Advances on the assessment of environmental pollutants to amphibians and reptiles

Isabel Lopes, Peter Dohmen

May 8, 8:35 - 10:15, Meeting Studio 313 & 315

Amphibian and reptile decline constitutes a global conservation problem that has been attributed to several environmental stressors (e.g. habitat degradation, diseases, invasive species, climate changes, chemical contamination) and to complex interactions among them. Many works have been carried out to establish a causal link between exposure to stressors and the observed effects at the population and species level targeting accurate risk assessments and conservation programs. However, many uncertainties and knowledge gaps still persist associated, among others, with: (i) methodological inconsistency to assess effects, especially in the case of reptiles, (ii) interactions occurring between contaminants and natural stressors, (iii) differential sensitivity among life-stages, (iv) effects caused at low levels of environmental stressors, (v) occurrence of long-term effects, (vi) linking laboratory with field data. This session aims at addressing the above topics to broaden the existing knowledge and contribute to decreasing uncertainties in ecological risk assessment of the herpetofauna. Platform and poster contributions from academia, industry, governmental institutions, NGO partners, are welcome. This SETAC session is being organized by the Global Advisory Group of Ecotoxicology of Amphibians and Reptiles.

Aquatic and Terrestrial Plant State-of-the-art Research linking ecotoxicology and exposure of chemicals

Joanna Davies, Silvia Mohr

May 9, 8:35 - 10:15, Meeting Studio 311 & 312

This session proposal aims to present scientific contributions that highlight topics within the fields of aquatic and terrestrial plant testing linking ecology and exposure via, pulse dose and recovery methodologies, algae and macrophyte mesocosm /microcosms and landscape level test designs, used in the risk assessment of chemicals. Abstracts may cover algae, periphyton and aquatic and terrestrial vascular plants testing methodologies, laboratory chemical mixture assessments and higher tier test design. For quite a few years now experts in the field of aquatic and terrestrial plant ecotoxicology, have identified through scientific workshops i.e. SETAC NTTP Workshops (April 2014 and September 2015) and conferences, the increasing need for quality and "test for purpose" higher tier plant testing. However, approved protocols for more realistic test designs i.e. including pulse dose or recovery tests, as well as terrestrial higher tier tests are not yet available from official bodies such as the OECD. Plants as key components in aquatic and terrestrial ecosystems with important structural and functional roles in ecosystem services have been thoroughly investigated and recent development of additional OECD tests with rooted aquatic plants (Myriophyllum spicatum; Glyceria maxima in development) have added more knowledge in standardized test design, but guidance for performing higher tier testing or for example exploring new higher tier risk assessment tools i.e. how to best use plant ecology data in ecological modelling as a higher tier tool, is still lacking. Overall, a better fundamental understanding of aquatic and terrestrial plant laboratory refined test designs and higher tier field / landscape studies are needed to improve risk assessments. Abstracts in this session cover the topics of: 1. Pulse dose exposure simulation testing of chemicals in plants (aquatic plants/ algae); 2. Using recovery in plant testing and risk assessment; 3. Lower tier (EPA and OECD) testing with focus on selecting species, endpoints and methods; 4. Sediment-exposure and effects on rooted, (aquatic) plants; 5. Higher-tier-testing with focus on plant Species Sensitivity Distributions and microcosm, mesocosm and field tests; 6. Ecological Modelling approaches as a higher tier tool in the risk assessment for plants; 7. Risk assessment schemes for plants under different regulations (PPPs, WFD, REACH, Biocides); 8. Plant ecology and trait based approaches in the context of the risk assessment of chemicals.

Behavioural ecotoxicology: Unravelling behavioural responses to aid environmental and regulatory toxicology

Alex Ford, Gregory Pyle, Minna Saaristo, Kathryn Arnold

May 10, 8:35 - 12:45, Meeting Studio 311 & 312

The field of behavioral ecotoxicology has provided important contributions for decades. Responses to contaminants vary in aquatic invertebrates and vertebrates, but common examples such as predatory -prey interaction, feeding, nest guarding, phototaxis, boldness and olfaction could have significant implications for aquatic populations, particularly in the case of threatened and endangered species. Recently, it has been suggested that personality might also play an important role in population-level adaptation to new or shifting environments. These behavioral responses of aquatic models routinely serve as early warning systems for accidental or intentional contamination events, and provide alternative animal model systems for neuroscientists, pharmacologists and other disciplines in the biomedical studies. Corresponding technological advances have allowed for unprecedented capacity to quantify such responses.Despite these contributions, applications and technological advances, behavioral perturbations elicited by contaminants are rarely employed during traditional environmental risk assessments, potentially because standardized methods and adverse outcome pathways have not been developed and validated across species and laboratories.The main objective of this session is to provide insights into the behavioural responses of animals to environmental stressors.The goal of this session is to critically examine the role of behavior within the context of mechanistic toxicology, environmental hazard and risk assessment. Questions such as: 1. What information is needed to advance the field?; 2. Which behaviors represent ecologically important adverse outcomes?; 3. Where are technological advances improving behavioral studies?; 4. How can laboratory variability be defined?; and 5. Should ecologically important behavioral responses contribute to regulatory toxicology and decision making? are targeted for this timely session.

Big data analysis of monitoring data: what questions can be addressed?

Martina Vijver, Gert Everaert, Jörg Roembke

May 10, 14:20 - 16:00, Meeting Studio 313 & 315

Many chemical and ecological data are collected under different monitoring programs, which are often designed to establish the current status of an environment or to establish trends in environmental parameters. Well known examples on the European level are the Marine Strategy Framework Directive (MSFD) or the European Water Framework Directive (EU-WFD). Additional programs are run on the national level, most profoundly for soils where a European program is lacking. Unfortunately the use of monitoring data is often limited to the purpose of which they are collected. In addition, there are often difficulties in causally linking stressors with observed differences in ecosystem structure and functioning in natural environments because both natural processes as well as the influence of stressors are highly variable in both space and time. Despite these disadvantages, field data provide the only means to capture actual environmental conditions and ecological complexity. To tear down these pre-assumptions and try to get "hands on ideas" on how to make use of these data we would engage researchers to presents their ideas and projects. We think that the large amount of monitoring data does give huge opportunities to tackle a variety of challenges. Moreover, to date, due to improved technologies the computational time for transferring environmental data into scientific knowledge has drastically decreased. As a lot of physical-chemical and biological data have been collected, merging different sets of data has significantly increased our ability to investigate and quantify how stressors potentially alter biodiversity and ecosystem functioning (including interactions between anthropogenic and natural stress). As such, big data analysis will become increasingly relevant for risk assessment procedures and are already required in some European regulations (e.g. Post-Registration-Monitoring of pesticides). Last but not least the outcome of such monitoring programs is a strong communication tool, linking scientific results with public experience. In this session, we invite contributions that perform meta-analyses of existing sets of monitoring data aiming to improve our knowledge about the impact of stressors on biodiversity and ecosystem functioning and to expand our ideas on how to effectively use the large quantity of valuable data. This session targets a broad audience, including ecotoxicologists, ecologists, conservationists and environmental scientists, but also those involved in the authorization/registration of chemicals as well as those involved in the design and implementation of nature policy and management. In particular we invite people directly working with data bases containing ecological and ecotoxicological information to illustrate the power of existing data for answering long-lasting environmental questions.

Combined effects of chemical and environmental stressors: from local stressors towards climate change

Robby Stoks, Paul van den Brink, Matthias Liess, Andreu Rico, Lizanne Janssens

May 8, 8:35 - 16:00 / May 9, 8:35 - 10:15, Hall 400

Organisms in terrestrial and aquatic ecosystems are increasingly exposed to combinations of chemical stressors and environmental stressors related to global change (e.g. eutrophication, salinization, UV, warming, droughts and floods). Stressor combinations challenge our ability to predict the impact of single chemical stressors under realistic field conditions. To improve ecological risk assessment we need to understand and be able to predict the occurrence of interactions between chemical and environmental stressors across levels of biological organization: from the (sub)-individual up to biological communities and ecosystem functions. This has been proven to be especially difficult when stressors affect different endpoints and effects are evaluated at higher levels of biological organization. Moreover, to relate effects across biological organization levels, we need to consider both direct effects as well as indirect and cascading effects that may shape biotic interactions and ecosystem functions. Significant advances have been made to increase our insights into the occurrence and combined effects of stressors. These include new mechanistic approaches to diagnose cause in complex stressor scenarios (including single-stressor diagnostic indices, traits-based approaches and functional genomics). Furthermore, considerable progress is being made in the area, of ecosystem observation through advances in earth observation technologies, ecogenomics, telemetry and the emergence of large-scale ecosystem assessment models, linked to high-capacity data streams from monitoring and assessment programs. This session welcomes presentations on multiple stressor studies preferentially addressing following questions on the effects of chemical stressors in a global change context: (i) To what extent do different stressors generate the same stress responses and what is the mechanistic base for the interactive effects of multiple stressors? (ii) Do stressors interact in the same way at different levels of biological organization? (iii) Are there geographical patterns in the effects of multiple stressor combinations? (iv) How can we link the performance of individual organisms under multiple stressor exposure with ecological functions at higher levels of biological organization (such as biotic interactions and ecosystem functions)? (v) How can we use mesocosm experiments and field monitoring in natural populations to increase our ability to extrapolate multi-stressor effects from the lab to the field? (vi) How can we use models to predict multi-stressor effects at different levels of biological organization? (vii) What combinations of chemical and environmental stressors will be most relevant in the future?

Determining population relevance of ecotoxicological effects

James Wheeler, Lennart Weltje, David Dreier

May 11, 11:05 - 12:45, The Arc

The protection goal of most environmental risk assessments is to protect populations instead of individuals of organisms (in contrast to human health assessments where the individual is the goal). This allows ecotoxicologists to accept some individual level effects as long as population stability and recruitment are not impacted. This principle should underlie all ecotoxicological testing and assessment procedures. However, in practise, conservative assumptions are made as to the likely population relevance of effects. At lower assessment tiers this is generally acceptable. Whilst at higher tiers there is an increasing need for trans-disciplinary approaches amongst eco/toxicologists, exposure scientists, ecological modellers and statisticians. This need is driven by an increasing reliance on higher tier approaches in a more complex regulatory environment. Further, mechanistic-based approaches in ecotoxicology are gaining importance. This is exemplified by the Adverse Outcome Pathways (AOP) concept and the regulation of some substances based on intrinsic properties related to the mechanism underlying the effects (i.e. endocrine disruption). Consequently, there is a much greater emphasis on generating mechanistic effects data (biomarkers, histopathology etc.). However, typically such data are not considered directly population relevant. Therefore, we require improved tools and frameworks in which to interpret mechanistic effects to ensure the 'A' in adverse is related to the protection goal at the population level. We hope this session will discuss these issues and propose ways forward for a better multi-disciplinary approach to defining and using population relevance in environmental assessments. We seek submissions in the following areas: • Defining the population relevance of effects from laboratory studies • Ecological modelling coupling mechanisms to the population level • Interpretation of endocrine disrupting effects • Adverse Outcome Pathways

Effects and ecological consequences of aquatic exposures to particulate materials from the nano- to macro- scale

Edward Salinas, Yasir Sultan, Sebastian Beggel, Juergen Geist

May 9, 14:20 - 16:00, Gold Hall

The current paradigm in aquatic environmental assessment, accepted by regulatory authorities globally, is that the dissolved molecule represents the most relevant exposure condition for aquatic toxicity testing and that testing above the solubility limit does not help to inform environmental risk. The increasing focus on nanomaterials, microplastics and other sparingly soluble particulates in the environment over the last decade is challenging this paradigm and has inspired debate regarding the adequacy of existing aquatic testing frameworks for substances, which are now realized to have potential for emission and transmission in the aquatic environment in varied undissolved/particulate states. The majority of published research that has investigated the potential ecotoxicity of nanomaterials and microplastics over the last decade has employed procedures involving exposure to substances above the solubility limit and in the presence of undissolved material. Relatively little attention has been given to addressing the distinction between intrinsic toxicity and physical effects associated with relevant physical states during exposure. The latter is a fundamental requirement for aquatic toxicology studies used in regulatory context. Generally, research focusing on nanomaterials, microplastics, or suspended solids have been considered separately, although they share common physical features as particulates. In this session, we seek to identify and highlight common critical considerations in aquatic exposures and for assessing risk of particulate materials. We invite abstracts which highlight work aimed at: • Distinguishing and characterizing intrinsic toxicity and physical effects of particulates in either lab or field settings from short or long-term exposures. This may include effects of particulate matter on biota, ecosystem processes and functions. • Identifying the key physical properties of particulates which are most relevant to hazard and risk in the aquatic environment (i.e. properties which may promote specific uptake of particulates or may lead to specific physical effects). When should particle size be a decisive factor for environmental risk assessment? • Identifying metrics and models to quantify particulate exposure and physical hazard in the aquatic environment. Are classical toxicological dose models appropriate and sufficient? • Determining the role of particulates in multiple stressor systems, especially considering indirect effects, influence of background particulates or interaction of particulate and dissolved stressors (i.e. adsorption/ desorption or leaching of contaminants, particles as vector for pathogens). • Aquatic environmental risk assessment strategies that consider population relevant impacts of physical (or indirect) effects from particulate matter and particulate anthropogenic contaminants.

Engineered nanomaterial effects on soil and terrestrial communities

Moira McKee, Juliane Filser, Maria Engelke, Patricks Voua Otomo

May 9, 11:05 - 12:45, Gold Hall

Due to their unique characteristics the use and emission of engineered nanomaterials (ENM) is steadily rising and with it the concern for the effects on the environment. Soils are considered a major sink for many ENM and - dependent on the chemical and physical composition of soil - modifications and transformations of ENM in the environment take place. Numerous studies on the effects of this novel technology on single soil organisms have been done. To increase the ecological and environmental realism of the studied systems there is an urgent need to examine how biodiversity, community composition, multiple community interactions within the food web (e.g. predation, mutualism, herbivory) and associated ecosystem functions and services are affected by ENM exposure. Knowledge gaps exist regarding important issues such as trophic transfer, bioaccumulation and biomagnification of ENM within terrestrial systems and the detection of ENM under environmental conditions still poses challenges. Long-term and multi-generation studies at environmentally relevant ENM concentrations are also needed. Little is thus far known on how soil organisms affect ENM characteristics, for example through uptake and modifications within the organisms. Mechanistic approaches, plant, animal and microbial studies are welcomed to this session. We invite presentations on data from lab and field studies and aim at offering a platform for the presentation of new approaches on assessing the environmental risks posed by ENM at a higher organizational level within terrestrial ecosystems.

Experimental approaches and field studies to investigate ecosystem integrity under multiple stress

Mirco Bundschuh, Jochen Zubrod

May 9, 11:05 - 12:45, Hall 300

This session aims at discussing recent insights in the individual and combined impact of various stressors - which comprise amongst others anthropogenic chemical pollution, predation (including predator or alarm cues), temperature variation, invasive species etc. - on different levels of ecological complexity. Thereby, the impact on the physiology of individual organisms and the potential propagation of these effects to higher levels of ecological organization will be one focus topic. Moreover, contributions addressing the consequences of stressor-induced alterations in the community composition of prey and predator organisms on horizontal (within a trophic level) and vertical (across trophic levels) interactions within food webs under stress are invited. Studies using controlled experimental approaches (e.g., factorial designs) that further the mechanistic understanding of stressors' interactions or correlational field studies are welcome. By doing so, the role of multiple stressors for the integrity of ecosystems' structural and functional characteristics are discussed, fostering a more holistic and realistic assessment of risks associated with the use of organic and inorganic chemical stressors.

Polar ecotoxicology: hot issues in cold climates

Nico van den Brink, Katrine Borga

May 8, 14:20 - 16:00, Meeting Studio 313 & 315

Assessment of risks of environmental contaminants in Polar Regions has gained increased interest in recent years. In the Arctic region, a potential increase of human activities like oil and gas exploitation and shipping related to the fact that larger areas will become free of ice over summer as a consequence of climate change, may result in increased risks of environmental release of contaminants. In the Antarctic, new contaminants are emerging, transported by related to long-range atmospheric transport. In addition the Polar Regions are may act as early warning of how climate change affects the distribution, uptake and effects of contaminants, as the environmental response to climate change will occur here fastest and with highest amplitude. A major factor affecting the environmental fate and hazards of contaminants in Polar Regions is the extreme seasonality of environmental conditions due to the high latitude, and the ecosystem adaptation to these conditions. The biological cycles are driven by sea ice dynamics and as such impact both the fate of contaminants as well as their potential effects. In this way Polar Regions differ from temperate and tropical regions, hampering the extrapolation of concepts and results between regions and studies. For instance, the adaptation of Polar organisms to seasonal food availability results in build up of energy reserves (lipids) over summer which may make them more vulnerable to chemical exposure and contaminants may be remobilised from lipid stores during specific time windows of enhanced stress. Hence, ecological constraints of Polar ecosystems and organismal adaptation to high seasonality may limit the resilience of organisms towards chemicals stress. On order to substantiate the need for Polar-specific risk assessment procedures and threshold levels, effects of different Polar specific factors on the vulnerability of local species to chemicals stress need to be quantified. In this session we solicit for papers that assess environmental hazard en fate of contaminants with specific focus on factors that modulate Polar specific impacts. This may include exposure and accumulation studies as well as effect assessments for both Polar regions. The aim of the session is to increase the knowledge of such factors, in order to increase the relevance of site specific ERA for Polar regions, but also to assess the potential risks of emerging chemicals to Polar environments even before their marketing.

Predictive models in ecotoxicology: bridging the gap between scientific progress and regulatory applicability

Andreas Focks, Alpar Barsi, Marco Vighi, Francesca Grisoni

May 10, 8:35 - 12:45, Hall 400

Modelling approaches have been an intensive topic for research in academic and industry research in the last years, because mathematical or computer models provide the means to gain a deeper mechanistic understanding of environmentally-related processes like fate and effects of organic contaminants in the environment and they enable predictions of effects or of processes like toxicity, biodegradation, uptake and bioaccumulation. Mathematical and computer models have in that respect unbeatable advantages: once established and tested, they allow predictions of expected behaviour and effects of contaminants for really large numbers of environmental conditions, while reducing animal testing at the same time, which means that the number of tested environmental situations and so the environmental safety can be increased at low monetary and ethical costs. While researchers suggest model applications in many cases, on the regulatory side the criteria for the acceptance of modelling are not the same for the different approaches. While distribution and fate models are generally accepted since a long time for exposure estimation in predictive risk assessment, the acceptance of QSARs and ecological modelling is still controversial and problematic. This session will show examples for QSAR (quantitative structure-activity relationship) models for the estimation of toxicity, biodegradation and bioaccumulation of organic contaminants. Other types of mathematical models are the toxicokinetic-toxicodynamic (TKTD) models, which relate the external exposure to expected effects on survival or other endpoints. For these models, we will see presentations about regulatory aspects, acceptability criteria and an application for a concrete risk assessment question. The presentations will be finished by a model based analysis of the impact of an endocrine disruptive compound on the population dynamics of a fish, and by exciting news from attempts to link adverse outcome pathways to dynamic energy budget modelling.

Wildlife ecotoxicology: cumulative effects through the food chain to the community

John Elliott, Veerle Jaspers, Kim Fernie, Renaud Scheifler

May 8, 11:05 - 12:45, Meeting Studio 313 & 315

Wildlife, including birds, mammals and amphibians, are exposed to a wide range of contaminants. Sometimes it is through direct exposure, which is commonly related to food web accumulation. Exposure to environmental contaminants, already released in the environment, is generally at relatively low levels but chronic over time. Additionally, animals may be exposed to rather high levels of compounds that are currently purposely released in the environment. Those can include plant protection products, insecticides or fungicides, or mammalian pest control products such as rodenticides. Effects of low level, chronic exposure to compounds may be very elusive and difficult to factor from effects of other stressors. However, advances in molecular biology our improving our ability to detect such subtle perturbations. Generally, exposure does not result in direct mortality, but animals show lower fitness, and may be more vulnerable to other stressors. In contrast, effects of acute toxicity may be relatively obvious, including mortality, although affected animals may be difficult to find in the field. Linking subtle molecular or 'biomarker' effects to individual health can be challenging, linking effects detected at the individual level, even mortality, to impacts at the population level is even more challenging. For both regulatory purposes and risk assessment it is essential to obtain information on risks from both acute and chronic exposure scenarios, and to attempt to determine links between measurable biomarkers, other stress factors and implications for populations, and even communities. In this session we are soliciting presentations that provide insight into effects at both molecular and higher levels or organization, and in particular studies that make credible connections between levels of organization and with other environmental variables. This could include assessments that employ an adverse outcome (AOP) framework.