Our results will determine whether biodegradable and non-biodegradable mulches pose risks to agricultural soils and whether there are significant differences between them in terms of contaminant transport.

3.21.P-We263 Metallic Additives Leaching and Extractions from Biodegradable Plastics Used in Fishing Gears and Potential Materials: Are They Truly More Environmentally Friendly?
Waranya Wataniyakun[1]*, Mya Schouwenburg*[2] *and Lisbet Sorensen*[3]*, (1)Arctic University of Norway (UiT), Norway, (2)Northern Analytical Laboratory Service (NALS), University of Northern Britsh Columbia, Canada, (3)SINTEF Ocean, Norway*
Additives are chemical compounds added into polymer synthesis to enhance performance, functionality, and properties of polymers. Each additive plays a different role in improving the final plastic product. Additives are categorized into four groups, namely functional additives, colorants, fillers, and reinforcements. Since they are not chemically bounded to the final material, additives could leach out of it. More focus has been given to organic additives in comparison to metallic ones due to their affiliations to chemical toxicity, with some falling into the same groups as persistent organic pollutants. However, in several studies, it was observed that while organic additives reached an equilibrium after approximately 14 days, leaching of metallic additives showed an increasing continuance. Metallic additives are cheaper than organic ones, with better heat and weathering resistance properties. Although certain metals have been banned from use, due to recycling of plastics, these toxic metals could still be present in trace amounts in newer products. Given their durability, lost fishing gears made of nylon could remain in the ocean for up to 600 years. In addition to visible impacts such as ghost fishing or ingestion, leaching of toxic additives is yet another potential problem that could intensify throughout the food chain. Biodegradable have increasingly been discussed as potential replacement materials for nylon with the advantage of a significant reduction of environmental impacts in case of loss. This study aimed to investigate the leaching pattern of metallic additives, and the total metallic additives content in nylon and five other biodegradable plastics. Of these, two materials, namely polybutylene succinate co-adipate-co-terephthalate (PBSAT) and Poly(butylene succinate-co-adipate) (PBSA) have been produced as fishing gears and have been tested in several fishing trials. The other three polymers, namely polybutylene succinate 1 and 2 (PBS) and polycaprolactone (PCL) are potential materials or potential blending materials for fishing gears given their individual physical properties. Each one of them was microwave digested at an elevated temperature to quantify the total metallic additive presence. Five different leaching experiments ranging from 6 hours to 31 days were set up at two different temperatures for each material at a concentration of 1 gL-1. Both leachates and extracts were diluted prior to analysis and quantification using ICPQQQ-MS.

3.21.P-We264 Biofilms enhance the adsorption capacity of Cd on weathered microplastics generated from mulching material (both biodegradable PLA and conventional PE)
Xiao Xiao[1]*, Mark Hodson*[2] *and Brett Sallach*[3]*, (1)Environment and Geography, University of York, York, United Kingdom, (2)University of York, United Kingdom, (3)Department of Environment and Geography, University of York, United Kingdom*
Biodegradable polylactic acid (PLA) mulch has been developed to replace conventional polyethylene (PE) mulch in agriculture as a response to growing concerns about plastic pollution. Under some management practices mulches are ploughed into the soil at the end of their use which can lead to the production of plastic fragments including microplastics (MPs). Microplastic mulch residues can also form following degradation of the mulches due to exposure to UV radiation and the weather. Cadmium (Cd) contamination of agricultural soils is an ongoing challenge due to the use of Cd-bearing phosphate fertilisers. Cd can adsorb to MPs. During MP formation, exposure in the natural environment can lead to the formation of biofilms on MPs, which may further impact their adsorption of contaminants. The aim of this study was to investigate the adsorption of Cd on both pristine and naturally weathered MPs (PLA and PE) generated from mulching material. We determined the biofilm content of the MPs to help explain our results. Therefore, large sheets of PE and PLA mulches were prepared and hung outside to age naturally from 3rd April in 2022 to 2nd August in 2023. Both pristine and weathered mulches were cut into small pieces using scissors, shredded to generate MPs using a blender and sieved to less than 2 mm. The PE formed platy particles whilst the PLA formed fibres. This generated the following sample types: pristine PE pieces (PPE), pristine PLA fibre (PPLAF), weathered PE pieces (WPE) and, weathered PLA fibre (WPLAF). Pristine and weathered PLA mulches were also cut to produce similar shaped particles to the PE using scissors (pristine PLA pieces, PPLAP, and weathered PLA pieces, WPLAP). 50 images of each MP type were captured using microscope and then analysed using imageJ. We carried out adsorption experiments to investigate the potential for different MPs to adsorb Cd. In the subsequence experiement, for each MP type, triplicate samples of four pieces of MP were analysed to determine the amount of biofilm on their surface by the crystal violet staining method. Our results suggest that, even when surface area per unit mass is taken into account PLA is more sorptive to Cd than PE. This may have implications for Cd bioavailability in Cd-bearing soils where PE mulches have been replaced by PLA mulches. Further, our results suggest that as MPs weather and biofilms develop on them, Cd mobility will be further decreased.

3.21.P-We265 A recipe for plastic: Expert insights on plastic additives in the marine environment
Thomas Maes[1]*, Fiona Preston-Whyte Ms.*[1]*, Stephanie Lavelle*[2]*, Alessio Gomiero*[3]*,* ***Andy Booth, PhD***[4]*, María Jesús Belzunce*[5]*, Juan Bellas*[6]*, Steven Brooks*[7]*, Adil Bakir*[8]*, Lisa Inès Devriese*[9]*, Christopher Pham*[10] *and Bavo De Witte*[11]*, (1)GRID-Arendal, United Kingdom, (2)GRID-Arendal, Norway, (3)Norwegian Research Centre (NORCE), Norway, (4)SINTEF Ocean, Norway, (5)AZTI, Spain, (6)Vigo Oceanographic Center of the Spanish Oceanographic Institute, Spanish National Research Center (IEO-CSIC), Spain, (7)Norwegian Institute for Water Research (NIVA), Norway, (8)Centre for Environment Fisheries and Aquaculture Sciences (Cefas), United Kingdom, (9)Ocean & human health, Flanders Marine Institute (VLIZ), Belgium, (10)IMAR/OKEANOS, Universidade dos Açores, Portugal, (11)Marine Research, Institute for Agriculture and Fisheries*

Research (ILVO), Belgium
The production and consumption of plastic products had been steadily increasing over the years, leading to more plastic waste entering the environment. Plastic pollution is ubiquitous and comes in many types and forms. To enhance or modify their properties, chemical additives are added to plastic items during manufacturing. The presence and leakage of these additives, from managed and mismanaged plastic waste, into the environment are of growing concern. In this study, we gauged, via an online questionnaire, expert knowledge on the use, characteristics, monitoring and risks of plastic additives to the marine environment. We analysed the survey results against actual data to identify and prioritise risks and gaps. Participants also highlighted key factors for future consideration, including gaining a deeper understanding of the use and types of plastic additives, how they leach throughout the entire lifecycle, their toxicity, and the safety of alternative options. More extensive chemical regulation and an evaluation of the essentiality of their use should also be considered.

3.21.P-We266 Low toxicity of environmental plastic from aquatic and terrestrial habitats
*Ricardo Beiras[1], **Begoña Espina**[2], Christian Scherer[3], Luís André Mendes[1], I Pinheiro[4], Laura Rodriguez-Lorenzo[5] and Kathrin Voges[6], (1)University of Vigo, Spain, (2)International Iberian Nanotechnology Laboratory, Portugal, (3)Department of Biochemistry and Ecotoxicology, Federal Institute of Hydrology (BfG), Germany, (4)Iberian Nanotechnology Laboratory (INL), (5)Water Quality Group, International Iberian Nanotechnology Laboratory (INL), Portugal, (6)Department of Biochemistry and Ecotoxicology,, Federal Institute of Hydrology (BfG), Germany*
The LABPLAS H2020 developed a Plastic Toxicity Testing Scheme for assessing the impact of plastics and associated chemicals on the environment. With that aim, we adapted internationally accepted ecotoxicological methods to assess plastic toxicity using a battery of bioassays representative of aquatic (both freshwater and marine) and terrestrial habitats. The scheme is based in recent consensus on environmental fate and effects of plastics: i. plastic litter fragments in the environment as a consequence of weathering producing secondary microplastics. ii. the smaller the particles the higher impact on environmental health. iii. chemicals intentionally or unintentionally added to polymers are the main toxicological concern. Field plastic liter sampling was conducted in 2022 and 2023 in the North Sea, Thames and Elbe river basins, Baltic coast, and a river basin in NW Iberian Peninsula that includes a drinking water reservoir and agriculture land. Plastics were ground down to <250µm particles. Leachates were obtained according to a standard methods (Almeda et al. 2023), using a 10 g/L solid-to-liquid ratio, and organisms were exposed to serial dilutions of the leachates (Tier I) and plastic particles of ingestible size range (Tier II).

This methodology is suitable to test the environmental toxicity of any plastic disregarding size or origin, either environmental samples or samples of commercial plastic materials. When this scheme was applied to monitor ecotoxicity of plastic litter across Europe, moderate to nule toxicity was observed in aquatic tests, and in those cases where toxicity was reported individual items were identified as responsible for the negative effects. These include cigarrete butts and electric cables. Otherwise, weathered plastic litter does not seem to pose a relevant environmental risk to microfauna or flora in aquatic ecosystems. In contrast, plastic litter of terrestrial origin inhibited earthworm reproduction according to a dose:response pattern, pointing at potential ecologically relevant effects on these key organisms in soil communities.

3.21.P-We267 Comparison of Species Sensitivity Distribution Methods for Risk Assessment of Microplastics
***Sara J Hutton**, Kenia Whitehead and Philip E Goodrum, GSI Environmental, Inc.*
Most papers published on ecological risks of microplastics (MP) are based on laboratory studies with limited exposure profiles or field studies that focus on the occurrence of MPs in aquatic organisms. However, the current scientific literature and knowledge regarding MP toxicity is sparse and often challenging to interpret, which can introduce uncertainty when conducting risk assessments (RAs). Most MP RAs currently published use a species sensitivity distributions (SSDs) approach. SSDs are a commonly used method that compare toxicity across species by taking a single point (e.g., NOEC or EC50) from a dose response analysis, however this approach can also underscore the variability and uncertainty in the data. In the past decade, there has been an increase in research and regulatory activity directed at supporting MP RAs that utilize the SSD approach. For example, in 2018 the state of California passed legislation requiring a comprehensive literature review to determine if a RA could be conducted for both human health (via drinking water) and aquatic organisms. California concluded there was insufficient data to conduct a formal RA for human health, but sufficient data were available to generate SSDs based on no observed effect concentrations (NOECs) or lowest observed effect concentrations (LOECs). The SSDs were used to define a 5 percent hazard concentration of 5 particles/liter which is cited in the draft 2024 California Integrated Report: Surface Water Quality Assessments as the threshold used to determine listings waterbodies based on MPs. A refinement to the SSD approach is to use the full dose-response curve (DRC) from each study and integrate these curves into one composite DRC. This approach was first developed by USEPA's Office of Pesticide Programs to support ecological RAs of pesticides, and subsequently applied to site assessments of legacy contaminants (e.g., PCBs). This method produces a composite DRC and confidence interval that reflects the variability and uncertainty in the DRC for each study. Here we compare the threshold values for MPs when SSDs are constructed using the NOEC/LOEC approach and the DRC approach applied to the same dataset. We find that when all study treatments are incorporated into the composite DRC the resulting confidence intervals span many magnitudes more than the SSD approach, this highlights the extent to which the methods used in RA reflect uncertainty which needs to be considered when conducing RAs.

3.21.P-We268 Bioassay-based hazard assessment of chemical mixtures released from plastics: PlastChemTox evidence map
***Ksenia J Groh, PhD**[1], Hans Peter Arp[2], Kiki Dethmers[3], Emera Forni[4], Molly McPartland[5], Laura Monclus[6], Sarah Stevens[7],*