

MARINE MEGA FAUNA AND LITTER IN THE MEDITERRANEAN

Overview of impacts in MedBioLitter



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Authors:

Antonio Sánchez (ETC-UMA), Dania Abdul Malak (ETC-UMA), Sonsoles San Román (ETC-UMA), Alina Vera (Interreg Volunteer Youth programme)

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Glossary

LEXICON	
Benthic	Of, relating to, or occurring at the bottom of a body of water.
Biota	The animal and plant life of a particular region, habitat, or geological period.
Chondrichthyans	Chondrichthyans are a class that contains the cartilaginous fishes that have skeletons primarily composed of cartilage. The class is divided into two subclasses: Elasmobranchii (sharks, rays, skates, and sawfish) and Holocephali (chimaeras, sometimes called ghost sharks).
Cnidarians	Cnidaria is a phylum under kingdom Animalia containing over 11,000 species of aquatic animals found both in freshwater and marine environments, predominantly the latter. They are invertebrates such as jellyfish and corals.
Colonization	The establishment of a species in an area not currently occupied by that species. Colonisation often involves dispersal across an area of unsuitable habitat. Marine litter items can become colonized and transport potentially invasive species into new habitats.
Entanglement	Many marine species such as seals, whales and marine turtles become entangled in marine litter, causing suffocation, strangulation and drowning. Marine litter can also restrict movement, reduce the ability to catch food and avoid predators, or cause lacerations and infections. The most frequent cause of entanglement is discarded fishing gear; other causes include 'six-pack' rings and balloon ribbons. (https://ec.europa.eu/environment/marine/pdf/flyer_marine_litter.pdf)
Ingestion	Mistaken as food or ingested accidentally during feeding, debris and litter may block the digestive tract or cause internal injuries and lead to death. It can also impair digestion and stunt growth as well as reproduction rates. There is increasing concern that, along with plastics, animals could be ingesting persistent organic pollutants (POPs) and toxic compounds such as medicines. (https://ec.europa.eu/environment/marine/pdf/flyer_marine_litter.pdf)
Pelagic	Living and feeding in the open sea; associated with the surface or middle depths of a body of water; free swimming in the seas, oceans or open waters; not in association with the bottom. Many pelagic fish feed on plankton. In FishBase, referring to surface or mid water from 0 to 200 m depth.
Scombrids	Scombrids is an order under the class of ray-finned fishes (Actinopterygii). It includes many of the most important and familiar food fishes such as the mackerel, tuna, and bonito family.
ACRONYMS	
ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area. A regional international treaty that binds its States Parties on the conservation of Cetacea in their territories. The Agreement aims to reduce threats to Cetaceans in the Mediterranean and Black Seas, as well as in the contiguous Atlantic area west of the Straits of Gibraltar.
ETC-UMA	European Topic Centre of the University of Malaga. An international research centre supporting the development of knowledge to feed evidence-based policy. Its major areas of expertise include land management, ecosystem services, coastal and marine studies, environmental conservation, territorial development, resource efficiency, and soil mapping.
IUCN	International Union for Conservation of Nature. An international organization working in the field of nature conservation and sustainable use of natural resources.



Introduction

This report follows the publication of the “Mediterranean biodiversity and marine litter: an interaction knowledge base” report in the frame of the Interreg Mediterranean Biodiversity Protection project published in 2019.

This report highlights the conclusions coming from the analysis of MedBioLitter spatial and scientific data on interactions between marine fauna and litter in the Mediterranean published in English as in v.8 updated in March 2022, integrated with marine litter data collected by ACCOBAMS in the frame of the Aerial Survey Initiative on cetaceans and marine litter. The analysis focuses on the impacts on marine megafauna (large mammals like cetaceans and seals, turtles, cartilaginous fishes like sharks and rays, and scombridae like tuna and swordfish).

The MedBioLitter dashboard developed by ETC-UMA provides access to statistical information and the scientific articles used for this study. The MedBioLitter dashboard can be accessed via [**biodiversity.uma.es**](https://biodiversity.uma.es)



ABOUT MEDBIOLITTER

The MedBioLitter knowledge base is a one entry-point to the peer reviewed research evidence published on the impacts of marine litter on marine biota in the Mediterranean region. This knowledge base was created in 2017 as part of the Mediterranean Biodiversity Protection Community, a project co-financed by the Interreg Mediterranean programme. Since its start, MedBioLitter is periodically updated every 6 months, in March and September each year.

MedBioLitter is the basis for the assessment of main findings related to interactions between marine biodiversity and litter in the Mediterranean as it registers the spatial information of the impacts published in scientific literature. Parameters referring to the geographical location of the interactions, relevant policies and directives, ongoing protection frameworks, species assessed, their habitats, and their conservation status as well as the interaction with marine litter registered per marine compartment (beach, sea surface, water column, seafloor) are available in MedBioLitter. Each MedBioLitter spatial registry of an interaction directs the user to the reference source and the authors of the peer reviewed article published.



Photo by: Naja Bertolt Jensen / Ocean Image Bank



Main conclusions from this spatial assessment

1

The distribution of knowledge across the Mediterranean region on the registered impacts of marine litter on megafauna and on the location of megafauna is uneven, across sub-regions, across species, institutions and across time.

- Underrepresentation is hindering regional comparisons and assessments of marine litter impacts on biodiversity: whereas the Western Mediterranean region seems to be well studied, other regions in the basin still suffer from major data gaps.
- There is a worrying lack of data across time in the south of the Western Mediterranean and the north of the Levantine Sea, being also marine litter hotspot areas where the evidence/knowledge on the degree of impact on these species is still lacking broadly.
- The metaanalysis outcomes and its updates through MedBioLitter over time shows an apparent downward trend during the last years in peer reviewed knowledge in the region.

2

Analysing data on marine litter accumulation and megafauna' sightings, using reliable sources, provides a solid reference for risk assessments allowing to better specify Mediterranean wide priority areas for biodiversity protection.

- As the problem of pollution goes across boundaries, countries and funding instruments are called to develop a strategy to ensure knowledge on regions lacking adequate representation supporting risk assessments at sub-regional scales.
- A greater systematic effort is needed to produce a reliable reference knowledge base to support a Mediterranean wide assessment on the impacts of marine litter on megafauna across scale and periodically updated over time.
- MedBioLitter is a database of peer reviewed scientific articles updated regularly with a meta-analysis at Mediterranean level that can enrich the evidence raising from relevant environmental knowledge bases including the ACCOBAMS Survey Initiative (ASI) and others.

3

Scientific collaboration and data integration are crucial across public and private institutions at local, national and regional level to understand and take measures to protect the Mediterranean from marine litter.

- Ensuring agreed standards to integrate collective scientific efforts to develop a Mediterranean-wide knowledge base provides actors with an evidence base to inform and set up relevant conservation strategies and hotspots for marine megafauna in the Mediterranean.
- Regular updates of such basin-scale efforts across years is crucial to correctly identify high-risk areas and their potential variations and trends in time. Such collaborative work should guide protection priorities in the region, particularly the targets set at EU level and the Mediterranean ones adopted by Mediterranean countries.





Photo by: Sören Funk / Ocean Image Bank



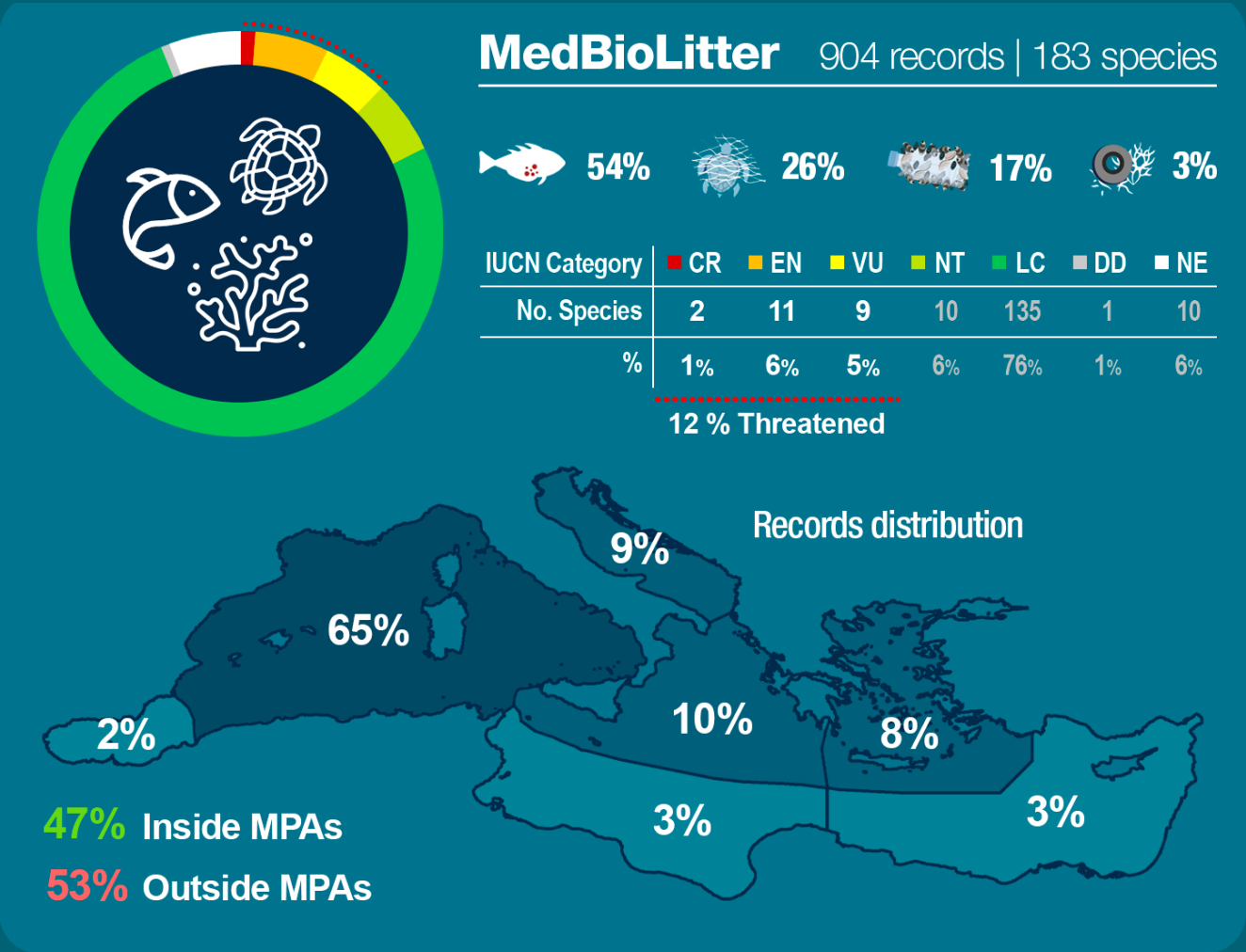
Key findings on species information

3.1 ABOUT THE SPECIES DATA COLLECTED

The results presented in this report are part of a regional assessment using peer reviewed articles on the impacts of marine litter on marine biota in the Mediterranean region. The knowledge base used for this assessment is MedBioLitter, version 8 (updated in March 2022). It includes 904 records or registries on litter interactions with 183 marine species, categorised under 14 taxonomic groups, 92% of which (168 marine species) are included in the IUCN Red List of Threatened species (figure 1).

183 SPECIES
were reported to be
affected by marine litter
in the region

The regional findings of MedBioLitter assessment show that the knowledge and spatial information published on the impacts of marine litter on marine species is registered inside (47%) as well as outside protected areas (53%) to a comparable extent when considering all records of the database. This worrying finding suggests that marine protected areas are not capable, with the current management structures, to reduce the impacts of marine litter on the biodiversity they host.



Species groups: Algae, Bacteria, Birds, Chondrichthyans, Cnidarians, Crustaceans, Fishes, Fungi, Mammals, Microfauna, Mollusks, Other invertebrates, Plants, Reptiles.

Figure 1. Summary of MedBioLitter v.8 data including statistics on the type of interaction distribution of records and red list categories.



Coral and fish species represent more than 50% of reported marine litter interactions.

Concerning the database of marine species, most records correspond to cnidarians (including jellyfish, sea anemones, and coral species among others) and fishes, registering more than 50% of the entries (figure 2). Other prominent taxonomic groups are crustaceans, reptiles (sea turtles species) and mammals (including cetaceans and phocids, the latter being represented by the Monk Seal). These represent 29% of the records; 81% including cnidarians and fishes.

The remaining nine taxonomic groups show a considerably smaller number of records (19%), being mainly species of other invertebrates, bacteria and algae. Within these groups, chondrichthyans (including species of sharks and rays) and plants (including *Posidonia Oceanica*) stand out due to their high ecological relevance. Together these two groups only represent 22 records (2%).

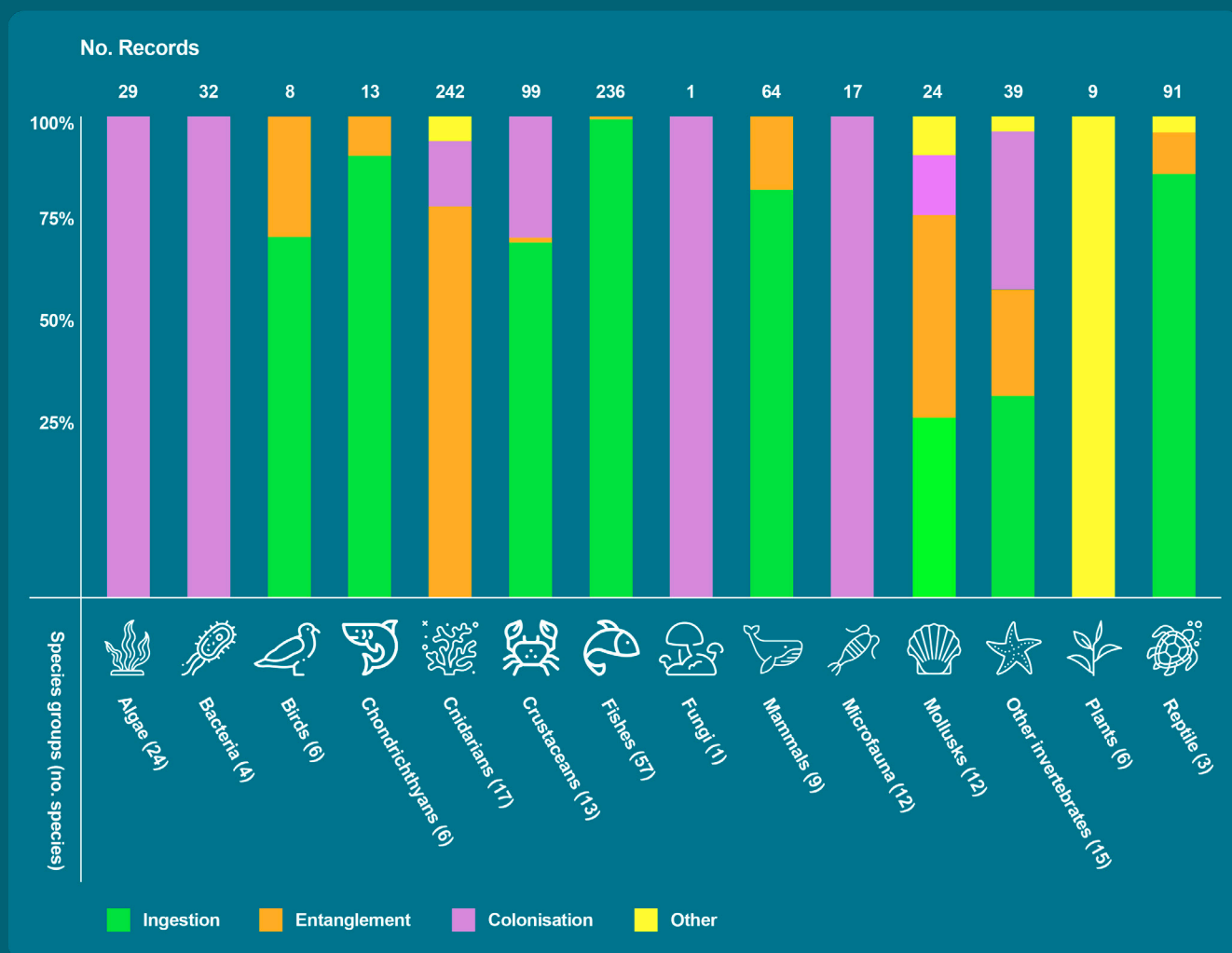


Figure 2. MedBioLitter v.8 data on the type of interaction and number of records by species group.

3.2 ABOUT THE GEOGRAPHICAL COVERAGE

The information compiled in the March 2022 edition of MedBioLitter shows a great disparity in the distribution of research efforts on the impact of marine litter on biota in the Mediterranean region (Figures 1 and 3). The MedBioLitter assessment shows that most research refers to the Western Mediterranean region (65% of records), while systematic information lags in other regions with the Ionian Sea registering 10%, followed by the Adriatic Sea (9%), the Aegean Sea (8%), the Levantine Sea (3%), the Tunisian Plateau/Gulf of Sidra region (3%), and the Alboran Sea (2%).

3.3 ABOUT HOW MARINE LITTER IMPACTS ON MARINE SPECIES

Litter interactions refer to encounters between marine species and litter items and are classified in four categories:

- 1) Ingestion;
- 2) entanglement, which affects mobility, often with fatal consequences;
- 3) colonisation, which occurs when certain species settle on floating litter; and
- 4) others, including different types of less frequent interactions namely breaks, crushing or impediment to normal growth when occupying natural substrate.

The dominant impact from litter on all types of studied biota (54% of the records) is ingestion, followed by entanglement (26%) and colonisation (17%) in addition to other types of impact to a lesser level (3%). When differentiated by sea water column depth, pelagic species show greater impact by ingestion (68% of the cases studied) while the species assessed in benthic zones (near the sea bottom) show impacts from ingestion and entanglement at similar levels being 44% and 40% respectively.

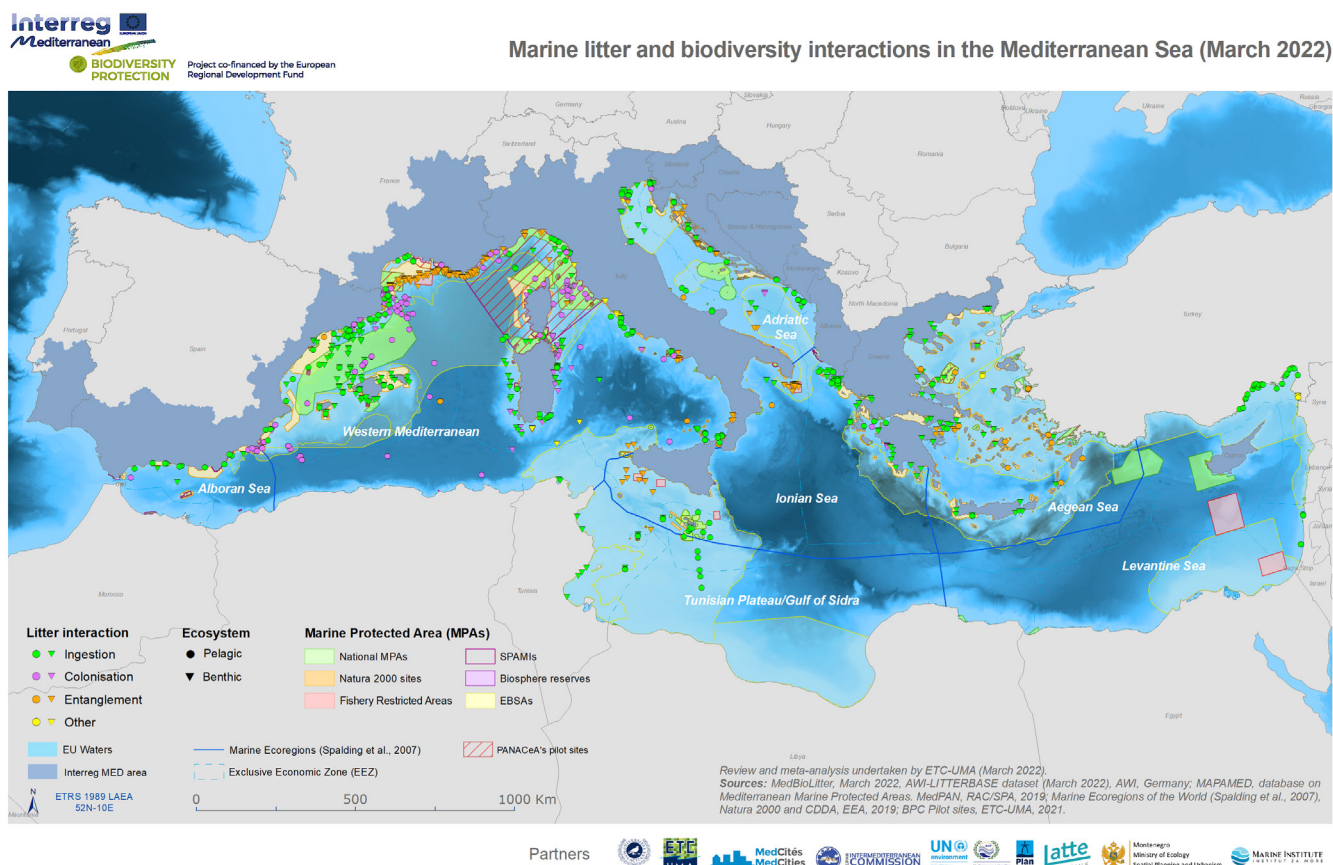


Figure 3. This map shows the interactions between marine litter and biodiversity reported by scientific publications available in MedBioLitter version 8, published in Western March 2022



Ingestion and entanglement are the main impacts among all relevant species.

Both represent 80% of reported interactions in MedBioLitter.

Ingestion is the prevailing interaction among all relevant species including cetaceans, reptiles (turtles), chondrichthyans, seabirds and commercially important species included in fishes and crustaceans groups.

Entanglement is one of the main interactions observed in benthic/sea bottom habitats, being the most frequently impact found on cnidarians (mainly coralligenous species) and mollusks.

Colonisation is mainly observed in cnidarians, bacteria, algae, crustaceans, mollusks and microfauna. Fungi present one case, being the only interaction reported for these taxonomic groups.

Other interactions are almost testimonial and affect specific taxonomic groups. They occur in benthic environments, (affecting cnidarians, mollusks and other invertebrates) and on beaches, where they affect the growth of dune plants (Poeta et al., 2017) or hinder the arrival of new-born turtles to the sea (increasing mortality) (Özdilek et al., 2006).

There are toxicological impacts on species caused by marine litter and their components, which might pass on through the trophic web, an important issue that requires further research, including the impact on human species' health.

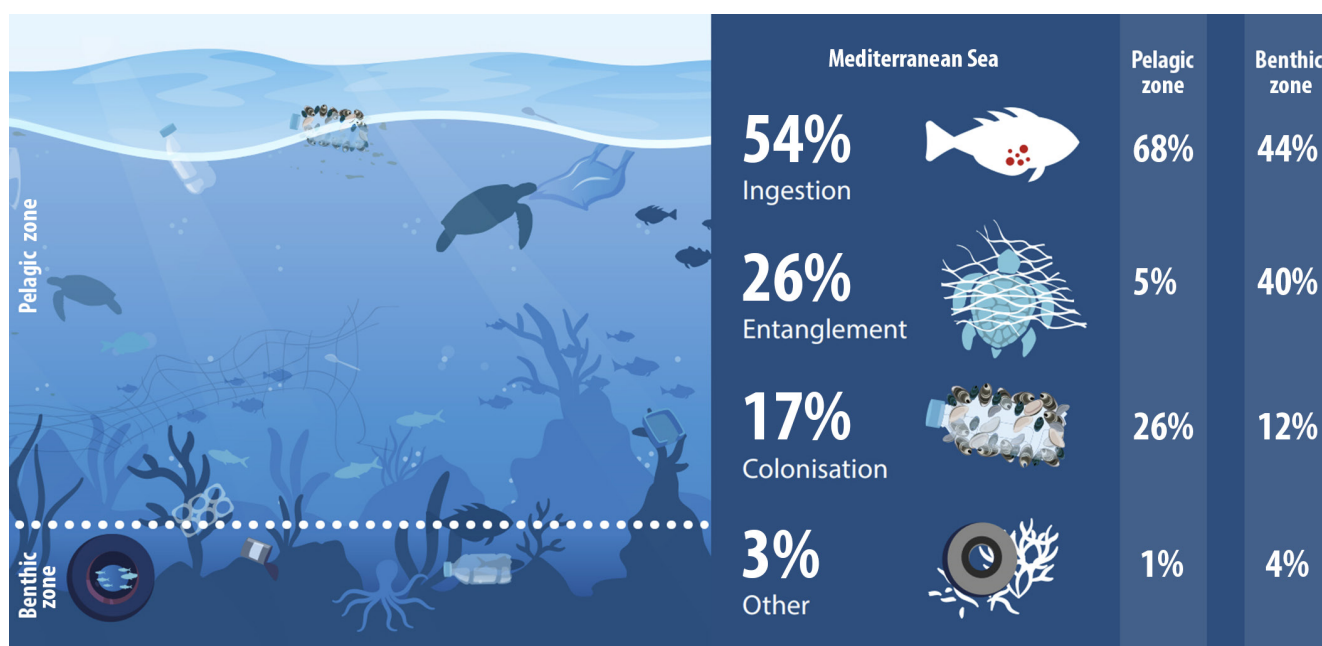
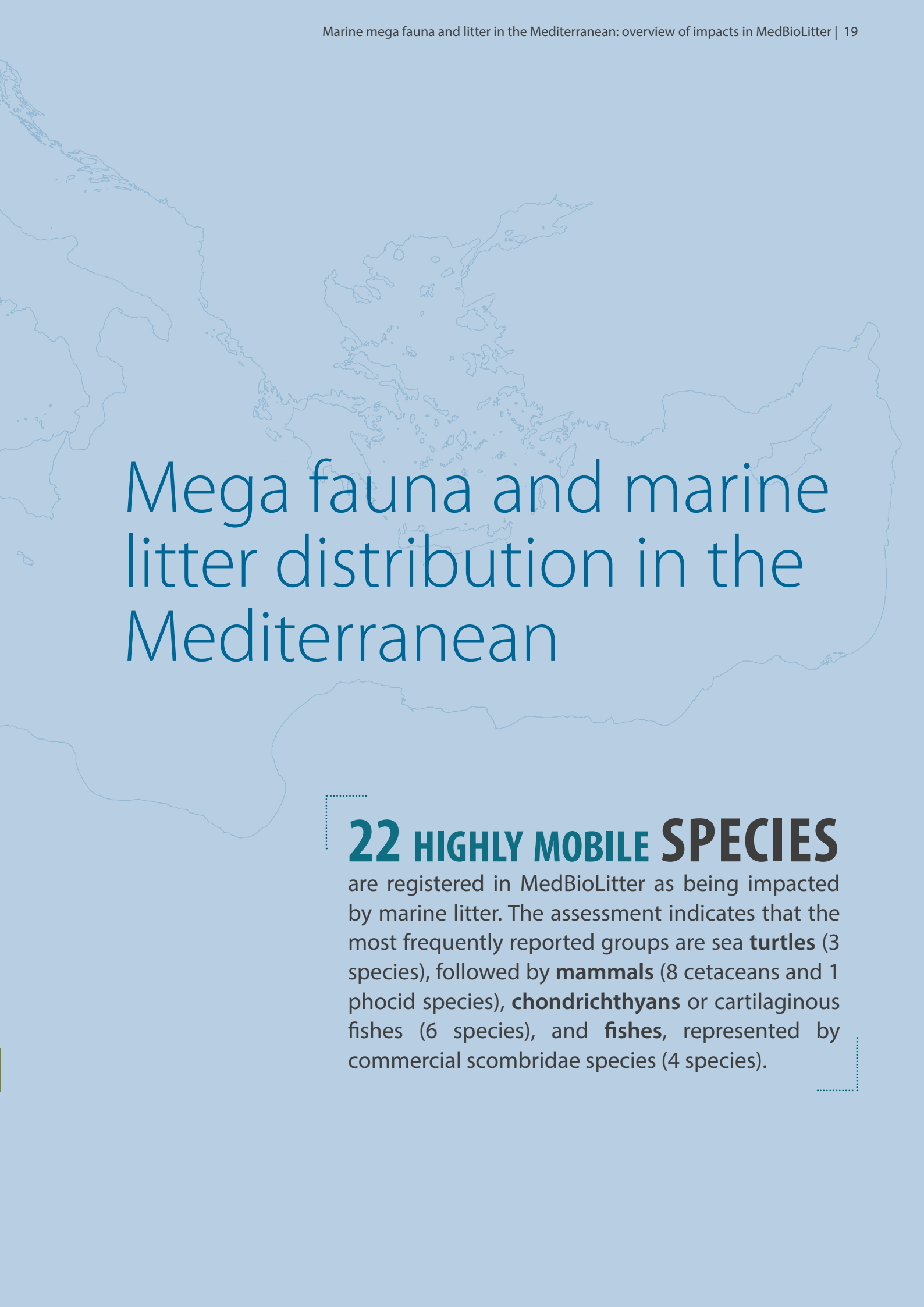


Figure 4. Percentage of data reported by type of interaction at the Mediterranean Sea level and in pelagic and benthic environments.



Photo by: Ignasi Mateo/ACT4LITTER



Mega fauna and marine litter distribution in the Mediterranean

22 HIGHLY MOBILE SPECIES

are registered in MedBioLitter as being impacted by marine litter. The assessment indicates that the most frequently reported groups are sea **turtles** (3 species), followed by **mammals** (8 cetaceans and 1 phocid species), **chondrichthyans** or cartilaginous fishes (6 species), and **fishes**, represented by commercial scombridae species (4 species).

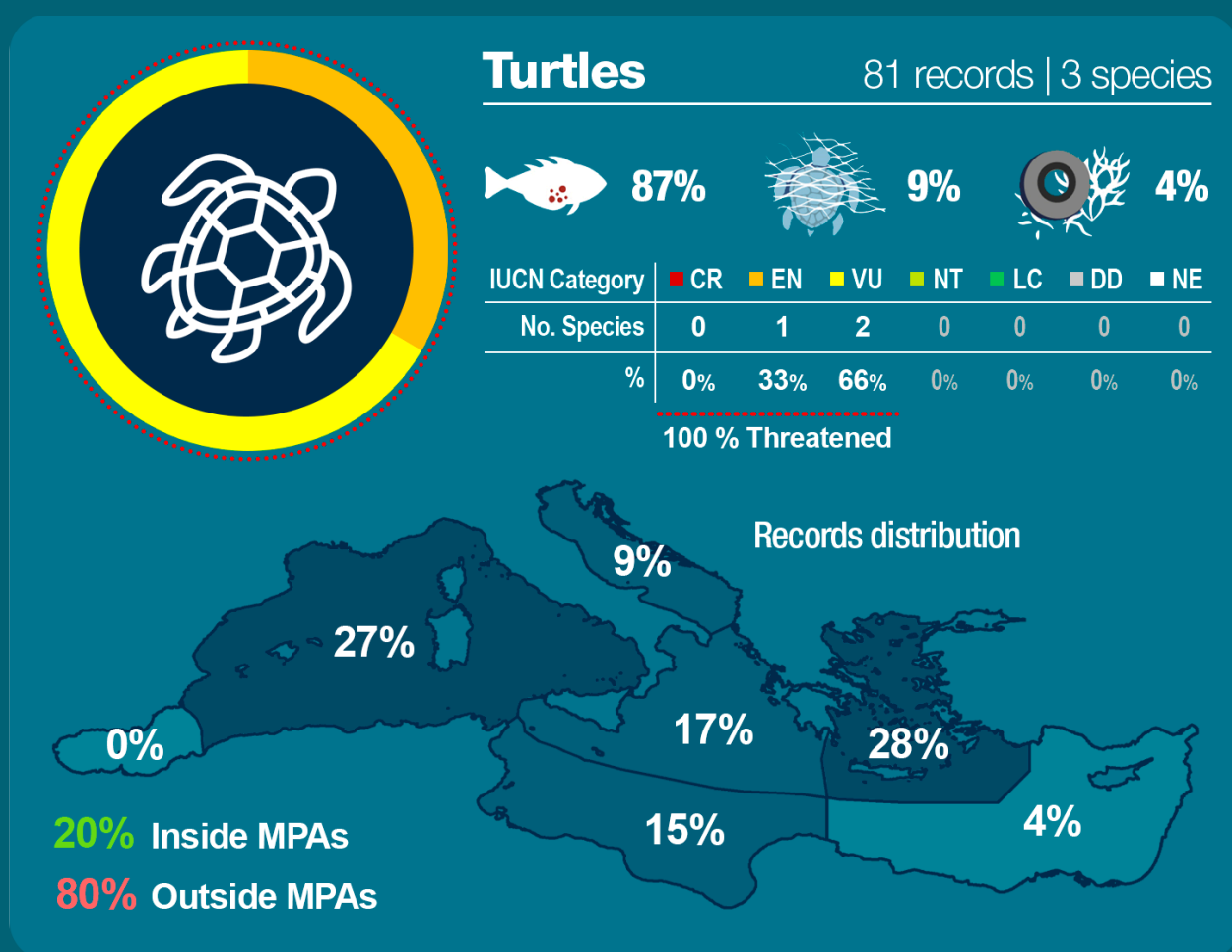
Reptiles: Marine Turtles

3 SPECIES 81 RECORDS

The Mediterranean Sea is frequented by three sea turtle species, all of which are included in the threatened categories of the IUCN Red List. Mediterranean turtles present different impacts (figure 5), the main one being the direct ingestion of macroplastics and the accumulation of microplastics (87% of records), followed by entanglements (9%) and the increase in hatchling mortality due to the accumulation of litter on the beaches, which acts as a barrier and makes access to the sea more difficult (4%).

Most records are registered in the Aegean Sea (28%) and Western Mediterranean (27%). The rest is mainly concentrated in the central area of the Mediterranean, distributed between the Ionian Sea (17%), the Tunisian Plateau/Gulf of Sidra Ecoregion (15%), and the Adriatic Sea (9%).

80% of the impacted turtles assessed within MedBioLitter in the Mediterranean have been recorded outside protected areas (80%), with few records on loggerhead turtles occurring within MPAs (20%).



Species reported: Green turtle, Leatherback turtle, Loggerhead turtle.

Figure 5. Summary of MedBioLitter v.8 data on sea turtles species.

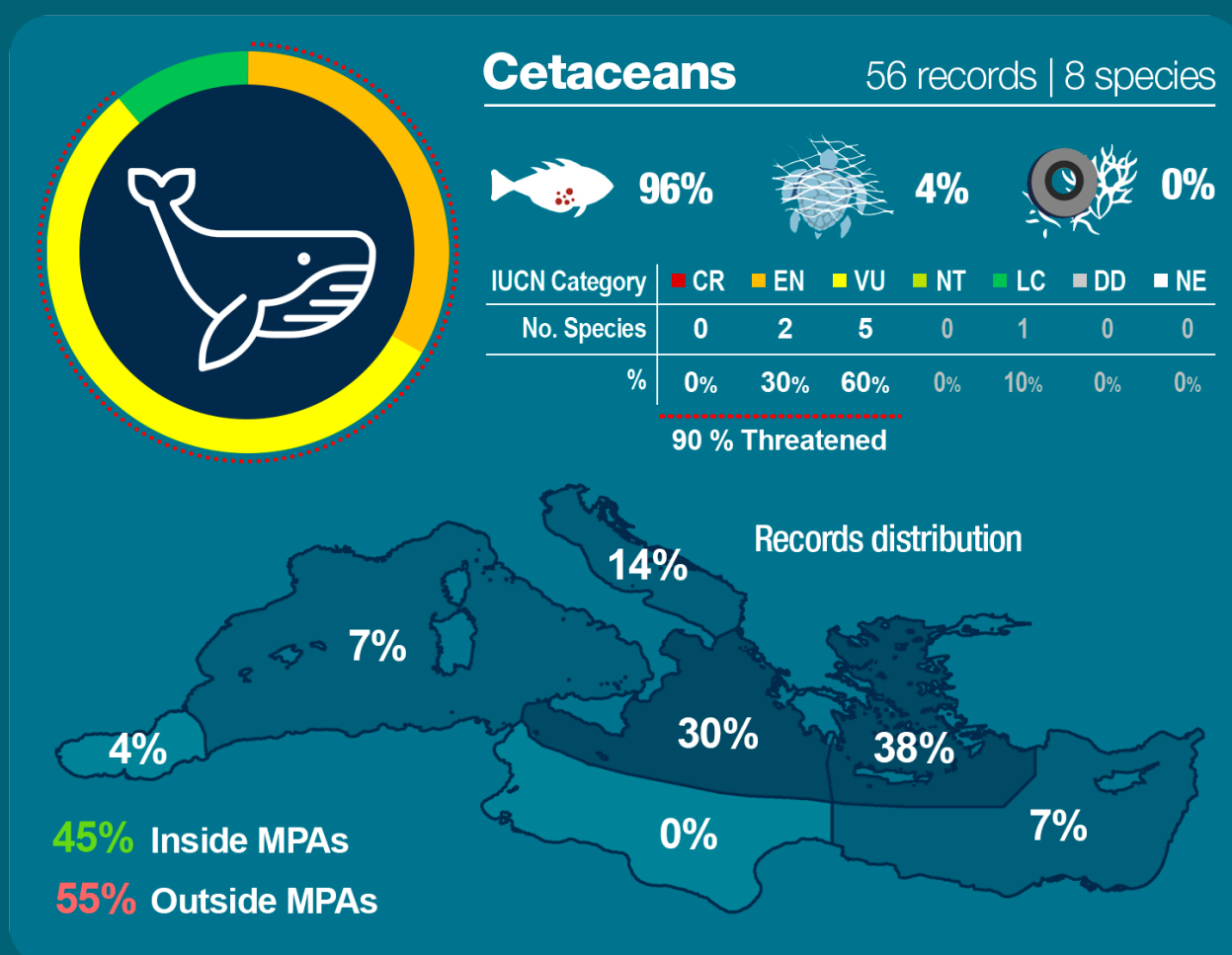
Cetaceans: Dolphins and Whales

8 SPECIES 56 RECORDS

According to the Mediterranean assessment of the [IUCN Red List](#) 23 cetacean species have been recorded in the Mediterranean and Black Seas, of which 8 species register impacts from marine litter based on the peer reviewed studies collected. All these species have targeted conservation status in the region and 7 are classified as under threat in the IUCN Red List categories (figure 6). Main impact affecting Mediterranean cetaceans is direct ingestion or accumulation of macroplastics and microplastics (96% of records). The other source of impact is entanglements, representing 4% of the records.

Records distribution is concentrated in the central and eastern part of the Mediterranean, being the Aegean and Ionian Seas the areas with the highest availability of data (38% and 30% respectively). The Adriatic Sea registered 14% of records, followed by the Levantine Sea (7%), the Western Mediterranean (7%) and the Alboran Sea (4%).

The regional findings of MedBioLitter assessment show that the knowledge and spatial information published on the impacts of marine litter on cetaceans is registered inside (45%) as well as outside protected areas (55%) to a comparable extent for most of the dolphin species and the sperm whale.



Species reported: Sperm whale, Fin whale, Cuvier's beaked whale, Risso's dolphin, Bottlenose dolphin, Short-beaked common Dolphin, Striped dolphin, Harbour porpoise.

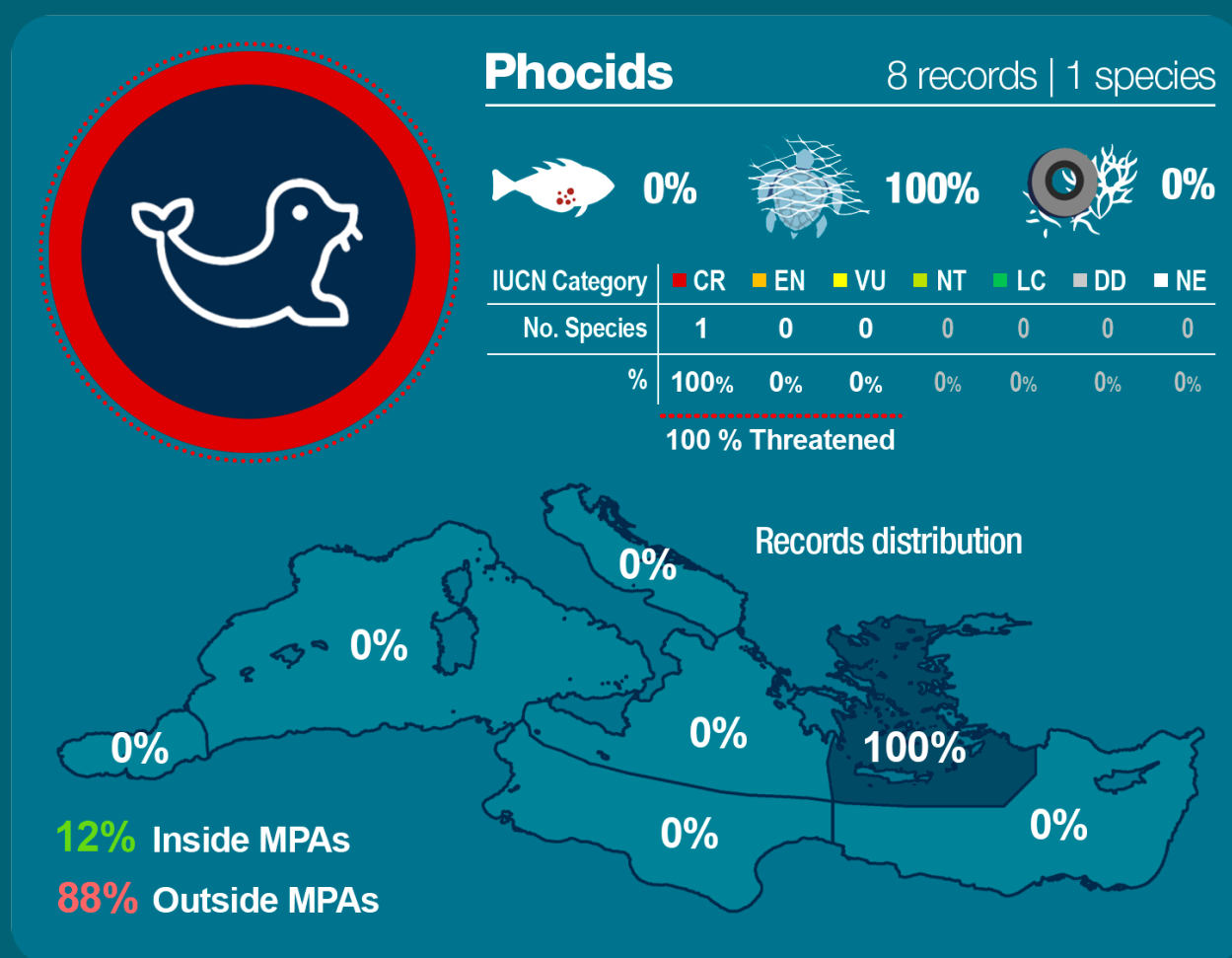
Figure 6. Summary of MedBioLitter v.8 data on cetaceans species.

The Monk Seal

8 RECORDS

The Monk Seal is one of the most highly endangered species in the Mediterranean sea based on the IUCN Red List. The greatest impact of marine litter on this species is entanglement, being 100% of the 8 records collected by MedBioLitter (figure 7).

All reported impacts in the assessment were registered in the Aegean Sea, while 88% is outside marine protected areas.



Species reported: Monk Seal

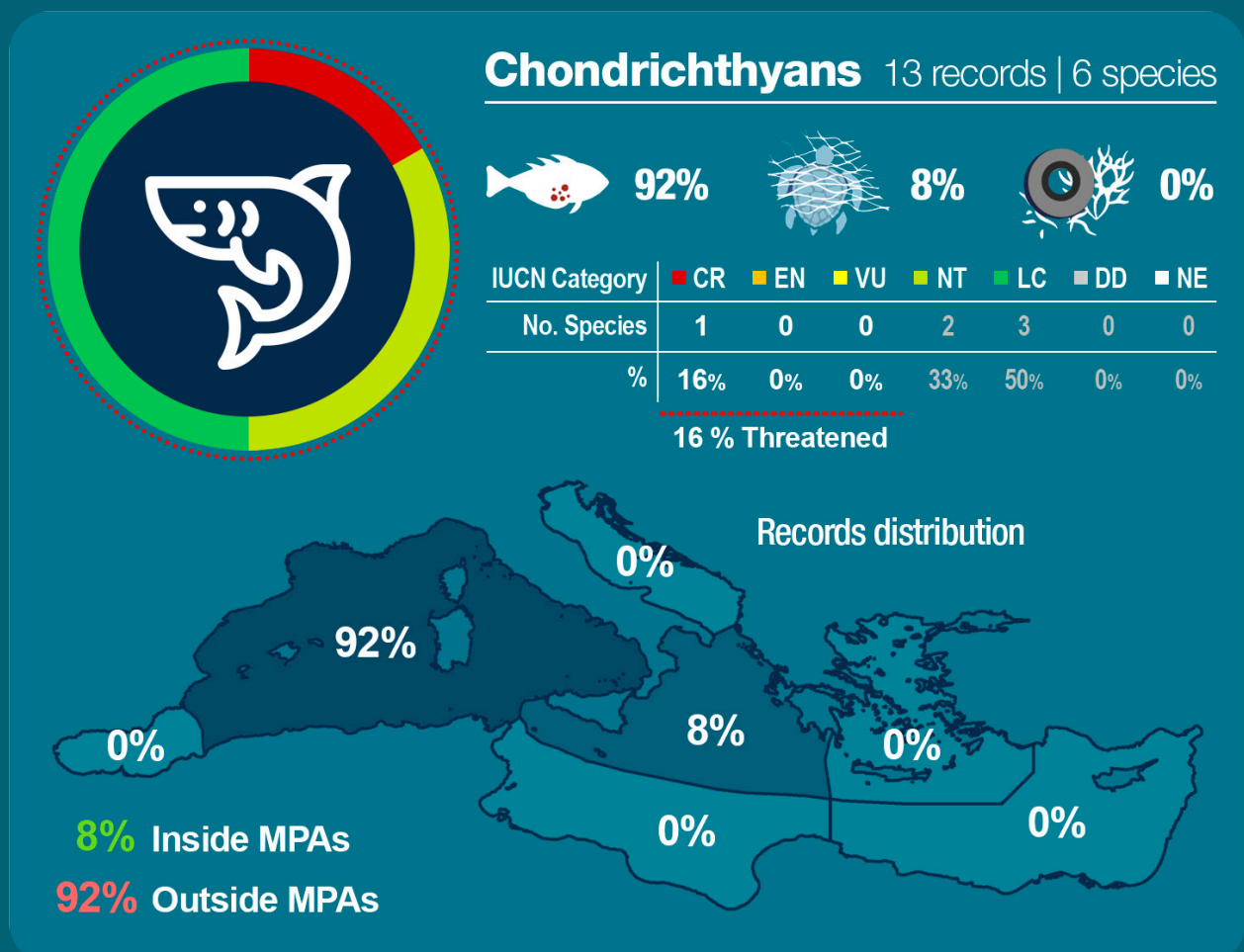
Figure 7. Summary of MedBioLitter v.8 data on the Monk Seal.

Cartilaginous fishes: sharks and rays

6 SPECIES 13 RECORDS

The warm waters of the Mediterranean Sea are home to at least 79 species of cartilaginous fishes (chondrichthyans), of which 6 species are reported to interact with marine litter (figure 8). One of these, the blue shark, is categorised as critically endangered by the IUCN Red List. The main source of impact is the direct ingestion or accumulation of macroplastics and microplastics (92% of records), followed by entanglements (8%).

Most of the records are located in the Western Mediterranean region (92%), followed by the Ionian Sea with 8% of the data. 92% of the records are registered outside marine protected areas.



Species reported: Blackmouth catshark, Blue shark, Brown Skate, Portuguese dogfish, Small Spotted Catshark, Thornback Skate.

Figure 8. Summary of MedBioLitter v.8 data on chondrichthyan species.

Commercial scombrid fishes

4 SPECIES 8 RECORDS

Scombrids includes many of the most important and familiar commercial fishes. In the Mediterranean 4 species were identified presenting impacts related to marine litter. One of these species, the Bluefin tuna, is classified as endangered by the Mediterranean assessment of the IUCN Red List. The source of impact reported for this species group is the ingestion and accumulation of microplastics (figure 9). Romeo et al. 2015 reported these impacts as causing reproductive alteration in swordfish and bluefin tuna in the Mediterranean Sea. Being commercially important species, questions arise about the risk these impacts on human health upon their consumption.

The collected records focus on the Western Mediterranean, counting 76% of the available data. The rest is divided between the Adriatic and Ionian Seas with 12% of the records each. All the reported impacts in the assessment for this species group were registered outside marine protected areas.

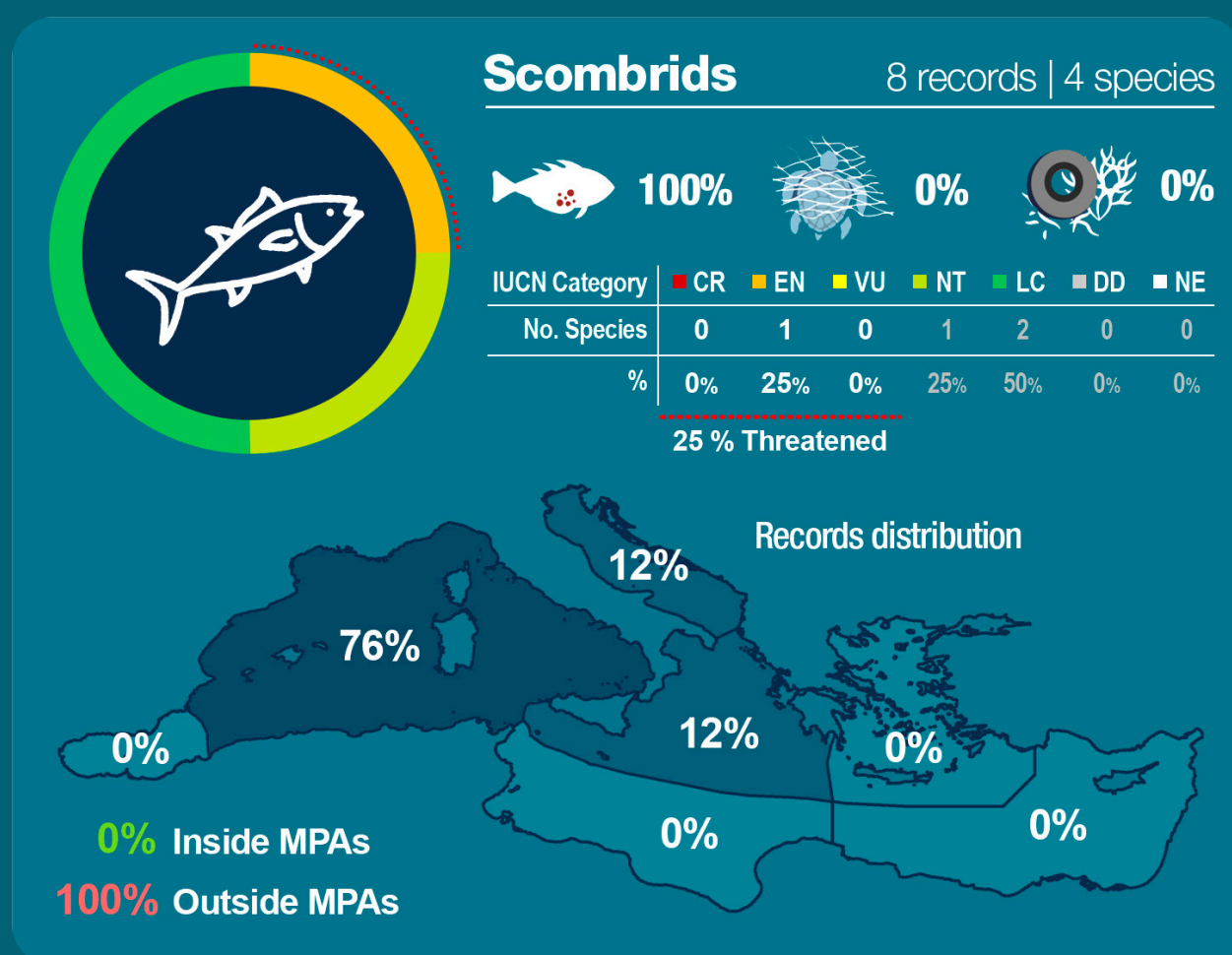


Figure 9. Summary of MedBioLitter v.8 data on sea turtles species.



Connecting marine litter and biodiversity occurrences

Figure 10 highlights registered marine litter impacts on highly mobile species assessed, by MedBioLitter, and the estimated concentration of floating debris during summer months in the Mediterranean Seas, a result of the ACCOBAMS Survey Initiative (ASI) survey (Lambert et al., 2020). This comparability study between both results confirms that while the estimated presence probability of floating mega-debris is high across the Mediterranean basin, the peer reviewed research effort on marine litter interactions with mammal species is irregular and scattered along the Mediterranean, with predominant results in the EU side of the Mediterranean basin.

It is observed that the main hotspots located in the western and central part of the Mediterranean Sea present a lack of knowledge for this species group. Of the observed high-pressure areas, the Adriatic region is the best represented based on its smaller size. The Western Mediterranean would be the most worrying considering the high presence of cetaceans in the region, presenting very few records for mammals. The eastern part of the Mediterranean region shows a lower pressure for floating debris but is the one that shows a greater abundance of data for mammals, mainly in the Aegean Sea.

Based on this comparison, it becomes clear that a greater scientific effort is needed in the Western Mediterranean, Ionian Sea and the Tunisian Plateau/Gulf of Sidra region in

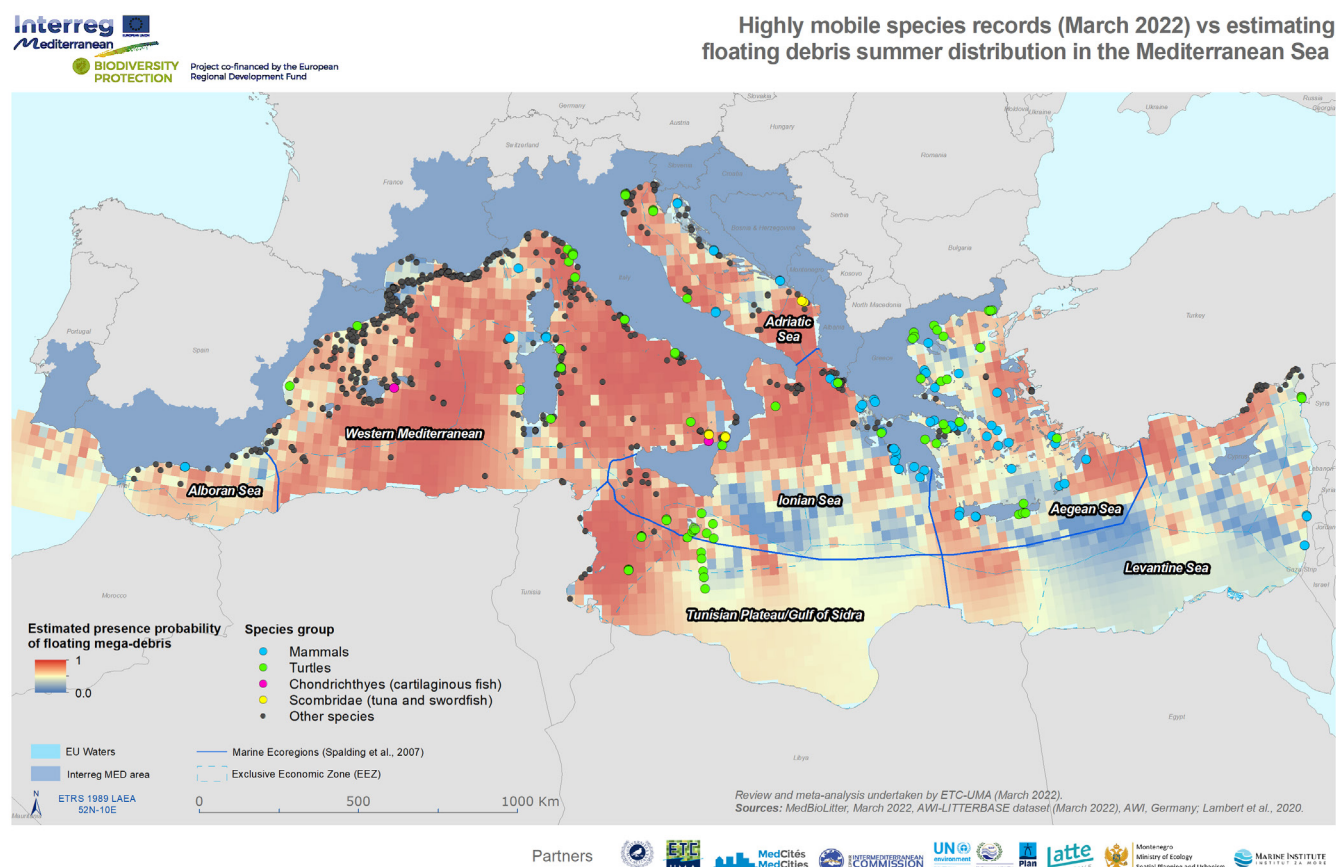


Figure 10. This map highlights registered impacts between highly mobile species and marine litter along the estimated concentration of floating debris during summer (based on MedBioLitter v.8 and Lambert et al., 2020).

order to have a more complete vision of the impact of marine litter on mammals across the whole basin. These efforts should be prioritized in the main areas where these species live and in those marine protected areas (MPAs) relevant to them.

Registered turtle encounters with marine litter occur mainly along the Mediterranean coast and on the beach, where the species breed. Hotspots are better represented by MedBioLitter data than in the case of mammals, with many impacts recorded in high marine litter concentration areas of the Western Mediterranean, Adriatic and Ionian Sea, and the Tunisian Plateau/Gulf of Sidra region.

Reported impacts for cartilaginous fishes, tuna species and swordfish are located in the Western Mediterranean and Adriatic Sea. Although these are marine litter high-density areas, the low number of records is not very representative of the total impact of marine litter in the region as they are located in specific points of the Balearic Islands, the Strait of Messina and the coast of Montenegro.

The implications of these findings on the potential impacts of microplastics on humans who consume large pelagic fish or even smaller fish containing microplastics are not yet fully understood. Government, academic, and independent sources interviewed in a recent article (Seltenrich, 2015) on the topic of seafood safety almost unanimously expressed a mix of scepticism and concern toward the thought of ocean plastics posing a human health risk. Without exception, they also advocated for further research. For this reason, linked to the high consumption of these species in the Mediterranean scale, this topic requires deeper investigation in the future.





Photo by: Bart Lukasik / Ocean Image Bank

Main recommendations

1

To scientists

Coordinated and consistent research publicly available is needed at local, country and regional levels, across the public, science and private sectors to tackle marine litter at Mediterranean level.

2

To territorial actors and decision makers

Measures to understand, prevent and mitigate the impacts of marine litter start in land and should continue at sea.

3

To conservationists and public authority planners

Priority areas for marine biodiversity protection should build on evidence taking as a basis marine litter hotspot areas and mobile species distribution.

4

To citizens

Prevent waste to prevent its impacts on the sea and its biodiversity.

Resources and references

The [ACCOBAMS Aerial Survey Initiative \(ASI\)](#) is a several-million euros project, developed and implemented by the Permanent Secretariat of the Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS), which also ensures the overall coordination of the project, with the support of a Project Steering Committee composed of the Regional Activity Center for Specially Protected Areas (UNEP/MAP/SPA-RAC), the IUCN Centre for Mediterranean Cooperation, the French Agency for Biodiversity, the Italian Institute for Environmental Protection and Research and the PELAGIS Observatory of the University of La Rochelle in France.

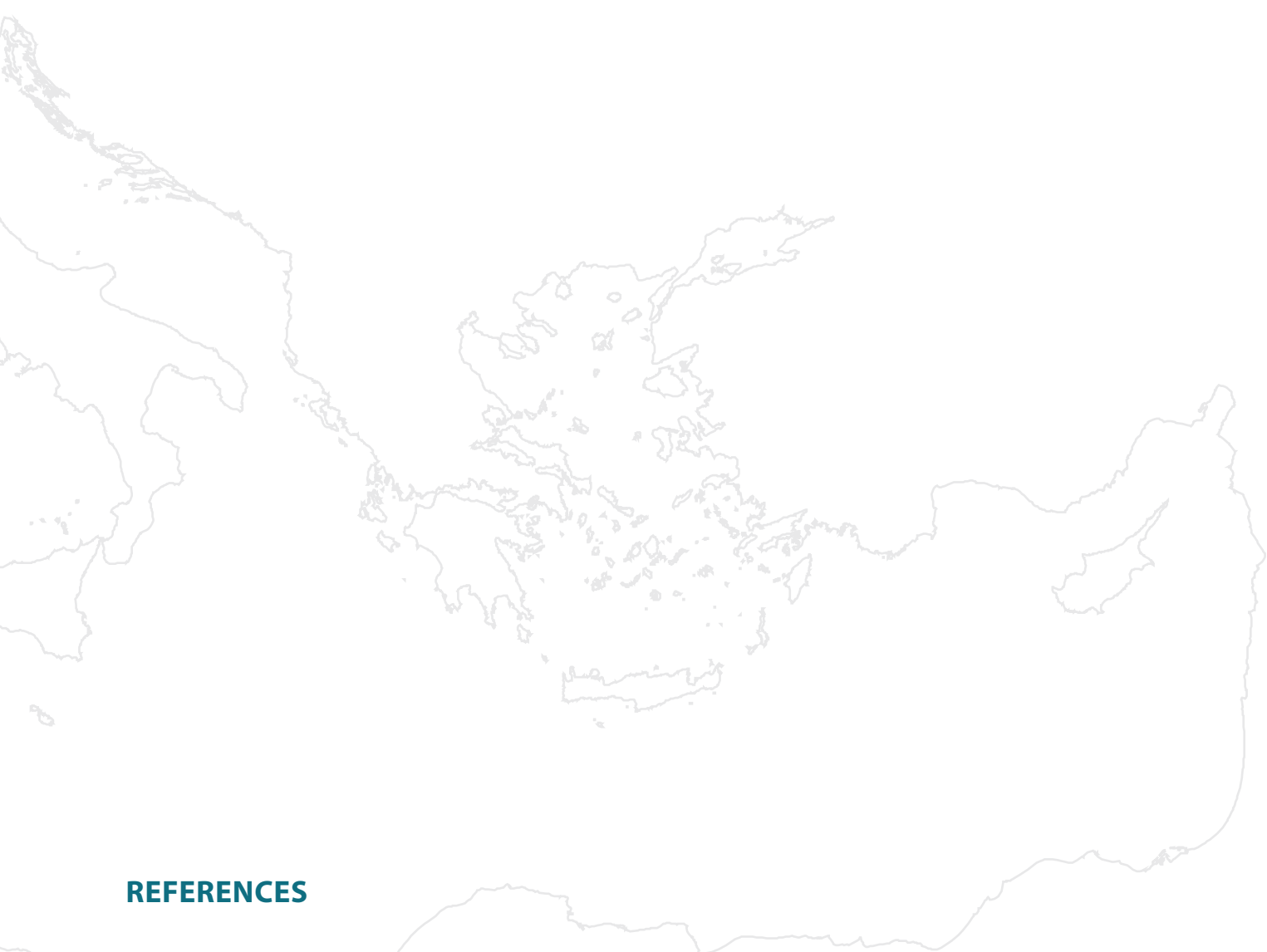
Previous [MBPC report on marine litter](#): Mediterranean biodiversity and marine litter: an interaction knowledge base, Interreg Med Biodiversity Protection project, 2019.

[MedBioLitter section](#) on the Mediterranean Biodiversity Protection Knowledge Platform website.

MedBioLitter Interactive Viewer

An online viewer where you can explore the latest MedBioLitter data and easily extract the information you need using the available interactive filters.





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THE MEDITERRANEAN BIODIVERSITY PROTECTION COMMUNITY

A collaborative Mediterranean community representing around 300 institutions are bringing together their work to identify the most effective mechanisms to manage and protect Mediterranean biodiversity.

The results of seventeen projects (ACT4LITTER, AMARE, AMARE+, CONFISH, ECOSUSTAIN, FISHMPABLUE2, FISHMPABLUE+, MEDSEALITTER, MPA-ADAPT, MPA-ENGAGE, MPA NETWORKS, PHAROS4MPAs, PLASTICBUSTERSMPA, POSBEMED, POSBEMED2, TUNE UP, WETNET) are being streamlined by the Mediterranean Biodiversity Protection Community to offer holistic solutions that bridge science, practice and policy to priority environmental challenges through an action roadmap implemented by several working groups.

This report is second in a series started by PANACeA in the framework of Working Group 1 focusing on protected areas and biodiversity management, led by ETC-UMA and MedCities.

The overall aim of the Mediterranean Biodiversity Protection Community, the second phase to PANACeA, is to increase the current understanding, knowledge and awareness of multiple environmental threats and promote best practices and Ecosystem-based Management tools as a response to address cumulative pressures and impacts affecting protected areas and functional ecosystem units in the Mediterranean.



Project co-financed by the European Regional Development Fund



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<https://biodiversity-protection.interreg-med.eu>



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MedBioLitter