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Additional information about the impacts on marine resources, other than fishing activities

Presentation by V. Čikeš Keč, F. Grati, S. Libralato & G. Triantaphyllidis

Marine Pollution Bulletin 91 (2015) 120–127

Contents lists available at ScienceDirect

Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Spatial pattern and weight of seabed marine litter in the northern and central Adriatic Sea

P. Strafella [a,*], G. Fabi [a], A. Spagnolo [a], F. Grati [a], P. Polidori [a], E. Punzo [a], T. Fortibuoni [b], B. Marceta [c], S. Raicevich [b], I. Cvitkovic [d], M. Despalatovic [d], G. Scarcella [a]

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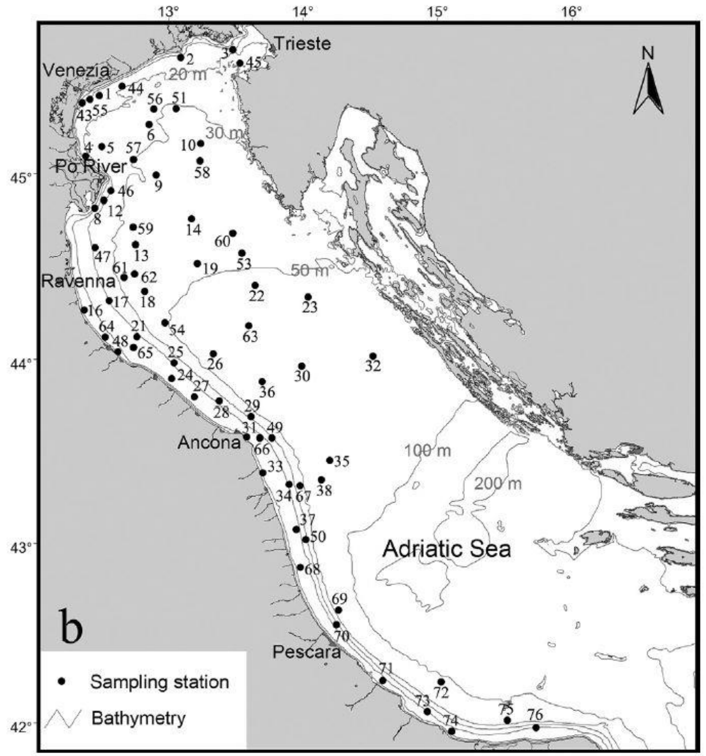
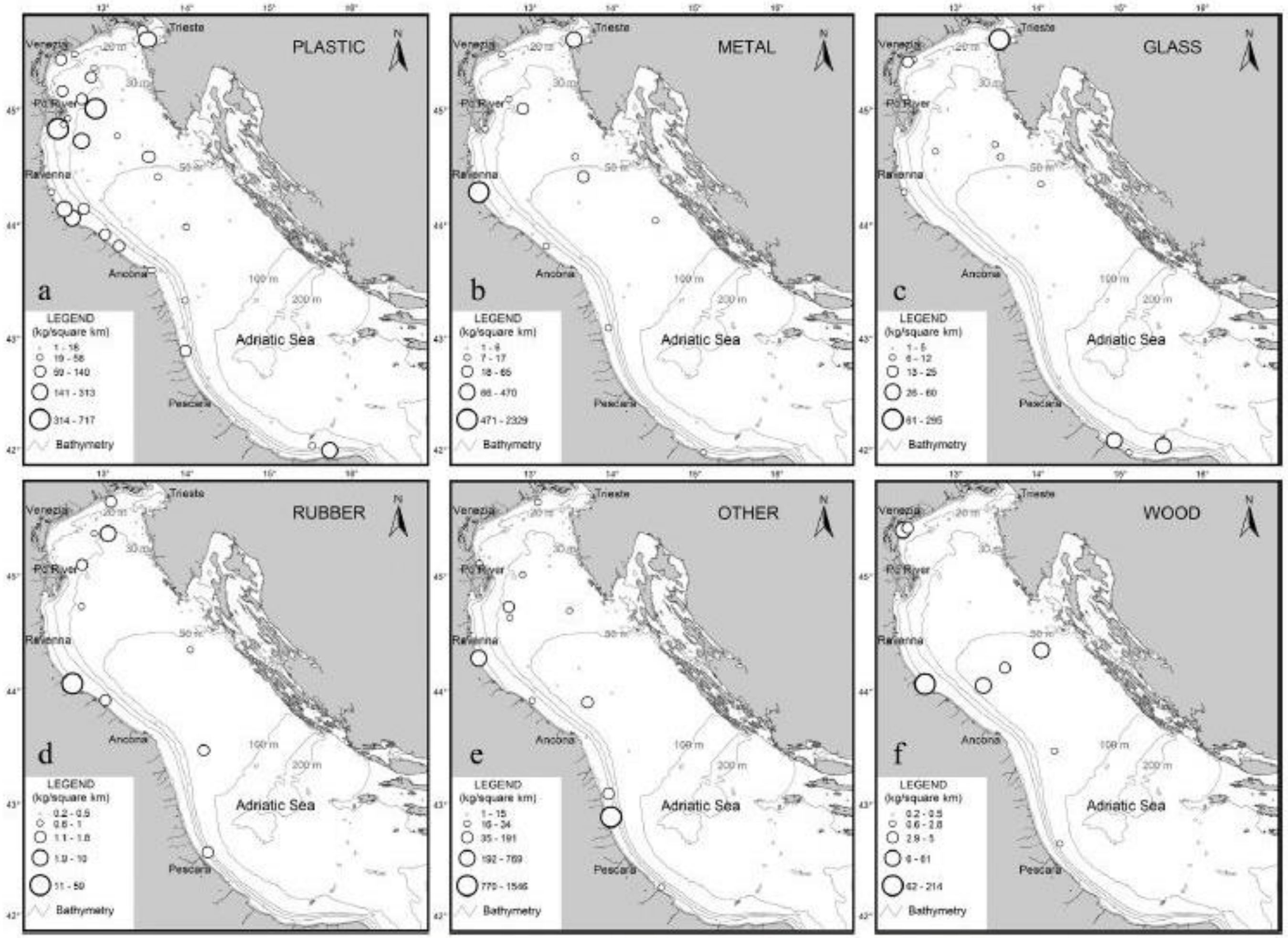
- Spatial distribution and typology of marine litter on the seabed in the GSA17 were assessed in 2011-2012 (67 stations of SOLEMON survey);
- Marine litter was sorted and classified in 6 major categories (plastic, metal, glass, rubber, wood, other).



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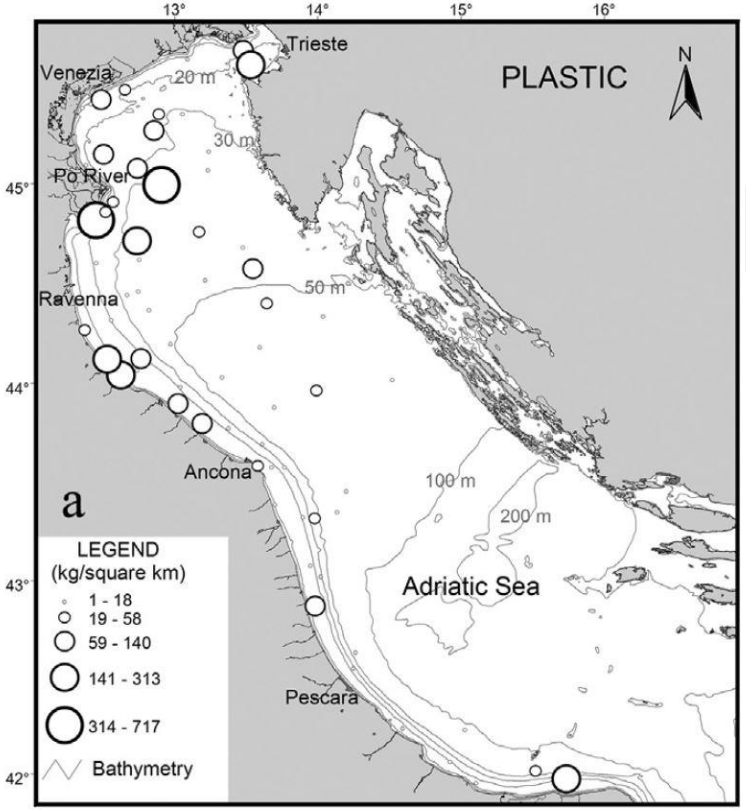

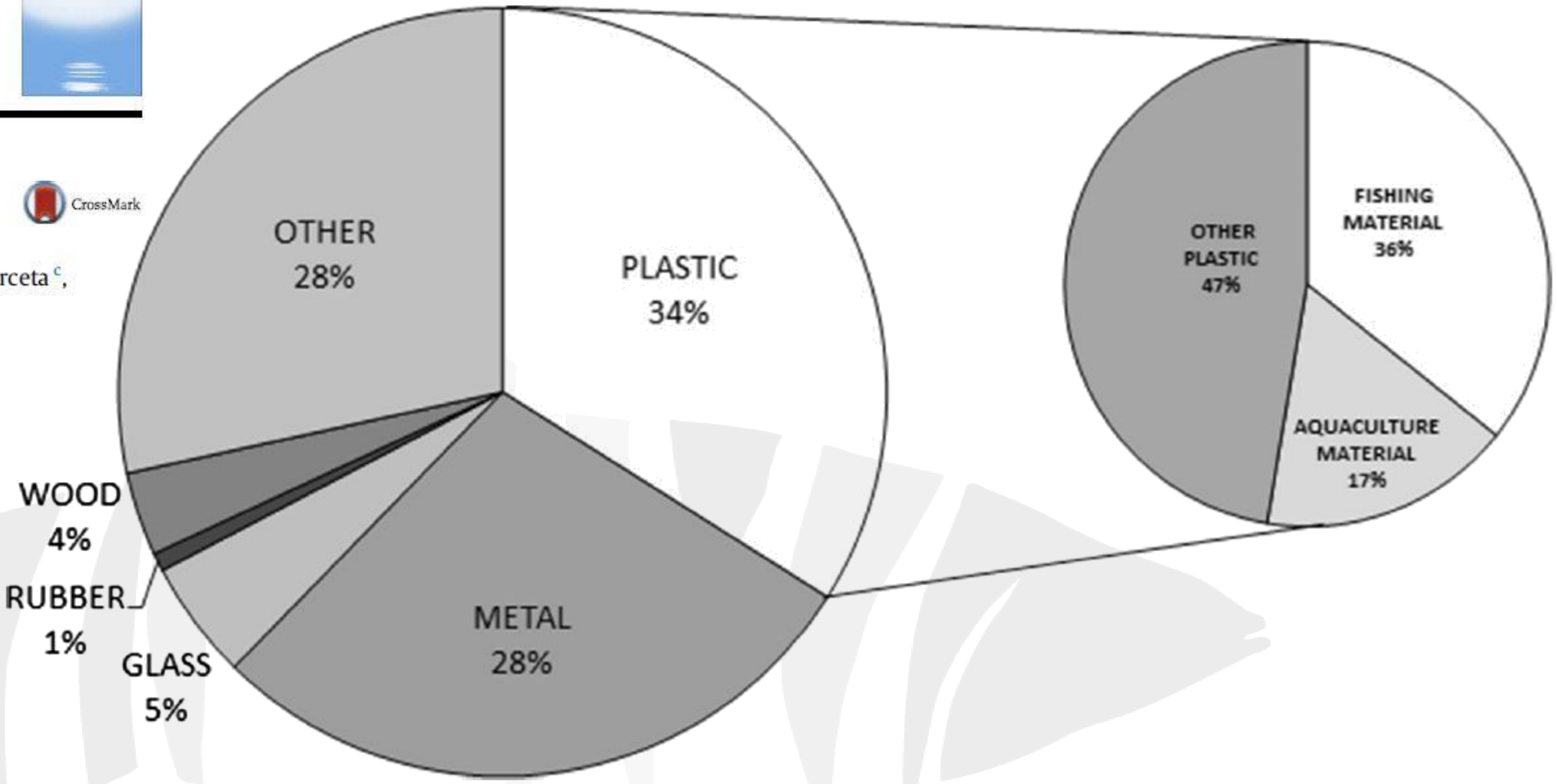

- Plastic was dominant in terms of weight followed by metal and other categories (up to 700 kg/km^2);
- Plastic litter was further subdivided in 3 sub-categories based on its source: fishing nets, aquaculture nets (mussel farms) and other;
- The highest concentration of litter was found close to the coast likely as a consequence of high coastal urbanization, river inflow and extensive navigation associated with the morphological and hydrological features of the basin.

Environmental Pollution 234 (2018) 943–952

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Environmental Pollution

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Characterization of microplastic litter in the gastrointestinal tract of *Solea solea* from the Adriatic Sea☆

G. Pellini [a], A. Gomiero [b, c, *], T. Fortibuoni [d, e], Carmen Ferrà [b], F. Grati [b], N. Tassetti [b], P. Polidori [b], G. Fabi [b], G. Scarcella [b]

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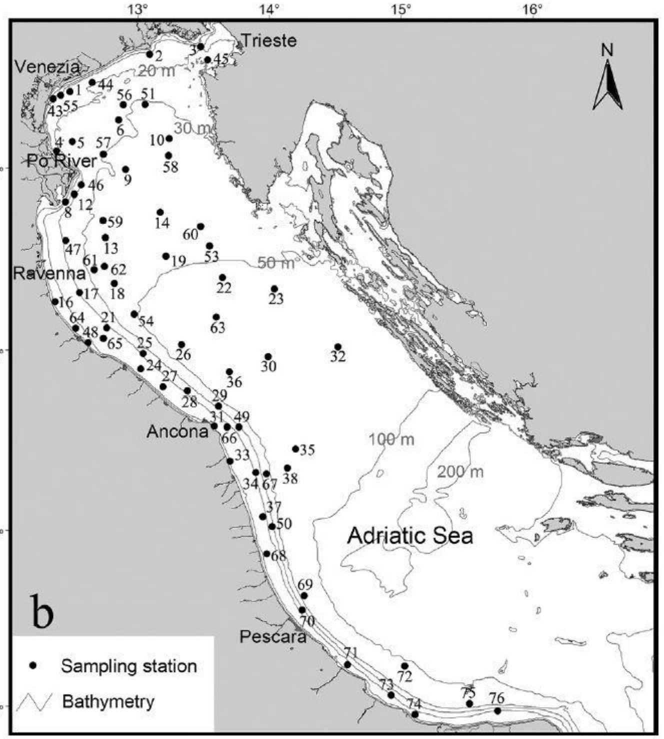
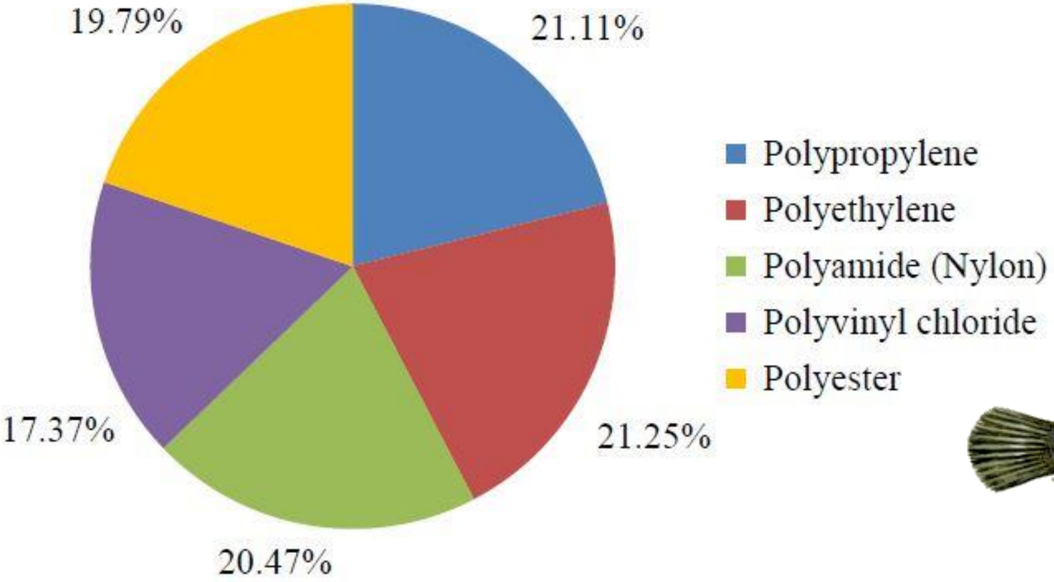
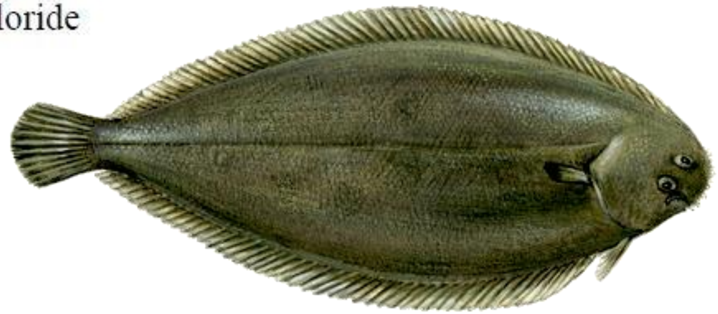
- Occurrence, amount, typology of microplastic litter in the gastrointestinal tract of the common sole *Solea solea* and its spatial distribution in the GSA17 were assessed in 2014-2015 (67 stations of SOLEMON survey);
- The digestive tract contents of 533 individuals were examined for microplastics, which were recorded in 95% of sampled fish, with more than one microplastic item found in around 80% of the examined specimens;
- The most commonly found polymers were polyvinyl chloride (PVC), polypropylene (PP), polyethylene (PE), polyester (PET), and polyamide (PA) (72% as fragments and 28% as fibers);
- PVC and PA showed the highest densities in the northern Adriatic Sea, both inshore and off-shore while PE, PP and PET were more concentrated in coastal areas with the highest values offshore from the port of Rimini.







Environmental Pollution 278 (2021) 116872

Contents lists available at ScienceDirect

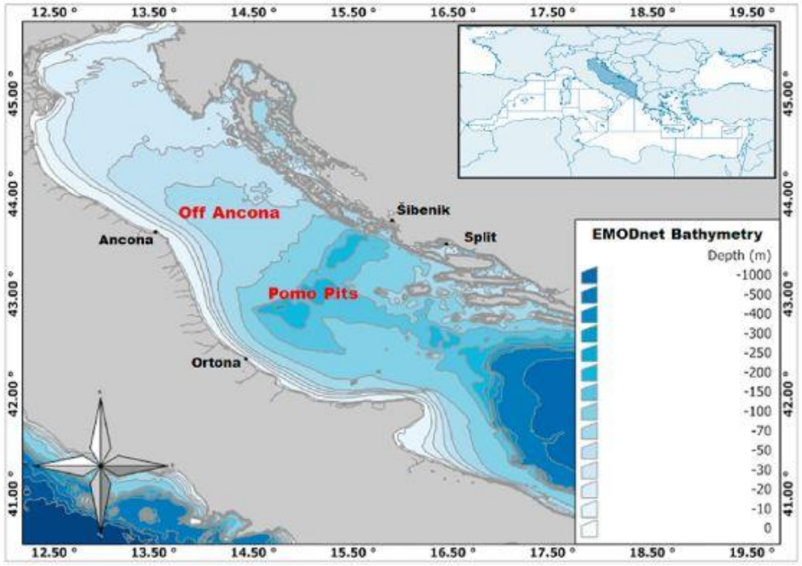
Environmental Pollution

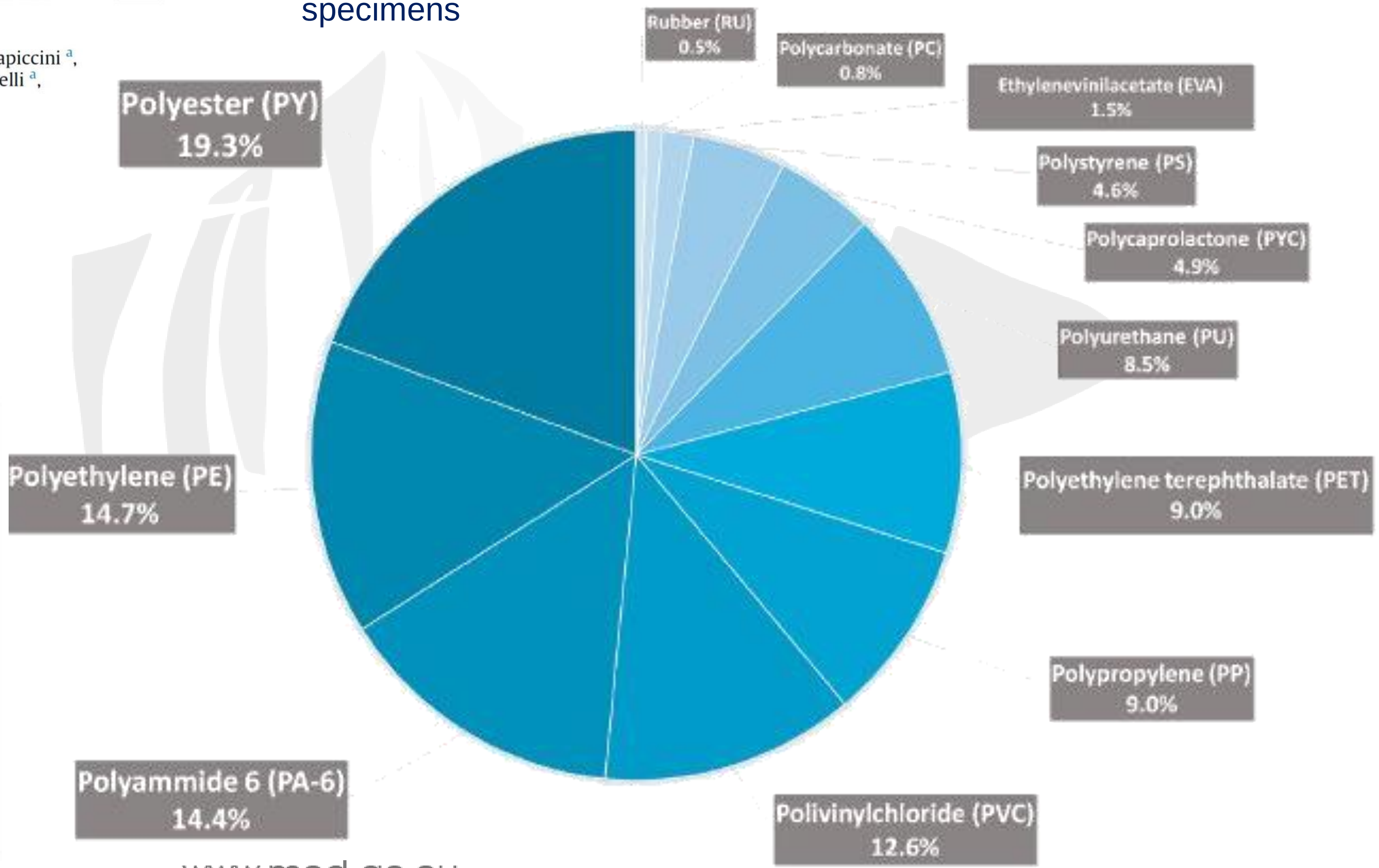
journal homepage: www.elsevier.com/locate/envpol

Preliminary results on the occurrence and anatomical distribution of microplastics in wild populations of *Nephrops norvegicus* from the Adriatic Sea☆

Michela Martinelli [a,1], Alessio Gomiero [b,*,1], Stefano Guicciardi [a], Emanuela Frapiccini [a], Pierluigi Strafella [a], Silvia Angelini [a,c], Filippo Domenichetti [a], Andrea Belardinelli [a], Sabrina Colella [a]

- Types and number of microplastics were assessed in 23 individuals of Norway lobster *Nephrops norvegicus* collected from two wild populations of the Adriatic Sea;
- MPs were found in all the investigated individuals with an average of about 17 MPs/individual
- Fragments were predominant over fibers with a ratio of about 3:1 specimens



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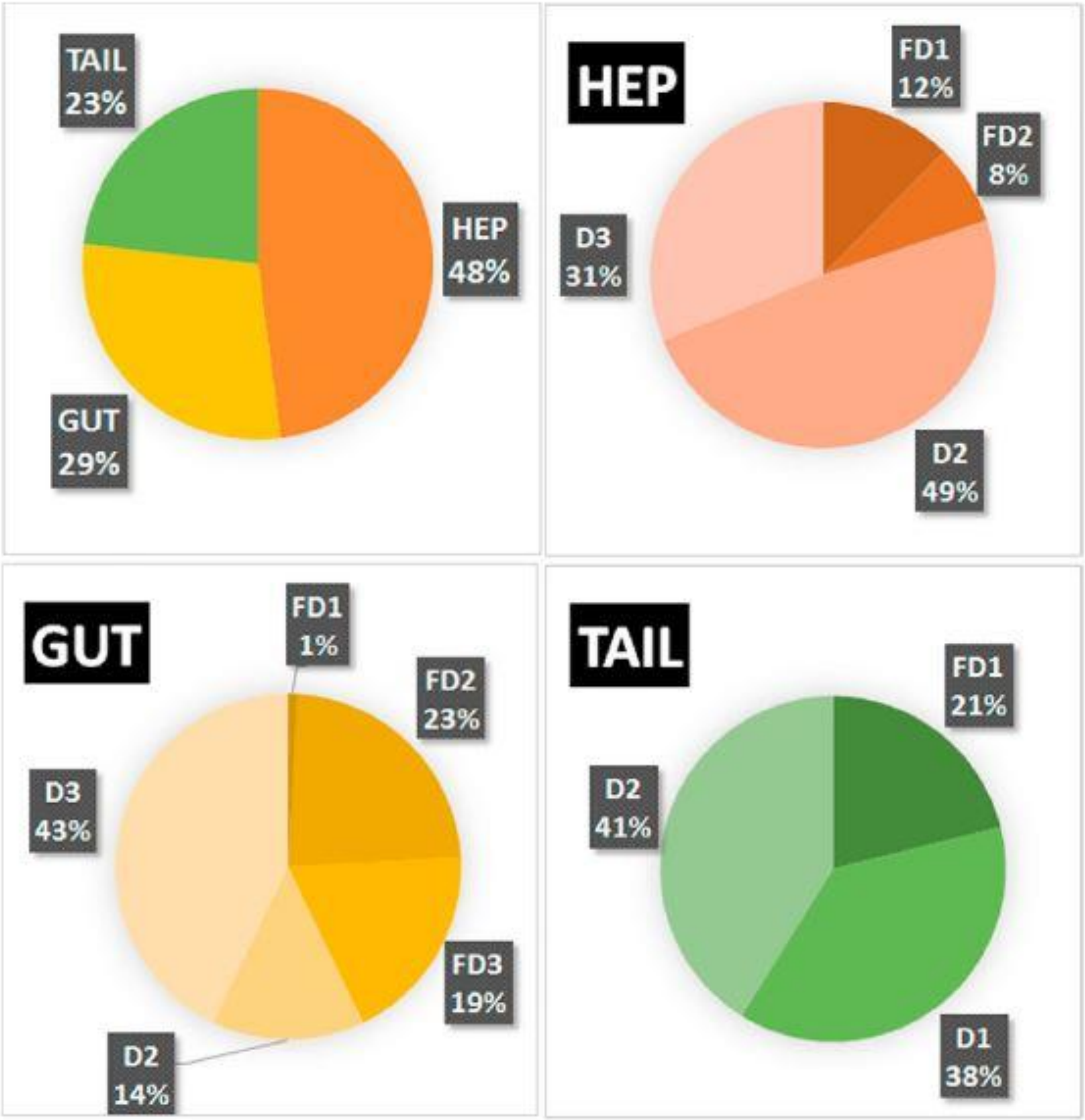
Preliminary results on the occurrence and anatomical distribution of microplastics in wild populations of *Nephrops norvegicus* from the Adriatic Sea☆

Michela Martinelli [a, 1], Alessio Gomiero [b, *, 1], Stefano Guicciardi [a], Emanuela Frapiccini [a], Pierluigi Strafella [a], Silvia Angelini [a, c], Filippo Domenichetti [a], Andrea Belardinelli [a], Sabrina Colella [a]



- The three anatomical compartments (hepatopancreas, gut and muscular part of the tail) were differently contaminated according to the shape and dimensions of the MPs. The largest MP particles in form of fibers (FD) were found in the gut, while the smallest in form of fragments (D) in the tail samples (FD1 50-100µm; FD2 100-300µm; FD3 >30µm; D1 20-50µm; D2 50-100µm; D3 100-300µm; D4 >300µm);
- The hepatopancreas was found to be the most contaminated compartment, while only the smallest fraction of MP particles was found in the muscular part of the tail.
- The results of this preliminary study indicate that MP pollution should be taken into consideration when preparing crustaceans for human consumption and while selecting portions to eat (e.g. avoiding hepatopancreas and intestine if possible), in order to minimize possibly derived human health concerns.

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Assessment on marine litter ingested by fish in the Adriatic and NE Ionian Sea macro-region (Mediterranean)

Aikaterini Anastasopoulou[a,*], Manca Kovač Viršek[b], Dubravka Bojanić Varezić[c], Nikoletta Digka[d], Tomaso Fortibuoni[e,f], Špela Koren[b], Milica Mandić[g], Chryssi Mytilineou[a], Ana Pešić[g], Francesca Ronchi[e], Jasna Šiljić[c], Michele Torre[a], Catherine Tsangaris[d], Pero Tutman[c]

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ARTICLE INFO

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Micro-litter
Adriatic and Ionian Sea

ABSTRACT

This study presents data on the marine litter occurrence in the stomachs of fish species living in different marine habitats for the Adriatic and NE Ionian Sea macro-region. "Macro-litter" was examined in 614 specimens belonging to 11 species, while micro-litter in 230 specimens belonging to 7 species. The study highlights for the first time the presence of litter in the stomachs of the fish species *Citharus linguatula*. The occurrence of "macro-litter" in the guts of fish was < 3% in both the NE Ionian and N Adriatic but reached 26% in the S Adriatic Sea. Micro-litter occurrence was 40 for the NE Ionian and increased to 87% in the N Adriatic (Slovenian Sea). The ingested "macro" and micro-litter differed among the areas. The marine habitat was found to affect the "macro"-litter ingestion but not the micro-litter.

1. Introduction

Ingestion of marine litter by a wide variety of marine organisms has been well documented and reviewed (e.g. Laist, 1997; Derraik, 2002; Kühn et al., 2015; Attademo et al., 2015; Hall et al., 2015; Wilcox et al., 2015; Macali et al., 2018). So far, almost 700 species have been reported to ingest marine litter (Gall and Thompson, 2015) and the number is constantly increasing.

Plastics (macro and micro) accounts for 92% of all encounters between organisms and marine litter (Phillips and Bonner, 2015). It is well known that plastic production grows at 5% per year (Andrady and Neal, 2009) and plastic does not really disappear as they fragmented into smaller persistent particles (secondary microplastics) under UV radiation, bacterial degradation and physical abrasion by wave action (Barnes et al., 2009; Kühn et al., 2015). Plastics may also be originally manufactured into very small sizes (primary microplastic, e.g. microbeads, plastic nanoparticles, "scrubs"). Therefore, litter particles can be ingested by marine organisms and there are indications that their chemical and physical impacts are likely to occur in marine food webs, which implies potential impacts on human end consumers (e.g. Farrel and Nelson, 2013; Setälä et al., 2014; Kühn et al., 2015 and references therein).

Marine litter also affects fish. However, the number of related references- although increasing year by year because many fish species constitute an important food source for humans- is still relatively low (Kühn et al., 2015). Fish consumption is significantly increasing, leading to a new record high of 20 kg in 2014 on world per capita fish supply (FAO, 2016). The increased fish consumption along with the constant increase of plastic production and the fact that fish constitute significant levels into food chain towards higher trophic levels (including human consumers), which raise potential concerns for the human health, make the necessity of such studies more and more imperative. Studies on litter ingestion by fish showed that a wide range of species having different feeding behaviors, inhibiting various geographic areas and depths has been affected (e.g. Boerger et al., 2010; Anastasopoulou et al., 2013; Lusher et al., 2013; Neves et al., 2015;

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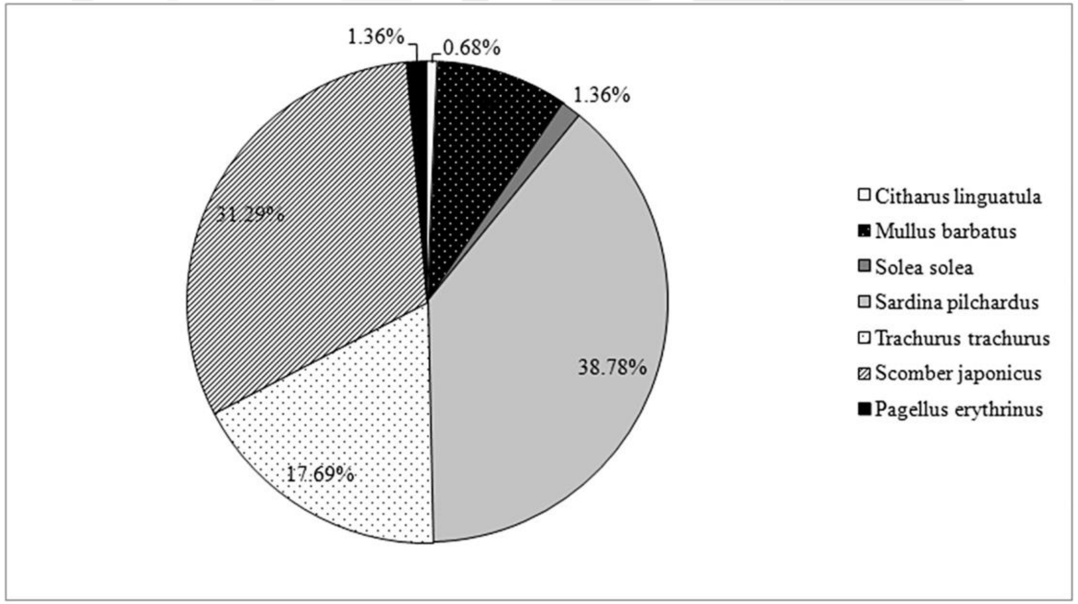
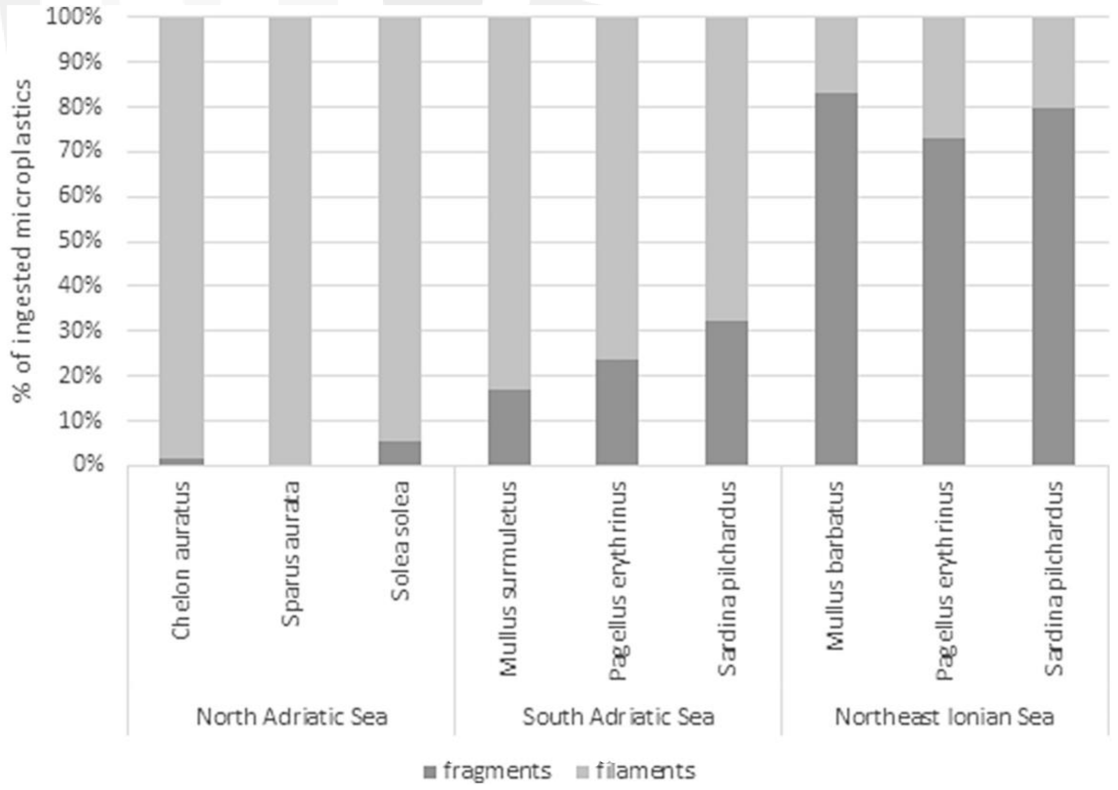
"Macro-litter":

- was examined in 614 specimens belonging to 11 species
- 147 "macro" litter items were identified among all fish specimens examined
- was present in the guts of 2.6%, 25.9% and 2.7%, individuals of the examined fish individuals, in the N Adriatic, S Adriatic and NE Ionian Sea



Micro-litter:

- 230 fish individuals were studied
- The concentration of micro-litter items per individual (all fishes pooled) was highest for the fishes from Slovenian Sea (6.7 ± 3.5 items/individual), followed by those from Croatian Sea (2.5 ± 0.2 items/individual). NE Ionian Sea was third in order (1.7 ± 0.2 items/ individual).
- the concentration of micro-litter items per individual was highest for Chelon auratus (9.9 ± 8.4 items/individual) from the Slovenian Sea and lowest for M. barbatus (1.5 ± 0.7 items/individual) from the NE Ionian Sea



Conclusion:

The frequency of “macro”-litter occurrence in the guts of all examined fishes per area was very low (< 3% in occurrence) in the N Adriatic and NE Ionian Sea but quite higher in S Adriatic Sea (26%). However, the occurrence of micro-litter in fish was much higher, ranging between 40% and 87%).

frontiers in Marine Science

ORIGINAL RESEARCH
published: 23 March 2021
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Effects of Nutrient Management Scenarios on Marine Food Webs: A Pan-European Assessment in Support of the Marine Strategy Framework Directive

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OPEN ACCESS

Edited by:
Xosé Anxelu G. Morán,
King Abdullah University of Science and Technology, Saudi Arabia

This analysis is a result from a series of workshops **“Redevelopping Models of the European Marine Environment” (MEME) promoted by DGMARE and DGENV**

In this group modelling experts from Low Trophic Level models (LTL; from physics to plankton) and High Trophic Level models (HTL; from plankton to fish & fisheries) interacted since 2014 to develop best models and approaches to link and connect LTL and HTL

In this work the aim was to examine how nutrient discharge to coastal areas influence marine ecosystems

LTL: 3D hydrodynamic biogeochemical models representing **the 4 main MSFD regions** (Mediterranean Sea, Black Sea, Baltic Sea and North East Atlantic)

HTL: 19 food web models (from plankton to fish ad fisheries) covering different areas.
11 ecosystem models representing areas of the Mediterranean Sea, 3 the Adriatic Sea

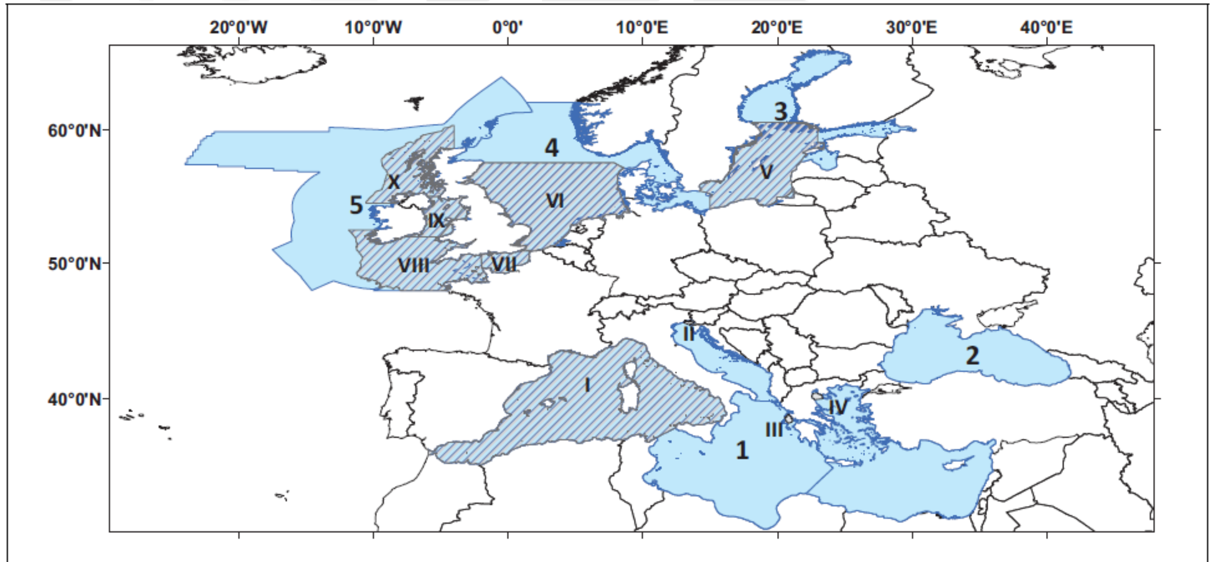
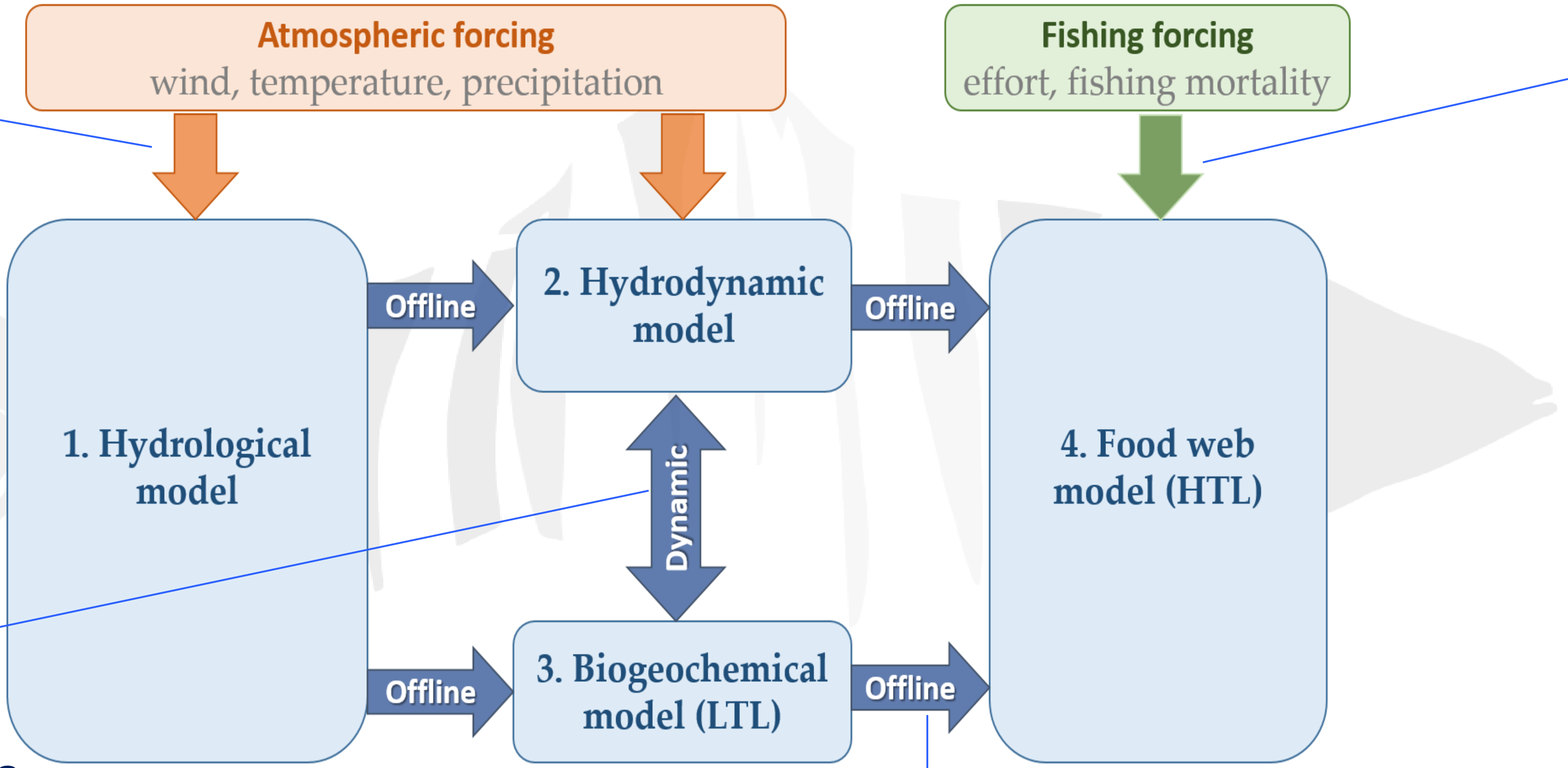


FIGURE 1 | Map showing the location and spatial extent of the 14 ecosystems models included in the analysis. Light-blue background and Arabic numbers correspond to MSFD regions and sub-regions (1 = Mediterranean Sea; 2 = Black Sea; 3 = Baltic Sea; 4 = North Sea; 5 = Celtic Seas) while dashed background and Roman numbers refer to smaller areas within an MSFD region/sub-region (I = Western Mediterranean; II = North-East Adriatic; III = Inner Ionian Archipelago; IV = Thermaikos Gulf; V = Baltic Proper; VI = North Sea; VII = English Channel; VIII = Celtic Sea; IX = Irish Sea; X = West Coast of Scotland).

The approach consists in a complex cascade of STATE-of-the-ART modelling approaches

LTL: Athmospheric and climatic drivers force the circulation model

HTL: Fisheries drives the food web model



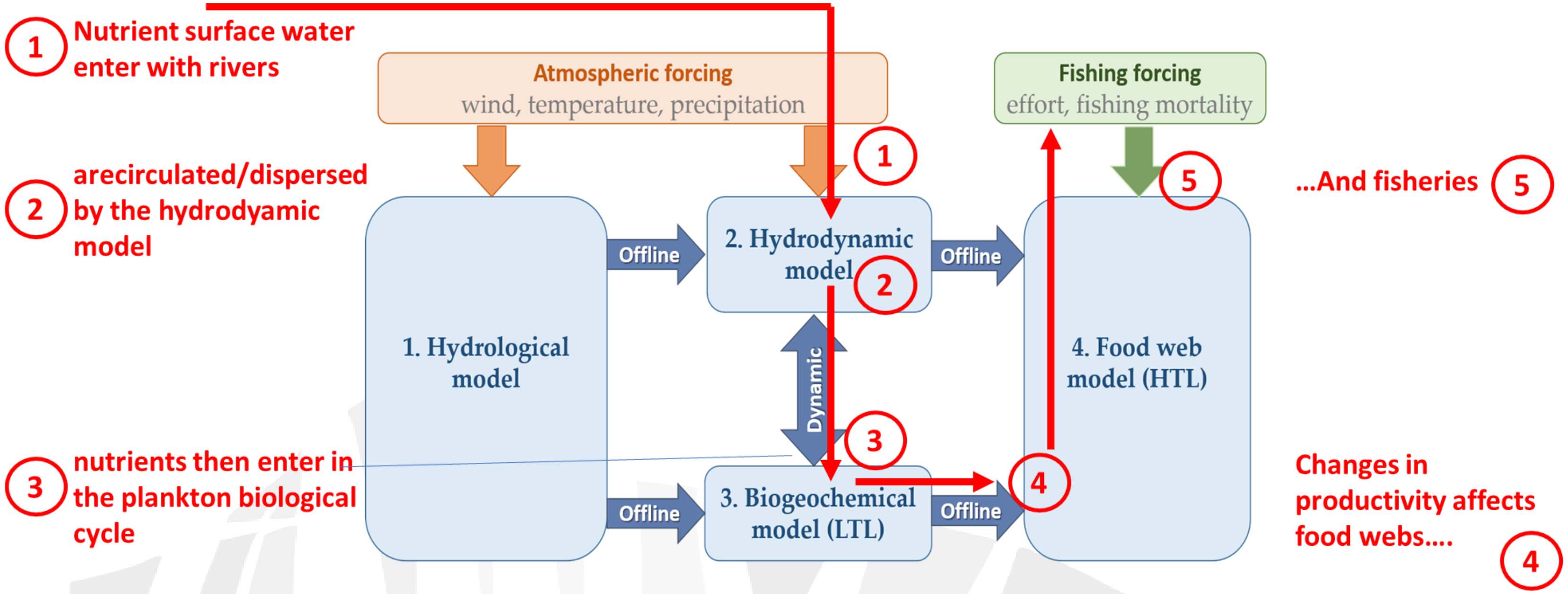
LTL: Circulation models (hydrodynamics) is coupled with plankton process (Biogeochemical)

LTL >> HTL: the production of plankton is linked offline to HTL model

IMPLEMENTED The two scenarios covering inland water quantity and quality (nutrients) in Europe include:

(1) actual nutrient loads from river discharge (reference scenario, REF)

(2) <u>maximum technically feasible reduction (MTFR scenario)</u> of nutrient input to surface water *(nutrient surplus in agricultural areas to a minimum, optimizing mineral fertilizer applications and upgrading wastewater treatments to the highest level of nutrient removal)*



RESULT 1:

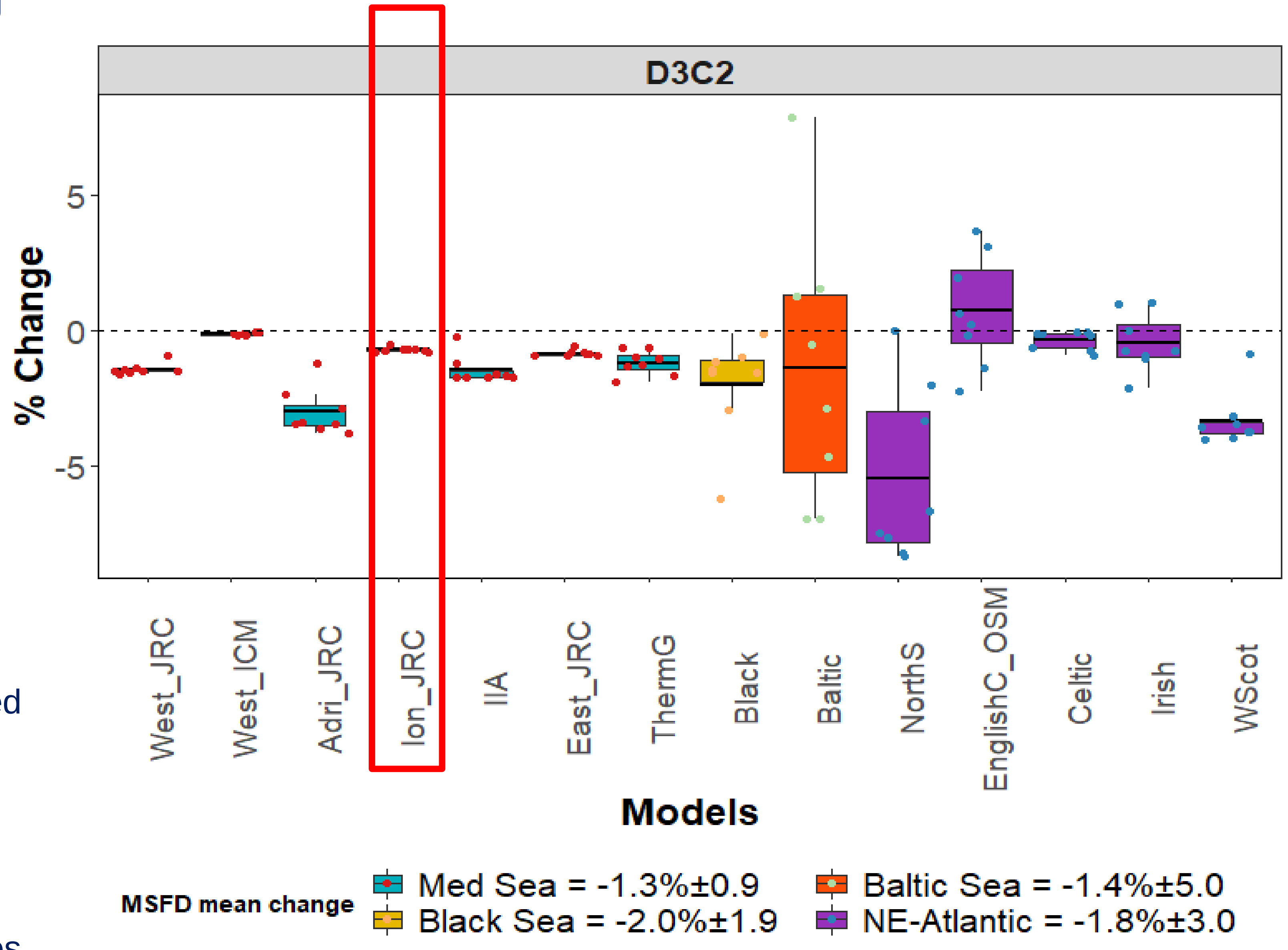
Substantial reductions on the INPUTS (Nitrogen -13%: -22%; Phosporous -28% : -35%)

result in MUCH LOWER reductions at sea (because of dispersion/use of excess) and smoothed effects of primary production BUT BIG SPATIAL DIFFERENCES

HTL European marine ecosystems	HTL Model type and acronym	HTL Spatial extent	Hydrological model		Hydrodynamic-biogeochemical models		
			Change (%)		Change (%)		
			TN	TP	DIN	DIP	PP
Mediterranean: West	EwE (West_JRC/West_ICM)	35.1–44.4°N and –5.9 to 16.2°E	–13.6	–35.7	–0.1	–0.2	–0.1
Mediterranean: West	Osmose (West_OSM)	35.1–44.4°N and –5.9 to 16.2°E	–13.6	–35.7	–0.2	–0.4	–0.03
Mediterranean: Adriatic	EwE (Adri_JRC)	39.7–45.8°N and 12.1–20.0°E	–21.8	–28.6	–0.5	–3.4	–1.5
Mediterranean: Adriatic	Osmose (Adri_OSM)	39.7–45.8°N and 12.1–20.0°E	–21.8	–28.6	–2.6	–4.5	–2.2
North-East Adriatic Sea	EwE (NE_Adri)	45.4–46.0°N and 13.0–14.0°E	–22.4	–36.7	–13.0	–6.6	–4.8

Indicators used to evaluate effects among scenarios:

Spawning stock biomass of one commercial species within the small pelagic group



RESULT 2:
Large differences by site, in general decrease of biomass between -0.1 : -5%

The Mediterranean Sea models highlighted a reduction in the SSB in all the models/areas considered

Mediterranean Sea SSB small pelagics decreases by -1.3%
Adriatic Sea SSB small pelagics decreases by -3%

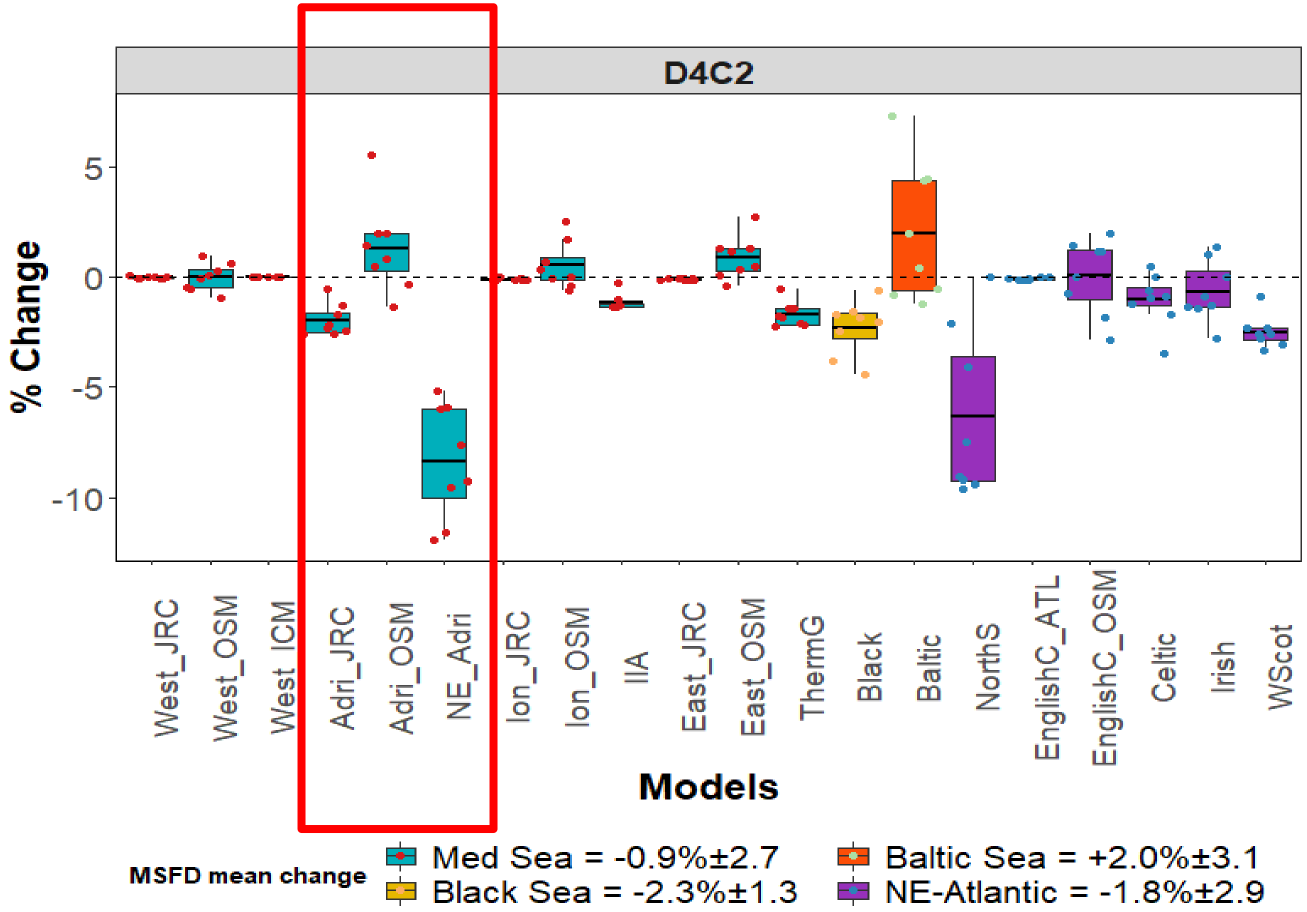
Indicators used to evaluate effects among scenarios:

Total biomass of small pelagic group

RESULT 3:
Small pelagic fish biomass had the highest variability among the areas/models

Mediterranean Sea total biomass of small pelagics decreases by -0.9%

At sub-regional level, the Adriatic Sea from the Mediterranean model (Adri_JRC) was the area with the highest reduction (-2.0%). Conversely, the Osmose model for the Adriatic Sea (Adri_OSM) projected an increase (+1.3%). the North-East Adriatic Sea showed the highest reduction (-8.4%)



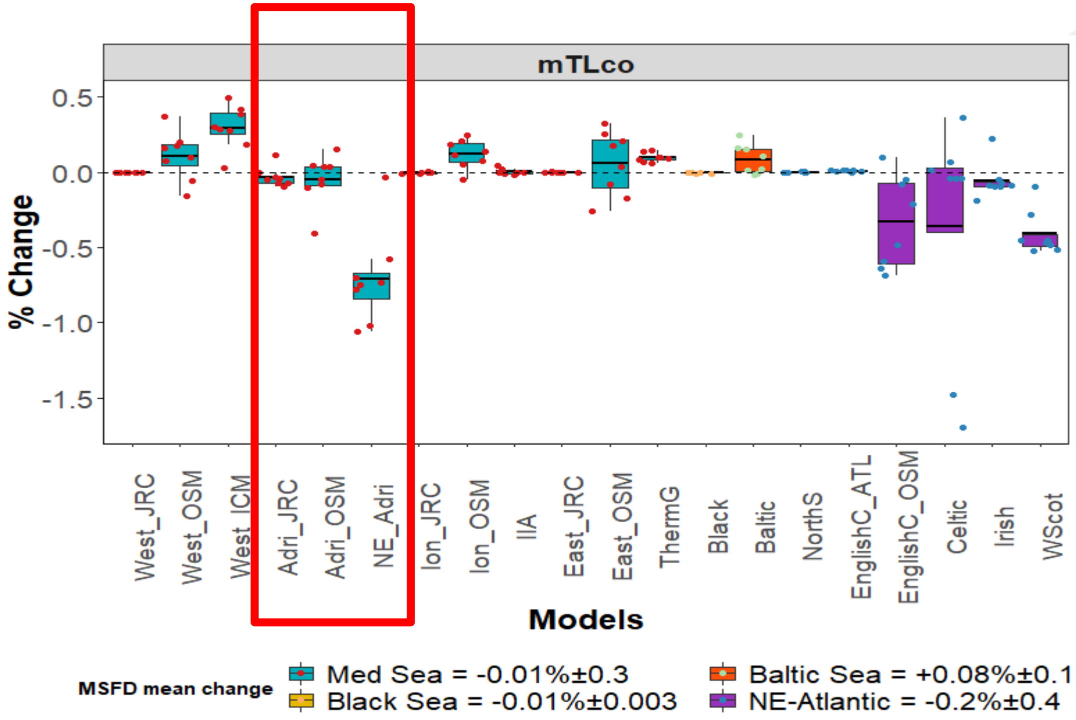
Catches follow the biomass change since fishing effort is assumed constant

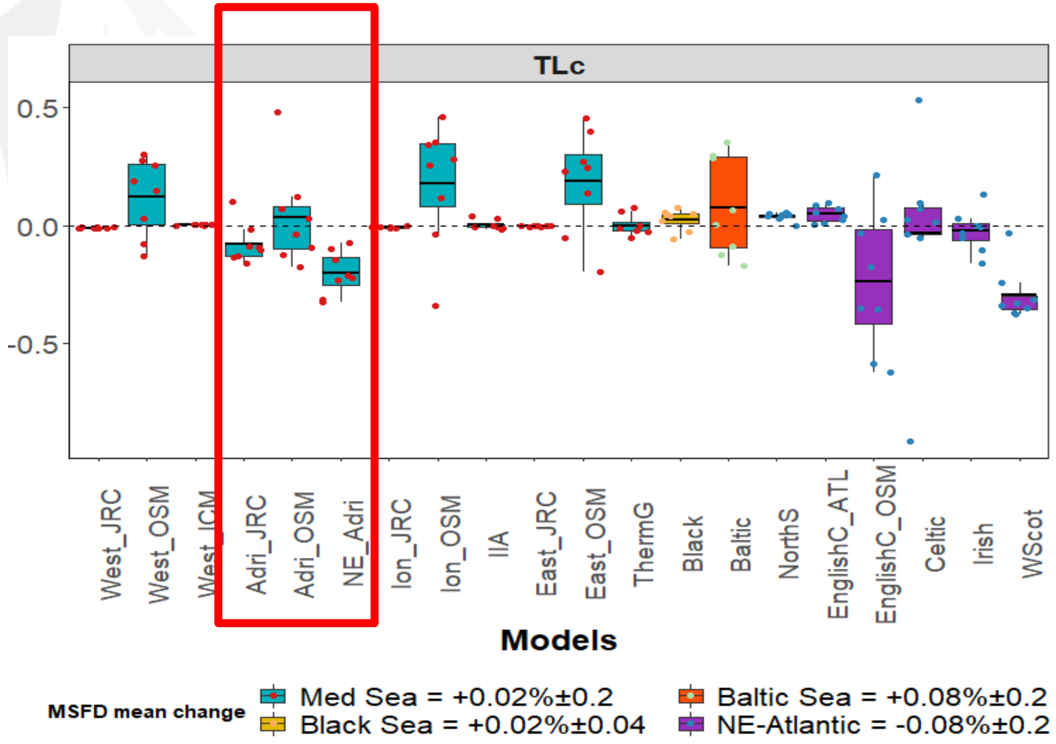
Indicators used to evaluate effects among scenarios:

Mean Trophic level of the community (mTLco) and mean trophic level of the fisheries catches (TLc)

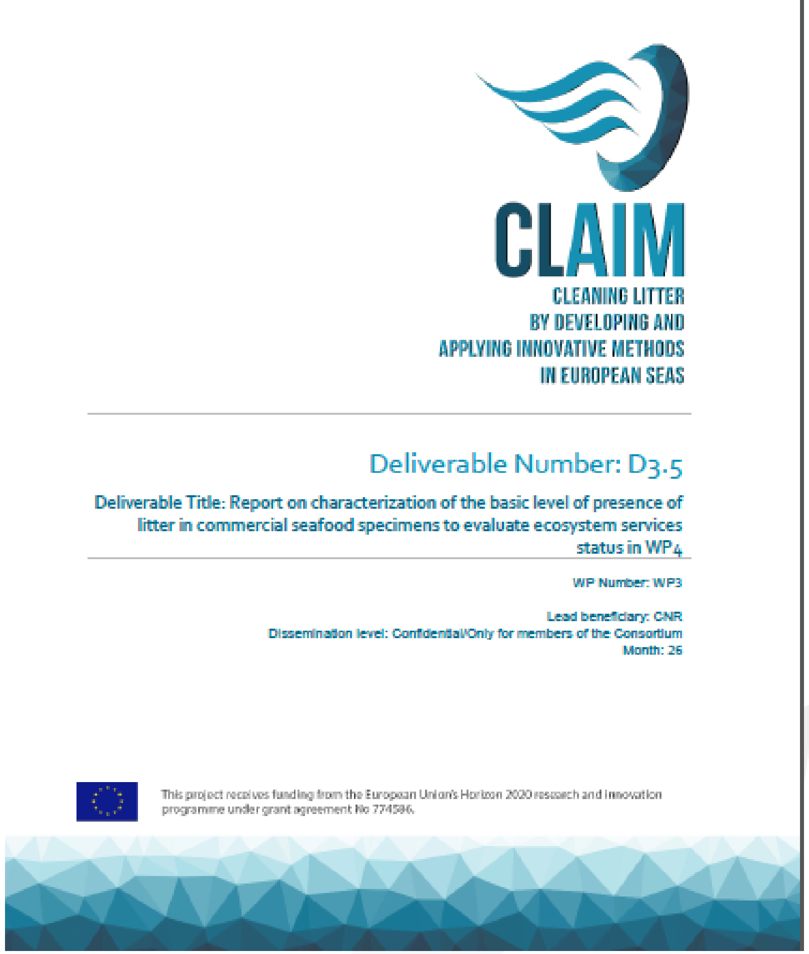
Looking at mTLco, the highest negative changes were observed at smaller scale with a reduction in the North-East Adriatic (-0.7%)

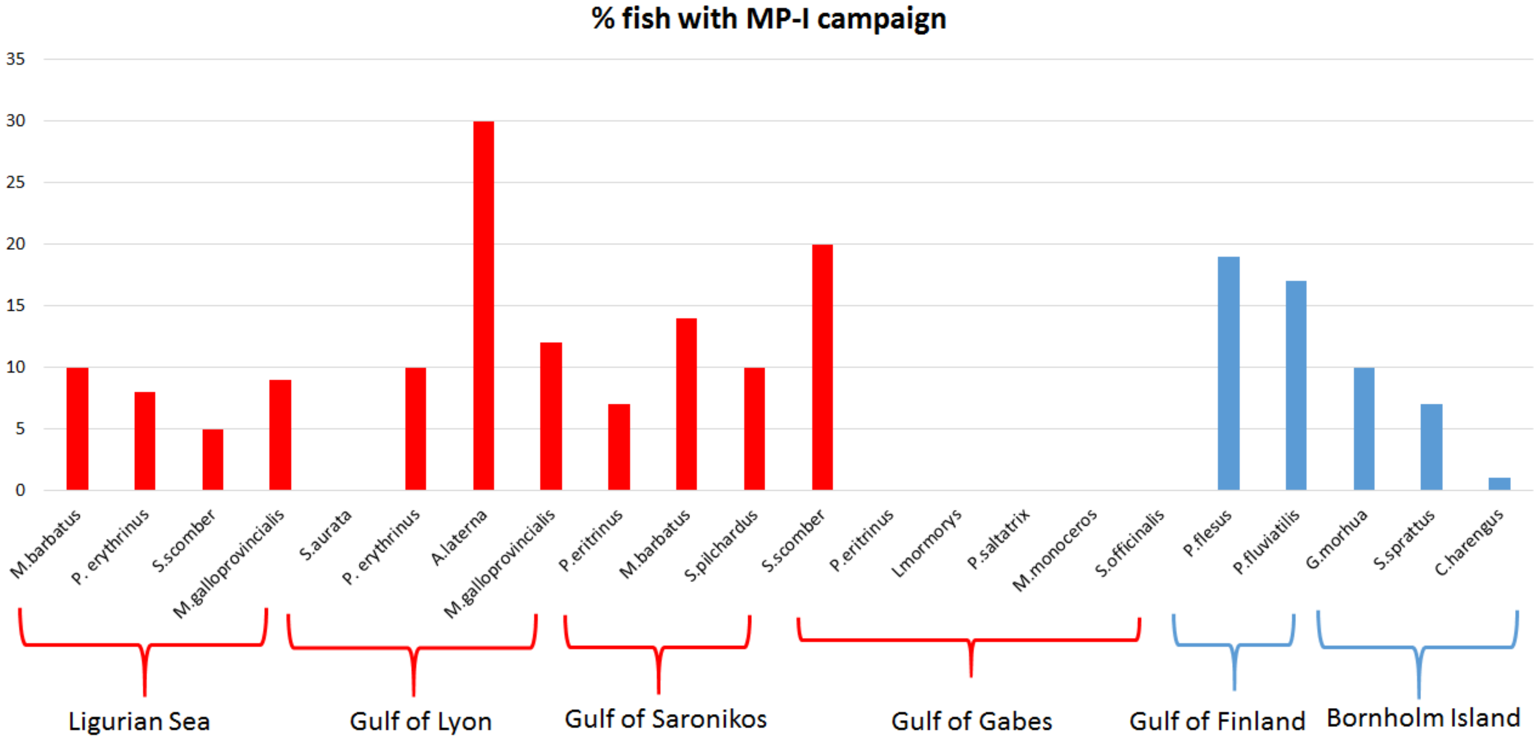
small reductions in TLc were observed in the North-East Adriatic (-0.2%)





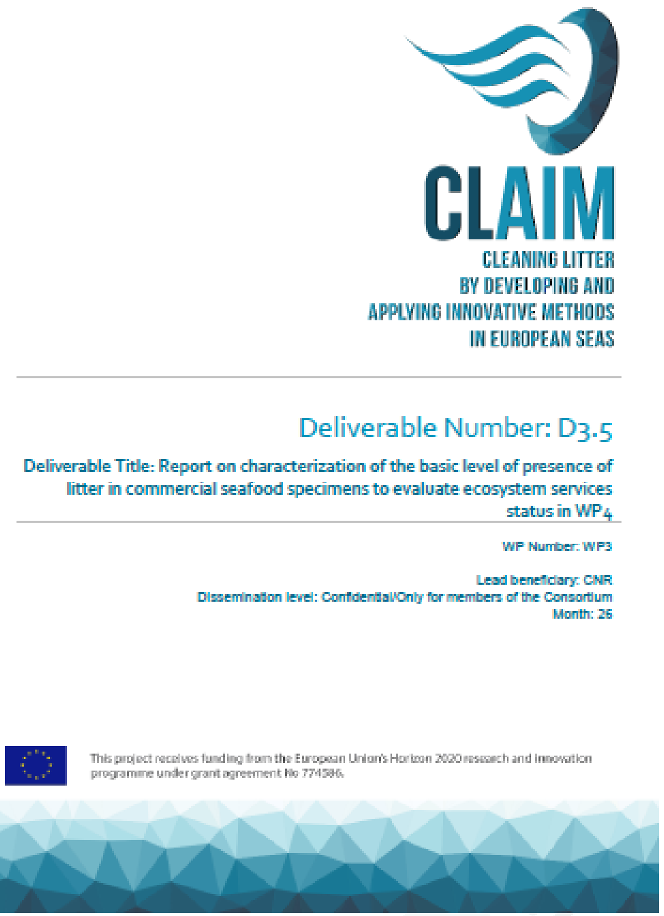
This study suggests that improved nutrient management, in line within European directives to preserve and/or recover the status of coastal and marine water status, will have little impact on the assessed HTL marine ecosystems. Although large differences occur across systems ad size of the area investigated.





MP ingestion by different species (% of individuals with MP in the digestive tract) analyzed during the 1st CLAIM campaign according to each sampling area. Red bars indicate Mediterranean region, blue bars indicate Baltic region.

The CLAIM project made a ccharacterization of the basic level of microplastics (MP) presence in seafood species of commercial interests (fish, bivalves, crustaceans, cephalopods) collected during two sampling campaigns in CLAIM key study areas of the Mediterranean (Ligurian Sea, Gulf of Lyon, Gulf of Saronikos, Gulf of Gabes). Different not-farmed seafood species have been collected from CLAIM key study areas and investigated for their MP content. Laboratorial analysis have been performed at the laboratory of CNR (Genoa, Italy) in order to gather data about MP abundance, shape, size and polymer composition in the investigated species of commercial interest.


CLAIM
CLEANING LITTER BY DEVELOPING AND APPLYING INNOVATIVE METHODS IN EUROPEAN SEAS

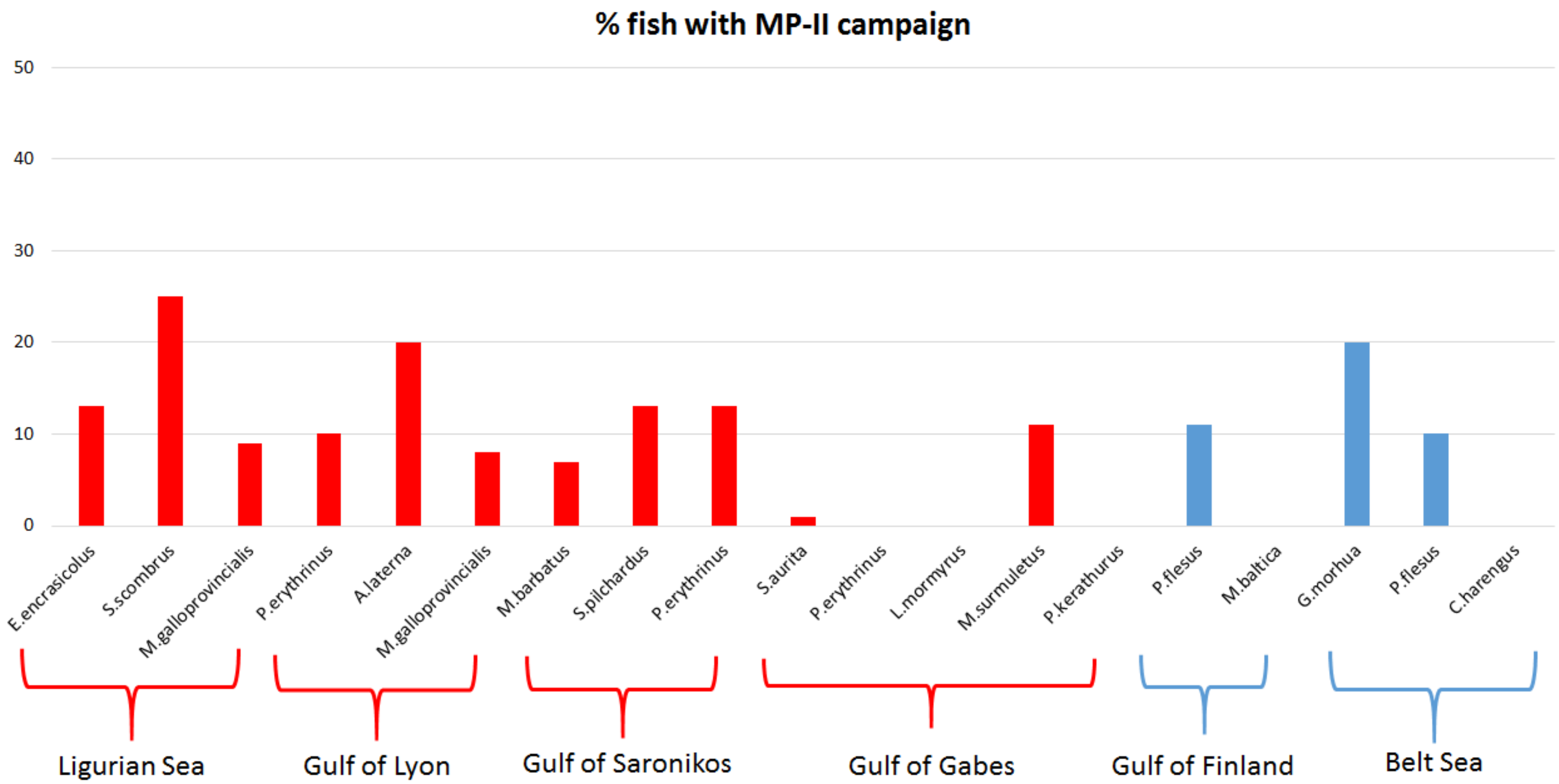
Deliverable Number: D3.5

Deliverable Title: Report on characterization of the basic level of presence of litter in commercial seafood specimens to evaluate ecosystem services status in WP4

WP Number: WP3

Lead beneficiary: CNR
Dissemination level: Confidential/Only for members of the Consortium
Month: 26

This project receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 774586.

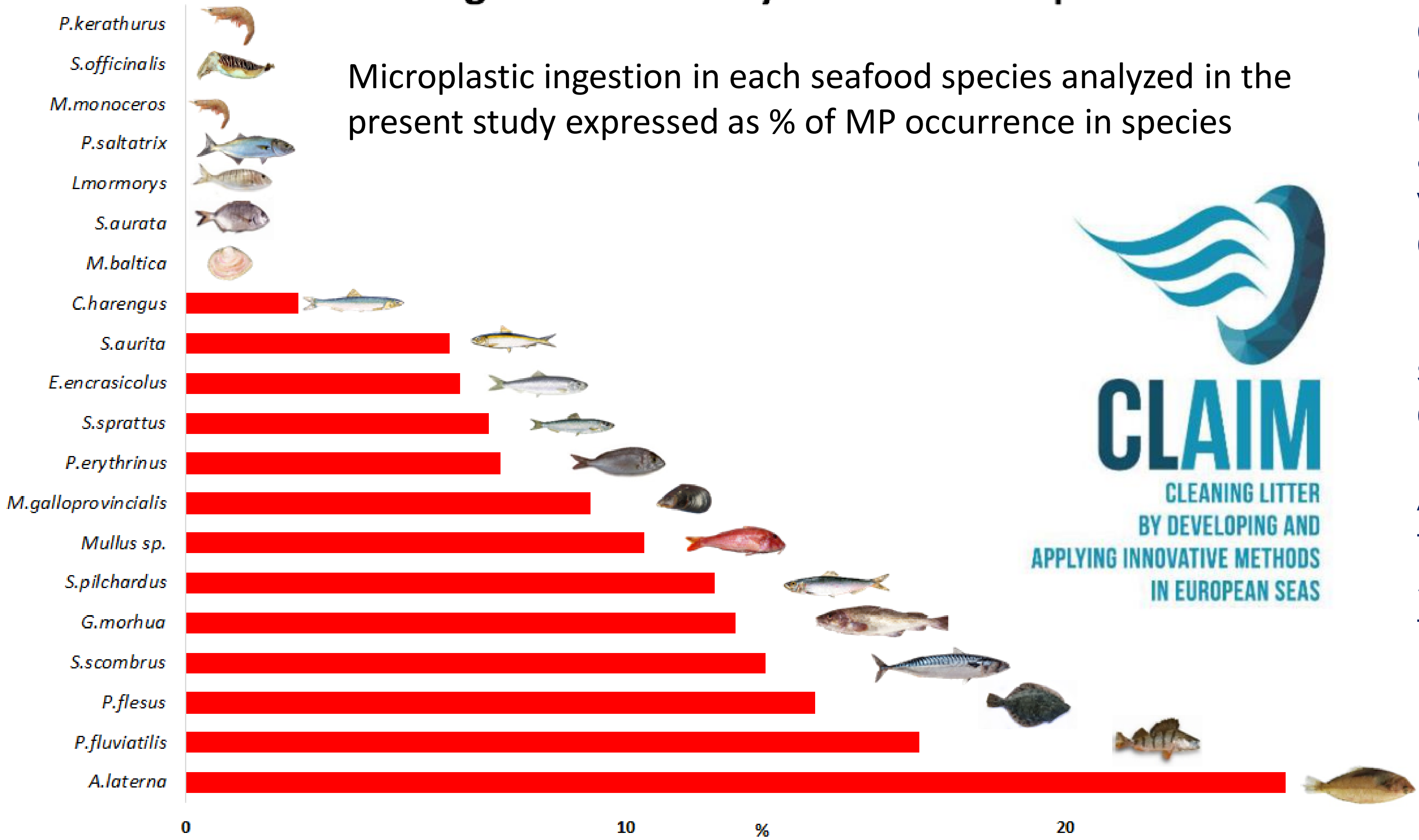


MP ingestion by different species (% of individuals with MP in the digestive tract) analyzed during the 2nd CLAIM campaign according to each sampling area. Red bars indicate Mediterranean region, blue bars indicate Baltic region.

The present study revealed a widespread MPs presence in seafood species, belonging to Mediterranean and Baltic regions, and sampled during two different campaigns.

MP ingestion in analyzed seafood species

Microplastic ingestion in each seafood species analyzed in the present study expressed as % of MP occurrence in species



CLAIM
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No remarkable differences in geographical or seasonal weather pattern of distribution were found; our results confirm MP ingestion by Mediterranean and Baltic species occurring with similar values: 8% of individuals with MP in the gut for Mediterranean species vs 10% of Baltic species (campaign I); 11% of Mediterranean species vs 8% of Baltic species (campaign II). Similarly, no differences in MP ingestion were found between species collected in Autumn/Winter (10% of seafood species found with MPs) and those in Spring/Summer (10% of seafood species found with MPs).

In the present work, it is interesting to note that we found at the top position three species *Arnoglossus laterna*, *Perca fluviatilis* and *P. flesus*, with demersal habitat, and therefore their feeding ecology may explain the higher MP ingestion compared to other species with different habits. Indeed, MPs could have been ingested during their normal feeding behaviour, with the sediment ingested when feeding on benthic invertebrates. Benthic environments retain MPs that sink to the ocean floor or river bed, with fragments being caught on or between grains of sediment. Katsnelson (2015) reported that MPs can be accumulated in deep sea floor at densities four times higher than at the sea surface.

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