



# Innovative diagnosis of the quality of aquatic environments

**Assessment of chemical contamination** of aquatic environments in the biota

**Analysis of the toxic effects** of contaminants directly in aquatic environments



## BIOMÆ's expertise

*A high-value service provided to our clients*

**BIOMÆ provides tools to diagnose aquatic environments based on 10 years of research conducted by IRSTEA (Lyon-Villeurbanne Ecotoxicology Laboratory).**

*BIOMÆ S.A.S., a young innovating company, is positioned in the sector of active biomonitoring of continental surface waters (rivers, canals, and lakes).*

*BIOMÆ proposes the first active in situ bioassays designed to measure bioavailable chemical contamination and toxicity using a sentinel shrimp, Gammarus fossarum, transplanted and exposed in the receptor environment by direct caging. Combined with modeling approaches, the measurements taken are comparable in space and time.*

**BIOMÆ's offer targets:**

- ▶ *Public sector water managers (water agencies, towns and cities, departmental councils, river associations, etc.) to conduct their campaigns monitoring the quality of aquatic environments.*
- ▶ *Industries involved in installations classified for environmental protection to carry out their impact studies on the receptor environment.*

**Our objective: diagnose the effects of micropollutants directly in aquatic envi-**



**Active bioassays performed using a ubiquitous and relevant pollutant-sensitive species, the gammarid**

**Genotyped gammarids** raised in aquaculture and confined to the laboratory before caging



**Calibration of organisms** to control biological confusion factors

**A reproducible transplantation and immersion *in situ* protocol** for greater environmental realism

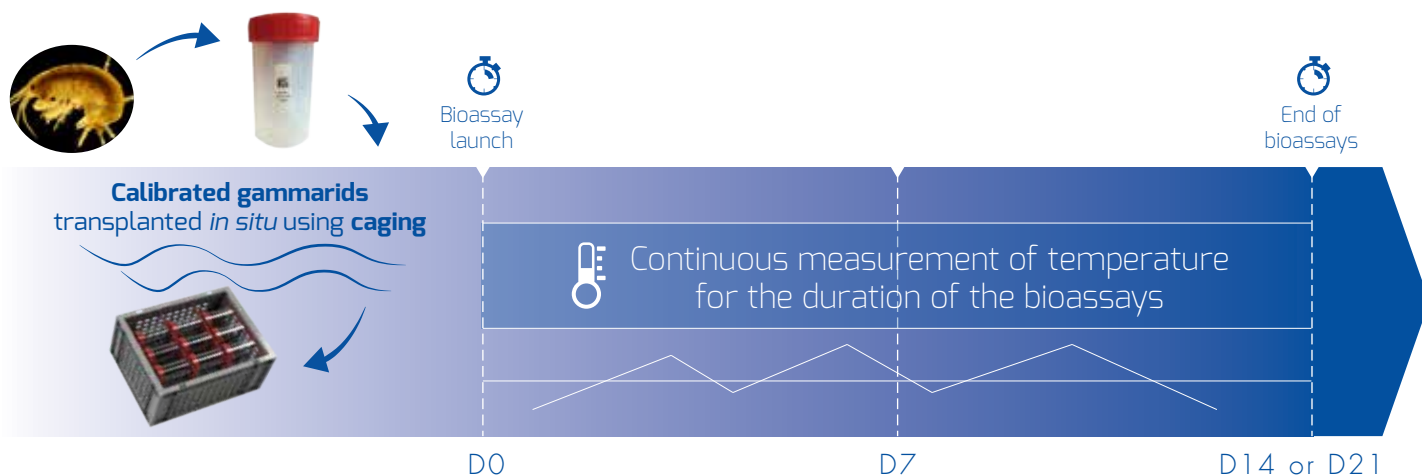


**Early, robust, and sensitive biomarkers** (bioaccumulation and toxic effects)

**Expertise to provide operating systems** allowing reliable interpretation and comparisons of results at large scale



# ACTIVE BIOASSAY PROTOCOLE



## Micropollutant bioaccumulation (7 days)

- Organic
- Metals

## Toxicity bioassays

- Feeding (7 days)
- Neurotoxicity (7 days)
- Reprotoxicity and molting (14 or 21 days)

## End of bioaccumulation

End of feeding bioassays and neurotoxicity

## End of reproduction and molting bioassay

# MEASUREMENT OF BIOAVAILABLE CHEMICAL CONTAMINATION

## Measurement of bioaccumulation (Bioavailable fraction of contaminants)



Freeze-drying of gammarids after exposure to environment and chemical analysis using mass spectrometry

## DOSAGE OF MICROPOLLUTANTS

heavy metals, pesticides, hydrocarbons, drugs, ...

- ✓ A reproducible and robust bioassay
- ✓ COFRAC-accredited analysis methods
- ✓ Gross concentrations bioaccumulated in the gammarid
- ✓ Interpretation of concentrations based on a field reference developed by IRSTEA researchers (notion of bioavailable contamination threshold for each substance)



# MEASUREMENT OF TOXIC EFFECTS OF MICROPOLLUTANTS

directly in aquatic environments

## ANALYSIS OF MARKERS AT 7 DAYS

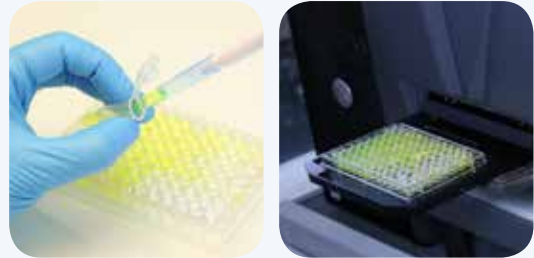
### Effect on feeding



Measurement of leaf consumption, correcting for size and temperature effect

### Neurotoxic effect

(acetylcholine esterase, AChE)



Biochemical dosage of enzyme activity of AChE

### GENERAL TOXICITY

### SPECIFIC TOXICITY

(carbamate and organophosphorus insecticides)

## ANALYSIS OF MARKERS AT 14 OR 21 DAYS

### Effect on reproduction and molting



Biometric measurements  
(fertility, molting cycle, ovocyte growth)

### GENERAL TOXICITY

Desynchronization of molting cycle and ovocyte growth

### SPECIFIC TOXICITY

(Endocrine disruption\*)

- ✓ Reproducible and robust bioassays
- ✓ Markers of sensitive effects used to characterize toxic impact
- ✓ Unique expertise in interpreting markers based on toxicity thresholds developed by IRSTEA researchers

# BIOMÆ's offer

at our clients' side for...

**In situ bioassays that can be routinely used for...**



## Monitoring aquatic environments

- Qualification and prioritization<sup>1</sup> of sites depending on their bioavailable contamination & toxicity
- Follow-up of bioavailable contamination & toxicity trends
- Measurement of priority substances in the biota (DCE -2013) and/or specific substances upon request

(1) IRSTEA/Biomæ field reference 



## Checking pollution in the receptor environment

- Assessment of corrective actions (investigative monitoring, etc.)
- Structure inspection (dam, storm spillway, construction work, etc.)
- Environmental impact study (potential polluting installations: industrial sites, WWTP, etc.)

**Protocols adapted to our clients' needs...**

### IN SITU MEASUREMENTS

UPSTREAM / DOWNSTREAM (close or far downstream)	UPSTREAM / DOWNSTREAM	MULTIPOINTS	BEFORE / AFTER a specific event
from industrial, mining, WWTP, etc.	rainwater outlet or storm drainage	monitoring campaign or large-scale assessment	dam release, canal dredging, etc.



Biomonitoring Aquatic Environment

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## A structuring ecosystem for development

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