VII INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES 2020

3AMAR

WORKSHOP ON MARINE LITTER

BARCELONA, JULY 01-03

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Abstracts Volume Workshop on Marine Litter (BAMAR 2020), July 2020
ISBN: 978-84-120734-6-1
Linckia

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BEACH LITTERING

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AN ANNUAL STUDY OF BEACH POLLUTION ON TENERIFE (CANARY ISLANDS)

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Abstract: Stranded marine debris from eight beaches of Tenerife (Canary Islands, Spain) was analysed. Sampling was conducted along the high tide line every 35 m over the whole lengths in periods of 5 weeks for one year. Evaluated particles included all materials bigger than 2 mm, which were subdivided in mesoparticles(2–10 mm) and macroparticles (> 10 mm). There was a great variability of plastic abundance regarding the locations and the sampling dates. In contrast, the occurrence of debris along the beaches showed consistency and even zones of high and low accumulation. The most polluted beach was Poris, which is indeed infrequently visited, but highly affected by the main current. Plastic particles were principally mesoparticles and white/transparent color. This study not only confirms,that the Canary Islands are highly affected by the marine plastic pollution, but also for the first time shows, that stranded plastic accumulates in restricted areas of sandy coastlines

Key words: Plastic, Microplastic, Marine pollution, Beach pollution, Canary Islands

Acknowledgments: This work was funded by project MICROTROFIC (ULPGC2015-04) awarded to A. H. which was supported by a postdoctoral fellowship granted by Universidad de Las Palmas de Gran Canaria (ULPGC-2014).

MICROPLASTICS IN BEACHED POSIDONIA OCEANICA REMAINS IN CASTELLÓ, VALENCIA

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The global concern about plastic pollution has increased since the revelation of the ubiquity of microplastics (plastic items smaller than 5 mm) in the marine environment, and is now considered as a major global environmental issue. Despite microplastics have captured widespread attention and there has been significant research on their occurrence in ocean's surface waters, beach, coastal and deep sediments, and marine organisms including some fisheries targeted species, the amount of plastics in the different marine compartments and their transport mechanisms, including their return to land, are still unclear. In this study we have sampled beached *Posidonia oceanica* remains, including accumulations of loose dead leaves and fibre balls of this plant, named aegagropilas, in Castelló, Valencia, Spain. Our aim is to whether or not these seagrass remains act as a natural trap for microplastics, and which are the mechanisms behind the expulsion of these small sized fragments from the marine environment towards land, where they were mainly produced, during storms.
We have sampled *Posidonia oceanica* remains in three beaches in Castelló in summer 2019, winter 2019-2020 and spring 2020, the later period encompassing the occurrence of a severe storm with strong wind and high waves called Gloria. We have extracted microplastics from both loose dead leaves and aegagropilas and determined size, shape, colour, and polymer composition for individual fragments. Our study will shed light on the transport mechanisms of microplastics in the coastal zone and the role of *Posidonia oceanica* meadows, known by their numerous environmental functions, in expelling and trapping plastic pollution from the marine environment.

Key words: microplastics, *Posidona oceanica*, aegagropiles, Castelló beaches, Mediterranean Sea

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HARMONIZATION OF PROCEDURES AND ADVANCED CHARACTERISATION OF MICROPLASTICS

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DEGRADATION OF CONVENTIONAL AND BIO-BASED PLASTICS UNDER CONTRASTING ENVIRONMENTAL CONDITIONS

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Abstract: Plastic pollution is one of the main threats that marine and terrestrial ecosystems face due to the high perdurability of these materials in the environment. The degradation of conventional and bio-based materials was evaluated through a mesocosm experiment during a year simulating contrasting terrestrial environmental conditions in the soil: two types of soil (sandy and silty) and two ranges of precipitation (humid and dry). By combining weight loss (%), spectroscopic and thermal analyses, the degradation patterns regarding the polymer structure were assessed. The two bio-based materials (single- and bilayer), which contained polylactic acid (PLA), showed higher degradability than the two conventional ones. The degradation rates were seven times greater than conventional plastics in all conditions. Besides, as regards PLA-based materials, single-layer ones degraded twice faster than bilayer ones in humid conditions, while in dry conditions this degradability increased, being four times higher. These results are similar to those obtained in marine sediment, where conventional plastics did not show significant weight loss, however PLA-plastics did. In marine sediment single-layer PLA-based plastics showed total degradation after 128 days, while in terrestrial soil PLA-based plastics showed about 70% of degradation in this time. Our results highlight the different degradability rates of materials depending on the specific environmental terrestrial and marine conditions.

Key words: plastic degradation, biobased and biodegradable plastics, terrestrial ecosystems and marine ecosystems.

Acknowledgments: This work has been funded by the Spanish Foundation for Science and Technology (FECYT2-19I; PR238). C. S. has been funded by the University of Alicante (Ref. UATALENTO 17-11)

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THE COLOURS OF THE OCEAN PLASTICS

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Abstract: Marine plastic debris shows a wide range of colours. Hence, the characterization of colours is common in studies on plastic pollution; however, the relevance and comparability of this information is limited by differences in colour categorization or observer subjectivity. We still lack a consistent framework for analysing plastic colours and interpreting results. Based on the analysis of thousands of floating plastic fragments from a global sample collection, here we propose a systematic semi-automatic method to analyse colours by using a reference palette of 120 Pantone colours. The results highlighted a general predominance of light tones as well as a relative high abundance of white and transparent items (47%), yellow and brown (26%) and blue-like colours (9%). The increases in the fraction of white plastic colours among the smallest pieces (< 5 mm) and in samples far from coastal pollution sources (> 500 km) suggest a linkage between exposure time in environment, discoloration and fragmentation. Yellow and brown colours were also highly conspicuous likely due to the oxidation process, which seems to begin a yellowing and follows with a tanning to result in peaks of yellow items around 1 cm and brown colours around 1 mm. The enrichment in floating blue-like plastics towards offshore waters might be partly supported by a lower detectability for this kind of colours by visual oceanic predators, often suggested as a common sink removing microplastics from the ocean surface. Plastic colour distributions seem to be mainly shaped by photo-degradation and weathering, leaving room for the possibility of estimating aging from colour characterization. Here we provide a wide empirical background to promote the discussion and applicability of the colour information on ocean plastics.

Key words: Plastic colour, methodology, standardisation, whitening, yellowing.

Acknowledgments: This study is an outcome of Malaspina 2010 expedition (Consolider-Ingenio 2010, CSD2008-00077). E.M. was supported by the Campus de Excelencia Internacional del Mar (CEIMAR) through a PhD Research Project Grant. We received additional support from PLASTREND (BBVA Foundation) and MIDaS (CTM2016- 77106-R, AEI/FEDER/UE) projects. We thank personnel from Malaspina 2010 expedition, MEDSea (EU contract number FP7-2010-265103), TARA Arctic Ocean, MAFIA (Migrants and Active Flux In the Atlantic Ocean), MEGAN (Mesoscale and submesoscale processes in the Strait of Gibraltar: The Trafalgar-Alborán connection), Seagrass and Mangrove Cruise through Red Sea and ETO y NST Cruise along Bay of Biscay, for the help with the sample collection.

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INTERACTIONS WITH ORGANISMS AND HABITATS

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DETERMINATION OF THE EFFECTS OF MICROPLASTICS AND CHEMICAL POLLUTANTS ON FISH

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Microplastic pollution is currently a matter of great concern to both the scientific community and the public. In previous studies carried out in the Canary Islands we have detected high concentrations of microplastics on beaches (244 g/m2) (Herrera et al. 2018), sea surface (1 million particles/Km2) (unpublished data) and fish (incidence of 78%) (Herrera et al. 2019). We have also found high levels of associated chemical pollutants, including DDT and UV filters (Camacho et al. 2019), and a microplastic dry weight/zooplankton ratio reaching 2 in areas of maximum contamination (unpublished data). Based on these data we know that marine organisms are exposed to both physical danger from ingestion and chemical contamination. The long-term effects of microplastics and associated chemical pollutants are not yet known, nor are known whether they pass through the food chain, biomagnify and bioaccumulate. One of the main challenges is to conduct "realistic" experiments with microplastics and concentrations of chemical pollutants similar to those found in the environment. Within the IMPLAMAC project we have studied under experimental conditions the effects of microplastics and associated chemical contaminants (DDE, UV BP-3 filter and Chlorpyrifos) on *Dicentrarchus labrax* fish. In these experiments carried out in mesocosms, naturally contaminated "real" microplastics collected from beaches were used for the first time, trying to simulate conditions as close as possible to those found in the ocean.

Key words: marine litter, plastics, marine pollution, persistent organic pollutants.

Acknowledgments: This work was supported by the projects IMPLAMAC (MAC2/1.1a/265) Interreg MAC (European Fund to Regional Development, Macaronesian Cooperation) and INDICIT II (European Commission, MSFD- SECOND CYCLE: IMPLEMENTATION OF THE NEW GES DECISION AND PROGRAMMES OF MEASURES).

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Workshop sobre Basuras Marinas
BAMAR 2020
Barcelona (Spain), 1st-3rd July 2020

FISHERS PERCEPTIONS ABOUT MARINE LITTER AND ITS IMPACT ON FISHING ACTIVITIES

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Abstract:
Marine litter poses a threat to marine life. Litter caught in fishing nets is becoming a frequent problem. The fishing industry is both a source of, and impacted by marine litter, with over 45% of plastic debris found in the ocean being (or being related to) Abandoned, Lost or Otherwise Discarded Fishing Gears (ALDFG). 55 semi-structured interviews and 2 participatory workshops were conducted with key players of the fishing industry (fishers, gear makers, management authorities, etc) to assess marine litter (domestic and ALDFG) produced by fishing vessels, its hotspots, composition (types of domestic litter and the most frequently lost gears) and the impacts of marine debris in fisheries across the North of Portugal and Galicia (Spain). 76% of the fishers interviewed reported that they rarely lose the entire gear, usually losing solely part of it, and they try to retrieve it, but only when the process is operationally feasible and economically viable. Besides the financial costs of losing the gear, there are also costs associated with retrieving lost gear, which includes fishing time, rest time and fuel. The main causes of gear loss are irregular bottoms, where parts of net or traps get stuck, and weather conditions. Hotspots of ALDFG are mainly located near the coast, especially areas with shipwrecks, rocks, and high hydrodynamics. ALDFG have an impact on the fishing activities, damaging gear and sometimes even destroying the catch, especially in the case of trawlers. Another problem frequently referred by fishers is the fact that lost gears can also affect the security and navigability of fishing vessels. Domestic marine litter occurs near the coast, close to river mouths, near fishing ports and shipping lanes. Marine litter has different levels of impact on fisheries and more research is needed to quantify it and awareness actions to minimize it.

Keywords: Iberian coast, Fisheries, Marine debris, Plastic, Pollution

Acknowledgments:
This papers results from the NetTag Project - Tagging fishing gears and enhancing on board best-practices to promote waste-free fisheries (EASME/EMFF/2017/1.2.1.12/S2/02/S12.789121). The authors would like to thank the European Maritime and Fisheries Fund (EMFF) and the Executive Agency for Small and Medium-sized Enterprises (EASME) delegated by the European Commission for the funding and support. The authors would also like to thank all stakeholders who participated in the several meetings, interviews and workshops.

EFFECTS OF CONVENTIONAL AND BIODEGRADABLE PLASTICS ON THE STIMULATION OF SOIL AND SEDIMENT RESPIRATION

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Abstract: Pollution by plastics is increasing exponentially. Aiming to minimize this environmental drawback, biodegradable alternatives to these materials, are being developed and widely used. However, inputs of labile carbon (C) may greatly stimulate respiration. This overactivation can cause the degradation not only of added carbon, but also of a recalcitrant pool of organic matter present in the soil or sediment that would not degrade without the addition of labile C. This leads to its release in the form of CO_2 due to the respiration of microorganisms and can have important consequences for the ability of soils and sediments to capture carbon. In this study, we evaluated the effect of biodegradable plastics based on polylactic acid, (and conventional plastics made of polyethylene on the respiration of two types of soils and two types of sediments with contrasting contents in organic matter. Carbon loss was estimated by measuring respiration and methane emissions and compared with the remaining C content. We assessed the trend of the responses along the gradient of conventional and biodegradable plastic concentrations to estimate. We also investigated the potential mechanisms (changes in microbial composition, C/N and C/P ratios) behind the responses observed. Our results evaluate how the presence of large amounts of (bio)plastics could cause soils and sediments, the largest reservoir of CO_2 on the planet, to lower their mitigation capacity against climate change.

Key words: Priming effect, bioplastic, marine ecosystems, polyethylene, polylactic acid.

Acknowledgments: This work has been funded by the Fundación Biodiversidad, del Ministerio para la Transición Ecológica y el Reto Demográfico (SOCIPLAS, FBIOMARINA19-01). C. S. has been funded by the University of Alicante (Ref. UATALENTO 17-11).

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ASSESSMENT OF PLASTIC INGESTION BY SEABIRDS IN THE BAY OF BISCAY: INDICATORS FOR RESIDENT AND FOR WINTERING/MIGRATORY SPECIES

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Abstract: Seabirds are being used to monitor pollution by plastic debris in the marine environment. In fact, one of the criteria associated to the Descriptor 10 (Marine litter) of the Marine Strategy Framework Directive (MSFD) is "Trends in the amount and composition of litter ingested by marine animals". The Northern Fulmar (*Fulmarus glacialis*) has been the main species used to monitor the ingestion of plastic litter by seabirds; it has been used as a policy indicator under the OSPAR Convention as well as to assess compliance with the MSFD. However, alternative species must be considered in areas where the Norther Fulmar is scarce, like the Southern European Waters. The Bay of Biscay is an important wintering region for northern seabirds as well as a strategic area for species migrating along the African-Eurasian flyway. The aim of this study was to evaluate different indicators of the incidence of plastic ingestion in seabird species present in the Bay of Biscay by using different approaches: analysis of the stomach content of wintering/migratory species; and the analysis of pellets of a resident seabird species (European Shag). The highest frequency of occurrence of plastics in bird stomachs (100%) was found in species of the Procellariidae family. Prevalences between 10 and 20% were registered in some other species. Frequency of plastics in shag pellets was around 10%. Factors that could be affecting the plastic ingestion by seabirds in the study area are studied based on Generalized Linear Mixed Models. The potential use of these indicators to assess plastic pollution in the Bay of Biscay is discussed.

Key words: Plastic ingestion, Seabirds, Bay of Biscay, Stomach contents, Bird pellets

Acknowledgments: This work was funded by Fundación Biodiversidad-Ecoembes (call for projects to combat marine litter), the Directorate of Fisheries and Aquaculture of the Basque Country, the Spanish Ministry of Economy and Competitiveness (CTM2013-47032-R

project) and the Department of Environment, Land Planning and Housing of the Basque Government. Dead birds for this study were collected by anonymous volunteers, ONGs, wildlife recovery centers and beach cleaning services.

PLASTIC INGESTION IN SEABIRDS AND THEIR POTENTIAL INGESTION PATHWAYS

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Abstract: Plastic pollution is being recognized as an emerging threat to marine wildlife. Plastic items break down into microplastics and have been commonly found to be ingested by many marine animals[1]. However, whether these plastics are ingested directly or indirectly by trophic transfer of these items is still unknown[2,3]. To understand the incidence of microplastic ingestion in seabirds and their potential ingestion pathways, we examined microplastic content (from 1 to 5mm) in the stomachs' contents of three seabird species caught by longliners in the Balearic Sea from 2003 to 2015, the Scopoli's *Calonectris diomedea* (N=67), the Mediterranean *Puffinus yelkouan* (N=17) and the Balearic *Puffinus mauretanicus* (N=23) shearwaters. We then compared size, shape and polymer type of microplastics found in seabirds with those ingested by their natural prey, the small pelagic fish, as well as with those found floating in sea surface at the same region.

In relation to the size, microplastics found in seabirds were clearly larger (mean± SD: 3.132 ± 0.960 mm) than those found in both, the small pelagic fish (2.000 ± 1.497 mm) and the sea surface (1.598 ± 0.274 mm). The most common microplastic shape found in seabirds and in the sea surface was the "fragment" shape, whereas in the small pelagic fish it was the "filament" shape. Regarding to the type, polyethylene and polypropylene were the two most common polymers and showed a similar relative abundance in seabirds and sea surface. Overall, our results show a high incidence of plastic ingestion in shearwaters although their impact is still unknown. The comparison between seabirds, small pelagic fish and sea surface shows microplastics are mainly directly ingested by seabirds from the sea surface and selected for their larger size rather than the result of trophic transfer, which contrasts with evidences of trophic transfer found in other marine top-predators[4,5]

Key words: Microplastics, plastic pollution, plastic consumption seabirds, small pelagic fish, western Mediterranean

Acknowledgements: All the fishermen who were kind enough to give us a call whenever they had an accidental sea bird catch. Andrea and Marina, who did most of the work in dissecting and finding plastic items in the sea birds' dissections. The Spanish Institute of Oceanography (IEO) and specially Salva, for giving us sea bird corpses and cooperating in the various necropsy workshops that let us have enough practice. The MEDIAS survey has been co-funded by the Spanish Institute of Oceanography (IEO) and the European Union through the European Maritime and Fisheries Fund (EMFF) within the National Program of collection, management and use of data in the fisheries sector and support for scientific advice regarding the Common Fisheries Policy.

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CHARACTERIZATION OF FAUNA ASSOCIATED WITH DRIFTING MACROPLASTICS IN THE CANARY ISLANDS

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Abstract: In the last decades, the increasing amounts of anthropogenic debris, mainly plastic, have far exceeded the quantities of natural floating substrates in the ocean. These exogenous elements in the marine environment allow the settlement of many organisms, which can expand their natural dispersion ranges due to the resistance and persistence of these materials. In this research, a first description of the meiofauna and macrofauna associated with drifting macroplastics collected in the Canary Islands was conducted. Floating macroplastics were collected randomly from the southwest coasts of Tenerife and El Hierro and were classified into 4 main categories: plastic bags, ropes, rigid items and mixtures. Whether or not samples were found on a drift of marine debris was also considered. Out of the 19 samples analysed, a total of 45 taxa were identified, including new records of four taxa for the Canary Islands: three crustacean species and the Order Ctenostomatida (Bryozoa). No significant differences in the species richness and density of the rafting communities were observed between islands, nor between samples that were collected on a drift of marine debris and those that were not. However, significant lower densities were observed in the communities associated with ropes. Since the barnacle species *Lepas anatifera* was found in almost all samples, the capitulum lengths of the largest individuals were used to estimate how long each plastic object had been adrift. A minimum drifting period was estimated for each object, allowing the evolution of the community colonization process to be modelled based on organism density. The best *fixing model* was achieved by smoothing splines ($p=0.74$, $R^2=0.77$), in which different successional stages can be clearly distinguished: i) colonization, ii) growth, iii) competition, iv) extinction and v) establishment.

Key words: Rafting communities, macroplastics, anthropogenic debris, marine pollution.

Acknowledgments: We would like to thank the staff and volunteers from Tonina Association and University of La Laguna for their assistance in the collection of samples in El Hierro and to Francis Perez for collecting the samples from Tenerife. We also thank Jorge

Núñez and Leopoldo Moro for their support in taxonomic identification of the different studied species and to Alejandro Escánez Pérez for his suggestions and valuable contribution.

CHARACTERIZATION OF MICROPLASTICS IN THE GASTROINTESTINAL TRACT AS WELL AS PHTHALATES AND BISPHENOLS IN SKELETAL MUSCLE OF STRANDED CETACEANS IN THE MACARONESIAN REGION

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Abstract:

Plastic ingestion by marine organisms may have physical and toxicological deleterious effects [1,2]. Stranded cetaceans represent a significant opportunity to study the interaction of marine fauna with plastic debris. Given their long life expectancy and their high position in trophic levels marine mammals are considered important sentinels for marine pollution [3].

Aiming to harmonize the available data to facilitate large-scale meta-analyses of plastic ingestion in the Macaronesian region, our approach is fully compatible with necropsy protocol in cetaceans [4], and at the same time complies with the recommendations for reporting ingested plastics in marine megafauna [5].

We examined the entire gastrointestinal tract of 12 individuals from 5 odontocetes species that stranded along the coasts of Madeira and the Canary Islands. The gastrointestinal contents were washed through nested sieves of 1000, 500 and 200 µm and the retained material was then collected and digested with 10% KOH. All filters were observed under microscope and micro-Raman analyses were performed to some of the particles allowing the identification of their composition.

In addition, the determination of different types of phthalates and bisphenols was carried out in skeletal muscle samples of these cetaceans by liquid chromatography with different detectors (diode array and mass spectrometry).

As main results, no plastic particles larger than 5mm were observed, except for the case of a plastic wrapper that was found in the oesophagus of one dolphin. On the contrary, all animals contained microplastics of diverse sizes, being most of particles classified as fibres

(98.2%, n=722). Likewise, different types of phthalates and bisphenols were found in all the muscle samples analysed.

The adopted workflow in this study allows the collection of valuable data for different interdisciplinary research teams, aiming to harmonize data, facilitate large-scale comparisons of plastic ingestion and also give scientific basis to future conservation policies.

Key words: microplastics, phthalates, bisphenols, protocol, stranded cetaceans, Macaronesia.

Acknowledgments: This work has been supported by a postgraduate research scholarship from the University of Las Palmas de Gran Canaria and carried out with funding from the European Regional Development Fund through the Madeira-Açores-Canarias Territorial Cooperation Operational Program (POMAC) 2014-2020 through the MARCET Project (MAC/1.1b/149).

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WHAT DRIVES THE COMPOSITION AND ABUNDANCE OF BEACH MARINE DEBRIS?: CITIZEN SCIENCE ASSISTING RESEARCHERS

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Abstract: Marine litter is becoming a growing environmental concern due to the increasing rates of accumulation in nature. Large efforts are taken to clean marine litter from nature in areas such as in beaches. However, still more research is needed to comprehend the sources and dispersion of marine litter so environmental managers and policy makers can apply optimized measures to limit this type of pollution. The monitoring effort to quantify and classify sufficient data on marine litter that would be large enough to give robust recommendations is huge, and hardly affordable with specific research projects. Through citizen science, volunteers in beach cleaning activities have been quantifying and classifying the marine litter that they have collected in numerous beaches in Spain since 2011. The aim of this work was to analyse the composition and abundance of this litter, as a response of relevant environmental, geographical, conservational and oceanographic variables using multivariate analyses and spatial auto-regression modelling. We also used remote sensing information to analyse the co-occurrence of marine plastic contamination with other global change drivers such as sea temperature and eutrophication. Here we present the preliminary results of this work. Our results will help environmental agencies to design more effective tools to reduce marine litter according to its expected composition based upon the characteristics of the environment.

Key words: Marine litter, citizen science, multivariate analysis

Acknowledgments: This work has been funded by the Fundación Biodiversidad, del Ministerio para la Transición Ecológica y el Reto Demográfico (SOCIPLAS, FBIOMARINA19-01). C. S. has been funded by the University of Alicante (Ref. UATALENTO 17-11). We are grateful to Ambiente Europeo and Vertidos cero for providing the citizen science datasets. We would like to thank Nuria Casado-Coy for her help with the data preparation.

MONITORING MICROPLASTICS IN BARCELONA NEARSHORE SURFACE WATERS

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Microplastics fragments of <5mm in size are recognised as a major global environmental issue, mainly due to their ability to adsorb hydrophobic contaminants and leach incorporated additives, and their potential to interact with marine organisms. Microplastics are now considered ubiquitous, and high concentrations have been found in remote regions such as the Arctic and deep-sea floor. Even though there are several studies on floating microplastics in the open Mediterranean Sea, those waters near the coats, including bathing areas, have been poorly investigated.

In this study we have quantified (items km^{-2}) and characterized (shape, colour, size, polymer type) floating microplastics in nearshore areas of Barcelona between July 2019 and April 2020, on a biweekly temporal resolution. Nearshore data acquisition has been possible thanks to the development of an efficient and low-cost manta-trawl adapted to sample floating microplastics from a paddle surfboard (Camins et al., 2020). With the paddle-trawl, and the local group of volunteers of the Barcelona Chapter of the NGO Surfrider Europe, we have been able to investigate the magnitude of plastic pollution and overcome the high costs of oceanographic sampling by creating a network of citizens engaged in the acquisition of samples for research. Therefore, alongside sample collection, we have engaged societal actors and raised public awareness on the plastic pollution problem.

During the study, we have been able to acquire samples before and after one of the most extreme coastal storms of the last century, named Gloria, that hit Barcelona in January 2020, and determine the impact of extreme atmospheric events on the presence of microplastics. Our study involves also an important component of citizen science, for which we have created a hashtag (#uPlasticsBCN) for social networks (Twitter, Instagram), allowing citizens to follow and share our progress and raise their awareness on microplastic pollution.

Key words: microplastics, plastic pollution, paddle surf, Barcelona, citizen science

Acknowledgments: The authors thank the volunteers of the Barcelona Chapter of Surfrider and Anywhere Watersports of Barcelona to lend us the paddle boards for the monitoring activity

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IS WESTERN ANTARCTICA FREE FROM MICROPLASTIC POLLUTION? EVIDENCE FROM ANTARCTIC FUR SEAL SCATS

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Abstract: Microplastics occur in almost all the seas and oceans, including the Southern Ocean (Tekman et al., 2017). The high prevalence of microplastics in the scats of eared seals hauling-out in the southern tip of South America and several Subantartic and Antarctic islands has revealed widespread microplastic pollution in the Southern Ocean north to the Antarctic Polar Front. South to the Antarctic Polar Front, microplastics occur mainly in coastal sediments close to research stations (Waller et al. 2017), but little is known about microplastic presence in Antarctic food webs. Here, we analysed 42 scats of Antarctic fur seals (*Arctocephalus gazella*) collected in late summer at Deception Island (South Shetland Islands archipelago, Antarctic Peninsula) to assess the presence of microplastics in the marine food web of western Antarctica. Furthermore, we analysed the hard remains of prey in the scats to characterize the compartments of the food web sampled by the fur seals and we instrumented 14 subadult male fur seals with Argos tags to identify the foraging grounds. Only the tracking and diving data corresponding to the three weeks following the instrumentation of each specimen were used for this study, to bracket the period when scats were collected (from late-February to early-March). Results revealed that, during late-February and early-March 2019, Antarctic fur seals hauling-out at Deception Island behaved as nocturnal predators, foraged within the Bransfield Strait and exploited primarily the top 50 m of the water column. Diet was strictly pelagic and dominated by Antarctic krill *Euphausia superba* and three species of Myctophid fishes (*Gymnoscopelus nicholsi*, *Gymnoscopelus braueri* and *Electrona antarctica*). Fourier-transform infrared spectroscopy (FT-IR) analysis revealed the scat samples were free of microplastics, thus suggesting that the epipelagic food web the Bransfield strait is also free of microplastics.

Key words: Plastic, Faeces, Diet, Dive, Satellite tracking.

Acknowledgments: The project was financed by grant CTM2017-83319-P from the Ministerio de Ciencia, Innovación y Universidades (Spain) and supported by AEI/FEDER/UE.

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MICROPLASTIC POLLUTION IN THE SURFACE WATERS OF THE GULF OF CADIZ

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Abstract: The impacts of microplastics on organisms and the environment have become of increasing concern but there is hardly knowledge about the sources, distribution and fate of it in the Gulf of Cadiz (GoC). A first assessment of the spatial variation in the abundance of microplastics in the GoC has been obtained using a system developed to collect particulate material (plankton and small pieces of plastic) below the water surface at a depth of approximately 5 metres from the research vessel during its sailing. The water is channelled through the ship's pipe system, its volume measured and filtered with a 50 µm mesh size. This method has the advantage of sampling particulate material continuously without creating extra work that would require putting rosettes or nets into the water, since the sampling is done from the tap that is on the ship. These samples were collected from 13 transects through the gulf of Cadiz in June 2019. Microplastics were identified using Fourier transform infrared spectroscopy (FTIR). Spatially, a clear pattern in relation to the distance from the coast was found, the density of microplastics decreased from the coastline to the outer stations, mainly in the transects of the GoC related to the three main estuaries (Guadiana, Tinto-Odiel and Guadalquivir). The highest values were found close to the Guadalquivir estuary, which contained a density that was twice that of the other two estuaries. Most of the plastics that were found were conventional plastics such as polyethylene and polypropylene. Our results indicate that this river is presently the greatest contributor of microplastics in the GoC, probably due to its higher freshwater discharge rate and the significant urban and industrial effluent originating from this basin. Monitoring efforts could therefore be focused on this area and this approach might provide data for reliable trend assessments.

Key words: Riverine inputs, pollution, gulf of Cadiz, microplastic

Acknowledgments: The authors would like to thank the staff involved in the STOCAL Survey (IEO). Financial support to the instrument was given by CSIC through Intramural Research program 2018 under grant number 201830I081.

Workshop sobre Basuras Marinas
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A MODELLING APPROACH TO MAP MICROPLASTICS AND ASSOCIATED CONTAMINANTS IN THE MEDITERRANEAN SEA

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Abstract:
Toxicological effects caused by the interaction of microplastics with marine species may be exacerbated by the potential of the former to act also as vectors of other contaminants (Syberg et al., 2015; Alimba & Faggio, 2019), such as the chemical additives used in the production of plastics other than conventional pollutants that concentrate on the organic surface of marine litter (Rochman, 2015; Tourinho et al., 2019). In our work, we provide a simple yet comprehensive modelling framework to account for both the distribution of microplastics at sea and their chemical interactions with the marine environment, focusing here on the Mediterranean Sea. Surface microplastics dispersal patterns are obtained with Lagrangian particle tracking simulations (as in Eriksen et al., 2014, and many others), where plastic particles are released from the most impacting sources of pollution, i.e. mismanaged plastic waste originated by coastal areas, in the watersheds of major rivers and due to maritime activities (Guerrini et al., 2019). During their transport by surface currents, as provided by oceanographic reanalysis products (Copernicus Marine Environment Monitoring Services, Simoncelli et al., 2014), simulated plastic particles interact with the surrounding environment in response to chemical gradients. Such particle-based simulations are coupled with the advection-diffusion of contaminants using a Eulerian model, so as to attempt a full description of the dynamics of primary pollutants in the sea. Our model permits thus to integrate the spatiotemporal evolution of pollutants in the water with the chemical exchanges occurring through microplastic particles. While providing further understanding in the distribution of microplastics at a Mediterranean-wide scale, our modelling approach contributes to assess their role as a vector of other pollutants of concern in the marine environment.

Key words: microplastics, marine pollution, Lagrangian modelling, Eulerian modelling, Advection-diffusion

Acknowledgments: This study received funding from the H2020 project *ECOPOTENTIAL: Improving future ecosystem benefits through Earth observations* (grant agreement No. 641762, http://www.ecopotential-project.eu).

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MICROPLASTIC IN CORAL REEF ENVIRONMENTS: THE CASE OF MALDIVES

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Abstract: the impacts of microplastics (MP) on reef environments are still larger unknown. Evidences from lab feeding trials that MP may be ingested by reef-building corals and cause adverse effects, *i.e.* necrosis and bleaching were recently collected, but "on field" studies are still limited. For this reason, we established in our research center located in the Faafu Atoll (Maldives) a research campaign devoted to highlight any possible correlation between the emerging presence of microplastic and the health of the coral reef organisms. The vulnerability of ecosystem prompt us to develop alternative analytical approaches to lower the possible impacts of the research, *i.e* we extensively implemented the use of solid phase microextraction as solvent free sample preparation method. Surveys on the subsurface water, sediments and key species showed that microplastic are concentrated mostly inside the atoll rims and that there is a positive correlation between the presence of MP and micropollutants in the selected organisms.

Key words: microplastics, analysis, atolls

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ASSESSMENT OF MARINE LITTER DISTRIBUTION FROM SEA-BASED ACTIVITIES: A RISK STUDY ON THE IMPACT OF THE FISHING SECTOR IN THE BAY OF BISCAY.

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Abstract: The importance of marine litter contribution from sea-based activities has become an area of concern, since intentional and unintentional littering at sea causes substantial and wide impacts for both open ocean and coastal regions. The major sea-based sources include fishing, shipping, recreational navigation and aquaculture activities. Between 3 % to 15 % of the marine litter items collected at the European beaches come from the fishing sector. Recent studies of floating marine litter (FML) in the coastal area of SE Bay of Biscay quantified fishing and shipping litter contribution around 35% and 55% in terms of number of items and weight respectively. Thus, evaluate the offshore distribution and the probability of FML arrival to the coastal area of the Bay of Biscay is crucial for an efficient management of litter generated by the fishing sector. The available data on geographical distribution and intensity of fishing activity (fishing grounds and navigation channels) provide valuable information to assess the consequences of FML for the marine environment. Using this information and a statistical methodology based on the combination of long-term historical met-ocean databases, Monte Carlo simulations and Lagrangian trajectory modelling we perform a risk assessment of the impacts of FML from fishing activities in the Bay of Biscay. A database of marine litter trajectories under different surface currents and wind conditions was simulated and analysed to obtain the transport, dispersion and the areas of accumulation.The risk assessment was based on the evaluation of the probability of FML reaching key areas (e.g areas of high ecological value). Results provided in this study seeks to enhance knowledge on the impact of FML generated by the fishing sector in the Bay of Biscay with the aim of determine target priority areas to implement prevention and mitigation policies.

Key words: marine litter, Bay of Biscay, fisheries, Monte Carlo simulation, risk assessment

Acknowledgments: This research has been partially funded through the EU's LIFE Program (LIFE LEMA project, grant agreement no. LIFE15 ENV/ES/000252).

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ENVIRONMENTAL PROBLEMS ASSOCIATED TO POLYCHLORINATED BIPHENYLS ADSORBED IN MICROPLASTICS EMULATING A SEAWATER POLLUTED SYSTEM

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Abstract: Micro (MPLs) and nanoplastics (NPLs) are recognised by the scientific community as an emerging risk for the environment and human health. Due to their properties, they can also enhance the transport of many organic chemical contaminants by adsorption/desorption processes producing a potential impact on living organisms for the possibility to transfer them other co-contaminants present in the same compartment. The polychlorinated biphenyls (PCBs), are a specific group of persistent organic pollutants (POPs), that are characterised for their resistance to degradations, toxicity, bioaccumulation and long-term environmental transport [1].

In this context, the goals of this study were to study the adsorption/desorption behaviour between Polystyrene (PS), Polyethylene (PE) and Polyethylene terephthalate (PET) MPLs and 7 indicator PCBs in a sediment/water system. The sorption isotherms of these interactions were studied in microcosms emulating relevant environmental conditions along 21 days as an apparent equilibrium. The presence of PCBs in sediments, after MPLs removal, were carried out at by gas chromatography coupled to magnetic sector. The sorption percentages were ranging between 20 and 70% for PS and PET, where π-π interactions can be done while these percentages ranged from 10 to 60% for PE where van der Waals forces are the main bond in this polymer type. On the other hand, the more number of chlorines represent the main conformational impediment for the good interaction between PCBs and MPLs. In this sense, the less chlorinated PCBs have more tendency to be adsorbed than the others. Finally, the experimental isotherms were good adjusted to Freundlich model with regression coefficients higher than 0.9 for the sum of all PCBs and higher than 0.8 for individual PCBs. The characteristic parameters of this model indicate that those MPLs can easily sorb PCBs at low concentrations (below 25 ng/g) and, therefore, act as extra carriers for PCBs in the environment.

Key words: Marine litter, microplastics, POPs, PCBs.

Acknowledgments: This work was supported by the Spanish Ministry of Science and Innovation through the project PLAS-MED (CTM-2017-9701C3). A. Vega thanks his grant PRE-2018-083989.

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MARINE LITTER WINDROWS

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Abstract: Often used to refer the floating rafts of seafoam and natural debris on the ocean surface, windrows have now reached another dimension shaped by the current period we live on, increasingly known as the Plastic Age. The now common Marine Litter Windrows (MLW), aggregate all kinds of floating litter in the form of patches tens to hundreds of meters and sometimes a few kilometres long, reaching concentrations several orders of magnitude higher than in the surrounding waters. In the same way as some pelagic seaweeds (Ody et al., 2019), these aggregations can travel long distances under the action of winds, waves and currents (Butler, 1983; Winge, 1923). This means that sensitive ecosystems far away from pollution sources are not immune to the impact of marine litter. The fact that plastic litter provides extensive attachment substratum for diverse organisms, including micro- or macro-biota (Kiessling et al., 2015, Aliani et al., 2003), increases the risk of transfer of non-indigenous species by rafting on plastics (Barnes, 2002; Rech et al., 2018), with potentially far-reaching impacts (GESAMP, 2019). Previous studies (Ody et al., 2019), have proved the ability of satellite observations to successfully detect pelagic *Sargassum* abundance consistently with *in situ* observations being able to map distribution at a large scale and describe sub-mesoscale structures. These high resolution techniques together with an ecological community approach could provide a better understanding of MLW, therefore, an opportunity for detection and monitoring towards mitigation measures of litter pollution.

Key words: Marine Litter, raft, satellite, monitoring

Acknowledgments: This research is a contribution to PLASTREND (BBVA Foundation) and MIDaS (Spanish Ministry of Science, Innovation and Universities, CTM2016-77106-R, AEI/FEDER/UE) projects.

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HOW MUCH IS PLASTISPHERE DRIVEN BY THE SIZE, COMPOSITION AND INCUBATION TIME IN SEAWATER?

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Abstract: The "plastisphere" referred to the organisms living on the surface of plastic, which has significant impact on the plastic degradation, plastic dispersion, and potential pathogenesis induction. We previously reported a niche partitioning among bacteria living on plastics, organic particles and surrounding seawaters (Dussud et al., 2018). The composition of the plastisphere was shown to be influenced by geographic distance, season and plastic composition. Here, we hypothesized that the large spectrum of plastic size encountered in the environment may also influence the plastisphere. We follow 2 plastic types (PE and PLA, compared to glass controls) of 3 different sizes (particles of 100µm diameter and films of 3 mm^2 and 18 mm^2) during 66 days in aquaria with direct circulation to the sea. We also tested the influence of the rugosity for the small size by comparing spherical and irregular particles. The plastisphere was characterized in term of abundance (confocal microscopy), diversity (16s rRNA Illumina sequencing) and heterotrophic activity (^{3}H leucine incorporation). The results have shown that plastic composition and size did not affect the bacterial abundance during the 3 phases of primo-colonization (day 3), growth (day 10) and maturation phase of the biofilms (day 30), and the mature biofilm remained stable even after a diatom bloom (day 66). We found that bacterial community structure and activity were mainly driven by the successive colonization phases, by the plastic composition (PE and PLA), and in a lower extent by the plastic size. This study brings new knowledge on the impact of the plastic pollution in the marine ecosystems.

Key words: plastisphere, biofilm, biofouling, marine microbial ecotoxicology

Acknowledgments: The research was funded by project ANR-OXOMAR "Abiotic and biotic degradation and toxicity of oxo-biodegradable plastics in marine waters"

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A GLOBAL CHARACTERIZATION OF TEXTILE FIBERS IN OCEANIC SURFACE WATERS

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Abstract: Textile fibres are ubiquitous contaminants of emerging concern. Traditionally ascribed to the 'microplastics' family, their widespread occurrence in the natural environment is commonly reported in plastic pollution studies, with the misleading belief that they largely derive from wear and tear of synthetic fabrics. Their synthetic nature has been largely used to motivate their persistence in the environment, thus explaining their presence in virtually all compartments of the planet, including sea-ice, deep-seas, soils, atmospheric fall-out, foods and drinks. As of today however, an extensive characterization of their polymeric composition has never been performed, even though the evidence that most of these fibres are not synthetic, is slowly emerging. By compiling a dataset of more than 916 seawater samples collected in six different ocean basins, we confirm that although with some regional differences, textile fibres are ubiquitous in the world seas, but mainly composed of natural polymers. The chemical characterization of almost 2000 fibres through µFTIR techniques revealed that only 8.2% of these fibres are actually synthetic, with the rest being predominantly of animal (12.3%) or vegetal origin (79.5%). These results demonstrate the widespread occurrence of cellulosic fibres in the marine environment, emphasizing the need for full chemical identification of these particles, before classifying them as microplastics. On the basis of our findings it appears critical to assess origins, impacts and degradation times of cellulosic fibers in the marine environment, as well as to assess the wider implications of a global overestimation of microplastic loads in natural ecosystems.

MONITORING THE ABUNDANCE AND PROPERTIES OF FLOATING PLASTICS IN COASTAL WATERS

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Abstract:

Microplastics (< 5 mm in length) are considered a major environmental threat to marine and terrestrial ecosystems worldwide. Tracking the sources and fate of microplastics floating at sea has become challenging as they encompass a suite of various sizes, morphologies, colors, polymers and additives. Whereas numerical modelling is useful to assess microplastic dynamics on a broad scale, they often undermine local dynamics and sources. The current study aims to explore the main anthropogenic drivers of floating microplastics in the Western Mediterranean Sea by analysing a large spatio-temporal dataset at 6 stations located adjacent (4 km from shore) to the main river catchments and urban areas along the North-Catalan coast. A Manta Trawl (200 and 315 µm-mesh) towed by an inspection vessel was used for sample collection, which allowed an extensive characterization of >18.000 floating microplastics over a 5-year (2014-2017 and 2019) intra-annual time period. We assessed the differences regarding microplastic size, type, morphology, composition and color, and covered seasonal fluctuations in oceanographic settings, river dynamics and socio-economic factors, such as population density. Our preliminary results show a significant inter-annual variation linked to the size distribution of microplastics and likely as a function of riverine flux and proximity of industrial and recreational areas. Whereas weathered microplastic fragments and sheets dominate in all samples, polyethylene and polypropylene beads account for a large fraction of the smaller microplastics (200-315 µm in length). The highest microplastic abundances (> 1.300.000 items km^{-2}) were found near Barcelona city adjacent to the Besòs River, which also presented higher proportions of microbeads, and other type of land-sourced plastics (e.g. artificial turf filaments). Our study aims at contributing to help us better understand the sources and spatio-temporal variability of microplastics in order to develop relevant policies for mitigation, and stresses the need to increase microplastic data availability under 200-µm.

Key words: Microplastics, monitoring, coastal, Mediterranean Sea

Acknowledgments: F. López and R. Bou for their excellent and continuous support during the Cap de Creus cruises.

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BIODEGRADABLE PLASTICS CAN ALTER CARBON AND NITROGEN CYCLING TO A GREATER EXTENT THAN CONVENTIONAL PLASTICS

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Abstract: Plastic debris accumulates in oceans, mainly on the seabed, where it can remain for centuries. Biodegradable plastics are emerging as a possibility to limit their persistence in the environment. The seabed is responsible for key ecosystem functions related to the cycling of elements by decomposing the labile fraction of organic matter and fueling primary production, while storing the most recalcitrant part of this organic matter and limiting CO_2 emissions. Although plastics are expected to affect these processes, knowledge on this matter is scarce. Here we show that biodegradable plastics can stimulate the decomposition of marine-buried carbon and reduce the release of inorganic nitrogen. In controlled microcosms, we found that conventional and biodegradable plastics promoted anaerobic sediment metabolic pathways. Biodegradable plastics notably enhanced the CO_2 release to the water column, which suggests the decomposition of not only plastics, but also of buried organic carbon. The stimulation of sediment metabolism could be due to excessive carbon consumption by bacteria derived from a rise in the carbon:nitrogen ratio. Accordingly, the inorganic nitrogen flux to the water column lowered. Our results suggest that biodegradable plastics can hamper the carbon sequestration of coastal ecosystems by compromising their mitigation capacity against climate change.

Key words: Bioplastics, biogeochemistry, blue carbon, climate change, plastic pollution.

Acknowledgments: This work has been funded by the Spanish Foundation for Science and Technology (FECYT2-19I; PR238). C. S. has been funded by the University of Alicante (Ref. UATALENTO 17-11). Authors are grateful to the students that helped in the running of the experiments: Laura Tovar, Ana Belén Jodar, Amanda Cohen and Adrián Yagüe.

MONITORING FLOATING RIVERINE POLLUTION BY ADVANCE TECHNOLOGY

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Abstract: Rivers act as pathways to the ocean of significant but unquantified amounts of plastic pollution. Measuring with precision the quantities of riverine plastic inputs is crucial to support and ensure the effectiveness of prevention and mitigation waste management actions. However, there is a lack of technological tools capable of monitoring and, consequently, assessing accurately plastic abundances and its temporal variability through river water surfaces. Within the LIFE LEMA project, two videometry systems were installed at the river mouths of two European rivers (Oria in Spain and Adour in France) and a detection algorithm was developed to monitor litter inputs in near real time. The objective of these developments was to detect riverine pollution at water surface, with the goal of quantifying the number and providing data on the travel speed and size of the floating items. Between 2018 and 2020, the system was tested under different environmental conditions. These tests have led to develop a second version of the algorithm that improves the results reducing false positives. After these improvements, a new validation has been carried out consisting in detailed analysis of more than 300 short videos of 5 minutes duration recorded in Orio's station under different river flows, weather conditions and plastic loads. The validation results highlighted the operational reliability of the system. In a scale of 1 to 5 scoring (being 1 very bad and 5 very good) over 70% of the recordings scored 4 to 5. This also demonstrated the great potential of the videometry system in harmonizing visual observations of floating riverine litter. The data provided by the systems is currently being used in the LEMA TOOL, a tool designed to guide local authorities on managing, monitoring and forecasting marine litter presence and abundances in coastal waters of the SE Bay of Biscay.

Key words: Detection and monitoring, videometry, real-time, riverine litter, plastic pollution.

Acknowledgments: This research has been partially funded through the EU's LIFE Program (LIFE LEMA project, grant agreement no. LIFE15 ENV/ES/000252).

Characterization and removal of abandoned, lost or otherwise discarded fishing gear (ALDFG) on the Catalan coast (NW Mediterranean): first assessment and approximation of its impacts on marine communities

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Abstract:
Thousands of tons of land-based waste are thrown annually to seas and oceans. Part of these are abandoned, lost or otherwise discarded fishing gear (ALDFG), which produce important impacts on marine ecosystems all over the world. Among them, the *ghost fishing* effect (i. e. non-profit fishing) is the most considered, while the erosive effects of ALDFG on benthic communities are still largely unknown (Gilman, 2015; Macfadyen et al., 2011).
In the Catalan coast, the project *Evitem la pesca fantasma* started in 2015 with the aims of solving this lack of information and remove these objects from the seafloor.
For this, ALDFG were detected and localized with the aid of volunteers, and removed by scuba diving. Moreover, a sampling protocol was applied to describe their distribution along the coast and their effects on the species and habitats.
During this program 164 ALDFG and 1m^3 of fishing lines were removed. There was a predominance of recreational fishing lines and weights, as well as trammel nets and traps. All those fishing gears have a tendency to get stuck in rocky bottoms, especially in coralligenous, while 40% of them were removed from this habitat. 118 species were identified on nets and traps. Ghost fishing effect was detected, affecting 28 species. Moreover, 36 benthic species broken were registered, showing an important erosive effect of ALDFG.

These results show an important but an undescribed effect of ALDGF on benthic habitats, including the coralligenous, with a high biodiversity with patrimonial and habitat forming species (i.e. cnidarians as *Corallium rubrum* or *Paramuricea clavata*, calcareous algae as *Mesophyllum alternans*, sponges or bryozoans) which are highly sensible to physical perturbations.

This project showed also that the collaboration of government entities, scientific community, and fisheries sector, as well as society participation is indispensable to keep the Catalan coast free of ALDFG.

Key words: marine debris, discarded fishing gear (ALDFG), ghost fishing, benthic impacts, ALDFG removal.

Acknowledgments: this work was supported by Generalitat de Catalunya (DARP) and the University of Barcelona.

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SECOND CHANCES FOR FISHING AND AQUACULTURE GEARS

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Abstract:
Fishing and aquaculture play an important role in shaping the composition of marine litter in the SE Bay of Biscay, contributing with almost the 50% in weight to the abundance in superficial waters (Ruiz et al., 2020). Basque fishing and ancillary sectors have joined forces to find solutions. They are participating in 3 nationally and internationally funded projects (BLUENET, SARETU, SAREBIO) that promote the recovery of these materials to give them a second life. Three areas of work are presented. The first consisted of engaging the Basque fishing sector in the Fishing for Litter initiative. Twenty-three shipowners from 3 local fishing ports volunteered; the collected litter was characterised monthly. The second area focused on gathering information regarding the amount and type of discarded fishing and aquaculture gears. To do so, an aquaculture survey was launched at internationally and in parallel, the Spanish tropical tuna purse seiners were contacted, as a sector producing large quantity of discarded nets. The third consisted in the assessment of the recyclability of the materials by demonstrating the possibilities of recycling nylon and polyolefin fishing nets and aquaculture long-line ropes for textile and marine applications. The preliminary results indicate that the no-implication and no-willingness of the waste managers to deal with marine litter hindrance the success of the activity; in contrast, the recyclability of discarded nets and ropes is feasible, as shown by the new ropes manufactured for long-line mussel productions or textile products. Therefore, it is of utmost importance to engage both the waste and fishing authorities as well as recyclers, fishing and aquaculture sectors, waste managers and scientist to develop a common roadmap for the discarded gears and marine litter that could serve to establish a routine-logistics for this waste and start advancing towards the circular economy in the fishing and aquaculture sectors.

Key words: discarded gears, marine litter, recycling, fishing for litter, circular economy

Acknowledgments: This research has been partially funded by the European Maritime and Fisheries Fund through the projects BLUENET (EASME/EMFF/2017/1.2.1.12/S2/01/SI2.788894) and SAREBIO (EMFF–Basque Government), and private funds of Bermeo Tuna World Capital (SARETU project).

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EVALUATION OF YELLOWNESS INDEX OF MICROPLASTIC PELLETS WITH A SIMPLE COLOUR SCALE

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Abstract:

In recent years the number of papers related to the study of marine microplastics has increased significantly. Many of these scientific articles improve methodologies for sampling, collection and identification of plastic type (Andrady, 2011; Shim et al., 2017). The identification of the plastic composition is done mainly by infrared spectroscopy (FTIR) and by analytical pyrolysis with gas chromatography and mass spectrometry (Py-GC-MS).

These microplastics can be present in marine environment for long periods of time, being transported thousands of kilometers before reaching the coasts. The aging and degradation of the plastic produce a yellowing of it (Andrady, 2011). The most used index that defines the degradation state of these marine microplastic is the Yellowness index (YI) (%), however, standardized methods for YI determination and quantification are complex and require specialized equipment, not always available. For this reason, many authors use YI only from a qualitative or comparative point of view, without numerical values, losing information about the microplastic sample collected.

In this study we analysed marine pellets collected at Canary Islands coast (Spain). These samples were analyzed by FTIR to determine their composition. Samples of High Density Polyethylene (HDPE) composition was selected for having homogeneity on sample composition. These pellets were analyzed with a colorimeter, determining the YI for each sample following international standardized method E0313-15E01. With the samples studied, it was done a colour scale and their relation with YI value, which allows the determination of YI comparing with the sample colour instantly and easily. The comparison between the sample and this colour scale lets obtain a numerical value of Yellowness Index (YI) at any condition for pellets without colour additives, without the need to use any analytical equipment.

Key words: Marine microplastics, degradation, yellowness index, YI, colour scale.

Acknowledgments:
We would like to thank the Oceanic Platform of the Canary Islands (Plataforma Oceánica de Canarias, PLOCAN) for their magnificent support and sharing their research facilities with us.

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INVOLVEMENT OF A MATERIALS ENGINEER IN CITIZEN AWARENESS (MICROPLASTICS WATCHERS PROJECT)

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Abstract:

Microplastic watchers is a project of the Sea Observers platform that aims to promote research, learning and citizen awareness. To achieve this goal, the project involves citizens in diagnosis the presence and types of microplastics of the beaches of the Catalan coast as well as promotes reflection and awareness about their use of plastics and changes in consumption habits to be encouraged

The project is aimed at primary and secondary school pupils and has as its main objectives to bring children closer to real scientific research, to raise awareness of the problem of solid waste and microplastics on the coast, to implement scientific work strategies and promote teamwork.

The work presented here corresponds to the sampling of two beaches with different influxes of public, geographical situation and external cleaning, in order to determine the effect of these parameters in the presence and quantity of plastic waste.

The participation of a student of Materials Engineering degree from the University of Barcelona in this project arises from the need to identify rigorously through material characterization techniques, such as FTIR-ATR, the plastics that the students have collected and qualitatively identified using the protocol established in the project. The review of the sampling and classification protocol is also envisaged by introducing improvements in the stages of separation of plastics through tests that can be easily reproduced in schools.

The obtained results will be checked to have a reliable data in order to be the starting point for future actions and prepare a workshop for the pupils. For the preparation of this workshop, the Materials Engineering student must adapt the knowledge acquired during the Materials Engineering degree to the level of knowledge of the students without losing the scientific rigor.

Key words: Microplastics, citizen awareness, Materials Engineering, FTIR-ATR

Acknowledgments: Plasticopyr project. Interreg Poctefa

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http://www.ceab.csic.es/nou-projecte-microplastic-watchers (28/2/2020)
https://www.mmb.cat/en/projects/beach-observers (28/2/2020)

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HARMONIZATION OF PROCEDURES AND ADVANCED CHARACTERISATION OF MICROPLASTICS

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EXTRACTION OF MICROPLASTIC FROM DEEP SEA SEDIMENTS BY PRESSURIZED SOLVENT EXTRACTION

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Abstract:

The sea floor is considered the final sink for microplastics entering the marine environment and there is an urgent need to develop new analytical methods that help getting a more comprehensive picture of their contamination. Despite the effort of regulatory bodies to provide guidelines and protocols, the definition of an established and uniform method for measuring and reporting microplastics in the marine sediments is still lacking. Starting from this basis, we evaluated the performances of pressurized solvent extraction (PSE) as approach to provide reliable microplastic determination in deep sea sediments. Extracts were analyzed by infrared spectroscopy and the results were compared to the result provided by a reference density separation method. Overall PSE provided good recoveries even with smaller plastic fragments (size less than 30µm), and saving of time (the application of the automated procedure enable to run several parallel extractions in less than one hour). Drawbacks were the obliteration of particles morphology and the matrix effect induced by the biogenic matter

Key words: microplastics, sediments, extraction

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MICROPLASTICS AS A POTENTIAL RESERVOIR OF FAECAL BACTERIA

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Abstract: Microplastics are plastics smaller than 5 mm and are ubiquitous in marine water, wastewater, freshwater, soil, sediments, and biota, including food and drinking water (Browne et al., 2011; WHO, 2019; Woodall et al., 2014). Nowadays, microplastics are a big concern for oceanic ecosystems. Their threats for life are still being debated and mainly unknown but risks include: i) the particles themselves as a physical hazard, ii) toxicity from chemical pollutants adsorbed at the particle and iii) microorganisms that may attach and colonize the surfaces (WHO, 2019). Thus, microplastics could act as a reservoir of human and animal pathogens.

The aim of our study is to determine if floating microplastics in the nearshore serve as a reservoir of pathogens. We collected floating microplastics off the city of Badalona, (north of Barcelona, Western Mediterranean), where there are several stormwater overflows discharging sporadically non treated wastewater into the sea. We performed 10 samplings over a transect using a manta-trawl mounted on a kayak collecting microplastics and water.

We analysed culturable faecal indicators (*E. coli* and Enterococci), *Vibrio* spp. (TCBS media) and general marine bacteria (marine agar) attached to microplastics, suspended organic matter and water. Bacteria were detached from plastics using sonication and relative abundances were related to weight and microplastics characteristics (size, shape, and polymer type).

The highest values of bacteria in microplastics and water have been found after strong rainfall, when increases the volume of untreated wastewater reaching the marine environment. Our results show that faecal bacteria can become attached to microplastics at similar rate they do in the organic matter. *Vibrio* spp. and general marine bacteria were detected in high concentration in microplastics and organic matter. So marine and faecal bacteria have the ability to colonize microplastics. Whereas organic matter will be degraded in a short period of time, microplastics will remain for a long period spreading them in the environment.

Key words: microplastics, faecal indicator bacteria, Vibrio, bacterial colonisation.

Acknowledgements: We thank Club Natació Badalona to lend us the kayak to acquire samples, and the volunteers who accompanied us in the sampling.

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DEVELOPMENT OF A RELIABLE PROTOCOL TO DETERMINE MICROPLASTIC PARTICLES IN SALMON FISH STOMACHS

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Abstract: Scientific evidences on the ingestion of microplastics (MPs) by the different levels of the trophic chain abound [1]. Likely, they accumulate there and lead to harmful effects [2]. Following, the development of reliable analytical protocols to determine MPs in fish (mostly, in their stomachs and/or guts) is needed. Biological matrices have been digested with acids, bases, oxidizing agents and/or enzymes. However, many treatments (especially those using acids and bases) damage MPs and, so, underestimations are common [3].

This study reports a reliable enzymatic protocol to digest salmon fish stomachs. It has been validated by two means: Digesting true salmon samples spiked with MPs (1-2 mm) intended for an interlaboratory exercise (organized by the JPI-Oceans' funded BASEMAN project); and testing that the protocol is not harmful for plastics, using PA, PE, PP, PET, PS and PVC of 100-400 of µm size. The method involves an SDS pre-treatment, followed by a protease and lipase digestion and a final oxidation with H_2O_2. The analytical characterization combines stereomicroscopy and FTIR microscopy (in reflectance mode). To save time when searching for MPs with the FTIR microscope, *ad-hoc* aluminium plates with small cavities were designed. High recoveries were obtained, and the method ranked highest in the interlaboratory exercise.

Keywords: microplastics, salmo fish, enzymes, FTIR microscopy

Acknowledgments: The Spanish Government (Ministerio de Economía y Competitividad) and the JPI-Oceans European Program are acknowledged by the BASEMAN Project (PCIN-2015-170-C02-01, with FEDER funds). Spanish Government by the CTM2016-77945-C3-3-R (ARPA-ACUA) Grant. The Galician Government for its support to the QANAP group (Programa de Consolidación y Estructuración de Unidades de Investigación Competitiva. Ref. ED431C 2017/28) partially financed by FEDER funds.

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EFFECTS OF POLYETHYLENE MICROPLASTICS AND FLUORANTHENE IN *POSIDONIA OCEANICA* AND ITS ASSOCIATED N2 FIXATION RATES

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Abstract: *Posidonia oceanica* is an endemic seagrass in the Mediterranean Sea with important ecological roles. The N_2-fixing microorganisms associated with the plant can supply significant amount of new nitrogen in the Mediterranean basin. However, the Mediterranean is an intense site with 25% of the international tourism and 30 % of the marine traffic occurring. Due to its semi-closed geography, it has been considered one of the most polluted seas. Thus, in the last years marine pollution has been increasingly studied focusing on plastics and microplastics. Studies on how *P. oceanica* ecosystems respond to microplastic pollution needs to be studied given their importance in the Mediterranean coastal ecosystems. Here, we report a pioneering experiment to pretend evaluate the effects of microplastics in *P. oceanica*, specifically using polyethylene (PE) as it is one of the most abundant microplastic polymers, and its most common sorbed additives, fluoranthene. *P. oceanica* plants were exposed to PE and fluoranthene concentrations found in the water column (0.01 µg ml^{-1} and 0.03 µg l^{-1}), and in the sediment (100µg ml^{-1} and 300 µg l^{-1}) and their interaction at the higher concentrations. N_2 fixation rates using acetylene reduction assay (ARA) by gas chromatography (GC), the Alkaline Phosphatase Activity (APA) and Primary Production rates (NPP) were determined. The preliminary results of this study show positive significant effects ($p<0.05$) in APA rates with addition of fluoranthene. However, there are no significant effects ($p>0.05$) with additions of PE on nitrogen fixation rates associated with different plant parts of *P. oceanica* nor with the primary production of the plants.

Key words: Microplastics, Polyethylene, Fluoranthene, Marine pollution, *Posidonia oceanica*

Acknowledgments: This work was supported by funding to NSRA through the Agencia Estatal de Investigación and the European Regional Development Funds project CTM2016-75457-P and the Conselleria d' innovació, recerca i turisme CAIB) acción especial AAEE027/2017. We acknowledge the support and help of Scientific Technical Service Maria Trinidad Garcia Barceló of the University of the Balearic Islands for gas-

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LONG-TERM EXPOSURE TO MICROPLASTICS INDUCES OXIDATIVE STRESS IN GUT OF *Sparus aurata*

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Abstract:

The presence of plastic in oceans is extremely worrying because they possess potential threats for marine organisms including plastic entanglement and ingestion, amongst others. Moreover microplastics (MPs) have become an emerging contaminant causing widespread concern due to its potential toxic effects associated to Persistent Organic Pollutants and other contaminants added during their manufacturing processes or sorbed to their surface once in the marine environment. However, while the number of studies documenting the ingestion of MPs by fish has increased, fewer studies have addressed the toxicological effects derived from the ingestion of MPS in long-term laboratory conditions. The aim of this study was to evaluate the physiological response of gilthead seabream (*Sparus aurata*) exposed to low-density polyethylene (LDPE) plastic during 90 days followed by an additional 30 days of depuration through the application of oxidative stress biomarkers in the gut. Two different treatments were applied by means of diet and three replicate tanks were randomly assigned to each treatment. Fish were exposed to a control diet without MPs and a treatment diet enriched with 10% LDPE MPs. To analyse MPs ingestion effect on the oxidative stress, inflammatory response and antioxidant and detoxification system, catalase, superoxide dismutase, glutathione S-transferase, myeloperoxidase activities, and malondialdehyde and protein carbonyl levels were determined in 81 gut samples. The results showed that compared with controls, the activities of all enzymatic biomarkers significantly increased after 90 days of exposure to enriched diet with LDPE. After the detoxification period, all biomarkers levels recovered to the initial activities, as in the time 0. As a conclusion, MPs exposure during 90 days on gilthead seabream affected the physiological response through antioxidant and detoxification enzymes activation and oxidative damage in gut, yielding novel insights into the consequences of MPs exposure of this cultivated and commercial species.

Key words: Microplastics, Gilthead seabream, Biomarkers, Oxidative stress, Gut

Acknowledgments

Acknowledgments to the research project Plásticos derivados de la acuicultura: impactos y efectos en las redes tróficas marinas" (ACUIPLASTIC), with reference number CTM2017-88332-R and funded by the Programa Estatal de Investigación, Desarrollo e Innovación Orientada a los Retos de la Sociedad, en el marco del Plan Estatal de Investigación Científica y Técnica y de Innovación 2013-2016, from the Spanish Government. A. Sureda was supported by the Programme of Promotion of Biomedical Research and Health Sciences CIBEROBN CB12/03/30038.

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MICROPLASTIC QUANTIFICATION IN *NEPHROPS NORVEGICUS* AND RELATIONSHIP WITH BODY CONDITION AND BIOMARKER RESPONSE IN THE NW MEDITERRANEAN SEA

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Abstract:

Microplastic (MP) ingestion has been previously highlighted in some crustacean species (Carreras-Colom et al., 2018; Devriese et al., 2015; Murray and Cowie, 2011). Their close relationship with the sediment (burrowing behaviour, varied bentophagous diet) is thought to lead to an increased ingestion of MPs which may be retained due to the complexity of the digestive system (gastric mill). Particular occurrence of plastics in *Nephrops norvegicus* has been reported in the North and Irish Sea (Hara et al., 2020; Murray & Cowie, 2011; Welden & Cowie, 2016a) and has also been studied under controlled conditions (Welden and Cowie, 2016b) with a significant negative impact on body condition after prolonged exposure to MPs.

The present study evaluates the occurrence of MPs in wild-caught individuals of *N. norvegicus* from the NW Mediterranean Sea and its potential negative impact on individual's health. Three localities along the Catalan Coast were sampled in summer 2019. Biological parameters (size, total weight and weight of hepatopancreas and gonad, body condition indices) and enzymatic activities in tail muscle and hepatopancreas (acetylcholinesterase and lactate dehydrogenase, among others) were recorded. MPs were identified through visual inspection of digestive contents, with strict measures to prevent airborne contamination, and characterised with optical microscopy.

Overall, 85% of the individuals analysed contained fibre-shaped MPs which were sometimes tangled up in balls (20%). Differences in fibre load per individual between localities were

not found (mean values of 22.3mm/individual), yet occurrence of balls was lower in the southernmost sampling locality. No clear negative correlations were found between MPs and body condition indices nor enzymatic activities. Only a possible inhibition of catalase and an enhancement of glutathione-S-transferase were observed. Our results suggest that these individuals might be able to cope with the MP loads observed, which are lower to those reported in other areas for the same species (Murray and Cowie, 2011, Welden and Cowie, 2016a).

Key words: microplastic ingestion, *Nephrops norvegicus*, Mediterranean Sea, enzymatic activities

Acknowledgments: This study was supported by the Spanish Ministry of Science, Innovation and Universities project "PLASMAR" (RTI2018-094806-B-100) and by the Catalan Department of Agriculture, Livestock, Fisheries and Food (European Maritime and Fisheries Fund (EMFF)) project "SOMPESCA" (ARP059/19/00003). We thank all fishermen from commercial fishing vessels involved in the "SOMPESCA" project. Carreras-Colom benefits from an FPU Ph.D. student grant from the Spanish Ministry of Science, Innovation and Universities (FPU16/03430).

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MICROPLASTIC & HEAVY METALS COMBINED EFFECTS ON MARINE FAUNA

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Abstract:

The blue crab (*Callinectes sapidus*) is an invasive species in the Mediterranean. The sedentary and voracious behaviour of this species, as well as its presence on coasts and rivers, make it of interest in biomonitoring studies of environmental pollution. In the present study, we have used the blue crab to analyse the effect of microplastics in the tissue accumulation of lead. For this, we have exposed the crabs to virgin polyethylene particles, while they were fed with wild mussels (*Mytilus galloprovincialis*) from two areas of the Mediterranean coast with different presence of lead: San Pedro del Pinatar and Portmán. The exposure time was 7 days and the tissues analysed were hepatopancreas, muscle and gills. The only tissue that revealed significant differences in lead accumulation was the hepatopancreas. We have concluded that the presence of microplastics in the medium did not significantly affect lead accumulation in any of the tissues analysed. In all cases, the concentration of lead in muscle was below 0.5 mg / kg (fresh weight).

Key words: Blue crab, mussel, lead, microplastics

MICROPLASTIC INGESTION IN JELLYFISH *PELAGIA NOCTILUCA (FORSSKAL, 1775)* IN THE NORTH ATLANTIC OCEAN: UNPUBLISHED RESULTS.

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Abstract: The presents work is the first study that evidences the ingestion of plastic and microplastics in jellyfish *Pelagia noctiluca* in the Atlantic Ocean. A bloom of this organism was collected from Gran Canaria island coast. Then, separating umbrella from tentacles, a process of KOH digestion was carried out to obtain and quantify the plastic particles. A 97% of the individuals analysed had microplastics. The majority were blue and mostly microfibres. The presence of items in the gastrovascular cavity was confirmed. These results warn about the implications for jellyfish health, the transfer to jellyfish predators, human consumed jellyfish and the transport of carbon and microplastic in the water column.

Key words: microplastic, ingestion, bloom, jellyfish, *Pelagia noctiluca*

Acknowledgments: This work was supported by the projects IMPLAMAC (MAC2/1.1a/265) Interreg MAC (European Fund to Regional Development, Macaronesian Cooperation) and INDICIT II (European Commission, MSFD- SECOND CYCLE: IMPLEMENTATION OF THE NEW GES DECISION AND PROGRAMMES OF MEASURES). Our sincere gratitude to Latitud Azul Environmental Conservation Association for his work.

MICROPLASTIC POLLUTION AND ITS EFFECTS ON THE MARINE FOOD WEB IN CANARY ISLANDS WATERS

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Abstract: Marine ecosystems are being invaded by wastes of anthropogenic origin, mostly plastics. In the recent decades a new threat from plastic, microplastics, has been detected. These microplastics, can be ingested by fish, zooplankton, and other organisms and transferred through the food chain. In addition to the physical hazards associated with ingestion, there are also biochemical hazards because microplastics adsorb persistent chemical contaminants (POPs) that bioaccumulate and biomagnify in the food chain. Our studies have revealed that a large amount of microplastics from the ocean accumulate on the Canary Island coast. The Canary Current flows through the Canary Islands in a south-southwest direction, transporting surface wastes that are deposited mainly on the beaches most exposed to the prevailing winds and surface currents. In the areas of maximum concentration, more than 300 grams/m^2 of microplastics have been detected from the tide line. In addition, these samples were contaminated by organic chemicals, among them polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides and derivatives of UV filters. Many of these compounds have carcinogenic effects and act as endocrine disruptors (compounds that alter the normal biological function by substituting for hormones).

These organic compounds have already been detected associated with microplastics in waters of the Canary Islands, but it is still unknown how they impact marine organisms and the food chain. Particularly, their impact on the local fishery and human consumption and health is not known, but potentially important. Therefore, we consider it a priority to study the effect that the ingestion of microplastics and their associated contaminants, has on marine life using the biomarker CEA (Cellular Energy Allocation).

Key words: Microplastic pollution, CEA index, Food Web, Canary Islands.

Acknowledgments: This work is partially supported by the IMPLAMAC project (MAC2/1.1a/265) awardet to M.G

ASSESSMENT OF OPFRS LEVELS AND THEIR RELATIONSHIP TO ANTHROPIZATION AND MICROPLASTIC INGESTION IN THE MEDITERRANEAN BOGUE (*BOOPS BOOPS*, LINNEUS 1758)

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Abstract:

The increase of plastic litter pollution in the seas and oceans worldwide is raising major concern for its potential effects on marine fauna. Aside from physical damages caused by ingestion and entanglement, marine organisms may also suffer from the toxic effects produced by the additives used to improve plastic features (*e.g.*, plasticizers, flame retardants, Lithner et al., 2011). In this study, muscle samples of 30 bogues (*Boops boops*; Linneaus, 1758) caught in the North Western Mediterranean Sea were analysed to assess the concentrations of 19 organophosphate flame retardant (OPFR) compounds and their potential relationship with microplastic ingestion and relative levels of anthropization. OPFR analyses detected 6 compounds, of which Tri-n-butyl phosphate (TNBP), 2-ethylhexyldiphenyl phosphate (EHDPP) and Triphenylphosphine oxide (TPPO) were the most abundant. As expected, higher OPFR concentrations were detected in the fish caught in the marine area off the highly anthropized coast of Barcelona. However, no significant correlation was detected between OPFR concentrations and microplastic ingestion. Our results provide a first evidence of OPFR presence in the muscle of Mediterranean bogues and identify the coastal area of Barcelona as a possible concentration area for plastic-related contaminants, which further supports the use of the bogue as a bioindicator of plastic pollution in the Mediterranean Sea.

Keywords: Plasticizers, marine litter, organochlorine flame retardants, fish, bioindicator

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MICRO-LITTER INGESTION IN EUROPEAN ANCHOVY AND ITS POTENCIAL IMPACT ON FISH HEALTH STATUS

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Abstract: Micro-litter (including plastic, non-plastic fibres and other particles) ingestion has been described in many fish species, but its potential impact on wild marine organisms remains totally unknown. Thus, the possibility that these materials can reach trophic chains maintains an open discussion on its possible implications in marine communities at the ecological level and for human health. European anchovy (*Engraulis encrasicolus*) is a fish species of great ecological and commercial importance which has been reported to ingest microplastics in the NW Mediterranean (Compa et al., 2018), and it has been suggested as a suitable monitoring species for this kind of debris in epipelagic environments (Bray et al., 2019).

In our current study, we aimed to determine the micro-litter ingestion in European anchovy and its potential effect on its health status. Classification of the different types of micro-litter was performed by visual characterisation (Rodríguez-Romeu et al., 2020). Health status was assessed by a multidisciplinary approach: analysis of fish condition indices, enzymatic biomarkers and histopathological alterations. Samples were collected from the NW Mediterranean Sea at two sampling stations located nearby a highly and a lower populated area (Barcelona and Girona, respectively).

Preliminary results showed 61% of fish containing micro-litter in their gastrointestinal tract,

49.4% corresponding to particles and 50.6% to fibres. Mean intensity was 2.40 (SD = 1.64) items/individual. No differences between areas in total prevalence nor intensity were found. However, micro-litter composition varied between sites, with higher abundance of particles (fragments and films) in Barcelona (61.90%), while in Girona fibres were the most abundant (71.9%). No correlation between the amount of micro-litter and fish condition indices nor biomarkers were found. Some common histological alterations in wild fish were also detected in the liver of European anchovy, including changes in the cytoplasm of hepatocytes, small inflammatory foci and presence of macrophages. However, none of these alterations seems to be attributable to micro-litter. Therefore, current results points to the good health status of European anchovy, and the micro-litter ingestion does not seem to have any impact on their health.

Key words: *Engraulis encrasicolus*, micro-litter, microplastic ingestion, health status, NW Mediterranean Sea.

Acknowledgments: This study was supported by the project "SOMPESCA" (ARP059/19/00003) by the Catalan Department of Agriculture, Livestock, Fisheries and Food (European Maritime and Fisheries Fund (EMFF)) and the Spanish Ministry of Science, Innovation and Universities project "PLASMAR" (RTI2018-094806-B-100). Authors would like to the fleet of commercial fishing vessels of Barcelona and Blanes and fisherman associations "Confraria de Pescadors de Barcelona" and "Confraria de Pescadors de Blanes" for their support.

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EXTRACTION AND CHARACTERIZATION OF MICROPLASTICS FROM GASTROINTESTINAL CONTENT OF THE SMALL-SPOTTED CATSHARK (*Scyliorhinus canicula*): A PARAMETERIZATION AND MONTHLY EVALUATION

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Abstract:

Since the worldwide production of plastics began in the 1940s, microplastics have become a problem of high-profile pollutants due to their widespread presence in aquatic environments. Marine fauna is severely affected by microplastic ingestion which is readilly incorporated into marine food chains due to their small size (1-2). Such harmful interactions depend on the biology of the affected species, as well as the distribution and abundance of the different microplastic types (3). Regardless, there is a lack of information and standardized methodologies for the extraction and characterization of microplastics from environmental matrices (4). Studies have been carried out with acid extraction protocols which have been found to have strong detrimental effects on various plastic families (4). In contrast, alkaline extraction better preserve plastic polymers and microplastic particles when processing organic tissue samples (4). In the present study a slight modification of the extraction and characterization protocol stablished by Dehaut for microplastic analysis in biological samples was applied (5). The method employs an alkaline solution and relatively high temperatures during 24 h for efficient digestion of biological tissues without significant degradation in the tested polymers. The adapted methodology was validated and applied to real gastrointestinal samples of the species of elasmobranch *Scyliorhinus canicula* (Linnaeus, 1758). This species of the family Scyliorhinidae is one of the most abundant bottom-dwelling cartilaginous fish, on sandy, coralline algal, gravel or mud bottoms in Mediterranean and Northeastern Atlantic waters (6). The results obtained have been satisfactory and allow us to characterize according to their physical structure (fragments or fibers). In fact, the application of the method on the gastrointestinal tracts, has allowed us gather new data regarding the presence and distribution of microplastics in the seabed of the Western Mediterranean (3). Its abundance among demersal fisheries bicatch, as well as its trophic position and sedentary/philopartric nature, makes it an excellent option for the monitorisation of microplastics (7-8).

Key words: microplastic extraction, *Scyliorhinus canicula*, alkaline digestion, Mediterranean sea.

Acknowledgments: This work was supported by funds of IMEDMAR-UCV (Spain). Special thanks to Calp´s fishing guild.

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EFFECTS OF BIOMICROPLASTICS IN SEAWATER SYSTEM

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Abstract:
During the last years different research initiatives at European level have been promoted such as the development of biodegradable plastics, named bioplastics, to be used as a substitute of fuel polymers. To disconnect plastic production from the oil industry and to find sustainable materials under the frame of the circular economy during the last years new bioplastics have been developed. In this regard, there is a need to monitor the fate and the effects of microbioplastics (bioMPLs) under relevant environmental conditions to assess their impact in water systems as well as their potential to be bioaccumulated in biota.
In this context, the main objectives of this work have been i) the characterization of degradation products after weathering effects on two types of bioMPLs in marine microcosm experiments, and ii) to assess their adsorption capacity for selected surrounding co-contaminants. With this aim, different samples from microcosms were taken after 1 and 2 weeks followed by 1, 2 and 3 months. These samples were directly analysed by liquid chromatography coupled to high resolution mass spectrometry QExactive working in full scan method in order to identify any possible degradation product coming from weathered bioMPLs. In parallel, different sorption studies were carried out with selected antibiotics (carbapenemes) and pesticides as surrounding co-contaminants (Proia 2018). bioMPLs were exposed to these contaminants and different samples were taken after 1 day, 1 week and 1 month.
The main results of weathering effects on selected bioMPLs, showed that the two biopolymers are partially degraded after the 2-months exposition in water systems. In the case of sorption experiments, all the compounds were sorbed on selected bioMPLs although these were partially degraded during exposure time. In addition, the results were approximately to Freundlich isotherm model as it has been observed for other organic co-contaminants in water systems (Llorca 2018). These results highlight the possible effect of bioMPLs as transfer vectors.

Key words: biomicroplastics, degradation, sorption isotherms, antibiotics, pesticides

Acknowledgments: This study is funded by the Ministry of Economy and Competitiveness through the project DEGBIOPLAST (RTI2018-097860-J-I00).

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NEUSTONIC MICROPLASTICS AND ZOOPLANKTON IN THE MACARONESIAN REGION

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Abstract:

High concentrations of microplastics have been detected in the ocean, mainly in the subtropical gyres that accumulate this type of waste. The long-term effects of this type of pollution on ecosystems and marine biota are still unknown. The present study aims to quantify and characterize neustonic microplastics and zooplankton in the waters of the Macaronesia, an area little studied to date. Our results show a great variability in the concentration of microplastics with maximum values of more than 1 million particles of microplastics per square kilometre in Las Canteras (Canary Islands) (Herrera et al. 2020). Abundances of zooplankton were also highly variable between the different sampling areas, the main components being copepods and eggs. In Las Canteras, the area of highest accumulation, for the fraction 1-5mm, twice as much plastic as zooplankton in dry weight was found. These values highlight the potential danger that contamination by microplastics -and their associated chemical contaminants- poses to marine biota, especially for large filters.

Key words: marine litter, plankton, plastics, marine pollution, persistent organic pollutants.

Acknowledgments: This work was funded by projects PLASMAR (MAC/1.1a/030),

LIXAZ (AÇORES-01-0145-FEDER-00053), and PLASTICGLOBAL funded by the Lisboa 2020 programme (LISBOA-01-0145-FEDER-016885).

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MICROPLASTICS IN THE BAY OF BISCAY: AN OVERVIEW

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Abstract: Microplastics (MPs) are an environmental problem of growing concern. Given that some studies identify the Bay of Biscay as a marine litter accumulation zone (Galgani *et al.*, 1995; Lebreton *et al.*, 2012), a critical overview is presented, compiling the research performed to date on the abundance of MPs in this marine region, with the aim of addressing the general situation in the different marine compartments, highlighting limitations and knowledge gaps.

Eighteen studies were located to date on waters, sediments and biota. The comparative assessment on each compartment reflects high spatial and temporal variability in the distribution of MPs, suggesting seasonal and short term influencing factors. MPs appear in all sampled compartments in a wide range of abundances, presenting in at least 50% of the samples in surface waters and sediments, with 100% occurrence in some studies. Polypropylene, polyethylene, polyester and polystyrene are found most frequently, in agreement with the main polymers reported in worldwide studies, as well as with the main polymers consumed worldwide (GESAMP, 2015). The predominance of fragments and fibres over other kind of shapes of MPs in all sampled compartments (surface water, sediments and biota) suggests that the MP source in the Bay of Biscay is more related to the decomposition of larger plastic waste rather than to direct primary inputs such as pellets or microspheres. Studies show the ubiquitous distribution of fibres in the deep marine environment in the BoB, while studies of beach sediments more frequently report MPs in the shape of fragments.

The Bay of Biscay could be considered as medium MPs concentration region. However, monitoring programs are needed to compile data over time to make evaluation of trends possible. The present work highlights difficulties encountered comparing studies due to their differing methodologies. Hence, an urgent consensus is needed to standardise procedures.

Key words: microplastics, marine, Bay of Biscay, abundance, characterization.

Acknowledgments: This work was supported by the Provincial Council of Gipuzkoa (ItsasMikro project) and the European Union (LIFE LEMA project, LIFE15/ENV/ES/000252).

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MONITORING OF FLOATING MARINE MACRO-LITTER: RESULTS FROM A COMBINED APPROACH USING UNMANNED AERIAL VEHICLES AND VESSEL-BASED VISUAL OBSERVATIONS IN THE NORTH WESTERN MEDITERRANEAN SEA

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Abstract:

The Marine Strategy Framework Directive and other legislative frameworks strongly recommend monitoring floating marine macro-litter (FMML) within the European seas (Galgani et al., 2013). Although the distribution and density of FMML have been traditionally assessed through observer-based methods, the development of new technologies, such as the use of Unmanned Aerial Vehicles (UAVs), opens new horizons for monitoring. However, previously to their implementation, these technologies need validation to guarantee that results are comparable and consistent with the datasets obtained with existing methods (Garcia-Garin et al., 2020). The aim of the present study was twofold: 1) to compare the results obtained through concurrent monitoring based on UAVs and vessel-based visual observations, and 2) to produce monitoring data on FMML by UAV surveys along the North Western Mediterranean Sea. Two types of UAVs were used: a Mavic Pro and a Phantom 3 Advanced, both equipped with 12 mega pixel cameras. A sailing catamaran served as platform for both visual observations and drone operations. The comparison between monitoring techniques was performed on 85 km transects, distributed in 18 segments. Over 1300 images were collected and checked by a photo-interpreter, obtaining similar densities of FMML in both methods (16 items km^{-2} UAV, vs 19 items km^{-2} vessel-based). The monitoring data for the North Western Mediterranean was reached by joining the above 1300 images with 4500 further images obtained along 40 additional UAV transects. The densities of FMML observed across the waters off the Catalan coast ranged 0-200 items km^{-2}, with somewhat higher values in the *Delta de l'Ebre* and the city of Barcelona and lower values off the *Cap de Creus* Marine Protected Area. These results provide a validation of the use of UAVs to monitor FMML and contribute to increasing the knowledge about abundance of FMML in the North Western Mediterranean Sea.

Key words: UAVs, FMML, Remote sensing, Aerial surveys, Marine pollution

Acknowledgments: This study was supported by the project MEDSEALITTER (1MED15_3.2_M12_334; European Union- European Regional Development Fund- Interreg MED). OGG's Ph.D. was funded through an FPU scholarship granted by the Spanish Government.

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