SEDNET Enewsletter of December 2025

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If you read this, you already know that **freshwater sediments are a sink of contaminants**. If not, now you know. Those contaminants are polycyclic aromatic hydrocarbon[1] (PAH), polychlorinated biphenyls (PCB), pharmaceuticals and personal care products[2] (PPCP), per- and polyfluoroalkyl substances[3] (PFAS), metals[4,5]... This is a non-exhaustive list. Today, **chemical analyses** are the primary approach for studying sediment contamination, in line with the Water Framework Directive (WFD) requirements. However, it is important to complete these with **bioassays** to provide an **effects-based** assessment of sediment quality and to integrate **chemical mixtures** and **bioavailable** compounds. In standardized guidelines, **formulated sediment** is recommended as control (eg. OECD 218). This formulated sediment is mainly composed of quartz sand, kaolin and peat and can be used for soil organisms (nematodes, ISO 10872), aquatic plants (watermilfoils, OECD 239), and benthic macroinvertebrates (amphipods, NF T 90-338-1). In an effort to develop new bioassays with a European amphipod, ***Gammarus fossarum***[6–9], the relevance of the control sediment need to be verified. Two biomarkers, the **feeding rate** expressed in mg of food consumed per organism per day (AFNOR XP T 90-722-3) and the **reproduction** expressed as the number of embryos per female (AFNOR XP T 90-722-2), have been measured on gammarids exposed to **formulated sediments and natural sediments** from either Lake Geneva or dredging.

Concerning formulated sediments, results show a good reproducibility between controls but there is a high variability within conditions for the feeding rate (coefficient of variation up to 49%). The second result refers to the interpretation of the toxicity of natural sediments by comparing them to the control (i.e., formulated sediment). Respectively one and three sediments are considered as toxic regarding the feeding rate and the reproduction tests. Nevertheless, the feeding rate of the control is below most natural sediments data and usually feeding behaviour is a more sensitive biomarker than reproduction[10]. Therefore, the formulated sediment is compared to uncontaminated natural sediments, selected among 127 natural sediments tested, when metals, PCB and PAH concentrations were under the associated Threshold Effect Concentration[11]. The control remains under the uncontaminated natural sediment which indicates that formulated sediment is not adapted for feeding rate measurement.

Overall, after validating bioassay protocols for both biomarkers on more than 130 natural sediments, we show that ***Gammarus fossarum* is a promising organism to assess freshwater environmental sediment toxicity**. In order to refine the interpretation of results, we are currently establishing **threshold values**.

The work presented on this poster is a part of my PhD project, which is included in R&D project conducted by a French research institute (INRAE) and a French company (Biomae, subsidiary of CARSO Group).

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Biomae & RiverLy teams for their technical support;

CIPEL for funding the sampling campaign on Lake Geneva and to F.-A. Forel Department (University of Geneva);

the Swiss Centre for Applied Ecotoxicology (Ecotox Centre) for organising and providing logistical support

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Poster & photos:

BIOASSAYS WITH THE EUROPEAN AMPHIPOD *GAMMARUS FOSSARUM* TO ASSESS FRESHWATER SEDIMENTS TOXICITY

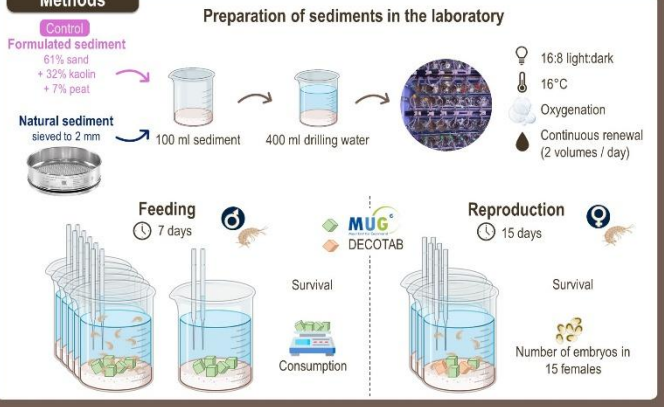
Introduction

Sediments are a **sink of contaminants** such as polycyclic aromatic hydrocarbon (PAH), polychlorinated biphenyls (PCB), pharmaceuticals and personal care products (PPCP), per- and polyfluoroalkyl substances (PFAS), and metals. **Toxicity monitoring** complements chemical monitoring of sediments, which relies on only a few substances and whithout any notion of **impact**. The test organism currently used for **amphipods** is the *Hyalella azteca*, a north-american species. In **Europe**, the model amphipod is ***Gammarus fossarum*** and **standards** already exist for measuring biological responses. This is why we aim to propose this species to develop new **bioassays** to assess environmental **sediments toxicity** in Europe, based on two biological responses : **feeding rate and reproduction**.

Objectives

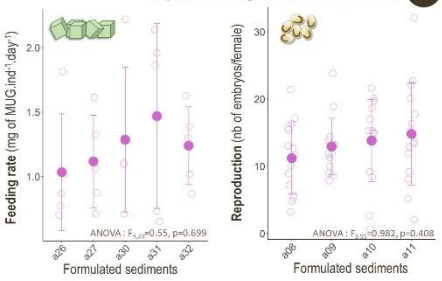
1. Reproducibility of the lab control : formulated sediment
2. Proof of concept of the sensitivity of responses to identify toxic sediments through case studies

Methods



Results

Reproducibility of control sediment 1

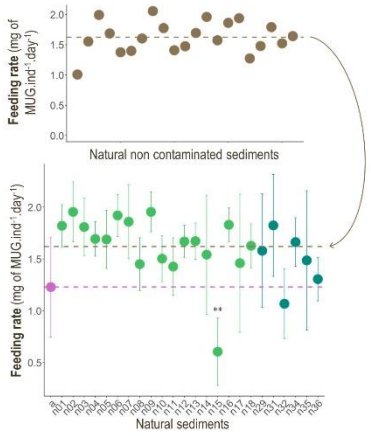


No significant difference between controls so we can use a laboratory reference → **average control**

However, **high variability** within condition for **feeding rate** → **relevance of formulated sediment** on this biological answer ?

Discussion

Feeding rates of **non contaminated sediments** [selected if metals, PCB and PAH centrations under **Threshold Effect Concentration** (MacDonald et al., 2000)]

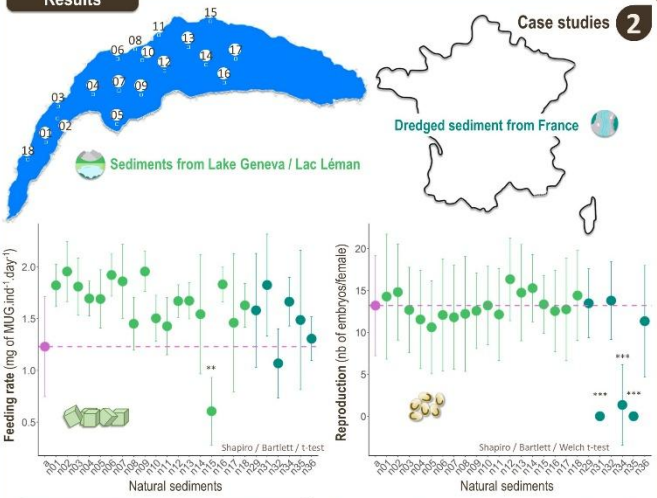


Better sediment discrimination

→ The **formulated sediment** may not be a good control

Results

Case studies 2



Feeding inhibition for only **1 lake** sediment

Impact on fecundity for **3 dredged** sediments

However, the **feeding rate** of the control is **below natural sediments** while usually **feeding** behaviour is a **more sensitive** biomarker than reproduction (Jubeaux et al., 2024)

Conclusions

- ✓ **Protocol validated** : *Gammarus fossarum* allows the assessment of environmental sediment toxicity due to its good reproducibility
- ✓ **Formulated sediment is reproducible** and can be used as a laboratory control for **reproduction**
- ✗ **Impact** of formulated sediment on **feeding** biomarker

Perspectives

New control
or
Threshold value ?

Standardisation

Acknowledgement to **Biomae** & **Inrae** teams for their technical support ; **CIPEL** for funding the sampling campaign on Lake Geneva, and to **F.-A. Forel Department (University of Geneva)** ; the **Ecotox Centre** for organising and providing logistical support

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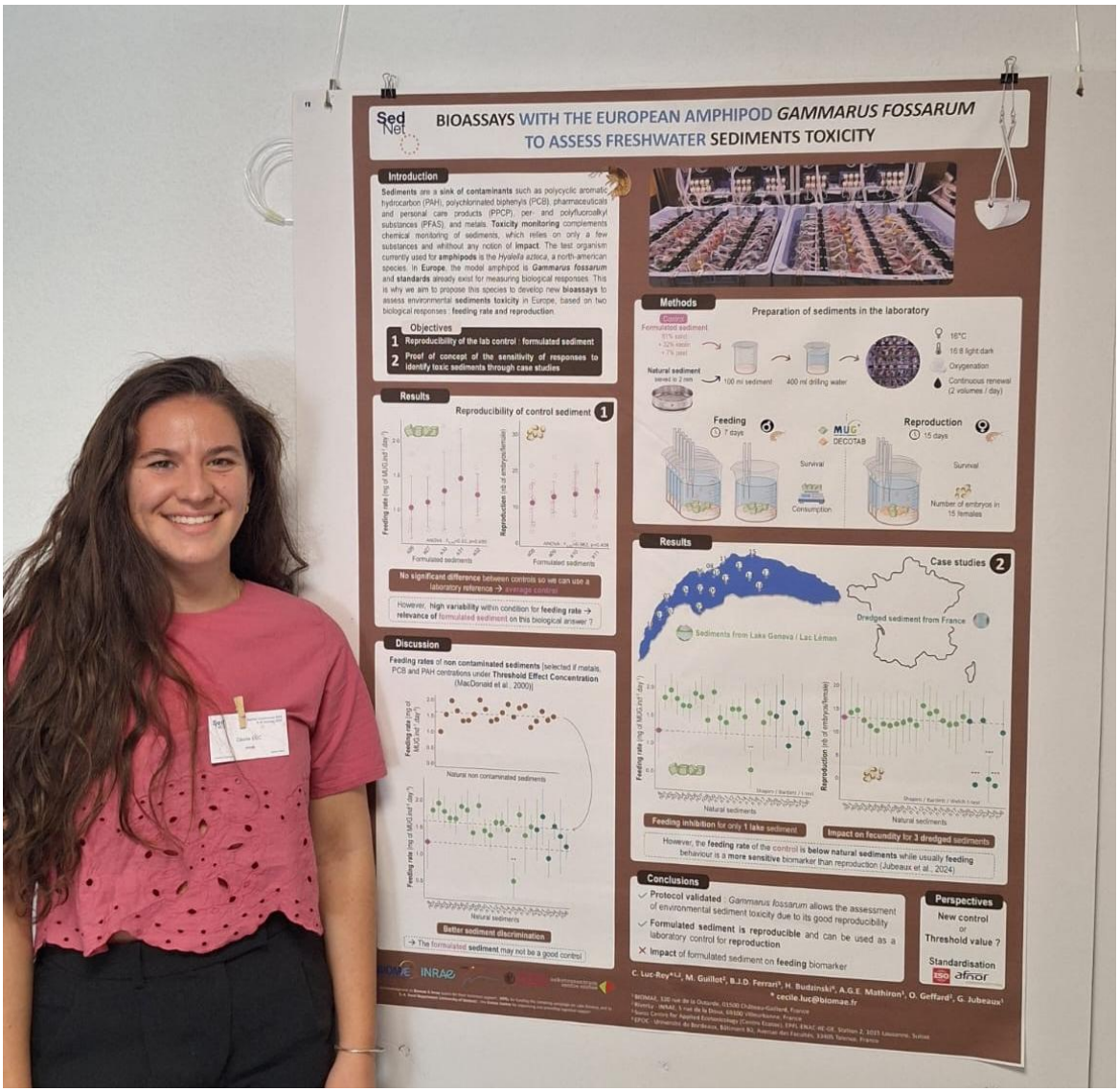

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