TOXICITY ASSESSMENT
WP3 Organism Level WP4 Cellular and Mollecular levels
BIVALVES

EPHEMARE – ECOTOXICOLOGICAL EFFECTS OF MICROPLASTICS IN MARINE ECOSYSTEMS

JPI OCEANS

Partners involved in the bivalves framework:

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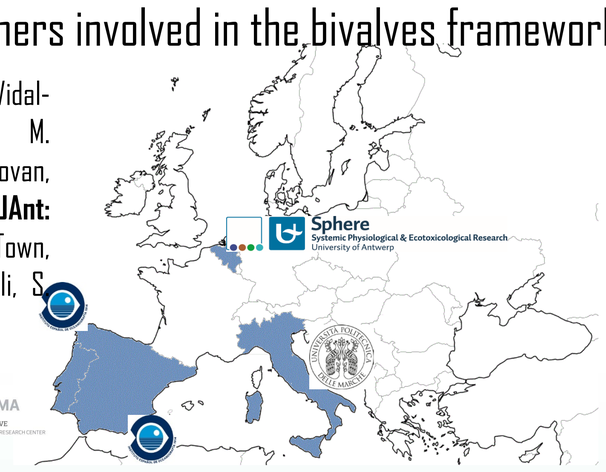
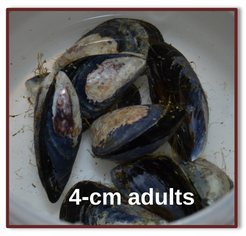


Test Organisms

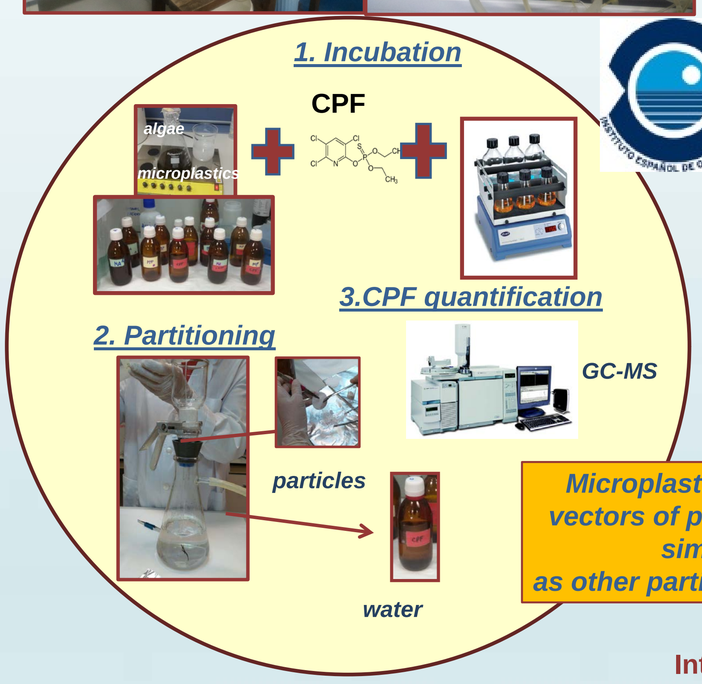
Mytilus galloprovincialis



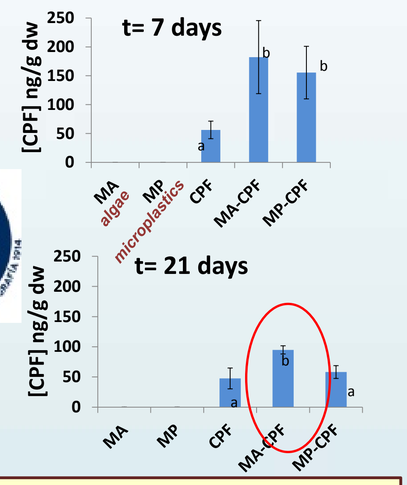
Scrobicularia plana

Bivalves experiments under the WP3 & WP4 frameworks were directed to evaluate the effect of MPs and adsorbed PPs using a variety of biological responses, at cellular, biochemical, molecular and physiological levels in two species: the mussel *Mytilus galloprovincialis* ,the worldwide sentinel species used for monitoring pollution and the clam *Scrobicularia plana*, a benthic bivalve used in sediment pollution studies.

Microplastics loaded with Chlorpyrifos



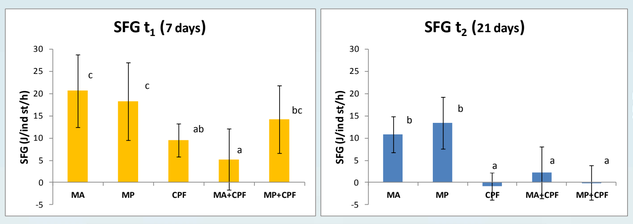
CPF Bioaccumulation



Higher CPF accumulation when pollutant is offered through particles, especially through microalgae

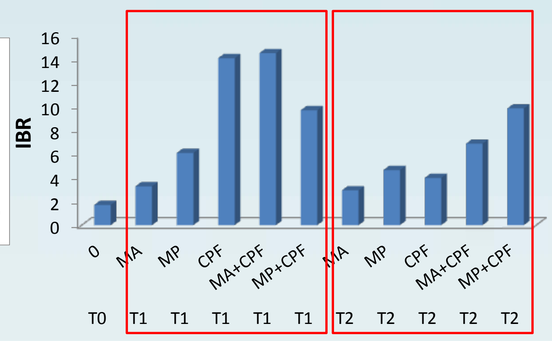
Microplastics really act as vectors of pollutants but in a similar way as other particles of the seston

Scope for Growth Responses

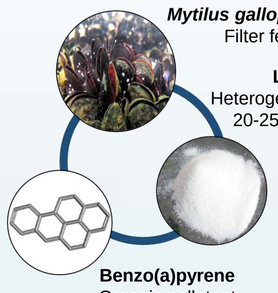


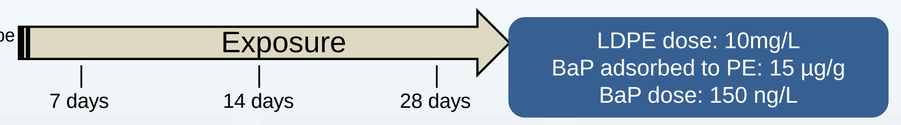
MP increased biochemical biomarkers. CPF, independently of the via of exposition, affected growth and biochemical biomarkers.

Integrated Biochemical Biomarker Response



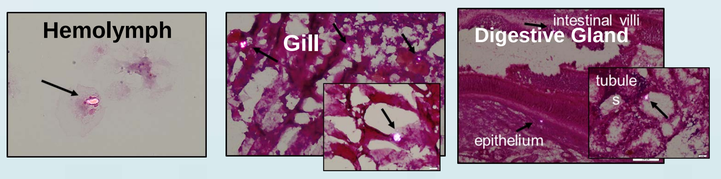
Microplastics loaded with BaP

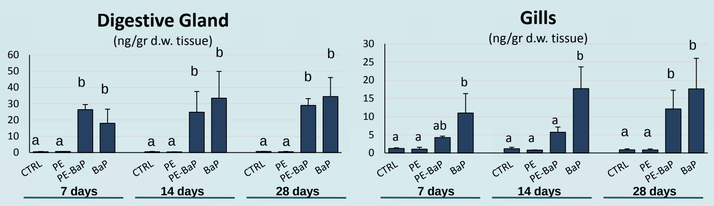




After 7, 14 and 28 days, organisms were collected; analyses included: Histological Examination (occurrence and localization of microplastics), Chemical Analyses (BaP accumulation), Biomarkers (immunological parameters, antioxidant defences, oxidative stress, DNA damages, neurotoxicity, peroxisomal proliferation).

QUALITATIVE ANALYSIS OF MICROPLASTICS UPTAKE AND BaP BIOACCUMULATION

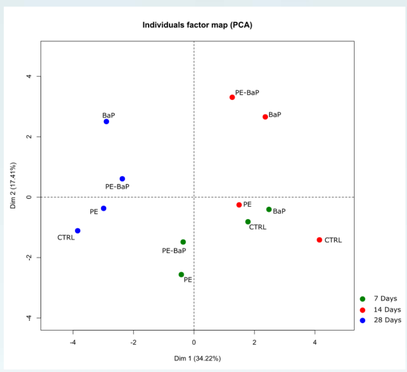




The uptake of PE particles was revealed by polarized-light microscopy, showing microplastics in the hemolymph, gills and digestive gland. Chemical analyses highlighted a marked accumulation of BaP both in mussels exposed to contaminated microplastics and to pollutant alone. In the digestive gland the maximum of bioaccumulation was observed already after 7 days of exposure, while in the gills the same condition was obtained after 28 days. Levels of BaP measured in the water of contaminated MPs group is below detection limit, thus excluding a significant desorption of BaP from plastics to seawater and confirming that bioaccumulation occurred after microplastics' ingestion.

PRINCIPAL COMPONENT ANALYSIS (PCA) AND ELABORATION WITHIN THE WOE MODEL

Individuals factor map (PCA)



Results of the PCA analysis on the whole set of biomarker responses indicated that separation of groups at the initial stage of the exposure (7 days) is related to the polymer itself. Over the time the separation is more evident for both BaP groups (14 days). After 28 days separation is clearly caused by exposure to the chemical alone.
Results on the WOE model indicated that contaminated MPs cause a "MAJOR" risk in respect to the virgin ones mostly related to BaP bioaccumulation the risk associated to treatments is not time-dependent.

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Scrobicularia plana exposure to LDPE microplastics with adsorbed BaP, BP3 and PFOS*

Gills, Digestive gland, Hemolymph

Treatments:

Control	LDPE (11-13 µm)	LDPE (11-13 µm) + BaP (17 µg g^{-1})	LDPE (11-13 µm) + BP3 (82 ng g^{-1})	LDPE (11-13 µm) + PFOS (70 µg g^{-1})

Biomarkers with elevated levels when compared to controls, with time:

CAT	GST	AChE	SOD	SOD
GPx	AChE	LPO	LPO	LPO
GST	LPO	DNA damage		

Adsorbed contaminants present in microplastics affect clams; Synergy between LDPE and BaP after 14 days for GST; Tissue specific response

		Class of hazard		Class of risk
TREATMENT	TIME	BIOAVAILABILITY	BIOMARKERS	WOE
PE	7 DAYS	Absent	Slight	SLIGHT
PE-BaP		Severe	Slight	MAJOR
BaP		Severe	Slight	MAJOR
PE	14 DAYS	Absent	Slight	SLIGHT
PE-BaP		Severe	Slight	MAJOR
BaP		Severe	Moderate	MAJOR
PE	28 DAYS	Absent	Slight	SLIGHT
PE-BaP		Severe	Slight	MAJOR
BaP		Severe	Slight	MAJOR

*For further details check poster by Mestre et al., entitled: *Ecotoxicological effects of microplastics with adsorbed contaminants in the clam Scrobicularia plana*

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