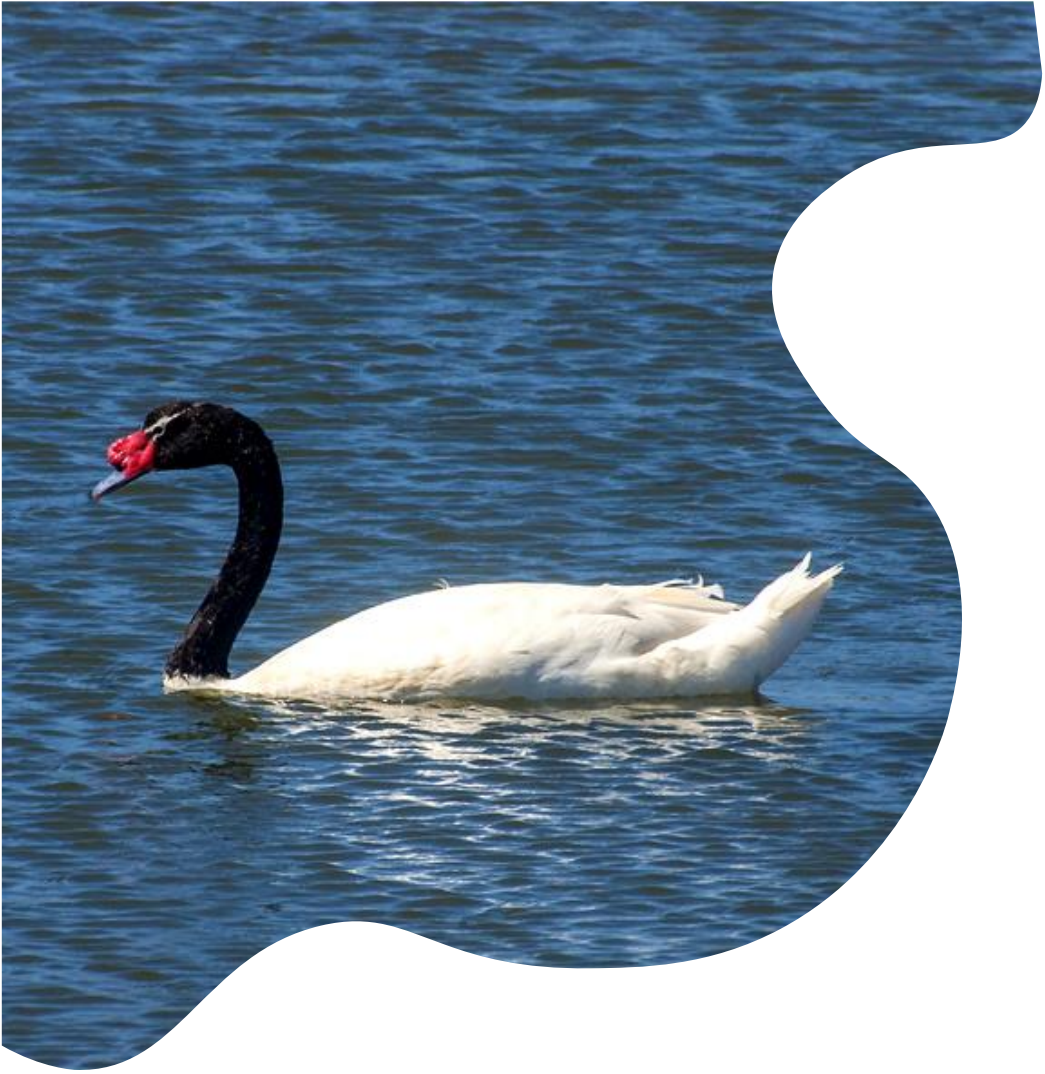

Abstract Book

SETAC Latin America 14th Biennial Meeting

Latin America, Diversity of Knowledge for a Sustainable Future

26–29 SEPTEMBER 2021 • VIRTUAL

Abstract Book

SETAC Latin America 14th Biennial Meeting

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This book comprises the abstracts of the presentations for the platform and poster sessions of the Society of Environmental Toxicology and Chemistry (SETAC) Latin America 14th Biennial Meeting, conducted virtually from 26–29 September 2021. The abstracts are reproduced as accepted by the Scientific Program Committee and appear in numerical order. In each abstract, the presenting author's name is underlined. The author index cross-references the corresponding abstract numbers.

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The Society of Environmental Toxicology and Chemistry (SETAC), with offices in North America and Europe, is a nonprofit, professional society established to provide a forum for individuals and institutions engaged in the study, analysis and solution of environmental problems, the management and regulation of natural resources, environmental education, and research and development.

Specific goals of the society are:

- Promote research, education and training in the environmental sciences
- Promote the systematic application of all relevant scientific disciplines to the evaluation of chemical hazards
- Participate in the scientific interpretation of issues concerned with hazard assessment and risk analysis
- Support the development of ecologically acceptable practices and principles
- Provide a forum (meetings and publications) for communication among professionals in government, business, academia and other segments of society involved in the use, protection and management of our environment

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- Publish scientific journals, a newsletter and special technical publications
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Environmental Quality Through Science

Abstracts

1A. Effects and Risks of Pesticide Used in Agriculture

01A.01 Developing Higher-Tier Tools for Aquatic Risk Assessments and Risk Management of Pesticides in Latin America

X. Patino, Bayer SA / Environmental Safety Assessment Latam; A. Ritter, Waterborne Environmental, Inc. / Exposure Modeling

In 2017 CropLife Latin America and local industry associations engaged in an initiative with Peruvian regulators to improve the scientific basis for aquatic exposure assessments by defining and updating screening and higher tier tools needed to conduct aquatic risk assessment, this effort was then extended to the Colombian environmental agency. The development of the models was funded and developed through a CropLife Latin America project with the technical support and experience of Waterborne Environmental. Such effort additionally required close interaction with local regulators and industry representatives to establish crops of interest, local agricultural practices, availability of suitable global soil, climatic and local cropping spatial data; technical expertise and recommendations needed to fit the tiered approach settled by the Andean Technical Manual. As a result of this project three aquatic exposure tools were created: the Andean Aquatic Screening Tool and a higher tier tool named Andean Pesticide Exposure Simulation Tool ANDES, which additionally includes the first rice model in Latin America. These models provide consistent and transparent approaches for aquatic pesticide exposure characterization and better definition of mitigation measures in the Andean region and have the potential to be adapted to other Latin American countries. Likewise, they allow the possibility of measuring the impact of implementing common mitigation measures.

01A.02 Development of a Tool for Farm-Scale Evaluation of Agricultural Conservation Practices to Reduce Pesticide and Nutrient Loading to Surface Water

J. Stryker, M.F. Winchell, Stone Environmental; B. Patterson, Stone Environmental / Geospatial Data Solutions

A web-based modeling tool was developed with the goal of incentivizing farmers to implement field and farm-level conservation practices that improve water quality. Application of this tool has recently been focused on the Lake Champlain Basin in the northeastern United States (US), where phosphorus is the primary water quality contaminant of concern and the subject of recently updated total maximum daily loads (TMDLs). The Farm-P Reduction Planner (Farm-PREP) was designed to objectively quantify farm-specific reductions in phosphorus and to allow farmers and/or planners to identify field by field agronomic practices that allow them to achieve targeted pollutant reductions. The Agricultural Policy / Environmental Extender Model (APEX) serves as the water quality and agronomic modeling engine for Farm-PREP. This talk will synthesize and present the development of this scientifically defensible decision support tool, including specific efforts to calibrate and validate the APEX model based on edge of field and tile drained sites, as well as to develop a global parameterization for implementation in this tool. The physical mechanisms that drive contaminant transport and loading from the landscape, including primarily runoff and erosion, are similar for nutrients and pesticides. APEX also simulates the fate and transport pesticides and the framework presented here for evaluating the impacts on phosphorus is transferable to the evaluation of other contaminants. Efforts to expand Farm-PREP are ongoing and include broadening the tool capabilities to quantify pesticide aquatic exposure reductions and motivate farmers to implement conservation practiced based on pesticide metrics as well. The direction of nutrient and pesticide management will also be discussed in the context of future and potential uses of this and similar tools, which can aid in integrated evaluation of the impacts of agronomic management.

01A.03 Prospecting Brazilian Native Bees for Managed Crop Pollination

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Agricultural settings usually demand great amounts of pollination but are unfriend environments to most pollinator species. As a consequence, the introduction of man-managed pollinators is needed to ensure the target yield. Bees are the main crop pollinators, but only some species of *Apis* and *Bombus*, and a few solitary bees are reared and managed for crop pollination, most of them species found only in temperate climates. Meanwhile, Brazil which is one of the world leading countries both in agriculture production and crop diversity relies only in Africanized honeybee as a managed crop pollinator. This bee, however, is not an effective nor efficient pollinator of many crop species. Therefore, the current study prospects Brazilian native bee species as potential crop pollinators. The main objectives are to identify species which are efficient pollinators of crops, are gregarious or not too territorialists, multivoltine and can be reared and managed in hives or trap nests. Among a diversity of potential candidates, the stingless bee species *Melipona subnitida*, *Scaptotrigona* aff. *depilis* and *Plebeia* aff. *flavocincta*, the large carpenter bee *Xylocopa frontalis*, the oil-collecting bees *Centris analis* and *Tetrapedia diversipes*, and the resin bee *Epanthidium tigrinum* stood out as the most promising species so far. The four solitary bee species are active all year-long, accepted well trap nests and although not truly gregarious species, are doing well with artificial nesting devices designed to stack one on top of the other or placing multiple nests side-by-side. For the stingless bee species, techniques to use the excess of young queens to produce new colonies are being tested with good results. Although the project is still halfway through, promising results allow to envisage some breaking through findings.

01A.05 Parameterization of a Brazilian Scenario in the USEPA Pesticide in Water Calculator (PWC) Tool to Estimate the Environmental Exposure of Glyphosate in Surface Waters

T. Kaminski, Syngenta Crop Protection; E. Vieira, Instituto Biologico / Laboratório de Ecologia dos Agroquímicos

The current pesticide registration process in Brazil is mainly based on the classification of products as hazardous to the environment, not considering the exposure and therefore the risk. However, this scenario

has presented changes among local regulatory agencies and discussions on risk assessment models to be implemented in Brazil is already being undertaken. The PWC modeling is used as a regulatory tool for aquatic exposure assessment in Canada and USA for registration of agrochemical products, however, the available scenarios consider the conditions of international scenarios. This work aimed to demonstrate the feasibility of parametrization of a Brazilian scenario to estimate the aquatic concentration, considering the active ingredient glyphosate and the sugarcane practices, using the Pesticide in Water Calculator (PWC) from EPA. In that sense, show the possibility of implementation as a regulatory tool for aquatic exposure in Brazil and highlight the importance of developing local scenarios for strategic agricultural areas in the country. Essential parameter data to build the specific local scenario were collected from literature and official Brazilian database. The estimated environmental concentration of glyphosate according to the conditions established was 1.427 $\mu g.L^{-1}$ for the 1st day and 0.174 $\mu g.L^{-1}$ for the 60th day. These values can be used on acute and chronic aquatic risk assessments of glyphosate considering the agricultural practices used in the developed scenario. A difference of 7 times and 1.5 times greater than the estimated concentration in the Brazilian scenario was noted comparing two standard scenarios for sugarcane from EPA, demonstrating the importance of local data choice for an appropriate estimation of concentration in surface waters to be used in aquatic risk assessment in Brazil.

01A.06 Efecto de dos insecticidas formulados con las diamidas antralitricas clorantraniliprole y cyantraniliprole sobre la metamorfosis del sapo Rhinella arenarum

S.F. Peña, Instituto Nacional de Tecnología Agropecuaria / Buenos Aires; J. Brodeur, CONICET - INTA; G.S. Natale, CIM, Departamento de Quimica, Facultad de Ciencias Exactas, UNLP, CONICET / Department of Chemistry

Tiametoxam e imidaclorpid son insecticidas utilizados en cultivos de soja. El objetivo del presente trabajo fue determinar el efecto sobre la metamorfosis de los formulados comerciales Actara y Confidor, los cuales contienen 25% y 20% de tiametoxam e imidacloprid respectivamente en renacuajos del sapo *Rhinella arenarum*. Los ensayos se realizaron por separado para cada insecticida, se expusieron renacuajos en estadio 27 hasta completar la metamorfosis, en un sistema semiestatico a concentraciones ambientalmente relevantes de 5, 50, 500 y 5000 µ/L de tiametoxam e imidacloprid. El efecto en el desarrollo de la metamorfosis se determinó evaluando el tiempo necesario para que el 50% de los individuos alcanzaran el estadio 39, el estadio 42 o que completaran la metamorfosis. Los efectos de los neonicotinoides en estudio sobre los tiempos de la metamorfosis se evidenciaron desde el estadio 39. En el caso de tiametoxam, el tiempo requerido para que la mitad de los individuos expuestos al insecticida alcanzaran el estadio 39 presento diferencias significativas con el grupo control a excepción de la concentración 500 µ/L. Los individuos expuestos a 50 y 5000 µ/L necesitaron más días a diferencia de los individuos expuestos a 5 µ/L los cuales tardaron menos tiempo en llegar al estadio. En cuanto a los individuos expuestos a imidacloprid se logró registrar que los renacuajos expuestos a las concentraciones 5 y 500 µ/L requirieron menos tiempo en alcanzar el estadio 39 presentando diferencias significativas con el grupo control. Durante el avance del desarrollo metamórfico se evidencio que todos los individuos expuestos a los distintos tratamientos de tiametoxam necesitaron más tiempo para alcanzar el estadio 42 y finalizar la metamorfosis presentando diferencias significativas con el grupo control. Lo registrado en imidacloprid permitió evidenciar que igual a lo ocurrido en tiametoxam los individuos expuestos a los distintos tratamientos a excepción de 500 µ/L requirieron de más tiempo para alcanzar el estadio 42 y finalizar el proceso metamórfico.

01A.08 Distribution of Lipids in Liver of Poecilia reticulata Indicates the Persistence and Possibility of Reversal to Co-Exposure to IONPs and Glyphosate

J.d. Faria, Federal University of Goias / Lab Celular Behavior; L. Nunes Guimarães, Federal University of Goias / Lab Cellular Behavior; V. Costa da Silva, Universidade Federal de Goiás; L. Braga Alonso, Federal University of Goias / Lab Cellular Behavior; M. Santos Costa, P. Neres de Lima, Federal University of Goias / Dept of Morphology; B.d. Magalhães, Federal University of Goias; S. Teixeira de Sabóia-Morais, Federal University of Goias / Dept of Morphology

Glyphosate is historically recognized as the active ingredient of widely used herbicides, and Brazil is the country that applies glyphosate the most in the world, which has led to research into its toxicity at various concentrations and in various species, including fish. The wide use of glyphosate causes contamination in soil and water, especially near vegetable crops. In this sense, it is important to seek alternatives for glyphosate remediation and this is why this work presents iron oxide nanoparticles (IONPs) as a tool that needs risk assessment, since it has the ability to adsorb GLY on its surface, presenting a high potential for remediation of environments contaminated with GLY. The toxicity of isolated IONPs and GLY has been investigated by several

ecotoxicologists, so it is important to study the association of IONPs and GLY. Therefore, this work evaluated the distribution and organization of lipids by co-exposure to IONPs with GLY and with Roundup® (GBH) - commercial formula of GLY, in the liver of the biological model *Poecilia reticulata*, considering that this is an animal recommended by the OECD, present in all tropical range with wide distribution in the Brazilian territory. The animals were exposed to IONPs 0.3 mg/L + GLY 0.65 mg/L; IONPs + GBH 0.65 mgGLY/L; IONPs + GBH 1.30 mgGLY/L, for 7, 14 and 21 days, followed by an equal post-exposure period in reconstituted water to evaluate the possibility of recovery of the animals. The liver from two animals at each time was collected and processed for transmission electron microscopy. With the TEM blocks positioned vertically it was covered with carbon and analyzed by backscattered electrons in scanning electron microscopy, so that lipid zones became brighter due to the affinity of osmium with the fat droplets in hepatocytes, which allowed to evaluate the area occupied by lipids from the processing of the images with Image J Fiji software. The results showed that lipid accumulation is gradual throughout exposure, reaching its peak in all treatments after 21 days of exposure, so that animals treated with IONPs + GLY showed greater lipid area than those treated with IONPs + GBH, but during post-exposure, the reversal of lipid accumulation in IONPs + GLY was faster than in IONPs + GBH, so that the associations of IONPs + GBH have the effect dependent on the concentration of GBH, which allows us to assume that GBH has potential to inhibit the inflammatory response entails a greater persistence of the detoxification effort of the animals, even after being removed from the exposure condition. Thus, this study sheds light on the understanding of the toxicity of the associations, as well as fosters future investigations on the potential use of IONPs in remediation processes, allowing risk analysis of the mixture in aquatic environments, as well the resistance and resilience of *Poecilia reticulata* in contaminated environments.

01A.09 Mitigation of Run-Off in Environmental Risk Assessment and Management

R. Sur, Bayer AG - Crop Science Division / Environmental Safety

Run-off is the most important exposure pathway from agricultural fields into the aquatic environment. Effective mitigation measures may be critical to ensure the environmental safety of plant protection products. It is important that the regulatory risk assessment and management considers toolboxes of different mitigation measures that are either already applied by farmers or are new to propel their implementation and application. The poster provides an overview on different edge-of field and in-field run-off mitigation measures such as vegetated filter strips, conservation tillage, and micro-dams and their implementation in exposure assessment tools to assess their effectiveness on the reduction of surface water exposure to pesticide emissions from fields. Different tiers including field-evidence based approaches but also dynamic, event-based mechanistic modelling will be in the scope of the poster presentation.

01A.10 Soybean Flower Visitors: Bee Diversity and Time Preferences

D.L. Gazzoni, Embrapa - Brazilian Agricultural Research Corporation / Chemical Ecology

Soybean is the most important agricultural commodity produced in Brazil, comprising more than 39 million hectares, different latitudes, edaphoclimatic conditions, and an appreciable diversity of genotypes. During the 2016 to 2018 soybean seasons, the abundance, diversity, time preference, and soybean cultivar attractiveness were investigated for either the honeybee (*Apis mellifera* Linnaeus, 1758 (Hymenoptera: Apidae)) or native visiting bees on soybean flower. Assessments were carried out in the following Brazilian municipalities representing important soybean production regions, being Passo Fundo and Cero Largo in Rio Grande Sul; Londrina, Arapongas, Ibiporã, Sabáudia, Iguaraçu, Bela Vista do Paraíso, Primeiro de Maio, Tamarana and Florestópolis in Paraná; Florínea in São Paulo; Dourados in Mato Grosso do Sul; Sorriso and Campo Novo do Parecis in Mato GrossoT; and Luís Eduardo Magalhães in Bahia. The assessments were performed by visual counting during 5 min on 2 m of soybean rows, or using a sweep net on 10m of soybean row. In all locations, *A. mellifera* was the most frequent species among the floral visitors. In Sorriso - MT, where Bt and non-Bt soybean varieties were assessed, a higher number of floral visitors was observed in non-Bt varieties. In locations where assessments were made at different times (Passo Fundo, Cerro Largo, Londrina, Dourados, Sorriso, and Luis Eduardo Magalhães), higher frequencies of honeybee visitation on soybean were observed between 9 a.m. and 11 a.m. Forty-one species of bees were collected on soybean in different locations. These species belong to the families Andrenidae (3), Apidae (22), Halictidae (15), and Megachilidae (1). Results indicated that the diversity of bee species visiting soybean flowers is high. The visits concentrated in the morning, possibly due to lower temperatures that are more favorable to keep higher volumes of nectar present on the nectaries.

01A.11 Soybean Yields Are Incremented Close to a Repository of Native and Managed Bees

D.L. Gazzoni, H.L. Pereira, C.B. Campo, Embrapa - Brazilian Agricultural Research Corporation / Chemical Ecology; G. Zocolo, J.P. da Graça, Embrapa - Brazilian Agricultural Research Corporation / Chemical Ecology; R.S. Parpinelli, Universidade Estadual de Maringá / Departamento de Zootecnia

The Brazilian Forest Code (Federal Law 12.651) imposes restrictions for land use on private properties, being the farmers obliged to preserve native vegetation on the so-called Permanent Preservation Areas and Legal Reserve Areas. Accordingly, the landscape where soybean is cultivated is composed by interlaced preserved and cropped areas. The preserved sites constitute a repository for beneficial species, especially biological control agents for pest control and pollinators of cultivated species. To understand the effect of pollinating bees on soybean yield, two experiment were set up at the sides of a fragment of native forest, located in a soybean farm in Campo Novo do Parecis, Brazil (13º 07' 52" N; 57º 59' 40" W). The fragment contained both native bee species as well as several colonies of honeybee (*Apis mellifera* Linnaeus, 1758 (Hymenoptera:Apidae)). Experiments consisted of plots located on six transects, distant 12.5, 25, 50, 100, 200, 400, 600 m (exp. 1) and 25, 50, 100, 200, 400 and 800 m (exp. 2) from the border of the forest fragment. During soybean blooming, the number of bees were assessed on each plot by counting the bees observed during 5 min, in 2 m of soybean lines in front of the observer, repeated three times each week. When soybean reached maturity, 4 m of two consecutive rows of soybean were harvested for yield evaluation, and 1m of soybean row for estimating yield components. In both experiments, bee counts decreased almost linearly as sampling point departed away from the forest border. In the exp. 1, bee counts decreased from 8.6 (12.5 m) to 0.95 m^{-2} 5 min^{-1} (600 m); in the exp. 2, on average, 5.1 bees m^{-2} 5 min^{-1} were observed at 25 m and 0.9 at 800 m, at the closest and farther distances from the forest. Soybean yields decreased almost linearly for distances lower than 200 m

from the forest, the distance from which the yields were similar. In the exp. 1, no significant differences were observed between the yields in plots distant up to 100 m from the forest border, being the overall mean 3,880 kg/ha. This value was 16 % higher than the average yield of 3,338 for distances of 200 m and over. For the experiment 2, results indicated that the yield of soybean up to 100 m from the border of the forest fragment were significantly different from ones located at 200 m and over. The soybean mean yield in plots distancing up to 100m was 4,201 kg/ha, contrasting with the mean yield in plots distant of 3,677 kg/ha in plots distancing between 200 m to 800 m from the border of the forest fragment, indicating 14.5% higher yield in areas closer to the forest fragment. These results may indicate that soybeans cultivated up to 100 m from a bee repository have greater yields, compared to those cultivated more distant.

01A.12 Supplemental Pollination by Apis mellifera Increased Soybean Yield in Brazil

D.L. Gazzoni, Embrapa - Brazilian Agricultural Research Corporation / Chemical Ecology; J.V. Barateiro, Universidade Federal de Lavras / Departamento de Entomologia; C.B. Campo, Embrapa - Brazilian Agricultural Research Corporation / Chemical Ecology; G. Zocolo, J.P. da Graça, Embrapa - Brazilian Agricultural Research Corporation / Chemical Ecology; R.S. Parpinelli, Universidade Estadual de Maringá / Departamento de Zootecnia

Brazil is the major global soybean producer, with an estimated soybean area of 40 million hectares to be cropped in the 2021/2022 growing season. As soybean areas approach the apiaries, in recent years, we have observed a growing interest of beekeepers to migrate their beehives close to soybean fields for foraging. To investigate the effect of complementary honeybee pollination on the soybean yield, three experiments were set up in Londrina, Brazil, to assess the yield of soybeans and their components, whose flowers were not visited by *Apis mellifera* Linnaeus, 1758 (Hymenoptera: Apidae). The study was developed between 2017/18 and 2019/2020 soybean growing seasons, and the treatments consisted of (1) open plots, with free access of bees; (2) caged plots with a honeybee beehive inside; and (3) caged plots completely free of bees or any other pollinator. The visitation of honeybees on soybean flowers was monitored during the soybean blooming stage (9 am, 10 am, 11am), indicating consistent visits of bees both on open and caged plots with beehives. In both treatments, larger numbers of *A. mellifera* were observed visiting soybeans at 11 am. The average soybean yield increments in soybean produced in caged plots and in open plots were 639 kg/ha (12.97%) and 274 kg/ha (5.58%), compared to caged plots without a beehive, considering the average of the three years of study. It was observed that the yield increments were mainly associated with the occurrence of more pods with 3 or 4 seeds, a larger number of seeds per pod, and higher seed weight. It was also observed a smaller number of pods with zero or one seed on treatments with the presence of bees, compared to the caged plots without bees. These results indicate that supplemental honeybee pollination may increase soybean yield under similar growing conditions, thus reducing the need for expanding area, resulting in a more sustainable soybean production system.

01A.13 Soybean Yield Does Not Increase Due to Supplemental Pollination on Low Yield Potential Conditions

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Since the 2019/20 growing season, Brazil became the major global soybean producer, with an estimated 38% market share for the 2021/22 season. As the soybean area is widespread on different edaphoclimatic conditions, and with a large choice of cultivars, soybean is grown on different potential yield conditions in Brazil, since the very favorable to the ones with restrictions for expression of the actual soybean potential yield. This study aimed to investigate the effect of the honeybee (*Apis mellifera* Linnaeus, 1758 (Hymenoptera: Apidae)) visitation on soybean flowers, and its consequent pollination, on soybean productivity when it is cropped with a constraint to the expression of its potential yield. The experiments were set up in Londrina, Brazil, during the 2016/17 and 2019/20 growing seasons, in areas presenting subsurface compaction layer, which prevents soybean roots from deepening in the soil and restricts the absorption of water and nutrients by the plants. The treatments consisted of 1) open plots, mimicking a typical grower field with free access to bees; 2) a caged plot with a honeybee beehive inside, and 3) a caged plot to avoid the presence of bees or any other potential pollinating insect. Results indicated no yield differences due to the pollination of soybean flowers by honeybees, compared to the treatment with the absence of bee visitation. The overall soybean yield was 2,745 kg/ha, representing only 78% of the Brazilian soybean yield for the 2020/21 season, thus demonstrating that the compaction layer reduced soybean potential yield, preventing soybean plants to benefit from supplemental pollination by the honeybees. Observations of honeybee behavior demonstrated that only 27.9 % of the bee visits on soybean flowers resulted in nectar hoarding, with a time-lapse of 4.52 seconds to visit each flower. When a flower was only tested (72.1%) without nectar collection, the average time of the bee visit was 1.38 seconds. These results indicate that despite active flower visitation by honeybees, the presence of conditions that refrained the expression of potential soybean yield, no benefits arose from the supplemental pollination.

01A.14 Integration of Production Systems With Environmental Service of Pollination: The Role of Stink Bugs' Tolerant Soybean Cultivars

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Plant tolerance is the inheritable attribute of producing, even when standing a certain amount of damage caused by herbivory that would cause susceptible ones to fail. As tolerance comprises only the plant's response to pest herbivory, the adoption of tolerant cultivars stands out as one of the most sustainable strategies in Integrated Pest Management (IPM). In a production system adopting tolerant soybean cultivars, the farmer can either avoid insecticide sprays or halt its applications in a development window comprising the period of bee foraging. Thus, tolerant soybean cultivars are qualified to integrate production systems with environmental services of pollination. Aiming to increase the market offer of herbivory tolerant soybean cultivars, experiments were

carried out in four planting seasons to select cultivars or promising genetic inbred lines from the Embrapa Soybean's breeding program. Seeds of genotypes were sowed in plots (8m x 2m), in an incomplete randomized block design. Adults and nymphs of stink bugs were weekly monitored, by using the shaking cloth sampling method, from R3 to R8 developmental stages. The predominant species was *Euschistus heros* in all weeks of each planting season. Data analyses consisted of examining the visitation curves of each genotype, to identify in each experiment the week of maximum infestation of adults, nymphs, and nymphs + adults of *stink bugs*. Best Linear Unbiased Prediction (BLUP) estimated of data from those weeks and yield, leaf retention, seed quality, and percentage of tradable grains were used to build decision plots. These plots consisted of scatterplots showing the relationships between the number of stink bug visitants and the agronomical attributes and reference lines in both Cartesian axes defined by 95%-confidence intervals for estimates of the control genotype. The analyses of these graphics facilitated the characterization of genotypes, which were more productive and tolerant to *E. heros* attacks. Using this protocol, we registered five tolerant soybean cultivars in the Brazilian Ministry of Agriculture: BRS 391, BRS 423, BRS 439, BRS 543RR, and BRS 1003PRO. In addition to tolerance to *E. heros*, the most important stink bug pest in the soybean production system in Brazil, these cultivars are among the most productive cultivars on the market, present good seed quality, and favorable agronomic traits, which qualify them as one soybean IPM strategy to prevent insecticide sprayings during foraging periods of bees.

01A.15 Monitoring Nectar Sugar in Nectaries During the Day and Night Periods of Soybean Flowers

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The nectar composition varies according to many factors, such as plant species, the progressing of the flowering season, time of the day, and the type of pollinator. Various models of the biochemical and molecular mechanisms underlying nectar production and secretion have been proposed. To obtain information about the chemical composition of the nectar, soybean cultivars TMG 7063 IPRO (white flowers) were sowed. Flowers were collected in different volumes at six different times, 5:00 am (0 mL, 20 flowers), 8:00 am (1 mL, 20 flowers), 11:00 am (2.5 mL, 3 flowers), 2:00 pm (0.5 mL, 15 flowers), 5:00 pm (0.3 mL, 20 flowers), and 8:00 pm (0 mL, 20 flowers), for three days. The sugar concentrations in the samples were established by Nuclear Magnetic Resonance (^{1}H qNMR). The identification of the constituents was carried out using 2D NMR and showed that the nectar of soybean cultivars is composed of different amounts of sucrose, glucose, and fructose. During the collection performed at 8 am, sucrose concentration varied in a range of 0.00 - 0.033 mmol L^{-1}. Simultaneously, glucose production was in the range of 0.186 - 0.370, while fructose was not detected. The sum of the glucose + fructose concentrations in the sample collected at 11 am reached the maximum concentration level of 0.746 mmol L^{-1}, ranging from 0.145 to 0.746 mmol L^{-1}. At 2 pm, sucrose ranged between 0.113 - 0.258 mmol L^{-1} and glucose + fructose between 0.083 - 0.394 mmol L^{-1}. The sugars present in the nectar collected from the soybean flower remained stable throughout the flower's opening period, which indicates that post-secretory modification is unlikely. There was no detection of disaccharides and monosaccharides in the nectar collections at 5:00 am 5:00 pm, and 8:00 pm. Results help explaining why the peak of honeybee visitation to soybean occurs between 11 am and 2 pm, as the peak production of monosaccharides was observed at the end of the morning, along with the greater volume of nectar and higher concentrations of sugars, comprising the final anthesis period of the flower, active floral nectary for nectar secretion, and the hydrolysis of sucrose in the nectarian tissue.

01A.16 Floral Anthocyanins in Soybean Cultivars: Detection and Differentiation by Using Uplc-Hrms Strategies

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The color of the petals given by the anthocyanin type and content is one of the sensory cues that orient pollinators to explore resources, such as nectar and pollen. The objective of this study was to detect and differentiate the anthocyanins present in soybean flowers with purple and white petals. The cultivars BRS399 RR (purple) and BRS388 RR (white) were grown in a greenhouse under controlled conditions. The flowers were collected in the flowering soybean phase, and the petals were separated, extracted, and analyzed by liquid chromatography coupled to the mass spectrometer (UPLC-HRMS - XEVO QToF, Waters). In general, the anthocyanins detected were delphinidin, petunidin, malvidin, pelargonidin, and cyanidin conjugates with sugars and anthocyanidins, as coumaroyl. Only conjugated cyanidin and the anthocyanidin forms were detected in white flower cultivars. BRS399 RR (purple) showed more anthocyanins compounds than the BRS388 RR (white). All anthocyanins observed on purple petals extracts were conjugated by one or more sugar (glycosides). Chromatograms of BRS388 RR cultivar with white petals showed three anthocyanins and cyanidin. Glycosides were predominant, but in BRS388 RR extracts, a cyanidin 3-(6-*O*-*p*-coumaroyl)-5-*O*-diglucoside presented an acyl radical. Anthocyanidins were detected in the cultivar petal extracts. These substances, corresponding to aglycone anthocyanins, are biosynthesized from phenylpropanoid's general pathway. Various flavonoid biosynthetic enzymes can be associated with prolonged plant survival and increase the possibility of reproductive success. The identification method proved efficient for detecting and comparing anthocyanins in soybean flowers and is characterized by presenting high-quality chromatographic and spectrometric data. These results have great potential for application in studies of the relationships between pollinators and soybean flowers and the role of anthocyanins in the visual sensory attraction, orienting pollinators to flowers with resources.

1B. Effects and Risks of Pesticide Used in Agriculture

01B.02 Assessing Groundwater Exposure of an Insecticide Used on Sugarcane in Brazil

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Within any ecological or human health risk assessment framework, quantitative pesticide exposure and risk modeling is a powerful tool to make the important distinction whether a compound is safe or not safe to use under specific conditions. Brazil is one of the largest users of pesticide products registered for agricultural use and the availability of exposure scenarios representing local conditions is important for efficiently conducting realistic risk assessments. While in the past, efforts were undertaken to develop surface water exposure scenarios, development of groundwater exposure scenarios has received less attention. Groundwater, however, is an important drinking water resource in Brazil. With no Brazil-specific groundwater scenarios available, the Brazilian regulatory agencies rely on scenarios developed for or modeling analyses performed in North America and Europe. However, the use of scenarios and assessments from other regions (e.g., US, Canada, EU) may not be relevant for some compounds and use pattern because climate, soils, geology, and agronomic practices are highly variable between those regions and Brazilian agriculture. This study demonstrates the importance of groundwater scenarios representing local conditions by conducting a groundwater exposure assessment using the PRZM-Groundwater model for an insecticide in the sugarcane growing areas of south-central Brazil. The objective of this modeling exercise was to better understand the variability in expected groundwater concentrations across the high intensity sugarcane growing regions. This involved the following steps: (1) spatial identification of the high intensity sugarcane growing areas, (2) obtaining representative long-duration (30-year) daily climate records, (3) identification and characterization of the range in soil conditions associated with sugarcane growing areas, (4) determination of groundwater table depths for sugarcane growing areas, and (5) development of PRZM groundwater scenarios and modeling for the range of conditions determined in the previous steps. The modeling results provided a range of relevant expected groundwater concentrations showing very significant differences within the sugarcane growing areas. This emphasizes how important accounting for environmental variability is to fully understand exposure potential to groundwater.

01B.03 Statistically-Based Soil-Climate Exposure Scenarios for Aquatic Pesticide Fate Modelling and Exposure Assessment in the Pampa Region of Argentina

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Although pesticides are intensively employed in the Pampa region of Argentina, the possibility to perform environmental risk assessment (ERA) remains limited due to the absence of readily available databases to run pesticide fate models and the lack of standardized realistic worst case scenarios. The aim of the current study was to further advance capacities for performing probabilistic ERA in the Pampa region by dividing and parameterizing the region into functional soil-climate mapping units (SCU) and defining statistically-based worst-case soil-climate exposure scenarios. Results obtained demonstrated that the SCU selected for a specific modelling exercise should depend on the dissociation constant (Kd) of the pesticide evaluated and whether short-term or long-term pesticide fate modeling and risk assessment is required. Four regionally representative SCUs were specifically identified for modelling the fate of pesticides with low, high and intermediate values of Kd. Fate modeling of pesticides with an intermediate Kd requires the use of a different SCU for short-term versus long-term pesticide modelling, whereas this distinction is not necessary in the case of pesticides with both low and high Kd. The current definition of realistic worst-case soil-climate scenarios represents a crucial step towards better pesticide fate modeling and risk assessment in the highly agricultural in the Pampa region of Argentina.

01B.04 Are Global Standard Test Species Suitable for Environmental Risk Assessment of Crop Protection Products in Tropical Environments?

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Surrogate species of fish, aquatic invertebrates, and primary producers are used for assessing risk of pesticides to cover the main aquatic trophic levels. Test species have been chosen due to their ecological relevance, sensitivity, availability, ease of testing, reproducibility and robustness, and availability of standard of test methods. This study aims to evaluate whether the standard test species are suitable for use in risk assessments in tropical environments. Data for tropical fish, invertebrate and primary producer species were extracted from the USEPA ECOTOX database, peer reviewed literature, supplementary data presented in Wang *et al.* (2019) and EFSA reports. For each pesticide, the most sensitive regulatory endpoint for fish, invertebrates and algae/ aquatic plants was selected. The ratio of the endpoint for the tropical species and for the most sensitive regulatory endpoint was determined. Thus, values > 1 indicate that the tropical species are less sensitive than the respective standard species. Acute toxicity data for tropical organisms were found for 41 pesticides. In 86.8% of the evaluated fish data the tropical fish species were less sensitive than the standard fish species. In 10.7% of the cases the data showed only slight differences that are in the range of the standard variability of data (factor 3 to 5), indicating that there is no significance between tropical and standard species. In total, for 97.5% of the comparisons the tropical fish are less or similarly sensitive. For the aquatic invertebrates, 80.3% of the evaluated tropical species are less sensitive compared to a standard species. In 14.9% of the cases the data showed only slight differences that are in the range of the standard variability of data (factor 3 to 5). In total, for 95.2% of the compared data the tropical invertebrates are less or similarly sensitive. For primary producers, for 95.7% of the evaluated data the toxicity ratio of the tropical and the standard species endpoints results in values >1. Overall, standard species used globally were more or of similar sensitivity (within a factor of 5) in more than 95% of the cases. In conclusion, data derived from the standard global bioassays performed with freshwater fish, invertebrates and primary producers are suitable for risk assessment in tropical regions.

01B.06 Density of Neonicotinoid-Treated Seeds Available to Birds After Sowing Corn, Sorghum and Soybeans

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Field investigations in Europe and North America have contributed to predicting the risk of poisoning by ingestion of neonicotinoid-treated seeds for birds. In South America, research on the subject is incipient. In order to complete and improve these risk assessments, field data from the region are necessary. In this sense, the objective of this work was to quantify the density of treated seeds that remain in the soil available for birds after sowing corn, sorghum, and soybeans in commercial fields located in the Argentine Espinal ecoregion. Forty-three fields (16 corn, 9 sorghum and 18 soybean) distributed in two departments of the province of Entre Ríos were evaluated through transects with equidistant points. A metal ring (0.25 m2) was placed at each point and the unburied seeds were counted. In addition, more than 30 variables related to characteristics and conditions of the field, of the crop, and of the technical aspects of sowing were surveyed. The richness and abundance of birds were estimated in 25 of the 43 fields by a 250 m transect at the headlands and inside the field. Unburied seed samples were collected in each field to determine chemical residues. The number of seeds/m² in the headlands was significantly higher than that of the field interior. The number of seeds weighted by surface ranged between 0.022 and 2.321 seeds/m² in corn, between 0.007 and 2.142 seeds/m² in sorghum, between 0.559 and 2.629 seeds/m² in the first soybeans, and between 0.079 and 5.426 seeds / m² in the second soybeans, the difference between crops being significant. Most of the surveyed variables were associated with the crop variable (corn, sorghum, first soybeans, second soybeans). The richness of seed-eating birds was higher in the headlands than in the field interior. The abundance of seed-eating birds differed between crops, being higher in corn. Neither abundance nor richness showed a clear linear relationship with the density of exposed seeds in the soil. All corn and sorghum seeds contained at least one neonicotinoid. In contrast, residues of a neonicotinoid were found only in one of the 18 soybean samples. Therefore, although soybeans were the crop with the highest density of unburied seeds, the proportion of seeds treated with neonicotinoids was much lower than in the other two crops.

01B.07 Imidacloprid Seed Coating Poses a Risk of Acute Toxicity to Small Farmland Birds: A Weight-Of-Evidence Analysis Using Data From the Grayish Baywing Agelaioides badius
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The aim of this study was to estimate the risk posed by imidacloprid (IMI) seed coating to passerine birds of the Pampa Region of Argentina using data specifically generated with the grayish baywing (Agelaioides badius). Median lethal dose (LD50) of the IMI-based formulation tested was 57.11 mg IMI/kg body weight (bw), with intoxication signs starting from 20.6 mg IMI/kg bw. The feed intake rate (FIR) was estimated experimentally as 4.895 g/day per bird, representing 12.43% of bw. It was calculated that the ingestion of 7–10% of the FIR as treated seeds would be enough to achieve the LD50 for sorghum, corn, sunflower, and alfalfa, whereas consumption of 31 and 54% of FIR was necessary for oat and wheat, respectively. Based on spill data values available in the literature, it was calculated that, for most crops, a baywing would have to forage an area of field corresponding to less than 60 m2 to obtain the number of seeds required to reach the LD50. It was also shown that this number of seeds is coherent with the amount of seeds ingested in a bout. In a pilot study, all grayish baywings fed with millet seeds treated with 3 g IMI/kg died within three to five days of exposure. In Tier I risk assessment, the trigger value was achieved for all crops except soybean and a weight-of-evidence risk assessment was performed. All lines of evidence examined are consistent with the view that grayish baywings, and probably other small farmland birds, are exposed to a risk of acute toxicity and mortality under both worst-case and mixed-ration exposure scenarios. The possible impacts on bird species calls for an urgent reconsideration of IMI seed coating practices currently approved in the Pampa Region of Argentina and the various parts of the world where this practice is still in use.

01B.08 Repellency, Anorexia, and Aversion by Neonicotinoid-Treated Seeds and Cotyledons on Birds
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Farmland birds can be exposed to neonicotinoids used for seed treatment through the ingestion of unburied seeds and cotyledons. The aim of this study was to evaluate the avoidance (through repellency, anorexia, and/or conditioned aversion) of sorghum and soybean seeds, and soybean cotyledons treated with imidacloprid, clothianidin or thiamethoxam on eared doves (*Zenaida auriculata*) by one-choice tests in captivity. The doves were exposed to the treatments (control vs. neonicotinoid-treated sorghum, soybean or cotyledons, plus maintenance food) for 3-5 days to study the repellency of the treated seed and anorexia, followed by a 7-day period on maintenance food to study the persistence of the anorexic effect after neonicotinoid exposure. Right after, the same doves were exposed to treated food during a second period of 3-5 days to study the repellency and/or the conditioned aversion after the previous exposure. Finally, doves were exposed to the respective untreated type of food to study the conditioned food aversion independently of the treatment. Intoxication signs, differences of body weight and other adverse effects also were determined. With sorghum, the three neonicotinoids produced a marked repellent effect, decreasing the consumption of treated seeds by >97% compared to control birds. However, this repellency was not enough to prevent the death of 3/8 and 1/8 of the doves exposed to imidacloprid and clothianidin, respectively. Imidacloprid-treated soybeans caused a significant repellent effect, but this was not observed for the cotyledons. Signs of anorexia were only observed against the neonicotinoid-treated sorghum. The birds did not avoid the untreated seeds after exposure to the treated ones, suggesting the importance of the color, odor or taste to cause the repellence and the absence of a conditioned aversion. In conclusion, seed avoidance caused by neonicotinoids at the recommended application doses was strong, but it failed to prevent intoxication and death on eared doves in the case of exposure to treated sorghum seeds.

01B.09 Rapid Hemocolourant As an Alternative Stain for the Sparrows Peripheral Blood Micronucleus Test
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Ecosystem pollution is a global problem, caused mainly by disorderly human activities. Currently, biomarkers are a useful in monitoring damage to ecosystems and their organisms. In the case of genotoxic contaminants, one of the most widely used diagnostic techniques is the

micronucleus test (MT), which is an excellent alternative in monitoring genetic damage in wild populations. It is highly reliable, effective, fast and simple. The MT requires one to two drops of blood on a slide, then it is fixed and stained with an acridine orange solution that has high affinity to DNA, which allows to observe the contrast between the cytoplasm and the nucleus of the erythrocytes. This technique requires a microscope equipped with fluorescence and a mercury lamp, which must be changed approximately every 100 h. However, acridine orange is a mutagenic and dangerous substance for the environment. Rapid hemocolourant stain is a commercial variant of Romanowsky's stain, it is also used to stain blood smears, one of its advantages is that it reduces the processing time and in the observation of blood cells it highlights cytoplasmic elements through the use of a simple optical microscope. The objective of this research work was to evaluate the use of rapid hemocolourant-staining as an alternative to the use of acridine orange in the test of micronuclei and nuclear protrusions in peripheral blood in the grasshopper sparrow (*Ammodramus savanarum*) and Baird's sparrow (*Centronyx bairdii*). For this, during the winter of 2020 in Cuchillas de la Zarca, Durango, Mexico, 31 individuals of *A. savanarum* and 21 of *C. bairdii* were captured through the use of mist nets. Blood smears (two per individual, one for each stain) were obtained from these organisms and analyzed. Micronuclear erythrocytes (MNE) and erythrocytes with nuclear protrusions (NPE) were quantified for every 10,000 total erythrocytes. As a general result, it was observed that rapid hemocolourant staining underestimated the frequency of abnormal erythrocytes (MNE and NPE) in relation to those obtained by acridine orange staining, probably due to the higher contrast and staining of fragments or complete chromosomes within the cytoplasm, which does the acridine orange stain. It was not possible to obtain the same results with both types of stains; however, the differences were not greater, in this sense it is recommended to increment the analysis of blood samples to normalize variables and reduce the error of the statistics analyzed.

01B.10 Pesticide Formulations Effects on the Expression of Antioxidant Enzyme Genes and Genotoxicity in the Native Reptile Species Caiman latirostris

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Pesticide exposure could alter the response of the antioxidant system both, affecting the function of enzymes that contribute to the first line of antioxidant defense, such as superoxide dismutase (SOD) and catalase (CAT), or modifying the expression of the genes encoding for these enzymes. In the last years, our group have reported genotoxicity and oxidative stress in blood of *C. latirostris* exposed to different pesticides and their mixtures, in neonates and yearlings under laboratory controlled condition. The aim of this study was to quantify the expression levels of CAT and SOD genes and the activities of the enzymes they encode, and how this relates with oxidative damage to lipids, DNA and genotoxicity in blood of *C. latirostris* hatchling exposed to pesticide formulations under semi-natural conditions. One hundred hatchlings (20 days old) coming from five different clutches were equally distributed into the following treatments: negative control (NC-tap water), glyphosate 2% (GLY, Roundup® Full II), cypermethrin 0.12% (CYP; Atanor®), chlorpyrifos 0.8% (CPF, Lorsban®), and their ternary mixture (M). The concentrations and schedule of application were those recommended in soybean crops. Blood samples were taken for the analysis of the frequency of micronucleus (FMN), DNA damage and oxidative DNA damage, lipid peroxidation levels, the activities of CAT and SOD enzymes and the expression of their corresponding genes. Pesticides analyzed in soil and water 15 days after application showed residues of all compounds in both matrices. Results of biomarkers showed a statistically significant increase in DNA damage, oxidative DNA damage and FMN for GLY, CYP, CPF and M ($p< 0.05$, in all cases), but no effect on lipoperoxidation or modification of antioxidant enzymes was observed. In turn, a statistically significant increase was found in the expression level of *cat* gene only in the group exposed to CYP compared to the NC ($p < 0.05$). When M was compared with the compounds separately, we found a lower expression of both genes with respect to CYP. Registered pesticide residues are comparable to those found in agricultural environments. This reinforces the validity of the experimental design used and the concentrations applied. As it was shown, pesticides tested produced general and specific genetic alterations in this species, and can threaten, in the long term, the health status of wild populations.

01B.11 Atrazina: Caracterización de la sustancia, usos, monitoreo e impacto ambiental en Argentina

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La atrazina (ATZ) es el tercer herbicida de mayor uso en Argentina (10 mil t/año); aprobado para caña de azúcar, lino, maíz, sorgo y té. Aquí se presentan los resultados de un informe solicitado por< w:sdt sdttag="goog_rdk_0" id="1004786687"> el Ministerio de Ambiente y Desarrollo Sostenible de la Nación para evaluar el impacto ambiental de la ATZ en el país. Se realizó una revisión de 541 trabajos técnicos y científicos nacionales e internacionales y una encuesta a técnicos, aplicadores y productores (n=82). El trabajo muestra que en Argentina existen 211 plantas elaboradoras de agroquímicos y 152 presentaciones comerciales de ATZ, con clase toxicológica II, III y IV. La encuesta indica que el 94% de las aplicaciones de ATZ son terrestres con máquina, 5% con mochila y 1% aéreas, y que el principal desvío de su uso es en el cultivo de soja . El relevamiento muestra que la ATZ se registra con elevada frecuencia (50-100 %, pudiendo exceder límites permitidos) en agua superficial y subterránea, sedimentos y suelos de Argentina. Indica que la ATZ induce efectos subletales en especies de invertebrados y vertebrados a concentraciones inferiores a los niveles guía propuestos en Argentina para la protección de la biota acuática (< 3 $\mu g\ L^{-1}$). En humanos, las concentraciones ambientales informadas implicarían exposición crónica de bajo grado. Resalta la falta de datos epidemiológicos y de evaluaciones de riesgo sobre la salud. En consecuencia, se recomienda: gestionar la reducción de los volúmenes de ingreso al ambiente; evitar el desvío de uso y promover una ley

nacional de presupuestos mínimos sobre la gestión de agroquímicos; ampliar estudios sobre toxicidad y ecotoxicidad con especies nativas y en ecosistemas locales; incrementar estudios epidemiológicos y de monitoreo de ATZ en zonas rurales, urbanas y periurbanas; establecer zonas de amortiguación para su aplicación; revisar la clasificación toxicológica y establecer estrictas pautas de manejo. Se discutió el cumplimiento de los requisitos para considerar su inclusión en el Anexo A (Eliminación) o B (Restricción) del *Convenio de Estocolmo*. Respecto al *Convenio de Rotterdam*, se recomendó elaborar un estudio de riesgo ecológico y para la salud humana de la ATZ que permita evaluar la posibilidad y conveniencia de su inclusión en el Anexo III. Se espera que el presente informe sirva como insumo para las autoridades competentes y sea tenido en cuenta en los análisis que se realicen sobre la comercialización y los usos actuales de este herbicida.

01B.12 The Treasure Is in the Soil: A Discussion on Risk Assessment Schemes for Soil Organisms in Brazil

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Soil organisms are key contributors to soil health, being responsible for generating and maintaining a significant portion of the ecosystem services in this compartment *e.g.* soil quality and composition, carbon and nutrient cycling, decomposition *etc*. The maintenance of soil health and the ecological services provided by these organisms is of interest of farmers. When it comes to pesticide use in agriculture, it is necessary to evaluate the effects on soil organisms in order identify possible risks and develop strategies either to prevent or mitigate them. To accomplish this goal, an environmental risk assessment (ERA) must be able to identify possible concerns and their impact by considering the exposure and the sensitivity of non-target organisms. The ERA will also help to define strategies to protect soil organisms and the ecological services they provide. In Brazil, the regulatory frameworks are evolving from a hazard-based analysis to an ERA-based analysis. In this sense, a published risk assessment scheme (FAO 2018 and Daam *et al*. 2019) was evaluated, where by the risk assessment scheme may consider specific regional criteria for tropical environments by making a tiered approach where the degree of complexity increases as the evaluation progresses. We have applied this approach to 9 off-patent pesticides, equally divided in fungicides, insecticides and herbicides. At the first Tier, the exposure was calculated using a generic equation, commonly used by regulatory agencies such as the US-EPA and the UK HSE, which yields an Estimated Environmental Concentration in soil (EEC_{soil}). Nineteen pesticide molecules were assessed to select the most critical rate to estimate the EEC_{soil}.To validate the risk scheme, two of these molecules were toxic references that are knowingly toxic to soil organisms. Ecotoxicological data was retrieved from a public data bank (PPDB) and the level of concern (LOC) was set to 1.0, as used by some regulatory agencies. Using this strategy we have been able to go through several tiers (Tier I up to TIer III), as some of the tested crop protection failed lower tiers and explore refinement options. We understand that this is an initial exercise and an expansion of this assessment is recommended, including more pesticides, so we can understand whether this risk assessment scheme is suitable in the Brazilian context.

01B.13 Priority Pesticides in Chile: Predicting Their Environmental Fate, Bioaccumulation, and Transport Potential

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There is a growing interest in knowing the environmental behavior of organic compounds approved for daily use, mainly because of their associated risks and the known damage they can cause to people's health and to the environment. The high number of compounds that have been synthesized complicate a traditional experimental analysis, therefore making the use of computational estimations to evaluate potential persistence, bioaccumulation, and transport very useful. The main objective of this study was to estimate the environmental behavior of pesticides commonly used in Chile, to identify those that pose a higher potential risk to the environment. We generated a database of pesticides authorized by the *Servicio Agrícola Ganadero* (SAG) and used the Estimation Interface from the US Environmental Protection Agency "EPI Suite" to estimate their distribution coefficients, half-lives, and bioaccumulation potential. Additionally, we used the "Pov & LRTP Screening Tool" to estimate their overall environmental persistence and transport efficiency; and to generate a P-B-LRT score, which considers persistence, bioaccumulation, and long-range transport potential. All results were evaluated using a family of polychlorinated biphenyls (PCB), a group of known persistent organic pollutants, as reference. Based on this analysis, a list of 21 priority pesticides marketed in Chile was generated. Most of these pesticides showed similarities in their molecular structures and will require further experimental analysis.

01B.14 Preliminary Toxicological Evaluation in the Conlara Basin (San Luis, Argentina) Through the Use of Different Bioindicator Species

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Anthropic activities can be a source of pollution and have a great negative impact on biodiversity. The Conlara River basin is located northeast of San Luis (Argentina), being an area of tourist activity and mixed agricultural exploitation (livestock and intensive agriculture). The objective of this work was to evaluate the current state of the basin by combining bioindicator species and ecotoxicological tools. Five sampling sites were selected along the basin from S1 (upstream) to S5 (downstream). Water and sediment samples were taken from each site to carry out the bioassays on the following bioindicators: *Oocistys* sp., *Hyalella* sp. and *Rhinella arenarum*. In the samples, heavy metals and physicochemical parameters were determined. The bioassays were carried out to evaluate mortality and under controlled laboratory conditions at different exposure times according to the species: *Oocistys* sp. (48h), *Hyalella* sp. (96h) and *R. arenarum* (168h). For data analysis, multivariate statistical techniques (PCA) and Probit analysis were used to obtain toxicological parameters such as lethal time 50 (TL50) and growth inhibition (IC50). The values of the physicochemical parameters showed an increase in conductivity, organic matter, phosphorus and heavy metals as the water course progresses (S1 to S5). In the case of *Oocystis* sp., a significant decrease was observed from S2 that allowed estimating IC50 values: S2 = 126.05h, S3 = 64.24h, S4 = 43.87h and S5 = 28.96h. Mortality analyzes revealed only TL50 = 10.88h values in S4 for *Hyalella* sp. while in S5 the mortality was 100% in *Hyalella* sp. and *R. arenarum*. The first 2 components of the PCA explained 84.05% of the total variability. This analysis showed that S4 and S5, in contrast to S1, S2 and S3, were characterized by high concentrations of heavy metals and organic matter, related to an inhibition in algae and high mortality in invertebrates and aquatic vertebrates. In addition to this, analyzing macroinvertebrates as ecological indicators, more sensitive families (Ephemeroptera) identified in S1 and more tolerant organisms

(Chironomidae) found mainly in S4 and S5 were observed. This preliminary toxicological analysis tested on different aquatic bioindicators shows a deterioration downstream of the basin (S4 and S5) that could be explained by the anthropic practices of the region.

2. Micro- and Macroplastics Pollution

2.01 Are Microplastics a Risk to the Endangered Galápagos Penguin? Modelling Microplastics Bioaccumulation Potential in the Galápagos Archipelago

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Millions of tons of microplastics (MP, < 5mm) are released into the ocean each year and, while their implications on marine individuals and their abundance and distribution have been reasonably explored, further research is needed to investigate the levels of MP exposure resulting from transfer between trophic levels. Laboratory and field studies have revealed MP transfer between low trophic levels; however, few studies have modelled the bioaccumulation potential of MP across foodwebs. This research aims to advance knowledge on MP bioaccumulation potential using the endangered Galápagos Penguin as an endemic sentinel species. MP have reached the remote and historically significant UNESCO-World Heritage site, the Galápagos Islands, but the implications for the endemic and culturally significant species inhabiting these islands remain underexplored. Few penguin species have been the subject of MP pollution studies and the endangered Galápagos Penguin, the only tropical penguin species north of the equator, likewise, has received little attention in terms of anthropogenic pollutants. To explore the bioaccumulation potential in grams of MP/kg of biomass, we developed an Ecopath and Ecosim (EwE) trophic dynamic ecosystem model focused on the Galápagos Penguin, but also included other high trophic level species such as the endemic Galápagos Sea Lion. MP concentrations empirically reported for Galápagos' waters in previous studies were entered into the EwE model as input data using the Ecotracer (contaminant tracing) routine. A simulation period of 100 years was assessed including varying levels of observed MP water concentrations and various fecal elimination rates of MP. The trophic magnification factor (TMF) was also calculated using the modelled data. The resulting TMF was compared against other Ecotracer runs in existing EwE models available through Ecospace, including Galápagos' Darwin, and Wolf Islands and Floreana Island ecosystems. Preliminary outcomes show that even though low MP concentrations were predicted in seabirds, ranging 1.5×10^{-5} to 9.6×10^{-5} g/kg, statistically significant TMF values ranged from 4.7 to 23.8, indicating potential biomagnification. This study simulates MP interactions in a tropical foodweb and explores one avenue of the widely debated question: where does marine MP pollution ultimately end up? Are MP accumulating in marine foodwebs and are high tropic level species exposed to greater level of risk due to bioaccumulation?

2.02 Combined Toxicity of Micropollutants From a Wastewater Effluent and Polystyrene NanoPlastics Towards Three Freshwater Organisms

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Ecosystem pollution by plastic particles is a growing concern and their ubiquitous presence is undeniable. Furthermore, the knowledge about the smallest fractions, called nanoplastics (NPs, size less than 1 μm at least in one of its dimensions) is very scarce, although this fraction is potentially the most hazardous. Their unique chemical, physical, mechanical, and electrical properties could increase their interaction with other pollutants and environmental parameters, making them more dangerous for the biota. One of the main sources of entry of NPs to freshwater ecosystems is the wastewater treatment plants (WWTP). It is well-known that wastewater effluents may contain different chemicals that are not totally eliminated in the WWTP. In the last years, several studies have pointed out the capacity of plastic particles to sorb different chemical compounds, representing a sink and thus a new source of entry of these chemicals to the ecosystems. In this work, both, abiotic exposure for 24 h of polystyrene NPs (30 nm) and effluent wastewater (to study potential adsorption of wastewater chemicals onto NPs) as well as the effect of combined exposure of effluent wastewater and NPs towards organisms from different trophic levels, a microalga, *Anabaena* CPB4337 (a bioluminescent bioreporter strain), a plant, *Spirodela polyrhiza* and the crustacean *Daphnia magna* for 24, 72 and 48h, respectively, were studied. The organisms were exposed to concentrations of NPs (12.5-200 mg/L) and wastewater (0.0625- 1 dilution) individually and in binary mixture (full factorial design). Endpoints such as the inhibition of bioluminescence, of growth and immobilization were analysed. For predicting mixture toxicity, data were analysed using the *combination index* (CI). Our results showed that during combined exposure, NPs were able to adsorb micropollutants present in the wastewater effluent, particularly those with positive charge. This adsorption was responsible for the observed reduction of toxicity towards the three tested organisms; as antagonism was the main interaction found in combined exposure; although at the highest affected fractions, synergism in *S. polyrhiza* was observed. Our study supports the need of studying the effects of pollutants in a real environment scenario such as mixtures.

2.03 Microplastics: A Study Case in Mazatlán, Mexico

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Microplastics (MPs) are pervasive contaminants that can be found in all types of environmental compartments such as air, water, soil, and sediments. This study is a baseline of MP contamination in a tourism destination at the SE entrance of the Gulf of California (Mazatlan, Mexico) assessed from beach sands, surface waters, and suspended sediments to study its temporal variability and distribution. The MP concentration in beach sands from urban and rural areas ranged from 4-36 MPs m^{-2}, 1.7-2.0 MPs m^{-3} in surface waters, and in sediment trap samples varied widely from 40-782 MPs m^{-2} day^{-1}. The prevailing shapes were fragments in beach sands and surface waters (59-80%) and fibers (75%) in suspended sediments. The synthetic polymers polypropylene, polyethylene, and polyethylene terephthalate were the most abundant in all samples. MP concentrations on beaches were not affected by population density; discharged effluent waters were proposed as a likely source for the MPs detected on surface waters. The presence of MPs in suspended sediments was likely caused by surface

runoff during the rainy season.

2.04 Microplastics: An Assessment Case of Two Bays in Baja California, Mexico

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Littering and, in particular, "plastic debris" is a global problem with strong impacts on the environment and human health. Microplastics (MPs) are a subclassification of plastic, which is related to their size. Once MPs enter the marine environment, their persistence is attributed to their physical and chemical characteristics. These properties allow them to be widely distributed due to the oceanographic and environmental conditions that prevail in the area. This research aims to assess the impact of MPs on two coastal bodies located in Baja California, Mexico: San Quintin Bay (SQB) and Todos Santos Bay (TSB). These bays have different economic and demographic characteristics, SQB has a low population density (rural area) and less surface; TSB has a larger population (urban area) and surface area. We collected, surface sediment and surface water samples from both bays during March 2019. Preliminary results show high accumulation areas of MPs in both bays. In surface waters of TSB, a higher proportion of fragments, greater than the number of fibers was observed (50-80%), with the exception of two manta trawls where the fibers dominated the composition of MPs (> 65%). A low incidence of macroplastics was observed in TSB samples (< 4%). On the other hand, the composition of MPs in SQB was dominated by the fibers (65-74%). While in surface sediments, a higher proportion of fibers was observed (77% in TSB and 97% in SQB). The type of polymer was determined *via* micro Fourier transform infrared with attenuated total reflection spectrometer. In surface water samples of TSB, 10% of the total fragments have been analyzed, finding mainly a high incidence of synthetic particles such as polyethylene (PE), polypropylene (PP), and polystyrene (40, 25, and 16%, respectively). Preliminarly, 70% of the fibers analyzed in the samples (representing 21% of the total analyzed) were of synthetic origin, predominating the PP and its copolymer (27%), polyacrylic (13%), PE (5%), semisynthetic cellophane (4%), among others. Meanwhile, the proportion of natural fibers was 19%, and only 13% of the particles showed a spectrum that could not be identified. Our preliminary results suggest that MPs distribution is dominated mainly by the water circulation patterns in both bays more than by the proximity to their sources or by population density pressure. The different composition of MPs seems to indicate that their origin of these microparticles in both bays is different.

2.05 A New Environmental Problem: Coronavirus and Disposable Face Masks

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The use of disposable face masks increased due to the COVID-19 pandemic because they decreased the transmission of the SARS-CoV-2 variant. Plastic pollution is an ever-increasing problem, and the use of personal protective equipment (PPE), plastic items, and the single-use of medical equipment during the pandemic has increased this environmental problem. In this study, we are presenting the case of the city of Superior in Wisconsin, USA. Superior was broken up into sections to survey biweekly to collect the data for a total of 6-months. Afterward, analyses will be done to determine the amount of PPE found and the proportion of the different types. The results will be compared to national and possibly global data to determine how much of an impact can be made. The increase of plastic items in the time of pandemic will have pros and cons. Still, overall it is essential to emphasize to the community a change of attitude and responsibility of taking care of the plastic wastes.

2.06 Are All Micro Particles Plastics?

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Superior

Microplastics (MPs) are defined as particles < 5mm in size derived from petroleum and they are not biodegradable. MPs not only vary in their morphology, but also their sizes, and chemical composition. These MPs are found in all environments (air, water, soils, and sediments). The main objective of this research is to have a clear identification of synthetic particles using micro-infrared spectrometry with attenuated total reflection (µFTIR-ATR). The signals of each spectrum are compared with standard spectra. In our research results, the minimum percentage of comparison with standards is 70%, to be considered a valid result in the identification of plastic polymers. Similarly, it is important to recognize the presence of non-synthetic materials such as cotton and cellulose that are easily confused with plastic polymers. Analysis of microplastics is more complex as their sizes decreased and the signals around the 1000- 1032 cm-1 area are alike; therefore, it becomes complicated to differentiate between a natural and a synthetic polymer. During the analysis, the process is important to use blanks of procedure to monitor possible contamination for external microparticles. In conclusion, when studying MPs, it becomes extremely important to be able to identify between natural and synthetic polymers (polyester, polyethylene, and polypropylene).

2.07 Microplastic Exposure Landscapes for Sandy Beach Macroinfauna Are Determined by Grain Size and Morphodynamics, a Case Study in Uruguay

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Despite the global occurrence of microplastic contamination on sandy beaches, evidence of microplastic distribution within beaches remains contradictory. When conflicting evidence is used to inform sampling surveys, it increases uncertainty in resulting data. Moreover, it hampers spatially explicit risk characterization of microplastic pollution to intertidal fauna. We aimed to guide sampling designs for microplastic monitoring on beaches, and to quantify macroinfauna exposure to microplastics. Microplastic abundance, quantified between 5 mm–66 µm, lacked a significant zonation across the top sediment layer of sub-terrestrial, upper and lower midlittoral, and swash zones at two sites with varying anthropogenic influence on a microtidal dissipative beach in Uruguay. Microplastic abundance decreased exponentially with increasing grain size, as revealed by Bayesian Poisson regression, although the decrease was less steep compared to prior knowledge regarding sediment – plastic interactions obtained for large (millimeter-sized) industrial pellets. Significant differences in microplastic

contamination between the two sites with varying anthropogenic influence likely related to their proximity to a freshwater canal. Corresponding field measurements of body burdens of fibers and irregular particles were significantly lower for the polychaete *Euzonus (Thoracophelia) furcifera*, despite its preference for finer sediments with higher microplastic loads, compared to the isopods *Excirolana braziliensis* and *Excirolana armata*. Results provide critical insights toward representative sampling of microplastics within beach sites. Specifically, we caution against sampling limited to the drift line, and instead recommend: 1) reporting beach morphodynamic characteristics; 2) using clearly defined, ecologically informed zonation schemes; and 3) accounting for sediment grain size as a covariate to normalize among reported contamination levels. The results contribute valuable baseline data toward realistic exposure landscapes relative to the sediment grain size preferences of macroinfauna, needed to inform laboratory experiments.

2.09 Microplastics Effects Assessment in Ecotoxicology on Invertebrate Models: Integration of Biomarker to Microbiome Studies

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Microplastics present a challenge to ecotoxicology, as new ways to address the effects of these permanent and ubiquitous pollutants are required. Despite advances in ecological risk assessment to consider effects more holistically, such as the adverse outcome pathway perspective, this still fails to address more chronic long-term effects. Further, ecotoxicology is still far to include the effects on microbiomes on the effect assessment. We conducted a pilot study to address the effects of microplastics on invertebrate homeostasis, particularly their immune and inflammatory response. We propose this as the basis to integrate physiological, behavior and micribiome effects of these pollutants on Aquatic invertebrates. The analysis of the preliminary data show the potential and challenges of measuring and relating the changes in the immune response of invertebrates to microplastic exposure, as well as the potential for haemolymph microbiome to follow up on these effects.

2.13 Microplastic Concentrations in Cultured Oyster in Two Seasons From Two Bays of Baja California, Mexico

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Microplastics (MPs) are one of the most numerous wastes reported in the marine ecosystem. They represent a risk for exposed organisms. As filter feeders, bivalve mollusks have a high risk of contamination by MPs, so their consumption can be considered a transfer vector to humans. In Mexico, few studies evaluate the presence of microplastics in organisms, so our work aims to expand knowledge on this topic. In this study, we evaluated the MPs concentrations found in the oysters *Magallana gigas* cultured in two bays in Mexico (Todos Santos Bay, TSB; and San Quintin Bay, SQB), during two seasons in 2019 (winter and summer). The objective was to evaluate whether oyster consumption could be a significant transfer vector of MP to humans. We hypothesized that the organisms cultivated in TSB would present a higher concentration of MPs than those cultivated in SQB, mainly attributed to a more significant population pressure (~ ten times higher) and the socioeconomic activities around this bay. Oysters harvested during the winter season were expected to have the highest concentrations, because most rain events in the region occur during this season. Samples sites selection was based on the commercial concessions for oyster farming in each bay. The oyster's tissue was chemically digested to remove the organic matter and subsequently filtered. All particles considered as possible MPs were quantified according to their physical characteristics using a stereoscopic microscope. The type of polymer was determined *via* µ-FTIR-ATR spectrometry. MPs were found in all samples from both seasons, finding that microfibers were the most abundant particles. Polyester, polyacrylonitrile, and rayon were the most common plastics detected. Statistically significant differences were observed in the mean concentration of MPs between winter and summer for TSB and SQB organisms, with the highest concentrations found in winter. Only for summer, the content of MPs was compared between the digestive system and the rest of the soft tissue in organisms from each site, and statistically significant differences were observed. Despite this, a trend where the higher concentrations of MP were detected in soft tissue. However, due to the low concentration of MPs found in oysters, at this time, its consumption does not represent a risk to human health. Also, MPs concentrations in organisms appear to respond to variables such as temporality and the water circulation dynamics within the bays.

2.14 Ocurrence of Perfluoroalkyl Substances in Plastic Debris in Central Chile

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Plastic is a practical material due to its durability, flexibility, low density and resistance. Because of their physicochemical properties, plastics accumulate a complex mixture of contaminants present in the environment, adding to the cocktail of chemicals already present from manufacturing. Concentrations of chemicals such as plasticizers and POPs have been reported in plastic waste from beaches around the world; however, few studies have reported concentrations of Perfluoroalkyl Substances (PFASs) that have been widely used as surfactants in a wide range of products and are considered dangerous for human health and the environment. The main objective of this study is to analyse the presence of PFASs in plastic debris (PDs) from six beaches of Concepción Bay in central Chile. This study will contribute new information to motivate the development of national strategies aiming to reduce the impact of plastic pollution in the marine ecosystem. For the collection of samples in spring 2017, three transects were taken perpendicular to the coast. Transects were divided in three quadrants from the highest site of the beaches to the low tide line. The sand was sieved in situ through a sieve metal screen (1 mm) and collected in aluminum foil envelopes. PDs were physically characterized. The identification of polymers was carried out with a Fourier Transformed Infra-Red spectrometer (FT-IR). POPs were extracted using in an ultrasonic bath and hexane. Silica gel and sodium sulfate columns were used to clean-up the samples, eluting with DCM/hexane 1:1. This final extract was used to quantify 21PFASs in HPLC-MS/MS. Results obtained showed, that the most frequent polymer were polypropylene (PP). In this study 21 PFAS were analysed

but only 15 compounds were detected at all sampling sites, and ranged from 279 to 1211 pg g^{-1}, being higher than those reported in other studies. MeFOSE accounted for 46% of the total PFASs composition, followed by PFHxS (14%) and PFPA (11%). MeFOSE is a PFOS precursor which was primarily used on textiles as dirt-repellent. Studies have shown that MeFOSE can metabolically degrade to PFOS, which would lead to possible risk to human health. PFHxS has been used as a substitute for two other fluorinated compounds PFOS and PFOA. The PFPA used as surface active agent, fertilizers, and other agricultural chemicals. Further research is still need to assess the impact of PFAS in Concepcion bay population.

2.15 Assessment of Microplastic Particles (MP) in Marine Bivalves for Human Consumption From the Southern Coast of Chile

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In the last decade, increasing concern has been raised to protect the marine environment to the occurrence of emerging contaminants (EC), such as microplastics particles (MP) (< 5 mm). Recent investigations, have demonstrated the ingestion of MP in various marine organisms. In particular, the aquaculture activities in Chile are quite important; it has been estimated that the per capita consumption of fish and seafood products in Chile is 22 kilos per inhabitant per year. In this study we have analyzed microplastics in mussels (*Mytilus chilensis*) (canned in water) for human consumption from the Southern coast (Puerto Montt/Chiloé) of Chile (Figure 1a). The stomach content of the canned mussels (200 g) were grouped (by n= 7 individuals) and were homogenized; then a basic digestion was performed using KOH, concentrated, filtered and keep in glass fiber filters for analysis. Samples were analyzed optic and physically for size, color and shape using a stereoscopic microscope with 4x magnification. To identify the chemical composition of the particles, we used the FT-IR equipment. The physical characteristic showed that the particle size 0.5 mm (42%) was the most abundant; red particles were the most abundant (23%) and black (21%. The most abundant type of shape detected was fiber (with 57%), followed by pieces of bags (14%), solid pieces (10%), and pellet (1%). However, from all MP found only 4 particles (4/20= 0.2 particles, 20%) were identified as plastics polymers i.e., Polypropylene (3%) and Polyethylene (1%). These preliminary findings showed there is a low incidence of MP (occurrence) in canned mussels consumed by humans. A more exhaustive research is still need to evaluate MP presence in a wide range of marine products. *Acknowledgement* - The authors thank Fondecyt grantt n°1161673 and 1211931 (PI: Karla Pozo) and CIPA, CONICYT Regional, GORE BIO BIO, R17A10003, and CMA (Centro de microscopia avanzada) Universidad de Concepción in Chile. This research was supported by the RECETOX Research Infrastructure (LM2015051 and CZ.02.1.01/0.0/0.0/16_013/0001761).

2.16 Microplásticos Presentes en Efluentes y Lodos de una Planta de Tratamiento Convencional del Gran Buenos Aires y su Aporte a una Cuenca Urbana

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La aparición de contaminantes emergentes en los diversos cuerpos de agua es uno de los efectos colaterales del desarrollo de las sociedades. La detección de microplásticos en cuerpos de agua superficiales es una problemática de preocupación creciente de particular interés en cuencas urbanas. La identificación de fuentes y sumideros resulta indispensable para poder realizar un control eficiente a fin de evitar una mayor degradación ambiental. Diversos estudios identifican a las plantas de tratamiento de aguas residuales como potenciales fuentes de microplásticos. En este trabajo se comparó la cantidad de microplásticos presentes a lo largo de dos procesos de tratamiento de aguas residuales domésticas de una planta de tratamiento convencional, con una planta de tratamiento de tecnología similar, y con sitios representativos de la cuenca de influencia (Cuenca Matanza-Riachuelo). Para el análisis se consideraron las diferentes propuestas metodológicas que fueron empleadas en el estudio estos contaminantes, según fue reportado en las revisiones bibliográficas disponibles. Los resultados indicaron que las aguas residuales domésticas que eran tratadas presentaban las mayores cantidades de microplásticos, respecto de los sitios representativos de la cuenca Matanza Riachuelo. La evaluación de los procesos unitarios dentro de la planta de tratamiento indica que la sedimentación sería el principal proceso involucrado en la remoción de estos contaminantes en las operaciones de tratamiento, siendo las lagunas de sedimentación las que presentan la mayor eficiencia de remoción. A raíz de los resultados se apoya la consideración de las plantas de tratamiento evaluadas como fuente de microplásticos. Los resultados derivados de la metodología empleada fueron contrastados con los de otras metodologías, pudiendo caracterizarse sus ventajas y desventajas para realizar una puesta a punto de la técnica. Este estudio resulta de importancia para la identificación de sitios puntuales a través de los cuales se podría regular el aporte de estos contaminantes emergentes a los cuerpos receptores.

2.17 Microplastics and Hydrocarbons in Soils: Quantification As Anthropic Carbon Source

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The presence of microplastics (MPs) has been evaluated in different environmental compartments, however studies about the potential impact on terrestrial ecosystems are still scarce. Once into the soil, MPs are detected as organic carbon (SOC) for traditional quantification methods (e.g.: loss on ignition). For this reason, the objective of this study was to quantify the carbon (C) contribution of total hydrocarbons and MPs to the SOC in a coastal urban wetland (Reserva Costera Municipal de Avellaneda, Buenos Aires, Argentina; RCMA) with the features of a subtropical humid forest. To this aim, the ecosystem was characterized by the calculation of aboveground net primary productivity (ANPP) using a time-series of NDVI data (Terra/Aqua MODIS sensor 16-day, years 2018 to 2020) and superficial soil samples (n=4) were collected in April 2019. Soil samples were split for analysis of: moisture content; texture (sieve and pipet method); organic matter as loss on-ignition (LOI; 8hs at 450°C); total hydrocarbons (gravimetry of solvent extractable matter); and extraction of MPs through density separation by floatation using a concentrated NaCl solution, vacuum filtration, H_2O_2 digestion and visual sorting under a dissecting microscope. The annual ANPP average 4.94 ± 0.07 Ton C/Ha, coincident to other estimations to the alluvial forest ecosystem. The superficial soil in RCMA was a sandy clay loam with a large organic matter content (19-30%) and an estimated soil bulk density of 0.54 ± 0.07 g/cm^3. Organic matter content is typical of flooding and soil saturation conditions with a slow organic matter mineralization. Applying a correction factor of 1.7 to LOI, soil retained 77.8 ± 7.3 Ton C /Ha. Total hydrocarbon averaged 2.5 ± 1.9 g/Kg (1.4 ± 1.3 Ton /Ha), and the average number of MPs was 587 ± 277 MPs/kg of dry soil,

equivalent to 0.2 to 2.4 g of MPs/ Kg or 0.13 to 1.33 Ton MPs/Ha. Taking account of the C content (85.7% in THCs, and ~90% in MPs), THCs and MPs add to the soil 1.23 ± 1.10 Ton C/Ha and between 0.12 to 1.20 Ton C / Ha, respectively. Therefore, to this system with humid forest characteristics, the MPs represent between 0.15 to 1.54% of soil estimated carbon, in a magnitude similar to the C contribution of HCTs (0.6-4.2%). This preliminary study showed the relevance of discriminating MPs from other carbon sources, and presented a description of MPs impact in soils as advance to future research or tools for decision makers.

2.18 Microplastics in California Sea Lion (Zalophus californianus) Rookeries

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Microplastics (MPs) are highly bioavailable and easily confused as a natural food by many organisms at different trophic levels within the marine ecosystem. This research aimed to investigate if California sea lions (*Zalophus californianus*) populations are being impacted by MP pollution through the ingestion of these tiny particles. Samples of scats from five rookeries were collected at the Gulf of California and from the coast at Cabo Haro, Guaymas, Mexico, during the breeding season (July-August 2018) and the resting season (January 2020). Samples were chemically digested (KOH 30%), and the separation of possible plastic particles was developed using a stereomicroscope equipped with a camera. Particles founded were mainly fibers (91.8%) and fragments (8.2%). Blue-colored particles were more abundant (52.2%), followed by black (23.8%) and gray color (8%). Size distribution ranged from 250 to 500 µm(26%), 500 to 1000 µm(26%), and bigger than 1000 µm(25.8%).GF/F filters were used as blank controls (11 in total). The identification of the type of polymer was by analysis of the particles using infrared spectrometry (FTIR-ATR). All the particles analyzed showed a mix of natural and synthetic polymers, with 50-60% identified as cotton and cellulose and 40-50% synthetic and semisynthetic polymer. The main polymers identified were polyethylene, polypropylene, polyethylacrylate, polyester, and cellophane.

2.19 Microplastics in Different Tissues of the Crab Neohelice Granulata in an Estuary in the Province of Buenos Aires, Argentina

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Microplastics (MPs), < 5mm, can be found worldwide, especially in aquatic ecosystems. In these habitats, MPs can affect different organisms in diverse ways. Some research suggests that crabs can also accumulate MPs and may be at high risk, not only due to their diet but also through their gills. It is significant considering that crabs are essential players in aquatic ecosystems, with an important work of bioturbation, being transition animals in the marine food web. The present work classifies (according to shape, size, and color) the MPs and analyzes their abundance in different tissues -gills (Gs), digestive systems (DS), and shells- in females and males of a resident crab, *Neohelice granulata*. Water and sediment samples associated with crabs were also analyzed. The crabs were collected at two different sites in the Bahía Blanca estuary: Puerto Cuatreros (PC), in the inner zone, and Puerto Rosales (PR), in the middle zone. Fibers were the most abundant particles, with 66%, followed by the fragments with 24%. The remaining corresponded to films and pellets. Transparent items were the predominant (44%), followed by black (17%) and blue colors (16%). The most frequent sizes were < 0.5mm with 44%, followed by sizes between 1 and 5 mm (29%). The PC crabs presented higher amounts of MPs in their tissues compared to those of PR. This agrees with the condition index, lower for the PC crabs (39.79 ± 13.96 vs 43.12 ± 16.44). However, this index and MPs amount did not show significant differences between the different sites. The Gs show a higher number of MPs than the DS, both in PC and PR crabs, but without significant differences within and between sites ($p > 0.25$). The amount of MPs in shells for the PC crabs was 0.66 ± 0.6 ítems/shell and 1.33 ± 0.6 ítems/shell for those of PR. The content of MPs in sediment samples for PR were higher than PC, with a significant difference, and the opposite happened with the water samples. MPs both in Gs and in the DS are due to its close association with the sediment, as a deposit feeder and cave builder, and with water, for being a semi-terrestrial species. The presence of MPs in their shells shows that the bioturbation processes can remove and mix the sediment and these contaminants, adhering to their bodies. These studies will allow us to know the health status of the organisms and their ecosystems and the dynamics that MPs may have. Determining the types of polymers in the different samples will provide valuable data for reaching more complete conclusions.

2.21 A Validated Laboratory Protocol for Microplastic Identification and Quantification From Organic Rich Sediments

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Plastic pollution presents a global environmental concern with potentially widespread ecological, socio-economic and health implications. Methodological advances in microplastic extraction, quantification and identification from sediments have been made. However, integrating these fragmentary advances into a holistic, cost-effective protocol and applying it to organic rich sediments with fine grain size remains a challenge. Nonetheless, many hot spots of microplastic contamination such as harbour and estuarine sediments are characterised by such sediments. We conducted a series of experiments to integrate methodological advances, and clarify their applicability to organic rich sediments with fine grain size. The resulting protocol consisted of three stages. First, pre-treatment with Fenton's reagent was found to be efficient in reducing organic matter content, compatible with later Fourier Transform-Infrared Spectroscopy (FT-IR) for polymer identification, although it did affect the size of polyethylene (PE) and polyethylene terephthalate (PET). Secondly, a novel density separation column with a top overflow (the OC-T) obtained recovery rates above 90% for microplastics present in a $ZnCL_2$ solution. Finally, automated epifluorescence microscopic image analysis of Nile Red stained filters with selected validation of polymer identities using FT-IR revealed 91.7% of stained particles to be plastics. A case study on estuarine sediments demonstrated a high extraction efficiency with quantification possible down to 125 µm and detection possible down to 62.5 µm. This makes this protocol suitable for large scale monitoring of microplastics in sediments of estuarine origin provided polymer specific recovery rates, background contamination and uncertainty in Nile Red identification is accounted for. Subject to further validation, the protocol could also offer a solution to similar organic rich sediments with fine grain size, such as some soils and sludge, to improve our ability to

conduct cost-effective, large scale monitoring of microplastic contamination.

2.22 Presence and Risks of Microplastics in the Amazon River

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Only a limited number of households in the Amazon are served by sewage collection and treatment facilities, suggesting that there might be a significant emission of plastics and microplastics into freshwater ecosystems. In this work, we performed a large-scale monitoring to assess the emission and exposure of microplastics on freshwater ecosystems of the Brazilian Amazon. Our study included 40 microplastic samples taken during November-December of 2019 in the Amazon River, in three of its major tributaries, and in small tributaries crossing four important urban areas (Manaus, Santarém, Macapá, Belém). Microplastic sampling was done by pumping a given amount of water (0.3-4.6 m^3, depending on the contamination level) over plankton nets (down to 55 µm). Then the samples were filtrated and the microplastics were sorted, sized and classified by shape (fragment, fibre, bead, granule and film) with a microscope, followed by polymer characterization using Fourier Transform Infrared Spectroscopy (FTIR). The data analysis is still ongoing, but preliminary results show that microplastics are ubiquitous contaminants in relatively remote areas of the Amazon and that concentrations increase significantly in urban streams of the Amazon by two to three-fold (up to 6 particles per liter). The majority of the analyzed microplastic particles were polypropylene and polyester. The dataset will be used to provide a quantitative assessment of microplastic emission from important urban areas into the Amazon and to assess their long-term risks for freshwater biodiversity.

2.23 Preliminary Studies on the Abundance of Microplastics (MPs) in Commercialized Bottled Waters in Chile

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Nowadays, bottled water is the preferred choice over tap water due to global concerns about the security and quality of water sources. The most common components of water bottles are Polyethylene Terephthalate (PET) and High-Density Polyethylene (HDPE). Recent studies have detected relatively high concentrations of microplastics (MPs) in bottled water, mainly finding particles in the < 20 µm range. This is relevant, because the toxicological risks associated to microplastics usually increase with decreasing size of the particles, which can have consequences in the lymphatic and circulatory systems. The possible causes of release and/or presence of these particles in the aqueous matrix can be the physical stress applied to the bottle during transport, storage, shaking, and/or injection of high-pressure water into the bottle during the stage of production.In this research, 13 bottled water brands (non-sparkling) distributed within the Metropolitan Region of Chile were analyzed for MPs using fluorescent marking with Nile Red due to its capacity for staining plastic particles. The visualization methodology was based on a combination of optical microscopy using orange emission light filters (529 nm) and a blue excitation filter (450 nm). The analysis was based on the abundance of plastic particles in each sample, measuring their size and subsequent identification. MPs with sizes ranging between 20 and 50 µm were found. Based on these results, the presence of MPs in bottled water sold in the Chilean market, of widespread consumption specifically in the Metropolitan Region, was evaluated, also considering their source of origin and physicochemical parameters.

2.24 Sorption Kinetics and Interactions Between Enrofloxacin and MPs Derived From Polylactic Acid

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Plastic pollution is ubiquitous in terrestrial and aquatic ecosystems, and the evidence about its negative effects on the environment has increased in recent years. The production and use of biodegradable plastics began as an alternative to reduce the impact of plastics in the environment. However, recent research has shown that some biodegradable plastics commonly used have identical behavior to regular plastic materials, when they are not exposed to the specific conditions needed for biodegradation. Therefore, it is important to evaluate their interaction with other relevant pollutants in the environment. We have selected microplastics (MPs) derived from Polylactic acid (PLLA), one of the most used biodegradable plastic, to evaluate the sorption kinetics and interaction with Enrofloxacin, a veterinary drug widely used in cattle raising. PLLA MPs were obtained from disposable cups, which are widely used in the food industry. The PLLA cups were ground and exposed to UV radiation and H_2O_2 (30% v/v) for 72 hours and then divided into three size ranges within the scale of MPs. The interaction between PLLA MPs and enrofloxacin was evaluated in natural river waters using a non-linear kinetic isotherm model to choose the best adjustment. The results showed the effect of MPs aging over the sorption process in all size ranges.

2.25 Presence, Transport, and Fate of Microplastics in the Continental and Transitional Aquatic Environments of Latin America: A Systematic Review

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Microplastics (MPs) are polluting plastic particles, which are divided into two categories: small MPs (from 1 to 100 µm) and large MPs (from 100 to 5000 µm). It has been shown that MPs are ubiquitous and widely distributed in the environment, and are subjected to potential transport processes, meteorological factors, and the effects of human migration. The presence, transport, and fate of MPs in the global marine environment has been extensively studied and reviewed. However, there is a lack of comprehensive information regarding the presence of MPs in continental and transitional waters, particularly in Latin America. These environments are of vital importance to understand key components of the global plastic cycle. The aim of this study was to carry out a systematic review of scientific articles focusing on the presence, transport, and fate of the MPs in continental and transitional Latin American environments. First, a modified PRISMA methodology was applied, using keywords such as microplastic, micro plastic; in online databases such as Web of Science, PubMed, and Scielo. This analysis provided a comprehensive description of the current state of the research

on MPs found in continental and transitional waters of Latin America, and was complemented with a demographic correlation analysis. The results helped in the identification of research gaps and future directions that will improve our understanding of the plastic cycle in national and regional contexts.

3. Chemistry and Exposure Assessment

3.04 Determination of the Water Ecological Quality in the Orienco Stream Using Benthic Macroinvertebrates as Bioindicators in the Northern Ecuadorian Amazon

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The Ecuadorian Amazon constitutes 45% of the Ecuador's territory and has a 1.5% share of the Amazon River basin. The province of Sucumbios (0º6'0'' N and 76º52'0" W) in the Northern Ecuadorian Amazon (NEA) represents one of the richest ecosystems of the area. The NEA region has a high biodiversity and is home to the ancestral territories of indigenous groups. Despite the ecosystem services provided by the NEA, the region faces pressures including habitat loss, land use conversion, urbanization, and agricultural development. Specifically, Nueva Loja, the largest city in the NEA, has experienced many changes due to oil companies building roads for export the past 30 years. As a result, the urbanization associated this has impacted the quality of natural resources. One example is the freshwater Orienco stream (11.87 km), which crosses the city of Nueva Loja. It is the only urban water body that collects the domestic and industrial inputs from the city. The present study focused on determining the water quality of the Orienco stream by using benthic macroinvertebrates as bioindicators of water pollution level in the urban stream. In this study, samples of water and macroinvertebrates were collected from 17 sites across the Orienco stream. Water quality parameters including BOD, COD, NH_3, pH, conductivity, TSS, and temperature were measured in each of the sampling sites, and macroinvertebrates were identified to family level. The results estimated a poor water quality, based on the Biological Monitoring Water Quality (BMWP) value of 45 for the Orienco stream. Additionally, results showed that although parameter values in the water did not significantly vary among the sampling points, the species composition changed with the sampling site. The species analysis showed a family composition of 76% Turbificidae, 19% Chironomidae, 4% Physidae, and 1% allocated among Glossiphoniidae, Hyalellidae, Hydropsychidae, Naucoridae, Corydalidae, Culidae and Hydrophilidae. Moreover, these results are consistent with the stream's lower Simpson and Shannon diversity index values of 0.38 and 0.71, respectively. The high occurrence of very tolerant macroinvertebrates from the Tubificidae and Chironomidae families are bioindicators of the poor water quality of the Orienco stream in the urban environment in Nueva Loja. The present study provides evidence of the environmental risk that a poor-water quality stream might pose to the population of a small urban area in the NEA.

3.05 Indices de Lixiviación de Pesticidas Hacia Aguas Subterráneas. ¿Son LAS Predicciones Confiables?

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Los pesticidas son un componente fundamental en la agricultura moderna, gracias a ellos es posible controlar de manera efectiva plagas que, de otra manera, serían perjudiciales para los cultivos. Sin embargo, su uso no está exento de problemas ya que estos pueden causar diversos impactos ambientales como la contaminación del suelo y aguas subterráneas. El presente trabajo consiste en el análisis de 16 índices de lixiviación de pesticidas para evaluar la capacidad de lixiviación de los pesticidas utilizados en la zona de Rinconada de Cato (5 km al norte de Chillán,Chile). El objetivo principal fue evaluar la capacidad de predicción que tienen estos índices de lixiviación con los pesticidas utilizados en la zona de estudio y aplicar un análisis estadístico a estos resultados. Para ello se investigaron las características del área del estudio junto con los principales compuestos activos ocupados en la zona. Se calculó el potencial de lixiviación de los 23 compuestos activos identificados, mediante el uso de los índices de lixiviación. El análisis estadístico a utilizar fue un Análisis de Componentes Principales (ACP) junto con un test de Kruskal-Wallis. Los resultados tanto de los índices como del ACP fueron contrastados con una revisión bibliográfica del potencial de lixiviación de los pesticidas.Los principales resultados fueron la identificación de dos series de suelo predominantes en la zona (Chacayal y Mebuca). Dichas series de suelo se diferenciaban en su densidad y su porcentaje de materia orgánica (%OM), en el cual la serie Chacayal presentaba 4 veces más materia orgánica que la serie Mebuca. En relación a los índices estos presentaron resultados contrapuestos en la predicción del potencial de lixiviación. Además, aquellos índices que catalogaban al pesticida según su potencial de lixiviación, no lo hicieron apropiadamente ya que estos rangos no estaban diseñados para las características del área estudiada. Por otra parte, la realización del ACP no mejoró la capacidad de predicción de los índices. El test Kruskal-Wallis arrojó que los índices no presentaron diferencias estadísticamente significativas entre ambas series de suelo a excepción de un índice (Ground Water Contamination Potential ,GWCP). A pesar de esto, los índices de lixiviación siguen siendo una buena herramienta como primera aproximación a la evaluación del potencial de lixiviación del pesticida. Especialmente cuando se debe priorizar entre un grupo grande de pesticidas para realizar planes de monitoreos de aguas subterráneas. Índices como el Groundwater Ubiquity Score (GUS), Leachability Index (LIN) y Vulnerability Index (VI) fueron los que presentaron los mejores resultados además de presentar una baja variabilidad de ellos. De estos solo el VI incluye parámetros fisicoquímicos del suelo, lo que lo hace ideal para identificación de zonas vulnerables a la infiltración de pesticidas.

3.06 Contaminant Transfer From Plastics to Compost and Agricultural Soils

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The presence of plastics (macroplastic, MAP, mesoplastic, MEP and microplastic, MP) in recycled fertilizers is an environmental issue the extent and consequences of which are not clear yet. Data on the amount of plastics and their additives ending up into agricultural soil through the application of compost products are very scarce. Our research focused on the occurrence of plastic items in compost samples and on the transfer of selected contaminants (heavy metals, polycyclic aromatic hydrocarbons, phthalates, acetyltributylcitrate, dodecane, and nonanal) from plastics to the compost itself and to soil where the compost is applied. The selected compost was a mixture of biowaste and composted sewage sludge produced by a waste treatment company (Labio Ltd., Lahti, Finland). Compost, soil, and plastic samples (MAP/MEP) were extracted with hexane and analyzed with gas chromatography-mass

spectrometry. Compost was extracted as such and after the removal of MAP/MEP. Soil samples were collected from four agricultural fields, two of which had been fertilized with Labio compost, a third one with sludge, while no fertilizers were used in the fourth fiel. Microplastics were extracted using olive oil, with a novel method developed in our laboratory. MP, MAP and MEP were identified with FTIR spectroscopy. Our results show that MAP/MEP and MP concentrations in compost were 6,5 g/kg and 6,6±1,5 pieces/kg respectively. Except for metals and polycyclic aromatic hydrocarbons, contaminants concentrations were significantly higher in compost as such than in the compost where MAP/MEP were removed before the analysis. DEPH and acetyltributylcitrate concentration in fields where compost was not used was significantly lower than in fields where Labio compost was applied. These results indicate that plastics end up in the fields through the application of compost and that they can transfer contaminants to the compost itself and later on to the agricultural fields.

3.07 Assessment of As, Cr, Cu, Ni, Pb and Zn Levels at Mudbelts From the Southern Brazilian Shelf

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Mudbelts are mud depocenters found on continental shelves. They are potential sink for inorganic pollutants, such as metal ions, which can be adsorbed into fine particles. Thus, the research focusing on these elements can characterize the anthropic influence in these areas, assessing the potential of contamination and its possible effects on marine biota. The aim of this study is quantifying and evaluating the distribution of As, Cr, Cu, Ni, Pb and Zn, in mudbelts from the southern Brazilian shelf and their possible enrichment and contamination in the region. The elements of 120 samples from 8 multiple cores (MUCs) were quantified by Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES), after a process of partial digestion. The results of all the elements in each MUC were below Brazilian regulations, indicating low probability of adverse effects to the biota. Once it is difficult to distinguish natural levels of As, Cr, Cu, Ni, Pb and Zn, from those originated from human action, the Enrichment Factors (EF) were determined, with a normalization using a background from the bottom of each core, and a particle size proxy element. By the mathematical formulation, values higher than 1 indicates an enrichment in relation to the bottom of the cores. With the exception of As the EF values in all MUCs were below 2, suggesting absence of contamination. The enrichment of As obtained can be understood by the high carbonate content in the samples and not from anthropogenic sources. Some vertical profiles of EFs indicated a slight increase towards the top, but on a small scale, not being possible to say that there is a significant change. However, another study in the same region reported an increase in Pb concentration and enrichment factors, with specific periods corresponding to the use of lead-enriched gasoline and anthropic actions from the Industrial Revolution in the country. The results obtained in this study are in agreement with those reported by other authors in the Southeast-South Shelf of Brazil, once that although there are indications that the area is not contaminated, the anthropic influence cannot be ruled out.

3.08 Contributions of Intrinsic Factors to the Modeling of Acute Toxicity in Freshwater Fishes

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Currently, contaminant exposure assessments are one of the most common topics in ecotoxicological literature. They are based on the relationship between pollutant concentration and measured response. To ensure the validity of results most of the environmental variables should be constrained and experimental animals are restricted by size, by age and, sometimes, even by sex. Imposing severe restrictions across the experiments heavily difficult the possibility of results extrapolations. To evaluate the effect of weight over the cadmium lethality determination 60 Lethal Concentration 50% - 96h (LC50-96h) were reviewed. Considering exposure concentration and organisms' weight, a Relative Exposure Dose (RD) was calculated and the allometric relationship was modeled. Results show a heterogeneous response related to a wide variety of life strategies. After regression analysis, three large groups with different sensibility were identified. Fishes adapted to water with low ionic burden (OF), fishes living in mesotrophic environments and cannot breathe air (WB), and those which can exchange gases through the air (AB). The most sensible of them were the OF, mainly because leaving in water with low ions dissolved it’s related to a higher gill permeability to maintain a good ionic balance enhancing cadmium absorption. On the contrary, WB fishes showed to be up to a thousand times more resistant to cadmium, this could be attributed to greater control and selection of environmentally incorporated ions. For the last, the most resistant were those with the capability of gaseous exchange through the air. Among those fishes, we found that those which exchange gases by gill were comparatively more sensible than those which exchange gases through specialized chambers or sacs. This approach allowed us to model the relationship between lethal dose and weight in freshwater fishes and also identify major concerning factors for cadmium toxicity. The exposure assessment approach and the incorporation of intrinsic parameters, such as age, sex, and environmental adaptations can strongly improve well-established models allowing a multispecies paradigm.

3.09 Urban-Rural Border: Glyphosate Occurrence in Urban Environments of Central Region of Argentina

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In Argentina, the use of pesticides< w:sdt sdttag="goog_rdk_1" id="2147092813"> increased 900% in the last two decades, reaching 500 million L/kg of formulations in 2019, of which 2/3 parts correspond to the herbicide *glyphosate*. Consequently, contamination by these compounds was evidenced in soils, surface water bodies and their bottom sediments, rainwater and ambient air of rural areas. In addition, genetic damage and adverse health effects due to them were demonstrated. Thus, concerns have arisen in the civil society and governments of various localities about the exposure of its inhabitants to agrochemicals applied in nearby extensive agricultural productions. Given this context, the present work aims to *characterize urban environmental scenarios regarding the occurrence of glyphosate in localities with less than 10,000 inhabitants of the Pampas region*. The study sites were two: (1) Guaminí, Buenos Aires province; (2) Chabás,

Santa Fe province. Two sampling campaigns were carried out: December 2018 and August 2019. Land use near urban centers were determined through the presence of *glyphosate* and its environmental metabolite *AMPA* (analysis by UPLC-MS/MS), in soils at different distances from the limit of the urban plant (n=50): from 0 to 250 meters (categorized as R1); from 250 to 1000 meters (R2); over 1000 meters (R3). The levels of these analytes at the interior of towns were studied by determining them in different environmental matrices: soils of public spaces (n=40, categorized R0), ambient air (n=72, sites=30, using passive monitors) and rainwater (n=51, sites=11, using collectors for each precipitation), covering its entire area and cardinal points. The results show that no significant differences are found between locations and campaigns. Soils: the detection frequencies by category of sites were, for *glyphosate-AMPA*: R0=16-36%; R1=83-83%; R2=82-100%; and R3=75-100%, respectively. Significant differences are observed between urban (R0) and rural soils (R1,R2,R3). The concentration ranges are: 1.3(Detection Limit, DL)-4744.2 µg/kg. Ambient air: *glyphosate* was detected in 93% of the sites (levels from 0.5(DL) to 37.0 ng/m^{3}d) and no positive samples for *AMPA* were detected. Rainwater: the detection frequency was 73% for *glyphosate* and 45% of the sites for *AMPA*, between 0.1(DL) and 4.2 ng/ml. Finally, the detection of *glyphosate* is positively associated with rainwater and rural soils, while *AMPA* detection is also positively associated with soil (R1,R2,R3) and not positively with ambient air.

3.10 Distribution and Accumulation of Monensin in Water-Sediment-Biota Microcosms Assays

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The occurrence of veterinary antibiotics in water courses has been reported in the recent years. Monensin (MON) stands out as a drug widely used in animal production and has been quantified in more than 20 water streams from Argentina. However, information about its environmental distribution is still scarce. The objective of the present work was to characterize the distribution and bioaccumulation of MON in microcosm systems of different composition. For this purpose, sediment samples were collected from a site of low agricultural impact previously characterized by the working group (A° El Pescado, BA, Argentina). The microcosm systems were assembled in glass jars with dechlorinated water, in combination with sediment, specimens of an aquatic plant (Pistia stratiotes) and tadpoles (Boana Pulchella). Once assembled, MON was incorporated into each system at a nominal concentration of 250 µg/L and maintained under controlled T and photoperiod conditions for 7 and 14 days. After the assay, all samples from each assay and matrix were pre-treated and analysed by LC-MS/MS. Regarding the biphasic water-sediment systems, MON accumulation was observed in the sediment, reaching between 21 and 52% of the initial aggregate mass. These percentages decreased in the presence of organisms, both individually and jointly. The distribution coefficients calculated in the different scenarios resemble values reported in real environmental scenarios but differ from those expected according to the physicochemical characteristics of the molecule. It is noteworthy the relevance of the soluble fraction of the compound, being the major compartment of occurrence of MON. In relation to the organisms, it was observed that the plant presented levels of MON concentrations in leaves up to 8 times higher than those detected in roots. These values increased in the presence of tadpoles, which presented significantly lower concentrations than the rest of the compartments, with incorporated mass percentages < 0.01% in all cases. Although in mass terms, the proportion of MON incorporated in plant organisms was less than 1%, the concentration levels found would highlight their potential as bioindicators for MON in aquatic systems. In the case of tadpoles, it has been demonstrated that they can incorporate antibiotics, and it is of interest to know the situation of these organisms in contaminated aquatic systems and to study the sublethal effects of MON on the several biologic responses.

3.11 Uptake and Translocation of the Veterinary Pharmaceutical Monensin in Lactuca sativa Cultivated in Composted Soils

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In recent decades, animal production has intensified and the use of veterinary antibiotics in animal husbandry has increased. Among the most widely used antibiotics in Argentina is monensin (MON). Since it is not completely metabolized by the animal, it is excreted and dumped together with the excreta (with or without treatment) in fields as a natural fertilizer. This practice raises questions about its destination, especially in soils and under the usual cultivation conditions. The objective of this work was to evaluate the potential incorporation and translocation of MON from the soil to a typical horticultural crop in the region. For this purpose, MON was impregnated on a local soil from a low anthropic activity (A° El Pescado area, Buenos Aires, Argentina), mixed with vermicompost at agronomic doses, to obtain nominal concentrations of 50 and 250 ug/kg. The treatments were fractionated in pots in which seedlings of lettuce (Lactuca sativa) were grown. Plants were maintained under controlled T, light, and irrigation conditions for 38 days. At the end of the trial, samples of plant tissue (leaves and roots), soil and irrigation leaching water were pre-treated, and extracts were analyzed by LC-MS/MS. A half-life of MON was observed in the study soil of 3.6 d, possibly due to the higher microbiological activity and organic matter in the compost. MON was not detected in leached water, evidencing its retention in the soil. Regarding growth, plants grown with the lowest dose tested had a greater leaf length growth compared to the other treatments, evidencing a hormesis effect, reported for other xenobiotics. As the test time elapsed, the concentration of MON increased significantly in the roots. The average root concentration range (3.2 -26.5 ug/kg) is on the order of those reported in cases of MON ingress from organic amendments. There were no significant differences in the root bioaccumulation factor (BFC) between treatments or times measured. Under the conditions tested, MON translocation to leaves was not observed, always obtaining values below the LOD (0.1 µg/kg). Under these conditions, no food safety risk associated with the consumption of lettuce was observed. However, their incorporation into roots highlights the need to explore these systems under conditions closer to real practices.

3.12 Commercial Marine Fish Species From Brazilian Coast Trace Metals Bioaccumulation

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One of the biggest problems in aquatic ecosystems is the bioavailability of contaminants, such as trace metals, that can cause several toxic effects and can be bioaccumulated by the biota, particularly fish that is consumed by human. Trace metals can reach water bodies due to intense human activities such as mining and also due to the natural soil erosion. The aim of the present study was to evaluate the levels of As, Cd, Pb and Hg in commercial marine fish along the Brazilian coast in 2018 and 2020, and compare to the Brazilian and international quality standards for human consumption. The study was carried out in 9 locations (Rio Grande/RS; Santos/SP; Niterói/RJ; Guarapari, Vitória, Jacaraípe and Regência, ES; Caravelas/BA and Natal/RN). The fish species *Micropogonias furnieri* (popularly known as Curvina); and *Cynoscion guatucupa, Cynoscion leiarchus, Cynoscion jamaicensis, Cynoscion steidachneri, Macrodon atricauda and Macrodon ancylodon* (popularly known as Pescada), which are widely consumed, were bought in fish markets and the muscle were sampled and analysed. The results showed that total As was quantified in all samples, with 41% of the samples in 2018 and 51% in 2020 with concentrations above of the quality standards for human consumption, mainly for Curvina. However, when the As speciation analyzes were performed the inorganic form concentrations were in accordance with the Food Standards Code (FSANZ). For Cd all samples were in accordance with the legislation for both years, and for Pb concentrations only 5% of the samples were above of the legislation. Hg analyses was performed only in 2020 and 3.9% of the results, all for Curvina samples, were in disagreed with Brazilian and international legislation. The comparisons between 2018 and 2020 showed significant differences for total As with higher concentration mainly in 2020 for Curvina samples and in 2018 for Pescada samples (*Cynoscion* gender). In conclusion, under the regulatory aspect, there is no difference of the quality standard for human consumption along the Brazilian coast. Furthermore, the temporal evaluation showed that the levels of As, Hg, Cd and Pb varied between years; however, the detected concentrations do not present an alert for human health in the fish consumption.

3.13 Sampling Sites Selection Based on Watershed Drainage Sig Analysis to Assess ENVIRONMENTAL Impacts of Feedlots and Poultry Farms

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The development of conservation strategies requires information about the spectrum of environmental conditions adequately distributed over a region. This is possible only if data collection is carried out through representative and adequately designed sampling. This study is part of a research project that aims to study the quality of the environments where native anurans with their infectious organisms inhabit. The study area is within the El Pescado stream basin (Buenos Aires, Argentina), a protected area due to its ecological importance. However, in recent decades it has undergone changes in land use associated with urban growth, the development of intensive agricultural production and the installation of feedlots and poultry farms, which together alter the hydrogeochemical characteristics of the basin and therefore its environmental quality. In this work we present a hierarchical methodology for the selection of sampling sites for the analysis of water quality in the Cajaravilla stream, tributary of El Pescado stream, in relation to feedlots and poultry farms location using Geographic Information Systems. Based on digital elevation models of the area of interest, sub-basins, micro-basins, drainage systems and areas of waterlogging of El Pescado and Cajaravilla streams were delimited and modeled with the QGis Desktop 3.18.2 program using the GRASS *r.watersheed* and *r.water.outlet* pluggins. Contour lines at 2 and 5 m asl were extracted to establish the sites that constitute permanent wetlands. The analysis of the digital models obtained and the georeferencing of feedlots and poultry farms allowed selecting suitable sites for sample collection of surface water, and subsequent measuring of the concentration of nutrients and other possible contaminants such as pharmaceuticals and agrochemicals. These measurements will allow us to analyze the impacts of these establishments on the water quality of the Cajaravilla stream.

3.14 Toxicological Evaluation of Chitosan Nanoparticle Derivatives

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Pristine chitin – poly-β-2-acetamide-(2-deoxy-D-glucopyranose), precursor of the biopolymer Chitosan – poly-β-2-amino-(2-deoxy-D-glucopyranose), is a naturally occurring biopolymer. Chitosan is very versatile and can be modified using a variety of chemical techniques. In nature, chitin and chitosan can be extracted from crustaceans, however in Latin America and the Caribbean (LAC), a large amount of this resource is generated and underutilized, and most often is treated as '*waste*'. Chitosan has many known properties, that have been utilized in many industries and sub-sectors owning to its antimicrobial, antioxidant, biocompatibility, biodegradability, muco-adhesive properties, and haemostatic effect. Thus, the physicochemical and biological nature of chitosan allows for advantageous and complex modifications that can be applied in water treatment, metal recovery, drug delivery, *inter alia*. However, for this to be realized, the toxicity of the final product for application in drug delivery, surgical dressings water treatment must be within the allowable acute toxicities (lethal dose [LD50]). Therefore, this study evaluated the toxicological properties of the most promising chitosan nanoparticle derivatives that can be of high importance and use in LAC. Investigations revealed that the nature of the weak cationic state of Chitosan allows for selective binding to metal ions, proteins, cholesterol, fats, and tumor cells. In addition, the haemostatic properties of Chitosan permit for the activation of macrophages and also causing cytokine stimulation. Moreover, the high toxicity against particularly Gram-positive and Gram-negative bacteria and the advantage of exhibiting low toxicity towards mammalian cells is of particular interest in the field of Biomedical Toxicology. Therefore, allowing Chitosan to be very attractive for various applications in Latin America and the Caribbean.

3.16 Insecticide's Genotoxicity Assessed by Allium CEPA Test: A

Systematic and Meta-Analytical Review

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Insecticides stand out as the most dangerous pesticides, and many of them can cause cytotoxic and genotoxic effects in organisms. Among the bioindicators to assess the genotoxic potential of pesticides, the A*llium cepa* system stands out, because it is a fast and efficient test, used as a short-term toxicity indicator. For this reason, a systematic review was performed focusing on the effect of insecticides on *Allium cepa* system by two way: 1) a scientometric study to identify trends and gaps in the literature in the evaluation of insecticides to direct research efforts and, 2) a meta-analytical approach compiling the information to obtain an overall result about insecticide effect on *A. cepa*. Data were obtained from the Clarivate Analytics Web of Science Core Collection (WoS). The Microsoft Office Excel and CiteSpace softwares were used to compile and analyze the results the scientometric study. The R software was used to conduct the meta-analysis tests. 29 articles were included in the scientometric review. Were found 11 and 27 datasets, respectively to micronucleus and mitotic index. It was found that there is an increased production of articles in this research area. The H-index of our data set was 11, with an average of 13.72 citations per item. The leader country in this research area was India, followed by Turkey and Brazil. The best cited research area was 'Environmental Sciences', followed by 'Environmental Sciences and Ecology 'and' Cell Biology'. The most used keywords were genotoxicity, pesticides and insecticide. The article with the most citations was "Cytogenetic effects of cypermethrin and fenvalerate on the root meristem cells of *Allium cepa*". The meta-analytical test showed that the number of micronuclei found in onion cells treated with insecticides is higher than that in untreated ones, and the use of pesticides reduces the mitotic index. In conclusion, the insecticides had genotoxic potential on *Allium cepa*, thus, it is evident the need of more studies about biotechnology, nanotechnology and biopesticides to development safer pesticides.

3.17 Assessment of Sulfadiazine Accumulation Capacity of a Native Macrophyte Using Optimized Analytical Methods

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Antibiotics are widely used to prevent/treat animal diseases and also as growth promoters and feed additives in intensive agri- and aquaculture production. These compounds are not completely metabolized and up to 90% of them are excreted into the environment via faeces and wastewater resulting in contamination events. Phytoremediation is a possible low-cost and eco-friendly technology to remove antibiotics from contaminated water by the use of plants. Therefore, sensitive and specific quantification methodologies to measure antibiotics accumulation need to be validated. This work aimed (i) to optimize the extraction methods of three veterinary drugs (flumequine, sulfadiazine and oxytetracycline) from a native macrophyte *Potamogeton pusillus* and (ii) to evaluate the sulfadiazine accumulation capacity of this macrophyte under laboratory conditions. To meet the first aim, two extraction methods were evaluated through recovery tests: 1) ultrasonic extraction using different solvents, acidic and basic solutions, followed by solid phase extraction (SPE); 2) QuEChERS dispersive solid phase extraction (d-SPE) at two pH values: 2.4 and 4. Antibiotics were quantified by liquid chromatography coupled to high resolution mass spectrometry (HPLC-HRMS). Flumequine and oxytetracycline were efficiently recovered by both extraction methods (88% and 81% recovery with ultrasonic extraction, 116% and 73% with QuEChERS, respectively). The highest recovery for sulfadiazine was observed with QuEChERS at both pH evaluated (48% and 54%). On the other hand, the macrophyte was exposed to 1 mg/L sulfadiazine solution in Hoagland nutrient medium. Both total accumulation and chlorophyll content were evaluated at 3 and 7 days of exposure. Results showed that sulfadiazine was accumulated at 91±35 and 187±9 ng/g w.w., after 3 and 7 days, respectively. Chlorophyll content indicated that there was no physiological damage. Further studies are required to indicate that this macrophyte can be effectively used for removal of sulfadiazine from polluted waters.

3.19 Influence of Different Horticultural Practices on Soil-Associated Pesticides. an Agroecological Approach

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The infestation with plant parasitic nematodes (PPN) is one of the main production problems in the Cordón Hortícola Platense, Argentina. Conventional practices use synthetic chemicals that are highly toxic and ozone depleting. In some family-farm types, agroecological practices are used to control PPN. In particular, biofumigation is a practice based on the degradation of Brassicaceae in soil, generating isothiocyanates as nematicidal agents. Likewise, organic matter incorporated into the soil could improve physical, chemical and biological fertility and stimulate the resilience of the system. In this context, the incidence of the multifunctionality of this practice on the stability of pesticides for horticultural use is unknown. The objective of this work was to analyze the concentration of pesticides in horticultural soils and to evaluate the relationships between their environmental stability and different practices for the control of PPN. For this purpose, soil samples were taken before and after the application of different sterilization treatments. Seven biofumigation practices (5 in an agroecological transition system and 2 in an established agroecological system) and two conventional practices based in commercial chemicals (methyl bromide and dichloropropene+chloropicrin) were studied. Samples were extracted by QuEChERS methodology, and a list of 23 pesticides (3 insecticides, 3 fungicides, 15 herbicides, 2 herbicide metabolites) were analyzed by UPLC/MS/MS. Among the most relevant results, it was observed that, although the presence of at least one pesticide was detected in 100% of soils samples regardless of the system production. Soils of the conventional systems showed a significantly higher total mass load (TML) than the transitional systems which also showed a higher TML than the agroecological ones. The insecticide Imidacloprid and the fungicide Tebuconazole were the most frequently detected and

showed the highest concentrations, comprising most of the TML of the quantified pesticides. In the conventional systems, no significant differences were observed in the concentrations after sterilization, while in the systems in transition, 60% of the biofumigations had a significant decrease in the TML of pesticides with respect to their initial condition. This result is promising considering the potential multifunctionality that this biofumigation practice may have associated with such systems, with high environmental, economic and health interests.

3.21 Efectos de la Regulación del Caudal Sobre las Características Físicas y Químicas de Arroyos Serranos de San Luis (Argentina)

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El crecimiento poblacional y el aumento de las demandas de agua para actividades productivas, a menudo resulta en la necesidad de regulación hídrica a través la construcción de embalses y presas. Esta transformación de un ambiente lótico a léntico o semiléntico modifica una amplia gama de factores bióticos y abióticos en los ecosistemas, y se considera uno de los impactos antropogénicos más significativos en los ríos a nivel mundial. San Luis, provincia ubicada en centro de Argentina, es una región que debido a su naturaleza semiárida, ha visto condicionado su crecimiento socioeconómico a la disponibilidad del agua, resultando en el desarrollo de una política hídrica focalizada en la generación de reservas hídricas. El objetivo de este trabajo fue evaluar el efecto de la regulación del caudal sobre la calidad físico-química de arroyos serranos de San Luis. Para este estudio se seleccionaron 13 embalses, donde se establecieron 2 sitios de muestreo, un sitio de referencia río arriba del embalse y un sitio ubicado río abajo. Se analizaron 24 parámetros de calidad de agua y se calculó un Índice Simplificado de Calidad del Agua (ISQA). Se aplicó el análisis de Mann Whitney para pares de comparaciones antes y después de la presa. Diez de los 13 embalses estudiados mostraron una disminución en la calidad del agua, con aumentos significativos ($p< 0,05$) en parámetros tales como: conductividad, sólidos totales disueltos, sólidos en suspensión totales, turbidez, color, calcio, magnesio y sodio; mientras que, cloruro, fósforo y amonio mostraron una tendencia, aunque no significativa, a aumentar aguas abajo ($p=0,07$). Los valores del ISQA no difirieron entre sitios antes y después de la presa ($p=0,11$); sin embargo, el puntaje/calificación en cuanto a calidad y los posibles usos del agua de los tramos estudiados, disminuyó río abajo en seis de los embalses, se mantuvo constante en cinco (clasificando como apta para todos los usos) y sólo en uno la calidad del agua mejoró. Estos análisis exploratorios permiten visualizar la complejidad, en cuanto al grado y la direccionalidad del efecto que puede tener la transformación de arroyos con regímenes naturales a sistemas regulados. Los resultados de este trabajo, como parte de un estudio de indicadores múltiples de calidad físico-química y biológica, podrán ser utilizados por los tomadores de decisiones para mejorar la gestión de los recursos hídricos regulados de la región.

3.22 Variaciones Espaciales y Temporales en la Calidad del Agua de Tres Sitios de la Cuenca del Río Reconquista con Distinto Impacto Antrópico

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El río Reconquista es uno de los cursos de agua más contaminados de Argentina y es un importante tributario del Río de la Plata el cual provee de agua potable a la ciudad de Buenos Aires y alrededores. En la cuenca del Río Reconquista se encuentra la subcuenca Las Catonas. El objetivo de este estudio fue caracterizar la composición hidroquímica y evaluar variaciones espaciales y temporales en la calidad del agua en tres sitios de muestreo de la subcuenca Las Catonas con distintos tipos de impacto antropogénico: residencial, agrícola e industrial. Los sitios de muestreo fueron: S_A (en un tributario aguas arriba, cercano a zona residencial), S_B (frente a una planta de tratamiento) y S_C (aguas abajo de S_B y lindero a una zona hortícola). Se realizaron 8 campañas de muestreo durante dos años (2017/2019) en las diferentes estaciones y se determinaron parámetros fisicoquímicos tanto *in situ* como en el laboratorio: temperatura, pH, OD, conductividad eléctrica, turbidez, dureza, alcalinidad, DQO, iones conservativos mayoritarios y nutrientes. En relación a la caracterización hidroquímica se graficó el diagrama de Piper, determinando que el tipo de agua dominante en los sitios de muestreo es bicarbonatada sódica, mientras que en el diagrama de Gibbs (con modificación de Wetzel) se observó que predomina el mecanismo de meteorización. Estas características concuerdan con lo descripto para las lagunas pampásicas. Por otro lado, se utilizó el diagrama de Schoeller-Berkaloff para una primera comparación entre los sitios, determinándose que las concentraciones de casi todos los iones mayoritarios son menores en S_A con respecto a S_B y S_C. El análisis de componentes principales (PCA) identificó tres componentes que representan el 76% de la varianza. Tanto el PCA como el análisis de cluster mostraron diferencias en los parámetros fisicoquímicos de S_A con respecto a S_B y S_C; y una agrupación entre las estaciones cálidas (verano y primavera) separadas de las frías (invierno y otoño). En el diagrama de loadings se observó una agrupación de S_A donde se encuentran las mayores concentraciones de OD; mientras que en la agrupación de S_B y S_C se encontró una correlación positiva fuerte entre el componente y las variables: dureza, nitrato, conductividad y amonio, y una correlación moderada con fósforo inorgánico. Las diferencias espaciales observadas podrían deberse al aporte de compuestos de origen antropogénico de desechos industriales y a la actividad agrícola de la zona.

3.23 Glyphosate and AMPA Mobility From Soybean Soils After Amendment With Poultry Litter

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The use of poultry litter (PL) as an organic amendment in agricultural soils is a common fertilization practice that promotes the material recycling. Besides providing nutrients into the soil cultivable layers, the material can alter properties (as pH, conductivity, organic matter) that can affect the sorption of soil pollutants that persist in those layers, as the commonly applied glyphosate (GLP) and its degradation metabolite, AMPA. The aim of this work was to evaluate the effect of PL amendment on the mobility of GLP and AMPA after a rainfall, by

studying the surface runoff and the soil column. For this purpose, 18 plots of 1 m^2 were randomly selected, and PL was applied on soils (PL-soils) at 5 ton/ha. according to reported conventional practice application rate. Another 3 random plots were kept unamended (UA-soils) to contrast the influence of the practice on 1: runoff water quality measured through soluble phosphorus, GLP and AMPA, 2: GLP and AMPA in soils profile. After 72h stabilization, a rainfall simulation was carried out and runoff water and soils were collected from each plot. For GLP and AMPA analysis in soils, PL and runoff waters, pre-column derivatization was applied with FMOC-Cl. Samples were spiked with isotopically labeled GLP and analyzed by LC-MS/MS. Glyphosate and AMPA were not detected in PL (< 0.1 µg/kg). Initial mean levels of GLP and AMPA in soils were 40±25 µg/kg and 61±26 µg/kg, respectively. After the rainfall simulation assays, quantifiable concentrations of GLP and AMPA were detected in both analyzed fractions of soils (0-2 cm and 2-20 cm) and in runoff water. GLP concentrations were significantly lower than those detected prior to the rainfall, which denotes the pesticide dissipation during the assay. Concentrations of these compounds, in surface runoff, were higher in soils amended with poultry litter than unamended ones, and both were also detected at the 2-20 cm soil layer. The increased concentration of soluble phosphorus species after the amendment was a relevant factor in the mobility of GLP from soil into surface runoff and favored the vertical mobility (leaching) of both GLP and AMPA, with greater incidence on the metabolite. Considering the extensively reported presence of pesticides in soils from Argentina, the risk of compounds mobilization after PL application, and the simultaneous release of veterinary antibiotics, the practice should be further investigated to prevent environmental consequences.

3.24 Lc-Ms Untargeted Analysis of Plastic Pellets From Coastal Areas in Central of Chile

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In the last decade, increasing concern has been raised to protect the marine environment to the plastic pollution problem (micro- and macroplastics particles (MP)). LC-MS untargeted analysis have grown rapidly over the past decade. The applications of this technology has been extended to several field of concern because offers advantages over other analytical platforms such as speed, sensitivity, relative ease of sample preparation, and large dynamic range. In this study, we analysed plastic resin pellet, from the coast of central Chile, to assess the efficiency of different solvent extraction procedure, using the untargeted analysis. Pellets were extracted with EtOH:H2O (1:1)(4 ml), shake in a sonnicator for 2 hours at 40°C. We used a Thermo Ultimate 3000 UHPLC system, the chromatographic system was linked with an Orbitrap Exactive mass spectrometer (Thermo Fisher Scientific, USA). Extract was injected (5 ul) in LC-HRAMS. The chromatography started with 90% phase A (water) and 10% B (methanol). For compound identification, the raw files acquired were processed using Compound Discoverer™ 3.1 (CD) (Thermo Fisher Scientific). The CD provides a wide list of annotated compounds (several hundreds). However, the majority of them do not present enough analytical evidence for tentative with exception of flame retardants, vitamins, hormones and other chemicals associated to the plastics pellets. Further research is still ongoing to carry future development in this research area.

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3.26 Exposure to Endocrine Disruptors Alters Inflammatory Markers in Mouse Hypothalamus In-Vivo and In-Vitro

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Bisphenol A (BPA) and Benzophenones (BPs) are endocrine disrupting chemicals (EDC). Previously, we showed that the in-vitro exposure to BPA, BP2 or BP3 decreased Kiss-induced GnRH gene expression in GT1-7 cells (Dr. Pamela Mellon, UCSD). In this study, we analyzed the in-vitro exposure of GT1-7 cells or isolated hypothalami from adult Balb/c males to BPA, BP2 or BP3 (Sigma, $1x10^{-9}$ M) on cytokine and glial fibrillary acidic protein (*gfap*) gene expression. After the incubations, RNA was extracted, reverse transcribed and qPCR performed using specific primers. The in-vivo exposure to BP2 or BP3 (250 µg/kg/day, orally, for five days) effects on gene expression in C57Bl/6 mice was also analyzed. Animals were sacrificed, brains rapidly dissected and placed in dry ice, and kept -80 ºC until processed. Micropunches that contained the Anteroventral Periventricular (AVPV) or Arcuate (ARC) nucleus were obtained and RNA was extracted, reverse transcribed and gene expression analyzed by qPCR. Results were expressed as Mean±SE and analyzed by ANOVA using Statistica (Statistica v StatSoft Inc, USA).Twenty-four hour BPA increased *il18* expression in GT1-7 cells (C=1.0±0.04, BPA=1.2±0.1, T-test $p< 0.05$, n=7), whereas neither BP2 nor BP3 had an effect. Twenty-four-hour BPA decreased *il6* its expression relative to C and to 12-hour BPA, whereas BP3 increased the expression at 12-hours and decreased it after 24-hour stimulation (Repeated Measures Two-way ANOVA: BPA-24h different from DMSO-24h and BPA-12h $p< 0.05$, BP3-12h different from DMSO-12h and from BP3-24h $p< 0.05$, n=4). In the hypothalami, BPA increased *gfap* gene expression (C=0.8±0.2, BPA=1.7±0.4; T-test $p< 0.05$, n=9). In-vivo BP2 increased *gfap* gene expression in the AVPV (Control=1.3±0.2; BP2=2.5±0.4; BP3=1.5±0.4; BP2 different from Control, p< 0,05), but neither BP altered *kiss1* expression in this nuclei. In the ARC, exposure to BP2 caused an increase in *gfap* expression that did not reach statistical significance (Control=0.9±0.2; BP2=1,7±0.5; BP3=1.2±0.2; ANOVA ns). Our results show that the EDC studied have the potential to alter the inflammatory state of GnRH neurons and to activate astrocytes in the hypothalamus. More experiments are needed to dissect the mechanisms involved. Funding: CONICET, ANPCyT, UBA, International Society for Neurochemistry, Asoc. ORT Arg., Fund. R. Barón, Fund. Williams.

3.27 Evaluación de la Capacidad de Potamogeton Pusillus de Remover Pb y Cd y su Posible Aplicación en la Remoción de Aguas Residuales

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La disponibilidad de agua es de suma importancia para la vida y el desenvolvimiento económico de cualquier región del mundo. Por esta razón la contaminación de los ambientes acuáticos es uno de los grandes problemas a nivel mundial, con riesgos para la salud humana a través del consumo de agua y/o el contacto con los contaminantes, como para el ecosistema. Los ecosistemas acuáticos se ven afectados por contaminantes, que pueden tener efectos nocivos para los mismos. Un ejemplo de ello son los metales, que se transportan y acumulan fácilmente en el ambiente. El crecimiento de la población debido a la rápida industrialización ha dado lugar al aumento de la descarga de aguas residuales en el medio ambiente, lo cual conduce a que la contaminación principalmente por metales. La fitoremediación constituye una alternativa posible para la remoción de metales en ambientes contaminados, para ello se ha utilizado *Potamogeton pusillus* que es una macrófita autóctona de gran importancia ecológica en el ecosistema acuático, y se encuentra ampliamente distribuida en Argentina. En este trabajo, se evaluó el empleo de *P. pusillus* como una herramienta estratégica para la restauración de ecosistemas contaminados por Pb y Cd; a su vez esta tecnología podría desarrollarse para el tratamiento de aguas residuales provenientes de distintas actividades productivas que en la actualidad representan un problema ambiental. Se realizaron exposiciones de *P. Pusillus,* para evaluar la capacidad de acumulación de (Pb^{+2}) y Cd^{+2} a partir de soluciones acuosas a distintas concentraciones del metal (0; 0,5; 1,0 y 2,0 $mg.L^{-1}$), durante 10 días bajo condiciones controladas en laboratorio. Además se evaluaron los parámetros fisiológicos como clorofilas, malonaldehído y azúcares para determinar síntomas de toxicidad en la macrófita acuática debido a la exposición de dichos metales. Con los resultados obtenidos se pudo observar que, *P. pusillus* fue capaz de acumular grandes cantidades de Pb^{+2} con un porcentaje de remoción del metal de (74-92) %. Además, *P. pusillus* también fue capaz de acumular grandes cantidades de Cd^{+2} con un porcentaje de remoción del metal de (89-91) %. De acuerdo a los resultados obtenidos se propone a *P. pusillus* como un organismo útil para ser empleado en la remoción de Pb^{+2} y Cd^{+2} en aguas contaminadas, característica que las hace recomendables para su aplicación en tecnologías de remediación en el tratamiento de aguas residuales de origen industrial y doméstico.

4. Contaminants of Emerging Concern

4.01 Maternal Transfer of Emerging and Legacy Persistent Organic Pollutants to Sea Turtle Eggs: A Meta-Analysis

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Maternal transfer of emerging and legacy persistent organic pollutants (POPs) confronts developing embryos with pollution even before coming into contact with the external environment, and poses conservation concerns due to its potential impacts unto subsequent generations. We conducted a systematic review focusing on: 1) processes of POP maternal transfer, 2) challenges and opportunities to synthesizing current knowledge on POP concentrations in eggs, and 3) a meta-analysis of patterns in current egg pollution data. Results suggest selective maternal transfer of individual compounds. These relate to biological factors such as the foraging and remigration behavior, and to the selective mobilization of POPs during vitellogenesis, such as increased diffusion limitation for lipophilic POPs and slower release and higher reabsorption of apolar POPs. A key gap relates to knowledge of further selective toxicokinetics during embryonic development, as research to date has mainly focused on initial uptake into eggs. Challenges in the synthesis of current data on egg contamination profiles relate to methodological differences, varying analytical approaches, restricted data access, and reporting transparency among studies. To increase opportunities in the use of current data, we propose best practice guidelines, and synthesize a database on POP concentrations within sea turtle eggs. The meta-analysis revealed a geographical and taxonomic bias on the West Atlantic Ocean, including the Gulf of Mexico and Caribbean Sea, with most studies conducted on green turtles. Concentrations of POPs show temporal patterns related to trends in usage, production, release, and persistence in the environment, often with regional patterns. The trophic level has the potential to influence POP patterns with higher concentrations in loggerheads compared to other species, but this is confounded by temporal and geographic trends. We argue for more mechanistically process-focused and methodologically comparable research.

4.02 Accumulation of Pesticides of Emerging Concern in Endangered Elasmobranchs From Southeastern Brazil

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Guitarfishes and angelsharks are two of the most endangered elasmobranch groups worldwide and their trade is prohibited in the Brazilian waters. Despite this, these organisms are still illegally consumed, remarkably in southern and southeastern Brazil. Assessing contaminant levels in these species is, therefore, of conservational and also public health concern. For this reason, we aimed to determine pesticides of emerging concern in four endangered species (*Pseudobatos horkelii*, n=10; *P. percellens*, n=6; *Squatina guggenheim*, n=9; and *Zapteryx brevirostris*, n=5) obtained in 2019 from São Paulo coast, Brazil, one of the most human impacted areas in South America. Liver and muscle samples were Soxhlet extracted and six analytes (atrazine, chlorothalonil, chlorpyrifos, dichlofluanid, diuron and trifluralin) were determined by gas chromatography coupled to mass spectrometry. Dichlofluanid and atrazine were the only analytes with more than 50 % of detection, with the first being the most detected one. Dichlofluanid had the higher median concentrations in either liver (3.6-44.7 ng g^{-1}w.w.) or muscle samples (0.3-17.9 ng g^{-1}w.w.). Atrazine levels ranged from 0.3 to 1.6 and 0.2 to 2.3 ng g^{-1}w.w. in liver and muscle samples, respectively. The high detection of these compounds must be attributed to their high usage in the study area. Atrazine, for example, is one of the most used pesticides in Brazil, being the 5th most traded compound in 2019. On the other hand, the high concentrations of dichlofluanid might be related to its presence in antifouling paint formulations, since the studied area has a high maritime and harbor activity. Guitarfishes of the genus *Pseudobatos* presented higher concentrations of pesticides and such similarities could be related to sympatry or phylogenetic driven metabolic capacities. Furthermore, no differences between tissues were observed for atrazine or dichlofluanid for any species (Wilcoxon paired test, $p < 0.05$), suggesting a chronic exposure to these compounds, since muscular tissue has low metabolic activity. This is concerning since exposure to both pesticides were associated to biochemical effects on vertebrates and it seems that these species are daily exposed to emerging pesticides in the studied area. Furthermore, human health implications should be taken into consideration, considering the levels of atrazine and dichlofluanid found for edible parts of elasmobranchs, represented herein by muscle samples.

4.03 Ecotoxicity of Per-/Polyfluoroalkyl Substances (PFAS): Challenges and Research Gaps

M.S. Sepulveda, Purdue University / Forestry and Natural Resources

Per-/Polyfluoroalkyl Substances (PFAS) can be persistent, bioaccumulative and potentially toxic. Exposure to PFAS occurs in the form of mixtures that vary in the number of halogenated carbons and functional groups, which directly impacts half-lives: longer chain (>C8) and sulfonate PFAS are usually more bioaccumulative compared to shorter chain (< C6) and carboxylated forms. The first studies on the ecotoxicity of PFAS were published in the early 90's, when only a couple of PFAS (PFOS and PFOA) were known. Today, with over > 5,000 PFAS identified, we have the immense challenge of determining the best way moving forward in terms of assessing risk to fish and widlife. In this presentation, I will summarize and briefly discuss, what I consider to be the "Major Findings" in PFAS ecotoxicity research over the past thirty years. I will cover major advances in PFAS toxicokinetics and, toxicodynamics, as well as significant discoveries in analytical chemistry and "omics" tools which have been instrumental in advancing this field. I will end discussing major research needs and challenges for the future.

4.04 Effects and Bioaccumulation of Pharmaceuticals on Native Anurans of Argentina

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Pharmaceuticals are worldwide emerging contaminants with potential to bioaccumulate in aquatic organisms. Although their presence in surface waters has been reported, little is known about their occurrence and

negative effects on biota. The aim of the study was to evaluate the bioaccumulation and effects of widely used pharmaceuticals on adult toads of *Rhinella arenarum*, a neotropical species whose status conservation is least concern. Two sites were selected in the province of Buenos Aires (Argentina): Site 1 contains mainly grasslands and temporary ponds with a low degree of anthropogenic influence and currently with livestock; Site 2 contains a sewage effluent that discharges in the surrounding fields and connects with small ponds and a lagoon. Water samples were collected in both sites, filtered through 0.45 µm nylon membrane filters, and extracted by solid phase extraction using OASIS HLB cartridges (60 mg, 3 cc). Adults collected from both sites were anesthetized for blood extraction with heparinized capillaries to determine blood parameters (hematocrit, hemoglobin); then, they were weighed, measured and dissected for sampling of different tissues (muscle, liver, and fat body). Different morphological rates (hepatosomatic, fat body and body condition rate) were also calculated. For the analysis of pharmaceuticals, tissue samples were freeze-dried and further extracted using a bead beater followed by a clean-up step with solid phase extraction. All the samples were analyzed by LC-MS/MS. This is the first national and international study to evaluate the environmental bioaccumulation and effects of pharmaceuticals in anurans. The body condition rate was the only one that showed significant differences ($p < 0.05$), with toads from Site 2 being smaller than those from Site 1. Toads of both sites showed bioaccumulation of more than 20 pharmaceuticals, including various analgesics, antibiotics, and psychiatric drugs, among others therapeutic groups. Pharmaceuticals' bioaccumulation can be a good biomarker of exposure to make inferences about the quality of the studied environments.

4.05 A Review on Persistent Organic Pollutants in Marine Mammals From Brazil: Occurrence, Distribution, Fate, Toxic Effects and Health Risks

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Persistent organic pollutants (POPs) are commonly found in marine mammals all over the world due to their characteristics, such as the great affinity for lipophilic tissues, bioaccumulative properties and wide dispersion by atmospheric and oceanic currents; moreover, POPs reach the highest concentrations in animals at the top of the trophic chain through the biomagnification process. Marine mammals are susceptible to POPs toxicity and their occurrence have been linked to cause reproductive and immune impairment. In Brazil, there are several studies investigating the contamination of marine mammals by POPs, but several gaps still exist. In the present review, the occurrence of POPs in marine mammals from Brazilian coast are systematically organized and summarized aiming to correlate POPs detected and their levels with species habitat and eating habits as well as evaluate the potential damage to these groups and identify the most threatened species. In general, the most studied species are Pontoporia blainvillei and Sotalia guianensis, with the latter showing higher concentrations of POPs. Most studies are with samples collected from southern and southeastern Brazilian coast and temporal assessments are scarce. The groups of POPs most analyzed are orgnochlorinated compounds, mainly polychlorinated biphenyls (PCBs) and dichlorodiphenyltrichloroethane and their metabolites (DDTs), followed by brominated flame retardants, such as polybrominated diphenyl ethers (PBDEs), and then the poly- and perfluoroalkyl substances (PFASs), especially perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS).

4.06 Pharmaceuticals and Other Urban Contaminants Threaten Amazonian Freshwater Ecosystems

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The Amazon is the largest river basin globally and contains about 40% of the world's remaining tropical rainforest, hosting a vast diversity of terrestrial and aquatic organisms. Only 10% of the population inhabiting the major cities of the Amazon are connected to sewage treatment facilities. This implies that most wastewater produced by the inhabitants of the Amazonian region are discharged untreated into the Amazon River, constituting a major environmental pathway for pharmaceuticals and other chemicals consumed by modern societies. Here we provide the first large-scale monitoring of pharmaceuticals and other substances related to human presence (psychostimulants, personal-care products, hormones) in the Amazon river, three of its major tributaries (Negro, Tapajós and Tocantins Rivers), and smaller streams crossing the cities of Manaus, Santarém, Macapá and Belém. We confirm that urban areas constitute important hot-spots for chemical contamination, with contaminant mixtures affecting up to 50-80% of aquatic species. The compounds showing the largest chronic risks were caffeine, paracetamol, estrone, furosemide, ibuprofen, paraxanthine, benzoylecgonine and 17β-Estradiol. Moreover, we identified several ubiquitous compounds in the Amazon River which can be used as tracers of anthropogenic pressure (caffeine, paracetamol). We conclude that the chemical burden created by Amazonian cities significantly contributes to a biodiversity loss in the region. Environmental policies should be implemented to improve the sanitation system and to monitor the chemical status of the Amazon River network.

4.08 Developing a Freshwater Indicator Species for the Environmental Reconnaissance of CECs in Chile

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In arid environments such as Chile, the fate and transport of water borne CECs is impacted by streamflow and surface runoff, as relatively long periods of low flow can be punctuated by significant runoff events that carry considerable chemicals loads. Consequently, efforts to chemically quantify CECs *in situ* are frequently ineffective, resulting in many environmentally collected water samples being devoid of chemical. Under such conditions, indicator fish may provide valuable information regarding the biological impact of CECs in local waterways. The freshwater biota of Chile is characterized by high levels of endemism, but low species richness with only 45 described fish species. In addition, to the native fishes, twenty-six invasive fishes have been identified into Chilean waters, including rainbow trout and brown trout. For the purposes of environmental reconnaissance, most work has been done on these two invasive salmonids as there is a great deal known about their reproductive and molecular biology. Consequently, the impacts that CECs would have on their life history are well understood. On the other hand, the use of these trout does not, necessarily, provide specific insight into a chemical's impact on Chilean fish or ecosystems. In

contrast, recent work has been conducted on the most widely distributed endemic species in Chile, the pencil catfish, *T. areolatus.* The use of *T. areolatus* is advantageous as the animal is native and a bell weather for the relative condition of the natural ecosystem. While much less is known about the molecular and reproductive biology of *T. areolatus*, that is changing quickly as a recently published paper described its transcriptome. Drawbacks to using *T. areolatus* focus on the fact that there have been no efforts to develop husbandry for the animal and consequently all fish used in environmental reconnaissance have been wild caught. This can create issues regarding experimental design, and relative to the preservation of a species considered to be vulnerable by the Chilean Ministry of the Environment. Selection of a suitable indicator species for the environmental monitoring of CECs is a balancing act, and no single fish is perfect. In Chile, *T. areolatus* may represent the best integration of these selection criteria.

4.09 Spatial and Temporal Distribution of Perfluoroalkyl Substances (PFAS) Detected After an Aqueous Film-Forming Foam (AFFF) Spill

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In 2015, more than 60 thousand litters of aqueous film-forming foam (AFFF) containing per- and polyfluoroalkyl substances (PFAS) were used to combat a major fire in a petrochemical fuel storage terminal in the largest harbor of South America, the Port of Santos. To characterize the extension of the AFFF spill and their transport through the Santos and São Vicente Estuarine System (SES), surface sediments were sampled in seven sites from the surrounding area in five different periods over a year (n=28) and analyzed for 15 PFAS. All analyzed PFAS were detected in concentrations above the method detection limit at some point. The concentrations of ΣPFAS in the sediments ranged from 0.13 to 16.0 (1.91, average) ng/g dry weight (dw). Linear perfluorooctane sulfonate (L-PFOS) was the most detected compound with concentrations varying from 0.39 to 4.54 (1.63) ng/g dw 15 days after the accident to 0.10 to 0.67 (0.21) ng/g dw one year after the accident. Interestingly, no branched (Br-) PFOS was observed in the sediments, which can suggest previous input of PFOS, as Br-PFOS is more soluble in water and might be removed with water exchange over time. Nevertheless, the presence of PFOS precursor in the AFFFs could be increasing the concentrations in the area. PFHxA was often found in the surrounding area of the accident in concentrations from 0.04 to 0.23 (0.16) ng/g dw after 15 days and from 0.01 to 0.17 ng/g dw one year later. This finding suggests important input of this compound through the AFFF spill. Higher values for both PFHxA (3.75 ng/g dw) and PFOS (10.5 ng/g dw) were seen after 45 days in the sampling point closest to the accident, suggesting an effect of the sediment remobilization and leaching from the mangroves surrounding the accident area. In this case, the high dynamic of the estuarine system may have influenced the plum spread with the foam, and consequently PFAS, and favoring the deposition of the compounds in the low estuary, the closest site to the ocean. Additionally, previous fires that occurred in sugar terminals in the SES may have contributed to the presence of PFAS in sediments from the lower estuary. Nevertheless, further studies are being performed to better understand the extension of the PFAS contamination in the SES and its effects.

4.10 Target Screening and Mixture Assessment of Organic Micropollutants in the River Aconcagua (Chile)

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Aquatic environments have been widely characterised by mixtures of micropollutants worldwide and scientific evidence has demonstrated a myriad of adverse effects on aquatic life (e.g., disruption of hormonal pathways and inhibition of neuronal synapsis in non-target organisms). Nevertheless, there are knowledge gaps about the chemical and ecological status of freshwater in developing countries. The River Aconcagua basin (Chile) is a basin under high water competition by mining, agriculture, and urban areas. Several settlements and relevant economical activities (mining, agriculture, and petrochemical industries) stretch along the river. Consequently, a diverse and complex pollution fingerprint occurs, driven by the various land uses. In this study, we used an on-site large volume solid-phase extraction sampler to collect 50 L of water at nine different sites (3 “reference” sites, 3 tributaries, and 3 sites along the river). Organic micropollutants were extracted and their concentrations were quantified using LC- and GC-High-Resolution Mass Spectrometry. The target-screening list comprised 824 chemicals from different chemicals groups (e.g., pesticides, pharmaceuticals and personal cares products, industrial chemicals, and some transformation products). The mixture assessment was conducted applying both the toxic unit approach and the species-sensitivity distribution modelling in order to predict effects at different trophic and community levels, respectively. We quantified 153 chemicals and overall 5 biocides, 35 industrial chemicals, 51 pharmaceuticals and personal care products, 62 pesticides were found at one or more sampling sites. Site-specific chemical fingerprints were used for mixture assessment and our results predicted that exposed biota in tributaries was at risk. The risk drivers were mainly pesticides and we predicted that algae were the most sensitive trophic level for herbicides, conversely, crustaceans and fish were the most sensitive trophic levels for insecticides and fungicides.

4.11 Ecological Risk Assessment of Human Pharmaceuticals in Aquatic Ecosystems of Latin America Compared With Other Regions of the World

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Pharmaceuticals are biologically active compounds that can interact with non target organisms through different mechanisms. Sewage discharges are the main environmental sources of human active pharmaceutical ingredients (HAPIs). Therefore, concern exists about the potential risk on aquatic ecosystems. This study was aimed to assess the ecological risk of HAPIs for aquatic communities of Latin America comparatively with other regions of the world. According to the available information, the selected group of HAPIs for the analysis were: acetaminophen, alprazolam, lorazepam, caffeine, sertraline, fluoxetine, metformin, carbamazepine, atenolol, enalapril, sildenafil, diclofenac, ibuprofen, indomethacin, ciprofloxacin, and 17α-ethinylestradiol (EE2). HAPIs environmental concentrations were

analyzed separately for the following world regions: LatinAmerica(LA), NorthAmerica(NA), Europe(EU), and Asia(AS). Biological effects were separately assessed for the following aquatic communities: algae, invertebrates, and fish. Acute and chronic effects were independently evaluated considering worst-case (maximum concentrations) and average (mean concentrations) scenarios. Risk characterizations for all HAPIs were performed calculating the risk quotients (RQ). A refined analysis using the probabilistic approach was done for EE2 and Ibuprofen, those presenting higher risk in LA and enough exposure and effect data. The exposure profile, given by the environmental concentrations, showed great variation between HAPIs among regions. Pharmaceuticals displaying higher toxicity were indomethacin and EE2 for algae and fish, respectively. The most sensitive species were *Pseudokirchneriella subcapitata* and *Danio Rerio*. Negligible risk of acute effects was estimated for all HAPIs under an average scenario, meanwhile, values >1 were found for indomethacin and EE2. Regarding the risk linked to long-term effects, values >1 were observed for indomethacin, EE2, carbamazepine, atenolol, ibuprofen, and acetaminophen. The probabilistic approach applied for EE2 and ibuprofen showed a negligible risk for lethal effects, but a substantial risk for sublethal effects. The risk associated with biomarker-like endpoints was higher than for endpoints linked to the biological performance of the organisms (i.e., condition, growth, reproduction). This study showed that HAPIs such as EE2, indomethacin, and ibuprofen could represent a risk for aquatic species in LA freshwater ecosystems.

4.14 One Health: Environmental Toxicity Within a Holistic Perspective

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Although the relationship between environmental toxicity and infectious diseases is little studied, it is likely to be more common than is recognized as high pollution could be associated with preexisting pathologies as well as high mortality. For instance, COVID-19 patients from countries/regions with the highest air pollution presented more severe clinical symptoms. Moreover, some conditions that are known to influence COVID-19 progression could have toxicological causes such as cancer, endocrine, neural and inflammatory disruptions, renal failure, etc. while some toxic chemicals as well as pathogens could exert dysfunctions on the same homeostatic regulators like for instance in the case of SARS-CoV-2 and some heavy metals like Cd on the HIF-1 and ACE2 systems. Considering those different pathologies/dysfunctions either as risk factors or due to the multiple forms of evolution of severe forms of disease as it was reported in the case of COVID-19, it seem to justify to expand the focus from atmospheric pollution to a more global perspective of toxicity and health. Thus, a precautionary approach is desirable, based on the principle of no toxins in toxic amounts in the environment. For instance considering streams and rivers the sink of anthropogenic activities, for aquatic life protection, from a holistic perspective sentinel organisms such as free living vertebrate embryos (fish, amphibians) could serve for monitoring/management purposes of effluents and water quality, based on their high sensitivity and high levels of exposure to environmental contaminant mixtures. Even just no lethal effects could be correlated with the survival of sensitive species in the water column and sediments (Herkovits et al., 2003). Water quality criteria could be improved by incorporating other end points for aquatic life protection like for instance teratogenesis. One health criteria will promote resilience and a circular economy from waste to resource stewardship.

4.15 Emerging and Legacy Persistent Organic Pollution Profiles in Hawksbill Turtle Nesting Beaches Reflect Local to Distant Pollution Sources in the Yucatán Peninsula, Mexico

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Knowledge regarding spatial variation in emerging and legacy persistent organic pollutants (POPs) among sea turtle nesting locations is limited. This poses challenges in identifying processes shaping this variability, sets constraints to sea turtle conservation, and the use of sea turtles in biomonitoring. We aim to increase understanding of the spatial variation in polycyclic aromatic hydrocarbon (PAH), organochlorine pesticide (OCP) and polychlorinated biphenyl (PCB) compounds among nesting beaches in the Yucatán Peninsula, one of the world's most important rookeries for of hawksbill turtles (*Eretmochelys imbricata*). Using gas chromatography, we confirm maternal transfer of a large number of compounds (n=69 out of 70) among 104 eggs collected from 21 nests across three beaches. The use of substitution for handling data containing concentrations below detection limit has been debated because an arbitrary value is inserted that could bias results. Consequently, we approach our analysis by estimating a cumulative frequency distribution for each individual pollutant on each nesting beach using Kaplan Meier estimation. Analysis of each individual component is then conducted using univariate Peto-Prentice tests, while the pollutant profile as a whole is analyzed using multivariate correspondence analysis. High variation in PAH profiles is observed among nesting beaches, reflecting local acquisition during recent migration movements. Diagnostic PAH ratios further support a local acquisition, showing clear petrogenic origins of PAHs in Celestún, the beach closest to petroleum industries in the Gulf of Mexico. By contrast, pollution profiles OCPs and PCBs show high similarity among beaches, reflecting the long-term accumulation of these pollutants at regional scales. We take a broader perspective by directly comparing our measured concentrations with other studies in the region. This confirms a general similarity for OCP and PCB concentrations within the wider Gulf of Mexico with some patterns unique to Mexico for DDTs and lindane. Meanwhile, we provide a first baseline for PAHs in eggs of Hawksbills for this region. In conclusion, spatial planning of protected areas and the use of turtle eggs in biomonitoring needs to account for the spatial variation in pollution profiles among nesting beaches. Moreover, conservation management of sea turtles in the context of pollution requires cooperation across geographic and political boundaries.

4.16 Genotoxicity of Textile Effluent on Rhamdia quelen (Teleostei) by the Comet Assay

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Textile effluent is a complex wastewater, with difficult degradation containing xenobiotic, recalcitrant and toxic substances. In contact with water bodies without proper treatment, it can cause damage to the health of the aquatic biota and trigger various environmental impacts. This study aimed to evaluate the genotoxic effect of the textile effluent before and after its treatment by an industry located in Southwest Paraná

(Brazil). Preliminary tests were carried out to determine the sublethal concentration. Subsequently, 180 fish (*R. quelen*) were divided in 60L aquariums. The fish were sub chronically exposed to the following dilutions: 0; 1.25; 2.5; 5.0; 7.5 and 10.0% of the raw and treated effluent. The experiment was developed in triplicates for 7 days under controlled conditions (pH, ammonia, nitrite, temperature and feeding once a day) and daily water renewals. Blood tissue was collected from individuals, stored in fetal bovine serum and the routine protocols were applied to perform the single cell gel electrophoresis test, commonly known as a comet assay. This technique was used because it is considered sensitive, simple, and quick to analyze possible genotoxic damage. The slides were stained with ethidium bromide and the analyzes were performed blindly under fluorescence microscopy, evaluating 100 nucleotides/slides, following damage stages from 0 (no damage) to damage 4 (cell apoptosis). The results were submitted to the two-way ANOVA test which resulted in a non-significant difference between different concentrations to both effluent types. On the other hand, a significant difference was identified between the raw and treated effluent. When observing the damage rate, the treated effluent shows higher comet tail scores than raw effluent. These largest tails in comets after effluent treatment may be attribute to two main causes: 1) the composition of raw textile effluent is very complex and contains heavy metals; so DNA-metals cross-links may have been formed in raw effluent, and these prevent the development of the comet's tail after electrophoresis, that are not detected immediately under standard comet test conditions; or 2) some photochemical reactions during treatment with the potential can generate intermediate components that are more toxic than the original ones, or that interact with other molecules, characterizing an increase in the toxicity of the treated textile effluent. More tests with other biomarkers are needed to conclude about toxicity of textile effluents.

4.17 Suspect Screening of Contaminants of Emerging Concern in Piaractus Mesopotamicus (Pacú), a Fish Species for Local Consumption and Export

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A major current concern is the widespread occurrence of anthropogenic emerging pollutants, due to their potential effects on environmental and human health. The insufficient infrastructure of sewage treatment plants in South American countries implies that domestic effluents, industrial effluentsand runoff discharges from urban areas and agricultural activities, loaded with a diverse range of emerging pollutants, enter water bodies. This alters the quality and safety of aquatic ecosystems, and may bear implications as well to the local populations that depend on them. Aquaculture, an activity that has grown worldwide at a great pace, is also rising in Argentina, with great potential to increase production for both local consumption and export. In order to durably establish this industry, the fish farmed in Argentina should be produced according to international standards, including good manufacturing practices and production in safe water bodies. In this study, we analyzed multi-class emerging contaminants in muscle samples of Argentine commercial Pacú (*Piaractus mesopotamicus*), a typical species of the Parana basin highly appreciated by local consumers. Briefly, the extraction method consists of the use of MeOH and 0.05 M HCl as extraction solvents, vortexing, ultrasonic bath, centrifugation and solid phase extraction (SPE), and samples were analyzed for >150 suspect-target micropollutants. Instrumental analysis involved ultra-high-performance liquid chromatography coupled to high-resolution mass spectrometry (UHPLC-HRMSQ-Exactive Orbitrap). Residues of pesticides, antibiotics, pharmaceuticals, personal care products, plasticizers, sweeteners, drug metabolites, stimulants, and illegal drugs were variously detected in the fish samples at confidence levels between 1-4.The study provides new occurrence data on contaminants impacting water resources and aquatic organisms, including fish for human consumption.

4.18 Environmental Risk Assessment for Two Emerging Contaminants, Diclofenac and Ibuprofen, in Daphnia magna, Lemna gibba and Paracheirodon innesi

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The environmental risk of two non-steroidal anti-inflammatory drugs, diclofenac (DFC) and ibuprofen (IBU), both widely used and available over the counter in Peru was evaluated on a multitrophic battery composed of three bioindicators: water flea (*Daphnia magna*), duckweed (*Lemna gibba*), and neon tetra fish (*Paracheirodon innesi*), in order to propose environmental quality standards in the category of conservation of the aquatic environment. The toxicity tests were carried out in accordance with the provisions of the OECD international guidelines for each species used. The TRAP v.1.30 (USEPA) software was used considering the 95% confidence limits for the calculation of the mean (effective) lethal concentration ($CL(E)_{50}$). The environmental risk assessment according to the European Medicine guide (EMEA)-2006, adapted with local data, used the calculation of the Risk Coefficient (RC) and the Acute-Chronic Ratio (ACR). DFC presented a higher degree of toxicity than IBU in the three biological models used. However, according to the CR, DFC only generated environmental risk for duckweed. In the case of IBU, the risk encompasses the three trophic levels evaluated: zooplankton, aquatic plant, and fish. In the category of conservation of the aquatic environment, an ECA (Environmental Quality Standard) of 0.007 $mg \cdot L^{-1}$ is proposed for DFC, while for IBU the ECA value was 0.021 $mg \cdot L^{-1}$. Drug concentrations above these values would already be generating a negative effect on freshwater species.

4.19 Mixture Analysis of Estrogens at Low Dose Levels Via ER Transactivation Assay

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The presence of endocrine disrupting compounds in aqueous matrices and their possible mixture effect have been a concern during the last decades. Although additive and synergistic effects have been reported for estrogenic substances, applied experimental designs consisted mainly of fixed-ratio dilutions. In this study, the joint action of binary mixtures of 17β-estradiol (E2), 17α-ethinylestradiol (EE2), estrone (E1) and estriol (E3) was evaluated in terms of ER induction via the transcriptional activation assay Yeast Estrogen Screen. Individual dose-response curves were assessed and then a partial fixed-ratio experimental design was performed with 23 combinations at various mixture ratios based on expected toxic strengths, thus enabling the construction of isobolograms and response surfaces. Test concentrations in mixtures were in the range 13.62 – 108.96 ng L^{-1}, 13.62 – 103.51 ng L^{-1}, 37.5 – 292.5 ng L^{-1} and 1750 – 12500 ng L^{-1} for E2, EE2, E1 and E3, respectively. Considering a sample enrichment factor of 25, those concentrations correspond to the environmentally relevant ranges of

0.55 – 4.35 ng L^{-1}, 0.55 – 4.14 ng L^{-1}, 1.50 – 11.17 ng L^{-1} and 70 –500 ng L^{-1} for E2, EE2, E1 and E3, respectively. Observed corrected absorbances were fitted to a Concentration Addition (CA) reference model and further extended to synergistic/antagonistic, dose-ratio dependent and dose-level dependent deviation models. Significance testing for models was ultimately performed through maximum likelihood analysis. Results showed a significant deviation from CA reference model for all mixtures, except for EE2+E1. Overall, synergism and dose-level or dose-ratio dependent synergism were the significantly ($p < 0.05$) most parasintonous model, with coefficient of determination (r^2) ranging from 0.908 to 0.971 and sum of squared residuals ranging from 0.547 to 1.876. Interactions were mainly observed at lower dose levels, in the region where limit of quantification of the YES assay stands and the estrogenic activity is calculated in terms of estradiol-equivalents. This suggests that, when assessed via the YES assay, synergism may be recurrently present within estrogenic activity results of environmental samples whose estrogenic potential is mainly due to estrogens and hence possible regulations for concentration limits and specific risk assessment should take this into account.

4.20 Toxicity Assessment of Emerging Contaminants Through Morphological and Hormonal Biomarkers and Gut Microbiome on Anuran Tadpoles

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Cattle, poultry, and swine mega industries contaminate aquatic environments with antibiotics and pesticides, being a matter of growing concern worldwide. The effects of contaminants on wildlife are essential for ecotoxicological risk estimation. The objective of the present study was to characterize the sublethal effects of two compounds that commonly occur in agricultural ponds on the morphology and developmental biomarkers of *Rhinella arenarum* tadpoles. Gut microbiome was included as a new biomarker of health status of exposed tadpoles. The experimental design consisted of individual and mixed scenarios (50:50% v/v) of 2 weeks of exposure to glyphosate-based herbicide (GBH, 2.5 mg L^{-1}) and the antibiotic ciprofloxacin (CIP, 100 µg L^{-1}). At the end of the assay, morphological (weight, length, developmental stage and abnormalities), hormonal (Thyroid levels –T4-) and gut microbiotic (diversity) biomarkers were measured in treated and control tadpoles. A high prevalence of morphological abnormalities (0.4 to 0.5) and a decrease of weight (12.3 to 13.5%) were observed in all treated tadpoles with respect to CO. GBH-treated tadpoles showed a lower mean developmental stage and higher body length (15%) than other treatments and CO. GBH and GBH-CIP treated tadpoles showed significant decrease in T4 levels (40.3%). The gut microbiotic analysis revealed a higher diversity of bacterial communities in GBH (taxa richness, TR=11 genera) and a lower one (TR=7 genera) in CIP treatment with respect to CO (TR=9 genera). Overall, the results suggest that a pesticide and an antibiotic have differential effects on tadpoles individually and in mixture expositions. Furthermore, the findings highlight the importance of evaluating different biomarkers when defining the ecotoxicity of a given contaminant. The increase of feedlots surrounding or inside wetlands and the deleterious effects of contaminant release on aquatic organisms show the need for urgent regulation.

4.21 Effect of Monoammonium Phosphate on Glyphosate Leaching and Residence in Rice Soils

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Glyphosate (GLY) is an herbicide widely used in rice farming production worldwide. Traditionally GLY has been considered to have low mobility in soils, but in recent years many investigations have focused on the effects of phosphorous fertilizers on GLY adsorption-desorption. Competition between GLY and phosphorous fertilizers for soil adsorption has been previously demonstrated, especially in temperate regions. The objective of this work was to characterize the effect of the addition Monoammonium phosphate **(**MAP) on GLY transport and mineralization in disturbed soil columns. Soil samples were taken from rice plots from the Espinal (CS1), Saldaña (CS2) and Villavicencio (CS3) regions in Colombia. The experiment setup consisted of six soil columns (L=30 cm, Ø= 8.9 cm^2) per soil. A pulse, containing GLY (dose of 1920 g a.i. ha^{-1} and 11224 Bq of ^{14}C-GLY) in 100 mL of distilled water was applied. After 24 hours, MAP was added to 3 columns per soil (dose equivalent to 60 kg ha^{-1}). Simulated rainfall consisted of 100 mL/day of distilled water. The leachates were collected daily and analyzed using a Liquid Scintillation Counter. GLY mineralization was measured every 24 h by collecting $^{14}CO_2$ with a NaOH trap placed on top of each column. The GLY maximum peak relative concentration (max_p) occurred at 3.4±0.3 (CS1), 2.3± 0.1(CS2) and 2.0±0.1 (CS3) PV. In GLY- MAP columns, the max_p occurred at 1.7±0.1 (CS1), 1.9±0.1 (CS2) and 1.9±0.1 (CS3) PV. MAP additions caused a significant faster GLY displacement in soils CS1 and CS2 ($p< 0.0001$). At the end of infiltration experiments, mass balance of GLY in the leachates ranged from 4.0±0.1 to 6.2±0.4 % of GLY. The addition of MAP caused a significant increase of 0.62±0.2% in the amount of total leached GLY in all soils. Herbicide mineralization was higher in CS2 (23.7%) followed by CS1 (17.9%) and CS3 (11.1%). No mineralization differences were found between treatment with or without MAP. Our results indicate that GLY has a high affinity for the studied soils, which limits its movement and mineralization. However, the use of phosphate fertilizers decreases GLY residence time and increases the total amount of glyphosate leachate. Thus, MAP additions in Colombian rice soils, increases the risks of groundwater contamination.

4.22 Emerging Drugs in Environmental Matrices of the Province of Córdoba As a Consequence of Veterinary Use in Dairy Production

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In recent years there has been an increase in the use of veterinary drugs such as antibiotics, antiparasitic drugs, and others in livestock. Animal manure and effluent generated by livestock are often used in agriculture as fertilizer, a practice that could represent a risk of contamination of agricultural production by these products. The accumulation of these residues in the soil degrades it and the presence of antibiotics can generate resistant microorganisms. Drugs and their metabolic products are discharged into the environment through waste (feces and urine excreted by animals). Waterways are an important transport route for used veterinary waste. The analysis of drug traces in environmental samples is known to present certain difficulties, such as the low concentration in these samples, matrix interferences during analysis, and the lack of a fast, efficient and reliable extraction method. Therefore, the investigation of these pollutants in different environmental matrices

requires separation and identification techniques that are efficient, selective, and sensitive. The objective of this work was to evaluate the presence of veterinary drugs in environmental matrices from dairy production in the province of Córdoba. Fifty establishments were sampled during the period September-December 2020, January-May 2021. Samples of liquid effluent, manure, and agricultural soil were taken. The drugs investigated were: Antibiotics (Enrofloxacin, Amoxicillin, Ampicillin, Penicillin, Spiromycin, Ceftiofur, Tylosin, Tetracycline, Oxytetracycline), Antiparasitics (Ivermectin and Abamectin), and the Anti-inflammatory Flunixin. In this study, the extraction methods of the analyzed drugs were developed and adapted and the conditions of the instrumental analysis by liquid chromatography coupled to tandem mass spectrometry were optimized. The parameters analyzed were satisfactory and fulfilled the bibliographic validation criteria: correlation coefficients for the calibration curves R2 = 0.990-0.9999, recovery range: 50-130%, relative standard deviation of precision: < 20%, limits detection and quantification: 1-20 ng g^{-1}. Forty-seven samples from each matrix were analyzed, and antibiotics and flunixin were found. The developed method was appropriate for the search, of the selected drugs, in the studied matrices. It provides new data to advance the analysis of the bioavailability, bioaccumulation and degradation of these drugs in environmental compartments.

4.23 Veterinary Antibiotics in Surface Water and Sediments of Two Rural Streams From the Southeast Pampas

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There is a lack of information on veterinary pharmaceuticals occurrence in aquatic ecosystems in Latin America. The presence of antibiotics in the environment can be associated with direct animal excretion of feces and urine, point source contamination, or the use of manure as fertilizer. The objective of this work was to study the occurrence in surface water and sediments of two antibiotics, oxytetracycline (OXT) and monensin (MON), commonly used in poultry and cattle production in Argentina. De los Padres stream (S1) is impacted mainly by agricultural land use that encompasses extensive crops and to a certain extent animal husbandry farms (e.g. horses, sheep, cattle). On the other hand, La Tapera stream (S2) basin is greatly impacted by horticultural crop production where it is common to apply poultry litter as a soil amendment. Stream water samples (n=51) were taken from January to October 2019 using propylene bottles. Stream sediment samples (n=24) were collected using cylinder samplers. Water pH and EC were measured *in situ*. Detection and quantification of the compounds was performed by ultra-performance liquid chromatography coupled to a mass spectrometer (UPLC MS/MS). The limit of detection and quantification was 0.1 µg/L in water and 0.1 µg/Kg in sediments. The average pH and EC in surface water were 8.9 ±0.7 and 849 ± 87.6, respectively. OXT was detected in 70.6% of the water samples and 41.7% of the sediment samples. MON was only present in surface water (23.5%) and not in sediment samples. Maximum concentrations in water were 1.2 and 0.7 µg/L for OXT and MON, respectively. We did not find an association between antibiotic presence in the water column and in sediments. Antibiotic distribution in the environment is dependant on the intrinsic properties of the compound and the physico-chemical conditions at the time of sampling. OXT has a high-water solubility, which favors its distribution in the water compartment. However, it also bonds to the particulate organic matter in sediments due to its polar functional groups (phenol, alcohol, amine, and ketone). On the other hand, MON water solubility is low and its K_{ow} value would suggest a high affinity to the sediment compartment. However, at pH>6 monensin is found in its anionic form, which decreases its sorption to sediment particles. Further studies are needed to understand the source of these compounds in the environment and their impact on aquatic biota.

4.24 Toxicity Study of Dibutyl Phthalate and Perfluorooctanoic Acid by Using Batteries of Schizosaccharomyces Pombe Strains

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Some daily commercial and industrial products have become emerging pollutants due to their high persistence in the ecosystems. One of them are di-n-butyl phthalate (DBP), a synthetic product widely used as plasticizer in polyvinyl chloride plastics thanks to its adhesiveness and flexibility. Another example is the perfluorooctanoic acid (PFOA), a man-made chemical with several uses in consumer products and industrial preparations. In order to investigate the mechanisms of toxic action and the efflux pumps involved in their detoxication, it has been used a strategy with batteries of *Schizosaccharomyces pombe* yeast strains, either defective in cell signalling, in detoxification pumps, or in cell surveillance mechanisms. The mechanisms of action investigated were spindle defects (mph1), stress (pmk1, sty1), DNA interference (rad3) or diverse effects (MDR-sup). The efflux pumps investigated were Bfr1, Pmd1, Mfs1 and Caf5 or the Pap1 transcription factor. Here, PFOA induced a weak higher toxicity than DBP in the wild type fission yeast. Furthermore, stress was the most relevant mechanism on DBP and PFOA with a higher ROS generation in the case of DBP. The protection provided for DBP by the transporters was more marked than for PFOA. Bfr1 was the principal role in the efflux of both compounds, being more important in the case of DBP. Moreover, Caf5 and Mfs1 were also involved in DBP and PFOA detoxification. However, Pmd1 only showed its role in DBP transport. Also, the mixture of both compounds induced a strong potentiation. Thus, due to the toxicity obtained from both compounds in their individual and in combination, more exhaustive controls and regulations in their use should be considered and further studies should to be performed.

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4.25 Accumulation, Subcellular Location and Biomarker Responses of Silver Nanoparticles (AgNPs) and Dissoved Silver (AgD) in the Clam Ruditapes philippinarum

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Nowadays, the aquatic ecosystem are the final sinks of many substances, including legacy and emerging pollutants. Among this last kind of substances, nanoparticles are found. Due to wide use, the number and amount of nanoparticles that are released to the environment have increased in the recent years; besides the current models predict that it will be the tendency in the next future. Nanoparticles have different characteristics and applications and one of the more employed are silver nanoparticles (AgNPs) because its

bactericidal properties. To assess the impact of aquatic pollution in aquatic ecosystems, the mollusks have been identified as good biomonitor for legacy and emerging pollutants, including nanoparticles. In this work, we have analyzed the effect of silver nanoparticles and dissolver silver, using the clam *Ruditapes philippinarum* as model organism. This mollusk has been widely distributed in the coast of the Mediterranean Sea. The bioassay was carried out under controlled laboratory conditions at silver concentrations of 1µg/L for both AgD and AgNP, for 1 week. The selected target tissue was the gills because they represent the first barrier to nanoparticles and dissolved silver. To assess the toxicity, several biomarkers were selected: lipid peroxidation (LPO), aspartate amino transferase (AST), alanine amino transferase (ALT) and total protein (TP). Accumulation of silver and subcellular silver fractionation was carried out in gills in order to determine if the metal storage was depending on the silver form (nanoparticle or dissolved) Results showed differences in the accumulation pattern between AgNPs and AgD and lack of significant response in terms of toxicity. Additional studies will be carried out to know in depth the relationship between silver form in the target tissue and threshold toxicity.

4.27 Use of a Chemical Fate and Transport Model to Determine Management Strategies for Land Applied Residuals That Minimize PFAS Leaching Into Groundwater

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One source of potential concern for the entry of PFAS into the environment is the land application of residuals, including industrial solids and municipal wastewater biosolids. When wastewater solids are land applied to agricultural lands, they offer many net environmental benefits such as enhancing soil health, recycling nutrients, sequestering carbon, and minimizing fertilizer and pesticide use. However, due to the ubiquitous nature of PFAS chemicals, their presence in residuals is often detected at variable concentration levels and may leach into nearby groundwater resources. Understanding the fate and transport pathways of PFAS in land applied residuals is of high importance in order to be protective of groundwater as a drinking water source. An approach to modeling the leaching of PFAS chemicals was developed based on the Pesticide Root Zone Model (PRZM) used by US EPA and other international regulatory agencies in both screening level and refined pesticide exposure risk assessments during the registration process. PRZM is a physically based model that accounts for agronomic practices and hydrologic processes specific to local climate, soil, and groundwater conditions, which directly impact the fate and transport of land applied chemicals. Predicted groundwater PFAS concentrations from land applied residuals using PRZM are presented for different scenarios (residuals application rates and concentrations, weather conditions, soil characteristics) under conservative assumptions (e.g., low sorption, shallow groundwater, no lateral flow, no degradation). A procedure for calculating a dilution attenuation factor (ratio of chemical mass applied over its concentration in the groundwater) is described which can be used to determine a maximum allowable PFAS application mass rate (per unit area) for any specified drinking water level of concern. An example comparison of PRZM modeling simulation results with field data demonstrates the reasonable accuracy of the modeling approach and the level of conservatism compared to measured groundwater concentrations. This provides confidence that the PRZM modeling approach is appropriate as a screening level tool for assessing potential levels of PFAS chemicals in groundwater resulting from land applied residuals. The methods presented could also be used to identify management strategies that balance the mass loading rate of PFAS in land applied biosolids and drinking water concentration safety limits.

4.28 Ecological Risk Assessment of Caffeine in Aquatic Ecosystems of Latin America: Risk Quotients and Species Sensitivity Distribution Approaches

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Caffeine has become one of the most consumed psychoactive substances in the world, not only as a natural ingredient of food and infusions, but also as a component of energy drinks and medicines. It is included in the group of contaminants of emerging concern (CECs) and they occur in water ecosystems worldwide. While wastewater treatment plants (WWTPs) have shown to be able to remove high percentages of caffeine in the water, this removal capacity is related to the available methods and technologies. In this context, the objective of this study was to identify the Ecological Risk Assessment of caffeine concentrations reported in aquatic ecosystems of Latin America. For this purpose, the Risk Quotients (RQs) and Species Sensitivity Distribution (SSD) approaches were used. We proposed two possible scenarios for RQs, using mean and maximum values. International reports were employed as source of toxicity data and measured environmental concentrations (MECs), while databases (US-EPA Ecotox, Envirotox, among others) were also employed for toxicity data. Geographical Information Systems were used to display the RQs for each point and if the MECs exceed or not the calculated Hazardous Concentration 5 % (HC5), in those cases with reported geo-references. A total number of 103 reports of MECs of caffeine (13 publications) were obtained from freshwater bodies of Latin America (particularly from Argentina, Brazil, Costa Rica and México). The 41 % of the sites showed RQmean > 1 and 46 % RQmax > 1, alerting for a possible risk for the biota inhabiting these ecosystems. On the other hand and considering the SSD approach, a HC5= 7.275 ug/L was calculated, with 18 % of the sites exceeding this value. The high proportion of sites with caffeine MECs with possible risk for aquatic biota gains relevance considering not only the annual increase of its consumption all around the world, but also the impossibility of having WWTPs with the best available technology to remove CECs in many places of Latin America.

4.29 Toxic Effects of 4 Non-Steroid Analgesics on Macrophyta Lemna gibba L

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The presence of drugs in natural and wastewater is a problem that has intensified for 10 years, since in natural waters and wastewater they have been detected in concentrations of ppb. Because these products are designed to be active at concentrations of ppb or ppm, they can cause deleterious effects to aquatic organisms. The objective of this study was to evaluate the toxic effect of 4 drugs: Acetylsalicylic acid, Paracetamol, Naproxen and Diclofenac, on the macrophyte *Lemna gibba*. Bioassays with a duration of 96 hours were carried out to determine the EC50 (concentration that inhibits population growth by 50%). The production of chlorophylls, carotenes, phenols and the level of lipoperoxidation (Tbars). The EC50 values obtained in the bioassays ranged from 17.42

to 1471.6 mg/L, the most toxic compound was Naproxen. A decrease in chlorophyll levels of 31%, 18%, 3.18% and 8.5% was observed for the tests with Acetylsalicylic acid, Paracetamol, Naproxen and Diclofenac, respectively. These values were significantly different compared to the control group ($P < 0.05$). Carotene and phenol concentrations were 10% to 360% higher in the exposed organisms compared to the control group. The levels of Tbars were high (between 60% to 400%) in organisms exposed to the drugs compared to the control group ($p < 0.05$). Because in Mexico only 14% of the wastewater produced receives some type of treatment, and there are no monitoring studies where the concentrations of these drugs are determined in aquatic systems, it is important to continue evaluating the effects of these compounds with in order to propose adequate management measures to reduce the risk of its presence in natural and waste waters.

4.30 Effects of Soil Contamination With Enrofloxacin on Growth, Nodulation and Nitrogen-Fixing Capacity of Bradyrhizobium japonicum

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Soil contamination by antibiotics is a global concern. In addition to its insertion in the food chain through plant accumulation, antibiotics can affect soil microorganisms, such as plant-growth promoters. Here, we evaluated the effects of soil contamination with enrofloxacin (Enro) on growth, nodulation and nitrogen-fixing capacity of *Bradyrhizobium japonicum*, as well as in physiological responses of soybeans inoculated with the bacteria. *B. japonicum* showed a minimal inhibitory concentration value of Enro of 0.61 µg ml^{-1}, which is several times higher than the antibiotic concentrations found in contaminated soils. However, the infection and nitrogen fixing capacity of the bacteria were reduced when it was inoculated in plants grown in soil contaminated with 200, 600 and 1000 µg Enro kg^{-1}. At R2 stage, the number of nodules and nitrogenase activity per plants and total ureide concentration in plant leaflets were reduced. Plant shoot and root biomass as well as ribulose-1,5-bisphosphate carboxylase/oxygenase activity state were not affected by Enro concentrations in soil. The results suggest that, although *B. japonicum* shows great tolerance to Enro, soil contamination with the antibiotic decreases the bacteria performance, affecting the bacteria nitrogen fixing capacity which can result in yield losses.

5. Traditional Knowledge, Policy, Management and Communication

5.02 Evaluation of Cropping Sequences on Sustainability of Production Systems: Agricultural Intensification Index

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In the last decades agricultural systems have undergone intensification and diversification processes to improve the productivity of land, the economic income as well as to face the climate variability. However, the concerns about environmental problems of agricultural practices on soil and freshwater ecosystems are increasing. In this way, some effects like as soil erosion, changes in soil carbon stock, fertility losses, eutrophication and aquatic biotic integrity degradation have been reported. Even though several methodological frameworks were developed to assess the environmental performance of farms and to support decision making process, normally relies on indicators that measure a particular characteristic of the agricultural system. The aim of this work was to propose an integrate index considering (a) sequence diversification, the area occupied by crops in winter and summer, as well as the percentage of participation of each crop in the sequence and (b) two weighting factors, that reflects the differential contribution in the environmental performance of the cropping sequences. The study was carried out between 2008 and 2020, in a commercial agricultural-livestock farm in the Northwest Uruguay with cropping sequences that include soybean, corn, sorghum and pastures. Our results show that the index is suitable to assess the intensification degree and allow selecting those agricultural sequences that present a higher environmental performance. The index was applied at different spatial scales and the optimal range of use is in farms no larger than 1000 hectares. In Uruguay this includes 90% and 95% of the cereal and rice farms, respectively. On the other hand, an inverse relationship was observed between the intensification degree and watercourse quality. Finally, it should be noted that the index is suitable to be applied in production systems from South of Brazil and the Center-East of Argentina that present similar physical characteristics, weather conditions, cropping sequences, and management practices.

5.03 Transdisciplinary Proposal to Integrate Scientific, Ancestral and Cultural Knowledge in Patagonia. Planeta Agua Project: Between Rivers and Fjords As a Pilot Case

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Aquatic ecosystems in Patagonia are relevant in terms of conservation, biodiversity and provision of ecosystem services, being for hundreds of years spaces of establishment and prosperity for different human populations and that currently sustain diverse socioeconomic activities. Releasing the importance of different knowledge provides a considerable advantage in addressing the sustainable use of the local biocultural heritage, integrating local scientific, ancestral and cultural knowledge. In this sense, the dissemination of science provides a set of pedagogical tools to collect and integrate this knowledge, achieving its effective transmission to the community. The Planeta Agua Exhibition: Between Rivers and Fjords, was designed considering this integration of knowledge, adding the link with the community from a gender and inclusion perspective. With these principles and a transdisciplinary team, we seek to generate community spaces for the co-creation of local, ancestral, and scientific knowledge in relation to the Patagonian aquatic ecosystems (rivers, fjords and sea). That is why the idea arose of holding a sensory - interactive exhibition with associated activities that is aimed mainly at the inhabitants of the Magallanes Region and that will be held in Puerto Natales city. The methodological proposal was designed with the support of allied community-based and public organizations. For the dissemination of each type of knowledge, stands were designed in which selected content will be presented and dialogue spaces were generated in relation to aquatic ecosystems. The contents of the scientific knowledge stand were designed by the project team plus the contribution of allied institutions in the science area. While the stands of ancestral and cultural knowledge will be generated through interviews, participatory mapping and "focus group" with communities of native peoples and social organizations. Thus, through the formulation of cross-cutting questions by the community, it will be sought to integrate this knowledge and advance in a common vision for the conservation of aquatic ecosystems and local sustainable development. The results obtained so far indicate that organizations and the community have a high interest in joining projects to disseminate knowledge on the subject of water in Patagonia.

5.04 Study and Application of Tools for Decision-Making in the Framework of Local Environmental Management of Pesticides

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The regulatory framework on agrochemicals is heterogeneous throughout Argentina and the controls regarding the use and application of these compounds are deficient. In the last few years, there has been a growing conflict over the use of pesticides and their impacts, mainly in urban-rural interface areas with proximity between agricultural and residential land uses. This study addresses the available cabinet tools that could be used to improve the environmental management of pesticides from municipalities; generating technical information to dialogue with provincial or national authorities. In cabinet-work, the previously generated data in the field or laboratory is collected, systematized and analyzed. The tools associated with this modality attempt to integrate and generate useful information for decision-making. The presented work consists of the study and application of 11 tools that evaluate the consequences of pesticide use, based on the available information, obtaining results with different environmental relevance. For the analysis, they were grouped in Block I, tools to evaluate the potential of leaching; Block II, a set of indices to obtain a categorization of dangerousness or environmental impact; Block III, tools for the prediction of ecological effects. The tools were classified according to various pre-established criteria, such as the information they provide, the necessary technical knowledge of the user, the computer requirements, the entity responsible for their development, the possibility of free access, the complexity of the necessary input data, and whether or not they have an instructional manual; which allowed to obtain comparison matrices for each block. The tools were applied to a particular case of study for a total of 15 pesticides. The obtained results consist of an analysis of the advantages and disadvantages of each tool

and a diagram for their application taking into account the information available to the user with the purpose of organize and facilitate the development of ecological impact and risk assessments to local authorities. By providing technical elements, the presented methodology could allow strengthening locally the decision-making on pesticides environmental management and the articulation with higher jurisdictions.

5.05 Caracterización de Fibras de Asbesto a Través de Microscopía, Mediante la Simulación Casino Monte Carlo

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El presente trabajo muestra los resultados de un estudio de exposición a fibras de asbestos realizado en una población ocupacionalmente expuesta y otra en ambientes comunitarios. Son pocos los estudios en Colombia que se han realizado sobre la problemática en toxicológica ambiental y de salud pública que representan el asbesto. Por esta razón, se consideró fundamental realizar un estudio de campo que permitiera explorar la realidad en nuestro país, así como establecer protocolos de estudio de exposición a asbestos en ambientes de trabajo y en población general.En todo el mundo, la prevalencia de componentes estructurales con materiales que contienen amianto (MCA) que necesitan alguna intervención (reparación, demolición, sustitución, etc.) es una preocupación importante. Si bien la microscopía electrónica de transmisión analítica (A-TEM) es la primera opción para la caracterización ACM (porque esto podría proporcionar una caracterización de fibra inequívoca), la microscopía electrónica de barrido (SEM) permite una caracterización de la morfología de la fibra sencilla y asequible. Sin embargo, la caracterización SEM-EDS (espectroscopía de dispersión de energía) de las fibras de amianto apenas se utiliza debido a la inaceptable incertidumbre en la composición elemental de la fibra. Esta precisión deteriorada es una consecuencia directa de la influencia no despreciable del sustrato en el espectro general de EDS. En esta contribución, presentamos una metodología sencilla para la caracterización de fibras en ACM por SEM-EDS. Esta metodología se basa en la deconvolución teórica de las contribuciones individuales del sustrato y la fibra al espectro EDS experimental general. Utilizando el software gratuito Casino, se simula un espectro teórico de las emisiones de rayos X características y se compara con el experimental (después de la corrección de radiación Bremsstrahlung). Figura 1 - Micrografías SEM de dos fibras seleccionadas y detritos rocosos (izquierda) y los espectros EDS concomitantes (derecha). Las micrografías se registraron con electrones retrodispersados y 10 kV.Figura 2 - Concentración de elementos principales (a saber, O, Mg y Si) para dos fibras seleccionadas y escombros rocosos que se muestran anteriormente en la Figura 1.

5.06 Atoyac River Museum / Memorial: A Communication and Education Strategy for Socio-Environmental Conflicts

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The socio-environmental situation that exists in some regions of Latin America requires communication and education strategies according to the reality of the most vulnerable communities, in which knowledge is exchanged between scientists, educators, communities and policy makers. For 20 years a group of civil organizations and researchers have worked in rural communities of Tlaxcala, near the Atoyac River, finding serious effects on human health (leukemia, kidney failure, etc.) and environmental health (loss of ecosystems) due to exposure to Volatile Organic Compounds (VOC), Polycyclic Aromatic Hydrocarbons (PAH) and metals present in the area, in addition, the group determined that the perception of the children of these communities about the risks of their situation makes them vulnerable, because they do not recognize the dangers of living in an area with high levels of pollution. Based on these results, in 2019 an initiative emerged for the co-construction of communication and education strategies in and for communities in Mexico and South America facing socio-environmental crises: the Community, Sciences and Education Network (RCCE), which takes up the limitations of science teaching within basic education schools, based on the interdisciplinary and collaborative work that takes place in workshops with teachers from community schools. One year after the start of these workshops, teachers have been able to: a) use scientific tools to teach their students about the phenomena of river pollution, b) ask questions about the impact of pollution on their health, and c) make informed decisions in this regard to establish collaborative networks with civil associations in the region. With this work, the design of didactic projects with environmental themes has been promoted from an interdisciplinary perspective, between teachers and members of the RCCE and civil organizations. One of the most representative projects is the "Atoyac River Museum / Memorial" that organizes the work of teachers and students, which is presented in a virtual way and as a physical itinerant display of posters and videos, functioning as a communication bridge between school communities and other sectors of the community that present the same environmental problem. The "Museum / Memorial" has given greater visibility to the situation in the region and has opened the possibility of dialogue with decision makers.

5.07 Workshops on Alternative Methods to the Use of Animals in Toxicity Testing of Agrochemicals, for Regulatory Purposes: A Tool for Promotion and Acceptance in Latin America

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The use and acceptance of alternative methods to animal testing in regulatory studies of plant protection products in Argentina and Latin America is still limited. Currently, the legislation for the registration of these products and the regulatory authorities responsible for their authorizations, require toxicological studies carried out in animals and the acceptance of studies carried out by alternative methods is limited. In this context, it was proposed to organize an event with the aim of disseminate the existence of alternative methods available for the toxicological evaluation of plant protection products and to promote their acceptance by the regulatory authorities. In 2019, a working group was formed by representatives from academia, government and industry, interested in this subject. This group identified the workshops as an interesting tool to communicate and promote the use and acceptance of alternative methods. The first workshop was held in person at the School of Medicine of the University of Buenos Aires. The talks included referents presentation of each area and the possibility of exchanging opinions and knowledge in a round of questions and answers. Among the speakers were representatives of the Argentine regulatory authority, SENASA, academia and industry. There were more than 150 registered and 100 attendees to the event from different areas: academia, industry, government, service laboratories, and accreditation bodies. In 2020, a second workshop was broadcast online.

There were more than 500 registered and an audience greater than 200 people during the entire duration of the event. Among the speakers, there were referents from the European Union, the United States of America and Brazil, who spoke about the situation in their countries. Additionally, in a second block, representatives of the academy, the cosmetics industry and the service laboratory, shared their experiences in Argentina. Currently, the third edition is being organized to be held in November 2021, with the aim of continue generating a space for updating and exchange, and with greater scope. The workshops are a useful tool to exchange knowledge, disseminate progress and promote the acceptance of alternatives to animal testing in toxicological studies of plant protection products in Latin America, evidenced by the great interest they have had both by representatives of the industry, as from the academy and the government.

5.08 Use of Problem-Based Learning As a Teaching Tool to Raise Awareness of the Topic of Mollusc Contamination by Harmful Algae

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The harmful algae blooms (HAB) that were decades ago known as red tides have increased worldwide in number of events and virulence, aggravated, in turn, by by climate change. Certain human activities such as mariculture, depending on the sanitary conditions of the cultivated product, are strongly affected by these events. In this case, the phycotoxins produced by some microalgae species are accumulated by bivalve molluscs which, when consumed, become a risk to human health. Education plays an important role in raising awareness and creating communication networks that can assist managers who deal directly with this issue. The active methodology termed Problem Based Learning (PBL) comprises a valuable option to raise awareness among students and the general population and capacitate future Researchers and Environmental Managers to work on these challenging environmental problems, as in case of HABs. Two groups of students from Public Educational Institutions in the Região dos Lagos (Lakes Region) in the state of Rio de Janeiro were involved in a PBL methodology-based course, solving a problem concerning the harmful algae theme. The results indicate that PBL is able to promote meaningful learning on this topic and, when combined with the use of Concept Maps, was proven a promising methodology for introducing basic concepts regarding a more complex environmental theme that will promote initial training for more advanced education levels (undergraduate and graduate). In our study, reflections on the application of tutorials and related activities provided by the PBL methodology were necessary and reassess our role as process mediators within our mission as environmental educators. Therefore, in this context, PBL can be applied for different purposes, among them, the creation of scientific foundations concerning certain topics, providing a reflective environment and leading to citizen action by the social actors involved in the process.

5.09 Model for Deconstruction of the Non-Carcinogenic Risk of Metals and Metalloids in Food

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Heavy metals and metalloids are persistent and bioaccumulative pollutants, therefore, they are present in food and are toxic to human. To determine what are the allowable intake values of an element for a given human population, dietary habits constitute an issue to solve; in addition, it is necessary to establish national regulatory standards. In order to assess the acceptable limit values of element concentration for a given food, a non-traditional risk model has been developed, based on the reference dose as admissible daily intake for each contaminant, following a classical non-carcinogenic risk model in a backward sense. A characteristic annual dish must be proposed from the intake/year *per capita*, as a percentage of the total meal for each food item. Data included in the proposed dish are obtained from the national domestic consumption. Different exposure pathways have to be considered based on the human food web. Furthermore, it is necessary to characterize the diet throughout different regions in the country under assessment. Published element concentrations from different food chain are assessed and integrated in a unique annual dish, including wild animals (terrestrial and aquatic), farming animals (aquaculture, poultry and livestock), animal products, crops, processed grains and beverages. According to available data, different distribution models are suggested to be applied to assess the concentration of elements in food. Metal portion absorbed by each food web level is estimated from absorption factors published. The total annual intake of one element is calculated from the relative contribution of each diet item, considering each food chain when it is necessary. An estimation of non-carcinogenic risk could be done according to weight, age, and sex. This model could be used to

establish an acceptable maximum intake from a specific food origin, according to their element content. Besides, it is a preliminary attempt to build a model to integrate human health risks from different pollutants associated with ingesta;[1] [2] with the aim of reducing [3] uncertainties and increasing strengths, turning as a utility tool to decision makers to elaborate of guidelines values. The methodology presented was developed by the RSA-CONICET research group, contributing to establish food guidelines for metals and metalloids in the productive chain.

5.11 Spatio-Temporal Analysis of Chlorophyll in Six Araucanian Lakes of Central-South Chile From Landsat Imagery

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Chlorophyll-a (Chl-a) is an optically active compound commonly used as a proxy for phytoplankton biomass and trophic state in an aquatic system. This work aimed to analyze the spatiotemporal variation of Chl-a values in six Araucanian lakes in Central-South Chile. Here we combined in-situ Chl-a measurements and thirteen Landsat 8 satellite images to build a set of the linear and non-linear models to estimate Chl-a values in the lakes. Through the Taylor diagram, r Pearson, standard deviation, and other statistical indicators the Chl-a models were validated. A qualitative/quantitative analysis to identify the species of microalgae present in the lacustrine systems was used. Next, Chl-a estimation maps were created to understand the spatial and seasonal behavior of this variable in each aquatic ecosystem. We observed that during the Summer months the Chl-a values are higher than in the Spring months for all lakes, except in Pirehueico lake. Moreover, the Chl-a models created predict with great accuracy, the results of statistical indicators are $R2 \geq 0.94$, $IA \geq 220.80$, $RMSE \leq 0.138$ μg/L, and $MBE \leq -0.123$ μg/L. In the lake systems were found two invasive species, Ceratium hirundinella and Didymosphenia geminata, species recognized as bloom-forming in other aquatic systems. Finally, the Chl-a maps provided information on the monitoring of areas sensitive to Chl-a changes. This study is very important to conserve the water quality and early alert to forming phenomena like algal blooms which contributes to providing useful data for managers and policy-makers in Chilean lakes.

5.12 Environmental Education With Project "Municipio VerdeAzul"

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Environmental maintenance and education are extremely relevant topics for science as they are directly related to the performance of the management of the planet's natural resources and the development of sustainable alternatives for the use of these resources. Nowadays, one of the main concerns in the topic of environmental preservation is related to awareness of the population about the risks and the importance to protect the hydrography of their respective city. It is extremely important for the population to have the knowledge about the quality of the water they are consuming and what they can do to promote improvements once they have enough data to formulate opinions and discussions. Therefore, this current work provides information about the hydro graphic profile of the city of Sao Carlos, in Brazil, in order to analyze the results obtained and judge them according to seasonal environmental changes. The results obtained are shared and compared with those of other cities to set up a state ranking that promotes and serves as a basis for improving public sanitation policies, through a program that is developed in partnerships between research institutes and city governments. This program also focuses on the transmission of the results to the population, so they can be aware of the importance of hydrographic preservation. To fulfill this proposal, the project aims to collect water and analyze certain contaminants present in it, which is chosen according to the criteria proposed by CETESB, an agency of government in Brazil that is responsible for monitoring pollution. The errors of these methods are calculated as well, to provide solid and reliable information. Until now, the group already collected some data from the last research, but the purpose now is to continue the investigation of the water. By now, we found that the most significant criteria are Nitrogen Kjeldhal, pH, phosphorus and total organic carbon. The uncertainties have been calculated, which gave us high error for the analysis, however, given the actual situation of the COVID-19 pandemic in the country where this research occurs, we are still collecting data to compare and finish the work, even if it is slower than in the other years. Lastly, the work is still happening at the present time, but it's conclusion will be very important to the population and local government since it will provide resources to a better human-environmental relation.
Acknowlegments to the University of São Paulo for the scholarships to L. Figueiredo, L. Borges and L. Rossi.

6A. Aquatic Toxicology, Ecology and Stress Response

06A.01 Transgenerational Effects of Deltamethrin on Reproductive Abilities and Morphology of Chironomus Columbiensis (Diptera: Chironomidae)

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The use of pesticides triggers many response reactions in insects, including a decrease of the reproductive success and instability in the development of the species. This study evaluated the sublethal effects of Deltamethrin on reproduction (fecundity, fertility) and wing shape of *Chironomus columbiensis* over three generations. In addition, we studied the recovery of descendants of parents who had been exposed to stress by insecticide for two generations. The organisms used were laboratory-bred in three treatments: reconstituted water and two sublethal concentrations of Deltamethrin (CL_1=0.02 and CL_{10}=0.05 µg/L). Insecticide-exposed larvae (CL_1 and CL_{10}) had a 9.42% reduction in the number of eggs per spawning and changes in wing morphology. The fertility response was different, as only the CL_{10} treatment was different from its control, with a decrease of 3.34% of eggs hatched by spawning. Descendants of parents exposed to Deltamethrin had a recovery of up to 79.3% in fecundity, but two generations (without exposure to the insecticide) were not sufficient for a total recovery, unlike fertility and wing shape, where the specimens recovered 98.5% in the second generation without exposure. These results highlight that sublethal concentrations of long-term insecticides have severe effects on the biology of *C. columbiensis*, as it can affect the reproductive success and morphology of individuals over generations, on the other hand, they indicate that a proper management of insecticides (concentration and frequency of application) may be relevant for population recovery over time.

06A.02 Are Aquatic Ecosystems Contaminated With Fipronil and 2,4-D a Threat to Calanoid Copepods?

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Aquatic contamination by pesticides is a current concern worldwide since these substances are produced to eliminate undesirable organisms for agriculture. However, pesticides affect the target and the non-target organisms. Calanoid copepods are key components for aquatic ecosystems ecology, thus a direct or an indirect effect on them can trigger processes such as bottom-up/top-down. The aim of this study was to evaluate the effects of Regent 800 WG (Fipronil= F) and DMA 806 BR (2,4-D = D), isolated and in the mixture, to the abundance of Calanoid copepods stages (nauplii, copepodite, and adults), at 2, 4, 7 and 14 days after contamination using a mesocosms approach. The mesocosms were represented by tanks of 1500 L, consisting of five uncontaminated controls and three replicates of the treatments of F, D, and their mixture. The pesticide nominal concentrations were 64 µg and 452 µg of F L^{-1} and D L^{-1}, respectively. The treatments containing F presented zero abundance of Calanoid copepods, thus only D was considered in the statistical analysis, which was adjusted with mixed effect models, with Poisson distribution (fixed effects D, days, and community). For adults, the abundances decreased by all the effects, but were significant ($p< 0.05$) by the effects of days, community, the interactions between D and Days, D and community, days and community, and D, days and community; The random effect of mesocosms and days explained 0.280, and 0.065, of the variance, respectively. For copepodite, the abundances reduced by all the effects, but were significant ($p< 0.05$) by the effects of D, the interactions between D and Days, D and community, and D, days and community; The random effect of mesocosms and days explained 0.251, and 0.064, of the variance, respectively. For nauplii, the abundances shrunk by all the effects but were significant ($p< 0.05$) by the effects of D, days, the interactions between D and Days, D and community, and D, days and community. The random effect of mesocosms and days explained 0.195, and 0.011 of the variance, respectively. The contamination of F and D, isolated and in the mixture are toxic to Calanoid copepods. The D was toxic to the initial stages of copepods, but not to adults.

06A.03 Fish Male Exposure to Aluminum and Different Water Temperatures Affect Fatty Acid Seminal Profile

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The concentration of Aluminum (Al) found in some rivers, including in São Paulo (Brazil) is above that recommended by several environmental agencies. So far, this metal does not have any physiological role in vertebrates and may induce toxic and harmful effects, such as interference with metabolism and the reproduction of teleosts. Fatty acids (FAs) are important molecules in the composition of gametes since they are associated with the fluidity and structure of sperm membranes, influencing motility and fertilization capacity. This study aimed to evaluate the influence of Al and water temperature variations in the FA profile of semen of the native Brazilian species *Astyanax altiparanae*, correlating it with the seminal quality and reproductive parameters. Males were exposed to different experimental treatments, resulting from the combination of water temperature (20ºC; 25ºC), pH (neutral - 7.0; acid - 5.5), and the absence or presence of Al (0.5 mg L^{-1}). After 96 hours, the FA seminal profile was analyzed, and artificial fertilization was performed. Data were analyzed by two-way ANOVA, followed by the Holm-Sidak test. Pearson's correlation test was performed to evaluate the relationship between FA seminal profile and seminal quality variables in 10 and 30s after sperm activation (sperm motility, curvilinear velocity (VCL), average path velocity (VAP), straight-line velocity (VSL)), fertilization rate and the number of normal larvae. The percentage of polyunsaturated fatty acids (PUFA) decreased in the semen of fish exposed to neutral pH, while monounsaturated fatty

acids (MUFA) increased in all groups maintained at 20°C compared to 25°C. The exposure to Al decreased the percentage of C20:4n6 and increased the percentage of C22:5n3 (20ºC). The percentage of MUFA showed a positive correlation with VAP and VSL (10s). However, the percentages of total PUFA and omega 6 (n6) PUFA were negatively correlated with these same sperm velocities. In addition, omega 3 (n3) PUFA was positively correlated with sperm motility, while n6 PUFA and C20:4n6 were negatively correlated with VCL (10s). The fertilization rate correlated positively with MUFA and negatively with total PUFA, n6 PUFA, and C22:5n3. In conclusion, the temperature influenced the percentage of C20:4n6 and C22: 5n3 in *A. altiparanae* semen. Al exerted a more pronounced effect, influencing the composition of FAs regardless of treatment, with a consequent increase in the percentage of MUFA.

06A.04 Efecto de DOS Insecticidas Formulados con las Diamidas Antralitricas Clorantraniliprole y Cyantraniliprole Sobre la Metamorfosis del Sapo Rhinella arenarum

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Las diamidas antralitricas son una familia de insecticidas catalogados como novedosos. El objetivo del presente trabajo fue determinar el efecto sobre la metamorfosis de los formulados comerciales Coragen y Fortenza semillero, los cuales contienen 20% de clorantraniliprole y 60% de cyantraniliprole respectivamente en renacuajos del sapo *Rhinella arenarum*. Los ensayos se realizaron por separado para cada insecticida, se expusieron renacuajos en el estadio 27 hasta completar la metamorfosis, en un sistema semiestatico a concentraciones ambientalmente relevantes de 5, 50, 500 y 5000 µ / L de clorantraniliprole y cyantraniliprole. El efecto en el desarrollo de la metamorfosis se determinó evaluando el tiempo necesario para que el 50% de los individuos alcanzaran el estadio 39, el estadio 42 o que completaran la metamorfosis. El efecto de las diamidas antralitricas en estudio sobre los tiempos de la metamorfosis se evidenciaron desde el estadio 39. El tiempo requerido para que la mitad de los individuos alcanzaran el estadio 39 diferencias significativas entre todos los tratamientos y el grupo control en los renacuajos expuestos a cyantraniliprole, los organismos expuestos a las concentraciones 5 y 5000 µ / L requirieron de menos días mientras que los expuestos a las concentraciones 50 y 500 µ / L requirieron de más días para alcanzar el estadio; en el caso de clorantraniliprole solo se encontraron diferencias significativas entre el grupo control y las concentraciones 5 y 500 µ / L, estos requirieron más días para alcanzar el estadio 39. El avance en el desarrollo en los renacuajos consiguió registrar en el caso de cyantraniliprole diferencias significativas entre el control del grupo y los renacuajos expuestos a 50 µ / L los cuales requirieron de más para alcanzar el estadio 42 y finalizar el proceso metamórfico; en el caso de clorantraniliprole se pudo registrar que los renacuajos expuestos a 50 y 500 µ / L presentaron una aceleración respecto el grupo control tanto para alcanzar el estadio 42 como para la finalización del proceso metamórfico, a diferencia de los individuos expuestos a 5 y 5000 µ / L los cuales requirieron más días para alcanzar el estadio 42 y finalizar la metamorfosis. Estos resultados tanto para cyantraniliprole como para clorantraniliprole se expresaron de manera no monotónica, es decir que el efecto presento una relación dosis respuesta en forma de “U”.

06A.05 Acute and Chronic Ecotoxicological Effects of Drugs on the Neotropical Cladoceran Ceriodaphnia silvestrii

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The identification of drugs in surface freshwaters has generated concerns about their potential toxic effects on the aquatic biota. In this study we evaluated the acute (immobility) and chronic (reproduction) effects of the drugs caffeine, diclofenac sodium salt, ketoprofen, paracetamol and salicylic acid on the **neotropical** cladoceran *Ceriodaphnia silvestrii*. Acute (48h) and chronic (8 days) toxicity tests were performed for each drug following the procedures recommended by the ABNT (Brazilian Association of Technical Standards) NBR 12713:2016 and ABNT NBR 13373:2017, respectively. The results of the acute exposures showed the difference in the sensitivity of *C. silvestrii* to the drugs as follows: salicylic acid (EC_{50} = 69.15 mg/L) < caffeine (EC_{50} = 45.94 mg/L) < paracetamol (EC_{50} = 34.49 mg/L) < ketoprofen (EC_{50} = 24.84 mg/L) < diclofenac sodium salt (EC_{50} = 14.59 mg/L). Chronic toxicity data showed negative effects of the drugs ketoprofen, paracetamol and salicylic acid on reproduction. Ketoprofen caused total inhibition in fecundity at 5 mg/L. The LOEC (lowest observed effect concentration), NOEC (no observed effect concentration) and EC_{50} (8 days) values were 2.5 mg/L, 1.25 mg/L and 1.94 mg/L, respectively. Paracetamol caused reduction in fecundity in concentrations starting from 10 mg/L (LOEC), and the NOEC and EC_{50} (8 days) values recorded were 5 mg/L and 8.19 mg/L, respectively. The LOEC, NOEC and EC_{50} (8 days) values obtained for the salicylic acid were 35 mg/L, 25 mg/L and 42.9 mg/L, respectively. No reproductive effect was observed in the concentrations tested for the drugs caffeine and diclofenac sodium salt. Thus, it was not possible to determine the LOEC and EC_{50} (8 days) values for these drugs. The NOEC values for caffeine and diclofenac sodium salt were 32.5 mg/L and 6 mg/L, respectively. Although the concentrations of the drugs that showed a toxic effect on *C. silvestrii* are still above the detected in the aquatic environment, long-term exposures and the evaluation of other endpoints, may result in potential environmental risks, therefore, they need to be studied. This knowledge is important, as up to now there are neither established limit values or guidelines to control the elimination of drugs in freshwater in Brazil and other countries in tropical regions.

06A.07 Genotoxic Potential of Water From the Main Urban River of Cochabamba (Rocha River), Bolivia, Determined With Four-Eyed Frog (Pleurodema cinereum)

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Nowadays, worldwide urban river ecosystems are affected by complex mixes of organic and inorganic pollutants linked to the activities present around the waterbodies. Therefore, the changes of these ecosystems alter the environmental services of the urban rivers. In Bolivia the uncontrolled wastewater and solid waste management leads to severe impact on water quality and indeed on the aquatic ecosystems. In the foothills of the Andes, the Rocha River in Cochabamba, is one of the most polluted rivers of Bolivia, receiving untreated and partially treated domestic, industrial, and agricultural wastewaters from all the

metropolitan axis. Previous studies identified high levels of bioavailable metals, hydrophilic pesticides and microplastics in the water that could affect the river ecosystem. Amphibians are a regulatory component of these aquatic ecosystems. Their physiology and their development in two different environments make these organisms vulnerable to water quality changes and, thus, are good bioindicators of water pollution. The four-eyed frog (*Pleurodema cinereum*) was commonly found around the Rocha River but, in the last decades, its abundance decreased drastically. The current study investigated the effects of the Rocha River water on the development of *P. cinereum*. Eggs from a non-contaminated area were collected and then were exposed to water from different contaminated points of the Rocha River. To evaluate the effects of the water on the amphibian development, different comparison parameters were evaluated such as morphometric data by Gosner stage, time to metamorphosis, mobility, congenital anomalies, and micronucleus count. The morphometric data of the tadpoles are correlated to the nutrient and organic matter contents of the water samples, more than pollutant contents. However, the metamorphosis of the tadpoles in the river water was delayed compared to the control. Congenital malformations as polydactylism, syndactylism or bone malformations were registered in higher percentages compared to the control. Finally, the number of micronuclei in frog blood highlighted damages at the genetic level of the frogs exposed to the Rocha River water. The genotoxic risk of the Rocha River water, identified with these amphibians, could be linked principally to the high toxic metal contents. Finally, *P. cinereum* fulfills the requirements to be used as a bioindicator of genotoxic risk of natural superficial water in Bolivia.

06A.08 Metal Bioaccumulation in Fish Exposed to Atmospheric Particulate Material Released From Steel Industries

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The occurrence of atmospheric particulate matter APM) containing metals and metallic nanoparticles has increased in the world, causing environment contamination. In the southeast region of Brazil, APM from steel industries has contaminated aquatic environment. This study evaluated the bioaccumulation pattern of metals contained in APM released by steel industries in *Oreochromis niloticus*. APM was collected in Vitória's bay, Espírito Santo state, Brazil, and *O. niloticus* were exposed to 1 g APM L^{-1}) in a semi-static system, for 30 d. The metal profile of APM was analyzed and, water sampling and fish were collected every three days for water physicochemical variables analyses, metal chemical profiling of the dissolved metals e fish metal bioaccumulation in the viscera and fillet. Metallothionein and histopathology were analyzed in the gills. For the multi-element analysis, the samples were acid digested and the concentration of metals determined by ICP-MS (Inductively coupled plasma mass spectrometry). The following metals were identified and quantified: B, Al, V, Cr, Mn, Fe, Ni, Cu, Zn, As, Se, Rb, Sr, Ag, Cd, Pb, Hg, Ba, Bi, W, Ti, Zr, Y, La, Nb, Ce in the APM. Six metals (Cu, Fe, Al, Zn, Mn, Pb) were analyzed in the fish's viscera and fillet due to have high concentration in APM and limits determined by Brazilian and USA legislation. The concentration of Cu in water was higher than the limits established for freshwater from day 3 to 24. The concentration of Fe was higher from day 3 to 12, Al concentration was higher on all days, except on the 18th day. The determined bioconcentration factor (BCF) was >1 for all metals analyzed, confirming their bioaccumulation in tilapia. Metals as Al, Fe, Mn and Pb showed similar accumulation patterns with significant increase concentration in the first days until reaching a peak, followed by the subsequent decrease. Cu and Zn showed different bioaccumulation pattern with several peaks and persistence high concentration throughout the exposure. There was preferential bioaccumulation of those metals in the viscera compared to the fillet. The histopathological analyses and metallothionein concentration in the gills were unchanged after exposure to MPA. Exposure to higher concentrations of MPAS may trigger more severe responses. The metal bioaccumulation pattern was characterized by initial high increasing with subsequent decreasing, except for Cu and Zn which were persistent in the organism. Financial support: FAPESP Proc. 2019/08491-0, 2016/24257-2; CNPq Proc. 306818/2020-5

06A.09 Hepatotoxicity in Neotropical Catfish Rhamdia quelen Exposed to Ciprofloxacin

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The increase of antibiotics in aquatic ecosystems is a challenge due to the adverse effects as bacteria resistance and toxicity to non-target organisms, as fishes. Ciprofloxacin (fluoroquinolone class) is among the antibiotics commonly detected in water worldwide. Thus, this work aimed to evaluate the hepatotoxicity of ciprofloxacin in the Neotropical catfish *Rhamdia quelen*, a biological model that has been used for ecotoxicological pharmaceuticals studies. Therefore, the fish were exposed in a static bioassay at concentrations: 0 (control), 1, 10 and 100 µg/L of ciprofloxacin. After 96 hours, the fish were anesthetized and after euthanasia the liver was collected for genotoxicity, biochemical (Ethoxyresorufin-O-deethylase – EROD; superoxide dismutase – SOD; catalase – CAT; glutathione peroxidase – GPx; lipoperoxidation – LPO) and histopathological biomarkers analysis. The data were processed and it was considered significant differences when $p \leq 0.05$. Exposure to ciprofloxacin did not cause any mortality. However, the antibiotic caused genotoxicity to all concentrations tested, due to the significant increase in DNA damage, when compared to control group. The biochemical biomarkers showed an increase in the EROD activity at 10 µg/L; GPx and SOD at 100 µg/L and; CAT at 10 and 100 µg/L of ciprofloxacin. No changes were found for the LPO levels, which can be related to the activation of antioxidant system that can protect the membrane damage. Therefore, histopathological damage as great amount of leukocyte infiltration and necrosis were observed at 100 µg/L and higher numbers of pyknotic nuclei were observed at 10 and 100 µg/L, when compared to the control group. Ciprofloxacin caused genotoxicity and irreversible histopathological alterations, such as necrosis, demonstrated that can cause hepatotoxicity, even in short-term exposure and at low concentrations. Despite the activation of antioxidant systems, the higher incidence of genotoxicity and histopathology damages observed can be related to the action mechanism of ciprofloxacin. These antibiotic act by inhibiting DNA gyrase and topoisomerase IV, which can corroborate to breaks of DNA. Although its expected action is in prokaryotes, data indicate that

fluoroquinolone can interfere in fish DNA replication, generating toxicity. Therefore, the presence of these antibiotics in the aquatic environment demands the attention and surveillance due to the possible adverse effects to non-target organisms.

06A.10 Specific and Concentration Depending Transcriptomic Responses of Antarctic Clam Laternula Elliptica to Nanoparticles Exposures

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The Antarctic clam *Laternula elliptica* is a key species in the bentho-pelagic carbon flux on coastal areas, filtering sedimentary particles and planktonic organisms from the sediment-water interface. For these feeding features, *L. elliptica* may be affected negatively in case of marine pollution. Micro and Nanoplastics, and other nanomaterials as Nano Metal-Oxides, have been classified as "contaminants of emerging concern". Despite the isolated and almost pristine region, the Southern Ocean could present nanoplastic and nanometals pollution probably resulting for transporting from other regions and increasing anthropic activities. The current study raises the question of the consequences of single and combinate exposures to nano-polystyrene and nano-titanium-dioxide on *L. Elliptica* gene expression. To test the effect of these pollutants, genome-wide gene expression comparisons (RNA-seq) were performed between control and exposed *L. Elliptica* individuals. Single and combined exposure at realistic concentrations (5 and 50 µg/L) after 4-days produced alterations of transcripts potentially implicated in Shell biomineralization, neurotransmitter, mechanosensory, apoptosis, HSP, antioxidants and xenobiotic metabolism. We will test these transcripts as biomarkers of nanoparticles exposure with a gene target approach using a larger number of clam samples. Also, we will study lipid and protein damage by oxidative stress, detection of apoptotic cells and oxygen consumption to determine biochemical, cellular and physiological effect of nanoparticle pollution.

06A.11 Gonadal Histology of Leptodactylus Latrans (Anura, Amphibia) Males Inhabiting Areas Impacted by Sewage Effluents

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It is known that different anthropogenic compounds present in sewage effluents affect amphibian reproduction at different levels. It has been demonstrated by our group that some *Leptodactylus latrans* males inhabiting areas impacted by sewage effluents present secondary sex characteristics resembling those of females. In this context, the aim of this work was to evaluate the if gonadal structure was also affected. Frogs were collected from two sites were these animals normally reproduce in Buenos Aires province (Argentina): Site 1 is characterized by temporal water bodies, used for cattle grazing, with no evident presence of sewage effluents; and Site 2 is clearly affected by sewage effluent downloading in its water bodies. Adult males of this species were collected in both places. Once in the laboratory, everyone was anesthetized, weighed, snout to vent length measured and their gonads were extracted for analysis. Body condition index (relationship between weight and individual volume, snout to vent cubed), and gonadosomatic index (gonadal weight/individual weight x 100) were calculated. Then, testes were fixed, dehydrated, and embedded in paraffin for histological analysis. Each gonad was transversally sectioned at 6 µm and stained with hematoxylin-eosin. Testes cells were classified according to their maturation stage in early stages spermatogenic cells (including primary and secondary spermatogonia, and primary and secondary spermatocytes) and spermatogenic cells at later stages (primary and secondary spermatids and spermatozoa joined to Sertoli cells) and the numbers of cysts with spermatogenic cells at early or late phases were counted. Significance tests (U Mann-Whitney and t test) were made to compare final points between both areas. Of all measured parameters, only snout-vent-length and gonadosomatic index showed differences between places (α=0.05). Individuals from place 2 had a greater snout-vent-length but their gonads were smaller. Our results showed that even if there were morphological differences suggesting that males were affected by the environment, leading to a phenotype "feminization", no effects were observed at the gonadal histology. Some more studies are necessary to evaluated if serum androgen level and estradiol/androgens ratio are affected in these males.

06A.12 Environmental Concentrations of Copper Affect Photosynthesis, but Not the Growth of Microalgae Kirchneriella contorta

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Microalgae play an important role as primary producers in aquatic environments. They are photosynthetic organisms, participating in the fixation of atmospheric CO_2, and in energy flow of the community. They respond to environmental contaminants and due to their physiological plasticity they can thrive in dealing with low level stresses. In the last decades, intensified environmental contamination by anthropogenic activities that includes metals has been shown in literature. Copper is an essential micronutrient for microalgae and participates in the photosynthetic process. However, in excess, it can be toxic. Studies that assess the impact of copper concentrations in microalgae are many, but those that evaluate environmental concentrations of the metal in photosynthesis are scarce. In this study, we investigated the photosynthesis of the freshwater microalgae *Kirchneriella contorta* in environmental concentrations of copper. To do this, the cell were firstly grown in a wide range of copper concentrations (nominal copper $4x10^{-8}$ to $9x10^{-4}$ $molL^{-1}$) to be able to select those that did not affect growth rate (free copper $1.6x10^{-9}$ to $9.6x10^{-8}$ $molL^{-1}$), in comparison to the control. Thus, here environmental copper concentrations are defined as those in which no change in the algae growth rate is obtained. The photosynthetic process (PAM fluorometry) was further studied at these low copper values and the following parameters were determined: photosynthetic quantum yields (maximum and effective), photochemical (qP) and non photochemical quenchings (NPQ). In addition, cell density and growth rates were determined. The results showed that the cells ability to devide remained similar

regardless of copper concentrations, but the photosynthetic apparatus was sensitive to changes in the concentration of copper. There was an increase in nonphotochemical quenching in cells exposed to $1.4x10^{-8}$ - $9.6x10^{-8}$ mol L^{-1} of free Cu^{2+}. Since NPQ is a protective mechanism, under the low copper concentrations, it was enough to help the cells overcome copper stress, thereby, keeping photosynthetic yields similar to the control. From the present research, we can hypothesize that a cell that is dissipating some energy which otherwise would be directed to phosotynthesis and organic synthesis, would be susceptible to envitonmenntal variations that occur in natural ecosystems. Eventually this could in a more adverse environmental condition, affect phytoplankton based food chains.

06A.13 Evaluation of the Effects of Free-Copper Ions on the Physiology and Biochemistry of Freshwater Microalgae Kirchneriella aperta

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Copper is essential to microalgae and important in metabolic routes whereby it acts as enzyme cofactor, playing important role in the metabolism of phytoplankton that is responsible for more than half of the primary production in aquatic environments. However, in concentrations above those required, copper can interfere with the physiology of these organisms. This study aimed at analyzing the effects of sublethal copper concentrations in the physiology and biochemical composition of the freshwater microalgae *Kirchneriella aperta*. To perform this study, *K. aperta* was grown in a cylindrical bioreactor containing 2 L of BG-11 culture medium and an initial inoculum of 10^5 cells mL^{-1}. The tested copper concentrations were $7x10^{-10}$, $1.8x10^{-9}$, and $3.3x10^{-9}$ mol L^{-1} free Cu ions, in addition to the control, all in triplicates. The cultures were monitored by analyzing cell abundance and photosynthetic efficiency using a PAM fluorometer. Exponentially growing cells were analyzed for, photosynthetic electron transport rate (ETR), CO_2 fixation, effective yield (Φ'_M), and energy dissipation (qP and NPQ), total carbohydrates, total proteins, and pigments (chlorophyll *a* and total carotenoids). The results showed that copper concentrations did not affect cell density/growth rate or dry biomass yield of *K. aperta*, but affected the concentration of pigments and total proteins. Regarding the pigments, we observed a greater accumulation of chlorophyll *a* compared to the control. However, total carotenoids decreased with copper increase in the culture medium. Even though photosynthetic pigments were affected by the copper concentrations tested, the photosynthetic parameters were not. Consequently, inorganic carbon fixation estimates were not affected. The copper concentrations tested interfered with protein synthesis, but not with intracellular carbohydrates. A higher concentration of proteins in cells exposed to the highest copper concentration in comparison to the control. This study showed that free copper ions in environmentally relevant concentrations were sufficient to alter the concentration of proteins and pigments, but did not cause significant differences in growth rates and photosynthesis of *Kirchneriella aperta*. From the present research, we rationale that by affecting the composition of biomolecules on microalgae, environmental copper levels may interfere in higher trophic levels, as microalgae are the base of food chains in aquatic ecosystems.

06A.14 Fish Renal Antioxidant Imbalance and Genotoxicity Induced by Environmental Concentrations of Ciprofloxacin

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Ciprofloxacin (CIP) is an antimicrobial, of the fluoroquinolone class, it is a stable molecule that results in its accumulation in aquatic environments. The risks of antimicrobial residues in the environment were recently reported as a priority research for the one health context. This study evaluated biochemical and genotoxicity biomarkers in the kidney of *Rhandia quelen* after subchronic exposure (28 days) to environmental concentrations of ciprofloxacin. We hypothesized that exposure of fish to environmental concentrations of CIP causes oxidative stress and kidney genotoxicity. The concentrations of CIP were chosen considering a literature review of the presence of CIP residues in two different scenarios: I) in surface waters (1µg/L), and II) in effluents from hospitals (10 µg/L) and pharmaceutical industries (100 µg/L). The biochemical biomarkers measured were superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), glutathione S-transferase (GST), thiol/non-protein glutathione (GSH), and lipoperoxidation (LPO) concentrations. In addition, the level of DNA damage was measured using the comet assay, besides the assessment of apoptosis and renal necrosis processes. The CIP concentrations during the bioassay remained constant, with values of 0.0 (group control), 0.96± 0.02 (group 1 µg/L), 9.34±1.15 (group 10µg/L), 93.85±7.9 (group 100µg/L). The results showed changes in the renal antioxidants systems and genotoxicity. Exposure to 100 µg/L of CIP significantly increased the activity of SOD (68.67%) and GPx (87.90%), but inhibited the activity of GST (24.13%), when compared to the control group. These enzymatic changes were sufficient to prevent lipid peroxidation. However, it was still possible to observe renal cell necrosis ($p = 0.0146$). Instead of this concentration, the fish exposed to 1 µg/L of CIP significantly increased LPO (72.60%), which can be explained by a significant inhibition of CAT activity (30.33%), when compared to the control group. This oxidative stress explains the results of the comet assay that revealed damage to the genetic material of the animals in this group ($p = 0.0063$). The results suggest that exposure to environmental concentrations of ciprofloxacin caused an imbalance of the antioxidant system in the renal tissue of *R. quelen*. CIP presents in the water can change the physiological state of fish, even in short-term exposures and at low concentrations, and can be a risk to animals, the environment, and human health.

06A.15 Design of a Protocol to Evaluate Effects of Microplastic Particles in Cladocerans

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Microplastic (MP) contamination is considered a growing problem in terms of its production and observed impacts on various organisms. In this sense, numerous studies have provided information on the behavior and effects of MPs in aquatic biota, however, there are shortcomings in terms of the methodology applied and differences related to the use of surfactants and the modality (static or dynamic) used in each study. This work focuses on the design of a protocol to evaluate the effects of polyethylene (PE) MP on *Dapnia magna* and to provide evidence on the acute (mortality-48h) and chronic (life cycle- 21 days) impact of different sizes of MPs (1-5, 27-32, 45-53 and 212-250 µm). First, the use of tween 20 surfactant (0.1 and 0.05% v / v) and the static and dynamic study modalities (Twist Shaker TW3 (FINEPCR), VWR Shaker model 3500 and Silogex MS-M-S10) were evaluated. Neonates,

juveniles and adults were exposed to increasing concentrations of MPs including actual concentrations reported for the aquatic environment. Results indicated that the use of Tween 20 (0.1% v / v) is essential for particles between 45-53 and 212-250 µm, its use being optional in smaller sizes; while the static mode was the most appropriate for all the particles. An EC50 was established for each size of MP and significant differences ($p < 0.05$) were observed in the mortality of juveniles exposed to MP in the range 1-5 µm compared to the control, and significant differences between the results observed between neonates , juveniles and adults ($p< 0.05$). Particles of 1-5 and 27-32 µm significantly affected the life cycle of *D. magna* ($p < 0.05$), reducing the number of offspring compared to the control. Although all the MP studied except 212-250 µm were ingested by *D. magna*, only those of 1-5 µm caused the death of the organisms. Finally, the effect of the MP in cladocerans would depend on the concentration of particles, the exposure time, the size of the organisms and above all the size of the particle studied. This work is an important contribution to future research evaluating the adverse effects produced by MP, demonstrating that these emerging pollutants are effectively ingested by cladocerans, being able to transfer these particles to higher-level organisms and produce a negative impact on the trophic chain.

06A.16 Glyphosate and Arsenic Genotoxicity Studies in a Native Fish

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Arsenic (As) is a metalloid widely distributed throughout the Pampasic region. Glyphosate(Gli) is the active ingredient of Roundop® an agrotoxic used in crops in Argentina, where environmental As and Gli concentrations are higher than those established by current legislation. Exposure to this xenobiotics has been shown, to cause harm to aquatic animals but few studies have evaluated in mixtures both pollutants. The aim of this study was evaluates the genotoxic effect of both, As and Gli, in a native fish, Cnesterodon decemmaculatus. The Micronucleus (MN) and Nuclear Aberrations (AN) test, and the Comet Assay (CA) are genotoxicity biomarkers that indicate the level of DNA damage. In this study, an acute exposure test (96 hours) was carried out in glass fish aquaria in a culture chamber with an acclimatization period of two weeks. Adults animals both sexes obtained from laboratory culture were used and they were distributed in the following treatments in triplicate: 0.5 mg As (III)/ L + Moderately Hard Water (MHW), 10 mg Gli/ L+ MHW, 0.5 mg As (III)/ L +10 mg Gli/ L + MHW, Negative control (CN - MHW), Positive Control for genotoxicity (PC - 10 mg cyclophosphamide/ L) + MHW. The data were analyzed by one-way ANOVA or Kruskal Wallis with Tukey or Dunn's posterior test using Infostat software. 1500 cells were counted per sample and the amount of MN and NAwere recorded, classifying them as: notch, cutout, peanut, lobed, twinned, buds and double nucleus. Regarding the MN frequency, no significant differences were observed. For AN, a significant increase (+100%) was observed in all treatments with respect to NC. In the CA, types of damage (0 + I, without damage, II moderate damage, III damage and IV severe damage) were counted every 100 cells per individual; the Genomic Damage Index (GDI)was calculated and it was observed that there was an increase (+100%) in all treatments with respect to CN, being significant for the concentrations of Gli, CP and the mixture of contaminants (As + Gli). The percentage of cells with severe damage also increases in the case of the mixture. The fish exposed to As showed a higher percentage of grade II nucleoids while those exposed to Gli showed a higher percentage of grade III nucleoids. Animals in the wild are constantly exposed to a mixtures of pollutants. Our preliminary results highlight the importance of evaluating both contaminants in a native species used as a test organism for monitoring.

06A.17 Drugs Widely Used to "Treat" COVID-19 Patients Are Toxic to Artemia Sp.

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In the end of December 2019, a new coronavirus was identified as responsible for a severe acute respiratory disease, named COVID-19. It rapidly spread across the world and on January 30th 2020, the World Health Organization (WHO) declared a public health emergency of international concern. Since then, millions of people were infected around the world and more than 3.73 million died. COVID-19 was a new disease and since the beginning, there were no known effective medicines to treat the infected people. Lately it was evidenced that some anti-inflammatory and antiplatelet agents and anticoagulants could have a positive impact on the reduction of the severity in some patients. However, in some countries, the main governs strongly recommended the administration of ineffective drugs. As a result of the use of these recommended and not recommended drugs, it could be expected a higher input in the sewage systems and in the environment. In this study, we assessed the toxicity of two recommended (Loratadine and Betamethasone) and three not recommended drugs (Ivermectin, Hydroxichloroquine and Nitaxozanide) for COVID-19 on the brine shrimp *Artemia* sp. The drugs were diluted in water or acetone and 4 concentrations were prepared for each substance, plus the negative controls. The acute toxicity tests followed the international protocols for the species. Hydroxichloroquine did not cause acute toxic to *Artemia* sp., while Ivermectin, Nitaxozanide, Loratadine, and Betamethasone caused acute toxicity in all the tested concentrations. Our results show that an additional charge of these pharmaceuticals in sewage may potentially increase their environmental concentrations and consequently cause toxicity to the aquatic biota; this might be more concerning in those countries where sanitation systems are incipient and estimulated the administration of not recommended drugs. Further investigations are required to quantify the environmental concentrations and assess the environmental risks of drugs used to treat COVID-19 patients around the world.

06A.18 Toxicity Assessment of Anthracene and Oleic Acid-Coated Magnetite Nanoparticles to Embryos and Larvae of Rhinella arenarum

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One of the main economic activities of the northern patagonic region in Argentina is oil and gas production, and polycyclic aromatic hydrocarbons (PAH) are consequently generated as pollutants. Oleic acid-coated magnetite nanoparticles (OA-NP) have been developed for use in the remediation process of PAH. The purpose of this work was to assess the toxicity of both anthracene (Ant; as representative of PAH) and OA-NP to a native amphibian species at its embryonic and larval developmental stages. *Rhinella arenarum* embryos were collected from the wild and maintained in laboratory facilities until they reached the

appropriate developmental stage to be subjected to the tests. Individuals were exposed to different concentrations of Ant and OA-NP to establish toxicological parameters. Each concentration was tested by triplicate and each exposure was repeated at least three times. 72 h embryos and 10 days-old larvae were exposed for 96 h in modified Amphitox medium (containing a final concentration of 0,1% v/v of acetone) in static conditions, keeping a ratio of 10 individuals in 100 mL of medium. Mortality and malformations were assessed daily. A logistic model was adjusted to mortality data by non-linear regression and the toxicological parameters LC50, LC10 and LC1 were calculated. Anthracene was toxic for both embryos and larvae. For embryos, the toxicological parameters calculated were: LC50-96h: 4.65 ± 0.15 mg/L; LC1: 2.08 mg/L; LC10: 3.16 mg/L. Toxicological parameters for larvae were: LC50: 4.85 ± 0.13 mg/L; LC1: 2.85 mg/L; LC10: 3.76 mg/L. Individuals exposed to Ant showed malformations such as edema, caudal fin folds, blistering and lacerations. OA-NP were neither toxic nor teratogenic to embryos and larvae in concentrations up to 10 mg/L. Both embryos and larvae ingested the OA-NP, which were detected in feces. Anthracene toxicity was similar for both embryos and larvae of *R. arenarum*, while OA-NP displayed low apparent toxicity. Preliminary analyses on oxidative stress showed no significant effects. Experiments to evaluate the toxicity of the combination between Ant and OA-NP will be carried out, and sublethal exposures will be conducted to assess the impact of Ant, OA-NP and their combination at the biochemical and molecular levels in *R. arenarum* embryos and larvae.

06A.19 Effects of UV Filter Benzophenone-3 and Temperature on Hemocytes Condition of the Yellow Clam Amarilladesma mactroides

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Benzophenone-3 (BP3) is widely present in sunscreens used to protect human skin from UV radiation. This chemical is reaching coastal regions and have been detected in water, sediment and marine biota. Its low degradation rate and high lipophilicity contribute to BP3 bioaccumulation and toxicity. In addition to BP3 contamination, increasing in temperature, as a consequence of the global warming, is another factor that is impacting the ecosystems and may affect bioavailability of chemical compounds and their toxicity. In this sense, it is estimated that ocean temperature will increase by approximately 4.3 °C at 2100. This can affect biochemical reactions and physiology of organisms, including the ability detoxification. Thus, this study investigated if exposure to BP3 and high temperature affect viability and reactive oxygen species (ROS) levels in the hemocytes of the yellow clam *Amarilladesma mactroides.* Animals collected in Southern Brazil were exposed to BP3 at 1 µg/L, an environmental relevant concentration, for 96 h at the 20 °C and 24.3 °C. They were previously acclimated (15 days) to both experimental temperatures. Control groups, without BP3, were conducted for both temperatures. At the end of exposure time, hemolymph was punctured and the hemocytes were separated by centrifugation. Then, ROS was quantified, and cell viability was analyzed through the neutral red assay in microplate. Results showed an increase in ROS levels in the treatment with 1 µg/L of BP3 at 24.3 °C compared to the other experimental conditions. An increase in the viability of hemocytes was also observed for the same treatment. These results may be related to an increase of immune response or may indicate cellular stress caused by BP3 and high temperature together. As the hemocytes play a fundamental role in the defense system of invertebrates, it is noteworthy that a change in their condition can influence the resilience of yellow clams in impacted environments.

06A.20 Aproximación Ecotoxicológica en Peces Nativos de una Cuenca Andina: Río Garagoa (Boyacá, Colombia)

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Los peces son organismos vertebrados muy importantes para la seguridad alimentaria, desempeñan un papel fundamental en los procesos de transferencia de materia y energía entre los sistemas terrestres y acuáticos hacia otros grupos faunísticos, como eslabón en las redes tróficas. Los riachuelos (cuerpos de agua de baja magnitud, orden 1 a 3) presentan ictiofauna de pequeño porte, utilizados como carnada y también para consumo. Estas especies podrían ser más sensibles al efecto de los tóxicos, por lo cual cualquier incidencia negativa, además de alterar la dinámica y función del ecosistema acuático, podría repercutir en la productividad pesquera de ríos de orden mayor, no sólo porque se modificarían los eslabones de la red trófica en el continuo del río, sino también por la biomagnificación de contaminantes. En el departamento de Boyacá (Colombia), existen diferentes actividades conflictivas que afectan negativamente la biota acuática, sin embargo, aún no se tienen datos de línea base sobre contaminación por sustancias tóxicas en subcuencas afectadas por actividad minera, agropecuaria y asentamientos urbanos. Este proyecto indaga en particular sobre los niveles de mercurio y arsénico, en el agua y en la ictiofauna de la cuenca del río Garagoa, afectada por actividad minera de carbón y esmeraldas, además se analizarán cambios histológicos en peces por la contaminación acuática. El Hg y As son considerados desreguladores endocrinos que alteran la producción, liberación, transporte, metabolismo, unión o eliminación de las hormonas responsables de la homeostasis e interfieren en la regulación de los procesos de desarrollo embrionario de la fauna acuática. Así mismo, pueden alterar procesos fisiológicos esenciales que inciden en el crecimiento, la respuesta al estrés y la reproducción. Se incluirá además la participación de los ciudadanos del área de estudio en el reconocimiento de esta riqueza íctica poco conocida, sus usos, los riesgos químicos y en la construcción de la co-gestión comunitaria para restaurar y conservar los ecosistemas acuáticos. Este trabajo es pionero en la ecotoxicología de peces de ambientes acuáticos de los Andes Nororientales, importante centro de endemismos neotropical, y busca resaltar la necesidad de proponer medidas de conservación acordes con su importancia biogeográfica.

06A.21 Evaluation of the Toxicity of Sediments From a Feedlot Influenced Area Located in Northeastern Buenos Aires (Argentina) by Bioassays With Hyalella curvispina

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Intensive animal production of the feedlot type has spread in the Pampas region of Argentina. These activities can act as point sources of contamination if they are not properly designed and managed. The generation of large amounts of manure and its decomposition, releases, among other elements, nutrients that can infiltrate, or be transported by runoff and reach water courses where they can be captured by bottom sediments. A useful bioanalytical tool for diagnosing ecosystems is sediment toxicity bioassays. The aim of the study was to evaluate the toxicity of sediment samples from water courses in an area with present feedlot activity using *Hyallela curvispina*, a representative species of aquatic ecosystems of the neotropics. The study area is in a sub-basin of the El Pescado stream, northeast of the province of Buenos Aires, where a feedlot has been active since 2014. Four sediment samples were collected: 1) directly from a waterway that rounds the feeding lot, 2) from a waterbody located at the perimeter of the establishment, 3) from a permanent course of the sub-basin under study located 1 km downhill, and 4) from a reference site located 30 km from the feedlot. A bioassay (10 days) was performed following standardized protocols of the American Society for Testing Materials with minor modifications, placing 100 mL of sediment samples and 175 mL of water in 500 mL glass containers. Eight replicates per sample were used with 10 juveniles of *H. curvispina*. Mortality was determined by direct observation, and growth inhibition was assessed by measuring body length after digital photograph with the ImageJ program. In addition, physicochemical measurements (hardness, alkalinity, nutrients, among others) were made, and surface runoff and land use classification through the joint analysis of digital elevation models were evaluated using geographic information system tools. Sediments from the feedlot and the perimetral area showed significantly higher toxicity ($p < 0.05$) than the other ones, which showed less than 10% mortality. The results obtained allow us to conclude that the feedlot establishment is a locally pollution source, and toxicity bioassays are an efficient tool for the evaluation of environmental pollution. Future studies will focus on taking more samples from those sites where modeling and analysis of physicochemical parameters indicate whether pollutants are reaching the sites through runoff, and determining the pollution plume.

06A.22 Comparative Analysis of the Toxicity of the Fungicide Mancozeb in Early Developmental Stages of a South American Amphibian After 24 Hours-Pulse Exposure

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After application, pesticides can reach aquatic environments causing harmful effects on non-target species such as amphibians, which are particularly threatened due to their high susceptibility to chemical contamination and insufficient conservation programs. We studied the lethal and sublethal effects (i.e malformations and behavioral changes) of 24h-pulse-exposures to a commercial formulation of the fungicide mancozeb (MCZ) 80% of active ingredient in 4 embryonic developmental stages of the South American amphibian *Rhinella arenarum*. Concentrations evaluated were 0.1, 0.5, 1, 5 and 10 mg/L MCZ. For bioassays, 10 individuals (x3) were exposed in glass Petri dishes of 10 cm Ø with 40 mL of test solution for 24h, at blastula (S.4), neural plate (S.13), muscular response (S.18), and complete operculum (S.25). As dilution medium and negative control, it was used AMPHITOX saline solution (AS). After 24h, individuals were thoroughly washed and kept in AS for up to 504h. Mortality and, morphological and behavioral alterations were recorded every day, and LC50s for 48-504h post-exposure times were estimated for each developmental stage evaluated. Results of clearance experiments showed that after 24h-pulse of MCZ its toxic effects continued after stopping pesticide exposure. After 96h, S.4 was the most sensitive stage (96h-LC50= 2.25 (1.771-2.975) mg/L) while MCZ caused similar effects for individuals exposed at S.13 and S.18 (96h-LC50= 6.63 (5.708-7.729) mg/L and 5.93 (5.081-6.919) mg/L, respectively, $p>0.05$). Otherwise, S.25 showed higher sensitivity than S.13 and S.18 (96h-LC50 = 4.72 (3.789-4.745) mg/L) but lower than S.4. As time progressed, a gradual increase in toxicity was observed for all stages. At 504h LC50 values for S.4, S18 and S.25 did not differ significantly from each other (504h-LC50 = 1.46 (1.043-2.950) mg/L, 2.45 (1.737-3.366) mg/L and 3.23 (2.572-4.165) mg/L, respectively, $p>0.05$). S.13 showed the greatest resistance since its LC50 was higher (504h-LC50= 5.59 (4.550-6.812) mg/L. MCZ also caused morphological and behavioral alterations such as edema, reduced tail length, tail flexures, and erratic swimming after 168h of purging with a high incidence in embryos exposed at S.4, S.13, and S.18. For S.25, only a low percentage exhibited tail flexures as the main sublethal effect. In conclusion, short exposures to MCZ, such as during spill events, cause persistent detrimental effects in exposed amphibian populations near agricultural fields.

06A.23 Pesticides Present in Fecaes of 3 Penguin Species From Kopaitic Island and the Antarctic Peninsula

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The Antarctica was for a long time considered as one of the last pristine environments, due to lack of industrial and agricultural operations. However, contamination is a global phenomenon and transport of pollutants to remote areas, due to their dispersal capacity, moving from warmer to colder regions of the planet is sadly a fact. Over the last decades, many organochlorine pesticides (OCP) have been continuously analyzed in almost all regions of the planet due to their toxicity to fauna, persistence in the environment and its potential to bioaccumulate and biomagnify. Pesticides were first found in fat tissues of polar bears in the Arctic and Antarctic penguins in the late 1960s. These facts pushed researchers to study environmental contamination in Antarctica over the last years, assessing the fate and distribution of many pollutants in different biotic and abiotic matrices. Seabirds are sensitive to environmental changes and are part of the highest levels of the trophic chain, they are considered among the most reliable indicators for environmental changes caused by pesticides. Penguins represent the highest bird biomass in the Southern Ocean, being a reliable indicator of

Antarctica´s ecosystem health, taking this into consideration, feaces were sampled at colonies of Adelie, Chinstrap and Gentoo penguins near the O′Higgins Antarctic Base during austral summer of 2009. Samples were taken with the utmost care to avoid stress to the penguin colonies and nesting chicks. Fresh stool samples were collected from five nests for each penguin species. The results showed the presence of eleven pesticides, with Hexachlorobenzene (HCB) present in all samples followed by DDE and HCH isomers, Methoxychlor occurring in the highest concentration only present in 5 samples. Gentoo and chinstrap penguins presented the highest concentration of pesticides, while Adélie presented de lower values, which is explained by their different diets (carbon sources) and food web position, this was also shown by the results of isotopes analysis that showed a higher position for Gentoo and a lower position for Chinstrap and Adélie and Chinstrap, that have a similar carbon source.

06A.24 Effects of Satureja Montana L. Hydrolate on Freshwater Benthic Algal Communities and Its Microbiological Impact

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Satureja montana L. , commonly called winter or mountain savory, is a bushy perennial subshrub with woody stems at the base, small linear leaves, pale pink and white flowers. *S. montana* essential oil (EO) has pharmacological properties as antimicrobial, antifungal, antioxidant, antispasmodic, antiviral and antidiarrheal. In addition, this EO shows plant protection properties, including insecticidal and fungicidal. This study focused on the aqueous extract (hydrolate) of *S. montana*. Hydrolates have been considered by-products of the hydrodistillation process when obtaining essential oils, but, recently, interesting properties, that point to possible commercial and clinical uses (such as biopesticides or synergistic combinations with antibiotics), have been discovered. However, there are not complete studies on the micro and ecotoxicity of *S. montana* hydrolates available so far. The objective of this study is to analyze the ecotoxicity of *S. montana* hydrolate in non-target aquatic organisms using natural river communities of Periphyton, a complex community composed of algae, bacteria, fungi, protozoa and invertebrates that can be used as indicators of water quality. In these tests, an artificial fluvial microcosm system was designed consisting of a series of artificial channels where river conditions are simulated. The periphyton communities were obtained in methacrylate supports from the river Gállego (tributary of the Ebro River). The following concentrations of hydrolate were incorporated to the channels: 1000, 100, 10, 1 and 0.1 mg/L. and the effect on the photosynthetic yield was measured. The dose-effect curve allowed to calculate the LC values: LC_{50}=4.79 mg/L (4.17-5.46) and LC_{10}= 0.69 mg/L (0.51-0.88) of hydrolate. Furthermore, the microbiological impact of the main components of *S. montana* aqueous extract, carvacrol and thymol, was assessed in a battery of gram-positive and gram-negative bacteria. These results help us to better understand the impact that plant hydrolates can cause to the environment and help in making decisions when giving them commercial and clinical use. *The authors thank the financial support of Gobierno de Aragón-FSE-FEDER" Construyendo Europa desde Aragón" (Grupo E39_17R y RIS3 LMP28_18) and Catedra NOVALTIA.*

06A.25 Toxicity Assessment of Acetylsalicylic Acid Using Saccharomyces cerevisiae

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Urban and industrial growth has triggered the release of toxic compounds into the environment, causing negative impacts on the population and ecosystems. Among the pollutants, pharmaceuticals have drawn attention due to potential of impacting the environment at ecological relevant concentrations. Aspirin is widely used in human medicine as an analgesic, antipyretic and in actively preventing platelet aggregation, and it is frequently detected in influent samples at relatively high concentrations. The yeast *Saccharomyces cerevisiae* consists in simple eukaryotic model, widely used for toxicity assessment. The current study aims to evaluate the toxicity of the anti-inflammatory acetylsalicylic acid (aspirin) using viability and conductometric assays. The viability assays were based on the evaluation of the number of viable cells present in a cell suspension after 1 hour exposure, while the conductometric tests were done by monitoring of changes in the specific conductivity of suspensions of *S. cerevisiae* due to inhibition of fermentation in toxic conditions after 30 minutes of exposure. The viability tests showed no reduction of viability at the evaluated concentrations (up to 100 mg L^{-1}). The conductometric assays demonstrated low sensibility of the yeast to aspirin with $EC50_{30min}$ of 815 mg L^{-1}. The results also indicated that there was no increase in the sensitivity of conductometric assays even at 6 hours of exposure. Furthermore, the acute toxicity data was compared with data obtained from *in silico* toxicity models (ECOSAR). Toxicity data collated from the software from different trophic levels showed $EC50_{96h}$, $LC50_{48h}$ and LC_{96h} of 867, 1774 and 777 mg L^{-1} for green algae, daphnid and fish, respectively, indicating low toxicity of aspirin.

06A.26 Phytoremediation Capacity of Ciprofloxacin and Sulfametoxazol in Two Free-Floating Aquatic Macrophytes

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Water contamination by antibiotics is an emerging global problem, with impacts on both public health and the environment. In view of this scenario, the development of technologies able to mitigate water contamination is urgent and phytoremediation has emerged as a good approach. Here, we evaluated the capacity of the free-floating aquatic macrophytes *Lemna minor* and *Salvinia molesta* to reclaim the antibiotics sulfametoxazol (Sulfa) and ciprofloxacin (Cipro) from water. Plants were exposed to isolate and combined environmental representative concentrations of Cipro (0 and 1.5 µg l^{-1}) and Sulfa (0 and 0.3 µg. L-1) for seven days. *S. molesta* showed higher removal capacity of Cipro (47.50%±6.7) and Sulfa (43.12%±7.20) than *L. minor* (26.97%±4.61 and 30.82%±8.89, respectively) when the antibiotics occurred alone in the water. The uptake of Cipro by plants was decreased in 5.53% and 7.38% in *L. minor* and *S. molesta*, respectively, when Sulfa was present in the water. The uptake of Sulfa, however, was not affected by the Cipro presence. Although both species reclaimed Cipro and Sulfa from water, *S. molesta* is a better option for phytoremediation programs than *L. minor*. Moreover, our data indicate that the simultaneous occurrence of different xenobionts in water can affect plant removal capacity. Therefore, it is important to consider the occurrence of various contaminants in water when evaluating the remediation capacity of plant species.

06A.27 Does the Guanitoxin-Producing Strain ITEP-024 Affect the

Health of the Fish Oreochromis niloticus (Teleostei: Cichlidae)?

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Changes in environmental conditions in aquatic ecosystems caused by anthropic actions (i.e., effluent release and aquaculture activities) can modify the composition of primary producers, promoting the excessive proliferation of cyanobacteria. These organisms can form blooms, which directly affect aquatic life (e.g., fish). Thus, the present study investigates the toxicity of the cyanobacterium *Sphaerospermopsis torques-reginae* (strain ITEP-024) producing-guanitoxin in relevant environmental concentrations. For this, specimens of *Oreochromis niloticus* (Teleostei: Cichlidae) were subjected to acute 96-hour exposure to different concentrations of aqueous extract of the strain. The fish were divided into five different treatments: C = control group; T1 = 31.25 mg L^{-1}; T2 = 62.5 mg L^{-1}; T3 = 125 mg L^{-1} and T4 = 250 mg L^{-1} of the aqueous extract of the strain. To assess toxicity, biochemical (acetylcholinesterase – AChE, catalase - CAT, superoxide dismutase - SOD, glutathione peroxidase - GPx, glutathione S-transferase - GST, thiobarbituric acid reactive substances - TBARS) biomarkers were analyzed. The results shown that fish from treatments T3 and T4 showed changes in oxidative stress (in the enzymes GST and CAT) and inhibition of the enzyme AChE. The increase in GST activity is probably a defense mechanism against the increase in the formation of reactive species and may have prevented an eventual increase in the formation of TBARS. On the other hand, the decrease in CAT may indicate an imbalance in the oxidative stress x antioxidant balance. The inhibition of AChE indicated the ability of the compounds produced by the strain ITEP-024 to cross the blood-brain barrier of fish. Therefore, our results indicate that the cyanobacterium *S. torques-reginae* producing-guanitoxin can cause damage to tilapia exposed in a condition similar to flowering in an aquatic environment.

06A.28 Explorando La Calidad De Aguas Subterráneas: Uso Del Camarón De Vega Parastacus Pugnax Como Bioindicador De Contaminación Por Metales Traza En Chile

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Los ecosistemas subterráneos y su biodiversidad representan uno de los recursos naturales menos conocidos y protegidos del planeta. En estos, la infiltración de contaminantes en el subsuelo puede ser rápida y difícil de manejar, lo que los hace particularmente vulnerables a la contaminación. En Chile, la información y metodologías para caracterizar la calidad de las aguas subterráneas es escasa, siendo necesario establecer planes de monitoreo y gestión que aseguren su calidad y uso correcto, en este contexto, la utilización de organismos como indicadores biológicos se en una herramienta relevante para evaluar y controlar la salud de los ecosistemas y el impacto de la actividad humana en estos sistemas subterráneos. El camarón de vega *Parastacus pugnax* (Decapoda: Parastacidae) (Poeppig, 1835), es un buen modelo para evaluar niveles de bioacumulación de metales traza en ecosistemas dependientes de agua subterránea y su posterior efecto en la cadena trófica y salud de las comunidades que dependen de este recurso ya que estos desarrollan todo su ciclo al interior de las galerías que construyen en el subsuelo y son de gran importancia económica para las comunidades que los extraen. En el presente estudio se compararon los niveles de bioacumulación de diversos metales traza en cuatro zonas con distinta actividad antrópica, encontrándose que los camarones presentan concentraciones de estos elementos por sobre los límites máximos establecidos en nuestro país para el consumo humano, además adsorben una gran concentración de estos elementos respecto a las concentraciones que se encuentran en el ambiente, siendo estas más elevadas en lugares con mayor actividad antrópica pudiendo representar un riesgo para la salud de las personas que los extraen y dependencia de este recurso. El camarón de vega representa una herramienta útil para el biomonitoreo ambiental de la calidad de las aguas subterráneas al representar la carga de contaminación por metales en los ambientes subterráneos en los que habita. Financiado por CRHIAM ANID / FONDAP / 15130015. El camarón de vega representa una herramienta útil para el biomonitoreo ambiental de la calidad de las aguas subterráneas al representar la carga de contaminación por metales en los ambientes subterráneos en los que habita. Financiado por CRHIAM ANID / FONDAP / 15130015. El camarón de vega representa una herramienta útil para el biomonitoreo ambiental de la calidad de las aguas subterráneas al representar la carga de contaminación por metales en los ambientes subterráneos en los que habita. Financiado por CRHIAM ANID / FONDAP / 15130015.

06A.29 Biomarkers of Oxidative Stress in Bidens Laevis for Analyzing Pollution by Current Use Pesticides in La Brava Lake (Argentina)

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La Brava lake is a protected landscape by the Provincial Agency for Sustainable Development of Buenos Aires Province (OPDS), Argentina. Despite this status, the lake is surrounded by important agricultural activities. The aim of the present study was to evaluate the pollution by current use pesticides (CUPs) in surface water of La Brava basin using biomarkers of oxidative stress in the aquatic macrophyte *Bidens laevis*. Two samplings per year were performed in Tajamar creek, one in spring and the other in summer when peak pesticides concentrations were expected. Samplings were performed for two consecutive years. Each time, macrophyte samples (n=10) for biomarkers analysis and surface water (n=3) for pesticides quantification using UPLC- MS/MS, were collected. Catalase (CAT), glutathione reductase (GR), and guaiacol peroxidase (POD) activity, as well as levels of hydrogen peroxide (H2O2) and malondialdehyde (MDA) in roots and leaves were spectrophotometrically analyzed. In the first year, in spring the herbicide glyphosate (3.5 µg/L) and the insecticide chlorpyrifos (0.7 µg/L) were detected while in summer glyphosate (2.0 µg/L), its metabolite AMPA (2.7 µg/L) and chlorpyrifos (2.4 µg/L) were detected. Leaf tissues presented higher levels of H2O2 and MDA as well as higher activities of GR but lower activity of POD in summer than in spring. Roots tissues showed higher levels of H2O2 and MDA and lower activities of CAT and POD in summer, in comparison to spring. In the second year, only chlorpyrifos in spring (3.1 µg/L) and summer (1.5 µg/L) was found. In

both analyzed tissues, higher activity of POD, lower levels of H2O2 but higher levels of MDA in summer than in spring were detected. These results show that the oxidative stress biomarkers in summer increased respect the spring, mainly the oxidative damage, according to the highest levels of CUPs detected in La Brava lake. More studies will be carried out to elucidate the direct relationship between the CUPs and the adverse effects in *B. laevis*.

06A.30 Liver Morphological Alterations Induced by Glyphosate-Based Herbicide Exposure in Zebrafish (Danio rerio)

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The increasing use of pesticides in agricultural practices around the world is alarming. In this context, Brazil is one of the largest agricultural producers in the world, using large amounts of pesticides, among them, glyphosate-based herbicides (GBH) are the most used. GBH can reach and contaminate aquatic ecosystems, causing a reduction of the environmental quality and being able to affect non-target organisms. Zebrafish is considered a vertebrate model organism widely used in different areas of research such as genetics, developmental biology and toxicology. The liver plays an important role in biotransformation and excretion of contaminants, as well as in energy reserve and metabolism, biosynthesis of proteins, carbohydrates and in the accumulation of lipids. Therefore, the hypothesis of this study is that the liver is an important target organ of toxicity of GBH. The aims of this research were to characterize the cellular toxicity of the herbicide Roundup WG® on morphology and histochemistry of adult zebrafish (*Danio rerio*) liver. Females and males were exposed to two concentrations of GBH (0.065 and 6.5 mg/L) for 15 days (n = 5 fish/sex/group). The concentration of 0.065 mg/L was based on the maximum permissible concentration of glyphosate in Brazilian waters for human drinking by CONAMA (Resolution No. 357/2005). Non-exposed fish were used as controls (n = 5 fish/sex). The procedures were approved by the UFSC Animal Use Ethics Commission (No. 5466040416/2016). Fish were euthanized and livers were removed for morphological and histochemical analyzes by light microscopy. The organ index (I_{org}) was determined based on the importance factor of each observed alteration and its frequency, which indicates the extent of damage caused by the exposure. For histochemical analyzes, liver samples were stained with Coomassie Bright Blue (proteins) and Periodic Acid-Schiff (polysaccharides) and the integrated density with IMAGE J software was calculated. Result showed for both males and females, vasodilation and vacuolization in animals exposed to the two concentration. I_{org} values of exposed males and females were higher than control group. Polysaccharides and total proteins decreased significantly after GBH exposure compared to those of the control group. These results corroborated our hypothesis that GBH can promote hepatic morphological changes, being able to affect the biotransformation and detoxification function of liver.

06A.31 Mercury in Small Characids in the Brazilian Amazon

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Mercury is a global contaminant that mainly affects aquatic organisms. Analyzes of mercury contamination in small fish are generally neglected, as they are not used in the human diet. However, they are fundamental links for understanding the dynamics of mercury biomagnification. Characids Knodus heteresthes (Eigenmann, 1908) and Moenkhausia lepidura (Kner, 1858) were sampled in September and October 2016 in the Teles Pires and Juruena rivers in the Tapajós hydrographic basin, southern Amazonia. Stomach contents were analyzed for composition of the diet. Detection of THg in the samples with the aid of an atomic absorption spectrometer (240FS AAS, Agilent) with steam generation accessory (VGA 77 AA, Agilent) at the Ecotoxicology and Limnology Laboratory of the Center Research in Limnology, Biodiversity and Ethnobiology of the Pantanal (CELBE). In the Teles Pires river, both species were classified as omnivorous with an insectivorous tendency and average mercury concentration of 0.215 µg.g-1, in the Juruena river the insectivorous behavior occurs, with a mercury concentration of 0.131 µg.g-1, with significant differences when comparing both rivers ($t = -2.385$, $p = 0.023$). The concentrations were lower than those established by the World Health Organization for fish used for human consumption, but were considered high, because they are no larger than 5.5 cm, used in the diet of piscivorous birds and potentially piscivorous / carnivorous fish. The higher concentration of mercury in the fish of the Teles Pires River probably occurs due to a history of mining, deforestation and burning in the last decades in the region, and recently the implantation of hydroelectric dams in cascade.

06A.33 Effects of Acute Insecticide Exposures on Pomacea canaliculata

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The fresh water snail, *Pomacea canaliculata*, has particularities that makes it a potential good bioindicator. This species is affected by agrochemicals that can induce physiological and histopathological changes that have the potential to be characterized and could be used as biomarkers of freshwater contamination. In this study we a) identify the LC50 and $NOEC_L$ at 48 hours of exposure to the insecticides Deltamethrin (Decis forte® 10.5%), Chlorfenapir (Onfire® 24%) and Lambdacialothrin (Rafter® 5%); b) evaluate changes in the activity of antioxidant enzymes in the digestive gland after an acute exposure to $NOEC_L$ of these compounds, c) characterize whether exposure to these insecticides induces histological alterations in the digestive gland or in the presence of a symbiotic cyanobacterium that lives there. Adult animals (4 and 5 months) of both sexes cultured under laboratory conditions were used. Exposures of 48 hours to $NOEC_L$ doses were carried out in four experimental groups from which tissues samples were taken for protein extraction, evaluation of superoxide dismutase (SOD) and catalase (CAT) activities and for histological processing and subsequent morphometric analysis (Image ProPlus®), respectively. LC50 (48h) and $NOEC_L$ (48h) for Deltamethrin were 0.88 and 1.22 µg/mL, for Chlorfenapir were 2.85 and 1.00 µg/mL and for Lambdacialothrin 0.74 and 0.67 µg/mL. Acute exposure to insecticides produced a significant increase in SOD activity and also a significant decrease in CAT activity in Deltamethrin exposed animals (ANOVA I, Tukey post test). Likewise, the occupation of the glandular acini by symbiotic cyanobacteria was significantly decreased also in animals exposed to Deltamethrin (ANOVA I, Tukey post test). These results open the possibility of using *P. canaliculata* anatomical-physiological parameters as biomarkers of water contamination by insecticidal

agrochemicals like Deltamethrin, and future studies evaluating the activity of other antioxidant enzymes and morphological alterations in other tissues will complete their characterization.

06A.34 Mortality, Immobility and Biochemical Acute Effects of Thiacloprid on Two Populations of Hyalella Curvispina Amphipods From North Patagonia Argentina

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Thiacloprid (TCP) is a neonicotinoid insecticide widely used in the Valley of Río Negro River as pest control for fruit production. The aim of this study was to evaluate TCP acute effects in two different populations of the amphipod *Hyallela curvispina*, from a pristine site (LB) and an agricultural one (FO) located in North Patagonia Argentina. Both populations have shown differences in susceptibility to anticholinesterasic insecticides in previous studies. Amphipods from LB and FO were exposed to increasing concentrations (0-100 mg/L) of TCP (Calypso ®, Bayer), lethality and immobility were measured every 24 h for four days and 96 h LC50 and EC50 values were determined. In addition, amphipods were exposed to sublethal and lethal concentrations of TCP (LB: 0.02-2, FO: 0.02-100 mg/L), and enzymatic activity of glutathione-S-transferase (GST) and carboxylesterase (CE), and reduced glutathione content (GSH) were measured spectrophotometrically in surviving individuals at 48 and 96 h. TCP 96h-LC50 for LB was 0.42 (0.21-0.78) mg/L, while for FO it was 44.2 (15.6-134.8) mg/L, two orders of magnitude higher. Immobility 96h-EC50 value for LB was 0.14 (0.07-0.23) mg/L, and for FO, 0.14 (0.06-0.26) mg/L. GST activity in LB was not significantly affected by TCP. In FO it showed a tendency to increase at 2 mg/L and a significant increase with 20 and 100 mg/L (50 and 60% vs. control), and after 96 h with 0.2 and 2 mg/L (42 and 35%). There were no significant differences in CE activity in LB after 48 h, while all tested concentrations decreased after 96 h (48, 53 and 51%, respectively). CE activity increased in FO after 48 h exposure to 0.2; 2 and 100 mg/L TCP (28, 93 and 57 %, respectively) while no significant differences with controls were observed after 96 h. No significant differences were found in GSH content between exposed and control amphipods from both populations. Higher LC50 levels in FO compared to LB could be a sign of tolerance to TCP due to a history of use in this agricultural frame. However, both populations showed the same immobility response, which would most likely hinder the chances of survival in the wild. This highlights the importance of immobility as a biomarker of effect. The increase in GST and CE activities, even at sublethal concentrations, could be linked to a protective response in FO amphipods. The results obtained in this study constitute further evidence of the impact from continued neonicotinoid applications on autochthonous species.

06A.35 Global Warming and Cyanotoxins Effects in Neotropical Female Catfish: A Proteomic Approach

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Water has become one of the resources most affected by anthropic activities. The aquatic environment's eutrophication, together with the temperature rise due to the greenhouse gases, make potentially toxic cyanobacterial blooms more frequent and intensely. *Raphidiopsis raciborskii* is a cyanobacterium, whose strains in the Southern hemisphere produce neurotoxins called saxitoxins. This study aimed to evaluate how female Neotropical catfish respond to temperature rise and exposure to cyanotoxins produced by *R. raciborskii* (T3 strain), using a proteomic approach. *Rhamdia quelen* juvenile females were exposed to four treatments, based on literature: control at 25 °C (C25), control at 30 °C (C30), crude extract equivalent to 100000 cells/ml of *R. raciborskii* at 25 °C (STX25) and crude extract equivalent to 100000 cells/ml at 30 °C (STX30). After 96 hours, the animals were anesthetized and, after euthanasia, the liver, an important metabolism tissue, was collected for proteomic analysis. The proteins were extracted and the samples were analyzed at LC/MC. Three comparisons were conducted, using online software and databases (e.g. MetaboAnalyst, Gene Ontology and KEGG): C25 x STX25, to evaluate the cyanobacterial bloom in the current scenario; C30 x STX30, to evaluate cyanobacteria bloom in a global warming scenario; and STX25 x STX30 to assess the difference between temperatures. At 25°C, cyanotoxin was able to decrease the abundance of 53 proteins and increase of 6, which belong to 79 biological different pathways. At 30°C, cyanotoxin was able to decrease the abundance of 14 proteins and increase of 25, which belong to 48 pathways. The STX25 x STX30 comparison results in a decrease of 22 proteins and an increase of 58, which belong to 74 pathways. It was observed that saxitoxin can alter proteins related to reproduction, carbon metabolism, amino acids biosynthesis, apoptosis and necroptosis, regardless of temperature. However, the temperature rises to 30 °C can alter proteins related to different pathways, such as: arginine biosynthesis, phenylanine metabolism, phagosome and RNA degradation. These data demonstrate the effects range that saxitoxins can cause in non-target tissue and how the temperature rise can increase or decrease different proteins abundance in female fish exposed to saxitoxins, resulting in different effects on fish.

06A.36 Hepatic Transcriptomic Response in Aequidens Metae to Polycyclic Aromatic Hydrocarbons (PAH)

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Aquatic systems receive Polycyclic aromatic hydrocarbons (PAH) through atmospheric deposition and direct runoff release, being fish one of the targets with a particular interest because they occupy key positions in aquatic and terrestrial food webs. In fact, exposure to different PAH can generate specific responses in gene expression profiles associated with biotransformation that could be used as biomarkers of exposure to these hydrocarbons. In this regard, RNA sequencing (RNA-seq) has provided insight into response mechanisms in gene expression studies by integrating data on biological effects in response to sublethal PAH exposure in non-model organisms without available genomic information. However, there are no transcriptomic profiling studies in fish in Colombia. Therefore, the objective of the present study was to characterize the hepatic transcriptional response in the non-model fish *Aequidens metae* exposed to polycyclic aromatic hydrocarbons under acute exposure.Liver samples were taken from adult

specimens exposed via intraperitoneal to six conditions with five replicates, no injection control, solvent vehicle control, β-naphthoflavone (BNF), naphthalene (NAP), phenanthrene (PHE) and benzo[a]pyrene (BaP), transcriptomic analysis of RNA-seq derived data was performed. A total of 396 differentially expressed genes (DEG) were identified for the comparison between solvent and BNF, 330 for NAP, 396 for PHE and 381 for BaP of which 15 genes were common to all 4 PAH. In turn, enrichment analysis identified 9, 31, 12 and 31 KEGG pathways for BNF, NAP, PHE and BaP, respectively. In general, the pathways affected were associated with the processes of cell growth and death; lipid and carbohydrate metabolism; transport and catabolism; folding, sorting and degradation; the endocrine system; signal transduction; xenobiotic metabolism; nucleotide metabolism; viral infectious diseases and the endocrine system. Overall, the analysis showed evidence of toxic effects on liver tissue in fish exposed to the different PAH underlying molecular mechanisms through the study of transcriptomic profiling being a pioneer study in Colombian fish in this area. **Acknowledgment:** This study was funded by Colciencias-ANH and Universidad de los Llanos project No 162-2016 and also a project from the Pontificia Universidad Javeriana from Colombia.

6B. Aquatic Toxicology, Ecology and Stress Response

06B.01 Exploring the Potential Recovery of a Waterbird 16 Years After a Pulse Pollution Event in a Large Wetland of Chile

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In 2004, a pulse pollution event occurred on the Cruces River wetland in Southern Chile. During this event several Black-necked swans were affected including mortalities and massive emigration from the ecosystem. During this period, a correlation of body condition and blood parameters with the Iron (Fe) concentration in the ecosystem, including Fe concentration ranging from 10,000 to 30,000 mg/kg on swan`s main food item -aquatic plant *Egeria densa*- was established. Here we explore the variation of body condition, hematological and biochemical parameters in swans 16 years after the pollution event. We used hematological and blood chemistry parameters to evaluate the recovery of this population. We gathered data on these parameters from published sources and analyzed datasets from scientists who shared their data for this investigation replicating the sampling and analyses for recent years. Body condition was evaluated using Scaled Mass Index (SMI) as a proxy of individual quality by means of the energy accumulated in the body of swans as a result of feeding. Overall SMI of adult swans was significantly higher in 2019 (6.24 ± 0.85 kg) than right after the pollution event in 2004 (5.45 ± 0.83 kg). However, neither hematocrit nor erythrocytes and mean corpuscular volume were different in 2019 than values obtained both before and after the pollution event, with hemoglobin concentration showing significantly lower values in 2019 with respect to those measured in previous periods. The concentration of triglycerides and glucose in swan´s plasma was significantly higher in 2019 than right after the perturbation in 2004, reaching similar values in 2019 than before the pollution event. With regard to enzymes in blood, both aspartate transaminase and creatine kinase concentrations showed similar values in 2019 than before the pollution event and were significantly lower than right after the perturbation in 2004. Noticeably, concentration of both enzymes was higher than the reference values for the species both right after the perturbation and in 2019. Swan´s SMI increased from the year of the perturbation (2004) to present times (2019). However, current values of hematological and biochemical parameters do not support the hypothesis that Black-necked swan population have been recovered from the perturbation, as was suggested by recent studies based on increasing swan numbers and increasing distribution of their main food.

06B.02 Ecotoxicological Quality of Caraguatatuba Bay Sediment, São Paulo, Brazil

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Caraguatatuba Bay (-23.66363, -45.43035), at the northern seashore of São Paulo State, Brazil, is exposed to significant sources of marine pollution: domestic effluents and spills of oil and its derivatives. This is due to its proximity to the São Sebastião Channel, where the submarine emissary outfall takes place and where the largest oil transport terminal in Brazil is located. Due to their hydrodynamic characteristics, pollutants tend to deposit in the sediment, impacting the organisms associated with it. These organisms are of great ecological importance, linked to the basis of the food chain and many species are of nutritional and commercial interest. The region remains an important stronghold of artisanal fishermen and mollusk pickers, which raises concerns about the consumption of these organisms by the local population and tourists. The aim of this study was to evaluate the quality of the bay sediment by means of ecotoxicological tests on sediments collected at six points distributed in the bay, in the 2018 winter and in the 2019 summer. Total sediment acute toxicity tests were performed using the amphipod *Leptocheirus plumulosus*. Samples that presented different results compared to the control sample were only observed in the winter campaign, in three points: Indaiá and Centro Beaches, according to Dunnett's test ($p \leq 0.05$) and Indaiá, Centro and Camaroeiro Beaches, according to the t-test ($p \leq 0.05$). Sediment samples of these beaches showed adverse effect to the organisms of the assay, being considered toxic. Sediment samples from Porto Novo, Flexeiras and Palmeiras Beaches in winter and all points in the summer campaign did not cause adverse effects to the organisms and were not considered toxic. The three points which samples were considered toxic are on the beaches located from the center to the northern end of the bay where an inlet is formed. The distribution of points with toxicity follows the pattern of particle deposition and approaches the results of sanitary quality of the region according to CETESB, the São Paulo State Environmental Protection Agency.

06B.04 Estudio Ecotoxicológico del Arroyo las Conchitas, Provincia de Buenos Aires Realizado con Embriones de Rhinella arenarum y Danio rerio

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Se realizó un estudio ecotoxicológico del agua del arroyo Las Conchitas, partido de Florencio Varela y Berazategui, provincia de Buenos Aire comparativo al realizado en el 2002. Se seleccionaron en base a estudios previos cuatro estaciones de monitoreo, la primera con mínimo impacto y las restantes con un impacto antrópico elevado. Los bioensayos de ecotoxicidad se realizaron con embriones de un anfibio nativo, *Rhinella*

arenarum según el método ANFITOX y de *Danio rerio* con similar criterio. Con excepción a la primera estación de muestreo, la Reserva Ecológica Hudson, en la cual no se detectó toxicidad, en todas las demás estaciones de muestreo que incluyen zonas industriales y residenciales, la toxicidad fue superior a la máxima admisible para efluentes industriales según el criterio de la EPA (1991). Para toxicidad aguda los valores fueron hasta 2,5 veces superiores al máximo admisible para efluentes industriales y en el caso de la toxicidad crónica fue 5 veces superior para el mismo límite. En líneas generales los valores de toxicidad obtenidos con embriones de anfibio y del pez fueron similares lo que establece un principio de equivalencia entre resultados obtenidos con estas especies El estudio revela que a pesar que el arroyo Las Conchitas fue declarado en 1997 por el Gobierno de la Provincia de Buenos Aires en Emergencia Ambiental, la alta toxicidad registrada en la cuenca en el 2002 (Herkovits y col., 2003) continuo con valores muy altos en el 2019. El estudio confirma la posibilidad de evaluar la toxicidad como un fenómeno holístico, sumatoria de los impactos antrópicos en el recurso natural mediante una metodología estandarizada, simple, rápida, económica y acorde con estándares internacionales. Informando letalidad, el más básico criterio de evaluación ecotoxicológico, el deterioro en la calidad del agua es hasta 5 veces peor que condiciones mínimas de protección de la vida acuática. Como efectos subletales, se registraron retrasos en el desarrollo, agenesias, incurvaciones en el eje, microcefalia, ausencia de aleta ventral de la cola, etc. situaciones cuyo monitoreo permite perfeccionar gradualmente la calidad del agua hasta alcanzar una condición adecuada para la vida acuática**.** Aplicando el software ArcGis 10.5, se subdividió la cuenca en Alta, Media y Baja que se relacionó con las actividades antrópicas en cada región y los valores guía de referencia establecidas por el marco legal en la Argentina.

06B.05 Nuevas Nanopartículas de Plata con Acción Antimicrobiana de Aplicación en la Industria Enológica (NANOTOXWINE). Evaluación Ecotoxicológica

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El proyecto NANOTOXWINE propone el reemplazo parcial del SO_2 por nanoplata en atención que el SO_2 tiene efectos adversos sobre la salud y en algunos casos también sobre la calidad del vino. Se obtuvo Nanoplata que fue asociado a caolín documentando sus características por métodos analíticos, espectrofotometría, dynamic laser light scattering y microscopia electrónica de transmisión. Se seleccionó para los ensayos de vinificación Nanoplata-Caolin (NPC) obtenido por un método enriquecido desarrollado en el marco del proyecto. El poder germicida de las NPC resulto muy alto con excepción para *Aspergilus niger*. Aplicados a procesos de vinificación se obtuvieron con estas nanopartículas vinos tintos y blancos. La toxicidad comparativa de la plata iónica (Nitrato de Plata), Nanoplata y Nanoplata-Caolin fue evaluado con el bioensayo utilizando semillas de lechuga (*Lactuca sativa*) y para organismos vertebrados se evaluó directamente la toxicidad del complejo Nanoplata caolin con embriones de pez (*Danio rerio*). En el caso de la *Lactuca sativa* se comparó el crecimiento de la raíz (largo alcanzado a las 120 horas de incubación en hidroponía a 22 +/- 2 °C), la capacidad de germinación y presencia de necrosis en las concentraciones de 0 (control), 2, 5, 10, 25 y 50 mg/L de AgNO3, ídem para Nanoplata y para Nanoplata-caolin y un control positivo consistente en 20 mg/L ppm de $ZnSO_4$. En el caso del *DanioRerio* se realizaron tres réplicas con 8 embriones cada uno iniciando el ensayo a los 30 hs post fertilización utilizando Nanoplata Caolin por ser la sustancia de interés para la producción de vinos, evaluándose toxicidad aguda a los 24 y 48 hs de tratamiento. En el caso de la lechuga, la elongación de la raíz en los controles absolutos fue en promedio de 3,32 mm, mientras que en el caso de AgNO3 fue de 1,45; 0,4; 0,05; 0,00; 0,02 mm para las concentraciones mencionadas respectivamente; para la Nanoplata los resultados fueron: 1.82; 2.33; 1.57; 0.88; 0.37 mm respectivamente y para Nanoplata-Caolin 1,93; 2,07; 2,17; 0.95; 0,34 mm respectivamente. El control con Zn SO_3 resulto en 0.93 mm. En el caso del *Danio rerio* el análisis estadístico aplicando PROBIT resulto para el Caolín Nanoplata en una CL50 de 130mg/L para 48 hs de exposición, lo que indica el bajo impacto ecotox de la plata cuando se encuentra asociada con caolín, dato de interés por su potencial aplicación en producción de vinos.

06B.06 Evaluación de Estadios Embrionarios Indicados Para Medir Consumo de Oxigeno como Biomarcador de Toxicidad

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El consumo de oxigeno es un bioindicador metabólico no invasivo de toxicidad de interés por su fácil determinación y por permitir reconocer diferentes grados de toxicidad subletal como así también el límite compatible con la vida. En estudios previos hemos documentado diferencias significativas en la susceptibilidad a agentes físicos y químicos en diferentes estadios del desarrollo embrionario. Si bien habitualmente los estadios organogénicos suelen ser los más susceptibles a noxas es de interés determinar si dichos estadios embrionarios son también los más apropiados para medir consumo de oxigeno como biomarcador de toxicidad. A tal fin se evaluó el consumo de oxígeno en diferentes estadios del desarrollo embrionario de *Rhinella arenarum* con el propósito de reconocer los estadios con máximo consumo de oxigeno ya que serían los más apropiados para utilizar este parámetro como biomarcador de toxicidad, especialmente si se correlaciona con los estadios más sensibles del embrión a tóxicos. Se utilizaron no menos de 30 embriones por ensayo por duplicado utilizando un oxímetro Lutron DO-5510. Los valores de consumo en Célula Huevo y Blástula fue de 0,06, en Gástrula 0,5, Placa Neural 2, Respuesta Muscular 6, Circulación Branquial-Boca Abierta 10, Pliegue Opercular 17 y opérculo completo (etapa final del desarrollo embrionario) 21 mL de O_2 X 10^{-3} por minuto por embrión. A partir de este estadio si los embriones no son alimentados el consumo de oxigeno decae en forma proporcional al tiempo, a los 10 días se registró 4 mL de O_2 X 10^{-3} por minuto por embrión. En cambio, con embriones alimentados a partir del estadio de Pliegue Opercular se registró en opérculo completo un valor de 30 mL de O_2 X 10^{-3} por minuto por embrión. Considerando que el mayor consumo de O_2 se inicia con las etapas más susceptibles del embrión a noxas, el estudio permite recomendar medir consumo de oxigeno como biomarcador de toxicidad entre los estadios 21 y 25 según diseño experimental, ya que el consumo de oxigeno es alto y por ende más fácil de detectar diferencias significativas, se corresponde con etapas de alta susceptibilidad a noxas y no se requiere proveer alimento que podría enmascarar el resultado experimental v.g. por adsorción del toxico. Por otra parte el mayor consumo de oxígeno en las etapas organogénicas permite considerar que el metabolismo aeróbico requerido para el progreso del desarrollo embrionario implica como costo una mayor susceptibilidad a noxas.

06B.07 Organochlorine Compounds in Spinner Dolphins From the Outer Continental Shelf and Slope of Southwest Atlantic

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Organochlorine compounds are persistent, toxic, and easily transported in the environment. They bioaccumulate in biota and biomagnify along food webs. The bioaccumulation patterns for oceanic species in the South Atlantic are poorly understood. The present study aimed to evaluate levels and contamination profile of organochlorine compounds (PCBs, DDTs, HCHs, HCB, and mirex) in spinner dolphin (*Stenella longirostris*) from the outer continental shelf and slope off southeastern (SE) and southern (S) regions of Brazil. Subcutaneous adipose tissue from 43 individuals were sampled through remote biopsy. The assay consisted in Soxhlet extraction, followed by clean-up steps with acid and column purification. The analyses were performed in a gas chromatograph with mass spectrometry (GC-MS), with an electron impact source (EI). The specimens were grouped considering oceanographic processes of the southeastern (n = 33) and southern (n = 10) regions. Median concentration of SPCB for the SE region was 5437 ng/g lip and for the S region 2159 ng/g lip, SDDT was 4215 ng/g lip in the SE and 3189 ng/g lip in the S, and Mirex 1274 ng/g lip in the SE and 1393 ng/g lip in S. Mirex concentrations were among the highest reported in South Atlantic delphinids. Significative differences between regions were observed only for SPCB (Mann-Whitney, $p < 0.05$), being higher in SE dolphins. HCHs and HCB were not detected in any sample. Although PCBs represented 50% from contamination profile of the SE region, organochlorine pesticides (DDTs and Mirex) were also important. Meanwhile, for the S region, DDTs were the most representative (68%). DDT/PCB ratio indicates the main contribution from industrial source and high human densities in the SE (0.87) and agricultural activity for S region (1.53). In PCBs contamination profile, hexachlorinated compounds were predominant for both regions, especially the most recalcitrant congeners PCBs 153, 138 and 180, which were also present in the most used mixtures in Brazil. The metabolite *p,p'* -DDE predominated in DDTs contamination profile, indicating historic contamination. These results reveal the long range of organochlorine compounds for oceanic trophic webs, as well as their high biomagnification potential. Therefore, coastal regions can act as contaminants' source to oceanic waters species, such as spinner dolphin, from atmospheric and oceanic transport.

06B.08 Earlier Biomarkers in Fish Evidencing Stress Responses and Tolerance to Metal and Mrganic Pollution Along the Doce River Basin

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The Doce River Basin represents a well-described watershed in terms of contamination by metals introduced by historical mining exploration. After the environmental disaster involving the Fundão Dam Breakage in 2015, several studies reported the high levels of Fe, Mn, and Al in water and the most toxic elements As, Hg, and Cd in sediments, at concentrations exceeding the national standards. However, despite the great mortality of the fish fauna, very few studies investigated the health risks of wild fish chronically exposed to these contaminants since the event. Moreover, the influence of organic chemicals on fish from DRB has been historically neglected. The present study proposed to investigate earlier stress responses of fish exposed to the environmental chemicals present in the Doce River, considering: different species of fish (*A. lacustris; R. quelen; P. maculatus*); different target organs (liver, brain, muscle, blood); and the influence of seasonality. To achieve that, fish were collected along the DRB, and biomarkers responses (biotransformation enzymes, oxidative stress, and genotoxic and neuromuscular parameters) were assessed and correlated with the levels of inorganic and organic contaminants. As one of the most prominent responses, fish from the Upper DRB region showed the major oxidative stress responses, including higher levels of lipid peroxidation in the liver and brain, depletion of the antioxidant GSH, and lower activity of GST. Probably these responses are related to the higher levels of metals in this region due to the proximity of mining activities. On the other hand, higher levels of DNA damage and increased AChE activity and genotoxicity in blood cells from fish sampled in the Mid and Lower DRB are likely related to organic contaminants, in addition to metals, from other sources of pollution than mining. The analysis of multiple biomarkers, with the selection of suitable biomarkers according to the occurrence of contaminants of concern, represents an adequate strategy for assessing the ecological risks in the DRB, and consequently providing more accurate data for ecological restoration and the protection of fish fauna from the Doce River.

06B.11 Ecotoxicological Evaluation of Fruit Extracts From Yerba Mate Progenies (Ilex Paraguariensis a St-Hil.): A Natural Biopesticide

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This study evaluated the biocidal activity of aqueous fruit extracts from *Ilex paraguariensis* progenies at different ripening stages in two ecotoxicity assays using *Pomacea canaliculata* juveniles and *Danio rerio* larvae. Mutagenicity was verified by the *Salmonella*/microsome assay (TA 98 and TA 100) in the presence and absence of hepatic metabolism in vitro. The results showed that the snails were more sensitive than the larvae to the P.1 and P.3 progeny extracts were the most toxic to *D. rerio* larvae after 96 hours of exposure. In the *Salmonella*/microsome assays, the semi-ripe and ripe extracts from progenies P.1 and P.3 showed mainly base pair substitution mutation in assays with metabolism, but at higher doses than the toxic concentrations detected for *D. rerio* or *P.canaliculata*. The toxicity results indicate that the progenies' selection influenced the metabolic contents present in the fruits in all ripening stages over time, indicating

high molluscicidal activity for the P.1 progeny. Therefore, the toxicological investigation of the progenies' extracts can be interesting, given the selection of plant materials influenced the response of the bioassays.

06B.12 Reproductive Toxicity in Fish Females of Poecilia reticulata Exposed to Associations With Iron Oxide Nanoparticles and Glyphosate

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Iron oxide nanoparticles (IONPs) have attracted a lot of attention due to their application in environmental health. These particles have a high potential for nanoremediation, due to the ability to adsorb glyphosate (GLY) from the aquatic environment contaminated. However, there are many doubts regarding the effects of IONPs on the female reproductive system and on the stages of embryonic development, thus the toxicological effects of association with IONPs and glyphosate-based herbicides (GBH) will be investigated. For the experiment, young and adult females of guppy (*Poecilia reticulata*) were collected for toxicity tests on biological systems, occurring in triplicate (n = 10), with collections in 7, 14 and 21 days in experimental exposures with iron ions (0,3mg / L) and associations of IONPs (0.3mgFe / L) with GLY (0.65 mg / L) and GBH (0.65-1.30 mgGLY / L). L Morphological and histological analyzes were performed on ovarian tissue in 7 gonads of each treatment, meeting the following reaction patterns: Regressive Changes (Rp1); Inflammatory Responses (Rp2) and Circulatory Disorders (Rp3). The gonads evaluated showed changes in morphology at histological levels, causing cellular damage like degeneration of the ovarian follicle, atresia, leukocyte infiltration and vessel dilation at different stages of development. The toxic effect being present in all groups treated according to the histopathological index. The damage observed in cells and tissues demonstrates that the association of IONP's and GLY and GBH induces damage in the developmental biology, compromising the embryonic development of the species and the reproductive capacity. This study helps to understand the toxicity of associations and shows that more studies are needed to understand the complexity of the toxicity of IONPS and glyphosate in aquatic organisms.

06B.13 Lethal Concentration of a Textile Effluent on Larvae and Juveniles of Rhamdia quelen (Teleostei)

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RawTextile Effluent (RTE) is characterized as toxic by contain excessive organic load, complex mixture of chemical substances, including dyes and heavy metals. In contact with the surface waters, this effluent can trigger severe damage to the aquatic biota. Facing this problem, the aim of this study was to determine the Mean Lethal Concentration of RTE on larval and juvenile fish *Rhamdia quelen* in 96h ($CL_{50\text{-}96h}$). The tests followed the guidelines of the Brazilian National Standards Organization (ABNT) - NBR 15088. The viable eggs were placed in 24 wells microplates 8 hrs after fertilization (HPF) with concentrations 0, 0.5, 1, 2, 4 and 8% of RTE. Hatchability and survival were quantified at 28, 48, 72 and 96 hpf. The bioassay with juveniles was conducted at concentrations 0, 2, 4, 8, 16 and 32% of RTE and evaluated every 12 hours to quantify the mortality. The conditions of the experiment were controlled (photoperiod and temperature), and a semi-static assay was performed changing 50% of the solution for the larvae (2.5ml) and 25% for the juveniles (12.5L) every 24h. The data obtained was submitted to Probit calculation by Statistica software to define the CL_{50}. *R. quelen* larvae exposed to RTE were stressed and showed mortality of half of the exposed population at the concentration of 3,41% ± 0,33 (X±SD - v/v). Under the same stressor agent, *R. quelen* juveniles showed mortality of 50% of their population at the concentration of 13.42% ± 2,78 (X±SD - v/v). These LC_{50} values allow us to observe that RTE can be toxic at extremely low concentrations, especially for early life stages, and can cause damage to populations of exposed individuals, triggering potential imbalance in the trophic chain and damage at the aquatic ecosystem level. These results express a high toxicity of the RTE and highlight the importance of get an adequate and efficient treatment what removes the color and reduces the toxicity of the final treated wastewater. The CL_{50} is an important information of great use and application by the environmental agencies because it is a guideline usually evaluated by the competent agencies in inspections and surveys of environmental risks.

06B.14 Biomonitoreo del arroyo las Catonas, Cuenca Reconquista, Provincia de Buenos Aires, Utilizando el Gasterópodo Acuático Nativo Biomphalaria straminea

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En Cuartel V, partido de Moreno, Buenos Aires existen huertas de uso intensivo y plantas procesadoras de residuos que vuelcan efluentes a pequeños cursos de agua dulce. El uso de biomarcadores en organismos indicadores resulta una herramienta apropiada para estudiar esta contaminación. *Biomphalaria straminea* es un gasterópodo nativo de agua dulce útil para ensayos de toxicidad debido a su sensibilidad, distribución y facilidad para la cría y mantenimiento. El objetivo de este trabajo consistió en estudiar muestras de agua del arroyo Las Catonas de Cuartel V en un sitio “aguas arriba” (R), un sitio posterior a la zona de desecho de efluentes de una planta procesadora (M) y un tercer sitio “aguas abajo” (ABA) de la planta y de huertas que emplean distintos plaguicidas. A tal fin se evaluaron biomarcadores en individuos de *B. straminea* expuestos a las diferentes muestras que se tomaron por duplicado en marzo 2021 y se transportaron refrigeradas al laboratorio. Para el bioensayo se utilizaron por tratamiento (R, M y ABA) 8 recipientes de vidrio con 5 individuos cada uno. La exposición fue de 48 h, sin aireación ni alimento y en condiciones estandarizadas de temperatura y fotoperíodo. Luego, se evaluó por observación directa bajo lupa binocular letalidad, alteraciones del comportamiento y signos de neurotoxicidad y se realizaron homogenatos haciendo un pool de los 5 caracoles. En los sobrenadantes se determinaron las actividades de colinesterasas (ChE), carboxilesterasas (CE), glutatión S-transferasa (GST) y el contenido de proteínas totales. Las actividades enzimáticas se calcularon como relativas al contenido de proteínas totales. En los organismos expuestos al agua de M se observó únicamente una leve disminución de GST (16 %) con respecto a los expuestos a R. En

cambio, la exposición al agua de ABA causó letalidad en el 60 % de los caracoles y una disminución del 30 % de ChE, compatible con la presencia de insecticidas anticolinesterásicos. La contaminación del sitio ABA con compuestos provenientes de las huertas podría ser la causa de la alta toxicidad observada. *B. straminea* resultó un organismo bioindicador sensible para el biomonitoreo de los cuerpos de agua de la región mostrando efectos tóxicos con solo 2 días de exposición.
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06B.15 Evaluación de la toxicidad de un artrópodo del río Neuquén, Argentina, frente a dos contaminantes emergentes

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En las últimas dos décadas, los compuestos farmacéuticos se han identificado como contaminantes emergentes para los ecosistemas acuáticos. La presencia en el ambiente de los compuestos farmacéuticos se debe mayoritariamente a los vertidos de efluentes urbanos como consecuencia de tratamientos ineficientes de plantas de tratamiento de aguas residuales. Para poder determinar los efectos de estos contaminantes y sus mezclas en el ambiente acuático, se utilizan los bioindicadores como una herramienta de diagnóstico. El objetivo del presente trabajo fue evaluar la toxicidad aguda de soluciones individuales Diclofenac (DCF) e Ibuprofeno (IBP) comerciales y su mezcla en *Hyalella curvispina;* determinar la concentración letal cincuenta (CL50) y la mínima concentración que genera un efecto adverso (LOAEL). Los ensayos de toxicidad aguda se realizaron a 24, 48 y 72 horas de exposición. Las concentraciones de trabajo fueron determinadas por ensayos preliminares. Para cada nivel de concentración de DCF, IBP y su mezcla (D-IBP) se realizó un ensayo de 4 réplicas con sus respectivos controles para cada unidad experimental. El ensayo de toxicidad con D-IBP se realizó a partir de los resultados de LOAEL obtenidos en los ensayos individuales. La CL50 se calculó utilizando el método Probit; y la estimación de la LOAEL fue obtenida mediante ANOVA unifactorial y el test *a posteriori* de Dunnet. La CL50 obtenida como consecuencia de exponer a *Hyalella curvispina* a una solución de DCF a las 48 y 72 horas fue de 51,4 y 39,5 mg/L respectivamente. Para la exposición de los anfípodos a IBP se obtuvieron valores de CL50 de 82,4; 80,9 y 73,5 mg/L a las 24; 48 y 72 horas de exposición respectivamente. Se evidencia que DCF es más tóxico para *Hyalella curvispina* respecto de IBP. En cuanto a la LOAEL, surge que la especie *Hyalella curvispina* es un organismo más sensible a la exposición aguda de DCF comparado con IBP. Contrastando los resultados de mezcla (D-IBP) con los de DIC, por ser el contaminante más tóxico según los resultados hallados, se observa un incremento en el porcentaje de mortalidad en *Hyalella curvispina* expuesta a la solución de D-IBP. Asimismo, es importante analizar lo que sucede realmente en los ambientes naturales ya que las concentraciones de DCF e IBP en estos cuerpos de agua son tres órdenes de magnitud menores comparado con los valores de CL50 obtenidos en este trabajo. Estos resultados muestran que estos fármacos representan una baja probabilidad de riesgo al ambiente en términos de toxicidad aguda. En términos generales, la información en bioensayos sobre efectos tóxicos de compuestos farmacéuticos es escasa y particularmente nula en la región del Alto Valle de Neuquén. En este sentido, este estudio pretende generar una línea de base que aporte al conocimiento de los efectos toxicológicos de estos fármacos en la región.

06B.16 Contaminated Sediments: Biochemical Effects and Oxidative Stress in the Sábalo Prochilodus Lineatus, Exposed to the Antiparasitic Ivermectin

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Ivermectin (IVM) is one of the most widely used antiparasitics worldwide. It is a potent and effective drug for the treatment and prevention of internal and external parasite infections of both livestock and humans. IVM is excreted unchanged (≈90%) in manure of treated animals. Thus, residues of IVM may reach aquatic systems, affecting non-target organisms such as fish. High concentrations of IVM have been detected in sediments of water bodies close to livestock areas (feedlots). In this work, the effect on biochemical and oxidative stress biomarkers induced by IVM was evaluated in juveniles of the native freshwater fish *Prochilodus lineatus* (Characiformes), an inland fishery species. Fish (4.2 ± 0.9 g b.w; n=27) were exposed during 14 days to sediments spiked with environmental concentrations of IVM: 2 µg/kg and 20 µg/kg; following exposure gills, muscle, liver and brain were collected. Acetylcholinesterase (AChE) activity was measured in brain and muscle; and the following oxidative stress parameters were analyzed in all organs: lipid peroxidation levels (thiobarbituric acid reactive substances, TBARS), antioxidant capacity against peroxyl radicals (ACAP), catalase enzyme activity (CAT), glutathione S-transferase activity (GST) and reduced glutathione content (GSH). Differences between treatments were evaluated by one-way ANOVA ($\alpha = 0.05$) followed by a Holm-Sidak test. The lowest concentration of IVM produced a significant increase in TBARs levels in brain and a significant decrease in GSH content in gills. Moreover, the lowest concentration of IVM also produced a significant decay in ACAP and an increase in CAT activity in liver. A significant decrease in ACAP levels was observed for both IVM concentrations in gills, whereas in liver, IVM exposure at both tested concentrations caused a significant reduction in GSH levels. Muscle AChE activity was significantly decreased at both IVM concentrations. Taken together, these results suggest that the exposure of *P. lineatus* juveniles to environmental concentrations of IVM in contaminated sediments could generate oxidative damage in brain (TBARS), and alter the enzymatic biochemical responses (CAT) in liver as well as the levels of antioxidants (GSH decay) in gills. On the other hand, the decrease in ACAP observed upon exposure suggests that the internal response to reactive oxygen species is unbalanced and seems to not be sufficient to avoid oxidative damage and mortality.

06B.17 Pulse and Spiked Sediments Bioassay With a Commercial Formulation of the Insecticide Fipronil: Biomarker Responses in the Fish Prochilodus lineatus

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Toxicity of fipronil (FP) is well documented in insects although limited

knowledge of sublethal effects is available on fish. Fipronil can often reach aquatic environments via local inputs or surface runoff. Environmental concentrations previously reported in sediments were up to 5.5 µg/kg. In this work, we evaluated biomarker responses in target organs of *Prochilodus lineatus* juveniles after exposure to a commercial formulation of FP (Clap Bayer®) in a sediment static bioassay. Fish (4.2 ± 0.9 g b.w; n=27) were exposed during 14 days to three experimental conditions: fish exposure to sediments spiked with Clap (*Sp*) (5.5 µg/kg); fish exposure to sediments with a contaminant pulse with Clap (*Pu*) (50 µg/l), and control sediments (*Ctrl*). Following exposure, liver, brain, gills and muscle were collected. Antioxidant defenses (catalase activity, CAT; glutathione-S-transferase activity, GST; antioxidant capacity against peroxyls, ACAP; reduced glutathione content GSH) and oxidative damage parameters (levels of lipid peroxidation by TBARS) were determined in liver, brain and gills. Brain-motor parameter (acetylcholinesterase activity (AChE)) was evaluated in brain and muscle. Sediments, water and suspended particulate matter were taken for analytical quantification of FP. Differences between groups were analyzed by ANOVA followed by Tukey test ($p< 0.05$). In liver, the adverse effect of CLAP in *Pu* was evident by the significant inhibition of the GST activity (-44%), and an increase (+20%) in GSH content, while in *Sp* elicited a significative increase (+129%) of ACAP. In gills, spiked sediments produced a significantly decrease (-42%) of GSH content and ACAP levels (-31%); while in *Pu* a decrease (-23%) in ACAP was observed. Antioxidant responses were also observed in brain from *Sp* (42% increase in CAT activity and a significant increase in the ACAP values 167%), while a decrease in the antioxidant capacity was evident for ACAP (157%) from *Pu*. Muscle AChE activity was significantly inhibited in *Sp* (-31%) and in *Pu* (-42%). Our results indicate that both (pulse and spiked) exposure conditions induced adverse responses in biomarkers of *P. lineatus* juveniles at different levels. Antioxidant capacity was the most sensible parameter, while gills was the less affected organ.

06B.18 Ecotoxicological Evaluation of Two Systems Treating Wastewater Containing the Flame Retardant Tetrabromobisphenol-A Using Pristina longiseta

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Tetrabromobisphenol A (TBBPA) is a flame retardant considered an endocrinal disruptor that reaches water bodies through untreated wastewater and incorrect disposal of solid waste. To evaluate two systems treating wastewater containing TBBPA, acute bioassays were done using the Oligochaeta *Pristina longiseta* Ehrenberg, 1828. The lab-made affluent was fortified with 100 µg/ L of TBBPA (CAS # 79-94-7) and treated through structured fixed bed bench reactors using two biological systems: acidogenic (RA) and methanogenic (RM). To perform the bioassays, the following test solutions were used: raw effluent (100%) and dilutions (6; 12; 25; 50%). These dilutions were made with dechlorinated tap water and the bioassays were carried out in 100 mL beakers, containing 10 g of sterile muffle sediment (4h at 550 °C), 60 mL of the test solution, and 6 freshwater worms. At the end of the test (48h), the number of alive individuals was counted. Then, lethal concentrations in 10 and 50% of the individuals, LC10 and LC50, were calculated using the R software and MASS and DRC packages. Using the Past® software, the Two-way ANOVA statistical test was applied considering a 95% confidence interval to compare the results of each dilution. TBBPA removal from synthetic sewage averaged from 90% (RA) to 97% (RM), with an average compound output below 4 µg/L. The mortality rate in the affluent and effluent from RA and RM were above 50% in dilutions of 50%, while close to 100% in the raw samples. The results of the Two-way ANOVA test showed that there is a statistical difference between the dilutions used (p-value of 1.437x10-21). However, no statistical difference was observed between the test solutions (affluent and effluent from the RA and RM reactors) and the interaction of these two factors (p-value of 0.6787 and 0.5315, respectively). Tukey's posteriori test pointed out the 50% and 100% dilutions as different from the control for affluent ($p < 0.05$). Despite the survival rate for the affluent and effluents were close, a slight minimization of toxicity was observed for MR effluent (LC10 of 40.76% and LC50 of 51.16%) when compared to affluent (LC10 of 28.10% and LC50 of 47.58%). Moreover, the LC10 and LC50 for AR effluent were 27.45% and 43.49% respectively. Therefore, for this species, the acidogenic and methanogenic treatments were not enough to reduce the toxicity of the affluent containing TBBPA, and a post-treatment would be required to discharge the effluent into water bodies.

06B.19 In Situ Experimentation With Oreochromis niloticus to Assess Water Quality in the Salto Segredo Reservoir/ Rio Iguaçu/PR

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The Iguaçu river is in a hydrographic basin of fundamental socioeconomic and environmental importance for the Paraná State, Southern Brazil. The Iguaçu basin presents a rich biodiversity affected by urban, industrial, and agricultural discharges into aquatic ecosystems, intensified by population growth mainly in upper river basin. A recent study by the Cell Toxicology Group at Federal University of Parana revealed that the Salto Segredo reservoir, located in the lower Iguaçu river, showed diffuse sources of contamination, which may be compromising the water quality of the reservoir. The aim of this study is to evaluate more accurately the water quality of the Salto Segredo Reservoir/ Rio Iguaçu-PR through chemical analyses and biochemical biomarkers. The encaged (2X2X2 meters net tanks) juveniles of *Oreochromis niloticus* was exposed to reservoir water for six months during two seasons (autumn- winter and spring-summer) in three different sites of the reservoir. A control group was maintained in tanks of 1000L and water flow in the COPEL Station near the Segredo reservoir. Results show detrimental effects on growth and health at all studied sites. Chemical analyses detected an increased metal concentration at all sites during the summer comparatively with winter season. Biochemical analyses showed an increase of DNA single strands as well as an increase of catalase activity and variation in glutathione S-transferase activity in the liver, suggesting a pro-oxidant imbalance in the organ, while changes in the Condition Factor and Hepatossomatic Index showed a more marked seasonal physiological effect in summer. The biomarkers related to chemical data in this study show that *O. niloticus* specimens exposed to the water of the Segredo reservoir present biological alterations indicative of bioavailability of these pollutants responsible for biochemical and molecular damages. A higher

number of effects were observed comparatively between the studied sites in the spring and summer period. Finally, the current data show that the quality of the water in the Segredo reservoir is compromised by diffuse sources of pollutant, which can put in risk maintenance of endemic species and Impact the biodiversity of the Iguaçu basin.

06B.20 Desarrollo de un Índice de Calidad de Agua Para Lagunas Urbanas de la Ecorregión Pampa (ICApamp)

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Los índices de calidad del agua tienen como objetivo dar un valor único asignado por un sistema de clasificación de los ambientes acuáticos; basados en esta premisa la construcción de un Índice de Calidad de Agua (ICA) implica seleccionar los parámetros, transformarlos a una escala común (Ii), asignarle un peso diferencial (wi) y finalmente sumarlos para lograr una puntuación. En el presente trabajo se construyó un ICA adaptado a las lagunas pampeanas urbanas (ICApamp). El área de estudio se ubica en la ecorregión Pampa del noreste de la Provincia de Buenos Aires, Argentina; se realizaron 4 campañas entre 2017 y 2021 y se seleccionaron ocho lagunas. Se tomaron por triplicado muestras de agua, macroinvertebrados asociados a la vegetación y sedimentos en varios sitios dentro de una misma laguna; se midieron parámetros in situ (pH, oxígeno disuelto, conductividad y temperatura) y en laboratorio (nitrógeno total, amonio, nitrito, nitrato y demanda química y bioquímica de oxígeno, fósforo reactivo soluble, fósforo total, dureza, alcalinidad y sólidos totales). Los macroinvertebrados fueron separados e identificados hasta el menor nivel taxonómico posible, se determinó la riqueza taxonómica (Rt) la cual se utilizó como parámetro de calidad. Como primer paso en la construcción del índice se seleccionaron las variables a partir del análisis de regresión lineal o polinómica con Rt y se calculó la función Ii para cada variable. El peso (wi) de cada parámetro se calculó a partir de un análisis de componentes principales, promediando los loading ponderados por la varianza de los dos primeros componentes. Los intervalos de calidad para el ICApamp se definieron en base a su regresión lineal con IMRP (índice a partir de macroinvertebrados adaptado a los ríos pampeanos), obteniendo 5 intervalos de calidad. Del total de sitios evaluados 28,5% corresponden a calidad mala, 28,5% calidad regular, 10% calidad buena y 33% calidad muy buena. Los resultados obtenidos concordaron con la calidad que arrojó el IMRP, concluyendo que la aplicación ICApamp, a partir de parámetros fisicoquímicos, nos permite definir la calidad ecológica del cuerpo de agua y su potencial utilización por los organismos de gestión, una vez validados en un número mayor de lagunas u otros ambientes lénticos regionales.

06B.21 Toxicity of Mixtures of Dimethoate and Tebuconazole on the Embryo-Larval Development of Rhinella arenarum

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Frequently two or more pesticides are simultaneously or sequentially applied expecting a better crop yield. Amphibians are one of the most widely group exposed to these multiple pesticides scenarios in the agroecosystems, and the impact of pesticide mixtures represents a challenge for risk assessment and conservation purposes. The aim of this study was to evaluate the toxicity of individual and binary equitoxic mixtures of the insecticide dimethoate (DIM) and the fungicide tebuconazole (TEB) on the embryo-larval development of *Rhinella arenarum*. For this purpose, embryos from blastula (Stage 4) and larvae from complete operculum (Stage 25) were exposed for acute (96 h), sub-chronic (168 h) and chronic (336 and 504 h) periods to different concentrations of DIM and TEB, and dilutions of a DIM-TEB mixture. The lethal and sublethal effects of the individual pesticides and the mixture were evaluated and the interaction was analyzed at the different exposure times. The obtained results showed that embryos and larvae were more sensitive to TEB (LC50-504 h = 2.63 and 7.49 mg/L, respectively) than DIM (LC50-504 h = 50.31 and 26.48 mg/L, respectively) at all exposure times. The mixture of these pesticides was more toxic to larvae (LC50-96 and 168 h = 41.38 and 37.61 mg/L) than embryos (LC50-96 and 168 h = 112.52 and 79.16 mg/L) at acute and sub-chronic exposure periods, but expanding the exposure time there were no significant differences obtaining LC50-504 h values of 20.48 and 24.00 mg/L for embryos and larvae respectively. Respect to sublethal effects, embryos exposed to individual pesticides and the mixture showed cellular dissociation, general underdevelopment, edema and axial flexure. As for larvae, when embryos developed movements, swimming behavior, they presented mainly ethological alterations such as spasmodic contractions, erratic movements, weakness and finally complete immobility. The joint effects of the pesticide mixture showed antagonistic interactions in both embryo and larval stages. This study highlights the importance to evaluate the joint actions of pesticides, to simulate the real exposure conditions in agronomic scenarios. Moreover, complexity of toxicological interactions can lead to unpredictable effects of the mixtures putting in risk non target species.

06B.22 Evaluation of the Sensitivity of Organisms of Different Trophic Level to Cd. Cr, Cu, Mn, Ni and Pb Metals

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Metals such as Cd, Cr, Cu, Mn, Ni and Pb are found in high concentrations in some aquatic systems in the Valley of Mexico, for this reason in this work an evaluation of the deleterious effect of the metals Cd, Cr, Cu, Mn, Ni and Pb on organisms of different trophic levels: The microalgae *Pseudokirchneriella subcapitata* and *Monorraphidium* sp., the cladocerans *Daphnia magna, D. exilis, D. pulex* and. *Chydorus* sp; the copepod *Acanthocyclops americanus*, the ostracod *Cypris* sp. and the larvae of the charal *Chirostoma jordani* was carried out. Static bioassays with a duration of 48 hours were carried out for cladocerans and ostracods. And 72 hours for tests with fish larvae and microalgae. With the data obtained, the LC50 (Lethal Concentration 50) was determined (EPA Probit analysis). The results obtained showed that in the tests with microalgae a significant difference in sensitivity to metals was observed in almost all cases. The most toxic metal was Copper and the least toxic was Manganese. In the lethality tests with cladocerans, it was observed that the neonates of the 4 species were more sensitive to Copper and less sensitive to Manganese. The ostracods were more sensitive to Cadmium and less sensitive to Nickel. In the tests with *Ch.*

Jordani larvae, the toxicity of the metals was (from higher to lower effect): Cu> Cd> Ni> Pb> Mn> Cr. Likewise, the fish larvae are more sensitive to the metals Cu, Mn, Ni and Pb compared to other organisms such as *Daphnia magna* neonates. Likewise, the values established by NOM 001-Semarnat, for discharges in aquatic systems for metals Cd (0.1 to 0.2 mg L-1), Cr (0.5 to 1.0 mg L-1), Cu (4 to 6 mg L-1), Ni (2 to 4 mg L-1) and Pb (0.2 to 0.4 mg L-1) are higher than the LC50 values obtained in the tests with cladocerans, ostracods and fish larvae, for this reason it is important to continue performing Investigations and monitoring to detect responses that indicate the possible damage in the populations of these organisms due to the action of the discharges and different tensors, to avoid an irreversible deterioration of the populations in the medium and long term.

06B.23 Toxic Effects of Dichlorvos Pesticide on Chirostoma Jordani Eleutheroembryos

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The *Chirostoma jordani* charal is a species that lives in the lacustrine catchment area of the Valley of Mexico, it constitutes a source of income and food for the communities dedicated to its capture. Due to the fact that in the last 40 years the continuous contribution of pollutants has caused the deterioration of the areas where fishes live, the objective of this study was to determine the toxic effect of the pesticide DDVP on the eleutheroembryos of *Ch. Jordani*. Static bioassays (96 hours) were carried out where the fishes were exposed to 5 concentrations of the pesticide plus a control. The LC50 was determined and in tests with sublethal concentrations (LC10 and LC1) the following biomarkers were evaluated: growth rate, lipoperoxidation (Tbars) and the inhibition of the acetylcholinesterase enzyme activity (AchE). The results obtained show that the toxicity increased with the exposure time. The LC50 obtained in the toxicity bioassays was 0.013 mg L-1. The growth rates of the exposed organisms were between 30 to 75% lower than those observed in the control group. A decrease of between 40 to 80% in the activity of the enzyme AchE was observed and the degree of lipoperoxidation in the tissues increased up to 180%. The pesticide used is not very persistent in the environment but the results of this study indicate that its effects in sublethal concentrations were irreversible, which caused a mortality of 72% in the tests with sublethal concentrations, because the organisms do not feed

06B.24 Plastics in Scene: A Review of the Effect of Plastics in Aquatic Crustaceans

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Plastic pollution in aquatic environments is present in all compartments from surface water to benthic sediment, becoming a topic of emerging concern due to the internalization, retention time, and effects of these particles in aquatic biota. Crustacea with nearly 70000 species, broad distribution and roles in the trophic webs is a significant target of the increasing plastic pollution. This review gathers the available information on the use of Crustacea as model species in environmental impact for toxicity screening and hazard assessment. In this context, we summarize the published information based on the chronological and geographical aspects of the studies, the type of plastic detected, the species and habitats studied, the type of study (effects in field or laboratory exposure) and the impact both, at individual and population levels. At the present, 74 papers reported the impact of plastics in crustaceans (2011-2020), including macroplastic (plastic debris), microplastic (weathering plastic, microbeads, and microfibers), and nanoplastic, in a wide variety of components, principally polyethylene and polystyrene. The studies were focused on 45 species: 52% marine with a higher frequency in species of economic interest (fisheries and aquaculture) and decapods; 40% freshwater with a higher frequency in standard test species, principally cladocera; and 8% in estuarial species with ecological interest. The 63% reported analysis of toxicity (30% field study, 70 % bioassays) and 37% described the presence of plastic in digestive tract or gill chamber. The analyzed effects at the individual level include alterations in: survival, feeding rate, accumulation and assimilation efficiency, reproductive output, growth, malformations, behavioral disorders, osmoregulation, enzyme activity, oxidative stress, and genotoxicity. At the ecological level, the main processes include: selection and use of plastic debris, food-web transfer, bioaccumulation and transgenerational effects. All results suggest that crustaceans are at high risk for ecosystem disadvantage by plastic contamination loads, which reflects their relevance as bioindicators. Besides we identify knowledge gaps to propose some future directions in research, like the impact on ecdysis, on embryo development, on biomagnification, and the effects on target fisheries species which involves a possible effect on human health through ingestion (RIESCOS-CYTED 2018-P418RT0146).

06B.25 Critical Evaluation of Brazilian Regulations for Balneability: A Case Study in Freshwater Beaches

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Water monitoring is an important tool to verify the compliance with the regulations. In Brazil, the balneability of beaches are regulated by CONAMA no. 274 of 2000. However, the existing regulation is 21 years old and may not be as protective as it should be. It mainly includes E. coli as a quantitative parameter. Specially for freshwater water bodies, which these days are in their majority highly eutrophic, some microbiological parameters, such as cyanobacteria and cyanotoxins could be important to be considered. They can cause allergic reactions and their toxins can be present in concentrations that pose risk to humans during recreation activities. In this project, the Brazilian regulation for balneability was compared with several other norms from other countries and guidelines of WHO. For this study we selected sites where the waters are used for recreation in the PCJ basin. We used data kindly provided by CETESB from a period of 10 years. We compared cyanobacteria, cyanotoxins, and chlorophyll with the values provided in the different norms found in our survey. For several sites the values of the three parameters were above the maximum allowed values from other countries and WHO. We conclude that it is imperative that more studies are conducted to verify the possibility of the inclusion of those parameters in the national recreational norm. The work offers first insights for the improvement of the Brazilian regulation; however, other water bodies should be analyzed to offer a more accurate analysis.
Aknowledgements: CETESB – Environmental Agency of São Paulo State.

06B.27 Individual and Combined Effects of Current-Used Fungicides in Fish: Bioaccumulation and Oxidative Stress

Responses

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The intensive use of fungicides to maximize rice yields and control crop pests may pose a risk to fish inhabiting paddies. The aim of this study was to evaluate the effect, either individually or combined, of two fungicides commonly used in rice fields on bioaccumulation and oxidative stress in the freshwater fish *Prochilodus lineatus*. Juveniles (3.4 ± 1.1 g; 6.9 ± 0.7 cm total length) were exposed for 96 h to environmentally relevant concentrations, a low (1) and a high (2), of azoxystrobin (AZO-1 = 10 µg L^{-1}, AZO-2 = 100 µg L^{-1}) and cyproconazole (CYP-1 = 4 µg L^{-1}, CYP-2 = 40 µg L^{-1}), individually and in mixture (active principles and a commercial formulation). The fungicide concentrations and mixtures (ratio 70:30, AZO:CYP) were selected based on literature data and a previous sampling in a rice field. Treatments tested at triplicate were: AZO-1, AZO-2, CYP-1, CYP-2, mixture low M-1 (AZO-1 + CYP-1) and mixture high M-2 (AZO-2 + CYP-2). Besides, similar fungicide mixture treatments were assayed with a commercial formulation: F-1 y F-2. In addition, a negative control (NC) and a solvent control (SC) were tested. Bioaccumulation analyses were performed on whole fish due to their small size. Superoxide dismutase (SOD), catalase (CAT) and glutathione-S-transferase (GST) enzyme activities, as well as levels of lipid peroxidation (LPO) were evaluated in gills and muscle. Results showed that no significant differences were observed between NC and SC. Fish exposed to the higher concentrations (individually and in mixtures) bioaccumulated more fungicides than those exposed to the lower ones. No significant differences were observed among individual and mixture treatments within the same concentration levels. Alteration of tissue antioxidant defenses in muscle tissue was observed, mainly through SOD and GST activities which were significantly decreased in all experimental groups. In turn, muscle oxidative damage was present in fish at all treatments. By contrast, gills antioxidant enzyme response was variable among groups, except for GST activity which also decreased at all treatments. Increased gills LPO were only observed in M-C1. In conclusion, environmentally relevant concentrations of AZO and CYP accumulate and cause oxidative stress in *P. lineatus*, both individually and in combination. Gills were less sensitive than muscle tissue to fungicide exposure and similar effects were produced by the mixture of active principles and the commercial formulation.

06B.28 Exposición Aguda de Cnesterodon Decemmaculatus a Glifosato y Clorpirifós: Efectos en Parámetros de Defensas Antioxidantes, Estrés Oxidativo y Detoxificación

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En Argentina durante el año 2017 se aplicaron 196.009 toneladas de plaguicidas, siendo el herbicida glifosato (N–(fosfonometil) glicina, PMG) y el insecticida clorpirifós (O, O-dietil O-3,5,6-tricloro 2-piridil fosforotioato, CPF) los plaguicidas organofosforados más utilizados. La exposición a contaminantes ambientales puede generar un desbalance redox celular entre moléculas de alto potencial oxidante derivadas del oxígeno (especies reactivas de oxígeno, ROS) y las defensas antioxidantes, ocasionando finalmente daño sobre macromoléculas de vital importancia. El objetivo de este trabajo fue evaluar el efecto de la exposición aguda a PMG (1 y 10 mg × L^{-1}) o CPF (1 y 5 µg × L^{-1}) sobre biomarcadores de defensas antioxidantes, estrés oxidativo y detoxificación en un teleósteo nativo, *Cnesterodon decemmaculatus*. Se realizaron bioensayos semi-estáticos de toxicidad aguda con hembras de esta especie, según norma IRAM 29112-2008. Finalizado el tiempo de exposición (96 h) se prepararon homogenatos de la sección anterior, tercio medio y músculo, determinándose parámetros de defensas antioxidantes (catalasa (CAT), superóxido dismutasa (SOD), glutatión (GSH)); marcadores de estrés oxidativo (peroxidación lipídica (TBARS)) y actividad de la enzima detoxificante (GST). Luego de la exposición a CPF se determinó en la sección anterior un aumento significativo respecto al grupo control de la actividad de CAT del 40% y 111% para 1 y 5 µg CPF × L^{-1}, respectivamente. En el tercio medio la actividad de esta enzima disminuyó en un 64% para la concentración más alta. Por otro lado, luego de la exposición a 10 mg PMG × L^{-1} se observó en el tercio medio un aumento de la actividad de GST del 83% y de los niveles de GSH del 59%, mientras que en el músculo el incremento para GST fue del 57%. Finalmente, en ningún tejido se observaron cambios en TBARS ni en la actividad de SOD. Estos resultados evidencian que la exposición a estos plaguicidas genera, en las condiciones ensayadas, una respuesta de las vías de protección antioxidante en *C. decemmaculatus*, CAT para CPF y GSH para PMG, difiriendo además los efectos entre tejidos. Esto podría estar indicando que si bien ambos tóxicos estarían induciendo estrés oxidativo, los efectos sistémicos pueden diferir, dependiendo de las vías de metabolización y del destino de los mismos. Asimismo, en el escenario de exposición a glifosato los resultados sugieren que GST estaría involucrada en la vía de detoxificación de este xenobiótico.

06B.29 Mercury and Cadmium Bioaccumulation in Guiana Dolphins, Sotalia Guianensis (Van Bénéden, 1864) From Ilha Grande Bay, Southeast Brazil

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Guiana dolphin (*Sotalia guianensis*) is a small coastal delphinid with high residence and site fidelity, a long lifespan of about 30 years and a high trophic level. These characteristics make the species a good sentinel for coastal contamination by metals, like mercury and cadmium. The aim of the present study was to evaluate total mercury (THg) and cadmium (Cd) bioaccumulation by analyzing concentrations in the kidney of Guiana dolphins from the Ilha Grande Bay (IGB), southeast Brazil. The study area is a miscellaneous of protected areas and economic activities such as fishery, tourism, nuclear energy and oil-gas terminals. Samples were collected from 20 carcasses found stranded between 2013 and 2017. Renal THg and Cd concentrations did not vary significantly (student´s t-test, $p< 0.05$) between female (THg: 0.76±0.81 $mg.kg^{-1}$ w.w.; Cd: 0.99±0.63 $mg.kg^{-1}$ w.w.) and male individuals (THg: 1.69±1.06 $mg.kg^{-1}$ w.w.; Cd: 0.85±0.4 $mg.kg^{-1}$ w.w.). Both metals showed positive correlations between kidney concentrations and total length (Pearson correlation, THg: $r=0.66$, $p< 0.05$; Cd: $r=0.74$, $p< 0.05$) and only Cd showed a positive correlation with age (Pearson, Cd:

r=0.69, p< 0.05; THg: r=0.46, p>0.05). Despite being recognized as the main excretory organ in mammals and one of the routes for metals elimination, the kidney has an important role in Cd accumulation due to the presence of metallothioneins that exhibit a high affinity to this metal. The absence of a clear correlation between THg concentration and age must be interpreted with caution as positive correlations are widely reported in the literature. Once cephalopods are a well-known source of Cd for their predators, low levels of this metal when compared to squids feeding dolphins (*Stenella frontalis* and *Stenella clymene*) in the same region indicates low importance of squids on the diet of Guiana dolphins. Indeed, Cd concentrations reported in the present study are in the same range as other studies with no squids feeding dolphins from the Brazilian coast (e.g., *Tursiops truncatus* and *Steno bredanensis*). The THg concentration in the kidney was in the same range as other Guiana populations from the Brazilian southeast and northeast coast. This study was the first to assess Cd and THg in renal tissues of Guiana dolphins from IGB, supporting knowledge in ecology and helping to improve conservation and management actions.

06B.30 Using Trace Elements to Discriminate Populations of Franciscanas (Pontoporia blainvillei), the Most Endangered Dolphin From the Southwestern Atlantic Ocean

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Trace elements bioaccumulation patterns can be an important tool to evaluate differences among cetacean populations. In this work, their use as potential chemical markers to discriminate Franciscana dolphin (*Pontoporia blainvillei*) populations was evaluated. Franciscanas were collected from three states in southeastern Brazil, which comprise three different Management Units (Franciscana Management areas, FMA): Espírito Santo (FMA Ia; n=22), southern Rio de Janeiro (FMA IIa; n=10), and central São Paulo (FMA IIb; n=25). The concentrations of As, Cd, Cu, Fe, Hg, Mn and Zn were determined in the muscle, liver and kidney of dolphin carcasses collected from 2015 to 2020. Discriminant analysis applied to metal concentration values in liver and kidney distinguished at least two different groups: the FMA IIa stock and the others, mainly driven by higher Cd values in the former (medians of 5.66 and 21.4 $\mu g.g^{-1}$, dry weight in liver and kidney, respectively). We hypothesized that higher Cd levels in FMA IIa individuals are due to: (1) their diet being predominantly of cephalopods, opposing the predominantly ichthyophagous feeding habits of FMA Ia and FMA IIb animals; and/or (2) the influence of the South Atlantic Central Water (SACW) in the FMA IIa, as a source of trace elements to surface waters. Studies regarding Franciscanas feeding habits would help to advance these hypotheses but are still lacking in FMA IIa area. Slightly higher Mn concentrations in specimens from FMA Ia (maximum of 33.0 $\mu g.g^{-1}$, dry weight in liver) may be related to the tailings mud that reached the area in 2015, after a massive dam failure, and must be monitored. In general, concentrations were similar to those found in other FMAs. Trace elements concentrations in Franciscana dolphins may pose an additional threat to them and might represent the contamination levels in their environment, reinforcing the suitability of Franciscanas as a sentinel species. Therefore, information on trace elements concentrations is important to guide management and conservation actions for this endangered species.

06B.31 Low-Dose Copper Nanoparticles Can Affect Microalgae Physiology: A Case Study With Ankistrodesmus Densus

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The peculiar properties of copper nanoparticles (Cu NP) lead to their multiple applications in industrial sectors and, consequently, to their release in natural aquatic ecosystems. Presenting high reactivity, a tendency to adhere to particulate surfaces in the environment is expected. Microalgae are base of aquatic food webs and their cell surface constitute substrate for NPs adherence, posing into risk these organisms and those that feed on them. This study examines the role of low dose Cu NP in the growth and photobiology of a common freshwater phytoplankton, *Ankistrodesmus densus*. We investigated cell viability, growth rates and photosynthesis focusing in environmental concentrations of the nanoparticles. Laboratory controlled 72 h toxicity tests were conducted to expose the cells to a Cu NP concentration range from $2.1x10^{-9}$ to $8.4\ x10^{-9}\ molL^{-1}$. Free copper ions in culture medium were determined and used as surrogate for nanoparticles concentrations, since these particles release their constituent ions into the surroundings. Cell analysis was performed by flow cytometry, so inferring about their viability; photosynthesis was evaluated by pulse amplitude modulated fluorometry using a PhytoPAM unit to conduct rapid light curves. Their photosynthetic related parameters, in addition to carbon fixation, were analyzed. Still related with photosynthesis, effective and maximum quantum yield, photochemical (qP) and non-photochemical quenchings (NPQ) were also determined. We showed that Cu NPs concentration that were responsible for the release of as low as $2.1x10^{-9}\ molL^{-1}\ Cu^{2+}$ ions were enough to decrease growth rate of *A. densus*. Cell viability was the most sensitive parameter to Cu NPs and correlated inversely to copper ions in the medium. Although growth rate was less intensively affected, it also decreased as function of copper increase. In relation to photosynthesis, heat dissipation as inferred by non-photochemical quenching (NPQ), increased as copper increased in culture medium. Similarly, the efficiency of light use by the cells were highly affected in Cu NP exposed cells, but light saturation was not correlated to Cu NP concentrations. We clearly demonstrated that even environmental levels of Cu NP may pose into risk natural populations of phytoplankton, affecting their ability to complete photosynthesis and the viability of the cells.

06B.32 Masculinization in the Ten Spotted Live-Bearer Fish (Cnesterodon decemmaculatus) From the Middle Basin of the Reconquista River (Argentina) With High Anthropic Impact

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Fish are commonly exposed to several pollutants which can cause endocrine disruption. The Reconquista River (Buenos Aires) is the second most polluted river in Argentina, since it receives wastewater and untreated industrial discharges. Adults of *Cnesterodon*

decemmaculatus (Poecillidae, Cyprinodontiformes), a viviparous freshwater fish, were collected from the middle river basin. Water samples were taken to analyze the physicochemical parameters. *C. decemmaculatus* possess external sexual dimorphism, where males are smaller than females and have an intromittent sexual organ (*gonopodium*). The aim of this work was to compare fish from the Reconquista river with a laboratory raised group (control) using biochemical, energetic metabolic, and histological biomarkers. Gonads were fixed using Bouin solution and stained with Masson's Trichrome for routine histological analysis. For biochemical and metabolic biomarkers analysis we dissected: brain for acetylcholinesterase activity (AChE); liver for glutathione-S-transferase activity (GST), catalase (CAT) and glutathione content (GSH); gills for GSH content; and muscle for AChE and energetic metabolism: lipids, carbohydrates, proteins and the electron transport system of the mitochondrial chain (ETS). Morphometric indices were also calculated: FC (condition factor), HSI and GSI (hepatosomatic and gonadosomatic index, respectively). Significant differences between groups were analyzed by "t" test or Mann Whitney for paired samples using Infostat software. When fish were sexed under a stereoscopic microscope, intersexes were found. These showed a relatively well developed gonopodium together with female gonads with vitellogenic follicles and embryos; no testicular tissue was found. Brain and liver biomarkers from the intersexes river fish showed a significant increase (+ 25/50%) of AChE and GST activities as well as of GSH content, in comparison with control group. Muscle ETS activity was lower from intersexes river fish (-200%). Furthermore, morphometric indices (FC and HIS), were higher in intersex fish than in control ones. Water quality showed a hypoxic condition and high ammonium levels. These results are the first evidence of masculinization in *C. decemmaculatus* females in an urban river under a several anthropic impact. Since this fish species is widely used as a sentinel in environmental monitoring studies, this features could be considered as an indicator of contamination by endocrine disruptors.

06B.33 The Impact of Copper on Biomolecules Synthesis in Ankistrodesmus Fusiformis: A Chemical Stress Study

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Microalgae are photosynthetic organisms found at the base of the food chain, being the gateway to nutrients and other substances to higher trophic levels. Recently, the biotechnological potential of microalgae has been noted, which may produce molecules of interest to the pharmacological, food, aquaculture and agricultural industries, among others. Although presenting physiological plasticity and thus responding to environmental changes through the synthesis of compounds that can protect them, it is still a challenge to have microalgae producing high quantities of biomolecules while in high growth rate. Investigations show that at particularly low doses, copper can lead to increase in biomolecules productivity in some microalgae without affecting too much their growth rate. We studied 8 free copper concentrations ranging from 1.32x10-10 to 7.79x10-8 molL-1 in the physiology and biomolecules synthesis in the Chlorophyta Ankistrodesmus fusiformis under controlled laboratory conditions. Total chlorophylls and carotenoids, growth rates, photosynthesis through maximum and operational quantum yield, qP and NPQ, and rapid light curves parameters (alpha, beta, Ek, ETR) were studied through the chlorophyll a fluorescence technique using a PhytoPAM. The highest growth rate was obtained between 5.81x10-9 - 1.03x10-8 molL-1 free Cu2+, which was significantly higher than at 7.79x10-8. The highest total chlorophylls and carotenoids concentrations were obtained in cells exposed to 1.03x10-8 free Cu2+, which were significantly higher than those produced at 7.79x10-8 free Cu2+. For qP and NPQ quenchings, and rapid light curves (RLC) parameters, alpha and beta, copper had no effect. In 7.79x10-8 molL-1 free Cu2+, cells showed the lowest ETRmax and Ek, which were significantly different from those at all other Cu concentrations. Under the present conditions, 1.03x10-8 molL-1 free Cu2+ produced high population growth and high total chlorophylls and carotenoids, while maintaining optimum photosynthesis in the microalgae. This study contributes to a better understanding of the effects of low-dose copper on the physiology of Ankistrodesmus fusiformis, and developing a strategy to increase the production of biomolecules, thereby providing new insights into microalgae biotechnology.

7. Ecotoxicology of Birds and Mammals: Novelty and Challenges

7.01 Assessment of Erythrocyte Nuclear Abnormalities in Oiled Spheniscus Magellanicus As a Suitable Biomarker of Genotoxicity. New Tools for Rehabilitation Centers

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Genome stability could be influenced by environmental factors; therefore, it can be used as index for an individual's response on environmental impact and stress, such as pollutants. When birds are exposed to less than acutely lethal dosages, oil can cause a wide range of adverse effects, including hemolytic anemia, decreased nutrient absorption and decreased immune function. Evaluation of gene and cytotoxicity is an interesting field and valuable tool in environmental toxicology, although few studies have been conducted in wild birds. Among the methods for the estimation of genome instability is the evaluation of erythrocyte nuclear abnormalities (ENAs), which may be useful in field research of birds. The aim was to evaluate ENAs frequency in oiled Magellanic penguin (*Spheniscus magellanicus*) as biomarkers of genotoxicity. In addition, we assessed levels of ENAs in penguins during rehabilitation process. Peripheral blood samples of oiled (n=29) and rehabilitation (n=21) Magellanic penguins were taken during 2011 and 2013 in Buenos Aires Province, Argentina. The number of ENAs was scored for each blood smear in relation to 1000 mature erythrocytes. Considering the total of ENAs, oiled penguins (25.38 ± 12.16) presented significantly higher levels than rehabilitation animals (9.43 ± 5.71). In particular, oiled penguins presented higher values of the following ENAs: tailed nucleus, budding nucleus, kidney-shaped nucleus, nucleus with cavity and unknown nuclear malformation. No significant differences ($p>0.05$) were found between groups for micronucleus and lobed nucleus. The present study represents the first approach on assessing not only the frequency of MN but also other ENAs in *S. magellanicus*. The micronucleus is the most widely used genotoxicity marker in birds. However, micronuclei were found in low frequency (range: 0-4) in all Magellanic penguins, indicating that the evaluation of other ENAs is a better biomarker to evaluate genotoxicity for the species. The results show that oiling below lethal dosages produces genotoxicity in Magellanic penguin, and that the rehabilitation process is adequate to reverse this damage. However, although the number of ENAs decreases during rehabilitation, it is not known what the long-term damage could be. Therefore, it is important to record the effects of stressors such as oil for long-term comparisons.

7.02 Behavioral and Physiological Response of the Wild Grayish Baywing (Agelaioides badius) After Chronic Exposure to Imidacloprid Treated Seeds

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The imidacloprid (IMI) is a neonicotinoid insecticide largely used in seed treatment in many countries, including the Argentinean Pampa Region. The consumption of IMI treated seeds is a hazard for farmland birds, even if only a part of the bird's diet is composed of treated seeds. In this context, the objective of the present study was to characterize the effects of IMI in the wild grayish baywing (*Ageliaioides badius*) in a realistic scenario in which birds feed chronically on treated seeds as a portion of their daily diet. To address this issue, baywings were fed for 32 days with IMI treated seeds with 2.5 and 15 % of a regularly used concentration (3 g IMI/ kg seed), simulating the consumption of the 2.5 or 15% of their daily diet as treated seeds. Seeds were sprayed with the product Confidor® OD, and treatment concentrations were 0.075 g IMI/kg seed (Low dose) and 0.45 g IMI/kg seed (High dose). The effects exerted by IMI on birds were evaluated in a variety of behavioral, physiological, hematological, genotoxic, and biochemical parameters during and after exposure. In both treatments, delayed mortality was observed: 60% (N=7) of individuals died in the High-dose group within 15 days, and 8% (N=1) in the Low-dose group after 30 days. The mean survival time for the High-dose group was 12,5 days. High-dose birds significantly decreased their feed intake rate by 20% the first three days, compared to the other groups. High-dose birds also decreased their body weight the first week ($p< 0.05$). Birds treated with the High dose had lower escape reactions and lower response to a predator's sound ($p< 0.05$). Birds exposed to the higher IMI treatment, experienced reduced mobility in the cage the first two weeks, while the Lower-dose group experienced reduced mobility in the fourth week of exposure ($p< 0.05$). No alterations in the hematological or genotoxicity parameters were observed in treated birds after 32 days of exposure. After the 32 days of exposure, glutathione S transferase activity in the plasma of treated birds decreased, and the cholinesterases activity increased in the liver of treated birds ($p< 0.05$). This study highlights that consumption of only 2.5% of bird's daily diet as IMI treated seeds, is sufficient to generate sublethal effects and death. In the field, these effects may have consequences on wild birds affecting their capacity to search for refuge or escape from a predator, representing a risk to farmland bird populations.

7.03 Bottlenose Dolphins, Galapagos Sea Lions and Galapagos Fur Seals As Sentinels of Mercury Contamination in the Southeastern Tropical Pacific

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Anthropogenic mercury is a global pollutant of great concern and highly toxic to top predators, including marine mammals. It can biomagnify in foodwebs reaching exposure concentrations above threshold health effects. Bottlenose dolphins (*Tursiops truncatus*) are the most common cetacean found in the coastal waters, estuaries and mangroves of Ecuador. Galapagos sea lions (GSL, *Zalophus wollebaeki*), and Galapagos fur seal (GFS, *Arctocephalus galapagoensis*) are endemic and endangered marine mammals of the Galapagos islands. These species serve as sentinels of ecosystem health to assess and monitor the exposure to and impact of pollutants in tropical marine and estuarine environments. This research aimed to investigate total mercury (THg) bioaccumulation in marine mammals and assess these species as

sentinels of mercury exposure in Ecuador. We evaluated THg in free-ranging bottlenose dolphins in the El Morro Mangrove Wildlife Refuge (Guayaquil Gulf), and in GSL and GFS from different rookeries of the Galapagos Archipelago. Skin samples were collected from adult and subadults bottlenose dolphins using biopsy dart collection technique (n=9); hair samples were collected from pups (3 months of age) of GFS (*n*=50) and GSL (*n*=50) from seven rookeries of the GMR. The THg mean concentrations (±SD) were 3.2±0.64 and 2.7±0.68 mg/kg dw in males and females dolphins respectively, in GFS were 15.5±4.94 and 16.8±7.67 mg/kg dw in males and females respectively; and 14.9±4.27 and 15.7±9.67 mg/kg dw in males and females of GSL, respectively. There were no statistical differences observed between sex in any of the species. The skin concentrations found in dolphins were comparable to those reported in estuarine areas of the U.S. THg mean concentration in both pinnipeds species was 3 times higher than that reported on California sea lion juveniles and similar to that in Steller sea lion pups. The THg threshold effect concentration of 0.21 mg/kg ww, reducing lymphocyte proliferation in marine mammals, was exceeded in 100% of dolphins and Galapagos pinnipeds´ samples. Our finding shows that bottlenose dolphins in coastal Ecuador and Galapagos pinnipeds are exposed to environmental contaminants and can serve as sentinel species for ecosystem health to monitor pollution in the region and to support ecotoxicological risk assessment and pollutant management. This study also provides the first baseline on THg concentrations in Galapagos pinnipeds in the south eastern tropical Pacific.

7.04 Modeling Didelphis Albiventris and Didelphis Marsupialis As Bioindicators of Mercury Contamination in South and Central America

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Habitat loss and environmental fragmentation caused by anthropization have altered species richness and distribution, leading to foraging overlap. The genus Didelphis is recognized for its food plasticity and resilience based on characteristics, the dispersion and projections of areas occupied by *Didelphis albiventris* and Didelphis marsupialis were simulated. The simulations were performed using RStudio version 4.0.2 with dismo, sdm, usdm, rgbif, and maptools packages. A simulation uses the longitude and latitude data imported from the “Gbif” database and a raster that evaluated bioclimatic variations from the Worldclim database. The collinearity between the environmental variables was verified as well as the variation factor (VIF) to exclude highly correlated variables by the "stepwise" process. The maps were processed with the environmental variables in different palettes to indicate the distribution of species in South and Central America where the occurrence points were plotted. The bioclimatic variables used were the coefficient of variation of the character concerning seasonality and the annual mean temperature. *Dildelphis marsupialis* and *Didelphis albiventris* were modeled by analyzing the dispersion and potentiality of bioindication of contamination by heavy metals. Through the command "extract" the bioclimatic data were related to the coordinates of the species database and scaled into 5 groups with random plots. The modeling should be delimited to facilitate the simulation of “average annual temperature” climatic characteristics. After selecting the bioclimatic variables, the model is evaluated and the limit defined, generating the final graph of the model with *Didelphis albiventris* and *Didelphis marsupialis*. The models created can predict the distribution of species with potential bioindicators and help interpret the bioaccumulation of metals within trophic levels caused by the anthropization process. When modeling two species that occupy antagonistic spaces, *Didelphis albiventris* presented itself as a bioindicator of conserved areas, with high altitude and low temperature, as in the Andes mountain ranges, while *Didelphis marsupialis* is an indicator of fragmented, deforested, or urbanized areas.

7.05 Latin American Approaches for Evaluating Risk of Pesticides to Birds and Mammals in Agricultural Landscapes

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The development of a suitable framework and guideline for birds and mammals pesticide risk assessment is getting more and more attention in Latin America. As an example, the Brazilian Institute of Environmental and Renewable Natural Resources (IBAMA) has been working on establishing and implementing environmental risk assessment frameworks for different classes of organisms (e.g., pollinators and aquatic organisms) and has publicly announced that they will also develop a risk assessment approach for terrestrial vertebrates (birds and mammals). Other countries such as Costa Rica already uses European Food Safety Authority (EFSA) as reference guideline and Colombia has a guideline for birds and mammals risk assessment which is based on its own risk assessment framework (Andean Technical Manual) together with refinement options proposed by the United States Environmental Protection Agency (USEPA) or EFSA. A suitable guideline for birds and mammals risk assessment must be clear, protective, conceptually robust, and to a certain extend, pragmatic. The bird and mammal guidelines from the European and the US environmental authorities (EFSA and USEPA, respectively) are internationally recognized as references. However, adopting them in other regions, without a meticulous analysis and discussion, is challenging because their premises and assumptions are based on scenarios and species that are not necessarily representative of local biota and conditions. Our objective is to discuss the challenges and opportunities of using both guidelines. The limited data on the occurrence of birds and mammals in representative agricultural landscapes, and the insufficient data about residues in food items, are some examples of information gaps that should be considered when developing a risk assessment framework that will support the decision of risk managers. A clear and science-based environmental risk assessment framework is very important for pesticide registration and to contribute to the protection of local biodiversity.

7.07 Persistent Organic Pollutants in Killer Whale (Orcinus orca) From Argentina

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The killer whale (*Orcinus orca*) is a cosmopolitan marine top predator species, even preying on other marine mammals. This characteristic and the magnification of POPs in their trophic food web, it is responsible for the high accumulation in the species. The levels of POPs, mainly

polychlorinated biphenyls (PCBs), have been evaluated by several authors, because they represent a threat to different populations, even the data have been modeled to estimate the risk. Three killer whales stranded in northern Argentina, two females (estimated age < 10 years, and < 15 years) and one male (estimated age < 15 years) were analyzed. Organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs) were analyzed by GC-ECD in blubber, skin, liver, kidney, muscle, intestine (wall and content). Total OCPs showed higher concentrations than PCBs. Blubber showed the highest levels of both POPs groups, followed by liver/kidney, muscle/intestine wall and skin. The concentrations pattern of OCP was DDTs > drins heptachlors> endosulfans > chlordans > HCHs. DDE had a detection frequency of 100% in all tissues and specimens, with maximum levels in blubbler (688.9 ± 162.3 ng·g^{-1}, ww), while DDT only in one blubber sample; usually in marine mammals DDE is the main compound of DDT group, evidencing its capacity to biotransformation. Among HCH group, only α- and β-isomers were found, with a predominance of β-HCH in tissues and levels. Among 40 PCBs congeners, three dioxin-like (mono-ortho-substituted #118, #156 and #167) were found, and #118presented the highest levels. Similar to OCPs, PCBs showed the maximum concentrations in blubber (total PCB concentration 788.8 ± 203.0 ng·g^{-1}, ww), and they were present in 100% of samples. A predominance of 5-CB and 6-CB was observed in all analyzed tissues. These results indicate that despite the forbidden use of POPs, a bioaccumulation of PCBs and legacy OCPs were found in killer whales from Argentina, as it was reported for specimens from other geographical regions of the world.

7.08 Cytological Alterations in Red Blood Cells of Oiled Magellanic Penguins

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Crude oil is one of the most widespread pollutant released into the marine environment causing a wide range of biological effects in marine species, including birds. The hematological changes serve as an early indicator for screening the toxic impacts of pollutants on tissues. Toxic substances could induce damage to the red blood cells (RBC) that could lead to abnormalities in the cellular morphology. Mean number, prevalence, and intensity of cytological alteration in RBC, such as anisocytosis and poikilocytosis, were correlated with pollutants including PAHs. Within seabirds, penguins are widely used as biomonitors of the state of the ecosystem. Being long-lived and predatory at the top of the trophic webs, they are exposed to numerous stressors that can result in the accumulation of these pollutants in their tissues, with possible consequences on health. In particular, Magellanic penguin (*Spheniscus magellanicus*) is the most important marine bird as a tourist resource on the Argentine coast. This species is categorized as Near Threatened on the Red List of the International Union for Conservation of Nature. This responds to the fact that many populations are being affected by fishing activities, chronic oiling and global climate change. The aim was to evaluate cytological alterations frequency in oiled Magellanic penguin as biomarkers of cytotoxicity. Peripheral blood samples of oiled (n=29) penguins were taken during 2011 and 2013 in Buenos Aires Province, Argentina. Giemsa-stained blood smears were used for estimation of abnormality in RBCs including anisocytosis, poikilocytosis, hypochromasia, polychromasia and erythroplastids. Areas with a clear distribution of erythrocytes were identified for each slide as a well-defined and separate cytoplasm. Areas which presented overlapping cells were not taken into consideration. Additionally, hematocrit and lipid peroxidation, as TBARs levels, were determined for each penguin. Our hypothesis is that RBC cytotoxicity is associated to chronic oiling condition in Magellanic penguins, presenting higher frequency of cell abnormalities. Furthermore, these alterations are correlated with low hematocrit and high levels of lipid peroxidation.

7.09 Assessment of Anthropogenic Impact in Three Environments of Mendoza (Argentina) Using Satellite and Cytogenetic Tools in the House Sparrow (Passer domesticus)

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Free-living birds can be used as bioindicators to study biomarkers that can indicate the health of environments. In addition, these can be characterized by visual and digital analysis of satellite images. The objectives of the present study were to analyze the types and quantity of cytogenetic biomarkers in *Passer domesticus* from three environments: wild, urban and rural of the same phytogeographic region, characterized by the analysis of Landsat 8 images; and to analyze them in the context of land use and anthropogenic actions. A total of 5000 erythrocytes per bird from 30 *P. domesticus* were analyzed for the following nuclear alterations (NA): micronuclei (MN), anucleated cells, binucleated cells, nuclear notched, peripheral nuclei, nuclear buds, nuclear tails and nuclear bridges. The wild site was dominated by native bush (100%), the urban site by urban soil (87%), and the rural site had 5% agricultural crops within the flight radius of *P. domesticus*. The only NA that exceeded a frequency of 2 NA/ 1000 erythrocytes were the peripheral nuclei in the birds of the rural and urban sites, of greater anthropic activity with respect to the wild site. It is pertinent to comment that eight days before sampling, the rural site had been sprayed with chlorpyrifos 48%. On the other hand, the urban site presents reports of atmospheric contamination, mainly from vehicles. House sparrows inhabiting the rural site presented MN, peripheral nucleus and enucleated erythrocytes in higher proportion than house sparrows from the other sites ($p \leq 0.05$). A precedent is set for the use of environmental remote sensing in a complementary manner with cytogenetic biomarker studies in birds to obtain information on characteristics and possible impacts on environments.

7.10 Blood Transcriptome Analysis Reveals Significant Effects of Florfenicol in Gene Expression in a Long-Distance Migratory Bird

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Long-distance migratory Hudsonian godwit (*Limosa haemastica*) travels 15,000 Km from the Arctic to Chiloé Island to spend the non-breeding season. In recent decades, salmon farming industries have been established on Chiloé Island, thereby releasing considerable amount of antibiotics around godwits' foraging intertidal areas. Notably, during 2014 the salmon industry released to 451 and 563 tons of florfenicol and oxytetracycline, respectively. Despite the potential biological effects of

antibiotics to wildlife, detailed studies in this key coastal wetland are lacking. Here we used a non-lethal technique to assess the potential effects of antibiotics on Hudsonian godwits during the austral summer. To do so, we housed 16 godwits in indoor aviaries (two treatment and two control groups of 5 individuals each) and exposed treatment birds to environmentally relevant concentrations (16.35 mg d^{-1} $bird^{-1}$) of florfenicol in drinking water using acute (2d) and chronic (78d) expositions. After RNA extraction from blood, 135,860 transcripts were *De Novo* assembled annotating 47,951. Due to the non-lethal nature of this technique, two types of comparison are possible: traditional inter-groups (different individuals on different exposures -control groups vs treatment group) and temporal intra-group (same individuals before and after exposures). Strikingly, we retrieve about five times more differentially expressed transcripts from temporal intra-group compared to traditional inter-group comparison. Total number of transcripts changed in the blood of birds exposed to florfenicol were 64 for acute exposure and 118 for chronic exposure. Transcripts related to cellular stress such as Hsp70/DnaK were also affected. The most affected transcript was a coiled-coil domain-containing protein 117 associated with DNA damage which was upregulated in godwits chronically exposed to antibiotics. In general, chronic exposure exerted more changes in godwits' blood transcripts compared with acute exposures, including strong repression of several mRNA. This emphasizes the importance of extrinsic (anthropogenic) factors in regulating the physiology of migrating birds, with differential effects of (acute vs chronic) exposure to antibiotics potentially affecting migratory costs. Finally, this novel technique opens an avenue of environmental science research as it allows the examination of changes in physiological processes within wild animals across time, space and major life-history challenges.

8. Endocrine Disruptors Compounds Environmental Presence and Effects

8.01 Control Performance of Amphibian Metamorphosis Assays With Xenopus laevis

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The amphibian metamorphosis assay (AMA) is an *in vivo* screen to assess potential interactions with the amphibian thyroid system. Larvae are exposure for 21-days, at 7- and 21-days individuals are assessed for development and growth metrics. Thyroid gland histopathology is performed at test termination. This poster presents data from 46 studies performed to satisfy test orders from the United States Environmental Protection Agency's Endocrine Disruptor Screening Program. Data Evaluation Records were used to collate the typical control variability and performance of test parameters in AMAs conducted in different laboratories. We assess whether available historical control data (HCD) can assist evidence-based interpretation of the endpoints. Reliable HCD ranges could be developed for the core study endpoints and the associated validity and performance criteria. The data are discussed in terms of improving assay performance and interpretation.

8.02 Integrating Cytotoxicity Profiling to AID in the Interpretation of the H295R Steroidogenesis Assay

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The OECD validated H295R steroidogenesis assay (OECD test guideline 456) utilizes human adrenocortical carcinoma cells to evaluate chemical effects on testosterone (T) and 17β-estradiol (E2) production. This assay requires a parallel measure of cytotoxicity, generally by MTT. With steroidogenesis being a process, whose rate limiting, and commitment steps depend on mitochondrial enzymes, it is informative to assess cell viability and the state of the mitochondria to help inform on mechanism of action for potential steroidogenesis disruption. Herein we integrate a battery of cytotoxicity assays to inform on cell membrane integrity, mitochondrial function, and ATP quantification to comprehensively characterize chemical-elicited effects in H295R cells. Using a custom set of ten reference chemicals, this evaluation included 7 complementary assays to inform on potential modes of action for cytotoxicity. For example, we can assess which chemicals cause effects on cell membrane integrity (LDH-Glo) as opposed to mitochondrial effects such as depolarization (JC-10) or ATP production (MTT). Chemicals were evaluated at five test concentrations; after 48 hours of exposure, concentration-response effects on cell viability were assayed as well as quantifying T and E2 levels. For example, carbonyl cyanide m-chlorophenyl hydrazone (CCCP), a mitochondrial uncoupling agent, resulted in decreased T and E2 levels and elicited significant effects in the CellTiter-Glo, Mitotracker, and most notably the JC-10 assay which detects changes in mitochondrial membrane potential. These results confirm that CCCP impaired mitochondrial stability in H295R cells but did not cause overt cell death (with no significant effects detected by MTT, LDH Glo, or CellTiter Blue assays) within the timeframe of the study. Thus, for CCCP mitochondrial disruption likely underlies the observed decrease in hormone production. Cumulatively, this study reveals that comprehensive assessment of cytotoxicity probing cell and mitochondrial status is recommended to complement hormone data in order to separate specific versus non-specific cytotoxic effects on steroidogenesis.

8.03 Occurrence and Human Exposure to Organophosphorus Flame Retardants (OPFRs) in Car and House Dust Microenvironment From Three Colombian Cities

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Organophosphorus flame retardants (OPFRs) have been widely used for several decades in consumer products as additive flame retardants and plasticizers. OPFRs are semivolatile chemicals that are slow in emissions but have long-term effects in indoor environments. Dust from different microenvironments serves as a strong sink for indoor pollutants as OPFRs. Humans are exposure directly to OPFRs through dust should be concerned. Concentrations of 19 OPFRs were determined in house and car dust samples collected from three Colombian cities: Bogota, Medellin and Cartagena. On average, the total concentrations of OPFRs (Σ_{19}-OPFRs 19) in household dust were 46.2, 46.7 and 82.6 µg/g in Bogota, Medellin and Cartagena, respectively while in car interiors in the city of Medellin values of 230.8 µg/g were found these concentrations in car dust were 2 to 4 times higher than those found in dust homes. Regarding to the compounds, the highest average concentration in dust samples was found for TDClPP, (mean ± SD) 53.5 ± 9.9, µg/g, followed by TPHP 50.7 ± 32.1 µg/g, TClPP 21.0 ± 2.5 µg/g, TBOEP 19.2 ± 6.1 µg/g and TCEP 12.1 ± 5.0 µg/g. On average, estimated daily intake (EDI) of ΣOPFRs from dust ingestion in children and adults in households was at 0.0003-0.040 and 0.00011-0.13 µg/kg body weight/day, respectively. For car dust intake in children and adults, it was 0.0003-0.27 and 0.00003-0.034 µg/kg body weight/day, respectively. The interpretation of the EDIs for the OPFRs, it found that the EDIs are several orders of magnitude below the corresponding reference of doses (DfR). Concentrations of OPFRs of the similar studies from other countries were compared with this study which were several order of magnitude higher. Ingestion of indoor dust is an important route of human exposure to OPFRs and could represent a health risk.

8.04 Are "Key Characteristics" Valid for Identifying Endocrine Hazards?

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A new approach for identifying endocrine disrupting chemicals (EDCs) has been recently proposed that involves evaluating chemicals according to whether they exhibit ten "key characteristics" (KCs). This approach is based on the success that has been claimed for the 10 KCs proposed for identification of carcinogens. Using scientific articles published in peer-reviewed journals through the end of 2020, we evaluated the KC approach for EDCs conceptually and empirically for transparency, susceptibility to bias, and for consistency with principles of endocrine pharmacology and dose-dependence of mechanisms of action. We found deficiencies in the KC approach for EDCs that are like those that have been demonstrated previously for the ten KCs of carcinogens. The KC approach for EDCs fails to apply the consensus definition of EDC and it is not amenable to empirical testing or validation. As formulated, it is intended to be flexible according to diverse goals, but this flexibility also ensures that it will produce inconsistent and unreliable results. The proposed KCs for EDCs ignores principles of hormone action and

characteristics of dose-response in endocrine pharmacology and toxicology. The KC approach for EDCs also lacks a means to reach a negative conclusion about a chemical's EDC properties and appears to be incapable of distinguishing EDCs from non-EDCs. This KC approach for EDCs provides no means for developing a valid consensus among experts nor does it provide a means of resolving conflicting interpretations of data. A better approach to the identification of EDCs would build upon validated methodologies using weight of evidence approaches that incorporate critical components lacking in the proposed KC approach for EDCs. Robust WoE approaches include appropriate contextualization of in vitro assays and evaluate data quality and the relevance of the data to specific, testable hypotheses. They also acknowledge the importance of mechanistic potency relative to endogenous hormones, the need to establish causality between mechanistic steps, and consider the dose-dependence of those mechanisms and their relevance in the context of human exposures.

8.05 When Does the Data "Weigh" Enough? Weight of Evidence Approaches for Both Data-Rich and Data-Poor Substances

E.M. Mihaich, ER2

In chemical risk assessment, scientist that follow a weight-of-evidence (WoE) approach evaluate the totality of the scientific evidence to assess if the science supports a given hypothesis. This approach ensures that the most reliable, relevant, and credible studies have the greatest influence in addressing the hypothesis, while acknowledging that some tests and endpoints are more predictive than others. Integrating the various lines of evidence together also allows for the assessment of data consistency and reproducibility. In the case of an evaluation of a potential endocrine mode of action, this assessment becomes a bit more challenging in order to distinguish between endocrine and non-endocrine adverse effects. However, this challenge underscores the importance of using a formal, transparent and systematic WoE process to evaluate potential endocrine activity. No matter how much data is available, the WoE assessment should be based on an unbiased, data-driven scientific analysis of all of the available data that is relevant to test the given hypothesis. For data-rich chemicals, the determination of the existence of a causal link between the mode of action and the adverse effect, a requirement of the definition of an endocrine disruptor, may be fairly straightforward with existing in vitro and in vivo data. However, with the advent of New Approach Methodologies, even decisions for data-poor substances can benefit from a WoE assessment. Case studies will be presented for developing WoE assessments for data-poor and data-rich substances in order to illustrate the development and integration of various lines of evidence for making decisions on causal linkages between potential endocrine modes of action and adverse outcomes.

8.06 Human Exposure to Heavy Metal Pollution in the Colombian Caribbean Sea

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Although elements considered as heavy metals occur naturally in the earth's crust, metal pollution and human exposure are as resulted of the anthropogenic activities. In the Colombian Caribbean Sea, activities such as artisanal gold mining, drinking groundwater, smelting, lead battery recycling and electroplating use of metals and metal-containing compounds. Heavy metal pollution have been related to health effects and several disease conditions because the toxicity of these metals can be endocrine disrupters, affect the central nervous function leading to mental disorder, damage the blood constituents and may be damage of lung, liver, kidneys and other vital organs. Their toxicity depends on several factors including the dose, route of exposure, and chemical species, as well as the age, gender, genetics, and nutritional status of exposed individuals. Arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), and mercury (Hg) rank among the priority metals that are of public health significance because of their high degree of toxicity. Our research group has been analyzed blood samples of high exposure people using atomic absorption spectroscopy with graphic furnace, cold vapor and hydride generation techniques. Concentrations of Pb were analyzed from Cartagena city in informal workers of smelting, battery recycling, and panting which were mean ± SD (range) of 15.3 ± 0.74 (13,6 -16,6), 5.55 ± 6,55 (< LOD – 16.3) and 1,02 ± 3,95 (< LOD – 15,3) µg/dL, respectively. A group of gold mining (n= 106) and non-mining workers (n=18) from San Martin de Loba (Bolivar) were analyzed for Hg concentrations in blood samples obtaining values of 8.82 ± 10.3 (0.61 - 82.5) and 5.69 ± 7.71 (0.75 - 34.4) µg/L, respectively. On 151 participants from studied municipalities Margarita and San Fernando (Bolivar) who drinking groundwater wells (n= 32) with a median (IQR) of 33.3 µg/L (30.9- 36.7) and concentrations of urinary arsenic metabolites were determined, the median (IQR) were 0.8 (0.30 - 1.3) for inorganic As, 0.6 (0.5 - 1.3) for monomethyl As and 1.7 (1.1 - 2.8) µg/g creatinine for dimethyl As.

8.07 Does Exposure to Environmental Concentrations of Plasticizer Bisphenol a Cause Reproductive Alterations in the Cichlid Fish Cichlasoma dimerus?

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Nowadays, aquatic environment and associated biota are exposed to numerous compounds of anthropic origin. Some of these can act as endocrine disruptors (EDCs) interfering with normal functions of endocrine system of non-target organisms. The plasticizer bisphenol A (BPA) is present in aquatic environment from dumping of waste without treatment of large quantities of plastics. BPA has already been described as an EDC in various organisms. It binds to estrogen receptor and alters functions related to reproduction. *Cichlasoma dimerus* is a freshwater fish belonging to cichlid family (Cichlidae) widely distributed in South America. Its adaptations to captivity and reproductive characteristics allow its use as a good model in ecotoxicological tests. In the present study, subchronic exposure tests (14 days) were performed in adults of *C. dimerus* at sublethal and environmentally relevant concentrations of BPA (1; 10; 100 µg / L), based on data from Europe, Asia and North America. Physiological responses to exposure, analyzed from circulating levels of sex steroids (testosterone and estradiol) and detection of vitellogenin (VTG) in plasma and gonadal histology, show that there were no significant effects with concentrations and times tested. However, a trend for decreased testosterone was observed in females exposed to all BPA concentrations, suggesting that significant effects could be seen at longer exposure times. These results contrast

with those carried out in other species of freshwater fish in which changes were only detected at BPA concentrations higher than those that are environmentally relevant or at longer exposure periods. Perhaps we could see changes at times and concentrations tested using more sensitive and early detection biomarkers, such as expression of VTG messenger or steroidogenic enzymes.

8.08 Paracetamol Effects in the Regulate Reproduction Axis of Male Neotropical Catfish

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Paracetamol is one of the drugs with analgesic properties most used in the world, but its exacerbated use and improper disposal contribute to the increased presence in aquatic environments, affecting the biota. In addition to the nephrotoxicity and neurotoxicity observed in aquatic organisms, paracetamol has also been studied as a potential endocrine disruptor. To investigate its action in fish, it is possible to evaluate different parameters in different tissues related to the reproductive axis, such as hypothalamus, pituitary, liver and gonads, as well as quantification of hormones. This study aimed to evaluate the endocrine disruptor effects of paracetamol in the male catfish Rhamdia quelen, using different biomarkers for the reproductive axis. After the acclimatization period, the male fish were exposed to the control treatment (water) and to three different paracetamol concentrations: 0.25, 2.5 and 25 µg/L. Following 15 days, the animals were anesthetized, blood was collected to obtain the plasma. After euthanasia, the hypothalamus, liver and gonad were collected and frozen at -80°C. Plasma was used for the estradiol quantification; hypothalamus for brain aromatase gene expression; liver for the vitellogenin gene expression and biochemical biomarkers (biotransformation, antioxidant system and lipid damage); and gonad for the biochemical biomarkers. Data were analyzed by a generalized linear model (GLM), with one-way ANOVA ($p \leq 0.05$). No alterations were found in the estradiol plasma levels, nor in the cerebral aromatase and vitellogenin gene expression. In the liver, the non-protein thiols concentration (GSH) increased at 2.5 µg/L. At 0.25 µg/L, superoxide dismutase (SOD), an antioxidant enzyme, and lipid peroxidation (LPO) were reduced in the liver. In the gonad, the biotransformation system enzyme glutathione S-transferase (GST) was increased. In this same tissue, glutathione peroxidase (GPx) activity, an enzyme antioxidant system enzyme, increased in the three paracetamol concentrations tested: 0.25, 2.5 and 25 µg/L. These results demonstrated that paracetamol can alter the antioxidant system of the liver and gonads of male catfish Rhamdia quelen under the tested conditions, however without altering hormones or genes expression related to reproduction.

8.09 Assessment of UV Filters Subchronic Toxicity in Tilapias Using Biochemical Biomarkers

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The term “endocrine disruptor” refers to an exogenous substance or mixture capable of interfering with normal hormones levels causing adverse health effects in an individual and its progeny. In fish, chemical UV filters have shown endocrine-disrupting effects impairing their reproductive performance. This work investigated the simultaneous exposure of juvenile *Oreochromis niloticus* to benzophenone-3 (BP-3), octocrylene (OC) and octylmethoxycinammate (OMC) at 0,5 mg/L and 0,001 mg/L concentrations using biochemical biomarkers after a 29 days bioassay. The study design and protocol were previously approved by the local ethics committee of the Federal Technological University of Paraná CEUA/UTFPR (Comissão de Ética no Uso de Animais – Re.-No. 23064.037216/2018-19). The fish (*Oreochromis niloticus)* were purchased from a local breeder and juveline animals were distributed in four groups of 10 individuals each: group 1 exposed to 0,5 mg/L of the contaminants, group 2 exposed to 0,001 mg/L of the contaminants, group 3 exposed to 0,045% ethanol and group 4 as the negative control. The contaminants and solvent were renewed every 24h for 29 days. At the end, animals were anesthetized and had liver removed for lipid peroxidation (LPO), glutathione-s transferase (GST) and catalase (CAT) analyses. Brain was also removed to investigate acetylcholinesterase activity (AChE) and all the biochemical levels were measured spectrophotometrically. During the bioassay, six deaths occurred being three from animals of group 1, one from group 2, one from group 3 and one from group 4. Data analyses did not show significant changes in GST ($p=0,5289$), CAT ($p=0,3329$) and AChE ($p=0,1312$) levels after exposure to chemical UV filters and ethanol in the investigated concentrations. Significant enhancement ($p< 0,0001$) of LPO activity was observed for the groups exposed to 0,5 mg/L and 0,001 mg/L of chemical UV filters when compared to the solvent and negative control groups. The enhanced LPO levels obtained may be an indicator for the potential harm of the chemical UV filters mixture in the environment, especially considering the number of deaths when animals were exposed to the highest concentration. According to the literature, lack of significant difference for GST and CAT activity could be due to an adaptive behavior developed by the individuals, and further investigation is necessary to evaluate this hypothesis for *Oreochromis niloticus* species when exposed to UV filters.

8.10 The importance of differentiating between risk and hazard in the assessment endocrine activity

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The UN Globally Harmonized System (UN GHS) for classification and labeling of substances is the starting point for hazard communication around the world. It is a useful tool for the communication of hazards to those who directly handle chemicals at the workplace or at home. For classification purposes, standardized testing is used in order to base decisions on consistent and comparable responses. The basic concept is that the hazard category or class communicates the adverse effect that might be expected if there is sufficient exposure to the substance. However, a risk assessment would be required in order to estimate the probability that adverse effects would actually occur by putting the hazard into context with the probability of exposure, relevant exposure pathways, and the dose/response. Recently, an extension of the hazard-based approach was highlighted in the European Commission’s plan to include new hazard categories for endocrine disruptors, PBTs/vPvBs, and persistent and mobile substances into the European Classification and Labeling regulations (CLP). While harmonization of existing regulatory test methods for the identification of adverse effects via an endocrine mode of action (MoA) has largely occurred, the development of new approach methodologies (NAMs) and a greater reliance on non-

animal methods highlight a need to ensure their appropriate use and interpretation in a regulatory context for hazard identification. Case studies will be provided that demonstrate the implications of a risk versus hazard approach in the assessment of chemicals for an endocrine MoA.

9. Behavioral Ecotoxicology: Where Organism and Population-level Effects Meet

9.01 Effects of Organophosphate Pesticides on Spatial Navigation in Bats

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Bats are potentially exposed to pesticides by eating contaminated insects in croplands. Commonly used pesticides such as organophosphates (OPs) are neurotoxic for non-target vertebrate species and even low doses can impair essential processes such as locomotion and cognition. These neurotoxic effects are usually sublethal and can therefore be difficult to study using traditional toxicological assessments. Behavioral studies are a promising alternative to evaluate sublethal effects of pesticides on bats. Echolocating bats often develop individual stereotyped flight patterns as they become familiar with a novel space. We evaluated bats' ability to memorize and navigate a new space by comparing the consistency of flight in bats exposed and unexposed to pesticides. We orally dosed captive big brown bats (*Eptesicus fuscus*) with an environmentally relevant concentration of Chlorpyrifos, a common insecticide, and tracked their flight behavior while exploring a tent. We evaluated the similarity of flight trajectories within and between trials, time spent in flight, and landing frequency. We also quantified cholinesterase (ChE) activity in brain and plasma as biomarkers of potential neurotoxicity. Preliminary results suggest there is increased variability of flight trajectories in bats exposed to Chlorpyrifos within trials, and an increase in landing frequency compared to unexposed bats. Exposed bats presented a 30% reduction of ChE activity in the brain. These results support the sensitivity of behavior as a biomarker of toxicity and as a tool to elucidate potential ecological implications of anthropogenic stressors on wildlife.

9.02 Can Triclosan Exposure Alters Chemosensory Function and Behaviour in Adult Zebrafish?

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Animal behaviour is an important feature to understand their fitness to the environment. On aquatic organisms such as fish, the capacity of perceiving their environment relies on chemosensory function. It is well-known that some contaminants can interact with fish chemosensory function consequently modifying their behaviour. Triclosan is an antibiotic commonly found in daily use personal care products. It is reported on literature that triclosan can act as an endocrine disruptor on exposed fish. The objective of this study is to analyze if triclosan exposure to zebrafish can alters fish chemosensory behaviour. Zebrafish were exposed for 96h to two triclosan concentrations (0.1 and 0.3 mg/l). We collect EOG (electro-olfactography) data, this is an electrophysiological technique that measures olfactory capacity. As a behavioral assay we adapted an open field test – in which it is possible to evaluate fish locomotory behaviour, and we add a food cue (L-alanine). Fish behaviour was recorded for 25 minutes, 5 min for acclimatation then 10 min before the cue and 10 min after delivering L-alanine. Combining those two data it is possible to understand if triclosan exposure can affect chemosensory function. Our EOG data showed that there was no effect of triclosan exposure on zebrafish chemosensory function. Behavioral results showed that there was no difference on zebrafish behaviour before and after cue delivery. EOG response corroborates with the results from behavioral assay, we can conclude that triclosan do not affect olfactory function and zebrafish behaviour.

9.03 Exposure to a Pesticide Mixture (Chlorpyrifos??'Difenoconazole) Caused Different Responses in Fish Species From Different Trophic Levels of the Same Community

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Pesticide contamination of aquatic ecosystems is a major concern in agricultural landscapes. The improvement of ecotoxicological methods should address the assessments of pesticide mixtures and the early effects caused in biota by exposure to sub-lethal concentrations. A multilevel biomarker approach was used to assess the effects of a transient exposure to a pesticide mixture on two freshwater mesoamerican fish species. *Parachromis dovii*, and *Poecilia gillii* were exposed for 48 h to a mixture of sublethal concentrations of chlorpyrifos (5 µg/L) and difenoconazole (325 µg/L). Transcriptomic induction of *cyp*1A, as well as 7-ethoxy-resorufin-O-distillase (EROD) and glutathione S-transferase (GST) activities, were measured as biotransformation-related biomarkers. Cholinesterase activity (ChE) was assessed as a neurotoxic effect biomarker. Resting metabolic rate (RMR) was measured as a physiological biomarker, and the movement of fish in a dark–light environment was assessed as a behavior biomarker. The exposure to pesticides had different effects on the fish: *P. gillii* had evident induction of biotransformation phase I, with significant induction of *cyp*1A transcription and increased EROD activity, accompanied by ChE inhibition in muscle and an increased permanence in the light side of the dark–light environment. On the other hand, *P. dovii* only showed a significant induction of cyp1A, without significant evidence of neurotoxicity or changes in behavior. None of the species showed physiological changes after exposure. This rapid, multi-level evaluation, applied to two fish species that share the environment and a predator-prey relationship, demonstrated that a short, sub-lethal exposure to widely used pesticides has the potential to cause impairment in the trophic structure of the community.

9.04 HeMHAS: An Methodological Upgrade to Assess Contamination-Driven Avoidance Behavior by Aquatic Organisms in Chemically Heterogeneous Landscapes

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Behavioral assessments in ecotoxicological studies have been focused on the changes in the swimming and movement patterns of exposed organisms. Particularly in relation to avoidance behavior, studies have been centered on how stressors may cause lethargy or stimulation in the displacement patterns of organisms. Nonetheless, in the last two decades, avoidance has been studied from a perspective of spatial displacement along gradients or patches of contamination in a multi-compartmented environment. Thus, in order to simulate chemically heterogeneous environments, non-forced exposure systems have been developed allowing organisms to move among environments with different levels of contamination. In line with this strategy, we recently developed a non-forced exposure system: HeMHAS (Heterogeneous Multi-Habitat Assay System). HeMHAS is a system formed by multiple compartments, which are connected and allow creating different scenarios of contamination, either regarding the levels of contamination or the connectivity among the areas. The current study aims to show the most updated versions of the HeMHAS that have been developed to increase the complexity of the environmental scenarios to be simulated and reduce the interferences produced by observer on the behavioral responses. In this work, we show the evolution of the non-forced multi-compartmented exposure systems, the diversity of scenarios that can be simulated in this system (rivers, lakes and estuarine areas) and the conceptual advantages offered by HeMHAS to ecotoxicological risk assessments. Finally, we discussed how behavioral responses studied in HeMHAS could help understanding (i) the effect of contamination on the spatial distribution of populations in a chemically heterogeneous landscape and (ii) the loss of local biodiversity and the consequent disruption in the functioning of the ecosystems due to evasion of organisms. Our innovation should be carefully considered in view of the use of HeMHAS in behavioral ecotoxicology as a complementary tool to understand the impact of contamination from a spatially broader and connected environmental perspective.

9.05 Is the Avoidance Behavior to Contamination an Sensitive Endpoint? A Review With Three Model Contaminants: Copper, Glyphosate and Silver Nanoparticles

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The use of non-forced multi-compartmented exposure systems to assess the avoidance behavior of organisms brings a novel perspective about how contaminants affect the spatial distribution of species and their processes of habitat selection. Differently from the standard exposure systems, in a non-forced exposure system organisms are exposed to a chemically heterogeneous scenarios and thus they can move throughout different levels of contamination. In spite of the ecological relevance of this approach, it is still incipient and poorly used in ecotoxicological risk studies. The current study aims to assess how environmentally protective the spatial avoidance in non-forced exposure system is in comparison with the traditional endpoints used in ecotoxicology. For that, we applied two tools: the sensitivity profile by biological groups (SPBG) and the species sensitive distribution (SSD). Three chemically different compounds were selected for this review: copper, glyphosate and silver nanoparticles (Ag-NPs). Considering the hazard concentration for 5% of the species (HC_5) avoidance behavior can be considered a very sensitive endpoint. In summary, avoidance behavior in non-forced multi-compartmented exposure systems could be a complementary tool to the ecotoxicological studies because it provides an overview on the level of repellence of contaminants and how they affect the distribution of species under chemically heterogeneous scenarios.

9.06 Water Quality As an Determining Factor for Fish Behavior: A Habitat Selection-Based Approach

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The pollutant discharges from industrial processes cause several environmental damages on aquatic ecosystems, declining the biodiversity and taking to the loss of ecological services. The behavioral analysis of the organisms to assess the risk of contaminants has been applied for decades and it tries to identify signals of the potential toxicity of chemicals. In this sense, a new multi-compartmented (non-forced) approach has been proposed as a complementary tool to assess the habitat selection process by organisms when exposed to different contamination scenarios. In this multi-compartmented approach, organisms are exposed to a chemically heterogeneous environment that allows them to move among different concentrations and to avoid the most stressful environments. In order to assess the effects of water quality at different points (P1: river source, P2: urban region and P3: rural region) of one model river (Ribeirao dos Pombos river, SP, Brazil), we verified the potential repellency of contamination to the freshwater fish *Danio rerio* by non-forced avoidance tests, in the dry and wet seasons. It has been hypothesized that the release of dairy wastewater into stretches of an already contaminated river might increase the avoidance response by fish towards other regions. As a result, we found that dairy wastewater repelled organisms in all the water samples taken from the river, although the magnitude of the avoidance varied. For instance, the values of AC_{50} for effluent when mixed with water from P1 was 8.15 and 2.84 times greater than those from P3 and P2, respectively, showing that at P1 the effluent was less repellent to fish. The repellency to fish of the dairy wastewater varied considerably between seasons at P2 and P3, while at P1 the results were more stable; probably, due to P1 being a more preserved area. We concluded that the potential to trigger avoidance behavior in fish of the dairy wastewater in the model river might vary regarding the water quality, which in turn might be related to the land use and human activities near.

9.07 Fish (Danio rerio) Avoid Single Environmentally Relevant Concentrations of Glyphosate, Chlorpyrifos and Chorothalonil, but

Is the Same Response for Mixtures?

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Aquatic environments associated with conventional agriculture are exposed to contamination with mixtures of pesticides. In this context, where substances with different biocide activities are frequently present, it is important to identify possible interactions that enhance their effects when in mixture. We applied avoidance tests with *Danio rerio*, exposing juveniles to three relevant current use pesticides: chlorpyrifos (CPF), chlorothalonil (CTL) and glyphosate (Gly), individually and in binary mixtures (CPF-Gly and CTL-Gly). Our goal was to identify the potential of contaminants and the mixtures to trigger avoidance response in fish. Avoidance was assessed for a period of three hours using an open gradient system with six levels of increasing concentrations of the substances. Fish avoided environmentally relevant concentrations of the three compounds. The avoidance of CPF [AC50= 7.95 (3.3 – 36.3) µg/L] and CTL [AC50= 3.41 (1.2 – 41.6) µg/L] was evident during the whole period of observation, with fish preferring the cleaner part of the system. In the case of Gly, a biphasic response was observed: fish initially (until 100 min) tolerated higher concentrations of the herbicide [AC50= 52.2 (12.1 – 2700) µg/L] and a clearer avoidance [1.5 (0.8 – 4.2) µg/L] was observed during the late period (after 100 min). The clear avoidance response observed with CPF and CTL alone was attenuated with the presence of Gly. Applying a mathematical model, the interactions of the mixtures were assessed and we observed that Gly acted synergistically with the other two compounds regarding the avoidance response of fish; but during the late period, the interaction was antagonistic with both substances. Although the avoidance is a response that prevents organisms of being continuously exposed to contaminants and gives us an idea about how the distribution of populations can be altered by contamination, our results suggests that in a context of mixtures the avoidance response can be impaired, making organisms more susceptible to toxicity.

9.08 Dissimilar Behavioral and Spatial Avoidance Responses by Shrimps From Tropical and Temperate Environments Exposed to Copper

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It is important to have a better understanding of how the behavior of organisms may be affected depending on how the exposure occurs: homogeneous (forced exposure) or heterogeneous (non-forced exposure) scenario. This study aimed at evaluating the effects of copper on two behavioral responses (locomotory activity and spatial avoidance) in two shrimp species (*Penaeus vannamei* and *Palaemon varians*), representative of different latitudes. The effects on locomotion were evaluated by exposing the shrimps to a range of copper concentrations (0, 0.5, 5, 50 and 250 µg/L) in a forced exposure scenario and following changes in the movement patterns. The avoidance response was assessed under a non-forced scenario, by placing shrimps in a multi-compartment system where they were able to move freely along a gradient of copper (0, 0.5, 5, 50 and 250 µg/L). In terms of locomotion, an opposite trend was observed between the species: movements were significantly reduced in *P. varians* with concentrations above 50 µg/L, while hyperactivity was observed in *P. vannamei*. When exposed to a gradient of copper in the multi-compartment system, both species significantly avoided the highest concentrations of copper, although the repellence of copper was stronger for *P. vannamei*. In summary, both species of shrimps were able to recognize and avoid copper; however, in terms of locomotion, probably they showed a different threshold sensitivity to copper and an opposite behavioral reaction. These results show that a contamination event can trigger different behavioral outcomes depending on the species and the exposure approach (forced and non-forced scenarios). Both approaches should be used complementarily to better characterize and predict the effects of contaminants at higher biological levels

9.09 Getting Over Lethal Tests: Habitat (Re)Colonisation, a New Perspective for Ecotoxicological Studies

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Aquatic ecotoxicology has paid little attention to the ecological concept of (re)colonisation, and its focus has been on disturbed ecosystems and not on recovering ecosystems. The concept of (re)colonisation is linked to dynamics of organisms' dispersion among connected ecosystems and might be determinant for local extinction of populations. With the development of non-forced multi-compartmented exposure systems, in which organisms are exposed to a gradient of contamination, it has been possible to study the ability of organisms to avoid based on their contamination levels. This shift in the paradigm of the exposure to contaminants simulating chemically heterogeneous environments opens a new conceptual perspective for ecotoxicology: the contamination-driven organisms' spatial distribution. Due to the lack of studies focusing on (re)colonisation, the current review aims to open four fronts of discussion: (i) the avoidance-(re)colonisation hypothesis, which attests that stressor-driven migration could predict the extent of population establishment in recovering habitats, (ii) how the direct relationship between avoidance and (re)colonisation might change if the contaminated area is more attractive (e.g., due to the availability of food or lower predation pressure) than the non-contaminated area to which organisms should migrate, (iii) the difficulty to predict (re)colonisation when toxic contaminants attract organisms or produce lethargy, and (iv) the use of (re)colonisation assays with vertebrates as a more humane alternative to lethal assays. The results described until now have shown that there is a good relationship between avoidance and (re)colonisation responses to copper by zebrafish, supporting the avoidance-(re)colonisation hypothesis. However, the presence of food or less

predation pressure could be a decisive factor for the avoidance-(re)colonisation response. In addition, the results of (re)colonisation studies with daphnids and shrimps exposed to cadmium, caffeine and the herbicide irgarol indicate a lack of relation between avoidance and (re)colonisation, probably due to the mechanisms of action of contaminants producing stimulative and lethargic effects. Considering that the consequences of the avoidance-(re)colonisation response could be ecologically analogous to mortality (as organisms disappear), these trials provide an environmentally protective approach and an ethical advantage to lethal tests, reducing the suffering of organisms.

9.10 Experimental Evidence of Contamination on the Dynamics of Shrimp Populations: Susceptibility to Spatial Isolation

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Landscape-scale ecology comprises complex structures where a flow of energy, materials and organisms among ecosystems conditions the dynamics of populations. Several natural and anthropogenic stressors are likely to affect the landscape composition, generally leading to the rupture of ecological connectivity among populations. Although contamination is considered one of the most threatening factors for biodiversity, its impact on spatial dynamics of populations (e.g., distribution, persistence and abundance) from an *eco*-toxicological perspective is still unknown. In the current study, the potential effect that contamination can exert on the loss of connectivity among populations (chemically fragmented habitats) leading to population isolation was assessed. The estuarine shrimp *Palaemon varians* was used as model organisms and a novel version of the HeMHAS (Heterogeneous Multi-Habitat Assay System) was used to simulate spatially heterogeneous landscapes. In order to provide more ecological relevance to the study, besides copper as stressor [at low (0.5 µg/L) and high (25 µg/L) levels], other two factors were simultaneously tested: fish kairomones (as a predation signal) and food availability. Different scenarios were simulated in the HeMHAS to create heterogeneous landscapes that vary depending on the presence or absence of these stressors. The behavior observed by the population of *P. varians* clearly showed that the shrimp detected copper and avoided the regions with the highest levels of contamination. However, when fish kairomones were added to previously preferred regions, the behavior of shrimp populations did a radical turn: they escape the predator signals, moving towards contaminated regions, but with a clear preference for less contaminated areas. When faced whether to stay in a clean area with no food or moving through disturbed regions to colonize a clean region with food, shrimps' populations crossed the regions, but with a more dynamic transit in the region with kairomones and no copper. These results indicate that contamination might interfere in the spatial dynamics of shrimps' populations by: (i) triggering avoidance, (ii) preventing colonization, (iii) isolating populations and (iv) making them more susceptible to local extinction.

9.11 Integrating Avoidance Behavior and Stress to Understand How Contamination Affects the Health and Spatial Distribution of Fish in Heterogeneously Contaminated Landscapes

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Environmental contamination might make ecosystems unsuitable to accommodate life due to their aversive effects on organisms. As many aquatic ecosystems are spatially connected, some organisms might avoid the consequences of a continuous exposure to contaminants by moving to less contaminated habitats. In this sense, the habitat selected by organisms might be conditioned by a balance among the advantages of moving to another area to escape from contamination, the level of stress produced in a contaminated area and the availability of uncontaminated areas. Considering the connectivity that exists among ecosystems and that contamination is not homogeneously distributed, the aim of the current study was to assess how the avoidance behavior can help reducing the stress (cortisol levels) of zebrafish (*Danio rerio*) in a chemically heterogeneous landscape. Zebrafish were exposed to heterogeneous copper contamination scenarios in a free-choice multi-compartmented system. Under those scenarios, fish escaped from the most contaminated areas, with an avoidance by 50% of population (AC_{50}) at concentrations of 41 (copper gradient scenario), 25 (poorly contaminated scenario) and 69 (highly contaminated scenario) µg/L. Higher stress levels was observed in the populations exposed to homogeneously contaminated and highly contaminated (by copper) scenarios, in which there are no clean areas to flee to. In summary, the uncontaminated areas might be crucial for the well-being and spatial dynamics of fish populations in a chemically heterogeneous landscape due to their role as escape zones to alleviate stress.

10. Engineering, Remediation and Restoration

10.03 Inhibition of the Anammox Process by Industrial and Municipal Wastewater Pollutants

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The use of the anammox process for nitrogen removal has gained popularity across the world due to its low energy consumption and waste generation. Anammox reactors have been used to treat ammonium-rich effluents such as chemical, pharmaceutical, semiconductor, livestock, and coke oven wastewater, and recently full-scale installations have been implemented for municipal wastewater treatment. The efficiency of biological processes is susceptible to inhibitory effects of pollutants present in wastewater. Considering the increasing number of emerging contaminants detected in wastewater, the impacts of the different types of pollutants on anammox bacteria must be understood. This review presents a compilation of the studies assessing the inhibitory effects of different wastewater pollutants towards anammox activity. The pollutants were classified as antibiotics, aromatics, azoles, surfactants, microplastics, organic solvents, humic substances, sugars, alcohols, and volatile fatty acids, or metals and metallic nanoparticles. The interactions between the pollutants and anammox bacteria have been described, as well as the interactions between different pollutants leading to synergistic effects. We also reviewed the effects of particular pollutants on distinct species of anammox bacteria, and the main toxicity mechanisms leading to irreversible loss of anammox activity have been identified. Finally, we provided an analysis of strategies to overcome the inhibitory effects of wastewater pollutants on the nitrogen removal performance. We believe this review contributes with essential information to assist the operation and design of anammox reactors treating different types of wastewater.

10.04 Iron Accumulation and Elimination in Poecilia reticulata Exposed to Associations With Iron Oxide Nanoparticles and Glyphosate

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Glyphosate (GLY) is the most widely used herbicide in the world, and Brazil is the country that most uses glyphosate-based herbicides (GBH) in vegetable crops throughout the national territory, and from its widespread use, it ends up contaminating soil and water, compromising biodiversity in ecosystems, which makes it necessary to investigate tools to solve this problem. In this sense, nanotechnology appears as a promising field for promising applications in environmental health, in this field are the iron oxide nanoparticles (IONPs) of maghemite (γ-Fe_2O_3) that present themselves as an alternative for the remediation of contaminated environments, since GLY can be adsorbed on the surface of IONPs. However, for the use for safe time and concentrations of IONPs, it is necessary to investigate the co-exposure of IONPs+GLY and IONPs+GBH, as well as their ionic counterpart, in search of obtaining information of the accumulation, persistence and toxicity of the associations in aquatic organisms. In this study, 3 female *Poecilia reticulata* were exposed for 7, 14 and 21 days to treatments with iron ions (IFe 0.3 mg/L), isolated IONPs (0.3 mg/L); IONPs+GBH (0.65 and 1.30 mg/L); and IONP+GLY (0.65 mg/L), followed by a post-exposure period in reconstituted water, with the same number of animals. The collected animals were dehydrated and had the iron concentration analyzed by ICP-OES. The results were time-dependent and showed that iron accumulation is related to its nanoparticle form, so that IONPs treatments had increasing iron levels throughout exposure, especially in animals treated with IONPs+GBH associations, suggesting that GBH is more toxic and persistent in the body than pure glyphosate. On the other hand, post-exposure showed that fish are able to eliminate IONPs from the body, as iron levels significantly declined as early as 7 days post-exposure. Overall, this study complements previous investigations by the team and provides data for the safe use of IONPs in glyphosate remediation, as iron accumulation can be reversed in recovery periods of the animals.

10.05 Caracterización de Enmiendas de Biochar Producidas a Partir de Residuos Locales Para la Inmovilización de Metales Pesados en Humedales Artificiales

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El enriquecimiento de los sedimentos de humedales construidos con sustancias bioabsorbentes, incrementa la capacidad de éstos para la remoción de contaminantes de la fase acuosa. Un material con alta capacidad de adsorción y con costos de fabricación bajos es el biochar. Este tipo de enmienda se caracteriza por presentar una elevada capacidad de intercambio catiónico y una gran superficie de exposición, lo que permite la inmovilización de metales pesados; un elevado contenido de carbono recalcitrante, lo que le atribuye una persistencia muy superior a la del resto de las enmiendas orgánicas; y puede ser elaborado a partir de residuos, lo cual lo hace ecológico y sustentable. Sin embargo la capacidad de cada tipo de biochar para inmovilizar contaminantes depende en gran medida de su material de origen y de sus condiciones de producción. En el presente trabajo se propone comparar las características de distintas materias primas disponibles a nivel local para la producción del biochar a dos temperaturas de pirolisis diferentes (300°C y 600°C). Los materiales de origen utilizados fueron los residuos del cultivo de maíz, cama de pollo, la biomasa de la macrófita *Juncus imbricatus* expuesta a una solución nutritiva y la biomasa de *J. imbricatus* expuesta a $50 mgL^{-1}$ de Cr para la fitoremediación de dicho metal. Los resultados indican que el incremento en la temperatura de producción aumentó significativamente el área superficial, al mismo tiempo que redujo el rendimiento, tendencias esperables en este proceso productivo. En todos los casos el pH fue básico para biochars producidos a 600°C y ácido para los generados a 300°C, excepto en la cama de pollo donde siempre fue básico. Además la conductividad eléctrica obtuvo mayores valores para los biochars producidos a mayor temperatura. Asimismo, la capacidad de intercambio catiónico en la mayoría de los casos fue superior a $100 meq.100g^{-1}$, valor superior al encontrado en otros biochars estudiados para inmovilizar metales pesados. Los resultados obtenidos posicionan a estos tipos de biochar como buenos candidatos a experimentos de remediación de suelos

contaminados.

10.06 Process-Based River Restoration: Hydrologic and Morphologic Alteration Over One Year of Field Experiment

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In November 2015, the rupture of the Fundão dam (Mariana, Brazil) has launched 43 million m³ of iron ore tailings into the Santarem Stream, flowing along its length until it reached the Gualaxo do Norte River (GNR) and, later, the Doce River. The deposition of tailings on the riverbed has changed the hydrogeomorphological characteristics of the GNR, resulting in a decrease in the diversity of physical habitats that supported ecological diversity. As a mitigation process, a river restoration project was implemented, using tree trunks (Large Woody Debris), branches and bundles of elephant grass (*P. purpureum*) to reestablish the natural geomorphological condition and the characteristics of the physical habitat, to favor the restoration of the biota. The wood structures were installed in two renaturalized (R) sections of the GNR (T6R 1.3 km and T7R 0.5 km) and were compared with the respective control (C) sections (T6C and T7C), located immediately upstream of the renaturalized sections, and to a reference section, located in the same river, but not affected by the tailings. Hydromorphological monitoring was carried out in 4 campaigns, 2 before and 2 after the set up of the wooden structures. In addition, 9 follow-up campaigns were carried out to evaluate the structure's conditions and record (photos) the evolution of the renaturalized sections. The results indicated that after 14 months there was an increase of 20.2% in hydraulic retention in the T6R and 63.5% in the T7R, when compared to their respective controls. This greater capacity for water retention favored sediment retention and accumulation, with 388 Tons deposited in the T6R and 396 Tons in the T7R, indicating that the structures proved to be efficient in retaining sediments from upstream areas, enhancing the formation of a natural barrier to trap sediments from the Fundão dam. The mapping of substrate types demonstrated that the implementation of this project favored the increase in the diversity of physical habitats, with an increase of 39.2% of the types of substrates, 43% of the diversity, and 21.4% of the evenness for the T6R, and 46.4% of substrate types, 34.7% of diversity, 12.8% of evenness, for T7R. The results indicated that the renaturalization project reached the proposed objectives, having increased the hydromorphological complexity of the channel, represented by the increase in the number of physical habitats, which serves as a basis for the restoration and development of the biota.

10.07 Process-Based River Restoration: Fish Community Responses Over One Year of Field Experiment

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The aquatic ecosystems have been impacted over years by anthropogenic activities that result in impairment of ecosystem dynamic and loss of biodiversity. In November 2015, the rupture of the Fundão dam has launched 43 million m³ of iron ore tailings into the Santarem Stream, flowing along its length until it reached the Gualaxo do Norte River (GNR) and, later, the Doce River. Therefore, from this event, many efforts have been made to accelerate the recovery of this impacted ecosystem, mainly the biological communities such as fish. The present study aimed to evaluate the fish community response along 1.8 km of Gualaxo do Norte River after one year of process-based river restoration using natural elements addition (tree trunks). The restoration project followed a before/after, and control/restored (BACI) design. In total, 5 reaches were monitored: T6C (T6 - control), T6R (T6 - restored), T7C (T7 - control), T7R (T7 - restored), and a reference site (Ref) (reach of the river that was not affected by the tailings). Fish samplings were carried out in four periods, two pre-installation and two post-installation periods of the wood addition, all conducted in the same season. The results showed that one year after the wood installation an increase of up to 81.38% in fish catches with hand nets in T6R. On the other hand, the T7R showed no improvements in relation to fish catches. Since this fishing gear result in many young individuals, this can be considered evidence of the fish recruitment. In addition, an increase of up to 100% in the abundance and biomass of some fish species were already observed, mainly in the reach T6, which was less impacted by the tailings plume. Despite of some positive results, only a year after the river restoration was not enough for the fish community to be completely restructured, since no increase in fish richness and diversity was detected. Therefore, it is expecting that in the medium term other positive results could be observed. In conclusion, preliminary results based on the fish community shown that the restoration project contributed to accelerate the river recovery post disturbance and could be applied in other reaches of Gualaxo do Norte River that were also impacted.

10.08 Process-Based River Restoration: Benthic Macroinvertebrate Community Responses Over One Year of Field Experiment

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In 2015, Gualaxo do Norte river was impacted by iron ore tailing from Fundão dam located in Mariana city, Minas Gerais, Brazil. Therefore, from this event, many efforts have been made to accelerate the recovery of this ecosystem, mainly the biological communities such as benthic macroinvertebrate. The process-based on river restoration is an important tool in restocking aquatic biodiversity in impacted rivers. In this context, the objective of the present study was to evaluate the effects on benthic community after 14 months of the renaturalization of two stretches of Gualaxo do Norte river, T6 and T7 (T6C - control, T6R - restored, T7C - control and T7R - restored). The renaturalization occurred through the installation of 203 wooden structures in riverbed. The design of monitoring followed the before-after-control-impact (BACI) methodology, with sampling carried out in four campaigns in renaturalized stretches, controls stretches (impacted but without the renaturalization project) and reference stretch (without impact), with two pre-installation campaigns, represent the scenario prior to the intervention, and two post-installation campaigns, approximately 2 and 14 months after completion of structures installation. The 15 equidistant samples were collected in each stretch, using a Surber type net (area of 0.09 m²). For post-installation period, sampling was also carried out on six structures by scraping the adhered material. The results obtained showed an increase of 110% in total abundance of benthic macroinvertebrate and 112% of Diptera exclusively in stretch where was a reflux of tailings (T6R). The increase in abundance for most sensitive groups (Ephemeroptera, Plecoptera and Trichoptera) was 124% in T6R and 27% in T7R (stretch directly impacted by tailings). Regarding functional trophic groups, there were increases in abundance of

predators (T6R - 215%; T7R - 21%), collector-filters (T6R - 83%; T7R - 60%) and scrapers (T6R - 96%; T7R - 40 %) in both sections. The composition of community adhered to the structures was mostly composed of taxa with low swimming capacity (Diptera and Trichoptera) from the natural flow of the river - drift. Thus, it is understood that the recolonization processes are underway in renaturalized stretches and that Renaturalization presented itself as a viable solution for accelerating the recovery of this aquatic systems in question.

10.10 Leaching Behaviour of Atrazine, Chlorfenvinphos and Chlorpyrifos in Soil Amended With Agro-Industrial and Composted Organic Wastes

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The large use of pesticides in agriculture has been a serious environmental concern because of the potential runoff and leaching of these compounds through the soil leading to contamination of surface and ground water. The use of organic wastes as soil amendment in agricultural practices is a possible strategy to reduce the risk of point source contamination by these chemicals, attending to the hypothesis that organic matter can retain pesticide by adsorption which implies a delay in their lixiviation and a chance to be degraded. The adsorption potential of composted sewage sludge, orujillo (residue from olive oil industry), sawdust and sunflower seed shell to remove atrazine, chlorfenvinphos and chlorpyrifos using fixed-bed adsorption column was studied. Hand packed columns were constructed from soil and soil amended with 10% of the cited organic wastes. Pesticides were applied at the beginning of the experiment and columns were subjected to a simulated rain. Pesticide in leachates were extracted by Stir Bar Sorptive Extraction and analyzed by Gas Chromatography coupled with Mass Spectrometry. Relative and cumulative breakthrough curves were constructed from pesticide detected each day in leachates. Faster breakthrough curves were presented by chlorfenvinphos and atrazine in column soils when compared to amended soil. All studied organic wastes had positive effect on chlorfenvinphos soil sorption capacity, delaying breakthrough curve time and lowering the high of the peak on curve. Chlorpyrifos sorption did not leach at all even in isolate soil columns. Results showed that organic waste incorporation in soil could reduce the leaching of pesticides depending on the properties of the added organic waste and pesticide characteristics as water solubility.
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10.11 Checking the Possibility to Use Locally Available Organic Wastes to Prevent Leaching of Pesticides to Groundwater Through Sorption-Desorption Studies

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Pesticides are used throughout the world for agricultural and public health purposes. But before pesticides binds to the plants, rain and irrigation washes many of them away, leaching to groundwater and/or flowing to different mass of water. While there, the pesticide disrupts the aquatic ecosystems and are a source of public health. Organic matter can retain pesticide by adsorption, so a possible strategy to reduce the risk of point source pollution by pesticides is using organic wastes as soil amendment in agricultural practices. In this study, several natural and economic locally available organic wastes are proposed as adsorbents to prevent and control the pollution by priority and toxic pesticides. Sorption/desorption of alachlor, chlorpyrifos and simazine on sawdust, chicken manure and olive oil solid waste (orujillo) were examined by batch experiments. Pesticide concentration was determined using stir bar sorptive extraction and gas chromatography coupled with mass spectrometry. Experimental data were modelled by Langmuir and Freundlich adsorption models, the last one being applicable in all cases. Attending to sorption constants, orujillo revealed as the best adsorbent. The desorption study revealed weak and reversible adsorption in most cases, with exception of sorption of chlorpyrifos on orujillo, which was strong and irreversible. Lowest desorption rates were observed for orujillo, except in the case of simazine, which was lower when using chicken manure as an adsorbent. Results showed that proposed organic wastes are good adsorbent for studied pesticides, though the high desorption rates observed for hydrophilic pesticides simazine (with exception of chicken manure) and alachlor suggested that special care should be taken when using them as soil amendments.
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10.12 Evaluación De La Respuesta De Cianobacterias Filamentosas y Coloniales Frente a Presiones Moderadas y Económicamente Obtenibles

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Las floraciones de cianobacterias se han presentado tanto en ríos, lagunas, lagos, tajamares y en zonas de la costa uruguaya. Existen distintas estrategias para abordar la mitigación de las floraciones, entre las que se encuentran las medidas físicas que afectan la flotabilidad de estos organismos. Con el objetivo de evaluar el efecto potencial de la presión sobre la flotabilidad de las cianobacterias, y con el fin de remover sus altas biomasas superficiales de la columna de agua, se realizaron experimentos en laboratorio bajo condiciones controladas. Los experimentos consistieron en trabajar con muestras con distintos grupos de cianobacterias. Por un lado, se realizaron experimentos con organismos principalmente filamentosos como *Raphidiopsis* sp., y *Planktothrix agardhii* y por el otro, con organismos coloniales del género *Microcystis* sp. En ambos grupos de experimentos las muestras fueron sometidas a distintas presiones y a distintos tiempos. Las variables de respuesta se analizaron por triplicado en superficie y fondo a los 15 minutos y a las 24 horas luego de ser expuestas a las distintas presiones (entre 1 y 7 bar), para lo cual se analizó la concentración de cianobacterias y la actividad fotosintética de las mismas, mediante analizador AlgaeOnlineAnalyser II– bbe Moldaenke. Encontramos que los organismos presentaron diferente distribución vertical, ya que las

cianobacterias filamentosas, presentaron un descenso en su abundancia a partir de 5 bar ($p < 0,05$) y a las 24 horas se distribuyeron de forma homogénea mientras que *Microcystis* sp. disminuyó significativamente en superficie a los 7 bar, estratificándose y decantando en fondo. ($p < 0,001$).

10.14 Tropical Reservoir Recovery by Mechanical Aquatic Macrophytes Removal: Ecotoxicological Analysis for Monitoring Water Quality in Araraquara, Brazil

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Besides environmental consequences, eutrophication can compromise water multiple uses, including human supply, fishing and recreational activities. In Araraquara, Brazil, the Lajeado Reservoir is in a predominantly agricultural watershed, in which diffuse contribution of nutrients caused aquatic macrophytes bloom. In this context, based on population's demand, public agencies performed the removal of macrophytes by an amphibious machine in order to recover this reservoir. However, sediment resuspension was a concern during this process, since it can worse water quality. Therefore, the objective of this study was to evaluate the ecological risk of macrophyte removal by monitoring water ecotoxicity with two native species *Ceriodaphnia silvestrii* and *Daphnia similis* as bioindicators. For 3-months period, water samples were collected weekly at three points of the reservoir (approximately 1 km-length): one upstream (control), one in the central region and another downstream (at the outlet spillway). The endpoint of the 48h-acute tests for both *C. silvestrii* and *D. similis* was immobility, and for 8 days-chronic tests only for *C. silvestrii*, the reproduction was evaluated, both tests according to the Brazilian standard ABNT NBR 13373:2017. Data were submitted to ANOVA, considering Dunnet's and Tukey's post-hoc tests, on Statistica 7 software (95% confidence level). Data was considered normal by Shapiro-Wilk test and valid on Levene's Test for Homogeneity. There were no significative differences on both *C. silvestrii* and *D. similis* 48h-tests comparing to laboratory control samples, which indicates no acute toxicity. However, for chronic tests, *C. silvestrii* showed increased number of neonates in later water samplings. There were no significative differences on longitudinal reservoir profile between water sampling points. These results may indicate an improvement on water quality due to macrophytes removal, although this process may resuspend contaminants on the sediment. For monitoring water quality, choosing native species is important to evaluate ecological risk on tropical environments.

10.15 Propuesta de estrategia de Remediación de suelos tratados con Deltametrina

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La recuperación de suelos contaminados con pesticidas ha generado la necesidad de implementar técnicas de remediación eficientes. En este trabajo se propone un método de separación por vía Física, la descontaminación por adsorción, que consiste en limitar la migración de la *Deltametrina* (DE), usando una sustancia orgánica *"cascarilla de arroz".* Esta se usa como adsorbente en el suelo para retener el contaminante y evitar la migración, reduciendo así la migración al ecosistema acuático por infiltración. En el laboratorio se trabajó con suelo de cultivo de flores, de la zona norte de la provincia de Corrientes, de la localidad de Santa Rosa. En primer lugar, se han determinado las isotermas de adsorción y desorción, poniendo en contacto soluciones de concentración creciente de la DE con una cantidad determinada de suelo a una temperatura estable y durante el tiempo de equilibrio determinado previamente. A partir de las isotermas de adsorción, se determinan los coeficientes que caracterizan la adsorción de DE por el suelo. Posteriormente se han determinado las isotermas de adsorción y desorción con suelo enmendado con cascarilla de arroz en un 10 y 40 % a la temperatura de 25°C. El método de extracción y concentración de DE adsorbidos en el suelo enmendado se realiza mediante extracción en fase sólida; también se determina la cantidad de DE remanente en la disolución mediante cromatografía de gases (GC). Los resultados obtenidos en los estudios de adsorción del suelo de la DE con el agregado de 10% y 40% de cascarilla de arroz se ajustan a los modelos de Langmuir, Freundlich, Temkin y Dubinin-Radushkevich. Se puede comprobar, además, que la adición de un 10% de cascarilla de arroz es suficiente para provocar un aumento importante en la capacidad de adsorción del suelo. Un agregado de un 30% más no implica un aumento mayor en la adsorción - En los experimentos de adsorción llevados a cabo tipo "batch" se ha comprobado que los contenidos en los residuos orgánicos de carbono orgánico influyen positivamente, tanto en la intensidad como en la velocidad de adsorción. -La adición de residuos orgánicos al suelo, en este caso la cascarilla de arroz, retrasa el momento de mayor elución de los plaguicidas y produce una reducción de la cantidad total que se lixivia. Por tanto, se favorece que los plaguicidas ejerzan su función y que puedan degradarse, con lo que se reduce su lixiviación hacia las aguas subterráneas.

10.17 Explorando residuos siderúrgicos carbonáceos como elemento de remediación de aguas naturales e industriales

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Tanto las aguas industriales que son tratadas antes de ser eliminadas hacia el ambiente como las aguas naturales pueden presentar niveles elevados de contaminantes, como por ejemplo color en el caso de los efluentes secundarios de celulosa y minerales como hierro, que en concentraciones elevadas (por sobre 10ppm) no solamente sobrepasa los límites de las normas Chilenas, sino que también puede generar efectos adversos para la salud. Es por lo anterior que en esta investigación se ha explorado a nivel preliminar el uso de residuos siderúrgicos de origen carbonáceo, como una alternativa al uso de carbón activado granular, que actualmente está siendo cada vez más popular en la remediación tanto de aguas naturales como industriales.Los residuos de carbón siderúrgico fueron obtenidos desde una empresa local, tamizados en diferentes tamaños y además se acondicionaron con procesos de lavados y secados. En cuanto a las aguas, se utilizó efluente secundario de celulosa, con el fin de evaluar la remoción de color y de conductividad. Igualmente, se utilizó un agua subterránea de la región de Ñuble, con niveles elevados de hierro (valores superiores a los de la norma 409, agua potable). Para esta última agua se utilizó un kit colorimétrico comercial para cuantificación de hierro. Las aguas se dejaron en contacto con los residuos de carbón bajo condiciones de agitación suave (shaker) y tiempos entre 0 y 6 horas.Los resultados mostraron que el pH de las aguas y la granulometría de los residuos tuvieron un efecto sobre

las tasas de remoción de color y conductividad en el caso del efluente secundario de celulosa kraft, y sobre la remoción de hierro en el caso del agua subterránea. En general, se apreciaron porcentajes de remoción entre 20 hasta 60% de cada uno de los contaminantes.Esta investigación abre nuevas alternativas para desarrollar tratamiento de aguas con contaminantes de diferente naturaleza (metales o moléculas orgánicas), en aguas tanto de origen industrial como natural.

11. Sources, Fate and Effects of Pollutants in Marine Ecosystems

11.01 Methylmercury Biomagnification in Coastal Aquatic Food Webs From Western Patagonia and Western Antarctic Peninsula

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Mercury (Hg) is a global pollutant of concern because its organic and more toxic form, methylHg (MeHg), bioaccumulates and biomagnifies through aquatic food webs to levels that affect the health of fish and fish consumers, including humans. Although much is known about trophic transfer of MeHg in aquatic food webs at temperate latitudes in the northern hemisphere, it is unclear whether its fate is similar in biota from coastal zones of the southeastern Pacific. To assess this gap, MeHg, total Hg and food web structure (using $\delta^{13}C$ and $\delta^{15}N$) were measured in marine macroinvertebrates, fishes, birds, and mammals from Patagonian fjords and the Antarctic Peninsula. The trophic webs in Patagonia were shown to have a much more vertical structure than in Antarctica. Thus, the $\delta^{13}C$ values in Patagonia varied between -7 and -18 $^{0}/_{00}$ at the site near the mouth of the Marchant River, while for the offshore site it varied between -10 and -16 $^{0}/_{00}$. For Antarctica, both sites showed a greater amplitude of trophic width, with values from -14 to -30 $^{0}/_{00}$ $\delta^{13}C$. In Patagonia, MeHg levels vary from 0.0019 mg kg^{-1} in filter feeders to 1.4625 mg kg^{-1} in predatory benthic fish. Meanwhile, in Antarctica the lowest levels were found in krill with 0.003 mg kg^{-1} and 10.797 mg kg^{-1} in elephant seals. Food web in Patagonia showed Trophic magnification slopes (TMS; log MeHg versus $\delta^{15}N$) for coastal food webs of Patagonia were high when compared with studies in the northern hemisphere, and significantly higher near freshwater inputs as compared to offshore sites (0.244 vs 0.192). Similarly, in Antarctica, the site closer to glacial inputs had a significantly higher TMS than the one in the Southern Shetland Islands (0.132 vs 0.073). Composition of the food web also had an influence, as the TMS increased when mammals and seabirds were excluded (0.132–0.221) at a coastal site. This study found that both the composition of the food web and the proximity to freshwater outflows are key factors influencing the TMS for MeHg in Patagonian and Antarctic food webs.

11.02 Concentration and Distribution of Polycyclic Aromatic Hydrocarbons in Oysters From Todos Os Santos Bay (Bahia, Brazil)

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Aquatic environments located near urban and industrial areas represent regions vulnerable to the presence of contaminants, such as Polycyclic Aromatic Hydrocarbons (PAHs) whose main sources for the environment are anthropic. Among these, we can mention oil (and derivates) spills, or deposition of compounds formed in the fossil fuels burn. Because they promote toxic effects, there is an interest in studying the concentrations, distribution, and sources of these compounds to aquatic systems. Bivalves are one of the main biomonitors of PAHs contamination studies because they have a wide geographical distribution, are sessile and filter large volumes of water, concentrating the contaminants present in the place where they are found. Besides, they are widely consumed by humans. These characteristics make bivalves good sentinel organisms. The present study evaluated the contamination of PAHs in oysters (*Crassostrea rhizophorae*) sampled in distinct areas of Todos os Santos Bay (BTS - Bahia, Brazil). This is the second largest bay of Brazil and is subjected to various anthropic activities, as industries, a petrochemical complex, oil refineries, maritime terminal, ports and shipyards. Further, BTS also receives both treated and untreated industrial/domestic sewage. Ten samples of oysters were collected in ParaguaÃu river, Madre de Deus port and Jaguaripe river. PAHs concentrations were determined using a gas chromatography coupled to a mass spectrometer. The highest concentrations of total PAHs were found in Madre de Deus port (36.3 to 37.8 ng g^{-1} in dry weight, dw). This region has industries, ports, and a petrochemical complex. In the Paragua!! river estuary, the concentrations were intermediate (23.2 to 25.7 ng g^{-1} dw). The region of the Jaguaripe river presented the lowest concentrations (1.7 to 32.4 ng g^{-1} dw). This area is relatively well preserved and has few direct sources of contaminants. Through the use of diagnostic ratios and the presence of high molecular weight PAHs, it was observed that the main sources of PAHs to the areas are pyrolytic. The toxic equivalence quotient estimated values for Benzo[a]pyrene found ranged from 0.28 to 4.17. A few stations in the Paraguaγu river and in Madre de Deus showed values above the acceptable levels for risk of cancer.

11.03 A Chemo-Metric Approach to Assess Heavy Metal Pollution Status in a Human Impacted Coastal System

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Estuaries are among the most threatened coastal environments since they receive several pollutants from riverine discharges, large urban settlements, industries and ports. Human pressures are enhanced in developing countries of South America, such as Argentina, where the biota is at risk due to several pollutants (metals, POPs and microplastics), and therefore, biomonitoring of these areas is highly recommended. However, few studies have achieved this concern and the scientific tools displayed in an integrative way where abiotic and biotic matrices are combined using multiple indices were even less studied. The current study compared metal concentrations (Cd, Cu, Pb, Zn, Mn, Ni, Cr, Fe) in sediments and a resident benthic crab species, *Neohelice granulata* and the biochemical biomarkers (CAT, GST, H_2O_2, MT) in this organisms in a salt marsh (SM) and a mudflat (M) in different

stations (autumn and spring) of a SW Atlantic estuary (Bahía Blanca estuary, BBE) in Argentina. This area is currently influenced by several industrial and domestic discharges, ports and large scale fisheries. Metals in sediments did not exhibit significant differences between sites and seasons, except for Mn that was higher in SM during spring. Crabs bioaccumulated more Cu from sediments during autumn than spring for both sites. Except for Cd in M, Mn, Ni and Fe in SM, metals did not exhibit significant differences between sites, but tended to increase in autumn at both sites. Through geochemical indices, it was observed that sediments were low to medium polluted with probable adverse biological effects to the biota. Some of the biochemical analyses applied (i.e., IBR) demonstrated high values in the SM during spring with a great contribution of H_2O_2 and GST. By multivariate analyses (Pearson correlations and PCA), it was possible to observe that the biomarkers induction might be due to natural intrinsic factors such as energetic costs for reproduction and not strictly metallic pollution. But also, it should be considered that during spring, the available organic matter in the estuary is higher and specifically in the SM that also uptakes metals coming from plants. These metals are ultimately incorporated into the body burden of organisms and some correlated metals like Zn, Cu, Mn and Cd can cause biomarkers induction.

11.04 Oxidative Responses As Biomarkers of Polycyclic Aromatic Hydrocarbons (PAHs) Pollution in Ramnogaster arcuata

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Polycyclic Aromatic Hydrocarbons (PAHs) are a global concern. Due to their ubiquitous presence and their impacts on organisms, PAHs have become a major threat to the health of the marine ecosystem. To assess their impacts, the use of biomarkers are useful early warning tools for biological effects detection in environmental quality studies. The present work assessed relations between muscle 17 PAHs and oxidative stress biomarkers in liver and muscle of an estuarine-resident fish: *Ramnogaster arcuata*. Specifically, lipid peroxidation (evaluated by thiobarbituric acid-reactive substances; TBARs), tripeptide glutathione (GSH) and glutathione S-transferase activity (GST) were determined in liver and muscle tissues. Fish were captured seasonally in Bahia Blanca estuary (BBE), an area highly impacted with one of the most important petrochemical parks of South America. The PAHs levels observed for *R. arcuata* were between minimally and moderately polluted (range: 5.14-340.31 ng/g w.w.), being the highest level observed in summer represented by a mixture of petrogenic and pyrolytic sources. Spearman correlation analyses showed positive correlations ($p < 0.05$) of total PAHs (Σ17 PAHs) with hepatic TBARs (0.66) and muscle GSH (0.62). Also, correlations with individuals PAHs were found: hepatic TBARs-anthracene (0.96), hepatic TBARs-phenanthrene (0.76), muscle GSH-anthracene (0.79), muscle GSH-naphthalene (0.72), hepatic GST-chrysene (-0.93), and hepatic GST-fluoranthene (-0.69). These results suggest that hepatic TBARs and muscle GSH could be more sensitive biomarkers to chronic pollution of complex mixtures of PAHs. On the other hand, the correlations of individual PAHs suggest that hepatic GST could be a more specific biomarker for 4-ring PAHs, since it only correlates with this group of PAHs. While both hepatic TBARs and muscle GSH could be good biomarkers for petrogenic PAHs. The results of this work increase the understanding about the oxidative stress biomarkers in response to PAHs in *R. arcuata* and confirms that this species is a good bioindicator of the BBE. These results could have a positive influence on future biomonitoring of estuarine areas, allowing the early detection of PAHs effects and the consequent decision-making before irreversible environmental damage occurs.

11.05 Assessment of Health Status of Artemia franciscana Nauplii Exposed to Contaminated Sediments

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The BRI Index (Biomarker response index) integrates the response obtained in the evaluation of physiological and biochemical biomarkers that can be evaluated in bioassays with environmental samples. This Index has been used to determine the State of Health of an organism. The objective of this work was to carry out an evaluation of 4 biomarkers in the microcrustacean *Artemia franciscana*, to detect the toxic and genotoxic effects of metals and persistent organic compounds (POCs) present in sediment samples, to determine the usefulness of these biomarkers in biomonitoring studies and in ecological risk assessment. The levels of metals and Cops were measured in seven sediment samples and in parallel bioassays were carried out with the nauplii of *Artemia franciscana*, to determine the toxicity of the sediments, in addition the following physiological parameters were evaluated: respiration rate, excretion rate and biomarkers: lipoperoxidation and genetic damage. The data obtained were integrated to establish the biological health status of the exposed organisms. The results indicated that in the multiple correlation analysis, a significant relationship was observed between the concentrations of the metals Cd, Cr, Ni, Pb, V, PAHs and PCBs and the response of the 4 biomarkers ($p < 0.05$). Therefore, the battery of biomarkers used could be a useful tool for environmental biomonitoring and ecological risk studies.

11.06 Assessment of the Toxic and Neurotoxic Effects of Coastal Systems Sediments

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In our country, studies of the presence and effects of pollutants in aquatic systems are scarce, for this reason the objective of this work was to detect the presence of compounds with a toxic and neurotoxic effect in sediments of 4 coastal lagoons located in the state of Veracruz: La Mancha, Farallon, El Llano and Laguna Verde, in addition to 2 beaches located in the Mexican Pacific: Papanoa and the Gatas Gro. Sediment samples were collected in each coastal lagoons and the supralittoral zone of the beaches. To evaluate the presence of toxic compounds, bioassays were performed with *Artemia franciscana* nauplii (NMX - AA-110). And for the detection of neurotoxic compounds, an *in vitro* test was implemented. The results obtained show that the degree of toxicity of the sediments was (from the most toxic to the least toxic): El Llano> La Mancha> Laguna Verde> Laguna Farallón. on the beaches: Las gatas> Papanoa. Of the total of 22 samples (100%), 45% of the samples (10 samples) did not present compounds with neurotoxic effects. The percentage of inhibition of the activity of the enzyme AchE, ranged from 55 to 14% in the tests. The highest values of AchE inhibition were recorded in the sediments of the La Mancha and Llano lagoons and the beach Las gatas. The evaluation of the Ache enzyme

activity in the *in vitro* test is a quick option to detect the presence of compounds such as PAHs, organophosphate pesticides, carbamates, metals and detergents in sediments.

11.07 Effect of Environmental Dynamic on Mercury Accumulation in Sediments of a Tropical Estuary, Colombian Pacific

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Anthropogenic activities have impacted coastal ecosystems, with estuaries being the main entry areas for mercury to the marine environment, where it accumulates in sediments and can become available to enter the food trophic chain. This study aims to determine the influence of environmental variables on the spatiotemporal dynamics of total mercury accumulation in sediments of a tropical estuary, the Buenaventura Bay. Sediment samples were collected from interior and exterior areas of the estuary during the dry and rainy seasons, representing the spatiotemporal gradients of the estuary. The grain size, organic matter content (OM), and total mercury concentration (THg) of the sediment samples, and salinity, temperature, dissolved oxygen, and pH of the water column associated with each sediment sample, were determined. The THg in sediments were higher in the rainy season than in the dry season and in the interior area of the estuary than in the exterior area. The results show that the dynamics of distribution and accumulation of mercury in sediments could be modeled from OM and salinity, where OM represents the pathway of transport and accumulation of THg, and salinity represents the influence of the hydroclimatic variations and environmental gradients of the estuary. These results can be useful to find places and times with the highest risk of mercury contamination in tropical estuaries.

11.11 Determinación de Aptitudes Biotecnológicas de Bacterias Lácticas Aisladas Desde Antártida, Para Su Uso Medioambiental

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La Antártida es un ambiente hostil, con condiciones climáticas únicas y extremas pero que posee abundancia en microorganismos incluidas las Bacterias Ácido Lácticas (BAL). Dentro de las funciones tecnológicas de las BAL está la inhibición de organismos patógenos, han sido muy utilizada como probiótico en las últimas décadas debido a que en cantidades adecuadas mejoran la salud, tanto de animales como de humanos. Para este trabajo nos concentraremos en su potencial uso de estas bacterias para mejoramiento medioambiental en condiciones extremas de salinidad, temperatura y pH. Se aislaron 17 cepas con diferentes orígenes (suelo, musgo y líquen) a las cuales se le realizaron pruebas bioquímicas (catalasa, tinción gram, peróxido de hidrógeno, consumo de sustrato, hidrofobicidad de la superficie celular y crecimiento de las BAL), de estas 17 cepas, se seleccionaron 4 cepas y se hicieron pruebas de estrés ambiental (Temperatura, acidez y cambio osmótico). Los resultados demostraron que las cepas son catalasa negativa, gram positiva, capaces de producir peróxido de Hidrógeno, con metabolismo heterofermentativo obligado y facultativo, cepas con hidrofobicidad baja, alta y media, capaces de crecer a 15 y 45°C. Se obtuvo que las 4 cepas fueron capaces de crecer a temperaturas de 15, 25, 35 y 45°C. Las cepas 186B y 184 crecieron a 2, 4, 6 y 8% concentraciones de NaCl y a pH 4, 5, 6 y 7. La cepa 197 logró crecer a 2, 4, 6 2 y 10% de NaCl y a pH 5, 6 y 7, mientras que la cepa 195 creció desde 2 hasta 10% de NaCl y a pH 5, 6 y 7. De las pruebas se concluyó que poseen las características típicas de las bacterias acido lácticas con metabolismo Heterofermentativo obligado o facultativo, con características que se pudieron generar debido al nicho ecológico de las cepas, de las cuales se pudo inferir que pertenecen al género Lactobacillus y Weissella. Se determinó que las cepas poseen un buen mecanismo de adaptación, ya que presentaron un óptimo desarrollo frente al estrés, demostrando indicios de aptitudes biotecnológicas, en condiciones ambientales extremas, las cuales pueden servir como materia prima para distintas aplicaciones ambientales, en condiciones adversas para otros organismos.

11.12 Alcances en torno a la presencia de residuos farmacéuticos en el ecosistema antártico

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Aunque parezca increíble, ambientes tan extremos como la Antártida, no están exentos de contaminantes nuevos como los llamados "emergentes" (Coes), que en la actualidad son de interés global debido a que día a día son descargados en los ambientes acuáticos, porque se incrementa el número de nuevos compuestos a sus listas y porque aún se desconocen los reales efectos que éstos podrían causar en los organismos acuáticos y terrestres. La presencia de estos contaminantes en la Antártida estaría dada principalmente por las aguas residuales descargadas desde las estaciones científicas y militares, en conjunto con las actividades turísticas.Este trabajo explora la ocurrencia de residuos farmacéuticos en Antártida, principalmente en las zonas con más actividad humana (islas Shetland, península Antártica y mar de Ross). Aspectos las condiciones climaticas de la Antártida y la baja radiación en gran parte del año podrían estar condicionando una muy baja tasa de degradación de muchos de estos contaminantes. De la mano con lo anterior, surge también la inquietud en torno a cuáles serían los efectos de los Coes sobre un ecosistema tan frágil y prístino como el Antártico. Finalmente, se hace un análisis en torno a la necesidad de mejorar los actuales estándares de tratamiento de los efluentes descargados en la Antártida, que pueden presentar fallas operacionales por las inclemencias climáticas, pero que también adolecen de tratamientos avanzados diseñados para remover específicamente a los Coes, en particular a los residuos de origen farmacéutico.

12. Environmental Toxicology and Stress Response

12.02 Assessment of Physicochemical Features Influencing the Bioavailability of Methylmercury in a Patagonian Aquatic Ecosystem

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Mercury is commonly found in the environment in different inorganic forms. One of the most important compounds due to its toxicity is its organic species, methylmercury. This organic compound is produced by bacteria present in the sediment and the efficiency of bacterial methylation of mercury as well as bioavailability depend on several environmental factors. This study approaches the natural dynamics of methylmercury in Northern Chilean Patagonia. Therefore, four types of aquatic systems were assessed: glacial source river, pluvial source river, estuary, and marine ecosystem. Methylmercury speciation was executed by gas chromatography and detected by cold vapor-Atomic Absorption Spectrophotometry on abiotic and biotic samples at each site. Physical-chemical features of water were measured, including temperature, salinity, dissolved organic carbon, and nutrients. To assess the influence of the water physical-chemicals parameters over methylmercury availability, principal component analysis, and correlation analysis were performed. The preliminary analysis showed that the estuary was the site with the highest levels of methylmercury. It was also observed a relationship between methylmercury and water temperature, organic carbon, and some anions (i.e., NO3-, PO4-3) concentrations. There are also seasonal variations (spring versus fall) in these interactions. These results suggest that rivers would be more important in the mercury transport of its inorganic form. Then, as it reaches the estuary and the fjord the methylation activity raises due to its sediment deposition, and a portion of it is bioaccumulated in the trophic food web. To our knowledge, this is the first research of mercury natural dynamic in Northern Chilean Patagonia that incorporates a multifactorial approach.

12.03 Chemical-Physiological Analysis in the Biomonitor Punctelia Hypoleucites Transplanted to Bajo de la Alumbrera Mine and Nearby Towns, Catamarca, Argentina

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In Bajo de la Alumbrera (open pit mine of Cu, Au and Mo, located in Catamarca, Argentina) and in three nearby towns, *Punctelia hypoleucites* (Nyl.) Krog (lichenized Ascomycete) was transplanted in order to evaluate its chemical-physiological response to mining activity exposure. Lichen material was collected at a site considered pristine (control site, C) and transplanted in polyester mesh bags to 10 sites: 6 inside the mine (DM), 3 outside the company boundaries in nearby towns (FM) and at C site (3 bags per site). After 3 months of exposure, parameters used in lichens as biomarkers of air quality were measured in the samples: chlorophylls *a* and *b*, phaeophytins *a* and *b*, carotenoids, total soluble phenolic compounds (TSPC), malondialdehyde (MDA), sulfur (S), lecanoric acid, trolox equivalent antioxidant capacity (TEAC) and percent of antioxidant capacity (%AC). Phaeo. *a*/Chl. *a*, Chl. *b*/Chl. *a* and carotenoids/Total Chl. ratios were also calculated. Part of fresh material without transplanting was also analyzed as a basal sample (B). Analysis of variance (ANOVA) was applied to data obtained. By comparison B vs. C, a significant decrease of Chl. *a*, Phaeo. *a* and sulfur concentrations as well as an increase of Chl. *b*/Chl. *a* index were found in transplanted lichens, indicating stress due to transplant. On the other hand, significantly lower values of carotenoid, lecanoric acid, TSPC concentrations and carotenoid/Total Chl. ratio were observed in thalli transplanted to DM sites compared to FM sites. Likewise, in DM sites, thalli showed significantly lower values of carotenoid concentration, and higher values of Chl. *b*/Chl. *a* index and S concentration than in FM sites. TEAC and %AC showed no effect. These results would be evidence that, although in *P. hypoleucites* the antioxidant response is associated with exposure in sites located outside the mining company, in DM sites there was an accumulation of sulfur in thalli accompanied by low carotenoid concentration and imbalances in chlorophyll levels that denote pollution stress. Therefore, these parameters would be suitable as biomarkers for the use of this species as a biomonitor of air quality related to open-pit mining in Catamarca.

12.04 A Review on Atmospheric Mercury Deposition in the Pantanal Biome

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In the atmosphere, mercury is subject to a variety of physical factors as well as chemical and photochemical processes or interactions. Natural geocentric sources are exceeded by anthropogenic emissions of this metal. Most of the mercury accumulating in canopy foliage comes from atmospheric sources by promoting mercury uptake by stomata and physiologically active mesophyll cells on the leaf surface, representing a diurnally changing sink absorbing many trace gases. Biomass burning in tropical forests has contributed to the release of mercury to the atmosphere. Part of this mercury released into the environment is reaching areas of the Pantanal, and can be observed through research on trophic levels, since its stay in the atmosphere is up to two years before deposition. The Pantanal is the largest seasonally flooded sedimentary plain in the world, representing an area of transition between the domains of the Cerrado in central Brazil, the Chaco in Bolivia to Paraguay, and the Amazon region to the north. It is a "globally" remarkable, vulnerable region with the highest priority for conservation on a regional scale. With its diversity and abundance of wildlife the Pantanal area is a threatened region. The fragile balance of the Pantanal ecosystems, defined by the dynamics of periodic flooding, is threatened by recent trends in economic development, mainly by persistent and lethal wildfires in the Biome.The Pantanal, like any aquatic ecosystem, is the ultimate receptor of pollutants that are difficult to monitor. Mercury contamination is a global environmental concern, because of the bioaccumulative effects of this metal that increases with the anthropization of the environment. Changes in the main sources of mercury create environmental problems of difficult monitoring and unpredictable consequences, for which environmental control agencies

are not prepared.

12.06 A Meta-Analytical Review on Lethality in Animal Exposed to 2,4-Dichlorophenoxyacetic Acid at Environmental Concentrations

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2,4-dichlorophenoxyacetic acid (2,4-D) is an auxinic herbicide disruptor of plant growth. It is applied directly on the soil or sprayed on crops, and can progressively be concentrated in the environment, and affecting non-target organisms. Many studies have evaluated its lethal effect on different organisms and often present conflicting or contradictory results. Meta-analysis is a useful tool for compiling results from different studies, synthesizing and forming a statistically reliable conclusion on the issue. This study aimed to evaluate the lethal effect of 2,4-D in several species of animals through a meta-analysis. A search was performed in the Web of Science and Scopus databases with the Boolean scripts: #1 TS="2,4-D" OR "2,4-dichlorophenoxyacetic acid" AND "toxicity" and #2 TS="2,4-D OR 2,4-dichlorophenoxyacetic acid" AND "survival OR mortality". The search resulted in 7,579 publications. They were refined by selecting only research articles that assessed the lethal effect of 2,4-D on animals and presented data on the dead and living exposed to the herbicide. The initial refinement resulted in 289 articles analyzed in their entirety. After this, were selected only papers evaluating environmental concentrations of 2,4-D, i.e. that recorded in environment after herbicide application. It resulted in 29 articles, and 87 datasets. The analyzes was performed in OpenMEE software with the effect sizes calculated using Risk Difference for binary data. The analysis of the lethal effect of 2,4-D indicates a difference between animals treated with 2,4-D and the control (E+ 0.043, IC: 0.023–0.064, $p< 0.001$) showing a significant increase in the mortality of animals exposed to pesticide. When categorized by formulation type, only the commercial one showed a difference in relation to the control group. For the category of animals evaluated: fish and birds showed a difference in relation to the control group; mollusks, mammals, insects, crustaceans, and amphibians showed no difference between the control and the treatment with 2,4-D. When analyzing mortality rates at different stages of life, it was observed that in the larval stage, there was a difference between the experimental and control groups. Animals submitted to immersion and pulverization exposure to 2,4-D were more affected than those in the control group. The lethality of 2,4-D depends of organism type, affecting more the initial phases of development, and varying according with the exposure route.

12.08 Antimicrobial ACTivity and Ecotoxicity of Tannic Acid

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Tannic acid is a polyphenol, usually found in tissues of plants such as persimmon, tea, coffee, pomegranate, etc. This compound belongs to the hydrolysable tannins group. Tannin acid is used in the chemical staining of wood, for the conservation of ferrous metal objects, as food ingredient in the wine and juice industries, etc. Physiologically speaking, the polyphenol family is known to show strong antibacterial activity. The use of natural products as environmentally friendly alternatives to classical synthetic antibiotics is a growing trend, not only because of their lower toxic potential for the environment, but also because of their promising results both in decreasing the dose of classical antibiotics through synergies, and in reducing the generation of bacterial resistance.Despite these uses, nothing is known about its ecotoxicity.The aim of this study is to analyze the antimicrobial potential of tannic acid on a selection of the most common human pathogenic bacteria, and its ecotoxicological effects on non-target soil and aquatic organisms. For this reason, the vascular culture plant, *Allium cepa* L. and natural river peryphyton communities have been used as a model.*Allium cepa* was exposed to the following concentrations of tannic acid: 0.2, 2, 20, 100 and 500 mg/L. Subsequently, the effect of root inhibition was measured to perform the ecotoxicity calculation: LC_{50} = 131.2 (109.5- 159.3) mg/L and LC_{10} = 0.5 (0.4-0.7) mg/L.The ecotoxicity of tannic acid on natural river periphery was measured through the design of a microcosm system that simulated the circulating water of a river, where the obtained periphery from the Gállego River, tributary of the Ebro, Zaragoza, (Spain) was arranged. In this microcosm, the following concentrations of tannic acid were tested: 0.1,1,10,100 and 1000 mg/L. In this case, the toxicity of tannic acid on these river communities was very low: LC_{50}> 1000 mg/L and LC_{10} = 7.22 (0.4-46) mg/L. For the first time, these results reflect that the ecotoxicity of this product on vascular plants is low and barely detectable in the case of complex aquatic communities which are very sensitive to pollution. *The authors thank the financial support of Gobierno de Aragón-FSE-FEDER" Construyendo Europa desde Aragón" (Grupo E39_17R y RIS3 LMP28_18) and Catedra NOVALTIA.*

12.09 Influence of Herbaceous Plant Cover on the Partition of Acetamiprid Toxicity in Soil

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The environmental dynamics of pesticides has been mainly studied in terms of analytical concentrations, rather than the resulting toxicity which is what ultimately matters most when it comes to protecting biota. Neonicotinoid insecticides such as acetamiprid are among the most used for pest control. Knowing the distribution of the toxicity of this product allows management decisions to be made to protect the ecosystems associated with agricultural systems. So, we studied the distribution and mobility of acetamiprid toxicity in a soil suitable for agricultural use, under conditions of presence and absence of herbaceous vegetation. In laboratory conditions, we performed rainfall simulations on natural soil samples of preserved structure in pre-(control) and post-application scenarios of the commercial formulation Mospilan® (20% acetamiprid-treatment). Artificial rainfall was performed using a passive rainfall simulator that generates uniform rainfall of 35mm/h intensity for 90min. Soil samples were taken from a reference site with not agricultural use history and consisted of 6 blocks (900cm^2 area, 20cm height) for runoff and leachate collection and 18 cylinders (29cm^2 area, 6cm height) for soil analysis. In half of the samples the vegetation was eliminated. A hand sprayer (diameter drops: 250µm) was used for insecticide application, during 30s at 20cm of height. During rainfall simulations, runoff and leachate samples were collected in 500ml fractions. Samples toxicity was evaluated by standardized tests with Daphnia *magna* (runoff, leachate and soil elutriate) and *Hyalella curvispina* (direct soil).

The preferential route of water loss in the blocks was runoff. Regardless of vegetation cover, runoff and leachate samples collected in the post-application scenario produced significant effects on *D. magna*. With vegetation, the initial toxicity of runoffwas higher and decreased over the fractions, whereas in absence of cover this trend was reversed. In both cases, from the fourth fraction, no significant toxicity was observed. For leachate samples, no significant differences were observed between the treatments with and without vegetation. No significant effects were observed in soil samples for any of the conditions evaluated. These results indicate that the toxicity of the insecticide acetamiprid shows mobility in both surface runoff and leachates and, therefore, may pose a risk to aquatic ecosystems, mainly due to runoff transport.

12.10 Dinamica ambiental de la Ciprofloxacina en dos suelos de cultivo de la Provincia de Corrientes, Argentina

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Los contaminantes emergentes (CE) son un problema ambiental cada vez más notable, ya que su existencia en aguas residuales se debe a que las plantas de tratamiento de agua residuales no depuran este tipo de contaminante. Su presencia se considera una amenaza al ambiente, por su persistencia y su acelerada bioacumulación en los organismos del medio ambiente. Los fármacos son los contaminantes emergentes más encontrados en aguas residuales como la ciprofloxacina , por ello es importante conocer el destino ambiental de este compuesto ya que su presencia en las aguas de riego hace que puedan perdurar en el suelo y contaminar las aguas subterráneas. el objetivo de este trabajo fue realizado la adsorción y desorción de la ciprofloxacina en dos suelos agrícolas. El muestreo del suelo se realizó en la zona de Aguacero perteneciente al departamento de Mercedes (ME), de cultivo de arroz y de la localidad de Santa Rosa (SR) de cultivo de flores, de la capa arable (10 cm). Los suelos presntan caracteristicas fisicoquimicas diferentes, sien el de ME franco arcillo limoso (2,5% MO) y del de SR franco arenoso (0,67% MO). La isotermas de adsorción se determinaron mediante ensayos de adsorción en lote. Se realizó un estudio cinético previo que muestra que el proceso de adsorción es relativamente rápido en una primera fase, alcanzando un pseudoequilibrio en pocas horas Las isotermas se ajustaron a la forma logarítmica de la ecuación de Freundlich ($R^2 = 0,983$). En general, la magnitud de la adsorción fue baja, para ambos suelos, $K_{fa} = 0,59 \pm 0,007$ y $1 / n_a = 0,89 \pm 0,06$ para ME y, $K_{fa} = 0,42 \pm 0,007$ y $1 / n_a = 0,76 \pm 0,02$ para SR. Queda un 74% (ME) y 64% (SR) del CE retenido, indicando una irreversibilidad del proceso ($K_{fd} = 0,78 \pm 0,006$ y $1 / n_d = 1,09 \pm 0,006$, $R^2 = 0,992$ (ME) y $K_{fd} = 0,81 \pm 0,008$ y $1 / n_d = 0,89 \pm 0,009$, $R^2 = 0,959$ (SR). Se puede observar que el suelo de ME con más contenido de materia organiza retiene más al CE, pero el suelo de SR igual retiene un alto porcentaje de CE, se buscara otras características del suelo para justificar el comportamiento del CE. Los resultados obtenidos ponen en evidencia la importancia del fenómeno de adsorción-desorción como fase inicial en la regulación de residuos de CE en el suelo. Permite comprender que un valor reducido de recuperación de CE, permitir considerar la posibilidad de lixiviación del CE hacia horizontes inferiores, con los subsiguientes riesgos de contaminación de aguas subterráneas.

12.12 Toxicokinetic-Toxicodynamic Modelling to Extrapolate From Standard Data to Real World Situation

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Current ecological risk assessments of pesticides are typically based on acute and chronic laboratory experiments with standard test species at constant conditions. As the environmental risk assessment of pesticides generally aims to determine the potential likelihood of adverse effects to non-target organisms, these standard testing regimes may not be appropriate. Natural ecosystems are characterized by a high spatial and temporal variability. For instance, exposure durations may be longer or shorter than in standard tests, and exposure will affect various species at varying size and developmental stages differently. During the last decade, the applicability of toxicokinetic-toxicodynamic (TKTD) modelling for the extrapolation of untested exposure situations has been demonstrated by an impressive number of studies. TKTD modelling allows to predict effects at time variable exposure as well as different environmental conditions like food situation or temperature. Also, extrapolation potential from one species to another is currently under investigation. For lethal effect the General Unified Threshold model of Survival (GUTS) Framework has unified all TKTD models to simulating survival. The Dynamic Energy Budget (DEB) model is used often with or without the combination of a TKTD module to simulate animals growth, reproducation and maturation. In a publicly available database called 'AddmyPet' more than 2800 species are already listed. For plants a combination of plant growth models with a TKTD component are used. We will demonstrate the use of these TKTD models for the environmental risk assessment in several case studies collected in the last decade for various insecticides, herbicides and fungicides. The use of a standardized modelling approach to apply to all these different questions will increase our scientific knowledge of the interaction of pesticides with non-target species. This knowledge reduce the uncertainty of the environmental risk assessment and help us to adapt the risk assessment to local conditions. Standardized TKTD modelling offers a new way of interpreting standard toxicity data based on OECD guidance. This allows a scientifically sound extrapolation from the constant laboratory condition to the local situation. This approach can be used for various species and allows to extrapolate to different food conditions, temperature and maybe even to untested species. Based on this approach a tiered risk assessment scheme might be established for the future in which the different tiers become more realistic, but also are more data and knowledge demanding.

12.13 Seasonal Variations in Arsenic Distributions and Mobility in a Shallow Pampean Lagoon

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The presence of arsenic (As) in surface and groundwater is a serious environmental concern because of its high toxicity and global occurrence in the environment. The Chaco-Pampean plain, is one of the largest areas in the world with elevated As levels (geogenic origin), as well as one of the most important agricultural-livestock regions of Argentina, constituting a high risk for the human health. The pampean lagoons are shallow and highly dynamic, where there are wide range of physical, chemical, and biological factors that affect the mobilization of As in the freshwater–sediment interface. The mobility of As in such water bodies can be of concern, particularly in water bodies with probable use as drinking water, livestock water and/or crop irrigation. The aims of this research were to elucidate: 1) the seasonal variations in the distribution of total and labile As fractions in the surface sediments of Los Padres lagoon located in Buenos Aires province, Argentina 2) their mobility to water column in relation to its availability in sediments, and 3) the possible risk of using this resource of water. Surface sediment and water samples were taken from the lagoon and associated streams during the four seasons of the year (2018-2019). Arsenic were determined by atomic absorption spectroscopy. Total As in sediments did not show a clear seasonal pattern, with a range between 3.6-14.8 mg/kg and a positive linear relationship (r^2=0.79, $p< 0.05$) with iron (Fe) concentrations was observed. Labile concentrations varied between 0.85-7.1 mg/kg, showing the following order of lability: summer (44%)> spring (29%)> winter (26%)> autumn (16%). The close relationship between As - Fe, under the oxidant conditions and alkaline pH of the lagoon, would suggest As co-precipitation and adsorption on Fe oxides as probable route of immobilization in sediments, determining its low lability. The As levels in water varied between 10.9-24.8 µg/L, with maximum values during summer, in accordance with that reported for other shallow lakes. This increase coincided with the maximum lability in sediments (44%), evidencing the release of As into the water column. All water samples exceeded the limit establish in Argentina for human consumption (10µg/L) while not those of livestock (67µg/L) and crop irrigation (100µg/L), but were very close to Canadian limit for livestock (25µg/L). These results constitute the first report on seasonal variations of As concentrations in a pampean lagoon.

12.14 Diuron and Its Metabolites Induce Toxicity on Caenorhabditis elegans

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Diuron herbicide induces toxicity in different tissues at high doses. However, events involved in its intimate toxic mechanism remain unclear. In this context, *Caenorhabditis elegans* (*C. elegans*) has been widely used as an experimental model to understand adverse events related to chemical exposures. This study aimed to identify the toxic mechanism of diuron and its metabolites, 3,4-dichloroaniline (DCA) and 3-(3,4-dichlorophenyl)-1-methylurea (DCPMU) using *C. elegans* wild-type N2, *Pllg-1*::GFP and *Pdat-1*::GFP strains. Worms in L1 larval stage were acutely exposed (1 hour) to the test chemicals and analyzed for % lethality, % survival, reactive oxygen and nitrogen species (RONS), glutathione, (GSH) and ATP levels, autophagy index, behavior and dopaminergic neurodegeneration. Significant differences were set at $p < 0.05$. Increased % lethality was found for all chemicals at the high concentrations, with significant difference at 500 µM DCA; the same was noted for % survival. No changes in RONS production were observed. Nevertheless, GSH levels were significantly increased upon DCA treatment. Moreover, ATP levels were decreased for all test chemicals, without impairment in the autophagic process. Under the present conditions, dopaminergic neurotoxicity was observed for all tested chemicals, but only diuron induced alterations in the moving average and smoothed speed (µm/s) of the worms. In this study, increased GSH levels acted as a compensatory mechanism against the generation of RONS by diuron and its metabolites. In turn, exposure to diuron and metabolites was sufficient to impair ATP levels, indicative of a potential alteration in mitochondrial function. Such conditions may trigger autophagy as an adaptive survival mechanism, but this was not observed in *C. elegans*; in fact, necrosis and apoptosis have been shown as the main types of cell death associated with the test chemicals in previous studies. Although dopaminergic neurodegeneration typically triggers motor impairment, only diuron elicited this outcome; alteration in the specific parameters evaluated may occur at different time point for the metabolites and was not accessed in the present study. Altogether, the results suggest that DCA in particular plays an important role in the toxicity observed in *C. elegans*. Acknowledgments: Breno Pannia Espósito for technical assistance, FAPESP [Grant No. 2017/25402-5] and CAPES [CAPES-PrInt Grant No. 88887.467311/2019-00] for the financial support.

12.15 Eco/Genotoxicity of Natural Anthraquinones Dyes

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In recent years, there has been a growing interest in reviving the use of natural dyes mainly for textiles. In the textile industry, anthraquinones (formed by the merger of three benzene rings) are used as dyes to give red colors to different fibers. Although natural dyes are obtained from natural sources, some of them have been shown to pose toxicity and mutagenicity to aquatic organisms, so the current study proposes an initial hazard assessment of three natural anthraquinones dyes from BioColour project. Dermocybin, Dermorubin + 5Cl Dermorubin, and Emodin dyes obtained from fungi, with a determined purity of ≥ 98%, were submitted to an eco/genotoxic evaluation from solutions in the limit of solubility in Dimethyl sulfoxide (DMSO). Acute toxicity to *Daphnia similis* was evaluated according to OECD Guideline N° 202. *D. similis* neonates (≤ 24 hours old) were exposed to different concentrations of dyes. Immobilized organisms were counted after 48 h of exposure. The mutagenicity test was performed with TA98, TA100, TA97a, YG1041 and TA1537 strains, applying the microplate agar protocol (MPA) of the *Salmonella*/microsome assay, in the absence and presence of the metabolic activation system (S9 mixture) at 5 and 10% for all dyes and with Emodin we also used 30% of S9 in the mixture. For Dermocybin, Dermorubin + 5Cl Dermorubin and Emodin, acute toxicity test with *D. similis* showed toxic effects to neonates, with EC_{50} = 0.99 ± 0.51 mg/L, EC_{50} = 7.7 ± 1.4 mg/L and EC_{50} = 1.9 ± 1.4 mg/L, respectively. *Salmonella*/microsome mutagenicity for Dermocybin and Dermorubin + 5Cl Dermorubin, provided negative results in the MPA at the limit of solubility for the 5 strains used, in the presence and absence

of S9. Emodin was positive for TA1537 with S9 when the percentage of S9 was increased from 5 to 10 and 30%. As already reported in the available literature, Emodin was mutagenic and its mutagenicity was better detected with 10% of S9. Derivatization of Emodin may be an option for the development of a non-mutagenic molecule, future assays will be performed to confirm this hypothesis. Based on this initial characterization, MPA showed good sensitivity for dye evaluation. For future ecotoxicity studies, hazard characterization will be performed for algae and fish as well.

12.16 New Approach to γ-Al2O3, NiO/γ-Al2O3 and Ni/γ-Al2O3 Nanoparticles Toxicity in Tomato-Plants (Lycopersicon esculentum) by Means of Electron Microscopy Techniques

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There are toxicological studies on metal oxide nanoparticles (MO-NPs) in plants by electron microscopy techniques (SEM/EDS and TEM), where toxicity evaluation focuses mainly on the presence of MO-NPs in roots, stems, and leaves, and on the changes in the nutritional composition. However, studies on morphological differences of MO-NPs with respect to nutrient particles are scarce; most of them considering the interactions between both types of particles. Since the solubility of MO-NPs in aqueous medium (STP) is negligible, toxicity is more likely to occur due to the effect of isolated or agglomerated particles than due to the presence of solutes in the plant. This aspect is important in toxicological studies and must be taken into account. The toxicity of metal ions in plants is well documented in the literature and many of the available MO-NP works focus on the result of the action of metal ions, neglecting the intrinsic effect of their nanometric size. The aim of the present work was to determine the morphologies of MO-NPs such as γ-Al_2O_3 (SNC), NiO/ γ-Al_2O_3 (PNC), and Ni/ γ-Al_2O_3 (NC) in plants and to compare them to nutrient particle morphologies. We also evaluated changes in the nutrient content in treated vs control plants, which might be associated with toxicity effects. Experiments were carried out in tomato plants *(Lycopersicon esculentum),* grown in soils, and irrigated with 100 ppm MO-NP suspensions (Al^{3+}content < 0,5%) in deionized water for 17, 21, and 30 days. Morphometric studies in roots, stems, and leaves were conducted by SEM and TEM, while quantification of elements and oxides was performed by EDSX. The comparative analysis of the TEM and SEM/EDS micrographs of these MO-NPs as powders with the plant micrographs, allowed us to differentiate the morphologies of the SNC, PNC, and NC from those of nutrient particles. Micrographs revealed SNC morphologies of agglomerates (500nm) and particles (10nm) consisting of hexagonal platelet-like sheets and also, SNC particles distributed in rod-like shapes. Similarly, PNC and NC agglomerates exhibited a platelet-like morphology together with NiO and Ni nanoparticles (50nm) dispersed in the γ-Al_2O_3 matrix. MO-NPs rod-like shaped, associated with nutrients could be absorbed via root pores and agglomerated within the plants. Even though the results allowed differentiating MO-NPs from nutrients particles, do not allow determining toxicity effects because of the random values observed in nutrient content changes.

12.17 Occurrence of Polychlorinated Biphenyls (PCBs) in Bombus Pauloensis From Areas With Different Land Uses in Buenos Aires, Argentina

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Bees (Fam. Apidae) are a crucial component in global biodiversity, ecosystems stability and crops production. In the last years, bees have been threatened by a combination of factors, such as habitat loss, pathogens, agricultural intensification and environmental pollution. Polychlorinated biphenyls (PCBs) belong to persistent organic pollutants, currently forbidden and regulated by the Stockholm Convention; however, they are still present in the environment and are matter of concern. In Argentina, the social bumblebee, *Bombus pauloensis,* is one of the most prevalent species of the genus inhabiting natural, agricultural, and urban areas. The aim of this study was to assess the impact of land use (conventional and ornamental plants agricultures, and natural reserve) on the levels of PCBs in *B. pauloensis*. Females (workers) and males were sampled from a conventional agriculture production area (A1), an ornamental plants field adjacent to an urban solid waste disposal site (A2) and a natural reserve with organic crops production (A3). Analyses were performed by GC-ECD. In general males showed higher levels than females in sites A1 and A3, while in A2 the concentrations were similar between both sexes. In the case of females, the maximum PCBs levels were found in A2 (58,72 ng/g), followed by A1 (40,22 ng/g) and A3 (27,77 ng/g), according to proximity at waste disposal, while in males the order was A1 (70,72 ng/g) > A3 > A2, where A3 (61,98 ng/g) and A2 (57,29 ng/g**)** differed slightly. The 3-CB were the main congener groups found followed by 5-CB in both sexes. The higher proportion of these groups could reflect atmospheric transport as the main source of these pollutants. However, it is not discarded an exposure to local source of heavy chlorinated biphenyls probably due to proximity to solid waste disposal (A2) and an important industrial area located near the sampling site A1. At our knowledge, this work represents the first study about PCBs on wild bees in Argentina and remarks the potential of *B. paulensis* as a biomonitor of environmental pollution.

13. Terrestrial Ecotoxicology and Ecosystem Services

13.02 Zinc Alleviates Copper Toxicity to Lettuce and Oat in Copper Contaminated Soils

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Copper (Cu) mining operations have a global footprint and have led to contamination of soils and Cu toxicity to plants. Understanding the controls of plant Cu uptake, including competition with other metals, such as zinc (Zn), is essential for improving plant growth in Cu-contaminated soils. The objective of this study was to evaluate the capacity of Zn to alleviate the toxicity of Cu in crops grown in Cu-contaminated soils. Lettuce was grown in 27 soils with ranges of total Cu and Zn concentrations of 82-1295 mg/kg and 86-345 mg/kg, respectively, for a period of 21 days. Oat was grown in 21 soils with the same total Cu and Zn concentration ranges for a period of 62 days. Regression analyses were used to evaluate the impact of total soil Zn on plant growth in the Cu-contaminated soils. We show for the first time that Zn alleviates Cu toxicity in lettuce and oat grown in soils. Specifically, we observed a negative (toxicity) effect of total soil Cu and a positive (protective) effect of total soil Zn on shoot growth response for lettuce and oat. The effective concentration 50% (EC50) of Cu/Zn mass ratio was 7.0±1.8 for lettuce shoot length and 5.9±1.0 for oat shoot weight. These results indicate that the previously demonstrated efficacy of Zn in mitigating Cu phytotoxicity in hydroponic systems can extend to more complex soil systems. Further research should be done to evaluate specific Zn amendments for restoring vegetative growth in Cu-contaminated soils.

13.03 A Process for Automatic Counting of Earthworm Juveniles From Chronic Laboratory Studies

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Earthworms are considered important engineers of agricultural soils. By burrowing through the soil in different layers, they provide important ecosystem services. To ensure these services, earthworm laboratory tests are a standard requirement for registration of agrochemicals in most regions of the world. Toxicity of chemicals entering the soil can be determined in acute laboratory earthworm tests (e.g. OECD 207) or by chronic reproduction tests with *Eisenia fetida/andrei*. In the earthworm reproduction test (e.g. OECD 222) adult earthworms are incubated for 28 days during which they are fed and produce cocoons. After removal of the adults from the test soil, the juveniles hatching from the cocoons grow for another 28 days to be finally counted. In the untreated control samples of laboratory studies conducted with *Ensenia fetida*, typically between 100 and 300 juveniles are produced from 10 adults per replicate. Juvenile abundance is determined either directly by hand sorting from the soil or by extracting them by heat and picking out the individual worms when appearing at the soil surface. For a typical dose-response study with 8 concentrations (4 replicates per conc.) up to 10000 individuals need to be counted if there is no pronounced toxicity. To reduce the high effort, to ensure accuracy and to explore the advantages of automated data generation, we aim at developing an automatic counting system for juveniles. We propose two novel contributions. First, we present a newly developed process for an accelerated extraction and fixation of juvenile earthworms providing them in a clean state. This allows to create high resolution digital images for automatic assessment. Second, we used Artificial Intelligence image processing methods to identify and count the juvenile earthworms. We tackled the key challenge to identify and separate potentially overlapping earthworms with a machine learning approach. To keep manual annotation effort at a minimum, we utilized an automatic image segmentation method based on deep neural networks, which have been pre-trained on publicly available grayscale images with labeled nematodes to detect worm like structures. This deep neural network was then refined in combination with additional filtering methods to segment earthworms in a previously unseen color image dataset. The final step of counting of the juvenile earthworms from the detected signals is under development and will eventually be validated against hand counting results to ensure accuracy.

13.04 Modular Kit for Soil Analysis Designed for Custom Farming and Sustainable Soil Resources Management

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The historical development of agriculture in Chile has been largely driven by an export-oriented production model but currently, food production's demands are not only quantity and quality, but also food safety. Therefore, the economic growth and agri-food development should go with a more professionalized agriculture and a social and environmental investment that able to manage risks related to resource extraction and the effects of climate change. But the lack of site-specific soil information makes decision-making difficult, putting human and ecosystem health at risk, promoting resource loss, ruining the local economy and putting future generations at risk. Detail soil analysis provide the necessary information for controlling soil erosion, boosting protection against chemical degradation risks and optimal agricultural practice management (FAO, 2013). Never the less, based on the heterogeneity of soil usage and degradation types found in Chile, site-specific soil physico-chemical studies are required. Traditional estimation of soil variability is based on many guidelines for the analysis and interpretation not easy to follow, requires a sampling and recording of edaphic properties with a high sampling density, the use of laboratory technologies for soil analysis involving sample transportation and a high cost of analysis, or the use of standard soil analysis kits. Thus, considering the large variations in soil agroecosystems in Chile, the farmers difficult technology access and the lack of site-specific soil kit analysis there is a great opportunity for creating an easy-to-use, cost-effective, context-based, customized and robust tool kits that can be adapted to diverse agroecosystems and that can easily be used by local communities. Here we present a details development of a personalized, accessible, cost-effective and easy-to-use tool kit that allows the objective physicochemical soil characterization: texture, organic matter, pH, carbonates, macronutrients (NPK) and metal content (Cu and As). The customized soil characterization kit was defined based on the analysis for in-situ soil characteristics in three distinct geographical regions in Chile (Northern, Central, Southern) and were designed, characterized and manufactured and tested in simulated conditions before doing an in-situ validation with local communities. The kit provides site-specific information that will permit a sustainable

management of the soil and its economic resources based around agricultural land, providing an objective tool that will allow a more comprehensive understanding of soil dynamics, which is extremely important due the current challenges related to land usage, resource limitations (natural and economical), climate change adaptability, natural disasters, laws and regulations adaptation, etc.

13.05 Investigating the Impact of Insecticides on Soil Mesofauna Abundance and Biodiversity and Its Impacts on Organic Matter Break Down in Arable Fields

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During a six-month field experiment we manipulated the soil mesofauna (Acari and Collembola) abundance and biodiversity by applying two legacy insecticides (Lindane and Methamidophos) at excessively high doses and measured the impact on organic matter degradation in a temperate arable field. Our results show that both insecticides had strong effects on Collembola and Acari abundances over the entire study duration by reducing their populations by up to 80%. In comparison the effects of insecticide exposure on mesofauna biodiversity were less pronounced and more complex. We document insecticide dependent temporal fluctuations (both reductions and increase) of different estimates (indices) of biodiversity over time and with the majority of treatments having no lasting impact after six months. When looking at the effects of both mesofauna abundance and biodiversity on three different measurements of organic matter breakdown (minicontainer with lucerne and straw and bait lamina strips) we found no evidence that either of them had a measurable impact. These results suggest that organic matter breakdown is likely driven by other trophic levels (e g. microorganisms or earthworms) with only limited contributions of the mesofauna community. These findings should be discussed in the context of the current understanding of soil food web function and its implications for future soil risk assessments in Latin America, in particular the definition of specific in-field protection goals.

13.06 Risk Assessment of Pesticides for Soil Organisms Following the Ecosystem Services Concept

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Plant protection products (PPPs) are widely used in agriculture to control pests, weeds, and diseases and thereby contribute to increasing yields worldwide. A robust environmental risk assessment for PPPs is necessary to protect non-target organisms and ecosystems from unacceptable side effects. In agricultural landscapes soil organisms are playing an important functional role by contributing to e.g. organic matter degradation, nutrient cycling, carbon sequestration, water infiltration and soil structuring, moreover also by acting as a critical component in a complex soil food web. Hence, a PPP risk assessment for soil organisms and their major functions is useful from both, an ecological and agronomical point of view. We present an outline proposal on a risk assessment and management framework for soil organisms and functions based on the Ecosystem Services concept. Different Ecosystem Services are provided by different parts of the landscape. Therefore, we propose a spatial differentiation of soil risk assessment by focusing on the most relevant services which are provided by the respective landscape elements. Targeted risk mitigation and management measures can help to minimize side effects of PPPs uses and ensure that environmental protection goals are met, and crop yields are maximized in a sustainable way.

13.07 A Modular Modeling Approach to Link Soil Exposure and Effects - a Case Study for Earthworms

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Earthworms are important ecosystem engineers and are considered as a key functional soil organism group in agroecosystems across temperate and tropical regions. As such, earthworms are part of the environmental risk assessment (ERA) of plant protection products (PPPs) in the European Union (EU) and Canada. In the EU, the soil risk assessment is based on the exposure and the effect assessments using a tiered approach. While the lower tier effect assessment takes a limited spatial and temporal variability into account, exposure models can provide a more detailed distribution of chemicals and environmental variables in soil. For earthworms, these spatio-temporal variability plays a significant role concerning their exposure to a PPP as they move vertically and horizontally through the soil and potentially change their burrowing behavior in response to changing environmental factors. Here, mechanistic effect modeling offers a powerful tool to not only integrate exposure and effect assessment, but also to enhance the understanding of earthworm ecology. We will present the FORESEE model, a modular modeling approach for earthworms for soil risk assessment. FORESEE consists of four submodules, covering the most relevant processes for earthworm risk assessment: the environment, the behavior (feeding and movement), the toxicity, and the population. The Environment module uses data of exposure models that provide temporally and spatially explicit information on PPP concentration (total and pore water) and environmental variables. The toxicity module is based on toxicokinetic-toxicodynamic (TKTD) models. Lethal effects are simulated using the General Unified Threshold model of Survival (GUTS), while sublethal effects can be modeled using the Dynamic Energy Budget (DEB) model. The population module incorporates existing population models for different species. The presented modular approach allows to take advantage of existing models by coupling them into a broader framework. Furthermore, modules can be exchanged or updated if new knowledge is available. The presentation will highlight how the FORESEE model can be adapted to conditions in Latin America and how it could be potentially used as a higher tier refinement option for the risk assessment of soil organisms.

13.08 Ecotoxicological Effect of a Digested Sludge of Pig Slurries From an Agro-Industrial Farm on Earthworm (Eisenia fetida) and Corn (Zea mays)

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Digested Sludge of Pig slurries (DSPS) is a by-product generated from

the treatment of organic waste by anaerobic digestion, implemented in porcine agro-industrial farms that, by environmental legislation, must be treated and disposed of without affecting the environment and ecosystems. The aim was to evaluate the ecotoxicological effects of the DSPS on the biological indicators as earthworm (*Eisenia fetida*) and corn (*Zea mays*), by means of the mortality and evasion measures of earthworm, and the corn germination process, obtaining various indices that determine the level of toxicity of the DSPS employment as a soil fertilizer. The values of LC_{50} in earthworm and IC_{50} in corn of 15.50% and 22.60%, respectively, calculated by the Probit method, while the evasion policy reveals a direct relationship with the presence of the DSPS, hence from the concentration of 12.5%, is considered a negative mean for the earthworm. The NOEC and LOEC showed significant differences for the parameters studied in the earthworm as mortality, fragmentation, wet weight and dry weight; and for corn, germination/inhibition, radicle, number of roots, coleoptile, height, number of leaves, wet weight, and dry weight, which will determine values of 25% and 50%, respectively for earthworm, and 15.625% and 18.75%, respectively for corn. Finally, it is concluded that the DSPS can be used as an organic allowance if it is used in concentrations that do not overcome the lethal and sub-lethal effects of the indicators of its use and that do not harm the functional and biological quality of the mixture.

13.10 Neurotoxic Effects of Agrochemical Exposures in a Wild-Caught Rodent Model on the U.S.-Mexico Border

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Yuma County is a large agricultural hub on the U.S. side of the Arizona-Mexico border. Yuma provides over 90% of the winter leafy greens consumed in the U.S. To maintain high agricultural output, more than 2.6 million kilograms of agrochemicals are used in Yuma County each year. This intensive use of agrochemicals leads to significant toxic chemical exposure for residents, especially the migrant and seasonal farmworkers and those living near agricultural lands. We used ICP-MS to quantify metal(loid) concentrations of human (n = 323) and rodent (*Peromyscus eremicus*, n = 300) hair samples. Concentrations of neurotoxic metals (especially Cu and Mn, which are widely used in pesticides) were at levels known to be associated with adverse health outcomes. We then conducted transcriptomic and lipidomic analyses to compare patterns of gene expression and lipid profiles in the brain between *Peromyscus* collected from agricultural areas with high neurotoxic metal exposure vs. a nearby reference site with low neurotoxic metal exposure. These analyses demonstrated disrupted genetic pathways, including those associated with lipid metabolism, carbohydrate metabolism, and muscle contraction. This project advances our understanding of neurological effects of exposure to agrochemicals in a wild-caught rodent, which can serve as a model for human health impacts in the underserved populations of farmworkers and Indigenous tribes in this border region.

13.11 Análise Comportamental de Minhocas (Eisenia andrei) Expostas a Defensivos Agrícolas Isolados e em Mistura de Tanque

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O uso de defensivos agrícolas tem crescido nos últimos anos devido à alta demanda de alimentos produzidos no setor agrícola, que além de serem utilizados de forma isolada, também opta-se pela mistura em tanque com dois ou mais produtos, de modo a intensificar sua ação nas lavouras. A aplicação incorreta e desenfreada dos defensivos agrícolas pode afetar negativamente o solo e os organismos ali existentes. Esse estudo objetivou analisar a resposta de minhocas (Eisenia andrei) expostas aos herbicidas Haloxyfop e Glifosato e ao fungicida FOX de acordo com a ISO 17512-1, aplicados de forma isolada e em misturas nas concentrações usadas em plantação de soja. Além de testar isoladamente os defensivos Haloxyfop, Glifosato e FOX, realizou-se duas misturas: Glifosato com FOX e Glifosato com Haloxyfop, todos realizados em cinco repetições para melhor análise dos resultados. Foram utilizados recipientes de plástico com capacidade de 2L, contendo 500g de solo controle (CN) com 40 mL de água de um lado e, do outro, 500g de solo com o(s) defensivo(s) agrícola(s) em concentrações indicadas para plantações de soja. Após a preparação do solo, foram inseridas 10 minhocas no centro de cada recipiente, que foram cobertos e armazenados em estufa BOD durante 48h. Por fim, para calcular a percentagem de fuga das minhocas, contabilizou-se a distribuição das minhocas em cada lado do recipiente. Percebeu-se através das respostas dos organismos que o Glifosato aplicado de forma individual não causou fuga ou atração, resultando em média igual a 0. No caso do FOX e Haloxyfop a média de fuga resultou em 68 e 92, respectivamente, o que demonstra que houve perda de habitat das minhocas. Na mistura contendo Glifosato com FOX a média foi igual a 64 e no Glifosato com Haloxyfop igual a 80, ambos demonstrando alto índice de toxicidade para os organismos testes. Os resultados obtidos demonstram o efeito negativo desses produtos em concentrações recomendadas para plantações de soja, devido ao alto índice de fuga e, consequentemente, à perda de habitat das minhocas. Ressalta-se a importância da fiscalização de órgãos responsáveis, bem como pesquisas e estudos nesta área, a fim de compreender cada impacto causado por esses defensivos agrícolas no solo, lençol freático e organismos.

13.12 Eucalyptus Urograndis Biochar: Effects on Eisenia andrei and Soil Microbial Communities

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Biochar is a product obtained from the pyrolysis of organic matter from several sources, characterized by high recalcitrant carbon content, which is produced in order to improve the soil quality for agronomic, forestry, and environmental purposes. The present study aimed to evaluate the ecotoxicological effects of eucalyptus biochar in soil, using a model organism *Eisenia andrei* and the soil microorganisms. Natural soil and tropical artificial soil (TAS) were used as substrates, with and without biochar (3.33 g L^{-1}). The biochar was obtained by slow pyrolysis at 450 ºC for a period of 8 hours, from *Eucalyptus urograndis* wood chips. The experimental design with *E. andrei* was carried out using the avoidance test and the reproduction/mortality test based on ISO 11268-2 (2012)

and ISO 17512-1 (2008). For the assessment of soil microbial activity, it were determined the: microbial biomass carbon (MBC) quantification test, soil basal respiration test, soil metabolic quotient (qCO_2) estimative and β-glucosidase enzyme activity. Only the avoidance test and the qCO_2 estimative for the natural soil showed significant differences ($p < 0.05$), between their respective control treatments and the biochar-amended soils. The treatment biochar in natural soil had an average avoidance percentage of 53.33 %, indicating the preference of the organisms for the soil without biochar. Despite the low amount of biochar applied in the soil, the avoidance of earthworms may be caused by heavy metals present in the ash and polycyclic aromatic hydrocarbons present in the biochar, which should be evaluated in further studies. Regarding qCO_2, average values of 1.85 C-CO_2 g^{-1} MBC $hour^{-1}$ were obtained for the soil without biochar, and 3.62 C-CO_2 g^{-1} MBC $hour^{-1}$ for biochar-amended natural soils, showing non-ideal conditions in long-term exposures. That may be due to the potential increase in energy expenditure by microorganisms and consequent consumption of nutrients. Further studies are still needed to establish the influence of eucalyptus biochar on other soils parameters and in plants. However, the data herein showed that the application of biochar to natural soil warrants concern despite no relevant effects being observed in artificial soils.

13.13 Toxicological Effects of Organophosphorus in Production Animals of Argentina: Retrospective Evaluation

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Organophosphorus (OP) are synthetic organic compounds widely used as agricultural insecticides and to control of ectoparasites in livestock. They have a nonspecific toxic effect due to inhibition of acetylcholinesterase (ACHE), since it does not only affect the target species. Poisoning has been reported in cattle, pigs and sheep, and in poultry associated with the mismanagement of OP. The rural establishments (cases) diagnosed by intoxication with OP by the Veterinary Diagnostic Service of INTA Balcarce were retrospectively assessed (1998-2020). In Veterinary Toxicology, the diagnostic approach is based on anamnestic data, clinical signs, the presence of OP and the activity of ACHE.From 3768 cattle, 2250 hens and 50 pigs,161 (4.3%), 200 (8.9%) and 5 (10.0%) animals died, respectively.In a farm poultry there was a 100% mortality 24 hs after consuming food contaminated with OP. In cattle and poultry cases where data were available, no differences in the frequencies of occurrence between ages. Mainly neurological clinical signs were described in bovine: opisthotonos, excitability, aggressiveness, circling, ataxia, hindquarters weakness, muscle tremors, ptyalism, epiphora, ptosis, blindness, and diarrhea. The OP presence was confirmed in 50% of the affected animals; finding OP residues in liver (71.4%), adipose tissue, abomasum content and central nervous system (28.6% each). In addition, decreased ACHE activity was observed in 35% of the cases. The most frequently OP compounds detected were chlorpyrifos, malathion and ethion. The poisoning in livestock were produced by consumption of pastures and feed (57.2%) contaminated with OP in beef or dairyfarms, or by overdosing with ectoparasiticides containing OP (14%). The main feeds were swept soy, wheat and pellets; while, in the remaining cases, the source of OP contamination could not be determined. In those cases in which the source could be established, it was clear that poisonings were associated with anthropic activities, that is, OP mismanagement, evidenced by the presence in non-target animals, with significant acute effects.

13.14 ¿La Preaclimatación deGerminados deAlnus Acuminata Mejora LA Tolerancia dePlántulas Al Arsénico?

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La germinación de *Alnus acuminata* puede darse bajo concentraciones de arsénico de hasta 10 ppm y las plántulas resultantes, sembradas en sustrato normal, pueden mostrar un vigor mayor que plantas provenientes de germinados control. Esta tolerancia germinativa de A. acuminata puede tener importantes aplicaciones en la recuperación de suelos contaminados, especialmente si se demuestra que plántulas provenientes de germinados preaclimatados puedan mejorar la su capacidad de bio-acumulación, una vez sean sometidas por segunda vez a un sustrato contaminado con arsénico. En este estudio, expusimos plántulas provenientes de germinados control (0.0 mg As L^{-1}) y preaclimatados al arsénico (2.5, 5.0, 7.5 y 10 mg As L^{-1}), a un segundo tratamiento de sustrato contaminado con 7.5 mg As por kilo de suelo seco (7.5 ppm). Pusimos a prueba la hipótesis nula de que la exposición de plántulas a una concentración de As mayor a la de preaclimatación reduce la tolerancia. Sembramos 136 plántulas que provenían de los tratamientos de preaclimatación en sustrato de humus + arena (5:2), regamos con agua para las plantas control, y una disolución de arseniato de sodio ajustada al volumen de sustrato para una concentración de 7.5 ppm. Mantuvimos las plántulas en un cuarto de crecimiento, con fotoperiodo de 15°C- 25°C x 12/12 horas. Al final de 20 días de seguimiento distribuimos las plántulas en cuatro análisis: material seco para finalizar el estudio de crecimiento y cuantificar la concentración de As en tejidos, material fresco de hojas para análisis bioquímico de contenido de clorofilas, azúcares, almidón y proteínas, y material fresco de hojas y raíz para cálculo de la actividad antioxidativa de catalasa y peroxidasa. El crecimiento caulinar fue mayor en las plántulas doble control, pero el área foliar, el número de hojas y la biomasa total de plántulas preaclimatadas y expuestas a sustrato contaminado fue similar o incluso superior al doble control. Las plántulas tuvieron una acumulación hasta de 4.2 µg As g^{-1} en raíz y 2.86 µg As g^{-1} en hojas, pero no hubo diferencias de concentración entre los individuos que habían tenido pretratamiento y los que fueron sometidos por primera vez al arsénico. La alta tolerancia a 7.5 ppm de arsénico estuvo asociada a una alta concentración de proteínas y clorofila en las hojas, además de una alta actividad de la peroxidasa. Nosotros concluimos que la preaclimatación no aumenta la bioacumulación, pero sí la tolerancia de *A. acuminata* al As.

13.15 Antimicrobial ACTivity of Citronellol and Its Ecotoxicological Effects in Non-Target Soil Organisms

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Citronellol, or 3,7-Dimethyloct-6-en-1-ol, is a natural acyclic monoterpenoid. Both enantiomers occur naturally in more than 30 plant oils (e.g. citronella, rose and geranium), in black tea, wine, and in certain fruits. It has been used for a long time in cosmetics, flavourings and fragrances and due to its pleasant rose-like odour may represent a suitable candidate as mosquito repellent and/or larvicide. Furthermore,

previous studies show that the structural family of citronellol may have interesting antimicrobial activity. In order to tackle antibacterial resistance world-wide issue, the discovery of new bactericide molecules is utterly important. Despite such products from natural origin are credited with safety, citronellol shows some dermal and oral toxicity when tested at high concentrations in laboratory animals. Nevertheless, reports of its ecotoxicity in non-target organisms can hardly be found when citronellol is used as an active ingredient in biopesticides.This study assesses the antimicrobial activity of citronellol on a selection of gram-positive and gram-negative pathogenic bacteria, as well as its ecotoxicological effects on non-target soil organisms (*Eisenia fetida* and *Allium cepa L.*). *E. fetida* was exposed to different concentrations of citronellol ranged from 0.1 to 200 mg/L. *A. cepa* root grow was monitored after exposure to the following concentrations of citronellol: 300, 30, 3, 0.3 and 0.03 mg/L, measuring, therefore, the phytotoxicity on this vascular culture plant. The dose-response analysis allowed us to calculate the ecotoxicity of citronellol on *E. fetida*: LC_{50} = 12.07 mg /L (8.47-17.28) and LC_{10} = 3.36 (1.54-5.21); and over *A. cepa*: LC_{50} = 172.40 mg /L (122.91-252.50) and LC_{10} = 0.033 (0.018-0.054). These results show that citronellol is not harmless on non-target soil organisms and it may produce both ecotoxicity and phytotoxicity. These systematic studies are relevant since they provide valuable information about the effects of biopesticide compounds on the soil environment and especially in non-target organisms, when taking decisions on their commercialization. *The authors thank the financial support of Gobierno de Aragón-FSE-FEDER" Construyendo Europa desde Aragón" (Grupo E39_17R y RIS3 LMP28_18) and Catedra NOVALTIA.*

13.17 Bioaccumulation and Translocation of Cu, Cd, Zn, and As in Four Native Tree and Shrub Species Growing on Soils Contaminated by an Abandoned Gold Mine

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Plants are known to have the ability to bioaccumulate metal(loid)s in tissues and translocate them from roots to aerial biomass. Native plants grow in soil contaminated with mining waste in the town of La Planta (Caucete, San Juan, Argentina). The objective of this study was to evaluate the bioaccumulation and translocation capacity of Cu, Cd, Zn and As in *Prosopis flexuosa* (*Pf*), *Larrea cuneifolia* (*Lc*), *Bulnesia retama* (*Br*), and *Plectrocarpa tetracantha* (*Pt*) that grow in contaminated soil. Organ samples (leaf, branches, stem, bark and root) of 3 plants per species (n=12) were collected. Rhizospheric soil samples around each tree and shrub were taken from the first 20 cm of depth (n=12). Concentrations of metal(loid)s in organs and soil were determined. Samples were digested with a combination of HNO_3, H_2O_2 and HF, and quantifications were made using ICP-MS. Bioaccumulation Factor (BAF) and Translocation Factor (TF) were calculated. Results showed that the most concentrated metal(loid)s in *Lc*, *Pf* and *Br* were Cu and Zn, and in *Pt* were Zn, Cu and As ($p< 0.001$). BAF and TF values greater than 1 were obtained for the four species, indicating that these species are bioaccumulators. The highest BAF values was obtained for Cu in the four species ($p< 0.001$). Regarding TF, higher values of Zn were only observed in leaf of *Lc* ($p< 0.001$). The high concentrations of metal(loid)s measured in plant organs of the four native species plus the values of BAF and TF indicate a high potential for phytoextraction. Comparing bioaccumulation capacities, *Pt>Pf>Lc* for As, *Pf>Lc>Pt>Br* for Cu, *Pf>Pt>Lc>Br* for Zn, and only *Pt* was effective for Cd. Bioaccumulation capacity of Cu, Cd, Zn and As found in the native plants studied in this work, generates baseline information for the implementation of phytoremediation strategies. These species present anatomical, morphological and structural adaptations that allow them to survive adverse climatic conditions that characterize arid and semi-arid environments. This would avoid the use of exotic species that could generate disturbances in the polluted environment and a higher economic cost.

13.18 Acute Toxicity of Soils Contaminated With Waste From an Abandoned Gold Mine on Seeds of Prosopis Flexuosa and Larrea cuneifolia

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The presence of metal(loid)s in soil causes toxicity in plants such as physiological disorders, and alterations in growth and development. The objective of this study was to evaluate the acute toxicity of soils contaminated with mining waste on seeds of *Prosopis flexuosa* (*Pf*) and *Larrea cuneifolia* (*Lc*), two native species from the Monte region (La Planta, San Juan, Argentina). Seeds were collected in the surroundings of La Planta and soil samples were taken in two sites: contaminated (S1) and reference sites (S2). Seeds were exposed to 6 increasing concentrations of soil mixtures from Site 1 and 2: 0, 10, 25, 50, 70, and 100% (v/v), where 0 corresponds to S2 soil and 100% to S1 soil. Experimental unit consisted of 20 seeds placed on wet soil into a Petri dish, reaching a total of 5 repetitions per treatment. A pre-germination treatment was applied to the seeds to ensure the seedling emergence. Toxicity test was carried out in a germination chamber in darkness at 25±2 °C. Due to differences in germination time of each species, exposure of *Pf* and *Lc* lasted 7 and 15 d, respectively. Mean germination time (MGT), germination index (GI), relative growth index (RGI) and IC50 of root (r) and hypocotyl (h) length were estimated. The concentration of the main metal(loid)s in soils were: S1) As=6608 mg kg^{-1}; Zn=10892 mg kg^{-1}; Cu=260 mg kg^{-1}; Cd=90 mg kg^{-1}, and S2): Zn=46 mg kg^{-1}; As, Cu and Cd were not detected. For *Pf* a significant increase in MGT was observed from treatment 70%, whereas a significant decrease in RGI_r and RGI_h, and GI were observed from 50% S1 concentration ($p< 0.001$). $IC50_r$ and $IC50_h$ were estimated in 21.1 and 40.3%, respectively. For *Lc*, seed germination inhibition of 100% was observed from 70% S1 concentration. Statistical differences between the values of RGI_r, RGI_h, and GI for remaining treatments were obtained ($p< 0.001$), while MGT showed no significant differences. The strongest inhibition was observed in 50% S1 concentration. $IC50_r$ and $IC50_h$ were estimated in 27.7% and 15.1%, respectively. The values of the toxicity endpoints and the phytotoxicity indexes showed that these native species are more tolerant to contaminated soil of La Planta than horticultural species evaluated in previous studies ($IC50_r$ < 1% S1 concentration). In future studies, chronic effects should be evaluated to determine the underlying physiological mechanisms of the metal(loid) tolerance in *Pf* and *Lc*.

13.19 Ecotoxicological Effect of Iron Contained in the Sludge of a Poultry Processing Center on Earthworms (Eisenia fetida) and Corn (Zea mays)

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One of the meats most consumed by the population is chicken, whose production generates considerable volumes of sludge as a by-product of the treatment carried out in the profit centers. The objective of this research was to evaluate the ecotoxicological effect of the iron contained in DAF (Dissolved Air Flotation) sludge from a poultry processing center on earthworms (*Eisenia fetida*) and corn (*Zea mays*) by means of two bioassays: mortality of earthworms and seed germination. The physicochemical characterization of the DAF mud and soil used in the bioassays was carried out and it was verified that the metals were within the limits of the Peruvian regulations. In the mortality bioassay with the earthworm, seven treatments were performed plus the control, the DAF mud concentrations established ranged from treatment 1.56% to 6.25%; and in the corn seed germination bioassay, six treatments were performed plus the control, the DAF mud concentrations ranged from 6.25% to 21.88%. All results were statistically processed. The LC_{50} of the earthworm was determined to be 5.219%, and it was observed that the weight of the earthworm increased in the first week, then decreased in the second; Likewise, it was observed that at very low concentrations of DAF sludge the formation of cocoons was promoted, and that there was a moderate to very good correlation between earthworm mortality (%) and the pH and EC parameters, respectively. For the corn seed germination bioassay, the Cl_{50} was determined at 11.1%. of DAF mud, it was observed that the higher wet and dry weights of the seed are due to a greater development of the seed, and that there is a moderate correlation between the germination of the corn seed with the pH; however, the correlation with respect to the EC is very low.

13.20 Phytotoxicity of Sugarcane Vinasse Biodigered in Acidogenic Anaerobic Reactor

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Considering the relevance of the contamination of soils and water resources by agro-industrial residues, such as sugarcane vinasse, this research aimed to evaluate the toxic effects of biodigested vinasse in the anaerobic acidogenic reactor through phytotoxicity tests on *Lactuca sativa*, *Eruca sativa*, and *Brassica oleracea*, because of their sensitivity to contaminants, rapid germination, and low cost. For the bioassays, vinasse influent and effluent of the reactor acidogenic were used as test solutions and their respective dilutions at a ratio of 1:1000, 1:20, 1:10, 1:2 and 1:1. The acute phytotoxicity test was carried out in glass Petri dishes lined with a sheet of filter paper as a qualitative substrate. Subsequently, 10 seeds were uniformly arranged in 3 replicates and 1 mL of test solution was added. The plates were placed under light shelter for 4 days at 21 ± 2ºC. After this period, the number of germinated seeds in each vinasse dilution was counted and the seedling size measured. The results of the germination EC50 obtained for the effluent vinasse ranged from 2 to 17% for all tested vegetables. These results demonstrate that *E. sativa* is the most resistant plant to sugarcane vinasse with EC50 above 17% vinasse dilution that affects 50% of the seeds. The two-way ANOVA statistical test showed that there was no statistical difference between the 0.1% dilution of influent and effluent vinasse with the control for *L. sativa*, *E. sativa* and *B. oleracea* with p=0.8641, 0 .8634, and 0.397, respectively. Furthermore, the statistical results showed that there was no difference in seed germination with samples from the reactors for *B. oleracea* and *L. sativa*. From the results obtained, it was possible to conclude that phytotoxicity tests are important tools allied to the biomonitoring of reactors in the degradation of pollutants, such as the treatment of vinasse, in anaerobic reactors. Vinasse is a complex effluent generated during the production of ethyl alcohol, which can present toxic effects to the biota due to its use in fertigation. The toxic effect of the leachate from this effluent resulted in high toxicity in the germination of *L. sativa*, *E. sativa* and *B. oleracea* seeds from the vinasse in 100%. These results highlight the importance of observing and monitoring the indiscriminate use of vinasse by fertigation, and the need to use a combined system (acidogenic reactor + methanogenic reactor) in the biodigestion of this by-product.

13.22 The Envirohealth Data Observatory: A Platform for Standardization, Characterization and Calibration of Environmental Air and Water Diagnoses in Chile

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Between 2021 and 2026 the Envirohealth Dynamic Systems team at the Universidad Del Desarrollo (UDD) will be leading the construction of a laboratory for calibrating low cost environmental sensors. The laboratory will host reference instruments for the measurement of air quality, meteorology, greenhouse gases, water quality, water flow and soil quality. The instruments will be available for scientists, citizen scientists and educational establishments from all over Chile (and in neighbouring Latin American countries) to be able to test their low cost sensing technologies. The platform and the community it forms will encourage and disseminate good practice in the usage of sensors for environmental field work. Many of the reference instruments (especially the air quality and meteorology instruments) will be set up in a mobile laboratory that will tour Chile from late 2021. The mobile observatory will visit specific locations in Chile, visit our partners, participate in field work and carry out outreach activities. We cordially invite you to make contact with us, become involved with our field work projects and join us to calibrate and learn more about your instruments and your local environment. This presentation will provide a sample of the collaborations and projects we will be undertaking in Chile over the next few years.

13.23 Monitoring Personal Exposure to Particulate Matter Air Pollution in Coyhaique, Chilean Patagonia With Walking Experiments

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Coyhaique In July 2019, the heart of the winter domestic wood burning season, a series of walking experiments with small low cost sensors were carried out in the town of Coyhaique. Particulate Matter levels in Coyhaique regularly exceed the Chilean national limits and WHO health

guidelines during the the winter. Levels are particularly high in the morning and the evening when households light their wood burning stoves. Coyhaique is surrounded by mountains on nearly all sides and therefore the temperature inversions of winter tend to be very shallow and very persistent and the build up of smoke and smog in the town is extremely noticeable from afar. The levels locals are exposed to put the population´s health at risk, both in terms of the indoor and outdoor air quality. A series of walking experiment were carried out three times a day, with 4 volunteers starting at the same point and walking a fixed route of about 2 km before returning to the starting point. On one evening twelve people were involved in a “mega walk” where they calibrated their sensors at a central point and then all moved to respective start points for individual set routes. Between these volunteers, the whole city was covered during a 45-minute period. The data was compared to the two official monitoring stations and a map was generated, showing that there was a huge spatio-temporal variation in pollution levels, with several hot spots of air pollution and other areas with considerably less pollution.

13.25 Eco-Physiometer an Open Source Approach to Environmental Monitoring

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Information is key to achieve the UN goal 6, “clean water and sanitation”. Whether this is attempted through regulation, or the application of efficient resource management, all strategies require at least a basic level of understanding of the system. Traditionally, this information is obtained through monitoring programs during which the parameters are usually assessed in the laboratory.Those monitoring programs present advantages because of their extent (number of sampling sites and parameters), however, limited by elevated costs and effort. An alternative to these laboratory based measurements for at least for a restricted number of environmental variables is the use of in suite approaches, i.e. deploying sensors directly on the system. Custom built sensors are an interesting option to develop cheaper and more target oriented monitoring programs. Still, the need for technical knowledge outside the field of expertise of research usually restricts the use of such sensors to its creator and collaborators. With the aim to develop a cost effective sensor that allows for customized applications, while keeping the required technical knowledge at minimum, we developed a spectrofluorometer from 3d printed and commercially available off-the-shelf parts, to be used in a plug-and-use manner at field applications. This spectroscopic technique was chosen because of its flexibility for developing analytical methods. This means that the same sensor can be used for measuring multiple variables. In support of this assumption, we are currently developing analytical methods to determine chlorophyll, cell counts and turbidity. In the mindset of open science, this sensor is also planned to be open source with all relevant documentation for the parts required, its assembly, calibration and operation. Also, to encourage collaboration and reproducibility, experimental designs and software developed to implement the methods will be made public at the project webpage, where people can also upload their contributions.

13.26 Design and Implementation of Real Time Water Quality Remote Monitoring Fix Stations Applied to Lakes in Central Chile

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Fresh and salt water bodies provide important habitat for biodiversity and provide a wide variety of ecosystem services to society. To preserve these bodies of water, it is necessary to have technological tools that allow knowing their current and periodic state, in order to make timely decisions; knowing the physicochemical dynamics of water for long periods. To achieve this objective, it is necessary to develop, implement and massify multidisciplinary - and accessible - technologies that allow the acquisition of high-frequency data. Where this information is freely available to the scientific community and government institutions. To address this challenge, a prototype of Remote Monitoring Stations (RMS) based on Open Source and with the objective of having a cost between 40 to 60% cheaper than current commercial systems is developed. This, with the aim of offering a technological tool that can be easily massifiable and that it becomes a useful tool for the various research centers in the country. The prototype is developed using a Raspberry Pi microprocessor, an Attiny85 microcontroller to program the sampling periods, the programming language used is Python, the electronic circuit is designed with Eagle software and the electronic board is manufactured using a mini CNC, for the Sending data, the GPRS network is used and the electrical supply is through a photovoltaic panel that stores energy in a set of 18650 batteries. For the calibration of the physicochemical sensors, reference solutions from the suppliers Hanna Instruments and Atlas Scientific are used . For validation of the determinations of the physicochemical parameters, carried out in a controlled environment, the Edge HI2020 Hanna Instruments and pH6 + Oakton multiparameters are used. Finally, an RMS is obtained capable of integrating up to 7 types of physicochemical sensors (pH, temperature, dissolved oxygen, salinity, conductivity, potential oxide reduction and total dissolved solids), which has the characteristic of being versatile: even 7 can be integrated sensors of the same parameter. The validation in real operating conditions was carried out in Lake Lanalhue, obtaining an autonomous operation of 60 continuous days, with a sampling frequency of 60 minutes. Where the data was sent through GPRS to a database and displayed on a website.

13.27 Vibratron: A Novel System for Vibration-Based Water Flow Monitoring

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In order to increase the efficiency of water resources management, it is necessary to create new ways of measuring streamflow that are adaptable to all types of natural watercourses. This project develops a flow sensor prototype that determines the flow velocity through the measurement of the vibrations that it causes on a metal rod. The objective of this work is to generate a resistant and cost-effective flow sensor for monitoring in rivers, estuaries and canals. To achieve this, we propose an experimental methodology that involves designing and building an experimental flow chamber with a water recirculation system that produces an adaptable flow. The vibration sensor rod measures water flow and acceleration data by means of the fast Fourier transform method. The results show that it is possible to build a device with an appropriate design criteria, where the signals are transferred into flow data by constructing a frequency/velocity calibration curve for the sensor from experiments in the water chamber. The main objective was met, although there is room for improvement in the design of the flow chamber and the calibration procedures. This project lays the groundwork for the use of a vibration monitoring system of water flow.

14. Environmental Impact of Mining and Other Industrial Activities

14.01 Analysis of Mine Indicator Metals in the Biomonitor Punctelia Hypoleucites Transplanted to Bajo de la Alumbrera and Nearby Towns, Catamarca, Argentina

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In Bajo de la Alumbrera (open pit mine of Cu, Au and Mo, located in Catamarca, Argentina) and in three nearby towns, studies were carried out with Punctelia hypoleucites (Nyl.) Krog (lichenized Ascomycete), using a transplant technique in order to evaluate the metal content related to the mining activity exposure and thus evaluate the biomonitory accumulation capacity of this species. Lichenic material was collected from a site considered pristine (control site) and distributed in 30 polyester mesh bags, and 3 samples were separated directly as a basal sample. The lichen bags were transplanted to 10 sites: 6 sites inside the mine (E1, E3, E4, E8, E9, E10) and 4 sites outside the company limits in the three nearby towns (E5-Amanao, E6-Los Nacimientos and E7-Hualfín) and the control site (SC). After 3 months of exposure they were transported to the laboratory, where the concentrations of some mine indicator elements (Cu, Fe, Mo, Sr, Pb, Zn, Mn, Cd) were determined by Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES). The ratio between the concentration of each element after exposure and the basal sample (exposed / basal - EC ratio) was used to investigate the lichen accumulation rates, as well as to compare between sites. A 5-class interpretive scale (severe loss, loss, normal, accumulation and severe accumulation) was used based on the deviation of EC ratio from "normal" conditions, which is assumed to be ± 25% from 1. Based on these ratios, severe accumulation of Cu and Mo was observed at the in-mine sites, mainly at E1 and E8. These sites are close to emission point sources (primary material crushing and stock pile sector). Accumulation of Fe, Pb, Zn, Mn and Cd were found in the control site. In addition, Pb and Zn showed severe accumulation only at off-mine sites. Since the higher Cu and Mo content in the in-mine sites corresponds to the geochemical characteristics of the deposit, it could be concluded that this species reflects the composition of the particulate matter generated by the mining operations and, therefore, could be used as a biomonitor of air quality related to open-pit mining.

14.04 An Integrative Approach to Assess the Environmental Impacts of Gold Mining Contamination in the Amazon

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The Amazon basin has been historically threatened by gold mining. As the number of legal and illegal mining sites increase, it is important to develop integrative methods to evaluate the effects of mining pollution on Amazonian freshwater ecosystems. Here, we sampled water and sediments in 11 sites potentially affected by mining activities in the Napo province of Ecuador, which is located in the Andes-Amazonia region. At each sampling site, environmental impacts were evaluated using four lines of evidence (LOEs): water physico-chemical parameters; metal exposure concentrations in water and sediments; macroinvertebrate community response via an index of family tolerances for environmental impacts (AAMBI); and toxicity by conducting bioassays with *Lactuca sativa* and *Daphnia magna*. For water samples, dissolved oxygen and total suspended solids were, in the majority of sites, under (< 80%) and above (>130 mg/Ls) quality standards, respectively. Ag, Al, As, Cd, Cu, Fe, Mn, Pb and Zn were detected above quality standards set by Ecuador, Canada, and the United States. For sediment samples, V, B and Cr concentrations were also above quality standards. Nine out of eleven sampling sites were classified as having bad environmental quality based on the AAMBI score. Ranges of *L. sativa* seed germination in both water (37% to 70%) and sediment (0% to 65%), indicate significant toxicity. For half of the sites, neonates of *D. magna* showed a 50% percent reduction in survival compared to the experimental control. Our integrated LOEs index allowed ranking of sites regarding their environmental degradation. Given the importance of the Andes-Amazon region for biodiversity preservation and ecosystem service provision, we recommend a further control of the mining expansion in the region and its continued environmental impact monitoring using multiple LOEs.

14.06 Evaluation of Soil Pollution Caused by Waste Accumulation From an Abandoned Gold Mine 50 Years Ago in La Planta, San Juan, Argentina

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Metal accumulation is the main soil pollution caused by abandoned gold mines. Metal(loid)s are not biodegradable and have high persistence in the environment. The objective of this study was to evaluate the degree of contamination generated by mining waste in La Planta, San Juan, Argentina. Ten soil samples were randomly taken at two sampling sites: contaminated (S1) and reference sites (S2). A physicochemical characterization was carried out. Total, mobilizable and soluble concentration of Cu, Cd, Zn, and As was determined. The Geoaccumulation Index (Igeo), Contamination Factor (CF) and Contamination Degree (Cdeg) were calculated to know the pollution generated by mining waste. Total concentration of metal(loid)s was contrasted with guideline values for residential and agricultural use (Argentine Law no. 24,051). An acid pH (=3) was recorded for S1 and slightly alkaline pH (=8) was recorded for S2. EC was 8 times higher in S1, reaching a maximum value of 41.2 mS cm^{-1}. Essential nutrients were less concentrated in S1. Total concentration of Cu, Cd, Zn, and As was statistically higher in S1 ($p< 0.001$). The mobilizable and soluble fractions were 7 to 38% of the total metal(loid) concentration in S1. While in S2, the mobilizable fraction was 12 to 38% of the total concentration, and the soluble fraction was not detected. The concentrations of metal(loid)s were below the reference levels for both agricultural and residential use in S2, while they were between 1 and 300 times above the reference levels in S1. The highest concentrations

were obtained for Zn (7123 mg kg^{-1}) and As (6516 mg kg^{-1}) in S1. A positive correlation was obtained between EC and the three fractions of the metal(loid)s in S1 ($R>0.7$; $p< 0.001$). The pH correlated negatively with the total and soluble fraction of As, and the mobilizable fraction of Zn ($R>-0.7$; $p< 0.001$). Igeo reached values higher than 5 for As, Cd and Zn in S1, categorized as *very strong contamination* and Cu corresponds to the category *uncontaminated to moderately contaminated*. Using CF values, S1 was classified as *very high contaminated site* for all four metal(loid)s. Values of Cdeg showed the highest category of contamination. Results indicate that soil is contaminated with at least Cu, Cd, Zn and As in La Planta, showing the need to carry out a remediation plan. We conclude that soil pH should be regulated in order to reduce the bioavailability of metal(loid)s and promote plant growth.

14.07 210Pb Geochronology and Trace Metal Fluxes (Cu, Zn, Pb, Cd, Ni, Fe, Al, V, Mo, As) in the InkaCoya Lake, Atacama Desert Chile

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Distributions of Cu, Zn, Pb, Cd, Ni, Fe, Al, V, Mo, and As were analyzed in a sediment core collected in the InkaCoya Lake, an important mineral region located in the Atacama Desert north of Chile, where data in metal accumulation and accretion rates are very scarce. Depth profiles of metal concentrations were converted to time-based profiles using a 210Pb-derived vertical accretion rate, estimated to be 0.19 cm year-1 on average. Sediments were dated up to 25 cm depth, corresponding to a layer of ca. 105 years old. The historical changes of metal accumulation along the sediment core have shown a moderate enrichment of Cu, Zn, Pb, Cd, Ni, V, and As concentrations at present, of about fourfold the corresponding background concentrations. Chronological trace metal records showed that metal fluxes have increased over the last 60 years, reaching the maximum values at present of 79.5, 48.8, 243.1, 6.2, 25.2, 34.3, and 31.2 (µg.g-1 cm-2 year-1) for Cu, Zn, Pb, Cd, Ni, V and As, respectively. These increments in metal fluxes are likely influenced by the development of mineral-exploited activities since, over this period of time, mineral production activities in the region have had significant development.

14.08 Ascotán and Carcote Salt Flats As Sensors of Humidity Fluctuations and Anthropic Impacts in the Transition Zone of the Andean Altiplano

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The Altiplano-Puna plateau is a climatic transition zone between the Atacama Desert, and the Amazon basin. The salt flats of the Altiplano are hydrogeological and ecological systems highly dependent and sensitive to seasonal, interannual and inter-decadal variations in humidity they may be affected by anthropic activities. We focused on Ascotán and Carcote, two salt flats located to 3,600 m of elevation in Chile, to determinate the relationship between the depositional environments and recent hydrological conditions, which can be used as sensors of the particular climatic conditions of the Altiplano and anthropic activities in these systems (the Ascotán presents a high anthropic disturbance that began in 1994 and the Carcote is an unaltered system up to the present). Results of analysis of sediment properties (mineralogical, geochemical and magnetic) and the water (elemental composition) of the different springs in the salt flats showed that the water and sediments of Ascotán and Carcote salt flats were heterogeneous composition, both intra- and inter-salt flat. The content of saline facies tended to increase in zones furthest from the edge and close to the depocenter of the basin, whose sediments were composed mainly of finer size grains. A significant difference in the magnetic signatures was also observed between the salt flats. The high χfd% values suggest small ferromagnetic particles that have magnetic sizes SP/SD. These small ferromagnetic particles are the result of authigenic processes that occur under wet conditions in the sediments, originated the transformation from detritic origin to Fe-bearing minerals of authigenic origin. The χ values the Ascotán are inversely related with χfd% values, unlike Carcote. The magnetic behavior in the Ascotán salt flat is because of variation in the water table due extraction by mining activity, the Fe-bearing minerals of authigenic origin may be subjected to oxidation processes, reducing χ values. The Fe-bearing minerals of authigenic origin of Carcote did not suffer oxidation. Our results suggest that Ascotán and Carcote salt flats constitute excellent sensors for current environmental conditions and anthropic disturbances which can be used as a sentinel in the understanding with other high Andean environments, in this way to understand the processes that occur in the formation of these systems and to differentiate the external processes that disturb their balance.

14.09 Differentiation of Diatoms Guilds in Extreme Environments From Andean Altiplano

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Near the Andean Altiplano are two salt flats, Carcote and Ascotán, the former almost undisturbed by human intervention, and the latter subjected to historical anthropic intervention by brine-mining. To identify the main factors that promote biotic community differentiation in these salt flats under different levels of human intervention, the aim of this study was to compare both the abundance and the taxonomic diatom community index by guilds present in these salt flat systems, their relationship to environmental conditions, and the potential anthropic impact on their community structures. Diatom guilds were compared between salt flats based on their diversity, species richness, and abundance relative to ionic concentrations and grain size. Beta diversity and the percentages of nestedness and turnover for each guild were also estimated. Results showed significant differences in ecological variables between the two salt flats. The largest values of species abundance, richness, and diatom Shannon diversity index were measured in Carcote (mining activities-free salt flat), suggesting greater primary productivity and diversity. The most abundant guild was high profile, and the greatest diversity and richness were measured for the motile species guild. The results also showed that the species composition of the motile guild was more differentiated between salt flats than other guilds, suggesting that motile diatoms are a key guild in maintaining the diatom community and that species from this guild are more sensitive to local conditions from each salt flat. A more heterogeneous community was observed in Ascotán than Carcote, showing that the mechanisms of maintenance of diversity, as dispersion abilities, were salt flat-dependent. This evidence suggests that the highest diversity could be related to human use, which challenges us to

reexamine the effectiveness of past conservation activities in the area and to develop future strategies including both connected basins.

14.10 Potential of Arsenic Bioremediation by a Cyanobacterium Isolated From the Salado River in the Atacama Desert

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A great environmental impact has been generated since the mining development in the Atacama Desert (21-26°S). Enrichment of heavy metals and metalloids has been registered in different environmental matrices such as sediments, atmosphere, rivers, lakes. Anthropogenic metal contamination can be an intense stressor on ecosystems and diver of biological population evolution in polluted environments. Cyanobacteria and microalgae are recognized as excellent metal(loid)s-bioremediators of aquatic systems. We isolated a cyanobacterium from the Salado River in the Atacama Desert, an impacted river in the northern of Chile, which was identified as Cyanobium sp. Growth inhibition bioassays were conducted with arsenic and cadmium, and tolerance of Cyanobium to these metals was estimated. Removal of arsenic was assessed under different pH conditions and over time. We showed that the Cyanobium strain isolated from the Salado River has a greater tolerance to the arsenic and cadmium compounds than other species commonly used in metal(loid)s-bioremediation. Removal of up to 90% of arsenic was obtained in alkaline conditions, within the first 3 hours of exposure suggesting that Cyanobium sp. isolated from the Atacama Desert could be further studied with biotechnological purposes and to understand the evolutionary mechanisms of adaption to arid environments.

15. Alternative Approaches to Animal Testing in Ecotoxicity and Risk Assessment

15.01 The "Tripod" Strategy to Reducing Fish Testing in a Major International Oil and Chemical Company

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Animal testing is used for protection of human health and the environment and is often required by regulation for product registration and effluent testing. However, there are strong ethical, scientific and business drivers to move away from animal testing as the method to demonstrate product safety. Many companies including Shell are committed to eliminating the need to do testing involving vertebrate animals. With the aim to replace animal testing by suitable alternatives while ensuring that industry can continue to innovate, develop and maintain new and safe products and technologies. In examining its annual vertebrate use numbers testing with fish, either for product testing or whole effluent toxicity testing, was by far the largest category of vertebrate animal testing conducted by or on behalf of Shell or Shell joint ventures, accounting for 85% of the ~71,000 total animals used in 2019. From this information Shell developed a three-pronged (tripod) strategy aimed at reducing fish testing overall: 1) *Numbers* - understanding where we are and how are numbers are produced to identify where R&D and advocacy efforts should be targeted; 2) *Research & Development* – conduct research on alternative methods that can replace standard methods and target alternatives for those that generate the most numbers; 3) *Advocacy* – work with stakeholders and peers in targeted scientific, regulatory and industry forums to foster the adoption of alternative approaches. An overview of Shell's strategy to eliminating fish testing will be presented along with examples and experiences with some of these alternative test methods, including a combination of *in silico*, *in vitro* and *in vivo* techniques. It may be that no single method or test by itself is enough to replace fish testing but using a weight of evidence approach could help to reduce or eliminate fish testing.

15.02 Disruptive Effects of Chlorpyrifos on Predator-Prey Interactions of Ceratophrys Ornata Tadpoles: Consequences at the Population Level Using Computational Modeling

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Large-scale ecotoxicological studies have technical and ethical limitations related to the need to expose large numbers of individuals to potentially harmful compounds. Also, if we consider the growing interest in the effects of pollutants on behavioral traits, more limitations emerge since traditional ecotoxicological tools requires a detailed analysis of many simultaneous interactions, a non-disturbing video recording system, and the exposure of many living organisms that will likely perish during the test. The advance of knowledge and the possibility of developing new techniques in accordance with the care and welfare of laboratory animals, call for novel and rigorous ecotoxicological procedures. The aim of this study was to evaluate the effects of chlorpyrifos (CPF) on intra and interspecific interactions of *Ceratophrys ornata* tadpoles, complementing traditional ecotoxicological tools with a theoretical analysis verified by computational simulations. The design consisted of an experimental stage to obtain information about predator-prey interactions of the species, followed by a theoretical stage which consisted of running three different models based on experimental observations: Model I without an antipredator mechanism, Model II with an antipredator mechanism, and Model III (= Model II + insecticide) which simulates the behavior of the exposed individuals. The study was based on the Monte Carlo method in order to understand the behavior of a given system of particles characterized by unknown parameters, many of which are difficult to determine experimentally. The models were based on the particle-concept by focusing on tadpole's interactions with their neighbors; they were tested by Computational Simulations and were then compared with those of the experiments performed. Results were computed based on repeated random sampling, and statistical analysis allowed solving deterministic problems. Results showed that computational modeling accurately reproduced the experimental conditions, being a useful tool to understand complex systems. This tool could be used not only to evaluate potential effects of compounds with similar modes of action to CPF on *C. ornata*, but also to model the effects of CPF and related compounds on related species with similar behavior. In this way, the tool would allow preventive conservation decisions to be made even before bioassays are conducted, reducing the number of animals used for toxicity tests.

15.03 Proposal of a Chronic Toxicity Test Using the Tropical Epibenthic Amphipod Parhyale hawaiensis

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Chronic toxicity tests with representative organisms of tropical marine and estuarine regions are essential for deriving reliable and relevant criteria. However, the majority of the standardized ecotoxicological tests are being performed with acclimated exotic species from temperate areas. Recently, the circumtropical marine amphipod *Parhyale hawaiensis* has been shown as a promising test organism and protocols for culture and acute toxicity test in water and sediment were developed and published. This study aimed to propose a chronic toxicity protocol using endpoints as survival, reproduction, and growth. First, we tested different conditions such as number of organisms, medium volume, and amount of food per replicate. We monitored physical-chemical parameters, time required for sexual maturity, and the time required for neonates hatching. The best test condition was 10 organisms with ≤52 days-old, 100 mL of media, constant aeration, and 0.003 g of food per replicate, five replicates for treatment, 42 days of exposure time, changing the medium and feeding three times a week. To proof the test conditions, we performed two independent experiments with zinc sulphate (concentrations of 0.02 to 2.0 mg Zn/L) and 3,4-dichloroaniline (concentrations of 0.01 to 1.0 mg/L). One-way analysis of variance (ANOVA) and Dunnett's test were used to analyse the data ($p \leq 0.05$) and to establish the no observed effect concentration (NOEC). The negative controls data obtained from the independent four tests were pooled and acceptability values were set. Because no statistical

difference was observed among the negative controls values were established for survival as ≥80% and for mean reproduction as 3 ±1 neonates/female. However, for growth we observed statistical difference among the controls, therefore a range was obtained (0.045 to 0.089 mm/day). For the two selected toxicants, we observed significant reductions in survival, reproduction, and growth. For zinc, the NOEC for survival was 0.2 mg Zn/L and for reproduction and growth, 0.1 mg Zn/L. As for 3,4-DCA the NOEC for survival and reproduction was 0.3 mg/L, and for growth 0.01 mg/L. Data with other marine test organisms are being retrieved from the literature for sensitivity comparisons. The developed protocol seems promising and could be used for testing metals, pesticides, and environmental samples to verify its utility as a chronic test using speciments cultivated in the laboratory. **Ack:** CAPES (Finance code 001) and CNPq.

15.04 Species Selection in Monitoring Wastewater Toxicity Beyond Their Regulatory Guidelines

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The assessment of effluent toxicity is a relevant tool in the monitoring of aquatic contamination. Regulatory guidelines are established to prevent adverse effects of wastewater discharge to aquatic biota. Brazilian legislation about levels of toxicity are placed according to the quality of the receiving waterbody and indicates the use of two trophic levels for monitoring bioassays. In this research, was applied bioassays in a single affluent and effluent sampling from an Anaerobic Fluidized Bed Reactor (pilot scale), installed at the municipal sewage plant from São Carlos (SP/Brazil). Two standardized species (*Daphnia magna* and *Ceriodaphnia silvestrii*) and three representatives from the Brazilian benthic fauna (*Chironomus sancticaroli*, *Allonais inaequalis*, and *Pristina longiseta*) were used for acute toxicity investigation. All the selected species are from the same trophic level but from different habitats, hence, the goal is to infer an additional path in the choice of test-organisms for effluent monitoring. The dilutions follow the proportions of 100%, 50%, 25%, 12% and 6%, in triplicates. The effective and lethal concentration (CE50 and CL50) were calculated for the plotting of the Sensitive Species Distribution curve (SSD). To evaluate statistical differences, the Kruskal-Wallis test followed by Dunn's post-hoc was applied, considering a 95% confidence interval. The survival of the organism presented a progressive decay in the way that the sample concentration increases, which was confirmed by the statistical analysis. Similarly, was observed for effluent less impact on the survival of all species than the respective dilution of affluent. Although species from the Chironomidae family and Oligochaeta often present less sensitivity to various toxicants than cladocerans, the opposite behavior was observed for this sewage contamination. The SSD curve showed the following distributions: *A. inaequalis* > *P. longiseta* > *C. sancticaroli* > *D. magna* > *C. silvestrii*. The less survival in benthic species might indicate a greater source of toxicity arising from decanted particles than from dissolved. The species' sensitivity to discrete changes in the environment characterizes them as good bioindicators of aquatic contamination. Species selection on wastewater monitoring could take into account different habitats rather than trophic levels, which could target toxicants from diverse sources, otherwise, the real harm of sewage contamination could be underestimated.

15.05 Interspecies Correlation Estimation Models As Alternatives to Animal Testing: Scientific Basis and a Case Study

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The need for non-animal alternatives in ecotoxicology has led to directives worldwide encouraging innovation for toxicity evaluation. Computational approaches developed from existing data are quantitative and defensible alternatives to animal testing and useful in providing predictions for substances with limited data. Interspecies correlation estimation (ICE) models, represent one such approach. ICE models are mathematical relationships between a pair of species that can be used to predict chemical toxicity from one surrogate test organism to a species of unknown sensitivity. Model outputs can be used to augment taxa diversity in Species Sensitivity Distributions (SSDs) from which protection levels can be derived. The motivation of this presentation is two-fold: first, highlight attributes of ICE models that make them amenable for wider use, including regulatory applications; and second, demonstrate how leveraging knowledge through data mining can facilitate the development of such models. A case study is presented on the development of ICE models for alcohol ethoxylates (AEs), a group of chemically related nonionic surfactants with a common mode of toxicity. Curated aquatic toxicity data for AE substances were used to develop ICE models, resulting in predictions that were generally within a 3-fold difference of observed toxicity values not used in model development. Previous studies and findings from this case study suggest that ICE models for structurally similar substances could prove useful in addressing data gaps, while reducing the need for animal testing. The development of future collaborative case-studies would enable greater use of ICE models, contributing to their acceptance as a scientifically defensible non-animal alternative.

15.06 Aquatic Eggs and Larvae: Advantages and Limitations As Detectors of Endocrine Disruptors

G.F. LEMKINE, Watchfrog S.A.

Endocrine disruptors are characterized as substances acting at the whole-organism level. Targeting hormonal systems, these substances mimic the pleiotropic nature of hormones, meaning that they act through complex mechanisms affecting all of the major functions of the organism without necessarily interacting with a hormonal receptor. To specifically reveal endocrine disrupting activity, the use of tests which reproduce vertebrate physiology in its integrity are therefore essential, in order to guarantee the best sensitivity, but also to prevent false positive results. Nevertheless for obvious ethical reasons, it is indispensable to develop these *in vivo* models in the perspective of using them in an *in vitro* context. The association of egg or embryo-larval developmental stages of fish or amphibians with the use of genetic markers is a highly advantageous ethical alternative for the characterization of raw materials destined for consumer goods. Just after hatching, these models represent an *in vivo* test solution at the *in vitro* scale. However, the use of these 2-3 millimeter miniature, translucent larvae, requires a particular technical skill. On the other hand, their miniature nature allows automation of production and analysis procedures. Another advantage of this approach is the possibility to anticipate combined effects of “cocktails” of chemicals. The embryonic exposure window is extremely predictive of disruption of the major physiological functions which are put into place

from the earliest of stages. For example, it is possible to anticipate from the egg stage the effect of a mixture of substances on the sexual determination of fish. Equally, these models provide a response to the question of non-monotonic dose-effect relationships because they naturally integrate the physiological mechanisms which can cause low-dose effects in addition to other mechanisms taking the lead at higher concentrations. Several models, specific for the estrogen, androgen, thyroid, and corticosteroid axes, have been developed by a number of different research organizations in recent years. The robustness of these published models allows the standardization of test protocols and the optimization of guidelines based on inter-laboratory testing. Associating physiology, animal husbandry, molecular biology and imagery, these models can provide quantitative and qualitative information which can form the basis for industrial, environmental and regulatory decisions.

15.07 Induction of MT, HIF-1 and VEGF Genes Expressions As Early Angiogenesis Pathway Biomarker in Adult Zebrafish (Danio rerio) Exposed to Cd, Pb and As

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Metals are natural components of the biosphere, and although Cu, Fe, Ni and Zn are necessary for living beings, Cd, Pb and As do not have an essential biological role, accumulating in organisms. Once the metabolic, storage and detoxification capacity is exceeded, the risk of toxicity due to absorption through the liver, gills, muscles or intestinal wall increases. The aim of this study was to evaluate the temporal metal mediated-toxicity through the induction of MT, HIF-1 and VEGF genes expression in liver and gills of adult zebrafish (Danio rerio) chronically exposed to sublethal As, Cd, and Pb concentrations, in order to assess their behavior as metabolic pathway biomarkers of early exposure (MT gene) and subsequent effects such as oxidative stress and early angiogenesis (HIF-1 and VEGF genes respectively), comparing the pattern of basal expression of these genes and their temporal responses to waterborne metal exposure in similar environmental relevant concentrations previously reported in highly metal impacted areas of northern Chile. Our results have shown these concentrations were capable of causing hypoxia-mediated angiogenesis in zebrafish adult liver. The metabolic pathway evaluated through the sequential response of initial biomarkers of exposure (MT gene expression) and subsequent biomarkers of effect (HIF-1 and VEGF genes expression) allowed to reflect the protective effect of the Cd-induced metallothioneins, hypoxia caused by As and early angiogenesis caused by Pb>As>Cd, becoming a potential Adverse Outcome Pathway (AOP) for metal-induced carcinogenesis.

15.08 Incorporating Non-Animal Alternatives Into Eye Risk Assessment of Pesticides

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For the registration of agrochemical formulations, acute eye toxicity assessment is required by regulatory agencies. The Draize rabbit eye test (OECD TG 405) has worldwide acceptance for assessing eye irritation, but it has been increasingly questioned. The test distinguishes four categories considering reversible and non-reversible ocular injuries according to the UN GHS Categories 1 (severe eye damage), 2A and 2B (reversibleeye damage) and No Category (minimal effects). The aim of this work was to integrate the results of different *in vitro* or *ex vivo* methodologies to evaluate the eye irritation risk of 17 pesticides and then classify them according to the UN GHS system. These agrochemical formulations were manufactured by ATANOR SCA and had been previously classified as Category 1, 2A, 2B or No Cat. using the Draize eye irritation test. Two independent approaches were carried out in order to predict the ocular damage of the products under study. On the one hand, SIRC cells (rabbit corneal cell line) were used in a wound healing assay to evaluate if the replication and migration rates were related with the irritation *in vivo* categories. A correlation between wound closure and categories was observed. However, the subsequent performance of cytotoxicity tests (dose-response curves and IC50 estimation) was necessary to adjust the pesticide concentration, which allows for 70% cell viability. On the other hand, Short Time Exposure (STE) and Bovine Corneal Opacity and Permeability (BCOP) tests were used. They are methods to identify Cat. 1 and No Cat. products, according to OECD TG 437 and TG 491 respectively. Their limitation is classifying in the mid-range categories (2A and 2B). By STE test, all formulations were tested at 5% and 0.05%. In the BCOP test, liquid products were tested neat and at 10% and then corneal histopathological analysis was performed to assess the damage to the epithelium, stroma and endothelium using the Depth of Injury (DOI) model. Taking into account the sensitivity and specificity of each method, we have distinguished the products into three categories: 1, 2A+2B and No Cat. with an accuracy of 76.5% (13 of 17). The remaining 23,5% corresponds to products whose damage was over-estimated with respect to the *in vivo* test; there were no cases of under-estimation. Finally, we successfully established an in-house strategy for ocular risk assessment of agrochemicals.

15.09 Sedimentable Atmospheric Particulate Matter Impairs Respiratory Response to Hypoxia in Freshwater Fish, Nile Tilapia, Oreochromis niloticus

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In Brazil, recent studies have demonstrated that aquatic environment can be cross-contaminated by atmospheric particulate matter (APM) produced by steel industry. APM consists of a complex mixture of particles that includes a large number of metallic nanoparticles and it has been described as a relevant sublethal pollutant that could damage aquatic biota and human population. Further, the present legislation is limited in dealing with both problems: air to water cross-contamination and sublethal levels of AMP contamination. We evaluated metabolic

and cardiorespiratory response to progressive hypoxia in tilapia, *Oreochromis niloticus*, after contamination by sedimentable atmospheric particulate matter (SeAMP). We recorded cardiorespiratory and metabolic variables during trials of progressive short-term hypoxia (PwO2 100, 70, 50, 30, 20, 10 and 5%, 30 min each step), under intermittent respirometry protocol, after 96 hours of exposure (n = 10 for each experimental group and control) to raw SeAPM generated by steel industry complex near Vitoria – ES. SeAPM exposure affected respiratory efficiency and impaired the respiratory response to hypoxia. SeAPM exposure had compromised the ability to maintain resting metabolic rate in normoxia and moderate hypoxic levels. These alterations lead to a presumed higher and nonnegligible ventilatory cost, and therefore it changes the energy allocation strategy. The respiratory inefficacy raised critical tension (from 26 to 34% of O2 or from 1.84 to 2.76 mg $O_2 \times L^{-1}$), which might change the dynamics of environment usage since fish might spend a longer part of the day unable to compensate for oxygen availability. Therefore, those alterations compromised energy obtainment, allocation, and consequently fish "strategy" to confront ecological challenges. Based on the present results, we indicate that this sublethal level of contamination might limit long-term population survival and therefore, it should be appropriately considered by the regulatory agencies.

15.10 The Effect of Glyphosate and Ciprofloxacin Exposure on the Diversity of Gut Bacterial Microbiota in Rhinella arenarum (Anura: Bufonidae) Tadpoles

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The presence of agrochemicals and antibiotics in agricultural ponds poses a risk to aquatic wildlife. Gut microbiota reflects tadpole health and is related to the environmental quality. The aim of this study was to evaluate the toxicity of commercial formulations of a glyphosate-based herbicide (GBH) and a fluoroquinolone antibiotic, ciprofloxacin (CIP) on gut bacterial microbiota diversity of tadpoles of the common toad (*Rhinella arenarum*), considered as sentinel species. Embryos (Gosner Stage 3-5) were exposed to 2.5 mg L^{-1} GBH and 100 µg L^{-1} CIP, individually and in a 50:50% v/v mixture, and to a negative control (dechlorinated water) during four weeks. At the end of the assay, intestinal contents were extracted, homogenized and seeded in culture dish for microbiota analysis. The composition of the gut bacterial communities was evaluated by taxonomic identification of randomly selected colonies (N= 60 per treatment) using classical microbiological analyses (gram staining and biochemical tests), and matrix-assisted laser desorption ionization-time of flight mass. The microbiota from treated GBH tadpoles had greater taxa diversity and richness, including some genera, such as *Proteus* spp. and *Yersinia* spp., which were absent in control. In contrast, bacterial diversity of microbiota from treated CIP tadpoles was reduced, showing *Aeromonas* spp. dominance and presence of *Leclercia* spp. The GBH-CIP treatment showed changes in taxa composition, including decrease of *Klebsiella* spp. and *Pseudomonas* spp. To the best of our knowledge, this is the first report on the dysbiosis of gut microbiota of tadpoles caused by a mixture of two contaminants of emerging concern. The increase of medicalization and the occurrence of bacterial resistance in aquatic systems show the need for future studies considering that tadpoles are important microorganisms reservoirs.

15.11 A Review of the Use of Small Mammals As Heavy Metal Bioindicators

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Environmental contamination at different trophic levels occurs through the bio transfer of metals in water, soil, plants, and seeds. Small mammals can change their trophic level and dietary patterns according to environmental changes. The orders Didelphimorphia and Rodentia are alternative bioindicators of metals in the biota as they occupy several ecological niches. The articles published on the contamination of heavy metals in small mammals mainly portray the order Rodentia, with a wide global distribution, with 468 genera and 2052 species, another order is Didelphimorphia with 15 genera and 63 species. With a variety of habits, niches, diets, these mammals disperse and adapt to local environmental conditions. They are the basis of the diet of medium and large predators, as they have large populations. In small mammals, the concentration of heavy metals can indicate the trophic level, exposure time, and concentration of metals in the study areas, in addition to indicating different contaminants. In the Web of Science database, the search term was used Boolean operators AND and OR and the use of () the words used were (small mammals AND (heavy metals OR mercury)) with a return of 355 articles after refining for the last five years 81 articles were selected, in the Base Scopus search the same protocol was used resulting in a return of 208 articles after refining 48 articles were selected and in the Base ScienceDirect search the search returned from 60 articles and after refining 11 articles were selected. demonstrate gradual responses to different concentrations of exposure throughout the life cycle, with the interpretation of how these animals react to environmental changes being extremely important. In surveys carried out, these animals are more used as interesting bioindicators, considering that we can carry out monitoring without causing the animals' death.

15.13 Study of Toxic Mechanisms of Action in Schizosaccharomyces Pombe of Two Preservatives, Triclosan and Propylparaben, With Relevant Health and Environmental Impact

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Triclosan (TCS) and propylparaben (PPB) are antimicrobials widely used. They present many similarities in their applications and, also, in their human and environmental health risks. In order to investigate the mechanisms of toxic action and the efflux pumps involved in their detoxication, in the present work has been used a strategy with batteries of *Schizosaccharomyces pombe* yeast strains, either defective in cell signalling, in detoxification pumps, or in cell surveillance mechanisms. The results showed that TCS was 75 times more toxic than PPB in the wild type fission yeast. More oxidative stress and less protection by exclusion pumps were observed for TCS than for PPB. The level of

protection against TCS by the efflux transporters decreased from Bfr1, Mfs1, Pmd1 and Caf5A. In contrast, cytotoxic concentrations of PPB caused only a mild stress. The protection provided by the transporters was more marked than for TCS, decreasing from Pmd1, Caf5, Mfs1 and Bfr1. Furthermore, microtubule and DNA interferences were revealed for PPB, according to the sensitivity of mph1 and rad3 defective cells, respectively. Moreover, the mixture of both compounds also induced a significant toxicity in yeast proliferation. In conclusion, TCS was much more toxic than PPB on *Schizosaccharomyces pombe* strains, being the exclusion pumps more efficient for PPB than for TCS. However, as both compounds present complex adverse effects at concentrations close to exposure, and their combination clearly causes a strong potentiation, more exhaustive controls and regulations in their use should be considered. Aknowledgments: Consejería de Economía y Conocimiento de la Junta de Andalucía (Grant CTM2016-76304-C2-1-R, 2019-PPI1901 VPPI-UPO).

15.14 Gold Metallophosphazene Nanocompounds Induced Cytotoxicity and Oxidative Stress

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The therapeutic use of gold and its complexes dates back to thousands of years ago. However, the elaboration of gold based antiproliferative agents is a relatively young and intensively developing area of medicinal and pharmaceutical chemistry. Phosphazenes has been said to represent a new strategy in nanomedicine and they could be involved in a new strategy biomedical option. The great synthetic versatility of phosphazenes, whether in trimers, dendrimers or polymers, allows the design of a wide variety of ligands capable of coordinating with metal complexes to obtain materials with unique properties (redox, magnetic, biomedical, etc.). In the present work, two metallophosphazenes nanocompounds with the same central skeleton and different gold content in their composition, were studied: metallophosphazene Fz Au1, with two gold atoms; and, metallophosphazene Fz Au2, with three gold atoms. The cytotoxic activity of both compounds was tested in human breast adenocarcinoma (MCF-7) and human hepatocellular adenocarcinoma (HepG2) cell lines by two in vitro cell viability assays, the Neutral Red uptake and the Alamar Blue assays. All effective medium concentration (EC50) values obtained with both compounds were below 3 μM, being more potent than cisplatin. Furthermore, a possible relationship between structure and activity was determined. Metallophosphazene Fz Au had lower EC50 values. In order to elucidate the possible mechanism of toxicity, the generation of reactive oxygen species (ROS) was studied. Results showed an increase in ROS production in cells exposed to both metallophosphazenes. More studies are needed to elucidate the mechanism of action of the tested compounds that could be related with the inhibition of thioredoxin reductase, the main target of gold compounds. Aknowledgments: Consejería de Economía y Conocimiento de la Junta de Andalucía (Grant CTM2016-76304-C2-1-R, 2019-PPI1901 VPPI-UPO), MINECO-FEDER (Project MAT2017-84838-P), and Gobierno de Aragon-FEDER (Groups E47_17R and B25_17R, FEDER 2014-2020).

15.15 Sea Turtles (Eretmochelys Imbricada, Caretta CARETTA, and Chelonia Mydas) As Bio-Indicators of Inorganic Elements in Quintana Roo State

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Despite the current environmental concern regarding persistent pollutants in marine ecosystems, the biomonitoring of inorganic elements in sea turtles from Mexican Caribbean Sea haven't been thoroughly elucidated. With the advent of precise equipment, and application of non-invasive, and non-destructive sampling techniques in wild populations Scute and blood analysis are valuable tissues for bio-monitoring concentration of inorganic elements. In this study, we analyzed the concentration of 50 relevant inorganic elements as persistent pollutants in the marine environment of clinically healthy nesting hawksbills (*Eretmochelys imbricata*), green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles of Quintana Roo State nesting areas. We categorized it into 4 groups; Group A, corresponding to the essential mineral elements with toxic potential; Group B, corresponding to non-essential elements with high toxicity; Group C corresponding to non-essential minority toxic elements and Group D, corresponding to rare earth elements, and other minorities. All samples showed detectable levels of the elements commonly known as heavy metals. Our study reinforces the importance of scute as indicator of long-term exposure.

15.17 Extreme Environment Microbial Community Response to Heavy Metals/Metalloids Concentration in Loa Basin, Chile

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The Atacama desert is the most arid desert in the world. In Chile, the Atacama desert has a few courses and water bodies, and has been classified as a hyperarid system due to this condition, and also, due to high radiation and low rainfall. In this region of the planet, Loa basin is located in North of Antofagasta region, and is the most important basin, because is the only one exorheic basin in this region. Throughout the basin there are many mining industries, which cause several impacts to the Loa river ecosystems, and on the quality of the river sediments. In the river, there are few studies on the biological species that inhabit the Loa and no studies that reveal the response of the community of Bacteria phylum to high concentrations of heavy metals/metalloids. In order to fill that knowledge gap we studied the response of microbial community to heavy metal impact on this area. We use the richness and diversity indices from microbial community associated to surface sediments and the calculated pollution indices as geoacummulation index (Igeo), enrichment factor (EF), Nemerow pollution index (PIN), and the potential ecological risk (RI). The Loa river sediments present a natural and antropic high concentration of heavy metals/metalloids. Basin Loa has altitudinal gradient of minning impacts. Our results shows that lead, lithium and cadmium were the main chemical species responsible for modulating the community. Of 49 Phylum detected,

within the 10 most abundant, only 2 (Firmicutes and Cyanobacteria) were negatively correlated with pollution indices. The present study contribute to the understanding how the microbial communiy associated to surface sediments is affected by local human impacts in one of the most extreme rivers of the planet. This information helps future policy management in the country.

16. Occurrence and Risks of Pollutants in Latin America

16.01 Proposal for a Tiered Regulatory Framework for the Aquatic Effect Assessment of Pesticides in Neotropical Areas

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The modernisation of agricultural practices in neotropical areas has led to an increasing use of pesticides over the past decades. Brazil, for example, became the world's top pesticide market consumer in 2008 and pesticide consumption has remained on the rise since then. Ecotoxicological research into the fate and potential side-effects of pesticides on aquatic ecosystems surrounding agricultural fields, however, has focused almost exclusively on temperate countries. Consequently, aquatic risk assessments in neotropical countries usually rely on toxicity data derived for temperate species that often do not exist in neotropical countries. It is therefore necessary to address uncertainties related with this extrapolation and to evaluate its implications for the regulatory approach to be adopted in neotropical areas.In this study, toxicity data obtained from bioassays and model ecosystem experiments in temperate and tropical areas were mined and compared. Subsequently, implications for procedures aimed at the derivation of regulatory acceptable concentrations (RACs) for pesticides in edge-of-field surface waters in neotropical countries are discussed. Based on the study outcomes, a proposal of a tiered regulatory framework for the effect/toxicity assessment in neotropical areas is presented. A distinction will be made between pesticides that were already evaluated in temperate areas and those not previously evaluated. In addition, the proposed effect assessment schemes will allow for the derivation of RACs on the basis of two options: (1) the ecological threshold option (ETO), accepting negligible population effects only, and (2) the ecological recovery option (ERO), accepting some population-level effects if ecological recovery takes place within an acceptable time period.

16.02 A Tiered Weight-Of-Evidence Risk Assessment Methodology for Informing Decisions and Drawing Conclusions About Chemical Management

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This paper presents a tiered approach to WoE developed through workshops in Latin America and elsewhere. A tiered approach begins with a relationship among assessors and risk managers as they address a problem from their unique perspectives. For practical reasons, it makes sense to begin simply and to ensure there is a shared understanding. The fundamental elements of WoE are present in these initial steps. This ensures a continuum of understanding and purpose This guides the marshaling of evidence that the assessor and manager collectively understand are needed to ensure a reliable basis for decision-making. We outline a tiered WoE approach that reflects lessons learned and input from a number of workshops at SETAC meetings around the globe. Importantly, there is keen interest in reliable starting points (i.e., Tier 1) within developing countries. The approach is organized around three tiers and is designed to complement recent OECD guidance. The relationship aspects between assessors and managers are emphasized and guidance is provided on the types of information and tools that might be used at each tier. The approach also incorporates explicit feedback mechanisms to guard against unknowns. This is believed to be especially important for management of emerging chemicals. While it might be challenging to reach consensus among stakeholders around complex chemical use and management problems, the proposed tiered WoE could be the framework for achieving a shared understanding and the confidence needed to make decisions regarding acceptability, unacceptability, use restrictions, or the need for further information.

16.03 Metal Contamination in Fish From the Amazon and Human Health Risk Assessment

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The main objective of this study was to assess the levels of metal contamination in different fish species of the Amazon region and to assess the potential risks for the local population consuming them. For this, we analyzed the concentration of 10 metals (Cr, Mn, Fe, Ni, Cu, Zn, As, Cd, Pb, and Hg) in 56 flesh samples of 11 fish species obtained from local markets in urban areas of the Amazon, which were fished in 21 different locations in the Brazilian Amazon. The quantification of metals levels in fish samples was carried out by ICP-MS. The estimated human daily intake (EDI) for each metal was calculated considering an exposure frequency of 365 days/year, during an average lifetime of 70 years, a bodyweight of 60 kg, and a fish ingestion rate of 258 gr/day, which corresponds to the estimated daily fish intake for riverine populations. The EDI was compared with the oral reference dose (RfD) for each metal obtained from WHO. To assess human health risks, the Target Hazard Quotient (THQ) was calculated assuming that the ingestion dose is equal to the absorbed dose and cooking has no effect on the contaminants. If the THQ value is lower than 1, the exposed population should not expect any adverse health risk. Conversely, if the THQ is equal to or higher than 1, health risk is probable, with an increasing probability as the value increases. Only Cr, Pb and Hg were found in concentrations above the limit allowed for fish by the Brazilian legislation. Levels above the limit were detected in 3% of the samples for Pb, 41% for Hg, and 100% Cr. The estimated average daily intake for Hg was higher than the corresponding RfD. For the other metals, the EDI average was lower than the RfD. However, the estimated maximum daily intake for Cr, Ni, As and Hg was higher than the RfD. The THQ based on the average concentration of metal in fish indicated risk for Cr, Mn, Ni, and Hg. The THQ based on maximum values exceeded 1 for Cr, Mn, Ni, As and Hg. The toxicological mode of action is not the same for different metals. Therefore, the effect of metal mixture cannot be evaluated using the concentration addition approach. However, to have an indication of the comprehensive risk for metals, the total THQ was calculated as the sum of the individual metal THQ values. [mv1] The total THQ from the average concentrations was 33 indicating significant health risks from fish consumption. The total THQ for each fish also exceeds 1 indicating health risk from the consumption of these species. The individual THQ-total varied from 9 for the omnivorous *Colossoma macropomum* to 66 for the carnivorous *Arapaima gigas*, one of the most appreciated fish for local people. This study points out that there is a risk of adverse effects by metal uptake on human health emphasized by the high consumption of fish in the Amazon region.

16.04 Environmental Risk Assessment in a Peri-Urban Stream Surrounded by Horticultural Production

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A wide variety and load of pesticides are applied in horticulture due to each production unit having multiple crops simultaneously. The horticultural greenbelt of La Plata (Argentina) is one of the most important in the country with more than 6,000 ha. Despite the relevance of this activity, there is a paucity of information on the impact of horticulture to aquatic environments. The occurrence of mixtures is a big concern due to their potential additive or synergistic effects. Environmental Risk Assessments (ERA) facilitate the modeling of the expected toxicity of pesticide mixtures. The objective of this work is to analyze the concentration of pesticides in surface water and estimate the risk they represent for aquatic biota. Surface water of 5 sites along the Carnaval creek were studied during 6 sampling campaigns for 3 years (n=30). Samples were extracted with dichloromethane and analyzed by GC-MS for current and legacy pesticides. Precolumn derivatization with FMOC-Cl was performed for glyphosate AMPA analysis by UPLC-MS/MS. Acute and chronic (no observed effect concentration [NOEC]) toxicity endpoints for fish, aquatic invertebrates, and algae were obtained from the Pesticide Properties Database. Risk quotients (RQ) were calculated as the ratio between measured environmental concentration and the predicted no effect concentration (lowest NOEC divided by an assessment factor dependent on data availability). Concentration addition effect was assumed. RQ≥1 indicates high environmental risk. In 5 out of 6 sampling campaigns, at least one pesticide was detected every sample. Glyphosate (67%) and AMPA (83%) were the most detected, followed by the insecticides chlorpyrifos (47%), deltamethrin (30%) and the fungicide azoxystrobin (30%). Maximum detected concentrations were glyphosate 20.04 µg/L, AMPA 4.86 µg/L, deltamethrin 3.944 µg/L, cypermethrin 3.888 µg/L, and chlorpyrifos 2.645 µg/L, exceeding previously reported values. The ERA showed more than half of the sites presented RQ≥1. Furthermore, 30% of the samples presented a RQ greater than 1,000, and three values exceeding 10,000. Glyphosate and AMPA, despite being the most detected, contributed a maximum RQ of 0.24. Pyrethroids considerably contributed to the greater values RQ, with the lowest concentration representing RQ=20 (λ-cyhalothrin 0.004 µg/L) and the highest RQ=48094 (deltamethrin 3.944 µg/L). Horticulture, because of currently used insecticides, poses a great risk on aquatic biota.

16.05 Risk and Genetic Susceptibility to Arsenic Exposure From Drinking Groundwater in Populations of the Colombian Caribbean

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Inorganic arsenic (InAs) is considered to be the principal form of arsenic (As) in groundwater. The presence of As in waters naturally may occur and it is a serious global health issue. Lifetime average daily dose (LADD) is considered an important method for exposure assessment, because the effects of toxicity of InAs may be accelerated with an increase in exposure dosage. Urinary arsenic species (As^{III}, As^{V}, $MMA^{V,}$ and DMA^{V}) have been used as biomarkers for the As exposure dose. However, these can vary largely among individuals, possibly due to demographic, anthropometric factors, smoking history, and lifestyle. Besides, genetic factors have been reported to explain part of the variation, increasing the susceptibility to As toxicity. Nevertheless, more consistent evidence is needed on the focus of this issue. Therefore, this study aimed to evaluate the risk of As exposure in humans and the effects of genetic variants on urinary arsenic species in people exposed to drinking groundwater. Specific surveys were used to assess the demographic and anthropometric information of the subjects and their lifestyle. The groundwater and urine samples were analyzed for assessing total As and speciation, using HPLC-HG-AFS. Likewise, the exposure and risk of As was assessed by the LADD method and the Hazard quotient (HQ). Besides, six genetic polymorphisms (*GSTO2-rs156697, GSTP1-rs1695, GSTT1, GSTM1, As3MT-rs3740400 and MT2A- rs28366003*) were evaluated from DNA samples by real-time and/or conventional PCR. Twenty-two groundwater wells from studied municipalities were analyzed. The As exposure dose in the study population generated an HQ=1.2. The urinary arsenic species concentrations were 0.80 µg/L for InAs, 0.60 µg/L for MMA^{V} and 1.2 µg/L for DMA^{V}. The MMA urinary excretion was higher in subjects with heterozygous and/or homozygous genotypes of *As3MT*. Furthermore, DMA was lower in individuals with heterozygous and/or homozygous genotypes of *GSTP1*. Likewise, DMA and MMA concentrations were higher in *GSTM1*-null genotypes. Interactions gene-gene and gene-covariates modified the MMA and DMA urinary excretion. The interactions between *As3MT*GSTM1* y *GSTO2*GSTP1* polymorphic variants could be potential modifiers of the risk of toxicity to As through an increased urinary of MMA and InAs and decrease of DMA. The synergistic effect among these polymorphisms and age, daily doses of As, and alcohol consumption might vary the As individual metabolic capacity a large part.

16.07 Characterization of Cyanobacterial Biomass in Bloom Episodes for Its Biotechnological Potential

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The anthropic action has accelerated the eutrophication of aquatic environments, increasing the occurrence of cyanobacterial blooms that raise concerns about the possible production of cyanotoxins. The investigation of metabolites produced by cyanobacteria in blooms, aiming at their biotechnological use, can guarantee a different destination to this biomass, which, currently, is considered a major problem in the reservoirs and an additional residue to be discarded by WTP. In the last decades, several species of microalgae and cyanobacteria have been identified as a promising sources of bioactive compounds. These valuable molecules can be used in the most different sectors such as: in human and animal nutrition, in the search for new molecules to the pharmaceutical and cosmetics industries, in the extraction of high added value compounds such as toxins, fatty acids, pigments, among others. Worldwide, several metabolites have been identified and characterized. However, the cyanopeptide content of a bloom depends on the characteristics of the environment in which they occur. Therefore, this project aims to investigate the biotechnological potential of perennial blooms, in some reservoirs in the states of São Paulo, Rio de Janeiro, and Minas Gerais, Brazil, aiming at the use of biomass as a raw material in biotechnological processes. **Methodology**: the biomasses were collected, dried, and extracted with methanol: dichloromethane. The extracts were fractionated and each one of these fractions was subjected to biological activity tests. The fractions that showed biological activity were analyzed by HPLC-MS/MS. **Preliminary results:** the de-replication of one of the samples showed

no microcystins, saxitoxins, or anatoxins. The peptides found in the biomass belong to the classes of aeruginosins, micropeptins anabaenopeptins, and cyanopeptolins. Some putative compounds, already described in the literature, possess pharmacological properties well described as trypsin inhibitor ([M+H]+ 959.55) and thrombin and trypsin inhibitor (M+H]+ 605.37). The cyanopeptolin [M+H]+ 1021.56 is also described as a potent inhibitor against trypsin but was found to be toxic against some freshwater crustaceans. Indeed, some authors support the hypothesis that cyanopeptolins can be considered a second class of toxins in addition to the well-established microcystins. The other peptides found in these samples are still under investigation to establish their structures and functions.

16.08 Occurrence and Risks of Pesticides in Urban Streams of the Brazilian Amazon

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The Amazon has global importance, hosting a vast diversity of aquatic and terrestrial organisms, and playing a primary role in carbon sequestration, water cycling, and climate regulation. A predatory model of Amazon development, associated with increased population, disorderly urbanization, and environmental degradation, threaten those ecosystem services. The rise in the urban population increased the demand for food, boosting small-scale agricultural activities around the large urban areas of the Amazon. The cultivation of non-native fruits and vegetables to supply local urban markets increased the pesticides use to control pests and weeds. The use of pesticides and the high rainfall rates in the region contribute to the spread of pesticides into urban and peri-urban freshwater ecosystems. The objective of this study was to assess the occurrence of pesticides in urban areas of the Brazilian Amazon and to assess their risks for freshwater ecosystems. We analyzed exposure concentrations of 18 pesticides and five transformation products in 20 samples taken in the Amazon River and streams crossing the urban areas of Manaus, Santarém, Macapá, and Belém. We also calculated the ecological risks of pesticide mixtures following the Toxic Unit (TU) approach. Were observed high acute and chronic risks for malathion to invertebrates, high chronic risks for chlorpyrifos-methyl to invertebrates, moderate chronic risks of carbendazim for invertebrates and fish, and moderate chronic risks for chlorpyrifos to fish. This study indicates that urban and peri-urban agriculture in the Amazon can reduce freshwater biodiversity.

16.09 Fundão Dam Failure Event Contributed to Persistent Organic Pollutants Input in Sediments From the Espírito Santo Inner Shelf

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Dichloro-diphenyl-trichloroethane (DDTs) and polychlorinated biphenyls (PCBs) are persistent organic pollutants (POPs) with historical use as insecticides and in industrial activities, respectively. Despite the worldwide restrictions, they are still the most abundant and frequent legacy POPs in marine coastal sediments. The Espírito Santo inner shelf (ESIS), Southern Atlantic, receives terrigenous material and contaminants load mainly from anthropogenic activities developed in the Doce river basin. In addition, ESIS was recently impacted by the Fundão dam failure (FDF), in November/2015, which released 34 million m³ of mine tailings, creating a mud avalanche that wipes out land areas and flown the Doce river about 600 km until reaching the ESIS. Several studies suggest environmental impacts due to FDF, however, this is the first evaluation of the status of PCBs and DDTs. In this context, levels, inventories, and environmental risk regarding PCBs and DDTs in sediments from the Doce river mouth are presented. The sampling occurred monthly during the third year after FDF (October/2019 – September/2020). The mean value of total PCBs ($\sum_{47}$ congeners = 0.06 ± 0.31; up to 3.23 ng g^{-1}) was ~50 times lower than the baseline values for the area. Otherwise, DDTs (sum of DDTs, DDDs, and DDEs) had a mean of 1.03 ± 1.88 (up to 13.42) ng g^{-1}, while the previous value was 0.20 ng g^{-1}. Inventory and total mass estimative also indicate no recent contribution of PCBs to ESIS (maximum of 8.7 ng cm^{-2} and 1.2 ± 6.0 kg, respectively); while there was an expressive increase in DDTs after FDF (36.0 ng cm^{-2} and 19.8 ± 36.1 kg). Hazard quotient calculated for PCBs (0.3 ± 1.7) and DDTs (*p,p'*-DDE: 7.8 ± 10.4; *p,p'*-DDD: 12.0 ± 23.0; *p,p'*-DDT: 64.3 ± 191.4) suggests low environmental risk regarding PCBs and moderate to high for DDTs. These calculations did not include the outlier DDTs value of 369.6 ng g^{-1} recorded in one sample, which is the highest value of DDTs recorded in Brazilian marine sediments, increasing the concern. Therefore, the results indicate that FDF contributed to the DDTs input on ESIS, probably from remobilization of contaminated past sediments and soils from the Doce river basin. A decrease in the grain size of the coast sediments promoted by FDF also may favour DDTs accumulation in the area. DDTs contribution to the ESIS tends to continue since there is a large amount of tailing still stored in the river and estuary, that is mainly released in wet periods.

16.10 Spatial and Temporal Variations of Persistent Organic Pollutants in Surface Sediments of the Doce River Mouth, Southern Atlantic

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The inner continental shelf of Doce River mouth (DRM), Southern Atlantic, receives a high load of contaminants from the cumulative effects of the disordered population occupation and the variety of local human activities such as agriculture, construction of dams, and mineral exploitation industries. Despite these several potential sources, studies about chemical contamination in the region are scarce. This lack of information has been partially filled after the rupture of the Fundão Dam in 2015, considered the greatest Brazilian environmental tragedy in terms of tailings volume and traveled distance (> 50 million m^3 released). However, no information regarding Persistent Organic Pollutants (POPs) data in the DRM is available. This study aims to improve the understanding of POPs cycles on the continental shelf and provide data before the Fundão Dam failure. Thus, the levels of polychlorinated biphenyl (PCBs) and organochlorinated pesticides (OCPs) were evaluated in 20 samples of surface sediment of the DRM. These samples were collected in the wet (December 2010) and dry (July

2011) periods. The total PCBs (Σ51PCBs) and the OCPs Aldrin, HCHs, and Chlordanes (CHLs) were detected in both sampling campaigns, with maximum values of 9.50, 1.64, 0.28, and 0.63 ng g^{-1}, respectively. The maximum inventories of superficial sediments from the DRM were: 28.5 ng PCBs cm^{-2}, 0.60 ng DDE cm^{-2}, 1.90 ng CHLs cm^{-2}, and 4.91 ng Aldrin cm^{-2}. These results suggest that DRM presents a low potential of POPs accumulation compared to other regions worldwide. Furthermore, the calculated risk associated with the combined effects of detected POPs (total PCBs, HCHs, CHLs, Aldrin, and DDE) were below 1.0 in the two analyzed seasons, suggesting a minimal or no adverse biological effect. Variations in the spatial distribution and the slight increase of POPs frequency in the summer (wet) season were mainly related to the increase of Doce River flow in this period. In the winter (dry) season, there is a trend for transport northward and a large deposition of PCBs in samples further away from the coast, suggesting that the river is not always the main source of POPs for the continental shelf and the atmospheric processes may be considered. This is the first POPs assessment in the study area, being an important baseline data for the comprehension of spatial patterns of contamination of the selected POPs, their accumulation mechanisms, and their interaction with wildlife.

16.11 Assessment of the Variability of Human Exposure to Environmental Pollutants (POPs and Trace Elements) Through Lamb Meat Consumption in the Southern Macrozone of Chile

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Persistent Organic Pollutants (POPs) and trace elements are environmental pollutants of ubiquitous distribution, being known to bioaccumulate in the animal production chain and, for their harmful effects on human health. Sheep are a species of interest, as they tend to concentrate pollutants due to higher soil intake explained by the anatomy of their masticatory apparatus, and forage behavior close to the ground and traditional production system, without agronomic management with forage shortages in critical periods. From the socio-economic point of view, its major production is concentrated in southern Chile, where per capita consumption is the highest in the country. However, there is no current data on human exposure to POPs and trace elements through lamb consumption. Therefore, this study will assess the level of human exposure through lamb product intake to these contaminants in the southern macrozone of Chile.For this purpose, a trial will be carried out, using Suffolk-Down ewes, being the lambs born as the experimental unit. Four randomized treatments will be carried out using a 2x2 factorial design, where two factors can modulate the transfer of pollutants to the animals: 1) the use of agrochemicals and fertilizers: with (W/A) and without (W/O/A); 2) the availability of forage: high (HF) and low (LF). Creating 4 scenarios: W/A x HF; W/A x LF; W/O/A x HF; W/O/A x LF; where the last-mentioned scenario is the one that most resembles the condition of the productive systems in the south of Chile.Subsequently, muscle and organ (kidney, liver) samples will be taken and analyzed for PCDD/Fs, dl-PCBs, PAHs, trace elements (Pb, Cd), determining the concentration and contaminant profiles resulting from each treatment. The theoretical risk of human exposure will be calculated through a deterministic model of dietary intake, where the daily intake (DI) and tolerable daily intake (TDI) will be estimated with data on human consumption and the pollutant concentration in the lamb sampled. Furthermore, the ratio between DI/TDI will be calculated as a risk estimator.Finally, this work is based on the following hypothesis:Theoretical human exposure to POPs and trace elements will be higher in consumers of lamb products belonging to the SA x BD treatment, directly associated with higher soil consumption. Founding by Initiation Fondecyt Anid project N ° 11201282 [np1]poner en ingles [PS2]Puse esas siglas para que las revises

16.12 Soil Intake and Pollutant Transfer: Implications of Improvements in a Pasture-Based Lamb Production System

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The ovine production in the southern area of Chile is based on the use of grasslands as a food base. These are composed of perennial grass species, legumes, and a high proportion of broadleaf weeds, characterized by low dry matter yields (DM) and nutritional value, but of great help for times of scarce forage. In general, these systems are produced in areas of low productivity, due to the poor or non-existent agronomic management in terms of fertilization and grazing management, which implies the loss of herbs and more bare soil. Different investigations have evidenced ovine is sensitive to concentrate persistent organic pollutants (POPs) and some trace elements (Cu, Pb, Zn) because of the ability to involuntarily ingest quantities of soil, nearly 30% in some seasons, given to the grazing behavior very close to the ground. The low production of DM during winter/spring times entails a low plant coverage of the ground, therefore, could produce higher ingestion of soil and the risk of ingesting polluted materials or traces by the animal, which has an affinity with the organic matter of the soil and are mainly deposited in the fatty tissues. Consequently, the objective is to evaluate the effect of forage offer management and the use of agrochemicals ass modulators of soil consumption in an improve ovine production system and its impact on the final transfer of pollutants. For this purpose, a trial using Suffolk-Down lambs will be done. The experimental model corresponds to a 2x2 factorial design, two forage availabilities (high (HA) and low (LA)), and two levels of agrochemicals (with agrochemicals (WA) and no agrochemicals (NA)). In each one of the interactions, 5 sheep will be used plus their lambs in a 5000m2 area. The grazing will be done in stripes and, after 100 days only the lambs will be left in the grassland, which will be evaluated for soil consumption through a Ti marker methodology in the feces. Soil, forage, and fecal samples will be taken in every treatment, and the existence of different statistics will be evaluated. In addition, contaminants will be analyzed in soil and forage, and lamb samples. Therefore, the hypothesis of the experiment assumes that: lambs that graze in low availability grasslands and without the use of agrochemicals tend to have higher soil intake, and hence, the transfer of pollutants could be higher than in lambs that graze grasslands with greater forage. Funded by Fondecyt Initiation Project No. 11201280

16.13 Coastal Precarious Settlements, Flood Risk Assessment in La Ribera Quilmes Argentina

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Frequent floods worsened by the effect of climate change in riverside urbanizations in the Río de la Plata constitute a source of risk for inhabitants with deficits of basic services and unsatisfied basic needs (UBN). The risks of flooding for vulnerable populations settled on the coast of the Río de la Plata were analyzed.La Ribera neighborhood is located in Quilmes district, Bs. As., Argentina, where there are 153 households (approximately 600 inhabitants), built on land below 2 masl. on the coastline. It is categorized by RENABAP as a precarious settlement; 82% of households present one or more UBN indicators and lack facilities or poor access to electricity and water.14% of homes were surveyed virtually in March-April, using the Google Forms tool due to COVID-19 isolation. A leader in the community was the link to contact the households. No questionnaire had omitted or unknown answers to the questions.Results indicated that last 5 years the causes of flooding were: 45.5% river overflow, 38.1% rainfall, and 16.4% both.During floods, 66.7% surveyed stated that water entered their neighbor's homes, 47.6% flooded their street and entered their homes and 33.3% had to be evacuated. Waterlogging occurred 5 or more times and remained 1 or more days on the streets or their block (59.1%).Consequences were: 63% power outages, 54.4% overflow of cesspools, 50% appearance of garbage by water dragging 45.5%, dispersion of neighborhood wastes and unpleasant odors, 36.4% isolation of the neighborhood, and 4.5% flooding in ditches including wastesSafe water sources point out vulnerability to flooding, it comes from: 34.5%tap, 22.7%purchased and 18.2% use of the shared tap.Street lighting affects behavior responses to extreme events, 61.9% it was not working, and precarious electricity facilities show vulnerabilities, 40.9% do not have a meter and 18.2% share electricity with a neighbor, 36.4% have a light meter and legal access to the service. 90.9% of homes do not have sewer facilities.Due to the state of the streets 36.4%, accessibility to the neighborhood is poor and 22.7% told worsened during floods.Inhabitants' perception about the pollution origins to which they are exposed was it comes from: 77.3% Río de la Plata, 68.2%from the floods, and 50% drinking water and accumulation of waste. 47.5% of surveyed people associated pollution with health problems (dermal and respiratory), resulting in the children and the elderly are the most affected.

16.14 Air Quality in a University Center in Zapopan, Jalisco, Mexico

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Urban centers are expanding precipitously, becoming megacities or metropolitan areas with more than 10 million inhabitants. The great population density and the diversity of activities that occur, exert constant pressure on the landscape and the environment with impacts at the local, regional and international levels. Air pollution is linked to job occupation that occurs through direct contact with emission sources in work spaces, the main route of entry of these pollutants being the respiratory system. This study focuses on one of the most neglected sectors in occupational health and safety: University Centers (UC). An air quality monitor was used that was installed externally in the buildings that are located near the busiest avenues that adjoin the UC. The monitor records minute measurements from which hourly averages were determined. The measurement period was from January 4 to March 28, 2021 and the pollutants that were monitored were carbon dioxide, volatile organic compounds and particulate matter of 2.5 and 10 µm, in addition to the meteorological variables of temperature and humidity. The results were compared with the Official Mexican Norms (NOM) and the standards of the World Health Organization (WHO), as well as those reported in the scientific literature. The findings showed that the maximum limits established in the NOMs are not exceeded, but in some points the WHO standards are exceeded. The global hourly analysis showed a different pattern between PM2.5 concentrations with data from the State Atmospheric Monitoring System, registering unusual increases during the night and decreases during midday, an effect that could possibly be due to the influence of the works of the New Macrobus System of the peripheral ring of the Metropolitan Area of Guadalajara.

16.15 The Oxidative Potential of Particulate Matter Collected in Two Urban Sites in Chile

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The health effects related to atmospheric particulate matter (PM) exposure have been an issue in Latin America. The mass concentration of the PM has been the common descriptor used to assess and prevent them. However, these effects cannot be well evaluated only through mass concentration. The oxidative potential (OP) has been applied as a new metric to improve air quality assessment. It is defined as the ability of the PM to oxidize a target molecule or to produce reactive oxygen species that may lead to oxidative stress. The aim of this study was to evaluate the OP of PM_{10}, $PM_{2.5}$ and PM_1 samples collected in two cities of Chile with similar annual average mass concentrations, but different emission sources (Santiago and Chillán), using the dithiothreitol method. The inorganic and organic composition of the PM samples collected was also explored. The results showed that the measured OP was different between sampling sites, PM sizes, and seasons, and was related to certain metals and organic compounds from specific local PM sources. Higher mass normalized OP (OPm, a PM descriptor) was registered during cold periods in Chillán and warm periods in Santiago. Smaller particles showed the highest OPm. On the other hand, volume normalized OP (OPv, an air quality descriptor) was higher during winter at both sites, and PM_{10} showed higher OPv. Based on these results, we concluded that the OP gives important new information related to the chemical and physical properties of the PM that could help to improve current methods to evaluate air quality.

16.16 Polycyclic Aromatic Hydrocarbons in the South American Environment: Developing a Tool for the Systematic Review and Update of Current Trends and Future Perspectives

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Chemistry
Polycyclic aromatic hydrocarbons (PAHs) are organic compounds generated from the incomplete combustion of fossil fuels and other organic matter. They are ubiquitous contaminants, and some can be genotoxic, mutagenic and act as endocrine disruptors, thus representing a risk to ecosystems and human health. This study aims to develop a method to systematically review and constantly update the available information regarding the identification and quantitation of PAHs in South American environments, including Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Peru, Uruguay, and Venezuela. The objective is to develop research strategies for the improvement of PAH-related research in the continent, aligned with local interest, industries, and characteristics. Scientific articles published in the last decade (2010-2020) were retrieved from databases such as: JSTOR, ProQuest, SAGEjornals, SciELO, ScienceDirect, Web of Science and Taylor&Francis. We used an SQL based registry (Oracle SQL Developer) to organize and classify the information based on sampling techniques, sample processing, analytical method used, and matrix characteristics. Additionally, the data processing methods (such as principal component analysis (PCA), hierarchical cluster analysis (HCA), positive matrix factorization (PMF) among others) were also explored, along with mutagenicity, carcinogenicity and ecological risk tests used during the analysis. Based on the results, we identified research gaps in countries of South America, and proposed a line of research for each country, related to their local industry and needs. The results will be permanently available to the public and will be updated every year.

16.17 The Effects of the COVID-19 Pandemic on the Air Quality of Cities in Chile ¿did We Really Have "Lower" PM Concentrations During Quarantines?

T. Scott, C.A. Manzano, Universidad de Chile / Department of Chemistry

The COVID-19 pandemic has forced local government to take actions to reduce mobility in urban centers around the world. It is well accepted that these actions, particularly the quarantines, have helped improving some environmental endpoints (air/water quality). Several examples of the reduction of atmospheric particulate matter (PM) concentrations have been reported in every continent. However, several of these studies analyzed monthly averages and many have not considered potential meteorological confounding variables (rain, wind). This study aims to explore the effects of the quarantines in cities of Chile with different emission patterns and geographic characteristics (Calama, Santiago and Temuco). We generated a historical daily PM concentration average (2015-2019), using data derived from local air quality monitoring stations, and organized the data based on the Julian day number (starting with the first Monday of the year as day 1). The 2020 data were compared to this historical average, and the significance was estimated based on the *p*-value from a paired *t*-test. Additionally, meteorological characteristics (rain and wind speed) were considered. The results showed that the quarantines had different effects in the north, center, and south regions of Chile. The weakest effect was observed in Calama, where a historical behavior seemed to dominate the PM concentration reduction. On the other hand, Santiago showed reductions for fine PM (but not for coarse PM), while Temuco showed reductions for both (but the rainy days seemed to be responsible for most of the reduction). Based on these results, we propose the use of a daily historical average, with an associated significance, to evaluate the change in PM concentrations.

16.18 Predicting the Environmental Fate of Urban Contaminants Found in Three Cities of Chile Using Silicon Wristbands and Epi-Suite

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Chemicals of daily use include agrochemicals, pharmaceuticals, personal care products and more, many of which are of concern to ecosystems and human health. Recently, silicon wristbands have gained attention as a way to characterize part of that chemical exposome (the totality of chemicals to which a person is exposed to) and were used to collect samples from three cities in Chile (Iquique, Tocopilla and Santiago). All samples were analyzed without further cleanup in a comprehensive two-dimensional GC system with time-of-flight mass spectrometry. An average of 800 chemical features were tentatively identified in each wristband, with MS similarities above 500. The first objective of this study was to prioritize the chemical compounds tentatively identified based on their toxicity, carcinogenicity, and relative risks. These priority chemicals were then evaluated using a level-III fugacity model and the Estimation Program Interface from the US Environmental Protection Agency (EPI-Suite) to predict their potential transport routes and environmental fate. The results showed that some tentatively identified chemicals have long half-lives (biocides, antibacterials, and flame retardants). Additionally, most of the priority chemicals will tend to partition to organic phases, such as soil and house dust. Based on the results from this study, we created a list of priority compounds (65) to be monitored in future exposome studies in Chile. This priority list will complement the ongoing nontarget analysis of samples, and will provide easy and fast comparisons among cities, communities, and sampling seasons studied.

16.19 Cumulative Risk Factors in the Urban Environment: Interaction Between Air Pollution and Malnutrition on the Immune Response of Alveolar Macrophages

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General analysis of the urban population health must take into account the interaction of diverse stressors such as air pollution and malnutrition. Air pollution is the largest and most persistent environmental and public health concern in Latin American megacities. These areas are also characterized by socioeconomic gradients that enhance population inequalities, leading to malnutrition and, consequently compromising the body response to noxae. Either as a single risk factor or in combination with other agents, air pollution causes a wide range of acute and chronic respiratory diseases. The respiratory system is the principal target of air pollution where alveolar macrophages (AM) play a key role providing protection against xenobiotics through a variety of mechanisms including oxygen dependent pathways and pro-inflammatory cytokine production. Oxidants could lead to a redox

imbalance triggering a number of antioxidant mechanisms, of which the Nrf2-Keap1/ARE signal pathway is the most important to date. However, the mechanism linking air pollution exposure and malnutrition still remains unclear. Based on the above, the present study sought to investigate the effects of exposure to ROFA (Residual Oil Fly Ash, a surrogate of urban air pollution) on the lung immune response in rat nutritional growth retardation (NGR) model. Male weanling rats were fed a diet restricted 20% compared to *ad libitum* intake for 4 weeks in order to achieve NGR. NGR and Control rats were intranasally instilled with either 1mg/kg body weight of ROFA or its vehicle (Phosphate Buffer Solution) and euthanized 24h after exposure, and AM were isolated and cultured. Cell viability, phagocytic activity, antioxidant response, and pro-inflammatory cytokine release were evaluated in AM cultures. After ROFA-exposure cell viability and phagocytic activity were unaltered neither in Control-AM nor in NGR-AM. Whereas, Nrf2 expression and TNFα secretion increased in both Control- and NGR-AM, though the increase was lower in NGR-AM. Our studies showed that exposure to ROFA alters the defense mechanisms of AM from undernourished rats by altering Nrf2 and TNFα, essential cell mediators involved in cellular response by affecting the immune responsiveness to air pollutants.

16.20 Detection of Pesticides and Polychlorinated Biphenyls in the Cordoba City Air

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Persistent organic pollutants (POPs) are organic resistant compounds, most of them products of anthropogenic activities (pesticides, polychlorinated biphenyls, among others). They can be transported long distances from their emission source, and can be bioaccumulated in fatty tissues, with adverse consequences on both, the environment and the human health. The present work shows the results of the monitoring of a group of chlorinated POPs in the air of Córdoba City for a 7-month sampling period. The study site, located on the Universidad Nacional de Córdoba (31.4367°S; 64.1923°W) corresponds to an urban area, surrounded by large areas with agricultural activity. A high-volume air sampler equipped with polyurethane foam and quartz fiber filters were used to collect the sample during 72 hours. Procedures were carried out in accordance with US-EPA methods. The compounds were analyzed using gas chromatography with an electron capture detector and pollutants were identified using multi-component standards of chlorinated pesticides. The species identified were: lindane (γ-HCH), α-HCH, δ-HCH, Aldrin, heptachlor epoxide, α-endosulfan, β-endosulfan, dieldrin, endrin, endrin aldehyde, trifluralin, hexachlorocyclobenzene (HBC), dimethyl tetrachloroterephthalate (DCPA) and α-chlordane. As expected, the higher concentration of POPs detected corresponds to DCPA (6-40 pg/m^3), according to its application is not-forbidden. Concentrations of γ-HCH, α-HCH, δ-HCH and HBC are low in comparison with values reported for the Atlantic coast. Aldrin concentrations (8-54 pg/m^3) and endrín (banned in Argentina since the 1990s), and their metabolites dieldrín and endrín aldehyde, respectively, were detected. Also α-chlordane and DDE (the most common decomposition products of DDT, a pesticide banned since 1972) were detected, pointing out their high persistence. Although the presence of endosulfan (banned in Argentina during the last decade) was detected below the limit of quantification of the methodology used. Although the concentrations found are lower than those considered harmful to human health, there is evidence of the presence of non-permitted compounds in the air.

16.21 Multi-Causal Environmental Pollution in a Vulnerable Settlement in the Rio de la Plata Shore

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Pollution constitutes one of the most relevant socio-environmental problems in vulnerable neighborhoods and is the main cause of the reduction of the environmental and life quality of its inhabitants. The aim of the present work was to analyze the sources of contamination that threaten the environment and quality of life in vulnerable populations settled on the coast on low lands filled with urban solid waste (MSW) and subjected to recurrent floods. La Ribera, a neighborhood located on the southern coastal limit of the Río de la Plata, Quilmes, Buenos Aires, Argentina, was chosen as the study area. It is classified as a precarious settlement and flooding area; it lacks basic facilities, except electricity and water (informal connection). It has a total of 153 households equivalent to 612 inhabitants. Surveys were conducted in 14% of households during the period of March / April 2021. Due to the context of the health emergency caused by COVID-19, these surveys were carried out virtually, using the Google Forms tool. Inhabitants received the link through a leader from the community. Surveyed answered that the frequency of waste collection is 3 times a week (45.5%) and the rest said it is lower; 36.4% dispose garbage far from their homes. 68.2% of residents use plastic bags for waste, 37.6% deposit it in poled trash baskets, 28.6% use garbage can in front of houses, 23.8% do it at the corner or further away in containers, while only 14.3% throw it on the ground at the corner of their block and 13.6% burn it.40.9% separate metal, plastic, cardboard, glass from waste due to its commercial value. Questioning about floods during 2020, 59.1% were flooded 5 or more times, 47.6% the water entered the houses and 36.4% flooded the streets during one or several days. Flood events were associated with mosquitoes invasion (77.3%) increase of rodents or cockroaches (68.2%), wells overflowed (54.4%), dispersion of waste by water (50%) with unpleasant odors (45.5%). The mobility of services is interrupted by the flood phenomenon (22.7%). Regarding health problems, exposure to contaminated water and MSW are associated with skin and respiratory pathological issues. It is concluded then that the low frequency of the collection service, the presence of dumps and micro dumps with burning practices, the regularity of floods and rains are determinants for the spread of pollutants to water, air, and soil, increasing the presence of pathogens and vectors in the neighborhood of La Ribera. Health problems are exacerbated by floods due to accessibility lack.

Keyword Index

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