



# The Plastic Busters MPAs results and achievements – Cabrera MPA

Salud Deudero, Instituto Español de Oceanografía

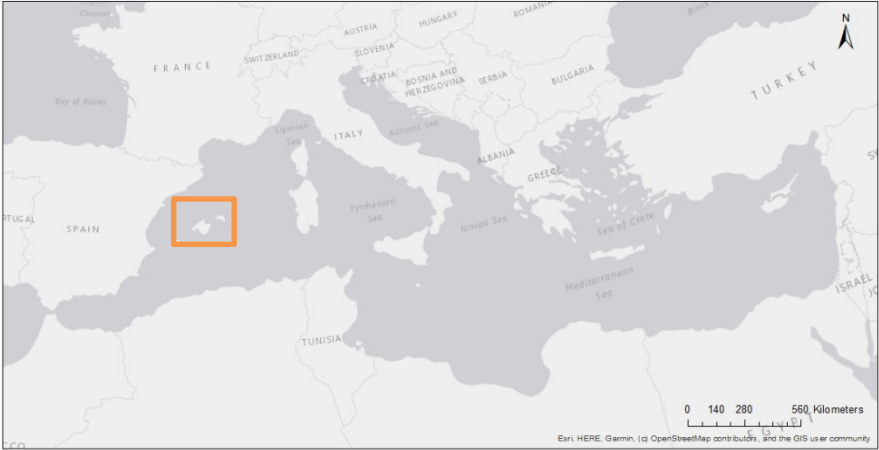
*Plastic Busters MPAs Capitalization Event | 12 October 2021*



Project co-financed by the European Regional Development Fund

# Cabrera Maritime-Terrestrial National Park

Cabrera Archipelago



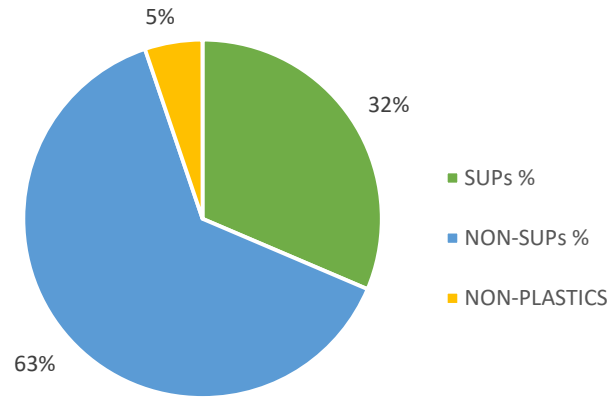
Balearic Islands



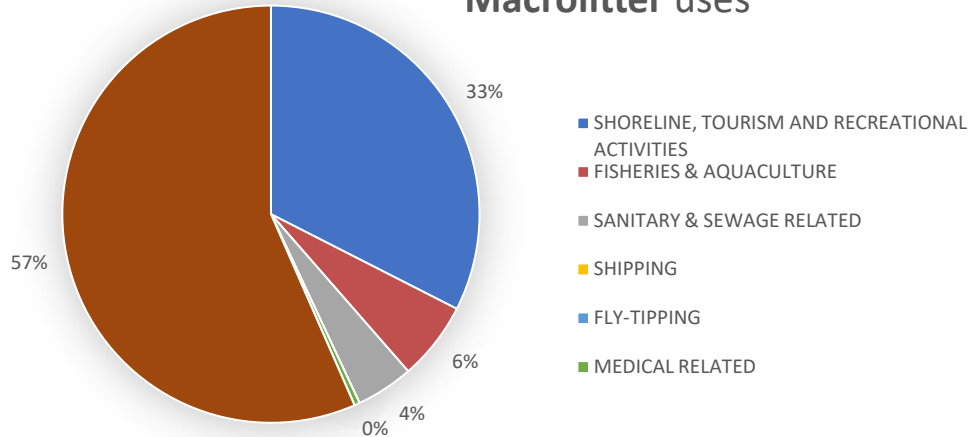
# Beach macrolitter

Sampling period  
 -12 sites in summer 2019  
 - 8 sites in summer 2020

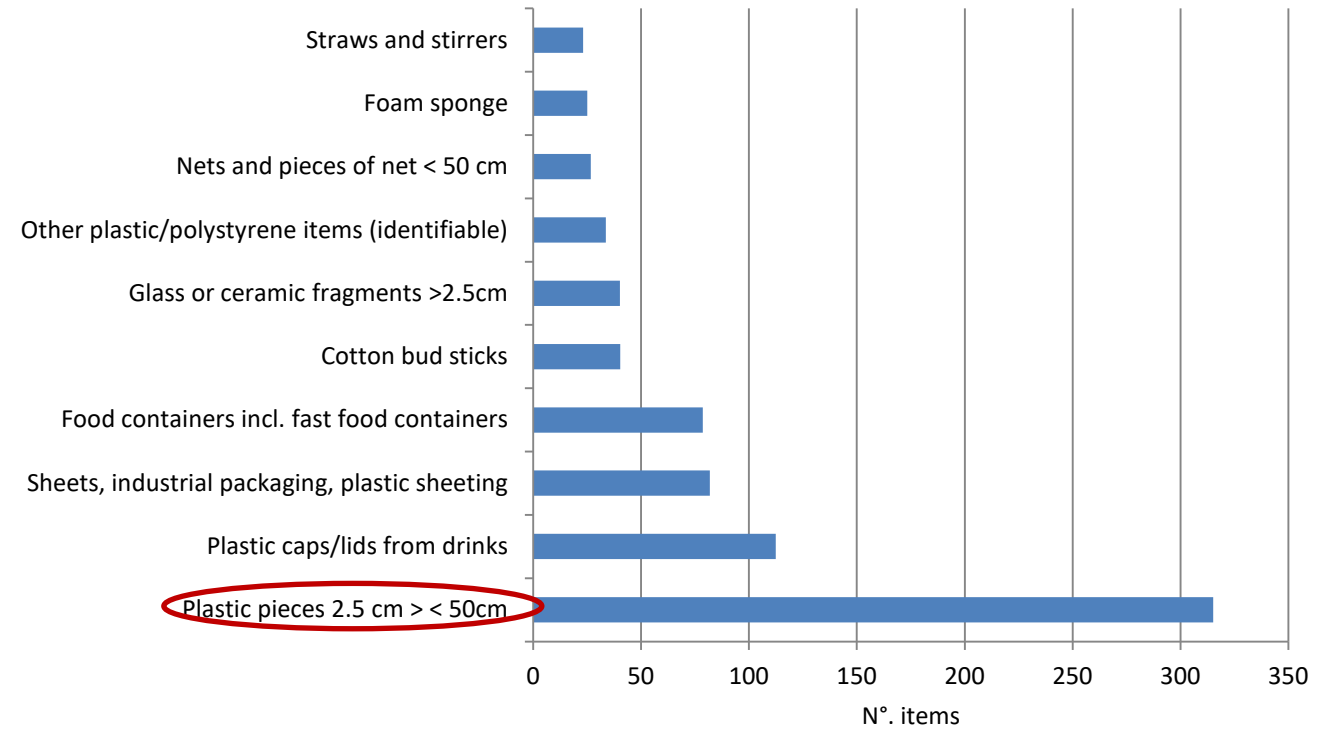
Macrolitter composition



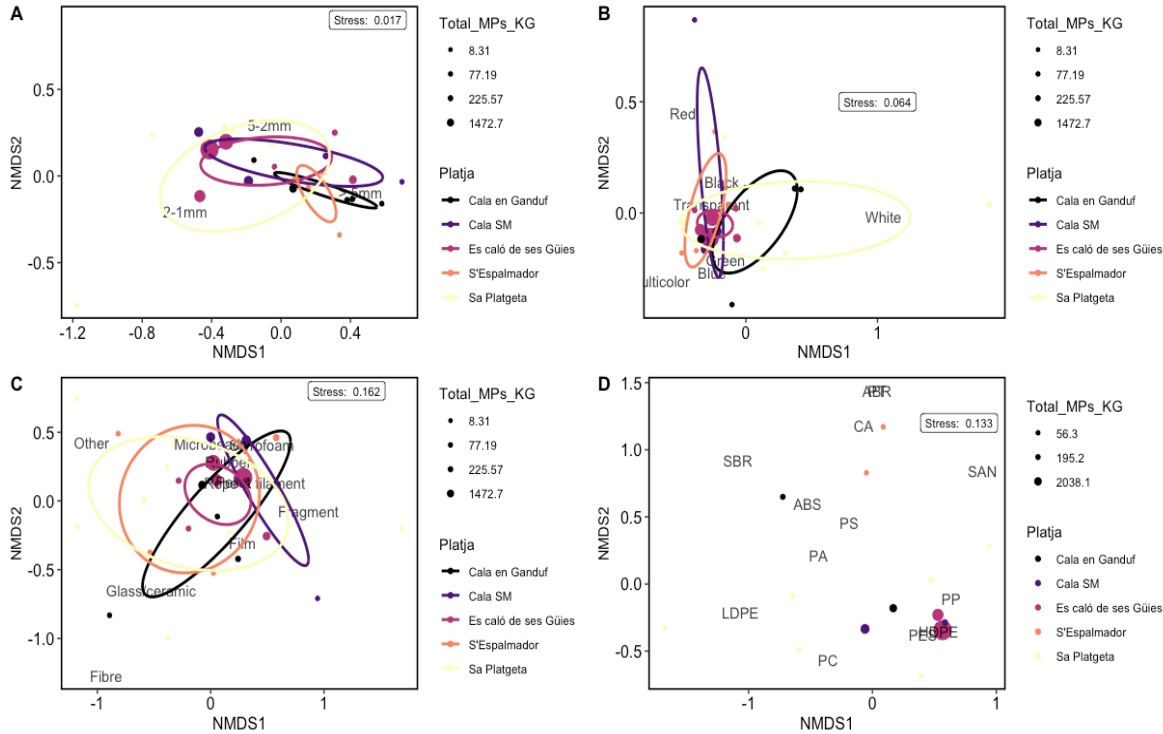
Macrolitter uses



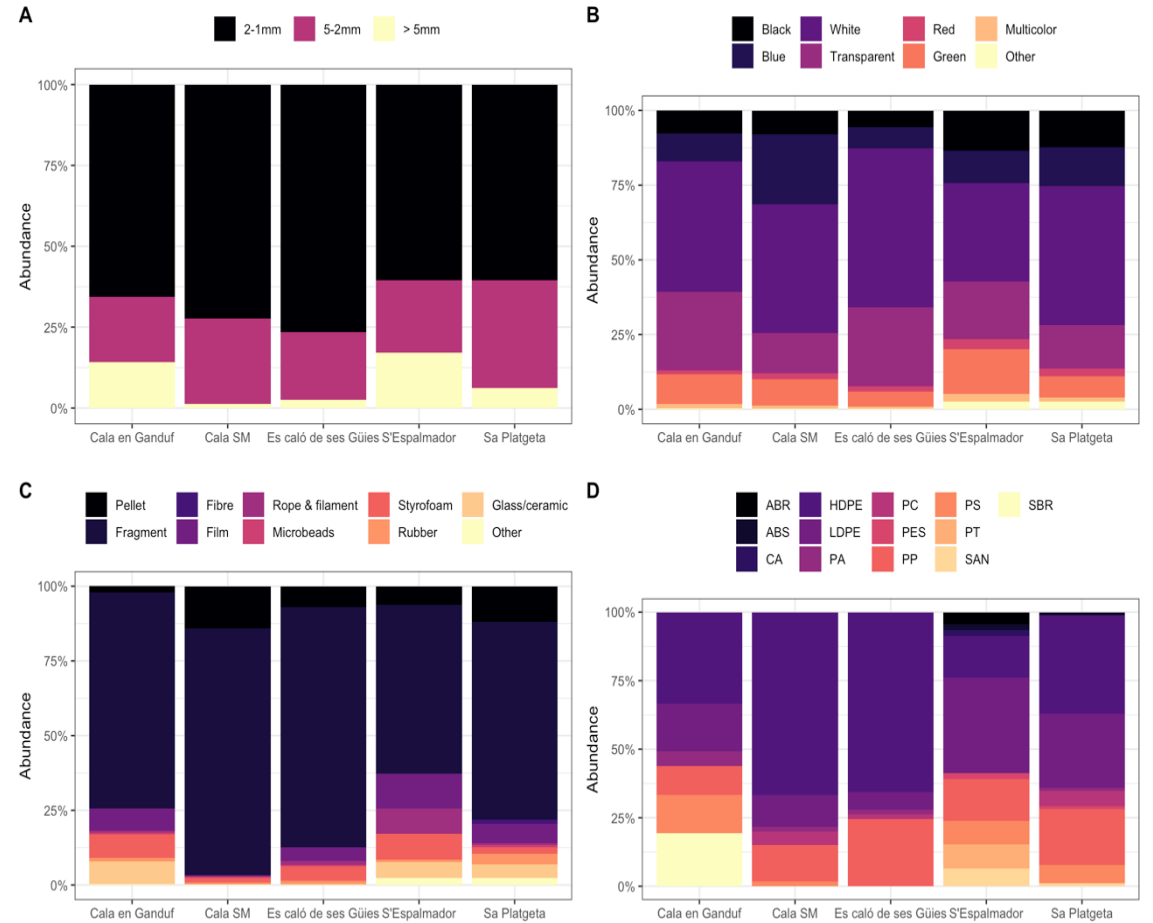
Top 10 items



# Beach macrolitter



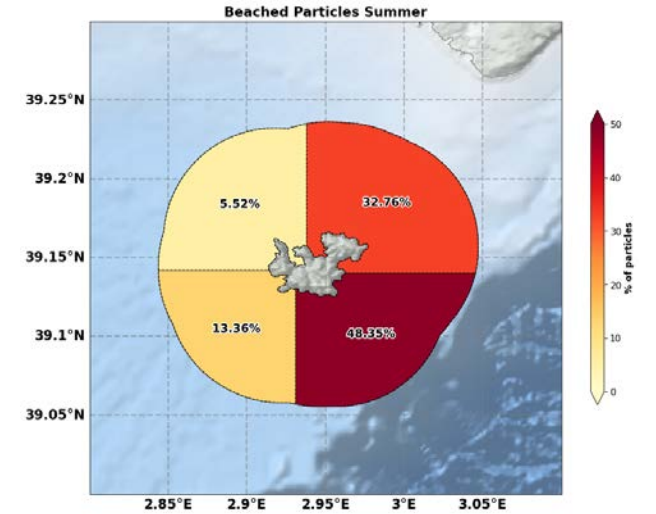
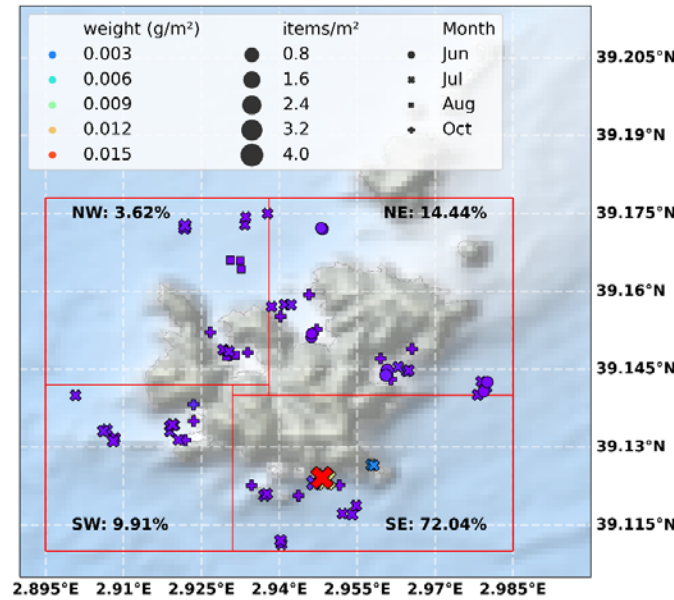
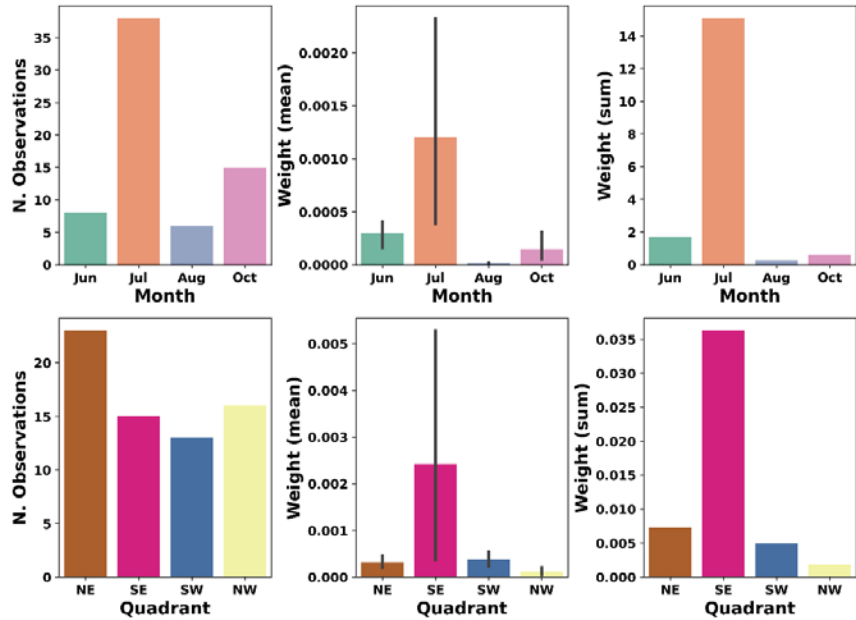
nMDS similarity item characteristics from sediment samples : A) size, B) colour, C) type and D) polymer. Bubble size represents items/kg d.w. sediment from each of the sampled sediment.



Contribution of plastic items in sediment samples at each beach: A) size, B) colour, C) type and D) polymer: high-density polyethylene (HDPE), low-density polyethylene (LDPE), polyamide (PA), polyester (PES), polypropylene (PP), polystyrene (PS), acrylonitrile-butadiene rubber (ABR), acrylonitrile butadiene styrene (ABS), styrene – acrylonitrile (SAN), styrene - butadiene rubber (SBR), and paint (PT).

Under review

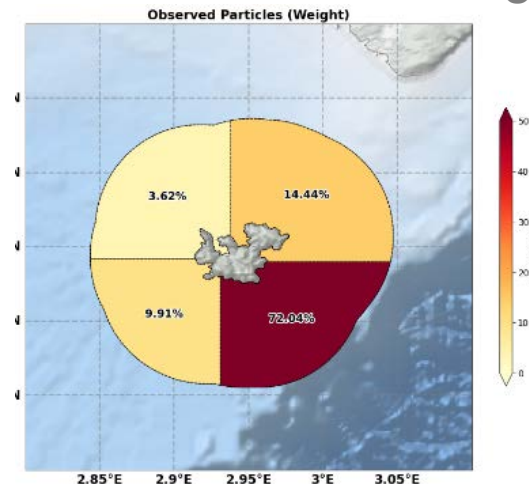
# LOCAL SCALE (Validating)



## Observations 2018-2020

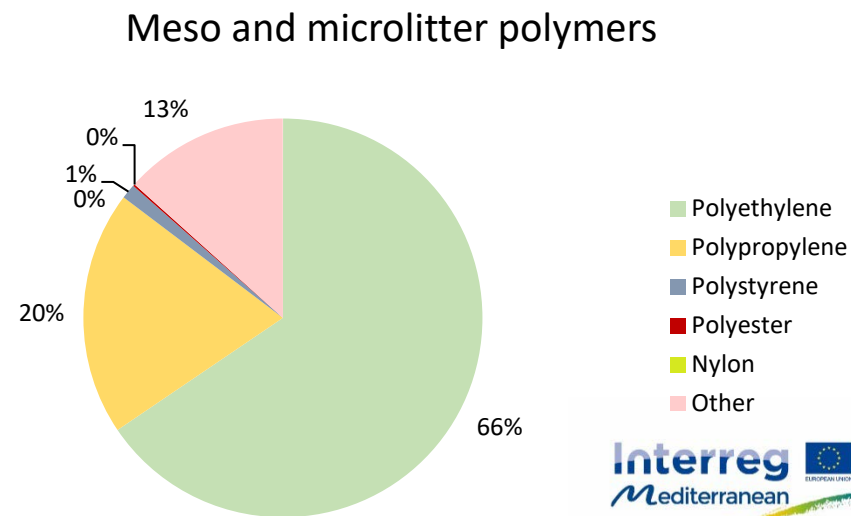
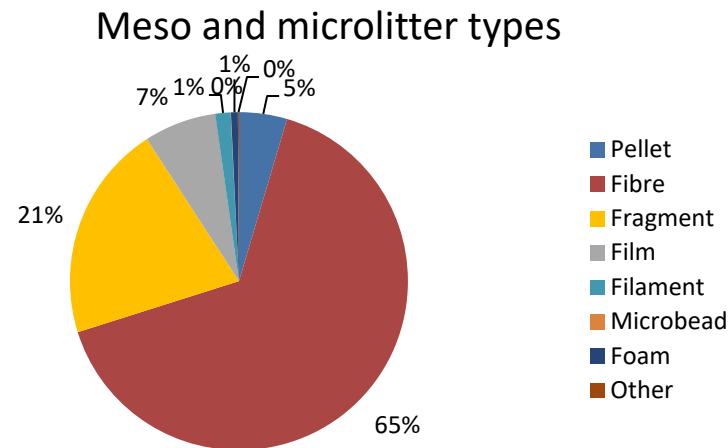
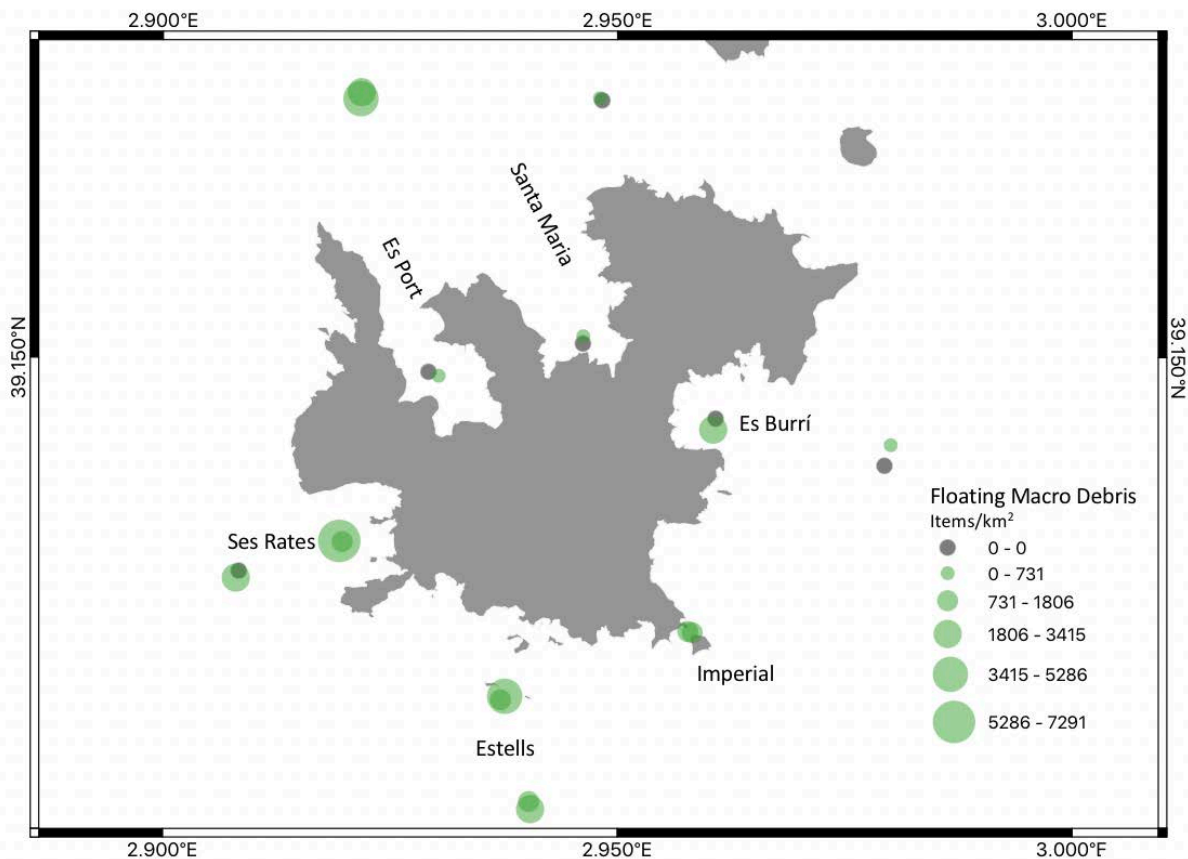
ML beaching larger on the eastern side  
 Southeastern quadrant receives the largest amount.  
 Consistent in model and observations

## Observations



# Floating meso & microlitter

*Work in progress*



# Seafloor macrolitter



12 locations

2 divers

3 transects

Classification items

**Under review**

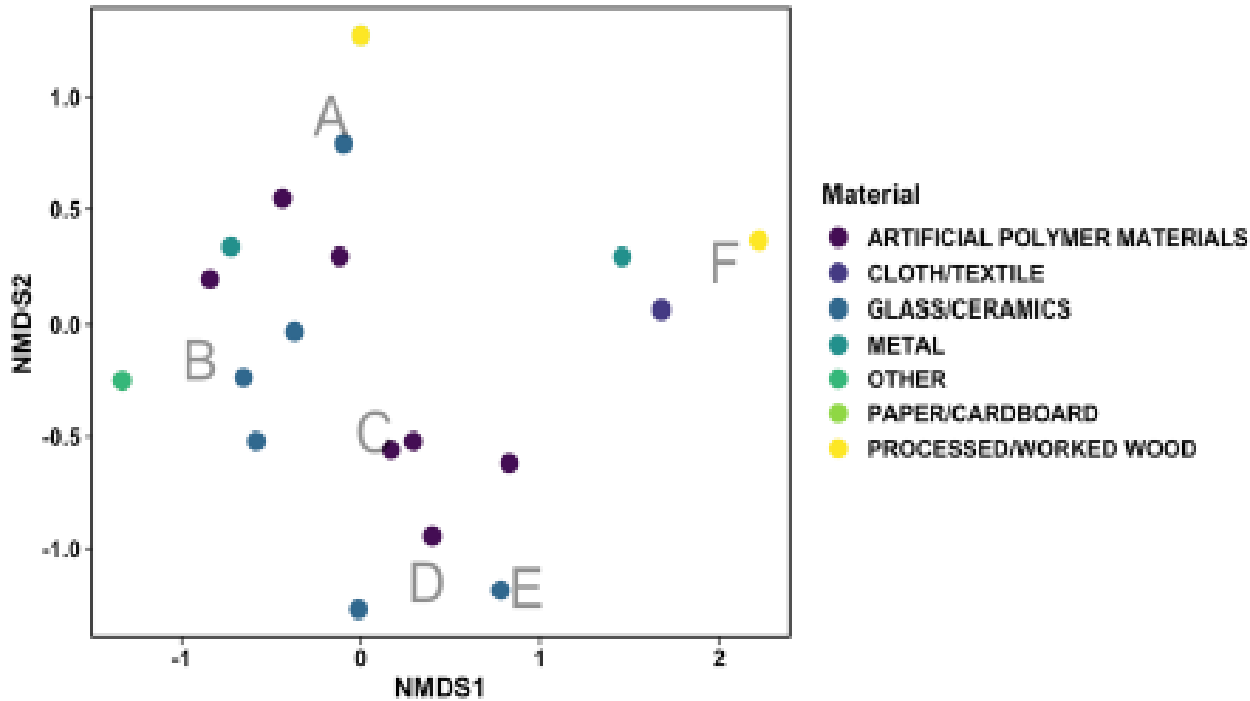
Summary average ( $\pm$ SD) marine litter (ML) collected per habitat during the seafloor visual scuba surveys

Habitat	ML abundance (n° items)	ML weight (g)	Percent (%)
Rocky	4.9 $\pm$ 17.7	204.6 $\pm$ 485.3	7.6
Sand patch	1.7 $\pm$ 2.7	81.5 $\pm$ 135.2	6.6
Sandy	1.9 $\pm$ 4.4	156.8 $\pm$ 283.5	30.5
Sandy and rocky	1.6 $\pm$ 2.5	35.6 $\pm$ 57.3	8.7
Seagrass	1.1 $\pm$ 0.6	350.2 $\pm$ 368.5	2.8
Seagrass and rocky	1.5 $\pm$ 1.8	53.6 $\pm$ 81.1	5.9
Seagrass and sand	2.2 $\pm$ 2.5	315.5 $\pm$ 1101.8	19.4
Seagrass with sand patches	2.3 $\pm$ 3.8	235.8 $\pm$ 813.9	18.4



marine litter on the seafloor in Cabrera National Parc from scuba diving surveys: A) scuba divers surveying in parallel for marine litter on the seafloor, B) glass bottles on the seafloor heavily covered with biota, C) rope entangled in *Posidonia oceanica* seagrass, D) plastic beverage container, E) derelict fishing gear and E) plastic materials and glass bottles marine litter

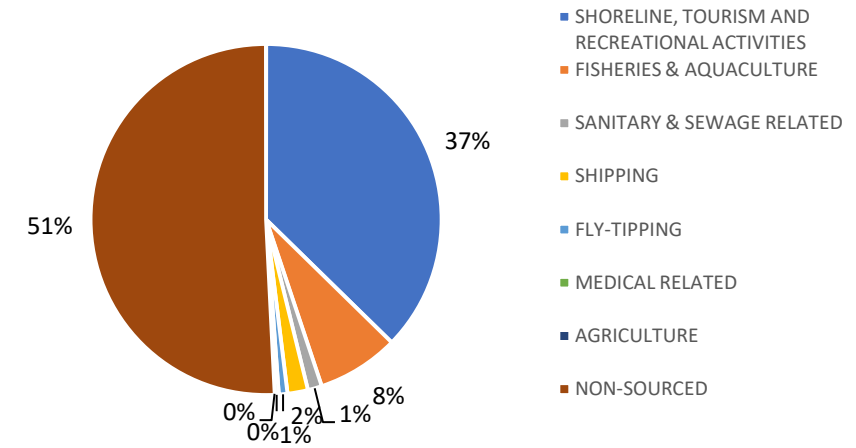
# Seafloor macrolitter



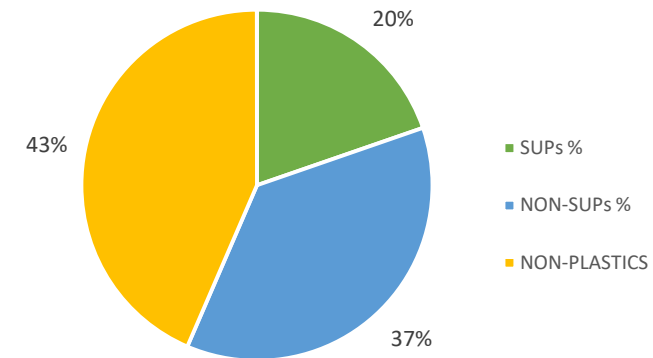
Multidimensional scaling (nMDS) for seafloor material types and items size classification. All items were categorized and assigned the TSG\_ML General Code, weighted to the nearest two decimal points (grams) and assigned the following sized classes: A = 25 cm<sup>2</sup>, B = 100 cm<sup>2</sup>, C = 400 cm<sup>2</sup>, D = 2500 cm<sup>2</sup>, E = < 1 m<sup>2</sup>, F > 1 m<sup>2</sup>.

*Under review*

## Macrolitter uses



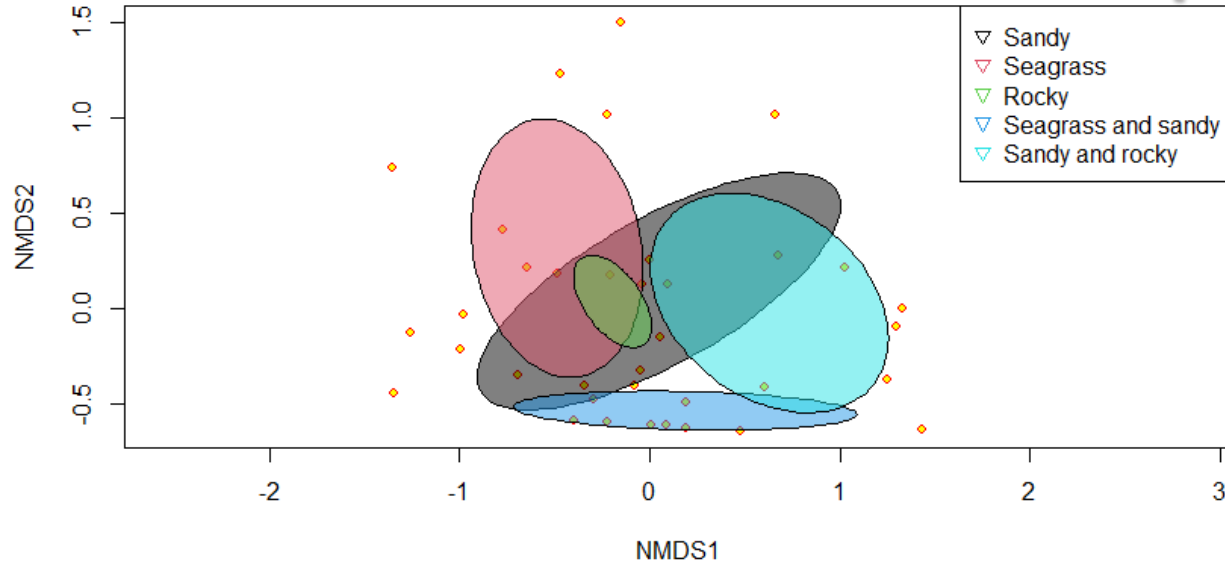
## Macrolitter composition





# Sediments microlitter

*Work in progress*



Multidimensional scaling (nMDS) illustrating habitat related pattern in typology of the MPs identified in seafloor samples within Cabrera MPA (stress value =0.10). Yellow points represent seafloor samples and ellipses habitats

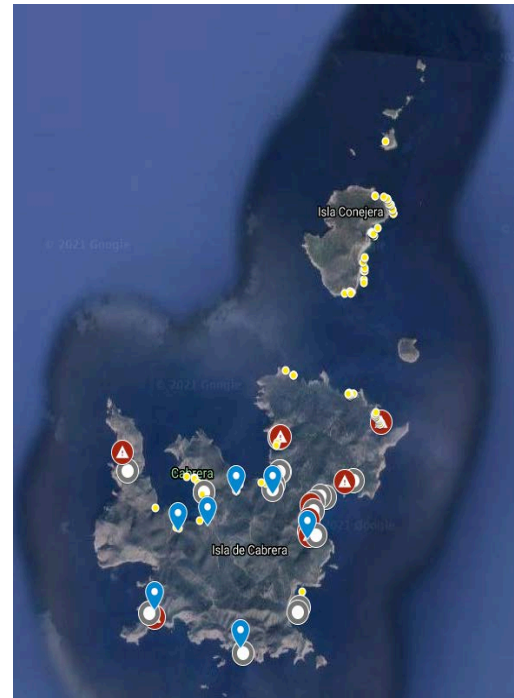
Average number of MPs/g ( $\pm$ SD) in seafloor samples

Station ID	Date	Mean value MPs/g of dry sediment ( $\pm$ SD)
Avarador des Far	2019	0.31 $\pm$ 0.15
Cala Gandulf	2019	0.19 $\pm$ 0.17
Cala March	2019	0.14 $\pm$ 0.03
Caló des Forn	2019	0.13 $\pm$ 0.01
Codolar Estells	2019	0.22 $\pm$ 0.28
Es caló de ses Güies	2019	0.23 $\pm$ 0.03
Olla	2019	0.46 $\pm$ 0.59
Olló	2019	0.27 $\pm$ 0.02
Sa Platgeta	2019	0.12 $\pm$ 0.11
Playa Espalmador	2019	0.21 $\pm$ 0.04
Playa Pages	2019	0.21 $\pm$ 0.18
S'Esclatasang	2019	0.57 $\pm$ 0.59
Cala Gandulf	2020	0.45 $\pm$ 0.01
Enciola	2020	0.35 $\pm$ NA
Es Caló des Macs	2020	0.39 $\pm$ 0.15
Espalmador	2020	1.21 $\pm$ 1.33
Estells	2020	0.39 $\pm$ 0.41
L'Olló	2020	0.81 $\pm$ 0.02
Sa Platgeta	2020	0.64 $\pm$ 0.1

# Identify Marine Litter Hotspots on coastline

*Work in progress*

4 hotspots surveys from February to July → total **1.041** items quantified



Marine litter quantified during hotspots surveys

Category	N	Percentage (%)
Barrels	42	4.03
Bags and packaging	62	5.96
Buoys	52	5.00
Caps	17	1.63
Fishing gears	21	2,02
Foam	9	0.86
Nets and ropes	155	14.89
Other	110	10.57
Plastic bottles	83	7.97
Plastic cases/porexpan	2	0.19
Plastic fragments	165	15.85
Porexpan	23	2.21
Tubes	5	0.48
Woods	295	28.34

# Monitoring invertebrates

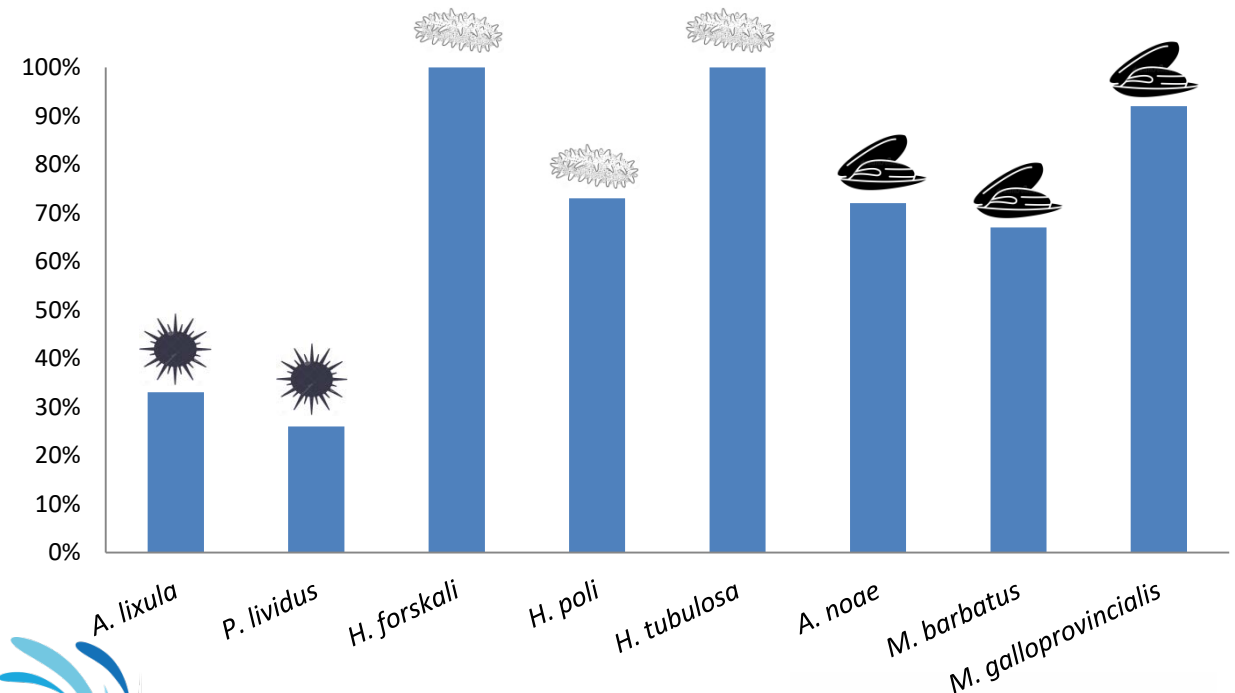
## Microplastic ingestion

Summary number individuals sampled and mean value ( $\pm$  SD) of MPs ingested/invertebrate species

Species	N	Mean value $\pm$ SD
<i>A. lixula</i>	18	1.1 $\pm$ 2.3
<i>A. noae</i>	18	4.8 $\pm$ 5.3
<i>H. forskali</i>	5	13.8 $\pm$ 8.8
<i>H. poli</i>	11	4.7 $\pm$ 4.8
<i>H. tubulosa</i>	5	15.6 $\pm$ 7.4
<i>M. barbatus</i>	6	2.8 $\pm$ 2.5
<i>M. galloprovincialis</i> - IN MPA	39	3.9 $\pm$ 3.1
<i>M. galloprovincialis</i> - OUT MPA	60	8.3 $\pm$ 6.6
<i>P. lividus</i>	27	1.4 $\pm$ 3.0

**Mussels** High % ind. with MP  $\geq 70\%$   
**Sea cucumbers** High % ind. with MP  $\geq 70\%$   
**Sea urchins** Low % ind. with MP  $\leq 30\%$

Microplastic occurrence in invertebrates (%)

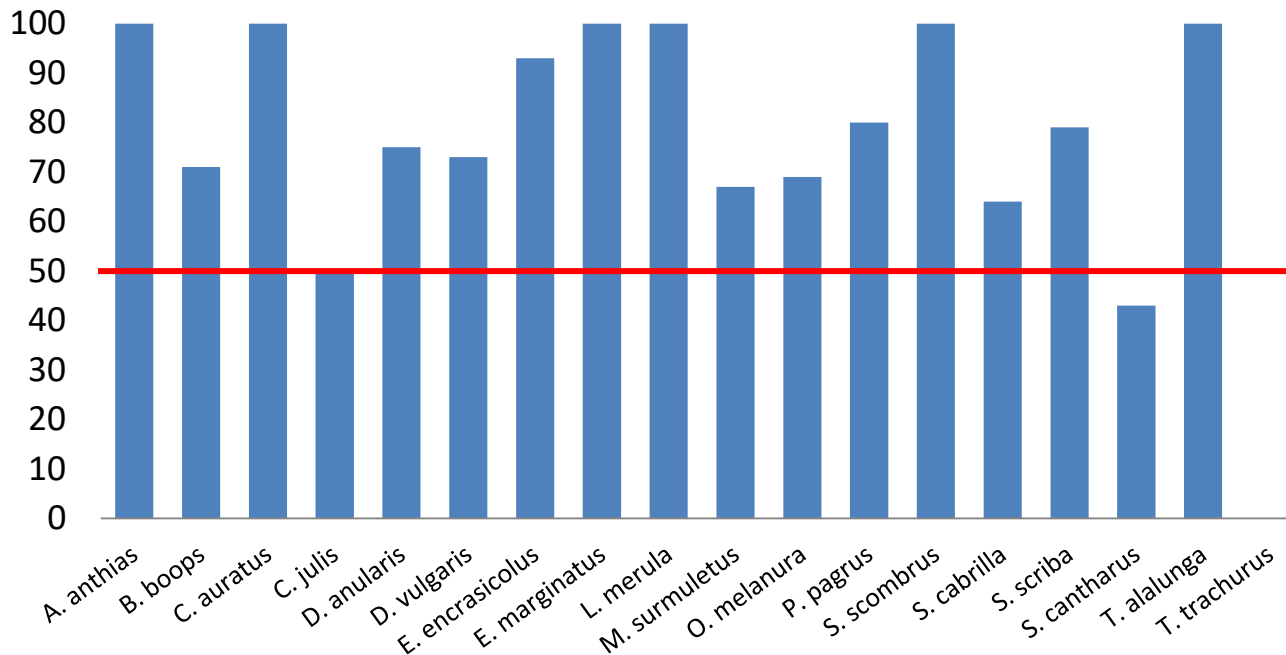


# Monitoring fish species

## Microplastic ingestion



Microplastic occurrence in fish species (%)

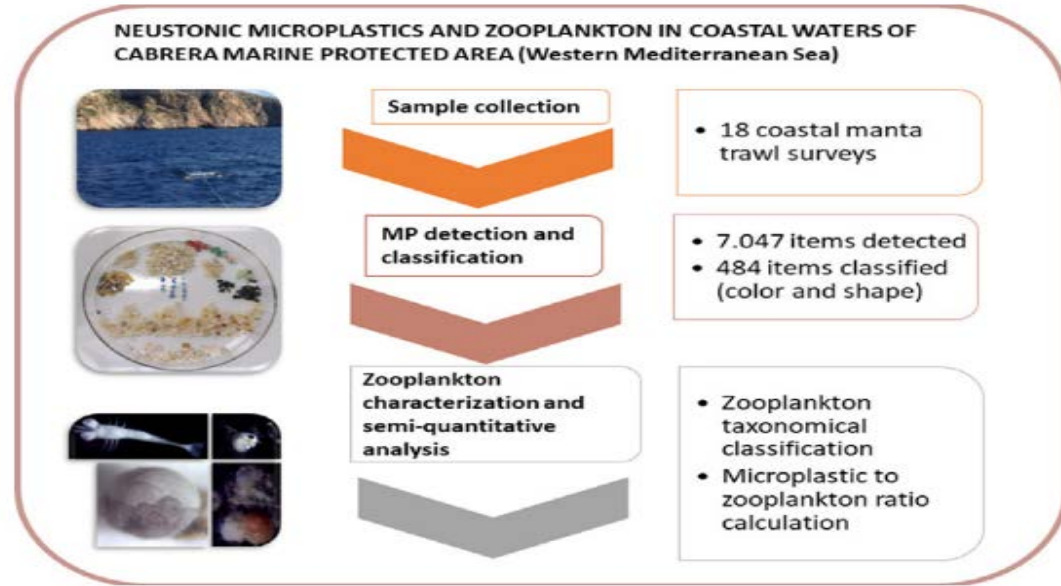


Summary of the number of the individuals sampled and mean value ( $\pm$  SD) of the MPs ingested per fish species

Species	N	Mean value $\pm$ SD
<i>A. anthias</i>	1	5.00 $\pm$ NA
<i>B. boops</i>	56	7.16 $\pm$ 8.04
<i>C. auratus</i>	1	4.00 $\pm$ NA
<i>C. julis</i>	2	1.00 $\pm$ NA
<i>D. anularis</i>	4	2.75 $\pm$ 3,10
<i>D. vulgaris</i>	11	1.50 $\pm$ 2.00
<i>E. encrasicolus</i>	55	3.27 $\pm$ 2.40
<i>E. marginatus</i>	5	6.80 $\pm$ 3.10
<i>L. merula</i>	1	4.00 $\pm$ NA
<i>M. surmuletus</i>	45	2.20 $\pm$ 2.88
<i>O. melanura</i>	16	2.60 $\pm$ 3.18
<i>P. pagrus</i>	5	4.40 $\pm$ 6.10
<i>S. scombrus</i>	2	2.50 $\pm$ 0.8
<i>S. cabrilla</i>	33	1.88 $\pm$ 2.06
<i>S. scriba</i>	75	3.18 $\pm$ 4.51
<i>S. cantharus</i>	7	3.43 $\pm$ 5.26
<i>T. alalunga</i>	5	4.80 $\pm$ 2.10
<i>T. trachurus</i>	1	0



# New knowledge



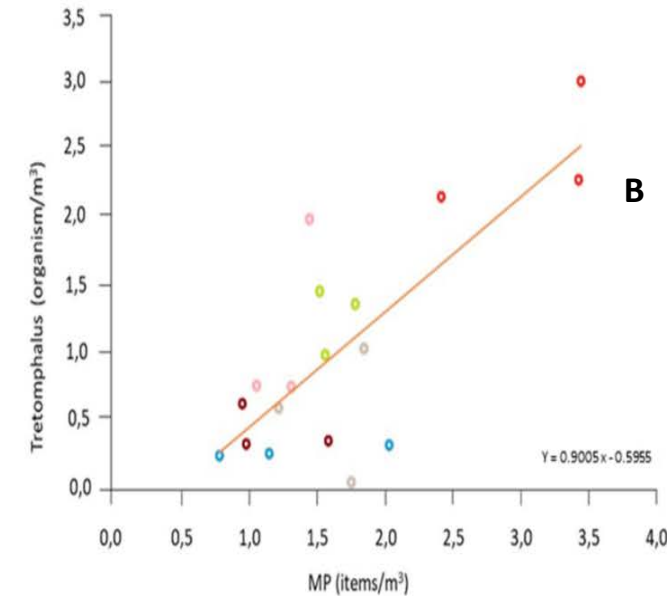
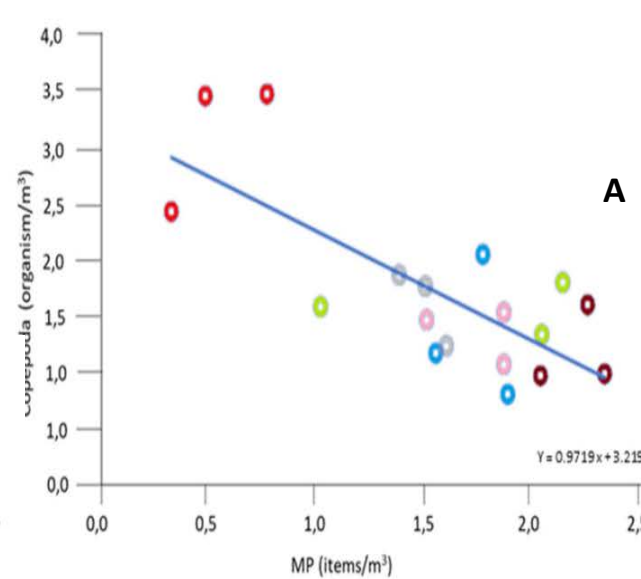
## Neustonic microplastics and zooplankton in coastal waters of Cabrera Marine Protected Area (Western Mediterranean Sea)

V. Fagiano<sup>a,b,\*</sup>, C. Alomar<sup>a</sup>, M. Compa<sup>a</sup>, J. Soto-Navarro<sup>c</sup>, G. Jordá<sup>a</sup>, S. Deudero<sup>a</sup>

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<sup>b</sup> University of Balearic Islands, Palma de Mallorca, Spain

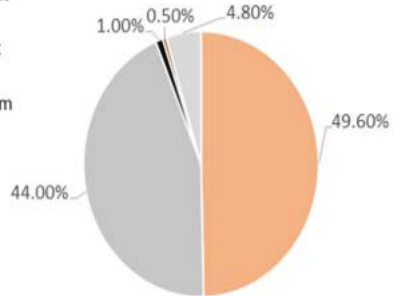
<sup>c</sup> Physical Oceanography Group of the University of Málaga (GOFIMA), Málaga, Spain



- A) MP abundance (items/m<sup>3</sup>) detected at each location in function of Copepoda taxa abundance (organisms/m<sup>3</sup>) ( $r = -0.51$ )
- B) Abundance of the planktonic stage (Tretomphalus) of the foraminifer *Rosalina globularis* (organisms/m<sup>3</sup>) in function of MPs (items/m<sup>3</sup>) abundances detected at each location ( $r = 0.81$ )

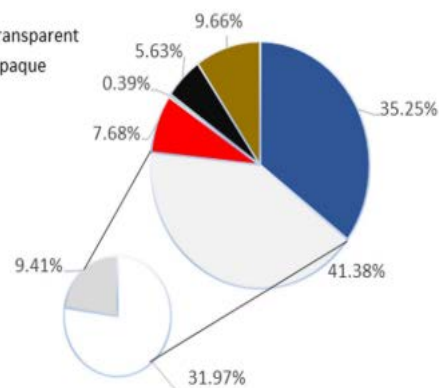
Plastic's shape categories

- Fragment
- Film
- Filament
- Pellet
- Styrofoam



Plastic's color categories

- Blue
- White
- Other
- Red
- Green
- Black
- White transparent
- White opaque

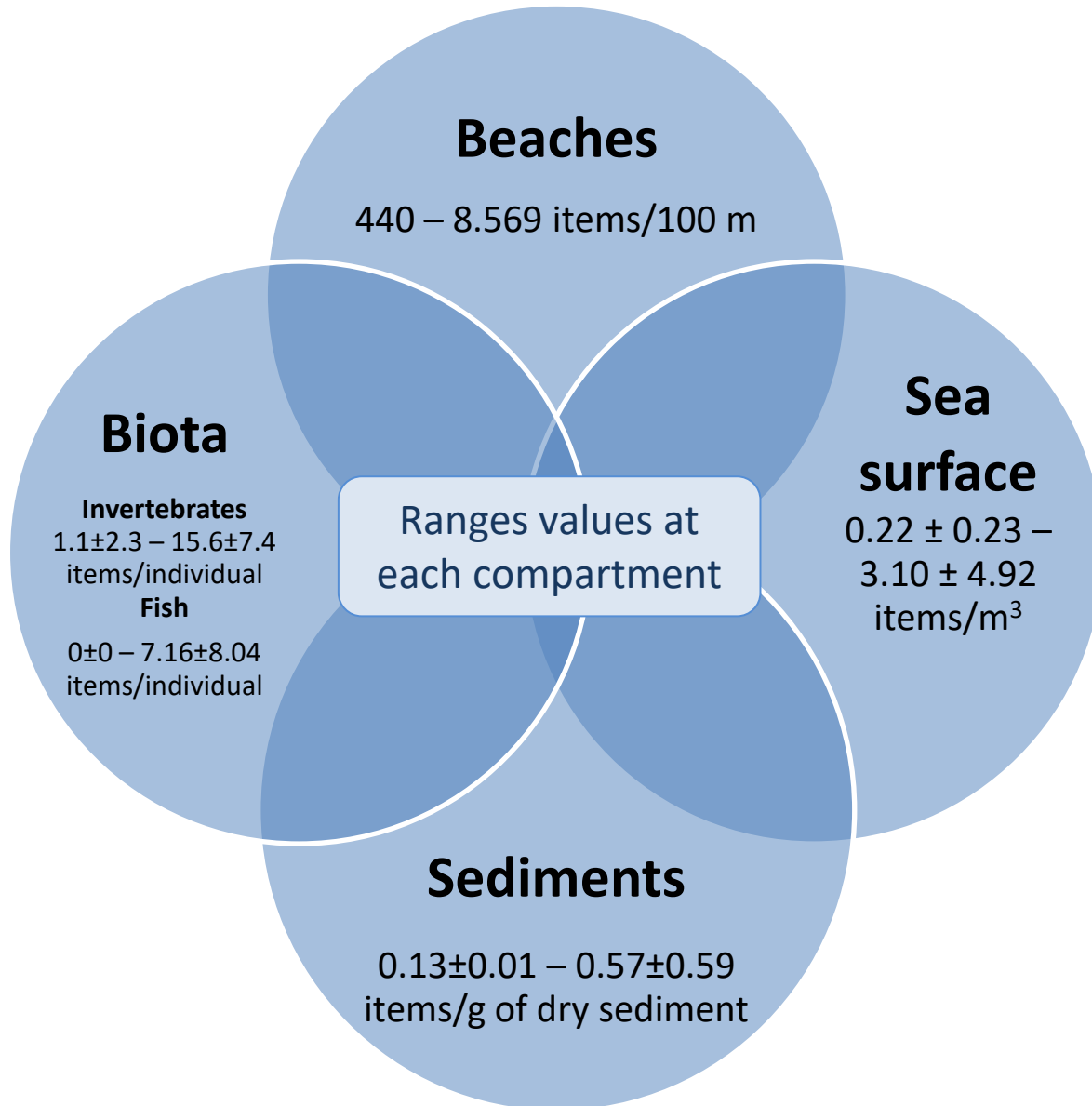


A) Pie chart summarizing the percentages (in abundance) of MP shape categories collected by manta trawl.

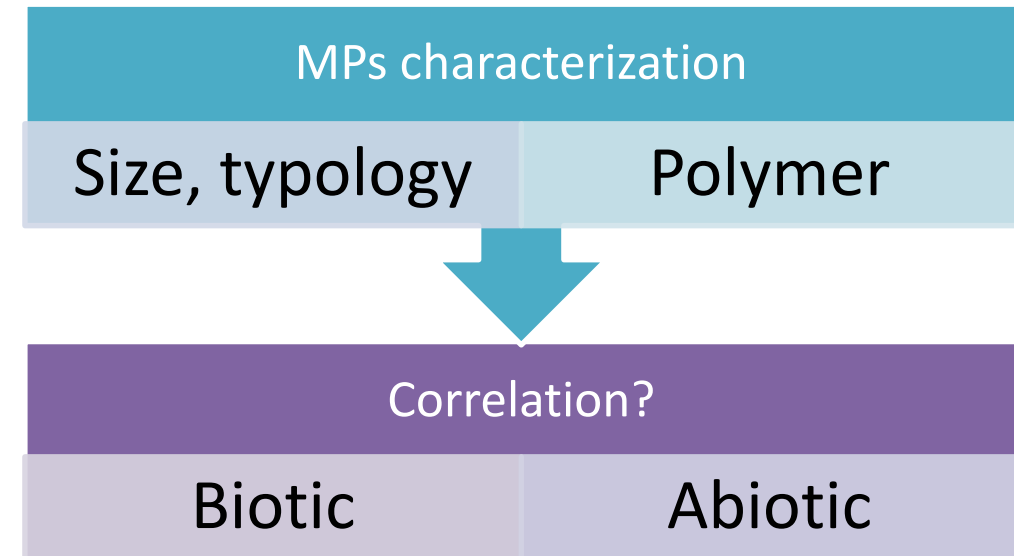
B) Pie chart summarizing the percentages (in abundance) of MP color categories collected by manta trawl



# Are biotic and abiotic compartments correlated?



**Work in progress**



# Lessons learned

- **High accumulation** of marine litter in **remote beaches** during low tourism season → Important **transfer pollution** from urbanized areas to MPAs
- Artificial polymers (**plastics**) were the most common marine litter items in **beach** samples
- **Glass** and **artificial polymers** were the most common items identified in **seafloor**
- Marine litter accumulation was higher in sand patches within **seagrass meadows** and in **rocky areas**
- **Nets/ropes** and **plastic fragments** are the most common items stranded in the coast of Cabrera MPA
- No correlation between **zooplankton** and **MP** abundances
- **Copepods** are negatively correlated to **MP** abundance
- **Mussels** from outside MPA had **higher MP ingestion** than mussels from inside Cabrera MPA
- All biota species ingested MPs (values ranging from 1.1±2.3 – 15.6±7.4 items/ind in **invertebrates** and 0±0 – 7.16±8.04 items/ind in **fish** species)







# Thank you

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[www.plasticbustersmpas.interreg-med.eu](http://www.plasticbustersmpas.interreg-med.eu)



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