investigate the potential for climate-driven remobilization, controlled incubations were performed on three permafrost soils with contrasting organic matter contents, along with a sterilized control, under a warming–cooling cycle. Across all active soils, temperature shifts led to measurable increases in EF up to 50-fold, indicating mobilization of previously bound organohalogens. Synthetic-like organohalogens showed faster release than natural ones, suggesting that NER binding history governs remobilization potential. The magnitude of release varied among soils: higher organic matter contents were associated with slower remobilization, while soils with lower organic matter exhibited more pronounced increases. Microbial activity proved essential, as distinct phyla were associated with enhanced release in each soil, whereas the sterilized control exhibited strongly suppressed remobilization.
Overall, the results indicate that climate warming can promote the remobilization of legacy organohalogen contaminants stored as NER in permafrost. These findings underscore the need to incorporate NER into soil monitoring and resilience frameworks, especially in northern regions undergoing rapid environmental change.

## 4.15.P Statistics for Setting Endpoints – from Tried and Tested to New and Exciting Methods

### 4.15.P-Th191 Statistical Analysis of Ecotoxicology Data for Regulatory Purposes: an IEAM Special Series

***Raoul Wolf***[1]*, David Fox*[2] *and Jannicke Moe*[3]*, (1)Norwegian Geotechnical Institute (NGI), Norway, (2)Environmetrics Australia, Australia, (3)Norwegian Institute for Water Research, Norway*

Statistical methodologies and tools applicable to ecotoxicology have developed and improved over recent decades. Nevertheless, regulatory risk assessments are still largely based on statistical principles and approaches that are no longer state-of-the-art. SETAC meeting sessions dedicated to statistical methods have witnessed a high level of interest and discussion regarding the progress and applications of statistical methodologies. Many ecotoxicologists have expressed interest in the revision of the 2006 OECD document no. 54 ("Current approaches in the statistical analysis of ecotoxicity data: a guidance to application"). This guidance is no longer considered reflective of contemporary statistical methods or computational platforms used in ecotoxicology, and its revision process is ongoing.
Against this background, a call for papers for a Special Series in Integrated Environmental Assessment and Management (IEAM) was launched in autumn 2024 with manuscript submissions until summer 2025.
The purpose of this Special Series was to provide an overview of the statistical ecotoxicology landscape and reflect on recent developments, processes and opinions. Relevant topics include (but are not limited to): similarities and differences of toxicity metrics (NOEC, BMD, NEC, ECX, NSEC, and more); developments and tools for dose-response modelling; developments and tools in SSD modelling (model averaging, mixture models); Bayesian vs. frequentist approaches; and case studies of novel statistical methodologies highlighting their benefits. We welcomed and encouraged contributions and viewpoints from members of all sectors, including academia, industry and government.
By the time of writing (November 2025), five papers have been accepted for the series, with several more manuscripts under evaluation. In this poster we give an overview of the final series of papers, focusing on the variety of approaches, scientific novelties, and implications for regulatory ecotoxicology and risk assessment.

### 4.15.P-Th192 The Benefits of Bayesian Statistics: Examples from the Revised OECD Document 54 Annexes

***Raoul Wolf***[1]*, Jannicke Moe*[2] *and David Fox*[3]*, (1)Norwegian Geotechnical Institute (NGI), Norway, (2)Norwegian Institute for Water Research, Norway, (3)Environmetrics Australia, Australia*

OECD Document 54 (“Current Approaches in the Statistical Analysis of Ecotoxicity Data: A Guidance to Application”), first released in 2006, is being revised to include Bayesian methods alongside traditional frequentist approaches. The OECD document 54 annexes provide example datasets from OECD test guidelines 201 (algal growth inhibition), 202 (Daphnia acute immobilisation), 211 (Daphnia reproduction), and 215 (fish juvenile growth). Additionally, a new dataset for 236 (fish embryo acute toxicity) was considered.
The revision reflects a broader shift in life sciences toward Bayesian statistics, valued for handling hierarchical, nonlinear, and data-limited scenarios, while offering transparent assumptions, improved uncertainty quantification, and reproducible workflows. Criticisms of Bayesian methods—higher data demand, greater uncertainty, and subjectivity due to priors—will be addressed through intuitive workflows, checklists, and comparisons with frequentist results.
For concentration-response analysis, log-normal, log-logistic, and Weibull type I models were applied, with model choice guided by Bayesian cross-validation. ECX values and credible intervals were derived from posterior distributions. Hypothesis testing used Bayesian hierarchical regression (analogous to ANOVA), with partial pooling to reduce false positives/negatives and significance assessed via posterior draws and the ROPE

principle, yielding NOEC/LOEC values.
Validation included prior-posterior and posterior-predictive checks, plus sensitivity analyses to detect prior-likelihood conflicts. Results showed Bayesian methods robustly produced EC/LCx and NOEC/LOEC values across datasets, with credible intervals automatically capturing uncertainty from data variability, sample size, and priors. While strong priors influenced some parameters, final endpoints remained unaffected.
Overall, Bayesian analysis matched frequentist outcomes in most cases and offered advantages in challenging contexts (e.g., zero-inflation, small samples). The methodology meets regulatory requirements in principle, demonstrating that Bayesian approaches are not more data-demanding, uncertain, or subjective than frequentist ones—and can even reduce uncertainty in some cases. The study encourages scientists and regulators to adopt Bayesian methods for standard ecotoxicity data analysis, highlighting their robustness, transparency, and potential to improve regulatory statistics.

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**4.15.P-Th193 FXMATE: Open-Access Statistics for Ecotoxicity Effects MAde Totally Easy**
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Chemical registration and environmental risk assessment depend on robust statistical evaluation of ecotoxicity test data. Despite the guidance provided, for example by the OECD, inconsistencies in statistical practice persist, often arising from custom code or opaque workflows. These limitations can bias toxicity estimates and complicate the statistical justification of regulatory decisions.
FXMATE is designed to address these issues as an open-access software framework for reproducible, transparent, and standardized ecotoxicological data analysis. The framework implements automated workflows aligned with OECD test guidelines (e.g., 201 and 211), covering data validation, guideline-specific preprocessing, dose-response modelling, and hypothesis testing. While experienced users retain full control over analytical choices, optional constraints and decision guidance are provided to reduce common statistical errors. The framework combines established state-of-the-art modelling approaches, such as bootstrapping and model averaging, with a modular architecture that allows integration of emerging statistical methods as they gain regulatory relevance, including recently proposed hypothesis tests for count data (e.g., CPCAT and Dunnett GLM). For continuous, quantal, and count data, decision trees derived from and extending OECD guidance formalize the selection of appropriate statistical analyses.
By combining guideline-conform statistical methodology with transparent implementations, FXMATE contributes to more consistent and defensible statistical evaluations of ecotoxicity data. This work contributes to ongoing efforts within the ecotoxicological community to modernize statistical practice and ensure that environmental risk assessments remain both reliable and reproducible. As an open-access scientific infrastructure provided entirely free of charge to the scientific community, FXMATE is expected to lower technical barriers, reduce analytical errors, and improve the quality and transparency of ecotoxicological assessments, goals aligning closely with SETAC's mission and good scientific practice.

**4.15.P-Th194 Rethinking NOEC Determination for Quantal Data with Cliff Responses: A Critique of the Cochran–Armitage Test and a Proposed Workflow**
***Zhenglei Gao**[1] and Andreas Solga[2], (1)Data Science, Bayer CropScience AG, Germany, (2)Bayer AG, Germany*

For quantal endpoints, the step-down Cochran–Armitage (CA) trend test is a common route to derive NOECs once monotonicity is confirmed. In cliff-edge response patterns, where no or minimal effects at lower doses followed by a sharp increase, the CA test's linear-trend assumption and default asymptotic p-values can yield false-positive LOECs, particularly when replicate structure is mis-specified. Using a Daphnia magna acute immobilization dataset (OECD 202) with 0% immobility up to 20 mg/L, a small effect at 40 mg/L (6.7%), and a large effect at 80 mg/L (63.3%), the standard CA procedure selected a NOEC of 20 mg/L (asymptotic p=0.006 at 40 mg/L). In contrast, bias-reduced logistic regression, Williams' test, Fisher's exact tests with Holm–Bonferroni adjustment, and an exact CA computed at the replicate level all support a NOEC of 40 mg/L. We investigate two parallel CA adjustments for replicated cliff patterns, trend-consistent overdispersion assessment with Rao–Scott correction and exact CA with replicate-based sample sizes and evaluate their performance alongside logistic regression in an extensive beta-binomial simulation framework using flexible probit-type dose–response curves. Preliminary results generalize the case study, indicating that both CA adjustments