



# Microplastics in Adriatic region



DeFishGear

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The Project is co-funded by the European Union,  
Instrument for Pre-Accession Assistance (IPA)





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# Microplastics in Adriatic-Ionian region

- The extent of microplastic pollution
  - an emerging field of research
  - lack of data on regional level
- Monitoring should be implemented in the countries of Adriatic-Ionian region
  - no standardized protocols
  - no adequately trained staff of competent agencies
- DeFishGear – sub-regional study
  - On the presence, quantity and type of microplastic particles and occurrence throughout time
- Outputs
  - first guidelines, protocols and recommendations for sampling and analysis of microplastics



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# DeFishGear microplastics pilot work



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- Developing a harmonized **methodology** for **monitoring** and assessment of microplastics;
- Providing all collaborating partners with the necessary **equipment** and **skills** for monitoring;
- Carrying out **research activities** to improve the understanding of the **quantities, types** and **sources** of microplastics in the Adriatic Sea on the **sea surface, river outflow, and beach sediment**, as well as their presence in **marine biota**;
- Undertaking studies to enhance knowledge on **persistent organic pollutants** (POPs) adsorbed on microplastics.



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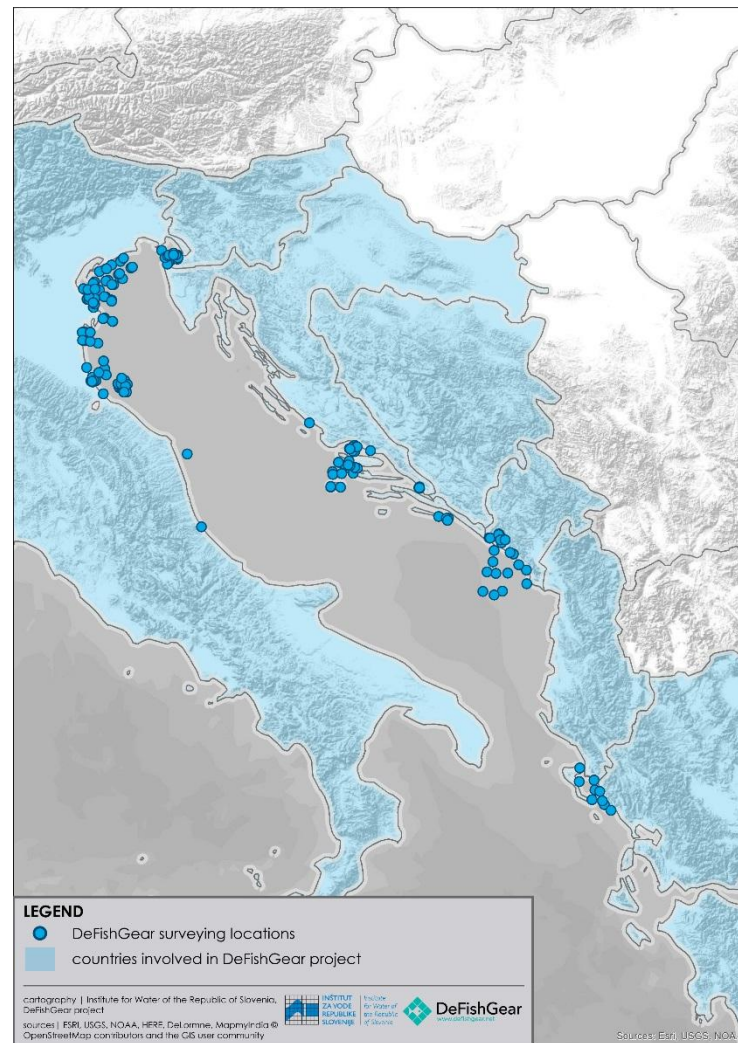


# DeFishGear pilot microplastics surveys



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- **Sea surface** (in fishing areas and near the rivers outflow)
  - 1 protocol developed (sampling by manta net)
- **Beach and sea bottom sediments**
  - 2 protocols developed
    - large microplastic particles (1-5 mm)
    - small microplastic particles (<1 mm)
- **Biota** (commercially available fishes and mussels)
  - 2 protocols developed (macro and micro litter)

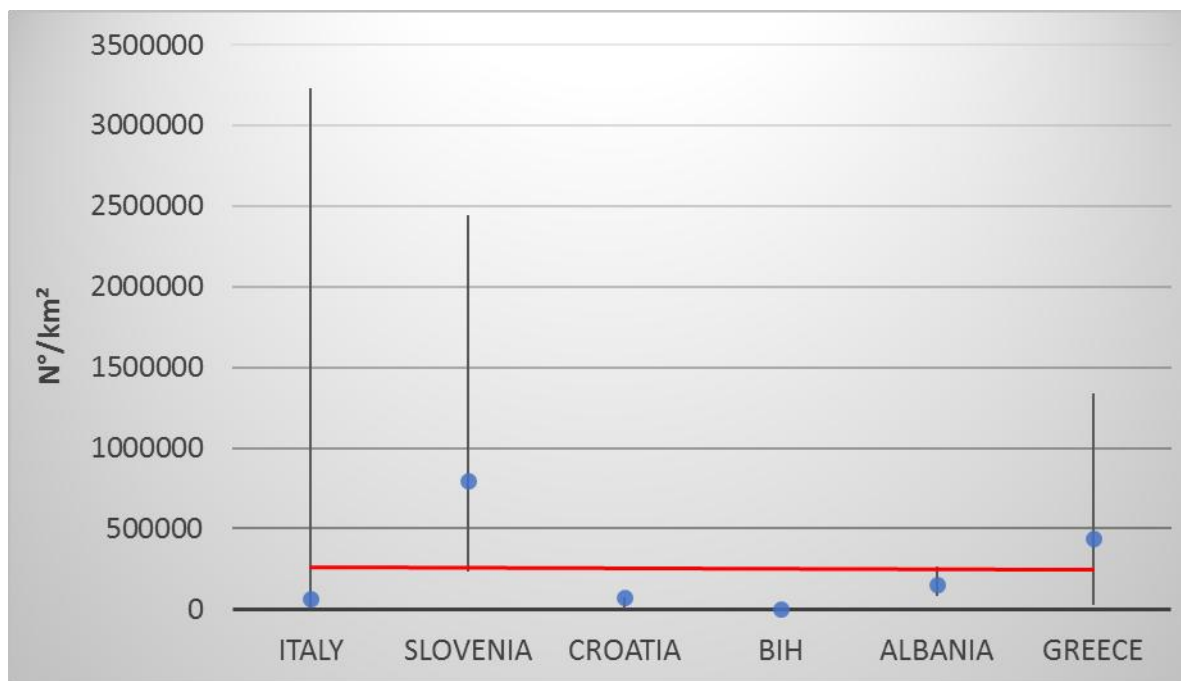


# Microplastics on the sea surface



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- Microplastics concentrations on the sea surface are in average  **$\approx 250.000$  particles/km<sup>2</sup>**



- the national average
- Adriatic-Ionian Sea region average

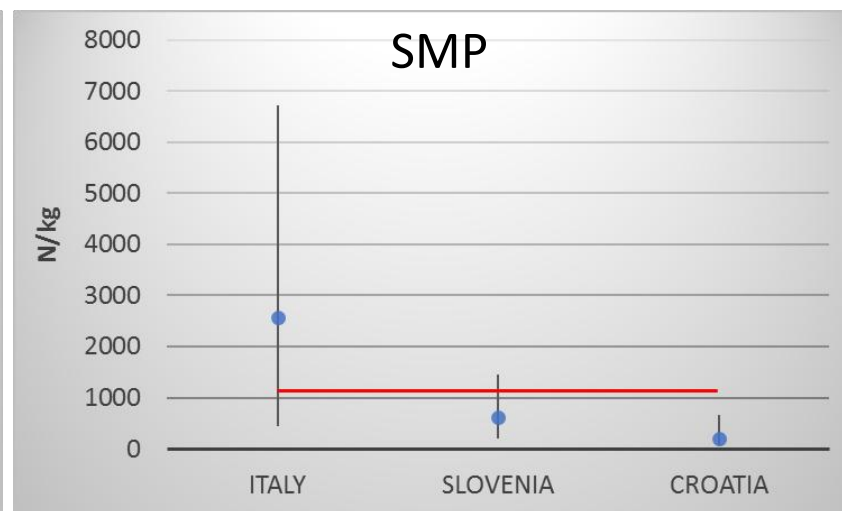
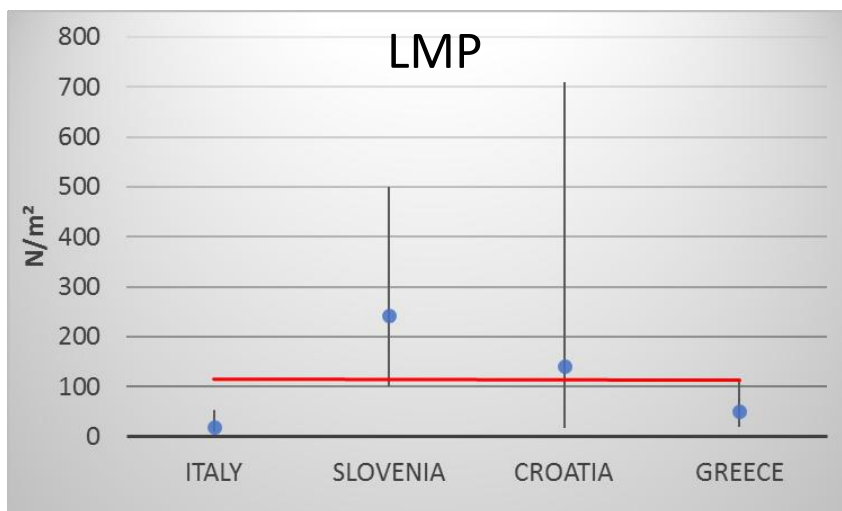


# Microplastics in beach sediments



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- Microplastics concentrations in the beach sediments are in average **110 particles/m<sup>2</sup>** for large microplastic particles (1 – 5 mm) and **1100 particles/kg** for small microplastic particles (<1 mm)



- the national average
- Adriatic –Ionian Sea region average

# Plastic pellets

- Hotspots (beach)
- e.g. in Croatia (Adriatic), Slovenia
  - no pellets were found in beach sediment surveys
  - Always found at one location (few m<sup>2</sup>) in Strunjan



Photo: Marilyn Pflieger

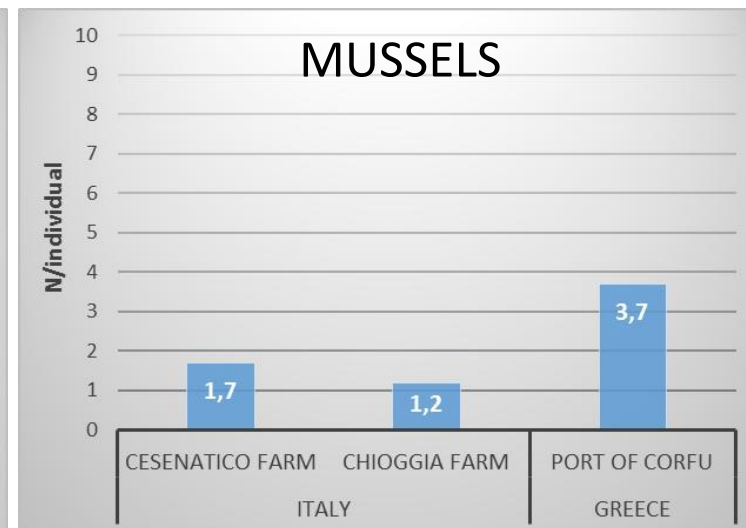
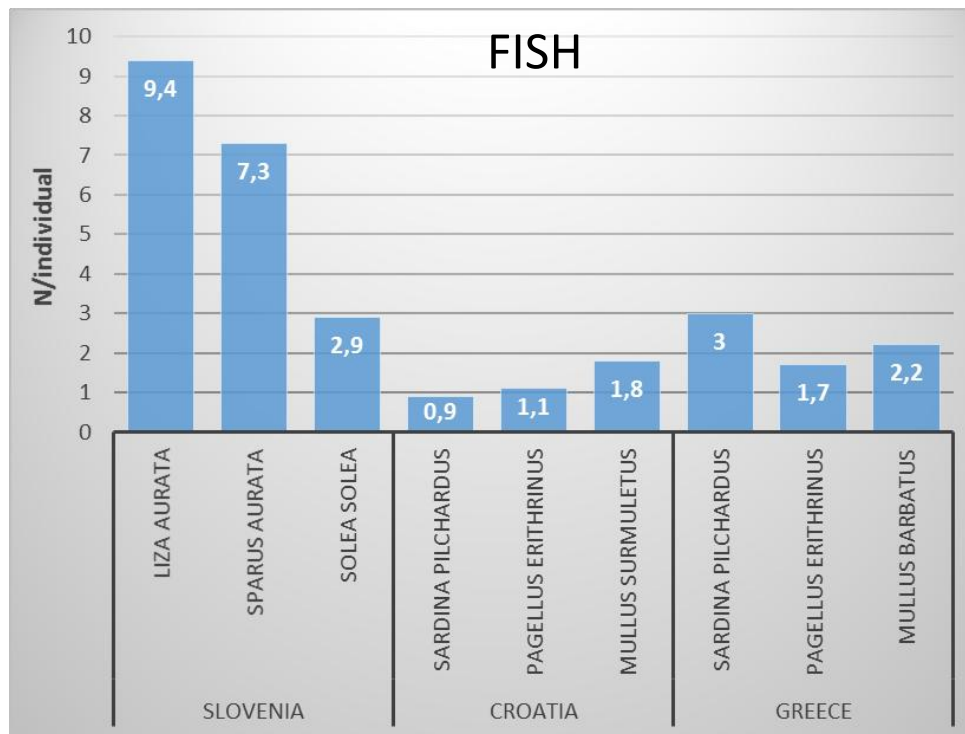


# Microplastics in biota



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- Microplastics concentrations in commercially available fishes are in average **3 particles per fish** and in commercially available mussels **2 particles per mussel**





# Composition of plastic microparticles



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- Prevailing composition:
  - **polypropylene (PP)**: packaging, textiles
  - **polyethylene (PE)**: packaging, bags, bottles
- Chemical analysis of microparticles
  - time consuming analysis
  - problems: biofouling, fragmentation
- First results for chemical composition of microplastics from **sea surface** :

Conutry	PP	PE
BiH	40 %	53%
Greece	93%	4%
Slovenia	6 - 17%	50 - 61%

- Different sources



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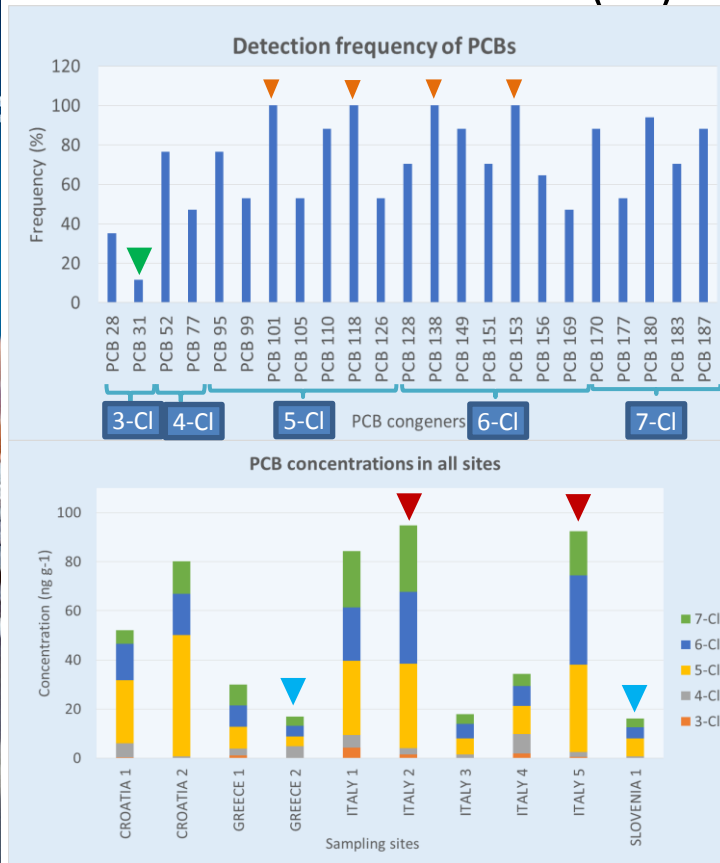


# POPs on pellets



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## PCB concentrations (23)



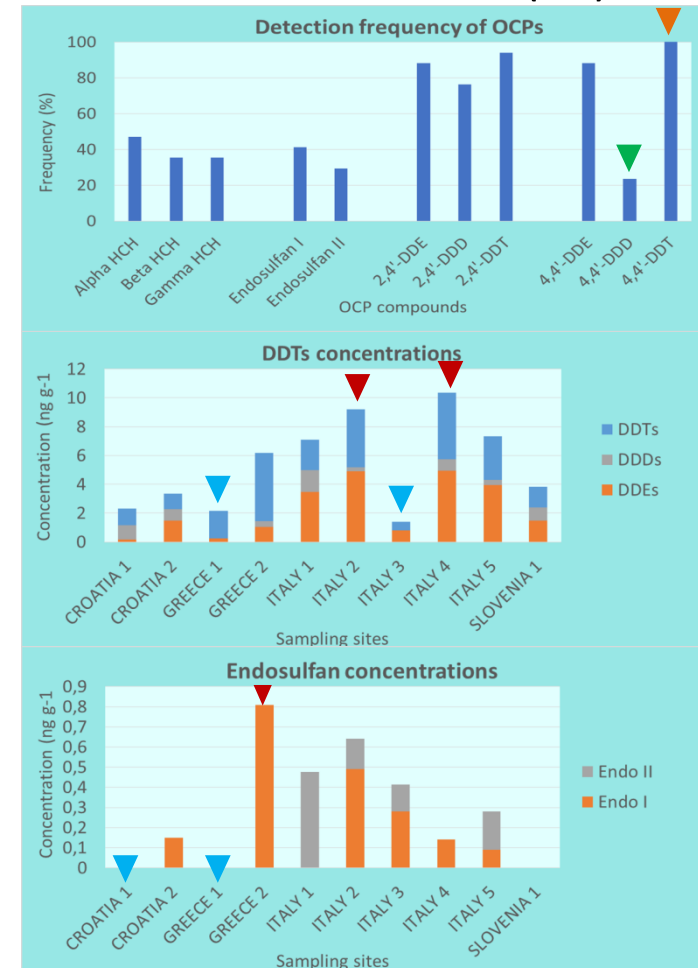
Found in all samples

The least detected

The highest concentration

The lowest concentration

## OCP concentrations (11)



The highest conc.: **PCB 138**: 50.7 ng g<sup>-1</sup> (ITALY 1)

**OCP: DDTs**: 10.6 ng g<sup>-1</sup> (ITALY 4)

**Endosulfan**: 0,81 ng g<sup>-1</sup> (GREECE 1)



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# POPs on pellets



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- Samples were collected separately for POPs measurements
  - Methodology for sampling plastic pellets for POPs determination
- These are preliminary results
  - 1 sample (10 pellets) analyzed per location and sampling event
- Older pellets have higher concentrations
- Pellets act as vector and concentrator of POPs
- The concentrations are within the range of concentrations found in other countries



# Microplastics studies



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- Previous studies report the **ubiquitous presence** of microplastics in the marine environment from the sea to the bottom sediments

Sea surface	Particles/km <sup>2</sup>	Beach sediments	Particles/m <sup>2</sup>
Pacific Ocean (Yamashita and Tanimura, 2007)	> 174,000 (Japan, Kuroshio current system)	Pacific Ocean (Kuriyama, 2002; Hidfalgo-Ruz and Thiel, 2013)	>1,000 pellets (Japan) 805 fragments and pellets (Easter Island)
Atlantic Ocean (Law et al., 2010)	> 580,000 (Caribbean Sea, North Atlantic)	Atlantic Ocean (Wilber, 1987)	2,000 – 10,000 (Bermuda)
NW Mediterranean Sea (Collignon et al., 2012)	mean: 115,000 – 1,050,000 max. 4,860,000	Indian Ocean (Khordagui and Abu-Hilal, 1994)	> 50 – 80,000 (Arabian Gulf)
Adriatic Sea (DeFishGear, 2013-2016)	<b>225 – 3,234,330</b>	Mediterranean Sea (Turner and Holmes, 2011; Cole et al., 2011) Van Cauwenberghe et al., 2013b)	0.7 – 175 (Malta); max. 1000 pellets 40 (Nile deep sea fan)
		Adriatic Sea (DeFishGear, 2013-2016)	<b>SMP: 1100 (70 – 6724)</b> all categories <b>LMP: 110 (16 – 500)</b> all categories

Only the data gathered with the same equipment as used in the DeFishGear project are cited.



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# Microplastics - conclusions



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- Sea surface
  - Microplastics concentrations in the Adriatic-Ionian region are higher than the proposed baseline **(80.000 – 130.000 items/km<sup>2</sup>)** for the future comparison as defined in document UNEP(DEPI)/MED WG.420/6
- Beach sediments
  - Microplastic concentrations in the Adriatic-Ionian region in beach sediments are in comparison with other published data from all over the world **in the middle**
- Biota
  - Microplastics concentrations in biota are in line with other studies from other parts of the world



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# Variability of collected data



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- Considerable spatial variability
  - sea surface: patches
  - beach sediments: hotspots
- Concentrations of microparticles vary widely → influenced by:
  - weather conditions
  - hydrodynamics and geographical features of sea and shore
  - seasons (touristic/non-touristic)
  - local sources of pollution
  - presence of cities
  - maritime and aquaculture activities
- Caution to data interpretation





**Thank you very much for  
your attention**

Image: for Eco Vitae, Boštjan Mljač

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