

“Transboundary marine litter pollution”



ISPRA - Italian National Institute for Environmental Protection and Research



cecilia.silvestri@isprambiente.it

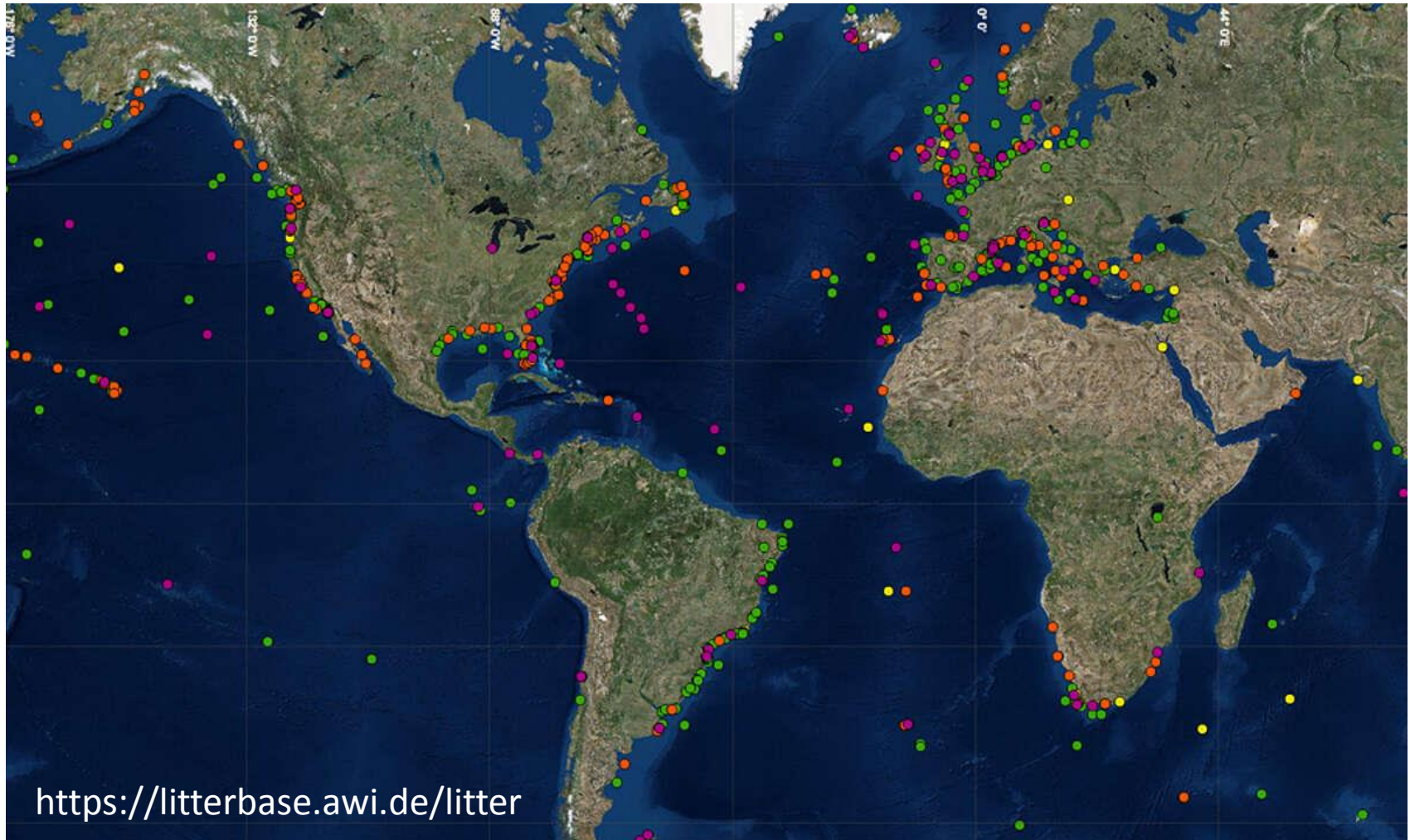
When we start to talk about marine litter?

Marine Strategy Framework Directive (2008/56/EC)

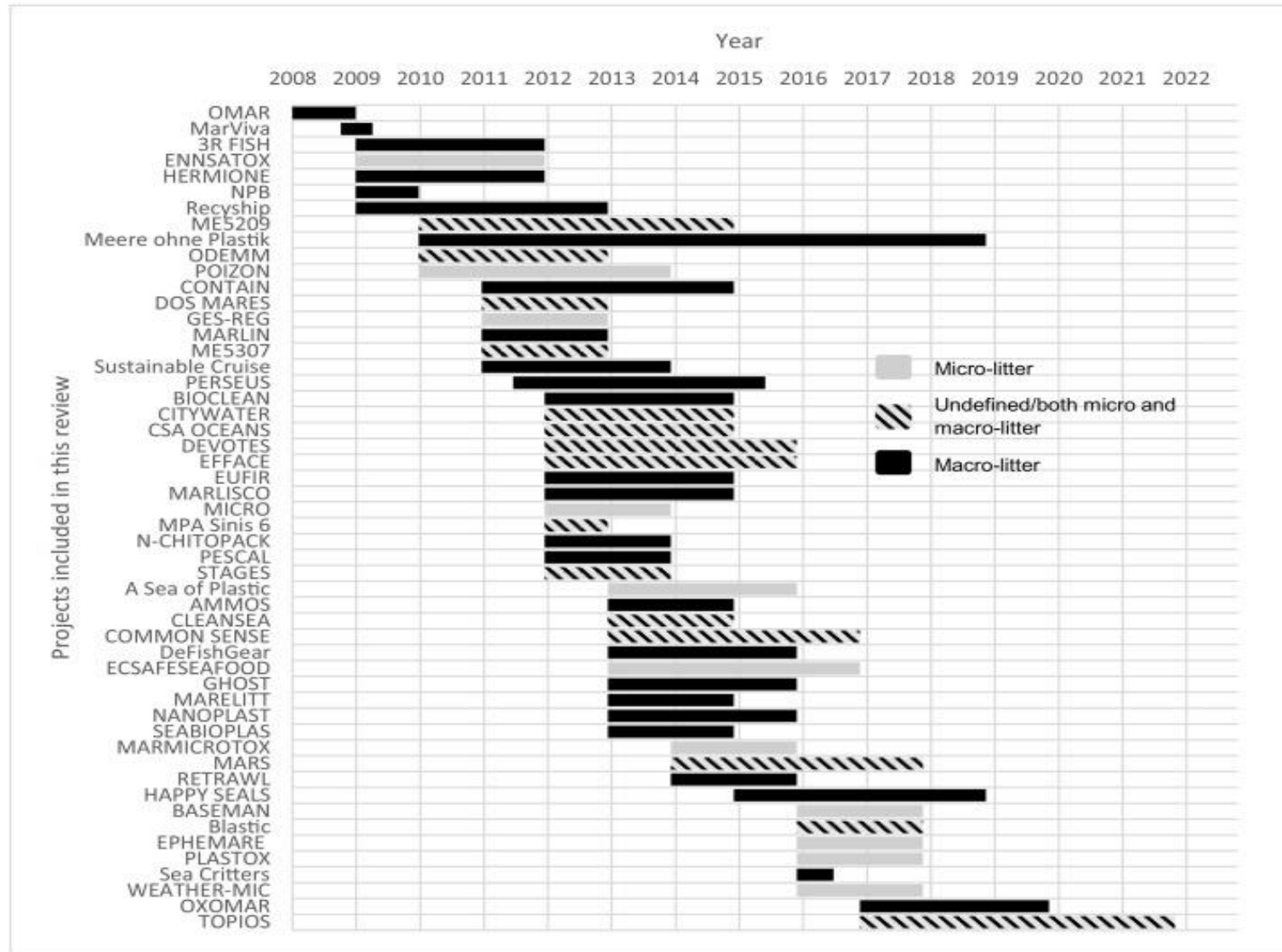


The increasing number of papers on marine litter

Distribution of litter types in different compartments (1036 publications)



The increasing number of projects on marine litter



What we Know

- ✓ **Every year, millions and millions of tonnes of litter end up in the ocean.**
- ✓ **Poor practices of solid waste management.**

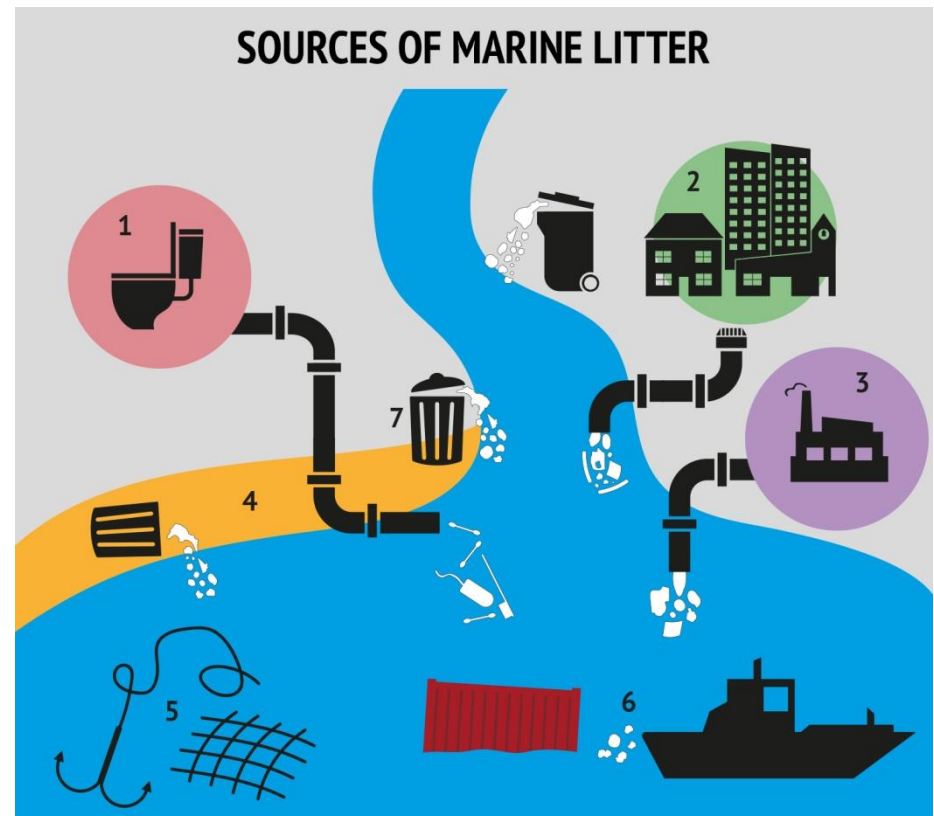
Main sources of marine litter

Land-based:

- land-fills and littering of beaches (tourism)
- rivers and floodwaters
- industrial emissions
- discharge from storm water drains
- untreated municipal sewerage

Sea-based:

- fishing and aquaculture
- Illegal dumping at sea from shipping
- offshore mining and extraction



What we know

15% on the coast



70% on sea floor



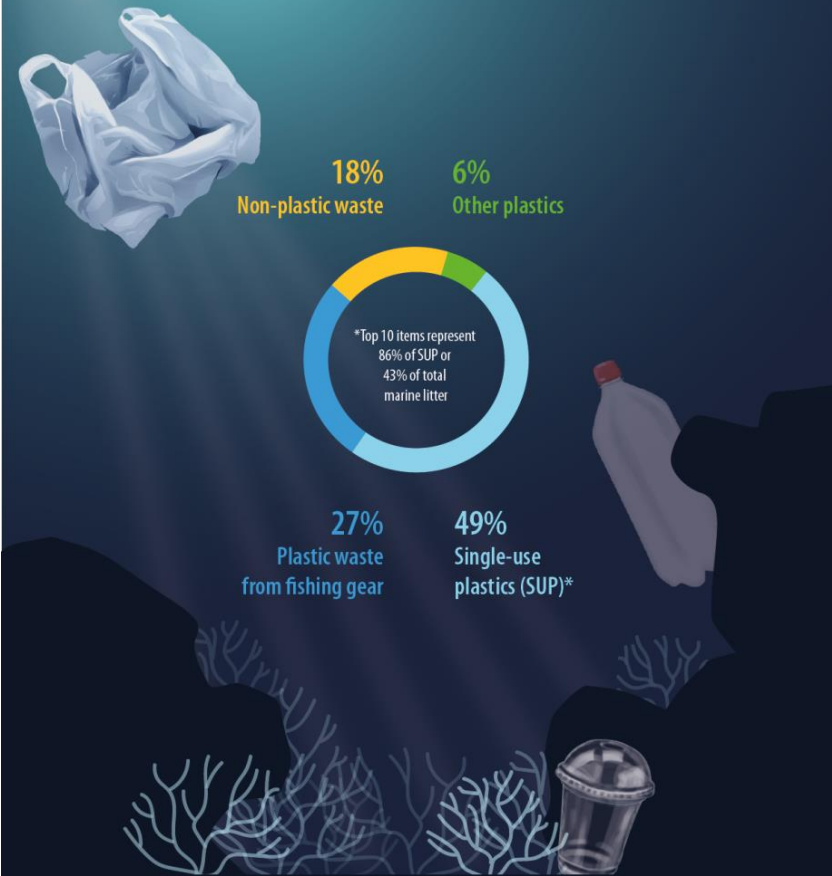
15% floating

What we know

70%
marine litter
is made of
plastic

80%
marine litter comes
from land
based activities

MARINE LITTER BY TYPE

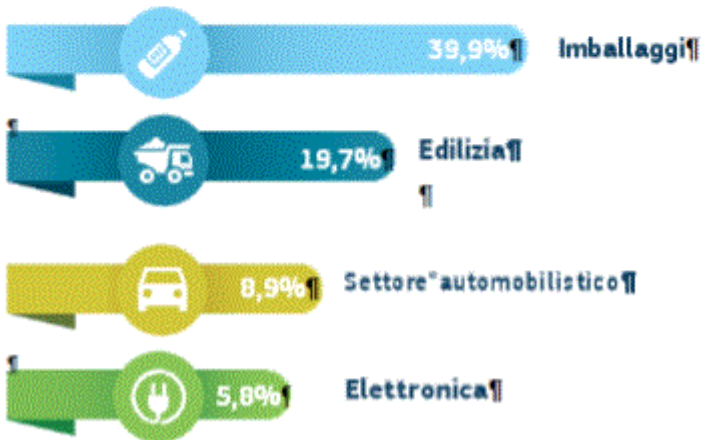


Source: European Commission

Global production of plastics

DOMANDA DI PLASTICA NELL'UE - 2015

49 milioni di tonnellate



Global production of plastics has increased twentyfold since the 1960s, reaching **322 million tonnes** in 2015. It is expected to double again over the next 20 years.



Every year, around **25.8 million tons** of plastic waste is generated in Europe, of which **less than 30%** is collected for recycling purposes.

Plastic in the sea

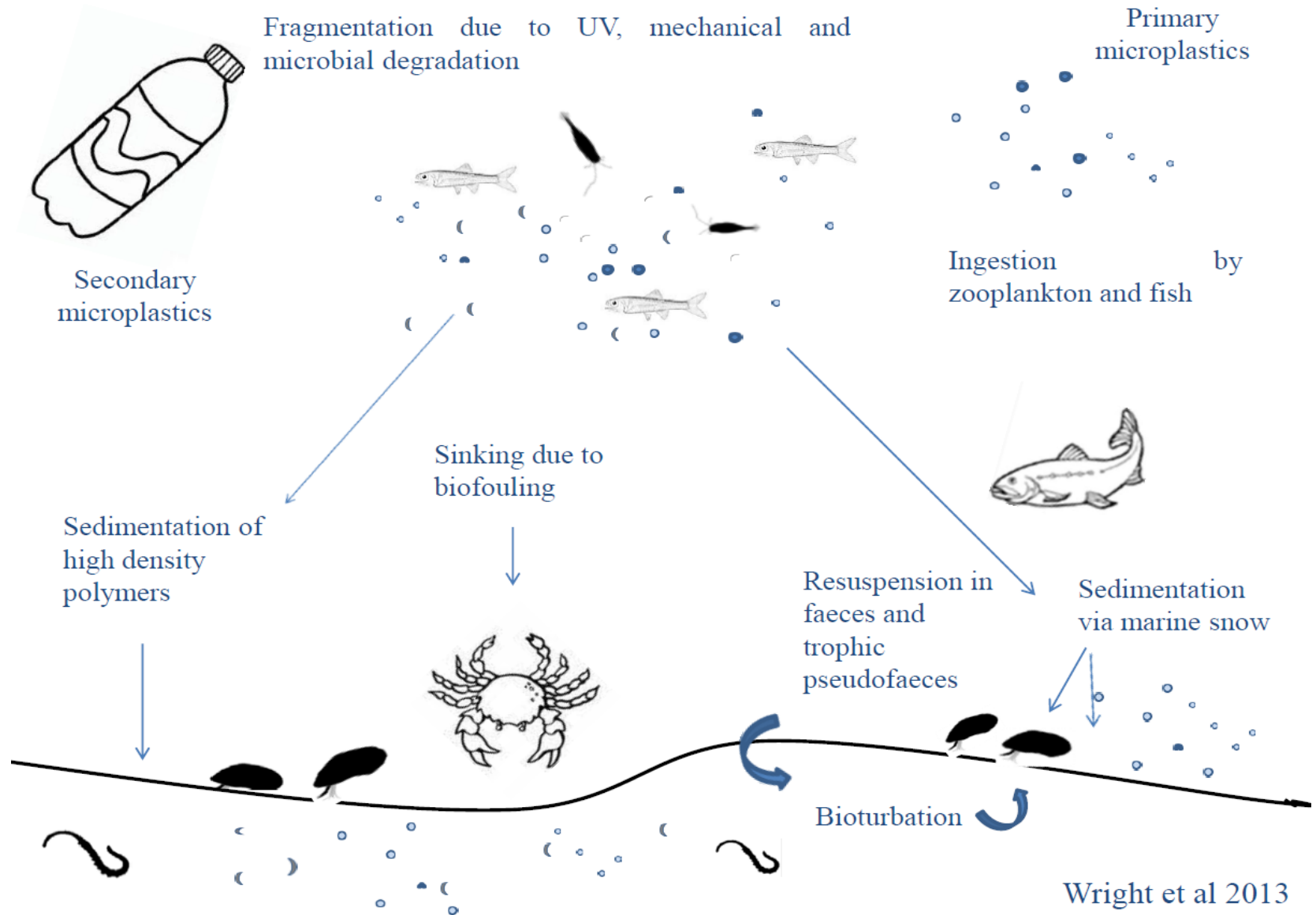
Globally, 5 to 13 million tonnes of plastics — 1.5 to 4 % of global plastics production — end up in the oceans every year



**= 1 ton = 13 million tonnes
of cars**



Microplastic

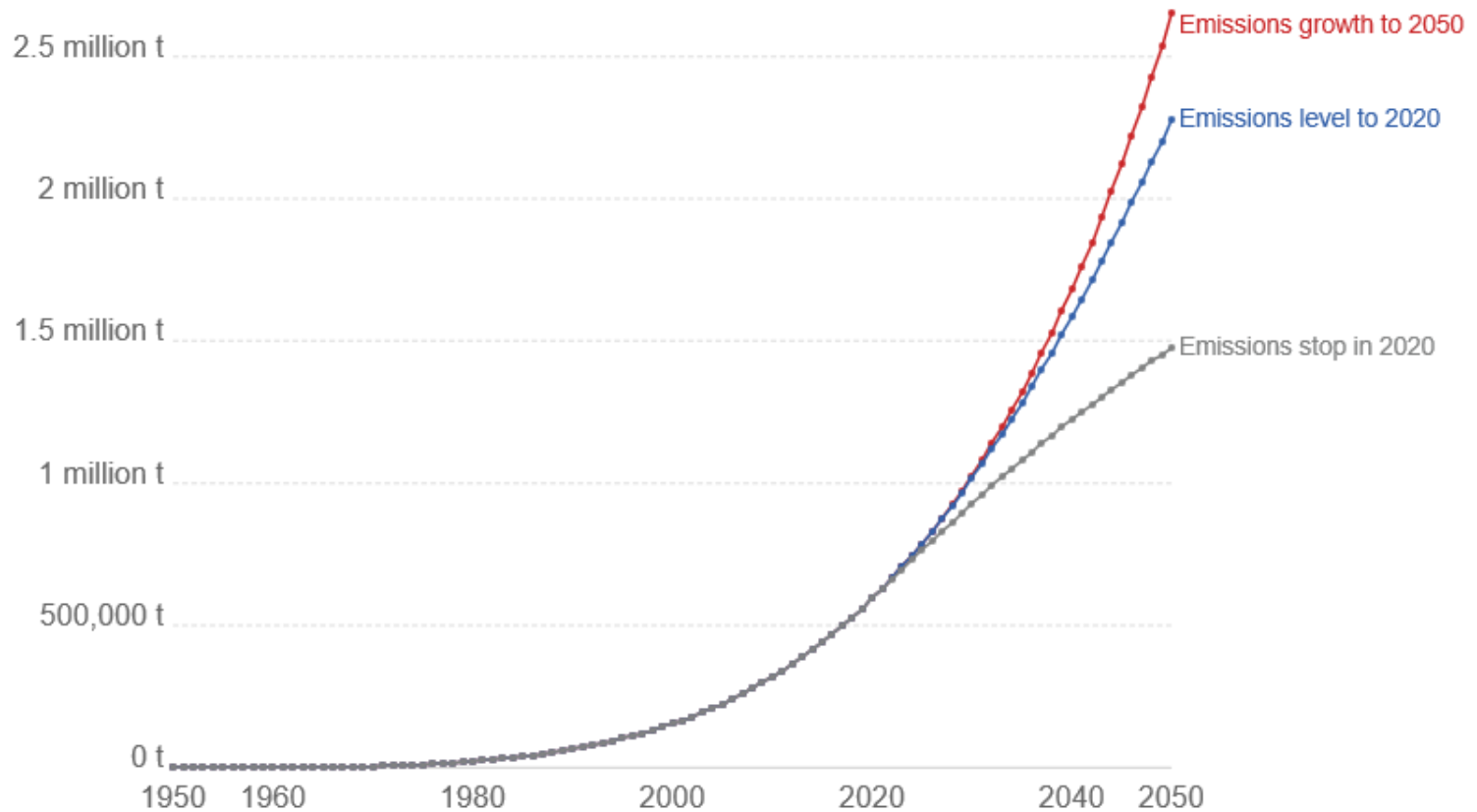


Microplastic

Microplastics in the surface ocean

Microplastics are buoyant plastic materials smaller than 0.5 centimeters in diameter. Future global accumulation in the surface ocean is shown under three plastic emissions scenarios: (1) emissions to the oceans stop in 2020; (2) they stagnate at 2020 emission rates; or (3) continue to grow until 2050 in line with historical plastic production rates.

Our World
in Data

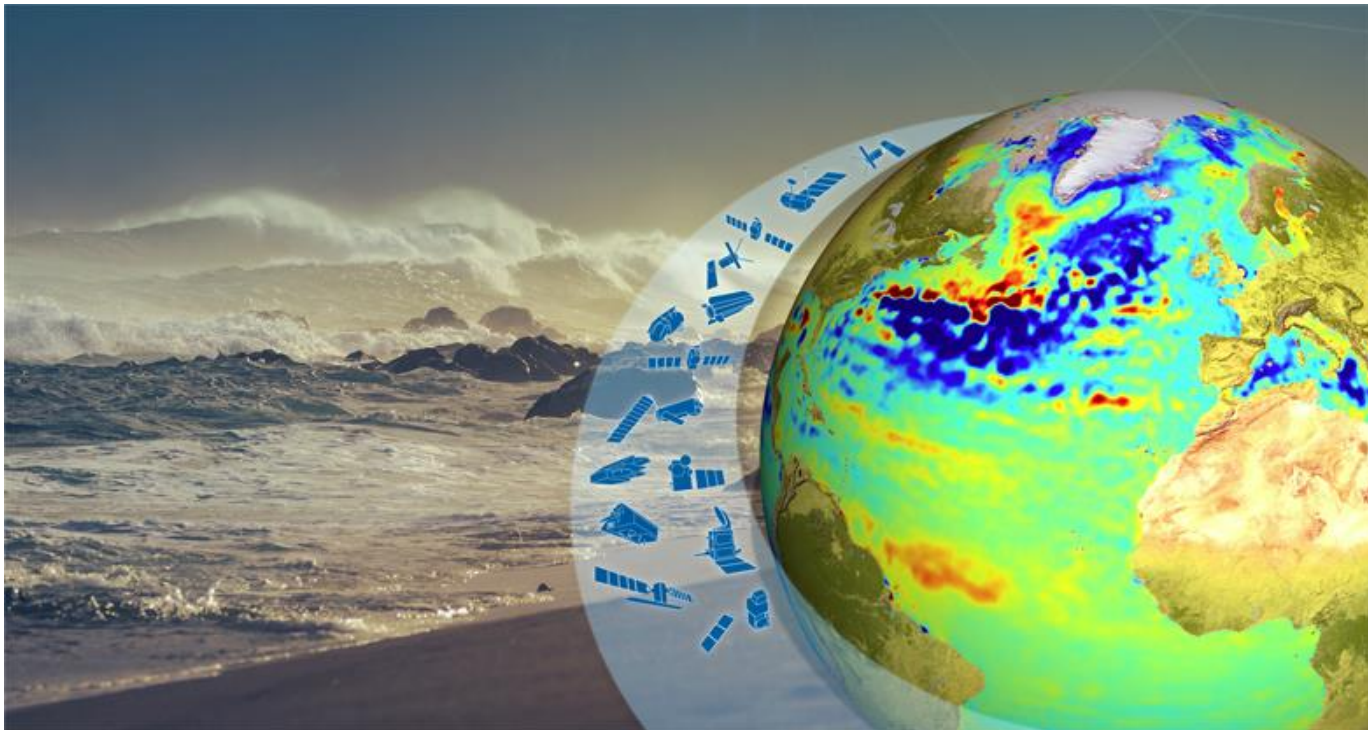


Source: Lebreton et al. (2019). A global mass budget for positively buoyant macroplastic debris in the ocean.

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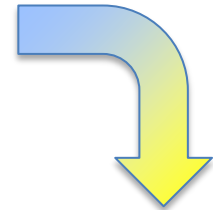
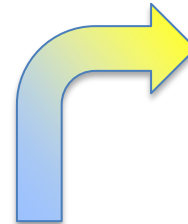
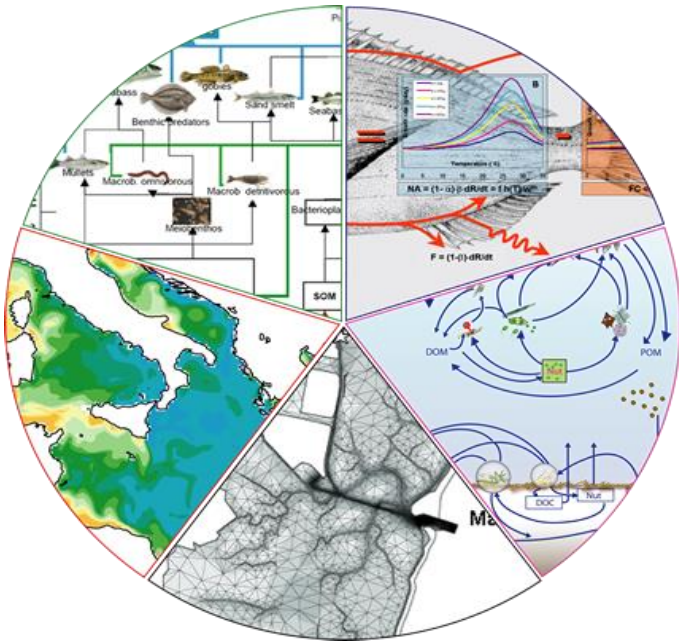
Which are the questions we need to answer?

- Where the marine litter accumulates?
- Which of the marine litter accumulation zones are areas at risk of exposure for marine organisms?
- What is the contribution of foreign sources to the national level of marine litter?

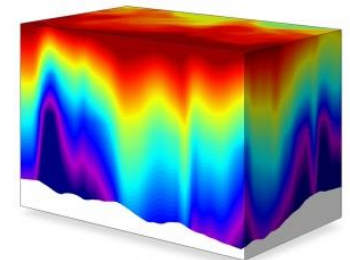


Which are the tools we need in order to answer?

- *In situ* data
- Modelling
- Remote sensing

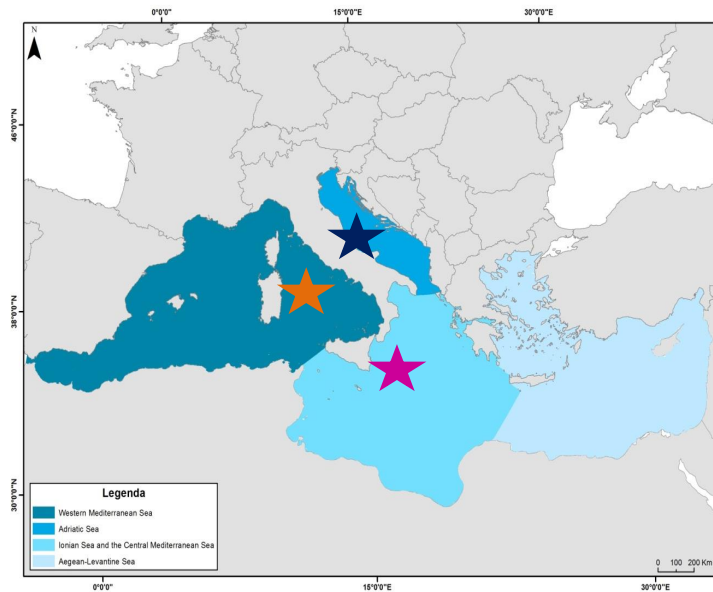


In-situ



Mathematical model

Marine litter in situ data



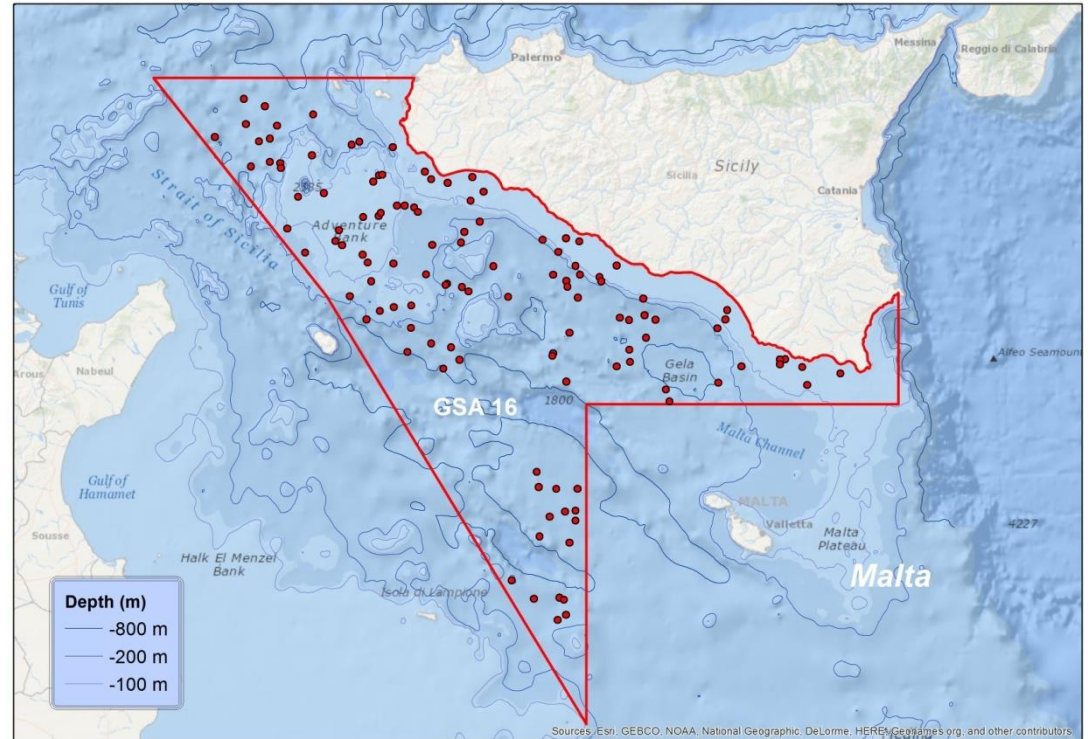
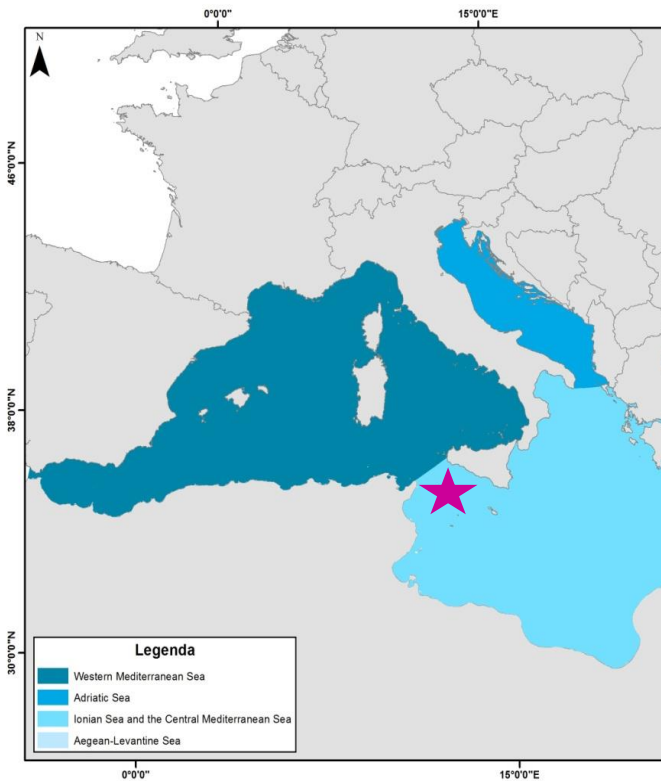
Element	IT_Adriatic sea Mean value ★	IT_Ionic/CentralMed Mean value ★	IT_WesternMed Mean value ★	Baseline IMAP (UNEP/MAP, 2016)
Beach litter (item/100 m)	912	375	888	450-1400
Floating litter (item/ Km ²)	4,7	1,9	2,3	3-5
Seafloor (item/ Km ²)		87-99	66,1	130-230
Microlitter (item/ m ²)	0,20	0,09	0,17	0,2-0,5
Sea turtles (<i>Caretta caretta</i>) Affected turtles (%)		27,2% 0,69	68% 1,0±0,2g	40-60 % 1-3 g

The map displays the Mediterranean Sea and surrounding regions. The Western Mediterranean Sea is shaded in dark blue, the Adriatic Sea in medium blue, the Ionian Sea and the Central Mediterranean Sea in light blue, and the Aegean-Levantine Sea in very light blue. A pink star is located in the Ionian Sea, indicating the study area. The map includes a north arrow, a scale bar (0 to 200 km), and latitude/longitude markings (0°0'0" to 30°0'0" E and 0°0'0" to 15°0'0" E).



271 item/100m
136 item/100m

Litter on Seafloor-MEDITS 2016

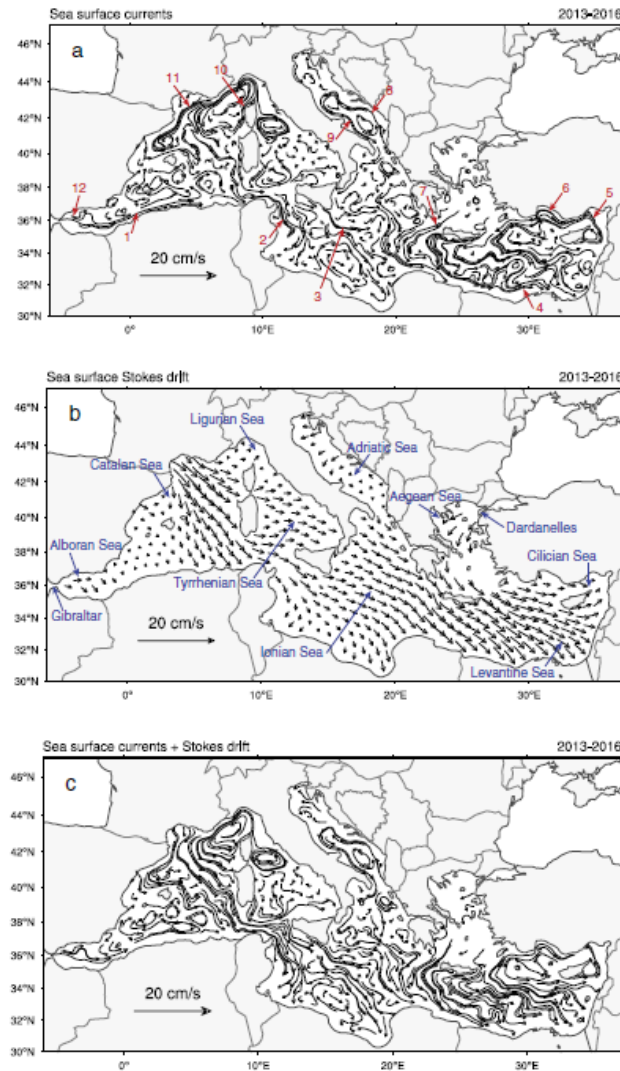


GSA 16	Foc %	N	kg	N/km ²	kg/km ²
Plastic	82,5	479	206	64	26
Other marine litter	68,3	307	470	23	43

➤ Where the marine litter accumulates? 1/7

S. Liubartseva et al.

Marine Pollution Bulletin 129 (2018) 151–162



Sea surface currents

Sea surface Stokes drift

Sea surface currents + Stokes drift

Copernicus services used

Fig. 2. Averaged over 2013–2016: (a) Sea surface currents, (b) Sea surface Stokes drift, and (c) Sum of surface currents and Stokes drift components. Some (a) general circulation patterns and (b) main subbasins used in the text are given (Pinardi et al., 2015; Poulain et al., 2012): the (1) Algerian Current, (2) Sicily Strait Tunisian Current, (3) Atlantic-Ionian Stream, (4) Southern Levantine Current, (5) Cilician Current, (6) Asia Minor Current, (7) Cretan Sea Westward Current, (8) Eastern South-Adriatic Current, (9) Western Adriatic Coastal Current, (10) Western Gorka Current, (11) Northern Current, and (12) Atlantic Water Current.

Liubartseva et al., 2018

➤ Where the marine litter accumulates? 2/7

Spatial distribution of the floating litter inputs

S. Liubartseva et al.

Marine Pollution Bulletin 129 (2018) 151–162

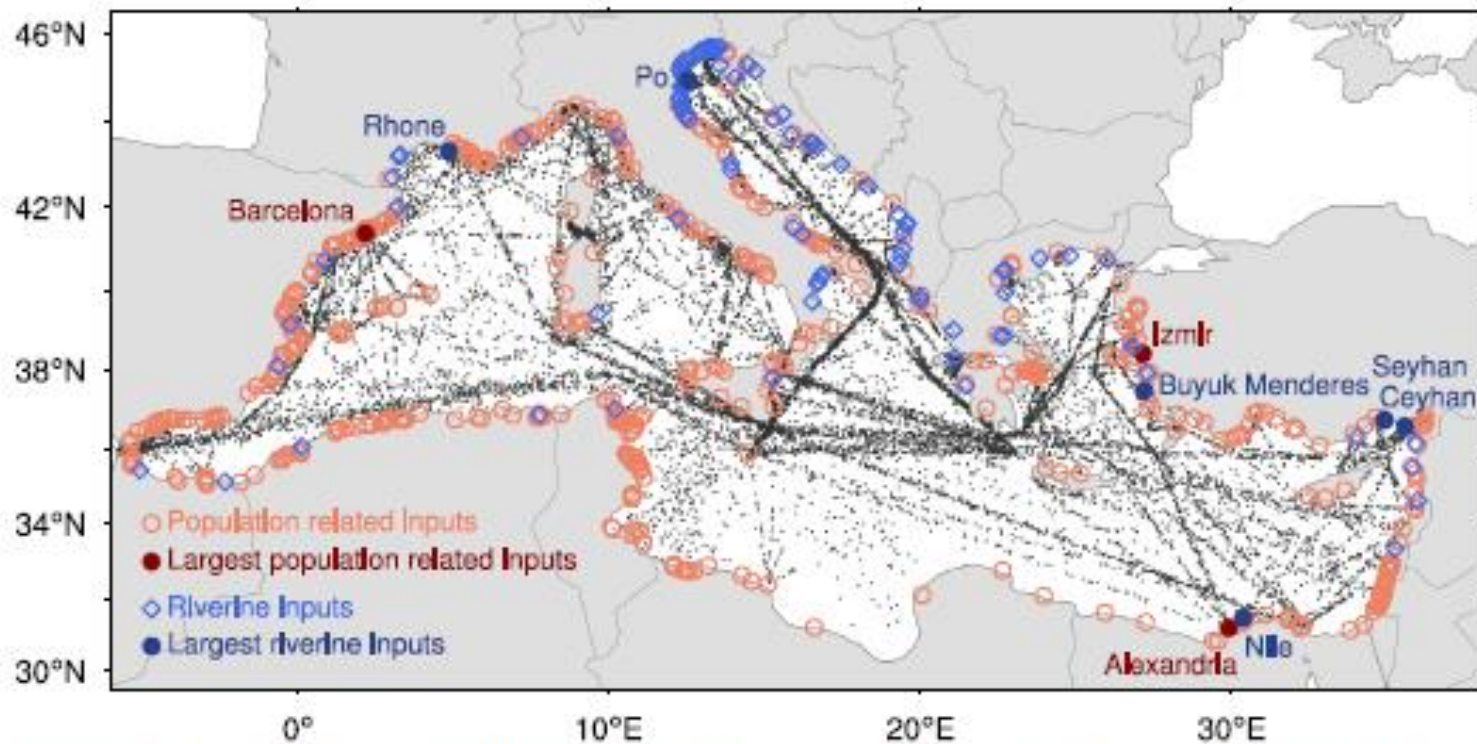
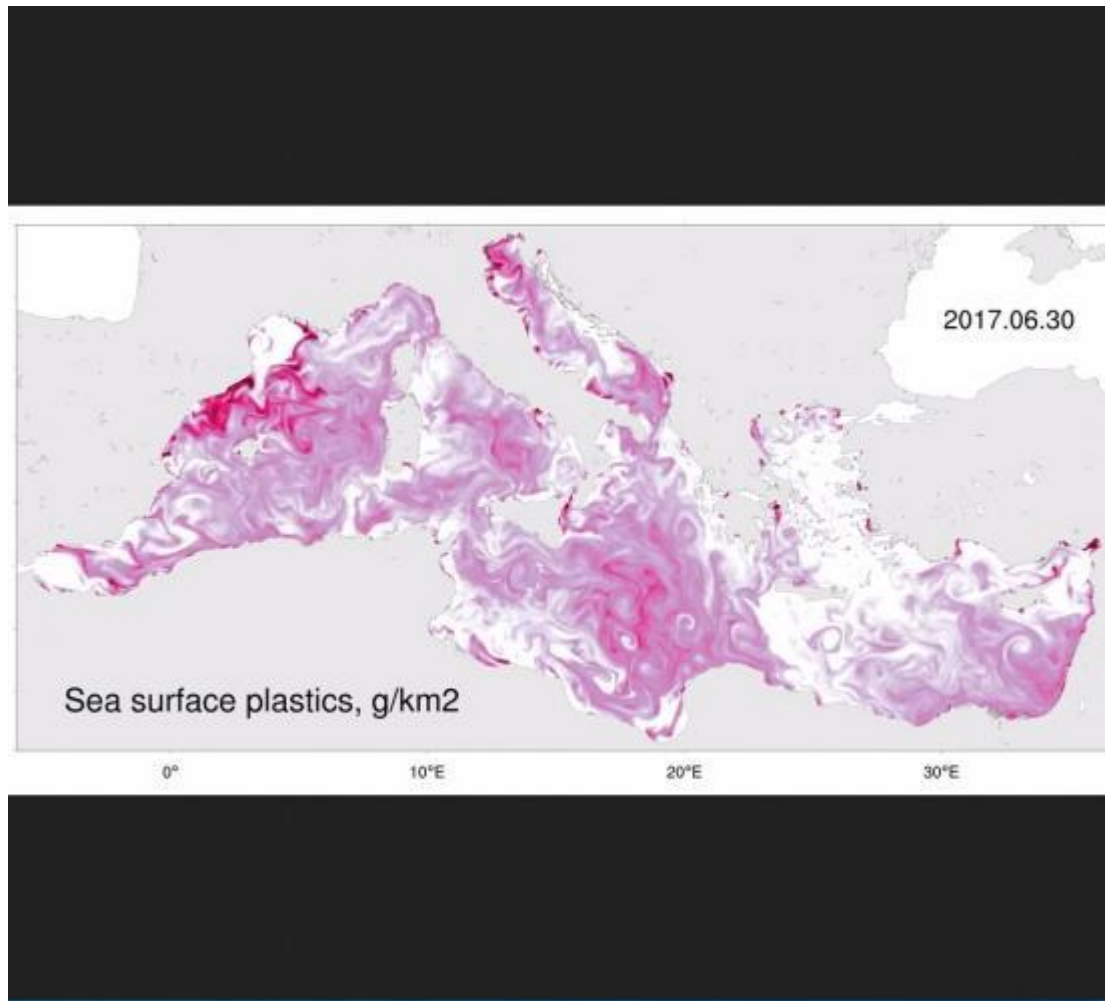


Fig. 1. Spatial distribution of the floating debris inputs into the Mediterranean Basin: shipping lanes (gray dots), rivers (open blue diamonds), the largest rivers (closed blue circles), cities (open red circles), and the largest cities (closed red circles). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

➤ Where the marine litter accumulates? 3/7



http://plastics.cmcc.it/files/Med_plastics.mp4

➤ Where the marine litter accumulates? 4/7

8 • M.T. Spedicato et al.

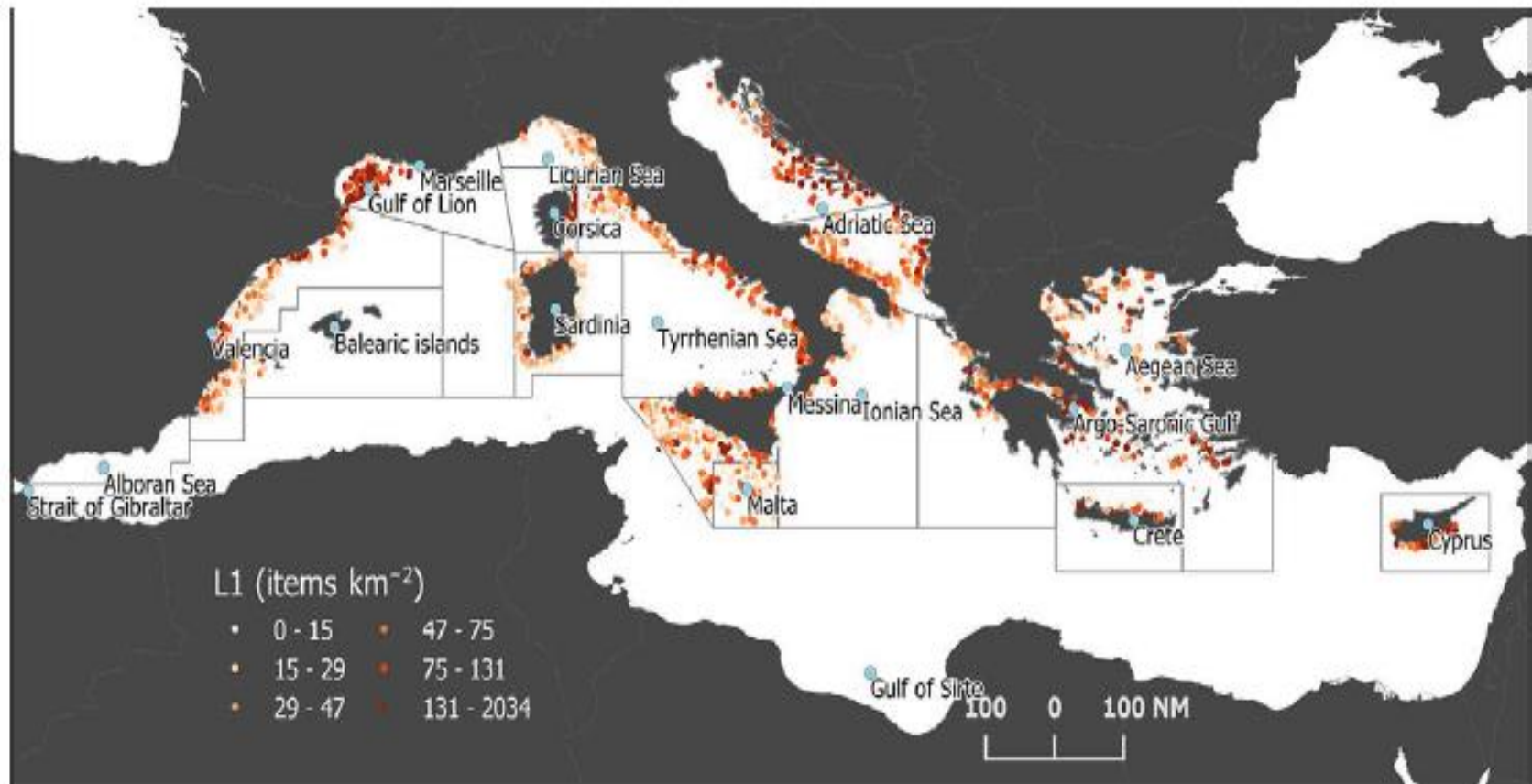
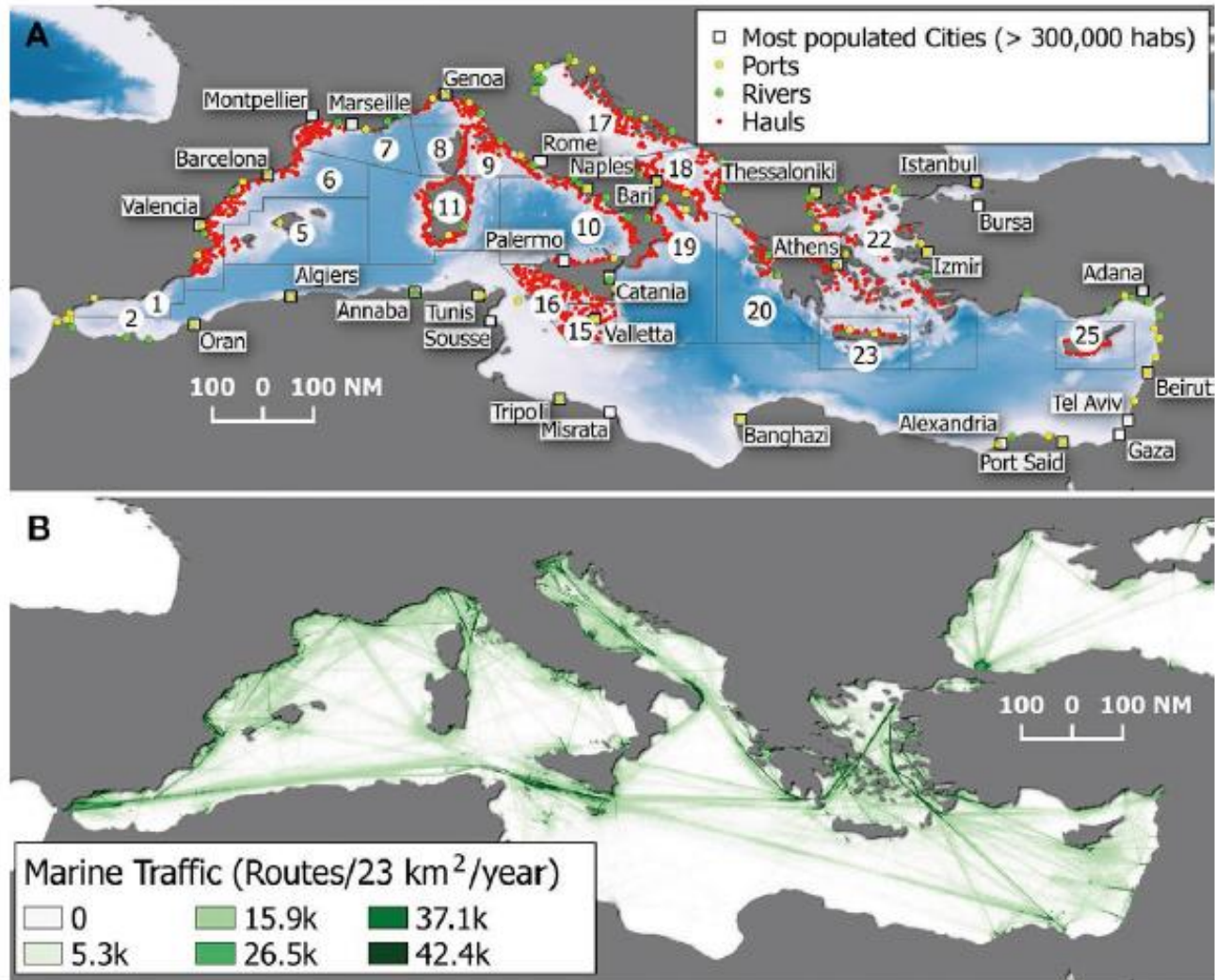
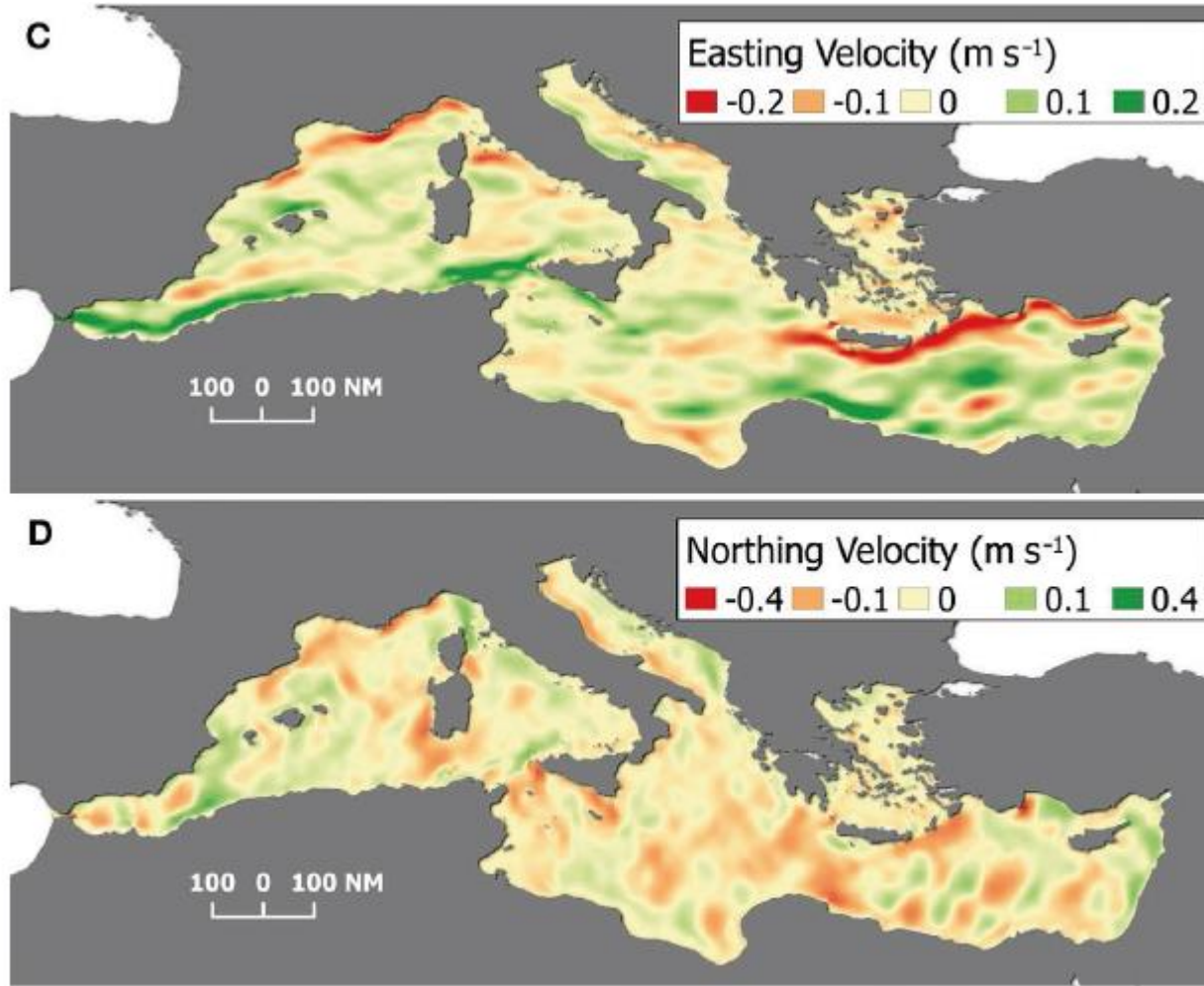


Fig. 4. – Bubble plot of plastic data by haul from the MEDITS surveys of 2013, 2014 and 2015; for each haul an average value among the three years is showed.

➤ Where the marine litter accumulates? 5/7



➤ Where the marine litter accumulates? 6/7



Current velocity

➤ Where the marine litter accumulates? 7/7

Distribution of macro-litter on the northern Mediterranean seafloor • 9

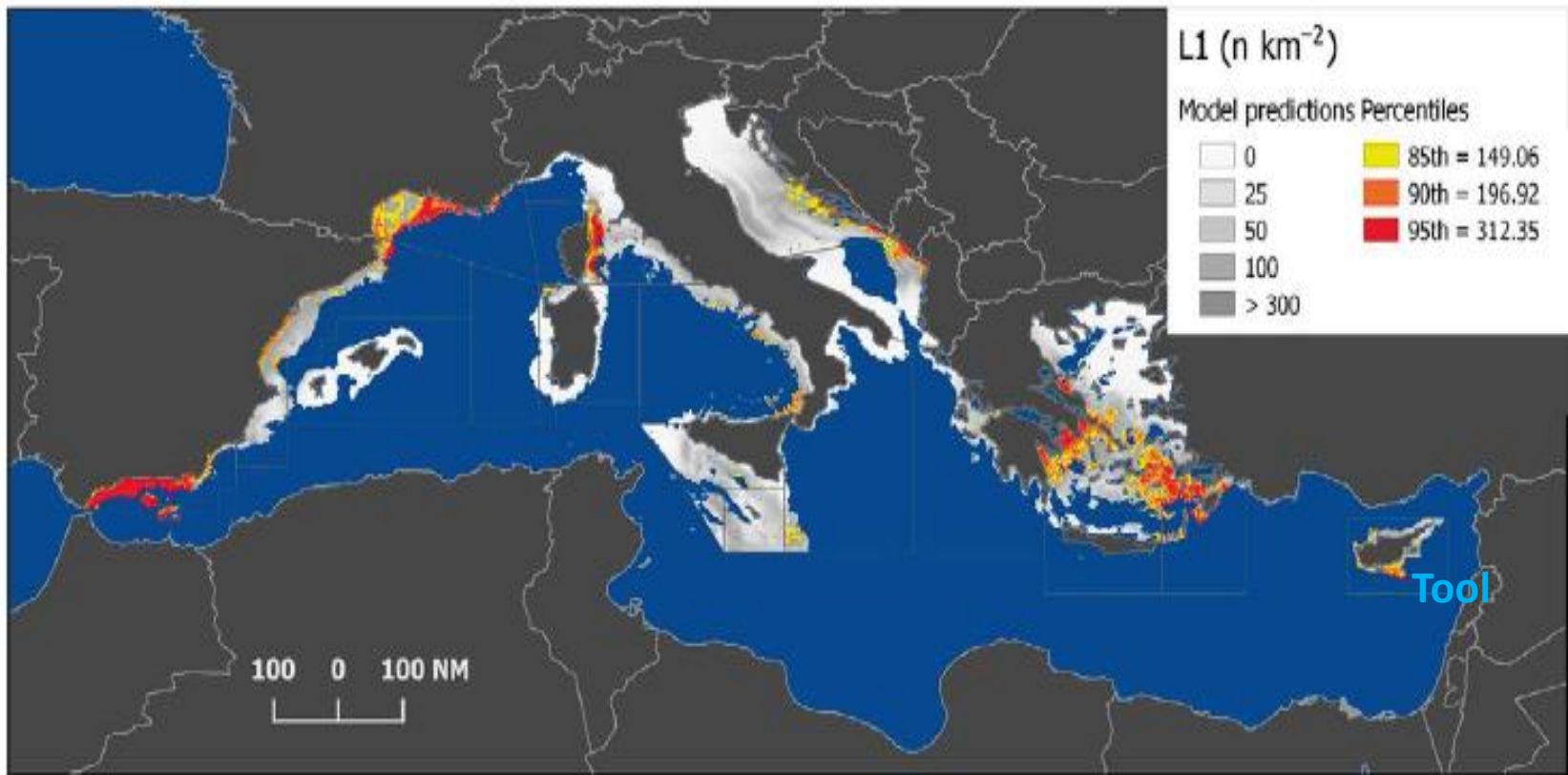
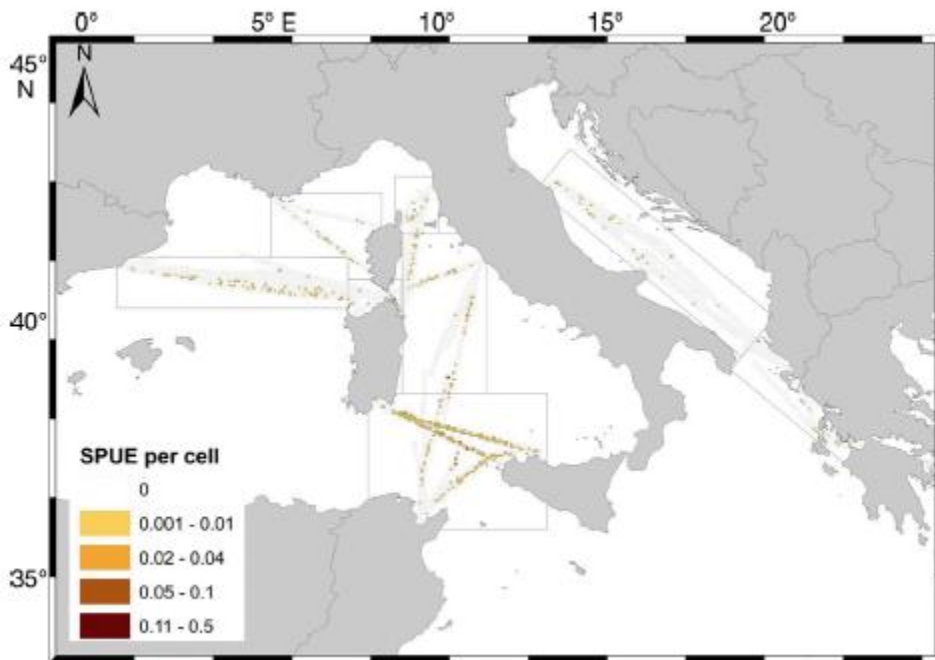
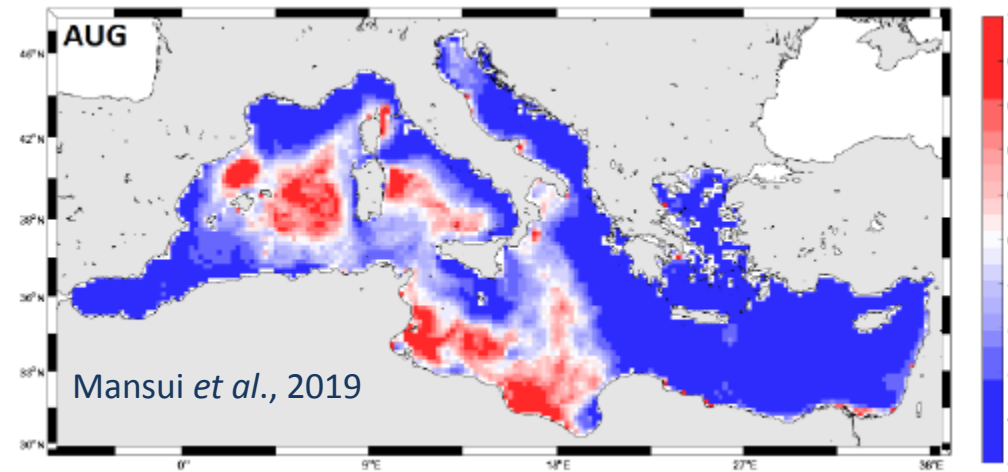


Fig. 6. – Map of the model predictions of plastic density on the seafloor in the northern Mediterranean basin. Density thresholds to identify hotspot areas are indicated in the legend in correspondence to the 85th, 90th and 95th percentiles of the raster data.

➤ Which of the marine litter accumulation zones are areas at risk of exposure for marine organisms? 1/2

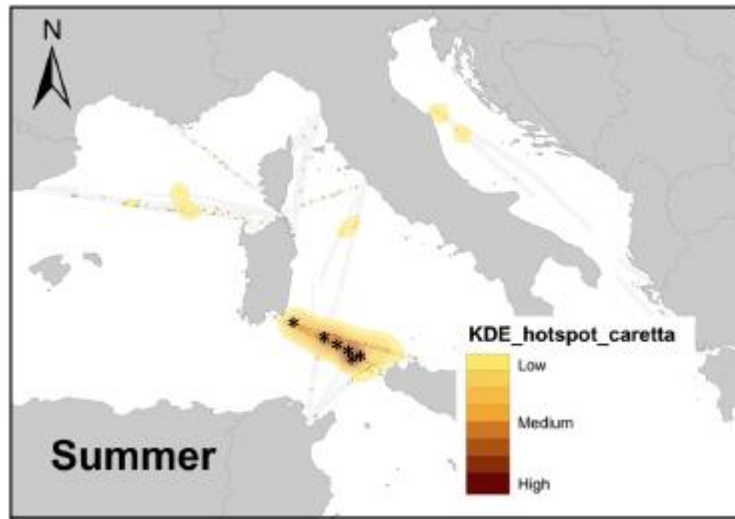
Arcangeli *et al.*, 2019

Marin litter accumulation areas

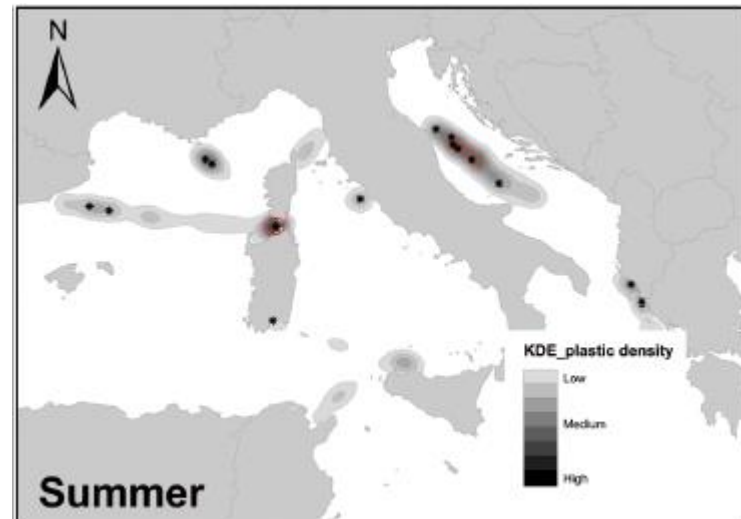


Spatial distribution of abundance of sea turtles (*Caretta caretta*) in the monitored areas .

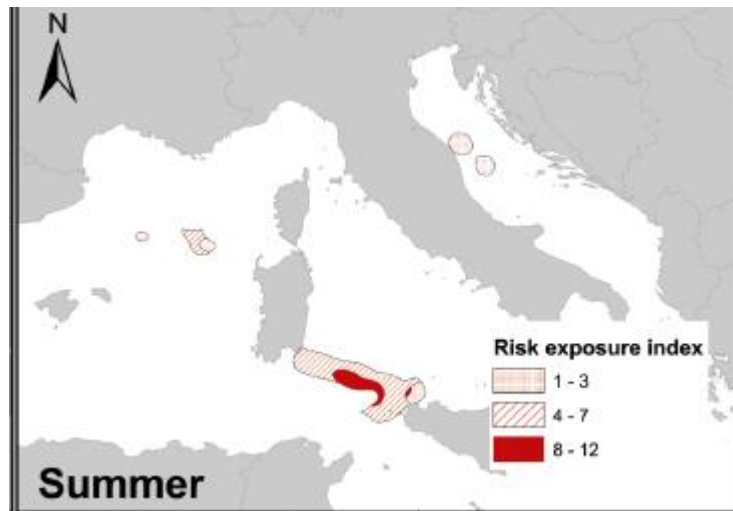
➤ Which of the marine litter accumulation zones are areas at risk of exposure for marine organisms? 2/2



Index of abundance of *Caretta caretta*



Accumulation area of plastic



Area at higher risk of exposure to macrolitter

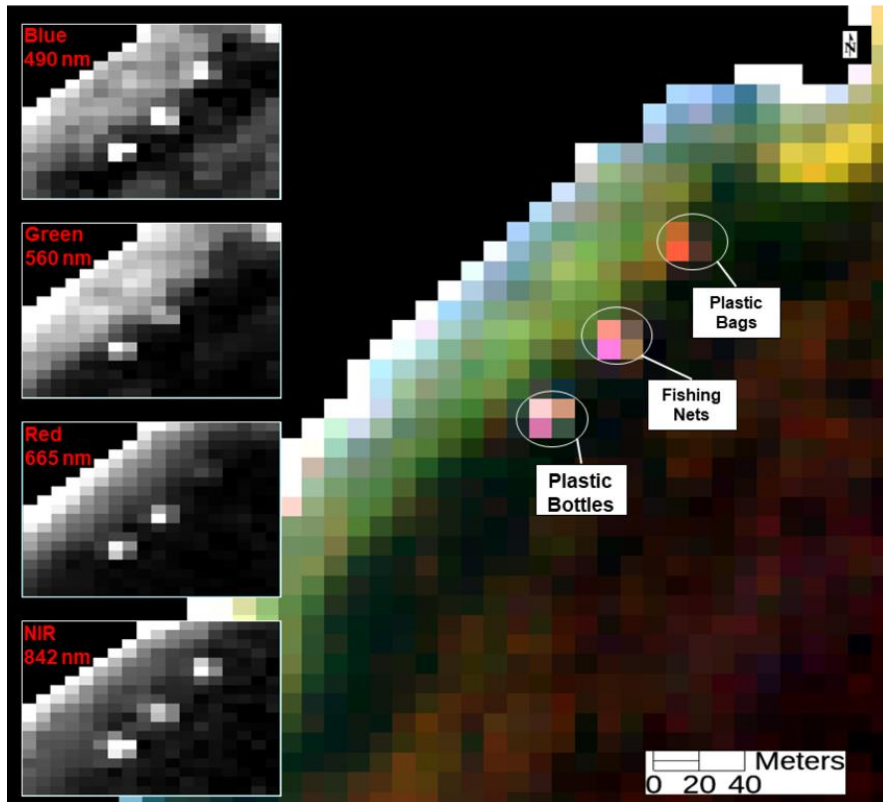
➤ What is the contribution of foreign sources to the national level of marine litter?

The application of modelling methods to describe the transboundary litter pollution and to estimate the contribution of foreign sources to the national levels is increasing. Liubartseva et al., 2018, provides modelling evidence that most of the beach litter originates from national sources (called the “boomerang effect”).



Detention of floating plastics from satellite

Sentinel 2 satellites have instruments with a maximum resolution of 10m. It means that a dot of color corresponds to an area of 10m X 10m. Objects at sea can be identified by themselves if they occupy a good percentage of this space.



A set of three artificial floating plastic targets were setup for remote detection in Greece marine waters.

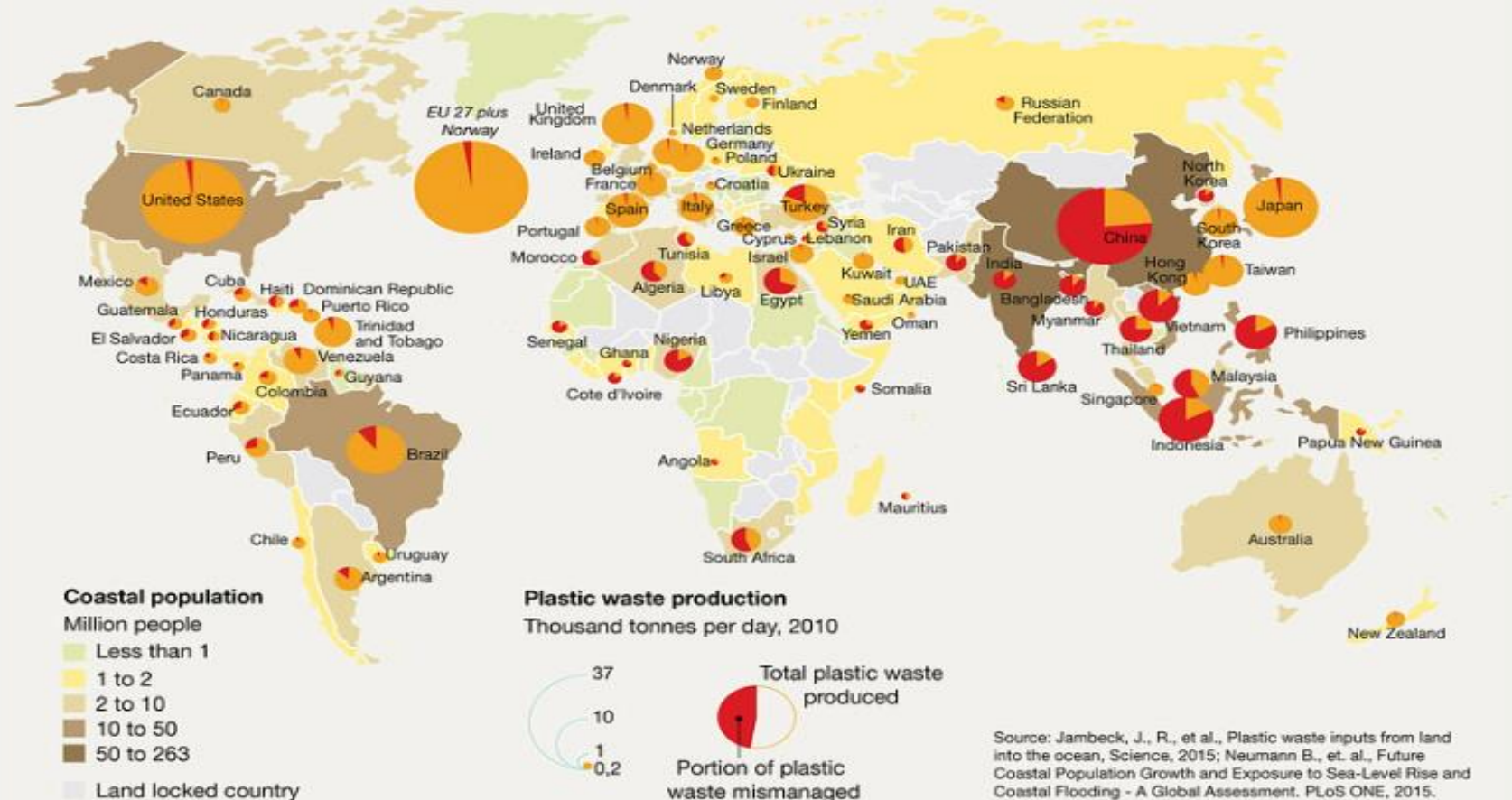


Plastic Litter Project 2018
J. Appl. Earth Obs, 79 (2019) 175-183.

Why is it so important to understand the transboundary litter pollution?

Countries need to evaluate the effectiveness of their programme of measures and actions plan to reduce their input of marine litter.

Plastic waste produced and mismanaged



Why is it important CALYPSO?

Additional studies are necessary to support the identification and indicative quantification of the origin of litter transported by the currents. Actions and measures taken by countries are expected to reduce transboundary marine litter pollution but we have to reduce the scientific gaps.



Interreg
Italia-Malta



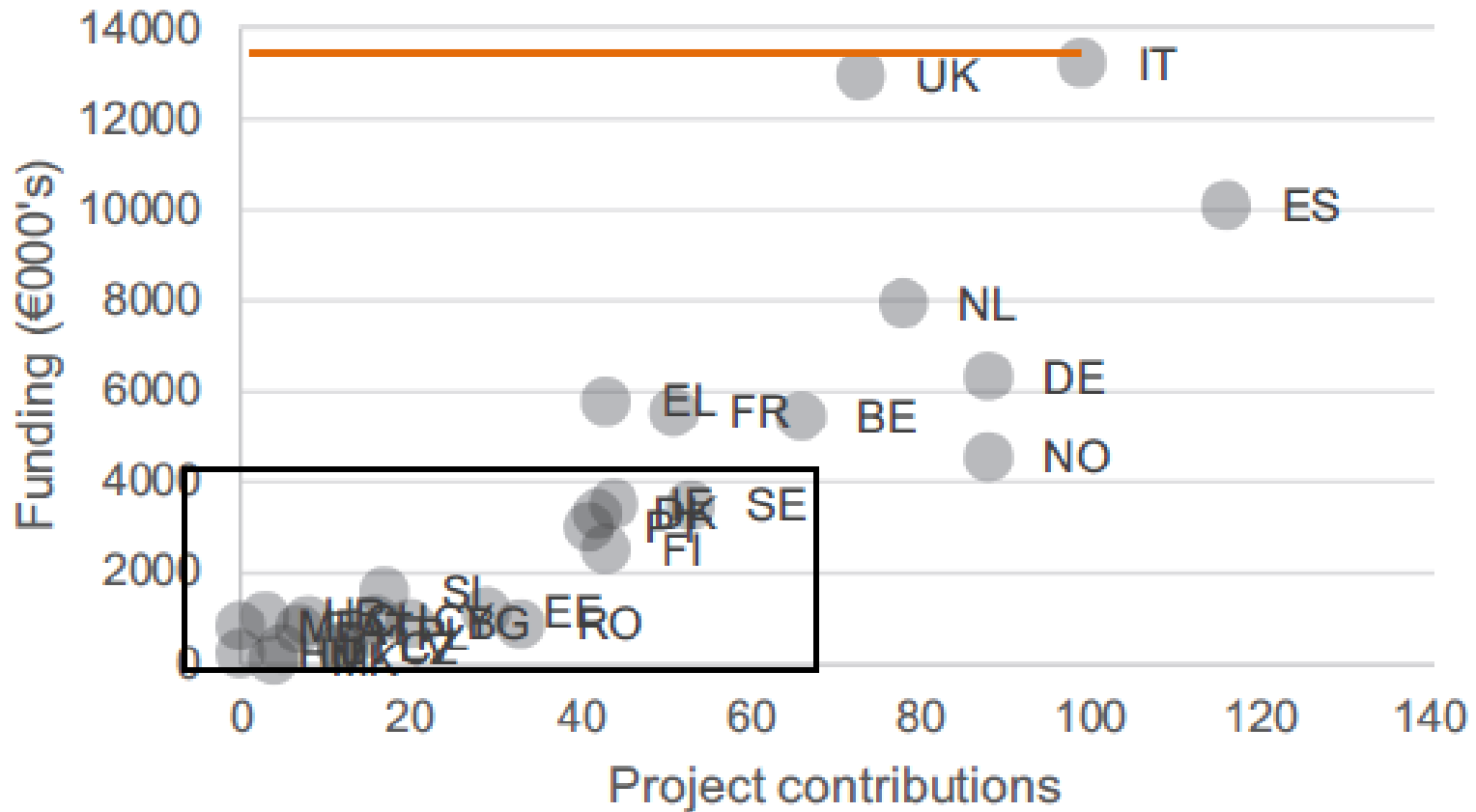
UNIONE EUROPEA
EUROPEAN UNION

Calypso South

Fondo Europeo di Sviluppo Regionale
European Regional Development Fund

Good news

Scientific research in the identification of marine litter at sea with Earth observation products: the role of Italy



From Maes et al. "Shades of grey: Marine litter research developments in Europe". Marine Pollution Bulletin 146 (2019) 274–281