



DEEP SEA LEBANON RESULTS OF THE 2016 EXPEDITION EXPLORING SUBMARINE CANYONS

Towards Deep-Sea Conservation in Lebanon Project

EXECUTIVE SUMMARY



Deep Sea Lebanon

Results Of The 2016 Expedition Exploring Submarine Canyons

Towards Deep-Sea Conservation in Lebanon Project

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MAVA Foundation for Nature

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Grab manoeuvre in the sunset. Jounieh, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.

The waters of Lebanon host an incredible variety of ecosystems, like coralligenous habitats, seagrass meadows, vermetid reefs, and deep-sea ecosystems such as underwater canyons. These canyons range approximately from 50 to 1600 m; they are 'keystone structures' for deep-sea communities, acting as nursery and shelter habitats, and providing a whole range of ecosystem services to humans, like fisheries and carbon sequestration. The Lebanese deep-sea canyons have been identified as Ecologically or Biologically Significant Areas (EBSA) because of their important role in ecosystem functioning, their uniqueness and rarity, and their special importance for life-history stages of the species that they host, among other characteristics.

Currently, Lebanese marine ecosystems are threatened by multiple sources. Marine sand and gravel extraction, sewage discharge and oil dumping, unsustainable and illegal fisheries, habitat degradation, recreational uses, coastal urbanisation, invasive species, and larger-scale impacts such as the effects of climate change, are the major pressures threatening Lebanese waters. Marine Protected Areas (MPAs) are an effective tool to protect marine biodiversity, supporting at the same time human wellbeing and sustainable development.

However, to date only two marine areas have been declared in Lebanon: the Palm Islands Nature Reserve, and the Tyre Coast Nature Reserve, covering 0,22% of national waters, far below the CBD Aichi Target 11 of 10% of coastal marine waters to be protected by 2020.

The lack of detailed information about marine habitats and species is an important obstacle to MPAs designation and management. This is especially true for the Mediterranean where, despite advancements in marine research technology and recent efforts to prioritise the study of marine ecosystems, little is known especially of the deep-sea ecosystems of the north-eastern part of the Levantine area. This issue was already recognized by the Lebanon Marine Protected Area Strategy, which identified deep-sea areas as one of the priority ecosystems to protect. Closing this knowledge gap was the primary aim of the Deep-Sea Lebanon project, which performed the first biological survey of deep-sea Lebanese waters. The objective was to provide first-hand information to the Lebanese authorities, which would use it to create Deep Sea MPAs, in order to increase the protection of Lebanese waters, and specifically of ecosystems found in deep areas. These areas may be designated to protect important geological features (e.g., submarine canyons), habitats, or community types, in order to **ensure the coherence and connectivity of marine protection in Lebanese waters**, and to help safeguard the natural corridor of the Eastern Mediterranean basin. This increased protection would contribute to reaching the national targets set by Lebanon's National Biodiversity Strategy and Action Plan (NBSAP) as well as the biodiversity Aichi Target 11 on protected areas, and to strengthening the natural marine biodiversity corridor in the Eastern basin, and would contribute to the implementation of the Dark Habitats Action Plan for the conservation of habitats and species' associated with seamounts, underwater caves and canyons, aphotic hard beds and chemo-synthetic phenomena in the Mediterranean Sea.



Tube anemone. Batroun, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.

Based on the official request of the Lebanese Ministry of Environment, Oceana carried out a research cruise in Lebanese waters during a period of nearly four weeks (3–27 October 2016) across five deep-sea areas, covering some of the main underwater canyons that lie off the coast of the country. Surveys of these zones were carried out on board the Sea Patron, a fully-equipped vessel of 42 m overall length and 11.4 m extreme breadth. For the first time an ROV was used to document benthic communities at greater depths. The research expedition was carried out with the financial support of the MAVA Fondation pour la Nature, and with the full collaboration of project partners: The Lebanese Ministry of Environment, the National Council for Scientific Research in Lebanon (CNRS-L), the Lebanese Army, IUCN Mediterranean Cooperation Center, IUCN Regional Office for West Asia (ROWA), and the Regional Activity Center for Specially Protected Areas (UN Environment/MAP SPA/RAC).

The five survey areas

The five surveyed areas are: Tarablus/Batroun, Jounieh, St. George, Beirut escarpment, and Sayniq (see map at page 6 and 7). They are broadly similar in terms of the marine habitats and communities supported. Nevertheless, they varied in terms of total biodiversity, and in the particular species and communities of interest that occurred within them (see a description of the areas at page 6).

MAIN RESULTS

Habitat Types

- Six main habitat types have been documented over a broad depth range (36-1050 m): coralligenous habitats and rhodolith/maërl beds; rocky bottom areas; muddy and sandy-muddy bottoms; sandy bottoms; canyon heads; and bathyal muds.
- **Coralligenous habitats and rhodolith/maërl beds** occupy extensive areas along the Lebanese coast, on the continental shelf and at the heads of the canyons. They form well-developed reefs, which support a high diversity of species, especially the endangered hatpin sea urchin (*Centrostephanus longispinus*). They appear to be the most affected by lost or discarded fishing gears, probably due both to its proximity to the coast, and to its relatively high productivity, which attracts fishers. Both coralligenous habitats and rhodolith beds are considered as vulnerable and essential to hundreds of species, and all Mediterranean states are committed to their conservation, as signatories of the Barcelona Convention.

Recommendation #1

Coralligenous concretions and rhodolith/maërl beds

Lebanon should prioritise the conservation of **coralligenous concretions and rhodolith/maërl beds**, because of their vulnerability to anthropogenic impacts. Both habitat types are listed as habitats of interest under the Barcelona Convention. Specifically, the distribution of coralligenous and maërl assemblages in Lebanese waters **should be mapped as soon as possible**, and management plans should be put in place to avoid any activities that may potentially damage these habitats or the communities that they support. **MPAs should be created** to limit localised threats to these important systems, including impacts from fisheries and other activities that directly or indirectly damage them, such as anchoring. It is also important to consider measures to reduce the impacts of more distal threats to coralligenous and maërl communities, such as land-based sources of increased turbidity and sedimentation (e.g., eroded river basins, untreated wastewater, and coastline degradation).

There is the need to grant coralligenous habitat and maërl beds **the same degree of legal protection** as *Posidonia oceanica* meadows, possibly using the tools of the Barcelona Convention.

The **prohibition of fishing** with trawl nets, dredges, shore seines and similar nets **over these vulnerable communities** should be applied to the entire Mediterranean basin, to enhance the protection of these important habitats at the regional scale.

- **Rocky bottom areas** support important benthic communities like corals, sponges, oysters, and brachiopods, while in deep-sea areas they are related to ancient fossil reefs built by corals, worms, and other organisms. In these places, particular species of interest were found, including stony corals (e.g. *Desmophyllum dianthus* and *Caryophyllia* spp.), glass sponges (*Farrea bowerbankii*), and gorgonians (*Swiftia pallida*). **Muddy and sandy-muddy bottoms** support vulnerable habitat-forming species, like sea pens (i.e., *Pennatula rubra*, *Virgularia mirabilis*, and *Funiculina quadrangularis*). Most of these species are assessed as threatened in the Mediterranean by IUCN, protected in the Mediterranean Sea, under the annex II (List of Endangered and Threatened Species) of the Protocol concerning Specially Protected Areas and Biological Diversity of the Barcelona Convention. and management measures should be put in place. Other habitats documented include **sandy bottoms, canyon heads, and bathyal muds**.

Tarablus / Batroun

- High diversity of key habitat types, and high variety of protected and/or threatened species
- High abundance of habitat-forming species
- The threatened tree coral (*Dendrophyllia ramea*) was found here in deep areas and on muddy bottoms, an occurrence that was only recently first observed in deep-sea areas near Cyprus.

Jounieh

- The highest diversity of species (nearly 300!)
- All key community types are present here, especially fossil reefs and sponge aggregations
- Many rare species are present here, such as the glass sponge *Farrea bowerbankii* and two starfish species that are typically considered to be Atlantic (*Hacelia superba* and *Leptasterias* sp.).
- The first-ever record of a gorgonian (*Swiftia pallida*) from Lebanese waters
- High abundance of sea pens

St. George

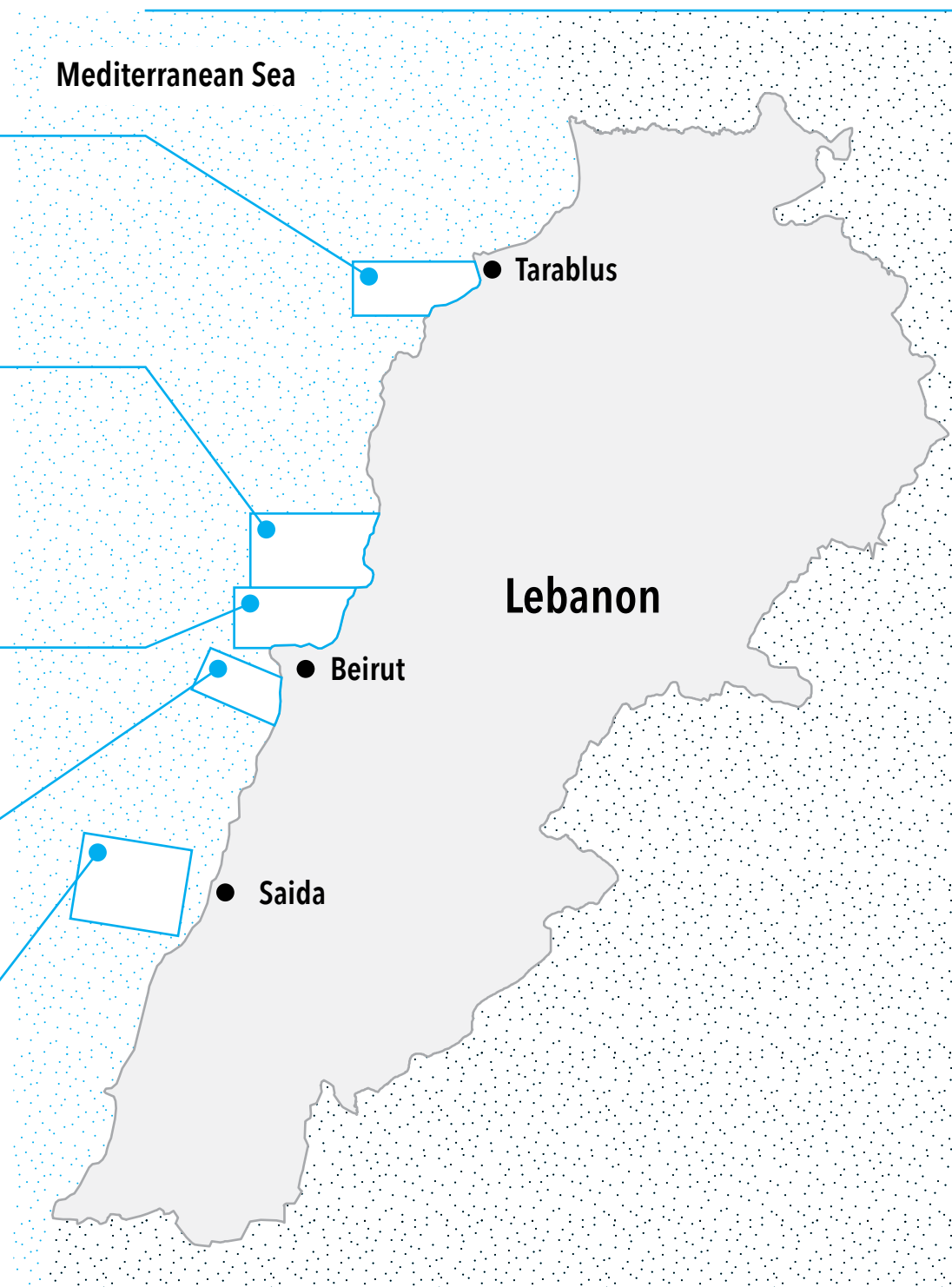
- The area with the most extensive and diverse coralligenous and maërl habitats;
- Two chondrichthyan species that are classified as Near Threatened (*Chimaera monstrosa* and *Dipturus oxyrinchus*) were observed only here
- The vulnerable species of coral *Desmophyllum dianthus* was observed only here, in association with the deep-sea fossil reefs

Beirut

- High abundance of sea pen fields
- High presence of aggregations formed by oysters and stony corals in the canyon heads
- It hosts the largest aggregation of the protected hatpin urchin (*Centrostephanus longispinus*) and the potential new species of starfish and coral (cf. *Anomocora* sp.)

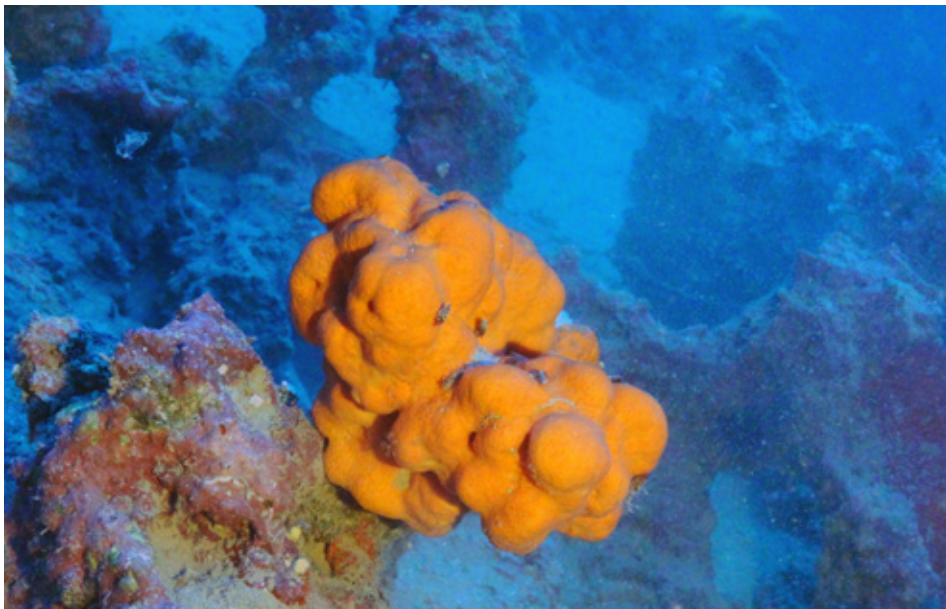
Sayniq

- The second-highest number of identified species
- Coralligenous formations, maërl beds, and sponge aggregations are particularly abundant
- It hosts large bryozoans (*Hornera frondiculata*) and rare, new, and protected sponge species.





Mediterranean moray (*Muraena helena*). Batroun, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.



Demosponge in rocky seabed with coralligenous. Batroun, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.



Lionfish (*Pterois miles*) among coralligenous. Batroun, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.



Seven-armed starfish (*Luidia ciliaris*). Saint George canyon, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.



Sloane's viperfish (*Chauliodus sloani*). Jounieh, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.



Crab (*Bathynectes maravigna*) and striped soldier shrimps (*Plesionika edwardsii*). Jounieh.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.



Tube anemones (*Cerianthus membranaceus*). Jounieh, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.



Blackfin sorcerer (*Nettastoma melanurum*). Beirut, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.

Recommendation #2

Fossil Reefs

Lebanon and other Contracting Parties to the Barcelona Convention should ensure that **fossil reefs** are managed under the same framework as other 'dark habitats', to ensure that threats to these systems are minimised or avoided altogether. The ecological importance of fossil reefs should be considered, as they still act as reefs, by providing valuable hard substrate in deep-sea areas, where such substrata are very scarce, and supporting a diversity of species.

Species

– A total of 622 taxa were identified, among which three species that are likely to be new to science: a **sponge** belonging to the genus *Axinella*, a **starfish** belonging to the genus *Luidia* (which appears to be different from its two known Mediterranean congeners), and a **stony coral** which is pending identification, but likely belonging to the genus *Anomocora* (see photos at page 8). Additional specimens obtained during the expedition are still pending identification and may yet reveal additional species of scientific interest.

– Dozens of species had never previously been recorded from Lebanon, like the glass sponge (*Farrea bowerbankii*), the rabbitfish (*Chimaera monstrosa*), the velvet-belly lanternshark (*Etmopterus spinax*), holothurians such as *Mesothuria intestinalis* and *Penilpidia ludwigi*, and cnidarians such as the gorgonian *Swiftia pallida*, sea pens (e.g., *Pennatula rubra*, *Virgularia mirabilis*, and *Funiculina quadrangularis*), and species of the subclass Hexacorallia, such as *Sideractis glacialis* and the tree coral (*Dendrophyllia ramea*).

– Three species of starfish have been spotted, which have not previously been recorded in the Mediterranean Sea: *Hacelia superba* on bathyal rocky bottoms, *Leptasterias* sp. on ancient fossil reefs, and a species of the genus *Luidia*, abundant on sandy bottoms in the circalittoral zone.

Recommendation #3

Sponges

Most of the **sponge species** that were documented during the expedition were living in association with coralligenous habitats. Therefore, many of the recommendations for coralligenous habitats would also be beneficial for the protection of sponge aggregations.

The **sponge aggregations** that were not linked with coralligenous assemblages should be considered as **Vulnerable Marine Ecosystems (VMEs)**, and appropriate measures should be taken for their protection (either under the General Fisheries Commission for the Mediterranean, or under the Dark Habitats Action Plan of UN Environment/ MAP SPA/RAC).

focus on: thermophilous fauna

Some species identified appear to be more related to Atlantic species than to other Mediterranean or even 'Lessepsian' species. Maybe some of this fauna is the remnants of an ancient 'thermophilous' fauna that survived in the eastern Mediterranean. This may explain the presence of species like the smooth sea star (*Hacelia superba*) in Lebanese deep-sea areas

Recommendation #4

Sea Pen Fields

All **pennatulaceans** should be included as **habitat builders** under the Mediterranean Action Plan for protecting dark habitats.

The **red sea pen** (*P. rubra*) is particularly diffuse and should be considered as one of the **key deep-sea community types** in Lebanon.

The **tall sea pen** (*F. quadrangularis*) should be **protected** not only in Lebanese waters, but also in the wider Mediterranean, due to its importance for both biodiversity and commercial fisheries, and its vulnerability to human impacts. Conservation and management of this species should be carried out in line with both the Dark Habitats Action Plan and measures being developed within the General Fisheries Commission for the Mediterranean, to protect those species identified as indicators of Vulnerable Marine Ecosystems (VMEs) from adverse impacts caused by fishing activities.

– Observed species also included those that have been assessed as threatened or at risk of becoming threatened. Seven of the identified species have been listed under Annex II of the SPA/BD Protocol of the Barcelona Convention. Six species are Red Listed by IUCN as threatened; they were distributed throughout the five sampling areas. In addition, three recorded species are listed under Annex III of the SPA/BD Protocol, which requires that their exploitation be managed (*Epinephelus marginatus*, *Scyllarus arctus*, and *Spongia officinalis*). Two species assessed by IUCN as Endangered in the Mediterranean Sea (*Epinephelus marginatus* and *Desmophyllum dianthus*), and five assessed as Vulnerable. Two additional species were observed that are considered Near Threatened (*Chimaera monstrosa* and *Dipturus oxyrinchus*). At one location in the Sayniq canyon, *Calyx nicaeensis* was also present. This cup-shaped demosponge has a fragmented distribution across the Mediterranean Sea, and concerns have been raised about the need for urgent conservation measures to protect it.

Recommendation #5

Vulnerable and Threatened Species

Lebanon should take legal steps to ensure the protection of *Sarcotragus foetidus* and its habitat, as it is listed as protected under Annex II of the SPA/BD Protocol of the Barcelona Convention.

Lebanon should ensure the maximum possible protection and recovery of *D. ramea*, as it is Red Listed as Vulnerable, and is also listed on Annex II of the SPA/BD Protocol of the Barcelona Convention. This includes prohibiting damage and destruction of its habitat. Legal measures should therefore be introduced in Tarabulus/Batroun, where it was documented.

Lebanon is required to grant the Red List-coral *D. dianthus* the maximum possible protection; therefore, legal measures of protection should be introduced in St. George, where it was observed.

Legal measures should be implemented to ensure the protection of the hatpin sea urchin (*Centrostephanus longispinus*) and of its habitat, as it is included on the SPA/BD Protocol of the Barcelona Convention list of endangered or threatened species.

It is recommended to include the star coral (*M. pharensis*) under the Dark Habitats Action Plan of UN Environment/MAP SPA/RAC, and manage it accordingly, because it appeared to act as a major habitat-forming species in Lebanese waters.

– Foraminifera have been found as particularly abundant in Lebanese waters. Large astrorhizid foraminifera, such as *Pelosina cf. arborescens*, occupied extensive areas of all bathyal muddy bottoms surveyed.

Recommendation #6

Gorgonians

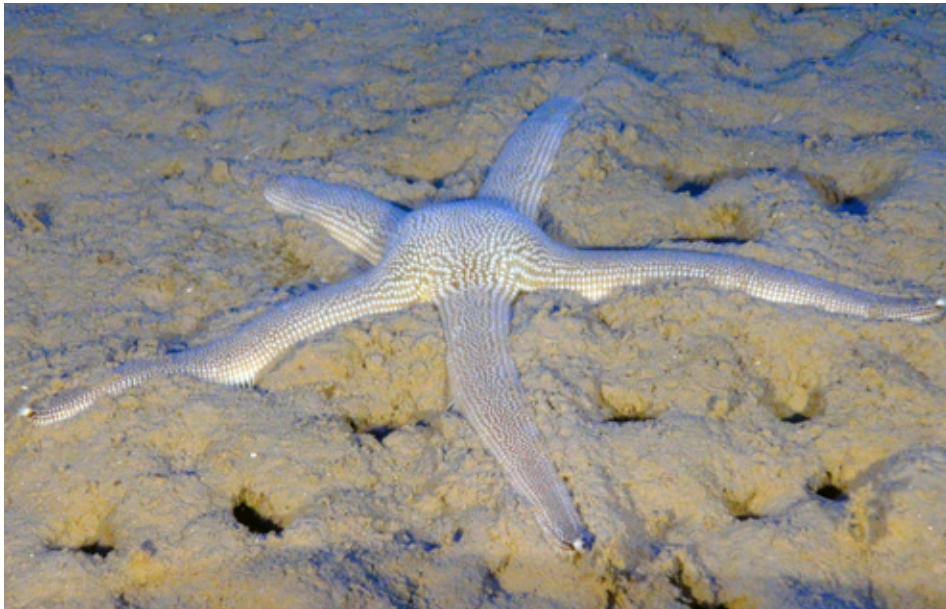
Gorgonians are very uncommon in the Levantine Sea, and must be protected and managed under the Dark Habitats Action Plan. Such measures may include the identification and protection of threatened populations, the designation of MPAs, and measures designed to address specific identified threats. Given the known sensitivity of *S. pallida* to impacts associated with exposure to oil, the planned exploratory drilling for oil and gas in Lebanese waters is reason for particular concern.

Recommendation #7

Oyster Aggregations

Oyster aggregations should be considered as key habitat-forming species under the Dark Habitats Action Plan, and be managed and protected accordingly.

Large quantities of deep-sea oysters (*Neopycnodonte cochlear*) were recorded at the continental shelf edge, in the canyon heads of Jounieh, St. George, Beirut, and Sayniq, and on the continental shelf. In some cases, they were found to be covering marine litter, such as tyres.



Starfish (*Luidia* cf. *hardwicki*). Saida, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.



Smooth lanternshark (*Etmopterus spinax*). Beirut, Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.



Rabbit fish (*Chimaera monstrosa*). Saint George canyon Lebanon.
Deep-sea Lebanon Expedition on board the Sea Patron. October 2016.

— and many others like:

- holothurians such as *Mesothuria intestinalis* and *Penilpidia ludwigi*
- sea pens: *Pennatula rubra*, *Virgularia mirabilis*, and *Funiculina quadrangularis*
- species of the subclass *Hexacorallia*, such as *Sideractis glacialis* and the tree coral (*Dendrophyllia ramea*)

decrease and manage anthropogenic impacts

– Marine litter – Marine litter was present in all habitat types and at all depths. In some cases, the sources of this waste were likely coastal, with ocean currents carrying litter offshore, while in other cases it was apparent that large objects such as appliances, tyres, and barrels had been dumped directly at sea. This means that Lebanon faces significant challenges on this respect, and should improve the disposal and management of the country's solid waste.

– Fisheries – Direct impacts of fishing activities on benthic communities were limited, thanks to the lack of bottom-contact fisheries. However, discarded fishing nets, lines, and traps were commonly found, particularly around coralligenous habitat, the shelf edge, and the heads of canyons. Although deep-sea benthic habitats and species are currently out of the reach of Lebanese fisheries, they are clearly affected by anthropogenic activities.

– Alien and invasive species – thirteen alien species were documented, some of which are considered to have invasive characteristics.

– Oil exploration – the majority of the blocks of the oil and gas exploratory area are deeper than the areas surveyed during this expedition, and overlap with two of the areas surveyed, i.e., Sayniq and Beirut. In these areas, exploratory drilling would directly affect both muddy bottoms (in which dozens of species were documented, especially arthropods, fishes, and echinoderms), and some patches of rocky bottoms (in which some stony corals were documented, as well as commercial species such as shrimps, dentex, rosefish, seabreams, and forkbeards).

focus on: exotic species

Exotic species were present in all surveyed areas, although they were fewer than expected. This because exotic, or 'Lessepsian' species, tend to live in shallow or pelagic waters, and avoid the deep-sea areas.



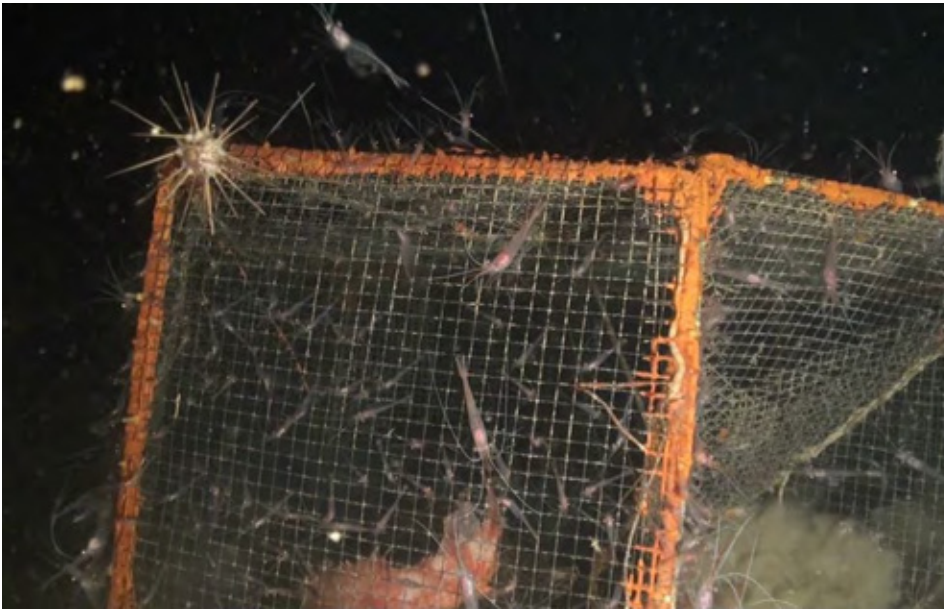
A barrel at the bottom of the Jounieh canyon, 596 m depth.



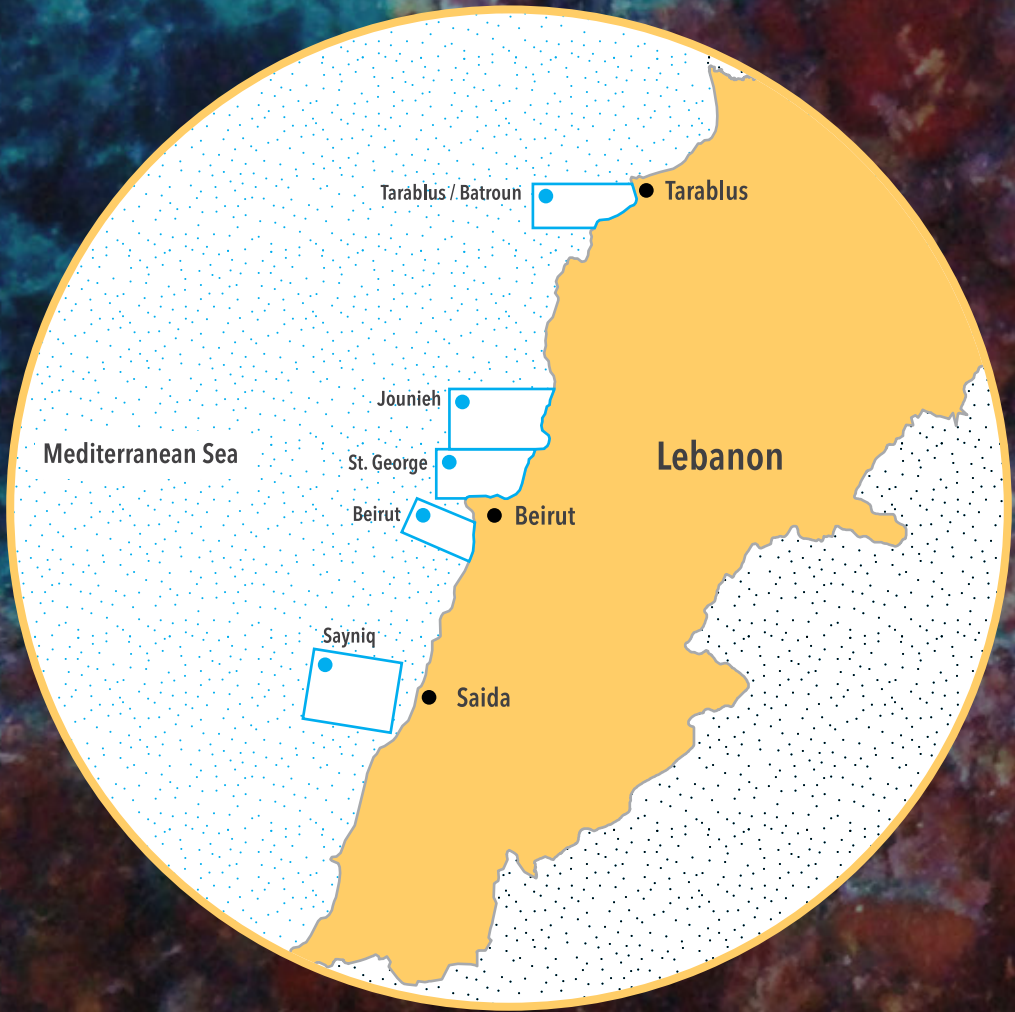
A disposal area of tyres, including glass bottles, on detritic bottoms (St. George, 70 m depth).



Lost fishing net forming an intricate tangle in the area of Tarablus/Batroun, 267 m depth.



Fish trapped by a lost fishing trap in St. George canyon, 307 m depth.



Map of the prospected deep sea canyons and escarpments offshore Lebanon



OCEANA



UN environment



CNRS

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