BIOASSAYS FOR INVESTIGATIVE MONITORING IN THE CONTEXT OF THE WFD : ASSESSMENT OF WASTE EFFLUENTS AND RECEIVING WATER BODIES

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Introduction

Bioassays are especially suitable for investigative monitoring in the context of the Water Framework Directive. Indeed, they are important tools to ascertain the causes of a water body failing to achieve the environmental objectives. They integrate all contaminants effects including unknown substances and breakdown products contained in environmental samples and wastewaters. They also take into account any additive and synergistic effects. These properties indicate that they can be good diagnostic tools allowing the poor ecological quality causes to be determined and traced back to source.

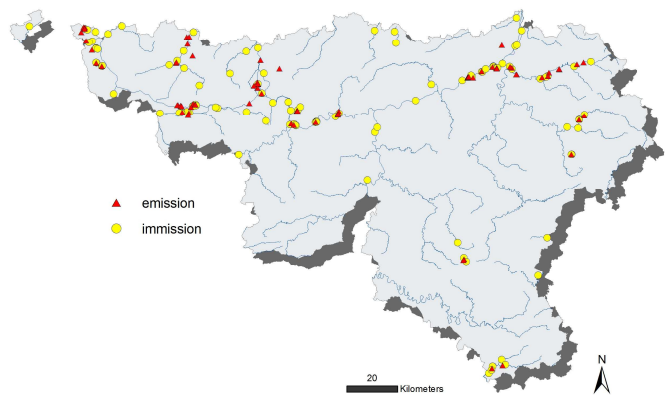
Materials and methods

In Wallonia (one of Belgium's 3 Regions), a monitoring using bioassays is being carried out for many years. It combines ecotoxicological and physico-chemical measurements at emission and immission. We use a battery of short and long term bioassays with the bacteria *Vibrio fischeri*, the alga *Pseudokirchneriella subcapitata*, the rotifer *Brachionus calyciflorus* and the microcrustacea *Daphnia magna*.
79 industrial effluents (▲) and 112 surface water stations (●) were investigated between 2000 and 2009 and sampled 6 times a year (emissions) or 4, 6 or 13 times a year (immissions ; some stations have been studied during several years).

Test battery used :

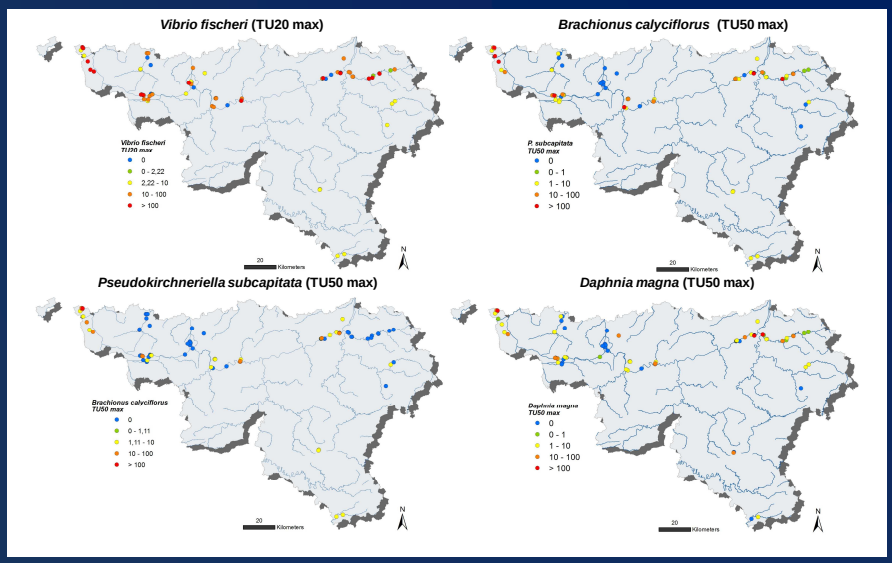
Function	Species	Test type	Refering to	Incubation	End point	Emission	Immission
Decomposer	*Vibrio fischeri*	Acute	NVN 6516	30 min	Luminescence inhibition	X	X
Producer	*Pseudokirchneriella subcapitata*	Chronic	ISO 8692	48 h	Growth rate inhibition	X	X
Consumer	*Brachionus calyciflorus*	Chronic	ISO 20666	48 h	Reproduction inhibition	X	X
	Daphnia magna	Acute Chronic	ISO 6341 ISO 10706	48 h 16 j.	Immobilization/mortality Reproduction inhibition	X	X

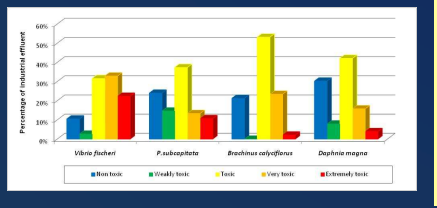
Investigative monitoring ecotoxicity network (2000-2009)



Results and discussions

Emissions
Intrinsic toxicity (Toxicity Units)



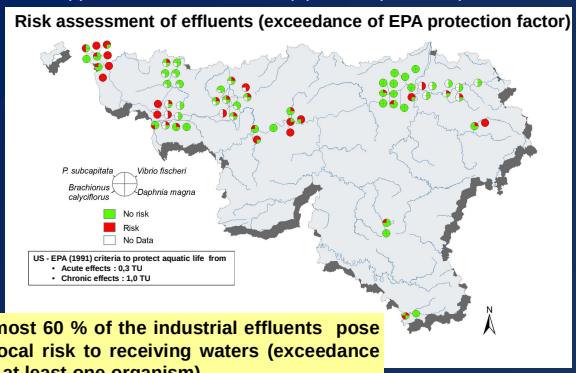


Species employed in the monitoring give complementary information : some are non reactive while others are reactive.
***Daphnia magna* and *Vibrio fischeri* appear to be, respectively, the less and the most sensitive species (even in terms of TU50 for *V. fischeri* ; data not shown).**
Amongst the 79 industrial effluents studied, 30 % were classified as very to extremely toxic, 40 % as toxic and 30 % as non to weakly toxic.

Emissions
Risk assessment

The risk posed by industrial effluent on receiving water bodies was assessed in a "worth case" basis and is based on (i) maximal toxic load for each organism, (ii) minimal river flow and (iii) EPA aquatic life protection factor.

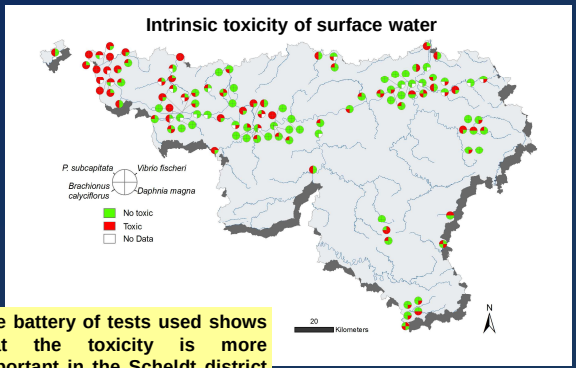
Risk assessment of effluents (exceedance of EPA protection factor)



Almost 60 % of the industrial effluents pose a local risk to receiving waters (exceedance for at least one organism).

Immissions
Intrinsic toxicity (toxicity units)

Intrinsic toxicity of surface water



The battery of tests used shows that the toxicity is more important in the Scheldt district (North-West of Wallonia).

Conclusions

These results underline the interest of using a bioassay battery to characterize industrial effluents and surface water. Complementary to physico-chemical data, these bioassays give additional information and also enable investigating the risk posed by industrial effluents on receiving water bodies. Therefore, bioassays are particularly useful for investigative monitoring to help determine the reasons for restricted ecological status. They are also helpful for the elaboration of management plans and their effectiveness assessment, both imposed by the Water Framework Directive.

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