Blue Growth

Lebanon scale

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Cooperating across borders in the Mediterranean

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Co-Evolve4BG

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

Blue Growth

Lebanon scale

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OVERVIEW

The present document was produced in the framework of **Co-Evolve4BG** project "*Co-evolution of coastal human activities & Med natural systems for sustainable tourism & Blue Growth in the Mediterranean*" in relation to Threats and Enabling Factors for maritime and coastal tourism development on a national scale" Co-funded by ENI CBC Med Program (Grant Agreement A_B.4.4_0075).

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REVIEW

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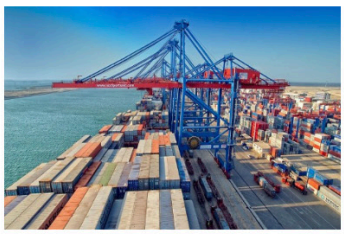



LAYOUT

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Index

List of figures

List of figures

I. Blue Growth Concept

The seas are increasingly viewed as a lucrative new frontier for future economic development, thus the exploitation of seas and coasts for economic activities is defined as "Blue Growth" which was initially inspired from the concept of Blue Economy. The Blue Growth refers to the expansion of such marine and coastal activities in a planned agenda, which involves conservation and long-term strategy to support sustainable growth in the marine and maritime sectors. This strategy includes the premise that healthy ocean ecosystems are more productive (OCTO, 2021).

Governance of marine resources use, and ecosystem sustainability is increasingly facilitated around a recently introduced term and concept of "Blue Growth". This concept is essentially the most used of many recent calls and for more integrated management of complex marine social-ecological systems (Slaughter *et al.*, 2001). However, despite its use by multiple and diverse stakeholders, the terms "Blue Growth" and "Blue Economy" have no generally agreed-upon definition. Instead, they embody vastly different meanings and inferences, depending on the social context in which the terms are used. The potential for miscommunication is high, as scientists from different fields, as well as other stakeholders, may be using the same terms but unknowingly perceiving the concept differently, leading to potential misunderstandings and possibly misguided governance outcomes.

Discussion of the meanings and implications of these globally important concepts is significantly needed. Although the terms are still strictly undefined; however, there must be a comprehensive understanding of the various definitions, as well as a heightened awareness of the constraints of, and possibilities within, the concepts. There is always an objective to enhanced communication among colleagues and across different disciplines and to the convergence towards an operational definition of Blue Growth necessary to create comprehensive science-based policy that delivers net social and economic benefits as well as benefits the aquatic environment, in particular marine systems (Eikeset *et al.*, 2018).

The concept of the Blue Growth can be referred to the conceptualization of sustainable development (SD), or the challenge of a sustainable use of natural resources, while at the same time securing economic and social objectives has been a focus of the international community since the 1960s (Najam and Cleveland, 2003).

The concept of Blue Growth is the newest of many recent calls for more holistic management of complex marine social-ecological systems. The complexity of ocean systems, combined with limitations on data and capacity, demands an approach to management that is pragmatic-meaning goal- and solution-oriented, realistic, and practical (Burgess *et al.*, 2018). Proposed five rules of thumb upon which to build such an approach. These are:

- Defining objectives, quantify trade-offs, and strive for efficiency,
- Available data can do more than what is expected,
- Proper engagement of stakeholders
- Evaluating the impact,
- Design must be for institutions and not for behaviors.

II. Initiatives to Promote Blue Growth at the National Level

Lebanon has been a Party to the 1982 UN Convention on the Law of the Sea and to the UN Compliance Agreement since 1995. Moreover, Lebanon is an active member of the General Fisheries Commission for the Mediterranean GFCM (DFW-MoA, 2013). The Lebanese government announced several MPAs for their nature conservation role but also for their crucial role in educating local communities and visitors about the culture, history and heritage of Lebanon located on the East Mediterranean. The designation of coastal or marine protected areas is associated with the history and current land use, historical and current human culture and values associated with specific localities in the Mediterranean marine environment. Some historic and cultural MPAs are declared to fulfill a single purpose, such as protecting a submerged cultural resource site from amateur souvenir hunters or professional salvagers, or to protect a single marine species from exploitation.

Others are created within a multiple-use approach that includes protecting historic and cultural values alongside biodiversity conservation and sustainable use. Educating visitors about sites of historic significance helps illustrate the relationship and interaction between people and marine environments. These sites can include shipwrecks, lighthouses, customary tenure boundaries, battle sites, hunting and collecting areas, ceremonial and sacred sites, fish traps, harbors, coastal fortifications, fish markets, fish smokers, salting and drying sheds, sail lofts and old ships and small boats. These sites are also important for developing local understanding of rights and responsibilities in using and caring for marine environments.

The announcement of Tyre Coast Palm Islands Nature Reserve has a very important role not only in marine and coastal biodiversity conservation and development, but also in national education, tourism and economic development and awareness rising. The marine protected areas are particularly important because they provide opportunities for people to experience and study marine plants and animals that survive in less degraded areas with almost restored natural balance between land and sea.

The coastal protected areas can thus become places where people can observe and compare with the impacts from disturbance by urban encroachment, pollution, overfishing and over exploitation. Children can learn about the lifecycle of fish and other marine animals, their habitat and risks surrounded. The dissemination of information and capacity building provided by these reserves can help students and large populations reach a level of knowledge that can help developing local communities that will have direct interest to protect and sustainably manage the unique marine environments.

III. Main Challenges for Applying Blue Growth at the National Level

Rapid and unchecked economic development in the ocean can produce substantial risks for people and the environment (Bennett *et al.*, 2021). In this regard, the Blue-Med Strategic Research, and Innovation Agenda outlines a set of key challenges for the Mediterranean, particularly knowledge gaps**,** specific activities enabling the Blue Growth, as well as measures for capacity building (SRIA, 2018). Sectors of interest in this strategy include ecosystems, climate change, biotechnologies, aquaculture, fisheries, tourism, shipbuilding, transportation, observing systems, data, offshore platforms, cultural heritage, and spatial planning (Figure 1).

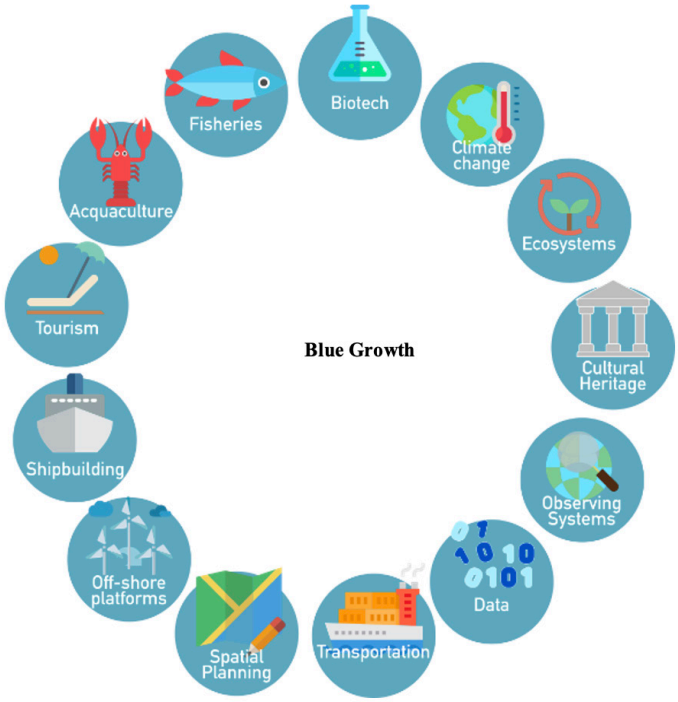

Figure 1. Key sectors for the Blue-Med Strategic Research and Innovation Agenda (SRIA, 2018).

III.1. Key enabling knowledge

- Mediterranean Sea ecosystems: characterize present dynamics, services, resources, vulnerability, and resilience to natural and anthropogenic pressures.
- Mediterranean Sea: forecast changes of the basin under climate and anthropogenic pressures and develop services in the field of sustainable adaptation to climate change and plans for mitigation.
- Hazards and protection of coastal areas and open sea in the Mediterranean.

- Innovative Blue Growth trajectories: biotechnologies, food, and the deep sea and offshore resources.

III.2. Key sectoral enablers

- Innovative businesses based on marine bio-resources in the Mediterranean.
- Ecosystem-based management of Mediterranean aquaculture and fisheries.
- Sustainable tourism and cultural heritage in the Mediterranean.
- Maritime clusters in the Mediterranean.
- Governance of maritime space and marine resources in the Mediterranean.

III.3. Enabling technology and capacity creation

- Smart, greener, and safer maritime transport and facilities in the Mediterranean.
- Observing systems and operational oceanography capacities in the Mediterranean.
- Innovative offshore industrial platforms including marine renewable energy and co-use.
- Marine and coastal natural and cultural heritage in the Mediterranean: discovering, protecting, and valuing.

IV. Measures Taken to Promote Blue Growth

Adopted since 1929 by the Lebanese Parliament, several laws and regulations addressed controlling the sources of coastal contamination, the protection of heritage and archeological sites, the regulation of the maritime public domains, organization of fishing activities, and recently the land use planning project (SDATL, 2004). The MoE is responsible for the most important law, code of the environment (444-29/7/2002), which deals with the protection and conservation of the land and marine ecosystems (Table 1). The MoE is also implementing, by the Decree 4869 of 2/9/2010**,** the GEF grant on "Sustainable management of marine and coastal biodiversity and habitats through policy and legislative development for mainstreaming in Lebanon".

Unfortunately, the "application decrees" are still pending the approval by the national cabinet. Furthermore, some of these regulations are issued, but poorly implemented on the ground.

Table 1. Lebanese regulations on the management of fishing and maritime domain.

Type and Number	Title
Law issued as Decision No. 2775 of 28/9/1929	Control fishing
Law 166 of 07/11/1933	Establishment of a regulation for heritage and archeological sites
Law of 24/9/1962	Urban Planning
Decree 4810 of 24/6/1966	Regulation of Maritime public domain
Law 444 of 29/7/2002	Code of the Environment
Decree 2366 of 20/6/2009	Master Plan for land use in Lebanon

The management and conservation of Lebanese marine and coastal natural reserves are additionally controlled by several international conventions and agreements that have been signed and ratified by the Lebanese government. These conventions are:

- The Barcelona Convention for the protection of the Mediterranean Sea against pollution.
- The Convention on Biological Diversity (CBD).
- The United Nations Convention on the Law of Biological Diversity.
- The Ramsar Convention on Wetlands of International Importance, especially as Waterfowl Habitat.
- The African-Eurasian Migratory WaterBirds Agreement (AEWA).

- The Agreement on Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic area (ACCOBAMS).
- The UNESCO Convention on the Protection of Cultural and Natural Heritage.

Several Lebanese laws are related to the conservation of marine and coastal areas. The first Law regulating the fisheries sector is Law No. 1104 issued by Decision on 14/11/1921. Since 1921, several Laws, decrees, and decisions related directly to fisheries were promulgated, with the most relevant being Law No. 2775 "Monitoring of coastal/marine fishing" passed in 1929 (Pinello and Majdalani, 2018).

This Law identified fishing, delimited the monitoring of fisheries, set various prohibitions like places, times, types of overfishing and fishing gears, and defined measures related to the organization and monitoring of fisheries and fishing by vessels. It set the rules to juvenile fish protection and conservation of fish and shellfish, minimum sizes of fish and shellfish to be fished, transported, and sold. It also prohibited baits, set the arrangements and precautions related to fishing operations, measures for practicing fishing by rod and line, fees for fishing licenses and fishing gears, and defined penalties.

Other Lebanese laws are related to the declaration of coastal nature reserves:

- Law no. 444/02 (Code of Environment) specifies, under Chapter VIII, the protection, conservation and management of nature and biodiversity.
- Law no. 121/92 declaring the Palm Islands Nature Reserve on March 9, 1992.
- Law no. 708/98 declaring the Tyre Coast Nature Reserve on November 5, 1998.
- Law no. 170/2020 declaring the Abbassieh Coast Nature Reserve on May 5, 2020.
- Law no. 508/04 (hunting law) is the latest attempt for regulating and controlling hunting in terms of season, type of protected birds forbidden for hunting, amount, and type of game birds along with a permit system based on hunting testing.
- Decree no. 8213, dated 24/5/2012 relating to the "Strategic Environmental Assessment for Proposed Policies and Plans and Programs in the Public Sector" or SEA decree.
- Decree no. 8633, dated 7/8/2012 relating to the "Fundamentals of Environmental Impact Assessment" or EIA decree. According to this decree, all major development, infrastructure, and industrial projects are subject to EIA or IEE studies including their effects on biodiversity, in order to promote conservation activities and prevent the damage of the surrounding environment by these projects before receiving approval.
- Decision of the Minister of Agriculture no. 125/1, dated 23/9/1999 banning the fishing of marine turtles, monk seals and whales as well as selling, use or trade of any derivatives from the mentioned species.

- Decision of the Minister of Agriculture no. 1/385, issued January 26th, 1997, stating that fishing activities are prohibited in all estuaries all year round. The protected area involved extends over 500 m on each side of the estuary, 500 m inside the river and two kilometers seawards. All human activities are banned except for those of scientists and the Coast Guard.

V. Established Sectors

V.1. Marine Living Resources: Fisheries

Lebanese fisheries are considered small-scale, artisanal, and traditionally based on bottom stationary gear (trammel nets and longlines), purse seine nets, and beach seines. However, the sea bottom grounds are mainly rough with frequent rocky patches that make them good for stationary demersal equipment. The small pelagic species are in the center of the fishing industry. Fishing operations are mostly carried out at medium depths of up to 50 meters. Most of the fishing nets have small mesh sizes *i.e.,* less than 2x2 cm. The national fish production is mainly consumed locally (Majdalani, 2005). Fishing techniques are mostly based on passive gears such as gillnets, confine nets, long lines, and purse seines (Sacchi and Dimech, 2011). Gillnets represented more than 50 % of the fishing gears used in Lebanon (DFW-MoA, 2013).

The number of fishing vessels reached 2,680 in 2004 [11] and 2,762 in 2011 (Majdalani, 2005; DFW-MoA, 2013). The fishing fleet operates from 44 ports and landing sites (30 official ports) that are mostly small, crowded, and need maintained breakwaters. In 2012, the average fishing vessel length was 7.04 m (DFW-MoA, 2013). The estimated number of fishermen was 6,500 in 2004 (Majdalani, 2004).

The concentration of effort on a narrow coastal strip has led to an overexploitation of coastal species. The yield reduction paved the way for the recurrence to harmful practices, such as the use of small mesh, hooks, and explosives, which thrive as a result of an outdated legislation and the lack of enforcement (Sacchi and Dimech, 2011).

The Department of Fisheries & Wildlife, MoA, is the responsible government body for the management of the Lebanese fisheries and aquaculture sectors. At local and professional level, the fisheries sector in Lebanon is represented by about 33 fishermen cooperatives and 86% of the 9,000 fishers hold a personal license. The weak funding and ineffective policy led to neglect the contribution of the fishery and aquaculture sectors to national economy and food security and caused a regression in their productivity that negatively affected the decent livelihood of fishermen and fish workers involved in ancillary activities.

High temperatures prevailing in the Eastern Mediterranean, compared to its western basin, give this region a tropical character regarding planktonic biota. This reflects on species' diversity and richness. In fact, within the Mediterranean, there is a gradient of increasing plant and animal species diversity from east to west. The southeast corner, the Levant Basin, is the most impoverished area. Such poor biodiversity of the Levantine basin and Lebanon Sea has begun to increase since the opening of the Suez Canal in 1869 (Sacchi and Dimech, 2011). During the last few decades, at least 300 Indo-Pacific species, known as Lessepsian migrants, have entered the Levantine basin giving to its communities a mixed Mediterranean-Red Sea species composition. About 60 Red Sea species have successfully colonized the Levantine Basin, some of them replacing native species, thus becoming important components of commercial fisheries.

MoA catch data for 2016 indicated that 17 species/families accounted for 80% of catch and that sardines and anchovies (*Clupeidae*) are the most important commercial species representing around 30% of production (Table 2). Previous years showed similar trends.

Table 2. Lebanese Marine Fish Catch Profile (2014-2016) (DFW-MoA, 2016).

Species		Catch (ton/year)		
Clueidae	Herrings, Sardines	326	517	1,263
Pagellus acarne	Axillary seabream	83	304	271
Euthynnus Alletteratus	little tunny	274	344	255
Diplodus sargus	While seabream	153	257	239
Liza aurata	Golden gray mullet	44	123	168
Boops boops	Bogue	226	65	157
Siganus rivalatus	Marbled spinefoot	535	232	155
Sardinella aurita	Round sardinella	15	105	141
Oblada melanura	Saddled seabream	113	101	128
Pagellus erytheinus	Common pandora	173	151	117
Pagrus caeruleostictus	Blue spotted sea bream	45	121	95
Seriola dumerili	Greater amberjack	-	96	95
Caranx crysos	Blue runner	29	60	85
Siganus luridus	Dusky spinefoot	25	70	78
Scomberomorus commerson	Narrow-barred spanish mackerel	9	49	67
Sphyraena chrysotaenia	Yellowstripe barracuda	73	74	62
Portunus pelagicus	Blue swimming crab	11	53	38
Other species		712	887	859
Total		2,931	3,611	4,273

V.2. Marine Living Resources: Aquaculture

Aquaculture on the coastal area of Lebanon was restricted to a small experimental station in Batroun with an area of 1,000 m^2. This station was not maintained in the seventies and eighties and finished by disappearing as a seed project for training of fishermen on best ways to cultivate marine fish. If properly developed and maintained, this nursery can turn into industry, closing the gap between the marine fish production and fish demand in the country, which is closed via the import of raised fish from Turkey and Cyprus. Such an industry could have created working places and reduced the drain of foreign currency for imported fish products.

V.3. Marine Non-living Resources: Offshore O&G

Offshore petroleum (oil and gas) field development refers to petroleum recovery, which has become a major component of the Blue Growth over the last few decades and anticipated to continue to grow over the coming decades. Thus, deep-water oilfield development may take ten years from the first exploratory well to the first barrel of oil sold, and pre-production costs, including development of wells and specially designed production facilities, may reach several billion dollars (USEIA, 2016). Nevertheless, the development of the offshore oil and gas industry has both positive and negative economic impacts on the overall Blue Growth. For the positive impact, it will substantially contribute to the increase of GDP, while it negatively influences the existing fisheries and marine-based aquaculture.

In Lebanon, offshore petroleum industry is almost absent; therefore, neither offshore oil platforms, nor oilfields for petroleum production exist. Thus, the country is importing about 98% of its energy. However, Lebanon encompasses three Trans-Arabian petroleum pipelines that are connected to two old refineries (in Tripoli and Zahrani), which are not operational anymore.

Petroleum exploration has a long history in Lebanon, which started in the 1930's, but exploring onshore sites started in the 1940's. The first petroleum well was drilled in 1947 in Terbol, and then it was followed by another six wells. Even though the depth of drilling was not sufficient to reach the hydrocarbon reservoir, oil and gas appearance was indicated.

Lately, Lebanon has been oriented again to the exploration stage; in this regard, PGS, Spectrum and Geco Prakla companies have carried out 2D/3D seismic soundings at different periods between 1993 and 2013. Consequently, promising results have been reached, notably that seafloor geological traps were identified, and the offshore Lebanon water was divided into 10 blocks (Figure 2) to prepare for biddings with different digging and exploration companies.

Except one offshore well, yet no wells have been dug to explore the potentiality of these traps to store hydrocarbons. The well dug by TOTAL Company in Block 4 (Figure 2) located to the northwest of Beirut was not creditably operated, because the digging reached to 1,500 m only, while the cap rock to capture hydrocarbon in the seafloor in Lebanon exceeds 3,500 m in depth.

According to official reports, the current estimates show that almost 45% of the Lebanese offshore water harbors 95.9 trillion cubic feet of gas and 865 million barrels of oil (https://lebanongasnews.com/wp/the-road-map-for-lebanons-first-offshore-licensing-round/). Nevertheless, one must be extremely careful when referring to estimates, since no wells have been drilled yet in the Lebanese offshore, but in general, the contribution of the offshore petroleum exploration in Lebanon will play a significant role in the Blue Growth of the country.

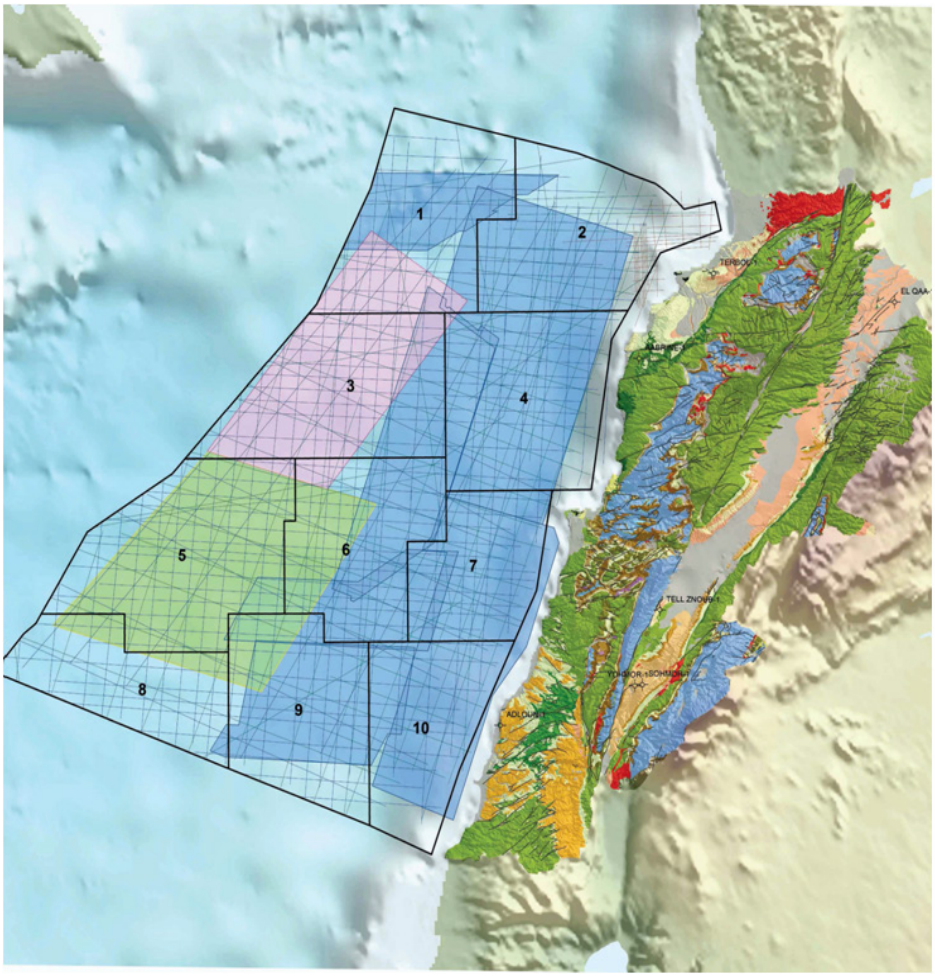

Figure 2. Offshore blocks for bidding to explore petroleum in Lebanon (https://lebanongasnews.com/wp/the-road-map-for-lebanons-first-offshore-licensing-round/).

V.4. Marine Non-living Resources (traditional): Operation /Extraction of Gravel, Sand, Clays, Kaolin, Extraction of Salt

Numerous non-living resources can be harvested, either from the seawater or from the seafloor. These resources provide several raw materials, drinkable water, and energy for the growing population. The capability of exploiting these resources depends fundamentally on the availability of technologies that enable harvesting and extraction of such resources.

- The investment of non-living (traditional) marine resources is widespread in many maritime regions worldwide. However, in Lebanon this operation is still untapped, whereas many potential natural marine resources are expected to locate into the seafloor of Lebanon including the following:

- Gravel and pebbles which are commonly deposited at several localities along the coastal zone of Lebanon, notably in the proximity of estuaries of rivers and streams. These materials are used for construction with different purposes.
- Friable sands for concrete and other construction purposes, and consolidated sandstone for decoration. In this regard, sand dredging is informally implemented along the coastal zone of Lebanon, and this can be either as dredging from offshore or directly excavating from beaches (Figure 3). Sand dredging resulted in several unfavorable impacts such as the case in Tyre, where collapses and cracks were noted in buildings due to sand dredging in the surrounding maritime region.
- Clay and kaolin are available in the maritime zones of Lebanon, and these natural resources are derived along the large-scale estuary of the Nile River, which delivers huge amounts of clay and relevant materials along the Lebanese, Syrian and even Turkish coasts. Nevertheless, these materials are not exploited in Lebanon yet.
- Groundwater discharges (as submarine springs) are well pronounced along the Lebanese coast where several studies have been carried out, the amount of groundwater discharges along the Lebanese coast as invisible rivers, is estimated to exceed 400 million m^3 per year, which is equivalent to some three Lebanese coastal rivers (Shaban ,2020).

If well managed, the non-living resources can significantly contribute to the development plans in Lebanon. Nevertheless, the extraction of raw materials (*e.g.,* sand, gravel, *etc.*) is poorly exploited and chaotically invested with no legal controls, which hurts the marine ecosystem along the entire maritime region of the country. This is also the case for the groundwater discharges into the sea which are neglected, and their sources (*i.e.,* terrestrial aquifers) are totally exhausted with no inland control of groundwater pumping.

Figure 3. Sand dredging: a common illegal maritime exhausting practice.

V.5. Marine Renewable Energy

Marine renewable energy, including offshore wind and solar power, as well as emerging ocean energy technologies, could support sustainable long-term development and drive a vibrant Blue Growth. For countries and communities around the world, marine renewables can provide reliable and stable electricity, as well as support water desalination and aquaculture**.** The development of renewable sources and technologies at the sea, promises to spur new industries and create jobs in line with the global energy transition. Therefore, offshore wind towers with fixed or floating foundations, and floating solar photovoltaic (PV) arrays, could offer clear technological and logistical synergies with the existing offshore oil and gas industry. Offshore renewables could provide clean power and ensure energy security for small island developing states (SIDS) and many of the least-developed countries (IRENA, 2020).

In Lebanon, the "National Wind Atlas of Lebanon" was published by the UNDP-CEDRO project early in 2011 and underwent a meso-scale and micro-scale modeling for the entire country to produce a wind map at heights of 50 m and 80 m above ground level and at a resolution of 100 m (Hassan, 2011). The study's main objective was twofold: the first was site-prospecting, in the meaning that the study helps to identify sites where further due diligence, in the form of local wind resource measurements, is warranted. Nevertheless, the Atlas did not account for any offshore positioning for wind resources.

Solar energy is also a valuable resource in Lebanon. With around 3,000 hours of sunshine per year, the addition of this energy source to the national grid could greatly contribute to the growth of clean energy in Lebanon. Solar energy currently represents around 0.26% of the country's energy mix. To grow this energy source, the MEW is launching two separate bids for solar farms with a total production capacity of around 450 MW. According to UNDP-CEDRO, the cost of generation of solar energy could reach as low as $6c per kwh in the upcoming bids. This could also contribute to considerable savings in oil expenditures. Given EDL's average production cost of about $17c per kwh, solar energy is a sustainable alternative for Lebanon with savings of up to $11c per kwh (Heinrich Boll Stiftung, 2019).

Like wind energy, the implementation of solar energy offshore Lebanon was never tackled. However, if these two aspects of green energy were exploited in the maritime region of Lebanon, they would, in addition to the optimal energy production, produce clean energy and avoid polluting the environment, and reduce the impact of noise and other disturbing elements.

V.6. Maritime Transport and Ports Activities

Due to several reasons, including the lack of coordination between ministries, overlapping of responsibilities and weak governance, Lebanon failed to create and maintain a sustainable transport system, including the maritime transport. A metropolitan planning agency is a must to ensure the coordination of land use and transport planning, to plan and maintain a resilient public transport network. In addition, the absence of a regulatory

authority urges the necessity of having a Land Transport Authority (LTA), responsible for planning and regulating public transport services.

Maritime transport in Lebanon is the most important mode for external trade and plays an important role in tourism mobility. There are four main ports in Lebanon:

1. Port of Beirut, located in the capital city (Figure 4): it is among the top ten seaports in the Mediterranean Sea and is considered the Mediterranean cruise port and gateway to the Middle East. After 1990, a large reconstruction of new infrastructure targeted the establishment of a new container terminal, and the rehabilitation of the old infrastructure at the Port of Beirut. The terminal project was completed in 2018.

Based on national funding, the Port of Beirut was transformed to a regional and a transshipment hub for the Mediterranean region. With large capacity for import, the port consists of a total area of 1.2 million m^2 and has four basins, 16 quays, and a new container terminal capable of handling about one million twenty-foot equivalent units (TEUs) every year. The new Free Zone, which covers an area of 11,200 m^2, has been re-launched after the civil war, and has been successfully operational since then. The old building was reconstructed into a modern passenger terminal (sized 600 m^2 or 6460 ft^2). Beirut cruise terminal is located on Quay 5 and faces Turning Basin 2.

The port of Beirut plays an important role in transporting goods to Syria, Jordan, Iraq, and the Gulf States, sharing 91% of imported and 91% of exported goods from Lebanon. Beside the port of Tripoli, it is expected to play an important role in the reconstruction of Syria. However, the Beirut Port Blast that occurred on August 4th, 2020, destroyed a significant part of the infrastructure of the Port and affected its activity.

2. The Port of Tripoli is the second most important port in Lebanon after the Port of Beirut (Figure 4). It has an approximate area of 3 million m^2 with a water area of 2.2 million m^2, a land area of 320,000 m^2, and a 420,000 m^2 dump area adjacent to the current port, reserved for the future Container Terminal and Free Market Zone. It receives approximately 450 ships yearly, averaging around 37 ships per month. Most ships carry general goods and dry discharge such as iron, wood, vehicles, and construction material. The Port of Tripoli also contains a Free Zone with an average area of 150,000 m^2.

3. Port of Sidon is a historical port, mainly used as a fishing port and for accommodating small freighters. About 200 ships enter this port each year from Europe, Africa and Arab countries. While the port can accommodate a larger number of ships, winds and waves prevent ships from docking due to the absence of wave breakers to protect them. The lack of such protection has forced many ships to dock in other ports. Yet, there have been several initiatives in recent years taken towards modernizing the commercial port.

4. Port of Tyre is a small harbor that is in South Lebanon. In this port, the breakwater protects the Marina harboring fishing boats and some private pleasure crafts or sailing boats but does not extend sufficiently to shelter vessels berthing at the main harbor. As such, during the winter season, the port may be inoperable for up to 10 days per month due to swell and waves. During recent years, only 2 to 3 vessels call at Tyre per month, mainly smaller RORO's (Roll-On, Roll-Off) discharging passenger cars from Europe. In fact, the Port of Tyre has no cargo handling equipment and warehousing facilities are limited to vehicles.

Beside the maritime commercial ports, several yachting ports, harbors, and marinas exist along the Lebanese coast such as Aquamarina, Holiday Beach and Movenpick, and designed for small residential speedboats; while La Marina JK Dbayyeh, the ATCL Automobile et Touring Club du Liban in Jounieh, and the Beirut Marina are open to large yachts. The ATCL Jounieh is the only one with a welcoming berth to receive the visiting yachts.

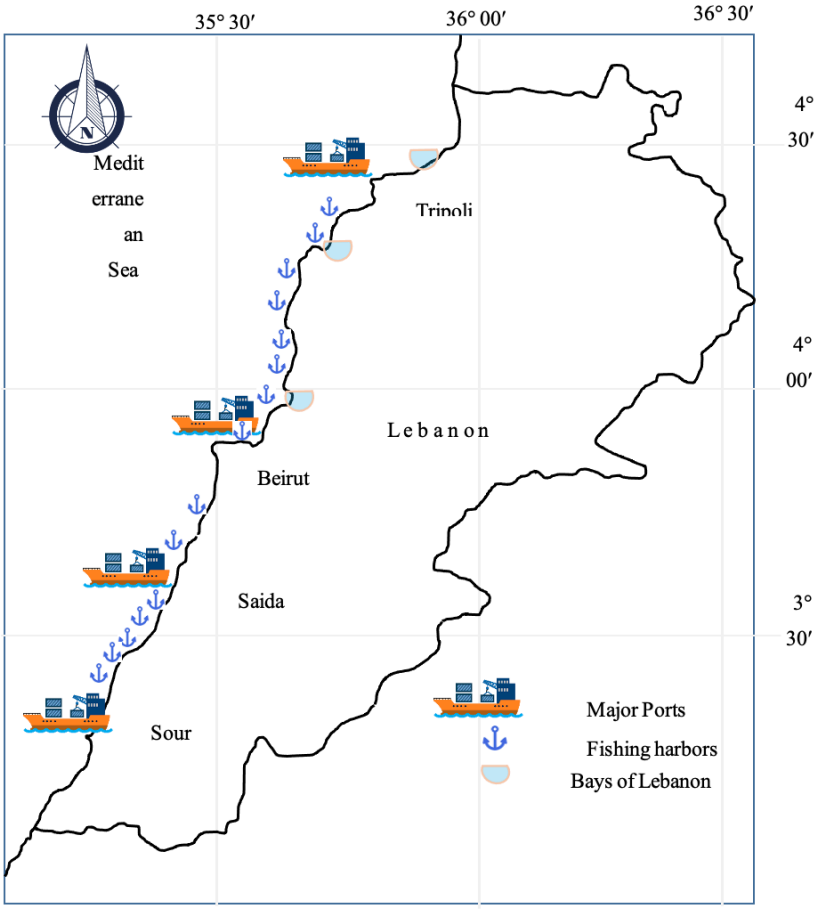

Figure 4. Major ports along the Lebanese Coast (https://www.researchgate.net/figure/Map-of-Lebanon-showing-the-two-mountain-chains-the-location-of-the-major-cities-the-4_fig1_328116690).

V.7. Shipbuilding and Repair

Shipbuilding industry has become more global than local, due to the increasing globalization demand and the ease of moving raw materials, components, and finished products across the world's waterways (https://assafinaonline.com/). Shipbuilding is considered one of the most strategic, oldest, most open, and highly competitive markets in the World. Although the shipbuilding industry has vast experience in surviving during the peaks and slumps of the economy, the current global economic, COVID-19 and political crises have hit the shipbuilding industry more severely.

The Lebanese shipbuilding market is valued at 121.420 million USD. In 2020, it was expected to reach 179.750 million USD by the end of 2026, growing at a compound annual growth rate (CAGR) of 5.7% during 2021-2026. The key factors driving the growth of the market are GDP, global seaborne trade, improved economic growth, rising urbanization, fossil fuel prices, and the increase in global steel production. Some of the noteworthy trends and developments of this industry are green shipbuilding technology, automation in the industry, modular shipbuilding technique, advanced outfitting, ship launching airbag, LNG/LPG fueled engines, autonomous ships, and solar and wind powered ships.

However, the expansion of the shipbuilding industry can be affected by increased competition, environmental regulations, enhanced globalization, and political and financial instability.

As for the global ship repair and maintenance services market, it is expected to grow from USD 18.89 billion in 2018 to USD 39.93 billion by 2026 at a CAGR of 7.04% during the forecasted period from 2019-2026. The key factors for market growth in the demand for new ships and activities are the shortening of supply chains in ship repair and maintenance services, increased seaborne trade against the backdrop of recent economic boom, and the increase in vessels' production.

In Lebanon, a total of 19 shipbuilding and repair companies are available. Recently, a dry dock and shipyard started to be built in Al Arida village, Akkar, with a USD 75 million investment, including a factory for manufacturing and maintaining yachts and ships (including the maintenance of oil ships), and a fishing farm (http://www.businessnews.com.lb/cms/Story/StoryDetails.aspx?ItemID=7225). The project will be built on a 200,000 m^2 plot of land, part of which on the seaside, with a total built-up area of 70,000 m^2. The factory will start manufacturing four yachts a year. It will create more than 50 jobs.

Lebanon is certainly famous for its legendary cedar wood used since ancient times both in shipbuilding and construction (houses and furniture). Cedar wood, finely worked with carvings, was well known and appreciated throughout the Mediterranean (Figure 5). Shipbuilding was certainly one of Lebanon's largest craft activities. The over-exploitation of the majestic cedars led the artisans to use different essences such as rosewood, olive, mahogany, and beech (http://www.webport.cloud/lebanon/the-great-craft-tradition-in-lebanon/?lang=en).

Figure 5. Samples of the traditional Lebanese Artisan shipbuilding from Cedar wood.

V.8. Coastal and Maritime Tourism

Depending on the sub-sector, maritime and coastal tourism is both a linear and area-based activity. In most cases, maritime activities start from the coastline as well as between the shore and on-water areas, while for instance diving, snorkeling and underwater cultural heritage exploration are place-based activities. The distance to shore is typically between zero and a few kilometers. Thus, water depth depends on sub-sector needs, and might be crucial element activities (*e.g.,* water-based activities such as boating, yachting, nautical sports).

Although mass tourism is likely to stabilize or even decline in the future, the spatial implication of this type of tourism will remain the same: direct use of sea space mainly along the coast, impacts on the sea environment and water quality and environmental pressure on land, are among the factors deserving special attention within MSP processes (Ecorys, 2013).

From the geographic point of view, the coastal and maritime regions proved to be susceptible for tourism industry and productivity especially that the coastal zones are always the main hubs of many regions where large cities and capitals are located, and therefore, all requirements for tourists are often available. However, the tourism industries are not restricted to the coast itself but to the maritime region that connects with these coasts, and both are overlapped in terms of touristic activities and facilities. Hence, coastal, and maritime tourism contribute significantly to the economy of many countries, and thus play an integral role in the development of Blue Growth.

Lebanon is a typical example for coastal tourism, but this is not the case for the maritime one. If the country is divided according to its geographic-related tourism types, coastal tourism will be ranked first, followed by mountainous tourism, and lastly maritime tourism.

This diversity in this classification is attributed to the fact that the entire Lebanon can be considered as a coastal zone, notably that the coast, mountains, and inner region are very close to each other, and this facilitates transportation between them. In addition, the mountainous region of Lebanon is characterized by a unique landscape (*e.g.,* water resources, snowpack, vegetation, *etc.*), which is remarkable in the whole Middle East Region. This diverts the attention on the maritime region where tourism witnesses several constraints, including:

- Geopolitical conflict that makes the maritime region under frequent threats.
- Financial resources to adopt large-scale touristic projects in the maritime region.

Frequently existing pollution events (*e.g.,* oil spills, liquid, and solid waste dumping, *etc.*).

The coastal tourism in Lebanon has a big deal in the economic and social aspects of the country, notably with the local community and the public authorities who represent the main actors in the coastal and maritime tourism in Lebanon. This was discussed in detail in the Deliverable ID-LB-16 (Maritime/Coastal tourism and the local community in Lebanon).

VI. Emerging Sectors

VI.1. Marine Non-living Resources: Marine Minerals (Deep Sea Mining)

Mineral and metal resources in the sea are potentially highly lucrative and non-renewable; however, the impacts of seabed mining operations are not well known. Regulations for seabed mining are beginning to emerge, with the "International Seabed Authority, ISA" leading the development (FAO, 2016).

There are many kinds of minerals that can be found either in the seawater or on the seafloor. These minerals are sometimes formed in-place and others are transported by erosion from the continents to the coastal areas, where they are mined from the shallow continental shelves and beach areas. Generally, the seawater contains considerable amounts of minerals, but the processing and appropriate technology is always the major control of investment. For example, seawater contains (on average) 1,270, 884, 0.09, 0.0003, 0.000008 ppm of magnesium, sulfur, copper, silver and gold, respectively. In the Mediterranean Sea, subsea mines have been known since ancient Greece at Laurium, where lead, zinc, iron, and other minerals were mined. Moreover, placer deposits of diamonds, tin, gold, and magnetite are being mined/dredged at various locations around the world from the sea.

Sea mining has numerous environmental considerations, including mainly the loss of or damage to habitat, pollution risks and carbon footprint, plus many other negative consequences on the marine ecosystem and the relevant biological components. Nonetheless, environmental consideration is always lacking in sea mining, especially where mining takes place at the Deep Ocean and at a range from the coast.

Sea mining for marine minerals in Lebanon does not exist and has never been accounted-for in the developing plans. This is due to the lack of scientific studies, as well as the unavailable financial resources. However, salt mining is the only aspect of marine mining in Lebanon (Figure 6) and has been known since ancient times. Nowadays, Lebanon produces about 45,000 tons a year for local uses. Most Salinas in Lebanon are located at the northern coast between Tripoli and Byblos.

VI.2. Blue Bioeconomy and Biotechnology

The emerging blue bioeconomy and biotechnology sectors focus on groups of marine organisms that are still underestimated for commercial exploitation (https://ec.europa.eu/oceans-and-fisheries/ocean/blue-economy/blue-bioeconomy-and-blue-biotechnology_en).

The marine organisms include microalgae, bacteria and fungi, algae and invertebrates like starfish, sea cucumbers and sea urchins. The potential of blue bioeconomy is hidden in the transformation of aquatic biomass into food, feed, nutraceuticals,

pharmaceuticals, cosmetics, energy, packaging, clothes and much more. Blue biotechnology is the application of science and technology to living aquatic organisms to produce knowledge, goods, and services (OECD, 2016).

Europe is witnessing fast, though uneven development of blue bioeconomy, which is supported by strong research and stakeholder engagement.

Figure 6. Salt mining in Enfeh, North Lebanon (https://lebanonuntravelled.com/anfeh-salt-mining/).

Algae can be potentially used to develop new pharmaceuticals including those related to Covid-19, bring healthy food to the market, or substitute fish oil in animal feed, and reduce methane emissions if added to the diets of bovine cattle. Besides providing healthy food, seaweed, and shellfish aquaculture, it can contribute to carbon sequestration, removal of nutrients and CO_2 from marine ecosystems. Algae can also be used in cosmetics (anti-aging moisturizers, toothpaste), crop nutrition as bio-fertilizers, biodegradable packaging, and biofuel. In addition, seaweed has many more innovative applications under development like textile fibers, laundry detergents, construction materials, and biochar for soil improvement.

An EU-funded project (COMMON) focusing on Italy, Tunisia, and Lebanon, targeted the cross-border cooperation as a basis for tackling marine litter, which threaten not only fish resources, but also the marine biotechnological potential. The outputs of this project focused not only on politicians but also on other groups of stakeholders (https://medblueconomyplatform.org/wp-content/uploads/2020/03/INPUTS_ENG.pdf). Building Network of Coastal cities against marine litter and a Permanent Network for Sea Turtles Rescue Centers for marine litter studies are foreseen in this project. The Mediterranean region, including Lebanon, accounts for some of the largest amounts of municipal solid waste generated annually per person, and has insufficient waste processing infrastructure (https://ufmsecretariat.org/wp-content/uploads/2021/01/

UfM-Towards-a-Sustainable-Blue-Economy-in-the-Mediterranean-region-EN_v2.pdf). The main sources of marine litter include poorly managed urban waste. The plastic litter in the Mediterranean coastal areas is usually found in the form of packaging, bags, wrappers, and fisheries-related objects (Figure 7).

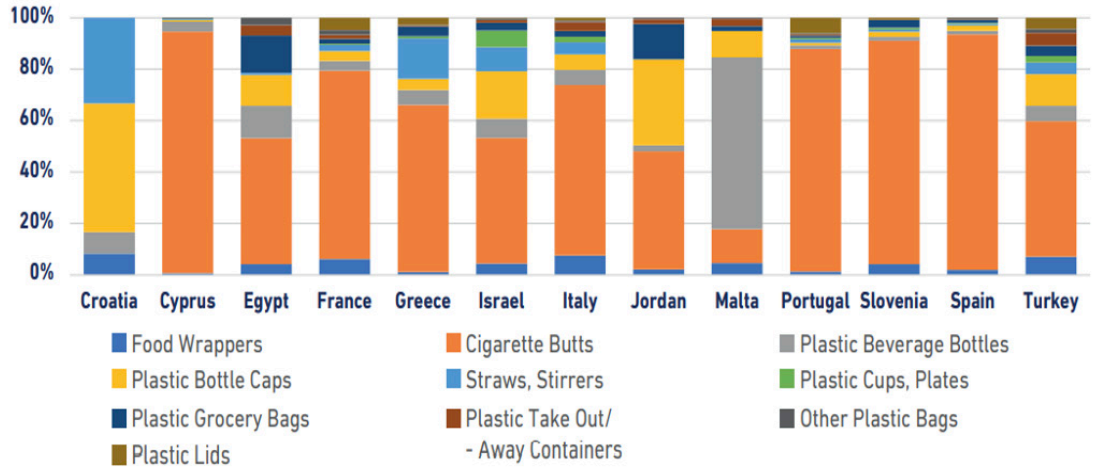

Figure 7. Top 10 marine litter found in the Mediterranean Sea (Trash Free Seas: International Coastal Cleanup - Ocean Conservancy).

VI.3. Desalination

Desalination has been lately adopted as one of the major technical measures for water management, as well as in the processes of adaptation and mitigation to water shortage and the changing climatic conditions. This is well pronounced in the arid and semi-arid regions where water availability is limited and sometimes does not exceed 250 m^3/capita/year.

There are mega desalination plants conglomerating around the Mediterranean Sea. In fact, in most South Mediterranean countries, there is growing concern that the available freshwater resources are now facing or will soon encounter severe chronic shortages that might make life difficult, and among the solutions envisaged by countries is to produce freshwater by desalinating seawater. Therefore, desalination plants have been built for several decades at various scales in almost all the Mediterranean countries. Recent advances in technology have made it economically viable. The capacity of desalinated water has dramatically increased from 2000 to 2013 by an astounding 560%. Spain has the highest installed cumulative capacity of 3.7 Mm^3/day, followed by Algeria, with respective daily production of 2.4 Mm^3/day (SEMIDE-EMWIS, 2015).

For Lebanon, no desalination plants exist even on small-scale. However, it is a paradox and early to propose desalination as an alternative water management approach, notably that water resources are tremendous to cope with the demand of inhabitants. This concept conflicts with the fact that water is available in Lebanon and estimated at 1,350 m^3/capita/year (IRENA, 2020).

VI.4. Maritime defense

Maritime defense is different from coastal protection, where the latter is attributed to the defense against natural hazards with impact on shorelines. However, the term "Maritime Défense" refers to the regulatory compliance for the activities in the maritime region (*e.g.,* oil, gas, chemical manufacturing, *etc.*) to develop appropriate policies and management approaches. It also provides maritime security with regulating solutions, usually tasked to the naval defense.

In Lebanon, threats are both internal and external to the country through its maritime borders, compromising national security on one hand, and international security on the other. Security threats are increasing off Lebanon's shores. Maritime threats to Lebanon fall into four broad areas: pollution; illicit trafficking of drugs; smuggling of weapons and explosives; and illegal immigration and human trafficking. Combating such a wide range of hazards requires a robust navy and, sometimes, regional coordination and information sharing as well as assistance from abroad (MEI, 2018).

An environment that is conducive to oil and gas exploration and investment in the Eastern Mediterranean requires agreements on cooperation and coordination between Lebanon and the maritime countries. There is already widespread international support for counter-terrorism efforts. Domestic, regional, and international agencies must join forces to maintain this high level of support, while also extending it to other areas related to maritime security (http://www.cytaglobal.com/en/submarine-cable-systems).

The Lebanese Navy must acquire the requisite capabilities to protect the maritime borders and assume effective security control over the national waters. These objectives are becoming harder to achieve with the current severe and protracted economic crisis that has deprived the Lebanese Navy of the necessary financial resources. Nevertheless, Lebanon must elaborate a maritime security strategy that considers the following provisions:

- The mitigation of maritime security threats.
- The protection of the potential infrastructure for oil and gas exploration and extraction and planning for the Navy's future role in defending economic interests more broadly.
- The gradual downsizing of the United Nations' Interim Forces in Lebanon's (UNIFIL)-Maritime Task Force (MTF).

VI.5. Submarine Cables

Lebanon relates to the world through Cyprus. The first cable is called CADMOS, which is a repeater-less cable system of SDH technology connecting Lebanon with Cyprus directly through two separate landing stations in Lebanon (http://www.cytaglobal.com/en/submarine-cable-systems) (Table 4).

Table 4. Marine cables connecting Lebanon with the world.

Cable	CADMOS	BERYTAR
RFS Date	1995	1997
Countries	Cyprus-Lebanon	Cyprus-Lebanon-Syria
Terminal Stations	Pentaskhinos-Beirut / Jeidehb.Beirut / Ras Beirut	Beirut - Tartus
System Length (km)	230	134
Technology	SDH	SD

UGARIT and CADMOS together with the BERYTAR cable system (Beirut – Tartous), 134 Km length, are fully integrated into a secure self-healing ring, interconnecting Cyprus with Lebanon, and Syria. A fourth cable exists called IMEWE (https://floatsea.org/compass/2020/1/31/the-internet-and-its-uncontested-dominion-on-land-and-sea) (2010), which has several landing points including Egypt, Italy, UAE, Saudi Arabia, Pakistan, France, India, and Lebanon. It is owned by Telecom Italia Sparkle, Etisalat (UAE), Tata Communications (India), Pakistan Telecommunications Company Ltd., Orange (France), Airtel (Bharti) (India), Saudi Telecom, Ogero, and Telecom Egypt.

To boost the Internet service locally and to turn Lebanon into a hub for Internet distribution to countries in the region, a new Internet submarine cable was planned to be launched to link Lebanon to Europe (https://www.albawaba.com/submarine-cable-speed-internet-402159). Another undersea cable project is scheduled to be launched to replace the 'Cadmos' cable which links Lebanon to Cyprus. Besides 'Cadmos', Lebanon is currently connected to the outside world by the submarine cable 'Alexandros' which links the country to France through Cyprus (http://www.businessnews.com.lb/cms/Story/StoryDetails/7158/Third-submarine-cable-to-boost-Internet-service).

VII. Advantages and Possible Impacts of the Blue Growth on Coastal/Maritime Tourism

Both established and emerging coastal and maritime sectors are continuously driven by innovation and show substantial potential to create new jobs and added value. It must be made clear that Blue Growth is a long-term strategy to support sustainable growth in the coastal and maritime sectors. For the Mediterranean Basin, the coastal and maritime regions are significant economic drivers and have great potential for innovation and growth. It is the maritime contribution to achieving the goals of all countries.

Blue Growth also provides support for the protection and development of more intangible 'blue' resources such as traditional ways of life, carbon sequestration, and coastal resilience to help vulnerable states mitigate the often-devastating effects of climate change. In addition, Blue Growth offers the possibility of improved efficiency in our land and ocean management, better treatment and governance of marine ecosystems, a more equitable model of global health standards and socio-economic growth. Therefore, the potential of Blue Growth contributes to the increase of long-term benefits of the sustainable use of marine resources for Small Island developing states (SIDS) and coastal least-developed countries.

There is an obvious interlinkage between scientific evidence of the association between Blue Growth and the UN sustainable development goals (SDGs), and relevance and alignment of stakeholders on the link between Blue Growth and the SDGs. Therefore, Blue Growth is highly associated with SDGs 14–17 (Lee *et al.*, 2020).

It was found that stakeholders prefer SDG 3 (Good Health & Well-Being) and SDG 8 (Decent Work & Economic Growth), SDG 8 (life below water) in the Blue Growth context. As stakeholder involvement shows some differences and variations in the relationship between Blue Growth and the SDGs, we consider that stakeholders can play some roles directly or indirectly in the Blue Growth - SDGs context.

For Lebanon, Blue Growth can be adopted as multiple strategic purposes for the coastal and maritime management, notably that the country has a small surface area, but it extends along the sea. That would be useful not only for the coastal and maritime regions, but also for the inland regions, which are in tight natural and anthropogenic interlinkage with the coast and sea of Lebanon. Therefore, the impact of the possible advantages of Blue Growth will include the entire country. Accordingly, the following are the main advantages of Blue Growth for Lebanon:

- The adoption of Blue Growth, including all existing and emerging sectors (mentioned in this report), will substantially play a role in the proper investments of the coastal and maritime natural resources.
- Blue Growth can contribute to protecting the entire coastline of Lebanon from all existing threats, which in turn plays a role in the enhancement of the tourism industry and return it back to its stable condition.

- There must be a national strategy where the Blue Growth concept must be adopted in the environmental, economic, and social aspects. This will assist in providing financial resources, as well as act on the conservation of the country's natural resources.
- By the adoption of Blue Growth, the maritime borders of Lebanon, notably those where oil and gas exploration and investment exist, will be delimited, and internationally recognized. This will avoid Lebanon further geo-political conflicts.
- Due to its small surface area, Lebanon needs larger space to implement large-scale projects; therefore, the coastal and maritime regions can be suitable for such projects.
- Following new technologies, especially green energy, alternative energy sources can be adopted in Lebanon, mainly at the coastal and maritime regions.
- The adoption of Blue Growth has proved its feasibility in many regions worldwide, and this is a good sign for Lebanon to improve its national and regional positions.

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