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European Biodiversity Partnership

New Approaches in Determining the Impacts of Chemical Pollution to Protect the Biodiversity of the Baltic Sea

Detect2Protect

Newsletter No. 3

THE MISSION

The **Detect2Protect project** examines the relationships between chemical pollution and biodiversity in the Baltic Sea. Apart from gaining important new knowledge on this linkage the objective is to develop integrated chemical-biological monitoring and assessment frameworks for the marine environment.

www.biodiversa.eu/2023/04/19/detect2protect/

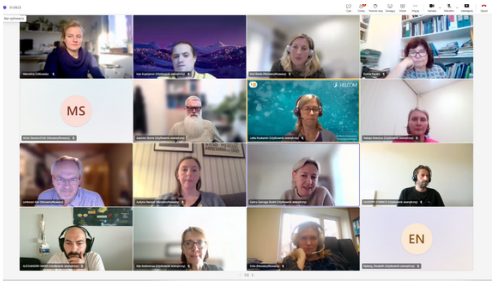
PARTNERS OF THE PROJECT

- Marine and Freshwater Solutions, Finnish Environment Institute, Helsinki, Finland (Syke)
- Department of Marine Systems, Tallinn University of Technology, Tallinn, Estonia (TalTech)
- Laboratory of Ecotoxicology, Nature Research Centre, Vilnius, Lithuania (NRC)
- Institute of Oceanology, Polish Academy of Sciences, Sopot, Poland (IO PAN)
- Marine Monitoring, Latvian Institute of Aquatic Ecology, Agency of Daugavpils University, Riga, Latvia (LHEI)
- Department of Biological and Environmental Sciences, University of Gothenburg, Gothenburg, Sweden (BIOENV)
- Environmental Science, Stockholm University, Stockholm, Sweden (SU)
- Department of Life and Environmental Sciences, Marche Polytechnic University, Ancona, Italy (UNIVPM) - subcontractor

Syke TAL TECH UNIVERSITÀ POLITECNICA DELLE MARCHE GAMTOS TYRIMŲ CENTRAS IBPAN LATVIJAS HIDROEKOLOĢIJAS INSTITŪTS UNIVERSITY OF GOTHENBURG UNIVERSITET STOCKHOLMS

LATEST ACTIVITIES

Detect2Protect project meeting & Advisory Board communication event



13 November 2025, 13:00–15:00 CET (MS Teams)

The event began with a brief welcome and each partner then provided a short status report on ongoing work and recent developments. The updates focused on field activities, laboratory analyses, preliminary datasets and the project's next steps. In the final part of the meeting members of the Advisory Board presented questions, comments and constructive feedback regarding the project's progress, methodologies and future directions. The session concluded with agreement on some follow-up actions and continuation of communication during the finalisation of the project.

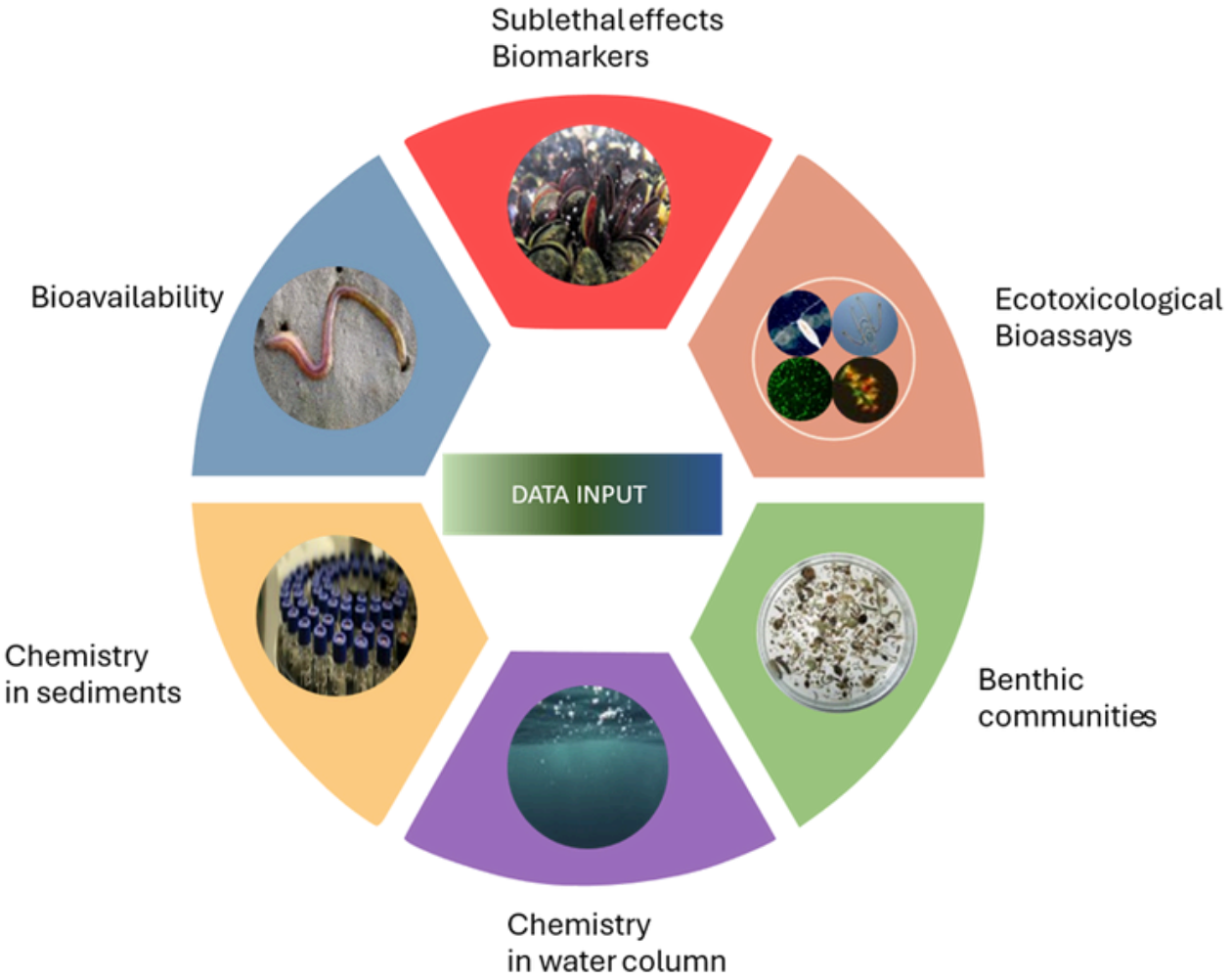
Four scientific events during autumn 2025: Tallinn, Sopot, Vilnius and Riga

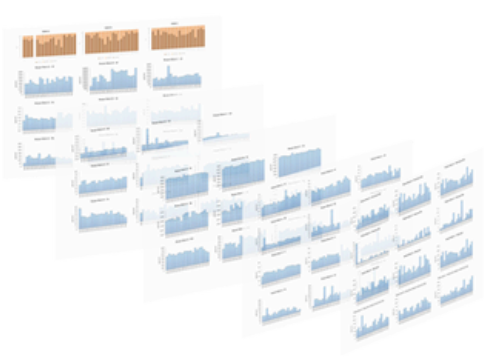
In sutumn 2025, four public science activities in Lithuania, Poland, Estonia and Latvia promoted information and awareness of ecotoxicology and chemical pollution. At **"Erdvėlaivis Žemė" in Vilnius**, a lecture series demonstrated case studies on how seemingly useful substances can harm ecosystems and human health. During **"Ocean of Changes" in Sopot**, a poster presented at a science picnic explained the impacts of pollution on marine organisms, stressing the need for the use of effect-based methods in the Baltic Sea as linked to the UN SDGs. At **"Researcher's Night" in Tallinn**, a TalTech workshop introduced ecotoxicological tools for assessing the health of marine biota and raised awareness of hazardous substances. Finally, at **"Researchers' Night" in Riga** LHEI offered interactive activities for all ages, including demonstrations of aquatic research, microscopy, plastics in the marine environment, alongside examples of innovative solutions such as smart buoys and floating islands.

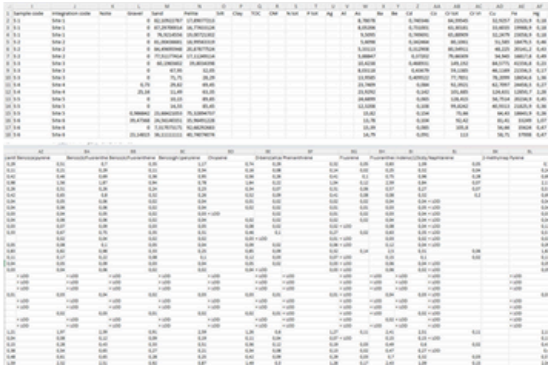
METHODS OF PROJECT DATA INTEGRATION

DATA INPUT

Heterogeneous data on chemicals in abiotic matrices, their bioavailability, sub-lethal effects, ecotoxicological bioassays, and alterations in benthic communities are often difficult to integrate, making it challenging to effectively communicate environmental assessments.



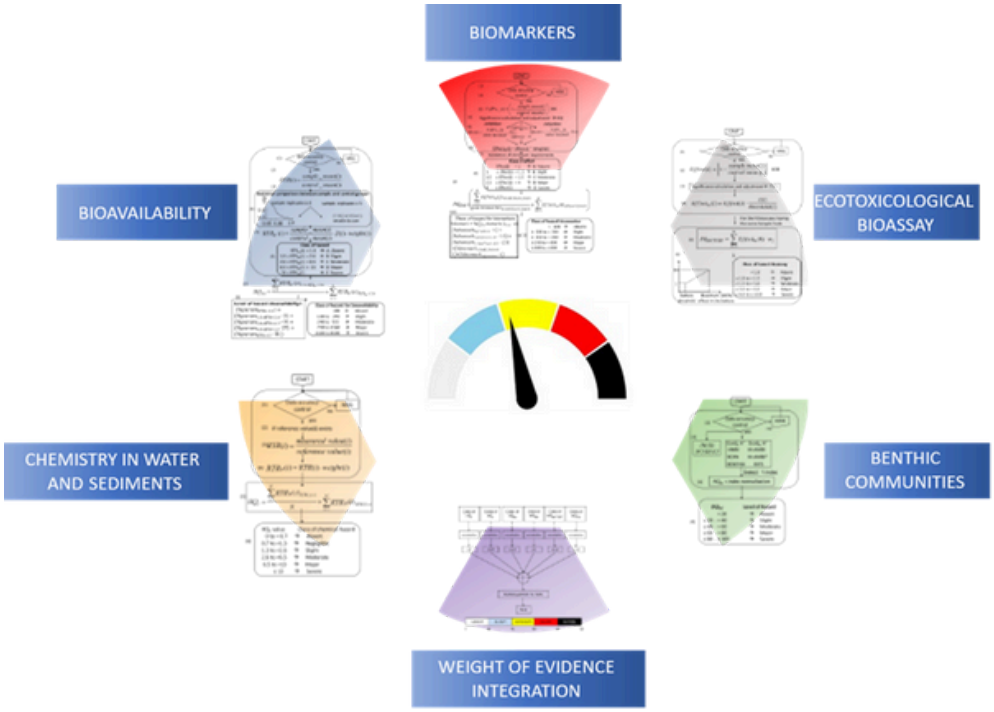




METHODS OF PROJECT DATA INTEGRATION

DATA PROCESSING

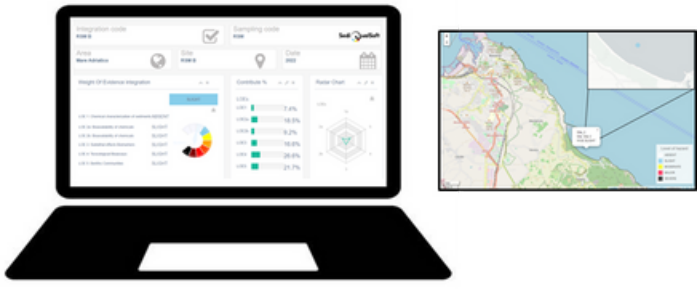
In the **Weight of Evidence (WOE)** framework, data from each typology of investigation (Lines of Evidence, LOE) are processed through dedicated modules, applying standardized workflows, algorithms, and statistical methods to produce comparable hazard indices. The approach uses specific thresholds and weights that reflect the number, magnitude, and typology of chemicals exceeding normative guidelines, and the toxicological relevance of the investigated biological endpoints or ecological indicators, as well as the magnitude of their variations relative to defined thresholds.



The approach assigns a hazard index to each LOE and a classification in one among five classes (Absent, Slight, Moderate, Major and Severe).

WOE INTEGRATION & OUTPUT RESULTS

Finally, all the LOE are integrated in a synthetic index and classification in the five classes, retaining all the scientific robustness but allowing for an easy communication of results, also providing visual outputs, including charts, summaries, and georeferenced maps



Q&A

DETECT2PROTECT PROJECT COORDINATOR KARI K. LEHTONEN

Q: Biomarkers are often described as early warning indicators of environmental stress. How do you bridge the gap between these molecular or cellular responses and larger-scale ecological effects such as changes in biodiversity or community structure?

Photo: © Luukas Myller/Syke

A: Obviously, this kind of a gap cannot be easily bridged with definitive cause-effect relationships due to the extreme complexity of biological and ecological systems including interactions between the parameters measured at the different biological levels. With our current technology that would not be a realistic goal. Instead, we are living in the reality of examining increased probabilities. Biomarkers present us with an important leap forward in detecting and assessing combined effects of environmental stress – including chemical pollution – experienced by organisms. They are direct biological responses of organisms to exposure to physical and chemical stressors such as temperature, salinity or concentrations of chemicals in the environment, not only observations on changes in these factors. Compared to the traditional metrics such as number of species, abundance and biomass of populations and communities biomarkers are far more sensitive, giving instant indications of biological disturbances. After all, most ecological disturbances have their mechanistic base in physiological alterations of individual organisms caused by environmental changes. By including biomarkers in our analytical toolbox we greatly increase the predictability of the potentially ensuing ecological effects generated by situations of increased stress. In few words, we are merging and translating data on abiotic parameters into biological terms to be able to better understand the impacts of environmental changes on populations, communities and biodiversity via observing the health status of individual organisms.

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Q&A

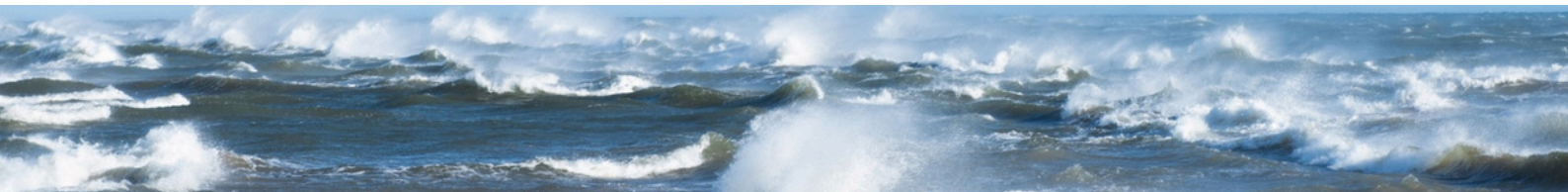
DETECT2PROTECT PROJECT COORDINATOR KARI K. LEHTONEN

Q: Different species and regions may respond differently to pollution. What challenges do you face when interpreting biomarker data across such a wide range of organisms and environmental conditions in the Baltic Sea?

A: Indeed, the Baltic Sea is a special environment with its physical and chemical characteristics, biota and ecology being shaped by many factors. Nevertheless, considerable variability occurs also within many other seas where the same species and community types are not found in every part. Thus, the same challenge exists everywhere and is not limited only to biomarkers but also to, for example, bioavailability and bioaccumulation of chemicals under different conditions. However, especially the constant brackish-water environment of the Baltic Sea poses particular challenges since many organisms are living at their physiological limits of distribution. Whatever the environment, for biomarkers the so-called baseline or normal range of response values has to be established for each species. In addition, some biomarkers can be affected by environmental factors such as salinity or low temperature; thus, it is important to establish the baseline values for larger areas with similar characteristics before one can reliably detect the stress signals caused by pollution. And yes, it still requires some more work but is certainly doable.

Q: The Detect2Protect project intends to integrate biomarkers with eDNA and chemical data. How does this combined approach improve our understanding of cause-effect relationships in marine ecosystems?

A: Integration of chemical data with biomarkers offers us a window to look into the complex maze of exposure and the ensuing biological effects that form the basis of physiological malfunctions, pathologies and diseases. Similar to eDNA, most biomarkers are measured in the laboratory from small environmental samples using modern analytical techniques, which are increasingly rapid. The greater speed of analyses combined with the increased quantity and quality of the information obtained using these new methodologies makes it possible to perform profoundly more comprehensive studies to elucidate the interactions between pollution and biodiversity compared to the traditional approaches. In fact, the technological development is currently so fast that it is foreseen that most of the novel methods of today are in routine use in a decade or so – and, invariably, at a very affordable cost. Using these methods in an integrated way brings us decisively closer to establishing more firmly the role of chemical pollution in ecosystem changes including biodiversity loss.



SAVE THE DATE – ONLINE STAKEHOLDER WORKSHOP ON **MAY 20 2026**

We will host an online stakeholder workshop on 20 May 2026 as the project's final event. It will feature a round-table discussion with experts in marine biodiversity and chemical contamination and representatives of regional marine management and environmental monitoring authorities.

The agenda and registration details will be shared soon. Please save the date and check our website for updates: www.syke.fi/en/projects/detect2protect

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