



# **bbe Daphnia Toximeter**

## **Data Explain Action of Pollutants**

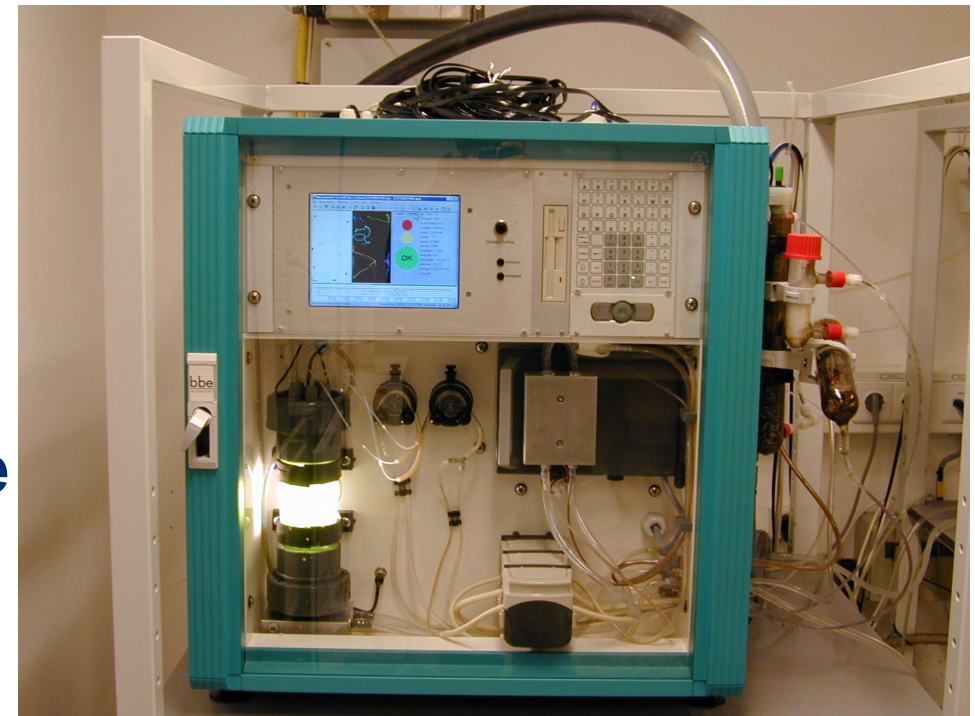
Arco Wagenvoort, AqWa, NL  
Corina de Hoogh, Kiwa Water Research, NL

**Kiel, 1-3 July 2008**

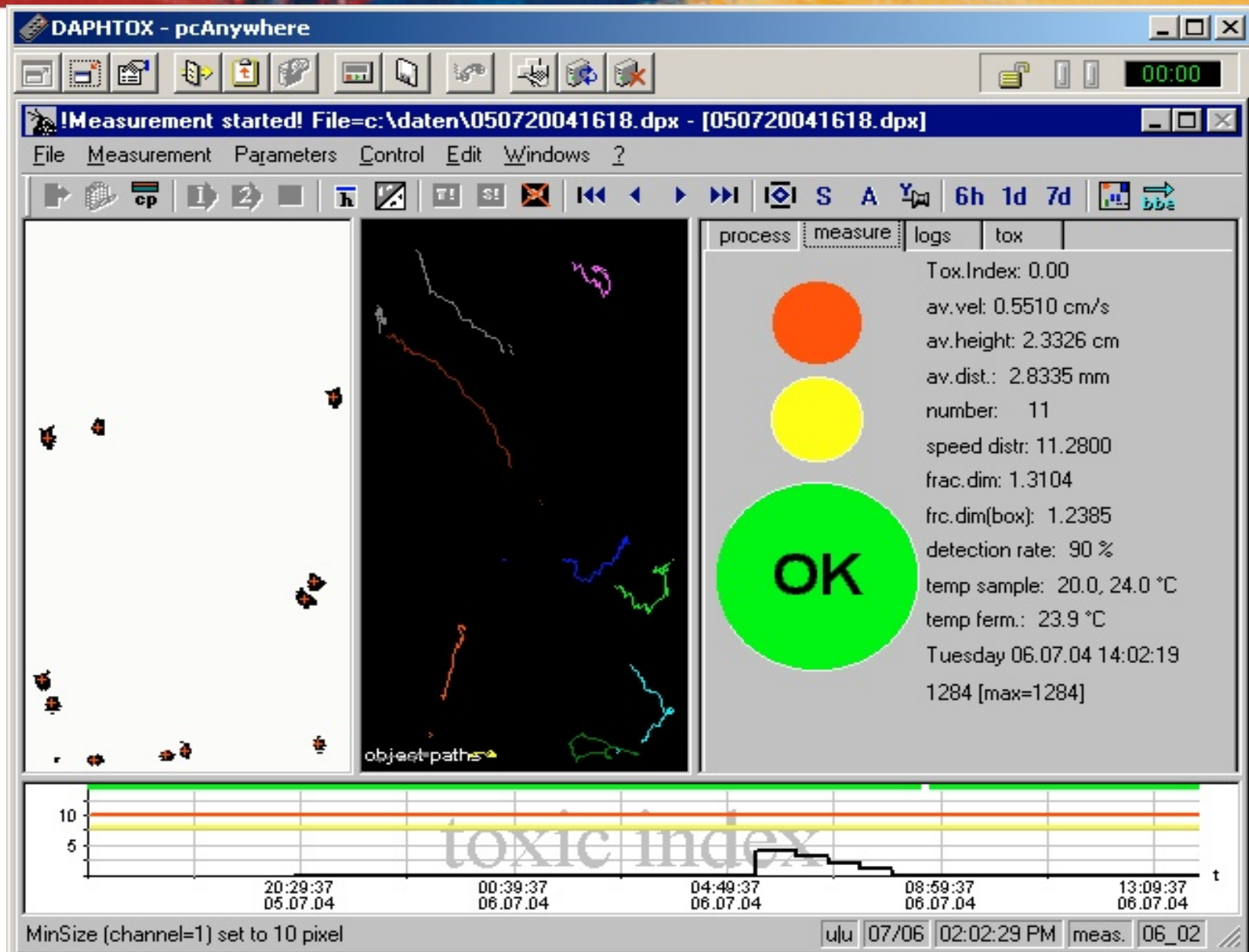


# Introduction

- Principle
- Data Evaluation
- Quality Control
- Cases 2007 in River Meuse
- Conclusions



# Principle

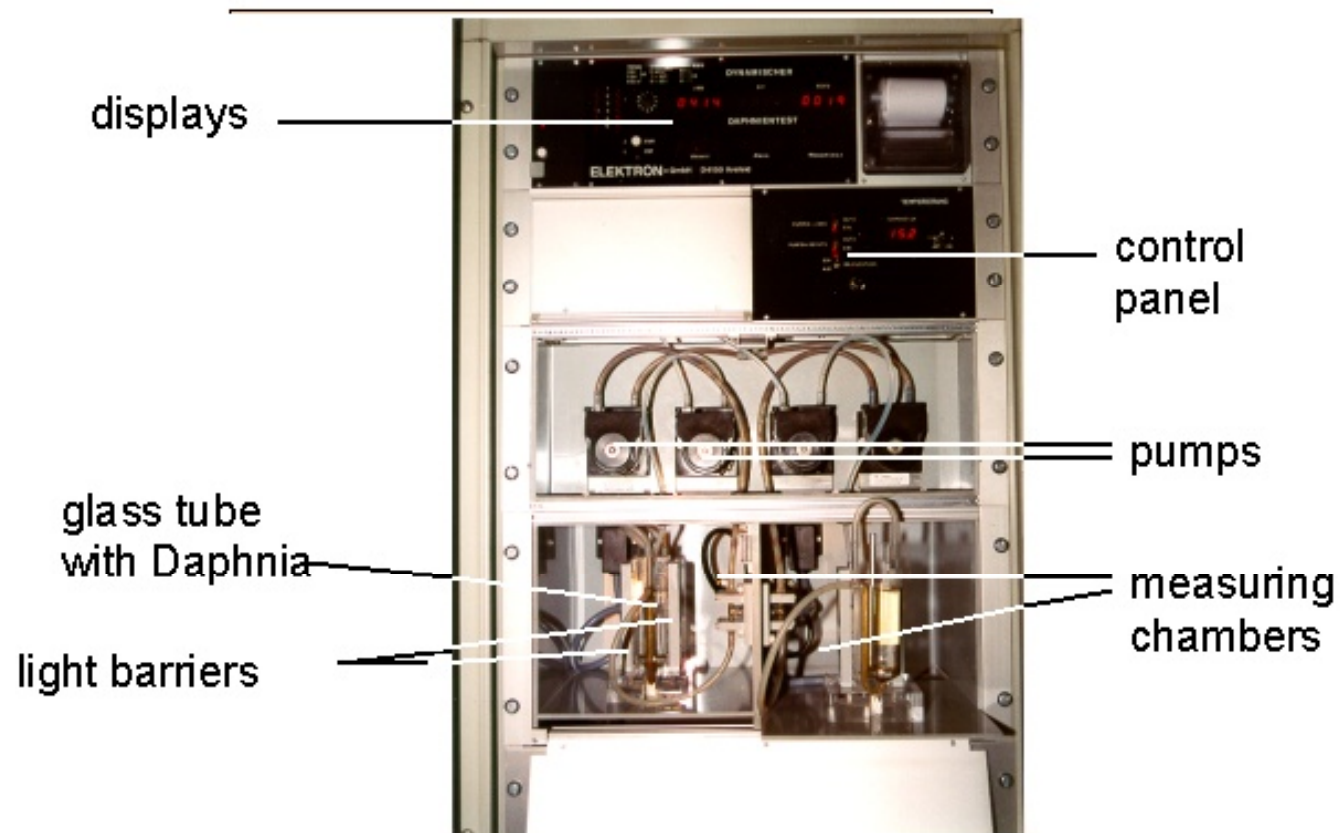




# Data Evaluation - Dynamic Daphnia Test

## ■ *Daphnia* test

**ALARM: activity lower than alarm limit  
not satisfactory: drift, insensitive**



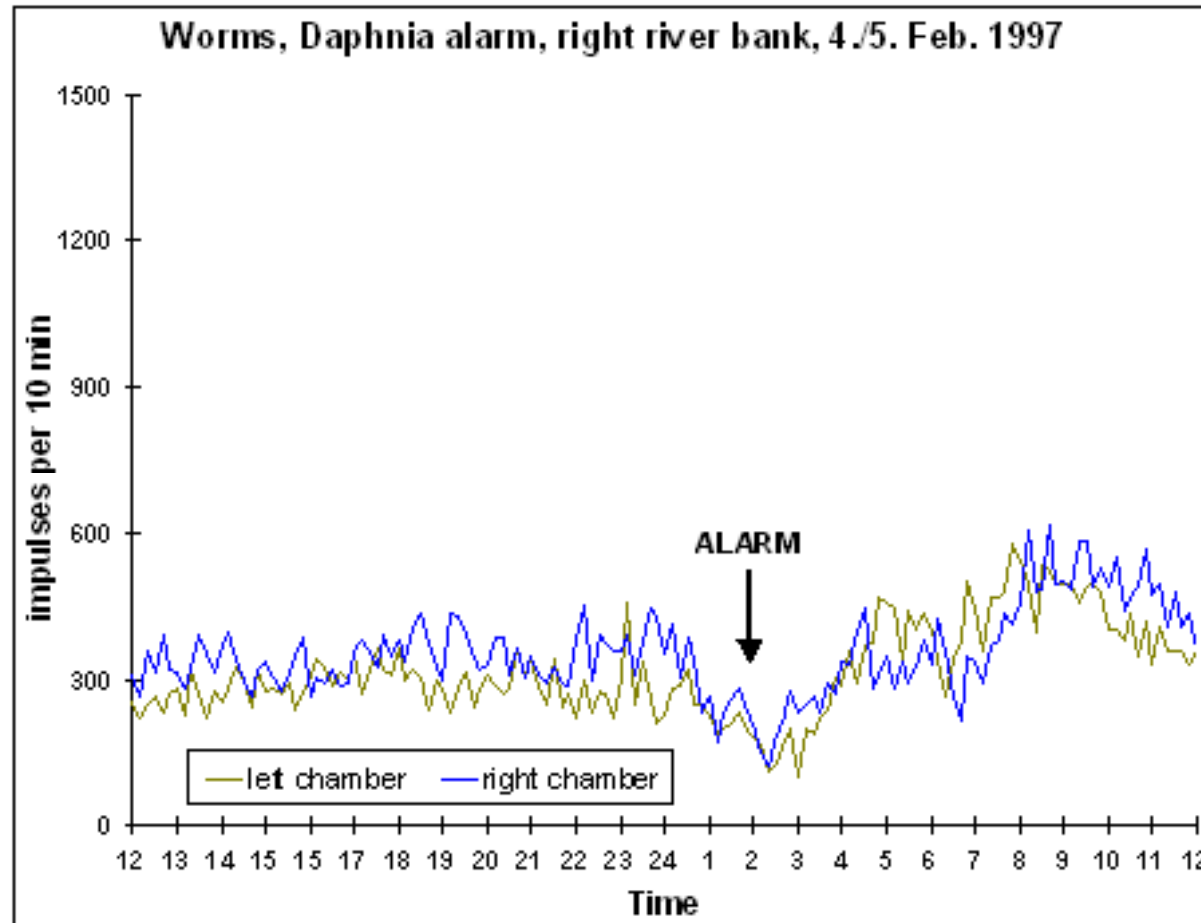
Chamber





# Data Evaluation - Dynamic Daphnia Test

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# Data Evaluation

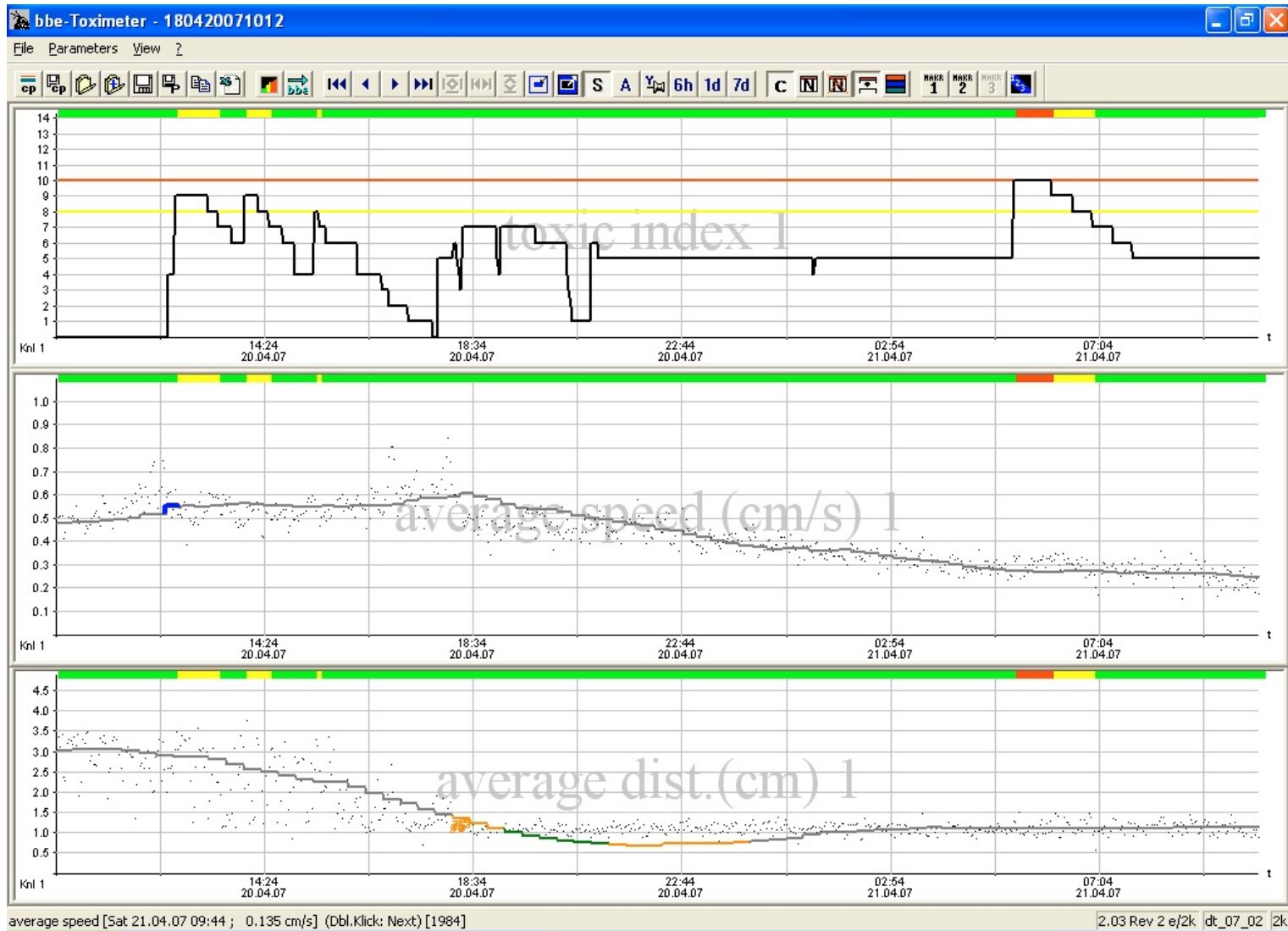


- ***Daphnia* test**  
**ALARM: activity lower than alarm limit**  
**not satisfactory: drift, insensitive**
- **1994 - introduction of Hinkley detector**  
**ALARM: differences in measurements,**  
**response to sudden changes**
- **1999 - introduction of two gradient detectors**  
**relatively slow rise or fall in measurements**



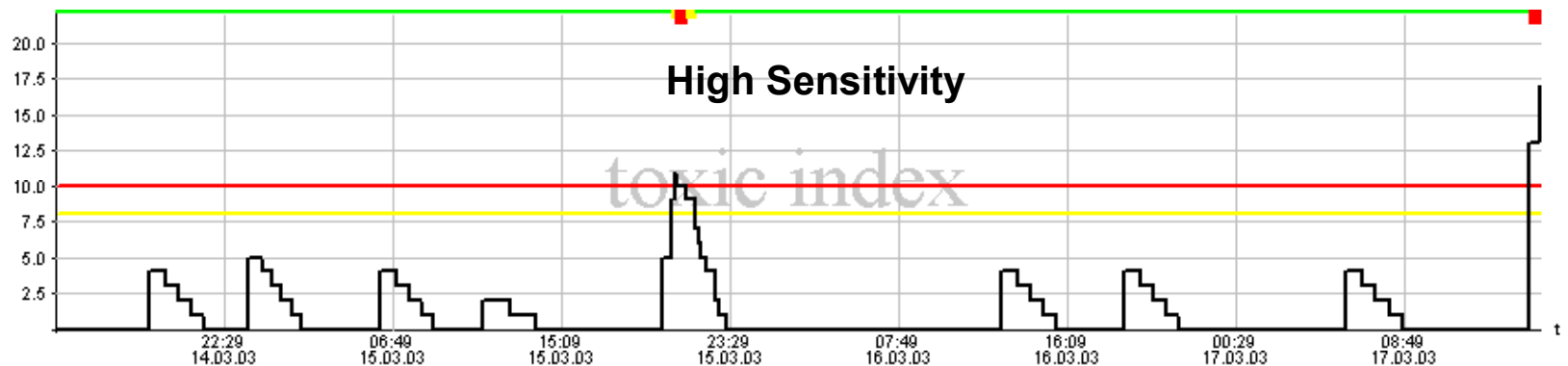
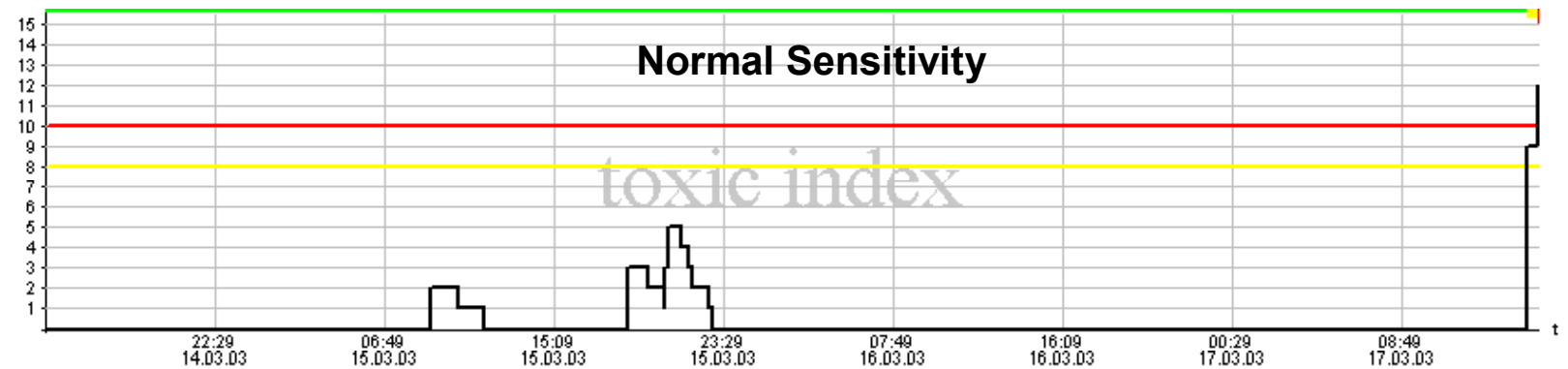
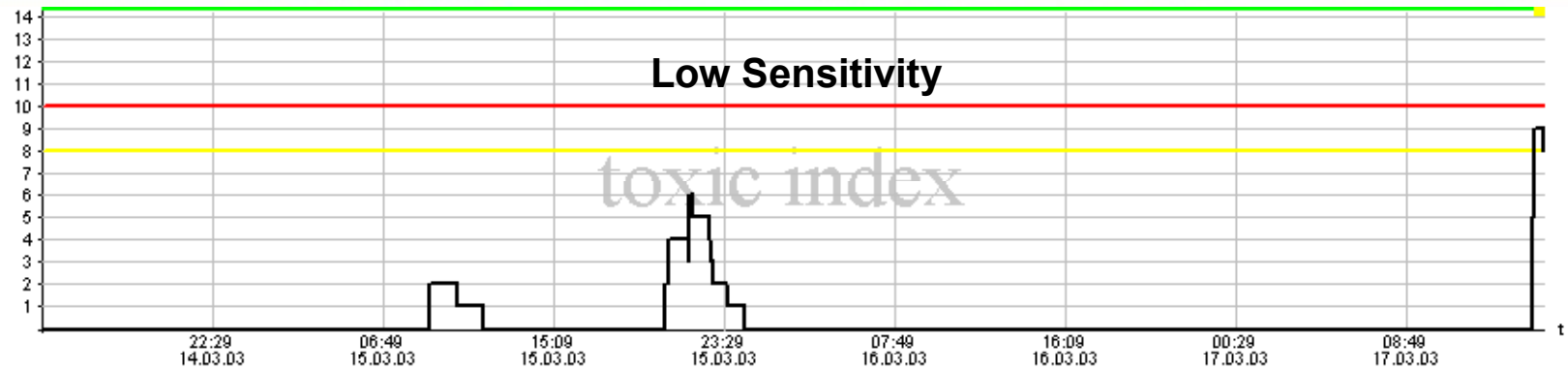
# Data Evaluation - Hinkley and Gradient Detectors

## ■ Hinkley detector and gradient detectors





# Data Evaluation - Hinkley and Gradient Detectors





# Data Evaluation

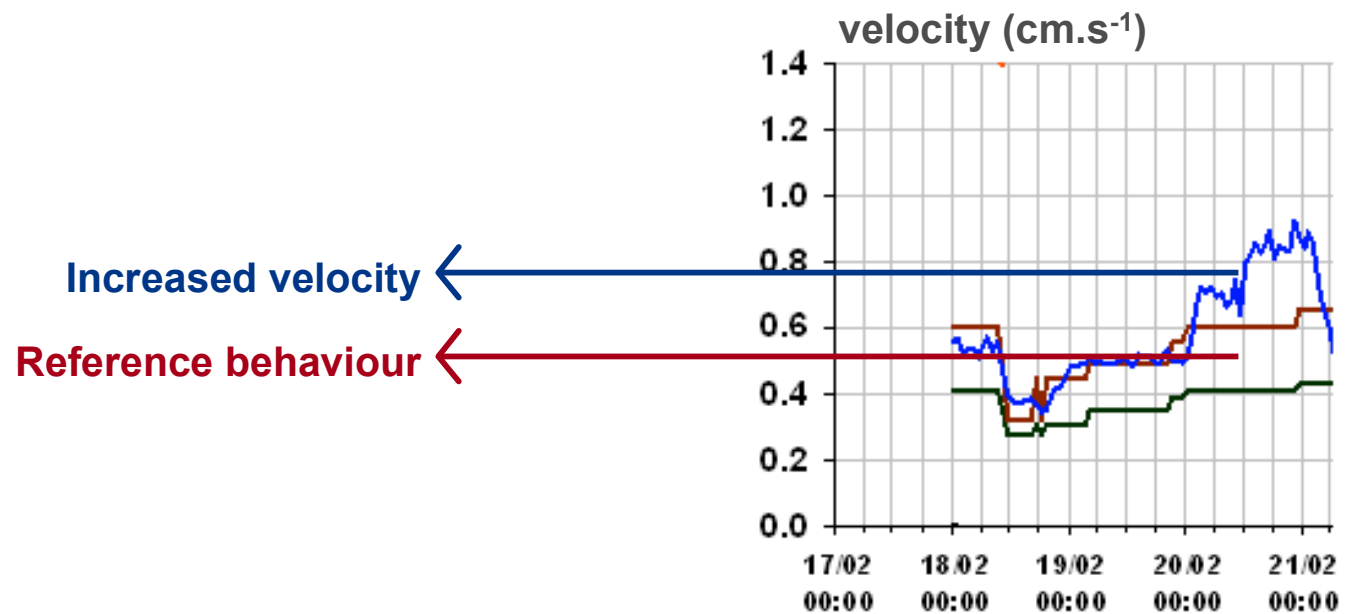
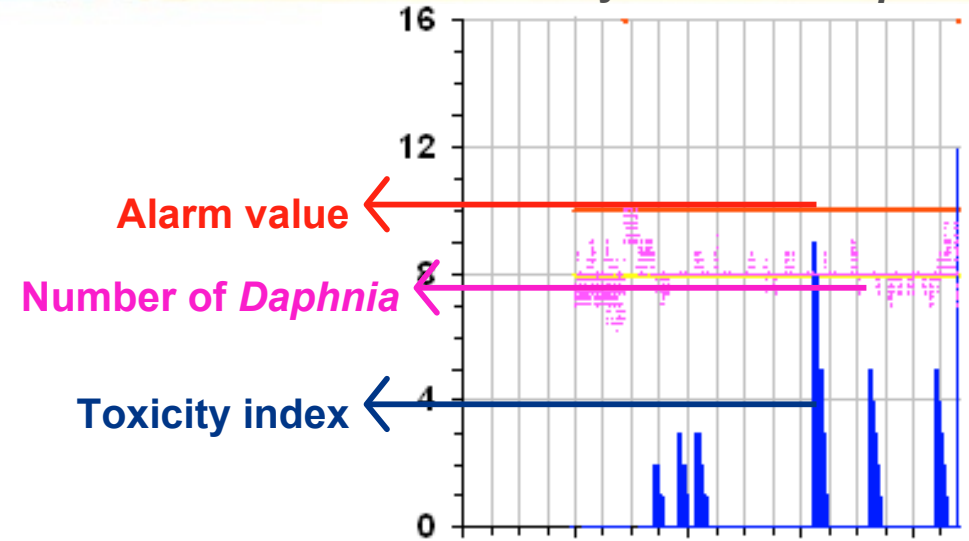


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**relatively slow rise or fall in measurements**
- **2004 - use of size-based alarm limits and mortality**  
**explains action mode of chemicals**



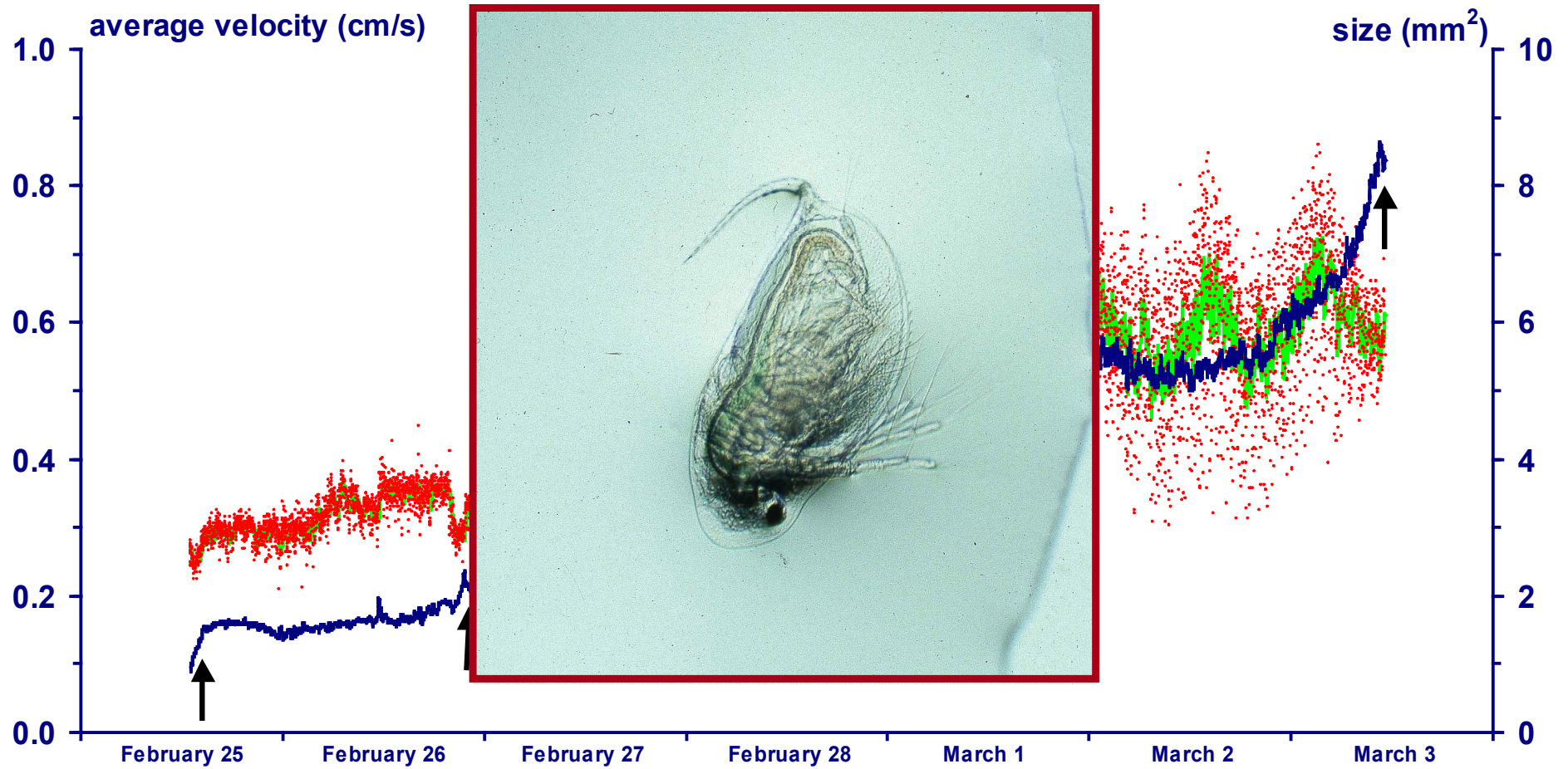
# Data Evaluation - Size-Based Data Evaluation

Toxicity index & # *Daphnia*



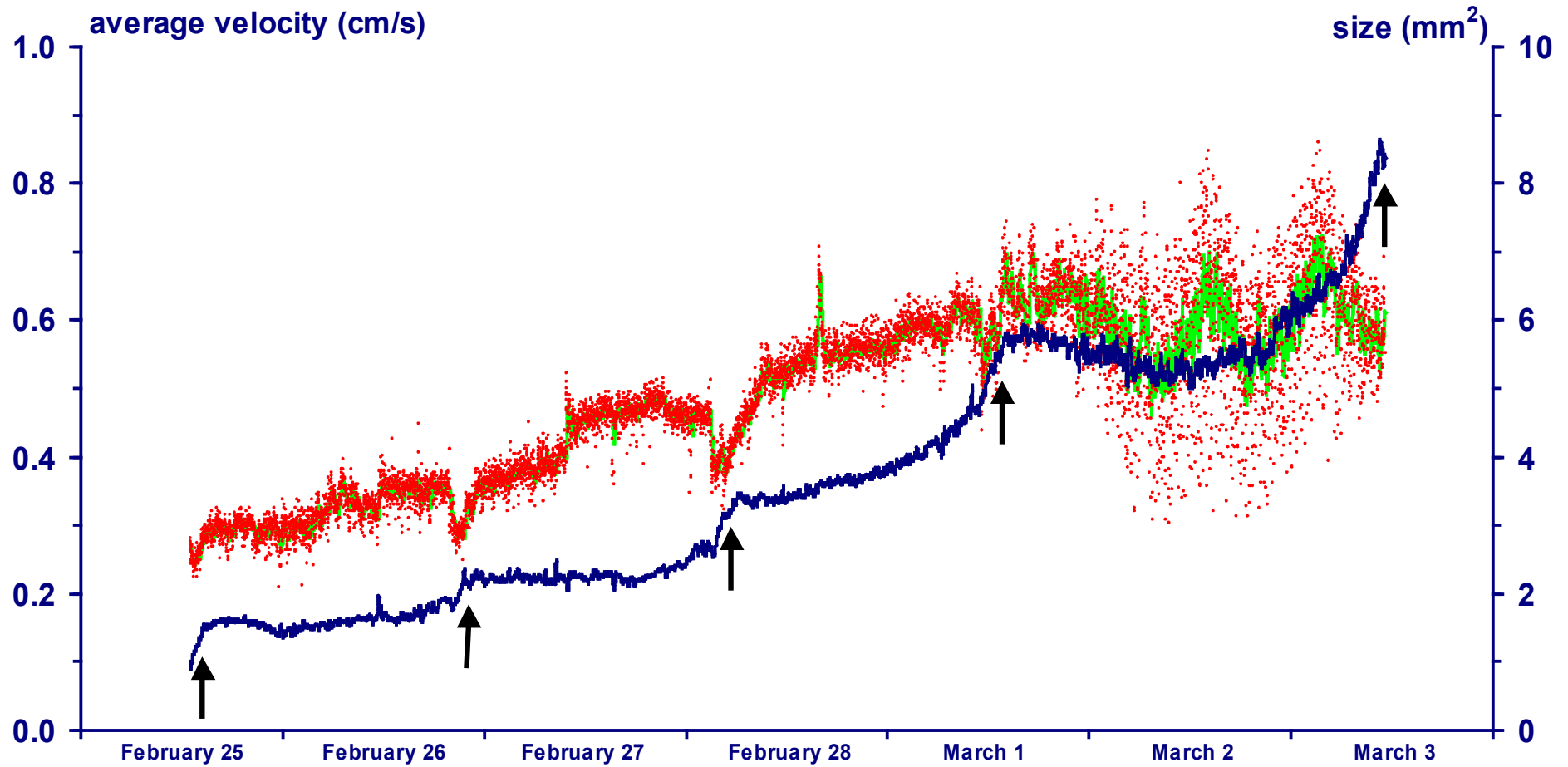


# Data Evaluation - Size-Based Data Evaluation





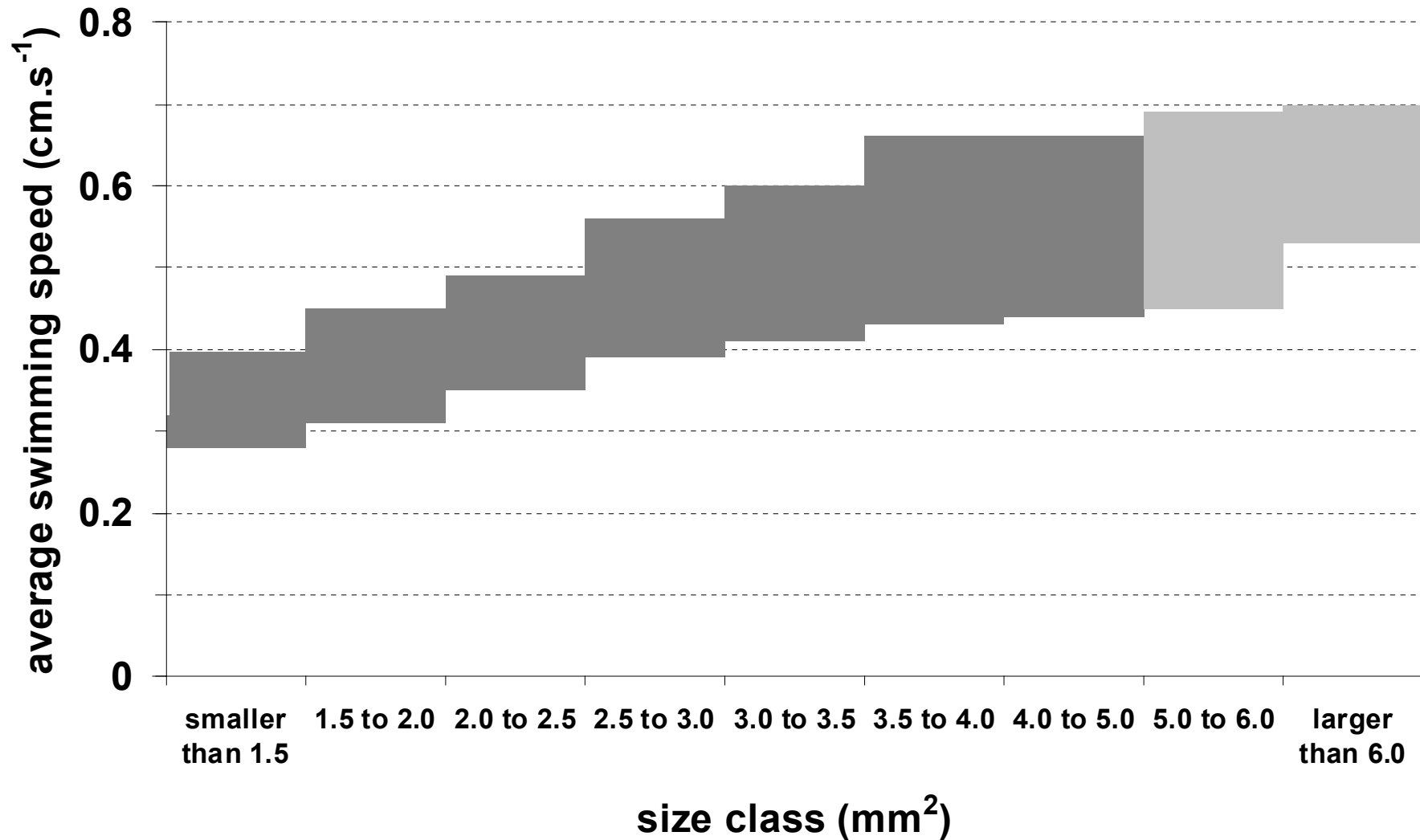
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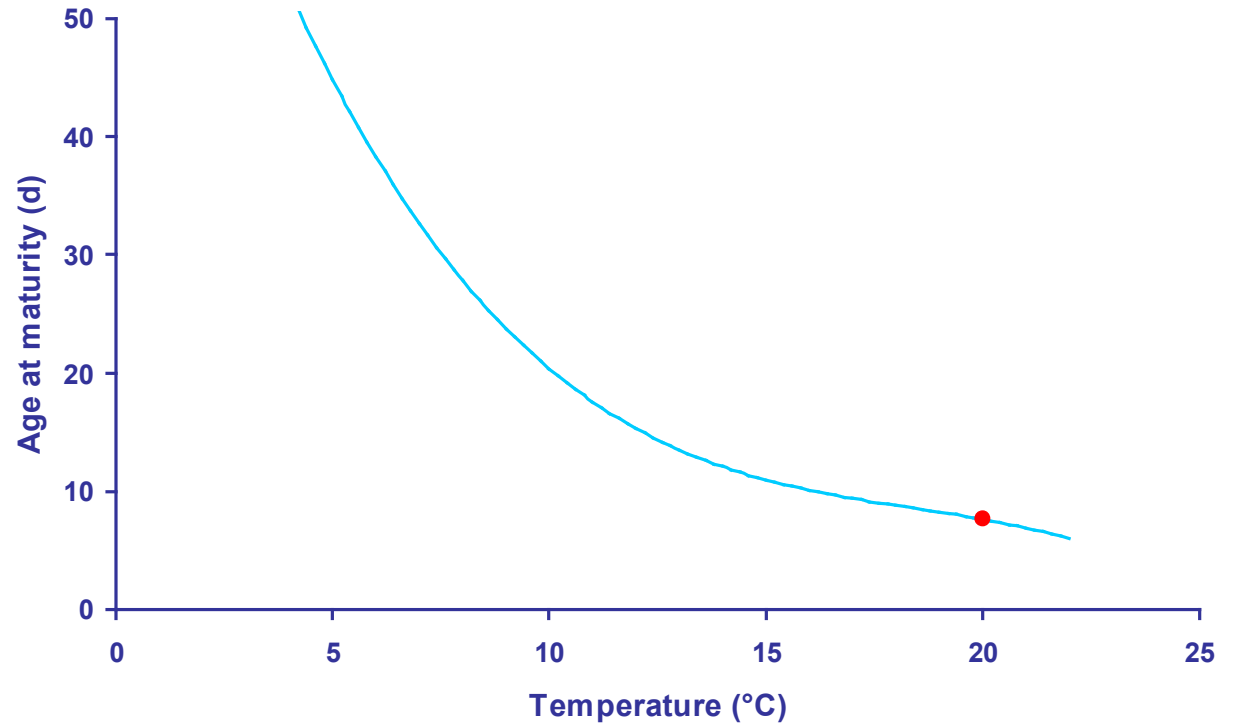
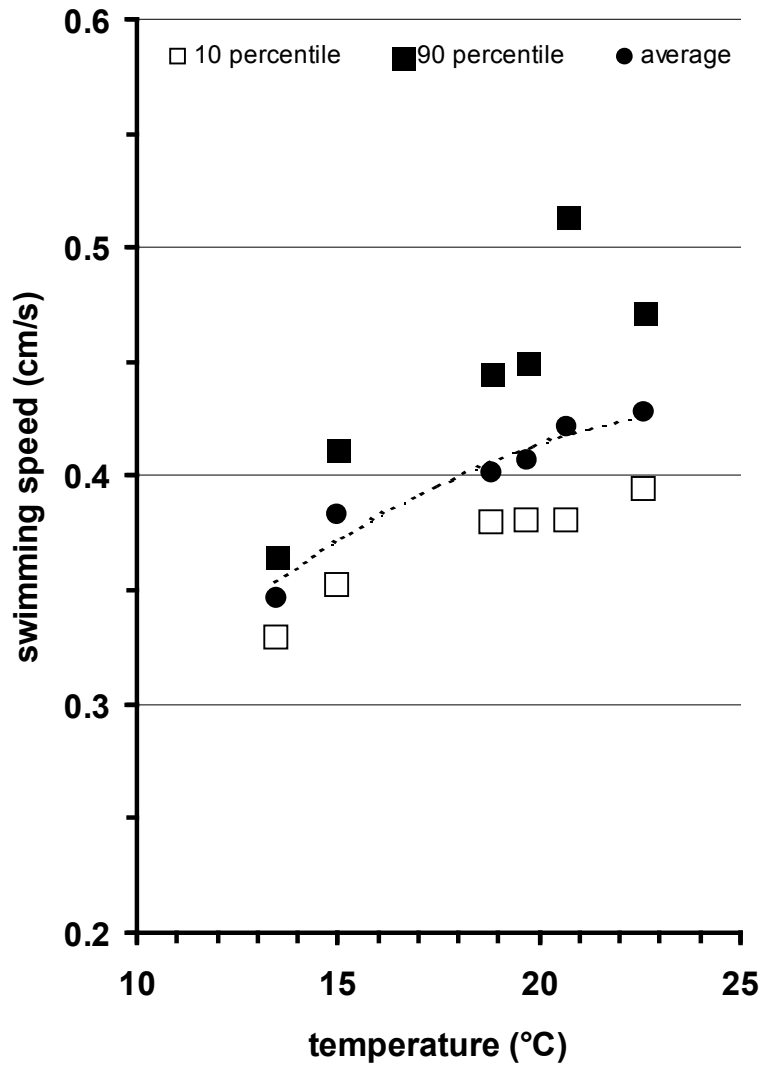


# Quality Control

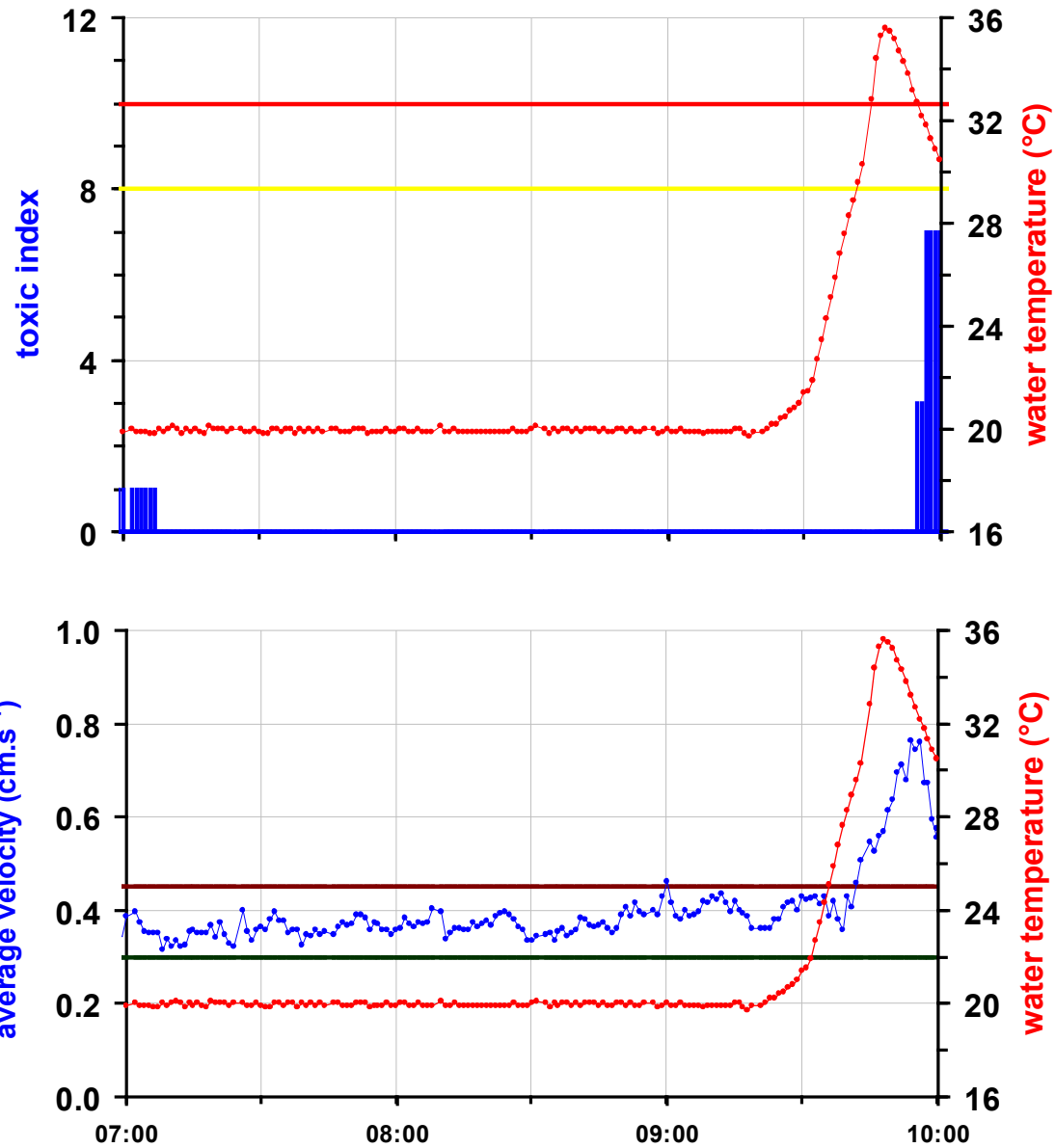


- **Important to avoid and to exclude false alarms**
- **Temperature**
- **Growth**

# Quality Control - Temperature



# Quality Control - Temperature

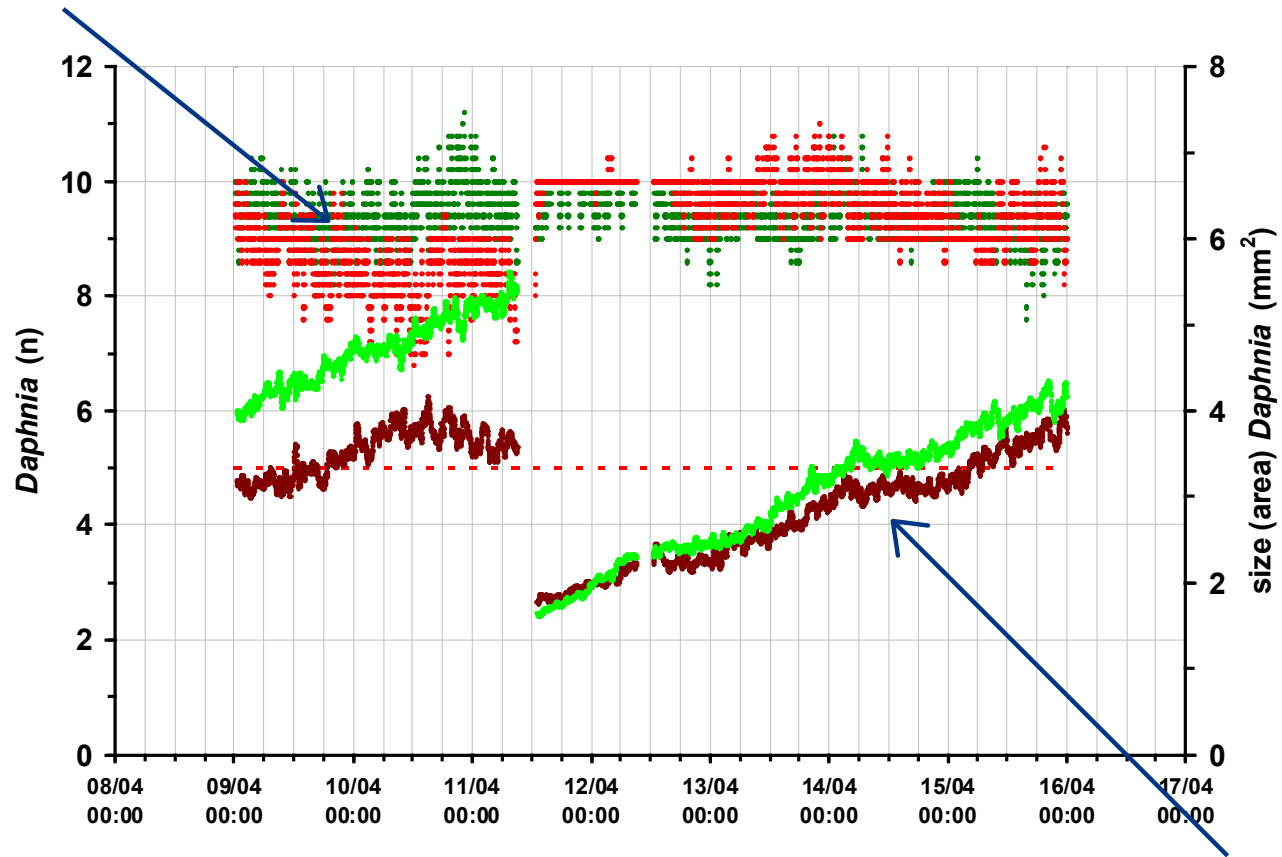




# Quality Control - Growth

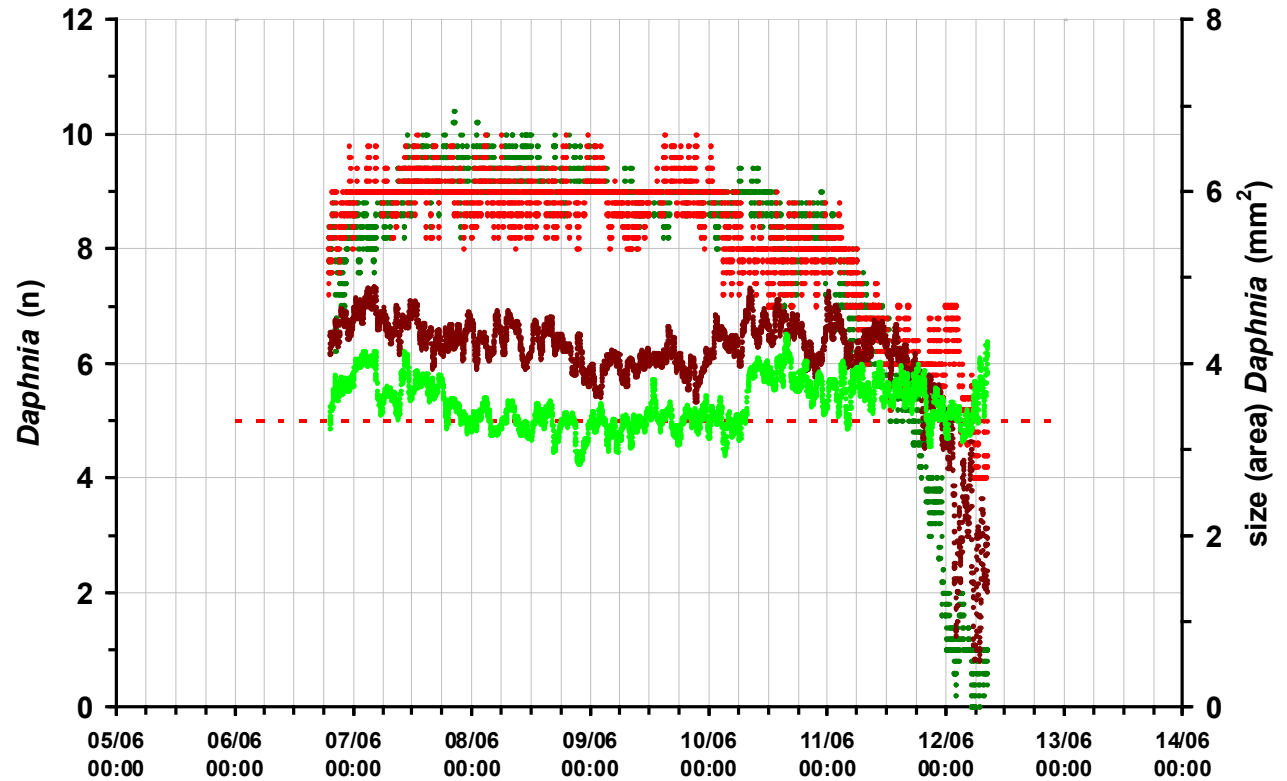
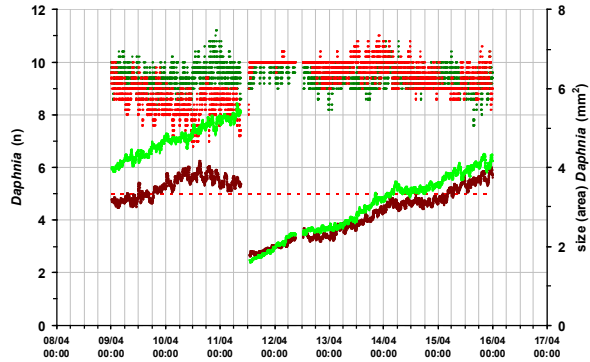


## Number of *Daphnia*



Size of *Daphnia*

# Quality Control - Growth

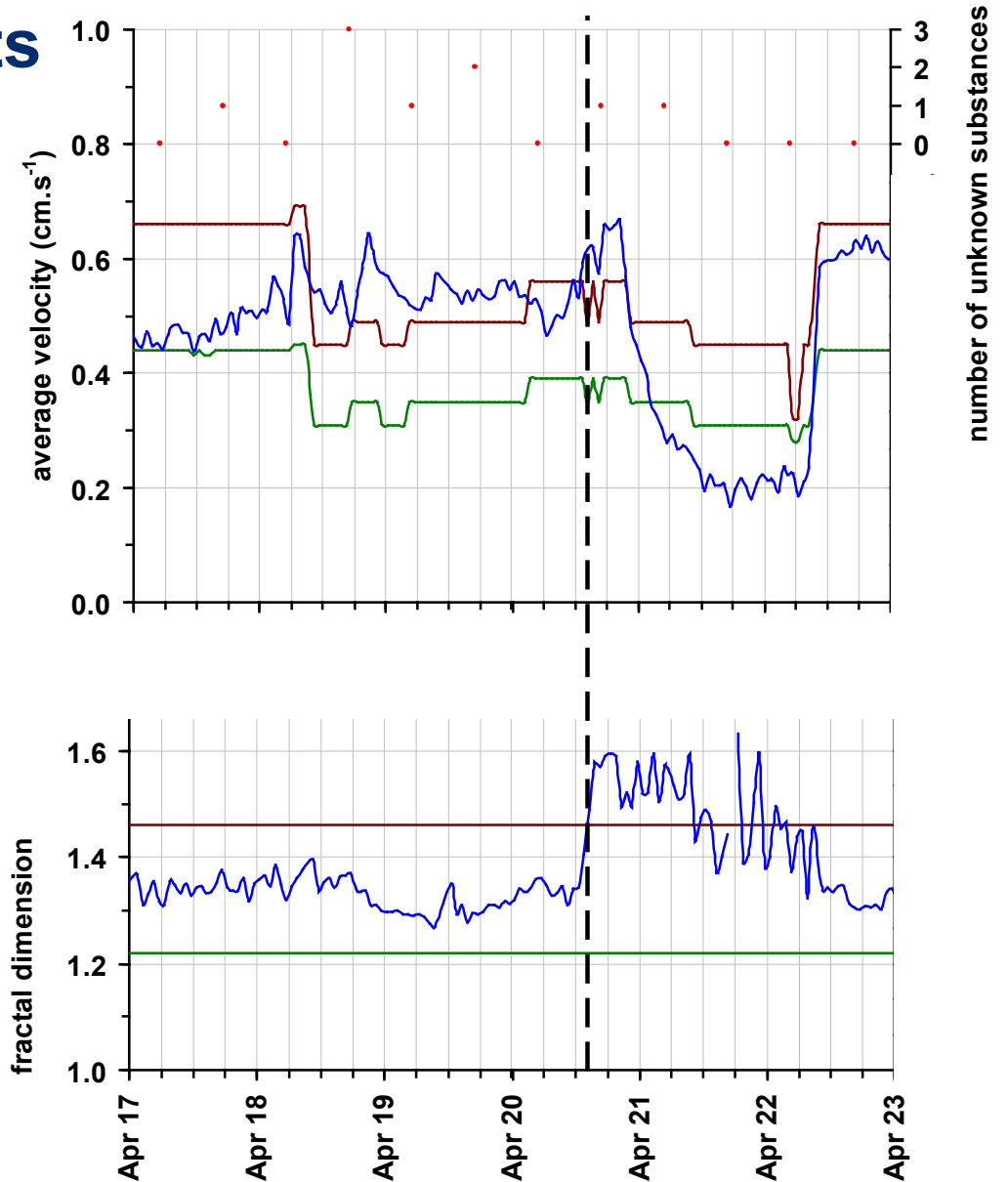
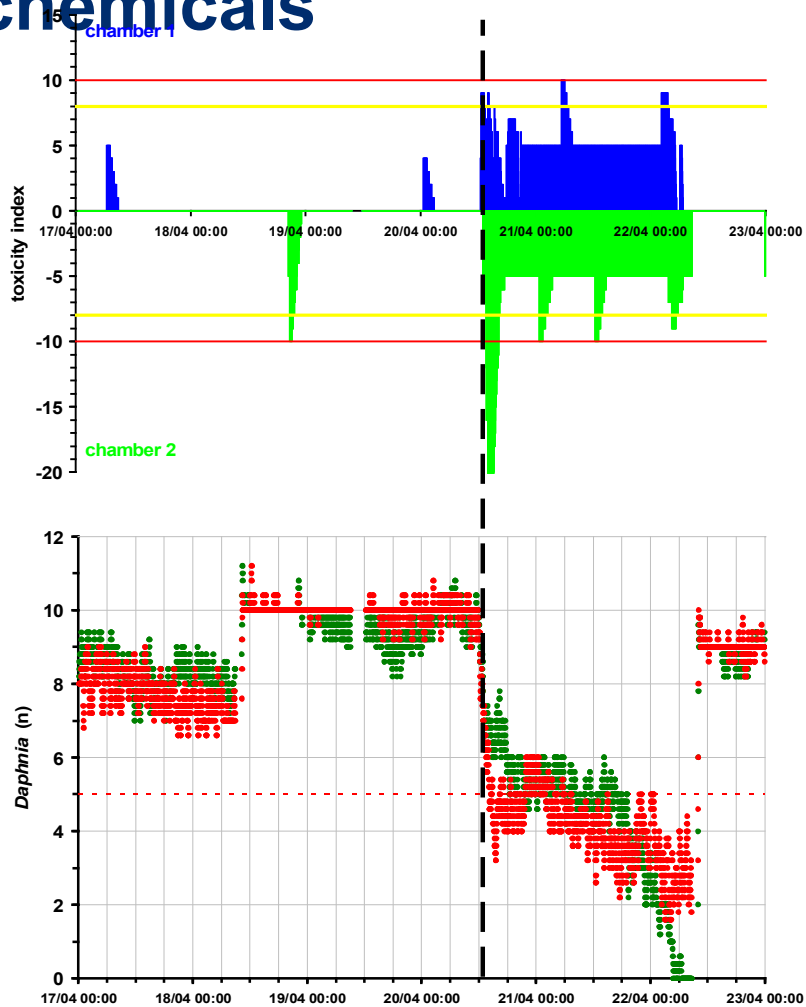




# Case - April 2007 - Meuse at Eijsden

## Size-Based Data Evaluation

■ Use of size-based alarm limits explains action mode of chemicals





# Case - April 2007 - River Meuse at Eijsden Size-Based Data Evaluation

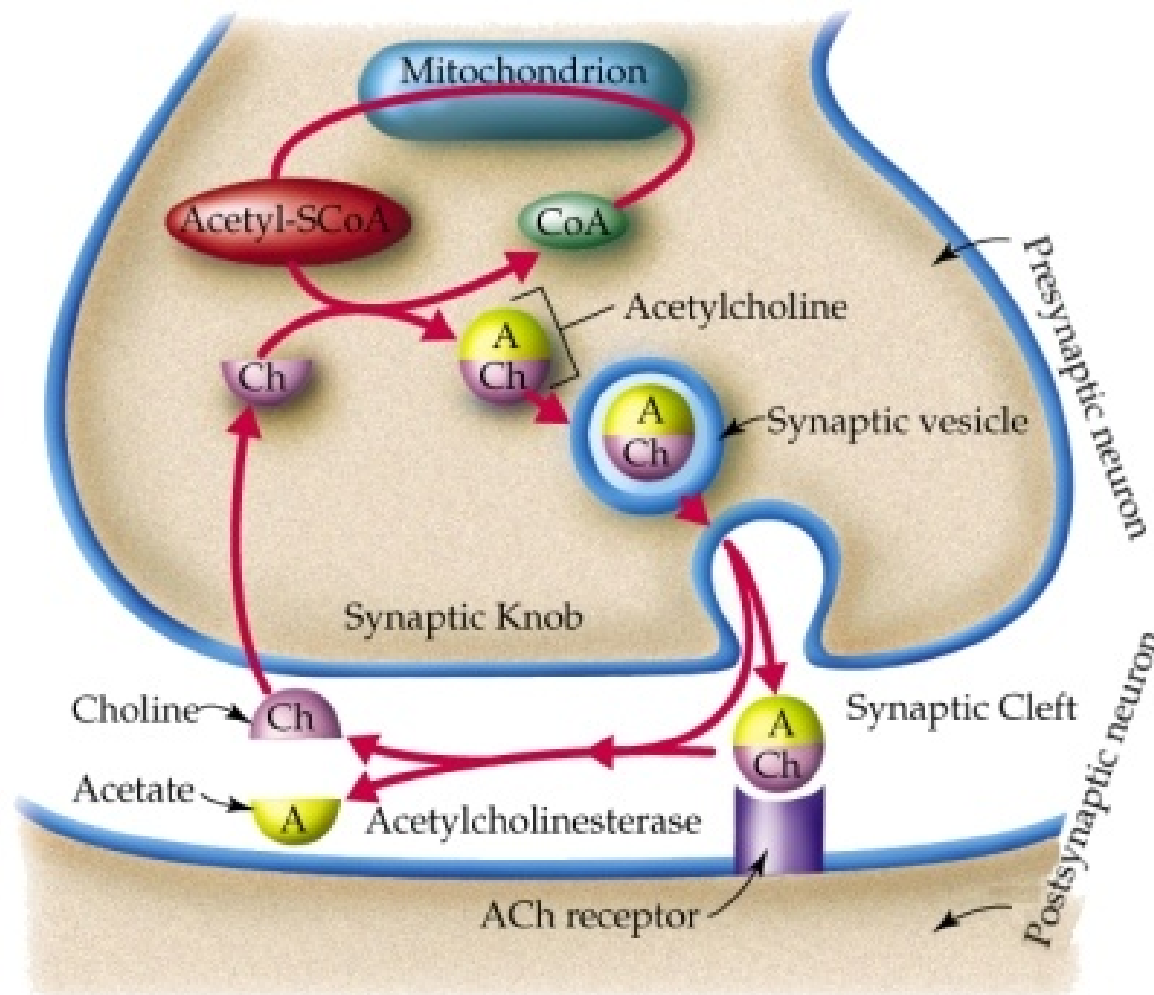
- **Use of size-based alarm limits explains action mode of chemicals**
  
- **Observed deviations:**
  - increased activity (swimming speed) over more than 24 hours
  - uncontrolled behaviour (increased fractal dimension)
  - mortality
  
- **Presence of insecticides (chlorpyrifos and diazinon) explained effects**



# Case - 2007 - River Meuse at Eijsden

## Action Mode of Cholinesterase Inhibitor

- Transmission of signal from one nerve cell to the next cell





# Case - August 2007 - River Meuse at Eijsden



- **Spill of chlorpyrifos and cypermethrin in river by industry (Chimac-Agriphar near Liege)**



- **mass fish kill**

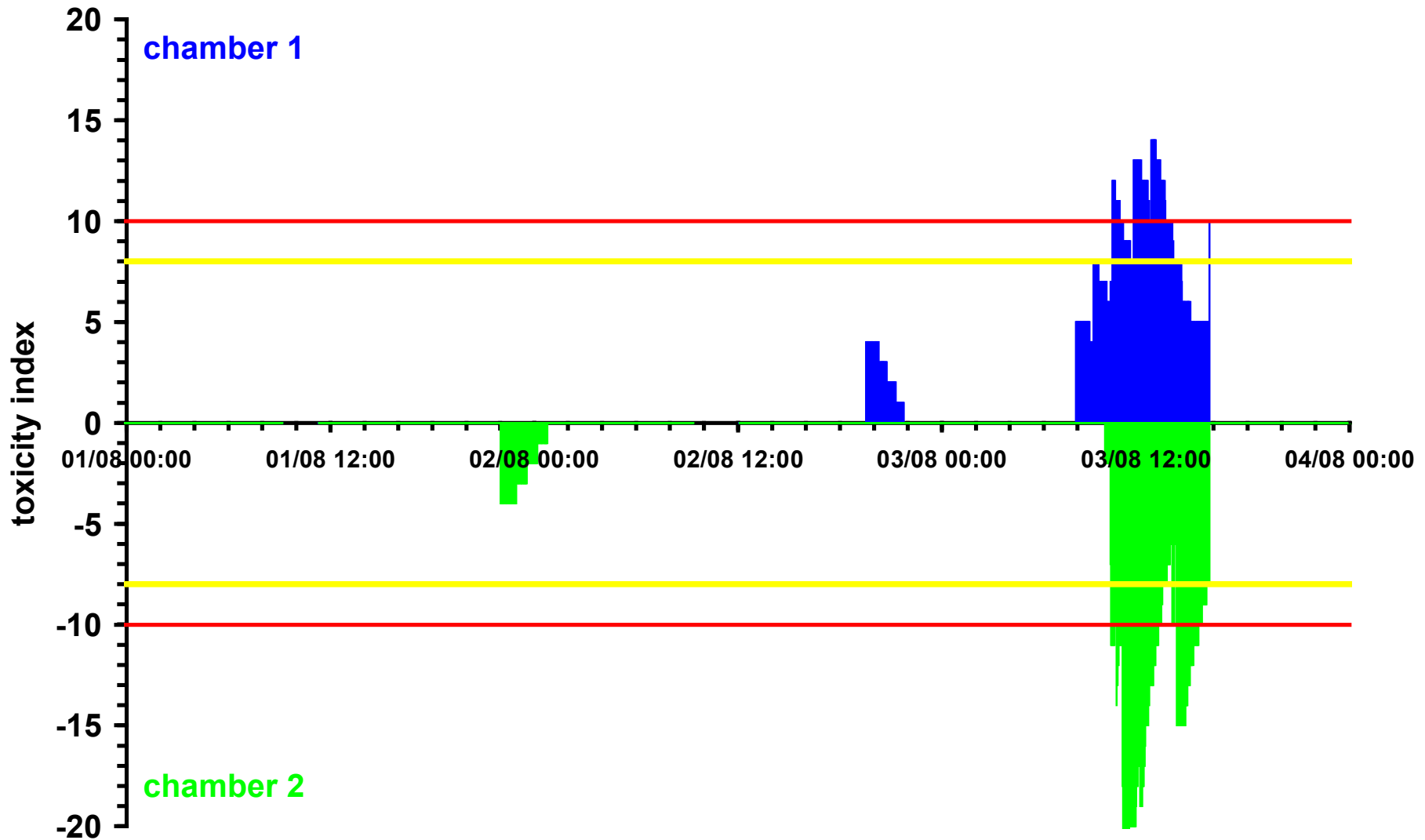
**AND.....**



# Case - August 2007 - River Meuse at Eijsden



## ■ Alarm generated by Daphnia Toximeter

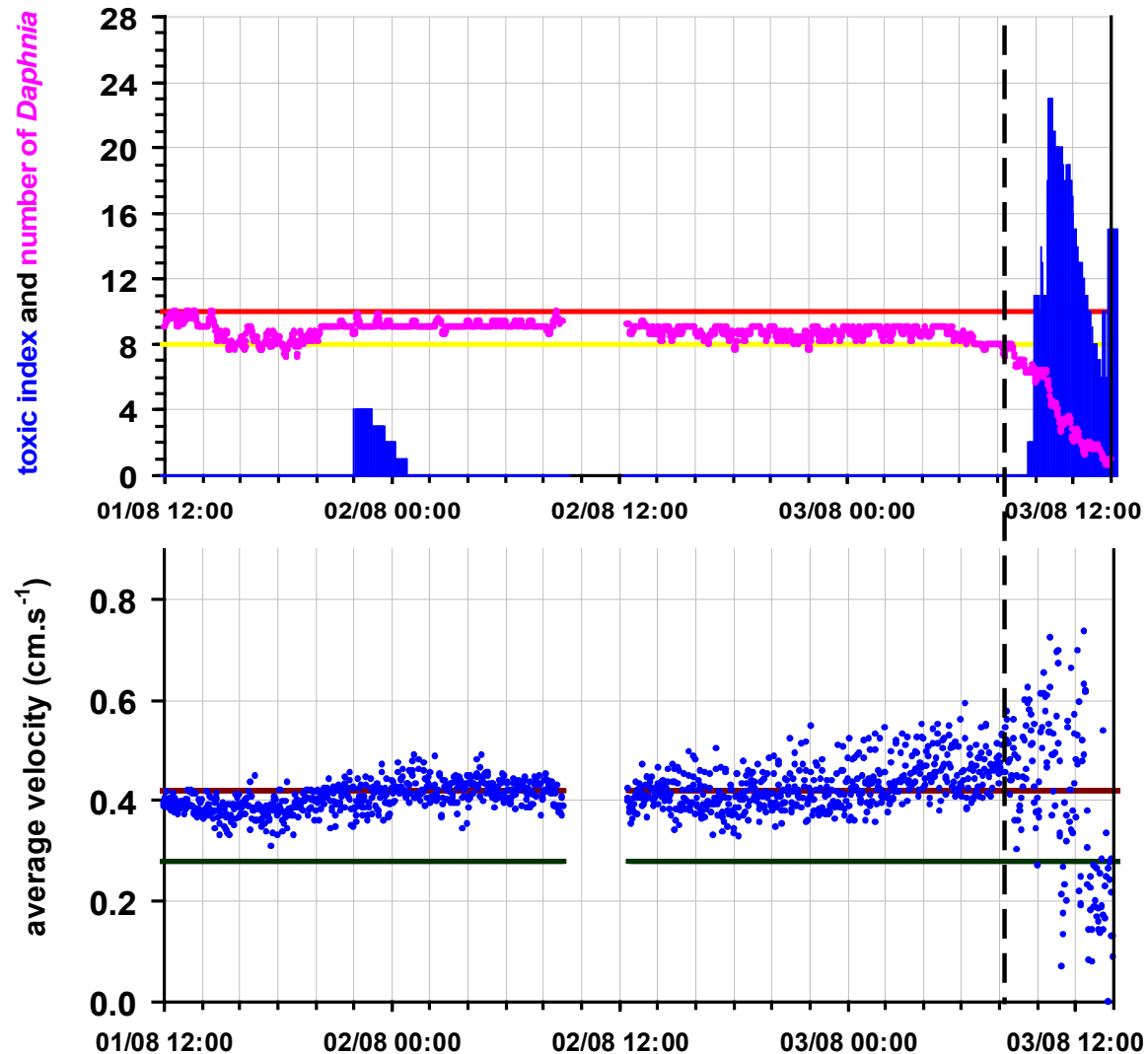


# Case - August 2007 - River Meuse at Eijsden

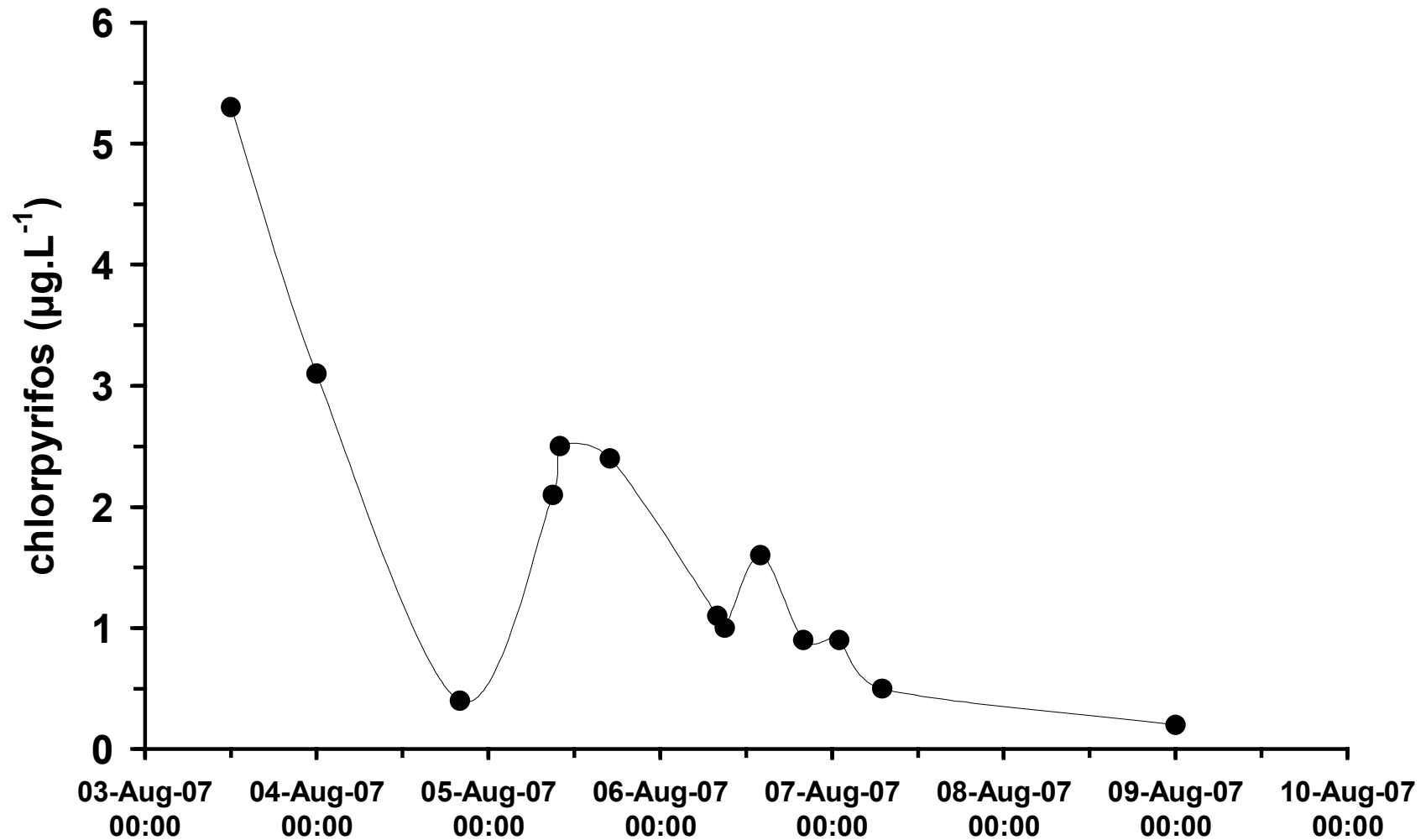


## ■ Alarm generated by Daphnia Toximeter

chamber 2



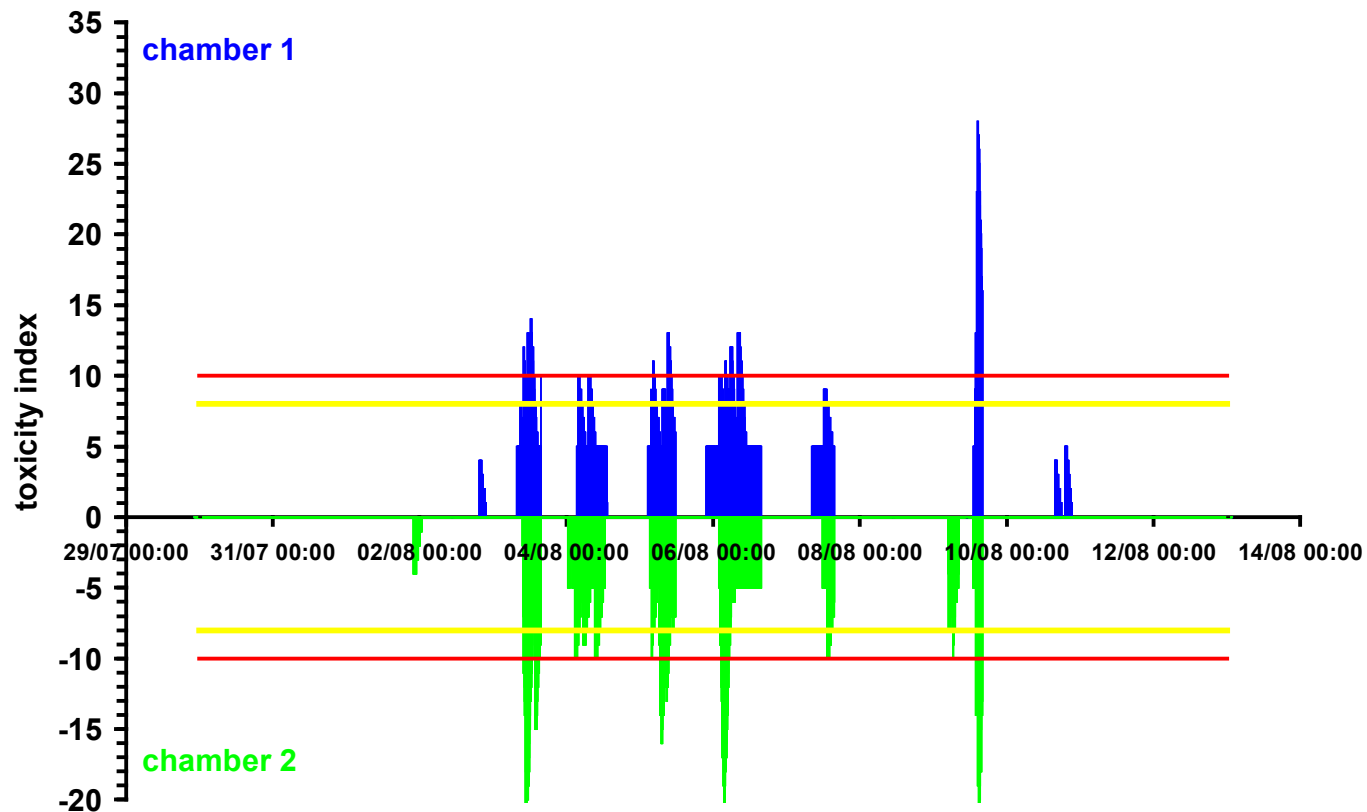
# Case - August 2007 - River Meuse at Eijsden



# Case - August 2007 - River Meuse at Eijsden



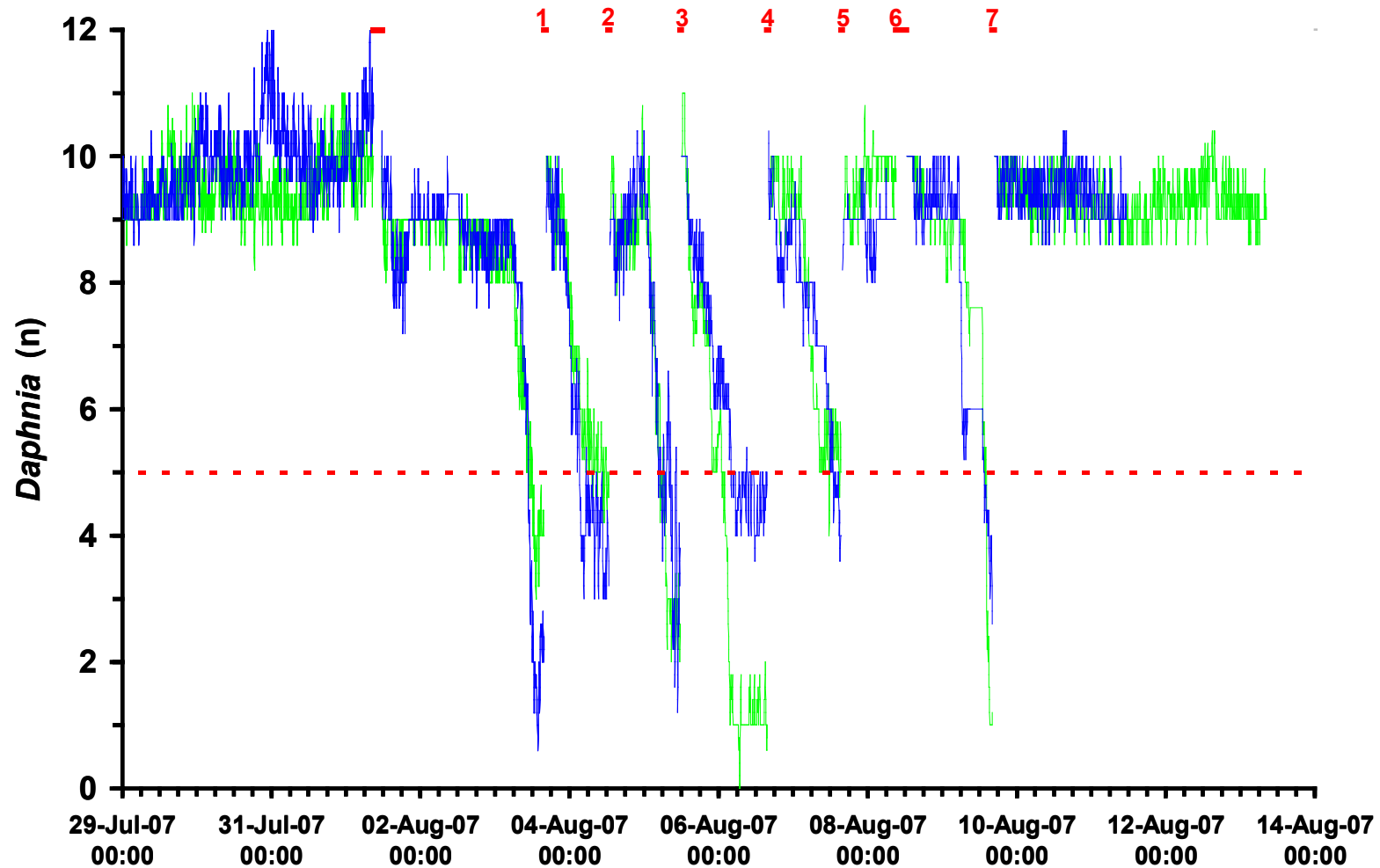
- Alarm evaluation using the Daphnia Toximeter
- Replace Daphnia and evaluate data



# Case - August 2007 - River Meuse at Eijsden



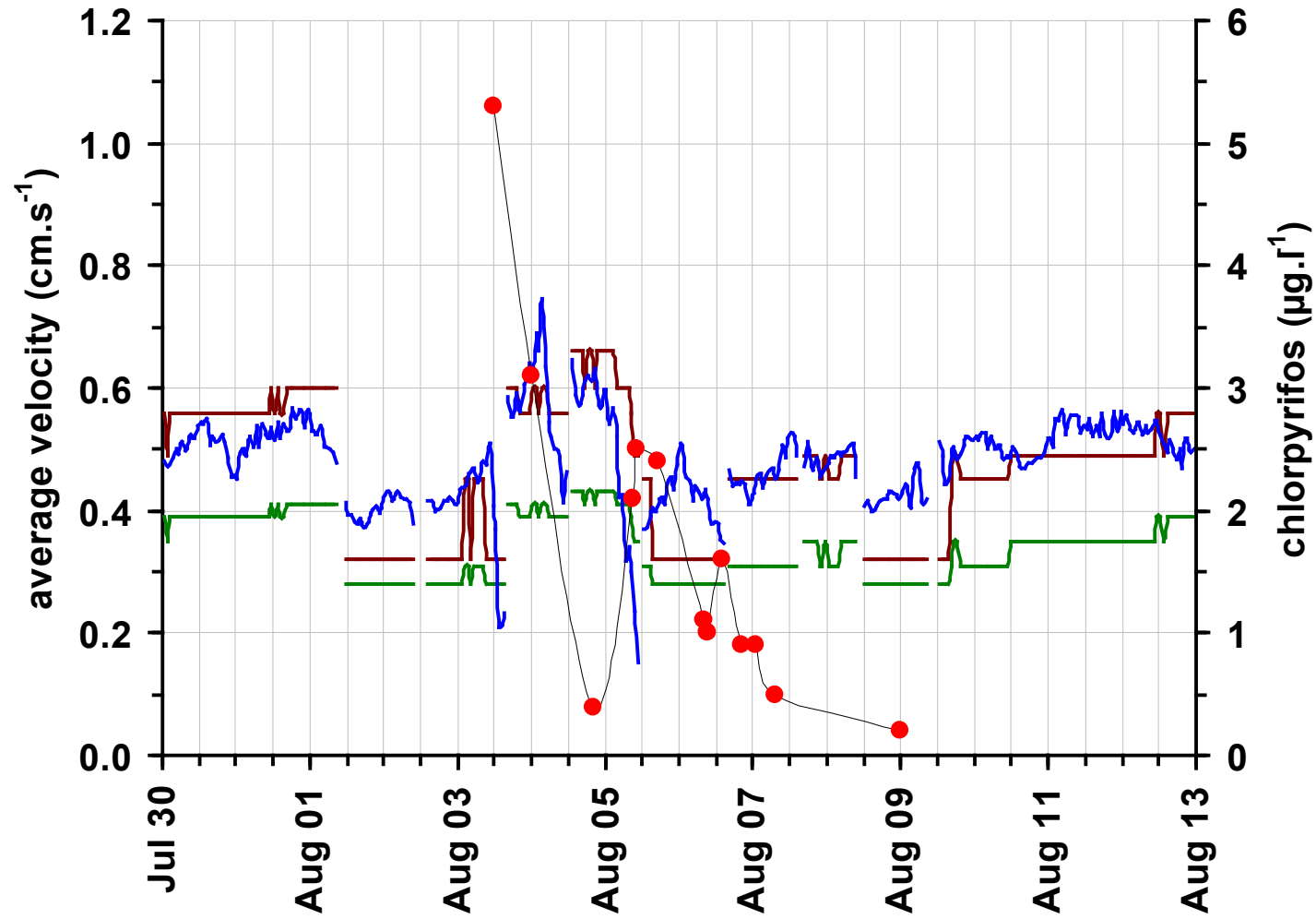
- Alarm evaluation using the Daphnia Toximeter
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# Case - August 2007 - River Meuse at Eijsden



- Alarm evaluation using the Daphnia Toximeter
- Replace Daphnia and evaluate data



# Conclusions



- **Results of Daphnia Toximeter reliable and reproducible**
- **Quality control will reduce false-positive alarms**
- **Use of size-based alarm limits and mortality**
  - **earlier and reliable response**
  - **explain action mode of chemicals**
- **In alarm evaluation using the Daphnia Toximeter:**
  - **replace test organisms**
  - **evaluate data**





# Thank you for your attention

**Arco Wagenvoort, AqWa, NL**

**Corina de Hoogh, Kiwa Water Research, NL**

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**Kiel, 1-3 July 2008**