8TH YOUNG ENVIRONMENTAL SCIENTISTS MEETING
05 – 10 February 2019, Ghent University, Belgium

GHENT BELGIUM
2019

FROM TEST RESULTS TO DECISION MAKING:

DRIVING ENVIRONMENTAL POLICY FROM THE HEART OF EUROPE

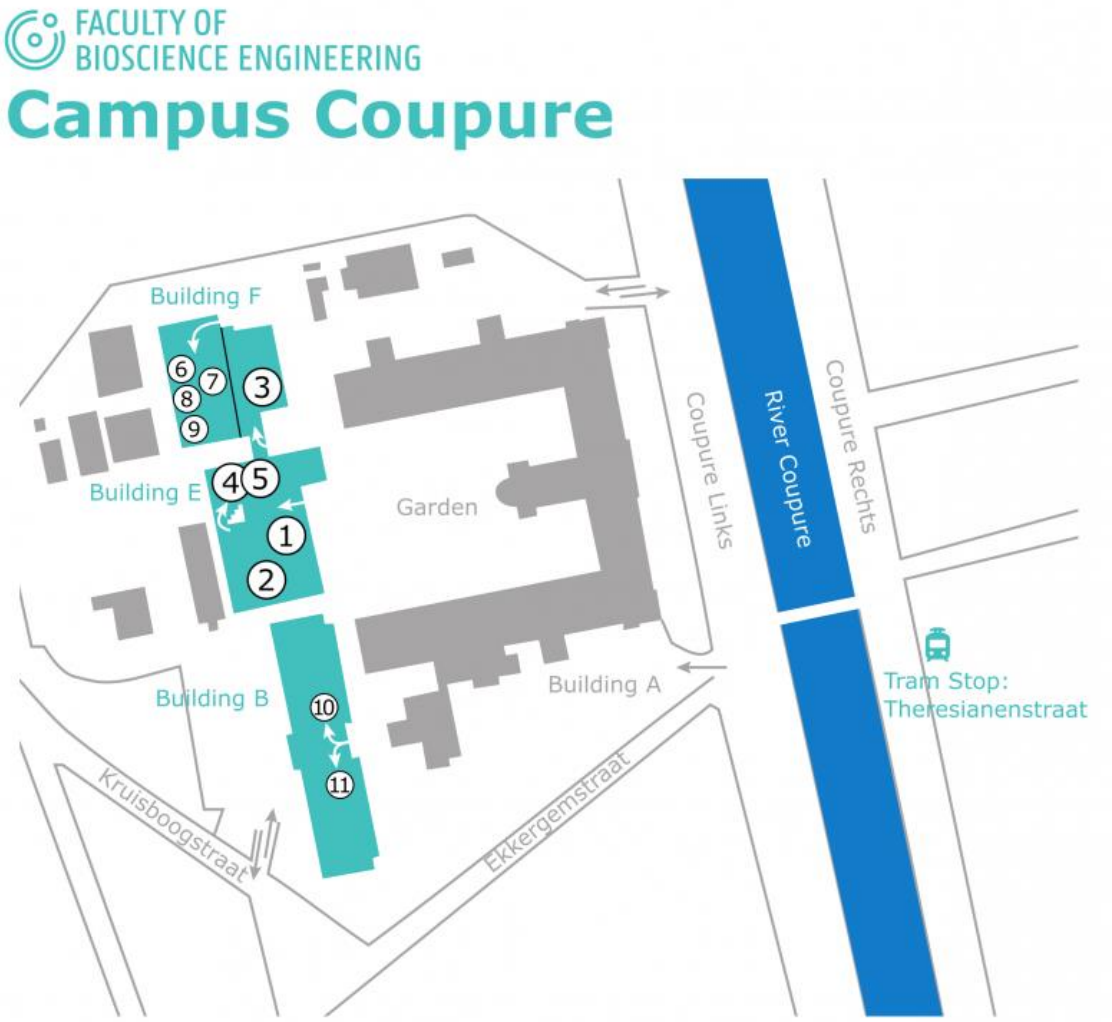
SAC EUROPE

SETAC®

Campus Coupure

Faculty of Bioscience Engineering, Ghent University

Coupure Links 653, B-9000 Ghent, Belgium



Main conference rooms

1. Agora (Exhibition Area)
2. Auditorium Oehoe (E1)
3. Restaurant (Resto Coupure)
4. Auditorium E2 (2nd floor)
5. Auditorium E4 (3rd floor)

Training course rooms

6. Leslokaal F0.1
7. Vergaderzaal F0.1
8. Practicumzaal F0.1
9. Practicumzaal F0.2
10. Vergaderzaal B0.3
11. Vergaderzaal B0.1

Welcome from the SEC

Welcome from the SEC

Dear Abdul, Afolarin, Agustina, Akintayo, Albert, Alena, Alexandra, Aliaksandra, Alina, Ana, Ana, Anatos, Anastasia, Andrea, Anna, Anne, Anne-Katrin, Annika, Anton, Antonia, Anzhelika, Apolline, Arinze, Artem, Bettie, Binita, Boitshwarelo, Catarina, Chloe, Chukwuka, Chukwuka, Claudia, Cynthia Beatriz, Daniela, Daniele, Ekaterina, Elena, Eli, Emeka, Esther, Fatima, Filipe Guilherme , Franklin, Friday Ojie, Gabrielle, Gisela, Gissela, Glaucia, Greta, Hannah, Hue, Ibiyemi, Ifeoluwa, Ilias, Inmaculada, Iohanna, Isadora, Janina, Jaya, Johannes, Johannes, Jonathan, Jordy, Julie, Karel, Katie, Kim, Kristi, Kyra, Laina, Lemessa, Lisa, Liubov, Macarena, Madson, Maita, Martha, Marc, Maresa, Maria, Maria Florencia, Mariam, Marie, Markus, Marta, Martin, Melanie, Michael, Mikhail, Nida, Norina, Ogemdi, Oleg, Pauline, Qinghua, Quyen, Rachel, Rada, Raphael, Robert, Rostislav, Ruben, Ruchika, Ruoyu, Samuel, Sanne, Sarah, Sebastian, Sebastian, Selena, Selim, Seyyed Afshin, Sharon, Supta, Susana, Sven, Tamara, Tamiris Pacheco, Tatiana, Tess, Theresa, Theresa, Tomas, Tomas, Tomas, Verena, Vienna, Vincent, Vyshal, Xiayan

Thank you very much for registering to the 8th SETAC Young Environmental Scientist Meeting and a warm welcome to the wonderful city of Ghent!

10 Years ago in 2009 a group of enthusiast SETAC students took the initiative in Germany and since then the SETAC YES meetings have developed into a series of truly global events organized alternatingly in Europe and North America. For this edition in Belgium we acknowledge the University of Ghent for hosting the meeting and the organizing committee for devoting so much time and efforts in making it happen. Thank you!

Whether you are form Europe, Africa, Asia-Pacific, North America or Latin America, environmental challenges are ahead and experts to assess the risks and solve the issues are needed. There may be many differences between the continents, but the scientific principals are the same and knowledge, methods and experiences should be shared. This meeting brings you all together to present your results, talk about successes and failures, explain your ideas, hear from others.

Participating to this meeting comes with a responsibility to connect, share and improve on what you are doing. And it gives you the opportunity to start collaborations and grow into a career where you can make a difference for the world. When it comes to providing the conditions for a sustainable use of our planet. We wish you an excellent time in Ghent, full of science, fun and friendship. And we hope to see you again at many other meetings to collectively work towards Environmental quality through science®.

Karel de Schamphelaere
SETAC Europe President

Bart Bosveld
SETAC Europe Executive Director

Welcome from the SAC

Dear participants and guests,

It is our pleasure to welcome you to this year's Young Environmental Scientists (YES) meeting. The first YES meeting was organized at the University of Koblenz-Landau in 2009 on the initiative of the Student Advisory Council of SETAC Europe (SAC). Since then, the YES meetings have remained the most important activity of the SAC. We are happy to see the YES meeting concept grow and develop throughout the years – in 2011 in Aachen, 2013 in Krakow, 2015 in Petnica, 2016 in Gainesville – for the first time in the United States, in 2017 in Stockholm and 2018 in Madison. YES meetings gather students from all SETAC geographical units, and have become a truly global SETAC event. Since 2016, YES meetings alternate between the US and Europe, a concept that may hopefully be extended to other Geographical Units in the future. We are happy to welcome students from 30 countries worldwide at this year's edition at Ghent University.

Based on experiences and feedback from previous meeting participants, the YES meeting 2019 will offer a mix of established and innovative concepts. We will open the YES meeting with a workshop touching upon our meeting motto "From test results to decision making: Driving environmental policy from the heart of Europe", with experts from the European Food Safety Agency (EFSA), ARCHE Consulting and the University of Birmingham. Again this year, we will offer free training courses for all participants and have the opportunity to listen to career talks from experienced professionals.

The Scientific Committee has carefully selected the reviewed abstracts and allocated them either to platform or poster presentations. One important part of YES meetings is providing time for discussions and to receive feedback from your peers through e.g. several poster socials.

The meeting organizers did a great effort to provide funding for the meeting that is free of charge for the participants and also to provide travel grants to the students who needed them the most. It would not have been possible without the assistance of all of the meeting partners and supporters. We would like to express our gratitude towards the SETAC units

and branches, SETAC Europe office, companies, universities, and research institutes. Thank you for supporting future generations of scientists!

The SAC celebrates its 13th foundation anniversary this year and we would like to say a special "Thank you!" to all the members and chairs who worked hard to represent and support the student community of SETAC Europe until now. The student community of SETAC finally became global through close collaboration with students from all other SETAC geographical units - especially the North America Student Advisory Council (NASAC).

We wish you a productive and exciting conference and hope you will go home enriched by new experience, friends, ideas, and perspectives. Have a good time!

Katharina Heye

Chair of SAC Europe

Mafalda Castro

Vice-Chair of SAC Europe

Welcome from the LOC

Dear Students and Graduates,

On behalf of the Local Organizing Committee (LOC), we welcome you all to Ghent. With Ghent's proximity to Brussels, the political heart of Europe, our meeting motto "From test results to decision making: Driving environmental policy from the heart of Europe" almost suggested itself. We believe that in order to move forward in environmental toxicology and chemistry, our society needs to keep bridging the gaps between academia, business and governmental institutions.

We are very pleased that this year's YES meeting has attracted so many high-quality abstracts from such a diverse group of young scientists from 30 countries representing all Geographical Units of SETAC. We encourage you all to get the most out of this meeting by participating in the scientific sessions, engaging with fellow students, and encouraging one another. We have done our best to ensure that the program is filled with interesting activities that help you develop your skills as a scientist but also leave enough time to have fun and work on building your scientific network in a non-intimidating atmosphere. However, all of this would never have been possible without the help of quite a number of helping hands. Thank you all for your support, we hope that you and all participants can enjoy this meeting to a max.

We'll be present during the entire conference and you can recognise us by our coloured badges, so please don't hesitate to approach us with any questions about the conference or SETAC. Most of us don't bite! Perhaps, some of you even become interested in joining the Student Advisory Council (SAC) this year to get involved in the organisation of future YES meetings! Please be sure to fill in the feedback forms at the end of the conference so that we can keep improving on upcoming YES meetings.

Welcome from the LOC

Last but not least, we would like to thank all of our meeting partners and sponsors – this event would not have been possible without the help and assistance of SETAC units and branches, the SETAC Europe office, as well as several companies and universities. Thank you for supporting us and creating this opportunity for future scientists!

Have a good time!

Josef Koch, Samuel Moeris
Co-Chairs of the LOC

WLAN information

Login name: **guestYesss**

Password: **7MAkbwWH**

How to connect

Make a wireless connection with "**UGentGuest**". If you have set up to request an IP address automatically, you will receive an IP address starting with 193.190.8x.

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About the SAC

The Student Advisory Council of SETAC (Society of Environmental Toxicology and Chemistry) Europe was established in 2006 during the annual meeting in The Hague. The main aim of the SAC Europe is to improve the communication among students within SETAC and to offer opportunities to students to get in contact with senior members of the society.

Almost 25% of all SETAC members are students and SAC is continuously working to represent the interests of this large group of members within the society. Numerous student activities at the annual meetings are organized by the SAC in order to support young researchers to become well-networked, self-confident scientists, and as a result, fully-fledged members of the society.

One of the most important and well recognized projects of the SAC is the Young Environmental Scientists (YES) meeting. This unique meeting is organized annually by students for students (and recent graduates) with the main goal of bringing young researchers together and helping them develop their skills and network in an international setting. For further information visit the SAC's Facebook page or follow us on twitter (@studentsofSETAC).

About SETAC

The society of Environmental Toxicology and Chemistry (SETAC) is a not-for profit, global professional society established in 1979 to provide a forum for individuals and institutions engaged in education, research and development, ecological risk assessment and life-cycle assessment, chemical manufacture and distribution, management and regulation of natural resources, and the study, analysis, and solution of environmental problems. SETAC is an open and democratic organization that operates in a broad social context, reflecting the needs of the environment and people. Application of sound science plays a key role in this process. Membership worldwide comprises about 5500 professionals in the field of chemistry, toxicology, biology, and ecology: atmospheric, health, and earth sciences; and environmental engineering.

SETAC Europe

SETAC Europe is one of five Geographic Units (GU) of the global Society of environmental Toxicology and Chemistry, established to promote and undertake activities of SETAC in Europe, and to support activities of SETAC in the Middle East and Russia. As a Geographic Unit we share the mission of SETAC. SETAC Europe is dedicated to the use of multidisciplinary approaches to examine the impacts of stressors, chemicals, and technology on the environment. The Society also provides an open forum for scientists and institutions engaged in the study of environmental problems, management and regulation of natural resources, education, research and development, and manufacturing. SETAC Europe is incorporated in Belgium as a not-for-profit organization. The society is governed according its articles of association and by-laws. SETAC Europe maintains its administrative office in Brussels, Belgium.

The primary goals of SETAC Europe are:

To support the development of principles and practices for protection, enhancement and management of sustainable environmental quality and ecosystem integrity.

To encourage interactions among environmental scientists and disseminate information on environmental toxicology and chemistry.

To provide a forum for communication among professionals in government, business, academia, and other segments of the environmental science community and for the protection and welfare of the general public.

About Ghent University

Ghent University is ranked among the top 100 universities worldwide (Shanghai ranking) and is with over 41,000 students and 9,000 employees one of the largest universities in Belgium. Located in Flanders, the Dutch-speaking part of Belgium and the cultural and economic heart of Europe, Ghent University participates actively in national and international educational, scientific and industrial cooperation.

Ghent University comprises 11 faculties that are composed of 117 faculty departments. These departments offer more than 230 high-quality degree courses in their respective scientific disciplines, each driven by innovative research.

As part of Ghent University, the Laboratory of Environmental Toxicology and Aquatic Ecology - Environmental Toxicology Unit (GhEnToxLab) is one of the leading research groups in environmental science and ecotoxicology in Belgium.

GhEnToxLab has close collaborations with several other departments at and outside of Ghent University. The department is housed in building F on the "Campus Coupure" where the faculty of Bioscience Engineering is situated.

Apart from the SAC, the Local Organizing Committee (LOC), consists of a group of enthusiastic PhD students from different Universities including Ghent University, KU Leuven, Moscow State University, Stockholm University and VU Brussels. While all are heavily overworked, they nevertheless committed considerable amounts of their time to make YES 2019 happen. So if you see one them around at the conference, don't be shy to approach them and/or invite them to a drink!

About Belgium

The Kingdom of Belgium is located in Western Europe and is also known as the “Heart of Europe”. With only 30,528 km^2 it is one of the smallest countries of the continent but has a high population density due to its more than 11 million inhabitants. Belgium has three official languages, Dutch, French and German, each forming one independent community; Flanders in the North, Wallonia in the South and the German-speaking community in the East of the country. Due to the linguistic differences, Belgium has a rich culture strongly influenced by its surrounding countries.

Belgium’s capital Brussels is the most populous city in Belgium and home of the main institutions of the European Union. It hosts the official seats of the European Commission, Council of the European Union and European Council, as well as a seat of the European Parliament.

Belgians are open and welcoming people and, due to the floating language borders, usually multilingual. A scenario where two Belgians meet and communicate in a non-official Belgian language (e.g. English) is very common. Many Belgians speak two or more languages fluently. Belgians are proud of their rich brewery and beer culture, Belgian fries and their National Football Team. An easy way to meet people is to get into touch while enjoying some French fries with a variety of sauces accompanied by a Belgian Strong Beer.

Lunch & Bring your own bottle

Lunch

Lunch is free for all participants from Wednesday 06th of February 2019 until Saturday 09th of February 2019 included.

From Wednesday until Friday, lunch will be available at the student restaurant (Resto Coupure, #3 on the map). The lunch covered by the YES meeting is composed of **either** a **warm dish including meat/vegetarian alternative, vegetables and carbs** (rice, potatoes,...) **or** a **warm soup and a bun**. **Drinking water** is available **for free** at the restaurant. On Saturday, a sandwich lunch will be provided by an external catering service.

Important note: The restaurant also offers desserts, soft drinks, etc. but **anything beside the warm dishes needs to be purchased by the meeting participants themselves**. Please be aware that the prices for non-Ghent University employees/students are quite high so we recommend you to rather use the vending machines in the agora in case you want to purchase e.g. a soft drink.

Bring Your Water Bottle

During the whole conference, drinking water will be available for free at the meeting venue. To reduce our waste output and contribute to a plastic-free world, **we encourage all participants to bring their own refillable drinking bottle**.

Daily schedule

Tuesday	**05th of February 2019**	**Get-together**
	17:00 - 19:00	Registration
	19:00 - 20:00	Opening ceremony
	20:00 - 23:00	Reception & Quiz

Wednesday	**06th of February 2019**	**Workshop Day**
	09:00 - 09:15	Workshop Introduction
	09:15 - 10:15	Workshop Part 1
	10:15 - 10:45	Coffee break
	10:45 - 11:45	Workshop Part 2
	11:45 - 13:00	Lunch
	13:00 - 14:00	Workshop Part 3
	14:00 - 14:15	Workshop Closing
	14:15 - 14:45	Coffee break
	14:45 - 15:45	Career talk 1
	16:00 - 19:00	Job corner event
	19:00 - 22:00	Pub crawl in the city center

Thursday	**07th of February 2019**	**Conference Day 1**
	08:00 - 09:00	Poster set-up
	09:00 - 10:50	Parallel sessions
	10:50 - 11:20	Coffee break
	11:20 - 13:00	Parallel sessions
	13:00 - 14:00	Lunch
	14:00 - 15:40	Parallel sessions
	15:40 - 16:00	Coffee break
	16:00 - 17.00	Career Talk 2
	17:00 - 19:00	Poster Social (& short presentation)
	21:00 - 02:00	Party

Daily schedule

Friday	**08th of February 2019**	**Professional training courses**
	09:45 - 10:00	Introduction - Training Courses
	10:00 - 11:00	Parallel courses Part 1
	11:00 - 11:30	Coffee break
	12:00 - 12:30	Parallel courses Part 2
	12:30 - 13:30	Lunch
	13:30 - 14:30	Parallel courses Part 3
	14:30 - 15:00	Coffee break
	15:00 - 16:00	Parallel courses Part 4
	16:00 - 17:00	Career Talk 3
	17:00 - 19:00	Poster Social (& short presentation)

Saturday	**09th of February 2019**	**Conference Day 2**
	09:00 - 10:50	Parallel sessions
	10:50 - 11:20	Coffee break
	11:20 - 13:00	Parallel sessions
	13:00 - 14:00	Lunch
	14:00 - 15:40	Parallel sessions
	15:40 - 16:00	Coffee break
	16:00 - 17:30	Poster Social (& short presentation)
	17:30 - 18:00	Poster takedown
	18:00 - 19.00	SAC perspective - YES meeting 2019
	19:00 - 20:00	Closing Ceremony
	20:00 - 22:00	Farewell drinks

Sunday	**10th of February 2019**	**Activity**
	09:45 - 12:00	Free walking tour in the city of Ghent

Thursday – Auditorium E2

		Microplastics & Nanomaterials	
09:00-09:20	01	48289	*Bettie Cormier*, Toxicological effects in different stages of zebrafish after direct and trophic exposures to microplastics collected from two Guadeloupe beaches
09:20-09:40	02	48175	*Lisa Hanslik*, Microplastic - a vector for anthropogenic contaminants in freshwater ecosystems?
09:40-10:00	03	48292	*Theresa Piana*, Ingestion of irregularly shaped microplastics by the freshwater oligochaete *Lumbriculus variegatus*
10:00-10:20	04	48291	*Katie Reilly*, Plastic conditioning and the effect on chemical toxicity in *Daphnia magna*
10:20-10:40	05	48143	*Theresa Schell*, Assessing relevant microplastic sources for freshwater ecosystems in semi-arid areas

		Microplastics & Nanomaterials	
11:10-11:30	06	48301	*Sven Seidensticker*, Microplastic as pollutant vector: Influence of non-linear sorption and coupled mass transfer
11:30-11:50	07	48317	*Tatiana Kuznetsova*, Functionalization of magnetite nanoparticles with alkoxysilanes and humics: Electrokinetic and ecotoxicological measurements
		Terrestrial Ecotoxicology	
11:50-12:10	08	48165	*Ruoyu Hu,* Mobility and transfer of rare earth elements from soil to plants by arbuscular mycorrhizal fungi
12:10-12:30	09	48048	*Claudia Lima*, Toxicity of imidacloprid to five different species of soil invertebrates
12:30-12:50	10	48115	*Jaya Sravanthi Mokkapati*, Do we use plant protection products correctly? Effect of agrochemicals on adult solitary bee, *Osmia bicornis*

		Terrestrial Ecotoxicology	
14:00-14:20	11	48249	*Fátima Santos*, Quantification of concentration and time resolved effects, towards an Adverse Outcome Pathway: Toxicokinetics in *Enchytraeus crypticus*
		Aquatic Ecotoxicology I	
14:20-14:40	12	48313	*Elena Adams*, Acute and chronic toxicity of environmentally relevant pesticide concentrations to early developmental stages of European Anura
14:40-15:00	13	48321	*Johannes Becker*, Compared investigation of chronic effects of carbamazepine and cyprodinil on Daphniidae
15:00-15:20	14	48299	*Apolline Chabenat*, Do antidepressants impair colour change and camouflage in two juvenile marine invertebrates, *Sepia officinalis* and *Carcinus maenas*
15:20-15:40	15	48384	*Vyshal Delahaut, Mercury transfer through the food chain of the three-spined stickleback (Gasterosteus aculeatus)*

Thursday – Auditorium E4

Environmental Science and Climate Change			
09:00-09:20	16	48302	*Vienna Delnat*, Daily temperature variation shapes how a pesticide increases mortality and decreases heat tolerance: contrasting effects between larvae and adults in a semi-aquatic insect
09:20-09:40	17	48269	*Tamara Djerdj*, Application of low-cost CO2 sensor systems as a tool for continuous uptake/emission measurements in Lemna toxicity tests
09:40-10:00	18	48142	*Ana Belén González*, Climate change evaluation: Effects of Benzophenone-3 and temperature on gene expression and enzymatic activity of the aquatic organism *Chironomus riparius*
10:00-10:20	19	48343	*Rada Reshetnikova*, To the question about the evolution of the Crimea landscapes in the Holosene (on the example of the Cape Martian soils)
10:20-10:40	20	48303	*Julie Verheyen*, Current and future daily temperature fluctuations make a pesticide more toxic: Contrasting effects on life history and physiology

Environmental Engineering and Sustainability			
11:10-11:30	21	48174	*Maresa Bussa*, Prospective LCA of a biorefinery concept for the production of pharmaceuticals and bioplastics
11:30-11:50	22	48273	*Samuel Frutos-Puerto*, Voltammetric determination of Cd(II) and Pb(II) on nafion-protected sputtered-bismuth screen-printed electrodes: Applicability to ambient water samples
11:50-12:10	23	48316	*Chukwuka Ogbonna*, Biodigestion of fresh cassava waste water: Maximizing resources from wastes, reducing Green House Gas emission, need for environmental sustainability
12:10-12:30	24	48234	*Ana Ramos*, Biomass as precursor for biofuels: predicting syngas applications according to quality indices
Risk Assessment and Regulation			
12:30-12:50	25	48211	*Vincent Baillard*, SSD models used for assessing interspecific competition impact on organisms' tolerance against chemical stress

Risk Assessment and Regulation			
14:00-14:20	26	48322	*Maria D'Andrea*, Framework for pesticide risk assessment in the Pampa region, Argentina
14:20-14:40	27	48235	*Andrea Gredelj*, Ecosystem modelling as a perspective tool for the ecological risk assessment of emerging contaminants: A study based on the river Po, Italy
14:40-15:00	28	48222	*Hue Nguyen*, Poly-/perfluoroalkyl substances in wastewater treatment plants across Australia: Distribution, mass load and environmental risks
15:00-15:20	29	48341	*Franklin Odili*, Toxicological assessments of borehole water samples from three industrial areas in Lagos State, Nigeria
15:20-15:40	30	48337	*Johannes Raths*, Bioconcentration and metabolism of laurate in the freshwater amphipod *Hyalella azteca*

Saturday – Auditorium E2

			Aquatic Ecotoxicology II
09:00-09:20	31	48324	*Tomas Makaras*, Behavioral and biochemical responses of rainbow trout juveniles and European perch exposed to sublethal concentrtions of complex metal mixture: comparison analysis between response endpoints
09:20-09:40	32	48368	*Anne-Katrin Mueller*, Effects of endocrine disruptors in sediments of the river Luppe assessed by biomarker and histopathological analysis of freshwater fish
09:40-10:00	33	48237	*Norina Pagano*, Tapping as a vibrational stimulus to investigate behavioral alterations in zebrafish embryos (*Danio rerio*)
10:00-10:20	34	48187	*Robert Rämö*, Adverse biological effects of activated carbon dependent on particle size and test organism
10:20-10:40	35	48253	*Markus Schmitz*, Impact of endocrine disruptors from sediment during a simulated flood like event on rainbow trout (*Oncorhynchus mykiss*)

			Aquatic Ecotoxicology II
11:10-11:30	36	48308	*Aliaksandra Shuliakevich*, Distribution of (anti-)androgenic potential in the river wurm by Aachen (North Rhine-Westphalia, Germany)
11:30-11:50	37	48183	*Esther Smollich*, Sublethal effects of chronic exposure to 2,4,6-tribromophenol and other degradation products of brominated flame retardants in a synthetic mixture in *Daphnia magna* and *Caenorhabditis elegans*
11:50-12:10	38	48336	*Alexandra Steele*, Is shyness strength? Dynamic exposure affects personalities exhibited by aquatic organisms in predator-prey interactions
12:10-12:30	39	48052	*Maita Subba*, Assessing effects of heavy metals on freshwater mudsnail *Potamopyrgus antipodarum*: A laboratory study
12:30-12:50	40	48263	*Qinghuq Zhao*, The effect of pesticides on target communities depends on multi-trophic diversity

			Effect and Exposure Modelling
14:00-14:20	41	48106	*Supta Das*, Towards improved modeling of pesticide volatilization: using measured soil-air partition coefficients of commercial formulation in a pesticide volatilization model
14:20-14:40	42	48333	*Annika Mangold-Döring*, A novel multi-species physiologically-based toxicokinetic modelling approach in support of environmental risk assessment of chemicals
14:40-15:00	43	48338	*Kim Rakel*, Bridging the gap across species by the means of TK-TD modelling
15:00-15:20	44	48116	*Kristi Weighman*, The combined potential of species-traits and mechanistic effect models
15:20-15:40	45	48277	*Sanne van den Berg*, Mapping dynamic exposure in artificial stream systems

Saturday – Auditorium E4

		Environmental Analytical Chemistry	
09:00-09:20	46	48246	*Selena Carretero Peña*, An exploratory study of smartphone-based digital image analysis for the measurement of atmospheric particulate matter levels
09:20-09:40	47	48265	*Maria Cerrato-Alvarez*, Applicability of images captured by a smartphone as digital signal source for monitoring of tropospheric ozone
09:40-10:00	48	48230	*Gisela Horlitz*, A retrospective analysis of organic micropollutants in sediment cores from a wastewater impacted recipient
10:00-10:20	49	48140	*Rachel Mackie*, Trends in nicotine consumption between 2010 and 2017 in an Australian city using the wastewaterbased epidemiology approach
10:20-10:40	50	48071	*Susana Méndez*, Accumulation of metals (Cd, Cr, Cu, Mn, Pb, Ni, Zn) and total mercury (THg) in sediments, macroalgae and sponge of a coral reef, Caribbean coast of Costa Rica

		Environmental Analytical Chemistry	
11:10-11:30	51	48434	*Ruchika Sah*, The heavy metal trails of River Ganga from Himalayas to Bay of Bengal: Anthropogenic or natural?
11:30-11:50	52	48318	*Kyra Spaan*, Mass balance of per- and polyfluoroalkyl substances (PFASs) and extractable organofluorine in marine mammals
		Molecular and Genetic Ecotoxicology and Omics	
11:50-12:10	53	48154	*Melanie Blanc*, Immediate and long-lasting effects of environmental chemicals in the Zebrafish liver (ZF-L) cell line and subsequent unexposed passages
12:10-12:30	54	48131	*Inmaculada Fuertes*, Effects of neuro-active pharmaceuticals on transcriptomic and lipidomic Daphnia magna responses
12:30-12:50	55	48130	*Marta Jaskulak*, Effects of sewage sludge application on metal accumulation, DNA damage, biomass and expression of metallothioneins in *Sinapis alba* during assisted phytoremediation of degraded soils

		Molecular and Genetic Ecotoxicology and Omics	
14:00-14:20	56	48095	*Sebastian Lungu*, Development of an oxidative stress in vitro assay in zebrafish (*Danio rerio*) cell lines
14:20-14:40	57	48172	*Rubén Francisco Martínez López*, Developmental fluoxetine exposure in zebrafish reduces offspring basal cortisol concentration via life stage-dependent maternal transmission
14:40-15:00	58	48342	*Catarina Moreira*, In vitro evaluation of potential oestrogenic compounds on oestrogen receptors of European sea bass, *Dicentrarchus labrax* (L.)
15:00-15:20	59	48305	*Janina Pažusien*, Environmental genotoxicity and risk assessment in herring (*Clupea harengus*) caught in the Bornholm and Gotland Basins from the Baltic Sea (2009-2017)
15:20-15:40	60	48261	*Albert Serra-Compte*, Elucidation of anti-inflammatories and nutritional limitation effects in freshwater invertebrates through a targeted and non-targeted metabolomics approach

Social program

Reception (05 February 2019, 20:00–23:00)
To welcome everyone in Ghent and have a first possibility to get to know each other, we will meet in the Agora (#1 on the map) after the opening ceremony. While drinks will be served you will also have to possibility to enjoy some Belgian Fries (Yes, they're vegan) and typical Belgian snacks freshly prepared in a food truck.

Pub crawl in the city center (06 February 2019, 19:00–22:00)
Now that the YES meeting has fully started, we want to make sure you will also get to know the beautiful city of Ghent. We will explore the city together with some of Ghent's best bars in small groups of approximately 20 people and finally meet up at one of the biggest pubs in town. Meeting place: Agora

Student party (07 February 2019, 21:00–02:00)
Still the best opportunity for networking – the student party will be organized in the A.M. club (Schuurkenstraat 2, 9000 Gent). The party will be kicked off by a local DJ before we will welcome a special guest DJ as of 00:00 for another 2 hours. The venue is all ours and it is up to you to make it unforgettable!

Farewell drinks (09 February 2019, 20:00–22:00)
Before you all return home packed with great experiences and new friendships, we would like to say goodbye. Take a last picture with your peers at the photo booth and exchange contact information (if not yet done) while enjoying some drinks and snacks at the agora.

Photobooth (09 February 2019, 09:00–22:00)
Take your picture at the photobooth on Saturday as a keepsake from SETAC YES 2019.

Free walking tour in the city of Ghent (10 February 2019, 09:45–12:00)
For those of you who still spend another day in Ghent, be welcome to join a free walking tour in the city center. We will meet our local guide at 09:45 at Sint-Michielsplein 21, 9000 Ghent (in front of the hostel Uppelink) and explore the city together.

Workshop: From test results to decision making – Driving environmental policy from the heart of Europe

(Wednesday 06th of February 2019)

1st Speaker (09:15–10:15): Mr. Mark Egsmose, EFSA

Mark Egsmose has been working as a Senior Scientific Officer at the Pesticides Unit of the European Food Safety Authority (EFSA) for the last 12 years. In his workshop presentation, Mark will focus on the evaluation process in risk assessment. What happens after the data generation before decisions can be made? Mark will address this question and also elaborate on the process of how new methodologies for risk assessment of substances are developed.

2nd Speaker (10:45–11:45): Dr. Frederik Verdonck, ARCHE Consulting

At his position as Science Project Manager at ARCHE Consulting, Frederik Verdonck is an expert in the development and implementation of new tools and data science in the field of risk assessment. In his presentation, he will focus on the risk assessment development process under REACH, CLP and BPR (biocides) giving answers to the question: How do lab test results and exposure-related information feed into the hazard and risk assessment?

3rd Speaker (13:00–14:00): Prof. Dr. Iseult Lynch, University of Birmingham

Iseult Lynch, professor at the School of Geography, Earth and Environmental Sciences at the University of Birmingham, is a leading expert in the investigation of impacts posed by nanoparticles in the environment. With her broad overview of all aspects of nanomaterials safety assessment and the associated data requirements, she will give a presentation on how we can design our experiments and capture the protocols and data in the most efficient and intelligent way (i.e. through electronic notebooks) in a format suitable for long-term storage and (open) sharing.

One of the most popular formats of YES meetings are the free training courses offered on **Friday 08th of February 2019**. During the registration you were given the opportunity to choose among 6 full-day training courses shortly described hereafter.

1. Marine environmental data: principles of good data management and access to open data resources (Vergaderzaal B0.1)

Within this course an overview of the main principles of good data management (documenting, archiving, data formatting, integration, and standardization) will be presented. There will be a focus on European open marine environmental spatial data types from different disciplines (biology, chemistry, geology, and physics) and how the data can be used. Participants will be trained *hands –on* how these marine European open data resources can be accessed and used for analysis in *R*.

Lecturers: Ms. Britt Lonneville; Mr. Lennert Schepers; Ms. Paula Oset, Flanders Marine Institute

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2. Bioinformatics in Environmental Science (Practicumzaal F0.1)

Genomics, transcriptomics and proteomics are becoming more and more popular in environmental science. This course will offer a first introduction into the computational tools and bioinformatics needed to analyse these complex datasets. It will include bioinformatics packages within R, using public molecular databases and basic quality control.

Lecturer: Dr. Jana Asselman, Ghent University

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3. Ecological Modelling in Python (Vergaderzaal F0.1)

This workshop serves as a primer for anyone interested in Ecological Modelling, but not equipped with the necessary coding skills. You will learn how to implement a dynamic ecological model as well as manage and visualize the results in Python. This will prepare you to easily move on to more complex modelling tasks.

Lecturer: Mr. Simon Hansul, Ghent University

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4. Simple dynamic modelling of toxic effects on growth and reproduction – an introduction (Vergaderzaal B0.3)

Chemical stress affects life-history traits of organisms such as body size and reproductive output. Even in the absence of stress, these traits change over time, and are also closely interlinked (reproduction starts at a more-or-less fixed size, and larger individuals produce more offspring). Toxicity is also a process that depends on time as chemicals need to be taken up into the body to exert an effect, and that uptake generally takes time. All in all, the relationship between toxic effects on life-history traits and time is rather complex, and to make matters worse: these relationships will be different under different environmental conditions (e.g., food availability, temperature, or other stressors). To make sense of this complex situation requires the use of dynamic models on a mechanistic basis. The simplest and most useful model approaches make use of the concept of an energy budget: traits like growth and reproduction require resources from food, so effects on these traits imply that less resources were acquired from the environment, or that resources are used in a different way. Following resources (or 'energy') is therefore an obvious way to structure our modelling efforts. Fortunately, such energy-budget models can be very simple, and DEBkiss is one of the simplest models of this type.

This course provides you with an introduction into the world of toxicokinetic-toxicodynamic (TKTD) modelling based on the energy budget. The course sports several short introductory lectures, but most of the time will be dedicated towards hands-on exercises/experimentation with the simple DEBkiss model. For this course, DEBkiss is forced into Excel; this software is not particularly suited for modelling, but we are aiming for a broad audience here (no specific knowledge of modelling, mathematics or coding is expected).

Requirements:

- Please bring a laptop with Excel installed, and make sure you know how to work with Excel at a basic level.

Lecturers: Dr. Tjalling Jager, DEBtox Research; Mr. Josef Koch, Ghent University

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5. The pacific garbage screening project – Tackling marine plastic waste in the oceans with innovative technologies (Practicumzaal F0.2)

This training course will give the participants the opportunity to address one of the biggest environmental issues of our time: The pollution of the oceans. Convinced by the idea that everyone can be part of the solution, architect Marcella Hansch at RWTH Aachen University started the 'Pacific Garbage Screening' project (PGS). During this course, the participants will be introduced to the project itself but will also be stimulated to design and present creative solutions from their respective fields of expertise – true to PGS's motto: "Be a part of the Solution".

Lecturer: Ms. Tessa Böttcher, Pacific Garbage Screening

Organiser: Pacific Garbage Screening

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6. Research in the modern age – Balancing research impact and research integrity (Leslokaal F0.1)

Part 1: Maximize the impact of science through kick-ass social media skills

In this session Esther will test your impact superhero readiness level by going through the basics of setting up a strategy for your research communication and science outreach. Drawing upon her experiences as a knowledge broker at Ghent University and as proud curator of @ResearchUGent, she will show the good, the bad, and the ugly of engaging in online interaction. You will discover how the principles of digital presence, storytelling, stakeholder analysis, and open science help towards achieving a greater impact.

Part 2: How do deal with research integrity dilemmas

Research integrity is the responsibility of the entire research community (researchers, publishers, funding agencies, etc.). During this workshop, Stefanie will give you hands-on advice based on real-life examples in science. Cases such as “How do you feel about exchanging co-authorship”, “What do you do when your private funder asks you to write bolder statements than your research results allow?”, “Is it ok to leave out outliers?” and other dilemmas in science will be discussed during the seminar. Additionally, Stefanie will link to codes of conduct and give tips and tricks on actions to take in an environment where integrity is one of the guiding principles.

Lecturers: Ms. Esther De Smet, Ghent University & Ms. Stefanie Van der Burght, Ghent University

Job corner event

Don't miss the opportunity to talk to some of our sponsors and find out about some job offers or their company in general at the first ever "Job corner event" organized at a YES meeting. The job corner event is scheduled for **Wednesday 06th of February** mainly in the agora (some part will be organized in Auditorium E2) **from 16h00 – 19h00**.

Visit one of the participating companies at their booth in the agora and get into touch with some representatives or find general informative material. Next to that, representatives are given the opportunity to present their company/programs during platform presentations in Auditorium E2 as of 17h00.

We will provide snacks and drinks to create a relaxed atmosphere and facilitate networking between students and company representatives.

Don't be shy and approach the company representatives/booths. People will be happy to tell you more about their company, work life, etc. Make sure you benefit from this unique opportunity and possibly find a future employer.

Code of conduct

The Society of Environmental Toxicology and Chemistry (SETAC) provides open, safe forums for the purpose of exchanging ideas and information on the study, analysis, and solution of environmental problems, the management and regulation of natural resources, promotion of scientific research, and the development of strong environmental education.

Members of SETAC are expected to adhere to the highest standards of integrity and professionalism. To ensure a strong and successful organization, SETAC activities require honesty and equity and should reflect well on the Society. In the spirit of promoting Environmental Quality Through Science®, members should strive to be good stewards of environmental resources, and effective and objective contributors to the environmental discussion globally and locally. Professional behavior and integrity are expected of every attendee (members and non-members alike) of SETAC meetings, workshops and activities and all authors of material in SETAC journals, books, or other publications.

Explicit guidance and expectations can be found in the Code of Conduct, the Code of Ethics, and our Publishing Policies.

Code of Conduct

Each member and all persons participating in SETAC meetings and activities are bound by this Code of Conduct and should:

- Avoid inappropriate and discriminatory actions. The diversity of human cultures, races, religions, ethnicities, nationalities, sexual orientations, gender expressions, gender identities, marital statuses, political affiliations, visible and unseen disabilities, employers, levels of employment, and educational backgrounds bring unique perspectives to our organization. Discrimination based on any of these, or other less apparent differences, will not be tolerated; show respect to colleagues, staff, and meeting vendors.
- Be professional. Refrain from using insulting, harassing, or otherwise offensive language in SETAC interactions. Disruptive, harassing, or inappropriate behavior towards other scientists, meeting attendees, staff, or vendors will not be tolerated.
- Conduct themselves responsibly, objectively, and with integrity (see Code of Ethics), in an objective, lawful manner.

- Refrain from representing themselves as spokespersons for SETAC without the express authorization by the Global Executive Director of SETAC, the SWC President or an appropriate SWC delegate.
- Respect personal boundaries. Boundaries set by others must be observed. Harassment of any kind, including unwelcome sexual advances and requests for sexual favors, sexually graphic statements, or any other verbal or physical abuse will not be tolerated.

Reporting Harassment or other violations

Individuals who become aware of breaches of this SETAC Code of Conduct and its practices are encouraged to communicate potential violations to the SETAC Global Executive Director, the President of SETAC, or an appropriate SWC delegate, who will evaluate the misconduct and determine appropriate actions. If an individual experiences or witnesses harassment at a SETAC conference, workshop, or meeting, they should contact a SETAC staff member at the registration desk, or use a venue phone and ask for security if they feel unsafe. All complaints will be treated seriously and responded to promptly.

- Complainants will not be expected to discuss the incident with the offending party. Their confidentiality will be maintained to the extent that it does not compromise the rights of others.
- An appointed SETAC staff member will discuss the details first with the individual filing the complaint, then with the alleged offender; seek counsel if the appropriate course of action is unclear; and report findings to the SETAC Executive Director.
- The individual filing the complaint will be consulted prior to any action.
- SETAC reserves the right to remove an individual from the event without warning or refund, prohibit attendance at future SETAC meetings, workshops, or other SETAC sponsored events, and notify the individual's employer.
- Retaliation for reporting harassment is also a violation of this policy, as is reporting an incident in bad faith.

1

Toxicological effects in different stages of zebrafish after direct and trophic exposures to microplastics collected from two Guadeloupe beaches

B. Cormier, University of Örebro; S. Zapata, University of Bordeaux / EPOC; M. Cabar, IFREMER / Laboratoire Ressources Halieutiques; C. Clérandeau, University of Bordeaux / EPOC UMR; F. Dubocq, MTM Research centre Örebro University; f. lagarde, Institute of molecules and materials of Le Mans / Institute of Materials and Molecules of Le Mans IMMM UMR CNRS; S. Lemoine, Université des Antilles; B. Morin, University of Bordeaux / EPOC; K. Van Arkel, Race for Water; M. Bégout, IFREMER / Laboratoire de Ressources Halieutiques de La Rochelle; S. Keiter, Orebro University / MTM Research centre; J. Cachot, University of Bordeaux / EPOC; X. Cousin, IFREMER / Laboratoire de Ressources Halieutiques de La Rochelle

In the environment, plastics are degraded in microplastics (MPs; particles smaller than 5 mm in size). The growing production of plastics leads to a significant increase in MPs in aquatic ecosystems. MPs represent a threat to coastal environments due to their physical properties and capacity to adsorb persistent organic pollutants (POPs). However, toxicity of MPs for wildlife is still poorly understood. Therefore, objectives of the present study were to investigate the toxicity of environmental MPs. Plastic samples were collected from two Guadeloupian beaches, one chosen as a reference beach and one as a highly contaminated beach (fishing prohibition zone). Collected debris were grounded and sieved (53 µm and 100 µm) to assess their toxicity on different stages of zebrafish (*Danio rerio*). Pollutants were analysed on particles through GC-MS, and type of polymers were identified using FTIR spectroscopy. Embryo-larval stages (non-protected stages according to regulation) of zebrafish were exposed up to 5 dpf to MPs via direct exposure. Acute toxicity (survival, hatching rate), biometry, genotoxicity, *in vivo* EROD activity, and locomotor activity were investigated to characterize the potential toxicity of MPs. Zebrafish were exposed to the same MPs by long-term trophic exposure, with MPs distributed at 1% of diet starting at 1 month and for 5 months. Molecular (oxidative stress, gene expression, endocrine status) and individual (survival, growth, reproduction, behaviour) variables have been monitored throughout exposure. Investigation of survival, growth and behaviour were also performed on non-exposed F1 generation. No effects were observed using zebrafish embryos and larvae exposed for 5 dpf. For the chronic exposure of juveniles, female weight exposed to MPs from both beaches decreased compared to control and the reproductive success of fish exposed to MPs from the contaminated beach was reduced compared to control and reference beach. The F1 generation showed hyperactivity of larvae when parents were exposed to MPs from the contaminated beach. These results suggest that a chronic exposure is required to highlight toxicity of MPs and associated pollutants.

Acknowledgement: This study has been carried out in the framework of JPI Oceans project EPHEMARE, ANR-15-JOCE-0002, the Cluster of Excellence IdEx from Bordeaux University and Formas - Swedish Research Council for Environment, Agricultural Sciences.

2

Microplastic - a vector for anthropogenic contaminants in freshwater ecosystems?

L. Hanslik, COS University of Heidelberg / Aquatic Ecology and Toxicology; S. Huppertsberg, Hochschule Fresenius University of Applied Sciences / Chemistry, Biology & Pharmacy; T. Braunbeck, COS University of Heidelberg / Aquatic Ecology and Toxicology

The ubiquitous presence of microplastic in freshwater ecosystems leads to an increasing number of studies dealing with toxic effects of these anthropogenic particles. Latest data are conflicting concerning potential adverse effects of microplastic particles on vertebrate model organisms. The present study investigates the effects of pristine microplastic particles and a model polycyclic aromatic hydrocarbon, on liver enzyme activities of CYP1A in zebrafish larvae (*Danio rerio*) by measuring the ethoxyresorufin-O-deethylase (EROD) activity *in-vivo*. Therefore, different types of microplastic particles were spiked with the benzo[k]fluoranthene (BkF), incubated with *Danio* larvae (96hpf) and alterations of EROD activity were detected. Microplastic was spiked with BkF, filtered, washed and resuspended. Cryogenically grinded polystyrene and poly(methyl)methacrylate (PMMA,

3

Ingestion of irregularly shaped microplastics by the freshwater oligochaete Lumbriculus variegatus

T. Piana, Goethe University Frankfurt Main; K. Klein, Goethe University Frankfurt Main / Aquatic Ecotoxicology; J. Oehlmann, Johann Wolfgang Goethe-Universitat Frankfurt / Aquatic Ecotoxicology

Since the start of mass production in the early 1960s, synthetic polymers, i.e. plastics, have been introduced in great quantities into freshwater and marine systems worldwide. These polymers have since been discovered in a variety of environmental media, including wastewater, fresh and marine waters, sediments and soil. On their way to the ocean, plastic materials are subject to fragmentation, which has led to a plethora of small plastic particles – termed microplastics (MPs). Lately, the fate and effects of MPs on aquatic invertebrates have been increasingly investigated. The majority of studies focus on new and pristine beads with a uniform shape and size distribution. Such laboratory experiments have limited environmental relevance due to higher abundances of irregularly shaped MPs in aquatic systems. Furthermore, there is still a lack of information on how the presence of natural particles like food, suspended matter or sediment particles influences the ingestion of MPs by aquatic invertebrates with no findings being available thus far for the sediment dwelling oligochaete *Lumbriculus variegatus*. To quantify the ingestion of unevenly shaped MPs by this species, an ingestion study was conducted with polyethylene terephthalate and polylactide fragments (PLA) (-1) as well as with and without natural food particles (α-cellulose). The latter variable was used to analyse the selectivity in food ingestion behaviour. The results show that all individuals readily ingest MPs, even at an environmentally relevant concentration (3 P mL^{-1}). Consequently, possible effects of MP on *L. variegatus* following ingestion should be considered as one focus of future studies. It is also shown that MP ingestion increases significantly with increasing plastic concentration in the ambient medium. No significant preference between polymer types is found. The presence of α-cellulose does not change ingestion of MP unambiguously. In order to determine to what extent MP affects mortality, reproduction and growth, two chronic follow-up tests will be conducted. First, irregularly shaped PLA will be spiked and homogenously distributed into the sediment, becoming available for the ingestion (1st experiment). Thereupon *L. variegatus* will be indirectly exposed to PLA, which will be withheld separately in aquatic media (2nd experiment). Ultimately particulate and/or chemical effects could be determined.

4

Plastic conditioning and the effect on chemical toxicity in Daphnia magna.

K. Reilly, The University of Birmingham; J. Sadler, The University of Birmingham / Department of Geography and Environmental Science; I. Lynch, University of Birmingham / Geography Earth Environmental Science

Microplastics are a widespread pollutant of concern that are found

ubiquitously across the globe. They have received increasing scientific, societal and media attention and support is growing from both industry and individuals for policy and behavioural changes. This research explores the potential impacts of polyethylene on key freshwater indicator species, *Daphnia magna* (water fleas), when combined with some chemicals of concern (DEET, Triclosan and Diclofenac) that are prevalent in the environment. This research compares toxicity under different exposure conditions to increase our understanding of the potential combined toxicity effects under realistic (competitive) exposure conditions. Corona formation on plastic particles changes the surface characteristics which can affect subsequent biological and chemical interactions. We compared the effect that plastic conditioned under different chemical and biological scenarios can have on the interaction with co-present pollutants, and the combined effect on *Daphnia magna*. Chemicals were selected from different groups to explore a range of potential effects and included insecticides (DEET), antibacterial (Triclosan) and pharmaceutical (Diclofenac). The study was broken into 3 main pathways to access any significant difference between the effects due to the order and combination of exposures; (1) Quantifying the amount of chemical that is incorporated into the protein corona, by forming a corona in *Daphnia-conditioned* medium prior to mixing with chemicals, and assessing the transfer rate of the chemical (leading to an increase in the chemical load on the plastic). (2) Evaluating the protective effect of the protein corona by pre-coating the plastics with the chemical and assessing the subsequent chemical displacement as a result of biological conditioning (leading to a reduction in the chemical load on the plastic). (3) Determine the effect of competitive binding by co-exposing the plastics to the mixture of chemicals and *Daphnia-conditioned* medium, and quantifying the transfer rate of proteins and chemicals. We assessed the effects using a range of standard OECD tests and end points. The effect that competitive binding of biomolecules naturally secreted by Daphnia have on both adsorption and desorption of the target chemicals on the plastic's surface was a key element of this study, to ascertain how chemically contaminated microplastics may be part of a more complex pollution issue in the environment.

5

Assessing relevant microplastic sources for freshwater ecosystems in semi-arid areas

T.C. Schell, IMDEA Water Institute / Ecotoxicology; R. Hurley, NIVA - Norwegian Institute for Water Research; A. Rico, IMDEA Water Institute / Aquatic Ecotoxicology; L. Nizzetto, Norwegian Institute for Water Research NIVA; M. Vighi, IMDEA Water Institute / Earth and Environmental Sciences

Wastewater treatment plants (WWTPs) have been identified as major pathways for microplastics (MPs) into the aquatic environment. MPs not retained by WWTPs are directly discharged through effluents, whereas the majority (>90%) is concentrated into the sludge phase during wastewater treatment. Water runoff, after application of sewage sludge to agricultural fields, may consequently serve as an additional source of surface water contamination by MPs. Therefore, the aim of this study was to assess the relevance of both potential MP sources (i.e. treated wastewater and runoff from agricultural fields). A study was conducted in the Henares River watershed (central Spain), an area characterised by a semi-arid climate with low rainfall. Influent, effluent and sludge of the main five WWTPs in the watershed were sampled. River water, as well as sediment samples, were taken at three differently impacted sites: i) low human impact; ii) high agricultural impact; and iii) high mixed impact (urban, agricultural and industrial). River water and wastewater were sampled by filtering sufficient amounts of water through plankton nets of different mesh size (300, 150, 55 and 20 µm). Furthermore, three different plots (2 m^2) were set up for runoff collection: (i) soil never treated with sludge (control), (ii) soil treated with sludge in the past (in 2013), and (iii) soil treated with sludge at the start of the experiment (in November 2017). Runoff was collected over a period of one year using modified Pinson collectors. Additionally, soil samples were taken from each plot at the start and end of the experiment. After extracting the content of MPs from all samples, MPs were identified visually and characterised chemically using FTIR. Preliminary results (based on MPs > 150 µm) show that the retention potential varied not only greatly between WWTPs but also between sampling events at the same WWTP (58-99%). On average 170 MPs/m^3 were emitted to the receiving river with treated wastewater. MPs were mobilized by runoff from all plots but higher concentrations were observed in the runoff water from the recently treated plot (November 2017). Fragments were the dominant MP shape and polyethylene the dominant polymer type in treated wastewater and runoff. Although runoff mobilized more MPs per m^3 compared to wastewater effluent, in this particular case-study treated wastewater has been identified as the most important MPs source for aquatic environments.

6

Microplastic as pollutant vector: Influence of non-linear sorption and coupled mass transfer

S. Seidensticker, Eberhard Karls Universität Tübingen / Center for Applied Geoscience; C. Zarfl, University of Tuebingen / Center for Applied Geoscience; P. Grathwohl, Uni Tübingen / Center for Applied Geoscience

As microplastic particles are ubiquitously detected in the environment and increasingly discussed in science and media, a realistic assessment of their potential to transport contaminants is needed. For that purpose we performed batch experiments with typical hydrophobic wastewater contaminants and different types of particles, varying in size, shape, and material in order measure sorption isotherms and kinetics. While for polyethylene linear sorption isotherms, clearly indicating partitioning, were observed, polyamide and polystyrene showed nonlinear sorption isotherms which were fitted by the Freundlich and Polanyi-Dubinin-Manes isotherms, respectively. Kinetic models, however, are usually based on linear isotherms without taking non-linear patterns into account. Kinetics was described as a combination of two different diffusive fluxes: external boundary layer diffusion internal mass transfer limited by intraparticle diffusion. Which of these mechanisms controls the kinetics depends on various factors, such as sorption coefficients, particle size, diffusion coefficients, and time. For linear sorption isotherms we use a coupled mass-transfer model to consider both, external and internal mass transfer based on an analytical solution via Laplace transformation. For nonlinear sorption a numerical model was developed which allow to use Freundlich or Polanyi-Manes sorption isotherms. To properly describe the transport process within the plastic particle, the particle needs to be spatially discretized which can be achieved by subdividing it into different cells. The diffusive fluxes within the plastic particle are specified as fluxes over the diffusion effective surface areas of the different cells. Furthermore, an additional cell representing the flux in the plastic/water interface is introduced to represent the boundary layer. The numerical code was successfully verified by comparison with the analytical solution for PE. Applying the model to other types of particles such as PA and PS allowed to successfully describe the measured kinetics and reasonable values for mass transfer coefficients and intraparticle diffusion coefficients were obtained. Subsequently, this coefficients were used to estimate transport distances of particle-bound contaminants for the plastics investigated. For PA and PS nonlinear sorption leads to significantly different transport ranges and a numerical model is necessary to properly assess the vector function of microplastic particles.

7

Functionalization of magnetite nanoparticles with alkoxysilanes and humics: electrokinetic and ecotoxicological measurements

T. Kuznetsova, L. Kuliabko, Moscow Aviation Institute; P. Uchanov, Severtsov Institute of Ecology and Evolution; V. Terekhova, Lomonosov Moscow State University; K. Kydralieva, Moscow Aviation Institute

The surface of the particle remains the primary interface through which the nanoparticles (NPs) interacts with its surroundings, and precise control of NPs surface chemistry is essential in controlling the biofate and transport of engineered NPs. This paper addresses the synthesis and characterization of Fe_3O_4NPs grafted with two different alkoxysilanes: tetraethoxysilane (T) and 3-aminopropyl-triethoxysilane (A) and/or humic acids (HA). The surface modification of NPs was carried out with alkoxysilanes via silylation reaction and with HA via coprecipitation. The higher plant - whitemustard *Sinapis alba*L.,green algae *Scenedesmus quadricauda*(Turb.) Brev., and infusorians *P?ramecium caudatum*were were used as test organisms for bioactivity evaluation. The XRD pattern for all samples showed the presence of the inverse spinel structure, corresponding to either magnetite phase. The presence of broad and intense peaks confirmed the formation of crystalline NPs. The average particle size was approximately 10 nm. The Fourier transform infrared spectroscopy analysis showed the characteristic absorption bands for the Fe–O bond, the Si–O–H and Si–O–Si groups and N–H asymmetric stretching of the amine H-bonds, indicating a possible NH_2interaction toward the NPs surface. The sequential layer-by-layer grafting of precursors onto the NPs surface demonstrated an logical increase in the hydrodynamic diameter (measured by dynamic light scattering) in the row: Fe_3O_4/TEOS < Fe_3O_4/TEOS/APTES < Fe_3O_4/TEOS/APTES/HA. In addition to hydrodynamic diameter measurements, DLS was used to determine the polydispersity index (PDI) of a dispersion. Higher PDI values were obtained for the silica grafted NPs in compare with NPs coated with HA. Zeta potential for silica grafted NPs varied considerably with layering from -20 mV (Fe_3O_4/TEOS) to -0.6 mV (Fe_3O_4/TEOS/APTES), which correlates with surface charge provided by the surface amino group of APTES. For Fe_3O_4 coated by HA zeta-potential increased from 15 mV for bare $Fe_3O_4$to -40 mV for Fe_3O_4/HA. The bioactivity of bare and functionalized NPs by silica and/or HA with respect to test-organisms demonstrated higher toxicity of Fe_3O_4/TEOS/APTES/HA in compare with Fe_3O_4/HA. Future studies will have to be conducted to clarify correlation between NPs fictionalization type, the colloid parameters and bioresponses.

*Acknowledgement.*This research has been financed by the Russian Foundation for Basic Research (*#18-33-01270/18)*.

8

Mobility and transfer of rare earth elements from soil to plants by arbuscular mycorrhizal fungi

R. Hu, Laboratoire Interdisciplinaire des Environnements Continentaux (LIEC) UMR 7360 CNRS; A. DE JUNET, T. BEGUIRISTAIN, C. LEYVAL, Universite de Lorraine
HU Ruoyu*, DE JUNET Alexis, BEGUIRISTAIN Thierry, LEYVAL Corinne, Université de Lorraine, CNRS, LIEC, F-54000, Nancy, France *ruoyu.hu@univ-lorraine.fr Rare earth elements (REE) are a group of elements composed of 17 elements which have been widely used in different industries such as automobiles, digital products, fertilizers due to their unique physical and chemical properties. However, the fate and the transfer of REE in terrestrial environment are poorly known (Gonzalez *et al.*, 2014; Carpenter *et al*., 2015). Phytotoxicity was observed in REE exploited areas and industrial regions. In order to control metallic contaminations, different rehabilitation methods have been studied. Arbuscular mycorrhizal (AM) fungi have been reported in previous research to have a beneficial role on plant growth in stressed environments, to reduce metallic trace element toxicity to plants and therefore to be interesting for biorehabilitation, especially in metallic contaminated soils (Weissenhorn *et al.*, 1994). This PhD work focuses on the mobility of REE from soil to plants with the influence of AM fungi and the toxic effects of REE to plants and fungi in different soils. Toxic effect experiments, adsorption kinetic experiments with AM fungi inoculated were performed in different soils with Samarium (Sm) as model REE. Further experiments with radioactive Sm probing (^{151}Sm) will allow following the transfer of this REE from soil to plant through the fungus hyphae, along with NanoSIMS technique which allows to precise the localization and the availability in the rhizosphere. These experiments will provide a better knowledge of the role of AM fungi in REE transfer to plants in polluted soils. **Reference:** Carpenter, D. *et al.* (2015) 'Uptake and effects of six rare earth elements (REEs) on selected native and crop species growing in contaminated soils', *PLoS ONE*, 10(6), pp. 1–21. doi: 10.1371/journal.pone.0129936. Gonzalez, V. *et al.* (2014) 'Environmental fate and ecotoxicity of lanthanides : Are they a uniform group beyond chemistry ?', *Environment International*. Elsevier Ltd, 71, pp. 148–157. doi: 10.1016/j.envint.2014.06.019. Weissenhorn, I. *et al.* (1994) 'Differential tolerance to Cd and Zn of arbuscular mycorrhizal (AM) fungal spores isolated from heavy metal-polluted and unpolluted soils', *Plant and Soil*, 167, pp. 189–196.

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Toxicity of imidacloprid to five different species of soil invertebrates

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Since 2013, imidacloprid has its use restricted within the European Union, due to its toxicity to bees. It is also known to be toxic to aquatic invertebrates, but there is a gap on the knowledge concerning its toxicity towards soil invertebrates. Aiming to bridge this gap, this study determined the toxcity of imidacloprid to earthworms and springtails targeting three questions: *(i)* Is there a difference in sensitivity between the studied taxonomic groups (Anellida and Arthropoda)?; *(ii)* Is there a difference in toxicity towards the different endpoints measured (survival and reproduction) when comparing the two groups of organisms? *(iii)* Is there a difference in the toxicity towards organisms having different modes of reproduction? Ecotoxicological tests following OECD guidelines 232 and 222 (with some adjustments) were performed in order to assess the toxicity of imidacloprid to the springtails *Folsomia candida, Sinella curviseta, Folsomia fimetaria, Heteromurus nitidus* and the earhworm *Eisenia andrei* in natural standard Lufa 2.2 soil. Imidacloprid was equally toxic to the endpoint survival, regardless the taxonomic group, with LC_{50}·s ranging between 0.5 (*F. fimetaria* and *F. candida*) to 1.55 mg/kg dry soil (*H. nitidus*). An exception was *S. curviseta*, which did not show any mortality at the highest concentration tested (30 mg/kg dry soil). *F. fimetaria* and *S. curviseta* were the most sensitive ones concerning reproduction, with EC_{50}·s of 0.14 and 0.17 mg/kg dry soil respectively, but all species were almost as sensitive, regardless the mode of reproduction, with EC_{50}·s ranging between 0.14 to 0.46 mg/kg dry soil. Based on recommended apllication rates, we calculated the PEC of imidacloprid to be 0.03 mg/kg in the top 5 cm soil layer. In earlier laboratory toxicity tests we found a DT_{50} of ~125 days (Lufa 2.2 soil). The application interval sugested for the formulation Confidor is ~7 days, so after 8 applications in a year, the concentration could increase up to ~0.13 mg/kg. This means that the PEC is already within the range of the EC_{10} for effect on the reproduction of *F. candida*, *S. curviseta* and *F. fimetaria* (0.09-0.12 mg/kg dry soil). This suggests that imidacloprid may affect the ecosystem services these species provide, such as the decomposition of organic matter.

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Do we use plant protection products correctly? Effect of agrochemicals on adult solitary bee, Osmia bicornis

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Insect pollinators decline worldwide over the last decades due to agriculture intensification and widespread use of pesticides. Because of the growing demand for food, it may not be possible to stop using pesticides at the moment. Therefore, we need to make every effort to ensure that they are used in a way that do not jeopardize pollinator populations. Bees are important economically and ecologically, and the solitary bee *Osmia bicornis* is considered a good candidate for risk assessment. In the present study, we tested three insecticide formulations, namely Dursban 480 EC containing the organophosphate chlorpyriphos, Sherpa 100 EC containing the pyrethroid cypermethrin, and Mospilan 20 SP with the neonicotinoid acetamiprid, for their effects on survival of female adult *O.bicornis* through three different routes of exposure. During oral exposure, in which bees were fed *ad libitum* with insecticide-contaminated 33% sucrose solution, a very high toxicity was observed for Dursban: the 96-h LC_{50} expressed relative to recommended concentrations for field application (RAC) was 0.004 (95% CI 0.0020-0.0071). The remaining two insecticides were less toxic, with 96-h LC_{50} for Sherpa 0.6 RAC (CI 0.49-0.80) and for Mospilan 0.4 RAC (CI 0.33-0.50). In topical exposure (1 µl of insecticide solution applied directly on bee pronotum), Dursban again showed the highest toxicity, with 96-h LC_{50} 0.3 RAC (CI 0.25-0.45). The 96-h LC_{50} for Sherpa was 18.1 RAC (CI 14.59-24.72) and for Mospilan 27.3 RAC (CI 20.87-40.79). In the experiment with bees exposed to insecticide-sprayed flowers, high mortality of control bees was observed repeatedly using two different flower species and different batches of bees, making results of this experiment hard to interpret in terms of insecticide toxicity. Regardless of control mortality, >50% bees'mortality was observed for Dursban within 24 h when applied at a rate 25 times lower than the recommended application rate (RAR). On the other hand, a reverse dose-dependent mortality was observed for Sherpa, the plausible explanation being the repellent action of the formulation or cypermethrin itself. Overall, the results show that irrespective of exposure route at least some insecticide formulations may cause unacceptable effects to pollinators even when applied according to recommendations, indicating the urgent need for revising current pesticide usage regulations. This study was supported by National Science Centre, Poland (2015/19/B/NZ8/01939).

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Quantification of concentration and time resolved effects, towards an Adverse Outcome Pathway: Toxicokinetics in Enchytraeus crypticus

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The Adverse Outcome Pathway (AOP) concept was proposed as a tool for chemical risk assessment in 2010. The determination of the molecular initiating events within an AOP is challenging, and depends on various factors, e.g. chemical-biomolecule interactions, exposure concentrations and also on toxicokinetics and toxicodynamics. The aim of the study is to investigate the toxicokinetics using the soil invertebrate *Enchytraeus crypticus* (Oligochaeta, Enchytraeidae). To understand the toxicokinetics of a chemical, bioaccumulation tests were performed in which the animals were exposed to soil spiked with $CuCl_2$, $CdCl_2$ and $CrCl_3$. Exposure consisted of 14 days for uptake followed by 14 days in clean soil. During this time, animal and soil samples were collected at several sampling times, following the OECD guideline recommendations. This will enable a better understanding of the time point at which the chemical reaches its initial target molecule. This helps addressing the question of molecular initiating events, for which the toxicokinetic behavior of a chemical is essential. Currently, chemical analysis of animal, soil and pore-water samples are ongoing, after which data analysis will follow. This is part of a larger project aiming to fill in information at additional levels towards an understanding of the mechanisms and with a strong focus on the time series sampling and observations, a current gap.

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Acute and chronic toxicity of environmentally relevant pesticide concentrations to early developmental stages of European Anura

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Amphibians are declining worldwide at alarming rates. Pesticides have been identified as one of the major reasons for these declines. Most studies examining the effects of pesticides on amphibians are conducted in simplified aquatic laboratory set-ups with only a few selected species. However, since most pesticides in the environment are present in mixtures, synergistic effects on amphibians cannot be excluded after a long-term exposure in a natural scenario. The aim of the present study was to investigate the effects of a realistic exposure with multiple pesticides on the early aquatic and terrestrial development of *Rana temporaria* and *Bufo bufo* in a combined semi-field and laboratory study. In spring 2018, tadpoles of an uncontaminated pond were placed in enclosures in eight ponds of different pesticide contamination in the viticultural area around Landau (Rhineland-Palatinate) in southwest Germany. Individuals were removed weekly to determine sublethal endpoints in terms of mass, length, behavioral abnormality, enzymatic stress response and time to metamorphosis (TTM). After metamorphosis, the juvenile *R. temporaria* were dermally exposed to soil contaminated with realistic field rates of the viticultural pesticides Folpan® 80 WDG and Folpan® 500 SC (a.i. folpet) as well as Taifun® forte (a.i. glyphosate). After 48 hours, effects on the survival as well as predation on *Drosophila melanogaster* were determined. As expected, primarily water temperature affected the aquatic development in terms of mass, length and TTM. However, pesticide exposure may have an effect on the biochemical biomarkers and the behavior. The respective data are currently analyzed. No effect of the aquatic exposure background on the terrestrial sensitivity could be detected. However, the terrestrial exposure lead to mortality rates of 17-100%. Moreover, preliminary results indicate sublethal effects after the pesticide exposure. The results of this study suggest that a chronic aquatic and terrestrial pesticide exposure can have adverse effects on multiple developmental stages of amphibians. These effects can result in an increased population decline leading to a possible extinction of the population. Since pesticide exposure was conducted under realistic conditions in the field (aquatic) and laboratory (terrestrial), the findings of this study can help to estimate the risk of sequential pesticide applications in agricultural landscapes dominated by viticulture for German Anura.

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Compared investigation of chronic effects of carbamazepine and cyprodinil on Daphniidae

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Nowadays, a big challenge for our aquatic environment is the entry of biologically active substances such as pharmaceuticals in the water body. These substances may have adverse effects on aquatic organisms. One example is carbamazepine, an anticonvulsant drug. Due to its high consumption volumes and low degradation in waste water treatment plants, carbamazepine is frequently detected in water bodies. In the literature there is no consensus whether carbamazepine affects Daphniidae. Therefore, our research question was whether there is a chronic effect of carbamazepine on Daphniidae. We examined potential chronic effects of carbamazepine with three different daphnid species (*Daphnia magna, D. pulex, Ceriodaphnia dubia*). Chronic reproduction tests with *D. magna* and *D. pulex* for 21 d and with *C. dubia* for 7 d were conducted. Observed endpoints were reproduction, day of first reproduction and growth. Cyprodinil, an active ingredient in fungicides which are still in use in Europe, was chosen as a positive control substance. It is also a contaminant in aquatic ecosystems. Additionally, the sensitivity of all three species to carbamazepine and cyprodinil was investigated. In our experiments, carbamazepine did not show any effect on any of the three test species up to a concentration of 10 mg/L. In contrast cyprodinil affected all three test species. The reproduction of *D. magna* and *C. dubia* was significantly reduced at a concentration of 32 µg cyprodinil/L while the reproduction of *D. pulex* was significantly decreased at 16 µg cyprodinil/L. Furthermore, the exposure to 32 µg cyprodinil/L resulted also in a delay of the first reproduction in *D. magna* and *C. dubia*. The growth of the Daphniidae was not affected by cyprodinil in the tested concentration range. The maximum measured concentration of carbamazepine in surface water is 6 µg/L. Because the concentrations in our tests were much higher than measured environmental concentrations, no chronic effects of carbamazepine as a single substance on Daphniidae are expected in the field. Further research should address the question if carbamazepine can be a relevant stressor for Daphniidae in combination with other contaminants. In addition, our experiments with cyprodinil show that in contrast to other studies *D. pulex* was more sensitive than *C. dubia*.

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Do antidepressants impair colour change and camouflage in two juvenile marine invertebrates, Sepia officinalis and Carcinus maenas?

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Prescriptions of antidepressants are still on the rise worldwide, and their excretion may result in a potential contamination of the aquatic compartments. Indeed, antidepressant residues such as fluoxetine (Prozac©) and venlafaxine (Effexor©) are currently detected at low concentrations, from $ng.L^{-1}$ to $\mu g.L^{-1}$. Due to bioaccumulation, however, the toxicity of these micropollutants is not necessarily represented by their concentration in the water body. Furthermore, these compounds conceived to treat depressive or anxiety disorders are worrisome because they can trigger neurobiological changes through targeting the serotonergic system of non-target organisms, such as marine invertebrates. Indeed, juvenile shore crabs and cuttlefish, which are particularly vulnerable to predators, thrive in the intertidal zone and coastal water. These animals express cryptic patterns enabling them to hide from their predators by blending into their environment. The dynamic change of patterns and the intensity of colouration can be achieved very rapidly as in *S. officinalis*, or more slowly as in *C. maenas*, either being controlled nervously, or by neuropeptide hormones, respectively. Neuronal and neurohormonal control, in turn, is influenced by neurotransmitters, such as serotonin. To study the effects of antidepressants at environmental concentrations, juvenile cuttlefish and crabs were exposed during 30 days to fluoxetine alone or in mixture with venlafaxine (*i.e.* 2.5 $ng.L^{-1}$ and 5 $ng.L^{-1}$). The animals passed several behavioural tests such as predation; colour change on opposite backgrounds, on grey medium or checkerboard background; sand-digging behaviour, to evaluate their camouflage and colour change efficiency each week. Juvenile cuttlefish exposed to low concentration of antidepressants showed a decrease in predation motivation and success, and modified colour change and camouflage in certain conditions. In young crabs low concentration of antidepressants seemed to elicit cuticule brightening as rapid and transient colour change.

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Mercury transfer through the food chain of the three-spined stickleback (Gasterosteus aculeatus)

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Mercury is considered as one of the top priority chemicals by the WHO and is a pollutant of global concern due to its capacity to travel long distances through the atmosphere. Nowadays, point sources of mercury pollution in Flanders are rare but certain regions are still contaminated as consequence of historical pollution. Microbes can convert inorganic mercury to a methylated form which is biomagnified through the food chain and has strong neurotoxic properties. The actual risk of transfer of environmental mercury to biota is highly dependent on physicochemical properties of the water and sediment since they influence methylation processes and bioavailability. Profound knowledge on the matter of bioavailability remains scarce due to the complexity of mercury speciation and sensitivity of mercury analysis. This study was setup to gain a better understanding of mercury bioavailability and the transfer through the food chain of the three-spined stickleback (*Gasterosteus aculeatus*). During a preliminary field study within the Scheldt and Maas basin of Flanders, 8 stickleback populations were identified by both high and low muscle mercury content. Subsequently, water-, sediment-, macroinvertebrate- and fish samples were collected and analyzed for total mercury concentration and additional physicochemical properties (water and sediment). Biota-sediment magnification factors (BSMFs) were calculated as a proxy for mercury bioavailability for benthic macroinvertebrates. Differences between populations in terms of bioaccumulation as a consequence of dietary mercury exposure was evaluated via estimated biomagnification factors (BMFs). The total mercury load within one specific river was positively correlated with organic matter content (R= 0.77) and smaller grain sizes (R=0.52), while samples with a higher percentage of sand had less mercury (R = 0.80). Organic matter content (R=0.67), a larger clay (R=0.62) and silt (R =0.57) fraction and higher acid volatile sulfide concentration (R=0.79) in the sediment did decrease the overall bioavailability of mercury for sediment dwelling invertebrates. The BMFs of the low-contaminated populations were close to or even below 1. On the contrary the biomagnification factors of highly polluted populations ranged from 2-4. The observed differences in mercury biomagnification between distinct populations of the same species is an interesting finding and possible explanations are currently being explored.

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Daily temperature variation shapes how a pesticide increases mortality and decreases heat tolerance: contrasting effects between larvae and adults in a semi-aquatic insect

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Because of failing risk assessment and global climate change there is increasing attention for the reciprocal effects between climate change and pollutants to improve risk assessment. Two important topics have been largely ignored in this context: (i) the role of daily temperature variation (DTV) as a key component of climate change, and (ii) differences in sensitivity to climate change and pollutants between larvae and adults. We investigated whether DTV magnified the negative effects of the organophosphate pesticide chlorpyrifos (CPF) on mortality and heat tolerance and whether this effect was stronger in aquatic larvae than in terrestrial adults of the vector mosquito *Culex pipiens*. Larvae were more sensitive to CPF than adults both in terms of mortality and in reduction of heat tolerance (CTmax). Moreover, DTV only magnified the CPF-induced mortality in the larvae, supporting a higher sensitivity to DTV in aquatic life stages that encounter lower DTV than terrestrial life stages. Exposure to CPF imposed mortality reduced the heat tolerance (measured as CTmax) in both life stages, which is consistent with the TICS concept ("toxicant-induced climate change sensitivity"). This phenomenon can be explained by a mismatch between oxygen demand (that increases) and oxygen supply (that decreases) under toxicant exposure. While DTV had no direct negative effects, it magnified the toxicity of the pesticide in terms of larval mortality, which is consistent with the CITS concept ("climate-induced toxicant sensitivity"). Exposure to DTV is assumed to be energetically costly because of the higher energetic costs incurred during the warming part compared to the energetic savings during the cooling part of a DTV cycle. Subsequently, in the presence of a second stressor like CPF, the exposed larvae likely have less energy to invest in detoxification and damage repair. Moreover, DTV caused a stronger CPF-induced reduction in heat tolerance of adult females, thereby illustrating the coupling of both concepts and providing support for the reciprocal effects between climate change (here DTV) and pollutants. Our results provide evidence that these reciprocal interactions are interdependent. Taken together, our results highlight the importance of integrating DTV and life-stage specificity to improve risk assessment of pollutants under global climate change.

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Application of low-cost CO2 sensor systems as a tool for continuous uptake/emission measurements in Lemna toxicity tests

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Introduction The relation between respiration and photosynthesis reflects the exchange of CO_2 with the atmosphere in plants. Until now, only a few studies have measured whole-plant or plant-community CO_2 release/uptake directly and continuously without disturbances. Although these measurements implement methods of high accuracy, they are still cost ineffective, require complex experimental setups, and provide discrete and discontinuous output data. This work presents an application of real-time continuous monitoring of the emission and uptake rate of CO2 concentrations in Lemna toxicity test, implementing a low-cost Arduino platform-based respiratory activity measuring system (ResTox). Materials and methods Plant material Cultures of *Lemna minor* were maintained in conditions that resulted in doubling time less than 2.5 days as required by standard protocols. Experimental setup One experimental set consisted of six test chambers (including control) for each test compound and one reference chamber. In each chamber containing culturing medium 21 fronds were placed. The experiments began in when a single dose of tested compound was added to the medium. Metal treatments consisted of Hg, Cu, Cd Co, while herbicides chosen were diquat, tembotrione, and clopyralid. Concentration ranges were chosen based on preliminary tests. Measurements The experimental setup was kept in darkness for 3h, and during that time an outburst of CO_2 was recorded. During the next 3h period the lights were switched on and the CO_2 decrease was recorded.\nAll measurements were made with an Arduino platform-based respiratory activity measuring system for real-time emission/uptake CO_2 measurements (ResTox), a prototype developed and assembled by the research team. Results and discussion Measurements of CO_2 concentrations were reported as dynamic curves. The results of CO_2 measurements demonstrated that tested metals and herbicides stimulated CO_2 exchange rate at low doses, while at high doses inhibited CO_2 exchange rate, which is a typical hormetic effect. Among metals, the strongest inhibitory effect was observed in the highest concentration of Cu, while in the case of herbicides significant stimulation of CO_2 exchange flux was determined for tembotrione. Conclusion The approach presented in this work enabled evaluation of acute toxicity mechanisms using CO_2 exchange flux rate as an endpoint during phytotoxicity experiments.

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Climate change evaluation: Effects of Benzophenone-3 and temperature on gene expression and enzymatic activity of the aquatic organism Chironomus riparius

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Climate change is one of the most important problems in our decade. Improving our knowledge about it will allow minimizing the impact on the environment. The effect of climate change is illustrated by the alteration of temperature patterns that affect the different compartments of the ecosystem. Most of the aquatic species are poikilotherms so they are strongly affected by the environment temperature. On the other hand, the ultraviolet filters, UV filters, are organic and inorganic compounds used in many personal care products (PCPs) and other commercial products. Their production has increased dramatically in recent years and are classified as emergent contaminants. These types of compounds are not totally removed in the waste-water treatment plants, so they are released back to the aquatic systems. UV filters have been associated with endocrine disruption activity in vertebrates but their effects in invertebrates are still poorly understood. Chironomus riparius is a dipteran with aquatic larvae frequently used in toxicity tests. To investigate the putative influence of temperature in the response to BP-3 in this species, we have analyzed the survival of fourth instar larvae to concentrations ranging from 0.01 to 10 mg/L at two different temperatures, 18.5 °C and 23 °C. Furthermore, using retrotranscription and Real-Time PCR it has been obtained the expression profile from 4th instar larvae exposed to 0.01 and 0.1 mg/L BP-3 for 8 and 24 hours at the same temperatures. The genes analyzed are related to the detoxification mechanisms, the endocrine system, and the heat shock response. Moreover, we have studied the enzyme activity of GST, Acetylcholinesterase and Phenoloxidase at 8 and 24 hours. The results suggest the alteration of different metabolic pathways according to the time and temperature exposition. At 8 h the gene expression profile of Glutathione-S-transferase delta 6 (GSTd6), heat shock proteins (Hsp22, Hsp26), Hypoxia up-regulated protein 1 (HYOU1) and Multi-Drug Resistance Gene (MDR1) were altered. At 24h GST omega 1 (GSTo1), Hsp70 and Ecdysone Receptor (EcR) genes showed significant differences respect to the control. Finally, GST and Acetylcholinesterase activity show differences at 24h. As far as we know, this is the first study that

evaluates the effects of temperature and the BP-3 at the same time. This work has been funded by the Ministerio de Economía y Competitividad, CICYT (SPAIN), CTM2015- 64913-R.

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TO THE QUESTION ABOUT THE EVOLUTION OF THE CRIMEA LANDSCAPES IN THE HOLOSENE (ON THE EXAMPLE OF THE CAPE MARTIAN SOILS)

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The work was supported by the grant of RSF No 17-14-01120. Red products of limestone weathering in the reserve "Cape Martian", called terra-rossa, are ancient relic products of tropical humid weathering, and the soils developed on them, preserved in an untouched state, are of interest for paleoecological studies. Specific magnetic susceptibility in the soil samples was measured on field kappameter (CT-5). The isotopic composition of carbon was measured on the mass spectrometer Thermo-Finnigan Delta V Plus IRMS. Soil age was determined by radiocarbon method. The high content of organic phosphorusin Cambisols (72 to 87% of the total) at a depth of 30-40 cm may indicate the buried nature of the studied horizon.The maximum values of magnetic susceptibility are confined with the middle part of the profile, and it is associated with the accumulation of humus and magnetic minerals, and indicates favourable climatic conditions of the corresponding era of soil formation. The maximum content of organic phosphorus corresponds to the maximum on the magnetic susceptibility curve; the obtained data correlate with the distribution of humic acids and their optical density curves. The synchronicity of maxima on the curves of soil group composition and magnetic susceptibility values in the upper part of the profile is modern, and in the middle – relic, diagnosing the existence of a period with high biological activity in the middle of the Holocene. The most of plants, according to the results of phytolith analysis were cereals.The isotopic composition was weighted down the profile in all soil sections for which δ13c values were obtained, which is a sign of increased aridity of the climate in previous eras.The proportion of plants with C-4 type of photosynthesis was calculated from the values of δ13c in soil samples. The obtained data reveal an increase in the proportion of C4 plants with depth and, accordingly, with the age of the soil and confirm the idea of the Mediterranean genesis of the Crimean soils, since C4 plants in Europe are distributed mainly in the Mediterranean. The radiocarbon age of Cambisol was 7060 ± 260 years. This figure corresponds to the climate optimum of the Holocene. The weighting of the isotopic ratios, the presence of phytoliths of cereal plants in the middle part of the profiles of red-colored soils indicate existing of the "steppe period" of ecosystems in the climatic optimum of the Holocene and the possible shift of vertical zones up the slope.

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Current and future daily temperature fluctuations make a pesticide more toxic: contrasting effects on life history and physiology

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There is increasing concern that climate change may make organisms more sensitive to chemical pollution. Many pesticides are indeed more toxic at higher mean temperatures. Yet, we know next to nothing about the effect of another key component of climate change, the increase of daily temperature fluctuations (DTFs), on pesticide toxicity. Therefore, we tested the effect of the pesticide chlorpyrifos under different levels of DTF (constant = 0°C, low = 5°C (current maximum level) and high = 10°C (predicted maximum level under global warming)) around the same mean temperature on key life history and physiological variables of *Ischnura elegans* damselfly larvae in a common-garden experiment. At all levels of DTF, chlorpyrifos exposure was stressful: it reduced energy storage (fat content) and the activity of its target enzyme acetylcholinesterase, while it increased the activity of the detoxification enzyme cytochrome P450 monooxygenase. Notably, chlorpyrifos did not cause mortality or reduced growth rate at the constant temperature (0°C DTF), yet increased mortality 6x and reduced growth rate with 122 % at low and 111 % at high DTF. This indicates that daily short-term exposures to higher temperatures are enough to increase pesticide toxicity. Our data suggest that when 5°C DTF will become more common in the studied high-latitude populations, this will increase the toxicity of chlorpyrifos, and that a further increase from 5° DTF to 10°C DTF may not result in a further increase of pesticide toxicity. Our results highlight the biological importance of including daily temperature fluctuations in ecological risk assessment of pesticides and as an extra dimension in the climate-induced toxicant sensitivity concept.

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Prospective LCA of a biorefinery concept for the production of pharmaceuticals and bioplastics

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The move towards a bioeconomy requires to overcome the lack of biomass and to develop new processes for the production of chemicals and materials. These processes can be integrated in a biorefinery concept and provide a viable alternative production pathway for pharmaceuticals and bioplastics. The hypothesis is that an integrative biorefinery concept for the production of multiple products is more sustainable than the separate conventional production of the products. This paper presents a prospective life cycle assessment (LCA) of a novel biorefinery concept, in its early stage of development, for the production of lipopeptides and polylactid acid (PLA) from cyanobacteria. Lipopeptides are a high-value compound and of high interest for the pharmaceutical industry due to its antibacterial and antifungal activities. They have shown the potential to exhibit antimicrobial action against multi-drug resistant strains and can be used together with catheters and other medical insertional materials in order to slower the biofilm growth on the materials and thereby reducing the number of hospital infections. PLA is a high volume product and expected to be the leading bio-based and biodegradable plastic by 2021. The properties of PLA are comparable to fossil-based polymers such as polypropylene (PP), polyethylene terephthalate (PET) as well as polystyrene (PS), resulting in a wide range of possible applications. Currently, plants like corn and cassava serve as a feedstock for PLA leading to land competition with food plants as well as negative environmental impacts of land-use change and pesticide use. The biorefinery concept in this work consist of the cyanobacteria cultivation and harvest, the extraction of lipopeptides and the production of PLA. Experimental and literature data are used to compile the life cycle inventory for the biorefinery concept. Different improvement scenarios are analysed: Use of renewable energies, reduction of carbon dioxide supply, use of waste streams to feed cyanobacteria and reduction of energy demand due to up-scaled processes. The outcomes of the scenario analysis suggest that significant improvements can be achieved in the mid-term future. The prospective LCA study provides relevant information and insights to industry and political decision makers in order to assure an environmentally friendly production of pharmaceuticals and bioplastics in the future.

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Voltammetric determination of Cd(II) and Pb(II) on nafion-protected sputtered-bismuth screen-printed electrodes. Applicability to ambient water samples.

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Bismuth-based electrodes have emerged as a promising alternative for the voltammetric determination of heavy metals in environmental samples replacing the highly toxic mercury electrodes [1,2]. In addition, bismuth electrodes are easily incorporated in screen-printed platforms, allowing the construction of flexible and affordable environmental monitoring tools for decentralized analysis. In this sense, commercial Sputtered-Bismuth Screen-Printed electrodes (Bi_{SP}SPE) [3] combined with miniaturized potentiostats represent one step further to reach this aim [4]. Besides, SPE surface can be modified by coating it with colloidal nanoparticles or additives as Nafion [5,6] for improving the electrode response. In this work, we employ commercial Bi_{SP}SPE's coupled to a portable measurement system for the on-site determination of Cd(II) and Pb(II) ions in natural water samples using Square-Wave Anodic Stripping Voltammetry (SWASV). We also explore the optimal pH conditions for the measurements and protection of the working electrode surface with the Nafion additive. Our results show an improvement of the sensitivity and stability for Nafion-protected electrodes in pH = 4.4 medium and lower detection limits than comparable methods [4]. The values obtained for Pb(II) and Cd(II) agree well with those obtained by the much more costly ICP-MS technique.
Acknowledgment We acknowledge Junta de Extremadura, Spain (projects PRI IB16114 and GR18068), and the air quality surveillance network of Extremadura (REPICA), all partially financed by European Union Funds for Regional Development (FEDER). **References** [1] Wang J, Lu J. Electrochem commun. 2000;2(6):390–3. [2] Economou A. TrAC - Trends Anal Chem. 2005;24(4):334–40. [3] Sosa V, Serrano N, Ariño C, Díaz-Cruz JM, Esteban M. Talanta. 2014;119:348–52. [4] Palomo-Marín MR, Rueda-Holgado F, , Pinilla-Gil E. Talanta. 2017;175:313–7. [5] Zhao G, Yin Y, Wang H, Liu G, Wang Z. Electrochim Acta. 2016.10.059 [6] Fu L, Li X, Yu J, Ye J. Electroanalysis. 2013;25(2):567–72.

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Biodigestion of Fresh cassava waste water: Maximizing resources from wastes, reducing Green House Gas emission, need for environmental sustainability

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Introduction: Waste management and healthy disposal has been a great challenge in developing countries. Agricultural and domestic wastes are improperly disposed contributing seriously to environmental pollution. Fresh cassava wastewater is one of such, disposed into farmlands and water ways. Though biodegradable, its cyanic acid content and other volatile organic compounds (VOCs) drastically reduce soil pH rendering farmlands unproductive. Most gases given off especially, CO_2 contributes to climate change as greenhouse gases. Most studies investigated the biodegradation of cassava mill effluents without harnessing the usable biogas amid need for renewable energy sources. This study investigated the possibility of trapping biogas and the associated CO_2 for more productive applications. **Methodology:** A simple 5-liter capacity bioreactor constructed at the National Centre for Energy Research and Development, University of Nigeria, Nsukka was used. Cassava wastewater of 1000ml was loaded into the bioreactor and allowed to ferment for a period of 28 days at ambient temperature. The bioreactor tap was opened at four days interval to let gases into the bench gas cylinder, fresh and the fermented substrate were analysed. Total viable counts (TVC) of the participating microorganisms was determined. Persistent Organic Compound and Methane Concentration were also determined. **Results:** The fresh cassava waste had more moisture content 0.8%, crude fat 0.15%, carbohydrate 2.09%, carbon 1.09%, Crude fibre 0.5%, BOD 19.2mg/l, COD 64mg/l and HCN 2.16 than the fermented waste water. The fermented substrate showed increased ash content 0.57%, Crude protein 2.97%, Nitrogen 0.48%, and 0.12% increase in phosphorus. Serial dilution factor of 10^{-6} showed a microbial load of $5.5 \sigma 10^{8}$cfu indicating that for 1000ml volume of substrate loaded in the biodigester, 5.5×10^{11}cfu microbial population was present for fermentation. Isolation test indicated the presence of both gram-positive and gram-negative bacteria (*Proteus, Vibro, Bacillus, Staphylococcus, Escherichia* and *Salmonella*). Also, the fresh water had more of the toxic pollutants than the fermented. The gases obtained after the fermentation were CO_2 18%, CO 0.0008%, NO 3%, and CH_4 79% **Interpretation:** 28 days of anaerobic biodigestion could reduce the amount of toxic pollutants being bio-transformed to biomethane which could be captured for energy needs together with CO_2 for production of other industrially useful compounds.

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Biomass as precursor for biofuels: predicting syngas applications according to quality indices

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Introduction: Biomass has been widely assessed as an option to fossil fuels, since it may be seen as carbon-neutral feedstock [1,2]. Thermochemical methods are able to decompose carbonaceous materials into their constituent molecules, recovering the energy present in the chemical bonds [3]. These "waste-to-energy" (WtE) techniques convert the initial feedstock into energy, simultaneously reducing or eliminating its disposal. Gasification shows high efficiencies and cleaner conversion processes, producing a commercial gas (syngas) composed of CO, CO_2, H_2 and light hydrocarbons [4]. Syngas may be further utilized in the electricity market, transports sector and chemical industry [5]. Therefore, the fine-tuning of gasification operational conditions will influence the quality and calorific value of the produced syngas, which states its subsequent uses. **Methodology:** Syngas calorific content from the gasification of miscanthus, peach stone and a blend of polyethylene (PET) and vine pruning was assessed. Temperature, equivalence ratio (ER) and steam to biomass ratio (SBR) were varied, and their effects on syngas lower heating value (LHV) were observed. Further uses for the produced syngas were suggested according to the quality indices accomplished. **Results:** Table 1 shows the quality indicators for the achieved syngas, under optimized experimental conditions. **Quality Indicators H_2/CO H_2+CO (%) LHV (MJ/Nm^3)** Miscanthus 1.00 34.0 6.45 Peach stone 0.77 31.0 5.80 PET-vine pruning 0.86 79.7 10.9
Interpretation: Improved calorific contents were seen for higher temperatures, lower ER and moderate SBR values (not shown here). PET-vine pruning blend depicted the highest LHV and H_2+CO > 80%, enabling the production of fuel gas or chemicals, respectively. Miscanthus and peach stone afforded adequate syngas for the production of synthetic fuels, due to proper H_2/CO ratios.
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SSD models used for assessing interspecific competition impact on organisms' tolerance against chemical stress

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Organisms are not alone in the environment. They interact with other individuals of same or other species in different ways. Interspecific competition is an important interaction for herbaceous plants in grass strips. Such vegetated areas generally act as buffer strips against pollutant flows and are thus submitted to various chemical exposures. However, competition is rarely considered in environmental risk assessment. To address this point, we tested whether competition modifies the way plants respond to herbicide (isoproturon) toxicity in an attempt to link individual tolerance of organisms and community dynamic. Then we investigated the impact of competition on species sensitivity distribution (SSD), a widely used community-level risk assessment tool that usually considers monospecific bioassays only. To do so, we exposed during 25 days 6 herbaceous species (representing varied isoproturon tolerance and competition ability) to 6 isoproturon concentrations (0 to 1.75µM) in presence and absence of a selected competitor, *Bromus erectus* (choice based on its high resistance to isoproturon and its high competitiveness). For each condition, 8 replicates were realized. After exposures, 10 different traits corresponding to morphological, biomass and physiological responses, as well as the response profile of 50 metabolites were quantified for aerial and underground plant parts, then representing respectively soft (easy to acquire) and hard traits. The consequent dataset generated was used to model plant responses depending on isoproturon concentration and competitor presence/absence. For soft traits, dose-responses curves were built for each species, in presence and absence of competitor for each endpoint to define (1) their sensitivity, (2) their relevance to assess toxicity, (3) how competition modify points (1) and (2). We then calculated toxicity values and built SSDs with and without competitor presence in an attempt to quantify competition effects compared to competitor-free ecotoxicological data. Finally, several classical scenarios for SSD building were used to test the impact of these scenarios on the obtained SSDs.

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Framework for pesticide risk assessment in the Pampa region, Argentina

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INTRODUCTION Risk assessment allows characterizing the adverse effects that pollutants may have on aquatic organisms. It consists of three steps: (a) characterizing the exposure: modeling the concentrations of pesticides present in water bodies after typical applications to obtain the predicted environmental concentration (PEC), (b) characterizing the effect: defining critical pesticide concentrations for aquatic biota obtaining the concentration without predicted effect (PNEC) and (c) assessing the risk for aquatic biota by comparing PNEC with PEC. The general objective was to develop tools to evaluate the ecotoxicological risk for the aquatic biota of the water bodies of the Pampa region. The specific objective for the exposure characterization was (1) to choose the most influential variables in the Pampas region for the Pesticide in Water Calculator model v1.52 (PWC) from a sensitivity analysis (SA). The SA results will facilitate the future generation of scenarios for PWC. The specific objective for the effect characterization was (2) to generate an application using R to calculate the species distribution curve (SSD) and calculate the PNEC. METHODOLOGY (1)The model PWC allows to estimate environmental concentrations of pesticides in water bodies. To perform a global SA of PWC, some parameters were fixed by Morris's method and then a more exhaustive analysis was performed with the Sobol method for 2,4-D and glyphosate. (2)Free software was developed with R programming language and it has a user interface generated with the Shiny package v1.1.0. RESULTS (1)The most sensitive variables of PWC were the kd and the half-life of the pesticide in the water body. The rest of the parameters depended on the chosen pesticide: for glyphosate several of the most sensitive parameters were related to water erosion as the factors of the universal soil loss equation LS, P and C, while for 2,4-D those of surface runoff as hydrological parameters of the water flow and the curve number. In addition, hydrolysis for 2,4-D and fraction of organic carbon in the water body for glyphosate. (2)The user interface of "shinyssd" allows to compare the adjustment of the data to the log-normal, log-logistic, pareto and weibull distributions and estimate the PNEC. INTERPRETATION This studies and developments made available tools and information relevant to those who study the ecotoxicological risk assessment in the Pampa region and/or are environmental managers.

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Ecosystem modelling as a perspective tool for the ecological risk assessment of emerging contaminants: A study based on the river Po, Italy

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Significant concerns have been raised regarding the presence of per- and poly-fluoroalkyl substances (PFASs) in Northern Italy over the past decade, becoming one of the major environmental issues, requiring the estimation of the ecological risks. Deriving Predicted No-Effect Concentration (PNEC), as the safe ecological threshold for the concentration of the chemicals in the ecosystems, below which no adverse effects on ecosystem structure and functions are expected, is one of the basic steps of ecological risk assessment (ERA). It is standardized on the European level through implementation of the REACH regulation and the Water Framework Directive with its guidelines for two methodologies for deriving PNEC, assessment factor (AF) and species sensitivity distribution (SSD). Both methodologies are relying only on the evaluation of the published ecotoxicological laboratory tests, directly extrapolating them to the real ecosystems using only simplistic factors. Here, risk posed by perfluoroalkyl acids (PFAAs) in the Po river, as the largest Italian river, known to be polluted not only by PFAS, but other emerging contaminants, was assessed by deriving PNECs with a novel methodology based on the US EPA AQUATOX mechanistic ecosystem model, and comparing them with PNECs derived with commonly used AF and SSD methods. Linear Alkylbenzene Sulfonate (LAS) and triclosan were also studied to evaluate the performance of the three methodologies for chemicals whose ecotoxicology and environmental fate are well-studied. AQUATOX was used to compute PNECs in an ecologically-sound manner by considering physical, chemical, biological and ecological processes in the river, this way taking indirect (besides direct) effects of chemicals into account, such as those resulting from predator-prey interaction. Through AQUATOX, water concentrations of chemicals resulting in a non-negligible biomass loss for each modelled taxa of the Po ecosystem were assessed, connecting the biomass density of each taxa (as the model output) to a "safe" concentration (PNEC). Results revealed that neglecting the role of ecological processes when extrapolating from laboratory ecotoxicological tests to ecosystems can lead to under-protective threshold concentrations for chemicals. We concluded that, and showed how, ecosystem models can contribute to existing laboratory-based methodologies, while the use of multiple methods for deriving PNECs can help to clarify uncertainties within ERA.

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Poly-/perfluoroalkyl substances in wastewater treatment plants across Australia: Distribution, Mass load and Environmental Risks

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Abstract: Poly-/perfluoroalkyl substances (PFASs) were found ubiquitously in wastewater and biosolids from wastewater treatment plants (WWTPs) due to their persistence and multiple sources. This study measured the concentration of PFASs in the samples of influent (77), effluent (154) and biosolids (71) collected in the following day of Australian Census day (2016) from 77 WWTPs across the country. Thirteen PFASs, including perfluoroalkyl carboxylic acids (PFACs) and perfluoroalky sulfonate (PFSAs) were detected by a measurement using liquid-chromatography tandem mass-spectrometry. The wastewater samples were extracted using SPE cartridges (Strata - WAX) and biosolids were extracted by sonication and then the extracts was analyzed using liquid-chromatography tandem mass-spectrometry (LC-MS/MS). In general PFOS was the most dominant compound in the influent, effluent and biosolids with the concentrations ranging from 3.7 – 40 ng/L; 1.6 – 90 ng/L and 1.6 – 40 ng/L, respectively. The presence of 2 PFASs precursors including 6:2 fluorotelomer sulfonate (FTS) and 8:2 FTS were also observed in the influent wastewater at the concentration from < LOQ – 319 ng/L for 6:2 FTS and 3.2 – 59 ng/L for 8:2 FTS. Mass load per capita of individual and total PFASs were estimated for each catchment using the daily flow data and population in which the mass load per capita of total PFASs varied in a wide range of 8.1 – 351 µg/day/person. Correlation analysis revealed that PFAS concentrations in the influent and effluent correlated to the numbers of industrial areas and airports located within/around WWTPs catchments. Higher concentrations of short-chain PFASs in the effluent observed in almost studied WWTPs suggested that the short-chain PFAS could be formed throughout the wastewater treatment process. A discharge estimation of PFASs using the concentration of PFASs in the effluent and biosolids, effluent data flow and daily mass of biosolids provides an overview of environmental burden from PFAS in WWTPs to Australia. [Key words: Poly-/perfluoroalkyl, wastewater treatment plants, biosolids, environmental risks]

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Toxicological Assessments of Borehole Water Samples from Three Industrial Areas in Lagos State, Nigeria.

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Borehole water is a major source of safe water for drinking and domestic purposes in Nigeria. The quality of borehole water is usually affected by toxic chemicals from industrial wastes, thus posing serious health risks when consumed. This study assessed the impact of toxic chemicals on the quality of borehole water in three industrial areas in Lagos State, Nigeria. Twelve water samples were collected from six active boreholes in Isolo, Ilupeju and Eric Moore industrial areas, and analyzed for their physicochemical, heavy metal and nutrient properties using atomic absorption spectrophotometry (AAS) and other standard protocols. The water samples were further assessed for their cyto-genotoxic effects using *Allium cepa* bioassay. The results showed that the pH, lead (Pb), nickel (Ni), zinc (Zn) and sulfate (SO_4^{2-}) concentrations in all the water samples were significantly ($p < 0.05$) higher than WHO and NESREA tolerance limits for drinking water. Furthermore, the results obtained from the cyto-genotoxicity studies indicated that, compared with the control (distilled water), the water samples caused significant reduction in root growth and mitotic index, as well as induced chromosomal aberrations in root meristematic cells of the *A. cepa*. Based on these findings, this study concludes that lack of proper waste management by manufacturing companies in the industrial areas are gravely affecting the quality of borehole water, thus posing serious environmental and health risks.

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Bioconcentration and Metabolism of laurate in the freshwater amphipod Hyalella azteca

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Introduction Regulatory assessment of bioaccumulation from water is commonly based on bioconcentration factors (BCF) derived from fish flow-through tests (OECD 305). Such experiments require a lot of laboratory animals and are time-consuming and costly. An alternative test set-up for organic, neutral compounds using the freshwater amphipod *Hyalella azteca* was suggested. In this study the bioconcentration of the anion laurate in *H. azteca* was investigated to elucidate the bioaccumulation potential of the test item in comparison to published data on zebrafish. **Methodology** In this study radiolabelled 1-^{14}C sodium laurate was applied to *H. azteca* in a flow through system. Media samples were analysed via LSC and radio TLC. Tissue concentrations were determined via LSC after combustion. The results of a first BCF-study were further elucidated by extensive research on the fate of laurate. Afterwards a second BCF-test was carried out under semi-static conditions to ensure stable exposure concentrations. Methods for tissue analysis methods were adjusted to allow an accurate quantification of the test item. **Results** The calculated BCF estimate was similar to the one described in the literature for zebrafish. A range of metabolites could be identified in Hyalella samples collected at the end of the exposure period. Laurate was rapidly metabolised by *H. azteca* and incorporated in the lipid fraction. However, more than 60 % of the total radioactivity found in the amphipod tissue was not extractable but could be driven out and captured by acidification. The results suggest that also mineralised laurate was bioaccumulated in the form of bicarbonate (HCO_3-) into the calcified exoskeleton of *Hyalella azteca* consequently leading to an overestimation of tissue concentrations and BCF estimates. **Interpretation** The results show that bioaccumulation of laurate varies between *H. azteca* and zebrafish. The mechanisms involved in the bioconcentration of the anionic compound seem to be more complex and cannot be simply transferred between organisms without further research.

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Behavioral and biochemical responses of rainbow trout juveniles and European perch exposed to sublethal concentrtions of complex metal mixture: comparison analysis between response endpoints

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The aim of the present study was to investigate changes in the locomotor activity of rainbow trout (*Oconrhynchus mykiss*) as a standard species and European perch (*Perca fluviatilis*) under the short-term (2 h) impact of complex metal mixture at low exposure

concentrations based on different behavioral (average, maximum and angular velocities, movement duration and body mobility) and biochemical endpoints (blood glucose) and compare the differences in sensitivity between the test species. Fish were exposed to five nominal solutions concentration as follows: control (0 %), MIX – (Pb^{2+} – 0.014, Cu^{2+} – 0.01, Cd^{2+} – 0.0015, Ni^{2+} – 0.034, Zn^{2+} – 0.1, Cr^{6+} – 0.01 mg/L, respectively) mixture at a concentration corresponding to maximum-permissible-concentrations (MPC) accepted for the inland waters in EU (Directive 2008/105/EC), MIX5↑ (5-fold increase of each metal concentration in complex mixture), MIX10↑ (10-fold increase of each metal concentration in complex mixture) and MIX20↑ (20-fold increase of each metal concentration in complex mixture). Swimming behavior of both fish exposed to metal mixtures showed a tendency to decrease with increasing metal mixture concentration. Meaningful results of the behavioral response of *O. mykiss* to metal mixtures were determined during the first minutes of exposure indicating the rapidness of the response of fish, while *P. fluviatilis* swimming behavior through time varied insignificantly depending on different behavioral endpoints. *O. mykiss* were more sensitive to metal mixture exposure than *P. fluviatilis* fish species. Biochemical data showed, that blood glucose, as stress indicator for both test species were not sensitive to exposure of metal mixtures at sublethal concentrations. For *O. mykiss*, average and angular velocity and for *P. fluviatilis* average and maximum velocity proved to be the most appropriate and sensitive among the selected behavioral endpoints. However, the established differences in values of effective concentrations between behavioral and biochemical endpoints suggest that in rapid toxicity testing it is essential to select suitable endpoints for the evaluation of fish response efficacy to chemical substances.

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Effects of Endocrine Disruptors in Sediments of the River Luppe assessed by Biomarker and Histopathological Analysis of Freshwater Fish

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A variety of different environmental pollutants including polychlorinated biphenyls, heavy metals and endocrine disruptors (EDCs, i.e. substances which cause disorders of the hormonal system of organisms) accumulate in sediments. These substances can be remobilized e.g. due to resuspension of the sediment during flood events and, therefore, become available in high and potentially toxic concentrations for aquatic organisms. Even small concentrations of EDCs can significantly interfere with the sexual development of fish, leading to the feminization of male fish and thereby adversely affect the reproductive success of whole populations. Buchinger et al. 2013 found high estrogenic activity in *in-vitro* studies in sediment of the River Luppe, a stream nearby Leipzig. The aim of the current study was to estimate whether these sediment-bound EDCs might pose a risk for the local fish community. Several freshwater fish species (*Tinca tinca, Rutilus rutilus, Scardinius erythrophthalmus*) were sampled in early August 2017 at the River Luppe as well as the River Laucha, which had low levels of endocrine activity in the sediment according to Buchinger et al. 2013. Additionally, fish from a commercial aquaculture were included as reference. Endocrine effects were assessed by the biomarker vitellogenin (VTG) in the fish mucus and the histopathology of gonads and livers. EDC contents (e.g. 37,000 µg/kg nonylphenol; NP) and estrogenic activities were measured in sediments from the river Luppe, whereas respective values were low in the surface water from both rivers. Resuspension of sediments revealed that sediment-bound EDCs, NP and 17β-estradiol in particularly, can be remobilized from sediments leading to high water contents above defined Environmental Quality Standards. Similar NP blood concentrations in all wild fish significantly exceeded the controls. Health indices and gonadal development stages showed an overall good condition and development. A significant VTG induction was detected in male fish from the Luppe but was not associated with further effects on the organ level. Histological analyses revealed altered gonadal development in female fish from both rivers. Environmental stressors, esp. high temperatures and hypoxia, however, might have influenced these developmental changes. Effects in wild fish cannot directly be correlated with EDCs. Instead a combination of EDCs, other contaminants and stressors might disturb the endocrine system of fish in both rivers.

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Tapping as a vibrational stimulus to investigate behavioral alterations in zebrafish embryos (Danio rerio)

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Changes in behavior can be a result of neurotoxic effects after exposure to environmental pollutants. Current studies on behavioral alterations in zebrafish larvae (*Danio rerio*) focus on photomotor response with set-ups using different dark-light cycles. Studies on behavioral alterations caused by vibrational stimuli are scarce. Dark-light changes do not influence the same mechanisms in fish as vibrational stimuli do. Therefore, investigations on vibrational stress may provide additional knowledge about effects of chemicals on the behavior of zebrafish larvae and also highlight new mechanisms for neurotoxicity. The present study analyzed the locomotor response in zebrafish embryos after exposure to selected compounds using a tapping device as a vibrational stimulus. Zebrafish embryos were exposed to PFOS (perflurooctanesulfonate) and methoxychlor and incubated under semi-static conditions until 5 days post fertilization (dpf). Five concentrations were chosen for both chemicals with a 1:2 dilution series (PFOS: 0.478 mg/L – 7.65 mg/L; methoxychlor: 3.75 µg/L – 60 µg/L). The hatched zebrafish larvae were additionally stressed with 10 consecutive tappings at 4 dpf and 5 dpf. PFOS was tested under static light conditions, methoxychlor was tested under static light conditions and additionally static dark conditions. For each test set-up 3 replicates were performed; each replicate consisted of four 96-well plates. Each plate included 12 embryos per treatment group (C1- C5, negative control and solvent control). PFOS caused hyperactivity in zebrafish larvae in concentrations between 3.825 mg/L and 7.65 mg/L at 4 dpf. Furthermore, the observed hyperactivity was preliminary to unexpected high lethality between 4 and 5 dpf. For methoxychlor, tested under light conditions, hyperactivity was observed for the highest concentration (60 µg/L). Under dark conditions, a significant hyperactive effect for the lowest tested concentration (3.75 µg/L) of methoxychlor was observed as well. Since the behavior was tested for each treatment group in every set-up with 144 larvae, the recorded raw data built a stable dataset for the statistical analyzes. In conclusion, tapping represents, in addition to light-dark challenges, a beneficial method to investigate behavioral changes in zebrafish embryos caused by pollutants.

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Adverse biological effects of activated carbon dependent on particle size and test organism

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Introduction Thin-layer capping with activated carbon (AC) has been suggested as an *in situ* remediation method for contaminated sediments. A few studies have reported negative effects of AC on benthic organisms, such as weight- or lipid loss and increased mortality in laboratory studies, and a decrease of benthic species' diversity in field trials. Currently, several hypotheses relate adverse effects to nutrient sorption or AC ingestion. Our aim was to directly study these negative effects over a range of AC particle sizes using two sediment-ingesting benthic species. **Methodology** Five non-overlapping AC particle size distributions (15 to 1700 µm) were tested: three powdered AC and two granular AC. The primarily deposit feeding bivalve *Limecola balthica* and the deposit feeding polychaetae *Marenzelleria spp.* were collected from the Baltic Sea. Five and six individuals, respectively, were introduced to sediment and brackish water from a reference site in the Baltic Sea. The five AC were applied as thin layer caps at a realistic dose (600 g?m^{-2}) using five replicates and controls with no capping. Animals were exposed over 3 months and then fed a pulse of ^{14}C-labeled diatom plankton. They were permitted to feed on the diatoms for one week, then surviving animals were collected, gut purged, dry weighed, and measured for ^{14}C uptake and lipid content. **Results** The polychaetae *Marenzelleria spp*. was strongly adversely affected by all powdered AC, with reduced weight and next-to-none ^{14}C uptake compared to control. Survival was high in all treatments and lipid content was not significantly affected. Effects in granular AC did not differ from control, and animals in granular AC had a significantly higher dry weight and ^{14}C uptake than those in powdered AC. The bivalve *L. balthica* was not adversely affected by AC thin layer caps. Generally, animals exposed to non-ingestible particles sizes were not adversely affected in this study. **Interpretation** These results confirm earlier studies that have suggested adverse effects are dependent on particle size of AC and clearly demonstrates that effects are also species-dependent. We will highlight the importance of choosing an appropriate test organism, provide an overview of current hypotheses on the causes of adverse effects in sediment-ingesting species, and based on our results challenge the hypothesis of nutrient sorption to AC in the sediment.

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Impact of endocrine disruptors from sediment during a simulated flood like event on rainbow trout (Oncorhynchus mykiss)

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Floodevents become a rising threat to aquatic wildlife. Various anthropogenic micropollutants accumulate in high quantities in river sediments including endocrine disrupting chemicals (EDCs). Sediments might turn into a source for those substances e.g. during flood events. So far, little is known about to what instant flood events might result in adverse effects for aquatic wildlife caused by such remobilized substances. The main objective of the project Floodhydrotox is to estimate the effects of EDCs remobilized from sediments during flood events on fish, i.e. rainbow trout (*Oncorhynchus mykiss*). In this study rainbow trout were exposed in an annular flume to Luppe-sediment which is known of to contain high amounts of nonylphenol as well as estrone. The annular flume allows for the simulation of a flood-like event by remobilizing the sediment through a stepwise application of defined force onto the sediment (i.e., bed sheer stress). Natural sediment from the river Rhine in the area of Koblenz (Ehrenbreitstein) was used as control. 25 fish were exposed for 7 days and the shear stress was increased in 8 steps from 0.05 N/m^2 to 0.4 N/m^2. Water samples were collected during every increase stage and were used for chemical analysis to receive time-dependent resolved data about the behaviour of the main EDCs (i.e., nonylphenol and estrone) and passive samplers (ChemCatcher) were used to assess their bioavailability. Vitellogenin was measured in mucus as an initial biomarker and plasma concentration of the target EDCs was measured via LC-MS/MS. Furthermore, gene expression of selected target genes (e.g., *vtg* in liver and aromatase) will be investigated to reveal the physiological reactions caused by these compounds. Results so far showed a 100fold increase of bioavailable nonylphenol in the water column (3300 ng/L vs. 34 ng/L) and a fivefold higher plasma concentration (33 ng/L vs. 7 ng/L) in the Luppe treatment compared to the Ehrenbreitstein-control. However, no increase in vitellogenin in mucus was measured. Ongoing work will assess the relationship between the EDC concentration in the water collumn and the amount of remobilized sediment. This project is among the first investigating the impact of sediment-borne EDCs on fish, which is of great importance in context of the increasing frequency of flood events expected with climate change scenarios and the observed decline of many fish populations globally.

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Distribution of (anti-)androgenic potential in the river Wurm by Aachen (North Rhine-Westphalia, Germany)

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The contamination of surface waters by endocrine-disruptive compounds (EDCs), especially by estrogenic-active ones, is a well verified ecotoxicological problem. Nevertheless, the knowledge about the presence, distribution and possible effects by compounds mimicking androgenic activity in the environment is insufficient. Emissions of androgenic active compounds have been in part associated with effluent from wastewater treatment plants (WWTPs). The present study was taking place within the $DemO_3^{AC}$-project aimed at assessment of ecotoxicological status of the river Wurm near Aachen (North Rhine-Westphalia, Germany). It subjects to high urban and agricultural anthropogenic pressure. In order to evaluate the distribution of an (anti-)androgen-disruptive potential, water and sediment samples were taken along the river Wurm and in its tributary Haarbach up- and downstream of the local WWTPs. Additionally, in- and effluent of the WWTP as well as the content of the rainwater spillway basin were sampled in order to evaluate a possible contribution of WWTPs to the effects. Prepared water and sediment samples were extracted with a mixture of MeOH/DCM (50:50, v/v). The (anti-)androgenic potential of these environmental extracts was assessed using the *in vitro* bioassay (Anti-)AR Calux with the U2OS cell line. Androgenic activity was detected in the WWTP-influent only, being completely eliminated after conventional treatment steps.

Contrary to that, anti-androgenic activity was detected in all water samples within the range of 2,34E+04 - 6,61E+04 ng Flu-EQ/L. The reduction of the anti-androgenic activity within the conventional WWTP modus accounted for 70%. The anti-androgenic activity in the sediment samples was hundredfold higher than that in the water samples. Such distribution pattern within the river compartments cannot rule out the possible impact by remediation activities in the riverbed as well as historically inherited burdens. As solid depositions from the rainwater spillway basin concealed a tenfold higher anti-androgenic activity than this in the sediments, its contribution on an anti-androgenic activity cannot be excluded as well. This study highlighted a high accumulating potential of sediments toward pollutants with anti-androgenic activity as well as specification and sensitivity of the reporter gene activation-based cell *in vitro* bioassays for screen endocrine activity in environmental samples.

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Sublethal effects of chronic exposure to 2,4,6-tribromophenol and other degradation products of brominated flame retardants in a synthetic mixture in Daphnia magna and Caenorhabditis elegans

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Brominated flame retardants (BFR) are used worldwide in many materials to comply with fire safety requirements. Contaminations by these BFRs are considered problematic due to the molecules' persistence, bioaccumulative properties, and potential toxicities. An intermediate in the synthesis as well as the degradation of many BFRs, including the new and allegedly safer polymeric BFRs, is the compound 2,4,6-tribromophenol (TBP). Additionally, TBP is used as a pesticide against insects, fungi, and bacteria. Currently, it is the most widely produced brominated phenol. The intended and unintended release of TBP into the environment has led to its widespread detection. However, the European Chemicals Agency has reached no conclusion in an evaluation of TBP under REACH, due to the limited number of available studies. If TBP is released from degrading BFRs, it will also likely co-occur with other degradation products. Therefore, this study aimed to investigate sublethal ecotoxicological effects of TBP individually and in a synthetic mixture with three other BFR degradation products on two model organisms in chronic experiments (21d and 4d, respectively). OECD test No. 211 (*Daphnia* reproduction) and ISO 10872 (nematode growth and reproduction) were applied. Effects of individual TBP exposure were compared to the effects of the mixture to study possible synergistic, additive, or antagonistic effects of BFR degradation products occurring simultaneously. Exposure concentrations were monitored by HPLC-DAD, LC-MS and ICP-MS analysis. The EC_{50} (21d) for *Daphnia magna* reproduction of single compounds in the mixture was shown to be more than 75% lower, compared to the EC_{50} (21d) of TBP in individual exposure. This result stresses the importance of considering co-occurring substances in ecotoxicity testing. Surprisingly, TBP was shown to have significant stimulating effects on growth and reproduction of *Caenorhabditis elegans*, even in high exposure concentrations (up to 4.5 mg/L), possibly due to endocrine effects. In the mixture, these positive effects were canceled out. Again, the variability of the results of the exposure of only TBP versus its effect in a mixture is distinct. All in all, the experiments contribute to the ecotoxicological evaluation of TBP individually and of mixtures of BFR degradation products.

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Is shyness strength? Dynamic exposure affects personalities exhibited by aquatic organisms in predator-prey interactions

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The structure of environmental contaminant plumes varies across space and time due to hydrodynamic characteristics of the environment (Edwards and Moore 2014; Harrigan and Moore 2017). However, the dynamic nature of toxicant movement is not being addressed in studies that use static exposures to assess the degree of environmental risk to which aquatic organisms are subjected (Asifa et al. 2016; Karntanut and Pascoe 2002). These classic toxicity experiments use highly controlled exposure conditions creating disparate results from that of exposure conditions experienced in natural environments. These experimental designs only investigate mean response of a population of individuals and use robust endpoints such as fatality. These practices neglect the sensitive responses of individuals to toxicant introduction and individual variation in response. The resulting flawed deduction of toxicity may create an inefficient allocation of resources and remediation efforts, or erroneously classified ecosystems leading to greater environmental risk. The purpose of this study is to understand the effects of the structural characteristics (concentration, duration, and frequency) of temporally and spatially variant contaminant plumes on the personality of individuals. This experimental design is aimed to construct an accurate definition of exposure to connect to the effects of toxicants on an organism. This study used escape response of *Faxonius virilis* crayfish from the predatory odor of *Micropterus salmoides* prior to andfollowing exposure to the herbicide, atrazine. Atrazine was delivered in pulses to flow through exposure arenas for a total of 47 hours while manipulating the concentration, frequency, and duration of the herbicide pulses. Escape response of crayfish prior to exposure was used to categorize animals into bold and shy personalities. The change in escape response was analyzed and resulted in a personality-dependent altered sensitivity to the polluted environment. Individuals classified as bold showed increased sensitivity to predatory odor relative to shy animals. Bold exhibited decreased activity after exposure where no change was presented in shy individuals. Shifts in individual behavior have impacts on the population level (e.g. resource acquisition/value; interspecies competition) and the ecosystem level (e.g. food web dynamics; trophic cascades). This demonstrates the importance of sensitive measures in environmental risk assessment methods.

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Assessing effects of heavy metals on freshwater mudsnail Potamopyrgus antipodarum: A laboratory study

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Heavy metals are the most common pollutants in the water around the world. Increasing concentration of these pollutants in the aquatic environment is a serious threat to aquatic ecosystem because they are persistent, toxic, bioavailable and can biomagnify in the food chain. We modified OECD (2016) procedure and conducted a chronic (28 d) exposure of commonly detected heavy metals, copper (Cu) and zinc (Zn), and evaluated survivorship, growth, and reproduction of freshwater mudsnail *Potamopyrgus antipodarum* under laboratory conditions. This mudsnail are operculate (has operculum) and undergoes asexual reproduction by parthenogenesis and ovoviviparity (produces live embryos). Adult snails (3.5 - 4 mm), were exposed to 3 concentrations of Cu (0.002, 0.0125, and 0.025 mg/L) and Zn (0.01, 0.1 and 0.4 mg/L) at concentrations detected in freshwater around the world. Each treatment had 3 replicates. This current test is valid because there was 100 % survival in the controls for both the metals. Mortality was a sensitive endpoint in our study. We observed a significant effect on the survival of *P. antipodarum* at the topmost concentration of Cu and Zn ($p < 0.05$). But, both the metals had no negative effect on its growth (shell height) or reproduction

(embryos). However, hormesis effect on reproduction was observed at the lowest concentration of Zn (0.01 mg/L), with a significantly greater number (8.45 ± 1.09, mean ± standard error) of embryos than the control (5.75 ± 1.05, mean ± standard error) ($p < 0.05$). This result agrees with previous findings. Our study demonstrates the effect from 2 common metals on an ecologically important species, which has an important role as a detrivore and in transferring energy to higher trophic level. Overall, our study proposes to include these useful endpoints in risk assessment and in predicting the effect of heavy metals in the aquatic environment. *Keywords*: Copper; zinc, *Potamopyrgus antipodarum*; survival; growth; reproduction; hormesis

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The effect of pesticides on target communities depends on multi-trophic diversity

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Currently, the effects of pesticides on non-target communities are often evaluated on a single trophic level. In this study we merge the multi-trophic diversity into the effects of chemicals by included horizontal diversity (diversity within each trophic levels) and vertical diversity (number of trophic levels) into our experiments. We used a herbicide and an insecticide to study the effect of pesticides on target communities with varying trophic diversity. Each experiment included all combinations of three levels of vertical diversity (1, 2 and 3 trophic levels; primary producers, herbivores and predator), two levels of producer diversity (1 and 5 species), two levels of consumer diversity (1 and 4 species) and two levels of predator (0 and 1 species). In the first experiment we applied 1 µg l^{-1} of the insecticide chlorpyrifos, and in the second 100 µg l^{-1} of the herbicide linuron. Samples were taken on days 2, 4, 6,14 and 21. We used the effect sizes to quantify the impact of the pesticides (i.e., bio-volume in the treatment divided by the control). When exposed to the herbicide, increasing diversity of the primary producers decreased the impact of the herbicide. This could be attributed to functional redundancy, because the reductions of sensitive species by pesticide are compensated by an increase of tolerant species. Increasing herbivore diversity, however, increased the impact of herbicide. When present predator, the predator decreased the density of herbivores. But the primary producers are still controlled by the herbivores, the presence of a predator still increased the impact of the herbicide compared to the treatments with only primary producers. When exposed to the insecticide, increasing diversity of both primary producers and herbivores decreased the impact of herbicide, while the presence of the predator increased the impact of the insecticide. Given that multi-trophic diversity widely exist in natural systems, we call for more eco-toxicological studies which include horizontal and vertical diversity.

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Towards Improved Modeling of Pesticide Volatilization: Using Measured Soil-Air Partition Coefficients of Commercial Formulation in a Pesticide Volatilization Model

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Introduction. Volatilization can cause significant loss of pesticides from agricultural fields, leading to reduce the efficacy of the pesticide and harm to non-target ecosystems. Our research group previously developed a model to predict the cumulative volatilization losses of pesticides from agricultural fields, based on environmentally relevant partition coefficients and the mass-balance distribution of pesticides between soil, air, and water compartments.[1] Originally, we used $K_{soil\text{-}air}$ partition coefficients for pure active ingredients input values in the model. However, to better understand and predict pesticide volatilization, we need to know how partition coefficients are affected by the chemicals (e.g. solvents, wetting agents, solvents, dyes and/or other adjuvants) found in real commercial pesticide formulations. In addition, little actual data about adjuvant effects on pesticide volatilization exist in the literature. Methodology. In this project, a modified version of a fugacity meter was used to measure the $K_{soil\text{-}air}$ values of three semi-volatile pesticides (chlorpyrifos, pyrimethanil and trifluralin) as (a) pure active ingredients, (b) in typical commercial formulations, and (c) in commercial formulations with one additional commercial adjuvant, which is sold to enhance pesticide uptake and spreading. Experiments were conducted at several environmentally relevant temperatures (10-30 °C). Results.Approximately one order of magnitude of decrease in the values of log $K_{soil\text{-}air}$ in commercial formulations (i.e. $K_{soil\text{-}air,\ formulation}$) was observed with the use of commercial formulations over active ingredients. For example, the measured log $K_{soil\text{-}air}$ for pure pyrimethanil was 8.47 whereas that for pyrimethanil in its commercial formulation was 7.28. However, commercial adjuvant had minimal effect on $K_{soil\text{-}air}$ values. When the $K_{soil\text{-}air,\ formulation}$ values were used as input values in the pesticides volatilization model,[1] the cumulative percentage volatilization for 24 hours increased by up to five times compared to when using the $K_{soil\text{-}air}$ value for the active ingredient alone. This suggests that a better qualitative understanding of how adjuvants present in the commercial formulation affect pesticide-soil interaction is needed. Reference. Davie-Martin, C.L., K.J. Hageman, and Y.P. Chin, *An improved screening tool for predicting volatilization of pesticides applied to soils.* Environmental Science and Technology, 2013. **47**(2): p. 868-876.

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A Novel Multi-Species Physiologically-Based Toxicokinetic Modelling Approach in Support of Environmental Risk Assessment of Chemicals

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The production and release of chemicals by our society has been described as one of the greatest threats to the sustainability of human activities on this planet. Legislations of varying rigor have been implemented globally and seek to minimize impacts of chemicals on the environment through ecological risk assessments (ERA). The foundation of ERA are standardized toxicity data which are generated in laboratory experiments with model species. However, these species are not necessarily representative of native species of concern in an ecosystem. Furthermore, a wealth of data from non-model species is available in the scientific literature but cannot be utilized in ERA because the data were not derived in compliance with test guidelines. Therefore, approaches are needed that enable inclusion of these data, such as models, that enable transposing these datasets into a format that is useful in ERA. One class of models that facilitate extrapolation between levels of biological organization, exposure conditions, and among species are physiologically based toxicokinetic (PBTK) models. In our previous research we successfully re-parameterized a single-species PBTK model for multiple species and integrated this model into a multispecies modeling framework. In contrast to this “top-down” approach, here we present a “bottom-up” multispecies PBTK modeling framework which will be based on available data from the 221 freshwater fishes found in Canada. This approach – unlike all previous models – does not require full sets of model

parameters to define individual species fully but will rather make use of a database of all available data to describe the statistical distributions of model parameters. These distributions are then used to feed into random number generators in stochastic Monte Carlo simulations to make probabilistic cross-species toxicokinetic predictions. In addition to enabling cross-species extrapolations in ERA, our novel stochastic multispecies PBTK model provides a framework that can help address various environmentally relevant questions by providing predictions for specific taxonomic, ecological, or geographic groups of fishes. As such, our new model will potentially enable more environmentally relevant predictions using already existing data, and could ultimately lead toward more sustainable use of existing data.

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Bridging the gap across species by the means of TK-TD modelling

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In aquatic effect assessment, results from standardized laboratory experiments at constant environmental conditions are used for the derivation of relevant endpoints. These standard test organisms are kept under different 'optimal' temperatures, which might differ across species. Apparent toxicity outcomes, such as the LC_{50}s, may depend on the ambient temperature particularly in aquatic invertebrates and other ectotherms. It has been demonstrated that changes in physiological rates with different temperature regimes can be described by the Arrhenius function. We will show that this temperature dependency also applies to the rate constants of general unified threshold model of survival (GUTS) using *Daphnia magna* as a case study. We employ this approach to account for species differences in the toxic effects for 10 aquatic species and explore parameter correlations. Species differed in their effect threshold (z), which in turn was found to correlate with the volume-specific somatic maintenance rate (pM). In context with the DEB theory, pM is the major component of respiration, and thus equals the metabolic rate. The applicability of this approach for higher level effect prediction will be illustrated by using an individual-based model. The results indicate a reduction of uncertainty in higher tier effect assessments.

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The combined potential of species-traits and mechanistic effect models

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A key challenge in ecological risk assessment (ERA) is to assess the potential risk of chemicals to the wide range of species in the environment on the basis of laboratory toxicity data derived from a limited number of species. Recently, it has been proposed that the inclusion of species traits in ERA could provide a useful description of species assemblages in nature and has the potential to replace classical taxonomic approaches. Additionally, there is a growing recognition that the use of mechanistic approaches in ERA, especially quantitative models, may improve predictive and extrapolative power. An example of such quantitative mechanistic effect models are toxicokinetic (TK)- toxicodynamic (TD) models of the General unified Threshold models of Survival (GUTS) framework, which link external exposure and survival effects by describing dynamically the process of TK (uptake, biotransformation, and elimination) and TD (damage/hazard, internal recovery and thresholds). We hypothesise an amplified combined potential of GUTS models and trait-based approaches, due to the mechanistic match between species traits and GUTS parameters. We test this by performing linear regressions between i) classical sensitivity endpoints (LC50 and EC50) and species traits, and between ii) GUTS parameters and species traits. Additionally, we implemented a cross-validation step that uses predicted GUTS parameters as an input for the prediction of sensitivity endpoints. The whole analysis is done for twelve freshwater arthropods exposed to chlorpyrifos. We find that neither of the standard sensitivity values, i.e. the LC50 or EC50, showed a strong correlation with traits (option i), whilst multiple quantitative links between traits and/or trait combinations and process based GUTS model parameters could be established (option ii). Our results demonstrate the combined potential of mechanistic effect models and trait-based approaches. However, results from the cross-validation and the final prediction of sensitivity endpoints from GUTS parameters show that methods still can be improved further, e.g. by the further division into functional groups or extension of trait collections. Additionally, the model should be validated more extensively by adding other species.

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Mapping Dynamic Exposure in Artificial Stream Systems

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Aquatic ecosystems are highly variable in both space and time. Understanding what processes drive the distribution of anthropogenic chemicals within these dynamic environments requires three-dimensional geospatial information. In flowing environments, the movement and distribution of chemicals are determined by the degree of turbulent flow. Variation in the degree of turbulent flow alters the structural patchiness of toxicant plumes within a stream environment. This patchiness translates into variability in exposure pulses for organisms encountering the plume. Across locations within a stream, the processes which give rise to chemical plume structure will vary as a function of local flow characteristics. This research aims to utilize an interdisciplinary approach to more fully understand how the hydrodynamics of streams influence exposure events for aquatic organisms. More specifically, this project examines the influence of toxicant mode of entry and stream flow velocity on the spatio-temporal patterning of exposure. Two introduction treatments were evaluated: the first mimicking groundwater and the second mimicking runoff. The influence of flow regime was examined through the comparison of models constructed under three different stream flow velocities. Concentrations of a tracer molecule were recorded using an electrochemical monitoring system. From these localized, direct measurements, geographic information systems (GIS) were used to model chemical distribution throughout the stream. Variation in chemical exposure was used to construct three-dimensional toxicant "hot-spot" maps. These maps can be utilized to compare patterning of exposure in streams of different flow velocities, taking both mode of toxicant introduction and organism position in the water column (benthic, mid-water column, or surface) into consideration. Differences in the spatial and temporal patterning of exposure were apparent both within treatments (at different levels in the water column) and between treatments. These differences reflect that, at the scale of macroinvertebrates, variation in stream hydrodynamics creates variability in the frequency, duration, and magnitude of exposure events. Utilizing point measurements to more accurately characterize dynamic exposure throughout artificial streams is a first step towards understanding how flow variation impacts exposure events at the scale of organisms of interest in natural environments.

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An Exploratory Study of Smartphone-based Digital Image Analysis for the Measurement of Atmospheric Particulate Matter Levels

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Particulate matter (PM) is one of the most damaging air pollutants to human health, especially the low size, respirable PM2.5 and PM10 fractions. Therefore, monitoring PM pollution and controlling their concentration in the ambient air has become one of the main objectives of the environmental institutions (EPA, EEA, WHO). In this way, we present a novel methodology for estimation atmospheric particulate matter (PM) levels in ambient air based on colorimetric analysis of digital images of samples captured on filters, using a conventional smartphone. Different studies have used digital image analysis in determination of different elements or compounds in several types of matrices [1, 2], but no references have been found about its use in PM monitoring. The main objective of this work is the exploration of digital image analysis for the estimation of PM concentration (samples collected on filters) with the aid of a smartphone camera. The procedure starts by taking photographs of PM filters under controlled light conditions. A mobile application is then used to provide RGB parameters for interpretation and statistical analysis. The concept has been tested with samples from different locations of Extremadura region (Spain), covering a wide range of pollution and atmospheric situations. We could differentiate PM10 levels at urban and rural areas, and the system was also able to identify atmospheric effects as episodic African dust outbreaks. The estimated PM levels have been correlated with standard gravimetric analysis. The proposed methodology complements the reference methodology for the monitoring of PM levels in ambient air. **Acknowledgement** We acknowledge Junta de Extremadura (projects IB16114 and GR18068), and the Air Quality Surveillance Network of Extremadura (REPICA), all partially co-financed by the European Funds for Regional Development (FEDER). **References** [1] Iqbal, Z. and Bjorklund, R.B. Colorimetric analysis of water and sand samples performed on a mobile phone. *Talanta*. **2011**, 84, 118-1123. DOI: 10.1016/j.talanta.2011.03.016 [2] Levin, S.; Krishnan, S.; Rajkumar, S.; Halery, N and Balkunde, P. Monitoring of fluoride in water samples using a smartphone. *Sci. Tot. Environ*. **2016**, 551-552, 101-107. DOI: 10.1016/j.scitotenv.2016.01.156

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Applicability of images captured by a smartphone as digital signal source for monitoring of tropospheric ozone

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High tropospheric ozone concentrations are related with negative effects to public health and vegetation [1]. Several standard analytical techniques (e.g. UV photometry) for detecting ozone [2-4] enable accurate determination of ozone concentrations in real time, but the required instruments tend to be bulky and expensive. Recently, low-cost methods have been developed for the determination of ozone, based on its reaction with indigotrisulfonate (ITS) [1,5]. In this work, we propose an alternative low-cost procedure based on the processing of digital images of the remaining ITS after the sampling stage (chemical reaction O_3 -ITS). The images were captured using a smartphone camera and converted to RGB values using Matlab R2015a software. The reflectance value from the R channel was inversely proportional to the colour intensity of ITS with good linear correlation (R^2=0.99). The results provided by the smartphone were compared with a reference method [1], with good agreement (R^2=0.78), demonstrating the usefulness of the colorimetric sensor in real applications. Passive sampling combined with low cost sensors is a promising alternative since this strategy can provide average concentrations in multiple points. Moreover, it can help to enhance pollution assessment in developing regions, where the costs of acquiring and maintaining commercial instrumentation hinders the implementation of environmental monitoring for health and ecosystems protection. **Acknowledgment** We acknowledge Junta de Extremadura, Spain (projects PRI IB16114 and GR18068), and the air quality surveillance network of Extremadura (REPICA), all partially financed by European Union Funds for Regional Development (FEDER). **References** [1] G. García, A. Allen, A. Cardoso. Journal of Environmental Monitoring 12 (2010) 1325-1329. [2] G. García, A. Allen, A. Cardoso. Water Air and Soil Pollution 225 (2014) 1836:1844. [3] J. Filho, J. Da Silveira, A. Cardoso. Talanta 140 (2015) 73-80. [4] E. Félix, J. Filho, G. García, A. Cardoso. Microchemical Journal 99 (2011) 530-534. [5] M. Cerrato-Alvarez, C. Miró, E. Pinilla-Gil. Sensors and Actuators B: Chemical 273 (2018) 735:741.

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A retrospective analysis of organic micropollutants in sediment cores from a wastewater impacted recipient

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The removing efficiency for organic micropollutants (e.g. pharmaceuticals and personal care products) in wastewater treatment plants (WWTP) is often insufficient, leading to a release of these substances and their transformation products (TP) into receiving waters. In this study, the retrospective accumulation of a set of 24 organic micropollutants (comprised mainly of pharmaceuticals) was investigated in sediment of a wastewater recipient along a 6.7 km long stretch. A reference sediment sample was collected before the WWTP and sediment cores were taken both in a transport- and an accumulation bottom downstream. An efficient extraction method using salting-out-assisted liquid-liquid-extraction (QuEChERS) was optimized for the studied large range of target compounds. Target analysis was performed by using UHPLC-MS/MS. In total, all 24 target compounds were detected in surface sediment samples at all three sampling locations in concentrations ranging between 0.2 (± 0.01) µg kg^{-1} dw for carbamazepine-10,11-epoxide (a TP of carbamazepine) and 77 (± 3.3) µg kg^{-1} dw for the antidepressant fluoxetine. The concentrations in the sediment taken at the site closer to the WWTP outlet were up to one order of magnitude higher than in the lake located further downstream. Vertical concentration trends were found for 23 of the target compounds in both core samples, with a majority of chemicals remaining into sediment layers below 15 cm. The concentration trends found in the lake sediment core could be correlated to pharmaceutical consumption data during the last decade. Seven compounds showed increased concentrations towards the sediment surface. The results indicate that organic micropollutants remain longer in natural sediments than predicted in biodegradation studies.

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Trends in nicotine consumption between 2010 and 2017 in an Australian city using the wastewater-based epidemiology approach

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University of Queensland; J. Mueller, UQ / Queensland Alliance for Environmental Health Sciences
Monitoring smoking prevalence is key to assessing responses to tobacco control measures, and evaluating associated health and economic costs. Estimates of tobacco consumed in Australia are based on various data sources – tax excise clearances, sales, and self-report surveys. There are limitations with each of these data sources which makes triangulation of cigarette use estimates by multiple methods important. Wastewater-based epidemiology, the systematic sampling and analysis of wastewater, is now a routine method to measure and monitor human exposure to a range of chemicals. This study provides a high frequency long-term temporal assessment of exposure to nicotine, the main addictive component of tobacco, using this approach. 291 archived wastewater samples collected from a large, nonmetropolitan catchment from 2010 to 2017 were analysed for human-specific nicotine metabolites (cotinine and trans-3'-hydroxycotinine), to estimate per capita nicotine use. Temporal trends in nicotine use determined by wastewater-based epidemiology were compared with national sales and survey data. Wastewater results showed a 25% reduction in the mean number of cigarette equivalents consumed from 2010 to 2017, representing a 3% annual decline. These findings are in good agreement with estimates based on surveys and sales data, indicating annual declines of 5% and 4%, respectively. Other findings revealed regular consumption throughout days of the week and months of the year, which is consistent with previous wastewater-based studies. This study demonstrates WBE to be a relatively cost-effective and objective approach to reporting long-term data on nicotine consumption. When combined with alternative data sources, and valuable sociodemographic information of surveys, wastewater-based epidemiology helps to refine our estimates and understanding of the total impacts of smoking. More broadly, this approach may help to understand smoking prevalence among different demographics and socioeconomic communities to identify areas of concern and assess harm reduction strategies.

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Accumulation of metals (Cd, Cr, Cu, Mn, Pb, Ni, Zn) and total mercury (THg) in sediments, macroalgae and sponge of a coral reef, Caribbean coast of Costa Rica

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Anthropogenic activities are one of the main causes of metal (including mercury) contamination in coral reefs. Moín, on the Caribbean coast of Costa Rica, is a multi-use coastal zone with a variety of activities: urban settlements, port, industry and agricultural developments. High persistence and distribution capacity of metals makes it easy for them to reach different environmental compartments, were they can become bioavailable, and be accumulated and biomagnified through the food chain. With the purpose of knowing which is the current metal and mercury presence in Moín, and their bioaccumulation in organisms of the coral reef, we evaluated seven metals (Cd, Cu, Cr, Mn, Ni, Pb y Zn) and total mercury (THg) in samples of bottom sediments, macroalgae (*Cryptonemia crenulata*) and sponge (*Cinachyrella kuekenthali*) in three sampling stations of the Moín reef, and in three sampling stations in the South Caribbean of Costa Rica as the reference site. Metals and total mercury were analyzed by ICP-MS and DMA methods, respectively. Results were compared to data of previous studies and limit guidelines, the bioconcentration factor and the geo-accumulation index (only for THg analysis) was calculated. The concentration range found for sediments was Mn>Cu>Zn>Cr>Ni>Pb>Cd>Hg, for algae Mn>Cu>Zn>Ni>Cr>Pb>Cd>Hg and for sponges Mn>Cu>Zn>Ni>Cr>Cd>Pb>Hg. Metals and mercury concentrations were higher in Moín than in the reference site however, no significant differences were found, which suggest that the marine currents are favoring the distribution of contaminants along the entire coastline. Cu showed slightly higher concentrations in algae, Cd, Ni and Hg had significant higher concentrations in sponges and Cr, Mn and Pb in sediments. All sediment concentrations were below the effect limits (ERL and ERM) and the Sediment Quality Guidelines (SQG). Sediment THg concentrations were classified as uncontaminated at both Moín and the reference site, according to the geo-accumulation index (I_{geo}). Cd, Cu, Ni, Zn and Hg were bioconcentrated by algae and sponge, showing possible bioavailability in sediments. Results show that all metals and mercury are present in the coral reef ecosystem of Moín and that they are being accumulated by biota. The concentrations found, even if low in some cases, could cause toxicity to the species studied and to other sensitive organism like corals or in higher trophic levels by biomagnification processes.

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The heavy metal trails of River Ganga from Himalayas to Bay of Bengal: Anthropogenic or Natural?

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River Ganga is the largest river in India travelling 2525 Kms in length from Himalaya to Bay of Bengal as it passes through five major Indian states and has rich heritage, religious and cultural value. The river receives most of its water from Himalayan glaciers and monsoon rains. Millions of people from the river basin depend on it for irrigation, drinking, industrial use and religious bathing since river system drains about one-fourth of the Indian subcontinents. This has resulted in discharge of tons of sewage as well as industrial waste into the river thus endangering the aquatic flora-fauna and diminishing the water quality. Amongst other pollutants, toxic metals are of prime concern due to their persistence and ability to form harmful complex compounds in the aquatic organisms thus posing serious threat to the life and health of the species. Since heavy metals can originate from natural (weathering, erosion, leaching) or anthropogenic source, this study attempts for the first time, the spatio-temporal variation in the heavy metal contamination of water and sediment from entire river Ganga as it passes from rocky Himalayas to heavily populated and industrialized plain land. 120 water and sediment samples were collected from 56 sampling locations across the entire river Ganga through two seasons *viz*post monsoon and post winter (2017-2018). Standard USEPA protocol was followed for collecting and preserving the samples. Analysis was performed using ICP-MS and samples were tested for presence of nine heavy metals (As, Cd, Cr, Cu, Pb, Hg, Zn, Fe and Ni). Results will be interpreted against permissible Aquatic life criteria prescribed by International agencies and source of contamination will be reported for policy and decision makers.

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Mass balance of Per- and Polyfluoroalkyl Substances (PFASs) and Extractable Organofluorine in Marine Mammals

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ACES
Per- and polyfluoroalkyl substances (PFASs) are ubiquitous environmental pollutants. Over 4000 PFASs exist on the global market yet < 50 are included in routine monitoring programs. As high trophic level organisms, marine mammals receive a particular high dose of environmental contaminants. The hypothesis of this work is that marine mammals contain a large fraction of unidentified organofluorine, made up of previously unidentified and/or unmonitored PFASs. To test this hypothesis, a fluorine mass balance approach was applied to livers from eleven marine mammal species (i.a., seals, whales, dolphins, porpoises, and polar bears) from five locations (East and West Greenland, Sweden, Iceland, and Northeast United States) in the Atlantic Ocean and Baltic Sea using a combination of liquid chromatography – tandem mass spectrometry (LC-MS/MS) and combustion ion chromatography (CIC). Spike/recovery experiments with known PFASs revealed good method accuracy and precision and moreover that inorganic fluorine was removed sufficiently and did not contribute significantly to the measurements. Killer whale liver contained particularly high concentrations of perfluorooctane sulfonate (PFOS) and its precursor, perfluorooctane sulfonamide (FOSA), consistent with prior studies demonstrating poor metabolis of PFOS precursors by whales. Known PFASs found in Grey seal liver from the Baltic Sea included PFOS >> PFNA > PFDA > PFUnDA > PFOSA > PFTrDA > PFOA. Samples containing large quantities of unidentified organofluorine were further investigated using a high resolution (Orbitrap) mass spectrometry-based suspect screening approach. Collectively these data provide a comprehensive picture of PFAS exposure in a wide range of marine mammal species.

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Immediate and long-lasting effects of environmental chemicals in the Zebrafish Liver (ZF-L) cell line and subsequent unexposed passages.

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Several studies demonstrated that exposure to chemicals can induce epigenetic modifications in humans and other vertebrates including fish. Epigenetic changes were reported in pathologies with increasing incidence such as cancer and suggested to be a basis for heritable changes in gene expression and transgenerational effects.\nThe present study aims at investigating whether long-term changes in metabolic activity could be reflected in stable epigenetic alterations induced by acute exposure to an environmental chemical in the Zebrafish Liver (ZF-L) cell line. The cells were exposed for 48 h to the LC10 values of pesticides (methoxychlor (MXC), permethrin (PER)), plastic additives (bisphenol A (BPA) and S (BPS)), perfluoroalkyl substances (perfluorooctane sulfonic acid (PFOS), perfluorobutane sulfonic acid (PFBS)), 7-diethylamino-4-methylcoumarin (DEMC); and to the water solubility level of the pesticide vinclozolin (VCZ). Cells of the initial passage (P0, 3 days) were either sampled directly after exposure or kept in culture in unexposed conditions. Samples were additionally taken at P2 (9 days) and P5 (18 days) to investigate whether subsequent passages were continuously affected using the same methods. Expression of genes encoding factors involved in epigenetic mechanisms was monitored using RT-qPCR and analyses of metabolite profiles (lipidomics and untargeted metabolomics) were performed.\nAt the selected concentrations, all compounds induced changes in expression of one or several of the investigated genes. The most potent compound was BPS, which reduced the expression of all genes verified in this study. Ranked by decreasing incidence, it was followed by PFBS>MXC>PER>BPA>DEMC>VCZ>PFOS. Interestingly, industrial alternatives BPS and PFBS induced greater expression changes than the well-known BPA and PFOS. However, only small changes in gene expression could be observed in the P2 cells suggesting that most effects on transcription are transient and directly relate to the exposure itself. The metabolite profiles were determined both to identify changes in P0 cells as well as to investigate whether these changes are maintained in the P2 and P5 samples.\nIn order to relate long-lasting effects to stable epigenetic modifications, one outlook would be to perform direct analysis of DNA methylation and histone modification changes. Overall, this would bring more insight on how to use in vitro models to study mitotic inheritance of epigenetic-related effects.

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Effects of neuro-active pharmaceuticals on transcriptomic and lipidomic Daphnia magna responses

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Assessing the risks of emerging contaminants, such as pharmaceuticals in the environment, requires an understanding of their exposure regime and their effects at environmentally relevant concentrations across species. *Daphnia magna* represents an excellent invertebrate model species to study the mode of action of emerging pollutants, allowing the assessment of effects at different biological levels. The present study aims to test the effect of neuroactive pharmaceuticals at low environmentally relevant concentrations in *D.magna* from both transcriptomic and lipidomic point of view. Selected pharmaceuticals were carbamazepine, diazepam and propranolol, three widely prescribed compounds, already detected at considerable levels in the environment (ng to few µg/L). Fluoxetine, active component of prozac, was also selected for lipidomic analysis. Previous studies detected enhance reproduction effects by these pharmaceuticals and changes in phototactic behaviour. Transcriptomic analyses of *D.magna* exposed to carbamazepine, diazepam, propranolol or to an equitoxic measure of the threeidentified 2521 de-regulated genes that were clustered in four groups corresponding to A) down-regulated genes after any of the treatments, B) up-regulated genes after exposure to the mixture of pharmaceuticals, C) up-regulated genes after exposure to propranolol, and D) up-regulated genes after exposure to diazepan. Gene ontology analysis indicated a disruption of gene signalling pathways involved in lipid metabolism and transport, growth factor, sodium transporter, G-protein coupled receptor or structural costituent of cuticle, between others. Lipidomic analysis of samples exposed to these drugs also evidenced changes in glycerolipids and glycerophospholipids which are in concern with transcriptomic effects on metabolic pathways. *Acknowledgement* - This work was funded by the Spanish Ministry of Science and Innovation projects CTM2014-51985-R and CTM2017-83242-R. Inmaculada Fuertes acknowledges the Ministry of Economy, Industry and Competitiveness for her doctoral fellowship (FPI-MICINN BES-2015-075023).

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Effects of sewage sludge application on metal accumulation, DNA damage, biomass and expression of metallothioneins in Sinapis alba during assisted phytoremediation of degraded soils

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Heavy metals (HMs) such as cadmium are considered to be the

most critical soil contaminants due to their adverse effects on organisms and their possible transfer in the food web following their taken up by plants. Therefore, plants can be used or help in the removal of HM contamination from soils and water namely phytoremediation which is considered a cheaper alternative to physical and chemical remediation methods. In specific circumstances, the use of various fertilizers including waste products like sewage sludge (SS) can improve phytoremediation but safe soil application of such additives is a challenging environmental issue. Indeed, disposal of sewage sludge poses a threat to the environment, and today there is a growing pressure to minimize landfilling of SS which leaves two main ways of its disposal: incineration or land application. Land application is considered to be a beneficial method mostly because it allows for nutrient recycling. At the same time, it has to be taken into consideration that such actions involve risks because of the presence of contaminants and pathogens in SS. Thus, understanding of the effects of contaminants on plants is a prime objective in plant research. In this study, *S. alba* was grown in two different types of degraded soils characterized by a severe lack of organic matter due to overexploitation. One soil exhibited a metallic contamination mainly Cd, Pb, and Zn. Soils were supplemented with 4 different types of sewage sludges in accordance with the EU norms (170 kg of nitrogen/year/ha). Plants seedlings were exposed to such conditions for 6, 12, 24, 48, 72 hours and 7, 14, 21, 28 days. The measured endpoints were: biomass, roots length, metal contents in plants shoots, expression of *mt* gene encoding metallothionein, peptides that are thought to play a crucial role in metal homeostasis, and evaluation of DNA damage. The study contains an in-depth kinetic assessment of the sewage sludge influence. Overall the expression was elevated in samples supplemented with municipal sewage sludges after 2 or 3 days of exposure and continued to increase through the timepoints. On the contrary, the biomass and roots length were not affected by sewage sludge until the 21 days of the experiment when the biomass started to decrease severely in comparison to the control. Therefore, *mt* expression could be potentially used in phytoremediation process as an early indicator of metal stress – before any visible signs of toxicity will occur.

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Development of an oxidative stress in vitro assay in zebrafish (Danio rerio) cell lines

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Establishing *in vitro* methods is considered a high priority, since most risk assessment relies on in *vivo* studies. The Swedish Research council - amongst other European institutions - is increasingly funding programs dedicated to 3R principles. Therefore, we started our project “toxicity pathways – a novel strategy to reduce and replace *in vivo* studies in fish”. It is the prescribed goal to establish a battery of stably transfected *D.rerio* cell lines in order to test for specific toxicity endpoints. The latter may then be used for omics-based high throughput applications, screening, and prioritizing of positives. First, transfection efficiency of commercially available transfection reagents (Mirus X2, LT1, 2020; Promega FHD, F6, Viafectamine, TransFast; Roche XHP; Invitrogen Lipofectamine 2000; Qiagen SuperFect, Effectene) were tested in Pac2, ZF4, and ZFL *D.rerio* cell lines. Most promising candidates (FHD for Pac2 and ZF4, XHP for ZFL) were selected for cell transfection in transient reporter gene assays. A Nrf2-sensitive pGL4-based firefly-luciferase expressing plasmid was co-transfected with a normalizing renilla-luciferase plasmid. Second, all three reporter lines were exposed for 24h to exponentially increasing concentrations (0.1, 1, 10, and 100 µM) of known oxidative stress inducing chemicals (tertButylquinone, peroxide, and sulforaphane). In parallel, cell-viability was scored using standardized MTS-assay. Dose-response relationships could be shown in all transiently transfected cell lines for tertButylquinone and sulforaphane. Concentrations of causing less than a 20% decrease in cell-viability were considered as non-cytotoxic and should be used in ongoing assays for receptor activation or inhibition. ZF4 and ZFL were prioritized for further use. Last, a panel of environmentally applied pesticides (diazinon, deltamethrin, atrazine, metazachlor, tertButhylazine, diuron) was used for 24 h exposure (6.25, 12.5, 25, 50, 100 µM) of Nrf2 transiently transfected cells, in order to test for the ecotoxicological applicability of the bioassay. Dose response relationships were shown for certain tested pesticides (metazachlor, deltamethrin, diazinon), proofing the robustness of the assay.

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Developmental fluoxetine exposure in zebrafish reduces offspring basal cortisol concentration via life stage-dependent maternal transmission

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Fluoxetine (FLX) is a pharmaceutical used as antidepressant in humans. It is able to reach low µg/L concentrations in the environment, affecting inadvertently exposed fish in urban watersheds. In humans and fish, acute FLX treatment and exposure are linked to endocrine disruption, including effects on the reproductive and the stress axes. Basing on the recent finding that developmental FLX exposure can reduce cortisol production across generations, our study seeks to determine possible parental and/or life-stage (age and/or parity) contributions to this transgenerational phenotype transmission. Using zebrafish as model organism, we mated (at 5 and 9 months) control and developmentally FLX-exposed animals (F_0) of both sexes in a full-factorial design. We measured offspring (F_1) basal cortisol at 12 days post-fertilization (dpf). In addition, to investigate the potential molecular contributions, we profiled maternally deposited transcripts involved in stress regulation, epigenetic (*de novo* DNA methyltransferases) and post-transcriptional regulation of gene expression (miRNA pathway components and specific miRNAs) in unfertilized eggs. We found lower basal cortisol levels in the F_1 descended from FLX exposed F_0 females bred at 5 ($p< 0.001$), but not at 9 months ($p=0.696$), revealing a maternal, life-stage dependent effect. No paternal effect was found in any case ($p=0.228$ and $p=0.970$ at 5 and 9 months, respectively). Furthermore, maternal FLX exposure resulted in decreased transcript abundance of glucocorticoid receptor (*gr*), *de novo* DNA methyltransferases (*dnmt3-4* and *dnmt7-8*) and miRNA pathway components (the argonaute *ago2* and the ribonucleases *dicer* and *drosha*) in eggs collected at 5 months. Specific miRNAs predicted to target stress axis transcripts decreased (*miR-740*) or increased (*miR-26*, *miR-30d*, *miR-92a*, *miR-103*) in eggs collected from FLX females at 5 months. Increased abundance of *miRNA-30d* and *miRNA-92a* even persisted in eggs collected from FLX females at 9 months. In conclusion, our results shows that the reduced basal cortisol phenotype is maternally inherited and age and/or reproductive experience depending. It also suggest that the phenotype transmission to the offspring can be driven via miRNA signaling (gamete miRNA abundance). To our knowledge, our study is the first to describe contaminant-induced differences in miRNA levels in fish eggs, as it has been previously described in rodent models.

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In vitro evaluation of potential oestrogenic compounds on oestrogen receptors of European Sea Bass, *Dicentrarchus* labrax (L.)

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Oestrogens are important regulators of multiple physiological processes. Across vertebrates, the oestrogenic action is mediated by the binding to several oestrogen receptors. Specific transcription factors designated nuclear oestrogen receptors (Esrs) have been mainly associated with the classical activation of gene expression by oestrogens or structurally similar compounds. More recently,membrane receptors, such as the G protein-coupled oestrogen receptor (Gper), have been related to rapid, non-genomic responses. Both signaling pathways are present in fish, which express additional gene duplicates for both receptor types. Using the human embryonic kidney cell line HEK293, transient transfections were performed (1) to study the effects of two chemicals, genistein - a phytoestrogen - and fluoxetine (Prozac®) – an antidepressant - on the activation of the sea bass Esrs, using an ERE-luciferase reporter gene assay; and (2) to characterize the sea bass Gper duplicates, using a cAMP response element-luciferase reporter gene assay. Results indicate that genistein and fluoxetine affect each nuclear receptor in a different manner: Fluoxetine rather triggers an anti-oestrogenic response, while genistein behaves as an oestrogen mimic in the transactivation of the three Esrs. Oestradiol was able to induce luciferase activity in cells transfected with both membrane receptors, confirming, for the first time, that both teleost gene duplicates are functional. This study also demonstrates the suitability of the luciferase reporter assay as a tool to assess the oestrogenic potency and mechanisms of action of a wide variety of chemicals. Potential risks of the exposure of fish to various compounds in the environment or in aquaculture can be identified efficiently.

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Environmental genotoxicity and risk assessment in herring (Clupea harengus) caught in the Bornholm and Gotland Basins from the Baltic Sea (2009-2017)

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According to HELCOM CHASE confidence assessment, the Bornholm and Gotland Basins are mostly polluted by toxic chemicals such as anthracene, benz(a)anthracene, benzo(k)fluoranthene, DDE, dioxins, mercury and TBT. After World Wars I and II about 15 000 tons of chemical warfare agents (CWAs) have been dumped in wide areas of the Bornholm Island and the Gotland Deep Basins. Rusted bombs, shells and containers have eroded leading to the leakage of hazardous substances in to the environment.The aim of the present study was to examine the frequencies of micronuclei (MN), nuclear buds (NB), nuclear buds on filament (NBf) as genotoxicity endpoints in peripheral blood erythrocytes of herring (*C. harengus*) caught in the Bornholm and the Gotland Basins of the Baltic Sea. The nuclear abnormalities (NAs) were examined in 660 specimens of herring caught in 2009–2014 at 65 study stations, including 60 stations located in the Polish an Exclusive Economic Zone (EEZ) and 5 stations in the Danish EEZ, located mainly along chemical munition transport routes in the Bornholm and the Gotland Basins. The 308 fishes sampled in 2010–2017 at 24 stations located in the Polish EEZ, including stations situated near oil and gas platforms, and 7 stations in the Lithuanian EEZ (the southern zone of the Gotland Basin). The frequencies of NAs were strongly increased in herring at stations located close to CW dumping sites and where CWAs related substances were found in sediments. The highest and significant genotoxicity responses were recorded in fish caught at stations along CW transport routes, close to the Bornholm CW dumping area, in Polish EEZ with oil and gas platforms. Genotoxicity levels were found to be lower at stations located further away from the known pollution sources. Spatial analysis in GIS of genotoxicity risk based on the established background (BAC) as the sum ∑Gentox (MN, NB, NBf) of analysed biomarker responses (∑Gentox>BAC) was performed. Extremely high genotoxicity risk levels in herring caught at 65 study stations in Bornholm and Gotland Basins was indicated at 18 stations (27.7%). MN responses showed an extremely high risk in 50.8% stations, NBf – in 66.2% stations and NB – in 67.7% of studied stations. No genotoxicity risk was identified in the fish from three stations located in the Eastern Gotland Basin. An exceptionally high and high genotoxicity risk levels were found at 100% study stations in the Lithuanian EEZ, whereas at 96% – in the Polish EEZ.

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Elucidation of anti-inflammatories and nutritional limitation effects in freshwater invertebrates through a targeted and non-targeted metabolomics approach

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Freshwater organisms can be exposed to different stress conditions including chemical pollution (i. e. pharmaceuticals exposure) and changes in food quality due to seasonality, commonly observed in the Mediterranean zone. In this work, the effects of a mixture of five non-steroidal anti-inflammatory drugs (NSAIDs) (diclofenac, naproxen, ibuprofen and ketoprofen; all commonly found in the environment) and nutritional limitation conditions were investigated in the freshwater invertebrates (*Hydrophsyche* sp.). Bioconcentration of NSAIDs was investigated, as well as the ecotoxicological effects through a targeted metabolomics approach to characterize changes in the cascade converting arachidonic acid (ARA) to prostaglandins (which is affected due to NSAIDs administration in mammals), and complemented with a non-targeted metabolomics study. The experiments were carried out under controlled conditions during 24 days: 2 days of conditioning, 21 days exposure and 1 day depuration. Individuals were distributed in 12 mesocosms and exposed to four different conditions (factorial design, two factors, two levels, three replicates each): i) control, where organisms were fed with enriched fishmeal (containing ARA); ii) NSAIDs exposure, where organisms were fed with fishmeal and exposed to a mixture of anti-inflammatories at a final concentration of 19.17 µg/L; iii) low nutritional quality food, where organisms were fed with oat (which is a poor nutritional source) and iv) NSAIDs exposure and low quality food, where both NSAIDs and oat were administrated together. Bioconcentration of diclofenac, naproxen and ibuprofen was observed, but not for ketoprofen. The highest concentration in invertebrates was ibuprofen, 289 ng/g (dry weight), in treatments with NSAIDs. Concentrations of ARA, prostaglandin H2, prostaglandin D1 and prostaglandin E1 were lower in organisms exposed to oat food in comparison with organisms fed with fish food. However, NSAIDs did not seem to produce pronounced effects on concentrations of these metabolites. Non-targeted metabolomics revealed alterations in invertebrate`s metabolome

due to low quality food resource, both in the presence and absence of NSAIDs, but in this case, NSAIDs exposure in combination with poor quality food produced marked differences. For the first time, the combined effects of food quality and presence of NSAIDs in a freshwater organism have been investigated using a metabolomic approach.

P01

Chromium Removal in Constructed Wetlands and Physiological Response of emergent macrophytes from Argentina

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Introduction Leather tanning generates liquid effluents with high contents of organic matter, sulfides and trivalent chromium. The discharge of these untreated effluents in aquatic environments generate serious problems with ecological risks. The use of constructed wetlands is considered a reliable technology for the treatment of wastewater with metals, and aquatic plants have a fundamental role in these systems. *Schoenoplectus californicus*, *Juncus effusus* and *Eleocharis palustris* are native aquatic plants, of interest for their use in the phytoextraction of Cr. These macrophytes are perennial, rooted, rhizomatous and are part of the emergent vegetation in many lakes and estuarine areas of the Argentine Republic. Experimental work was developed to test the hypothesis that the aquatic species *Schoenoplectus californicus*, *Juncus effusus* and *Eleocharis palustris* are resistant to chromium exposure and can accumulate this metal in the root. **Methodology** *Schoenoplectus californicus*, *Juncus effusus* and *Eleocharis palustris* were exposed for four weeks to increasing concentrations of Cr (Control treatment T0: 0 mg L^{-1}, Treatment T1: 1 mg L^{-1}, Treatment T2: 10 mg L^{-1}) in constructed wetlands. The indicators of physiological damage that were analyzed were parameters of the photosynthetic system (chlorophyll, pheophytin, carotenoids), and also indicators of oxidative stress in stem and root, such as conjugated hydroperoxydienes and malondialdehyde. In addition, the removal of Cr from the solution and the accumulation of the metal in the root and stem were measured. **Results and interpretation** The macrophytes *Schoenoplectus californicus*, *Juncus effusus* and *Eleocharis palustris* exposed to increasing concentrations of Cr showed to be tolerant to the metal and not to affect the photosynthetic system. The removal of the metal from the solution was 99% in all cases and the largest accumulation of the metal occurred at the base of the stem and the root of the plants. Taking into account the tolerance of the macrophytes *S. californicus*, *J. effusus* and *E. palustris* at increasing concentrations of Cr, it could be determined that they are plants of interest for their use in phytoremediation of water contaminated with chromium.

P02

Toxicokinetics of imidacloprid in mayflies: a study on the degradation and biotransformation of imidacloprid

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1.Introduction Neonicotinoids (NNIs) belong to the group of nitroguanidine systemic insecticides, which induced increased environmental concerns recently, based on their potential risks to the aquatic system. Currently, the EU bans the outdoor use of imidacloprid (IMI), clothianidin and thiamethoxam. However, the degradation products and metabolites of NNIs are hardly studied, especially for the aquatic organism, which may hamper the environmental risk assessment of NNIs. To fill this knowledge gap, we will study the toxicity of IMI and its metabolites to aquatic organisms, which is the most used chemical among NNIs. The mayfly, which is found to be one of the most sensitive species and also the essential freshwater invertebrate, is chosen as the focal species. During upcoming experiments, the uptake kinetics of IMI and metabolites into the mayfly will be quantified and the toxicity of the parent and its metabolites will be explored. Our results will provide a further mechanistic understanding of the toxicokinetics of IMI and its metabolites in mayflies. 2.Methodology To answer the question of whether IMI is degraded or metabolised by mayflies, a 4-day toxicity study will be conducted with IMI and its metabolites. 10 individuals of mayflies will be put in a 1L beaker which contains different concentrations of either olefin-IMI, urea-IMI, 6-CNA, 5-OH-IMI or IMI . The mortality will be scored on day 1, 2, 3 and 4 and the remaining organism, as well as the water, will be sampling at 4d. The mayflies will be captured, homogenised, extracted with acetonitrile and further analysed by Liquid Chromatography-Tandem Mass Spectrometry for IMI and its metabolites. The water will also be extracted by liquid-liquid extraction, and also evaluated on residues of IMI and its metabolites. 3.Expected results The current study will (1) show the toxicity of the metabolites to mayflies, indicating whether metabolites are of importance for future risk assessment of IMI, (2) assess concentrations of IMI and its metabolites in the body of the mayflies, (3) show whether the degradation products of IMI in water are different from the metabolites found in the mayflies. In our hypothesis, whether IMI is metabolised or degraded to toxic metabolites by mayflies, such metabolism might explain their high sensitivity, in comparison to, for instance, Daphnia.

P03

Attractive and aversive responses of zebrafish larvae to frequently detected classes of insecticides

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Selecting appropriate behavioural responses is crucial for the survival of single organisms as well as the whole population. Such behavioural responses are based on sensing and processing environmental stimuli. Organisms possess an innate ability to escape from threatening situations they are exposed to. Such situations can be posed by unfavourable environmental conditions, predators or alarm substances. Similarly, they are attracted to favourable cues such as food sources or mating partners. As most insecticides are designed to interfere with neuronal signalling, they are able to adversely affect this ability to process sensory input and react appropriately to environmental stimuli with extensive ecological consequences. We are investigating whether different classes of insecticides lead to attractive or aversive responses of zebrafish larvae, and are additionally interested in the neuronal mechanism underlying the observed behavioural response. We aim to better understand how insecticides change natural behavioural responses of fish in order to better predict their impact on the ecosystem. Zebrafish larvae are exposed to the test chemical while the behaviour is tracked with an automated video recording system. The larva's space use and locomotor activity are evaluated. After the behavioural experiment, neuronal regions that were activated during exposure are visualised by staining the larvae for an endogenous activity indicator (pERK).For Nicotine we found an attractive response at 1µM, expressed by an increased dwell time in the nicotine containing zone. Higher concentrations (10 µM), on the other hand, appear to be clearly aversive, and larvae try to escape the dish. Attractive and aversive responses have been reported to be attributed to activity levels in the Habenula with according activation or inhibition of the Dorsal Raphe nucleus, a part of the reward system in the teleost brain. Interestingly, the two tested neonicotinoids, thiacloprid and imidacloprid, showed a different attraction pattern. While larvae were attracted to thiacloprid at 10 µM and 100 µM without showing an aversive response, no significant effect was measured for imidacloprid. We

are currently investigating whether other classes of insecticides trigger similar or dissimilar behavioural patterns.We will dissect which brain areas and which sensory systems are involved in the behavioural reactions. This will advance our understanding of the impact of insecticides on fish behaviour.

P04

Blood concentration of heavy metals in freshwater fish (Cyprinus carpio) and their effects on the serum biomarkers

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The main toxic metals associated with human and animal health are cadmium, lead, mercury and arsenic. Specific group of endangered animals are aquatic animals due to their constant contact with contaminated environment. Various toxic elements in polluted environments may have different effects on living organisms; therefore, it is necessary to monitor and test such associations between them. The aim of the present study was to investigate interactions between toxic metals content in the blood serum and serum biochemical and oxidative status markers (ROS, TAC) in common carp. The freshwater adult fish (*Cyprinus carpio*) were used in our study (n = 24). The fish were caught by seine net from university experimental pond (Kolinany, Slovakia). Blood samples were taken from male (n = 12) and female (n = 12) individuals from *aorta ventralis*. The content of selected heavy metals (Cd, Pb, Hg, and As) were determined in blood serum by inductively-coupled plasma optical emission spectrometry (ICP-OES). Serum biomarkers (urea, total protein, glucose, triglycerides, AST, ALT, ALP, cholesterol, bilirubin, and creatine kinase) were measured using the semi-automated clinical chemistry analyser Randox RX Monza. Oxidative stress markers (ROS, TAC) were assessed using luminol-based luminometry. The general scheme of descending concentrations of toxic elements in blood serum was follows: Pb ? Cd ? Hg ? As. Pearson correlations were used to assess the relationships between the serum biomarkers and the heavy metals concentrations. The correlation analysis showed the significant positive relationship between Hg and cholesterol ($r = 0.4725$; $P< 0.05$) and significant negative association between Cd and ROS ($r = -0.5067$; $P< 0.05$). The correlation analysis in female group of fish showed significant negative correlations between Hg and ALT (-0.6200; $P< 0.05$), Cd and cholesterol (-0.5762; $P< 0.05$), Pb and cholesterol (-0.6806; $P< 0.05$), and significant negative association between Pb and CK (0.7024; $P< 0.05$). The analysis in male group revealed significant negative associations between Cd and ROS (-0.7243; $P< 0.05$), and between Hg and TAC (-0.7906; $P< 0.05$). In conclusion, our results demonstrated effects of toxic metals to serum biomarkers in natural conditions. Further studies are necessary to test ecotoxicology interactions between heavy metals and health status. This work was supported by the Slovak Research and Development Agency under the contract No. APVV-16-0289 and VEGA 1/0539/18.

P05

Low concentration exposure of glyphosate based herbicides induce ultrastructural alteration in hepatopancreas and liver in non-target aquatic organisms

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Introduction: Glyphosate (GLY) based herbicides (GBH) are the most commonly used herbicide worldwide. The GLY has been detected in aquatic environments and species that inhabit these ecosystems are exposed to this contaminant. In Brazil, the GLY regulated concentration as the maximum allowed in the inland waters is established in 65 µg/L (CONAMA, Resolution n° 357/2005), while in the European Union, it is 0.1 µg/L. Previous studies have shown that this concentration induces cellular changes in different organs and animal models. Many xenobiotics, once incorporated by non-target organisms are biotransformed in the liver of vertebrates, or in the hepatopancreas in some invertebrates. These organs are known as targets of toxicity and may present alterations when exposed to xenobiotics. Our hypothesis is that the GLY concentration accepted in safe concentrations for drinking water in Brazil induces ultrastructural changes in the hepatopancreas and in the liver. The objective of this study was to evaluate the effects of GBH in the hepatopancreas of freshwater prawn (*Macrobrachium potiuna)* and in the liver of zebrafish (*Danio rerio*) exposed to 65 µg/L for 7 days. **Methodology**: The transmission electron microscopy (TEM) was performed to observe the effects of GBH on the ultrastructure of R cells of *M. potiuna* and hepatocytes of *D. rerio.* Three animals per group (control and 65µg/L) were used for each animal model. The organs were fixed in 2.5% glutaraldehyde and 2.5% paraformaldehyde diluted in 0.1 M sodium cacodylate. The samples were post-fixed with 1% osmium tetroxide, dehydrated in acetone and embedded in Spurr resin. Ultra-thin sections were stained with uranyl acetate followed by lead citrate, and examined using the TEM (JEM-1011). Each alteration of the subcellular component was categorized and the degree of severity was established by scores. **Results**: The main alterations in the hepatopancreas and the liver were observed in the mitochondrial profiles, evidenced by the mitochondrial crests loss. Moreover, dilated cisterns were evidenced in the rough endoplasmic reticulum and Golgi bodies and dilation of the perinuclear space. The cells also showed concentric membrane formations and vacuolization. Our study showed that the concentration 65 µg/L induced cytotoxicity in organs that present a key role in the detoxification processes of both analyzed organisms. This information can help the establishment of new water quality criteria and risk assessment stud

P06

Lethal, sublethal and biochemical effects of β-endosulfan insecticide on the Costa Rican frog Isthmohyla pseudopuma tadpoles

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Costa Rica is a pesticides dependent country in some of its agricultural practices, as evidenced by the last National Agricultural Census. The problem in using these biocides is that once they are released into the environment they are also toxic to vertebrates and invertebrates that are not the target of their action, such as β-endosulfan, a persistent organochlorine that has been registered in environmental samples of protected sites in the country. Amphibians are a group affected by pesticides. The effects on these animals have been observed in their behavior, growth, development, among others; however, information in the country continues to be scarce in relation to this problem. For that reason, the objective of this study was to evaluate the lethal and sublethal effects and the possible changes in three biochemical contamination markers (ChE, GTS, LPO) in *Isthmohyla pseudopuma* tadpoles exposed in the laboratory to he insecticide β-endosulfan. For this evaluation, we used lethal and sublethal concentrations, with ranges of 10 to 100 µg/L of β-endosulfan. The mean lethal concentration (LC50) was calculated and the total length, total weight and development of the tadpoles were measured by acute and chronic tests. In addition, we quantified the biomarkers cholinesterase, glutathione S-transferase and lipid peroxidation in the individuals that survived to the acute test. The LC50 for this species was 123.6 µg/L. At the concentration of 50

µg/L, both, the length and the total weight decreased compared to the control organisms, furthermore, when using concentrations 30 and 50 µg/L the individuals show a slower development. The measurement of biomarkers did not determine any effect at this level. This study determined that β-endosulfan is toxic to a native species at concentrations ≥123.6 µg/L, and this is relevant since there is a lack of information in the country. In addition, the results demonstrate that this insecticide has the properties to reduce the size and to delay the development in this species, which could occur with other tropical frogs, for which further investigation is required. These deficiencies show that in wild conditions these individuals would be more prone to depredation, desiccation, and would have less fitness, which affecting local anuran populations.

P07

Effects of 4- Nonylphenol and 17β- estradiol on synthesis of vitellogenin and balance of steroid thyroid hormones in sexually immature yeallowfin seabream, *Accanthopagrus Latus*

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In the study, the esterogenic effects of 4-nonyphenol (4-NP) and 17β-estradiol (E2) and on synthesis of vitellogenin (VTG), level of steroid and thyroid hormones and hepatosomatic index (HIS) in immature yellowfin seabream, *Accanthopagrus latus*, were assessed. To do this, a total number of 104 fish were abdominally injected by 10, 50,100, 150 and 200 µg/g/week and 2 µg/g/week of E2. The experiments were conducted over a period of two weeks. Induction of vitellogenin generation in plasma of treated fish was assayed indirectly by measuring of total plasma calcium and alkali-labile phosphate. The increased level of the indicators in treated fish's plasma showed the production of 4-NP in liver dose-dependently changed. Meanwhile, a significant dose-dependent increase was observed in HIS which indicated the activation of hepatic VTG production in 4-NP- and E2-injected fish. 4-NP treatment did not have any significant effect on plasma levels of testosterone. In addition, it was observed that 4-NP affect the level of thyroid hormones in fish. Plasma thyroxine levels rose in a dose-dependent manner after 7 and 14 days of the exposure. In contrast, a significant decrease in triiodothyronine levels was observed during the experiment period. Moreover, no significant change was detected for thyroid stimulating hormone levels in 4-NP-treated fish. These results demonstrated that 4-NP is so influential to induce the VTG. Based on the findings, it can be concluded that 4-NP can strongly disturb the balance of steroid and thyroid hormones with potential consequences for sexually immature male yellowfin seabream.

P08

Embryotoxic and behavioral effects in zebrafish embryos (Danio rerio) after exposure to binary mixtures of environmental pollutants

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Environmental contamination is usually comprised of a complex mixture of pollutants, each of them bearing the potential of causing different toxic responses towards humans and wildlife. However, current risk assessment approaches are still focusing on single compound evaluation. In contrast, present research shows that mixture components can act together to cause a toxic effect. The concentration addition and independent action models have been developed to more easily predict mixture toxicity. Both models assume that there is no interaction between the components, resulting in an additive mixture effect. In comparison, a greater (synergistic) or lower (antagonistic) mixture effect than the predicted additive effect indicates mixture interactions. In the present study, embryo toxicity tests (OECD 236) with zebrafish embryos (*Danio rerio*) were performed to investigate whether the toxicity caused by binary mixtures of environmental pollutants can be predicted by the two models. The embryos were exposed to binary mixtures of PFOS, PCB126 and Benzo[a]pyrene (BaP) under semi-static conditions until 96 hours post fertilization (hpf). The highest mixture concentration contained LC_{25} of each of the two compounds and the four lower concentrations were prepared by a 1:2 dilution series. For each binary mixture, 3 replicates were completed and each replicate consisted of 192 individuals. In addition to evaluating the acute toxicity, behavioral alterations were investigated at 96 hpf. The zebrafish larvae movement was measured during exposure to interchanging light and dark periods. A comparison between the observed and the predicted mixture toxicity indicates that the two prediction models tend to underestimate the toxicity and that the mixtures are causing a synergistic effect. The greatest underestimation was seen for the mixture containing PCB126 and PFOS, with a ten-fold difference between the observed and predicted LC_{50}-value. Moreover, the mixture containing BaP and PFOS resulted in behavioral alterations, like hyperactivity, which was not seen for any of the single compounds. In conclusion, the present study shows that prediction of mixture toxicity by using prediction models results in an underestimation of the risks that binary mixtures are posing. However, for a more reliable assessment and a better understanding of mixture toxicity further investigations are required to study the underlying mechanisms.

P09

Detection of hyper- and hypoactivity in zebrafish embryo using the spontaneous tail coiling (STC) test

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The observation of spontaneous tail coiling (STC) in zebrafish (*Danio rerio*) embryos might be a useful diagnostic tool to identify potential neuroactive chemicals in complex environmental mixtures. STCs are normally observed at its stable peak between 23 and 25 hours post fertilization (hpf) in chorionated embryos and changes in this behavior may be linked to developmental and neurotoxicity in early life-stages of the embryos. In this study, we investigated the capacity and consistency of STC in zebrafish embryos by focusing on the detection of hyper- or hypoactivity after exposure to neuroactive chemicals and a contaminated environmental extract. In particular, we analyzed the repeatability and reliability of the test after exposure to chlorpyrifos (CHP) and abamectin (ABA). Our laboratory data were compared to literature data and the observed effect was confirmed by using the acetylcholinesterase inhibition (AChE) test. Results showed that the behavioral effects of CHP and ABA obtained from the literature can be successfully reproduced also in our laboratory. Furthermore, the observed hyperactivity of an environmental mixture was confirmed in the AChE test. Our results reveal the potential capacity of the STC test to capture early effects and to predict neurotoxicy within a short duration testing framework. This could be of high relevance for diagnostic risk assessment of environmental samples.

P10

Characterization of cholinesterases in different organs of Poecilia velifera and the effect of Chlorpyrifos at different salinities

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Chlorpyrifos is a widely used organophosphate insecticide; its insecticidal action is due to the inhibition of the enzyme acetylcholinesterase (ChE), which cleaves the neurotransmitter acetylcholine in the nervous system. Yucatan's molly (*Poecilia velifera*) is an endemic fish from Yucatan Peninsula in southeastern Mexico. They are found in fresh, brackish and marine waters. This species has been listed as endangered in the Mexican Official Norm. Previous reports have indicated the presence of pesticides in sinkholes and wetlands where this species inhabit. This study was divided in two parts. First, the biochemical characterization of ChE in brain, gills, liver and muscle was done using selective substrates and inhibitors. Results confirm the presence of the two types of ChE found in vertebrates, acetylcholinesterase (AChE) and butyrylcholinesterase (BChE), showing different tissue distribution. Acetylcholinesterase (AChE) was the predominant ChE present in brain. An atypical BChE was found in gills, muscle and liver. In the second part, the inhibitory effects of Chlorpyrifos on ChE activity were determined *in vivo*. Fish were exposed to four different concentrations of Chlorpyrifos (1, 5, 10, 25 µg/L) at two different salinities (8 and 24 ‰). Results indicated that *P. velifera* has great sensitivity to Chlorpyrifos and that there is an interaction with salinity. Different levels of inhibition were found at the different tissues that were studied.

P11

Effects of an antimicrobial mixture on the leaf-shredding amphipod Gammarus fossarum under different exposure pathways

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The breakdown of leaf litter is of fundamental importance for detritus-based stream ecosystems. Leaf-associated microorganisms (i.e., fungi and bacteria) as well as leafshredding macroinvertebrates play a key role in this process, while they can be negatively affected by antimicrobial substances such as fungicides and antibiotics. It is also important to consider that shredding macroinvertebrates are affected through waterborne exposure and their diet. The latter pathway includes the dietary exposure towards antimicrobial substances adsorbed to leaf material as well as an altered leaf associated microbial community which determines its nutritious value for shredders. As it is unclear what the combined effects of antibiotics and fungicides are on such microbe-shredder interactions, we examined the waterborne and diet-related effects of ciprofloxacin (CIP) and azoxystrobin (AZO) on the amphipod model shredder Gammarus fossarum. Gammarids' leaf consumption, feces production and growth were assessed for 24 d using a 2x2-factorial test design: Gammarids were fed with leaf material microbially conditioned in the presence or absence of CIP (500µg/L) and AZO (15 µg/L) and were cultured in medium with or without these antimicrobials. The conditioning of food in the presence of CIP and AZO resulted in a significant increase of gammarids' leaf consumption and growth (~19%, ~131%) in comparison to the control. This is most likely explained by an improved food quality as a result of CIP-induced negative effects on leaf-associated bacteria. The reduced competitive pressure may have favoured fungal growth. On the other hand, waterborne exposure towards CIP and AZO resulted in an almost unchanged leaf consumption, while growth was still higher than in the control (~30%). The combined exposure pathway lead to intermediate results for leaf consumption and growth (~9%, ~96%). This observation indicates an additive effect of both exposure pathways suggesting that the beneficial impact on leaf quality was partly compensated by direct effects on gammarids' physiology through the waterborne exposure pathway. Additionally, effects from experiments using only one antimicrobial are used to compare the observed mixture effects with those predicted by the Independent Action model. In conclusion, this study provides new insights on the effects of antimicrobial mixtures on microbe-shredder interactions, improving the understanding of potential implications for leaf litter breakdown.

P12

Toxic effects of copper on the sea star Asterias rubens (Echinodermata) through different levels of biological organization

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The aim of the present study was to investigate the suitability of the White Sea starfishes Asterias rubens as a protentional organism for marine water quality bioassays. The effect of copper chloride wide range of concentrations on different levels of biological organization has been studied. The experiments included estimation of survival, the behavioral response of starfishes, changes in cellular elements of coelomic fluid, cell membrane stability, and heat shock protein 70 (HSC70) levels were measured in response to copper exposure there investigated. Half-lethal concentrations (96 hours) were established for copper as 0.98±0.16 µM. Exposure to this metal led to a significant righting time growth. Cu exposure resulted in changes of coelomic fluid cells proportion, namely, an increase of the proportion of agranulocytes (cells with phagocytic activity) and small cells (not differentiating cells) on other side decreases of granulocytes proportion (B-lymphocytes like cells) as well as increasing number of coelomocytes in general. We found higher HSC70 protein levels in experimental aquariums with higher Cu concentration. Cell membrane stability of the coelomocytes was determined by measuring the cells ability to retain neutral red dye decrease conversely. Metal determination performed by inductively coupled plasma atomic emission spectrometry (ICP-AES) showed that Cu was dose-dependent bioconcentrated in the bodies of Asterias rubens. Effects on all levels of a biological organization were relevant. Taken all together, our results confirm the feasibility of sea star Asterias rubens as indicator or biosensors of stress condition on different levels of biological organization in the marine environment. NOAEL was close to copper limit level according to Russian norms for sea waters, so it needs more accurate control of copper concentration in the marine environment.

P13

Trophodynamics and parabolic behaviors of polycyclic aromatic hydrocarbons in Dianshan Lake food web

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Abdul Qadeer, Min Liu, Jing Yang, Xinran Liu, Saira Khan Khalil, Yi Yang **Introduction** This study investigated trophodynamics of 16 priority PAHs in both whole body and muscles of fishes in the freshwater food web of Dianshan Lake. This is first report where whole body and muscles of same species studied in one research. Differences of trophodynamics between whole body and only muscles were highlighted, and results of this study were compared to previous studies. Briefly pooled samples of similar size of 14 species were collected from Dianshan Lake for analysis. The trophic levels of the organisms were based on stable nitrogen isotope ratios. (Fisk et al., 2001; Hussey et al.). TMF was calculated using a single linear regression equation showing the relationship between trophic level and logarithm concentration. log concentration (lipid normalized) = $a + b \times$ (TL)

where *a* and *b* represent the intercept and slope of the regression equation, respectively. Finally, TMF was calculated using *b* (slope) in the following equation. TMF = 10^b The procedure for PAHs extraction was modified from previous studies (Buckman et al., 2006; Liang et al., 2007; Yang et al., 2018). **Results summary** In general, there was no evidence of biomagnification of PAHs congeners but only 9 PAH compounds in food web_m showed a statistically significant negative relationship between trophic level and lipid normalized concentration compare to 6 PAHs congeners in food web_{wb}. However, TMF values of PAHs in food web_m ranged from 0.32 for pyrene to 0.68 for phenanthrene compared to TMF values of food web_{wb} ranged from 0.34 for pyrene to 0.74 for fluorene. Because of two opposing scientific views for biomagnification and biodilution of PAHs in the food web, albeit based on a rather limited number of studies, our study investigated that there is parabolic behavior of most of the PAHs especially for high molecular weight compounds (HMW) in the freshwater foodweb. Parabolic trends suggested short food web of higher trophic level can show pseudo trophic magnification.. The difference of PAHs trophodynamics and concentrations between food web_m and food web_{wb} are attributable to multiple reasons including differences in lipid and presence of vital organs (liver, kidney, gills and digestive system) for storing and regulating pollutants in whole bodies.

P14

Relationship between concentrations of human pharmaceuticals in muscle and EROD and BROD hepatic activity in fish from the inner Rio de la Plata estuary and Lower Uruguay River

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The aim of these study was to asses the occurrence and concentrations of four of human pharmaceuticals active compounds (HPhACs): atenolol (ATE), carbamazepine (CBZ), enalapril (ENA) and sildenafil (SIL) in the muscle of four fish species: *Prochilodus lineatus, Salminus brasiliensis, Leporinus obtusidens and Pimelodus maculatus,* and asses the relationship with hepatic EROD and BROD activity. Fish were collected from two areas, one located in the southern sector of the riverine Rio de La Plata estuary (RLP) and other at the Lower Uruguay River (URU) during 2016 fall. Chemical analysis in muscle was carried out by UPLC-MS . EROD, BROD and GST activities were fluorometrically and spectrophotometrically measured in *P. lineatus and P. maculatus.* The limit of detection (LOD) and quantification (LOQ) of assessed HPhACs were between 0.05-3.59 ug/kg and 0.16-11.98 ug/kg respectively. Recoveries were between 30% and 90%. Overall occurrence showed that ATE, ENA and SIL were ubiquitous. Significantly higher of total HPhACs concentrations were found in *P. maculatus* and *S. brasiliensis*. Not significant differences were observed in fish species from RLP and URU. The highest maximum concentrations were for ATE (230.71 ug/kg) in *P. maculatus* and SIL (54.82 ug/kg) in *S. brasiliensis.* BROD and GST activities were significantly different among sities only for *P. lineatus.* Negative correlation between total pharmaceuticals concentrations and enzymatic activity were statistically significant only for GST. In addition, higher activities of the biotransformation enzymes were usually observed in fish collected in RLP. All of the detected concentrations were above the maximum residues limits (LMR) established by the European Union for the HPhACs diclofenac in bovine muscle (5 ug/kg). Including these compounds in monitoring programs is advised. This was the first report on bioaccumulation of pharmaceuticals in fish of ¨Rio de La Plata¨ basin.

P15

Tools' development to detect the molting disturbances in Palaemon serratus: a revelation of a silent alteration?

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Molt is a crucial physiological event in which organisms as crustaceans liberate themselves from their exoskeleton shells to ensure their growth and development. Besides, it has a crucial role in the metamorphosis of young life stages and in the reproduction of adults. Instead of its simple macroscopic actions, the molting process is regulated by a multitude of complex hormonal events, well documented due to commercial interests for insecticide synthesis. Since the 1790s, numerous studies were interested in the disrupting effects of environmental chemicals on crustacean molting of non-target species. Despite this, available tools for the *in situ* assessment of the adverse effect of environmental chemicals on crustacean molting are still scarce (Zou 2005). In this context, we are identifying, in the emblematic European marine crustacean species *Palaemon serratus* several biomarkers (*i.e*, chitinolytic enzymes activity, macromolecular cuticle structure) that will allow us to have an *in situ* assessment/evaluation of molt impairment. *P. serratus* is an ecologically relevant species because of its wide presence along western European coasts and its central place in sea trophic chains and ecosystem processes. Furthermore, it has already been used in several ecotoxicological and biomonitoring assessment studies (Erraud *et al.* 2018a, b). The aims of our methodology are: 1) the development and optimization of protocols for *P. serratus*; 2) the characterization of the natural variability of the biomarkers (*i.e*, between sex and molt-stages) which can represent confounding factors for the evaluation of the effect of environmental chemicals (Spindler-Barth 1990); and 3) the validation of the sensitivity of the biomarkers by the exposition of organisms to different xenobiotics under laboratory conditions and the study of natural populations of *P. serratus* located at different sites known for their contrast in toxic charge content. These results will help us to understand the mechanisms of impact of different xenobiotics in the molting process of crustaceans and to biomonitor the perturbations occurring in aquatic ecosystems.

Keywords: ecotoxicology, crustacean, molt impairment, biomonitoring, marine ecosystems

P16

Bioaccumulation and Toxicokinetics of PACs and Metals in the Freshwater Mussel Pygandon grandis Exposed to Water from a Simulated Diluted Bitumen Spill in Boreal Lake Enclosures

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With global demands for energy still growing, transporting Canada's landlocked bitumen to global markets is imperative. However, there are many concerns with the various methods of transportation as they can lead to the release of diluted bitumen (dilbit) in the environment. In the summer of 2018, a once in a lifetime collaborative large-scale field experiment was conducted at the International Institute for Sustainable Development - Experimental Lakes Area (IISD-ELA), a world-renowned aquatic research facility. The research objectives of the Boreal lake Oil Release Experiment by Additions to Limnocorrals (BOREAL) project are geared towards reducing recently highlighted

knowledge gaps on the fate, behaviour, and potential toxicological effects of dilbit in a freshwater, in particular, boreal lakes. A range of controlled dilbit spills were conducted in seven 10 m diameter mesocosms (~157,000 L of water) resulting in environmentally realistic dilbit:water dilutions ranging from 1:100,000 to 1:1,000, covering the upper half of the distribution of spill sizes occurred in North America in the last decade. Additionally, two mesocosms, not treated with dilbit, were studied as controls. This presentation will focus on a subsection of the general BOREAL study aiming to identify and quantify bioaccumulating compounds associated with naturally weathered dilbit in giant floater mussels (*Pygandon grandis*) and determine the rates at which they are being uptaken and excreted. More specifically, the bioaccumulation and toxicokinetic parameters of polycyclic aromatic compounds and various metals were assessed in giant floater tissues exposed ex-situ for 41 days (25 days of exposure and 16 days of depuration) to water from the lake mesocosms. These compounds of interest have shown to negatively affect a number of freshwater organisms, however, there are significant knowledge gaps associated with these compounds when derived from naturally weathered dilbit. Data obtained from the BOREAL project, the first controlled *in situ* ecosystem level exposure of dilbit in a freshwater ecosystem, will improve our understanding of dilbit fate and effects as well as provide scientifically-sound environmental management tools and inform regulators of potential dilbit spills in Canada.

P17

Turquoise killifish (Nothobranchius furzeri) as a new model in behavioural ecotoxicology

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Pharmaceuticals are essential for human wellbeing. However, due to their increasing and continuous use, sub-lethal concentrations of pharmaceutical compounds have already been detected in the aquatic environment. As these compounds are designed to elicit specific biological effects at low concentrations, standard ecotoxicity tests are unable to correctly assess environmental risks associated with pharmaceutical pollution. Reproducible tests that are based on sensitive behavioural endpoints and that accommodate a high ecological relevance have been promoted to fill this gap. We assessed the impact of a three-week exposure to the antidepressant fluoxetine on behavioural traits in *Nothobranchius furzeri* (Turquoise killifish). Overall, this study shows that fluoxetine can impact life skills, such as feeding behaviour, habitat choice in a novel environment and antipredator response of *N. furzeri* individuals while effects on basic behavioural traits were less clear. *N. furzeri* has recently been introduced as a novel model organism for standard ecotoxicological tests and now its potential for behavioural ecotoxicology is being explored.

P18

Impacts of methylmercury on early life stages of a marine forage fish

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Methylmercury (MeHg) is a neurotoxin that is found in fish tissues and bioaccumulates in aquatic food webs over a wide range of geographic areas. The extent to which fish exposed to food with high MeHg concentrations are impacted is largely unknown, particularly in marine fish. Previous studies on freshwater fish have suggested that MeHg concentrations can cause adverse effects on growth, behavior, reproduction, and other sublethal endpoints. Some species of marine fish have high tissue concentrations of MeHg but effects on behavior and reproduction are little known. Here we examined effects of MeHg to a marine fish at the larval stage, the sheepshead minnow *Cyprinodon variegatus*. Fish were exposed to MeHg through diet or maternal transfer. For dietary uptake, larvae (ages 7 d to 5 weeks) were fed commercial fish flakes containing 0 or 4.8 ppm MeHg. Growth rates, respiration rates, swimming activity, and prey capture ability were tested. For evaluating the maternal transfer of MeHg, the female juvenile fish were fed control and MeHg-contaminated diets from an age of 3 -5 months. After exposing the fish to MeHg, female fish were paired with Hg-free male fish for spawning. We assessed egg production, hatching success of embryos, survival of larvae, the growth of larvae and swimming behavior of larvae. Data to date suggest that dietary MeHg has no significant impact on larval fish growth and swimming activity (swimming speed, acceleration, active time and swimming distance) even when their tissue MeHg concentrations greatly exceed 0.3 ppm, the reported threshold for toxicity in freshwater fish. MeHg had a small but significant impact on the respiration rates and prey capture ability of these fish. Decreased egg production and hatching success were not observed after dosing juveniles. Survival, growth, and swimming of larvae were not affected. Mercury/Selenium molar ratios in juveniles range from 0.1 to 3.04, which helped to explain why there were no effects on fish reproduction.

P19

How best to express aquatic toxicity of organic chemicals: lethal concentrations at defined exposure time, or time-to-death at defined concentrations?

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The OECD specifies assays for determining the concentration causing lethality of 50% of organisms (LC50) within a test duration e.g. 96h., with stringent test parameters such as temperature, oxygen concentration, and quality/number of test organisms. Another approach is Time-To-Death (TTD) where a constant concentration is maintained, such as in experiments by van der Heijden et al.[2]using passive dosing techniques. We believe that a graphical mass balance model of uptake can also be valuable for data analysis. The Chemical Exposure Toxicity Space (CETS) diagram was presented in Mackay et al.[3]as a tool to aid in designing aquatic toxicity tests. It is based on the Arnot and Gobas[4]first order 1-compartment bio-uptake model (Equation 1): Here $C_F$is the fish concentration, $C_W$is the water concentration, $k_1$is the respiration uptake constant, and $k_2$is the respiration loss constant. Equation 1 can be parameterized in terms of the concentration causing lethality, where C_W=LC50, and C_F= critical body residue (CBR). The bioconcentration factor (BCF) = (k_1/k_2), and the remaining time term is designated as 'F'. Rearranging Equation 1: The quantity CBR/BCF is the minimum concentration to causes lethality, or 'incipient lethal concentration' (ILC). LC50 can be plotted againstFto give a function showing the minimum concentration required to cause lethality at a given time. Aqueous solubility and maximum test duration are added as limits, along with the steady-state ILC to give a CETS diagram shown in Figure 1: Figure 1: Chemical exposure toxicity space diagram showing the toxicity hyperbola separating non-toxic regions below from toxic the region above. In Figure 1 TTD method is shown along the XY lines while the OECD LC method is shown along line AB. Note the TTD method results in many points defining the ILC line whereas the LC method gives only one useful point. If the TTD method is used then a CETS plot can be obtained directly from experimental data, such as in Figure 1 (XY lines). TTD methods also have the additional benefit of reducing wasted tests, money, and organisms. For prescribed LC methods the CETS diagram can aid in choosing concentrations, however water concentrations must be closely monitored to ensure constancy, or passive dosing techniques can be used as suggested by Mayer et al.[7]. **Refs DOI** 1) 10.1787/20745761 2) 10.1021/es505078r 3) 10.1002/etc.3668 4) 10.1897/03-438 5) 10.1016/0166-445X(92)90001-4 6) 10.1007/BF00116339 7) 10.1021/es980889

P20

Population level risk assessment of copper toxicity to rainbow trout (Oncorhynchus mykiss)

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Currently, ecological risk assessment of metals is mostly based laboratory toxicity test that measure the effect of a metal concentration on individual-level endpoints. Mortality, dry weight, biomass, fecundity and hatchability are individual-level endpoints that are often measured in toxicity tests. However, individual-level endpoints do not necessarily translate directly to a similar effect at population level and therefore also not to adequate guidelines for the protection of species at population level. Population models can potentially help to overcome this problem. Therefore, the goal of this study is to investigate the effect of copper toxicity on the performance of a rainbow trout (*Oncorhynchus mykiss*) population using an individual based model (IBM). Furthermore, this study will quantify population level ECx values for the effect of copper toxicity and compare those with ECxvalues reported for individual-level endpoints. We hypothesize that the population level EC.x values will be higher than the individual-endpoint based ECx values. To estimate population level ECx values, an already existing IBM for brown trout, inSTREAM-Gen (Ayllón et al. 2016)was adapted and extended with a toxicity component. The toxicity component included the effect of copper on the survival and growth of rainbow trout. The effect of copper on survival over time was estimated using the General Unified Threshold for Survival model (Jager and Ashauer 2018). The population model was then used to estimate relative population sizes in each year of the simulation. These data were then used to estimate population level ECx values for the effect of copper toxicity on the population size and the probability of persistence after 10 years. We found that the population level ECx values were higher than the individual-level ECx values. The found difference between individual-level endpoints and population level-endpoints highlights the need of addressing the toxicity of metals on population level.

P21

Ecorelevance - improving ecological realism in metal risk assessment: development, validation and application of population models for population-level effect assessment

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Recent developments in risk assessment challenge the use of species sensitivity distributions (SSD) for predicting field effects of chemicals. The ecological aspect of the SSD approach is under debate, as toxicity data used to construct the SSD is based on individual-level experiments under laboratory conditions. Nonetheless, protection goals in EU legislations (e.g. WFD) state that protection of populations and communities is needed to maintain ecosystem functioning. The Ecorelevance research project is a long-term vision developed by the University of Ghent and Arche Consulting to ultimately improve ecological realism in metal risk assessment. A crucial part in this project is the development and validation of population models for risk assessment. In this poster, we present several cases where mechanistic models have been successfully applied to predict toxicity of metals (Ni and Cu) at the population level. In a first case, individual-level effects of Cu on the freshwater snail *Lymnaea stagnalis*were extrapolated to the population level. At the organism level, the sensitivity of the snails largely depended on the food source. At the population level, the food source effect was still present, albeit less pronounced. A second case covers the temperature effect on Ni sensitivity of *Daphnia magna*. In a population experiment, no effects of Ni to a *D. magna*population were observed, despite significant effects in the standard toxicity experiment. The population model confirmed this unexpected finding. Extrapolating to untested concentrations showed population-level effects at higher concentrations than tested. A final case presents the effects of Cu on a *D. magna* population. Again, during a population experiment no significant effects of Cu were observed at concentrations which did affect traditional, apical endpoints. Population modelling confirmed these results. Predicted population-level effect concentrations for Cu were indeed higher than the tested concentrations.

P22

Stable deuterium isotope labelling as alternative to radioactive labelling to study the fate of pesticides

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Pesticides are organic contaminants of particular interest since they are applied deliberately and in large amounts to soils. The main pathway of their ultimate detoxification is considered to be microbial degradation. The carbon or nitrogen from an organic contaminant can be used by microorganisms for synthesis of their biomass compounds (such as lipids, proteins and sugars). After the microorganisms die, these biomolecules are incorporated into the organic matter (OM) of soil or sediment forming ultimately the so-called biogenic non-extractable residues (bioNER). Stable isotope tracers such as ^{13}C or ^{15}N enable the detailed study and quantitation of the C and/or N flux from a targeted pesticide via microbial biomass to bioNER. However, due to high natural abundances of ^{13}C or ^{15}N isotopes in soils, sediments, and plants, the turnover mass balance of these isotopes is only possible at the initial application rate of 20 – 50 mg/kg. In contrast to ^{13}C and ^{15}N, the heavy H isotope (deuterium, D) is present at a low amount in the environment. Here we show the turnover mass balance of D and ^{13}C labelled 2,4-Dichlorophenoxyacetic acid (2,4-D) -a widely used herbicide- under 8 incubation experiments with pure culture of *Cupriavidus necator* JMP 134 (*C. necator*) –a well-described 2,4-D degrader in soil. Previous studies have illustrated the turnover mass balance of ^{13}C-2,4-D in soil and proved the efficacy of using stable isotopes instead of radioactive ones. This study aims to compare the turnover of ^{13}C-(2,4-D) with D-(2,4-D) in pure culture at a low initial application rate of 1 – 2 mg/kg, which corresponds to environmentally relevant concentration of pesticides. If deuterium labelling proved successful, it would be a cheaper and more realistic approach to study the fate of pesticides.

P23

Excess lifetime Cancer risk and Radiation Pollution hazard indices in rocks and soil of some selected mining sites in Nasarawa State, Nigeria.

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Radiation exposures from mining and mineral processing industries can lead to high incidence of disease conditions like nausea, lung cancer, sterility, fatigue, and diarrhoea among mine workers. The concentration of natural radionuclides (^{238}U, ^{232}Th and ^{40}K) in some selected mining sites in Nasarawa State, Nigeria was examined in this study. Soil and rock samples were collected from eight different mining sites and analyzed for radionuclides activity concentration using gamma ray spectroscopy NaI (Tl) detector system, while soil physical and chemical parameters were analyzed using standard methods. Data obtained were subjected to

simple descriptive statistics using SPSS statistical package. The results of the soil physical and chemical properties analyzed were: pH (5.92-6.84), EC (18-77 ds/m), OC (0.14-0.66 g/kg), OM (0.24-1.14 g/kg), % sand (61.52-87.52), % silt (10.00-26.00) and % clay (0.48-16.48) respectively. The range of activity concentrations of ^{232}Th, ^{238}U and ^{40}K for soil samples were 3.28-17.98, 11.82-31.61 and 3001.87-14402.00 Bq/kg respectively, while those of rock samples ranged from 6.67-17.32 for ^{232}Th, 16.49-26.77 for ^{238}U and 1731.90-13035.99 Bq/kg for ^{40}K. The radioactivity concentration values obtained in these mining sites were below the world average values of 45 and 33 Bq/kg for ^{232}Th and ^{238}U respectively but higher than 420 Bq/kg for ^{40}K. The result obtained for the annual gonadal dose equivalent, absorbed dose rate, outdoor annual effective dose equivalent, indoor annual effective dose equivalent and excess life time cancer risk were above the world permissible limit of 300 µSv/yr, 60 nGy/h, 70 µSv/yr, 450 µSv/yr and 0.29 (10^{-3})respectively, for both rock and soil samples.

P24

Determination of pesticide residues in plasma of occupationally exposed individuals in Córdoba Province (Argentina)

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Despite the many technological advances brought by the modern intensification of agriculture, the increased yields were achieved primarily through the use of fertilizers and pesticides. Terrestrial applicators of pesticides are who deal with the highest levels of exposure. The present study was designed to evaluate pesticides levels in terrestrial pesticides applicators working in extensive crops of Córdoba province with the hypothesis that occupational exposure to pesticides will correlate with higher values in the concentration of pesticide residues compared to non-exposed populations. An analytical method to detect and quantify pesticide residues in plasma was optimized for 18 pesticides and some of their metabolites. PCB28 was used as internal standard. The set-up was performed with plasma samples from volunteers without known exposure to pesticides. After protein precipitation of 0.5 mL of plasma and liquid extraction with hexane, samples were dried under nitrogen stream and the concentrate was reconstituted in 0.1 mL of isooctane. The extracts were analyzed by gas chromatography (CG-ECD ^{63}Ni). Linearity of the method ranged (µg/L): 0.08-6.8 (organochlorine and organophosphorus), and 1.2-67.5 (pyrethroids). Lower limit of detection was experimentally chosen as the lower level in the calibration curve (µg/L): 0.1 (organochlorine and organophosphorus), and 1.2 (pyrethroids). Selectivity, accuracy and precision were also evaluated. The validated method was applied to quantify pesticides residues in plasma of two different populations: pesticide applicators working in extensive crops, exposed group, and non-pesticides applicators, control group. We found higher frequency of pesticides detection in exposed subjects (HCB, β-HCH, chlorpyriphos methyl and ethyl, heptachlor and heptachlor exo-epoxide, α-endosulfan, pp´DDE, deltamethrin, mirex and endrin) than in control subjects (HCB, β-HCH, chlorpyriphos methyl, α-endosulfan, pp´DDE and deltamethrin). Concentration levels of pesticides in the exposed group at least triplicate the concentration found in the control group, with the exception of permethrin. These differences evidence the greater exposure of the exposed subjects in relation to the control subjects. This case-control study allows us to conclude that the exposed group has an increased exposure to pesticides in the present working conditions. These findings also highlight the need to promote safer work practices and to elaborate preventive proposals.

P25

The estimation of hydrocarbons bioavailability in oil contaminated soils using extractants of different polarity

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Investigations of the biological transformation of hydrocarbons in soils are based on the concept of limited bioavailability of hydrocarbons (as well as other hydrophobic organic pollutants) due to the distribution of hydrocarbons molecules within the soil matrix with the formation of various bonds with different components. Thus, determination of the bioavailable fraction of hydrophobic organic pollutants is important issue. Nevertheless, there is no any one-size-fits-all approach currently, that can reliably determine the bioavailability of hydrocarbons. One approach is developed using a procedure of mild extraction with aliphatic alcohols - most commonly is n-butanol. The goal of our study was to evaluate the effect of various parameters on hydrocarbons extraction from soils contaminated with HC from different sources (oil, aerosol particulate matter). Extraction time (1–16 hours) and solvent polarity (BuOH 100%, BuOH:H_20=90:10) were evaluated in number of model experiments with different time of soil pollution (1, 21, 100 days). Analytical determination of hydrocarbons in soil samples was performed using reverse-phase high-performance liquid chromatography (Agilent HPLC 1260 infinity) with a fluorescence detector (Agilent 1260) and gas chromatography–mass spectrometry (Agilent 6890/5973 GC–MS) During the study, the following results were obtained: Different degrees of polarity (the presence of water in the extractant) doesn't have a noticeable effect on the degree of extraction of bioavailable hydrocarbons from significantly oil-contaminated soils (10%). Significant differences between extractants of different polarity in soils with a high level of hydrocarbon oil pollution weren't found. The addition of water to butanol significantly increased the efficiency of PAH extraction in soils with low pollution. Within the first 8 hours of the interaction of the soil with the extractant, the increase in hydrocarbon output from the soil was revealed. Sufficient time for carrying out the extraction of bioavailable hydrocarbons was 8 hours; the further extraction time didn't increase the output. Significant influence of centrifugation on the output of all PAHs analyzed wasn't detected. The output of the bioavailable fraction of hydrocarbons of the studied soils decreases with an increase in the period of pollution (aging of the soil).

P26

Multi-class screening of antimicrobial drug residues with high resolution mass spectrometry in fresh water ecosystems in Flanders

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The presence of antimicrobial drug residues in the aquatic environment can alter the growth of microorganisms that are important for the ecological balance of the food chain and the conservation of biodiversity. The overall objective of this project was to assess the contamination status of amphibian breeding ponds with antimicrobials as part of wildlife conservation. For this reason, a novel ultra-high performance liquid chromatographic high-resolution mass spectrometric (UHPLC-HRMS) method for the simultaneous quantification of 40 targeted antimicrobial drugs in fresh water was developed with the possibility to screen for a virtually unlimited number of (un)known compounds. A suitable extraction method based on solid-phase extraction (Waters Oasis HLB 200 mg, 6 ml) was designed, assisted by fractional factorial design. A broad polarity range of compounds was covered. More

specifically, the log K_{ow} ranged from 5 to 12 including major representatives of the following classes: sulphonamides, tetracyclines, quinolones, macrolides, lincosamides, diaminopyrimidines, nitrofurans, penicillins, cephalosporins, pleuromutilins and phenicols. All analytes were separated using a 1.9 µm Hypersil Gold column (100 mm x 2.1 mm) and detected in full-scan at 140.000 FWHM. The developed UHPLC-HRMS method was validated according to CD 2002/657/EC for evaluating its performance (i.e. limits of quantification, limits of detection, specificity, selectivity, linearity, trueness and precision). Analysis was performed in triplicate on 18 amphibian breeding ponds, selected throughout different ecoregions in Flanders. The results of the sampling campaign will be presented at the conference. This research is supported by the Special Research Fund of Ghent University grant number BOF16-GOA-024.08. *: corresponding author: tess.goessens@ugent.be[1]

P28

Effects of bioturbation on the freely dissolved hydrophobic organic chemical contribution in sediment cores of the German Bight

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Marine muddy sediments store a large amount of legacy hydrophobic organic chemicals (HOCs), such as polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). The primary emissions to the environment of many HOCs have been reduced as a result of strict regulations. Undisturbed sediment serve as sink for HOCs and exhibit a normal distributed chemical profile according to the historical input of HOCs in the environment. For example, the PCB concentration first increases with depths until a maximum is reached and then decreases again with depths according to the temporal industrial use. The release of HOCs from the sediments to water and biota pose a risk of negative effects on the local ecosystem. Especially the benthic community is directly exposed to organic pollutants in the sediment. However, the reworking activities of benthic organisms, a process called bioturbation, can enhance the sediment-to-water flux of HOCs. The organisms' activities disturb the sediment profile and mobilize the chemicals from deeper layers. Beside the chemical analysis of the total sediment concentration (C_{total}), the determination of the freely dissolved pore water concentration (C_{free}) is more crucial since it accurately reflect the bioavailable fraction. Based on C_{free}, the chemical activity (a) can be determined, which describes the potential for ecologically relevant spontaneous processes such as diffusion, bioconcentration and baseline toxicity. In this study, C_{total} and C_{free} of sediment cores from the German Bight (North Sea) were investigated. Recent advances in equilibrium passive sampling methods (EPSMs) offer a promising alternative to the measurement of C_{total} and support improved risk-based decision making since bioavailability of sediment contaminants can be directly quantified via C_{free}. Currently, freely dissolved concentration will establish as an important endpoint for sediment quality and risk assessment (Mayer et al. 2014). The determination of C_{free} of PAHs and PCBs in sediment pore water was performed using solid phase microextraction (SPME) according to Witt et al. (2009). Furthermore, the community bioturbation potential (BPc) was determined according to Queirós et al. (2013) after benthos analysis. Finally, C_{free} and C_{total} were correlated with the bioturbation potential to identify whether there is a mobilization and redistribution of HOCs in the sediment cores caused by bioturbation.

P29

ANALYTICAL INVESTIGATIONS OF SOIL AND WATER IN COAL MINING IMPACTED AREAS OF ENUGU STATE, NIGERIA.

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Soil and water in the coal mining communities of Enugu State were investigated for the presence of heavy metals in the soil and water. Three of the communities which is akwuke, udi and ngwo were coal mining impacted areas, though coal mining has been stopped for over 20years now in these communities. The heavy metal of soil and water from these areas were investigated, using Atomic Absorption Spectrophotometer (AAS). The result of Heavy metal levels in soil of the three communities are within the permissible limit in agricultural soil (Awashthi, 2000), though higher level of Mn, Pb and Cd were observed in Akwuke soil over other communities which could be attributed to anthropogenic and mining activities that took place in the area, and the use of fertilizer. The heavy metal levels in well water followed the same trend as observed in soil. However Mn, Cr and Pb level in well water from the three communities were above W.H.O (2005) permissible limit of 0.05mg/l, 0.05mg/l, and 0.01 for Mn, Cr, and Pb respectively. The high level of these metals in well water could be attributed to anthropogenic source as well as underground water pollution due to leaching of these metals in the soil to underground water. It was observed that pH level of Ngwo soil compared to that of Udi and Akwuke soil which is below W.H.O standard may be attributed to anthropogenic sources. The specific gravity and bulk density of soil from, Ngwo, Udi and Akwuke were below the WHO allowable limit. The anion levels, NO3, PO4, SO4 and Cl2 levels in soil from the three communities studied were within permissible limit (EPA, 2012), though PO4, SO4 and CL2 level of Udi soil were significantly higher than the values in the communities. The decrease in pH of well water from Udi and Akwuke, 4.80±0.01 and 5.54±0.01 respectively was an indication of acidity of the well water. These values are above W.H.O standard level (6.5) for portable water. The conductivity levels of well water from the three communities investigated were within the EPA permissible level (5-50µhons/cm3) for drinking water. The observed levels of total solid, total dissolved solid and total suspended solid of well water from the three communities were within the WHO permissible limit for drinking water, except chloride level (916.00±1.00) in Udi well water which was above W.H.O permissible limit (250mg/l) for chloride. **Key words:** Soil and Well Water, Pollution, Permissible Limits, Enugu State, Nigeria

P30

Environmental Impacts of Spent Oil Lubricants on Soil Properties and Environmental Segments in Orji Mechanic Workshop, Imo State Nigeria

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ABSTRACT The study investigated the effects of spent oil lubricants on soil physical and chemical properties. Twelve (12) different soil samples were collected from the auto-mechanic villages and from the Federal University of Owerri (FUTO) university agricultural land that served as the control. Two (2) samples were collected from these three points 5^0 31.114N $7^0$02.703E, $5^0$31.165 N 7^0 2.670E and $5^0$23.35N$6^0$59.176E at profile of 0-15cm and 15-30cm.Twenty three (23) different parameters were analyzed for the soils such as pH, bulk density, total organic carbon, particle size distribution, heavy metals of Ni, Cu, Zn, Ar, Cd, Hg and Pb. Standard methods were employed in the course of the analysis. All the parameters tested was in good condition except for the soil pH and concentrations of heavy

metals which were more significant as pH of the auto-mechanic soils were acidic in the range of 4.3- 5.0 in comparison with the control with mean value 5.6. Heavy metals were higher and richer in auto mechanic soils than in the control and their concentration decreases in this trend Cu 0.940> Hg 0.211> Ni 0.093> Zn 0.051>Pb 0.021> Cd 0.015 >Ar 0.003; Hg 1.385> Cu 0.853> Ni 0.079> Zn 0.041> Cd 0.04>Pb 0.034>Ar 0.004 for the soil auto-mechanic soil 1 and 2. Ar had zero values in the soils of the control. Pearson Correlation coefficient was computed in testing the hypothesis using SPSS v. 20 where significant positive correlations were obtained at values 0.957 and 0.99. P value 0.00;0.874 and 0.999, P 0.00; 0.997 and 0.912, P 0.000; 0.997 and 0.918 P 0.000 all at 0.01 level of significance.The null hypothesis was rejected on the basis of the significantcorrelations for relationships between the use of lubricants and physico chemical variables, physico chemical variables and depths of the soil across the profile, use of oil lubricants and soil particle size distribution, use and disposal of oil lubricants and soil texture.Recommendations were made like adherence to proper disposal of auto mechanic wastes, use and enforcement of Environmental Management Plan in auto- mechanic workshop villages and remediation measures to correct the concentration of parameters as identified using phyto- remediation for a sustainable soil and environmental management in the vicinities of the workshop.

P31

Pesticide occurrence in a watercourse impacted by intensive horticultural production in the outskirts of La Plata, Argentina

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La Plata (Argentina) has one of the most important horticultural greenbelts in the country, where highly diversified and intensive production systems predominate. Despite a production highly dependent on pesticide use, their impact on the surrounding environment remains largely unknown. The objective of the current study is to investigate on the occurrence and concentrations of pesticides in the different environmental matrices of a representative watercourse surrounded by horticultural production. For that purpose, five sites along the Carnival creek were studied during six sampling campaigns (C1-C6) encompassing 3 years. Surface water (total) were extracted by liquid-liquid extraction, suspended particulate matter (SPM, filtered *in situ* through 0.45 µm) by ultrasonication, and sediments by *QuEChERS*. Precolumn derivatization with FMOC-Cl was performed for glyphosate (GLY) and its environmental metabolite, the aminomethylphosphonic acid (AMPA). Instrumental analysis was carried out by gas or liquid chromatography coupled with mass spectrometry in selective ion mode. For each matrix 30 samples were analyzed, bringing it to a total of 180 samples. Surprisingly, GLY + AMPA were detected in all matrices in all sampling campaigns, except for one. Other herbicides, such as atrazine and trifluralin, were detected at frequencies >25%. In C2 and C4, insecticide concentrations were above the guideline for aquatic life protection. In SPM, GLY + AMPA were detected in 75% of the samples. Azoxystrobin was detected in water and sediment samples (>25%). In sediments, C4 presented the highest total pesticide mass, 12725 ng/g: 63% due to herbicides and 32% due to insecticides. While in C1, 72% of the 5163 ng/g found were due to insecticides, and 21% due to herbicides. The highest concentrations found were 4634 ng/g of GLY + AMPA (C4), 2258 ng/g of chlorpyrifos (C1), and 2605 ng/g of λ-cyhalothrin (C4). Maximum pesticide loads were as it follows: C4>C1>C2>C6>C5>C3. From the headwater, as the horticultural activity intensifies, surface water concentrations reflect on the pesticide use trend in the area: herbicide concentrations decreased as insecticide concentrations increased. Up to 12 pesticides were detected in the same campaign (C2). One of the most relevant findings is the detection of herbicides in a horticultural setting. Pesticides used in this productive activity can effectively reach nearby watercourses and have the potential to negatively affect the aquatic life.

P32

PFOS bioaccumulation in a tropical estuary

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Perfluorooctanesulfonic acid (PFOS) is a ubiquitous contaminant which is regulated under Annex B of the United Nations Stockholm Convention on Persistent Organic Pollutants (UNSCPOP). PFOS has been linked to hepatotoxicity, developmental alterations, immunotoxicity, and hormonal adverse effects in biota. While accumulation of PFOS has been identified in organisms around the globe, surprisingly few data are available for the South American ecosystems. This region is important for studying PFOS occurrence due to the ongoing manufacture of Sulfluramid, a PFOS-precursor which is produced in Brazil under UNSCPOP manufacture and use exemptions. In the current study, we investigated biomagnification of PFOS in an aquatic food web from a tropical estuary in Bahia, Brazil. Twenty-one species over five different trophic levels were sampled. Stable-nitrogen ($\delta^{15}N$) and carbon ($\delta^{13}C$) were used to determine the trophic positions of the organisms while the determination of PFOS was carried out by liquid chromatography-tandem mass spectrometry (LC-MS/MS). PFOS was present in 86% of samples at concentrations of 0.14 (*Ucides cordatus)* to 3.63 ng g^{-1} (*Litopenaeus* sp.) (1.01 ± 0.82 ng g^{-1}, average ± SD). Spearman's rank correlation analysis showed a statistically significant correlation between PFOS concentrations and trophic level (n = 21; rs = 0,493, p = 0,023). Food web magnification factors were greater than 1, indicating that biomagnification of PFOS occurs across trophic levels. These data indicated the widespread occurrence of PFOS in the biota of a tropical estuary, and further highlight the potential for PFOS to biomagnify in the food web, consistent with prior studies.

P33

Heavy metal concentrations in surface water and sediment from Odidi Oil Field, Niger Delta, Nigeria.

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Oil industry activities such as exploration, transportation, storage, use and disposal, as well as oil spills are sources of major contamination problems in Niger Delta, which have significant deleterious effects on aquatic organisms. The objective of this study was to evaluate the impact of crude oil spillage and production activities in Odidi oil fields. The sampling stations are Odidi Flow Station (OFS), Egwua11 Flow Station (EFS), Batan Flow Station (BFS), and Warri town (WT) which is reference station. The result from this study shows that the heavy metal concentrations in surface water ranged between 0.0144mg/l (WT) and 0.108mg/l (BFS), 0.0223mg/l (WT) and 0.0685mg/l (BFS), 0.0024mg/l (WT) and 0.0169mg/l (OFS), 0.0013mg/l (WT) and 0.0027mg/l (BFS) for Cadmium, Lead, Nickel and Vanadium respectively. The heavy metal concentrations in sediment samples also ranged between 0.0444mg/l (WT) and1.9289 mg/l (BFS), 1.0283 mg/l (WT) and 4.52645mg/l (BFS), 0.0398mg/l (WT) and 0.5680mg/l (OFS), 0.0018mg/l (WT) and 0.2487mg/l (EFS) for Cadmium, Lead, Nickel and Vanadium respectively. The

decreasing trend of metals in both surface water and sediment were Pb>Cd>Ni>V. These results showed that heavy metal concentrations in sediments were significantly ($p< 0.05$) high than that of water. Also, heavy metals concentrations in water and sediment were above the permissible limit by FEPA/DPR, USEPA and WHO. The areas sampled had high heavy metals concentrations that are likely to crude oil spillage and production activities. It could be concluded that the Odidi Oil Field is heavily polluted which could have negative impacts on aquatic organisms inhabit the area.

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Environmental risks of metals contamination in sediments of tropical reservoirs

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Despite the central role of clean water for humankind, water pollution has become a global concern. Sediments from reservoirs can work as both sink and source for pollutants. Once released into the water column, contaminants can be transferred through the food chain, and be toxic to biota and to humans. Anthropogenic activities continuously emit metals to the water environment, where they may accumulate in the sediment. Therefore, studies investigating metal contamination in reservoir sediments are needed. Here, we have investigated the surface sediment contamination by copper (Cu), chromium (Cr), cadmium (Cd), lead (Pb), zinc (Zn) and iron (Fe) in six reservoirs in the southeast of Brazil. In addition, we assessed the metal contamination in sediment cores, representing an assessment over time, and compared the results with toxicity guidelines. Furthermore, we evaluated the potential environmental risk associated with the metal contamination of the water reservoirs. The bioavailable fraction of metals was quantified using a moderate acid extraction combined with flame atomic absorption spectrometry. In general, the surface sediment concentrations of Cu, Cr, Cd, Pb, Zn, and Fe were homogeneous within and between the reservoirs. Further, there were no clear temporal trends in sediment concentrations, except for Cr, Cd, and Pb that showed a decreasing pattern over time. Although the reservoirs are located in different basins of Brazil, the anthropogenic influences and possible sources of metals are similar. However, the reservoirs located downstream the city of Juiz de Fora (Minas Gerais state) showed higher metal contamination and potential ecological risks. In 1982, these reservoirs received waste from a mine dam collapse. Despite the use of a moderate acid extraction, metal concentrations exceeded the limits recommended by the guidelines to avoid potential adverse effects on aquatic organisms. The harsher extraction method, that provides total metal concentration, generally used in guidelines for water quality criteria, does not target the fraction that is taken up by biota and is thus not optimal for use in the management of water quality. Moreover, as metals are not isolated in the environment, guidelines need to take into account the toxicity of mixtures. Our findings point out the need for further research to bring more information for decision makers to review the limits and the methods of current guidelines.

P35

Persistent Organic Pollutants and chlorpyrifos in feathers of the threatened Olrog's gull (Larus atlanticus) wintering in southeastern Buenos Aires province, Argentina

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Persistent Organic Pollutants (POPs) such as Organochlorine pesticides (OCPs), polychlorinated biphenyls (PCBs) and polybrominated diphenyl ethers (PBDEs) are anthropogenic chemicals characterized by their hydrophobicity, volatility and environmental persistence. These characteristics lead to them to be highly toxic, have considerable bioaccumulation and biomagnification in the food web. POPs were banned years ago and have been regulated since 2001 under the Stockholm Convention. Chlorpyrifos is an organophosphate insecticide currently in use, whose use has been increased following the banning of endosulfan in 2013. Marine birds, such as gulls, have been used as an indicator of chemical pollution of aquatic ecosystems given their trophic position; besides these species are capable to bioaccumulate pollutants in their tissues. In this context, the objective of this study was to determine levels of POPs and chlorpyrifos in feathers of the Olrog's gull (*Larus atlanticus*) and examine its relationship with sex and age class, during the non-breeding season in Mar Chiquita lagoon, Buenos Aires province, Argentina. POPs and chlorpyrifos were identified and quantified by gas chromatography with electron capture detector (GC-ECD). Chlorpyrifos was found in greater quantities among all the pollutants in all groups of individuals (c= 262,93 ng/g), resulting from current agricultural practices. The highest values of POPs (males c = 280.45 ng/g, females c = 300.6 ng/g) were found in juvenile birds. OCPs were found in all sampled birds. Endosulfan was the main OCP group, which contributed to the total OCPs concentration in 33%, followed by HCHs with 28%. Among the PCBs, there was a predominance of dichlorbiphenyls and trichlorbiphenyls (#33, #44 and #31+28); these congeners have greater volatility and solubility than more chlorinated PCBs, which justifies the possible external deposition of these contaminants. The presence of hexachlorbiphenyls (#153 and #138) and PBDE-153 in juvenile birds would be a consequence of the location of the nesting area, possibly next to the Bahia Blanca estuary, known for being a POPs hot spot. Concentrations of POPs and chlorpyrifos showed difference between sexes in subadults and adults birds, while levels found in males were higher than in females. Overall, the present study provides relevant information for the development of monitoring programs and regional strategies to improve the conservation status of the threatened Olrog's gull.

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Persistent organic pollutants in humpback whales from the southern hemisphere: influence of stock and trophic ecology

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Humpback whales (*Megaptera novaeangliae*) from the southern hemisphere undergo large scale seasonal migrations between their summer feeding grounds near Antarctica and their winter reproductive grounds in the subtropical to tropical regions. However, little is known about their trophic niche and their contaminant burdens. The aim of this study was to understand the isotopic niches and persistent organic pollutants (POPs) burdens of Humpback whales from two stocks: stock C1 breeding off Mozambique and stock G breeding off Ecuador. We focused our analysis on the main POPs; polychlorinated biphenyls (PCBs), pPolybrominated diphenyl ethers (PBDEs), and organochlorine pesticides (OCPs) including dichlorodiphenyltrichloroethane and its metabolites (DDXs), hexachlorobenzene (HCB), lindane (HCHs), chlordanes (CHLs) and methoxylated PBDEs (MeO-

PBDEs). The analysis of stable isotopes $\delta^{13}C$ and $\delta^{15}N$ in skin resulted in further insight on their feeding ecology, which was in agreement with a diet focused mainly on low trophic level prey species, such as krill from Antarctica, *Euphausia superba*. However, one group in the C1 stock had higher $\delta^{15}N$ values that could be explained by sex, metabolic state, age or geographic $\delta^{15}N$ variations, or a more opportunistic diet in Antarctica that includes fish. POPs were measured in all humpback whales in the order of HCB > DDXs > CHLs > PCBs > HCHs > PBDEs > MeO-PBDEs. HCB (mean : 66.5 ng/lw in Mozambique and 36.5 ng/lw in Ecuador) and DDXs (mean : 8 ng/lw in Mozambique and 24 ng/lw in Ecuador) were the predominant compounds in all humpback whale samples. HCB accounted for 81% of POPs in Mozambique and 54% in Ecuador while DDXs accounted for 10% of POPs in Mozambique and 35% in Ecuador. Among DDT compounds, *p,p*'-DDE was the major pollutant, reflecting its long-term accumulation in humpback whales. Significantly higher concentrations of HCB were found in whales from Mozambique while significantly higher concentrations in DDXs and HCH were found in whales from Ecuador. No significant differences were found in PCBs concentrations. Levels in POPs were in accordance with other studies from this hemisphere and were in each case lower than in the Northern hemisphere. Pollutants were not correlated with $\delta^{15}N$, lipid content in the blubber or time. It may indicate different exposures of the whales according to their feeding zones. Further investigations are required to assess exposure of southern humpback whales throughout their feeding zones.

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Organic Waste Management-Special Focus on the Effect of Nutritional Composition of Fruit Wastes on Methane gas Production and Energy Quality.

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Production of methane gas from organic wastes, is an effective two pronged method of generating sustainable alternative energy and managing organic wastes in the environment. Nutrients have been considered to be the main factor affecting microorganisms responsible for methane gas production during anaerobic digestion process. In this study the nutritional composition of some fruit wastes; mango (M), watermelon (W), pawpaw (P), their effects on methane gas production, and resulting energy values were assessed. The proximate composition of the substrates were determined using standard methods of the Association of Official Analytical Chemists, while the mineral element composition were assayed using Perkin Elemer atomic absorption spectrophotometer (Model 306). Qualification of methane gas yield was by Exibd I Portable Multi-Gas Analyzer (Model 160204001). The calorific values of the methane gas were determined using standard equations. The nutritional analysis revealed that the substrates had high amounts of nutritive contents suitable for methane gas production, however, pawpaw substrate contained a high level of cellulose. Total solid (TS) content values of 21.5, 9.5 and 16.5 were respectively measured in M, W, and P substrates. Volatile solid (VS) values of 90.94, 95.4 and 96.48, with C/N ratios of 32.7:1, 25.8:1, 51.5:1 were recorded in M, W and P substrates respectively. The mineral elements, potassium, sodium, calcium, magnesium, iron, zinc, copper, manganese and phosphorus were detected in the different substrates at varying concentrations. At the end of the production process the total methane gas yields from the different fruit waste treatments and the positive CONTROL (Cow dung) treatment were 86.8cm^3, 232.8 cm^3, 0.0 cm^3, 309.4 cm^3, 103.2 cm^3, 56.2 cm^3, 263.2 cm^3 and 252.2 cm^3 from M, W, P, WM, PW, MP, MWP and CONTROL, each having energy value estimations of 62600 kJ/m^3, 209600 kJ/m^3, 0 kJ/m^3, 274400 kJ/m^3, 211200 kJ/m^3, 69400 kJ/m^3, 284400 kJ/m^3, and 97200 kJ/m^3. The measured concentrations of the mineral elements present in the substrates were not above the thresholds that can inhibit methane gas formation. All the wastes treatments evaluated produced detectable methane gas with the exception of Pawpaw treatment. In addition, the energy value of the methane gas from Water melon treatment and other mixed treatments were appreciably high, thus, can contribute to the development of renewable energy and waste management.

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Environmental impacts of woody biomass ash application for soil neutralization

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The environmental concerns about climate change encouraged the construction of power plants fueled by forest biomass, increasing the amount of ash produced. An important aspect of sustainable development is the implementation of effective waste management strategies. An alternative of ash recycling includes its incorporation in forest soils to correct soil acidification, since wood ash is alkaline and readily reacts with acidic components in soil. Therefore, the purpose of this study is to compare the environmental impacts of woody biomass fly ash landfilling (typical disposal option) and landfarming through the application of life cycle assessment. The fly ashes under study are generated from the combustion of eucalypt and maritime pine in a vibrating grate furnace. The functional unit is the landfilling/landfarming of 1 t of ashes. The system boundaries include the transport of the woody biomass ash from the power plant to its destination, the on-site processes and the production of materials/energy consumed in each scenario. Furthermore, when the ash is landfarmed the product system is credited with an avoided burden based on the reduced requirement for conventional liming products. Three substitution alternatives were studied, namely, limestone, quicklime and hydrated lime. The characterization factors used in this study for the impact assessment were those suggested in the International Reference Life Cycle Data System (ILCD). It was observed that the application of woody biomass ash on land for soil neutralization presented lower impact than when conventional liming products are used for the impact categories climate change, particulate matter, mineral and fossil depletion and acidification. The ranking of the liming products from highest avoided impact to lowest is: hydrated lime, quicklime and limestone. The substitution of hydrated lime by ash avoids considerable energy and materials, since its production requires many process to be produced (e.g. mixing, hydrating and drying) than the other liming products in study. However, the net impact only varied by 2-5 % between hydrated lime and quicklime. For the impact category photochemical ozone formation the use of woody biomass ash presented a greater impact than the use of conventional liming products. However, none of the landfarming scenarios had higher impact than landfilling, indicating a significant improvement of the environmental performance for the valorization of ashes as soil ameliorant.

P40

Domestic wastewater discharge as a potential source of personal care products (PPCPs) to water environment: a case study in a sub-urbanized area in Sri Lanka

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Few studies have been conducted in sub-urbanized areas of developing countries where infiltration or direct discharge of waste water could release the Pharmaceuticals and Personal care products (PPCPs) into the environment. The research site of this study is Galle, capital city of the Southern Province of Sri Lanka, a high density sub-urban city with an incomplete sanitary facility.My research objectives are (1) to evaluate the situation of wastewater system with the PPCPs consumer behavior and (2) to address the occurrence of the emerging pollutants PPCPs in water environment corresponding to domestic wastewater emission pathway. The very initial step was to conduct questionnaire survey to approximately 100 household to picture the wastewater treatment practice in Galle area. The result showed 75% household greywater (from laundry, bathroom, kitchen) are directly disposed to the receiving water via the city drainage canals and finally reach to the sea while blackwater from toilet are collected in simple constructed septic tank and pits. Moreover, there is a lack of guidance for the disposal of unwanted medicine and personal care products, which is indicated by 65% and 22% respondent answered that they will dispose to as garbage or flush to the toilet. Influent and effluent wastewater samples collected from nearby Hikkaduwa sewage treatment plant was qualitatively screened for 82 PPCPs and 20 of them were detected. Four compounds acetaminophen, carbamazepine, DEET and caffeine were in high level. This fact has risen the threat to water resources and indicated that ecological and human health are in a potential risk of PPCPs exposure. From this initial results, a sampling campaign in August, 2018 was designed to examine the occurrence of 17 commons PPCPs over the city sewer canal system and from domestic greywater. Samples were collected and the solid phase extraction procedure was done in Sri Lanka. Cartridges were then vacuum dried and frozen at -20^{o}C until transported to Ochanomizu University, Japan for the remaining steps. Samples are now ready for LC-MS analyzing. As far as my knowledge, this is the first study concern about the emerging pollutant in Sri Lanka. From this preliminary study, further works could be considered to help improve the sanitary practice in Galle area toward the United Nation goal number 6 Clean Water and Sanitation.

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Life Cycle Assessment for urban sustainable development: a study to support public policies in Brazil

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The latest World Urbanization Prospect shows that the urban population is expected to be over 66% in 2050, an increase of over 2 billion inhabitants. According to the International Panel for Climate Change, cities are already responsible for about 71–76% of energy-related CO2 emissions. Aiming for more environmentally sustainable cities' development, decision-makers must be supported with reliable information on environmental impact. This research proposes the use of Life Cycle Assessment for environmental impact's scenarios processing in order to create more assertive laws and regulations through Brazilian City's urban planning. For that, the urban planning procedure in Brazil was investigated, as well as sustainable development concepts. A Systematic Literature Review was conducted to present an overview of the existing literature on life-cycle thinking tools applied to cities and urban territory`s analysis. Results indicate that most studies focus on the search of different system solutions separately – water, transport, etc.–, using life-cycle environmental assessment and climate change indicators. However, there is no agreement or consensus on what methodology should be used to assess inventory data and impact when performing a territory or city assessment. As highlighted by Louiseau and colleagues, there are two main procedures for a Territorial Life Cycle Assessment: an urban system based assessment, and a production-consumption assessment. Considering that production-consumption may be a very broad approach, susceptible to consumer behaviors inserted in the local culture and the availability of local raw material and land use, the system based approach is considered more suitable for public policies proposition. Thus, the next step of this research is to perform the impact assessment of the urban mobility system of the City of Porto Alegre, Brazil. The procedure to run Porto Alegre mobility`s Territorial LCA will be mapped, seeking to understand the methodology and the application limits. Finally, an analysis of the implementation on urban planning for urban plans decisions will be made. The research brings results on the formal application of Territorial LCA as an urban sustainable development tool in the Brazilian context. The author expects to produce recommendations for decision-makers and scientific community on how to create better opportunities for the tools usage to scientifically base policies towards sustainability.

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Utilization of waste palm kernel shells as a fuel source for power generation in a direct carbon solid oxide fuel cell

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Direct carbon fuel cells (DCFC) offer attractive advantages such as higher conversion efficiency (80%) and low emissions which makes them superior for operation over the conventional coal-fired power plants. DCFCs which utilize biomass derived fuels combined with carbon capture and storage, present possible prospects of a carbon negative technology. This study relates to the utilization of biochar derived from waste palm kernel shells (PKS) as a fuel source in a Direct Carbon Solid Oxide Fuel Cell (DC-SOFC). The biochars, pre-treated with HCl and NaOH (referred to as PKS_HCl and PKS_NaOH, respectively) were tested in a DC-SOFC and comparisons are made with commercially available Activated Carbon (AC) fuel. The relation between the surface properties and electrochemical performance of the biochar fuels was studied. The biochar fuels were characterized by their chemical composition (ultimate/proximate analysis), Thermogravimetric Analysis (TGA), Fourier Transform Infrared Spectroscopy (FTIR), X–ray Diffraction (XRD), Brunauer–Emmett–Teller (BET) and Scanning Electron Microscopy (SEM), to find out the possible correlation between the cell performance and biochar features. The results showed that NaOH-treated biochar fuels have the highest electrochemical reactivity in the DC-SOFC system. The analysis showed that high carbon content, reduced ash content, porous structure, high thermal reactivity, and presence of oxygen functional groups on the biochar surface have a direct impact on the electrochemical reactions in the DC-SOFC system. The overall electrochemical reactivity of carbon fuels is in the order PKS_NaOH > PKS_HCl > AC.

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Development of regionalized Life Cycle Impact Assessment method for African Countries

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The 2017 United Nations previsions predict that the African population composed of 1.2 billion people nowadays might reach 2.5 billion by 2050, with more than 400 million people, Nigeria is projected to be the 3rd world population by 2050. From an economic perspective, according to a PWC report published in 2017, three African countries will be among the thirty strongest

economies in 2050: Nigeria(14th), Egypt (15th) and South Africa (27th). This population and economic growth will for sure have an impact on the environment in Africa, the continent is already experiencing several environmental issues including especially Air Pollution, Water scarcity, Human Toxicity or Land Use degradation as highlighted by the 2013 UNEP report: African Environment Outlook (AEO-3). From the viewpoint of LCA, the number of groups focusing on LCA in Africa is still very limited compared to other regions of the world (Bjorn et al 2013). Even regionalization has been getting a trend in LCA, nothing has been really made for the African continent. Therefore, this study aims at bridging the research gaps by providing specific characterization factors for African countries.

P45

Model proposed for assessment of environmental impacts arising from electricity generation (Gas and Coal): An LCA approach

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Electricity is a critical component of India's rapid economic growth. A consistent and efficient supply of Sustainable electricity is essential to maintain the fast trajectory of development. A life cycle assessment approach is adopted in the study quantify the environmental impacts of coal and gas-based electricity generation in India. After a thorough assessment of the environmental impacts of coal and gas-based electricity generation, a comparative analysis was performed. This paper presents a Coal and Gas based Electricity Environmental Performance Assessment Model (CGEEPAM), developed based on the life cycle assessment approach. ReCiPe method has been used to assess the results of this study. The proposed model was developed using the variables and selected impact categories to assess the environmental impacts of existing and new thermal power plants. Primary data was collected personal visits to the power plant which have been further analyzed using the SimaPro software and the results obtained through the analysis have been used to develop this model. Comparative analysis with similar international studies from Thailand, Japan, Turkey, Europe, U.S., U.K., Netherlands, Pakistan, and Mauritius have been performed. CO_2 emissions from PP2 (India) are the highest i.e 1,287 g CO_2eq/kWh and the emission observed from Turkey is at the minimum at 533 g CO_2eq/kWh. This paper highlight approaches for decision making considering pathways to sustainability which would be beneficial both in the planning of an LCA study and in the interpretation and understanding of the results. The key research ideas highlighted in this paper links to the current and future prospects of fuel for electricity generation considering significantly improved emission technologies and contribute to the shared responsibility of meeting the goals of the Paris climate change agreement. Natural resource consumption, ecosystem, and human health are the broad categories which face the final impacts due emissions and waste from fossil fuel based electricity generation. It is crucial for India to implement responsible and sustainable innovation in the energy sector as a part of the strategy of providing more efficient technologies like Supercritical (SC) and ultra-supercritical (USC) systems of thermal power generation as well as focus on Carbon Capture Storage (CCS).

P46

Compositions and contents of n-Alkanes and n-Methyl Ketones in Soils Albic Retisols under broad-leaved forest plant community

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Soil organic matter (SOM) plays a key role in the ecosystem functioning. Such individual components of SOM lipid fraction as *n*-alkanes are widely used as a biomarkers of vegetation type. *n*-Methyl ketones are produced during first steps of *n*-alkanes degradation. Annual dynamic of main alkane homologues ratios – CPI, OEP, LSR, calculated for soil density fractions allows to evaluate the extent of recovery of carbon pools related to different stabilization mechanisms of SOM. The test plot was selected under lime tree plant community where typical Albic Retisols are developed. Sampling was made from leaf litter, roots of topsoil, soil of horizons AY, AYel, EL, BT, twice in autumn and once in summer. Soil density separation was performed using flotation method in heavy liquid ZnCl2 (ρ= 1.60 g), the two fractions was separated – the free light fraction and the heavy one. In these samples total C and N concentrations were determined with a CHNS analyzer (Elementar). Lipid components were extracted by the method of pressurized fluid extraction in ASE 200 (Dionex). Sample purification and fractionation were carried out in an adsorption column with aluminum oxide. The qualitative identification and quantitative determination of target components were performed by GC/MS Agilent 6890N (Agilent Technologies) with a quadrupole mass-selective detector MSD5973N (Agilent Technologies). The contribution of the light fraction is about 5% of the organic carbon of the soil according to the results of dense fractions analysis of the upper horizons. The relative content of *n*-alkanes in SOM increases for the bulk samples down the soil profile up to 2 times and reaches maximum quantity in the EL horizon -725 µg/gCorg. Analysis showed significant seasonal changes in the content and compositions of *n*-alkanes. In summer their amount in light fraction is about 1-2% of total carbon, and increased up to 4-8% during the autumn. *n*-Alkane content increases from 195,3 to 360,6 µg/gC in bulk soil with the dominance in the upper part of the profile of long-chain plant origin alkanes (C27, C29) and an increase of the part related to medium-chain in underlying horizons as a result of a greater contribution of bacterial biomass (LSR increases from 8.5 to 10.5).

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Determining Habitat Suitability for the Atlantic Coast Leopard Frog: Is High Salinity to Blame for Their Absence?

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The Atlantic Coast Leopard Frog (ACLF) (*Lithobates kauffeldi*), determined to be a distinct species in 2014, occurs in wetlands from Connecticut to North Carolina. Based on their known habitat preference, ACLFs are not found at many potential sites. Preliminary results showed that bioaccumulated pesticides and other non-metallic contaminants do not explain the absence of ACLFs at prospective wetlands. However, due to run-off from the heavy use of road salts in urban areas where ACLFs occur, we hypothesized that salinity in potential ACLF wetlands could predict the occurrence of this species. Potential ACLF sites in New Jersey (NJ) and New York (NY) were selected for this study based on habitat characteristics. Monthly surveys for the frog were conducted from February 2018 until September 2018 by listening for adult mating calls and visual inspection for adults and tadpoles. Water conductivity was measured as a proxy for salinity. Salinity values ranged from 30.8 – 12640 µS/cm (median of 406 µS/cm) for sites without the ACLF and ranged from 37.1- 948 µS/cm (median of 451 µS/cm) for sites with observed ACLFs. Liberty State Park was an outlier site and accounted for the six highest observed conductivity values for non-ACLF sites. Therefore, the data was not normally distributed. An analysis of variance was done on log transformed data that showed “site” was a statistically significant factor ($p< 2e-16$), but there was no statistical difference between conductivity levels at sites with and without the ACLF ($p=0.31$). The within site variance was 20.725 µS/cm. Thus, due to large variability within and among the sites sampled, water conductivity is not a predictor of the occurrence of ACLFs. These

results suggest that although road salt use in the ACLF range is high in NJ and NY, it is not impacting the distribution of this species. To better understand the current distribution of the ACLF, other environmental factors should be considered outside toxicant influences. Once influential factors have been identified, they can be used to inform the conservation of this species.

P48

CFCs substituents: Atmospheric chemistry mechanics of a series of Hydrofluoroolefins (HFOs) towards Cl atoms

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Abstract Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs) that have long atmospheric lifetimes and represent one of the important anthropogenic sources of reactive chlorine in the stratosphere. These Cl atoms participate in destructive catalytic cycles of ozone, therefore, the development of environmentally less harmful alternatives is required[1]. In this sense, hydrofluoroolefins (HFOs) are currently under study as viable substitute compounds of CFCs because they have high reactivity in gas phase compared to the Hydrofluorocarbons (HFCs) currently used[2]. Before its use in commercial applications, it is necessary extend the study of its degradative chemistry and the possible impact on the environment. In this work we have studied the photodegradation initiated by Cl atoms of 2-fluoropropene ($CH_3CF=CH_2$), hexafluoroisobutylene ($(CF_3)_2C=CH_2$) and (*E/Z*) -1,2,3,3,3-pentafluoropropene ((*E/Z*)-$CF_3CF=$ CHF) using a quartz glass environmental chamber of 1080 L at 298 ± 2 K and atmospheric pressure of synthetic air using in situ FTIR spectroscopy to monitor reagents and products. The main products observed in the reaction with Cl atoms, main atmospheric oxidant, in coastal and marine areas, were: $CF_3C(O)F$ (59 ± 6) % and HC(O)Cl (42 ± 5) % of co-product for the Cl + reaction $CF_3CF=CH_2$; $CF_3C(O)CF_3$ (110 ± 11) % and HC(O)Cl (64 ± 7) % of co-product for the Cl + reaction $(CF_3)_2C=CH_2$ and $CF_3C(O)F$ (103 ± 13) % and HC(O)F (97 ± 11) % co-product, for the Cl + reaction (*E/Z*) -$CF_3CF=CHF$. The results indicate that the reaction of the Cl atoms with the HFOs proceeds mainly by the addition of Cl to the double bond >C=C

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Microplastic pollution in Lake Ziway, Ethiopia

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Microplastic pollution in lakes has currently become an environmental concern in many countries. Yet, few information is available on microplastic pollution in African lakes like Lake Ziway of Ethiopia. Lake Ziway is one the largest lakes in Ethiopia and it is known for its fishing and drinking water supply. This study aims to examine the condition of Lake Ziway in relation to microplastic pollution by investigating the occurrence of plastic particles (PPs) in shoreline sediment and in four of the major fish species of the lake: Oreochromis niloticus, Clarias gariepinus, Cyprinus carpio and Carassius carassius. Sediment samples were collected during dry and wet seasons from different sites of the lake and density separation technique was employed to separate PPs. Also, 360 fishes were collected in dry and wet seasons and gastrointestinal analysis was performed to quantify ingested PPs. The maximum and minimum mean particle density counted in sediment samples were 1081 ± 260 count/m^2 and 59 ± 51 count/m^2. The highest particle density (dry season = 1081 ± 260 count/m^2, wet season = 578 ± 44 count/m^2) was observed in sediment samples taken from the part of the lake where wastewater drainage from nearby town (Batu) enters the lake. There was statistically significant difference between sediment plastic particle density measured during dry and wet seasons with higher density in sediment sampled during dry season. The lowest and largest particle size measured in sediment were 0.15 mm and 45 mm, respectively. Fish gastrointestinal analysis also indicated that 35% of the sampled fishes were found with ingested PPs. The highest percentage of the fish species with ingested PPs were C. gariepinus (60%) and C. carpio (60%). Statistically significant association was also observed between number of fishes found with ingested PPs and the location of the lake from where the samples were taken. The lowest and largest particle size in the gastrointestinal tract of the fishes were 0.2 mm and 40 mm, respectively. Moreover, there was significant difference between wet and dry seasons with respect to the ingested PPs in sampled fishes. Polypropylene, polyethylene and polyethylene terephthalate were the major PPs found in sediment and fish guts as confirmed by Attenuated Total Reflectance-Fourier Transform Infrared Spectroscopy analysis. These plastics are likely originated from towns around the lake and further study is required on the effects of the pollution.

P50

The kinetic evaluation of the accelerated aging of the polypropylene and polyethylene as a tool for the classification of microplastics origin

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Many studies have shown the presence of microplastics (MPs) in different compartment of the enviroment, through description of its morfological features and chemical identification obtained by infrared spectroscopy. However, studies that aim to evaluate evidences on the origin of the collected MPs are scarce, if they are classified as primary (already fabricated on micro scale and commonly trasnported by domestic wastewater) or secondary (resulting from the fragmentation of bigger plastics thrown in the enviroment), because understanding the origin of MPs is extremely useful information to find attenuating measures for solid residue manegement. In this aspect, the goal of this study was to associate residence time of the plastic material through chemical and physical alterations on polyethylene (PE) and polypropylene (PP) when submitted to termal and photochemical degradation. PE and PP polymers were selected for this study because they represent the most significant percentage in consumption and they're the most representative in the composition of MPs found in the enviroment. Sample with dimensions of 105 mm x 75 mm x 2 mm of each polymer were prepared by means of melting pellets PE and PP without additives (185°C).The termal and photochemical degradation were realized in aging accelerator chamber according to the ASTM International G–154 standard. In the times 500, 740, 1000, and 1240 hours, the sample were taken from the chamber and characterized by infrared spectroscopy (FT-IR-ATR) and scanning electron microscopy (SEM). The results indicates that the fragmentation of the sample and generation of secondary MPs occures at 1000 hour of exposition for the PP polymer, the same didn't happen for the PE due to its different mecanism of degradation that occurs in its chemical structure. However, the images from the SEM and the IR spectrum indicates the physical

and chemical alterations on both materials, as well as the presence of porosity, cracks and color changes observed on the images and increase of t0 to t4 carbonyl index (CI) from 0,00 to 0,57, respectively, for PE of 0,09 to 1,04 for PP, calculated from band at 1700 cm^{-1} assigned to C=O. Therefore, the aplication of (CI) in the analysis of the MPs's PE and PP by FT-IR, colected in the enviromental sample, and compared to these study's results, could be an useful tool to help with the comprehention of time of residence of the material and consequently help in placing the MPs as primary or secondary.

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Impact of Di-isononyl phthalate on apoptotic process in zebrafish ovary

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Endocrine Disruptors Chemicals (EDCs), substances able to interfere with the endocrine system, are affecting reproduction in different animal models. Apoptosis and autophagy are two physiological processes occurring in ovaries, both correlated and involved in the cell homeostasis and survival. Based on this evidence, the DiNP (di-isononyl phthalate), an EDC used to replace the bis(2-ethylhexyl) phthalate (DEHP), recently reported to induce alterations in reproductive processes of zebrafish (*Danio rerio*), was used in the present study as toxicant to evaluate its effects on the apoptotic pathways in zebrafish ovaries. To achieve this goal, mature zebrafish female were chronically exposed (21 days) to three environmental relevant concentrations of DiNP: 42 µg/L; 4.2 µg/L and 0.42 µg/L. Ovaries from each experimental group were removed and immediately frozen on dry ice and stored at -80ºC. The mRNA was extracted, cDNA was retrotranscribed and RT-qPCR were performed for the evaluation of the expression of genes coding for signals involved in the apoptotic process and in oxidative stress. The lowest concentration of DiNP significantly upregulated the gene coding for *tnfa* (tumor necrosis factor a). Regarding the medium concentration, DiNP significantly upregulated the genes coding for *bax* (BCL2 associated X), *tp53* (tumor protein 53) *caps8* (caspase 8), *casp3* (caspase 3), all involved in the apoptotic process. Concomitantly, a significant higher level of *sod1* (codifying for the superoxide dismutase 1) involved in the response to oxidative stress was observed. Surprisingly, the highest concentration of DiNP did not alter the expression of all the genes tested in this study. Hence, DiNP inducing the expression of genes involved in apoptosis suggests its action in promoting apoptotic process in the ovaries. The adverse effect of DiNP on female reproductive physiology acts through a non-monotonic fashion being the medium concentration tested the most effective. Additional tests to mark the apoptotic cells within the ovary of females exposed to DiNP are actually in progress.

Funding: this work has received funding from *Fundação de Amparo à Pesquisa do Estado de São Paulo* (FAPESP) (process nº 2018/10495-0) to F.G. and from *Progetti di Rilevante Interesse Nazionale* (PRIN) 2010 – 2011 (prot 2010W87LBJ) to O.C.

P52

Endocrine disruptor activity of diclofenac and caffeine on the reproductive parameters of Astyanax altiparanae (Teleostei, Characidae).

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The increase of release of pharmaceuticals compounds in the aquatic environment has impacted many non-target organisms, concerning the environmental agencies. Indeed, the presence of these compounds have been increasing due to the growing and aging of the population. Studies in vertebrates and invertebrates highlighted that these substances can act as endocrine disruptor chemicals (EDCs), disorganizing the endocrine function of the hypothalamus-pituitary-gonads axis (HPG). Diclofenac (DCF), a nonsteroidal anti-inflammatory drug (NSAID) altered sexual behavior in male frogs and modulated prostaglandins in mussels, while caffeine (CAF), a stimulant of central nervous system (CNS), triggered an increase of vitellogenin (VTG) synthesis in male fish. Based on the occurrence pharmaceuticals in the environment and the effects in organisms, our hypothesis is that DCF and CAF acts as EDCs and the mixture of both could enhance the impact on the HPG axis, compromising the reproductive performance of aquatic organisms. Fish males of *Astyanax altiparanae*, a brazilian endemic species was exposed to 3 treatments (DCF, CAF and DCF+CAF)+ Control, during 96h. Previously, a range finding test (RFT) and lethal concentration (LC_{50}) test were carried out to choose the concentration of acute exposure. Plasma levels of gonadal steroids (testosterone (T), 11-ketotestosterone (11-KT), 17β-estradiol (E2) and somatic index (liver and gonads) were analyzed. The CL_{50} for DCF in 96h was 30.7 mg/L and for CAF was 95.8 mg/L. After exposure, T levels decreased in animals exposed to DCF compared to the control while E2 plasma levels decreased in the animals exposed to DCF and CAF. The gonadosomatic index increased in the DFC+CAF treatment compared to control, while hepatosomatic index did not change. The results suggest that both compounds act as EDC, altering the steroid levels of *A. altiparanae* males. In agreement with previous studies, our results evidenced the capacity of these compounds to change hormone levels. NSAIDs like ibuprofen exhibits similar effects in *Danio rerio* (zebrafish) modulating genes of HPG axis. CAF has been identified as an estrogenic substance in *Carassius auratus* (goldfish) males that present increased VTG plasma levels,-a biomarker in males of estrogenic activity- an action that has been investigating in this study.

Funding: *Fundação de Amparo à Pesquisa do Estado de São Paulo* (FAPESP) (process nº 2017/07139-5) to F.G. and Project nº 2017/11530-1 .

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Monitoring Marine Environmental Stress using Gene Expression Technology

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Over the past decades, the marine environment has been influenced by several human activities which have led to global climate change and chemical pollution. This multiple stress context demonstrates the need for marine biomonitoring. In this study, the focus is put on understanding the impacts of different changing environmental conditions on zooplankton communities. These embody a significant part of the marine environment because of their vital trophic ecosystem functions in the pelagic food web. A novel technology for monitoring marine environmental stress of the Belgian part of the North Sea is developed based on the calanoid copepod species *Temora longicornis*, which is the dominant zooplankton species. As marine environmental stressors provoke physiological responses which are originally gene-driven, a well-grounded knowledge of the genetic fundamentals is of great

importance. Therefore, differentially expressed genes as a response to environmental stressors are assessed by sequencing the whole transcriptome with RNA-seq technology. The relative contribution of different stressors to zooplankton community dynamics may then be quantified. Zooplankton community dynamics and gene expression data are eventually integrated and analyzed in a seasonal and spatial framework. From the generated data, the health of these zooplankton communities is investigated to eventually deduce marine environmental stress levels.

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UV-Induced stress response of marine copepod Tisbe battagliai: Oxidative stress and gene expression

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Ultraviolet B (UV-B) radiation causes detrimental effects to the survival and development of aquatic invertebrates, e.g. the crustacean copepods (vital primary consumers in aquatic food-webs). To quantify acute exposure effects, using the marine copepod Tisbe battagliai, we evaluated intracellular reactive oxygen species (cROS) and mitochondrial ROS levels (mROS), alongside changes in the expression of key oxidative, DNA damage and apoptosis genes. T. battagliai lives in the marine intertidal zone, often in shallow rock pools or on damp rocks and seaweeds. As such, they are subject to potentially high UV-exposure levels, and coupled with a semi-transparent body, they should in theory respond to UV associated stress. LC50 values were calculated using a mixed effect generalised linear model of survival during a modulated 14:10 hour diurnal cycle over 48 hours, with cROS and mROS data collected temporally after 6, 24 and 48 hours of exposure to assess when these molecular effects occurred. This pathway-oriented mechanistic approach under mimicked natural UV conditions provides new insights into the mechanistic response of marine copepods to UV-B exposure, and is, to the best of our knowledge, the first report for T. battagliai.

P55

Effects of temperature on the transcriptome of the marine copepod Temora longicornis

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Over the past decades, the world's oceans and seas have been influenced by several human induced impacts, including climate change. In the North Sea region, the average sea surface temperature of the water has already risen with 1-2 °C over a time-period of twenty-five years and is likely to rise further. Understanding the impacts of this changing environmental condition in zooplankton communities is crucial, as alterations in the zooplankton communities can affect entire marine ecosystems. Here, we focus on the potential effects of an increase in temperature on the calanoid copepod species, *Temora longicornis*, the dominant zooplankton species of the southern part of the North Sea. Since responses to environmental stress are genome-driven, a genetic study on the physiological responses to thermic stress can provide an increased mechanistic understanding and help predict potential responses to climate change in this copepod species. Therefore, we sequenced the whole transcriptome (using RNA-seq technology) in *T. longicornis*, after being exposed to thermal stress, to investigate gene expression differences as a response to temperature fluctuations. As such, this dataset will provide us with new insights on how exposure to increased sea water temperatures may affect the fitness of the most dominant zooplankton species of the southern part of the North Sea.

P56

Artificial enzyme-based model of living organism for integrated assessment of potential risk of toxicants

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Nowadays, there is a trend that different soils, which are used for growing a wide range of crops, are over-contaminated by some toxicants due to overuse of pesticides or heavy metals. The result of this action is not only a significant decreasing of crop productivity but also is dramatically increasing the potential risk of negative impact on human health of agricultural products, which have been grown in contaminated soils. For preventing the potential risk of negative impact on human health of such agricultural products, there is a need for a development brand new method of the risk assessment. We propose an artificial enzyme-based model of a living organism (EBMofLO) as a perspective bioassay that could solve the problem of integrated assessment of the potential risk of toxicants in the soil samples. For creating this EBMofLO, enzymes that have a crucial role in metabolism were chosen. The primary basis for the development of the EBMofLO was bioluminescent enzyme system of marine bacteria NAD(P)H: FMN-oxidoreductase+ luciferase (R + L) enzyme system. Previously, it has been reported that, firstly, the R + L enzyme system has great perspectives for environmental monitoring and medical diagnostics. Secondly, the R + L enzyme system has a high bioluminescent detection level when coupled with lactate, malate or alcohol dehydrogenases. The aim of this work was investigating the possibilities of application of enzymatic systems R+ L + lactate dehydrogenase (R + L + LDH) as a bioassay to evaluate the soil contamination status. The sensitivity of the R + L + LDH enzyme system to pesticides and copper ions in water and water extracts from soils were estimated. For this, the toxicological parameter IC20 reflecting the sensitivity limit of the enzyme system to the toxicant was used. It was revealed that the R + L + LDH enzyme system has greater sensitivity to the pesticides and copper ions than the R + L enzyme system. This pattern can be used as a tool to improve the properties of enzymic bioassays. In addition, the effect of extracts from uncontaminated soils of various types on the enzymatic system differs, which makes possible to design the specialized enzymatic bioassays. The reported study was funded by RFBR according to the research project No 18-47-240005.

P57

Environmental transformation and ecological effects of iron oxides nanoparticles: model experiment

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The surface characterization of nanoparticles (NPs), in particular magnetic nanoparticles, is most important for understanding the behavior of NPs in the environment. In the environment, NPs can be exposed to various conditions under which the appearance of the NPs changes and/or the protective shell. In this work results of a complex study of Fe_3O_4 functionalized by humic acids (HA) were described. We hypothesized that along with the NPs size, the surface functionalization was a major factor contributing to sorbent toxicity mitigation. Fe_3O_4 NPs coated with HA (20÷80 wt%) have the average particle size from 8.4 nm for Fe_3O_4-HA20 to 4.5 nm for Fe_3O_4-HA80. The fluorescence quantum yield depended on the HA content and confirmed that the humic component interacted with ferric ions. Increase of HA content from 50 to 80 wt.% leads

to the zeta potential increasing, that indicated on system stability. Biosafety of Fe_3O_4-HA NPs was investigated in laboratory biotest systems using the higher plant - whitemustard *Sinapis alba* L. and green algae *Scenedesmus quadricauda* (Turb.) Brev. as test organisms. Experiments with two biotests showed that, in controlled chemical conditions, water suspensions of the preparation can be safely used for biota given a certain concentration limit. Algae appeared more sensitive: EC_{20} was 0.01% in the biotest with *S. quadricauda* for Fe_3O_4, Fe_3O_4-HA50, and Fe_3O_4-HA20. To simulate the environmental conditions, the Fe_3O_4-HA NPs were oxidized in a mill in air. Mössbauer spectroscopy data show that sample has maghemite γ-Fe_2O_3-HA phase. According to optical spectroscopic data there is no interaction between new phase and HA. Bioassay experiments showed that bare Fe_3O_4 has a toxic effect on the seedings of *S. alba* and inhibits the growth of *S. quadricauda* cells as well as chlorophyll fluorescence. Iron oxides covered by HA reduces toxicity for both Fe_3O_4 and Fe_2O_3 in the test with the *S. alba* and *S. quadricauda*. Thus, humic acids as a passivation agent contribute to the stability of iron-based NPs in a way similar to polyelectrolytes by providing electrosteric stabilization as well as modify bioactivity of iron oxide NPs. *Acknowledgement.* This research has been financed by the Russian Foundation for Basic Research (*#18-33-01270/18).*

P58

Combined toxicity of copper and zinc oxide nanoparticles to two marine microalga - Cylindrotheca closterium and Phaedactlylum tricornutum.

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The last decade has seen advances in nanotechnology resulting in increased production of engineered nanomaterials (ENMs), extensively used in the manufacture of industrial and consumer goods such as electronics, sun creams, water filters etc. Direct and indirect discharge of ENMs in aquatic ecosystems and the potential negative impacts these ENMs pose to aquatic biota have drawn the attention of environmental agencies. To date, much of the research evaluating the ecotoxicity of ENMs has been undertaken on a single contaminant basis. In addition, a larger part of nanotoxicity studies have mainly focused on impact of ENMs in freshwater ecosystem and results are extrapolated for more complex environmental systems (marine, soil, sediment). The increasing use of several ENMs will consequently lead to the presence of different ENMs in the marine environment. Estuarine sediments are a possible sink for ENMs as nanoparticles tend to form aggregates that may settle at the bottom in seawater medium. Data on the effect of two or more ENMs is limited. Therefore, much research is needed to account for potential negative effects due to combined nanoparticle-nanoparticle interactions. In this study, the joint toxicity of two metallic-oxide nanoparticles (CuO and ZnO) will be evaluated in two marine microalgae – *Cylindrotheca closterium* and *Phaedactylum tricornu tum*. The release of metal ions has been documented as one of the mechanisms by which metal-oxide nanoparticles exert toxicity. Previous studies have shown that mixtures of dissolved heavy metal ions may interact to produce more-than-additive (synergistic) and less-than-additive (antagonistic) effects. Thus, we investigate if bi-metal-oxide nanoparticle (CuO and ZnO) applications to marine algae may also result in deviations from the assumption of additivity. The results from this study will help to improve current understanding of the risk associated with joint nanoparticles co-exposure in the marine ecosystem.

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Influence of weathered multiwalled carbon nanotubes on distribution, mineralization and formation of non-extractable residues of 14C-Bisphenol A in a natural water-sediment system

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One of the most promising materials in nanotechnology are carbon nanotubes (CNTs). It is likely that the amount of CNTs released into the environment will increase due to production, product life cycle and disposal. Hence, understanding their environmental behavior is inevitable. Since CNTs are built of aromatic ring structures, they have a high sorption potential for hydrophobic chemicals. Therefore, an impact of CNTs on the environmental fate of other chemicals is possible, which could lead to alterations in persistence, bioavailability and toxicity of these chemicals. Under certain weathering processes, such as UV-light, CNT's molecular surface may be modified by the formation of functional groups (-OH, -COOH). These weathered CNTs (wCNTs) thereby may have an altered sorption behavior. Influence of multiwalled wCNTs on the environmental fate of ^{14}C-Bisphenol A was investigated in a water-sediment system. Bisphenol A (BPA) is an estrogen active pollutant with a high production volume. In aquatic ecosystems BPA is usually rapidly degraded under oxidative conditions. However, the presence of wCNTs in the aqueous phase (50 mg/L) lead to a decrease in mineralization (17%±1% compared to 20%±2% after 14 days) and an increased formation of non-extractable residues of ^{14}C-BPA (100 µg/L) in water-sediment systems (36%±1% compared to 21%±2% after 14 days). The greatest impact was observed in the water phase. Four hours after ^{14}C-BPA was applied into the water phase, 89%±4% of the initial amount could still be detected there, while this amount was reduced to 13%±1% when 50 mg/L wCNTs loaded with ^{14}C-BPA were applied. This effect occurred due to sorption of ^{14}C-BPA to wCNTs, so agglomeration and sedimentation of wCNTs resulted in a removal of ^{14}C-BPA from the water phase. Furthermore, the sorption of ^{14}C-BPA onto wCNTs in water in dependence of concentration and time was assessed. No adsorption occurred at wCNT concentrations of 0.1 mg/L and 1 mg/L. 27%±3% of ^{14}C-BPA (100 µg/L) sorbed to wCNTs at 10 mg/L and extensive sorption (92%±1%) occurred at a wCNT concentration of 50 mg/L. Impact on environmental fate was clearly linked to interaction of ^{14}C-BPA with wCNTs, since a concentration of 0.1 mg/L wCNT only lead to negligible or none alterations of the fate of ^{14}C-BPA in water-sediment systems. According to these findings we conclude, wCNTs concentrations of environmental relevance (

P60

Assessing the implementation of Best Available Techniques at the local scale in the absence of industrial sectoral reference: an issue for compliance demonstration

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The Industrial Emissions Directive (IED) aims to achieve a high level of protection of the environment as a whole and of human health. It is based on four main principles: The facilities concerned must have an environmental permit to operate, the conditions of which are reviewed periodically ; The need for continuous improvement in terms of prevention or reduction of emissions / consumption of facilities. In this purpose, the IED requires the implementation of techniques with performance equivalent to the

Best Available Techniques (BATs) described in the reference documents (BREF, Best Available Technical Reference Documents) ; Soil and groundwater remediation in a condition at least equivalent to that of the site prior to commissioning, as described in the "Baseline Report" ; Public information and participation in the decision-making process. However, when drawing up or revising a BREF at European level, it is not possible to precisely cover each industrial sector or subsector for all or some of the identified Key Environmental Issues (KEI). There are then different types of situations for which the BAT reference is incomplete or non-existent. Furthermore, the implementation of BATs is not limited to activities under the IED, but also applies to other sectors through their own regulation, which do not have their own BREF. Industrial plants involved in these activities without reference are not exempt from implementing BATs. However, the lack of reference technologies "officially" considered as BATs may lead the site operator to skip the installations concerned in his reflection on the establishment of BATs and / or the competent authority not to check BAT compliance. The first results of surveys carried out in the process of application of the IED in France and the literature review show that the degree of verification and the methods for evaluating the implementation of BATs at the local scale are heterogeneous. Moreover, the large discrepancies in the processing of regulatory files can potentially give rise to distortions of competition. In this context, there is a need to develop a methodology allowing the operator of an IED or non-IED installation concerned by the problem to demonstrate to the competent authorities, in the absence of an official reference, that a technique is BAT for the considered installation. Keywords : Best Available Techniques (BATs), environmental performance, Key Environmental Issues (KEI)

P61

Dose-dependent effects of bisphenol A on TM3 Leydig cell line

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A number of man-made chemicals, often referred to as xenobiotics have been shown to have endocrine and estrogenic activity which may negatively affect humans and animal health. One of the oldest synthetic compounds known for its endocrine activity is bisphenol A (BPA). This compound is an essential component of epoxy resins that are mainly used to coat the inner surface of food and beverage metallic cans. BPA has been associated with many human diseases, such as obesity, chronic respiratory and cardiovascular diseases or behavioural troubles. However, BPA as an environmental contaminant has been also demonstrated to adversely affect the male reproductive system. Many studies have shown that exposure to high or low concentrations of BPA induces a range of negative effects such as decreased sperm count, DNA damage, reduced sperm mobility and decreased steroid hormone production. However, the fundamental mechanism of this phenomenon is largely unexplored. The main objective of this study was to determine the potential consequences of BPA action on TM3 Leydig cell line *in vitro*. TM3 cells were exposed to different experimental doses (0.04-5.0 µg/mL) of BPA during 24 h. Subsequently, the cytotoxic effect was evaluated by measuring the inhibition of metabolic activity (alamarBlue), loss of membrane integrity (CFDA-AM) and lysosomal activity (neutral red) assay. We found that 24 treatments of BPA caused significant ($P< 0.001$) decrease in metabolic activity at 0.2-5.0 µg/mL. A significant ($P< 0.001$; $P< 0.05$) loss of cell membrane integrity was recorded from 0.2 to 5.0 µg/mL of BPA. In addition, incubation with BPA for 24 h also decreased the lysosomal activity of TM3 Leydig cells at 1.0; 2.5 and 5.0 µg/mL. The results of our *in vitro* study suggest that the cytotoxic effect of BPA starts at low experimental concentrations, which adversely affect sensitive parameters of exposed cells. A considerably more detailed and systematic research in endocrine disruption is required for a better understanding of risks associated with reproductive toxicology in humans and wildlife. This work was supported by the Slovak Research and Development Agency under the contract NO. APVV-16-0289 and VEGA 1/0539/18. **Keywords:** bisphenol A, Leydig cells, cytotoxicity

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Tarragona mother-child risk exposure assessment to wide spread Endocrine disruptors (EDs) and in Vitro EDs exposure effects on adipogenesis.

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Endocrine disruptors (EDs) can affect the different levels of epigenetic control and in some cases can act transgenerationally, if the exposure to EDs occurs during “critical windows of exposure”, the prenatal and the early life period. In this study, it was selected bisphenol A (BPA) and di-(2-ethylhexyl) phthalate (DEHP) due to the wide spread distribution of the products that contain them and because the prenatal or early exposure to these chemicals is related with two potential diseases, obesity and diabetis in childhood. Nowadays, some regulations has been imposed, such as the withdrawal of baby products containing BPA and phthalates by the European Comunion (EC). However, the principal analogues of BPA (BPS and BPF) and the presence of some other phtahaltes are still in them.The main objective of this studywas to estimate the fetus exposure to BPA and DEHP through pregnant women by a physiologically based pharmacokinetic (PBPK) model. As a secundary objectives, on the one hand, elucidate the principal exposure pathways to these chemicals in total prenatal exposure. And on the other hand, assess and compare in vitro the endocrine activity of BPA and their other analogues non-removed by EC.The pregnancy PBPK model structure was adapted for pregnant women from Sharma et al. (2018). Estimates of exposure from different pathways along with their relative importance were provided. Diet showed the higher contribution to total exposure with >99.9% for BPA and 63% for DEHP. Although diet was considered the primary source of exposure to BPA and phthalates, non-dietary sources need to be more thoroughly evaluated because with these sources the first-pass metabolism is lacking, so these may be of equal or even higher toxicological relevance than dietary sources. Regarding in vitro experiments, BPA showed more toxic effects than their analogues. However, BPS and BPF and the mixture of these two, showed that a surprising higher endocrine activity.

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Effect of climate-weather factors on the qualitative composition of the surface of the atmospheric air

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The monsoon climate of Vladivostok provides self-purification of atmospheric air. The purpose of the study was to establish the correlation between various climatic and weather factors and the qualitative composition of the surface layer of atmospheric air, taking into account the specifics of the climate in this part of Vladivostok located on Russky Island. In turn, the quality of the air significantly affects the respiratory diseases like a bronchial asthma or COPD. The work was carried out on the basis of IMCR. Assessment of pollution of a ground layer of free air of Russky Island was carried out during different seasons of year 2013-2018 by Yankova's method with coauthors having analyzed 38 tests. At the time of their selection the air temperature, a dew point, the direction of wind, wind speed, wind gusts, the relative humidity, atmospheric pressure, a cloudiness, humidity of a soil cover were estimated. The fractions of particulate matters (PM) were taken: PM_1, $PM_{2.5}$, PM_{10} and particles with a diameter of more than 10µm.

Correlation between distribution of sizes of suspended particles in the air and meteorological parameters are studied. The smallest concentrations showed a PM range from 0.1-1µm, while with a diameter of 0-0.1µm were not detected, because there is no high traffic on the Russky, and there is no strong exhaust pollution gases. Due to the presence of dusty roads throughout the island, the highest concentrations reached PM with a diameter of 10 to 100. The weather factors have the greatest influence on the 2.5-10µm, since this fraction is most strongly affected by sticking and, accordingly, moving to higher ranges. The strongest correlation with PM was for cloudiness, due to the specific climate, fogs, which in turn contribute to particle deposition, accompany cloudiness. The high level of correlation with atmospheric pressure is due to the fact that it is an integral indicator. Investigation shows that fogs and a cloudiness promote a self-cleaning of air and provide the favorable environment for the health.

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Ecotoxicology of silver species brought by sewage sludge in terrestrial environment

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The rise of nanotechnologies in the 90s led to the important use of silver nanoparticles (AgNPs) in many products, mainly due to their antimicrobial properties. Consequently, the discharge of silver (Ag) into wastewater leads to an accumulation of silver species in sewage sludge. Thus, a primary source of Ag contamination in terrestrial environments is related to sewage sludge land application for agricultural or remediation purposes. In terrestrial ecosystems, exposure to AgNPs may change microbial biomass and diversity, decrease plant growth and inhibit soil fauna reproduction. Physiological, biochemical and molecular effects have been evidenced in various soil organisms and microorganisms. Therefore, AgNPs undergo speciation before spreading on agricultural parcels. The effects of dominant form in sewage sludge, silver sulfide, are still too little studied. Some experiments have been conducted to evaluate the impact of Ag species on macrofauna and soil microorganisms. In microcosms, earthworms have been exposed to natural soil and sewage sludge. Fully characterized sewage sludge was contaminated with realistic doses of AgNPs before fermentation to allow forms of Ag to undergo speciation like in wastewater treatment plant. Then, realistic doses of contaminated sludge were added in microcosms in order to mimic land spreading. First results confirmed that the totality of AgNPs added in microcosms were transformed in sludge. These Ag forms impacted moderately the earthworm test species *Eisenia fetida*. Life traits were not affected by Ag although Ag accumulated in their organism. Expression levels of genes involved in defense mechanisms against metals are currently being studied. DNA and RNA sequencing show that soil global communities and soil active communities were modified in presence of Ag suggesting that Ag affects soil activities. Our experiments suggest that 1- although Ag contaminated sludge does not appear to be extremely toxic to earthworms, Ag forms accumulated in animals and thus could be transferred in trophic chain; 2- the alteration of the diversity and activities of soil microflora could affect long term soil fertility since communities of soil microorganisms are essential for soil fertility.

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Lethal and sublethal effects of viticultural pesticides (folpet and glyphosate) on juvenile Rana temporaria

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In recent decades, amphibian populations have declined worldwide. The use of pesticides in agricultural landscapes is one of the main reasons for the decline of amphibian populations. Especially due to their permeable skin, dermal exposure *via* contaminated soil is a major threat. In this study, dermal sensitivity of juvenile European common frogs (*Rana temporaria*) to viticultural pesticides sprayed on soil was investigated. Tadpoles of an uncontaminated pond were raised until metamorphosis. Afterwards, juveniles were dermally exposed to soil contaminated with realistic field rates of the active ingredient (a.i.) glyphosate (Taifun® forte) and two formulations of folpet (Folpan® 80 WDG and Folpan® 500 SC). It was hypothesized that the pesticides lead to sublethal effects at environmentally relevant concentrations, i.e. changes in behavior, enzymatic stress response and body mass decline. Furthermore, an effect of the formulation additives on the toxicity was expected. For each scenario, eight juvenile frogs from each pond were separately kept in plastic boxes containing over-sprayed OECD standard soil for 48 h. To investigate behavioral changes (effects on average moving speed, time of resting and total distance moved), individuals were filmed for ten minutes in arenas (glass petri dishes) after test termination. Glutathione, acetylcholinesterase and protein carbonyls will be analyzed spectrophotometrically as additional biomarkers to provide insight in the enzymatic stress response. Although only sublethal effects were expected at realistic field rates, Folpan® 80 WDG resulted in 17-100% mortality (mean: 58%) at 50% of the maximum *recommended* field rate (FR_{max}), whereas Folpan® 500 SC lead to a mortality of 0-17% (mean: 10% at 50% FR_{max}). 0-17% (mean: 4%) of the test organisms died after Taifun® forte exposure at 100% FR_{max}. The comparison of the folpet formulations at equal amounts of a.i. revealed a highly significant effect of the formulation additives on mortality. Preliminary results show that 48-h body mass decline was marginally higher in treatment groups than in control groups. Further results of sublethal effects will be analyzed and presented in the conference contribution. These findings show that environmentally relevant concentrations of registered pesticide formulations show high acute effects in a laboratory design. Potentially, these products can have a major impact on Anura populations and could be further impaired by sublethal effects.

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Investigation of antibiotic effects on the soil environment in model experience

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Data on the adverse effects of the uncontrolled use of antibiotics are alarming for environmentalists and the general population (Timofeev, 1989; Cherkashchina et al., 2011, Akimenko, 2015; Research Techart, 2013). In Russia ~3.5 thousand tons of antibiotics are used annually, of which 36% as antiparasitic drugs, 23% for the treatment and prevention of animals, 19% as growth stimulants, 22% as preventive drugs. The problem of resistance to antibiotics, their influence on the ecological functions of the soil and the trophic network in water bodies is a topical problem, on the solution of which human health depends. The study of the dependence of carbon content on the resistance of natural objects to antibiotics is also a new stage in the way of solving environmental problems affecting human health. In this regard, two types of soils with different levels of carbon were taken for the study: chernozem, Voronezh region (C_{org} 5.5±0.02%) and agrozem, Kalmykia (C_{org} 1.5±0.02%). Under model laboratory conditions, two antibiotics tetracycline and streptomycin were introduced into these soils, as the most common antibiotics at the moment, in concentrations of 300, 600, 1200 mg/kg. The measurements were carried out for two months on the 3rd, 30th and 60th days in order to get a complete picture of the changes in the effects of antibiotics on the soil biota. Chromatographic methods were used to obtain the results. The gas chromatograph was used to measure CO_2

emissions and nitrification of N_2O. According to the results of the study, such regularities were revealed: on chernozem (with greater microbial activity) there is a slight decrease in carbon microbial biomass, with a constant response to the introduction of antibiotics, and on an agrozem (with less microbial activity), there are differences in the use of tetracycline and streptomycin (in the first case, microbial activity is practically not suppressed). There was a general trend of increased activity in the first days, further attenuation in the middle and reverse growth of carbon microbial biomass at the end of the experiment. The final conclusion may be the assumption that the increase in the effects of antibiotics is actively influenced by the presence of humus in soil samples. Which in turn gives direction to new research on this issue. Bibliography: Anderson, J.P.E. Domsch, K.H. (1978) A Physiological Method for the Quantitative Measurement of Microbial Biomass in Soil. Soil Biology and Biochemist, 11

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Heavy metal accumulation on plants growing in the abandoned monarch gold mine in Francistown, Botswana

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ABSTRACT Heavy metal contamination from abandoned mine sites is an increasing concern to the governments, stakeholders and the public. Therefore a need exist to develop a better remediation strategy, and phytoremediation could be used to remediate these sites. The use of plants in removing or rendering heavy metals in the soil harmless is a desirable option as it is cost effective compared to other remediation techniques. This study was carried out to assess heavy metal accumulation in abandoned mine site, Monarch Gold mine, Francistown for bio-prospecting and assessing the extent of contamination in plants. Three parameters were investigated which include plant heavy metal concentration, bioaccumulation factor and translocation factor in three locations. Results showed that the general distribution of heavy metals in plant organs differed between shoots and roots. In shoots, (Pb(262.36mg/kg)> Mn(80.45mg/kg)> Cu(70.77mg/kg)> As(26.31mg/kg)> (24.85mg/kg) and in the roots (Mn(124.02mg/kg)> Pb(110.59mg/kg)> Cu88.59mg/kg) >As(50.60mg/kg) >Zn(32.84mg/kg)). The translocation factor trend was as follows (Pb(3.24)> Zn(1.02)> Cu(1.01)> Mn(0.91)> As(0.74)) and the bioaccumulation factor trend was (Cu(2.58)> Pb(0.96)> Zn(0.94)> As(0.19)> Mn(0.15)). Amongst all the sampled plants maximum concentration of heavy metals was found in the roots of Cenchrus biflorus; arsenic (135.03mg/kg), copper (562.96mg/kg), manganese (300.25mg/kg), lead (541.48mg/kg) and zinc (112.90mg/kg). In the shoots maximum concentration of heavy metals was found in Fadogia homblei (73.24mg/kg)-arsenic, Boscia albitrunca (1118.34mg/kg)-copper, Grewia bicolor (243.16mg/kg)-manganese, Cenchrus ciliaris (5179.72mg/kg)-lead and Portulaca oleracea (89.83mg/kg)-zinc. These results provide us with an evidence for the selection of plant species, which are possible efficient heavy metal accumulators. Keywords; phytoremediation, bioaccumulation, translocation, heavy metal

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Comparative acute toxicity of active substances and commercial formulations of three pesticides to earthworm, Eisenia foetida

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The agriculture and the plant protection products are closely tied. But the pesticide application influences on human health and environment. For this reason before the appearing of new pesticide on market the scientific research and environmental risk assessment are obliged. Another problem is the appearing of pesticide formulation which contains more than one active substance. The negative impact of such formulation hasn't been investigated. And the third problem is the lack of data about the toxicity of commercial formulations of pesticides to non-target organisms. The aim of this research is to compare the acute toxicity of active substances and their commercial formulations to earthworm, Eisenia foetida. **Materials and methods** The earthworms, *Eisenia foetida* were maintained at the room temperature in horse manure according to OECD guidelines (OECD 1984). Three pesticides - benomyl, imidacloprid, metribuzin and three commercial formulations Lazurit (700 g/kg a.s.), Benorad (500 g/kg a.s.), Tanrek (200 g/l a.s.) were selected for this study. These pesticides are the most popular active substances to protect potato from insect, fungus and weed and widely used in agriculture. The toxicity test was conducted in accordance with the OECD 207 (1984) regulations. The artificial soil consisted from 10% sphagnum peat, 20 % kaolin clay and 70 % industrial sand. The earthworms have been conditioned for 24 hours in an artificial soil and then washed quickly before use. For the test, 500 g weight of artificial soil was placed into each glass container. Soils were moistened by adding deionised water to obtain 60% w. of the maximum water holding capacity. 10 adult earthworms were added to each of the jars. There were the same concentrations for commercial formulations. Tests were realized with 3 replicates for each pesticide treatment and control soil. The test duration was 14 days (assessment of mortality at 7 and 14 days). The probit analysis was realized to calculate the acute toxicity of pesticides to *E. foetida*. **Results** The LC_{50} values as follow: 439,51 mg/kg for metribuzin, 5,06 mg/kg for benomyl and 3,16 mg/kg for imidacloprid. The imidacloprid shows the highest toxicity to *E. foetida*. Other side the LC_{50} values for Lazurit (700 g/kg a.s.) and Tanrek (200 g/l a.s.) are less than for metribusin and imidacloprid: 291,90 mg/kg and 2,82 mg/kg. **Acknowledgments** The reported study was funded by RFBR according to the research project No 18-316-00054. **\n**