Water and Environment Support
in the ENI Southern Neighbourhood region

Activity: WES N-E-MO-2

Training workshop on marine litter monitoring & mitigation

Marine litter in the Mediterranean: an overview of research and policy advances related to monitoring & mitigation

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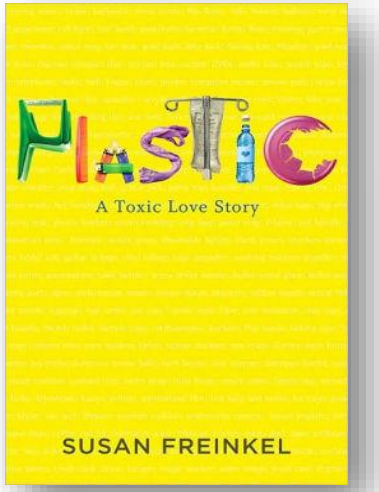
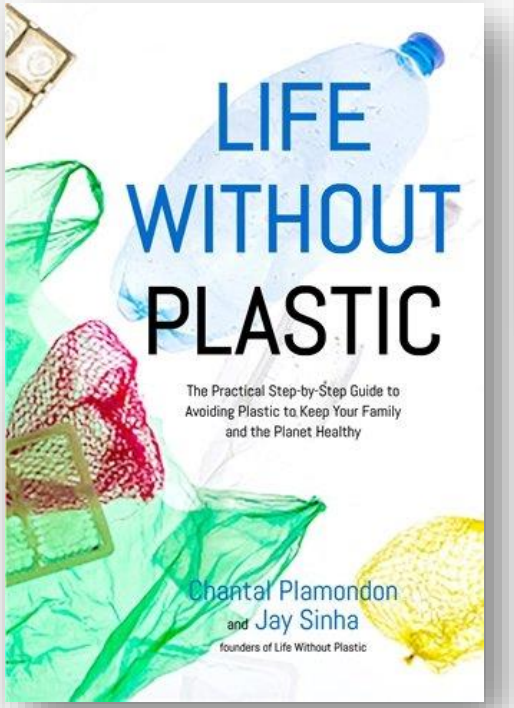
Senior MIO-ECSDE Policy & Programme Officer
WES Marine Litter Expert
Member of the MSFD Technical Group on Marine Litter
Member of the UNEP/MAP CORMON Group
WP Leader of H2020 SOS-ZEROPOL 2030

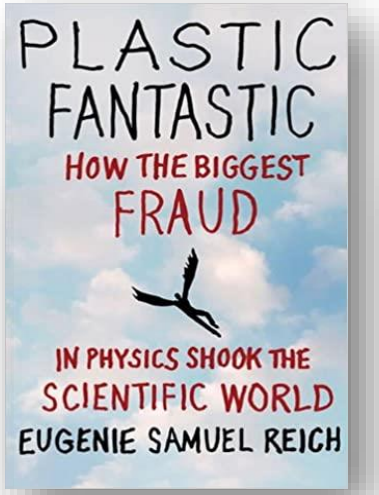
LDK CONSULTANTS S.A.

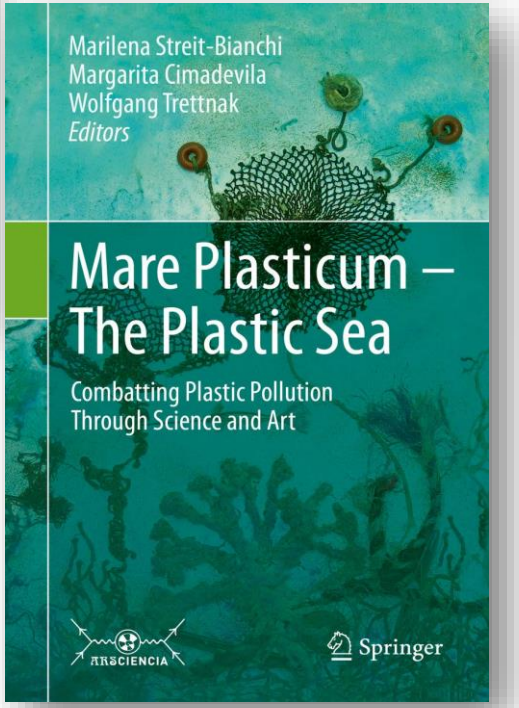
This Project is funded by the European Union

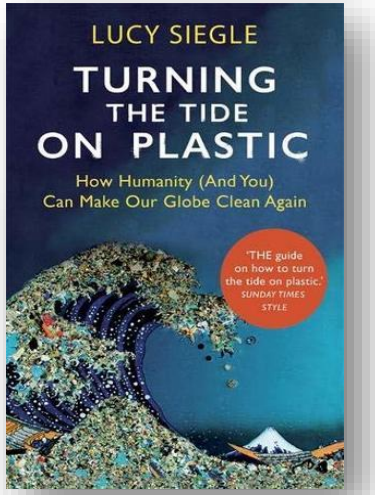
FROM THE ANTHROPOCENE TO THE PLASTOCENE…

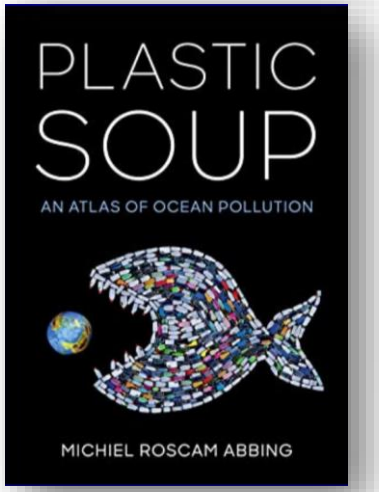


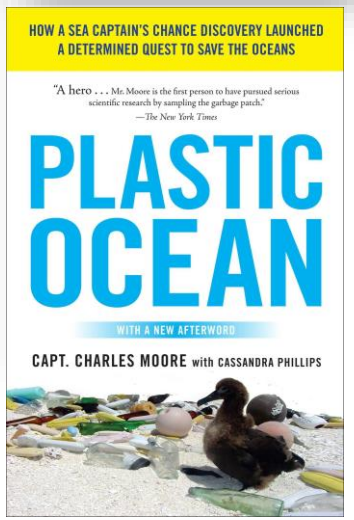




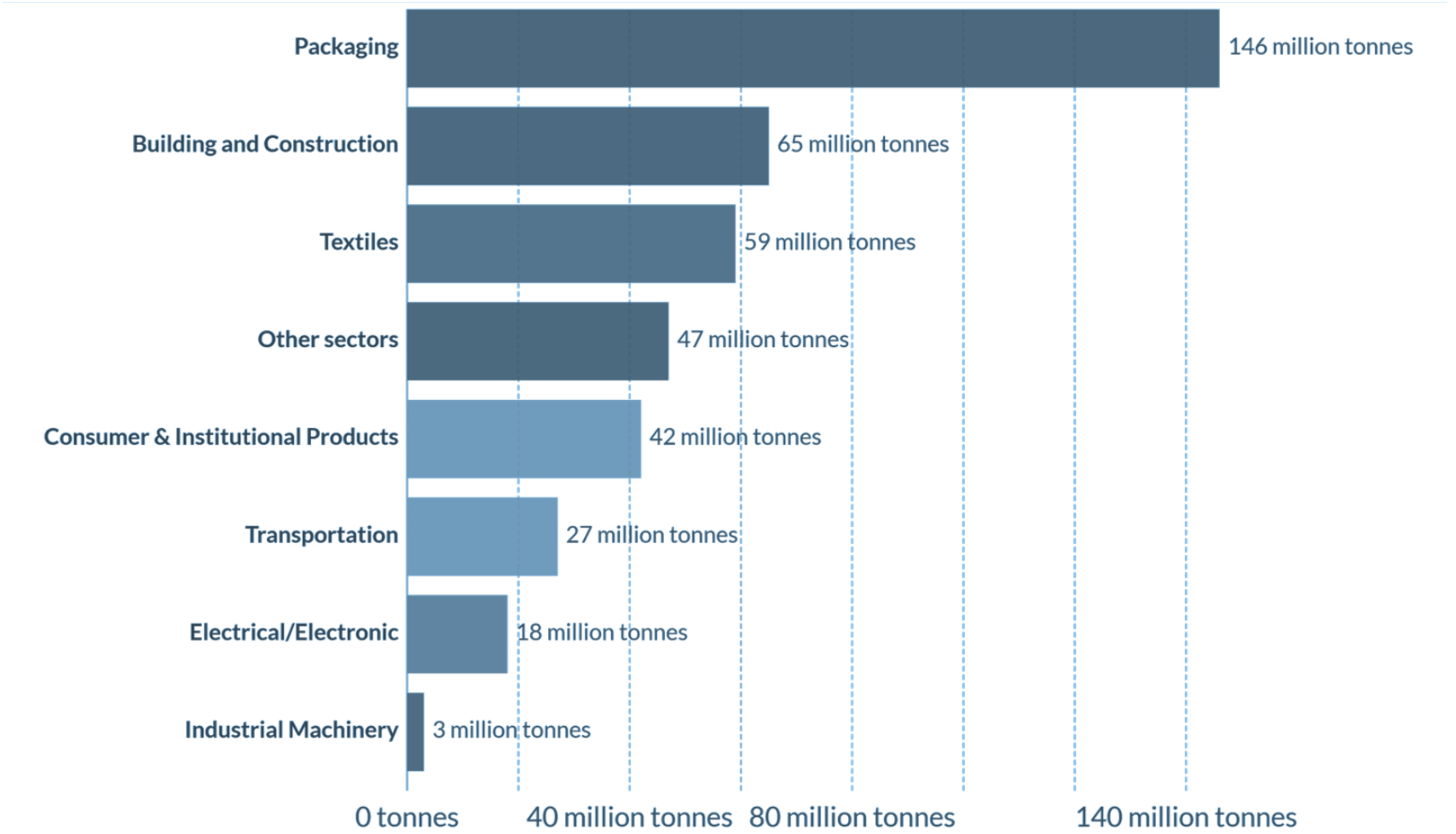








GLOBAL PLASTIC PRODUCTION BY INDUSTRIAL SECTOR



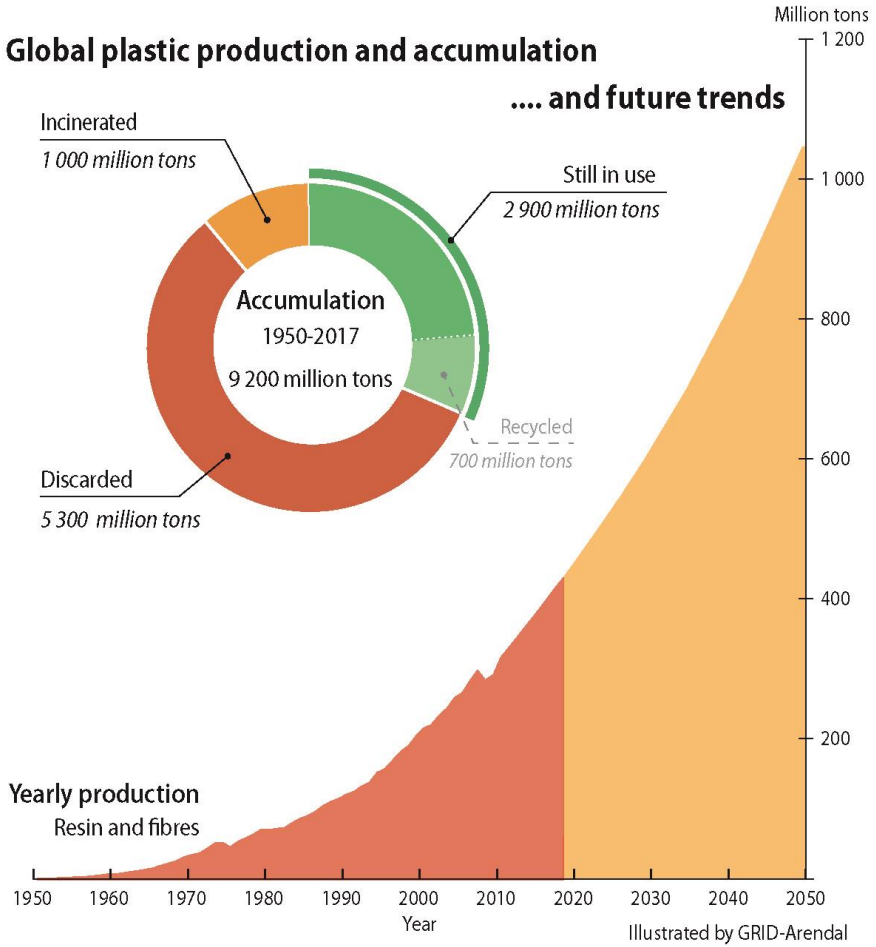
The world produces more than

400 million tons

of plastics every year

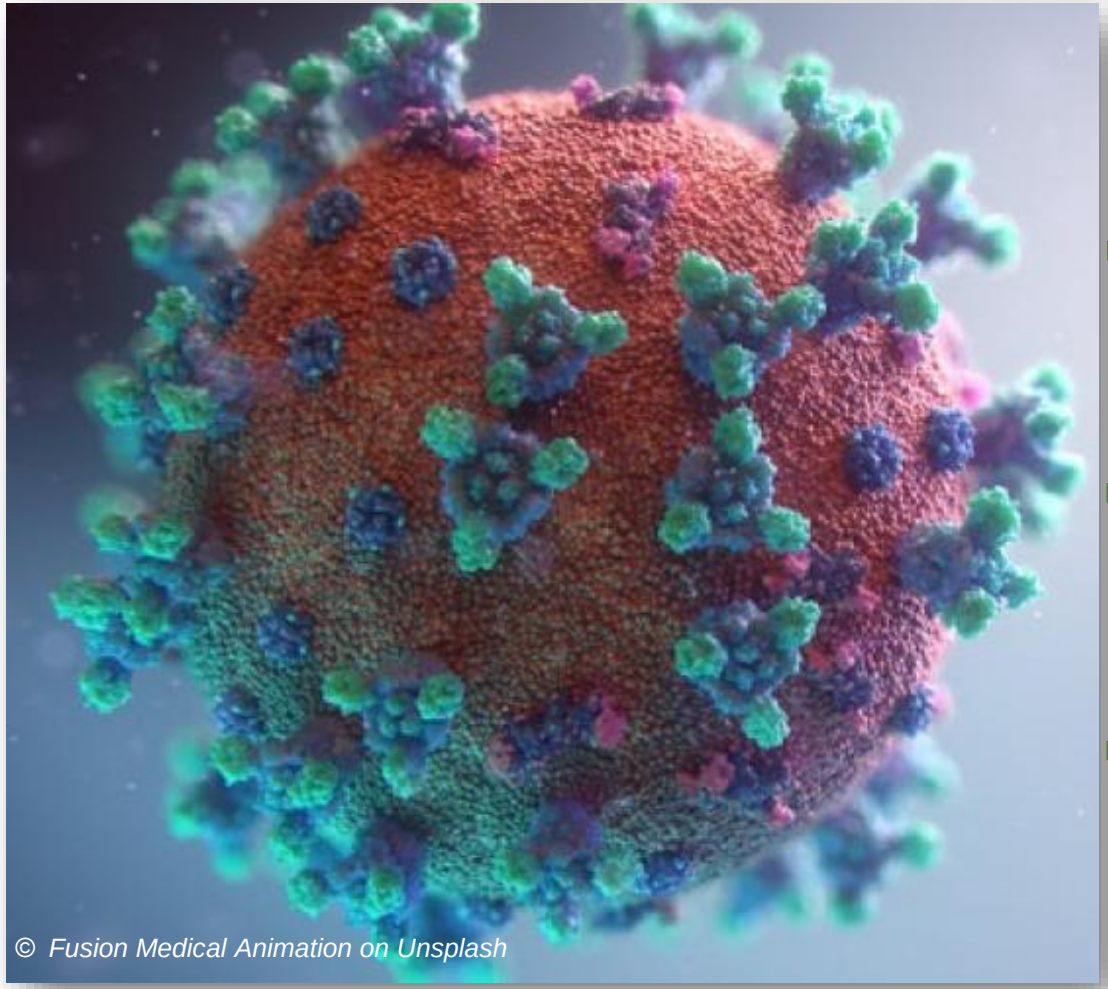
Source: Geyer, R., Jambeck, J. R., Law, K. L., 2017. Production, use, and fate of all plastics ever made. Science Advances, 3(7), e1700782.

GLOBAL PLASTIC PRODUCTION & FUTURE TRENDS



UNEP (2021). From Pollution to Solution: A global assessment of marine litter and plastic pollution. Nairobi.

IMPLICATIONS OF COVID-19 ON PLASTIC WASTE GENERATION



Plastic medical waste

Plastic personal protection equipment (PPE)

Single-use plastics (SUPs)

COVID-19 induced plastic waste generation

THE GROWING THREAT OF PLASTIC POLLUTION

Air

Water (freshwater & marine)

Land

Biota

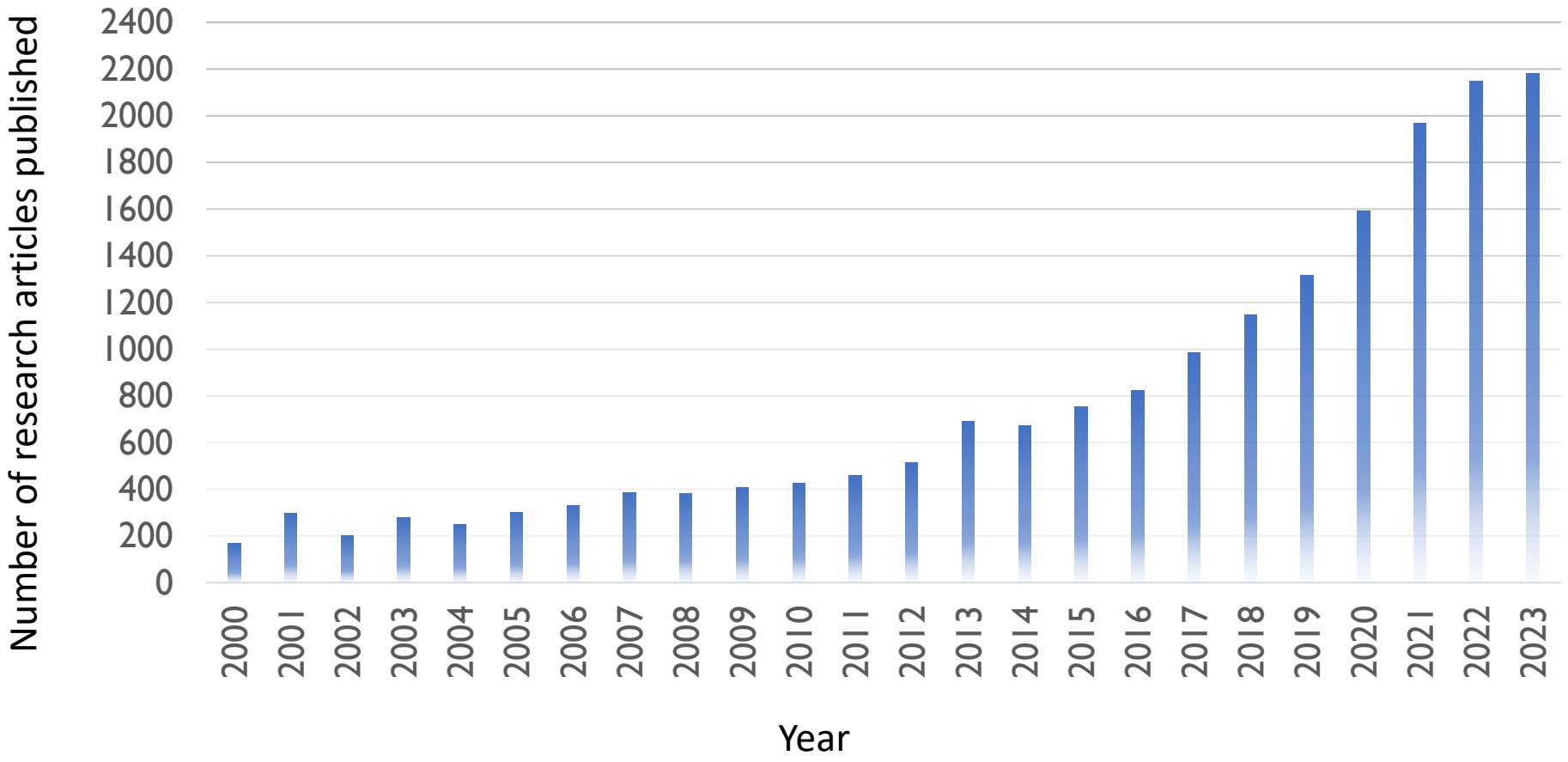
Plastics ‘leak’ into all environmental compartments from different entry points and in various size fractions inducing wide-ranging effects

MARINE PLASTIC POLLUTION AS A PLANETARY BOUNDARY THREAT

- Worldwide dispersion
- Non-reversible exposure
- Endangering global ecosystems

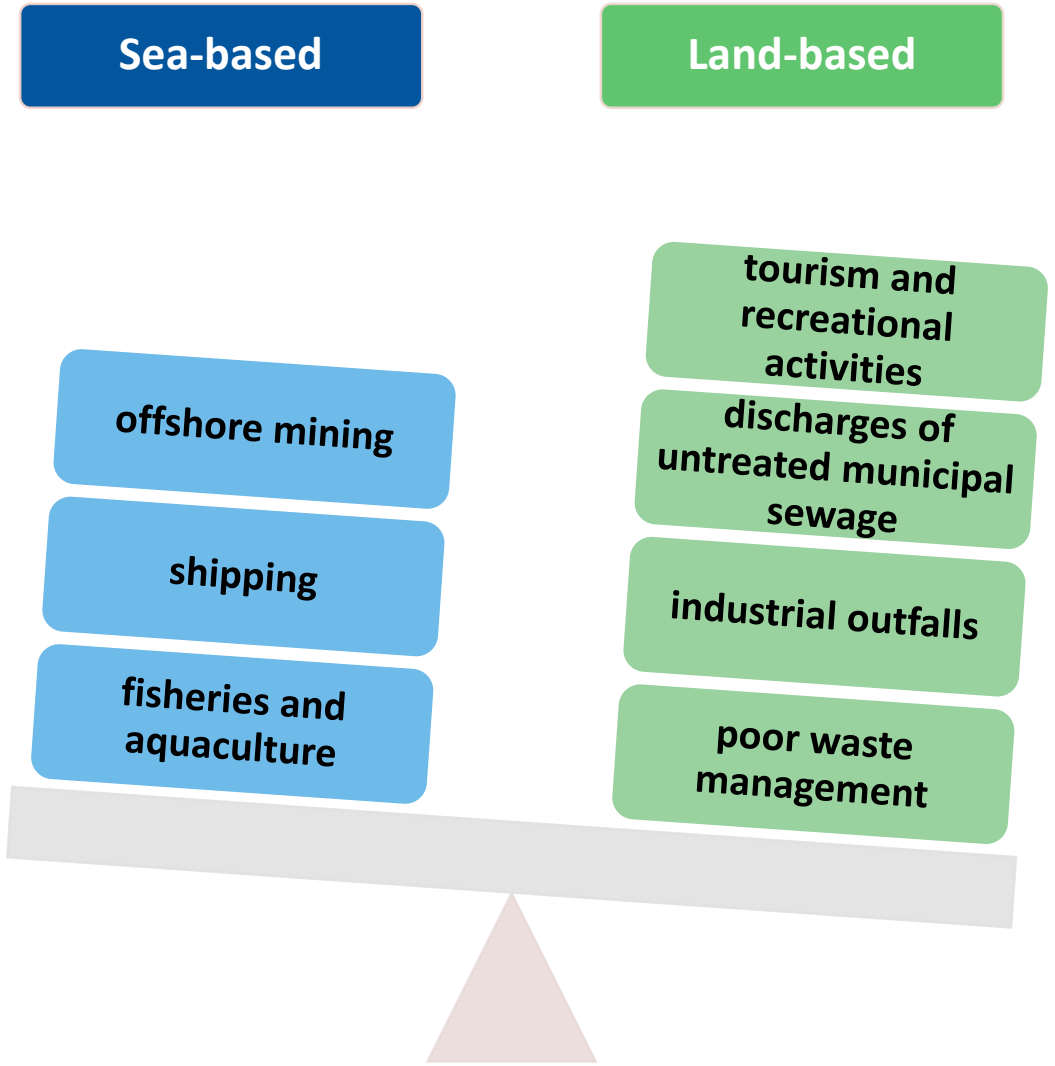
MARINE LITTER & MARINE PLASTIC POLLUTION | AN INDISPUTABLE GLOBAL THREAT THAT IS GROWING

Some 19,000 research articles have been published in the last 23 years documenting the marine litter and marine plastic pollution threat



MARINE LITTER & MARINE PLASTIC POLLUTION SOURCES | FACTS

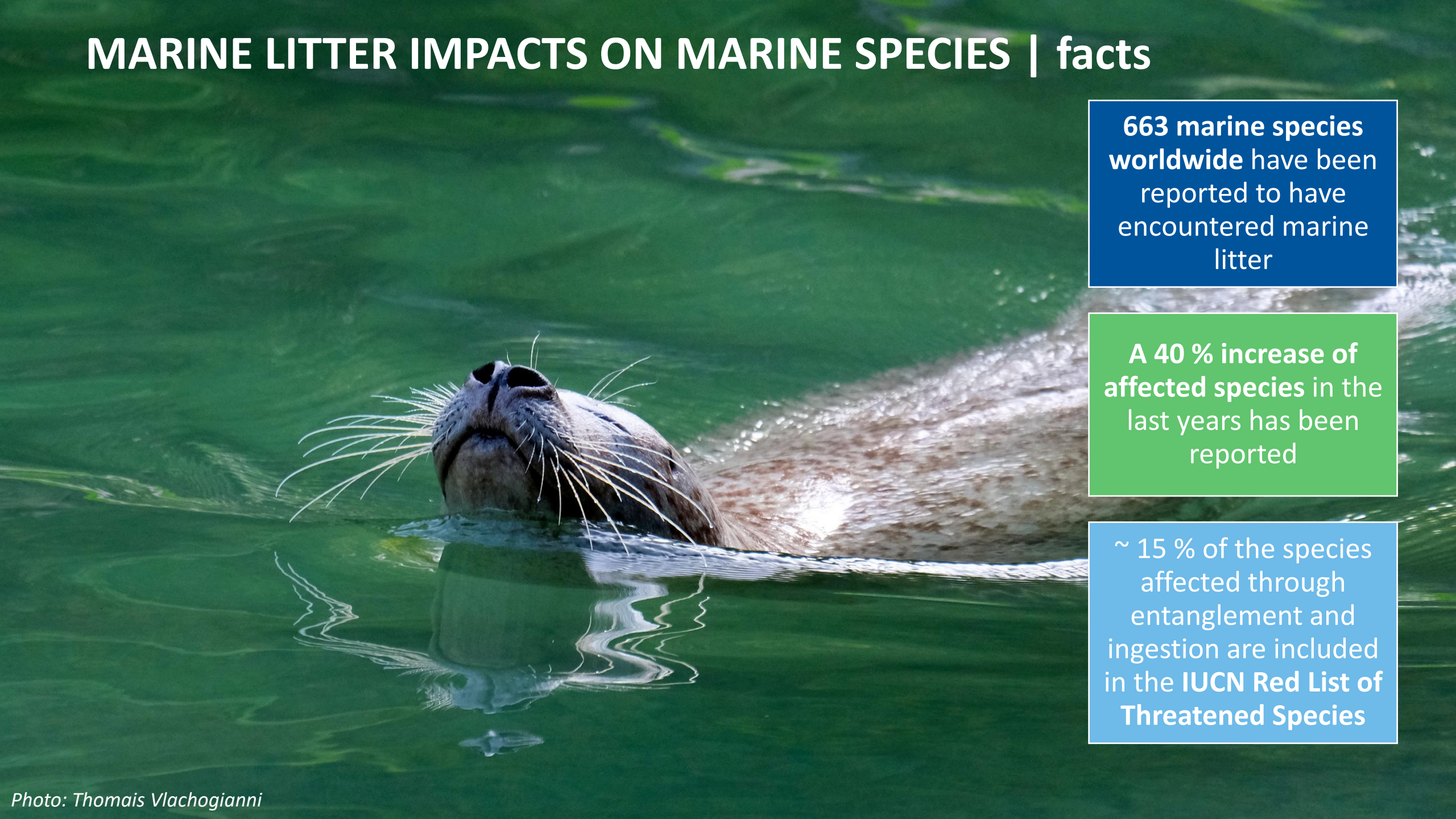
- **Assessing the relative importance of the different sources is challenging** given that a considerable percentage of litter items cannot be attributed to a specific source.
- **Beach litter research results are biased towards reflecting marine litter inputs from tourism and recreational activities** as most beach litter surveys are carried out in tourism destinations.
- **The origin (transboundary effect) of marine litter** is difficult to be determined.
- **The riverine inputs of marine litter are substantial**.



MARINE LITTER COMPOSITION | FACTS

- Plastics are ubiquitous in the coastal and marine environment accounting for some **70-90%** of all litter items found. Leakage' of plastics into the ocean can occur at all stages of the production-use-disposal cycle.
- A large amount of litter items found in the Mediterranean are **single-use plastic items**.
- **Fishing and aquaculture related items account for some 37.5%** of total items recorded in certain areas of the Mediterranean (Vlachogianni et al., 2018).
- There are **no reliable estimates of the microplastics** quantities entering the marine environment.
- **Microplastics greatly outnumber large plastic items in marine systems**. Even if all releases of plastic to the environment were to cease immediately, the number of microplastics in the ocean would be expected to continue to increase as a result of continuing fragmentation.

MARINE LITTER IMPACTS ON MARINE SPECIES | facts



663 marine species worldwide have been reported to have encountered marine litter

A 40 % increase of affected species in the last years has been reported

~ 15 % of the species affected through entanglement and ingestion are included in the **IUCN Red List of Threatened Species**

Photo: Thomais Vlachogianni

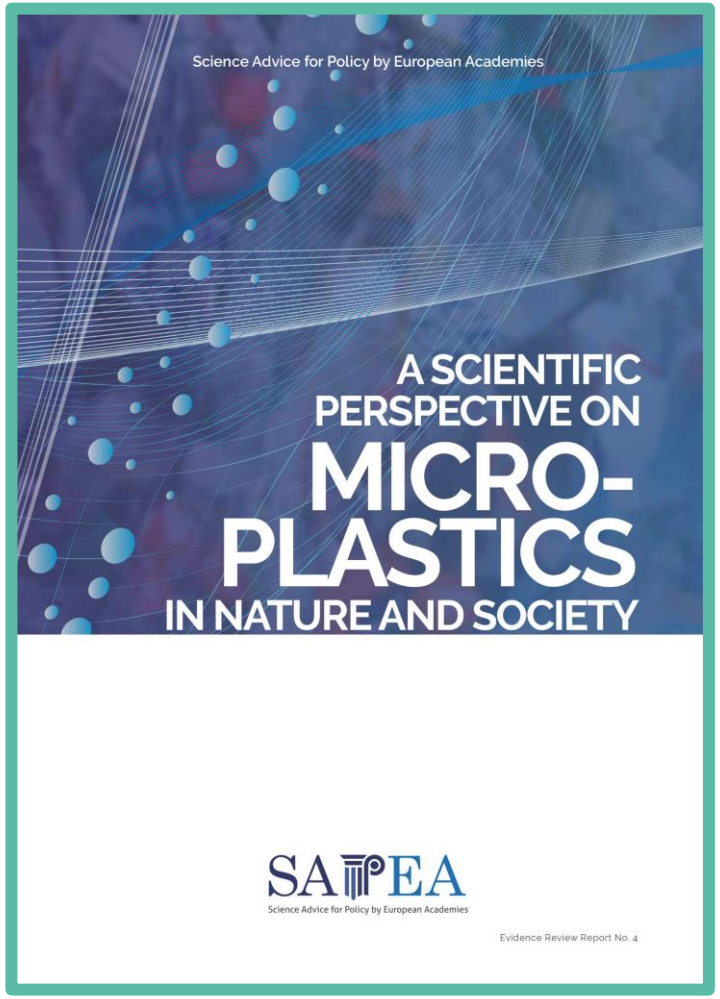
MARINE LITTER IMPACTS | FACTS

- **Uncertainties remain regarding the extent of harm caused to marine species by ingestion** of microplastics and their exposure to hazardous chemicals leaching from or adsorbed on microplastics.
- **Currently there is no evidence to support or refute potential bio-magnification** of particles or associated chemicals.
- **Basic toxicological data on the consumption of microplastics and nanoplastics by humans** for a food risk safety assessment are lacking.
- **Measuring the full economic cost of marine litter** e.g. including the inhibition of the proper functioning of marine ecosystems is not possible.

Stomach contents of sea turtles that were dissected at the Talamone Sea Turtles Rescue Centre located in south Tuscany

MICROPLASTICS – WHAT DO WE KNOW?

- A lot is already known about microplastics, and more knowledge is being acquired, but some of the evidence remains uncertain and it is by its nature, complex (for instance, differences in size, shape, chemical additives, concentrations, measurements, fates, unknowns, human factors, actions).
- There is a fair knowledge of microplastics concentrations for freshwaters and the ocean surface, but little is known about concentrations and implications of microparticles below the ocean surface.
- Most microplastics go in and out of most organisms, and as with many chemicals, 'the poison is in the dose'. Most effect studies are performed using concentrations that are much higher than those currently reported in the environment, or using very small microplastics for which limited exposure data exists, or using spherical ones which are not representative of real-world types of particles, or using relatively short exposure times. Currently, it is not known to what extent these conditions apply to the natural environment. This limits the reliability of the risk assessments.



HUMAN HEALTH IMPACTS OF PLASTICS

Water and Environment Support
in the ENI Southern Neighbourhood region

Humans are exposed to a large variety plastics (micro, nano) through inhalation, ingestion, and direct skin contact, all along the plastic lifecycle

Basic toxicological data on the consumption of microplastics and nanoplastics by humans for a food risk safety assessment are lacking

PLASTICS & CLIMATE CHANGE

Water and Environment Support
in the ENI Southern Neighbourhood region

- Plastic contributes to greenhouse gas emissions at every stage of its lifecycle, from its production to its refining and the way it is managed as a waste product.
- According to the 2019 CIEL report "Plastic & Climate: The Hidden Costs of a Plastic Planet" by 2050, the greenhouse gas emissions from plastic could reach over 56 gigatons—10-13 percent of the entire remaining carbon budget.

KEY MEDITERRANEAN PROJECTS COMBATING MARINE PLASTIC POLLUTION

MARINE LITTER MED, IMAP/MPA, ECAP

SEIS

WES

SWIM-H2020 SM

ACT4LITER

AMARE

INDICIT I & II

IPA-ADRIATIC DEFISHGEAR

LIFE+

SMILE, AMMOS, GHOST ,DEBAG, MERMAIDS

MED SEALITTER

PLASTIC BUSTERS MPAS

FP7 CLEANSEA

FP7 MARLISCO

FP7 PERSEUS

HORIZON 2020 SOS-ZEROPOL 2030

MED BLUEISLANDS

PLASTIC BUSTERS CAP

HORIZON 2020 BLUEMED COORDINATION AND SUPPORT ACTION

Mediterranean Sea basin lighthouse - actions to prevent, minimise and remediate litter and plastic pollution

MELTEMI

COMMON

marGnet

BLUEMED

PLASTIC BUSTERS CAP

CUTTING EDGE MEDITERRANEAN PROJECTS ON MARINE & RIVERINE LITTER

The 4-year SOS-ZEROPOL2030 project (budget: 3,000,000 euros) funded by the EU's Horizon 2020 scheme, focuses on 4 pollutant types, one of which is plastic pollution. One of the cutting edge aspects of the project is it case study pollutant: Tire Wear Particles.

The 3-year ADRION project (budget: 1,700,000 euros) focuses on enhancing cross-border cooperation for riverine plastic litter reduction in the Adriatic and Ionian Seas. It entails monitoring and participatory science actions as well as riverine plastic litter prevention, reduction and restoration activities.

TETHYS4ADRION

Photo©Thomais Vlachogianni

THE UfM LABELLED PLASTIC BUSTERS

HARMONIZED MONITORING

SETTING UP A JOINT GOVERNANCE PLAN

DIAGNOSING THE IMPACTS

BUILDING CAPACITIES AND TRANSFERRING KNOWLEDGE

IDENTIFYING MARINE LITTER HOTSPOTS

SHOWCASING PREVENTION & MITIGATION MEASURES

Union for the Mediterranean
Union pour la Méditerranée
الاتحاد من أجل المتوسط

Interreg Mediterranean
EUROPEAN UNION
PLASTIC BUSTERS MPAs

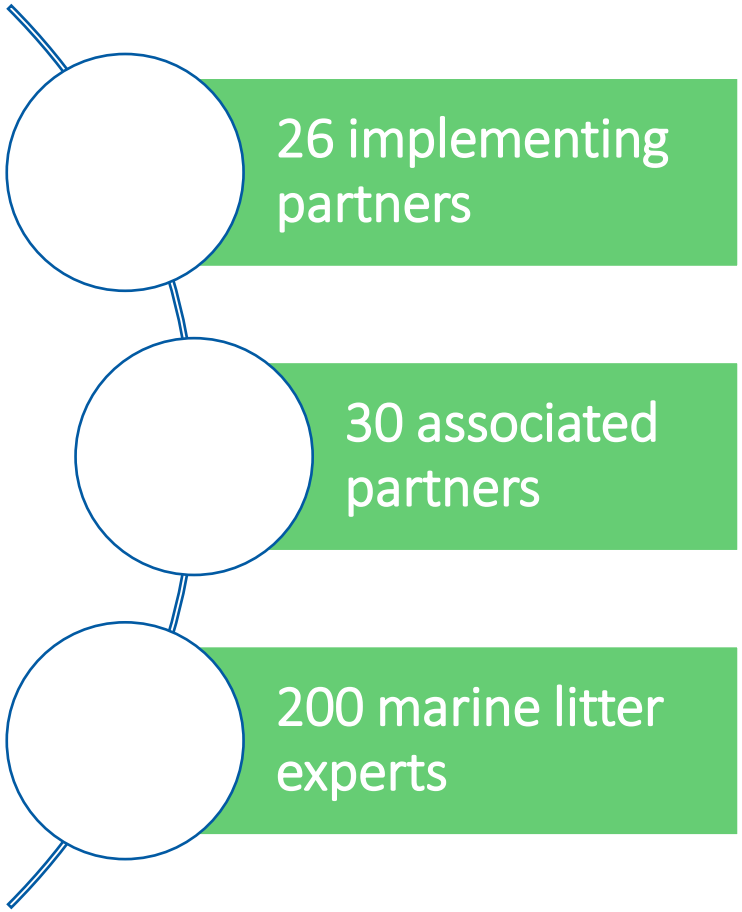
ENI CBCMED
Cooperating across borders in the Mediterranean

Project funded by the EUROPEAN UNION

REGIONE AUTÒNOMA DE SARDIGNA
REGIONE AUTONOMA DELLA SARDEGNA

Plastic Busters CAP

THE PLASTIC BUSTERS GEOGRAPHICAL SCOPE



Albania	Algeria	Croatia	Cyprus
Egypt	France	Greece	Italy
Jordan	Lebanon	Morocco	Montenegro
Slovenia	Spain	Tunisia	Turkey

PLASTIC BUSTERS:
A HARMONIZED DIAGNOSIS OF THE ML PROBLEM MPAs

Beach

Sea surface

Seafloor

Biota

MACROLITTER
ITEMS > 2.5 CM

MICROLITTER
ITEMS < 0.5 CM

Union for the Mediterranean
Union pour la Méditerranée
الاتحاد من أجل المتوسط

Fit-for-purpose data

Comparable data

Reliable data

Interreg Mediterranean
EUROPEAN UNION
PLASTIC BUSTERS MPAs

ASSESSING THE EFFECTS OF MARINE LITTER ON BIOTA

A three-fold marine litter monitoring approach in biota

Interreg Mediterranean — PLASTIC BUSTERS MPAs

UNIVERSITÀ DI SIENA 1240

i Plastics detection

Analysis of ingested litter:
- Occurrence (%)
- Abundance (n)
- Weight (g)
- Polymer analysis

ii Plastic tracers' detection

Analysis of plastic additives:
- Phthalates
- PBDEs
- Bisphenol A

Analysis of PBTs:
- PCBs
- DDTs
- PAHs
- Mercury

iii Biomarkers detection

Effects at molecular level:
- DNA damage
- Alterations of gene expression
- Alteration of proteins

Effects at cellular level:
- Alteration of cell functions

Effects at tissue level:
- Histological and histopathological alterations

ASSESSING THE EFFECTS OF MARINE LITTER ON BIOTA

Endangered species


Sea turtles

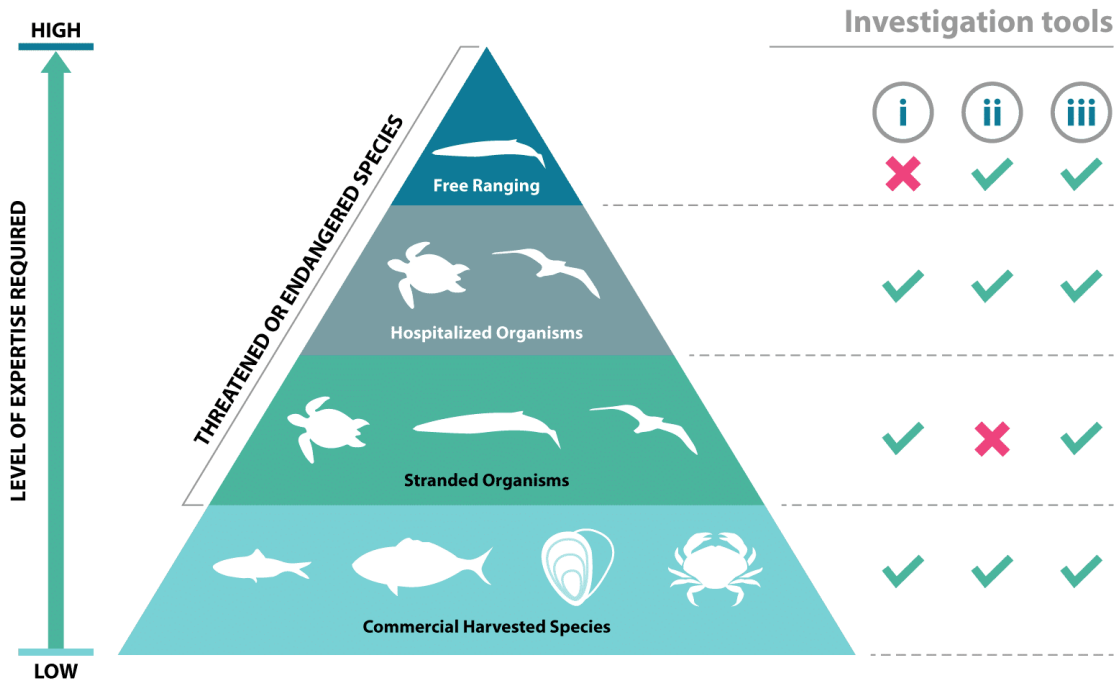

Monk Seal


Cetaceans


Invertebrates


Vertebrates

Commercial species



46 species investigated for the presence and effects of marine litter

2180 specimens analysed

BIOINDICATORS SELECTION IN RELATION TO HABITAT & HOME RANGE

Basin scale

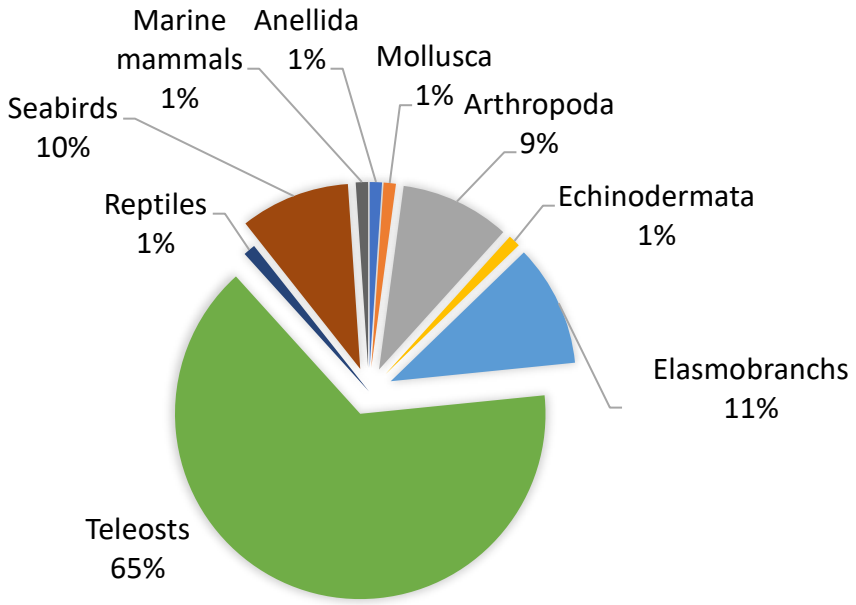
	SEA SURFACE	COASTAL WATERS	OPEN WATERS	SEAFLOOR	COASTLINE & BEACH SEDIMENTs
BASIN SCALE (Mediterranean Sea)	*Calonectris diomedea, Puffinus yelkouan*	*Calonectris diomedea, Puffinus yelkouan*	*Balaenoptera physalus; Cetorhinus maximus Xiphias gladius; Thunnus thynnus Xiphias gladius; Thunnus thynnus Caretta caretta Physeter macrocephalus*		
MEDIUM-SCALE (Mediterranean UN Environment/MAP sub-regions)			*Thunnus alalunga Coryphaena hippurus Caretta caretta Thunnus alalunga*		
SMALL-SCALE (FAO GSA)		*Boops boops Trachinotus ovatus*	*Maurolicus muelleri Engraulis encrasicolus Sardina pilchardus* Myctophids	*Mullus barbatus Nephrops norvegicus, Galeus melastomus, Merluccius merluccius, Solea spp. Galeus melastomus, Scyliorhinus canicula*	
LOCAL SCALE				Holoturians	*Mytilus galloprovincialis Arenicola marina* Decapods *(e.g. Carcinus sp.)*

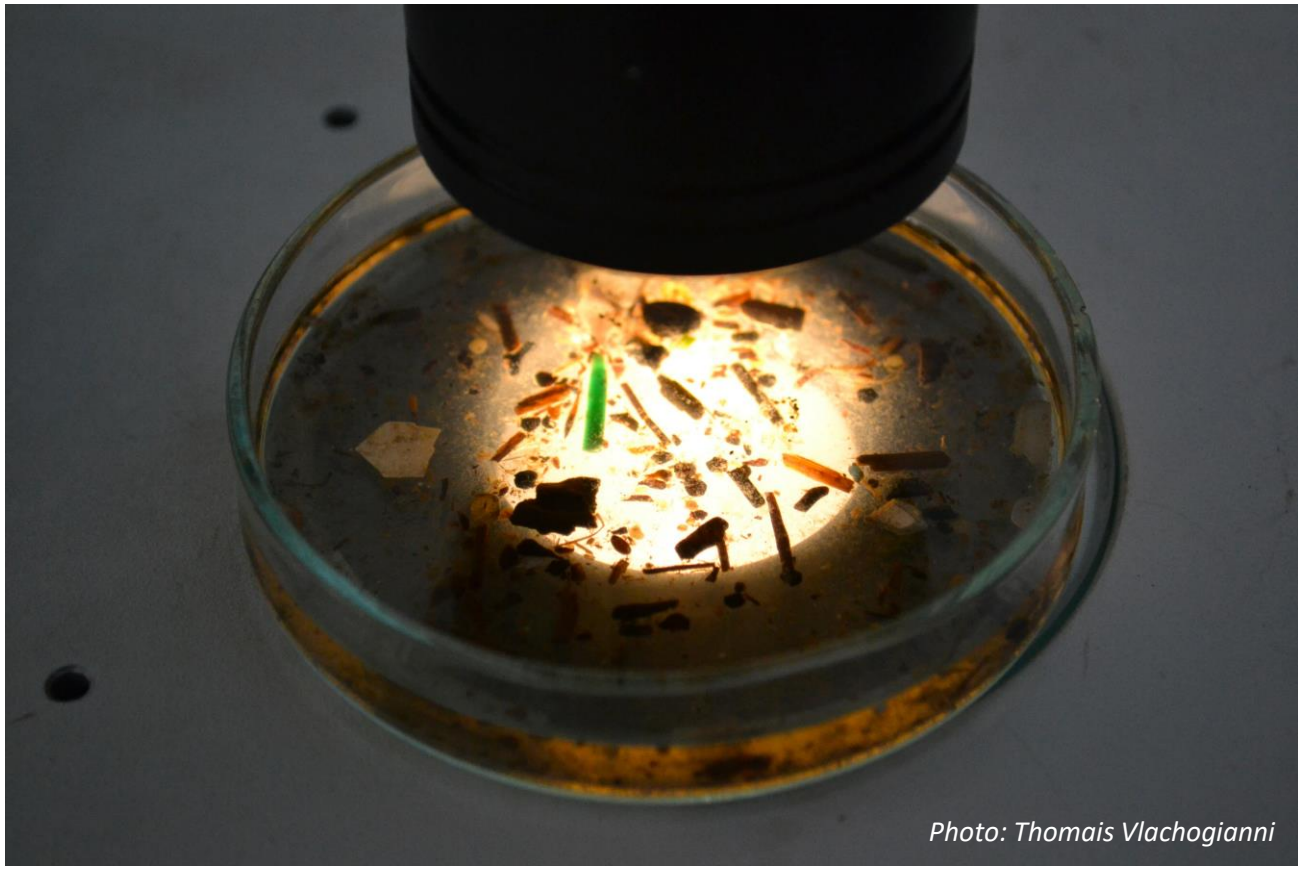
biondicators for macrolitter

bioindicator for microplastics

Local scale

PERCENTAGE OF SPECIES INVESTIGATED AMONG DIFFERENT TAXA FOR MARINE LITTER INGESTION IN THE MEDITERRANEAN SEA

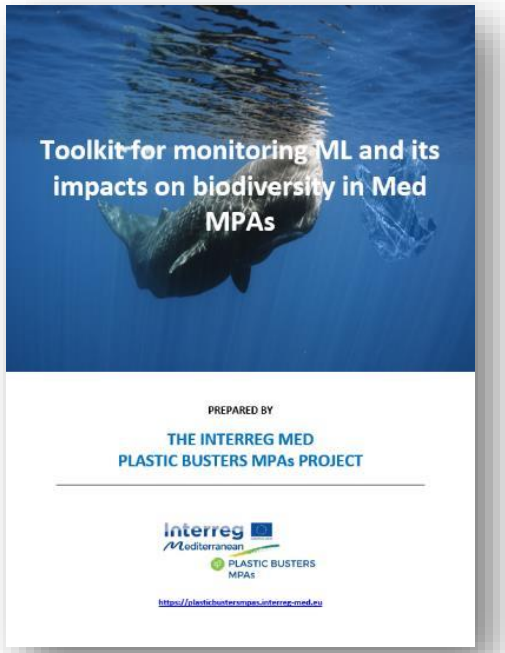


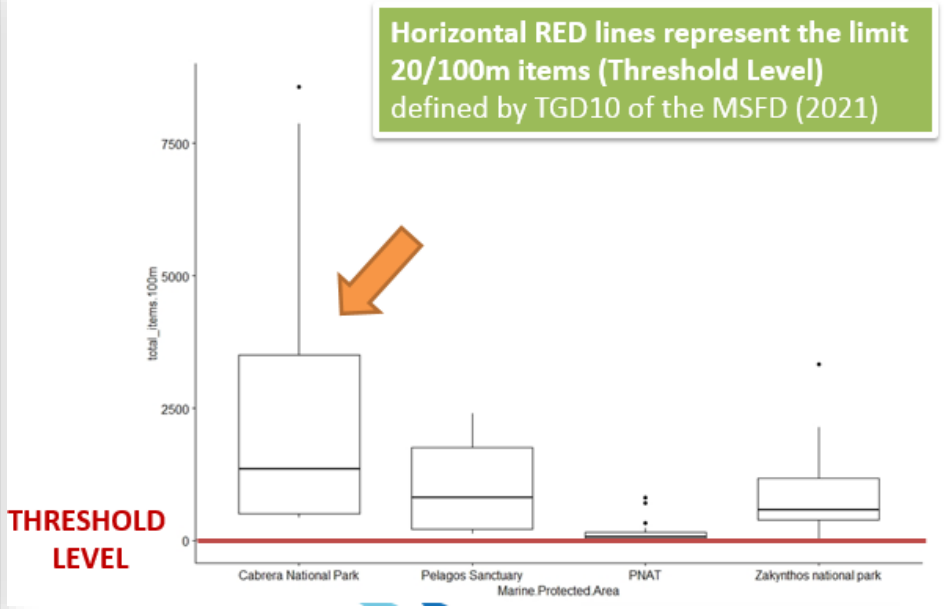


Source: Vlachogianni, et al., 2018. State-of-the-art methods to monitor marine litter and its impacts on biodiversity. Interreg Med Plastic Busters MPAs project.

THE PLASTIC BUSTERS MPAs MONITORING EFFORT IN THE 4 MPAs

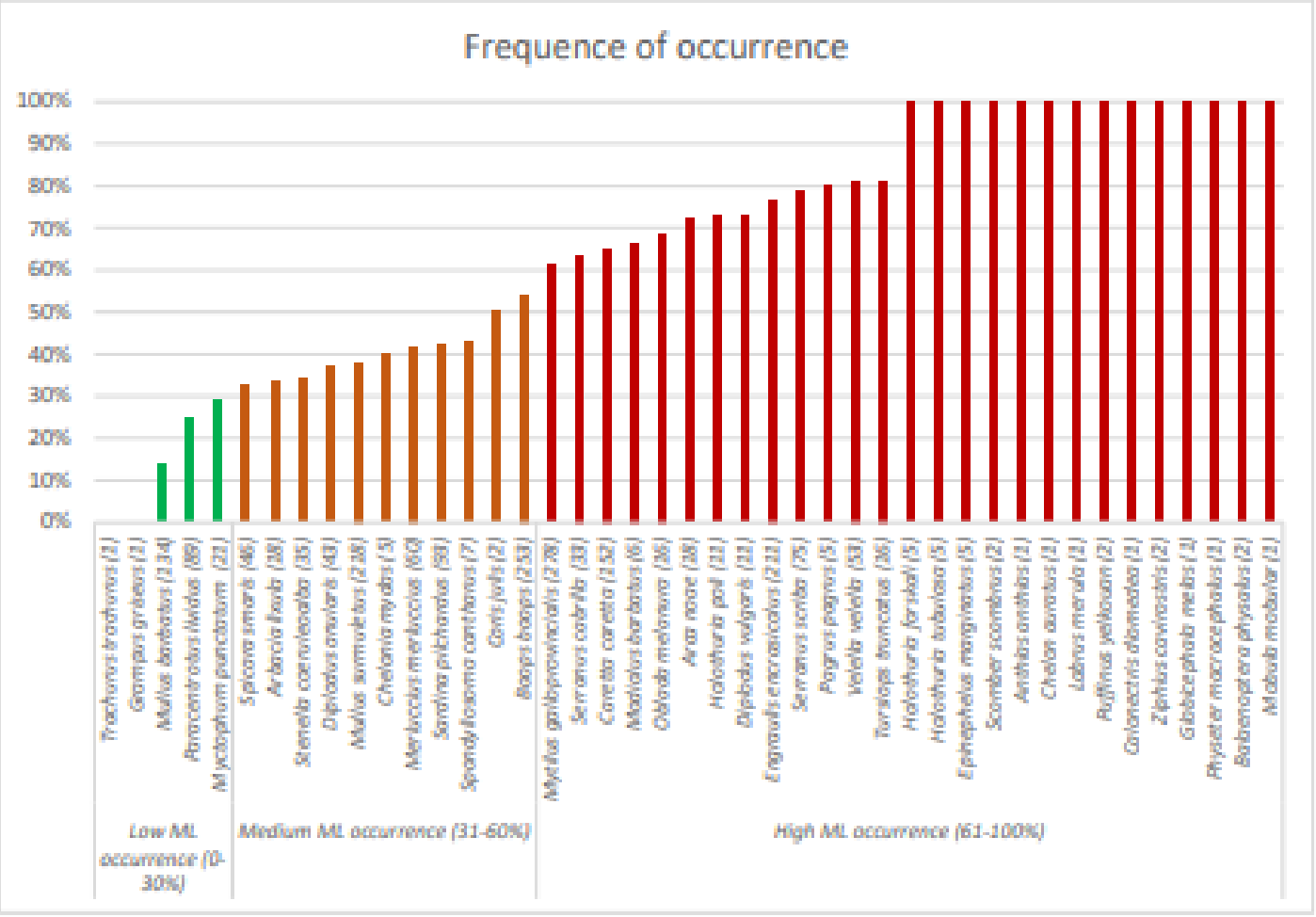
TYPE OF SAMPLE/SURVEY	N°
Floating macrolitter	314
Floating microlitter	213
Beach macrolitter	135
Beach microlitter	810
Seafloor macrolitter	51
Seafloor microlitter	51
ROV	7





1530 Samples/Surveys!

MARINE LITTER OCCURRENCE



Fossi M.C.; Vlachogianni, T., Anastasopoulou, A. , Alomar, C., Álvarez, E., Angiolillo, M., Baini, M., Bray, L., Caliani, I., Campani, T., Capo, X., Casini, S., Clar, M., Consoli, P., Cillari T., Compa, M., D'Alessandro, M., Deudero, S., Digka, N., Dimitriadis, C., Fagiano, V., Galgani, F., Galli, M., F., Kaberi H., Koutsoumpas, D., López, F., Martínez, D., Morató, M., Panti, C., Patsiou, D., Pedà, C., Rios-Fuster, B., Romeo, T., Ruíz, A., Scotti, G., Torre, M., Tsangaris, C., 2022. D.4.3.1 Report on the results and findings of the piloted marine litter monitoring approach to assess the impacts of marine litter on biota. Interreg Med Plastic Busters MPAs.

Interreg Mediterranean
EUROPEAN UNION
PLASTIC BUSTERS MPAs

THE PLASTIC BUSTERS CAP PARTICIPATORY SCIENCE CAMPAIGN

1. Albania
2. Algeria
3. Croatia
4. Cyprus
5. Egypt
6. France
7. Greece
8. Jordan
9. Italy
10. Lebanon
11. Libya
12. Morocco
13. Slovenia
14. Tunisia
15. Sri Lanka
16. Togo

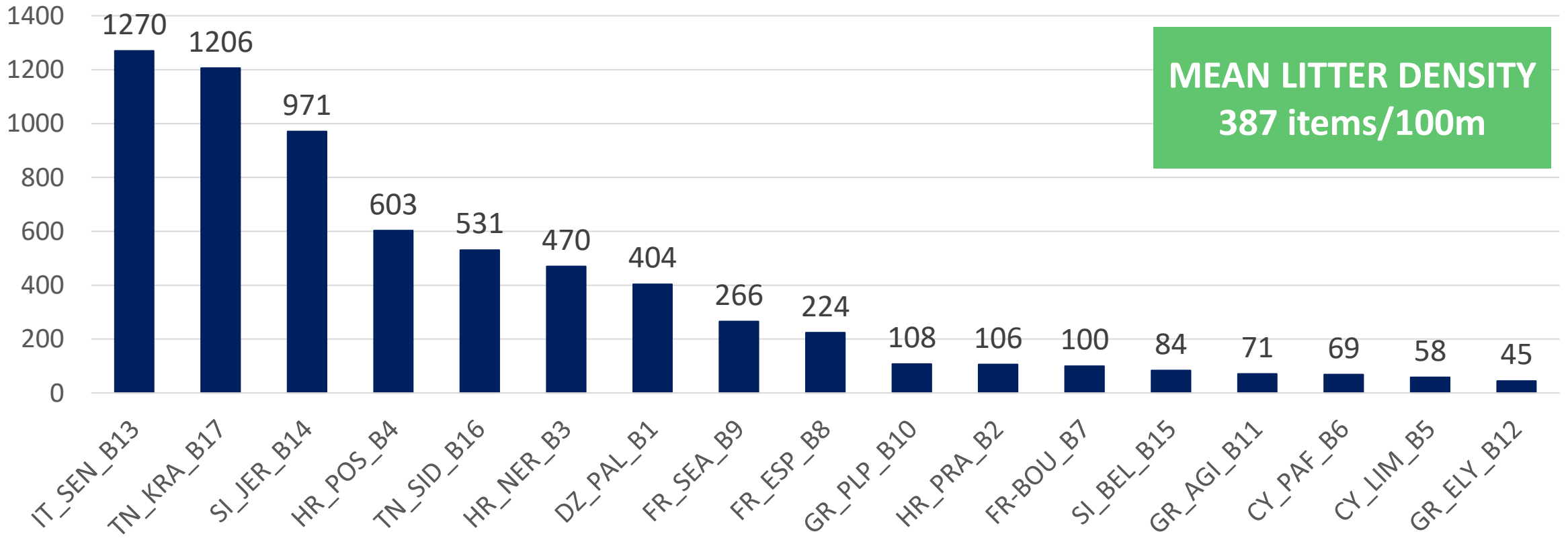
More than 100 marine litter practitioners were involved in a collective data gathering process

THE ORGANIZATIONS INVOLVED

16 ORGANIZATIONS
AQUAMAR (Algeria)
IOF (Croatia)
SUNCE (Croatia)
UNIVERSITY OF DUBRONVIK (Croatia)
AKTI (Cyprus)
SEAQUARIUM (France)
RESEACLONS (France)
MIO-ECSDE (Greece)
LOCAL MANAGEMENT COMMITTEE OF ASTEROUSIA (Greece)
LEGAMBIENTE (Italy)
MANAGEMENT BODY OF DEBELI RTIČ LANDSCAPE PARK (Slovenia)
MANAGEMENT BODY OF LANDCSAPE PARK STRUNJAN (Slovenia)
INSTITUTE OF WATER OF THE REPUBLIC OF SLOVENIA (Slovenia)
GZD (Tunisia)
TUNSEA (Tunisia)
OCEANIS (Tunisia)

BEACH LITTER DENSITIES IN NUMBER OF ITEMS/100M

A total of 6,586 litter items were collected, sorted and classified in 17 beaches



MEAN LITTER DENSITY
387 items/100m

KEY LEGISLATIVE FRAMEWORKS RELATED TO MARINE PLASTIC POLLUTION IN THE MEDITERRANEAN

KEY LEGISLATIVE FRAMEWORKS

EU

Marine Strategy Framework Directive

Plastics Strategy

Single-Use Plastics Directive

Barcelona Convention

Ecosystem Approach

Regional Plan for Marine Litter Management in the Mediterranean

Union for the Mediterranean

2030GreenerMed Agenda

UPCOMING INTERNATIONAL TREATY ON PLASTIC POLLUTION

BARCELONA CONVENTION: POLICY ADVANCES FOR MARINE LITTER

COP22 Antalya Ministerial Declaration: Leaving a Pollution and Litter-free Legacy

Updated Regional Action Plan on Marine Litter Management in the Mediterranean

Mediterranean priority list of SUPs per group of items

List of Chemical Additives of Concern Used in Plastic Production

2021 Baseline Values and Threshold Values for IMAP Common Indicator 22

COP23 Portoroz

QSR 2023

Riverine litter guidelines

Photo © Thomais Vlachogianni

MEDITERRANEAN PRIORITY LIST OF SUPS

Group of items	Items
Packaging	Bags
Smoking-related	Cigarette filters
Food and beverage packaging	Drink bottles, caps and lids, crisp packets and sweet wrappers
On-the-go food and beverage packaging	Cutlery, plates and trays, straws and stirrers, drinks cups and cup lids, food containers including fast food packaging
WC flushed items	Sanitary applications, including cotton buds, wet wipes and sanitary towels
Personal protective equipment	Masks and gloves

POLICY ADVANCES IN THE MEDITERRANEAN

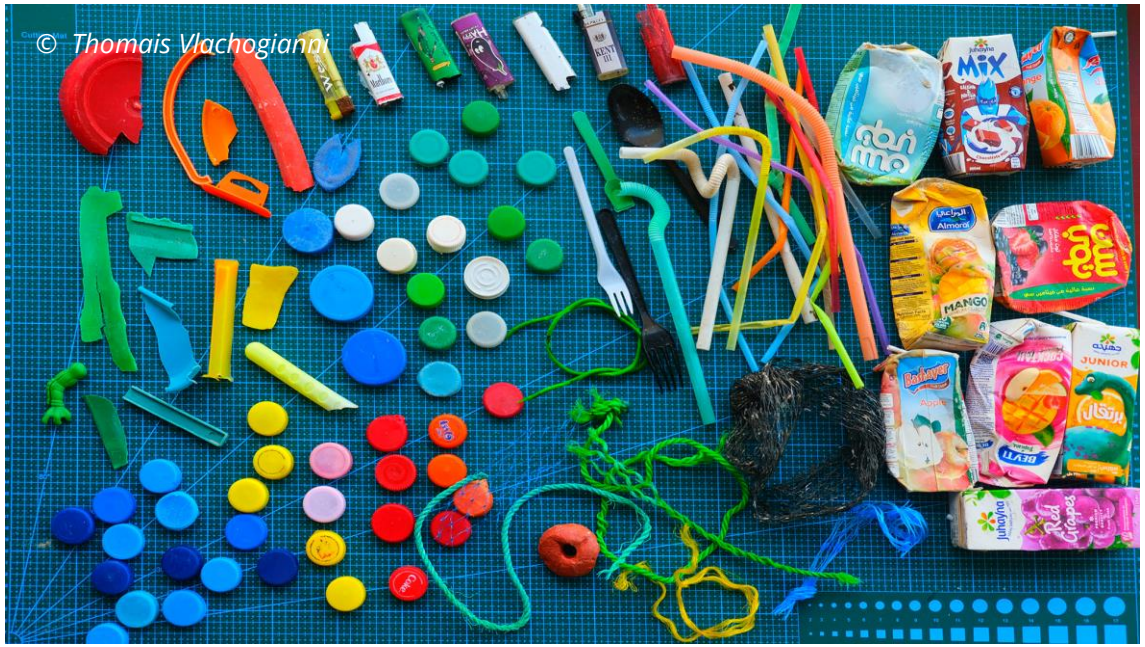
Effect of marine litter on biota: development of operational strategy & protocols

Marine litter assessment Criteria: Baseline Values & Threshold Values for IMAP CI22 & CI23

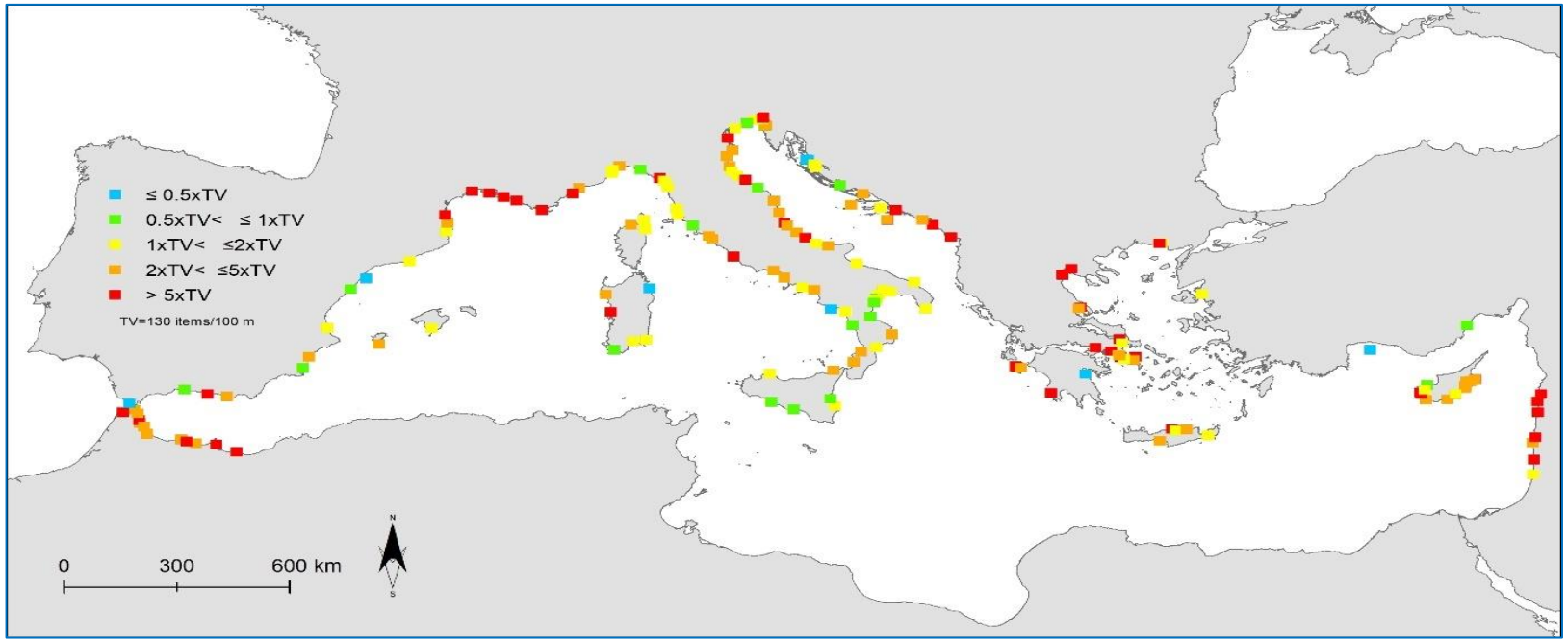
New monitoring guidelines: riverine litter and microplastics coming from WWTP

MEDITERRANEAN THRESHOLD VALUES FOR MACROLITTER

IMAP CI22 THRESHOLD VALUE	IMAP CI23 THRESHOLD VALUE
130 items/100 m	38 items/km²



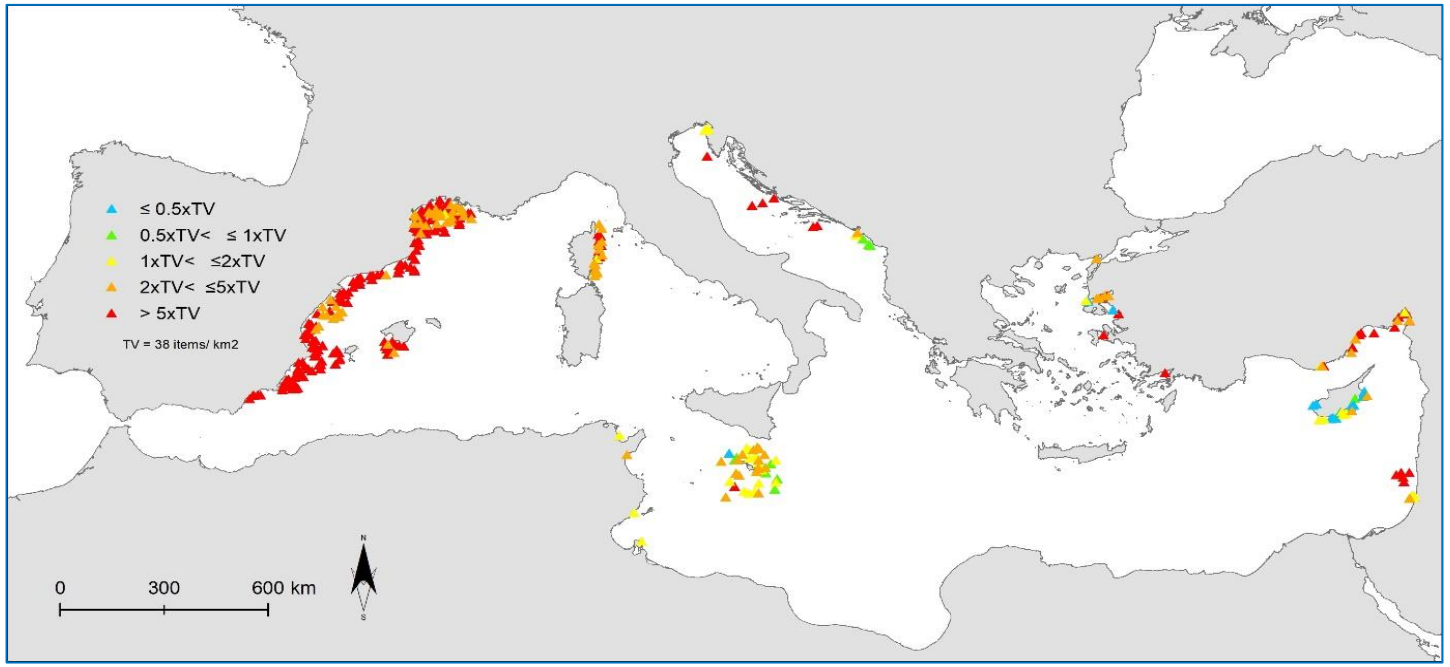
QSR 2023 – BEACH LITTER



192 monitored beaches in the Mediterranean Region

16 % of beaches in GES

QSR 2023 – BEACH LITTER



364 seafloor stations monitored in the Mediterranean Region

IMAP CI23 11 % of stations in GES

THE EUROPEAN THRESHOLD VALUE FOR BEACH MACROLITTER

Water and Environment Support
in the ENI Southern Neighbourhood region

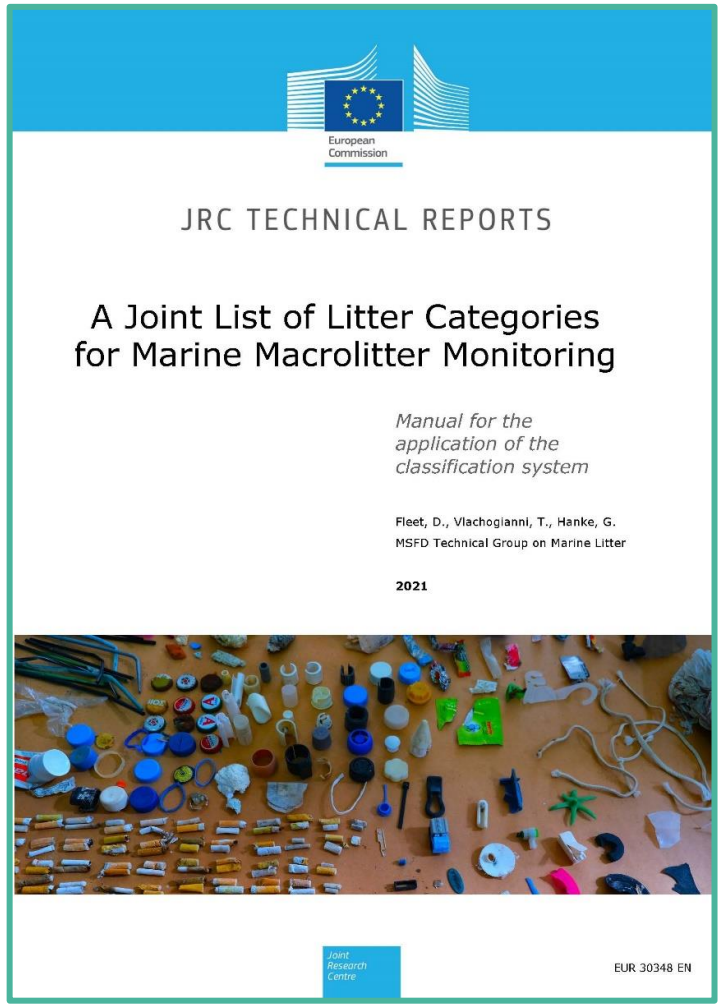
© *Thomais Vlachogianni*

A beach litter threshold value has been adopted at EU level

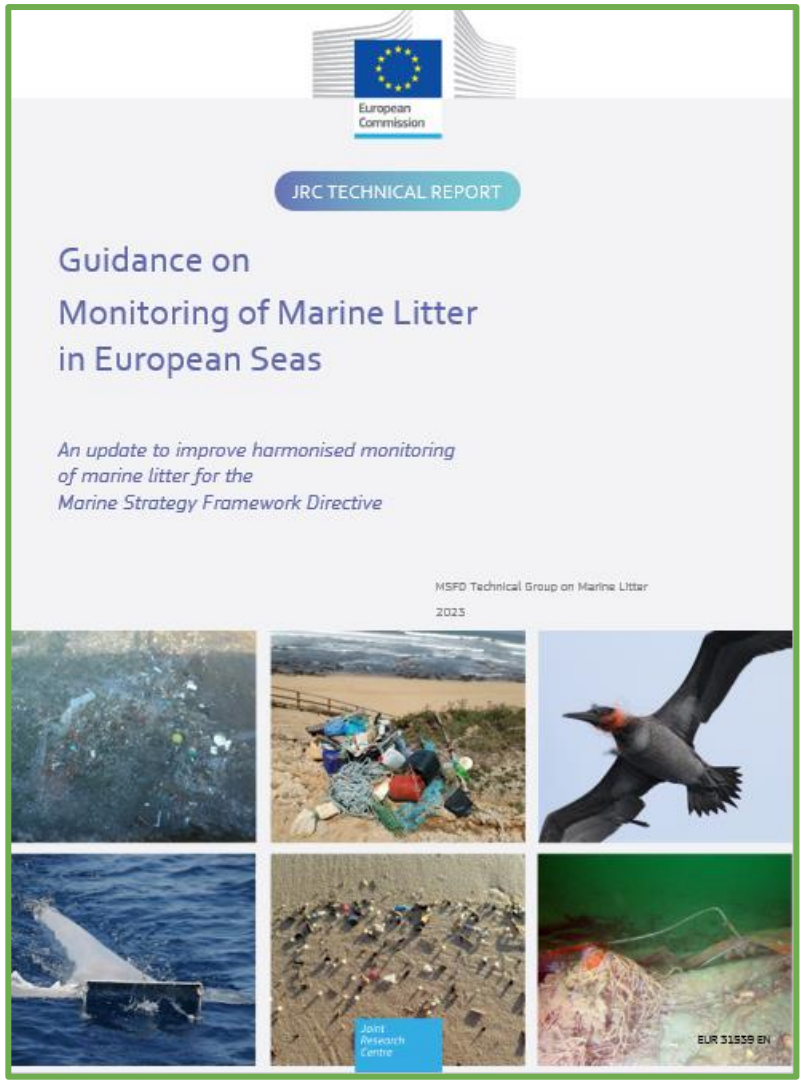
< 20 litter items for every 100 metres of coastline

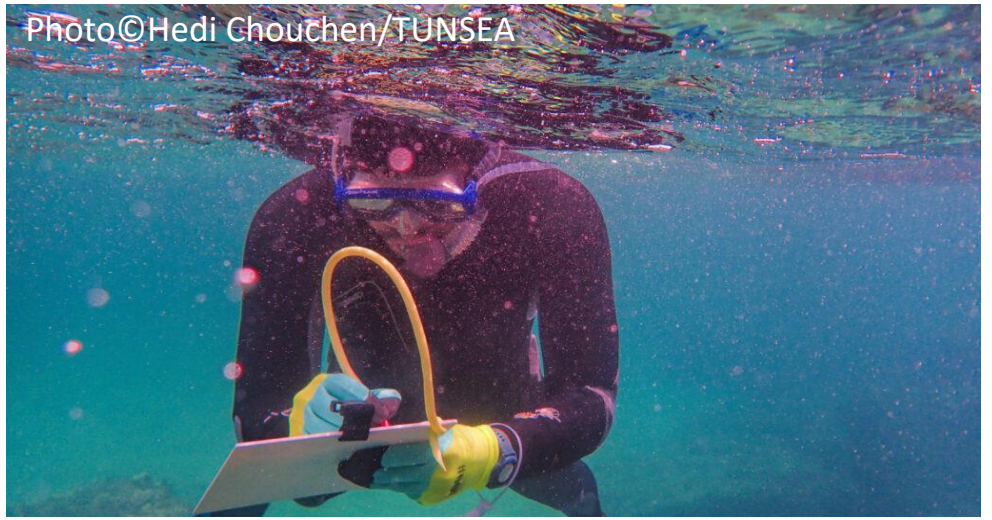
Good Environmental Status

THE JOINT LIST OF LITTER CATEGORIES



UPDATES GUIDANCE ON MONITORING MARINE LITTER





Water and
Environment Support
in the ENI Southern Neighbourhood region

Thank you for your attention!

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