Active biomonitoring using the freshwater crustacean Gammarus fossarum: an operational tool to monitor chemical contamination and toxicity in continental surface waterbodies

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BIOMÆ Biomonitoring Aquatic Environment
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CONTEXT & CHALLENGE

Standard approaches used to monitor the quality of continental surface water
- Chemical analysis of water → Toxicity? Bioavailability of chemical substances? …
- Ecological indicators → Sources of pollution ? (habitat, chemicals, …), …

Need of complementary approaches like ecotoxicological assays to monitor contamination and toxicity of aquatic environments

OBJECTIVES

Development of ACTIVE BIOMONITORING with a freshwater crustacean

1. Method for *in situ* bioassays with *Gammarus fossarum*
2. Method for endpoints interpretation
3. Applications for field monitoring

1. METHOD for *IN SITU* BIOASSAYS with *Gammarus fossarum*

1. One natural source of organisms
= Reference population (GAMMAREF®)

2. **Acclimatization**
Laboratory controlled conditions during 2 weeks

3. **Calibration of individuals:** size, sex, reproductive status, …

4. **Caging of individuals**
Launch of bioassays

5. **Transport**
to field stations

6. **Field exposure**
during 1 or 3 weeks
with continuous temperature control

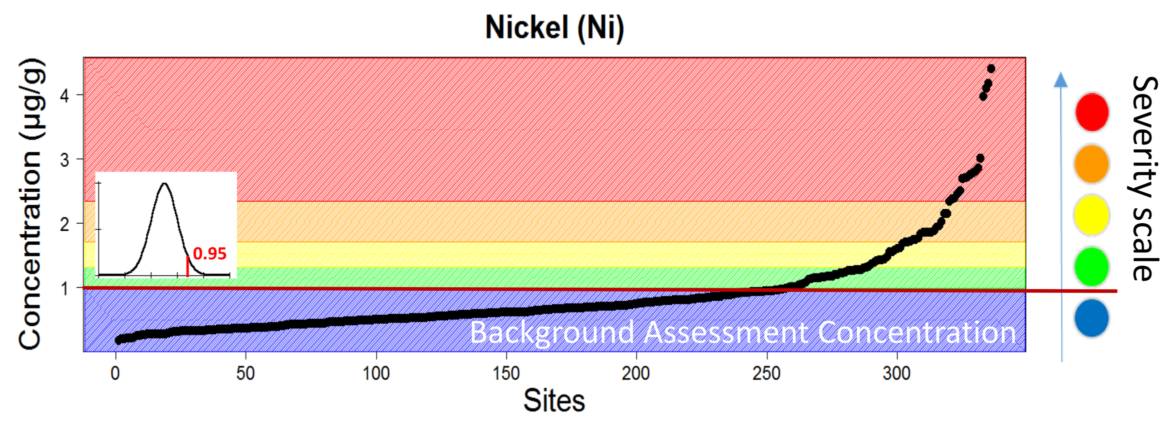
7. **Transport**
to laboratory

8.

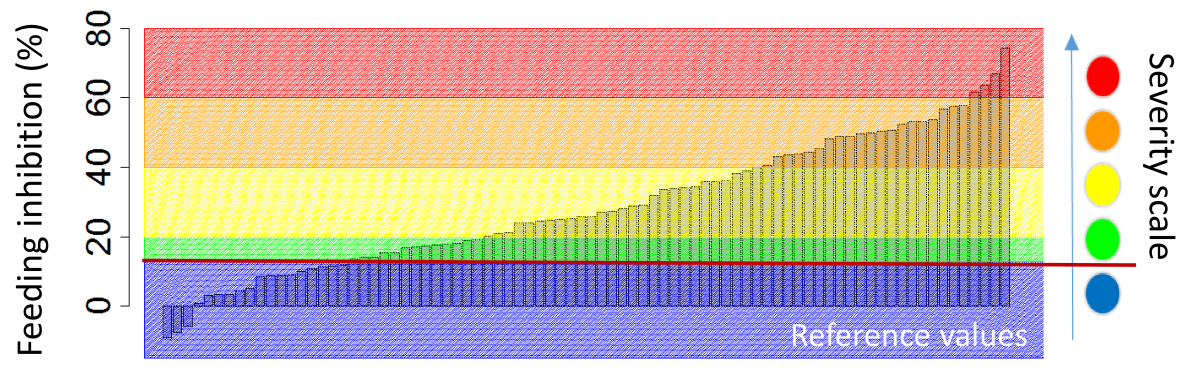
ENDPOINTS
- **Bioaccumulation** : bioavailable concentration of micropollutants (metals and organic compounds)
- **Ecotoxicological effects** : survival, feeding, AChE, reproduction and endocrine disruption

2. METHOD for ENDPOINTS INTERPRETATION

- **Bioaccumulation THRESHOLDS**
defined from a large scale field experiments (database)
→ Example for bioaccumulation of Nickel

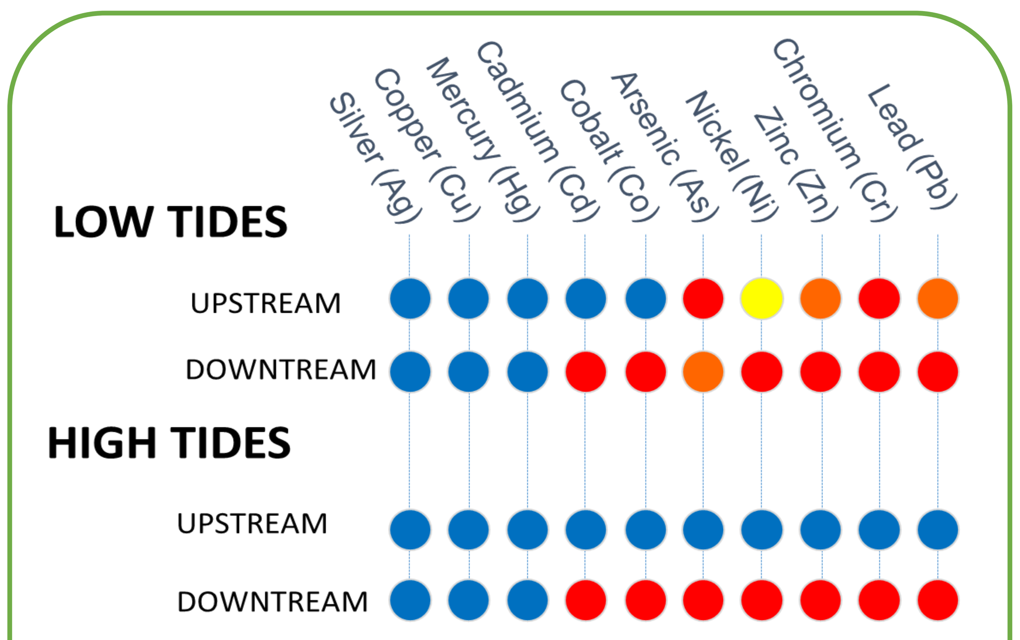


- **Ecotoxicological effects THRESHOLDS**
defined from both laboratory and field experiments (database)
→ Example for feeding inhibition



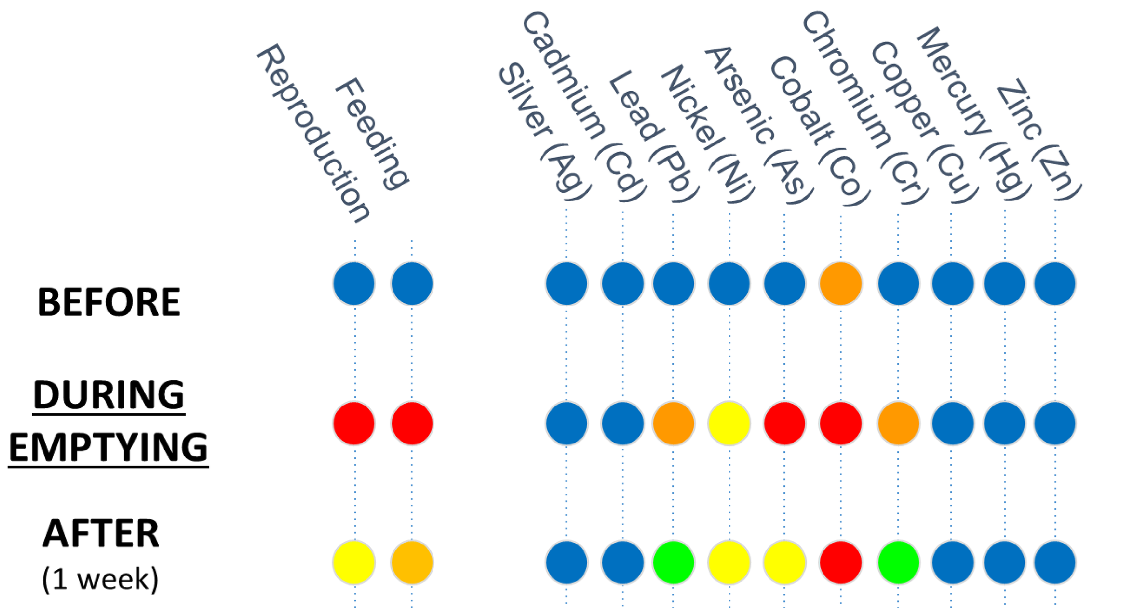
3. APPLICATIONS for FIELD MONITORING

INDUSTRIAL DISCHARGE



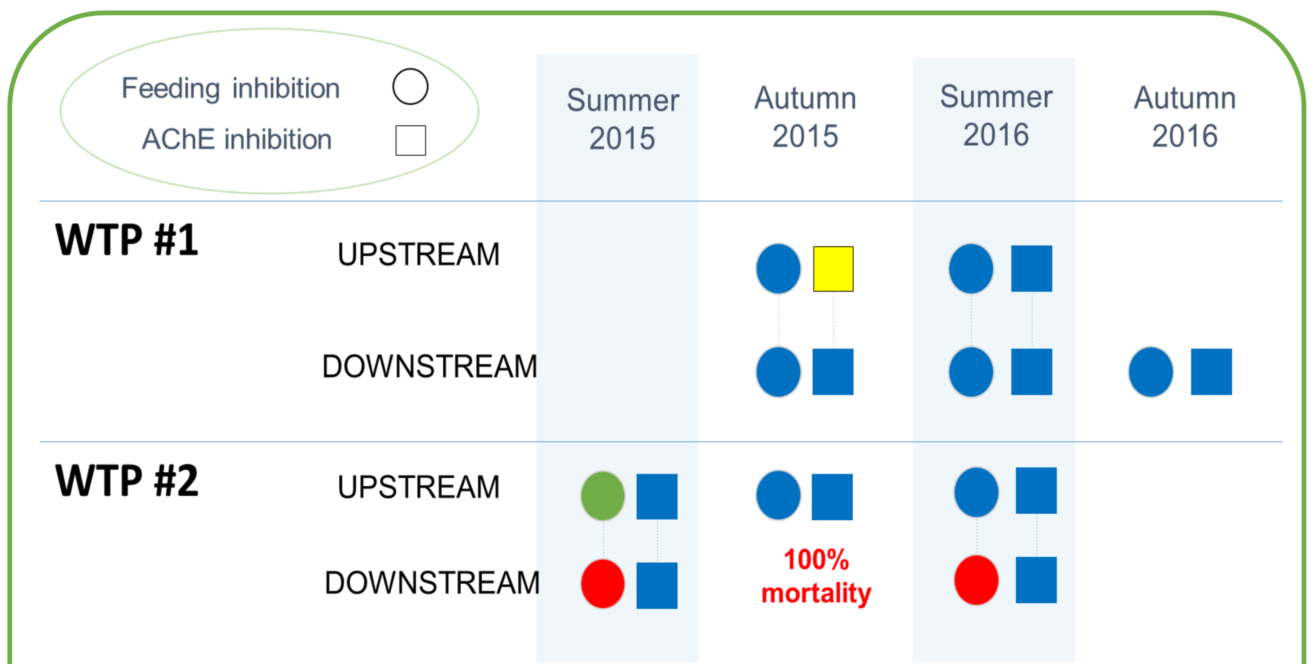
High contamination due to metallic discharge
Temporal variation (dilution due to outflow)
Dilution after confluence (*data not shown*)

HYDRAULIC STRUCTURE (dam emptying)



Before, low contamination and no toxicity
During dam emptying, contamination/toxicity increase
Contamination/toxicity decrease after one week

WASTEWATER TREATMENT PLANTS



WTP#1 : no toxic impact ; upstream neurotoxicity (AChE)
WTP#2 : toxic impact, especially in autumn
(strong low-water period)

CONCLUSION

In situ bioassays: relevant and complementary approach for biomonitoring

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Selected organisms (versus passive monitoring) to control biological confounding factors
Realistic and integrative exposure (versus laboratory exposure)
Proposition of reference values integrating effects of environmental confounding factors
Spatial and/or Temporal gradients with a « one-week » resolution scale
Operational for large scale deployment

For more information

Wide range of applications for public managers and industrials

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REGULATION → Compliance to EQS in biota (WFD, 2013)
Spatial and temporal comparison of stations into monitoring networks
Impact studies of industrials and hydraulic structures
Assessment of WTP treatment efficiency

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