Report on the baseline situation for common indicator 15 “Location and extent of the habitats potentially impacted by hydrographic alterations” in Lebanon

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TITLE
Report on the baseline situation for common indicator 15 “Location and extent of the habitats potentially impacted by hydrographic alterations” in Lebanon

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CARtography of LITtoral and upper-sublittoral benthic communities (CARLIT)

Council for Development and Reconstruction (CDR)

Conseil National de la Recherche Scientifique (CNRS)

Council of Ministers (COM)

Coastal Vulnerability Index (CVI)

Directorate General of Urban Planning (DGUP)

Environmental Impact Assessments (EIA)

Ecological Status (ES)

International Union for Conservation of Nature (IUCN)

Joint Research Centre (JRC)

Ministry of Agriculture (MOA)

Ministry of Environment (MOE)

Ministry of Public Works and Transport (MOPWT)

Mediterranean Surface Velocity Programme (MedSVP)

National Center for Marine Sciences (NCMS)

National Remote Sensing Center (NRSC)

Oceanografia e di Geofisica Sperimentale (OGS)

Schéma d'aménagement du territoire libanais (SDATL)

1 Introduction

The EC-funded EcAp MED III project entitled: “Support to Efficient Implementation of the Ecosystem Approach-based Integrated Monitoring and Assessment of the Mediterranean Sea and Coasts and to delivery of data-based 2023 Quality Status Report in synergy with the EU MSFD” will be implemented by UNEP/MAP in the framework of the GPGC Priority Area 1 – Component 4: International environment and Climate governance. It will support the delivery of a data-based 2023 Mediterranean Quality Status Report (2023 MED QSR) through support to the implementation of national IMAPs in the respective countries. It will also support harmonized assessment at national level through the preparation of national assessment factsheets. As such, the EcAp MED III project is directly linked to the implementation of the COP 19 Decision IG.22/7 on IMAP, of the COP 20 Decision IG.23/6, and COP 21 Decision IG.24/4 on the 2023 MED QSR Roadmap and Implementation Plan. Preparation of a baseline report on situation related to monitoring of CI 15 makes part of Activity 1.3.1 of the EcAp MED III Project.

The Ecological Objective 7 (Alteration of hydrographical conditions) addresses permanent alterations in the hydrographical regime of currents, waves, and sediments due to new large-scale developments that have the potential to alter hydrographical conditions. An agreed common indicator 15 “Location and extent of the habitats potentially impacted by hydrographic alterations” considers marine habitats which may be affected or disturbed by changes in hydrographic conditions (such as currents, waves, suspended sediment loads).

Hence, the following report provides a baseline on the situation related to monitoring of CI 15 in Lebanon. It does not monitor a particular site/installation but rather gather information on current situation as far as prerequisites for monitoring. The methodology for the preparation of the report was therefore based on the existing guidance factsheet for CI 15, which specifies assessment criteria.

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2 Characteristics of the coastal area and marine environment

2.1 Types and proportion of the different types of the coast

The Lebanese Coastal Zone is characterized by a great geomorphological diversity. Table 1 and Figure 1 shows the morphosedimentary types of the Lebanese coast in 2003. The coast is highly artificialized with about 41 %. On the other hand, rocky coasts represent 30.8 % (110 km), sandy beaches represent 22.8 % (81.9 km) and pebble beaches represent 5.3 % (18.9 km), (Faour and Rizk, 2014).

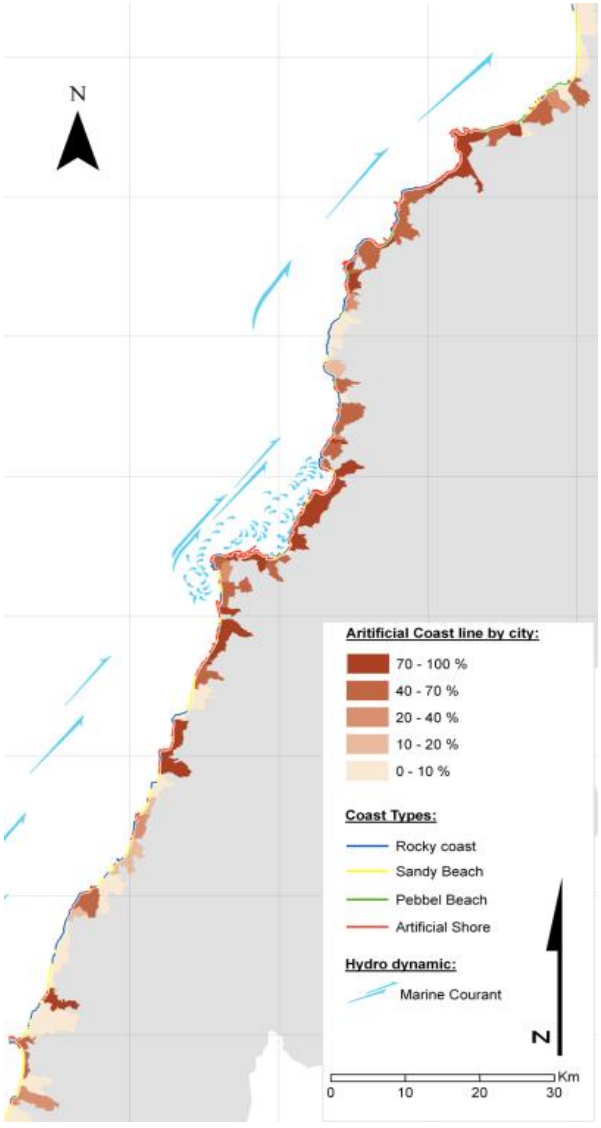

Figure 1 Coastal types and artificial coast (Source: (Faour and Rizk, 2014)

Table 1 Proportion (%) of the different types of coasts (extracted from (Faour and Rizk, 2014)).

Morpho sedimentary Type	On 2003 (Km)	Percentage in 2003
Artificial coast	147.01	41.03 %
Rocky coast	110.44	30.82 %
Sandy beach	81.90	22.86 %
Pebble beach	18.99	5.30 %

2.2 Main (natural) characteristics of the marine environment

The Lebanese coast hosts a wide variety of ecosystems, ranging from shallower features such as coralligenous habitat, seagrass meadows and vermetid reefs, to deep-sea ones such as underwater canyons. The coralligenous habitat extending along the Lebanese coast, on the continental shelf and at the heads of the canyons form well-developed reefs, which in turn supported a high diversity of species. They are vulnerable and essential to hundreds of species, and therefore protected through the Barcelona Convention in which all signing Mediterranean states were committed to their conservation. The rocky bottom areas support important benthic communities. They are covered by corals, oysters, sponges, and brachiopods. Muddy and sandy-muddy areas support vulnerable habitat forming species like sea pens that are considered as threatened in the Mediterranean by IUCN (Aguilar et al., 2018).

The Lebanese coast has a high biodiversity with thousands of species including macroinvertebrates species (Bitar et al., 2007; Zibrowius Helmut and Bitar Ghazi, 2003), phytoplanktons (Abboud-Abi Saab, 2009), fish (Bariche et al., 2009, 2007, 2004; Harmelin-Vivien et al., 2005), meiofauna (Mouawad, 2005) and macroalgae (Basson, P.-W., 1976). Dolphins *Delphinus delphis* and seals *Monachus monachus* are the most represented among mammals. Also, various threatened species are also present in the Lebanese coast. These include Endangered species such as shortfin mako (*Isurus oxyrinchus*) and common guitarfish, sperm whales, fin whales, striped dolphins, monk seal, and threatened sea turtles (i.e., *Caretta caretta*, *Dermochelys coriacea, Chelonia mydas*, and *Trionix triunguis*).

2.3 Erosion and accretion

Results from previous research studies showed minor accretion and major erosion problematic on the total length of the Lebanese coast. El Hage et al., (2011) compared satellite images taken between 1995 and 2007 and found that erosion of about 30 m occurred in Akkar and Tyre, and accretion of 160 m in Beirut. This variation is justified by the fact that in Akkar and Tyre, there are sandy beaches which are very vulnerable to erosion, while at Beirut there are artificial shores and cliffs like those of Raouche.

The withdrawal of the coastline is estimated at 1.4 meters per year and is mainly due to the marine currents occurring at high speed in a Northern North-eastern direction which is aggravated by the sand extraction of the beaches (Faour and Rizk, 2014).

Abou-Dagher et al., (2012) found that the beaches of North Lebanon have lost about 931,000 m^2 of its sand and pebble between the years 1962 and 2007, due to erosion (Figure 2).

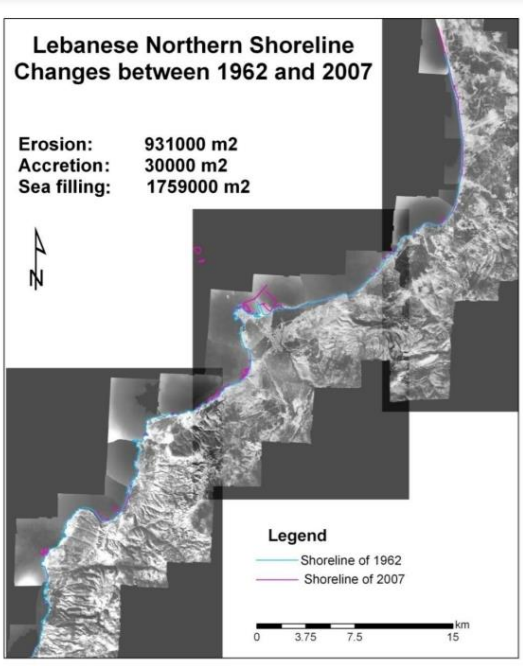

Figure 2 Erosion and sea filling in the Lebanese Northern coastline. Blue line represents the shoreline in 1962 and purple line represents the shoreline in 2007. Comparison between both shorelines shows erosion, accretion, and sea filling.

2.4 Data and studies on the coast, its length, spatial position, and its evolution/change

Few studies on the coast, its length, spatial position, and its evolution/change exist.

A complete list of these studies is summarized in table 2.

Table 2 List of studies on the coast, its length, spatial position, and its evolution/change

Author(s) of the study	Work done/Main findings
(Darwish et al., 2004)	Topographic maps [1/20000 scale] from 1962 and satellite imagery IRS-1C, 5-meter resolution from 2000 were used to assess soil degradation by land use / land cover change on the Lebanese coast
(El Hage et al., 2011)	Satellite images were digitized to evaluate the coastal vulnerability and to estimate the impact of the Mediterranean Sea level rise on the Lebanese coast.
(Abou-Dagher et al., 2012)	Aerial photographs for the year 1962 and satellite imagery for the years 1970, 1994 and 2007 were digitized and analysed to detect erosion, accretion, and sea filling along the coast of North Lebanon.
(Faour and Rizk, 2014)	Diachronic analysis of aerial photographs and satellite images taken between 1962 and 2003 in addition to the topographic map of 1963 were processed to assess the changes occurring throughout the Lebanese seashore.
(Faour, 2015)	The evolution of urbanization between 1963 and 2005 was investigated in major coastal Lebanese cities by processing and interpreting topographical maps and satellite images acquired by different space platforms.
(Ghoussein et al., 2018)	The Coastal Vulnerability Index (CVI) was implemented between 2005 and 2013, on the Southern Lebanese coast. The CVI was derived from six physical and geological variables including erosion. Results showed that the Southern Lebanese coast has a moderate (66% of its total lengths) to high coastal vulnerability (30% of its total lengths) to the sea-level rise.
(Badreddine et al., 2018)	CARLIT index, based on the cartography was applied to assess the ecological status of Lebanese coastal waters and calculate the relation between the CARLIT index and the anthropogenic pressures.
(Mitri et al., 2020, 2018)	The study compared historical aerial photographs and coastal topographic maps to evaluate erosion, accretion, artificialization and sea filling of coastlines. It also developed models to calculate sediment transport and identify hazard prone coastal areas.

Most of the studies listed in table 2 have produced shapefiles through the digitization

of satellite maps. However, these shapefiles are not available online and may be requested directly from the authors. On the other hand, the Lebanese Council for Development and Reconstruction (CDR) have produced maps and shapefiles in 2002/2003 on the natural and socio-economic resources of Lebanon in the framework of a project known as Schéma Directeur d'Aménagement du Territoire Libanais (SDATL). Maps describing the main human activities and location of sand beaches on the Lebanese coast were produced (Annexes). Also, the Lebanese National Remote Sensing Center (NRSC) have been monitoring land use change since several years (figure 3). They regularly prepare and update the Land Cover/Use for Lebanon at a scale of 1:20000 according to level four of CORINE Classification System, using very high-resolution satellite images like GeoEye. Information produced from these maps can be of high importance when adapted to focus on the coastal zone.

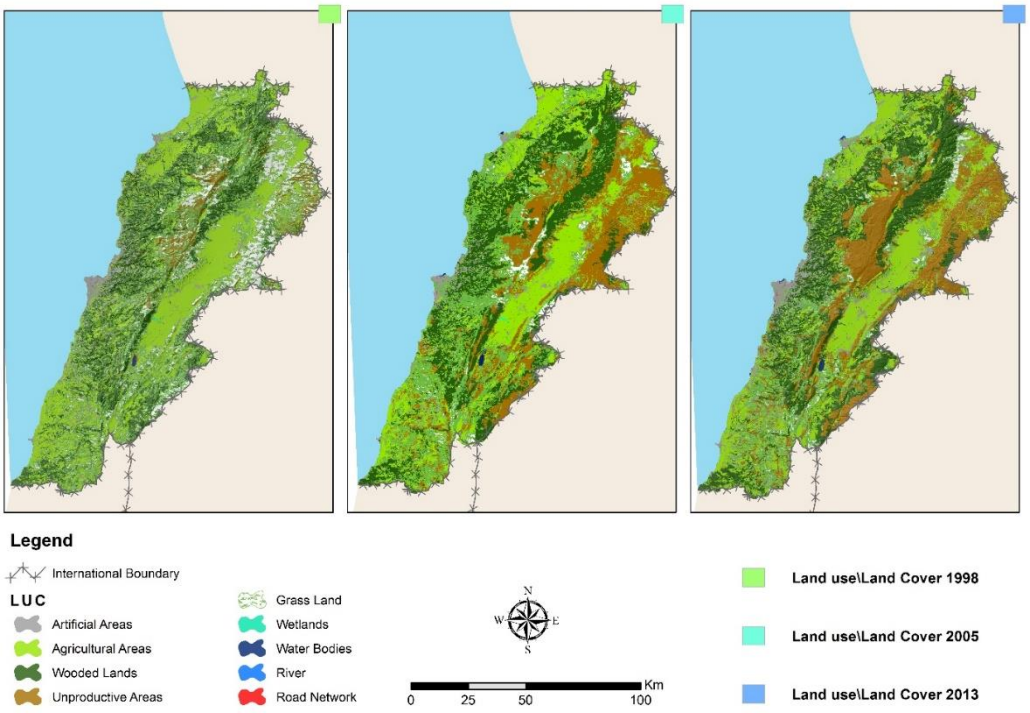

Figure 3 Example of Land use/Land cover maps produced by the NRSC. Comparison between the different maps can help extract changes on the Lebanese coast.

3 Anthropogenic Activities Present in marine environment

3.1 Main human activities present in coastal and marine environment

The Lebanese coastal zone hosts more than 55% of the total population. This population has increased after the Syrian war and after the small country has hosted the Syrian refugees (Aguilar et al., 2018).

There are four commercial ports, fifteen fishing ports, twelve oil pipelines, three power stations running on fuel. In addition, there are several resorts and industries constructed in coastal areas in a chaotic and unregulated manner. Agriculture is also prominent in most coastal areas with intensive use of fertilizers and pesticides.

This development has affected landscapes and threatened biodiversity, while structures like marinas have disrupted regular water flux, increasing sand deposition. Most solid waste along the Lebanese coast is discarded, including non-biodegradable plastic (i.e., plastic bags, other plastic debris, lost fishing gear), with deleterious effects on marine fauna. Untreated domestic sewage and industrial effluents represent the main sources of chemical pollution, while episodic pollution events have also resulted in significant impacts to marine life (Fakhri et al., 2008).

The influence of competing interests on the Lebanese coast have caused a marked deterioration of its water quality, ecological sites, and natural resources. The rapid demographic change and associated urbanization have greatly increased the demand on coastal resources. Beach resorts, large commercial and industrial units and ports cover almost 56 km of the coastline (MOE/ LEDO/ ECODIT, 2001).

In the absence of operational wastewater treatment plants, effluents from coastal agglomerations are directly discharged into the sea while effluents from inland communities are disposed of in river streams and on open ground or underground.

The local biodiversity is undergoing rapid alteration under the combined pressures of climate change and human impact. Native marine flora and fauna are competing with the increase in the number and populations of invading species originating from the Indo-Pacific and Atlantic oceans (MoE/UNDP/ECODIT, 2011).

The coastal and marine environment have suffered from 2 catastrophic oil spill events. The first occurred in July 2006 war following the bombardment of the storage tanks of the Jiyeh Power station. The second occurred in February 2021, when clumps of tar contaminated beaches stretching from the border town of Naqura to the

southern city of Tyr, including the Tyre nature reserve, a habitat for marine life and a turtle breeding area.

3.2 New coastal installations in the last 5 to 10 years

Some major new installation of structures in the Lebanese coastal environment took place in the last 10 years. Based on information from the Ministry of Public Works and Transport (MoPWT) and Remote sensing imageries, a list on these new installations can be found below:

- Construction of commercial basin in the port of Tripoli (figure 4).
- Construction of an unfinished new port in the coastal city of Jounieh.
- Construction of a new port named “Nabih Berri Port” in Adloun city in the South of Lebanon (figure 5).
- Expanding Saida port after the construction of breakwaters (figure 6).
- Creation on seafill Garbage dumping sites in Saida, BourjHammoud-Jdeide (figure 7), and Costa-Brava (figure 8).

Figure 4 Construction of commercial basin in the port of Tripoli

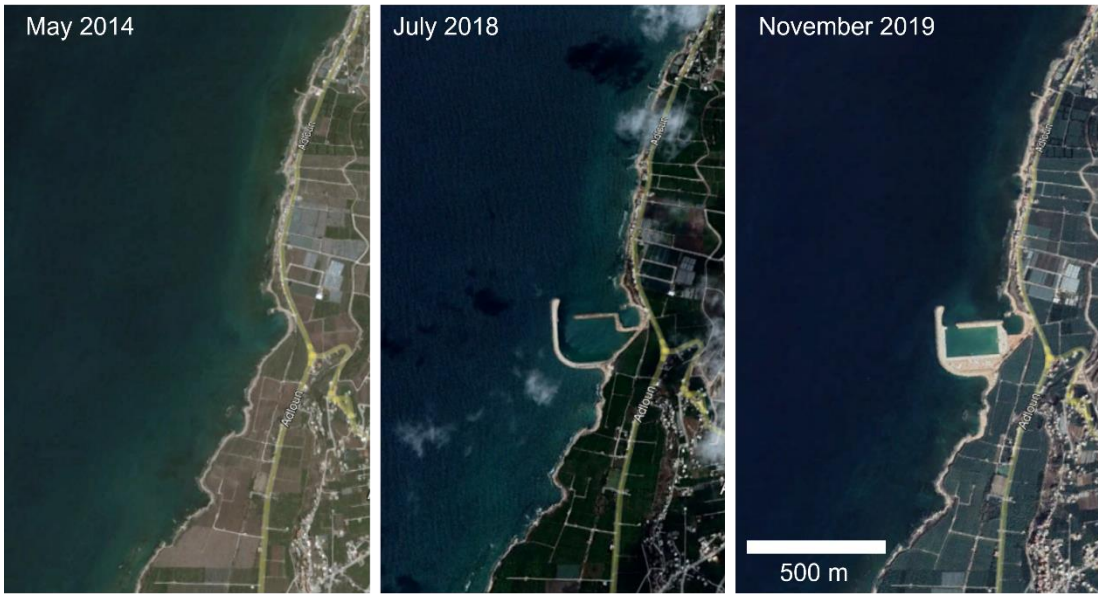

Figure 5 Nabih Berri Port constructed between 2016 and 2019

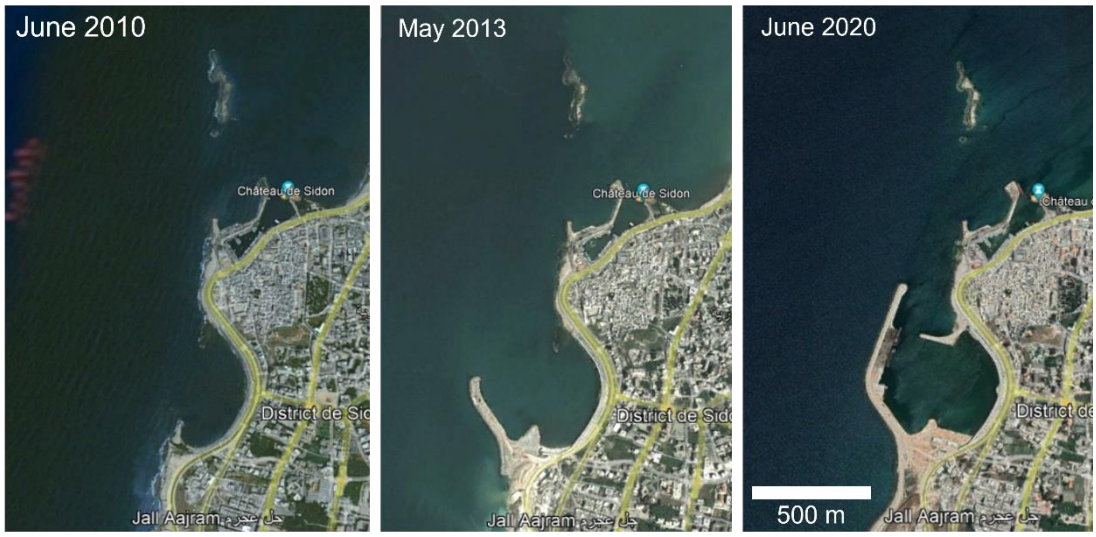

Figure 6 Port of Saida expanded after construction of breakwaters between 2013 and 2015

3.3 Dredging and dumping activities

Dredging and dumping activates are both present on the marine environment. Dredging is usually done under a license in the operation of removing material from one part of the water environment and relocating it to another and in the objective to create a greater depth of water. For instance, dredging works of access channel and inner basins at Tripoli Commercial Port in 2021, dredging works of the river mouth and partial channel, of nahr el kebir in 2018 and nahr el kalib in 2017, and dredging works for the tanker offshore of Coral Oil Terminal between 2010 and 2019.

Beside dredging, suction of sand and the extraction of gravel have greatly impacted

the Lebanese coast. Sand extraction from the beaches started during the war and worsened by the reduction of the sediments input due the construction of the Aswan barrier. The recent embankments (ports, the international airport of Beirut and the urban installations and equipment) and certain sand pumping from nearby sea-beds are also factors affecting the littoral hydrodynamics. This phenomenon is not recent, and it started in the 60’s but the technique of extraction evolved to reach up to 1500 m^3 per day. Sand extraction had important effects on sandy beaches. For instance, the width of the sandy beach of Tyr - El Qlaileh decreased from 90 m in 1962 to 20 meters (Faour and Rizk, 2014), with sand being replaced by pebble dunes.

On the other hand, dumping activities have become prominent in the recent years. In July 2015, a solid waste crisis erupted in Lebanon after the closure of the country’s main landfill in Naameh. Even if the closure was expected and the Ministry of Environment (MoE) had been preparing a solution for more than a year and a half, no political consensus was found, and the collection service simply stopped. In March 2016, the government eventually announced a plan to end the crisis and phase out of the emergency state (Azzi, 2017). The transition plan, adopted by the Council of Ministers (CoM) was designed for 4 years and relied on the construction of 3 coastal landfills which shall receive the municipal solid waste MSW of half the country’s population living in the dense and urbanised municipal solid waste BML region (Azzi, 2017). Figures 7 and 8 show the establishment of these coastal landfills.

Figure 7 Satellite images showing the establishment of the two coastal landfills (Bourj Hammoud-Jdeide area)

near the port of Beirut. Illustration produced by the author

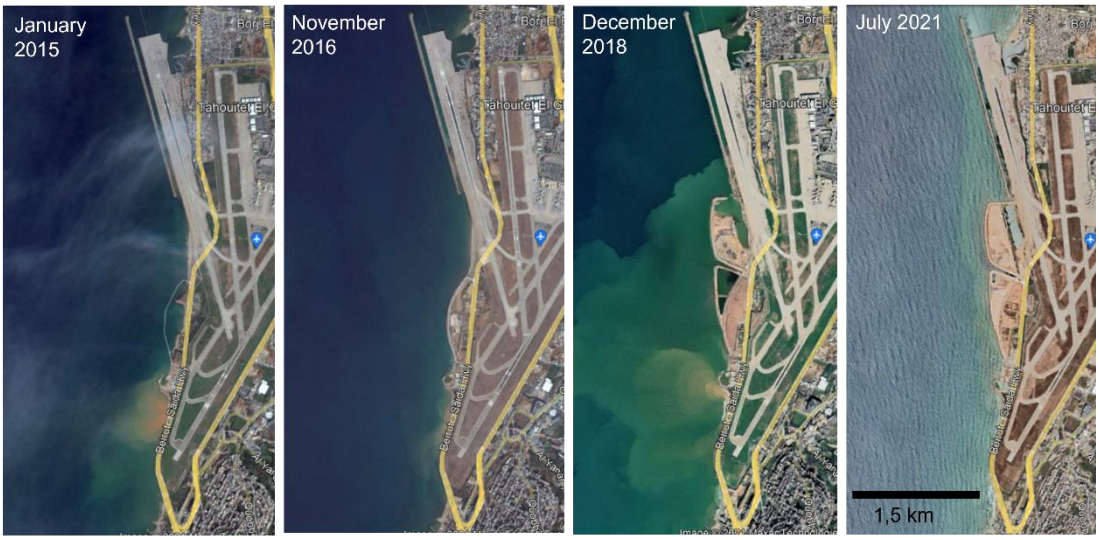

Figure 8 Satellite images showing the establishment of the coastal landfills (costa-brava) near the airport of Beirut. Illustration produced by the author

3.4 Authorization requests and impact studies

The lack of environmental standards for such activities has led to the proliferation of these practices. The extraction of sand from maritime public domain is governed by the Decree number 3899 date 06/08/1993. The law prohibits the extraction of gravel and sand from the maritime public domain and seabed but provides for an exception. Thus, the law allows the extraction of gravel, sand and sediments in certain cases based upon a decision of the Minister of Public Works and Transport, if such activities aim at cleaning ports and harbours, or if the extracted material is necessary for natural defence purposes for water filters. The law does not set any environmental restriction for public interest, except for taking into consideration the maritime public domain, preserving the beauty of the beach, and keeping a distance of at least ten meters between the authorized site and any private properties, roads, railways, or public facilities.

Despite the limited legal framework regulating such anthropogenic activities, the law requires environmental impact assessments (EIA) to be performed prior to decision-making. For instance, the new coastal sea fill sites selection has not respected such requirement. Some submitted EIAs to the MoE after beginning of construction or operation. Most did not bother with getting the approval of the technical committee. It should be mentioned that even the central facilities (i.e., the new coastal sea fills)

were decided without proper EIAs. It can be claimed that such actions were decided in an emergency state, and thus by-passed the normal procedure. On the other hand, according to Bassam Khawaja, Lebanon researcher at Human Rights Watch, Lebanese authorities have not conducted any studies on the environmental impact of the two dumps, near the Beirut airport and the Bourj Hammoud neighbourhood (Fadel, 2017).

4 Hydrodynamic conditions

4.1 Cartographic data on bathymetry

Within the framework of a French-Lebanese partnership, in collaboration between Ifremer and the Lebanese CNRS, an oceanographic cruise called “Le Suroît” was used to acquire fine bathymetry and fine reflectivity studies of the seabed, as well as images of the surface and deeper structures, thanks to a surface EM300 using seismic reflection and a towed SAR-PASISAR. Collected data cover an area of 11,000 km^2 as shown in figure 9. Each grid has a 100-m pixel size (figure 9). These data are available but with restricted access on the following link:
https://campagnes.flotteoceanographique.fr/campagnes/3020120/

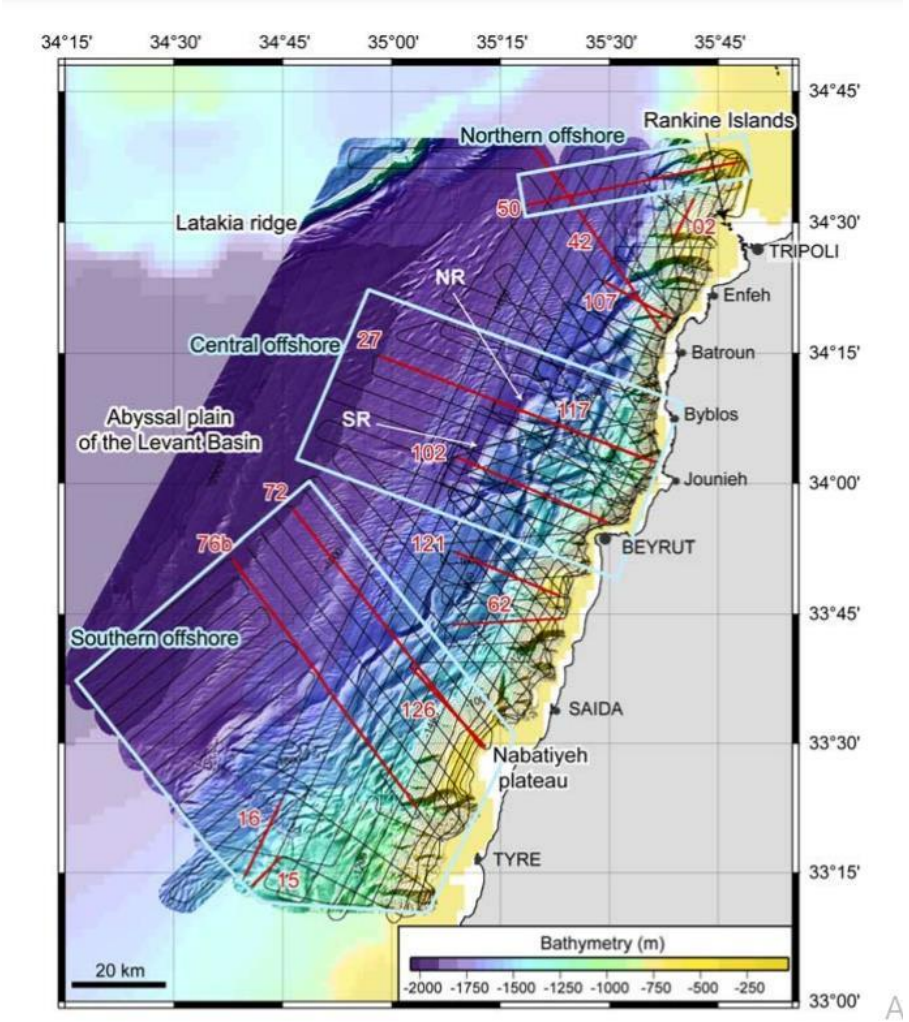

Figure 9 Bathymetric map of the 11,000 km^2 scanned offshore Lebanon. Data were recorded using an EM-300 Simrad (Carton et al., 2009).

However, since the surveyed area is 100 km off the shores of Lebanon and recognizing the necessity to connect offshore structures to the inland observed ones, the National Center for Geophysics tried to complete the bathymetric map within the Italian funded CANA-CNRS vessel, equipped with a costly multi-beam echo-sounder system with its sophisticated positioning system. These data may be accessed through an official request made to the National Center for Geophysics at CNRS.

4.2 Data and studies in place regarding the hydrodynamic conditions

Meanwhile there are very good number of studies addressing the salinity and temperature of the Lebanese coast (Abboud-Abi Saab, 2009; Abi Saab et al., 2008; El Hourany et al., 2017; Fadel et al., 2020; Kanj and Fadel, 2020; Ouba et al., 2016), there are very few studies that have addressed currents, waves, and coastal drift (Aoun et al., 2013; Issa et al., 2016; Safadi, 2016).

Issa et al., (2016) modelled surface currents in the Eastern Levantine Mediterranean using surface drifters and satellite altimetry. They used drifter data of currents provided by Mediterranean Surface Velocity Programme and Lebanese CNRS. Safadi (2016) presented a methodological approach for the evaluation of the natural affordances of old harbours located on the Lebanese coast. The author looked at two factors that characterize a harbour location: its afforded maritime accessibility and afforded protection. The methodology builds on an enhanced framework of analysis that includes modelling of wind speed and direction along the Levantine basin, and of wave heights for harbour sites. The study didn't use any in-situ buoy currents and wave data at the Lebanese coast. It was based on the wind and wave atlas of the Mediterranean Sea (Cavaleri, 2005). Aoun et al., (2013) attempted to methodologically assess the wave power prospects off the coast of Lebanon and found that the wave resources in the lower end of what is 'technically viable' to produce 12% target of renewable energy in Lebanon.

The National Directorate for Meteorology is one of the Directorates associated to the Ministry of Public Works and Transport (MoPWT). They had three buoys located in the North, Center (off the coast of Beirut) and South of Lebanon, however only the Beirut buoy provided reliable data for 18 months at one-hour intervals. The recordings spanned from December 2002 to May 2004 (figure 10).

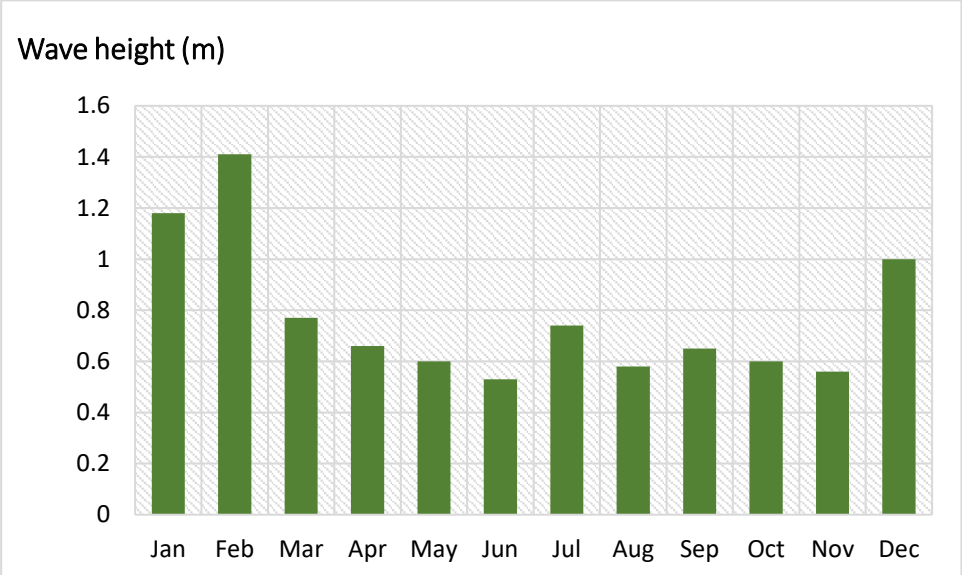

Figure 10 Average significant wave heights in Beirut between December 2002 to May 2004

An Inexpensive Device for Sea Level Measurement was installed in the frame of the initiative between European Commission's Joint Research Centre (JRC) and UNESCO for the installation of a series of mareographs in the NEAMTWS area (North East Atlantic and Mediterranean Tsunami Warning System). The sensor was installed in Batroun (Lebanon) at the following coordinates (34.25848 / 35.65678). Data are available since July 2016 with some gaps (figure 11). They are available in open access on the following link (*https://webcritech.jrc.ec.europa.eu/TAD_server/Device/94*)

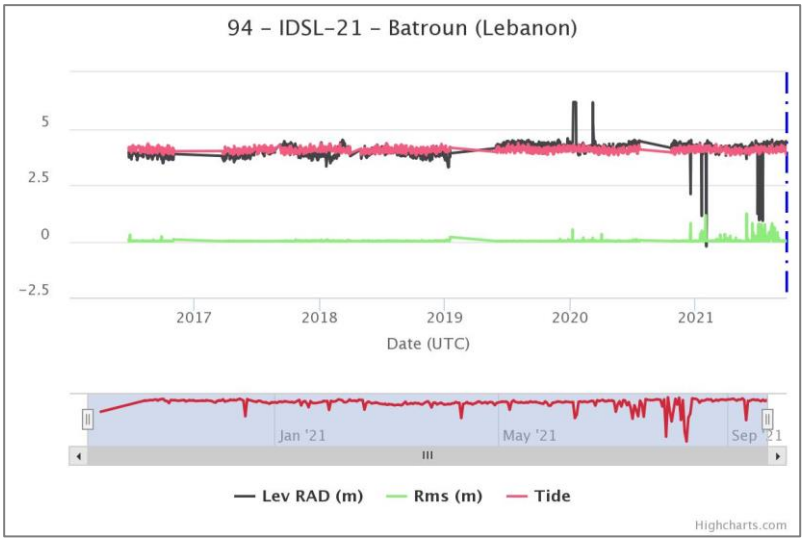

Figure 11 Sea Level Measurement at Batroun, Lebanon between 2016 and 2021. The water level is often close to 4 m with low fluctuations and errors except for the years 2020 and 2021.

The Lebanese CNRS funded a campaign of three AltiFloat MetOcean Iridium drifters' deployment using the research vessel "CANA" south of Beirut on 28 August 2013 (figure 12). These drifters were provided by the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS), Italy and LOCEAN institute of "Pierre et Marie Curie University", France. The drifter data are distributed by the Mediterranean Surface Velocity Programme (MedSVP) portal of OGS:

(http://nettuno.ogs.trieste.it/sire/medsvp/trajectories_all.php).

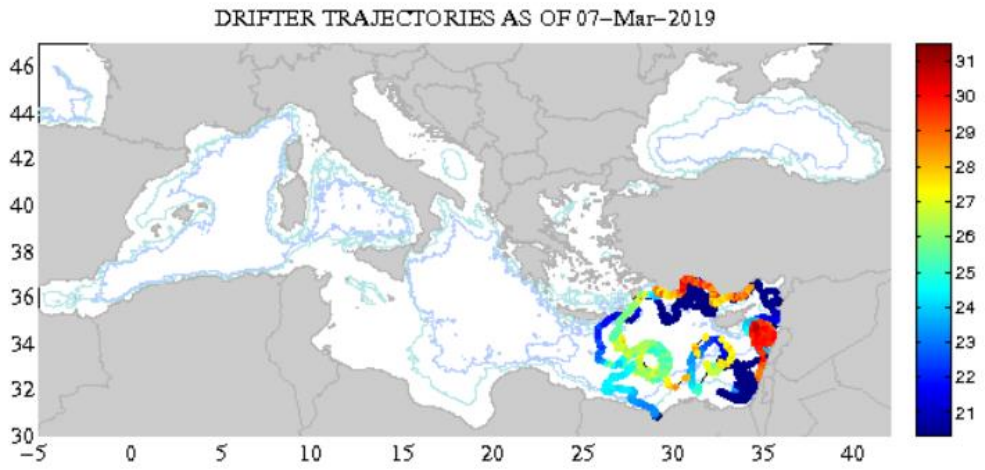

Figure 12 Drifter trajectories in the Levantine Sea to help monitor and understand the pattern of surface circulation. The change in color corresponds to the times at which the drifter was present at certain locations (Source: http://nettuno.ogs.trieste.it/sire/medsvp/trajectories_all.php)

4.3 Available in situ measurements

Regular in-situ measurements of the salinity and temperature were only collected by the Lebanese National Center for Marine Science (NCMS). The task of the NCMS is coastal monitoring. The research center has been assessing and measuring physical, chemical and biological variables on 36 sites on the Lebanese coast since mid-80's. Data are collected monthly on a 50 cm depth from surface using MEDPOL protocol. The following table presents the coordinates and the names of the monitored sites:

Table 3 Location of the 36 coastal sites monitored by the Lebanese NCMS

Study site	Coordinates	Study site	Coordinates
Akkar (AKK-2)	N34.59438° E35.98782°	Safraa (SFR-2)	N34.03432° E35.62494°
Mineh (MNY-2)	N34.48423° E35.92421°	Jounieh 2 (JUN-2)	N34.01058° E35.64383°
Tripoli 2 (TRI-2)	4.45646° E35.80976°	Jounieh 6 (JUN-6)	N33.98336° E35.62677°
Tripoli 4 (TRI-4)	N34.44698° E35.81119°	Dbayeh (DBY-2)	N33.94504° E35.59080°
Tripoli 6 (TRI-6)	N34.42913° E35.81458°	Antelias (ANT-2)	N33.91642° E35.58660°
Anfeh (ANF-2)	N34.36757° E35.73600°	Beirut 2 (BEY-2)	N33.90199° E35.47462°
Anfeh (ANF-3)	N34.36066° E35.73096°	Beirut 4 (BEY-4)	N33.90051° E35.47038°
Elherri (HER-2)	N34.30986° E35.71418°	Beirut 6 (BEY-6)	N33.87868° E35.47971°
Selaata (SEL-2)	N34.26810° E35.65715°	Khalde (KHL-2)	N33.78508° E35.47509°
Batroun 1 (BAT-1)	N34.25317° E35.65696°	Damour (DAM-2)	N33.70347° E35.43825°
Batroun 2 (BAT-2)	N34.25113° E35.65696°	Jiyeh (JYH-2)	N33.65953° E35.41700°
Amchit (AMC-2)	N34.16108° E35.63333°	Rmeili (RME-2)	N33.61291° E35.39802°
Byblos 2 (BYB-2)	N34.12384° E35.64325°	Awali (AWL-2)	N33.59460° E35.38777°
Byblos 4 (BYB-4)	N34.11264° E35.64883°	Sidon (SDA-2)	N33.57847° E35.38218°
Fidar (FID-2)	N34.10237° E35.65058°	Sarafand (SAF-2)	N33.46720° E35.30285°
aloqaibe (NIB-2)	N34.06059° E35.64242°	Adloun ADL-2	N33.40717° E35.26404°
albouar (BOR-2)	N34.04697° E35.63123°	Tyre (SUR-1)	N33.26471° E35.20414°
alnaqoura (NAQ-2)	N33.13839° E35.15363°	Tyre (SUR-2)	N33.25990° E35.20890°

In the Framework of “Enhancing socio-ecological climate change resilience of marine and coastal systems in Lebanon“ project funded by the Royal Norwegian Embassy in Beirut, a multisensory buoy was installed in front of Beirut (figure 13). This is the first and only buoy to be installed on the Lebanese coast. The buoy is equipped with multiple sensors (water temperature, salinity, turbidity, CO2, dissolved oxygen, chlorophyll, water level, waves height and a climate station) and was installed on 14 August 2021 to monitor the different environmental variables in both the sea & air in the context of climate change. The project was Implemented by: IUCN (ROWA) and the buoy is managed by the NCMS-National Center for Marine Sciences / CNRS-Lebanon. The data is part of the Mediterranean network of the buoys and will be open access.

Figure 13 Deployment of the Smart Oceanographic Buoy in front of Beirut (Source: Lebanese CNRS).

5 Planned new installations in coastal environment

5.1 Ministries responsible for authorizing construction

In Lebanon, there is an overlapping prerogative of the various ministries and local authorities making it hard to maintain a good environmental status on the Lebanese coast. Several ministries can authorize different types of constructions on the Lebanese coast.

For instance, Ministry of Interior and Municipalities has the main role authorizing construction in marine environment due to their authority in approving permit for any residential, touristic, and industrial activities on coast, controlling violations of laws (including those related to sand extraction) and infringements on the public maritime domain or municipal domain, stopping contraventions, creating, and managing public beaches, and cleaning up the shore

On the other hand, Ministry of Public Works and Transport (MoPWT) has issued Decrees 17614/1964 (exploitation of the public maritime domain) and 4810/1966 (Regulating the occupation of the maritime public domain). These decrees have instituted the procedure pertaining to the exploitation of the public maritime domain. The poor implementation of the issuance of permit procedures for the exploitation of the maritime public domain has led to environmental and ecological deterioration, and the interruption of the shoreline due to trespasses by public. Each permit is renewable on a yearly basis and no reference is made to the unconditional right of the public authority to recover or reclaim the "leased" section of the coast. The renewal application is submitted to the MoPWT and forwarded to the Directorate General of Urban Planning (DGUP), without any coordination or consultation with the Ministry of Environment (MoE). The latter only has an indirect role in the process through the Higher Council for Urban Planning in which the Directorate General of the Environment is a member, in addition to the evaluation of the EIA studies which shall be submitted to the MoE.

Legal documentation related to maritime transportation (ports and ships) lack proper environmental conditions especially regarding the construction and the exploitation

of maritime transportation vehicles and facilities. This loophole has led to disregarding environmental issues during the construction of harbours. Indeed, EIA studies were only implemented on a small number of harbours. This is because the concept of the EIA studies was adopted by the legislator in Law 444/2002, decree no. 8633/2012, and decisions no. 229/1 and 230/1 dated 16/11/2012.

In addition, the Minister of Public Works and Transport is entitled to license the disposal, filling or incineration, in territorial water or underneath the seafloor of territorial water, of materials that do not produce, inter alia, heavy metals, phenols, halogenated compounds, petroleum products, pharmaceutical by-products, peroxides and azides, ethers, chemical wastes, asbestos, and their derivatives, etc. These operations should not be carried out without proper monitoring of the possible impact on the maritime environment. However, the implementing decrees remain missing.

Ministry of Agriculture (MOA) also has a role in agricultural planning, forest protection, reforestation activities and creation of natural reserves which can indirectly affect the land use change. The ministry also does research and manage the fishing sector in cooperation with the MoPWT.

MOE formulate strategies, policies, programs, and action plans for CZM. MOE is responsible for the development of relevant legislation, and participation in the preparation of international treaties and protocols. Moreover, they promote awareness and guidance on CZM issues at community level. MOE has also the task of:

- Formulation of environmental guidelines for the creation and exploitation of public beaches
- The protection of the coastal zone
- Formulating the strategy, action plans, programs, and studies required for the integrated management of hazardous and non-hazardous solid waste, domestic and industrial wastewater, in addition to monitoring their implementation
- Regulating hunting and fishing activities in coordination with the MOA
- Controlling the use and disposal of chemicals

- Conducting inspection visits and stopping contraventions

5.2 New/expected structures

The main new structure expected to be finalized in the future is the new Jounieh port. Figure 14 shows how the new port will become after the construction works is done.

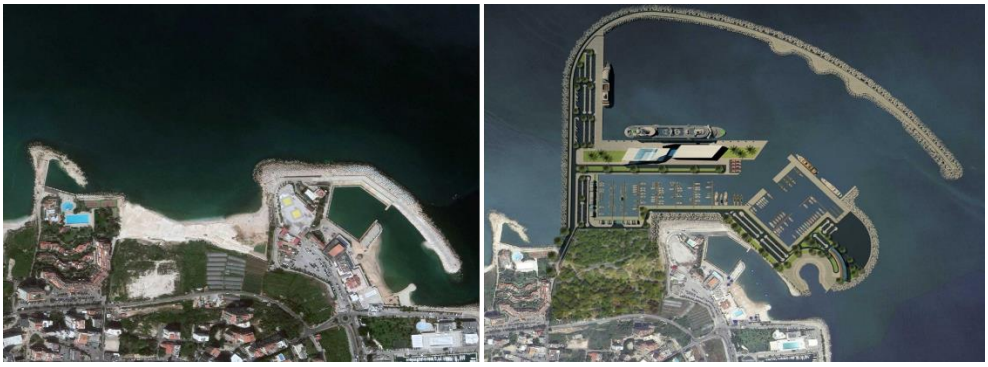

Figure 14 On the left: Old Jounieh Port before construction. On the right: The expected new port after construction works is done.

A reconstruction of the Beirut port is also expected after the blast that occurred on 04 August 2020 (figure 15). However, no details are available yet on how, who and when this will be done.

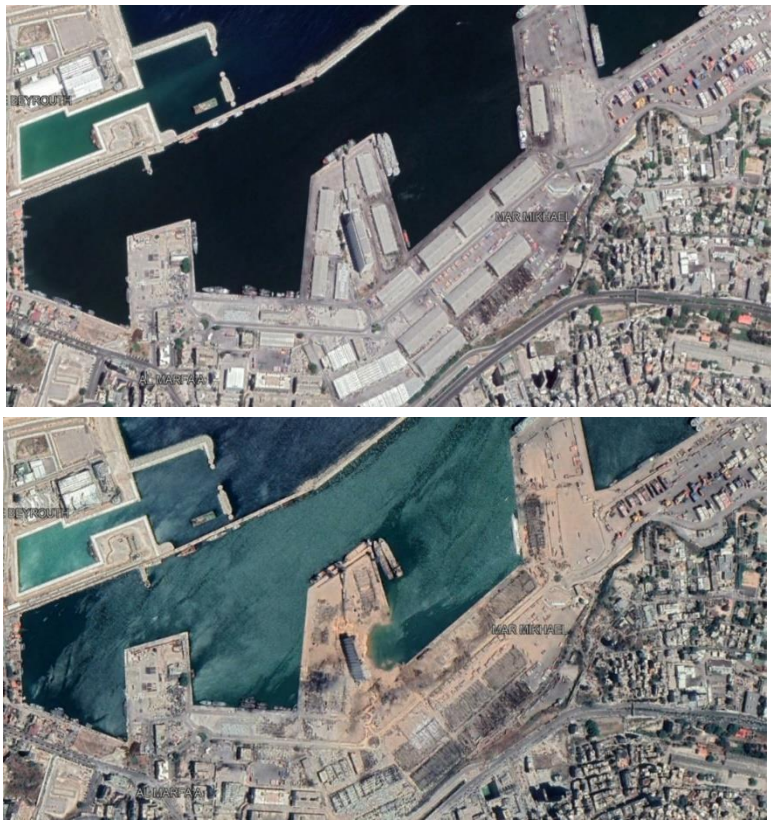

Figure 15 A part of Beirut Port before (July 2020, upper photo) and after (August 2020, lower photo) the explosion of 4 August 2020

6 Conclusion

The following report provides a baseline on the situation related to monitoring of CI 15 in Lebanon, according to the guidance factsheet. It resumes achieved studies that can be related to the CI 15. Concerning data availability, high resolution bathymetric data are available and can be requested from the National Center for Geophysics. However, some of these produced data can be old and need to be updated. Monthly temperature and salinity measurements (covering almost all the Lebanese coast) are available for the past 40 years and can be requested from the NCMS. However, there is a lack of enough data for waves, currents, coastal drift for the entire Lebanese coast. The new installed buoy in front of Beirut can be greatly exploited to investigate hydrographical alterations induced by new structure in that area as it provides all input data needed for modelling.

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8 Annexes

Maps of SDATL describing the location of industrial activities, agglomerations, and location of sand beaches on the Lebanese coast

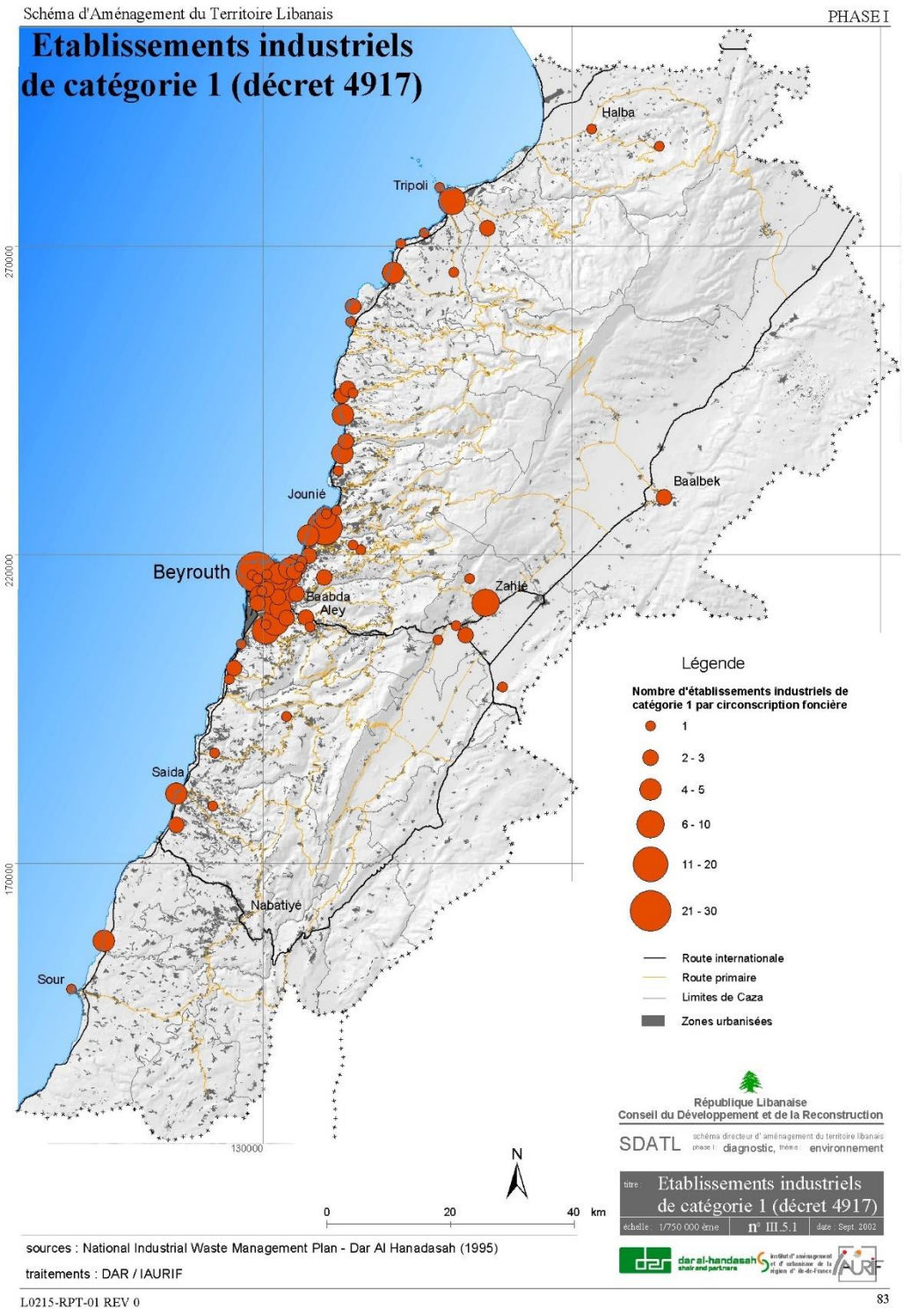

Figure 16 Map showing the distribution of industrial activities on the Lebanese coast. Larger red circles correspond to higher numbers of industries

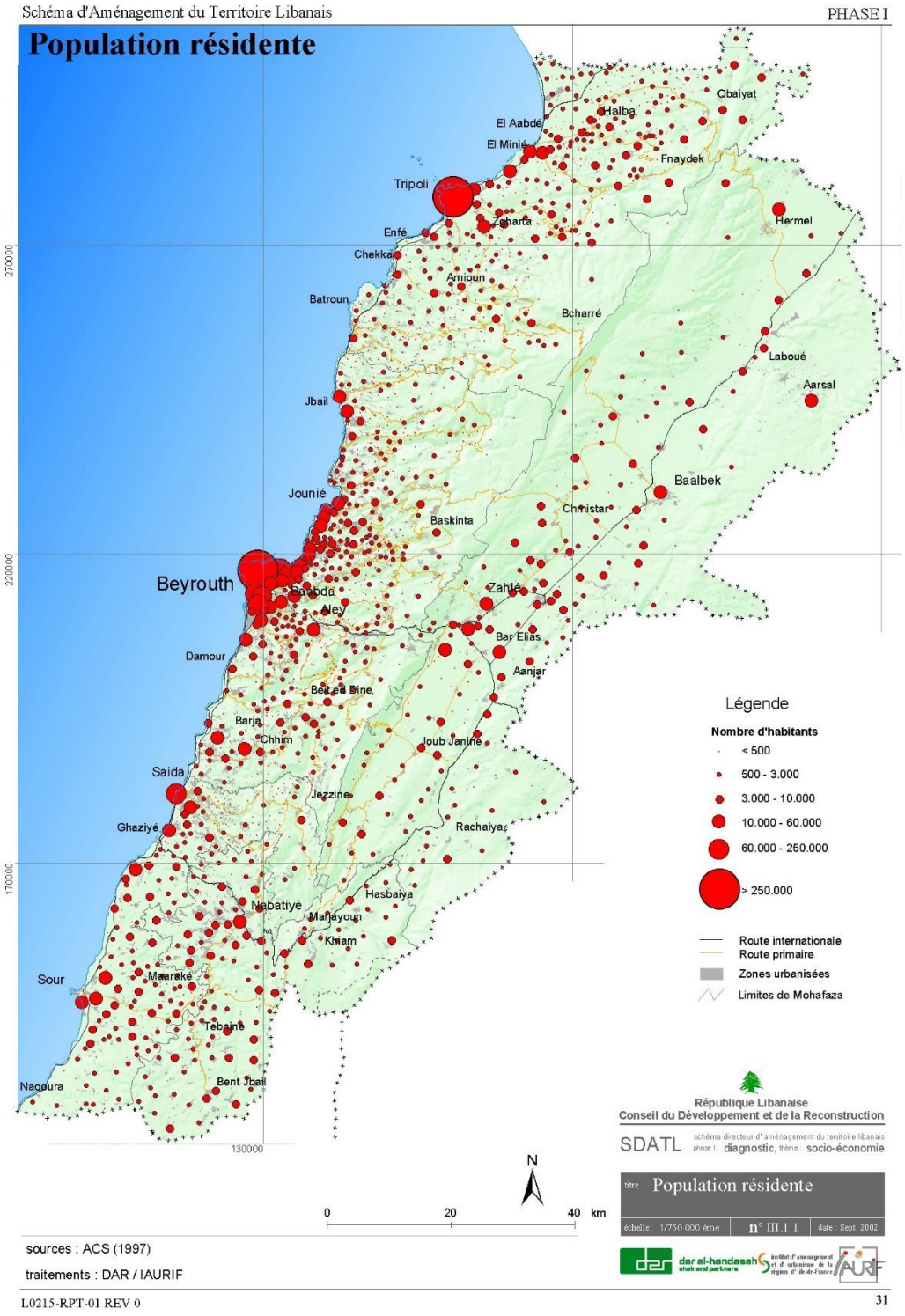

Figure 17 SDATL map of the number of inhabitants. Larger circles show higher density of inhabitants concentrated on the coastal zone.

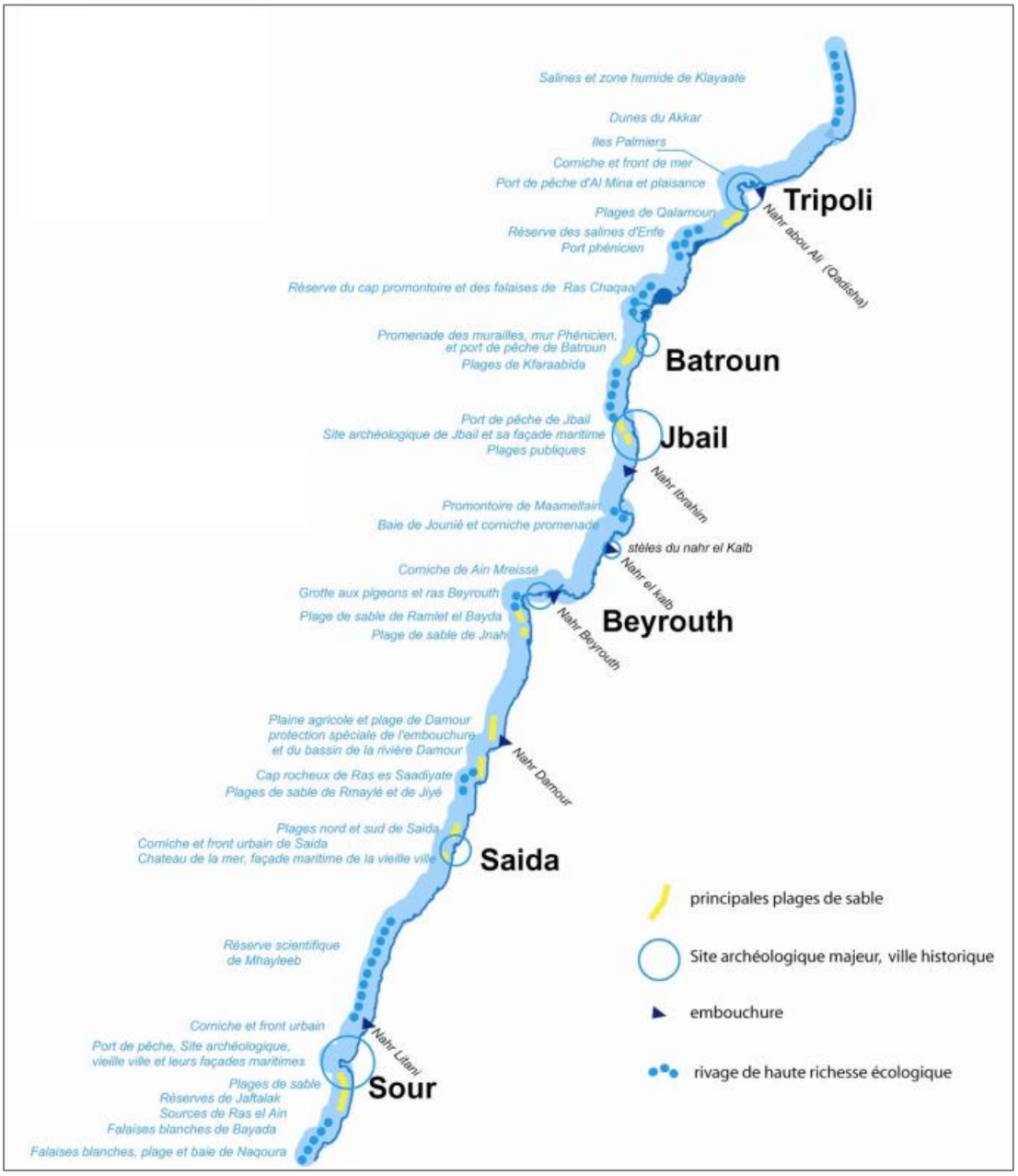

Figure 18 SDATL map showing the location and extent of sand beaches in yellow