

Plastic Busters MPAs Final Conference
Athens, 12-13 April 2022



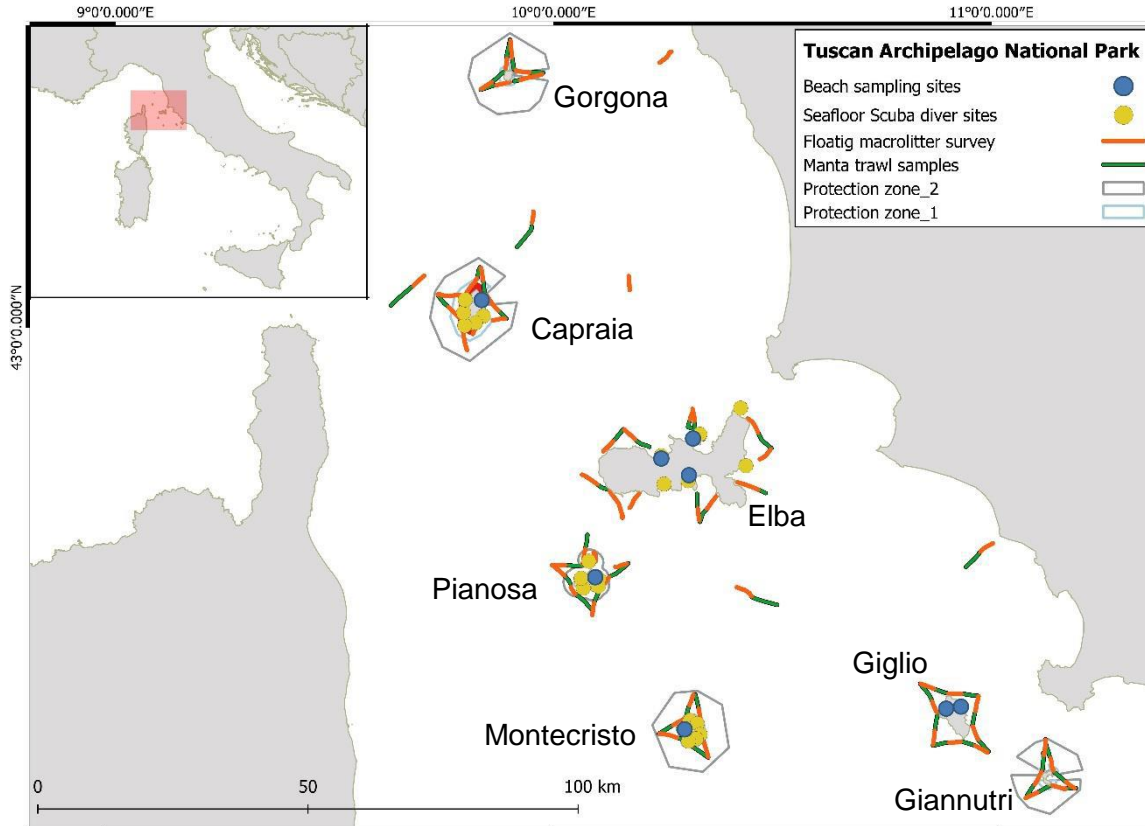
The Plastic Buster MPAs marine litter monitoring results and findings: PNAT

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Environment: sampling in PNAT



9 beach litter monitoring (4 seasons), macrolitter and microlitter (>210 plots)

100 floating macrolitter survey

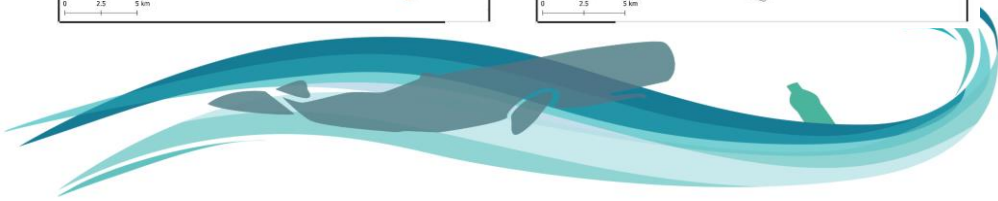
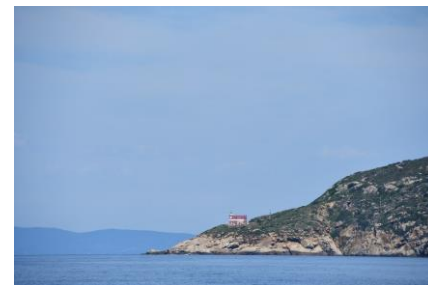
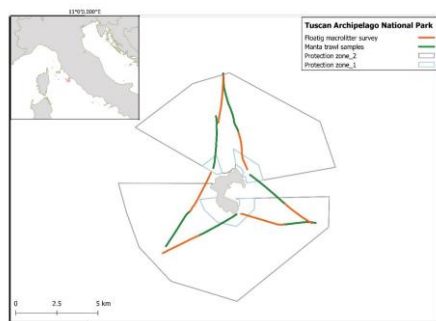
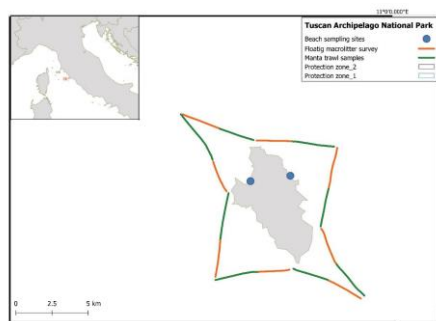
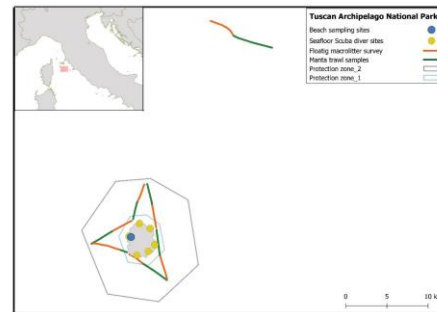
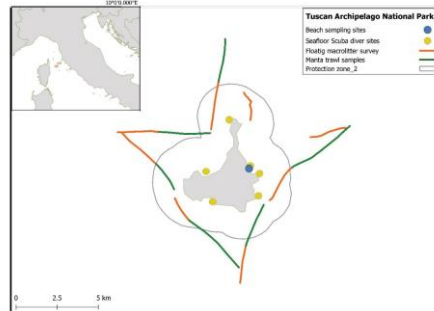
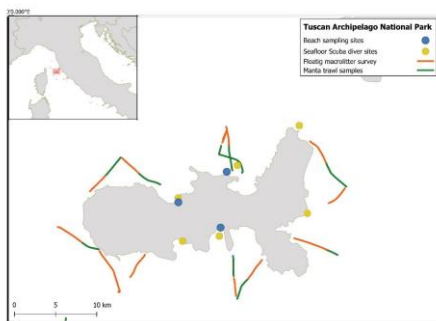
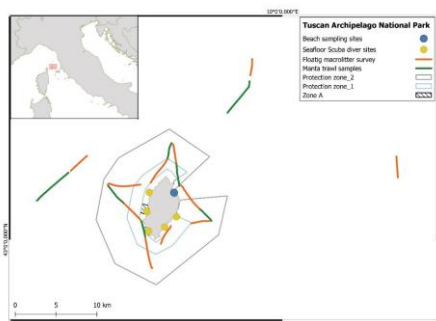
71 floating microlitter survey

4 islands monitored for seafloor litter (24 sites)

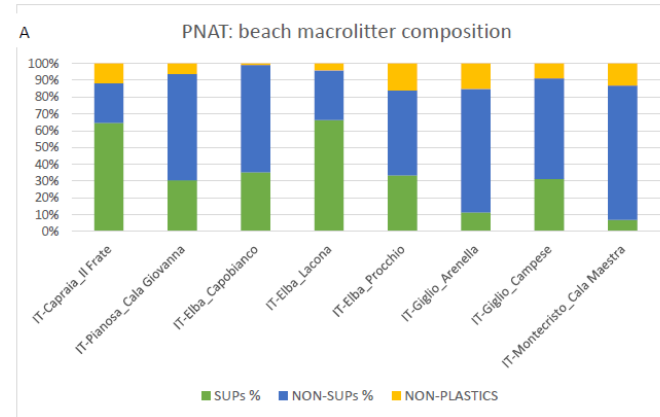
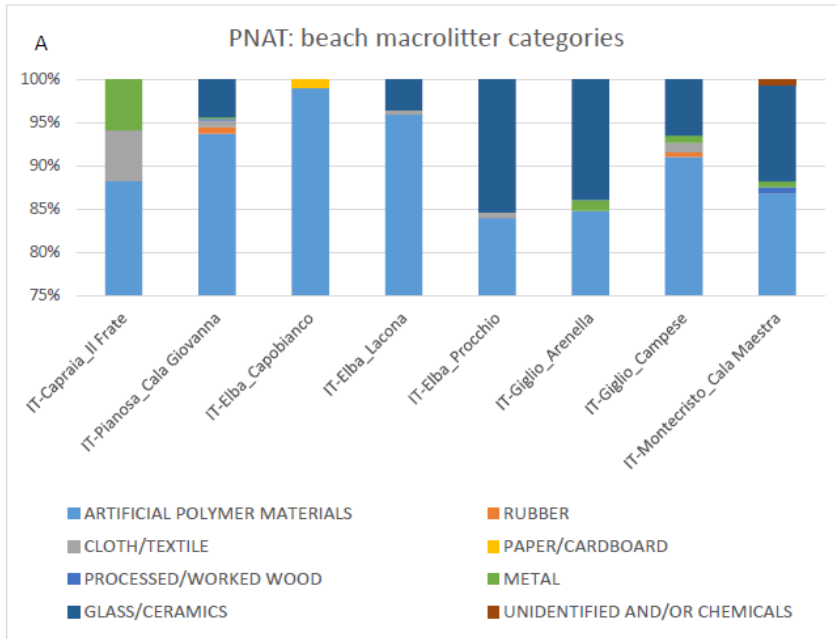
7 seafloor litter (deep sea, ROV)

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PNAT 7 islands sampling activities

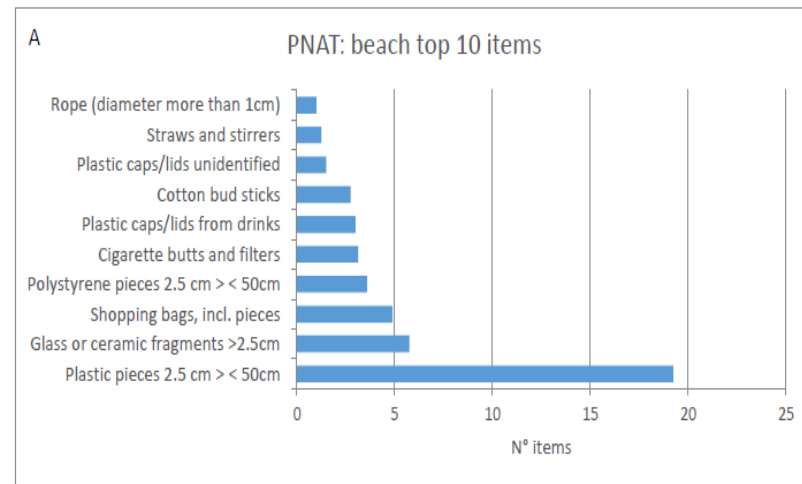
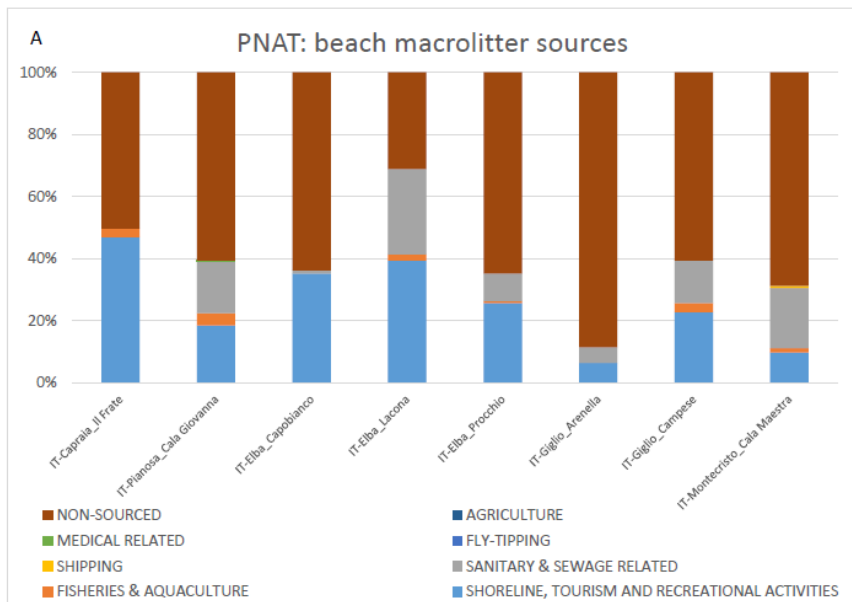


Results: macrolitter on beaches - categories



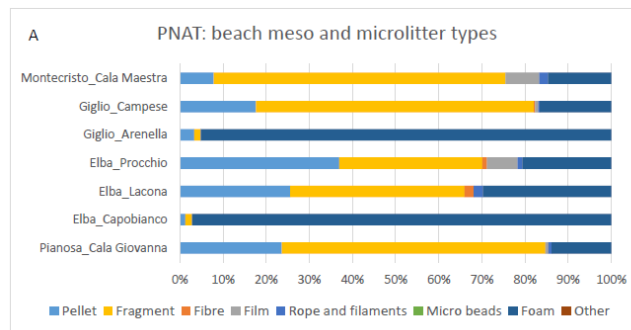
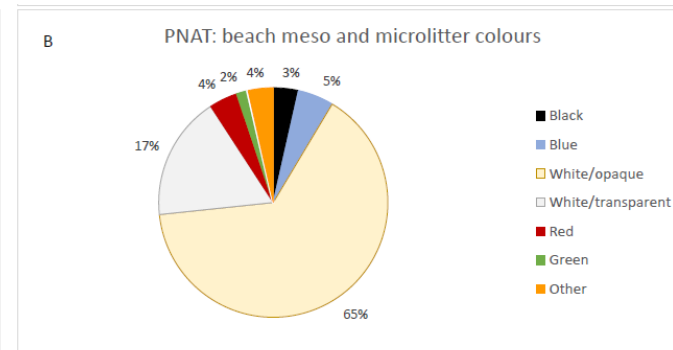
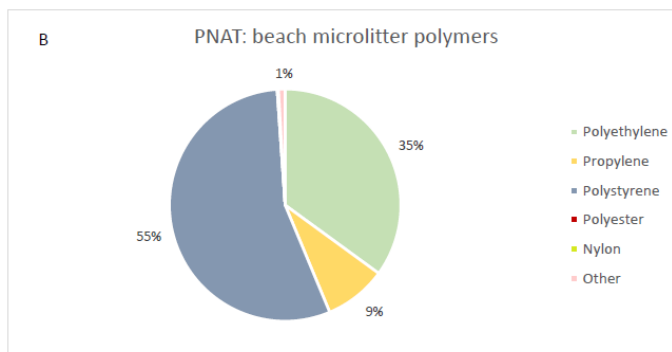
Beach name and project ID	Median number of items per 100 m.	Median number of items per m ² .
IT-Capraia_Il Frate	23	0.03
IT-Pianosa_Cala Giovanna	263	0.22
IT-Elba_Capobianco	53	0.04
IT-Elba_Lacona	49	0.02
IT-Elba_Procchio	39	0.03
IT-Giglio_Arenella	40	0.06
IT-Giglio_Campese	92	0.04
IT-Montecristo_Cala Maestra	144	0.05

Results: macrolitter on beaches – sources and top 10 items

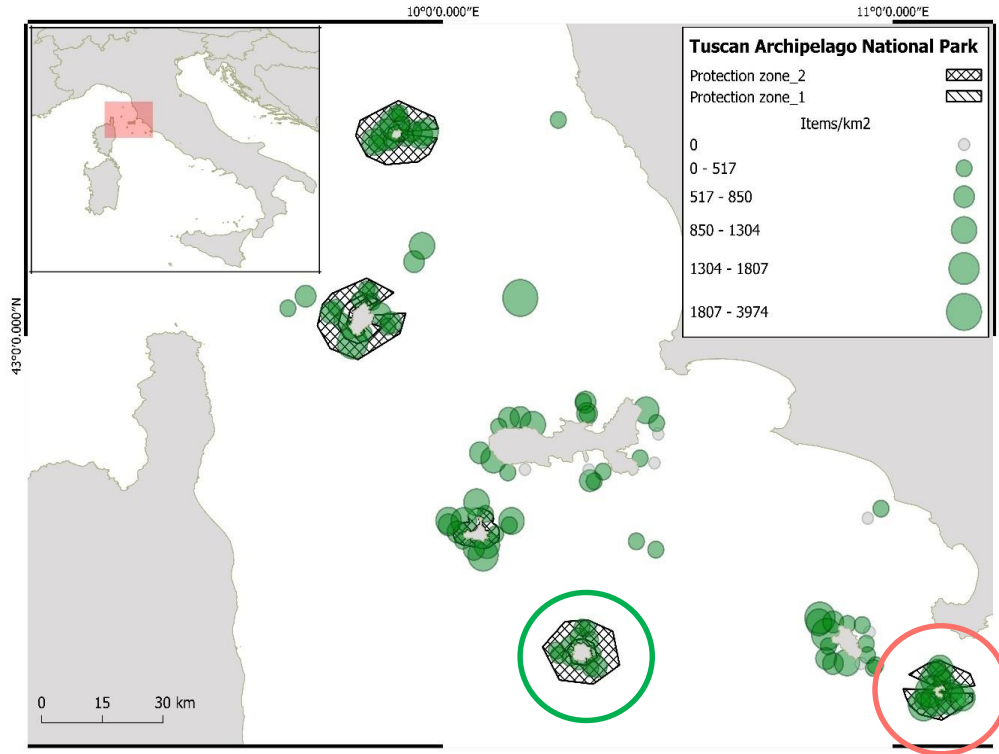


Results: microlitter on beaches

Beach name and project ID	Average number of items per m ² ± S.D.
IT-Pianosa_Cala Giovanna	104.9 ± 192.6
IT-Elba_Capobianco	79.7 ± 250.8
IT-Elba_Lacona	1.3 ± 4.3
IT-Elba_Procchio	3.0 ± 6.5
IT-Giglio_Arenella	218.6 ± 516.4
IT-Giglio_Campese	5.0 ± 13.2
IT-Montecristo_Cala Maestra	2.9 ± 6.1



Results: floating macrolitter



1458 items counted

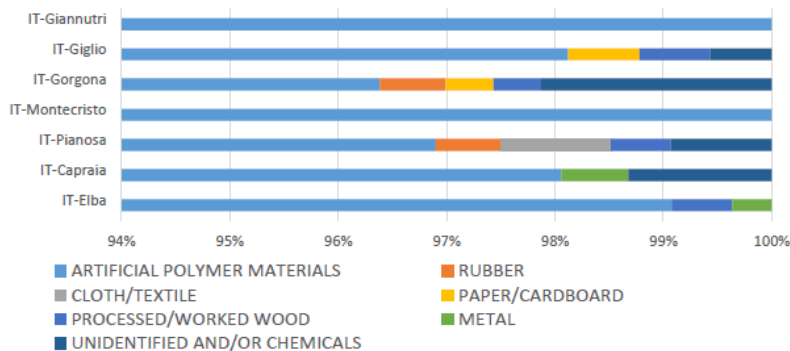
Litter observed in **92%** of transects (123/133)

Island	Average litter (items/km2)
IT-Capraia	523.0 ± 393.5
IT-Elba	430.4 ± 388.8
IT-Giannutri	1040.3 ± 648.3
IT-Giglio	607.3 ± 525.4
IT-Gorgona	727.6 ± 611.4
IT-Montecristo	264.9 ± 210.9
IT-Pianosa	748.3 ± 522.3

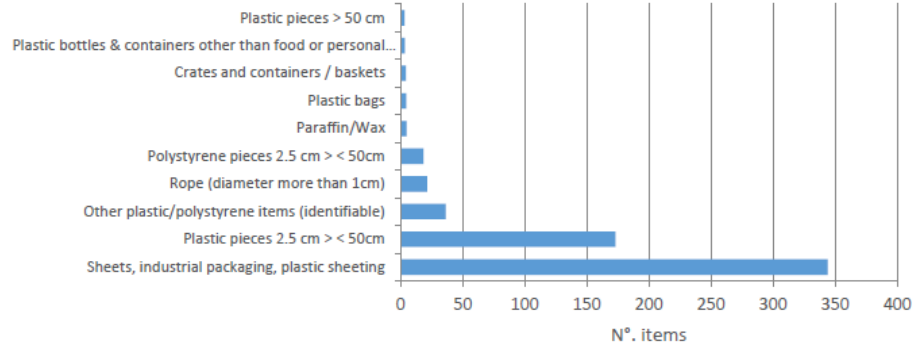
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Athens, 12-13 April 2022

Results: floating macrolitter categories

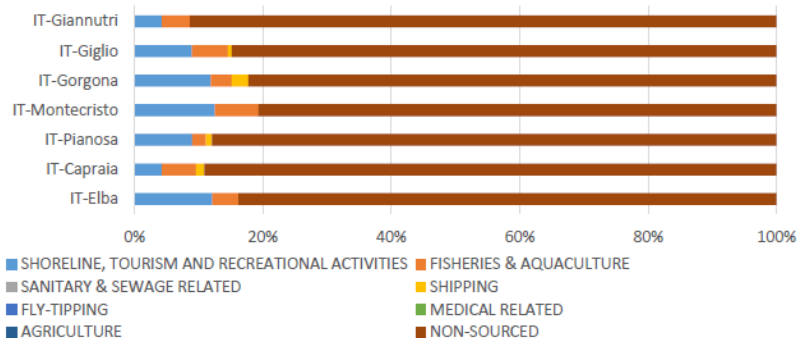
A PNAT: floating macrolitter composition



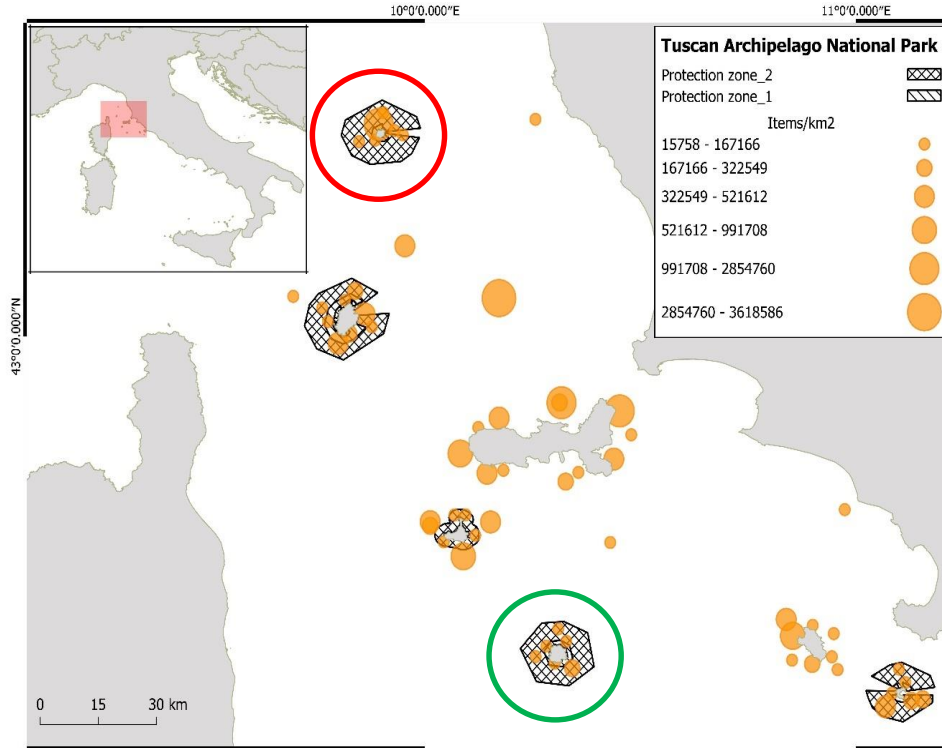
PNAT: floating macrolitter top 10 items



A PNAT: floating macrolitter sources



Results: floating microlitter



Mean concentration: 298,750 items/km²

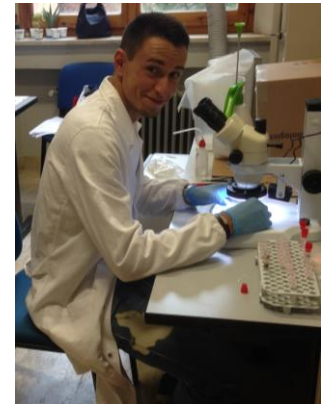
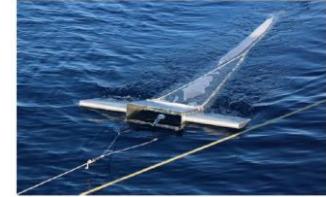
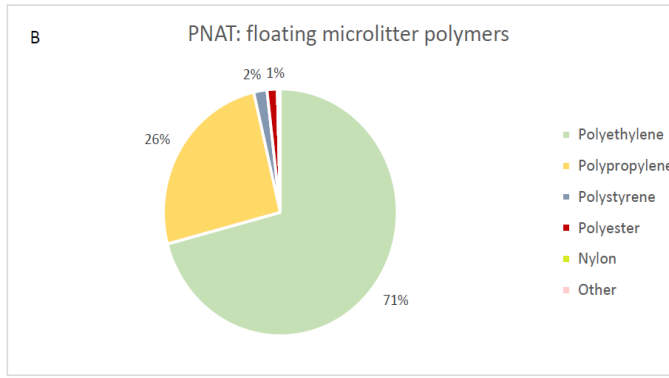
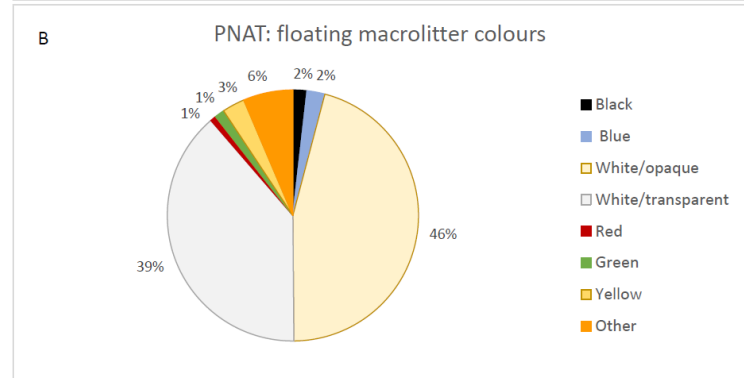
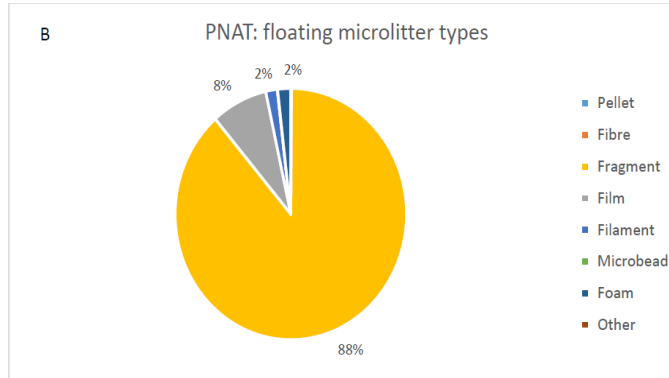
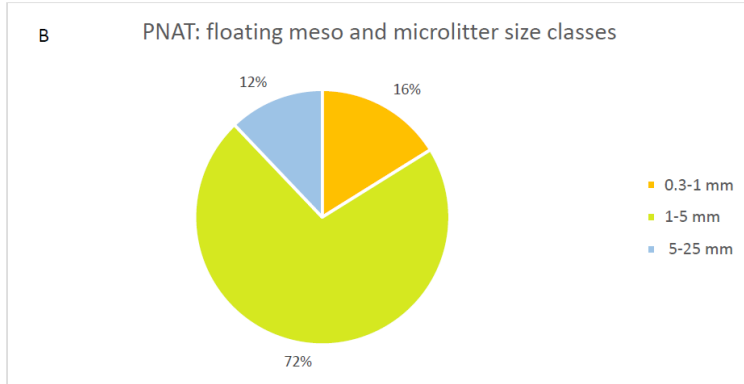


N°. 71 samples
40,225 items isolated

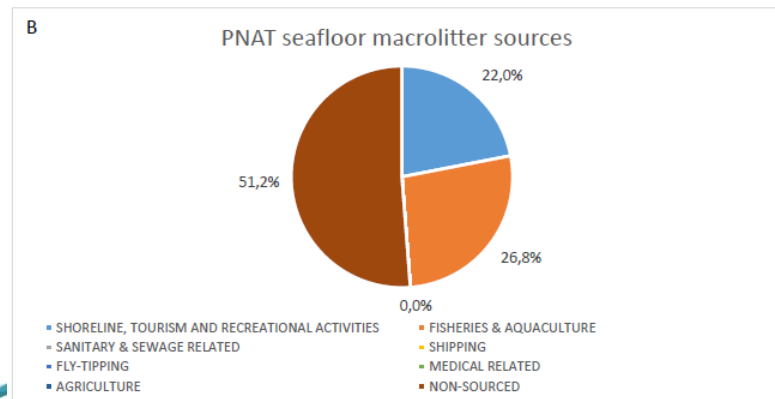
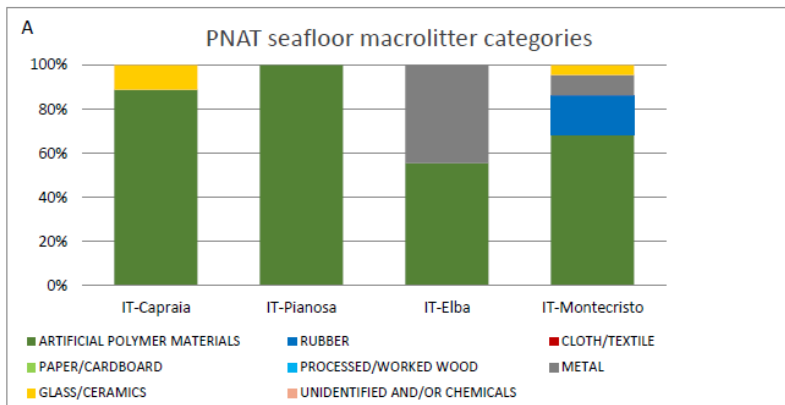
Interreg
Mediterranean

PLASTIC BUSTERS
MPAs

Results: floating microlitter



Results: macrolitter on the seafloor (w scuba divers)



Seafloor surveys were conducted in **six** sites for each of the **4 selected islands** (Capraia, Elba, Pianosa and Montecristo) for a total of **24 sites**

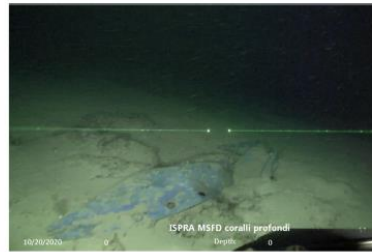
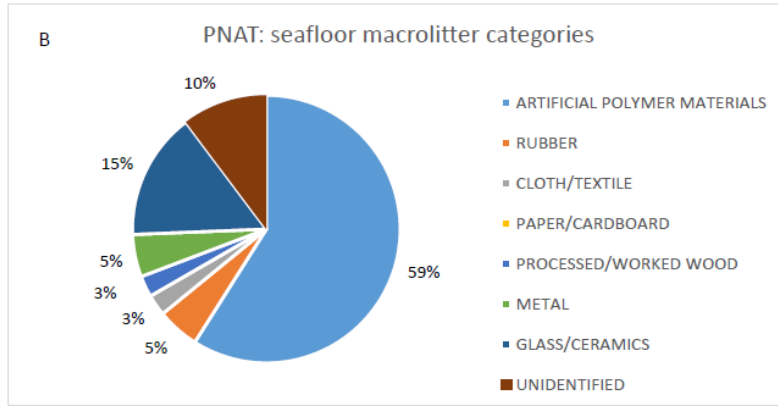
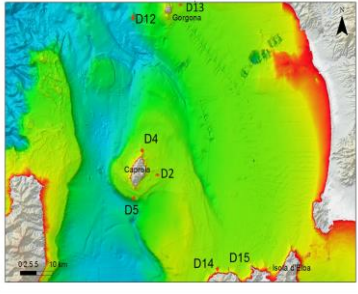
IT-PNAT top 10 items

Rank	G-code	J-code	Seafloor macrolitter category	N°. items/km ²	% of total
1	G7	J7	Drink bottles <=0.5l	111	9.8
2	G8	J8	Drink bottles >0.5l	111	9.8
3	G73		Foam sponge	111	9.8
4	G62	J62	Floats for fishing nets	83	7.3
5	G68	J68	Fiberglass/fragments	83	7.3
6	G124		Other plastic/polystyrene items (identifiable)	83	7.3
7	G134	J134	Other rubber pieces	83	7.3
8	G49	J49	Rope (diameter more than 1cm)	56	4.9
9	G197		Other (metal)	56	4.9
10	G182		Fishing related (weights, sinkers, lures, hooks)	56	4.9



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Results: macrolitter on the seafloor (ROV – deep sea)

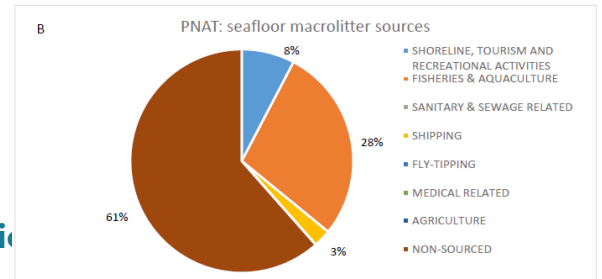


IT-PNAT top 16 items

Rank	G-code	J-code	Seafloor macrolitter category	N°. items	% of total
1	G59		Fishing line/monofilament (angling)	6.0	15.4
1	G49		Rope (diameter more than 1cm)	6.0	15.4
2	G51		Fishing net	4.0	10.3
2	G200		Bottles, including pieces	4.0	10.3
2	GXXX		OTHER	4.0	10.3
3	G3		Shopping bags, incl. pieces	2.0	5.1
3	G79		Plastic pieces 2.5 cm > < 50cm	2.0	5.1
3	G128		Tyres and belts	2.0	5.1
3	G208		Glass or ceramic fragments >2.5cm	2.0	5.1
4	G13		Other bottles & containers (drums)	1.0	2.6
4	G54		Nets and pieces of net > 50 cm	1.0	2.6
4	G67		Sheets, industrial packaging, plastic sheeting	1.0	2.6
4	G137		Clothing / rags (clothes, hats, towels)	1.0	2.6
4	G173		Other wood	1.0	2.6
4	G175		Cans (beverage)	1.0	2.6
4	G197		Other (metal)	1.0	2.6



Density of marine litter ranged from 0 to 0.8 items/100 m² (80-430 m)



Plastic



Biota: sampling in PNAT

50 Muscles in 3 islands

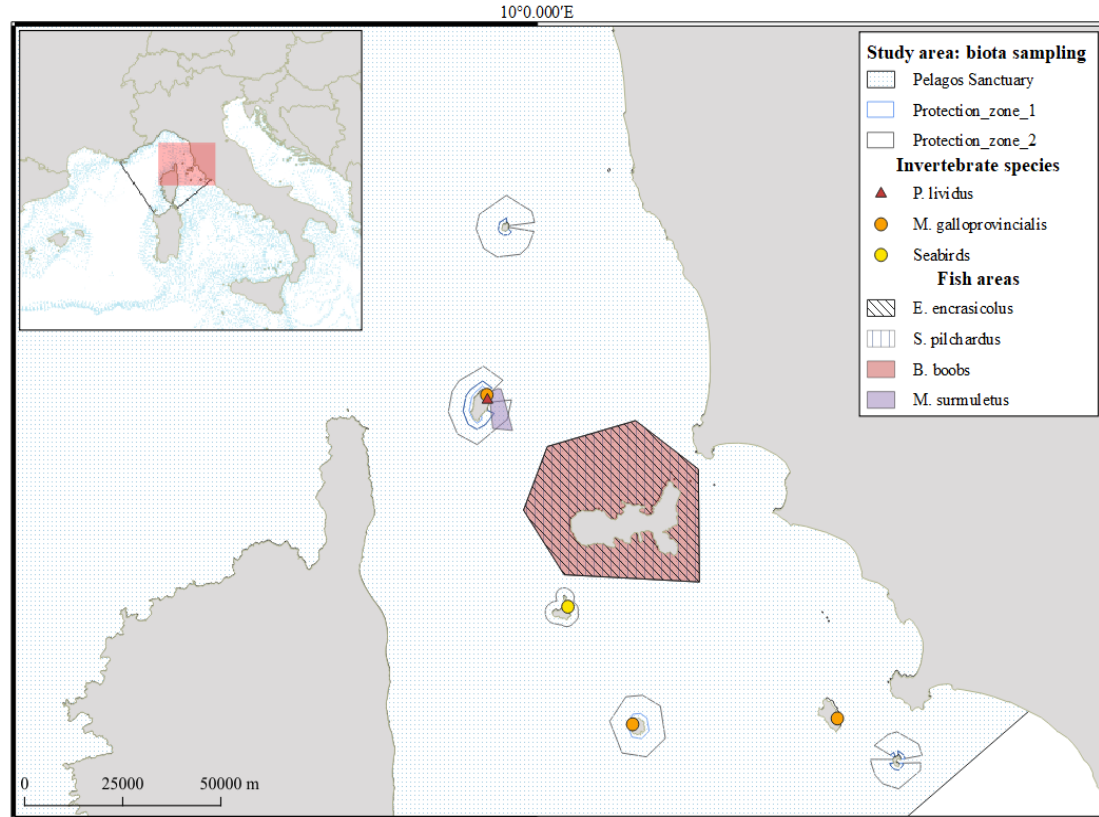
50 Striped mullet (*Mullus surmuletus*)

50 European anchovy (*Engraulis encrasicolus*)

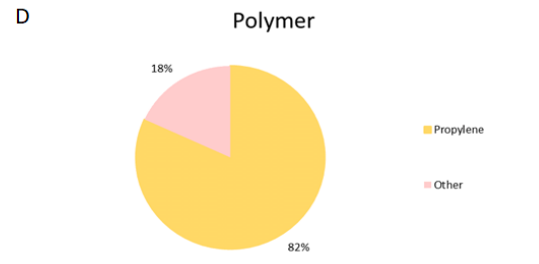
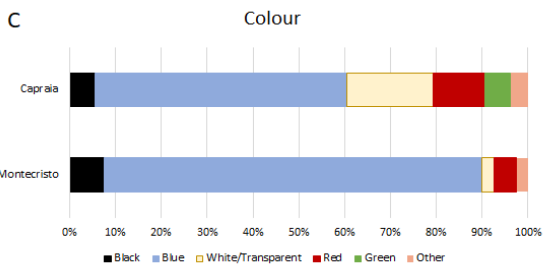
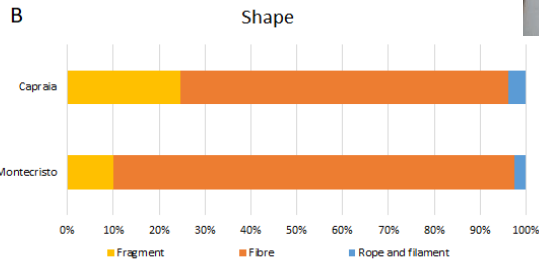
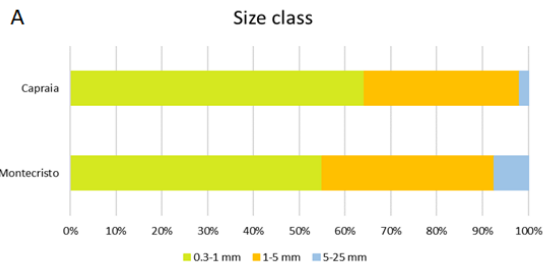
50 European pilchard (*Engraulis encrasicolus*)

80 Bogues (*Boops boops*)

Adouins's gull nests in Pianosa



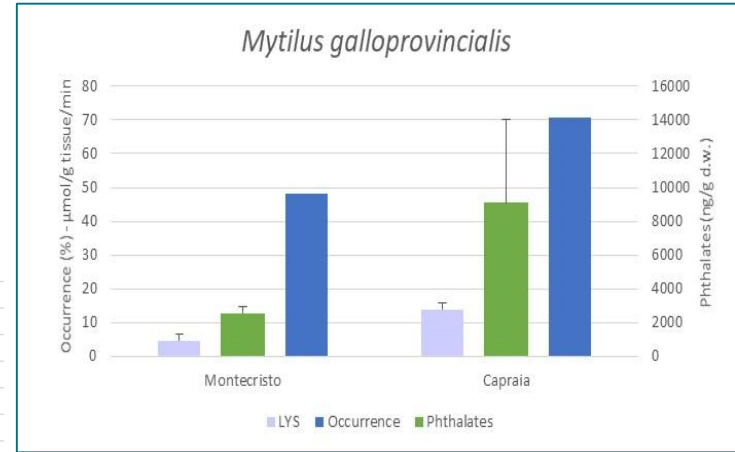
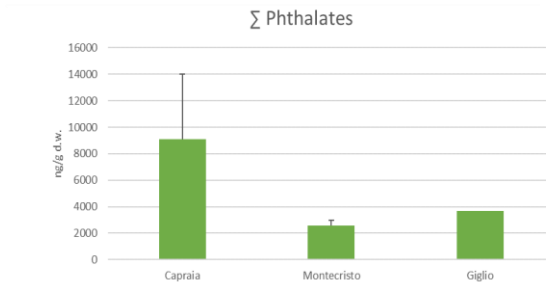
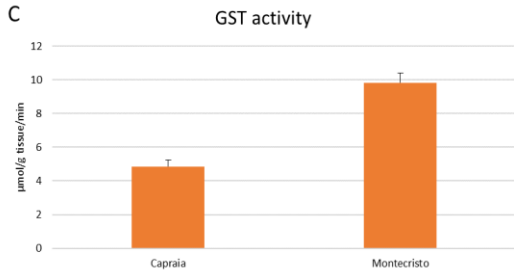
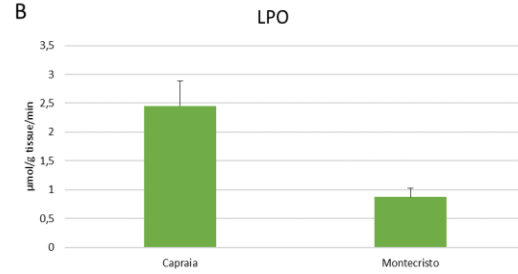
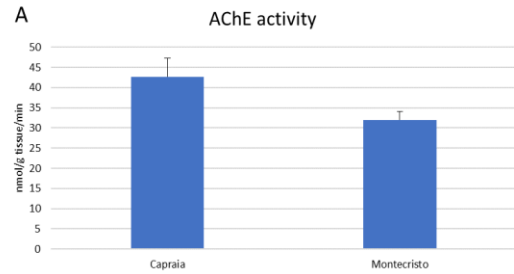
Mytilus galloprovincialis: MPs



Sampling site	Inside /outside MPA	N. of specimens collected	Frequency of occurrence (%)	Average number of items/individual (N)
PNAT (Capraia)	IN	24	70.8	2.21 ± 0.52
PNAT (Montecristo)	IN	27	48.1	1.48 ± 0.58
PNAT (Giglio)	OUT	3	0	0



Mytilus galloprovincialis: contaminants and biomarkers

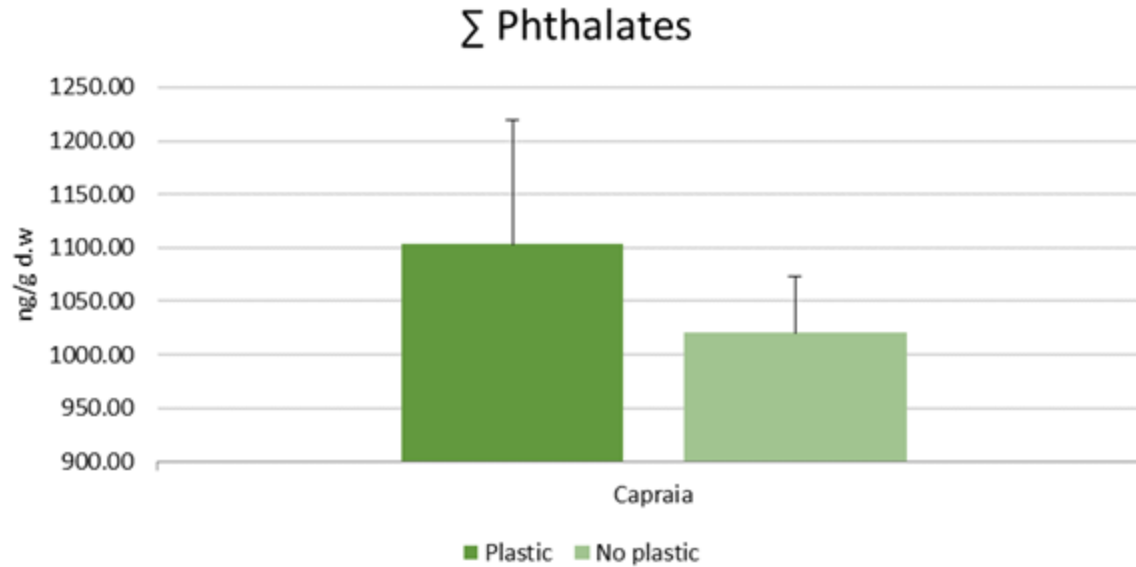


Fish species: sampling in PNAT

Species	Sampling site	Inside /outside MPA	N. of specimens collected	Frequency of occurrence (%)	Average number of items/individual (N)	Average number of items per individual with plastics
<i>Mullus surmuletus</i>	PNAT (Capraia)	IN	25	16.0	0.20 ± 0.10	1.25 ± 0.25
<i>Boops boops</i>	PNAT (Elba island)	OUT	50	50.0	1.00 ± 0.19	2.00 ± 0.24
<i>Sardina pilchardus</i>	PNAT (Elba island)	OUT	53	49.1	0.62 ± 0.10	1.27 ± 0.10
<i>Engraulis encrasicolus</i>	PNAT (Elba island)	OUT	50	82.0	2.16 ± 0.31	2.63 ± 0.33



Mullus surmuletus: contaminants (PAEs)



i) Plastic detection



- Analysis of the ingested marine litter/microplastics:
- Occurrence (%)
- Abundance (n°)
- Weight (g)
- Polymer analysis

ii) Plastic tracers detection



- Analysis of plastic additives:
- Phthalates
- PBDEs
- Bisphenol A
- Analysis of PBT compounds:
- PCBs
- DDTs
- PAHs
- Mercury

iii) Biomarkers detection

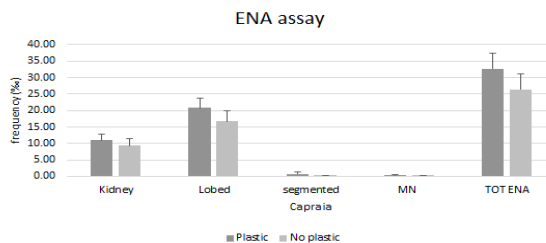
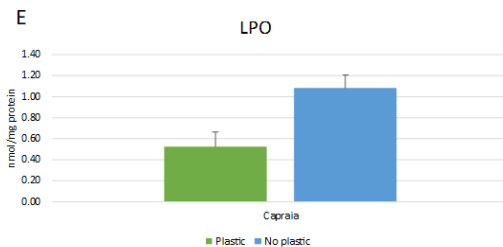
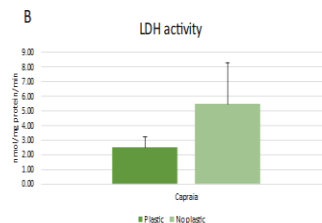
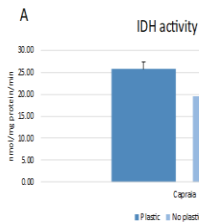
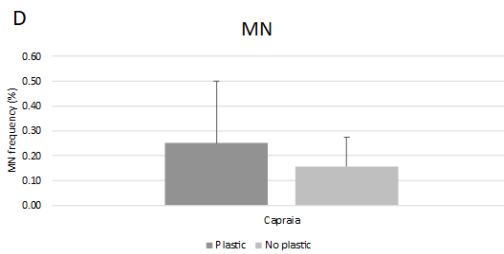
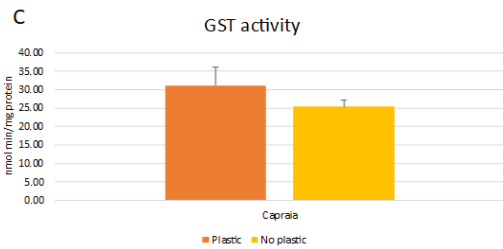
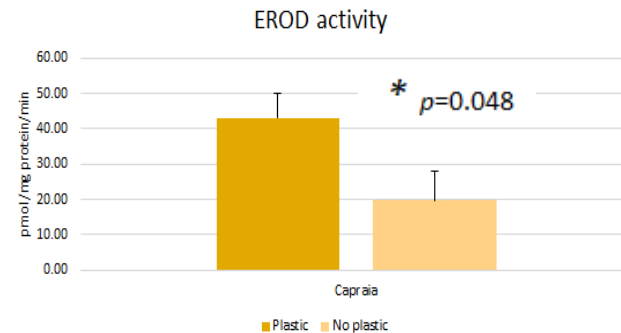
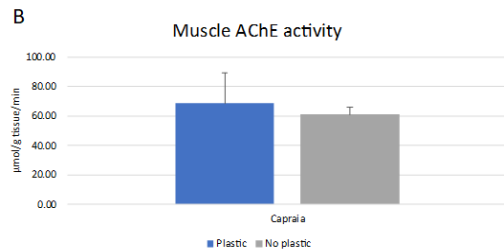
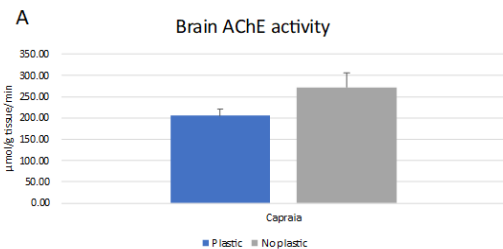


- Effects at molecular level:
- Measure of DNA damage
- Alterations of gene expression
- Alteration of proteins
- Effects at cellular level:
- Alteration of cell functions
- Effects at tissue level:
- Hystological and hystopathological alterations



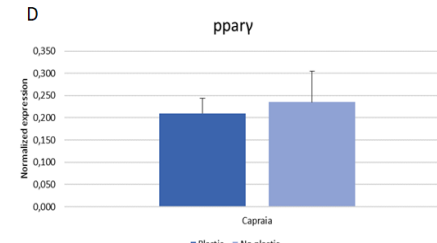
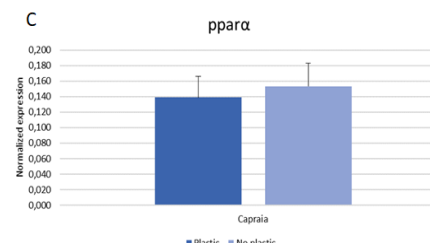
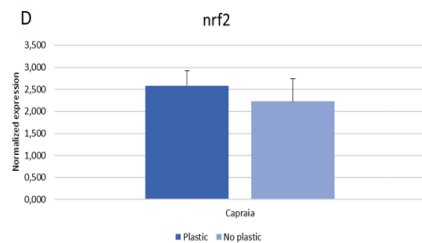
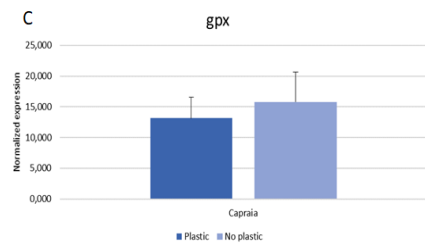
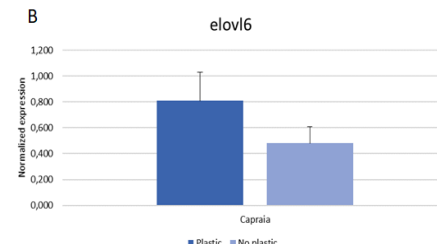
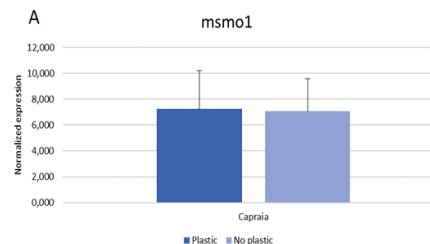
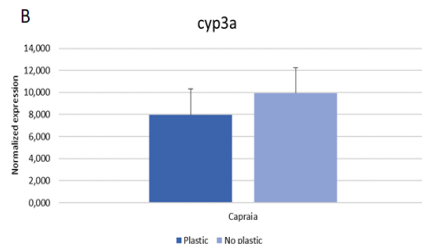
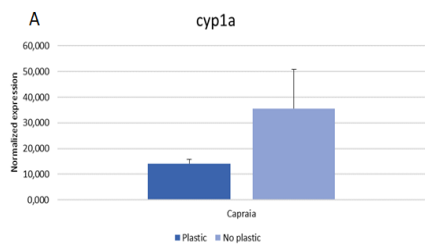


Mullus surmuletus: biomarkers





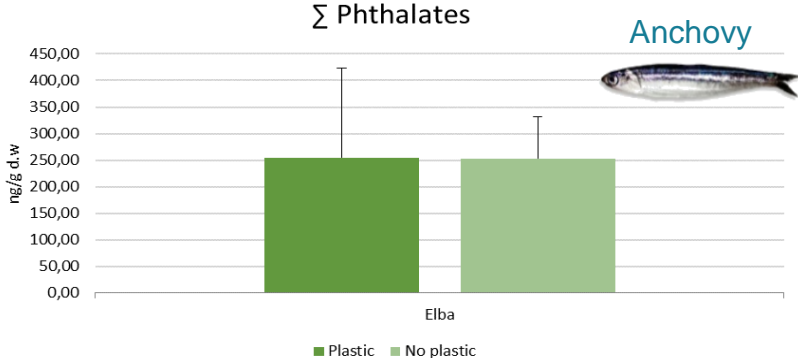
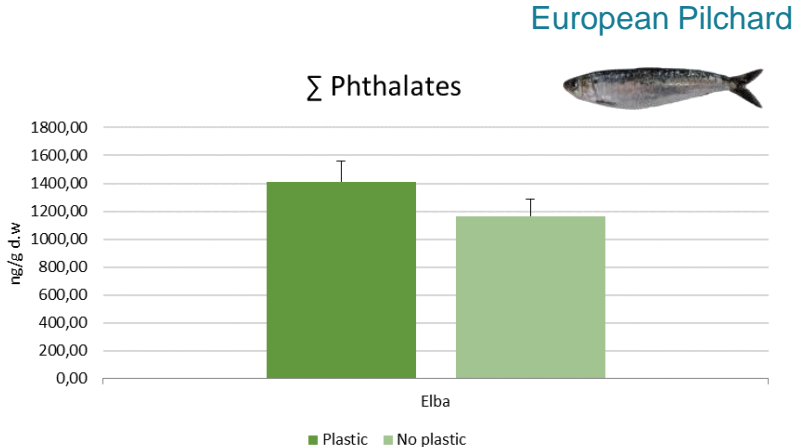
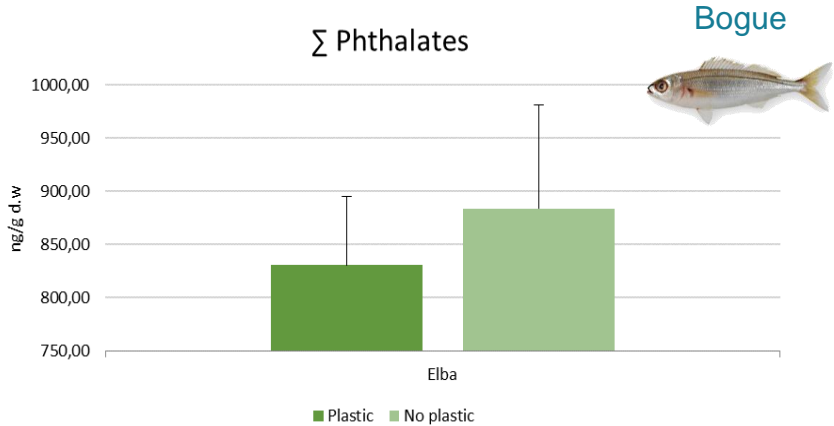
Mullus surmuletus: biomarkers



13 genes involved in several biological pathways (energy metabolism, detoxification, immune responses, etc.)



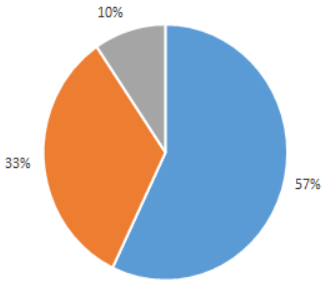
Fish species: contaminants (PAEs)



Seabirds: ML in *Ichthyaetus audouinii* nests

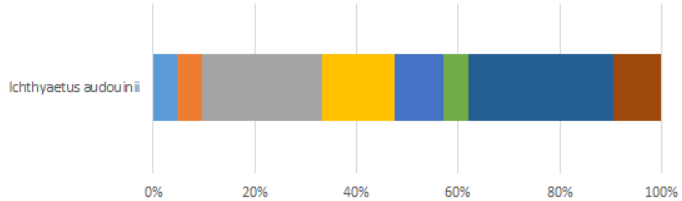
Pianosa

A



■ ARTIFICIAL POLYMER MATERIALS ■ CLOTH/TEXTILE ■ GLASS/CERAMICS

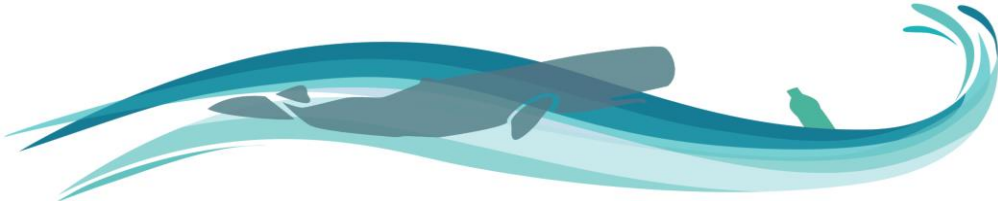
B



■ G4 Small plastic bags, e.g. freezer bags, including pieces ■ G50 String and cord (diameter less than 1cm)
 ■ G67 Sheets, industrial packaging, plastic sheeting ■ G79 Plastic pieces 2.5 cm > < 50cm
 ■ G124 Other plastic/polystyrene items (identifiable) ■ G142 Rope, string and nets
 ■ G145 Other textiles (incl. rags) ■ G208 Glass or ceramic fragments >2.5cm



Audouin's gull



Conclusions and lesson learned - Environment

BEACH

Macrolitter: main sources are shoreline, tourism and recreational activities and sanitary and sewage related items (>20 items/100m, MSFD threshold)

Microlitter: concentration range from 1.3 items/m² (Elba) to 218.6 items/m² (Giglio), PS most abundant polymer

SEA SURFACE

Floating macrolitter: Gannutri represents the most polluted area, while Montecristo the less polluted. Among the top 10 items sheets, industrial packaging and plastic sheeting and plastic fragments are the most abundant

Floating microlitter: Gorgona represents the most polluted area, while Montecristo the less polluted. PE, PP and PS are the most abundant polymers floating in the PNAT

SEAFLOOR

Scuba divers: Artificial Polymer Material and metals are the most abundant, at the top of the ten items there are drink bottles

Deep sea (ROV): Artificial Polymer Material and glass/ceramics are the most abundant, fishing related items as fishing lines (monofilament), ropes and fishing nets are the predominant items

Conclusions and lesson learned - Biota

MUSSELS

% **MPs occurrence** and **PAEs** accumulation: Capraia>Montecristo>Giglio

FISH SPECIES

% **MPs occurrence**: Anchovy>Bogue>Pilchard>Red striped mullet

max Items/individual: 2.16

Red striped mullet ([three-fold approach](#)): any statistically significant differences between individuals with MPs in their GI biomarker responses and plastic additives accumulation

SEABIRDS

Items detected in the **Adouin's gull nests** are APM, cloth and textiles and glass/ceramics





Plastic Busters MPAs Final Conference
Athens, 12-13 April 2022



Thank you!

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