COastal Management and MOnitoring Network

for tackling marine litter in Mediterranean sea

Activity 3.1.4

Data fine-tuning and studies delivery

dies

PREPARED BY

ENI CBC MED
COMMON project

Introduction

The COMMON project

Central to the idea of preserving the Mediterranean coastal zones is the ecosystem approach applied through Integrated Coastal Zone Management (ICZM), a process that takes into account the complex set of interactions of different drivers and competes for environmental, economic, social, cultural and recreational objectives that can affect ecosystems. Integrated Coastal Zone Management (ICZM) is a dynamic, multi-disciplinary process to promote sustainable management of coastal zones. Moreover, the Marine Strategy Framework Directive considers marine litter as one of the main causes of pollution of the sea and is largely proven that Marine litter is a global threat to living marine organisms and for coastal development (e.g., tourism). Given the nature of marine environments - not isolated from the surrounding context - problems linked to the sea can only be approached at the basin level and with multi-institutional and multi-stakeholder approach. The COMMON project aims at applying the ICZM principles to the marine litter management, improving the environmental performance of 5 pilot coastal areas in Italy (2), Tunisia (2) and Lebanon (1), testing a model that could be transferred to the whole Mediterranean area. Thanks to an improved knowledge of the marine litter phenomenon, specific training and capacity-building activities addressed to local and regional authorities, MPAs, Turtles Rescue Centres and citizens, thematic awareness campaign and material, and targeted networking activities at basin level, COMMON project will engage local communities in incorporating marine litter management and disposal in coastal planning with the ICZM approach. The project specific objective is to enhance the capacity of public authorities in the 5 selected areas to plan for sustainable management, use and monitoring of marine litter sources, treatment, and consequences, employing an effective participatory approach involving relevant stakeholders and local communities.

Abstract

The scientific monitoring activities of the project were primarily focused on analyses of macrolitter and microlitter in various key compartments, including beaches, the sea surface, and the ingestion by mussels, commercially valuable fish species, and sea turtles. These investigations were carried out in five distinct pilot study areas, aiming to comprehensively assess the presence and impact of litter at different levels within the marine ecosystem.

The **beach litter** monitoring activities involved three countries, five study areas, and eleven surveyed beaches. Plastic constitutes 80% of the marine litter found in the marine and coastal environment. The monitoring activities were carried out throughout the four seasons (autumn, winter, spring, and summer) using a standardized methodology and protocols derived from the Interreg Med Plastic Busters MPAs project. Over **90,000 items** were collected and analyzed, with approximately 17,000 (around 20%) being cigarette butts, followed by plastic fragments ranging from 2.5 to 50 centimeters (9%), resulting from the breakdown of larger plastic objects, and 6,000 (about 7%) cotton bud sticks. More than half of the collected litter (53%) comprised single-use plastics (SUPs).

In terms of investigating **microlitter in the water column**, **130 samples** were obtained from three countries and five different areas using the manta net. A total of **22,793 items** were isolated and characterized. The highest abundance of floating microlitter was observed in the waters facing the Tyre Reserve in Lebanon, particularly during the rainy season, indicating the significant impact of river runoff on the transport of marine litter and microplastics in the sea.

The data obtained during the project corroborate the harmful effects of marine litter and microplastics on Mediterranean biodiversity. This impact extends beyond physical harm to marine species and encompasses the potential ecotoxicological consequences associated with the release of toxic compounds present in plastic particles, including additives and absorbed contaminants.

The gastrointestinal tracts of more than **700 specimens** from six commercially important **fish species** were analyzed: *Engraulis encrasicolus* (anchovy), *Sardina pilchardus* (sardine), *Sardinella aurita* (round sardinella), *Boops boops* (bogue), *Mullus barbatus* (red mullet), and *Lythognathus mormirus* (striped seabream). On average, one-third of the analyzed specimens were found to have ingested microplastics, further substantiating the impact of marine litter on fish species in the Mediterranean Sea (Fig.3). Notably, certain species examined in the project, such as *Mullus barbatus* and *Sardina pilchardus*, were analyzed across all pilot areas, enabling these sentinel organisms to serve as indicators of environmental health and facilitate proper data comparison among different regions.

HARMONIZED MONITORING ACTIVITIES AT BASIN SCALE

WP3 - Improving knowledge of litter sources and impact on marine ecosystems in 5 pilot coastal areas.

The project's scientific monitoring activities were focused on the analysis of macrolitter and microlitter on the beaches, on the sea surface, and ingested by mussels, commercially fish species, and sea turtles in five study areas.

- ✓ The overall objective of this WP is to improve knowledge of ML sources and impact on Mediterranean marine ecosystems focusing in 5 pilot coastal areas: **Tyre (Lebanon), Maremma and Northern Puglia (Italy) and Kuriat Island and Monastir (Tunisia).**
- ✓ The activities of this WP will contribute to **maintain biodiversity** and preserve natural ecosystems in coastal areas, to monitor the source and **impact of ML on fish species** of commercial interest by defining and implementing a harmonized approach against ML.
- ✓ The main outcomes of this WP will facilitate the **identification of ML sources** in order to design effective **mitigation actions** in the 5 pilot coastal areas (activities of WP4 and 5).

BEACH LITTER
- Macro and micro litter

FLOATING LITTER
- Macro
- Micro

FISH SPECIES
- MPs ingestion
- Plastic additives
- Biomarker responses

Beach litter monitoring

The beach litter monitoring activities involved 3 countries with 5 study area and 11 beaches surveyed. **Plastic accounts for 80% of the marine litter dispersed in the marine and coastal environment** (Fig.1A). The monitoring activities were conducted in the 4 seasons (autumn, winter, spring and summer) using the harmonized methodology and protocols capitalized from Interreg Med Plastic Busters MPAs project. More than 90,000 objects were collected and analyzed: **17,000 (about 20%) were cigarette butts**, followed by **pieces of plastic with size between 2.5 and 50 centimeters (9%)**, derived from the result of the fragmentation of larger plastic objects, and 6,000 (about 7%) cotton bud sticks. **More than half of the litter collected (53%) is represented by single-use plastic (SUPs)** (Fig.1B).

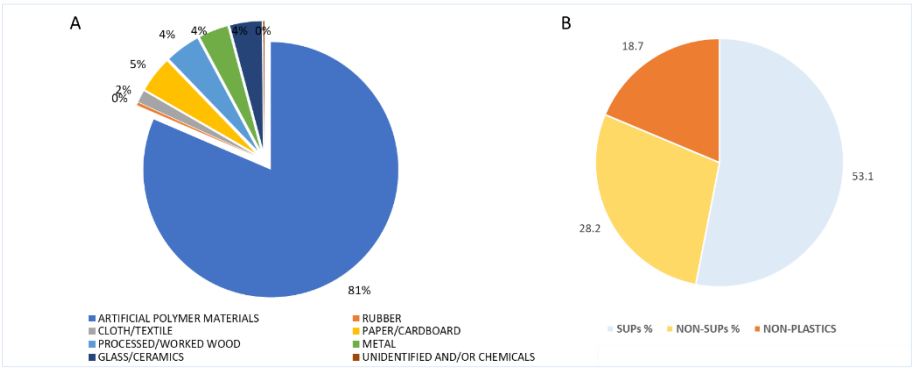
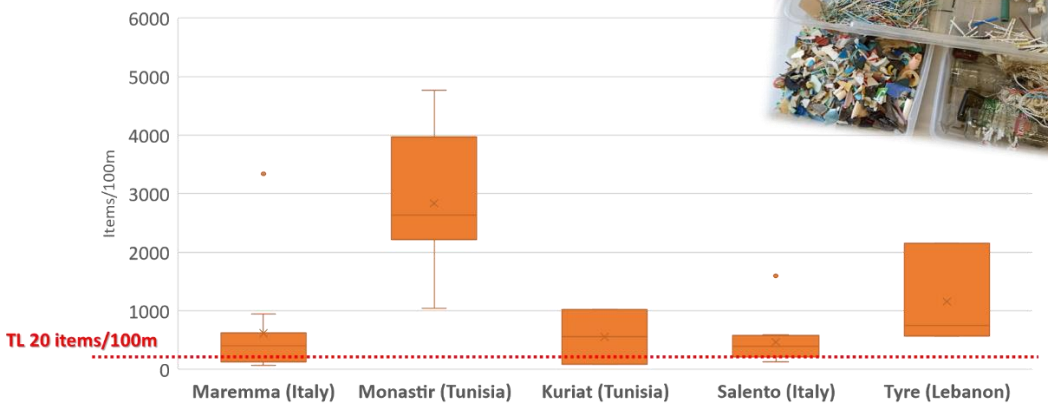
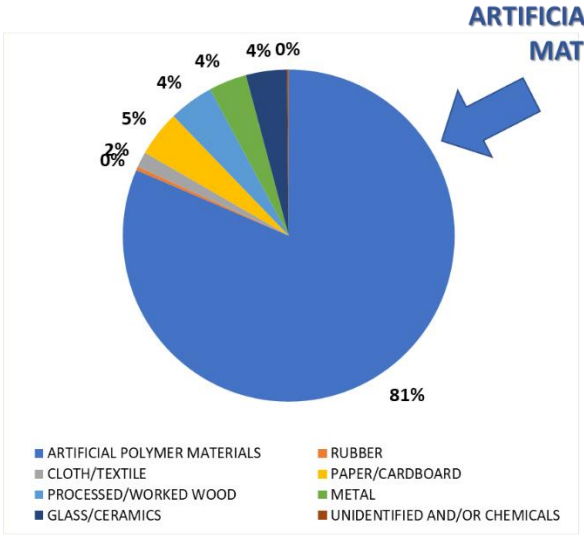
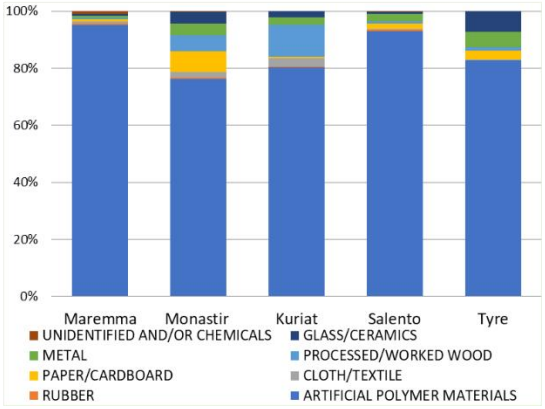


Fig.1 (A) Percentage of different categories of marine litter isolated from beach litter sampling in the 5 study areas and (B) percentage of Single Use Plastic (SUP).

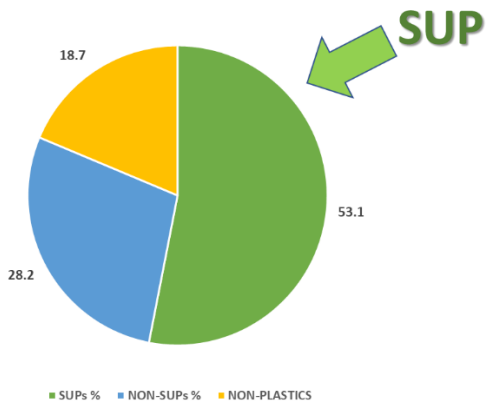
Beach litter monitoring

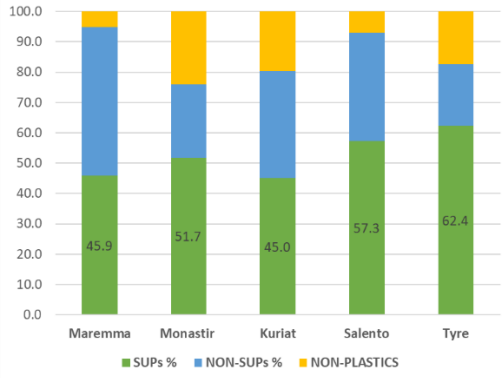




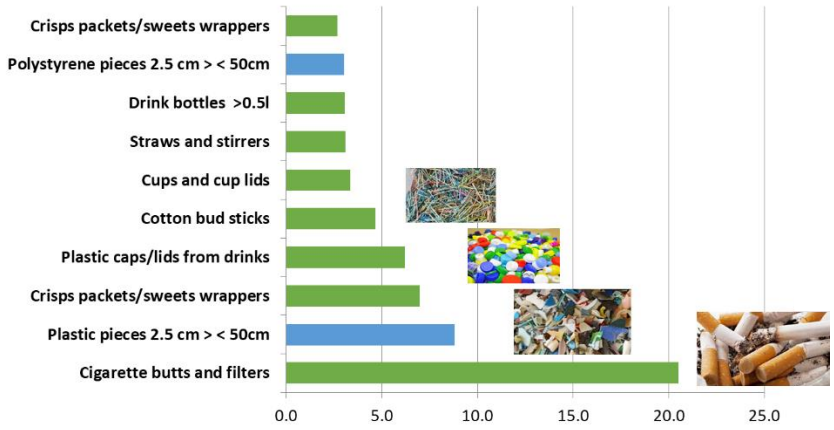


Beach litter composition

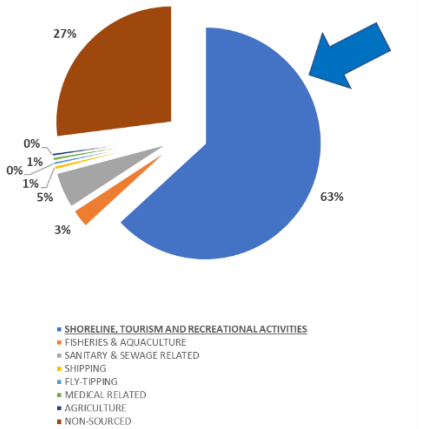


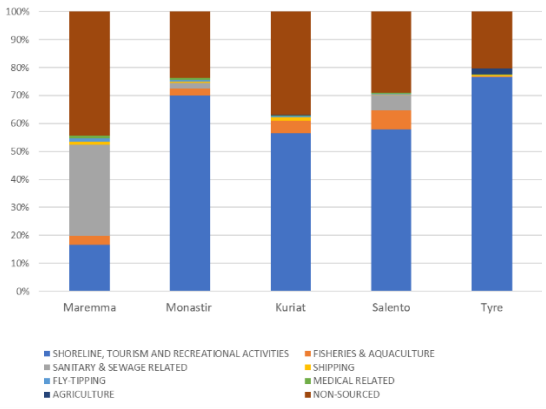


8 items out of 10 are Single Use Plastic



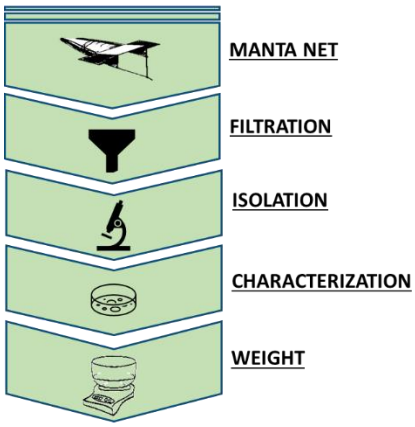
SHORLINE, TURISM AND RECREATIONAL ACTIVITIES

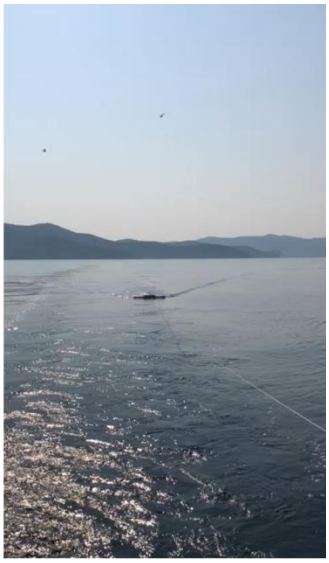




Floating microlitter monitoring

Material and Methods





Regarding the investigation of microlitter in the water column, 130 samples were collected in three countries and five different areas using the manta net. A total of 22793 items were isolated and characterized. The highest floating microlitter abundance was found in the waters facing the Tyre Reserve in Lebanon, particularly during the rainy season, demonstrating the strong influence of riverine run-off on the transport of marine litter and microplastics in the sea.

Floating microlitter monitoring

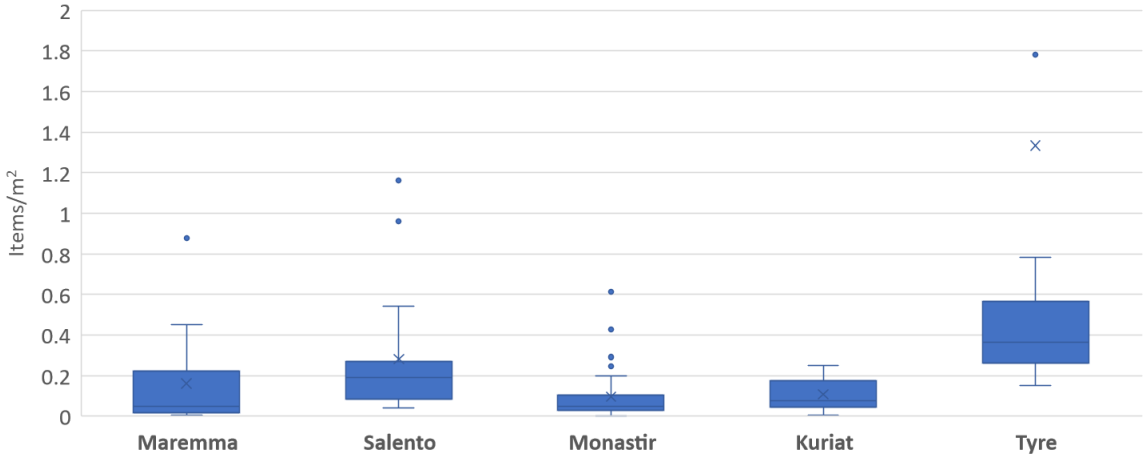
Results

3 countries involved with 5 study areas

132 manta-trawl surveys performed

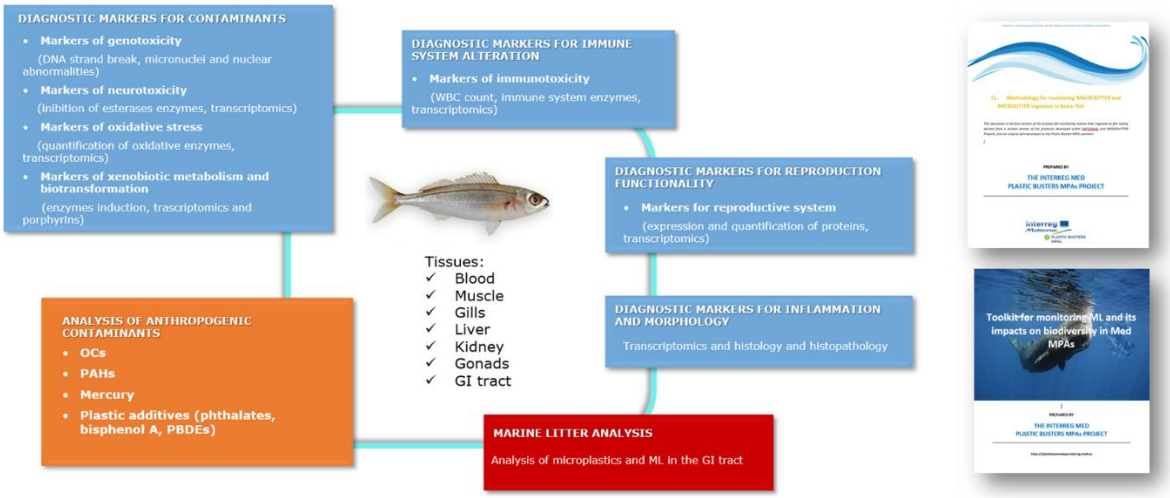
22793 items isolated

80000 m^2



Impact of marine litter on biota

The data obtained during the project confirms the impact of marine litter and microplastics on Mediterranean biodiversity, which is not only related to the physical harm to marine species but also the potential ecotoxicological effects related to the leaching of toxic compounds present in plastic particles both as additives and adsorbed contaminants.



The gastrointestinal tract of over 700 specimens of 6 commercially important fish species was analyzed: *Engraulis encrasicolus* (anchovy), *Sardina pilchardus* (sardine), *Sardinella aurita* (round sardinella), *Boops boops* (bogue), *Mullus barbatus* (red mullet), *Lythognathus mormirus* (striped seabream). On average, one-third of the specimens analyzed had ingested microplastics, confirmed the impact of marine litter on fish species in the Mediterranean Sea (Fig.3). The significant and innovative aspect of the analysis is that some of the species considered in the project (*Mullus barbatus* and *Sardina pilchardus*) were analyzed in all pilot areas, allowing these sentinel organisms to be used as indicators of the health of the environment being investigated and a proper data comparison among the different areas.

COMMON

Litter ingestion on fish species

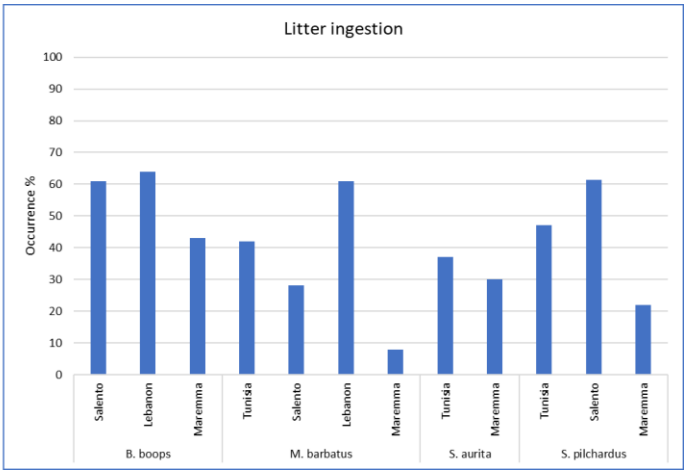
3 countries involved with 5 study areas

715 total specimens analyzed from 6 species

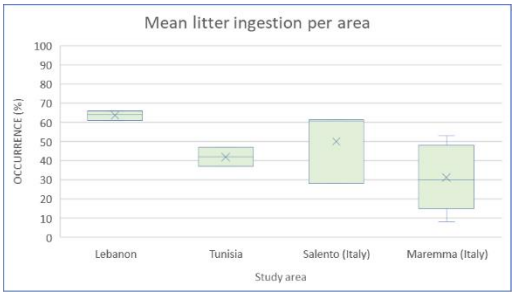
36% of fish with microplastics in the GI tract

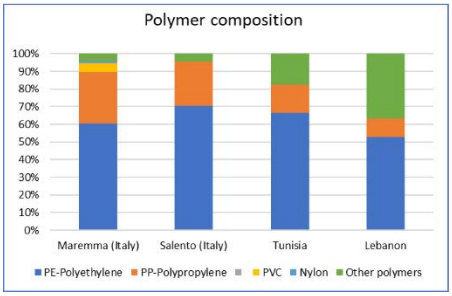
709 total microplastics characterized

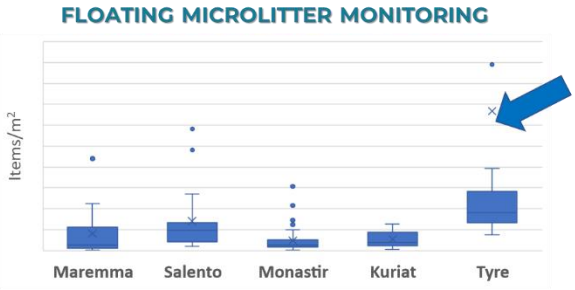
Area	Species	N°	Occurrence (%)
Monastir (Tunisia)	*M. barbatus*	40	42
	S. aurita	40	37
	S. pilchardus	40	47
Salento (Italy)	*B. boops*	69	61
	M. barbatus	64	28
	S. pilchardus	70	61
Maremma (Italy)	*E. encrasicolus*	52	53
	B. boops	49	43
	S. aurita	46	30
	S. Pilchardus	50	22
	M. barbatus	63	8
Lebanon	*M. barbatus*	30	61
	B. Boops	40	64
	L. mormyrus	20	66



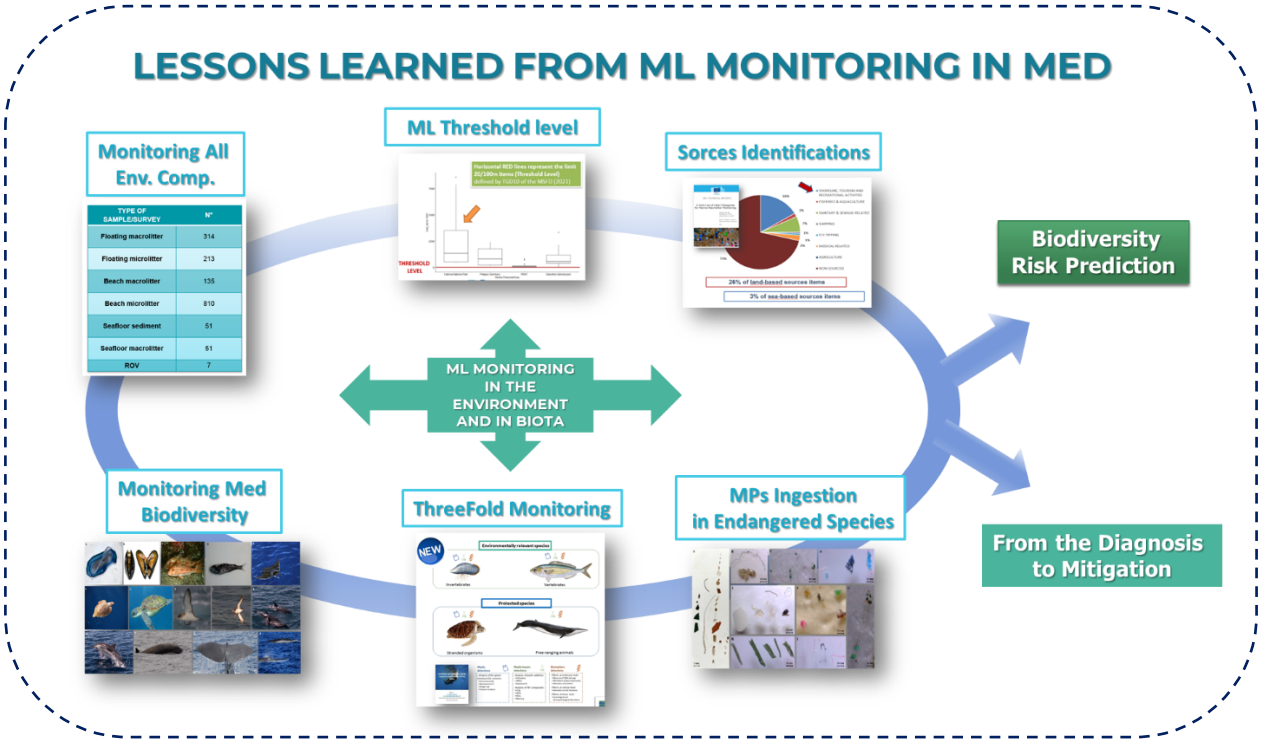
Litter ingestion on fish species







Conclusion



In conclusion, significant results have been collected regarding the presence, origin, distribution, typology, and impacts of micro and macro litter on the sea surface, beaches, and marine biota in the five study areas of the Mediterranean basin.

The integrated approach developed and applied in this project highlights the importance of applying several harmonized methodologies in each compartment to provide data on the multiple effects that can be caused by marine litter.

All the results obtained from the COMMON project highlight the impact of marine litter on the coastal marine ecosystem, contributing to:

- Expanding the knowledge base on the sources, spread, and impacts of marine litter contamination in both the abiotic and biotic components of the Mediterranean Sea.
- Emphasizing the urgency of promptly addressing the spread of marine litter contamination through adequate preventive and mitigation measures involving all relevant sectors.
- Developing and consolidating an integrated and harmonized monitoring methodology aimed at conserving and maintaining the coastal marine environment.
- Opening perspectives for implementing the same multisectoral approach in broader areas and involving other countries within the Mediterranean region.

The COMMON project stands is a unique example, within the Mediterranean basin, of the capitalization of monitoring methodologies developed in previous initiatives (such as the Interreg-Med Plastic Busters MPAs project) and their implementation through targeted diagnosis and mitigation actions, synergistically carried out on both sides of the Mediterranean.