

Effects of pollutants on
populations and
communities of North Sea
benthic organisms
(ECOTOX2)

Partners

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 - Ecology of Aquatic Ecosystems (Ch. Lancelot)
- Universiteit Antwerpen
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- Université de Liège
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Users

- Vlaams Instituut voor de Zee: Jan Mees
- Management Unit of the Mathematic Model of the North Sea (MUMM): Georges Pichot
- Greenpeace: Roland Moreau

Context

Contaminants of high concern in the North Sea (QSR 2000)

- Metals: Cd, Pb, Hg, Zn
- Endocrine disruptors: cPCB, dioxins, furans, PAH, PBDE
- Interactions with increased levels of organic matter

Context

Biomarkers

- Tools for assessing the effects of contaminants of high concern are requested
- Biomarkers (biological responses indicating the exposure to or the effects of a contaminant in an organism) are recommended
- Most current biomarkers consist in responses ranging from biochemical to individual levels

**Meaning at the population or
community level?**

Objectives

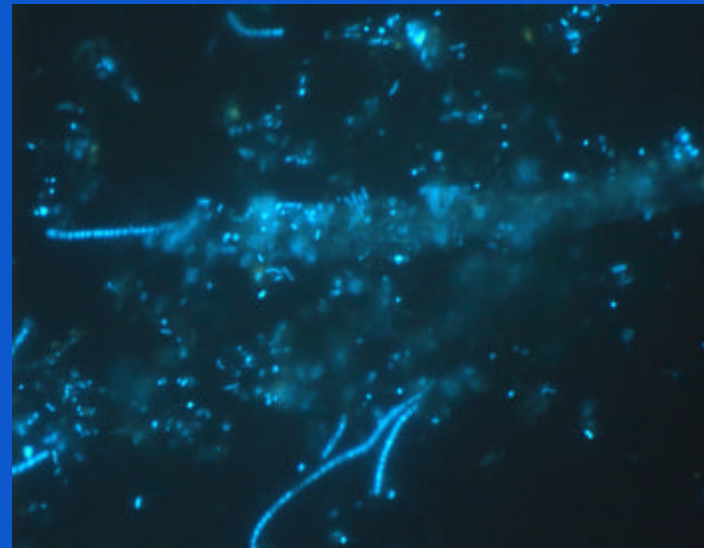
- To determine if the effects of contaminants of high concern monitored from genetic to individual levels result in significant impairments of populations or communities of benthic organisms
- To assess if early signals provided by biomarkers effectively predict these ecological effects

Strategy



Representative benthic organisms

- *Asterias rubens*
- *Mytilus edulis*
- Sediment-associated microbial communities



Strategy

- Field studies
- Mesocosm experiments

Field studies:

Actual effects in situ

- Analysis of contaminants
- Responses of selected biomarkers
- Determination of population or community parameters:
 - Population dynamics
 - Indices of storage and reproductive organs
 - Gametogenesis and reproductive capacity
 - Biodiversity of microbial communities

Mesocosm experiments: Effects of specific contaminants

- Contaminant concentrations fixed
- Measurements of selected biomarkers
- Measurements of relevant population or community parameters
 - Growth of juveniles
 - Growth and metamorphosis of echinoderm larvae (eutrophication linked micro-algae and contaminants)
 - Biodiversity and abundance of sediment-associated microbial communities

Analysed contaminants

- Metals: Cd, Pb, Cu, Zn
- cPCBs
- PCDDs, PCDFs
- PAHs
- PBDEs: ?
- Organic matter

Measured biomarkers

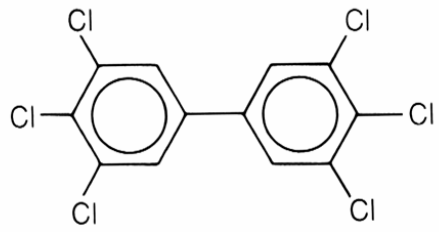
- Metallothioneins
- Cytochrome P-450 1A1
- Immune activity
- Embryotoxic assays
- Differential gene expression analysis
- Bacterial cell stress gene profiling assay

First results

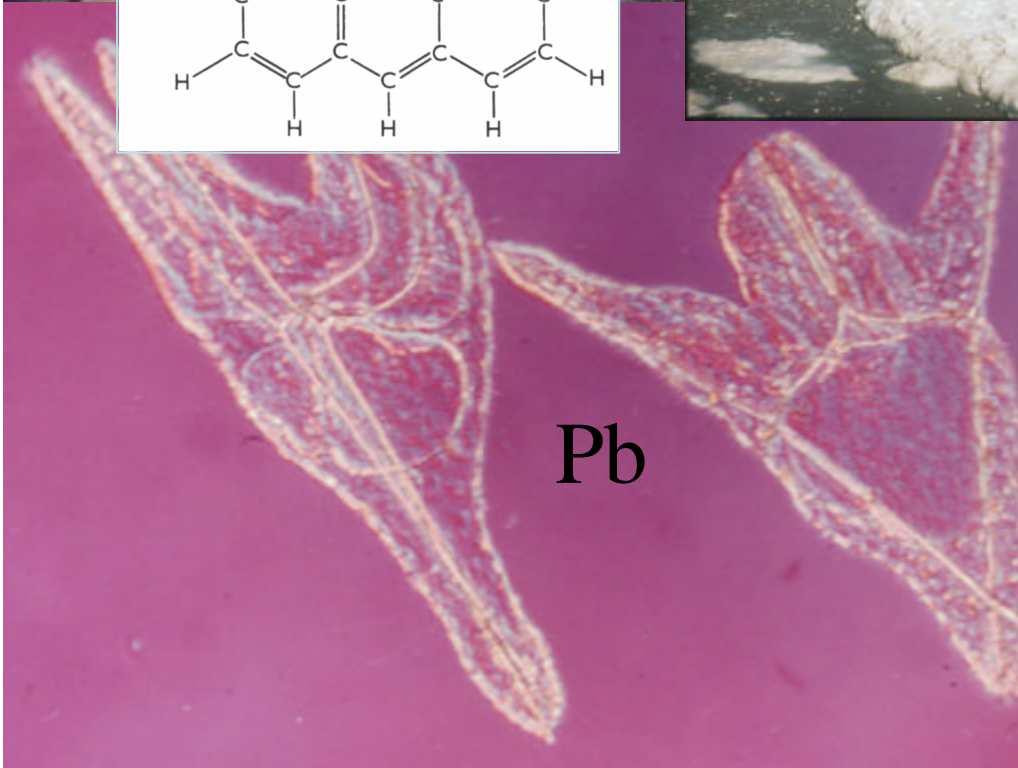
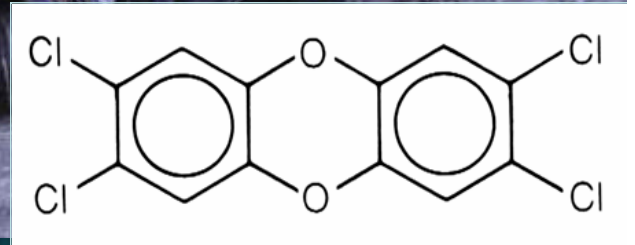
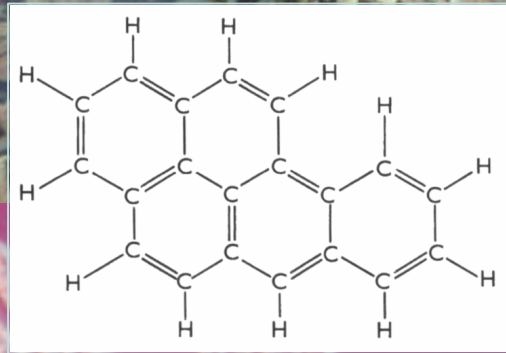
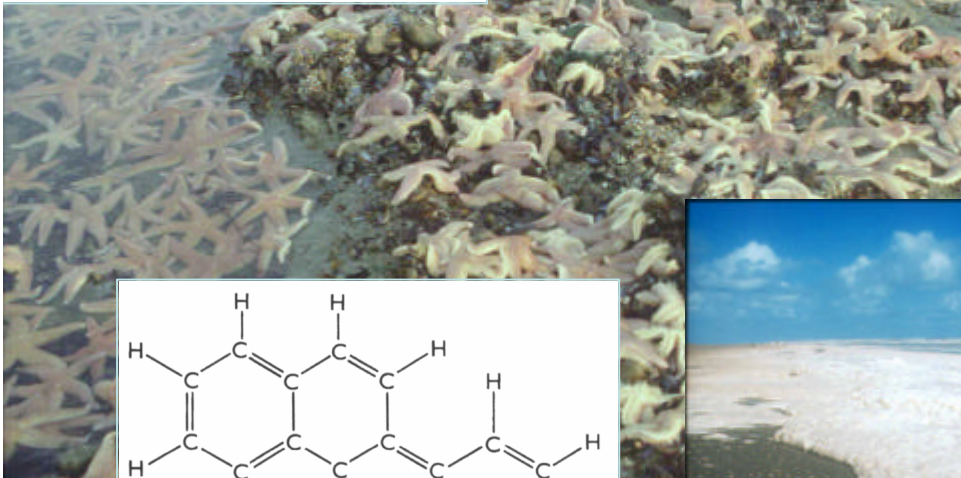
- *Asterias rubens* populations appear very resistant to contaminants despite effects recorded from biochemical to individual levels
- Pharmacodynamic models were developed to link exposure, accumulation and effects of microcontaminants in *Mytilus edulis*
- Specific sediment-associated bacterial communities are observed in metal contaminated sites

Exploitation of the results

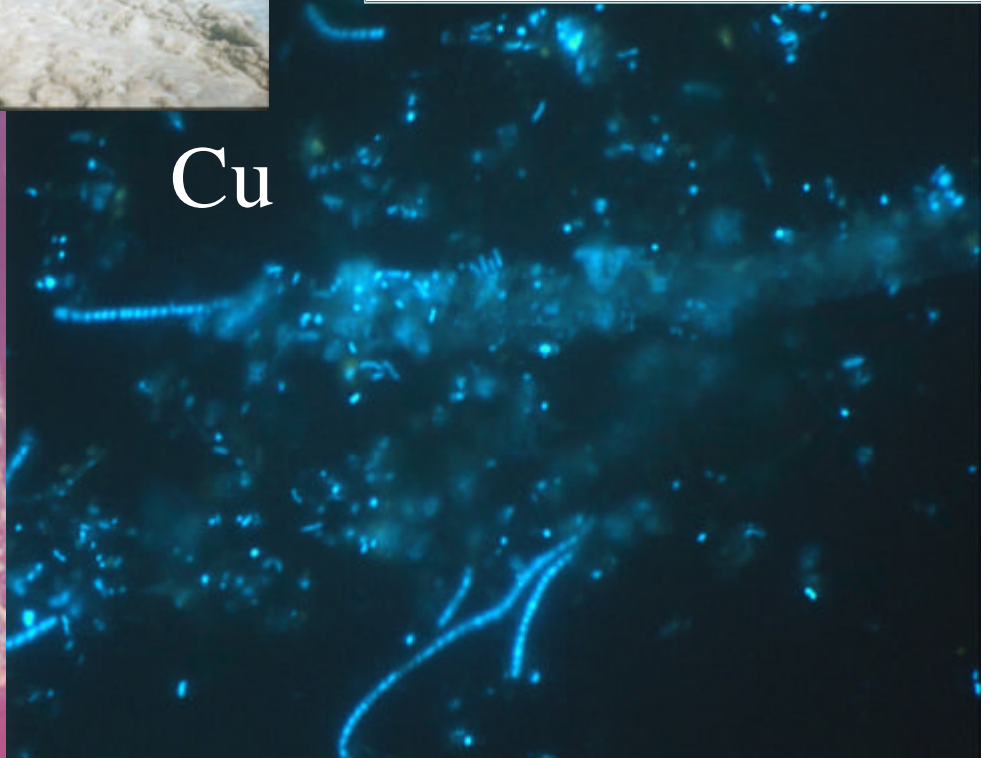
- Scientific community
- Regulatory authorities and Consulting offices:
 - Assessment of the effects of contaminants at ecologically-relevant levels
 - Assessment of biomarker signification
- NGO and public:
 - Circulation of scientifically-based information



Cd



Pb



Cu