



UNITED
NATIONS

EP

UNEP/MED WG.601/Inf.9



**Mediterranean
Action Plan**
Barcelona
Convention

29 December 2024
Original: English

Meeting of the Ecosystem Approach Correspondence Group on Marine Litter Monitoring (CORMON Marine Litter)

Videoconference, 29 January 2025

Agenda Item 3: Proposal for Updating IMAP Ecological Objective 10 (EO 10) on Marine Litter

National Strategy for Monitoring IMAP EO10 Candidate Indicator 24 in Lebanon

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Lebanon National strategy for monitoring IMAP Candidate Indicator 24



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For bibliographic purposes, this document may be cited as:

SPA/RAC-UNEP/MAP, 2021. Lebanon National strategy for monitoring IMAF Candidate Indicator 24. By Badreddine, A., Samaha, L., Abderrahim, M., Limam, A., & Ben-Nakhla, L. Ed. SPA/RAC. Marine Litter MED project. Tunis: pages 25.

Cover photo credit:

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The present report has been prepared in the framework of Marine Litter MED project financed by the European Union.

For more information:

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Lebanon National strategy for monitoring IMAP Candidate Indicator 24

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1 Introduction

Marine litter* is considered a global problem for the coastal and marine environment (UNEP, 2011, 2019). It is also considered an emerging issue threatening marine biodiversity (Ferretti *et al.*, 2008; Karamanlidis *et al.*, 2008; Deudero and Alomar, 2015; Casale *et al.*, 2018; Atzori *et al.*, 2021).

Consequently, many approaches to addressing these issues and methods and strategies to reduce marine litter pollution are beginning to be developed (UNEP, 2019), such as:

- The UN sustainable development agenda represents a plan of action involving 17 Sustainable Development Goals SDGs and includes targets to prevent and significantly reduce marine pollution of all kinds, including marine litter.
- The UN Environment Assembly (UNEA) and the Convention on Biological Diversity (CBD) have addressed the marine litter issue in resolutions and agreements.
- The G7 and G20 have adopted action plans to combat marine litter

The Mediterranean Sea is highly rich in species and endemism (Coll *et al.*, 2010) and is one of the most polluted and threatened semi-enclosed seas worldwide (Costello *et al.*, 2010), especially with regards to marine litter (Pham *et al.*, 2014; Suaria and Aliani, 2014; Boucher and Bilal, 2020). Moreover, many marine taxa, including red-listed species, are affected by direct effects of plastics, either ingestion or entanglement, and are in highly jeopardized situations (Deudero and Aromar, 2015).

Marine litter was addressed within the Mediterranean Sea under the 10th Ecological Objective (E010) of the Integrated Monitoring and Assessment Programme and related Assessment Criteria (IMAP). It was monitored through two Common Indicators (i.e., CI221 and CI232) and a Candidate Indicator **(CI24)*** (SPA/RAC-UNEP/MAP, 2021a).

Within the "Regional operational strategy for monitoring IMAP Candidate Indicator 24", the loggerhead turtle *Caretta caretta* (Linnaeus, 1758) has been adopted as the most appropriate species for this indicator. In addition, it has been recommended that each Mediterranean country should have:

- A well-established sea turtles stranding network for collecting data
- A standardized monitoring program of marine litter ingested by sea turtles
- A national strategy for monitoring IMAP CI24

Therefore, this report presents a national operational strategy for monitoring IMAP Candidate Indicator 24 in Lebanon.

***Marine litter (also called marine debris) is waste created by humans that have been discharged into coastal or marine environments, resulting from activities on land or at sea**

***IMAP Candidate Indicator 24 addresses the “Trends in the amount of litter ingested by or entangling marine organisms, focusing on selected mammals, marine birds and marine turtles” (Decision IG22/7, COP19).**

2 The Lebanese coastline and Marine biodiversity vs Marine Litter

Lebanon has about 220 km of coastline, from Arida in the north to Ras El-Nakoura to the south, which hosts 70% of the Lebanese population. The continental shelf in the Lebanese Coastal Zone (LCZ) is narrow, 3–7 km wide, and the coastline is characterized by the presence of three Marine Protected Areas (MPAs), Tyre Coast Nature Reserve (TCNR), Abbasiyeh Coast Nature Reserve (ACNR), and Palm Island Nature Reserve (PINR), a few bays (Bay of Beirut, Bay of Jounieh, Bay of Chekaa and Bay of Akkar), 4 commercial ports and over 19 fishing harbors, dozens of sea pipelines for petroleum imports, various industries, three power plants and fuel tank farms. Pebble beaches and rocky coasts are dominant, sandy beaches interesting only 20 percent of the coast (Figure 1) (Badreddine, 2018).

Moreover, the Lebanese coastal and marine ecosystems are considered a global biodiversity hotspot in the Mediterranean Sea since they support diverse and abundant marine life (Badreddine, 2018 and references therein) (Figure 1). It hosts:

- Many marine habitats and ecosystems include vermetid reefs, coralligenous habitats, seagrass meadows, seagrass beds, and underwater canyons.
- More than thousands of Atlanta-Mediterranean species belong to different zoological groups, including various iconic species considered at risk of extinction.

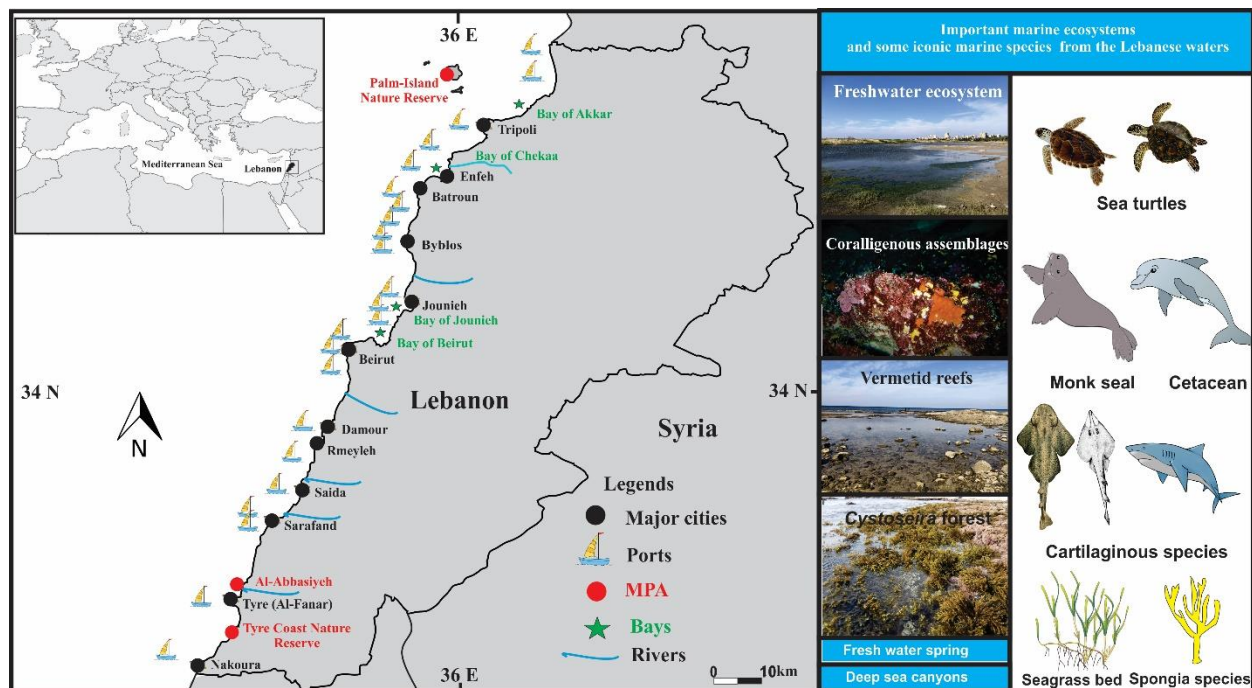


Figure 1: Map of Lebanon, showing the location of the major cities, the fishing harbors, the main rivers, the 4 bays, the 3 MPAs, the main marine ecosystems and some iconic species from the Lebanese waters

However, the Lebanese coastline is suffering from many sources of pollution, including marine litter coming mainly from the land (Figure 2) (Badreddine, 2018; MOE/UNDP/ECODIT, 2011). Recent studies demonstrated that high concentrations of marine litter were floating in different localities of the Lebanese waters, from Tripoli in the north to Tyre in the south (Kazour *et al.*, 2019; Jemaa *et al.*, 2021). Moreover, an increased occurrence of marine litter was

also proved on some marine taxa (e.g., the European anchovy, *Engraulis encrasicolus*, and the non-indigenous spiny oysters, *Spondylus spinosus*) in the Lebanese waters (Kazour *et al.*, 2019).

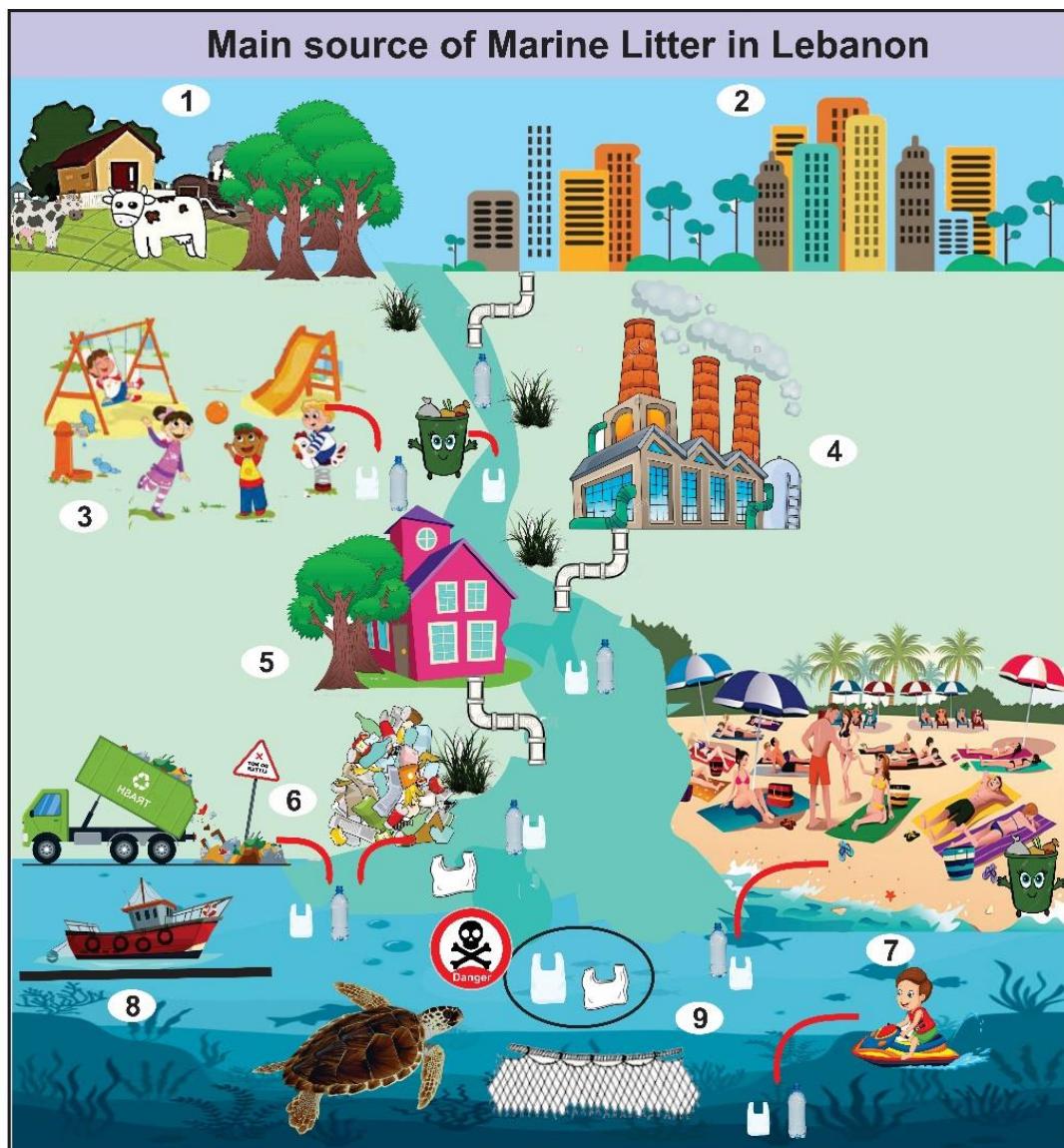


Figure 2: Main sources of marine litter in Lebanon. 1- Farms; 2- Cities; 3- Public park; 4- Factories; 5- Houses; 6- Dumpside; 7- Beaches (tourists); 8- Boats; 9- Current and Wide

2.1 Sea turtles vs Marine Litter

In the Mediterranean Sea, sea turtles are the most impacted by the effect of marine litter (Atzori *et al.*, 2021; Casale *et al.*, 2010, 2018, 2020; Panagopoulos *et al.* in: Margaritoulis & Demetropoulos, 2003). Indeed, the sea turtle *Caretta caretta* was the first marine species examined to evaluate the impact of marine litter. Moreover, it has been estimated that exanimated sea turtles from different localities of the Mediterranean countries were affected by almost 45% of litter ingestion (Deudero and Aromar, 2015).

It is worth noting that there are two potential pathways by which turtles may ingest plastic:

- Directly, when the animal eats the material due to similarity with their prey: e.g., loggerheads mistake plastic bags and balloons for gelatinous animals.
- Indirectly, when litter is accidentally ingested during prey consumption: e.g., green turtles grazing on algae and seagrass beds/ or ingestion of organisms adhered to plastics.

From a protection and conservation point of view, sea turtles are recognized as appropriate indicator species for monitoring the impact of marine litter ingestion. In this context, several methods are already available for better understanding the interactions between these taxa and marine litter (Matiddi *et al.*, 2019; SPA/RAC-UNEP/MAP, 2021a and references therein).

2.2 Sea Turtles in the Lebanese waters vs Marine litter

The two marine turtles species, the loggerheads (*Caretta caretta*) and the greens (*Chelonia mydas*) frequent the Lebanese waters. Those species are also nesting on many sites of the Lebanese coast (SPA/RAC- UNEP/MAP, 2020a, 2021b). From 2018, until 2021, within the framework of a project for the "Conservation of Marine Turtles in the Mediterranean Region", funded by the MAVA Foundation and executed by the Regional Activity Centre for Specially Protected Areas (SPA/RAC), in cooperation with the Lebanese Ministry of Environment (MoE) (and the project is ongoing), a total number of 20 sites along the Lebanese coast were defined as marine turtles nesting sites, including the three MPAs. As a result of the extensive monitoring carried out along those sites, a maximum of 107 nests of *Caretta caretta*, and 53 nests of *Chelonia mydas* were recorded during the marine turtles nesting seasons 2018-2021 (Badreddine in Casale *et al.*, 2020; SPA/RAC-UNEP/MAP, 2020a, 2021b).

However, sea turtles in the Lebanese waters, as the entire Mediterranean Sea, are highly affected by anthropogenic pressures such as traffic, fishing activities (including the use of illegal fishing methods), and marine pollution (including marine litter) (SPA/RAC-UNEP/MAP, 2020b, 2021c).

2.3 The standing sea turtles networks in Lebanon

In Lebanon, the sea turtles “stranding networks” has been established in 2019 (SPA/RAC-UNEP/MAP, 2020b, 2021c), in cooperation with the SPA/RAC and the Ministry of Environment (MoE). The “stranding networks” for sea turtles is mainly formed by the national marine turtles experts, and his trained team.

Therefore, any “stranded”, “floating” sea turtles reported by fishermen, citizens, tourists, or public authorities along the Lebanese coast were analyzed directly on the field, and correspondent data were collected.

Unfortunately, injured sea turtles are rescued by the “stranding networks” in cooperation with independent national “veterinaries”, and Non-Governmental Organizations (NGOs).

It is worth noting that the “stranding networks” for sea turtles cooperate with fishermen, Lebanese Civil Defense, the three MPAs (TCNR, ACNR, and PINR), MoE, Lebanese Ministry of Agriculture (MoA), and Non-Governmental Organizations (NGOs) for logistics issues related with moving the sea turtles from the waters to the coast/ or from a place to another/ or to access some private sectors on the Lebanese beach, and especially obtain permission to use laboratory of national MPAs/ or centers to analyze the sample collected in case of necropsy of the stranded sea turtles. It is worth noting that the stranding networks for sea turtles is also involved in any stranding incidents, related to dolphins, whales, and monk seals along the Lebanese coast.

During the two years 2019 and 2020, a total of 66 sea turtles stranding incidents were reported. In addition, litter ingestion was recorded in 26 necropsied sea turtles with a total marine litter percentage of 40 % (Figure 3). In the marine litter categories, the most dominant were non-plastic rubbish (e.g. newspapers, cigarette), net fragments, bags and industrial packages fragment.

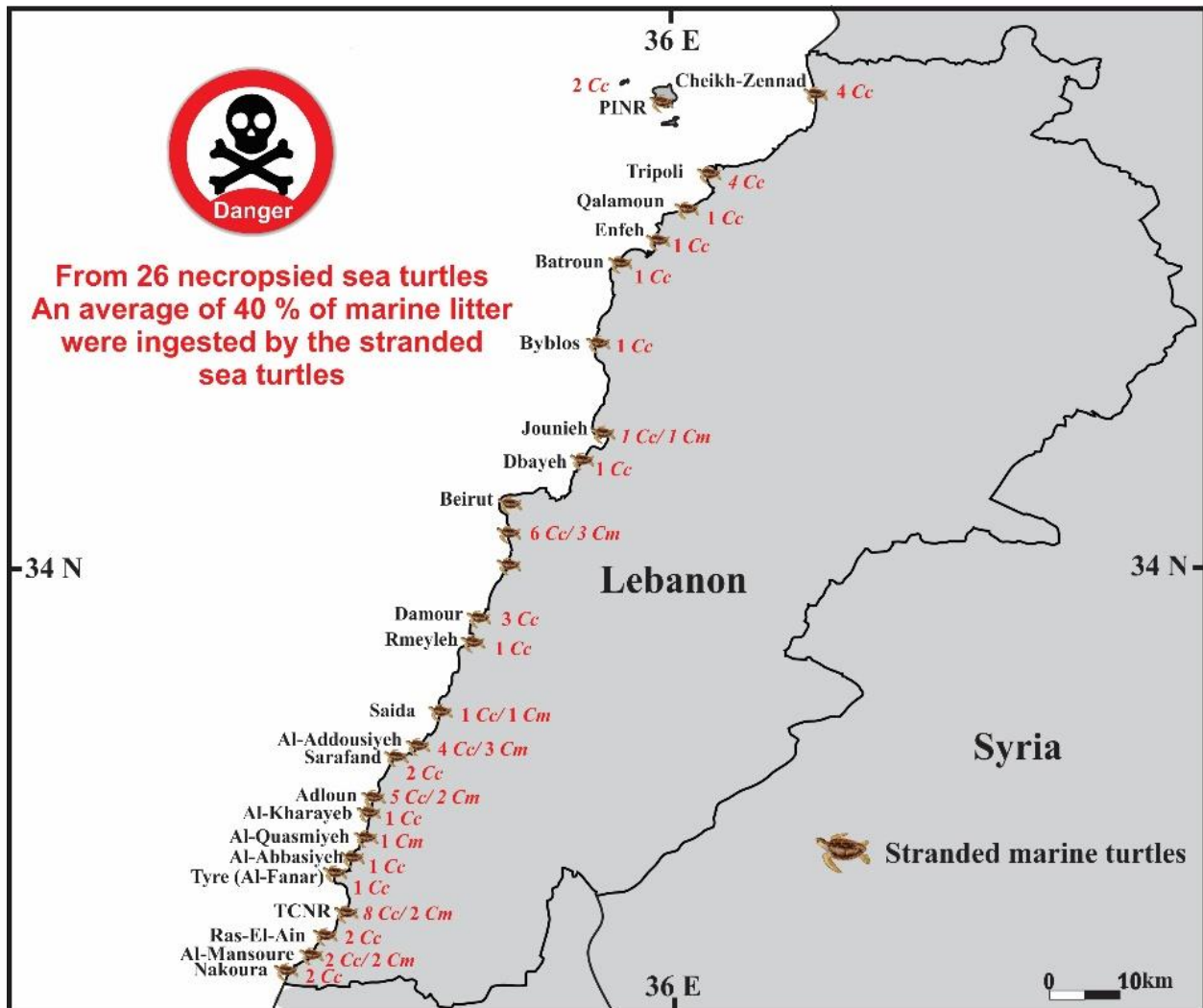


Figure 3: Map showing the number of sea stranded sea turtles during two years (2019 and 2020) and the percentage of marine litter on the necropsied sea turtles (SPA/RAC-UNEP/MAP, 2020b, 2021c)

3 National strategy for monitoring IMAP Candidate Indicator 24

First, it is essential first to mention the necessity of finalizing the sea turtles rescue center at the TCNR (Figure 4). This step is crucial and necessary to guarantee:

-  A long-term monitoring program of sea turtle activities
-  The good establishment and the development of the stranding networks for sea turtle
-  A sustainable awareness campaign for the protection and conservation of sea turtles
-  Application of the national strategy for the implementation of CI24

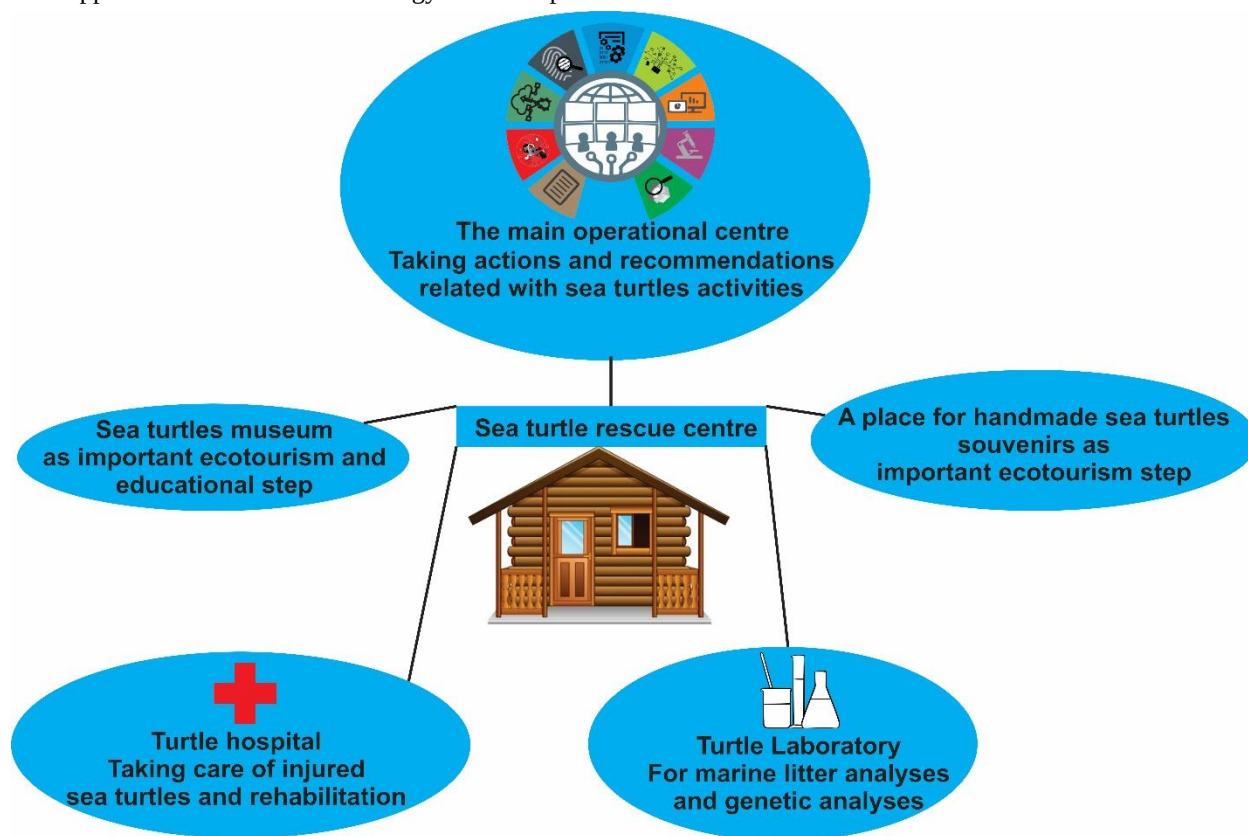


Figure 4: Illustration showing the importance of the sea turtles rescue center in Lebanon

The national strategy for monitoring IMAP Candidate Indicator 24 for Lebanon is based on principals working steps (Figure 5) related to the protocol for studying the interaction between marine litter and sea turtles, the importance of the awareness campaign on the protection and conservation of the sea turtles, the research and studies related to marine litter pollution, the national ecotourism plan based on sea turtles, and proposition and application of some necessary actions and recommendations. All these steps reduce marine litter and fight their impacts on sea turtles in the Lebanese waters.

Therefore, by 2027, Lebanon should have:

-  A well established and equipped sea turtles rescue center
-  A well established and developed stranding network for sea turtles

-  A well trained team for monitoring stranded sea turtles
-  A developed and standardize monitoring protocol for marine litter ingested by sea turtles
-  A well updated and established national action plan for sea turtles
-  A national ecotourism plan based on sea turtles
-  A well established and developed national strategy for the evaluation of the effect of marine litter on sea turtles

(CI24)

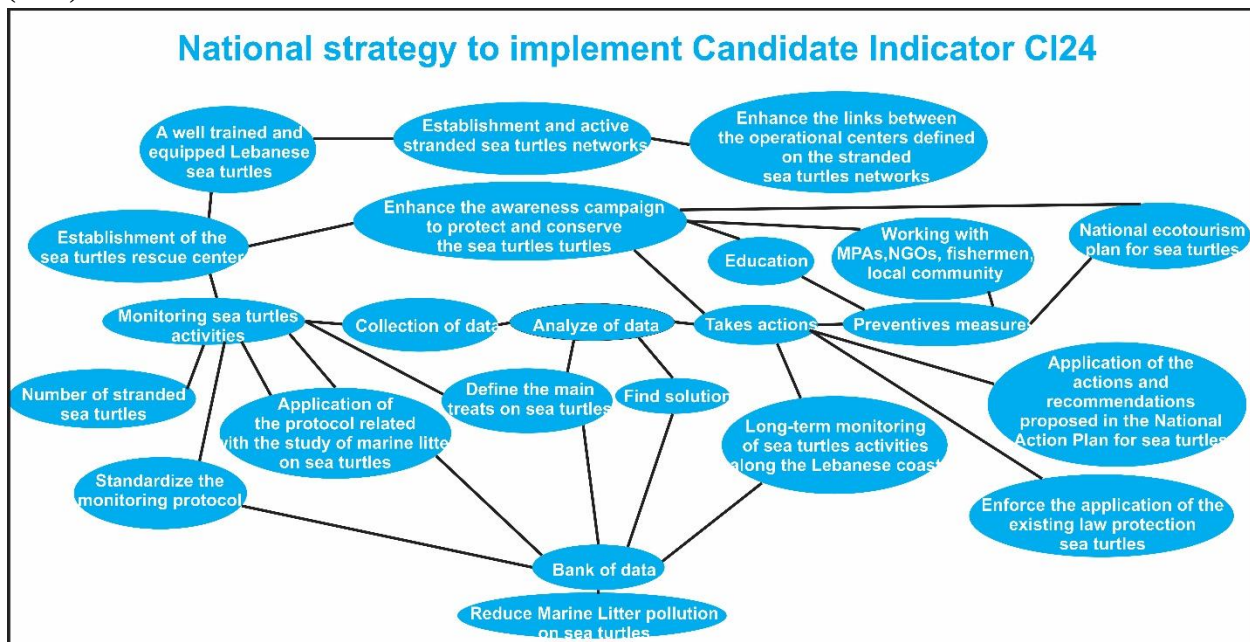


Figure 5: Illustration showing the main steps of the national strategy for monitoring IMAP Candidate Indicator 24

3.1 About the methods/ protocol for studying the interaction between marine litter and sea turtles in Lebanon

In 2019, a stranding network for sea turtles and a protocol for monitoring the interaction between marine litter and sea turtles had been established along the Lebanese coast.

The methods proposed in the report of “Stranding Network for Sea Turtles & A Protocol for Monitoring the Interaction between Marine Litter and Marine Turtles in Lebanon” (Figure 6) consist mainly to fill the observation sheet that contains details related to the observer, location, date, and time, photos of the case, stranded species (sex, morphological measurements, type of injury, and circumstances of death).

In case of necropsy (in the laboratory/ or on the field) of the stranded turtles, the steps proposed in the report of SPA/ RAC-UNEP/ MAP, 2020b, 2021c, should be prudently followed by firstly opening the carcass of the stranded sea turtles, separating, and evaluating of the GastroIntestinal (GI) system.

For studying the marine litter ingested by the stranded sea turtles:

Subsequently, the “Protocol for Monitoring the Interaction between Marine Litter and Marine Turtles in Lebanon” of SPA/RAC-UNEP/MAP, 2020b, 2021c should be applied, respectively:

- Marine litter ingested should be separated into seven categories and according to seven colors
- The dry mass correspondent for each category should be recorded

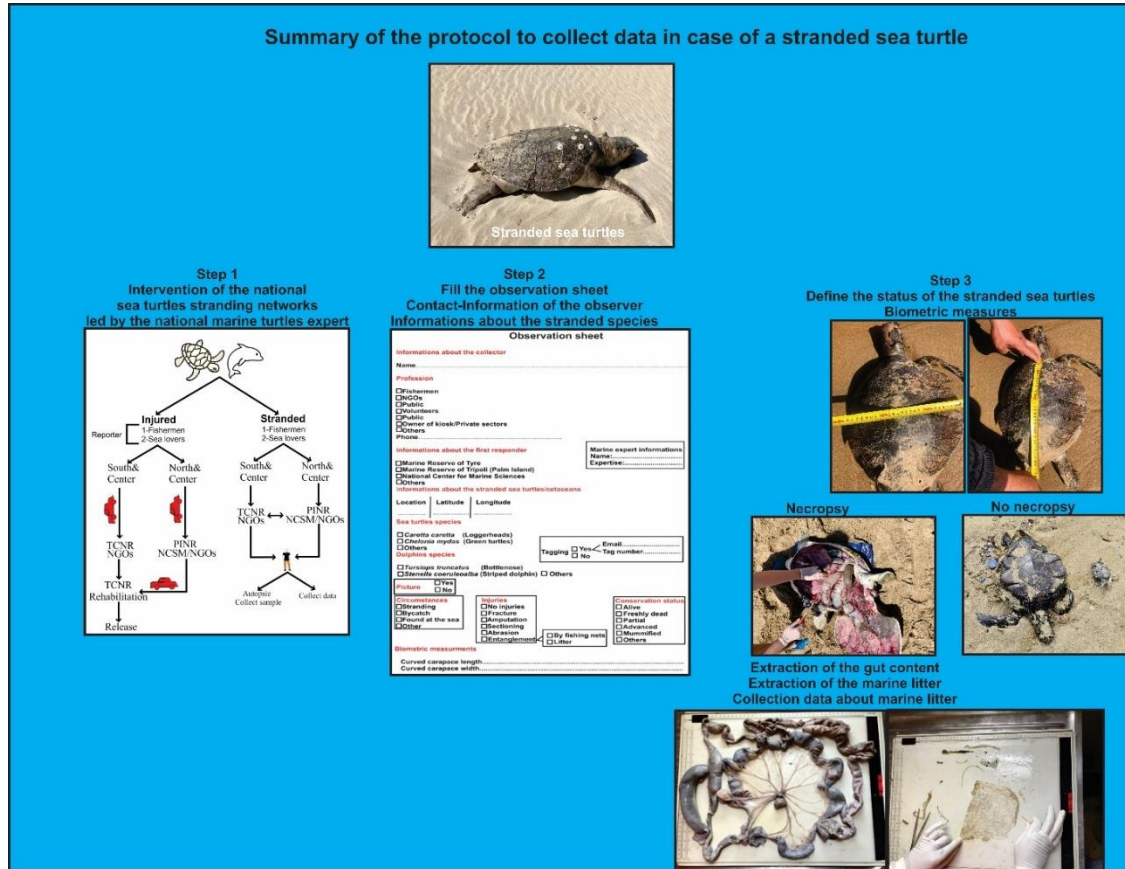


Figure 6: Summary of the steps to be followed in case of a stranded sea turtles (SPA/RAC-UNEP/MAP, 2020b, 2021c)

For a better established of the “Stranding Network for Sea Turtles & Protocol for Monitoring the Interaction between Marine Litter and Marine Turtles in Lebanon,” it is recommended to:

- Maintain the sea turtles stranding networks and implement the capacities building by involving and training more individuals, especially the MPAs team, eco volunteers, and students. Also, it is highly recommended to recruit a veterinary within the team. Moreover, an important step is to have a sea turtle hospital within the rescue center to help the injured sea turtles found in Lebanese waters.
- Organize workshops/ training sessions to:
 - The MPAs team, NGOs, ecovolunteers on the protocol to monitor and study the marine litter ingested by the sea turtle and techniques to estimate the concentration of marine litter on the sandy beach.

- The fishermen, divers on the techniques to help accidental caught sea turtles by fishing nets and techniques to evaluate and estimate the concentration of marine litter floating in the Lebanese waters, and especially around the sea turtles feeding area.
- Develop the monitoring techniques (and modify some steps according to the need/ or necessity) based on the data collected (e.g., Integrate the molecular/ genetic analysis to confirm the identity/sex of the stranded sea turtles). This step guarantees a long-term and sustainable monitoring program.
- Enhance the links (and good coordination led by the sea turtles stranding networks) between the different operational centers (sea turtles stranding networks/ MPAs/ National Center for Marine Sciences - National Centre for Scientific Research (NCMS-CNRS) (as the focal point of the ACCOBAMS in Lebanon, and responsible for the stranded mammals (Dolphins, and Whales)/ MoE/ MoA/ NGOs) proposed in the sea turtles stranding networks. This step is essential for the collection of data and take preventive measures and finds solutions to reduce the use of plastic and the concentration of marine litter.

3.2 Importance of the awareness campaign to reduce the effect of marine litter on sea turtles along the Lebanese coast

“It is essential first to mention that all the actions and recommendations taken for the protection and conservation of the marine turtles along the Lebanese coast are connected and should be taken simultaneously.”

Since 2018, an awareness campaign to protect and conserve the marine turtles in Lebanon have been launched within the framework of a project for the "Conservation of Marine Turtles in the Mediterranean Region", funded by the MAVA Foundation and executed by the Regional Activity Centre for Specially Protected Areas (SPA/RAC), in cooperation with the MoE (and the awareness is ongoing). As results:

- Lebanese fishers communicate directly with the national expert about any Marine Turtles activities. They are also doing their best to help and release any accidental catch of Marine Turtles in the Lebanese waters.
- Many Lebanese Facebook pages related to biodiversity are integrated to share information on Marine Turtles, and enhance this awareness. In this context, social media platforms are used to share friendly and accessible information about sea turtle life (mating, reproduction, and hatchlings, monitoring process during the nesting/hatchling season, main threats on marine turtles, advice allowing to help female Marine Turtles, e.g., in case of any problems, such as bycatch/ or injured Marine Turtles), and some update results of the monitoring survey of the Marine Turtle nesting/hatchlings season in Lebanon by publishing many Marine Turtles hatchlings videos, photos of Marine Turtle nests, important Marine Turtle nesting beach.
- The integration of many NGOs near the GOs, MPAs team and local communities in the monitoring, activities, protection, and conservation of the Marine Turtles in Lebanon
- Organization of Marine Turtles hatchlings events in different sites of the Lebanese coastline, with the participation of the local community (including kids), members of NGOs, members of Marine Protected Area team, members of the Ministry of Environment in Lebanon”. During this event, many activities are done:
 - Many essential information on Marine Turtles life cycle, mating, nesting, and hatchlings was shared with the participants, especially kids.

- Many gifts, including “Brochures”, handmade “Marine Turtles Posters, TeeShirts, Masks, Souvenirs” were distributed for free to participants.

It is worth noting that those activities were done, especially to remember and insist on protecting and conserving the sea turtles in Lebanon.

To guarantee the protection (and reduce) of sea turtles from the impact of marine litter, it is highly recommended to develop the awareness campaign for the protection and conservation of marine litter in the Lebanese waters already launched by focusing more on the impact of marine litter on sea turtles life and activities. In this context, some actions are recommended:

- Add signs and posters on sandy beach (as potential sea turtles nesting sites), especially within the MPAs, focusing on the impact of marine litter on sea turtles and solutions allowing to reduce this pollution.
- Guide/ Encourage beach visitors to always thinking of avoid using items made by plastic. It is important to share the four actions (Reduce/ Investing in reusable containers/ Bringing their own cutlery/ Pick up trash when they saw it) and work on the development of those actions.
- Distribution of brochures, especially within the local community, presenting some items that can be used to reduce the plastic pollution (Figure 7).
- Use social media platforms to share information, photos, and maybe results (e.g., concentration of marine litter in stranded marine turtles in the Lebanese waters) related with marine litter and their impact on sea turtles.
- Profit of the release sea turtle hatchling event by focusing on the marine litter and its danger to sea turtles.
- Share some educational/ environmental games (Figure 7) focusing on the danger of marine litter, especially with kids/ students. In this context, it is recommended to cooperate with school/ universities.
- Distribute gifts, including “Brochures”, handmade “Marine Turtles Posters, TeeShirts, Masks, Souvenirs” encouraging to avoid the use of plastic.
- Work more with Lebanese fishers/ and divers, and enhance the communication between them and the sea turtles stranding networks, especially concerning the loss of fishing nets (Ghostnets)



Figure 7: Example of environmental games and reusable bags based on the impact of marine litter on sea turtles

3.3 Importance of research and studies to reduce the effect of marine litter on sea turtles in the Lebanese waters

Recently, studies dealing with marine litter pollution along the Lebanese coast, and their impacts on marine biodiversity, starts to be performed. In addition, Lebanese organizations, sports clubs, municipalities, and MoE organized clean beach campaigns to face the marine litter invasion. Moreover, projects dealing with marine litter pollution and funded by international/ Mediterranean organizations start to be executed in many areas of the Lebanese coast by NGOs.

In this context, it is recommended to:

- Encourage Lebanese researchers to regularly study the concentration of marine litter floating in the Lebanese waters and their impact on the marine taxa, especially the sea turtles, as the most impacted by this pollution. In this context, it is highly recommended to share the collected data by publishing articles. Based on this, it is important to estimate:
 - The number/ concentration of plastic items floating in the Lebanese waters and present on the beach
 - The number of lost fishing net in the Lebanese waters, and especially around the feeding area of the sea turtles
 - The impact of macro/ micro plastics on marine taxa, and especially sea turtles, and cooperate with the sea turtles stranding networks concerning this point
 - Develop techniques time and cost effective to reduce marine litter
- Encourage students to take university projects related to marine litter pollution.
- Participate in national/ regional/ international symposium to share studies, techniques, methods dealing with marine litter pollution with other experts and sharing infos and ideas and finding the solution to reduce it.
- Coordinate with the national sea turtles stranding networks, led by the national sea turtle expert, to collect and share data
- Bank all the data collected in cooperation with the MoE, making the access of the data easier and possible

3.4 Importance to enforce the existing law protecting the sea turtles in Lebanon

“Measures to prevent and combat marine litter have to be taken in a large number of places, within a large number of activities and by many people in many situations”

The Marine Turtles in the Lebanese waters are protected through:

- The Barcelona Convention 1976 signed by Lebanon in 1976,
- The UN Convention on the Law of the Sea signed in 1995 by the Ministry of Agriculture (MoA) of Lebanon,
- The Decision of the MoA (no. 125/1 of 23/9/1999) banning the fishing of Cetaceans, Whales, Monk Seal and Marine Turtles (SPA/RAC-UN Environment/MAP, 2018; SPA/RAC-UNEP/MAP, 2020a).

From a protection point of view, it is important to enforce the application of the existing law. In this context, it is recommended to:

- Work/ cooperate more with the MPAs team, which should survey and help avoid any use of plastic, especially clean regularly the sandy beach

- Work/ cooperate more with the civil defense and MoA to survey the fishermen and avoid losing fishing nets
- Work/ cooperate with the Lebanese marine army and civil defense and MoA to control the marine traffic and try to reduce the shipment of big plastic items
- Work/ cooperate more with the municipalities to enhance and encourage people to recycle and help to reduce the use of plastics. In this context, it is essential to put garbage on all the Lebanese sandy beaches to encourage people to recycle.
- Apply and impose taxes for any marine pollution (pollutant should pay)
- Enforce and Develop the national contingency plan by adding marine litter as a danger pollution

3.5 Importance of the national ecotourism plan based on sea turtles to fight and face the marine litter pollution along the Lebanese coast

It is important to mention that “Tourism mainly responsible for marine litter on Mediterranean beaches”. In Lebanon, an ecotourism plan based on sea turtles for the TCNR has been established (SPA/RAC-UNEP/MAP, 2021d), and its application is undergoing. In this context, it is highly useful to:



Establish a national ecotourism plan based on sea turtles in Lebanon.



Coordinate and cooperate with municipalities and MPAs team to apply the ecotourism plan.



Involvement of local communities, and especially students, for more ideas and creativity.



Figure 8: A polluted beach does not attract people and it is dangerous for sea turtles, while a clean beach is a center of attraction

3.6 More actions/ recommendations for reducing marine litter pollution and impacts on sea turtles along the Lebanese coast

To guarantee a fast reduction of marine litter and anticipate their impact on sea turtles along the Lebanese coast, some actions are recommended and should be regularly done:

- Enhance and encourage the fishermen to clean the sea, especially after repairing their boats under the supervision of municipalities and the MoA
- Work with fishermen, and divers to launch cleaning sea bottom campaign, especially from ghostnets
- Work with municipalities, MPAs team, NGOs to clean regularly the sandy beach.

It is important to be careful not to clean so much!!



Figure 9: Mechanical rakes cleaning the beach. **This step should be avoided because the sea deposits plant debris and dead animals on the beach that protect from erosion.**

- Create new technologies (no time and cost effective) to recycle plastics
- Create an Android application, making easier the communication with the sea turtles stranding network and collection data
- Launch and promote website to share infos/ techniques/ protocols/ results related to the impacts of marine litter on sea turtles
- Improve the disposal and management of the country solid waste, including marine litter

- At the Mediterranean level, cooperate with other sea turtles rescue center along the Mediterranean countries for suggestions, advices, and sharing experience and information.
- Incorporate Mediterranean experts for advice in the application of the national strategy for the implementation of CI24 to reduce marine litter pollution (as national and regional pollution)

4 Conclusion

The proposed strategy should cover an implementation period of five years, after which an evaluation of the achievements (e.g. actions/ recommendations), should be done. In this context, and for a better establishment of the proposed program, an implementation table is proposed (Table 1).

Table 1
implementation table (Actions/ working years/ responsible)

Actions	Targets	Responsible
Establishment of a sea turtles rescue sea turtles	By 2027, Lebanon have a sea turtle rescue center well established and equipped	Marine turtle expert, MPA, TCNR, MoE, SPA/RAC
Establishment of a sea turtles stranding networks	By 2027, Lebanon have a well-established and developed stranding network for sea turtle	Marine turtle expert, MPAs, NCMS/ CNRS, MoE, MoA, Civil defense, NGOs
Development and update and standardize the marine litter on sea turtle protocol and monitoring	By 2027, Lebanon have a well-established and developed and standardized protocol to monitor the impact of marine litter on sea turtles	Marine turtle expert in cooperation with Mediterranean experts
Development of the awareness campaign to protect the sea turtle from the marine litter pollution	By 2027: More than 70 % of Lebanese people will know about the sea turtles monitoring and conservation program. Ecovolunteers, NGOs, local communities, student, universities would be involved in the monitoring and conservation program Use of items made by plastic will be reduced	Sea turtles stranding networks, MPAs, Municipalities
Development of researches and studies to reduce the effect of marine litter on sea turtles in the Lebanese waters	By 2027: Much research on marine litter concentration in the Lebanese waters and the sandy beach and their impact on marine taxa will be performed Developed techniques to reduce the marine litter impacts will be performed	Marine Turtle experts, NCMS/ CNRS, Universities, NGOs, SPA/RAC

	National/ International projects dealing with marine litter pollution will be launched Data collected will be banked within the MoE	
Enforce the existing law protecting the sea turtles in Lebanon	By 2027: The sea turtles will be fully protected by law and taxes will be imposed to pollutant	MoA, Civil defense, Lebanese marine army, MPAs
National ecotourism plan based on sea turtles	By 2027, Lebanon will have a well-established ecotourism plan based on sea turtles	Marine turtle expert, MoE, SPA/RAC
Marine litter cleaning campaign	By 2027: Sandy beach (as potential nesting sites) will be totally cleaned from marine litter, especially before the nesting sea turtles season Marine litter (especially ghostnets) in the Lebanese sea bottom will be reduced	Sea turtles stranding network, MPAS, Municipalities, Fishermen, Divers, NGOs
Improve the disposal and management of the country solid waste, including marine litter	By 2027, Lebanon develop and update a roadmap for plastic waste management	MoE
Cooperate with Mediterranean experts to develop the national strategy for monitoring IMAPI CI24	By 2027, Lebanon has links with other Mediterranean countries and projects (regional/ international) working with the impact of marine litter on sea turtles	Marine Turtles experts, MoE, SPA/RAC

References

- Atzori, F., Carosso, L., Cadoni, N., Frau, F., Gutierrez, M. L. G., De Lucia, G. A., ... & Arcangeli, A., 2021. Loggerhead sea turtle, *Caretta caretta*, presence and its exposure to floating marine litter in the Sardinia Channel and the Strait of Sicily: results from seven years of monitoring using ferry as platform of observation. *Mediterranean Marine Science*, 22(2), 422-435.
- Badreddine, A., 2018. Les écosystèmes côtiers du littoral libanais: état écologique, évolution, conservation Doctoral thesis, Univ. Nice Sophia Antipolis, 1-218.
- Boucher, J., and Bilard, G., 2020. The Mediterranean: Mare Plasticum. Gland, Switzerland: IUCN, 62pp.
- Casale P., Hochscheid S., Kaska Y., Panagopoulou A. (Eds.). Sea Turtles in the Mediterr Region: MTSG Annual Regional Report 2020. Report of the IUCN-SSC Marine Turtle Specialist Group, 2020.
- Casale, P., Affronte, M., Insacco, G., Freggi, D., Vallini, C., Pino d'Astore, P., ... & Argano, R. (2010). Sea turtle strandings reveal high anthropogenic mortality in Italian waters. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 20(6), 611-620.
- Casale, P., Broderic, A.C., *et al.* (2018). Mediterranean Sea turtles: current knowledge and priorities for conservation and research. *Endang Species Res*, 36: 229–267.
- Coll, M., Piroddi, C., Steenbeek, J., Kaschner, K., Lasram, F.B.R., *et al.*, 2010. The Biodiversity of the Mediterranean Sea: Estimates, Patterns, and Threats. *PLoS ONE*, 5, e11842.
- Costello, M.J., Coll, M., Danovaro, R., Halpin, P., Ojaveer, H., Miloslavich, P., 2010. A census of marine biodiversity knowledge, resources, and future challenges. *PloS one* 5, e12110.
- Deudero, S., Alomar, C., 2015. Mediterranean marine biodiversity under threat: reviewing influence of marine litter on species. *Marine Pollution Bulletin*, 98: 58–68.
- Ferretti, F., Myers, R.A, Serena, F., Lotze, H.K., 2008. Loss of large predatory sharks from the Mediterranean Sea. *Conservation Biology*, 22: 952–964.
- Karamanlidis AA, Androukaki E, Adamantopoulou S, Chatzispayrou A, Johnson WM, Kotomatas S, Papadopoulos A, Paravas V, Paximadis G, Pires R *et al.*, 2008. Assessing accidental entanglement as a threat to the Mediterranean monk seal *Monachus monachus*. *Endangered Species Research*, 5: 205–213.

Kazour, M., Jemaa, S., Issa, C., Khalaf, G., & Amara, R., 2019. Microplastics pollution along the Lebanese coast (Eastern Mediterranean Basin): Occurrence in surface water, sediments and biota samples. *Science of The Total Environment*, 133933.

Matiddi, M., deLucia, G.A., Silvestri, C., Darmon, G., Tomás, J., Pham, C.K., Camedda, A., Vandeperre, F., Claro, F., Kaska, Y., Kaberi, H., Revuelta, O., Piermarini, R., Daffina, R., Pisapia, M., Genta, D., Sözbilen, D., Bradai, M.N., Rodríguez, Y., Gambaiani, D., Tsangaris, C., Chaieb, O., Moussier, J., Loza, A.L., Miaud, C., 2019. Data Collection on Marine Litter Ingestion in Sea Turtles and Thresholds for Good Environmental Status. *J. Vis. Exp.* 147.

Panagopoulos *et al.* in: Margaritoulis, D. and A. Demetropoulos (editors). (2003). *Proceedings of the First Mediterranean Conference on Marine Turtles. Barcelona Convention – Bern Convention – Bonn Convention (CMS)*. Nicosia, Cyprus. 270 pp.

Pham, C. K., Ramirez-Llodra, E., Alt, C. H., Amaro, T., Bergmann, M., Canals, M., ... & Tyler, P. A., 2014. Marine litter distribution and density in European seas, from the shelves to deep basins. *PloS one*, 9(4), e95839.

Jemaa, S., Mahfouz, C., Kazour, M., Lteif, M., Hassoun, A.E.R., Ghsoub, M., Amara, R., Khalaf, G. and Fakhri, M., 2021. Floating Marine Litter in Eastern Mediterranean from Macro to Microplastics: The Lebanese Coastal Area as a Case Study. *Front. Environ. Sci.* 9:699343. doi: 10.3389/fenvs.2021.699343

MOE/UNDP/ECODIT, 2011. *State and Trends of the Lebanese Environment*. (Ministry of the Environment; United Nations Development Program; ECODIT: Beirut) pp. 355.

SPA/RAC-UNEP/MAP (2020b). *A Stranding Network for Sea Turtles and Cetaceans & A Protocol for Monitoring the Interaction between Marine Litter and Marine Turtles in Lebanon*. By Badreddine, A., Samaha, L., Joumaa, F., Abderrahim, M., Limam, A., & Ben-Nakhla, L. Ed. SPA/RAC. Marine Litter MED project Tunis: pages 19 + Annexes.

SPA/RAC-UNEP/MAP (2020a). *Conservation of the Marine Turtles in Lebanon. Results of the 2019 monitoring of the Marine Turtles along the Lebanese coast*. By Badreddine, A., Samaha, L., Abderrahim, M., Limam, A., & Ben-Nakhla, L. Ed. SPA/RAC. Conservation of Marine Turtles in the Mediterranean Sea project. Tunis: pages 39.

SPA/RAC-UNEP/MAP (2021a). *Regional Operational Strategy for Monitoring IMA Candidate Indicator 24*. 38pp.

SPA/RAC-UNEP/MAP (2021b). *Conservation of the Marine Turtles in Lebanon. Results of the 2020 monitoring of the Marine Turtles along the Lebanese coast*. By Badreddine, A., Samaha, L., Abderrahim, M., Limam, A., & Ben-Nakhla, L. Ed. SPA/RAC. Conservation of Marine Turtles in the Mediterranean Sea project. Tunis: pages 37.

SPA/RAC-UNEP/MAP, 2021c. Results of the stranding networks for sea turtles in Lebanon. By Badreddine, A., Samaha, L., Abderrahim, M., Limam, A., & Ben-Nakhla, L. Ed. SPA/RAC. Conservation of Marine Turtles in the Mediterranean Sea project. Tunis: pages 20 + Annexes.

SPA/RAC-UNEP/MAP, 2021d. Ecotourism program based on sea turtles for Tyre Coast Nature Reserve - TCNR. By Badreddine, A., Samaha, L., Abderrahim, M., Limam, A., & Ben-Nakhla, L. Ed. SPA/RAC. Conservation of Marine Turtles in the Mediterranean Sea project. Tunis: pages 37.

Suaria, G., Aliani, S., 2014. Floating debris in the Mediterranean Sea. Marine Pollution Bulletin, 86 (1-2), 494-504.

UNEP, 2019. Strategies to Reduce Marine Plastic Pollution from Land-Based Sources in Low and Middle-Income Countries. Nairobi: United Nations Environment Programme (UN Environment). 26pp.





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