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ABSTRACT BOOK

Responsible and Innovative Research for Environmental Quality

an ecologically relevant system, using the freshwater aquatic worm *Lumbriculus variegatus*, representing an entry point for nanoplastics from abiotic compartments of sediments, into biota. The role of surface functionalisation of fluorescently dyed nano-polystyrene (50 nm) upon their uptake is systematically examined using a combination of techniques including a novel fluorescence assay and fluorescence microscopy. A series of exposure scenarios are used to test the efficacy of different routes of uptake into the worm. Associations of nanoplastics to the worms' surface are examined in waterborne exposures, whilst dietary uptake is tested using nanoplastics associated with an algae food source. The accumulation of nanoplastics directly from contaminated sediments is also investigated, alongside the fate of these particles in sediments to assess the relationship between nanoplastic mobility and accumulation. Results indicate that pristine nanoplastics are accumulated or internalised both in waterborne exposures and from dietary uptake of a nanoplastic associated algal food source, with carboxylated and aminated plastics experiencing greater uptake than non-functionalised particles. Sediments on the other hand, reduced the availability of these particles for uptake into the worms, potentially though strong associations of the nanoplastics to solid constituents of the sediment. Ongoing work addresses the potential for formation of an "ecocorona" to alter the bioaccessibility of nanoplastics for the worms. These results will also be presented during the platform presentation.

341

Life-history and biochemical responses of Chironomus riparius exposed to different sized microplastics

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Freshwater basins are an integral part of microplastics life-cycle, being a repository of plastic micro-debris. In fact, the levels found so far are similar to those found in marine environment and shoreline regions. The deposition and persistence of plastic micro-debris in sediments (lakeshores and riverbanks) makes them long-time available for benthic species. The objective of this study was to investigate developmental, and physiological effects induced by the presence of polyethylene microparticles (PE) in *Chironomus riparius*, due to its key-role in the freshwater ecosystem. For that partial life cycle tests using different sized polyethylene particles (PE 40-48 µm; PE 125 µm and PE 350 µm) allowed evaluation of effects on C. riparius larval growth and emergence patterns while acute exposures were used to assess effects in parameters related to neurotransmission (AChE); antioxidant defences and biotransformation (CAT, GST total glutathione levels); oxidative damage (LPO); cellular energy allocation (CEA) and immune response (phenoloxidase). Exposure to PE 40-48 µm caused deleterious effects at lower concentrations in comparison with larger particles in several parameters: larval growth and development time of both male and female imagoes and on emergence rate. PE 40-48 µm were then selected to assess effects on physiological homeostasis. Acute exposures to PE 40-48 µm generated alterations in C. riparius larvae antioxidant and biotransformation enzymes activities (CAT, GST and total glutathione) and activation of immune response (induction of phenoloxidase). Larvae exposed to microplastics showed also a depletion in energy reserves. Our study highlights the potential deleterious effect of microplastics for aquatic invertebrate populations. Results will be discussed in terms of effects of different sized plastic particles on different levels of biological organization within freshwater invertebrates and on the needed and ongoing research aiming to address the long term and indirect effects of these particles for natural populations and ecosystem functioning.

342

The effects of rigid and flexible Polyvinyl chloride (PVC) microplastic particles on the transcriptome of Daphnia magna

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Microplastics are ubiquitous in aquatic ecosystems, posing as a threat to biota of all trophic levels, as they have the potential to leach out incorporated additives, such as plasticizers, to the surrounding medium. Yet the question arises, if possible effects on biota are based on the polymer type alone, or if incorporated additives are responsible for the observed effects, as they might desorb from the polymer matrix. With our transcriptome analysis, which was conducted via the use of a microarray, we showed that *Daphnia* reacts substantially different to the chronic (31 days) exposure to rigid PVC or flexible PVC (with diisononyl phthalate (DINP) as a plasticizer) with changes in gene expression. Rigid PVC caused a fivefold up regulations in a total of 19 genes (15 up-regulated and 4 down-regulated) related to structural components of the cuticle, molecular functions as well as serine type endopeptidase inhibitor activity. Flexible PVC exposition lead to a fivefold change of a total of 267 genes (238 up-regulated and 29 down-regulated) related to the GO terms of proteolysis, carbohydrate and chitin metabolism, Vitelline membrane formation, yet most genes were related to immune response. Our attained results imply that flexible PVC had a more severe effect that might be attributed to the leaching of DINP or on the altered biofilm formation on these two different microplastic particles. Therefore our results highlight, for the first time that differences in additive composition (absence or presence of a plasticizer) can lead to substantial differences in effects on aquatic species.

343

Poster spotlight: TU149, TU150, TU151

When ecotoxicology meets trophic ecology

344

Does stress propagate along aquatic food chains? An experimental approach with a tri-trophic brown food chain

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Pollution is a major driver of ecosystem change resulting in alterations in food webs and associated ecosystem processes. Some pollutants such as systemic insecticides are taken up by terrestrial plants and may enter aquatic systems with plant parts such as leaves that are an important energy source in stream food webs. Thereby, food web interactions across the aquatic-terrestrial boundary may be affected through alterations in food quality. Here we studied the effects of a systemic insecticide, the neonicotinoid imidacloprid, and their potential propagation in a brown food chain. The model food chain consisted of imidacloprid contaminated terrestrial leaves (alder, *Alnus glutinosa* Gaertn.), aquatic merolimnic invertebrate decomposers (*Protonemura* sp.) and predators (*Isoperla* sp.). Effects of imidacloprid on survival and growth of decomposers and its leaf processing were assessed in a microcosm setting. Therefore, decomposers fed on control or contaminated leaves for 3 days on the microcosms. Every 6 hours the number of dead individuals was recorded. Potential propagation of imidacloprid effects were assessed by transferring surviving decomposers to cages containing the predator. The cages were deployed in an unpolluted stream for 9 days after which predators' growth was analysed. Imidacloprid concentrations increased within the contaminated microcosms over time. The presence of imidacloprid in the water was associated with lower survival of decomposers and leaf decomposition in contaminated microcosms compared to the control. Furthermore, decomposer's biomass and length decreased in the contaminated but not in the control microcosms. Predators hunting decomposers from contaminated microcosms decreased in body size compared to the control. Systemic insecticides in plant materials can be a relevant source of exposure for decomposers with consequences for their population dynamics (e.g. increased mortality and reduced growth) and the associated ecosystem processes (reduced leaf decomposition). The effects can propagate through food chains and result in indirect effects in predators. Future studies should elucidate the spatiotemporal dynamics of exposure and uptake given that imidacloprid leaches from plant material and may influence downstream food webs directly and indirectly.

345

Accounting for trophic relationships in fish bioconcentration models applied as emergent-pollutants risk-assessment tools

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In the context of the SOLUTIONS EU FP7 project, we applied non-steady state bioconcentration models to predict concentrations of organic compounds in fish. A foodweb perspective was taken, accounting for uptake from water as well as from food, and accounting for different trophic relationships for several fish species used for human consumption. The foodweb bioconcentration model will be applied for a large number of emerging pollutants and a large number of locations (around 25,000 sub-catchments in the major European catchments). Water concentrations at these locations are obtained from chemical fate modelling using the STREAM-EU model. As a case study, results for 24 WFD priority substances are presented here. Predicted concentrations will be input to human health risk assessment. The model also provides insight in how trophic relationships together with species and compound characteristics detemine bioconcentration and thus ecotoxicological risk. The core of the foodweb model is a bioconcentration model for neutral and ionisable organic compounds (Arnot & Gobas 2004; Armitage et al. 2013) underlying each fish component. It calculates for given environmental conditions (pH and temperature) the uptake and elimination rates defining the one-compartment model of the internal concentration dynamics. The considered foodweb contains fish components with different trophic relationships, representing fish species used for human consumption with different body size and lipid content, chosen to represent extreme cases with respect to expected bioconcentration. Internal concentrations in phyto- and zooplankton are assumed to be in instantaneous equilibrium with water concentration. For 24 WFD priority substances concentration timeseries per sub-catchment from the STREAM-EU model were used as input to the foodweb bioconcentration model. Results were summarized in monthly and annual maximum and mean concentrations for all foodweb components in each sub-catchment and displayed in maps covering the

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