

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 the effects of all the contaminants including unknown substances and breakdown products contained in environmental samples and wastewaters. They also take into account any additive and synergistic effects. These properties show that they can be good diagnostic tools which enable the causes of poor ecological quality to be determined and traced back to source. They can also help to early assess the effectiveness of management measures.

Material and methods

In the Walloon Region of Belgium, an effect directed active monitoring using bioassays is being carried out for many years. It combines ecotoxicological measurements at emission and immission and physico-chemical measurements. We use a battery of short term and chronic bioassays with the bacteria *Vibrio fischeri*, the alga *Pseudokirchneriella subcapitata*, the rotifer *Brachionus calyciflorus* and the microcrustacea *Daphnia magna*.

EMISSION (red triangles):

78 industrial effluents were investigated from 2000 to 2008 Wastewaters were sampled 6 times a year.

IMMISSION (blue and magenta dots):

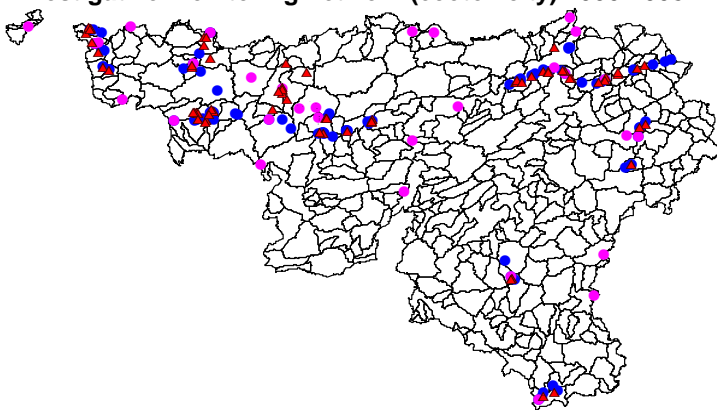
113 locations distributed along the river water bodies receiving industrial wastewaters, upstream and downstream of all the discharges, have been examined in 4 sampling campaigns from 2000 to 2008.

TEST BATTERY:

Function	Species	Type	Referring to	Incubation	End Point
Decomposer	<i>Vibrio fischeri</i>	acute	NVN 6516	30 min	Luminescence inhibition
Producer	<i>Pseudokirchneriella subcapitata</i>	chronic	ISO 8692	72 h	Growth rate inhibition
Consumer	<i>Daphnia magna</i>	Acute	ISO 6341	48 h	Immobilisation / Mortality
	<i>Brachionus calyciflorus</i>	chronic	NF T90-377	16 j.	reproduction



Investigative monitoring network (ecotoxicity) 2000-2008



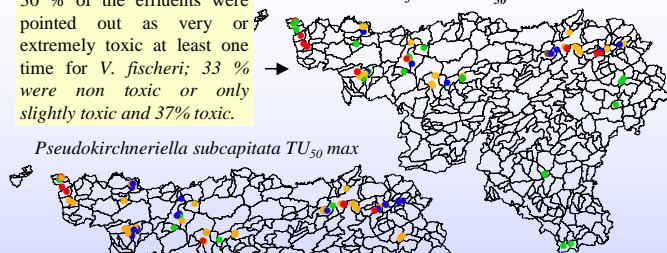
Results

EMISSIONS

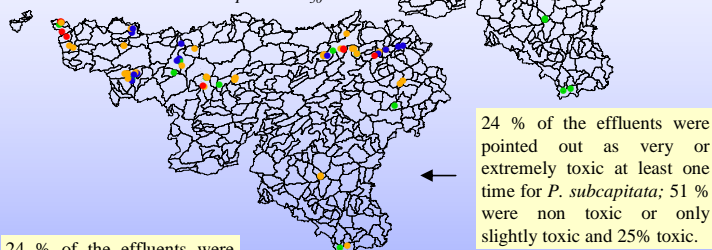
INTRINSIC TOXICITY (Toxicity Units)

30 % of the effluents were pointed out as very or extremely toxic at least one time for *V. fischeri*; 33 % were non toxic or only slightly toxic and 37% toxic.

Vibrio fischeri TU₅₀ max

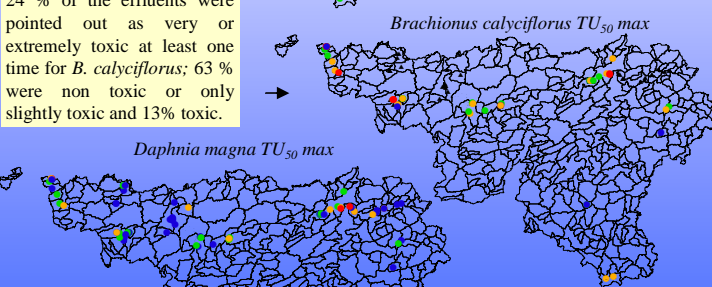


Pseudokirchneriella subcapitata TU₅₀ max

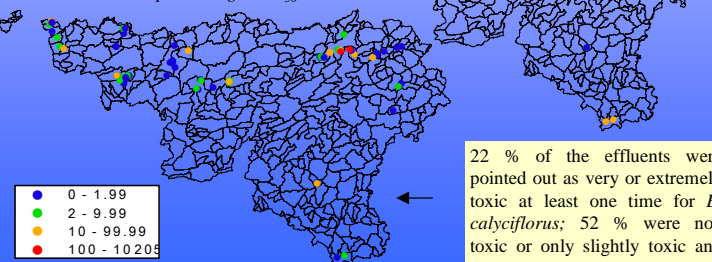


24 % of the effluents were pointed out as very or extremely toxic at least one time for *P. subcapitata*; 51 % were non toxic or only slightly toxic and 25% toxic.

24 % of the effluents were pointed out as very or extremely toxic at least one time for *B. calyciflorus*; 63 % were non toxic or only slightly toxic and 13% toxic.



Daphnia magna TU₅₀ max



22 % of the effluents were pointed out as very or extremely toxic at least one time for *B. calyciflorus*; 52 % were non toxic or only slightly toxic and 16 % toxic.

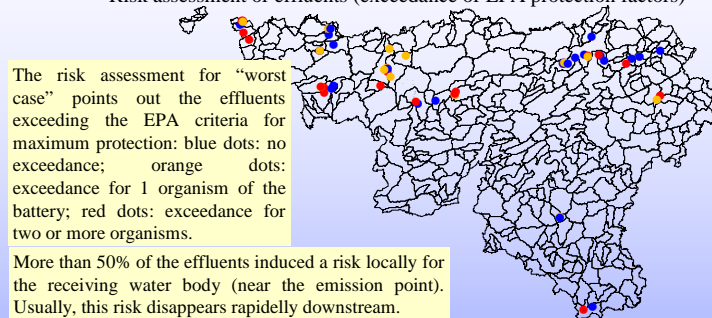
Acknowledgements : The DGO3 of Wallonia supports the net. We thank B.Tricot and B. Bastin for the fruitful exchanges.

EMISSIONS

RISK ASSESSMENT for receiving water body

Toxic characterisation of discharges and evaluation of "toxicity:dilution" ratio predict the capacity of the river to dilute toxic loads and therefore the propensity of the river to endure toxic pressure (risk assessment – worst case)

Risk assessment of effluents (exceedance of EPA protection factors)

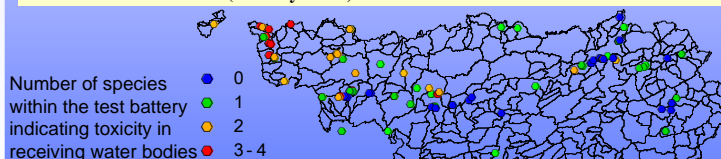


The risk assessment for "worst case" points out the effluents exceeding the EPA criteria for maximum protection: blue dots: no exceedance; orange dots: exceedance for 1 organism of the battery; red dots: exceedance for two or more organisms.

More than 50% of the effluents induced a risk locally for the receiving water body (near the emission point). Usually, this risk disappears rapidly downstream.

IMMISSIONS

INTRINSIC TOXICITY (Toxicity Units)



Number of species within the test battery indicating toxicity in receiving water bodies

- 0
- 1
- 2
- 3-4

The battery of chronic tests shows toxicity of the receiving waters (immissions) and is especially reactive in de Scheldt district.

CONCLUSION: Results show that bioassays are particularly useful for investigative monitoring to help to determine the reasons for restricted ecological status i.e. to separate effects due to toxicity and other problems such as dissolved oxygen, suspended solids or habitat constraints (e.g. heavily modified water bodies) and therefore for the elaboration of management plans and assessment of their effectiveness