreversible, but could foreseeably, be 'replaced' using appropriate technology, in some instances. Where possible, opportunities for biodiversity enhancement should be identified and supported.

The concept of no net loss (and net gain) is illustrated in Figure 3-5.

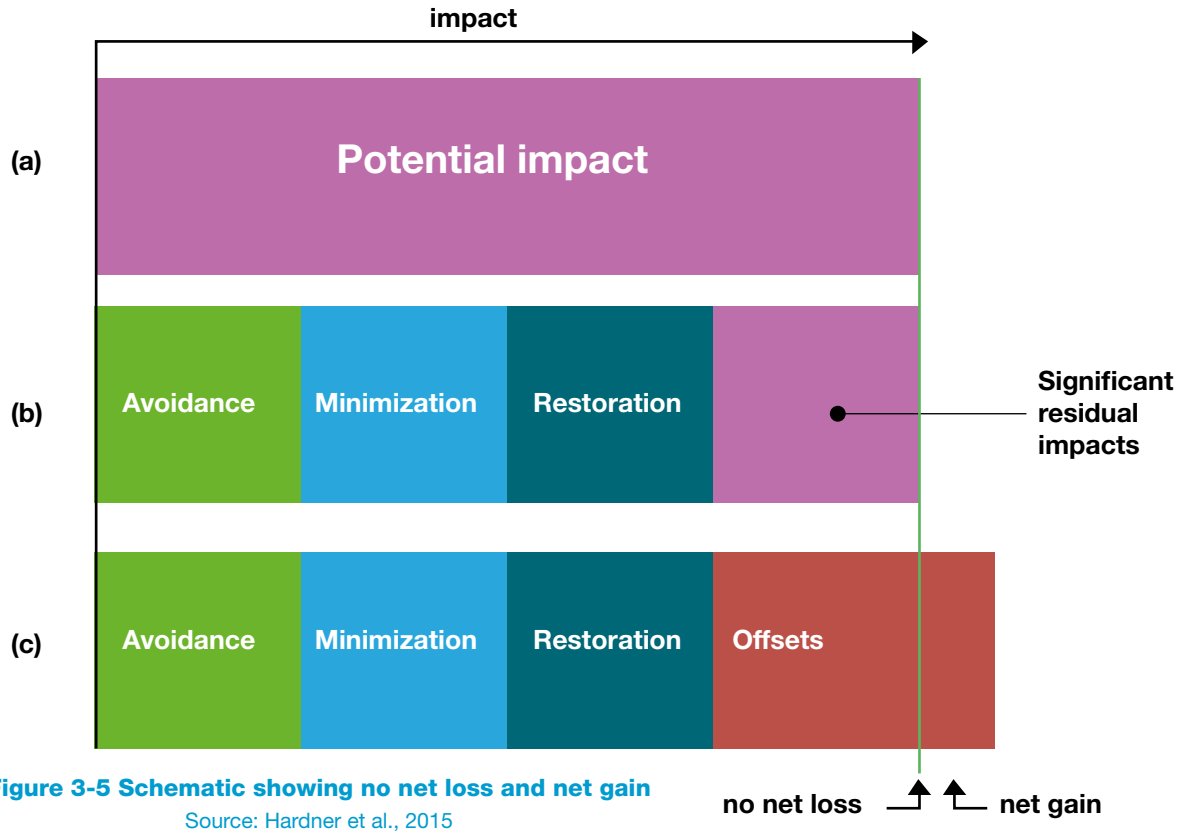


Figure 3-5 Schematic showing no net loss and net gain
Source: Hardner et al., 2015

- **Implementation of "No Net Loss" of biodiversity**

Achieving No Net Loss (NNL) and Net Gain (NG) requires quantifying both the losses of biodiversity caused by a development project and the associated gains (including biodiversity offsets) through implementation of the mitigation hierarchy, in order to demonstrate that overall gains in biodiversity are equal to (NNL), or greater than (NG), the losses. Losses caused by development projects might be direct or indirect, and cumulative with other development projects; and losses and gains include both those that are expected (as a result of project design) and those that are unexpected. It is emphasized that conservation 'gains' under biodiversity NNL/NG primarily compensate for losses, such that they do not represent absolute gains for conservation.

Offsetting residual biodiversity impacts, after all other impacts have been avoided, minimized, and restored, require practitioners to deal with a number of different factors. Offset multipliers, where a policy requires the offset of more than one biodiversity unit per unit impacted, are designed to address these. Offset multipliers can be used to deal with the achievement of conservation goals (so-called 'end- game' multipliers, where a multiplier is used to support no net loss or net gain); e.g. offsets for certain endangered species require larger offset ratios than for others, or to address social equity and distribution problems (Rayment et al., 2014). Offset multipliers can also be used to address lack of good quality data, the inherent uncertainty of ecological restoration or creation, and the complications of temporary loss of habitat while the offset site is created (Gardner et al., 2013; Pilgrim and Ekstrom, 2014; Tucker et al., 2014).

3.4.2.6 Biodiversity-inclusive monitoring phase

3.4.2.6.1 Overview

Monitoring and auditing are used to see what actually occurs after project implementation has started and whether the proponent is compliant with the environmental management plan (EMP) at the construction, operation and decommissioning stages. Management systems and programmes, including clear management targets and appropriate monitoring, should be set in place to ensure that mitigation is effectively implemented, unforeseen negative effects or trends are detected and addressed, and expected benefits/positive developments are achieved as the project proceeds. Provision should be made for emergency response measures and/or contingency plans where accidents could threaten biodiversity.

Monitoring and evaluation focused on the counting of species and measuring of surface areas only does not provide sufficient information. Understanding and monitoring the mechanisms behind these changes leads to better understanding of the effects of the intervention and the actual results of mitigation and/or compensation.

The results of monitoring provide information for periodic review and alteration of environmental management plans, and for optimizing environmental protection through good practice at all stages of the project. Biodiversity data generated by environmental impact assessment should be made accessible and useable by others and should be linked to biodiversity assessment processes being designed and carried out under the Convention on
Biological Diversity.

According to the International Finance Corporation's Guidance Note 6, long-term biodiversity monitoring may be required to validate the accuracy of predicted impacts and risks to biodiversity components posed by the project, and the predicted effectiveness of biodiversity management actions. The monitoring and evaluation programme should include the following: (i) baseline, measures of the status of biodiversity components prior to the project's impacts; (ii) process, monitoring of the implementation of mitigation measures and management controls; and (iii) outcomes, monitoring of the status of biodiversity components during the life of the project, compared to the baseline. In addition, clients should consider controls, monitoring in comparable areas where project impacts are not occurring to detect effects unrelated to project impacts. The client is expected to develop a practical set of indicators (metrics) for the biodiversity components requiring mitigation and management. Indicators and sampling design should be selected on the basis of utility, that is, their ability to inform decisions about mitigation and management, and effectiveness, their ability to measure effects with adequate statistical power given the estimated ranges of natural variability for each
biodiversity value.

Specific thresholds should be set for monitoring results that will trigger a need to adapt the management plan(s) to address any deficiencies in performance at all the project phases - construction, operation, and decommissioning. The results of the monitoring programme should be reviewed regularly. If they indicate that the actions specified in the management plan(s) are not being implemented as planned, the reasons for failure need to be identified (for example, insufficient staff, insufficient resources, unrealistic timeline, etc.) and rectified. If outcome monitoring results indicate that project impacts to biodiversity components were underestimated or that the benefits to biodiversity from management actions including offsets were overestimated, the impact assessment and management plans should
be updated.

3.4.2.6.2 Scope of monitoring

Monitoring focuses on those components of biodiversity most likely to change as a result of the project. The use of indicator organisms or ecosystems that are most sensitive to the predicted impacts is thus appropriate, to provide the earliest possible indication of undesirable change. Since monitoring often has to consider natural fluxes as well as anthropogenic effects, complementary indicators may be appropriate in monitoring. Indicators should be specific, measurable, achievable, relevant and timely. Where possible in marine and coastal areas, the choice of indicators should be aligned with existing indicator processes.

The timing and frequency of monitoring should also be discussed and agreed in advance. However, choices will depend primarily on the nature of the parameter of interest and the aims of the monitoring, but should also reflect site specific considerations and be reasonable in terms of practicality and cost.

For monitoring, the EIA should consider the following:

- Monitoring should be applied during the three phases of the project: construction, operation, and decommissioning.
- Construction monitoring: All development projects should be managed with the expectations of surprising outcomes. It is usually necessary to adapt and change implementation actions to meet goals. Construction monitoring provides an early warning that adverse impacts are occurring
- Strategic monitoring (one year before construction starts and three years after start of operation): Retrospective or hindsight monitoring and should be the main focus of the monitoring programme. The objective is to compare measurements of certain key characteristics of the environment before and after project work is done. It allows for an environmental audit of the project's effects and requires benchmark information to be collected before the project starts to provide a statistically sound baseline
- Tactical monitoring: Real time or oversight monitoring that is done in conjunction of the environmental management programme. The objective is to monitor the construction operation on a daily basis. Allows the detection of major negative impacts that may be occurring in real time. If problems are detected, construction/work is halted until the situation is corrected

- **Identification of appropriate thresholds**

It is necessary to consider appropriate (quantified) threshold levels which if exceeded, constitute the potential for remedial action. These threshold levels will be project specific, although they are often linked to the upper and lower limits of observed natural variability in the baseline. It should be noted that cumulative impacts - impacts of the new project in addition to existing stressors - can result in thresholds surpassing the carrying capacity of the receiving marine environment.

The range of natural variability can be relatively wide and it may be difficult in a practical (or contractual) sense to confidently attribute some types of observed change to the potential effects of a single development. Uncertainty in the degree of linkage between a potential cause and actual effect is greater where the mechanism is either confidently not anticipated, or poorly defined and understood. Uncertainty increases with the distance between the development and the affected area; also, if there are multiple developments present which could potentially also have contributed to the effect. Changes from a particular baseline condition might be the natural result of atypical periods of weather, possibly influenced in the longer term by global or regional patterns of climate change.

04.

Inspection checklist

4. Inspection checklist

4.1 Purpose and scope of checklist

The checklist serves as a tool for the MoE inspections of coastal establishments. It specifically addresses (direct and indirect) impacts to biodiversity, as well as relevant mitigation and monitoring practices. Its simple format, with Yes, No, or Not Applicable responses, is designed for a quick, but comprehensive assessment of a project's compliance with the biodiversity-inclusive EIA process. The checklist can be used to assess all types of projects located along marine/coastal zones.

4.2 Checklist questions

Questions	YES	NO	N/A	Remarks
Baseline description				
1. Is the Project area adjacent to or within any of the important biodiversity areas as designated by the MoE (i.e. Marine Protected Areas)?				
2. Does the project site encompass the protected habitats of endangered species designated by Lebanese laws or international treaties and conventions?				
3. Does the project site encompass ecologically valuable habitats (i.e. coral reefs, mangroves)?				
4. Is there a possibility that the project will adversely affect aquatic wildlife?				
5. Is there a possibility that the project will adversely affect aquatic vegetation?				
6. Does the project require any large-scale changes of topographic or geographic features or cause disappearance of the natural seashore?				
7. Were field surveys used to describe the biodiversity baseline study area?				
8. Does the baseline study area consider the distribution of biodiversity components, particularly those that are range-restricted and may be especially important for the interpretation of project impacts?				
9. Were the conducted field surveys adequately designed to assess variation in biodiversity components over time and within the baseline study area?				
10. Does the methodology include an approach to assess whether the sampling effort was sufficient?				
11. Have species surveys been organized with respect to their specific natural habitat types?				
12. Are maps available that show the distribution and/or abundance o fbiodiversity components in the baseline study area?				
13. If yes, were GIS software or HSI models used to determine biodiversity distribution and/or abundance?				
14. Were appropriate metrics(i.e.speciesrichness)used to measure the viability and function of the biodiversity components				
15. Were ecosystem services and their beneficiaries, defined through consultation with experts, organizations, and communities, clearly identified?				

Questions	YES	NO	N/A	Remarks
Stakeholder participation				
1. Has the content of the project and the potential impacts to biodiversity been adequately explained to local stakeholders based on appropriate procedures, including information disclosure?				
2. Does the project site encompass the protected habitats of endangered species designated by Lebanese laws or international treaties and conventions?				
Alternatives analysis				
1. Were alternatives to the project (including the "no-project" alternative) considered?				
2. Have alternative plans of the project been examined with respect to biodiversity?				
3. If alternatives were considered, was the proposed project determined to have the least impact on biodiversity?				
Impact assessment				
1. Have the relevant direct, primary effects on coastal land uses been assessed?				
2. Have the relevant direct, primary effects on geological features (i.e. soils and sediments) been assessed?				
3. Have the relevant direct, primary effects on hydrology and water quality been assessed?				
4. Have the relevant direct, primary effects on uses of the water environment been assessed?				
5. Have the relevant direct, primary effects on air quality and climatic conditions been assessed?				
6. Have the relevant direct, primary effects on the acoustic environment (e.g. noise or vibration) been assessed?				
7. Have the relevant direct, primary effects of heat pollution been assessed?				
8. Have the relevant direct, primary effects of light pollution been assessed?				
9. Have the relevant direct, primary effects on material assets and depletion of non-renewable natural resources (e.g. fossil fuels, minerals) been assessed?				

Questions	YES	NO	N/A	Remarks
Mitigation measures				
1. Has the Project proponent made a binding commitment to implement the proposed mitigation measures or that the mitigation measures are just suggestions or recommendations?				
2. Are adequate mitigation measures considered to reduce impacts during the Project phases (e.g., noise,vibrations, turbid water, dust, exhaust gases,and wastes)?				
3. If the Project's activities adversely affect the biological environment, are adequate mitigation measures considered to reduce impacts?				
4. If the Project's activities adversely affect the physicalenvironment, are adequate mitigation measures considered to reduce impacts?				
5. If alternatives were considered, was the proposed project determined to have the least impact on biodiversity?				
6. Does the management plan successfully mitigate risks and impacts to the biodiversity components?				
7. Did the management planning process involve appropriate stakeholder input?				
A. Avoidance				
1. Does the management plan consider avoidance of impacts that have severe consequences on biodiversity?				
2. Do proposed avoidance measures accommodate uncertainty regarding impact assessment or the efficacy of other management measures?				
B. Minimization				
1. Does the management plan include minimization of impacts on biodiversity where needed and possible?				
2. Are proposed minimization measures technically justified for the project and accompanied by monitoring for effectiveness?				
3. Is the management plan transparent about the information needed to design effective minimization measures?				
4. Is the management plan provided in a form that is appropriate for others (e.g., construction engineers) to carry out minimization measures?				
C. Rehabilitation and restoration				
1. Is rehabilitation/restoration the appropriate action given the significance of the impact on biodiversity?				
2. Have the contributions to avoidance and/or minimization been optimized first?				
3. Have realistic goals been set for rehabilitation restoration based on knowledge of the ecosystem,past experience, cost, stakeholder input, and other practical considerations?				
4. Is the proposed rehabilitation/restoration method tested and proven for the project setting? If not, are uncertainties clearly stated and accommodated with appropriate precaution?				

Questions	YES	NO	N/A	Remarks
D. Biodiversity offsets				
1. Is an offset appropriate given the significance of the impact on biodiversity? Are avoidance, minimization, or restoration measures practicable and more appropriate?				
2. If a biodiversity offset is used, is it designed according to generally accepted principles of good practice?				
3. Does the proposed offset plan accommodate uncertainty through monitoring and adaptive management?				
Monitoring plan				
1. Does the Project proponent develop and implement a monitoring programme based on the environmental baseline information for each biological and physical impact?				
2. Does the Project proponent establish an adequate monitoring framework (organization, personnel, equipment, and budget)?				
3. Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?				
4. If yes, is the Project proponent in compliance with these regulatory requirements?				
A. Air quality				
1. Are the construction sites watered to minimize dust generated?				
2. Are stockpiles of dusty materials (size with more than 20 bags cement) covered or watered?				
3. Is the management plan transparent about the Are all vehicles carrying dusty loads covered/sprayed with water prior to leaving the site?				
4. Are demolition work areas sprayed with water?				
5. Are dusty roads paved and/or sprayed with water?				
6. Is dust controlled during percussive drilling or rockbreaking?				
7. Are stack emissions tested regularly (according to regulatory requirements)?				
8. Do air pollutants, such as sulfur oxides (SOx), nitrogen oxides (NOx), emitted from the project's equipment comply with the Lebanese emission standards?				
9. If not, are any mitigating measures being taken?				

Questions	YES	NO	N/A	Remarks
B. Water quality				
1. Are all water discharge licenses valid?				
2. Is the Project compliant with the conditions of the licenses?				
3. Is a wastewater treatment system being used and properly maintained on site?				
4. If no, is wastewater diverted through the wastewater networks to a WWTP?				
5. Is any wastewater discharged to the storm drains?				
6. If so, is the wastewater being pre-treated?				
7. Are measures provided to properly direct effluent to silt removal facilities?				
8. Are sedimentation traps and tanks free of silt and sediment?				
9. Are all manholes on-site covered and sealed?				
10. If vehicles are washed on-site, are measures being taken to prevent wastewater from being improperly discharged?				
11. Is the public road/area around the site entrance kept clean and free of muddy water?				
12. Is domestic water directed to septic tanks or the wastewater network?				
13. Does the project cause any alterations in coastal lines?				
14. Does the project cause a change in water temperature or quality due to changes in flow regimes?				
15. Are pollutants, such as SS, BOD, COD, and pH tested regularly and in compliance with the Lebanon's effluent standards?				
16. Does the effluent water contain heavy metals?				
17. If so, are measures being taken to reduce theirconcentration and control their dscharge?				
18. Does the project prepare any measures to prevent polluting surface, sea or undeerground water by the penetration from reclaimed lands?				
C. Noise				
1. Do noise and vibrations generated by the facility comply with Lebanese standards?				
2. Do air compressors and generators operate with doors closed?				
3. Where applicable, are silenced equipment utilized?				
D. Odors				
1. Are there any noxious odors generated by the facility?				
2. Are adequate odor control measures being taken?				

Questions	YES	NO	N/A	Remarks
E. Waste management				
1. Is the site kept clean? (i.e. free of litter, good housekeeping practices)				
2. Are separated labelled containers/areas provided for facilitating recycling of solid waste?				
3. Are construction wastes/recyclable wastes and general refuse removed off site regularly?				
4. Are construction wastes collected and disposed of properly by licensed collectors?				
5. Are chemical wastes, if any, collected and disposed of properly by licensed collectors?				
6. Are chemical wastes, if any, properly stored and labelled?				
7. Are oil drums, if any, properly stored and labelled?				
8. Is there any indication of oil spillage?				
9. Are there proper measures to control/mitigate any oil spillage?				
10. Are wastes (i.e. sludge, oils, and solids) generated from the project facilities properly treated and disposed of in accordance with the Lebanese regulations?				
11. Is offshore dumping of dredged soil properly disposed in accordance with the Lebanese regulations?				
F. Resource conservation				
1. Is water recycled wherever possible?				
2. Are measures in place for preventing water pipe leakage and wastage?				
3. Are diesel-powered plants and equipment shut off while not in use to reduce excessive use?				
4. Are any energy conservation practices being adopted?				
5. Are any renewable energy alternatives being adopted?				
6. Are any recycled materials being used during construction?				
7. Are materials stored in good condition to prevent deterioration and wastage(e.g.covered, separated)?				
G. Emergency response plan				
1. Is there an emergency response plan?				
2. Are fire extinguishers properly maintained and not expired?				
3. Are accidents and incidents reported and reviewed?				
4. Are corrective & preventive actions identified and recorded?				
5. Is the site kept clean? (i.e. free of litter, good housekeeping practices)				
6. Are separated labelled containers/areas provided for facilitating recycling of solid waste?				

Environmental Status of the Establishment

Meets the conditions required (Circle one): Yes No

Does not meet the conditions required, especially for the following:

Baseline description

Stakeholder participation

Alternatives analysis

Impact assessment

Mitigation measures

Monitoring plan:

- Air quality

  Specify: _____

- Noise management

  Specify: _____

- Odor management

  Specify: _____

- Waste management

  Specify: _____

- Resource conservation

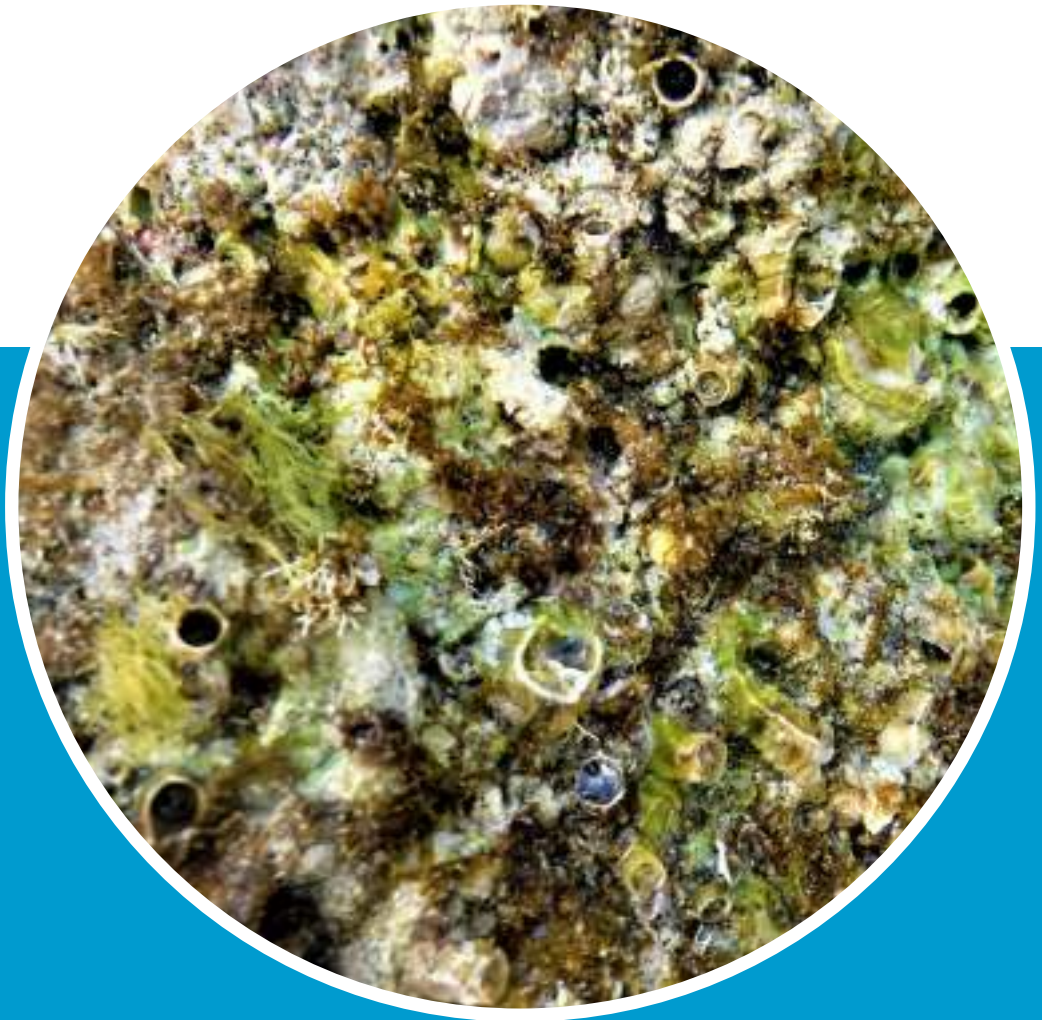
  Specify: _____

- Emergency response plan

  Specify: _____

Suggestions:

References



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Appendices

Appendices

Annex 1: Legal framework

Table 6-1 Summary of relevant environmental legislations

	Legislation	Year	Title	Key requirements
1	Law No. 64	1988	Preservation of the environment against pollution from dangerous waste and hazardous substances	The law defines dangerous waste and hazardous substances, and includes general provisions for handling hazardous waste, and sets sanctions in case of non-compliance with the provisions of the law Article 4 stipulates that: Every producer, exporter, distributer, holder or transporter has to prove to authorities that the dangerous wastes that he produces, exports, distributes, holds or transports are of the types that can be disposed according to the provisions of this law and the regulations to be issued for its application Article 6 stipulates that, it is not allowed, in any condition whatsoever, to import or hold or transport nuclear wastes or wastes polluted with nuclear radiation, or waste that contain toxic hazardous chemicals or materials dangerous to the public safety Article 7 stipulates that wastes shall be disposed either 1) by the person in charge of the wastes or 2) by public or private organizations specialized in wastes disposal. Types of wastes to be disposed by each party shall be determined by a decree to be issued by the Council of Ministers.
2	Law No. 121	1992	Establishment of two nature reserves (in some of the islands in front of Tripoli Beach)	Establishment of two nature reserves (in some of the islands in front of Tripoli Beach)
3	Law No. 708	1992	Creation of Tyre Coast Nature Reserve in Jaftlak Ras Al Ain – Tyre Real Estate Zone	Creation of Tyre Coast Nature Reserve in Jaftlak Ras Al Ain – Tyre Real Estate Zone The Law defines the reserve's borders which extends to the entirety of the territorial waters facing its coastal parts
4	Law No. 444	2002	Environmental Protection Law	It is the environmental protection framework law. Includes the general provisions for the protection of the environment Article 30 stipulates that it is strictly forbidden all discharges, immersions or burning in the Lebanese territorial waters of every material that may directly or indirectly: Affect the health of human beings or natural marine resources; Harm the activities and marine creatures, including shipping, fishing, flora and seaweed; Negatively affect the quality of marine water; Reduce the entertainment value and tourism possibilities of the sea and the Lebanese coast Article 31 requires a permit for discharge to sea (application decree not issued) Article 34 Damp areas and their ecological regulations are submitted to special protection which conditions are specified by a decree taken in Council of ministers upon the proposal of the minister of environment taking into consideration the role of these regions and there importance in protecting the marine and fluvial biodiversity and the comprehensive coastal environmental balances

	Legislation	Year	Title	Key requirements
				Article 44 requires a permit for the import, handling or disposal of dangerous/ hazardous chemicals (application decree not issued) Article 47: Shall be considered of public interest the protection of nature and the prevention and combat of desertification and the protection of all fauna and flora species and its habitats and the biological balances and environmental regulations and biodiversity, in the course of facing all deterioration, pollution and disappearing risks Article 48: The natural resources management and the protection of biodiversity in Lebanon is based on: Making a survey of the existing fauna and flora species, especially those incurring the risk of disappearance. Submitting all activities that might harm the environment to the prior notification of the ministry of environment. Proposing the plans of protection of the fauna and flora species habitats and the conditions of their living and development. Proposing the creation of national parks and natural reserves and protected areas and proposing the conditions of protection of natural sites and landscapes. Setting up a control system to gain access to the biological and bio genetic resources and its use in accordance with the conventions and international treaties that Lebanon had ratified, or will do so, in agreement with concerned ministries. Participation of the citizens and private and public institutions to the protection of biodiversity and sustainable development of natural resources. Decrees taken in Council of ministers upon the proposal of the minister of environment and the concerned ministers shall specify the details of implementing the provisions of this article According to the law, MOE has the powers for monitoring inspection and enforcement
5.	Law No. 690	2005	Organization of the Ministry of Environment	The MoE is responsible for all matters related to the environment sector. It holds the following tasks (among others): - Develop strategies, policies, projects and action plans, activities and studies for environmental protecting and sustainability of natural resources - Prepare legislation, specifications and standards for environmental protecting and sustainability of natural resources - Participate in the development of preventive plans to respond to disasters - Determine the environmental conditions for licensing the establishment and investment of institutions - Determining the environmental conditions related to land use and to the protection of the marine beaches, rivers, springs, lakes, marshes and valleys - Determine the environmental conditions related to land use in order to protect it from such activities that might cause any damage to the surrounding environment - Determine the areas that are appropriate to create reserves as well as the conditions that must be available, the rules and regulations to run them - Determine hunting seasons, locations, and the species the hunters are permitted to hunt, as well as the species of flora and fauna that are threatened or endangered Conducting tests and analysis to determine the pollution rates of air, soil and water and propose and follow up the implementation of measures taken by the concerned authorities

	Legislation	Year	Title	Key requirements
6.	Law No. 251	2014	Lawyers and investigation judges for environmental related cases	The law assigns fulltime lawyers and investigation judges for environmental related cases, and defines environmental crimes
7.	Law No. 77	2018	Water Resources Law	The law aims to organize, develop, and protect water resources. It also aims to promote sustainability by strengthening water establishments
8.	Law No. 80	2018	Integrated Solid Waste Management	The law sets integrated solid waste management principles. It provides guidelines for the management of non-hazardous waste and hazardous waste
9.	Law No. 130	2019	Protected Areas	The Law classifies the categories of protected areas, sets the requirements for their establishment, includes supervision and management requirements and defines zoning within protected areas
10.	Law No. 170	2020	Establishment of the Al Abbasieh nature reserve in Tyre Casa, located on a section of the coastal area and the marine area	The Law aims to preserve marine and coastal biodiversity and ecosystems and natural resources in the reserve, and to protect it from the risks of pollution and any other threats.
11.	Decree No. 5243	2001	Classification of industrial institutions	Amends Decree No.4917/1994 on the classification of hazardous, dangerous and harmful to health institutions (based on Legislative Decree 21/L/1932)
12.	Decree No. 8018	2002	Determining the rules, procedures and conditions for licensing and investment of industrial establishments	This decree determines the conditions of constructing, investing, renewal and modifying licenses for industrial establishments
13.	Decree No. 9765	2003	Monitoring of industrial institutions	Monitoring, measures and penalties related to the industrial structures for the protection of the environment and public health
14.	Decree No. 9765	2003	Control measures and penalties relating to industrial establishments	All industrial institutions are subject to the provisions of this decree, regardless of their classification The Decree sets the principles of inspection of all industrial institutions, and the measures and sanctions to be applied in events of violation
15.	Decree No. 13389	2004	Types of wastes of health institutions and how to discharge them	Classifies medical waste types and sets the requirements for disinfection, storage and disposal
16.	Decree No. 2275	2009	Organization and mandates of the MoE.	Application Decree on the Organization and mandates of the Ministry of Environment, its divisions and departments
17.	Decree No.2366	2009	National Land Use Master Plan	Classifies lands and organizes the territory based on the following major guidelines: - Structure the territory around the major urban centers; - Associate all regions to the national economic development; - Distribute the major public facilities in an effective and integrated manner; - Unite the territory with an efficient and developed transportation network; - Insure an urban development of good quality, respecting the characteristics of each region; - Highlight and benefit from the natural wealth of the country; - Exploit the water resources in a sustainable way; and - Resolve efficiently the problems of quarries, wastewater and solid wastes

	Legislation	Year	Title	Key requirements
18.	Decree No. 230/1	2012	The mechanism for reviewing environmental impact assessment and environmental impact assessment reports	This decree sets out the mechanism for reviewing environmental impact assessment and environmental impact assessment reports
19.	Decree No. 8044	2012	Endorsement of the Management Plan of Tyre Coast Nature Reserve (2011-2016)	Regulates the management of Tyre Coast Nature Reserve
20.	Decree No. 8213	2012	Strategic Environmental Assessment in the public sector	This Decree aims at determining mandatory procedures to be followed for the assessment of potential environmental impacts of any policy, plan, programme, study, investment or organization proposal that tackles an entire Lebanese region or an activity sector, in order to ensure that these activities are compliant with conditions related to health, public safety, the protection of the environment and the sustainability of natural resources
21.	Decree No. 8633	2012	Environmental Impact Assessment	This decree aims at setting forth the rules that shall be considered in the EIA of public and private projects to avoid potential environmental impacts during construction, operation and decommissioning of these projects
22.	Decree No. 8471	2012	Environmental compliance standards for industrial establishments	The decree defines the Concept of Environmental Compliance and the procedures to get an environmental compliance certificate (ECC). The ECC certificate will allow the establishment to benefit from economic incentives set forth in Law 2002/444 and Law 2005/690
23.	Decree No. 3989	2016	Environmental Police	Designation of an Environmental Police Department within the Ministry of Environment to regulate environmental crimes and enforce penalties; and specification of their organization and mandates
24.	Decree No. 167	2017	Application of article 20 of law 444/2002. (Tax reduction)	Tax reduction on environmental industry activities and on spending aimed at protecting and preserving the environment in a sustainable manner Reduction of customs duties on the import of equipment and tools that will be used to avoid or reduce or eliminate any form of pollution or treat, recycle and reuse waste
25.	High Commissioner's Decision No. 372	1926	Regulations related to navigation, fishermen and fishing boats	This decision determines the regulations of fishing boats and the fees imposed on them, in addition to determining the penalty for violations of the rules of the marine fishing system and fishing boats
26	High Commissioner's Decision No. 2775	1929	Monitoring of fishing practices in coastal waters	This decision aims to take the necessary measures to protect fish species of all kinds through monitoring coastal fishing, determining the places in which fishing can be prohibited, as well as the time in which some types of fishing are prohibited, determining the types of permissible fishing and the means of fishing and prohibited methods, as well as determining the fees imposed on fishing devices, fishing licenses and the imposition of criminal penalties on everyone who violates the provisions of this law
27.	High Commissioner's Decision No. 3178	1930	The navigation of foreign fishing boats in Lebanese waters	This decision specifies the conditions that must be met in foreign fishing boats and which roam in the Lebanese waters as well as it indicates the penalties in case of violation of the provisions mentioned in this decision

	Legislation	Year	Title	Key requirements
28.	High Commissioner's Decision No. 166	1933	Antiquities System	It sets the procedures for protecting and preserving antiquities and reporting of new archaeological findings
29.	High Commissioner's Decision No. 95/L	1939	Sponge catching	This decision aims to define the conditions given for sponge catching, as well as the fees required to obtain licenses for it, the mechanisms for selling it, and how to control and suppress violations
30.	MoA Decision No.125/1	1999	Prohibiting fishing of whales, seals and marine turtles	Prohibiting fishing of whales, seals and marine turtles
31.	MoEW Decision No. 14	2005	Establishment of the Committee for field emergencies for energy issues and aquatic resources	The Committee is directly linked to the Minister of Energy and Water and implements his instructions and recommendations
32.	CoM Decision NO. 103	2010	National Emergency Response Committee (NERC)	The committee comprises of 22 members representing the ministries of National Defence, Interior and Municipalities, Public Health, Public Works and Transport, Telecommunications, Environment, Energy and Water, Education and Higher Education, and Information as well as the Civil Defence and the Lebanese Red Cross. The NERC will develop (1) a general framework for combating disasters, (2) a detailed contingency plan to respond to threats from various types of disaster (i.e., earthquakes, floods, forest-fires, landslides, weapons of mass destruction, wars, and radioactive threats), and (3) an emergency management plan when a disaster occurs
33.	MoE Decision No. 20/1	2011	Amendment of two specifications of liquid waste generated by the chemical companies to be discharged into the sea	Amends MoE Decision 8-1/2001. Amendment entailed two specifications of liquid waste generated by the chemical companies to be discharged into the sea
34.	MoA Decision No. 1044/1	2014	General conditions to protect cetaceans and marine mammals	General conditions to protect cetaceans and marine mammals (i.e. whales, dolphins, and sea lions)
35.	MoA Decision No. 1045/1	2014	General conditions to protect sharks and dogfish	General conditions to protect sharks and dogfish
36.	MoA Decision No. 396/1	2014	Ban on catching seabirds	Ban on catching seabirds
37.	MoE Decision No. 262/1	2015	Defining the procedures for filing and review of an objection on MoE Decisions related to EIAs	Defines the procedures for filing and review of an objection on MoE Decisions related to EIAs
38.	MoE Decision No. 261/1	2015	Defining the procedures for the review of Scoping Reports (SRs) and EIA Reports	Includes the mechanism and procedures to review the EIA scoping reports and environmental impact assessment reports EIAs
39.	MoE Decision No. 791/1	2016	Procedure for assigning overtime for MoE staff to review IEE and EIA reports	Details the procedure for assigning additional time for MoE staff assigned to reviewing IEE and EIA reports
40.	MoE Decision No. 189	2016	Review procedure for environmental audit studies	Details the review procedure and the required content of the audit studies

	Legislation	Year	Title	Key requirements
41.	MoE Circular No. 9/1	2014	Relevant documents to be annexed to EIA and IEE reports as per decree number 8633 of 2012	Indicate the requested documents that need to be attached to EIA and IEE reports such as: maps, an aerial view of the property, a map matching the tree locations with the proposed construction site within the property
42.	MoE Circular No. 10/1	2016	To project developers in both the public and private sectors requesting them to abide by the applicable EIA decree number 8633 of 2012	It highlights the responsibilities of the MoE to remind public and private sectors implementing projects requesting EIA to abide by the laws during construction, operation, and dismantling activities. Including the submission of periodic reports to the Ministry of Environment
43.	MoE Circular No. 7/1	2019	Establishment of wastewater treatment plants from private enterprises	Instructions to private enterprises on how to establish waste water treatment plants and which legislations to apply

Table 6-2 Summary of draft relevant environmental legislations that are not yet enacted

	Draft Legislation	Year	Title	Key requirements
1.	Draft Law for Integrated Coastal Zone Management of the Lebanese coastal zone	2015	Draft Law for Integrated Coastal Zone Management of the Lebanese coastal zone	26 articles spread over seven sections Most important articles are the National Council for ICZM Independent unit headed by the Prime Minister Last six articles of the Law related to sanctions and penalties
2.	Draft Fishing Law	--	Fishing Law	Given that the existing fishing law in Lebanon is about 90 years old, a new draft law was prepared by the MOA taking into consideration the new challenges in fisheries management as well as the new scientific references and benchmarks for the sustainable management of marine resources

Table 6-3 Conventions relevant to the development projects affecting coastal and marine ecosystems

No.	Treaty, convention or protocol	Status	Objective and brief description of relevant articles
Conventions			
1.	International Convention on Civil Liability arising from Damage Resulting from Seawater Pollution by Liquid Hydrocarbons, held in Brussels on November 29, 1969	Authorization to conclude via Law No. 28/1973	This law implements the civil liability convention which ensures that adequate compensation is available to persons who suffer oil pollution damage resulting from maritime casualties involving oil-carrying ships
2.	Barcelona Convention and two of its protocols: a) 1976 Dumping Protocol, b)1976 Emergency Protocol	Ratified via Leg. Decree No. 126/1977	The 1976 Barcelona Convention for Protection against Pollution in the Mediterranean Sea is a regional convention to prevent and abate pollution from ships, aircraft and land based sources in the Mediterranean Sea. This includes, but is not limited to, dumping, run-off and discharges. Signers agreed to cooperate and assist in dealing with pollution emergencies, monitoring and scientific research. Article (7): Pollution Resulting from Exploration and Exploitation of the Continental Shelf and the Seabed and its Subsoil: The Contracting Parties shall take all appropriate measures to prevent, abate and combat pollution of the Mediterranean Sea area resulting from exploration and exploitation of the continental shelf and the seabed and its subsoil. a)1976 Dumping Protocol: Protocol for the Prevention of Pollution in the Mediterranean Sea by Dumping from Ships and Aircraft. It was amended in 1995 and recorded as: Protocol for the Prevention and Elimination of Pollution in the Mediterranean Sea by Dumping from Ships and Aircraft or Incineration at Sea. b)1976 Emergency Protocol: Protocol Concerning Cooperation in Combating Pollution of the Mediterranean Sea by Oil and other Harmful Substances in Cases of Emergency. It was replaced by the Protocol Concerning Cooperation in Preventing Pollution from Ships and, in Cases of Emergency, Combating Pollution of the Mediterranean Sea in 2002.
3.	MARPOL 73/78 and its annexes: Annex I, Annex II, Annex III, Annex IV, and Annex V	Ratified via Law No. 13/1983	The MARPOL Convention also known as the « Marine Pollution Convention » is an International Convention for the Prevention of Pollution from Ships from operational or accidental causes. The Convention includes the following Annexes: • Annex I: Regulations for the Prevention of Pollution by Oil.Covers prevention of pollution by oil from operational measures as well as from accidental discharges. It states that: - Ship must be proceeding en route, not within a “special area” and oil must not exceed 15 ppm (without dilution). Vessel must be equipped with an oil filtering system, automatic cut-off, and an oil retention system. - Shipboard oil pollution emergency plan (SOPEP) is required. • Annex II: Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk. Includes details the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk; some 250 substances were evaluated and included in the list appended to the Convention; the discharge of their residues is allowed only to reception facilities until certain concentrations and conditions (which vary with the category of substances) are complied with. In any case, no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land.

No.	Treaty, convention or protocol	Status	Objective and brief description of relevant articles
			• Annex III: Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form. Contains general requirements for the issuing of detailed standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions and notifications. For the purpose of this Annex, "harmful substances" are those substances which are identified as marine pollutants in the International Maritime Dangerous Goods Code (IMDG Code) or which meet the criteria in the Appendix of Annex III. • Annex IV: Prevention of Pollution by Sewage from Ships. Contains requirements to control pollution of the sea by sewage; the discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land; sewage which is not comminuted or disinfected has to be discharged at a distance of more than 12 nautical miles from the nearest land. • Annex V: Prevention of Pollution by Garbage from Ships. Deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of; the most important feature of the Annex is the complete ban imposed on the disposal into the sea of all forms of plastics. It stipulates that: - Disposal of garbage from ships and fixed or floating platforms is prohibited. Ships must have a garbage management plan and shall be provided with a Garbage Record Book. - Discharge of food waste ground to pass through a 25-mm mesh is permitted for facilities more than 12 nmi from land.
4.	UNESCO Convention on the Protection of Cultural & Natural Heritage, 1972	Adhesion via Law 19 dated 30/10/1990.	Ensuring the identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage.
5.	The International Convention relating to the Limitation of the Liability of Owners of Sea- Going Ships, and Protocol (Brussels, 1957)	Accessed via Law No. 294/1994	The owner of a sea-going ship may limit his liability in accordance with Article 3 of this Convention in respect of claims arising from any of the following occurrences, unless the occurrence giving rise to the claim resulted from the actual fault or privity of the owner: (a) loss of life of, or personal injury to, any person being carried in the ship, and loss of, or damage to, any property on board the ship; (b) loss of life of, or personal injury to, any other person, whether on land or on water, loss of or damage to any other property or infringement of any rights caused by the act, neglect or default of any person on board the ship for whose act, neglect or default the owner is responsible or any person not on board the ship for whose act, neglect or default the owner is responsible: Provided however that in regard to the act, neglect or default of this last class of person, the owner shall only be entitled to limit his liability when the act, neglect or default is one which occurs in the navigation or the management of the ship or in the loading, carriage or discharge of its cargo or in the embarkation, carriage or disembarkation of its passengers; and (c) any obligation or liability imposed by any law relating to the removal of wreck and arising from or in connection with the raising, removal or destruction of any ship which is sunk, stranded or abandoned (including anything which may be on board such ship) and any obligation or liability arising out of damage caused to harbour works, basins and navigable waterways.

No.	Treaty, convention or protocol	Status	Objective and brief description of relevant articles
6.	The United Nations Convention on the Law of the Sea (UNCLOS)	Ratified via Law No. 295/1994	The Law of the Sea Convention defines the rights and responsibilities of nations with respect to their use of the world's oceans, establishing guidelines for businesses, the environment, and the management of marine natural resources. UNCLOS divided the sea into zones, each subject to a different legal status and applicable law. UNCLOS outlines state's responsibility for protecting the marine environment from: "Pollution from installations and devices used in exploration of natural resources of the seabed and subsoil, in particular measures for preventing accidents and dealing with emergencies, ensuring the safety of operations at sea, and regulation of the design, construction, equipment operation and manning of such installations or devices". (Article 194 (3) (c) of UNCLOS 182 "Measures to prevent, reduce and control pollution of the marine environment").
7.	The Convention on Biological Diversity (CBD)	Ratified via Law No. 360/1994	The Convention has three main goals: 1) conservation of biological diversity; 2) sustainable use of its components; and 3) fair and equitable sharing of benefits arising from genetic resources. The Convention is legally binding; countries that join it ('Parties') are obliged to implement its provisions.
8.	Basel Convention on the control of transboundary movements of hazardous wastes and their disposal	Ratified via Law No. 387/1994	The main objective of the Basel Convention is to protect human health and the environment against the negative impacts resulting from the generation, management, movement and disposal of hazardous wastes. The Convention controls the transboundary movements of hazardous waste and considers shipments without prior consent as illegal. The provisions of the Convention centre around the following principal aims: 1) the reduction of hazardous waste generation and the promotion of environmentally sound management of hazardous wastes, wherever the place of disposal; 2) the restriction of transboundary movements of hazardous wastes except where it is perceived to be in accordance with the principles of environmentally sound management; and 3) a regulatory system applying to cases where transboundary movements are permissible.
9.	The Convention on wetlands of international importance – (Ramsar)	Ratified via Law No. 23/1999	Ramsar Convention is an international treaty for the conservation and sustainable utilization of wetlands, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. There are four Ramsar Sites in Lebanon: 1) Tyre Coast Nature Reserve; 2) Ammiq wetland; 3) Ras El Chaqaa; and 4) Palm Islands Nature Reserve. O&G activities shall not affect these conserved sites.
10.	Convention on the Law of the Non- Navigational Uses of International Watercourses	Ratified via Law No. 67/1999	The Convention noted the obligation of States to protect, maintain and prevent, reduce and combat the environmental systems of international watercourses, as well as to prevent, reduce and combat pollution, to prevent the use of international watercourses in violation of the principles and rules of general international law applicable in the event of an international or non-international armed conflict
11.	Stockholm Convention on Persistent Organic Pollutants	Ratified via Law No. 432/2002	Stockholm Convention on Persistent Organic Pollutants (POPs) aims to eliminate or restrict the production and use of persistent organic pollutants (POPs). Key elements of the Convention include the requirement that developed countries provide new and additional financial resources and measures to eliminate production and use of intentionally produced POPs, eliminate unintentionally produced POPs where feasible, and manage and dispose of POPs wastes in an environmentally sound manner.

No.	Treaty, convention or protocol	Status	Objective and brief description of relevant articles
12.	Convention on the Protection of the Underwater Cultural Heritage. Paris, 2 November 2001	Grant to join via Law No. 722 dated 15/05/2006.	The Convention aims to ensure and strengthen the protection of underwater cultural heritage. According to the convention, the preservation in situ of underwater cultural heritage shall be considered as the first option before allowing or engaging in any activities directed at this heritage and recovered underwater cultural heritage shall be deposited, conserved and managed in a manner that ensures its long-term preservation. Also, Underwater cultural heritage shall not be commercially exploited.
13.	Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade	Ratified via Law No. 728/2006	The convention promotes open exchange of information and calls on exporters of hazardous chemicals to use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans. Signatory nations can decide whether to allow or ban the importation of chemicals listed in the treaty, and exporting countries are obliged to make sure that producers within their jurisdiction comply.
14.	Ratification of the amendments made to the Barcelona Convention on the protection from polluting the Mediterranean Sea	Ratified via Law No. 34/2008	The main amendments made in 1995 concerned: 1) the extension of the Convention's geographical field of application to the coast; 2) the application of the precautionary principle; 3) the application of the "polluter pays" principle; 4) the promotion of impact assessments; 5) the protection and preservation of biological diversity; 6) combating pollution from cross-border movements of dangerous waste; and 7) access to information and public participation.
15.	IMO Ballast Water Management Convention	CoM Decision 31/2009	The convention represents a significant step towards protecting the marine environment from the introduction of non- indigenous species from the uncontrolled discharge of ballast water. The Convention requires all ships to implement a Ballast Water and Sediments Management Plan. All ships will have to carry a Ballast Water Record Book and will be required to carry out ballast water management procedures to a given standard. Parties to the Convention are given the option to take additional measures which are subject to criteria set out in the Convention and to IMO guidelines. At the time the Ballast Water Management Convention was adopted, suitable technologies allowing this strict standard to be met did not exist. Meanwhile, however, companies all over the world have developed novel systems and technologies which are now undergoing a complex approval procedure at IMO or the national approval authorities.
16.	The International Convention on the control of harmful anti-fouling systems on ships, 2001	Grant to join via Law No. 100/2010	The Convention prohibits the use of harmful organotin in anti-fouling paints used on ships and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems. (Anti-fouling paints are used to coat the bottoms of ships to prevent sea life such as algae and molluscs attaching themselves to the hull – thereby slowing down the ship and increasing fuel consumption.)
17.	The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Ratified via Law No. 223/2012	CITES is an international agreement between governments, which aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. It regulates the trade of wild species and restricts the exchange of certain species. Today, it accords varying degrees of protection to more than 37,000 species of animals and plants, whether they are traded as live specimens, fur coats or dried herbs. CITES is legally binding on the joined Parties; therefore, they have to implement the Convention. And the convention provides a framework to be respected by each Party, which has to adopt its own domestic legislation to ensure that CITES is implemented at the national level.

No.	Treaty, convention or protocol	Status	Objective and brief description of relevant articles
18.	Minamata convention on mercury	Adopted on 10 October 2013 and entered into force on 16 August 2017	The Minamata Convention on Mercury is a global treaty to protect human health and the environment from the adverse effects of mercury. It was agreed at the fifth session of the Intergovernmental Negotiating Committee on mercury in Geneva, Switzerland and it was adopted on 10 October 2013 at the Conference of Plenipotentiaries in Japan. The Minamata Convention entered into force on 16 August 2017.The Convention draws attention to mercury that has broad uses and is released to the atmosphere, soil and water from a variety of sources. While it is naturally occurring, controlling the anthropogenic releases of mercury throughout its lifecycle has been a key factor in shaping the obligations under the Convention.
19.	The Convention on Conservation of Migratory Species of Wild Animals (CMS); known as the Bonn Convention	Grant to join via Decree 3320/2018	CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range. Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Besides establishing obligations for each State joining the Convention, CMS promotes concerted action among the Range States of many of these species. Migratory species that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention. For this reason, the Convention encourages the Range States to conclude global or regional agreements. In this respect, CMS acts as a framework Convention. The agreements may range from legally binding treaties (called Agreements) to less formal instruments, such as Memoranda of Understanding, and can be adapted to the requirements of particular regions. The development of models tailored according to the conservation needs throughout the migratory range is a unique capacity to CMS.
Agreements			
20.	Agreement on the conservation of African-Eurasian Migratory Water Birds (AEWA)	Grant to join via Law No. 412/2002	AEWA is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. The core activities carried out under AEWA are described in its Action Plan, which is legally binding for all countries that have joined the Agreement. The AEWA Action Plan specifies different measures to be undertaken by Contracting Parties to warrant the conservation of migratory waterbirds within their national boundaries. These include species and habitat protection and the management of human activities as well as legal and emergency measures. In addition, special protective measures are to be implemented for those waterbird populations of particular conservation concern, listed in Column A of the Action Plan. Waterbird species and habitats shall not be affected by the O&G activities.

No.	Treaty, convention or protocol	Status	Objective and brief description of relevant articles
21.	The conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic-ACCOBAMS	Grant to join via Law No. 571/2004	ACCOBAMS is the Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area is 'a cooperative tool for the conservation of marine biodiversity in the Mediterranean and Black Seas'. ACCOBAMS aims to reduce threats to cetaceans in Mediterranean and Black Sea waters and improve our knowledge of these animals, and is the first Agreement binding the countries in the two sub regions, enabling them to work together on a matter of general interest. Annex A of the convention includes an indicative list of cetaceans to which the agreement applies. Annex 2 includes the conservation plans which includes the following measures of direct relation to O&G activities: Parties shall: - require impact assessments to be carried out in order to provide a basis for either allowing or prohibiting the continuation or the future development of activities that may affect cetaceans or their habitat in the Agreement area, including fisheries, offshore exploration and exploitation, nautical sports, tourism and cetacean - watching, as well as establishing the conditions under which such activities may be conducted; - regulate the discharge at sea of, and adopt within the framework of other appropriate legal instruments stricter standards for, pollutants believed to have adverse effects on cetaceans.
22.	Sendai Framework of Action	Endorsed by the UN General Assembly, June 2015	The Sendai Framework for Disaster Risk Reduction, otherwise known as the Sendai Framework, is a 15-year, voluntary, non-binding agreement which recognizes that the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government, the private sector and other stakeholders.
Protocols			
23.	Two protocols of Barcelona Convention: 1980 Land-Based Sources Protocol (LBS Protocol) and 1982 Specially Protected Areas Protocol	Ratified via Law No. 292/1994	Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources (LBS Protocol): This Protocol applies: (a) To discharges originating from land-based point and diffuse sources and activities within the territories of the Contracting Parties that may affect directly or indirectly the Mediterranean Sea Area. These discharges shall include those which reach the Mediterranean Area, through coastal disposals, rivers, outfalls, canals, or other watercourses, including ground water flow, or through run-off and disposal under the seabed with access from land; (b) To inputs of polluting substances transported by the atmosphere to the Mediterranean Sea Area from land-based sources or activities within the territories of the Contracting Parties under the conditions defined in annex III to the Protocol. This Protocol shall also apply to polluting discharges from fixed man-made offshore structures which are under the jurisdiction of a Party and which serve purposes other than exploration and exploitation of mineral resources of the continental shelf and the sea-bed and its subsoil. 1982 protocol concerning Mediterranean Specially Protected Areas: Contracting parties shall take all appropriate measures to protect marine areas which are important for the safeguard of the natural resources and natural sites of the Mediterranean Sea Area, as well as the safeguard of their cultural heritage in the region. Measures include among others: prohibition of the dumping and discharges of wastes and other matters which may impair protected areas; regulation of the passage of ships and any stopping or anchoring; regulation of fishing and hunting; the regulation of any activity involving the exploration or exploitation of the sea-bed or its subsoil or a modification of the sea-bed profile; the regulation of any activity involving a modification of the profile of the soil or the exploitation of the subsoil of the land part of a marine protected area.

No.	Treaty, convention or protocol	Status	Objective and brief description of relevant articles
24.	Cartagena Protocol on Biosafety	Ratified via Law No. 31/2008	The objective of the Protocol is to contribute to ensuring an adequate level of protection in the field of the safe transfer, handling and use of 'living modified organisms" resulting from modern biotechnology' that may have adverse effects on the conservation and sustainable use of biological diversity, taking also into account risks to human health, and specifically focusing on trans-boundary movements.
25.	2002 Emergency Protocol of the Barcelona Convention	Grant to join via Law No. 254/2014	The Protocol Concerning Cooperation in Preventing Pollution from Ships and, in Cases of Emergency, Combating Pollution of the Mediterranean Sea is the legal framework within which regional cooperation in the Mediterranean region in the fields of prevention of and response to marine pollution is developing. The 2002 "Prevention and Emergency" Protocol now covers prevention of, preparedness for and response to marine pollution from sea-based sources. Its text was also updated with a view to harmonizing it with the texts of other relevant international legal instruments developed since the adoption of the 1976 Protocol.
26.	Protocol on Integrated Coastal Zone Management in the Mediterranean (ICZM) of the Barcelona Convention (1995)	Accessed via Law No. 639/2014	The objectives of integrated coastal zone management are to: (a) facilitate, through the rational planning of activities, the sustainable development of coastal zones by ensuring that the environment and landscapes are taken into account in harmony with economic, social and cultural development; (b) preserve coastal zones for the benefit of current and future generations; (c) ensure the sustainable use of natural resources, particularly with regard to water use; (d) ensure preservation of the integrity of coastal ecosystems, landscapes and geomorphology; (e) prevent and/or reduce the effects of natural hazards and in particular of climate change, which can be induced by natural or human activities; (f) achieve coherence between public and private initiatives and between all decisions by the public authorities, at the national, regional and local levels, which affect the use of the coastal zone. Article 19 on Environmental Assessment states that: 1) Taking into account the fragility of coastal zones, the Parties shall ensure that the process and related studies of environmental impact assessment for public and private projects likely to have significant environmental effects on the coastal zones, and in particular on their ecosystems, take into consideration the specific sensitivity of the environment and the inter-relationships between the marine and terrestrial parts of the coastal zone; 2) In accordance with the same criteria, the Parties shall formulate, as appropriate, a strategic environmental assessment of plans and programmes affecting the coastal zone; 3) The environmental assessments should take into consideration the cumulative impacts on the coastal zones, paying due attention, inter alia, to their carrying capacities. Article 28 is related to Transboundary Cooperation, it stipulates that: the Parties shall endeavor, directly or with the assistance of the Organization or the competent international organizations, bilaterally or multilaterally, to coordinate, where appropriate, their national coastal strategies, plans and programmes related to contiguous coastal zones. Relevant domestic administrative bodies shall be associated with such coordination. Article 29 on Transboundary Environmental Assessment stipulates that: 1) Within the framework of this Protocol, the Parties shall, before authorizing or approving plans, programmes and projects that are likely to have a significant adverse effect on the coastal zones of other Parties, cooperate by means of notification, exchange of information and consultation in assessing the environmental impacts of such plans, programmes and projects; 2) To this end, the Parties undertake to cooperate in the formulation and adoption of appropriate guidelines for the determination of procedures for notification, exchange of information and consultation at all stages of the process; 3) The Parties may, where appropriate, enter into bilateral or multilateral agreements for the effective implementation of this Article.

No.	Treaty, convention or protocol	Status	Objective and brief description of relevant articles
27.	Nagoya Protocol	Accessed via Law No. 3/2017	The Nagoya Protocol is a multilateral treaty that sets up a legal framework for utilizing genetic resources. It is a supplementary agreement to the Convention on Biological Diversity that provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources. The Nagoya Protocol will create greater legal certainty and transparency for both providers and users of genetic resources by: • Establishing more predictable conditions for access to genetic resources; • Helping to ensure benefit-sharing when genetic resources leave the country providing the genetic resources. By helping to ensure benefit-sharing, the Nagoya Protocol creates incentives to conserve and sustainably use genetic resources, and therefore enhances the contribution of biodiversity to development and human well-being. The Nagoya Protocol creates a legal framework to consider the requests of developing countries (or any country that has ratified the protocol).
28.	Ratification of the amendments made to the Barcelona Convention from pollution the Mediterranean Sea: Protocol on Specially Protected Areas and Biodiversity	Grant to join via Law No. 127/2019	The law is issued for approving joining the Protocol of Barcelona Convention concerning Specially Protected Areas and Biological Diversity in the Mediterranean According to the provisions of the SPA/BD Protocol, SPAMIs may be established in the marine and coastal zones subject to the sovereignty or jurisdiction of the Parties and in areas situated partly or wholly on the high sea. The SPAMI's List may include sites which: • are of importance for conserving the components of biological diversity in the Mediterranean; • contain ecosystems specific to the Mediterranean area or the habitats of endangered species; • are of special interest at the scientific, aesthetic, cultural or educational levels. The SPA/BD Protocol provides the criteria for the choice of protected marine and coastal areas that could be included in the SPAMI's List (Annex I of the SPA/BD Protocol) as well as the procedure and the stages to be followed with the view of including an area in the List (read more about the procedure) According to the provisions of the SPA/BD Protocol, all the Parties to the Protocol are committed to respecting the protection and conservation measures defined in the proposal for inclusion

Annex 2: Non-exhaustive list of sources of secondary data

Aspect	Sources of data
Bathymetry and Submarine Canyons	• Ministry of Public Works and Transport –Directorate General of Maritime and Land Transport (2017). *The National Oil Spill Contingency Plan (NOSCP) in the Lebanese Waters* (Verison1). • Convention on Biological Diversity, & United Nations Environment Programme (2014). *EBSA Workshop*, Malaga, Spain, April 2014. • Würtz, M. (ed.). (2012). *Mediterranean Submarine Canyons: Ecology and Governance*. Gland, Switzerland and Málaga, Spain: IUCN. 216 pages • Elias, A., Tapponnier, P., Singh, S.C., King, G.C.P., Briais, A., Daëron, M., Carton, H., Sursock, A., Jacques, E., Jomaa, R., & Klinger, Y. (2007). Active thrusting offshore Mount Lebanon: Source of the tsunamigenic A.D. 551 Beirut-Tripoli earthquake. *Geology, 35*(8), 755–758. Retrieved from: doi:10.1130/G23631A.1. Retrieved 2 March 2011 • Shaban, A., and Khalaf-Keyrouz, L. (2013). The geological controls of geothermal groundwater sources in Lebanon. *International Journal of Energy and Environment*, *4*(5), 787-796. Journal homepage: www.IJEE.IEE Foundation.org. ISSN 2076-2895 (Print), ISSN 2076-2909 (Online) ©2013 • Bakalowicz, M. (2014). Karst at depth below the sea level around the Mediterranean due to the Messinian crisis of salinity. Hydrogeological consequences and issues. *Geologica Belgica*, *17*(1), 96-101 • IUCN (2012). *Lebanon's Marine Protected Area Strategy: Supporting the management of important marine habitats and species in Lebanon*. Beirut, Lebanon, Gland, Switzerland, Malaga, Spain: the Lebanese Ministry of Environment/ IUCN. Retrieved from https://portals.iucn.org/library/node/10304 • Nader, M., Indary, S., and Stamatopoulos C. (2012). *Assessment of the commercial fish species of the coast of north Lebanon 2006-2011*. International Conferences on "Land-Sea Interactions in the Coastal Zone", November, 2012, Lebanon. • Bariche, M. (2006). Diet of the Lessepsian fishes, Siganusrivulatus and S. luridus (Siganidae) in the Eastern Mediterranean: a bibliographic analysis. *Cybium*, *30*(1), 41-49. • SPA/ RAC–UN Environment/ MAP (2017). *Ecological characterization of potential new MPAs in Lebanon: Batroun, Medfoun and Byblos*. MedMPA Network Project, Tunis: 120 pages+ annexes. • National Council for Scientific Research-Lebanon (2014). *The CANA-CNRS Research Vessel & Project*. • Toropova, C., Meliane, I., Laffoley, D., Matthews, E., & Spalding, M. (eds.) (2010). *Global ocean protection: present status and future possibilities*. Agence des aires marines protégées, Gland, Switzerland, Washington, DC and New York, USA: IUCN WCPA, Cambridge, UK: UNEP-WCMC, Arlington, USA: TNC, Tokyo, Japan: UNU, New York, USA: WCS. Retrieved from: https://portals.iucn.org/library/node/9687 • Aoun, N.S., Harajali, H.A., Queffeulou, P. (2013). *Preliminary appraisal of wave power prospects in Lebanon*. Elsevier. Retrieved from: https://www.journals.elsevier.com/renewable-energy • Safadi, C. (2016). Wind and wave modelling for the evaluation of the maritime accessibility and protection afforded by ancient harbours. *Journal of Archaeological Science: Reports, 5*(February), 348-360. https://doi.org/10.1016/j.jasrep.2015.12.004 • *The Draft National Oil Spill Contingency Plan (NOSCP) in the Lebanese Waters*. • SINGH Satish. (2003). SHALIMAR cruise, RV Le Suroît. Retrieved from: http://dx.doi.org/10.17600/3020120

Aspect	Sources of data
Winds and Waves	• NG-IA. (2017). Sailing Directions (Enroute) Eastern Mediterranean. Springfield, Virginia: National Geospatial-Intelligence Agency. Retrieved from: https://msi.nga.mil/MSISiteContent/StaticFiles/NAV_PUBS/SD/Pub132/Pub132bk.pdf • MOPWT-DGLMT (2017). *The National Oil Spill Contingency Plan (NOSCP) in the Lebanese Waters* (Verison1), responsible for its development, maintenance, updating, and revisions. • Aoun, N.S., Harajali, H.A., & Queffeulou, P. (2013). Preliminary appraisal of wave power prospects in Lebanon. *Elsevier,* 53 (May), 165-173. Retrieved from: https://doi.org/10.1016/j.renene.2012.11.008 • TEDO-Tripoli Weather Station (2017). • Chemello, R., & Sergio, S. (2011). Vermetid reefs in the Mediterranean Sea as archives of sea-level and surface temperature changes. *Chemistry and Ecology, 27*(2), 121-127. Retrieved from: https://doi.org/10.1080/02757540.2011.554405 • Safadi, C. (2016). Wind and wave modelling for the evaluation of the maritime accessibility and protection afforded by ancient harbours. *Journal of Archaeological Science: Reports,* 5(February), 348-360. Retrieved from: https://doi.org/10.1016/j.jasrep.2015.12.004
Currents and tides	• MOPWT-DGLMT (2017). *The National Oil Spill Contingency Plan (NOSCP) in the Lebanese Waters* (Verison1). • Chemello, R., & Sergio, S. (2011). Vermetid reefs in the Mediterranean Sea as archives of sea-level and surface temperature changes. *Chemistry and Ecology. 27*(2), 121-127. Retrieved from: https://doi.org/10.1080/02757540.2011.554405 • National Geospatial-Intelligence Agency (2017). *Sailing Directions (En route)-Eastern Mediterranean*. NG-IA.
Sea Water Quality	• Abboud-Abi Saab, M., Fakhri, M., Romano, J.C., & Kassab, M.T. (2006). *Influence des Apports Fluviaux et Industrielles sur les Populations Phytoplanctoniques dans la Région de Selaata (Mer Levantin).* WATMED 3, 1-3 Novembre, 158. • Abboud-Abi Saab, M., Fakhri, M., Sadek, E., and Matar, N. (2007). *An estimate of the environmental Status of Lebanese Littoral Waters using nutrients and chlorophyll-A as indicators*. • Abboud-Abi Saab, M. (2008 a.). *Tintinnids of the Lebanese Coastal Waters (Eastern Mediterranean).* CNRS-Lebanon/UNRP/MP/RAC/SPA. MPA, 1925pp. • Abboud-Abi Saab, M., Fakhri, M., Sadek, E., and Matar, N. (2008 b). An Estimate of the Environmental Status of Lebanese Littoral Waters Using Nutrients and Chlorophyll-a as Indicators. *Lebanese Science Journal,* 9(1), 43-60. • Lakkis, S. (2011). *Le phytoplancton marin du Liban (Méditerranée orientale): biologie, biodiversité, biogéographie*. Roma: Aracne. • Lakkis, S., Novel-Lakkis, V., and Zeidane, R. (2011). *Le zooplancton marin du liban (Méditerranée Orientale): biologie, biodiversité, biogéograhie.* Publications de L'Université Libanaise. • National Council for Scientific Research-Lebanon (2014). *The CANA-CNRS Research Vessel & Project*.

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	• Fallah, R., Olama, Z., & Holail, H. (2016). Marine Quality Assessment of Northern Lebanese Coast: Microbiological and Chemical Characteristics and their Impact on the Marine Ecosystem. *International Journal of Current Microbiology and Applied Sciences*. • Kouyoumjian, H. and Hamze, M. (2012). *Review and Perspectives of Environmental Studies in Lebanon*. Beirut, Lebanon: National Council for Scientific Research. pp 328. • Nader, M., and Talhouk, S. (2016). *Updating the 2002 SAP-BIO National Report for the Country of Lebanon*. MoE/ GEF. • Nader, M. (2011). *National document aiming at the identification of important ecosystem properties and assessment of ecological status and pressures to Mediterranean marine and coastal biodiversity of Lebanon.* 50 p. • *Environmental baseline survey report, nesiphoros west 1 and nesiphoros west 2, block 11*, *The Republic of Cyprus.* (2016).
Sediments quality	• *Environmental baseline survey report, nesiphoros west 1 and nesiphoros west 2, block 11, The Republic of Cyprus*. (2016). • National Council for Scientific Research-Lebanon (2014). *The CANA-CNRS Research Vessel & Project*. • Abi-Ghanem, C., Mahfouz, C., Khalaf, G., Najjar, E., El-Zakhem, H., and Anneh, R. (2016). Pb, Cd and Cu Distribution and Mobility in Marine Sediments from two Ports in Lebanon: Beirut Army Naval Port and Tripoli Fishing Port. *Lebanese Science Journal*, 17(1). Retrieved from: https://doi.org/10.22453/LSJ-017.1.057073. • OCEANA MedNet (2011). *MPA Network proposal for the Mediterranean Sea*. • Jabali, Y., Millet, M., & El Hoz, M. (2017). *Determination of 48 pesticides in water by using DI-SPME coupled with GC/MS.*15th International Conference on Environmental Science and Technology - Rhodes, Greece, 31 August to 2 September 2017. • Nader, M., and Talhouk, S. (2016). *Updating the 2002 SAP-BIO National Report for the Country of Lebanon*. MoE/ GEF.
Phytoplankton	• Lakkis, S. (2011). *Le phytoplancton marin du Liban (Méditerranée orientale): biologie, biodiversité, biogéographie*. Roma: Aracne. • Abboud-Abi Saab, M. (2012). *Marine biodiversity in coastal waters*. Batroun, Lebanon: National Centre for Marine Sciences, National Council for Scientific Research. • Ouba, A., Abboud-Abi Saab, M., & Stemmann, L. (2016). *Temporal Variability of Zooplankton (2000-2013) in the Levantine Sea: Significant Changes Associated to the 2005-2010 EMT like Event.* Retrieved from: https://doi.org/10.1371/journal.pone.0158484. • Khalaf, G., and Fakhri, M. (2017). *Biodiversity in the Eastern Mediterranean Sea, including its impact on aquatic animal health in the Middle East*. Istanbul, Turkey: CNRS. • Lakkis, S. (2007). *Dataset and database biodiversity of plankton community in Lebanese seawater (Levantine Basin, East Mediterranean)*. Beirut, Lebanon: Section of Oceanography, Lebanese University.

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Zooplankton	• Nader, M., and Talhouk, S. (2016). *Updating the 2002 SAP-BIO National Report for the Country of Lebanon*. MoE/ GEF. • Khalaf, G., and Fakhri, M. (2017). *Biodiversity in the Eastern Mediterranean Sea, including its impact on aquatic animal health in the Middle East*. Istanbul, Turkey: CNRS • Lakkis, S. (2007). *Dataset and database biodiversity of plankton community in Lebanese seawater (Levantine Basin, East Mediterranean)*. Beirut, Lebanon: Section of Oceanography, Lebanese University. • Abboud-Abi Saab, M. (2012). *Marine biodiversity in coastal waters*. Batroun, Lebanon: National Centre for Marine Sciences, National Council for Scientific Research. • *Environmental baseline survey report, nesiphoros west 1 and nesiphoros west 2, block 11, The Republic of Cyprus.* (2016).
Bacterio-plankton and viroplankton	• Nader, M., and Talhouk, S. (2016). *Updating the 2002 SAP-BIO National Report for the Country of Lebanon*. MoE/ GEF.
Benthos	• Bianchi, C.N. and Morri, C. (2000). Marine biodiversity of the Mediterranean Sea: situation, problems and prospects for future research. *Marine pollution bulletin, 40*(5), 367-376. • Sardà, F., Molí, B., & Palomera, I. (2004). *Preservation of juvenile hake (Merluccius merluccius, L.) in the western Mediterranean multispecies demersal trawl fishery by using sorting grids*. • Galil, B., & Zibrowius, H., (1998). First Benthos samples from Eratosthenes Seamount, Eastern Mediterranean. *Senckenbergiana maritime, 28*, 111 (1998). https://doi.org/10.1007/BF03043142 • Bitar, G. (2010). *La flore marine benthique introduite de la cote Libanaise: état actuel de trois espèces envahissantes.* BAE Conference-INOC, Lattakia, Syria, 107-115. • Kanaan, H., and Belous, O. (2016). *Marine Algae of the Lebanese Coast*. Hauppauge, New York: Nova Science Publishers. • Nader, M., and Talhouk, S. (2016). *Updating the 2002 SAP-BIO National Report for the Country of Lebanon*. MoE/ GEF. • Kouyoumjian, H., and Hamze, M. (2012). *Review and Perspectives of Environmental Studies in Lebanon*. INCAM-EU/CNRS Lebanon pg. 328. • National Council for Scientific Research-Lebanon (2014). *The CANA-CNRS Research Vessel & Project*. • Badfeddine, A., Milazzo, M., Abboud- Abi Saab, M., & Mangialajo, L. (2018). *Threatnes biogenic formations of the Mediterranean: Current status and assessment of the vermetid reefs along the Lebanese coastline (Levant Basin)*.

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	• Abboud-Abi Saab, M. (2012). *Marine biodiversity in coastal waters*. Batroun, Lebanon: National Centre for Marine Sciences, National Council for Scientific Research. • Khalaf, G. and Fakhri, M. (2017). *Biodiversity in the Eastern Mediterranean Sea, including its impact on aquatic animal health in the Middle East*. Istanbul, Turkey: CNRS. • *Environmental baseline survey report, nesiphoros west 1 and nesiphoros west 2, block 11, The Republic of Cyprus*. (2016).
Sea mammals	• Nader, M., and Talhouk, S. (2016). *Updating the 2002 SAP-BIO National Report for the Country of Lebanon*. MoE/ GEF. • IUCN (2012). *Lebanon's Marine Protected Area Strategy: Supporting the management of important marine habitats and species in Lebanon*. Beirut, Lebanon, Gland, Switzerland, Malaga, Spain: the Lebanese Ministry of Environment/ IUCN. Retrieved from: https://portals.iucn.org/library/node/10304 • IUCN (2018). *The IUCN Red List of Threatened Species* (Version 2018-1). Retrieved from: http://www.iucnredlist.org • Khalaf, G. and Fakhri, M. (2017). *Biodiversity in the Eastern Mediterranean Sea, including its impact on aquatic animal health in the Middle East*. Istanbul, Turkey: CNRS. • National Council for Scientific Research-Lebanon (2014). *The CANA-CNRS Research Vessel & Project*. • Kerem, D., Hadar, N., Goffman, O., Scheinin, A., Kent, R., Boisseau, O., & Schattner, U. (2012). Update on the cetacean fauna of the Mediterranean Levantine Basin. *The Open Marine Biology Journal, 6*, 6-27. • Dedel, A., Saad, A., Fakhri, M., & Öztürk, B. (2012). Cetacean sightings in the Eastern Mediterranean Sea during the cruise in summer 2008. *J. Black Sea/ Mediterranean Environment,* 18(1), 49-57. • Abboud-Abi Saab, M. (2012). *Marine biodiversity in coastal waters*. Batroun, Lebanon: National Centre for Marine Sciences, National Council for Scientific Research. • Mytilineou et al. (2016). New Mediterranean Biodiversity Records. *Mediterranean Marine Science, 17*(3), 794-821. https://doi.org/10.12681/mms • Ramadan-Jaradi, G. (2017). *Mediterranean Monk Seal – Baseline Study.* Society for the Protection of Nature in Lebanon.14 p.p. • Boissea, O., Lacey, C., Lewis, T., & Moscrop, A. (2010). *Encounter rates of cetaceans in the Mediterranean Sea and contiguous Atlantic.*
Marine Herpetofauna	• Nader, M., and Talhouk, S. (2016). *Updating the 2002 SAP-BIO National Report for the Country of Lebanon*. MoE/ GEF. • IUCN (2018). *The IUCN Red List of Threatened Species* (Version 2018-1). Retrieved from: http://www.iucnredlist.org

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	• Cross, H., Rizk, C., Khalil, M. and Venizelos, L. (2006). *Population Status and Conservation Activities on Sea Turtle Nesting Beaches in South Lebanon, 2005*. Retrieved from: http://www.seaturtle.org/PDF/CrossH_2006_BCGFFEMMEDASSETMEDWESTCOASTMELRACSPAUNEPMAPUNDPTechReport.pdf • IUCN. (2012). *Lebanon's Marine Protected Area Strategy: Supporting the management of important marine habitats and species in Lebanon*. Beirut, Lebanon, Gland, Switzerland, Malaga, Spain: the Lebanese Ministry of Environment/ IUCN. Retrieved from: https://portals.iucn.org/library/node/10304 • Hraoui, B.-S., Sadek, R., Sindaco, R. & Venchi, A. (2002). The herpetofauna of Lebanon: new data on distribution. *Zoology in the Middle East,* 27(1), 35-46. Retrieved from: https://doi.org/10.1080/09397140.2002.10637939
Marine Ornithofauna (Seabirds)	• MoE/ UNEP/ GEF (2016). *National Biodiversity Strategy and Action Plan – NBSAP* • Ramadan-Jaradi, G., Ramadan-Jaradi, M. & Bara, T. (2008). The revised checklist of the birds of Lebanon. *Sandgrouse*, *30*(1), 22-69. • Bird Life International (2018). Country profile: Lebanon. Retrieved from: http://www.birdlife.org/datazone/ country/lebanon. Checked: 2018-07-17 • Nader, M., and Talhouk, S. (2016). *Updating the 2002 SAP-BIO National Report for the Country of Lebanon*. MoE/ GEF. • MOE/UNDP/GEF (2014). *State of Lebanon' s Birds and IBAs.* SPNL, 153 pp. • Codina-García, M., Militão, T., Moreno, J., & González-Solís, J. (2013). Plastic debris in Mediterranean seabirds. *Marine Pollution Bulletin, 77*(1-2), 220–226. Retrieved from: https://doi.org/10.1016/j.marpolbul.2013.10.002 • Ramadan-Jaradi, G. (2017). Status and distribution of migrating and breeding Marine birds in North Lebanon. *Lebanese Science Journal*, 18(2), 156-165. • Robalino, D., & Sayed, H. (2012). *Lebanon: good jobs needed*. World Bank.
Important Biodiversity Areas	• MoE (2006). *Protected Areas in Lebanon - Stable Institutional Structure for protected Areas management (SISPAM).* Retrieved from: http://www.moe.gov.lb/protectedareas/categories.htm • Espla, R., Alfonso, A., Bitar, G., Khalaf, G, El Shaer, H., Forcada, A., Limam, A., Ocaña, O., Sghaier, Y.R. & Valle, C. (2014). *Ecological characterization of sites of interest for conservation in Lebanon: Enfeh Peninsula, Ras Chekaa Cliffs, Raoucheh, Saida, Tyre and Nakoura*. Tunis: RAC/SPA - MedMPAnet Project. 168 pages + annexes. • Nader, M., Indary, S., & Boustany, L. (2012). *The Puffer Fish Lagocephalussceleratus (Gmelin, 1789) in the Eastern Mediterranean*. Greece: FAO EastMed. • Bariche, M., Sadek, R., Al-Zein, M., El-Fadel, M. (2007). Diversity of juvenile fish assemblages in the pelagic waters of Lebanon (eastern Mediterranean). *Hydrobiologia*, 580(April). 109-115.

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	• Crocetta, F., Zibrowius, H., Bitar, G., Templado, J. and Oliverio, M. (2013). Biogeographical homogeneity in the eastern Mediterranean Sea - I: the opisthobranchs (Mollusca: Gastropoda) from Lebanon. *Mediterranean Marine Science*. Retrieved from: http://dx.doi.org/10.12681/mms.404 • Couturier, C.I.E., Bennett, M.B., & Richardson, A.J. (2013). Mystery of giant rays off the Gaza Strip solved. *Oryx*, 47(4), 479-482 • Notarbartolo di Sciara, G., Bradai, M.N., Morey, G., Marshall, A.D., Compagno, L.J.V., Mouni, A., Hicham, M., Bucal, D., Dulvy, N., Heenan, A., & Coelho, R. (2007). *Rhinobatosrhinobatos.* In: IUCN. (2013). *IUCN Red List of Threatened Species* (Version 2013.2.). Retrieved from: www.iucnredlist.org • Dedel, A., Saad, A., Fakhri, M., & Öztürk, B. (2012). Cetacean sightings in the Eastern Mediterranean Sea during the cruise in summer 2008. *J. Black Sea/Mediterranean Environment*, 18(1), 49-57. • Abboud-Abi Saab, M. (2002). Annual cycle of the microzooplankton communities in the waters surrounding the Palm Island Nature Reserve (north Lebanon), with special attention to tintinnids. *Mediterranean Marine Science,* 3/2, 55-76. • Lakkis, S. (2011). *Le phytoplancton Marin du Liban (Méditerranée orientale): biologie, biodiversité, biogéographie*. Roma: Aracne. • Lakkis, S., Novel-Lakkis, V., and Zeidane, R. (2011). *Le zooplancton marin du liban (méditerranée orientale): biologie, biodiversité, biogéograhie.* Publications de L'Université Libanaise. • Abboud-Abi Saab, M. (2002). *Annual cycle of the microzooplankton communities in the waters surrounding the Palm Island Nature Reserve (north Lebanon), with special attention to tintinnids. Mediterranean Marine Science*. • Aguilar, R., García, S., Perry, A.L., Alvarez, H., Blanco, J., & Bitar, G. (2018). *2016 Deep-sea Lebanon Expedition: Exploring Submarine Canyons*. Madrid: Oceana. 94 p. DOI: 10.31230/osf.io/34cb9. • Walker, P., Cavanagh, R.D., Ducrocq, M. and Fowler, S.L. (2005). *Chapter 7 – Regional Overviews: Northeast Atlantic (including Mediterranean and Black Sea).* P86. In: Fowler, S.L., Cavanagh, R.D., Camhi, M., Burgess, G.H., Cailliet, G.M., Fordham, S.V., Simpfendorfer, C.A. and Musick, J.A. (comp. and ed.). *Sharks, Rays and Chimaeras: The Status of the Chondrichthyan Fishes*. IUCN SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. Retrieved from: https://doi.org/10.2305/IUCN.CH.2005.SSC-AP.9.en
Fish Resources (Fish, Cephalopodes, Crustaceans, Marine Ichthyofauna)	• National Council for Scientific Research-Lebanon (2014). *The CANA-CNRS Research Vessel & Project.* • Kouyoumjian, H. and Hamze, M. (2012). *Review and Perspectives of Environmental Studies in Lebanon*. INCAM-EU/CNRS Lebanon. pp 328.
Archaeology and Cultural Heritage	• MoE. (2006). *Protected Areas in Lebanon - Stable Institutional Structure for protected Areas management (SISPAM)*. Retrieved from: http://www.moe.gov.lb/protectedareas/categories.htm • UOB/UNEP/MoE (2013). *Environmental Resources Monitoring in Lebanon (ERML) project, Improved Understanding, Management and Monitoring in the Coastal Zone*.

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