Online biomonitoring for continuous water quality control

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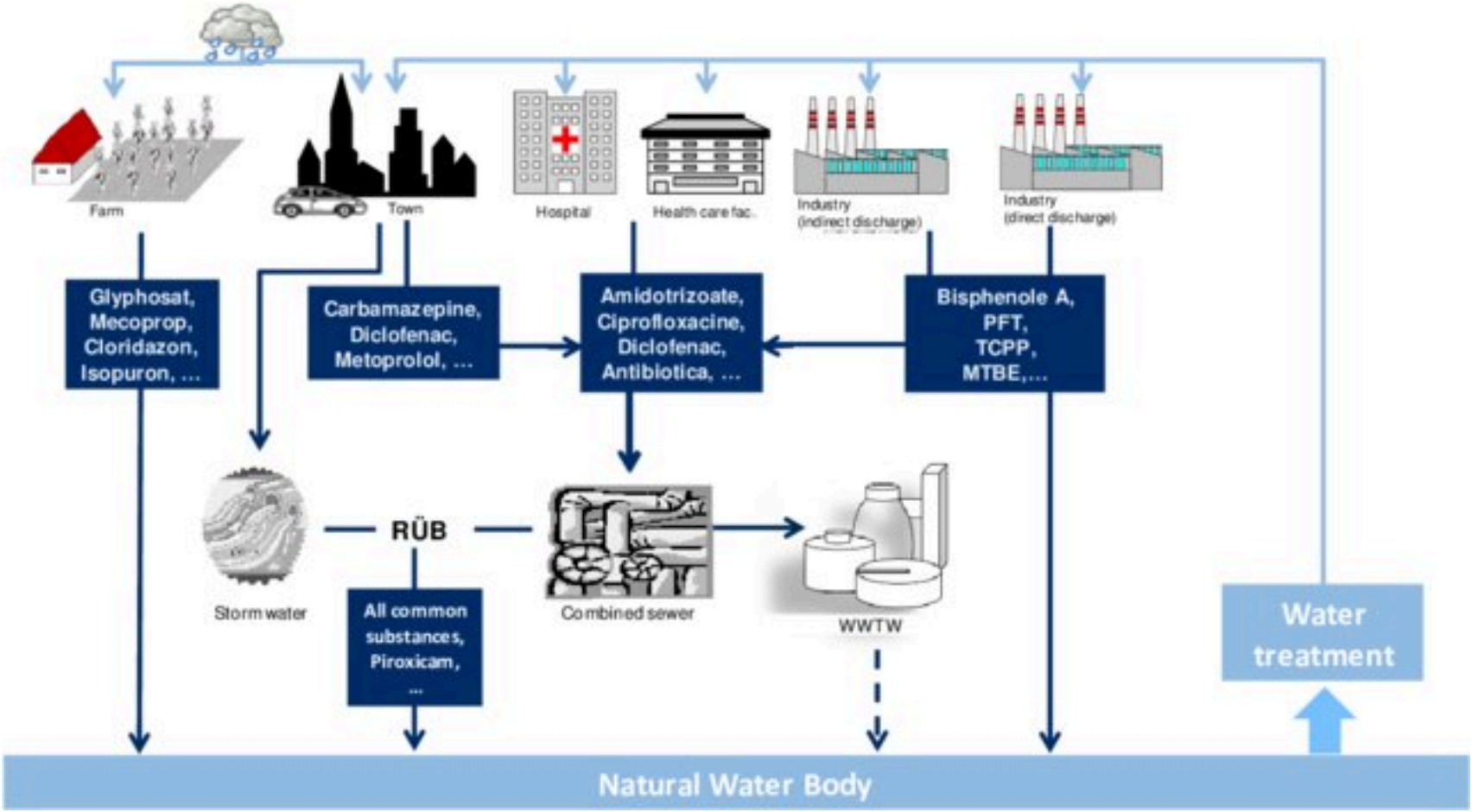
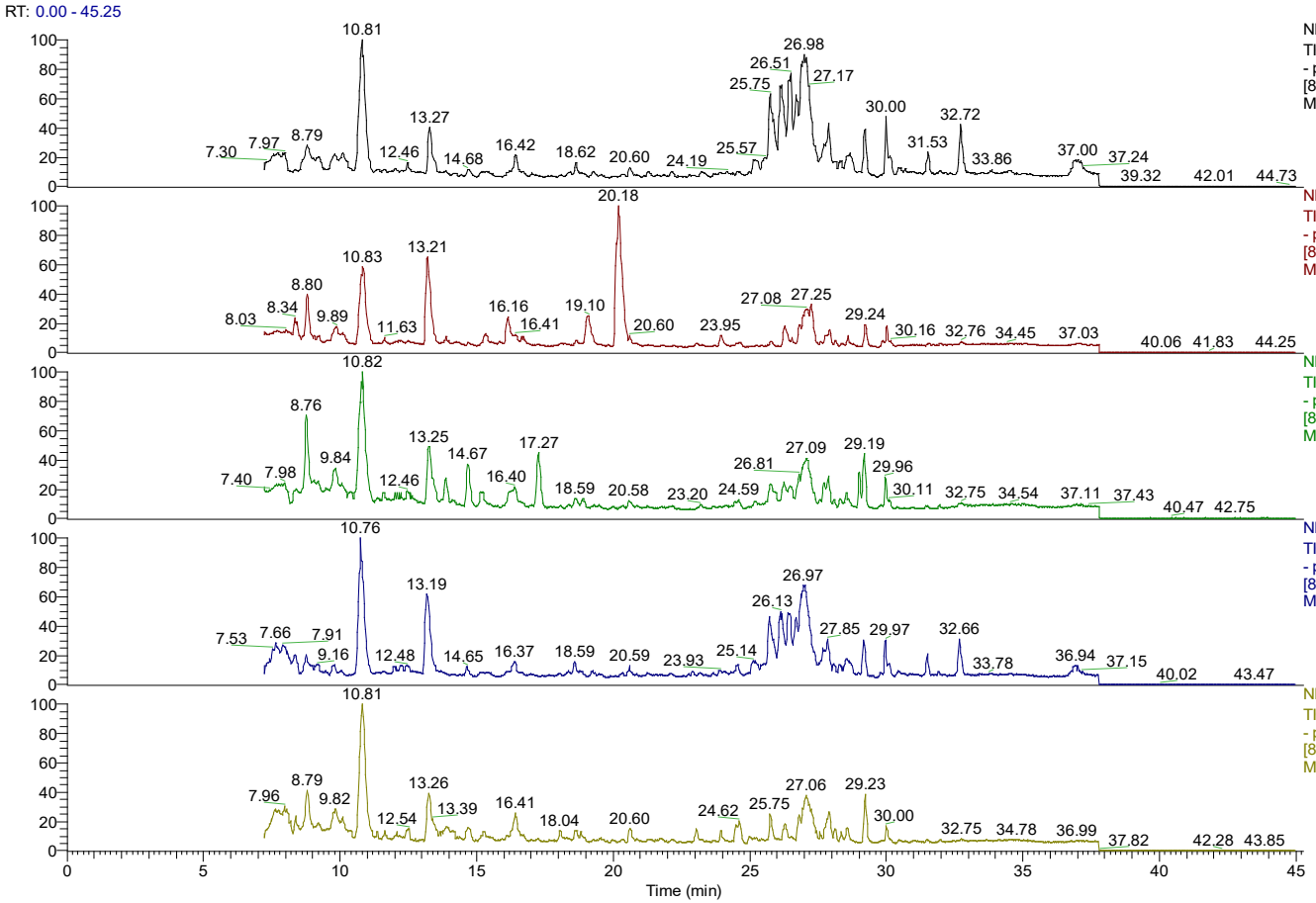
Organic micropollutants



Picture: Antakyali et al., 2015

Chemical screening



Sewage A

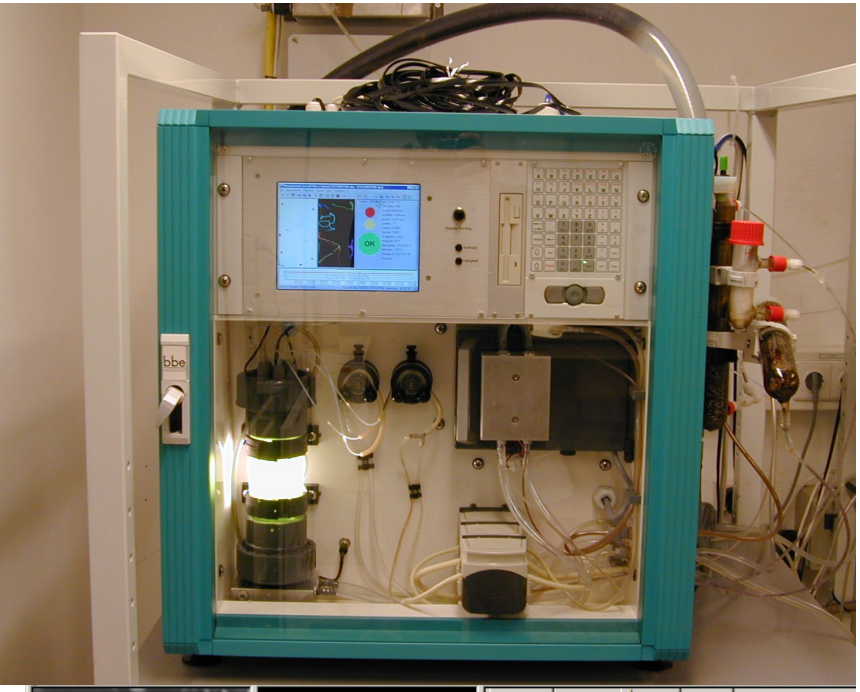
Sewage B

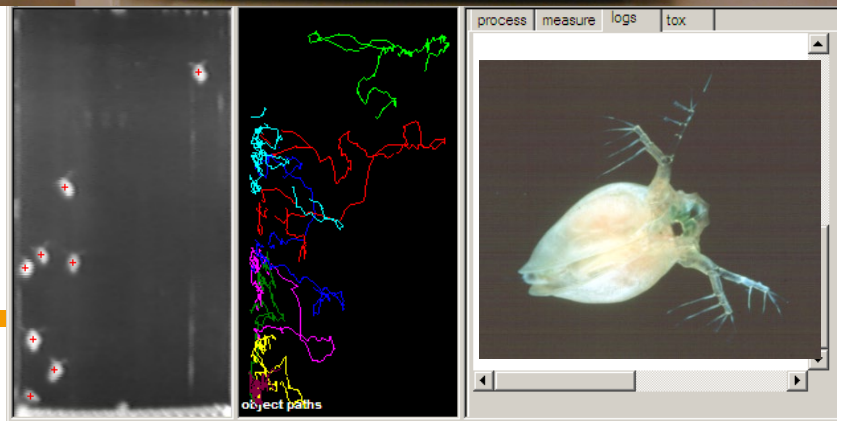
Sewage C

Sewage D

Sewage E

Biomonitoring for early warning





Waterbedrijf Groningen

Online biomonitors

IAZI Sitech services

Requirements for case Sitech (IAZI effluent)

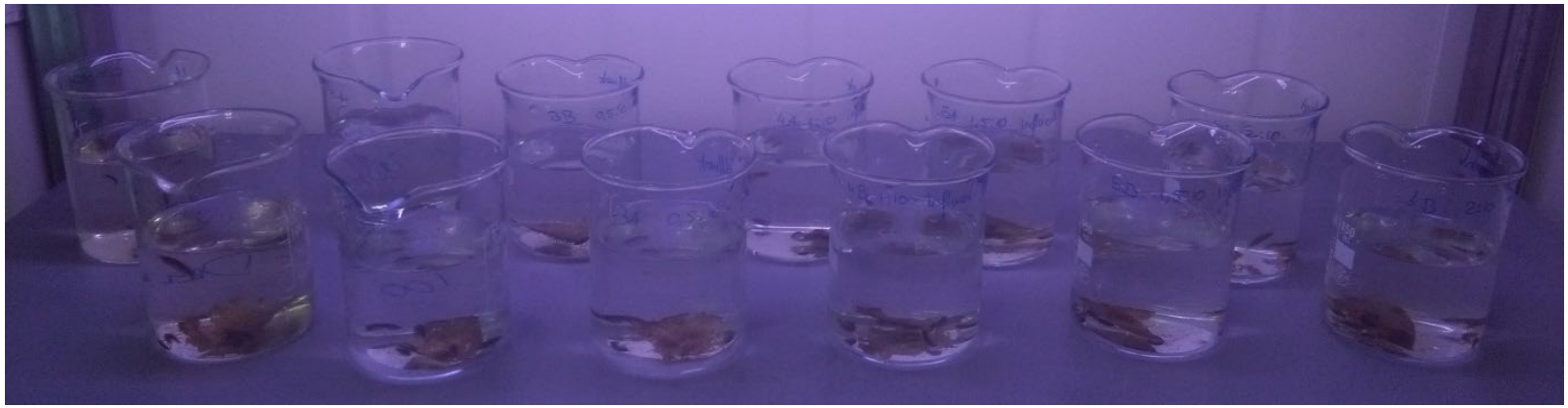
- Sensitivity: at least comparable with other biomonitor
- Trustability: no false negative alarms.
- Processing rate: no time loss due to pre-treatment of test water.
- Simplicity: system is easy to maintain by Sitech operators, maintanance < 4 hours per week).
- Robustness: system operates at least 95% of time, regardless the circumstances.
- Supplier: expected that supplier can support the system on long term (> 5 years).

Data screening: sensitivity model organisms

- 81 substances, relevant for Sitech
- Fishes, Daphnia sp., Algea, Gammarus sp., Vibrio fischeri and mussels.
- LC50 of EC50 values (modelorganisms – substances) in databases: mainly fish, Daphnia, algea.
- Literature search for mussels, Vibrio fischeri, Gammarus.

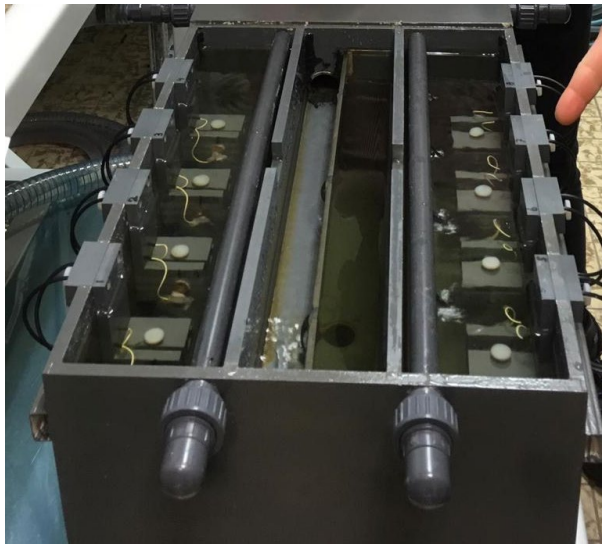
	Fish		Daphnia		Algea		Gammarus sp.	
Position	Frequency (%)	Times in this position	Frequency (%)	Times in this position	Frequency (%)	Times in this position	Frequency (%)	Times in this position
#1st	25	7	59	17	40	8	33.3	2
#2nd	61	17	24	7	25	5	33.3	2
#3rd	14	4	17	5	15	3	0	0
#4th	0	0	0	0	20	4	33.3	2
Sum	100	28	100	29	100	20	100	6
Average Ranking	-	1.9		1.6		2.2		2.3

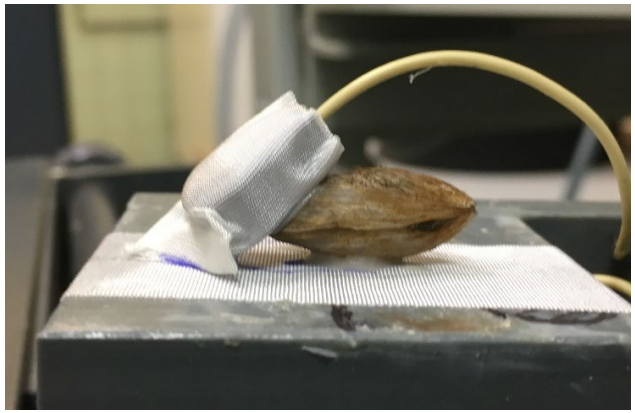
Sensitivity Gammarus pulex

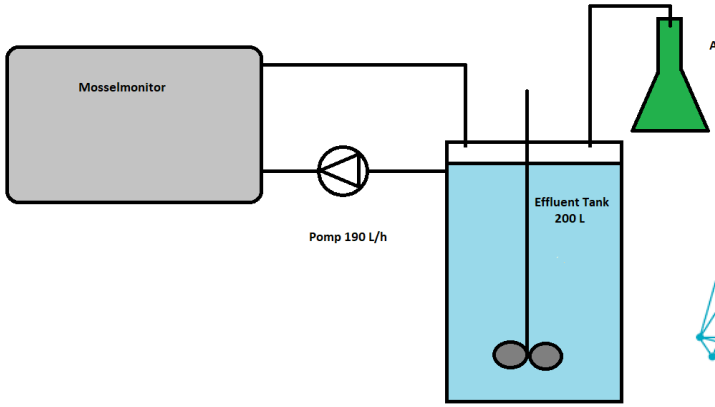


- Sensitivity assessment in batch mode: Gammarus versus Daphnia
- Concentration ranges Sitech influnt / effluent (% v/v)
- EC50 Gammarus pulex ≈ EC50 Daphnia magna
- Observed inactivity Gammarids after couple of days…..
- Natural behaviour or feed deficiency?
- To many questions…..

Musselmonitor preliminary tests Leeuwarden







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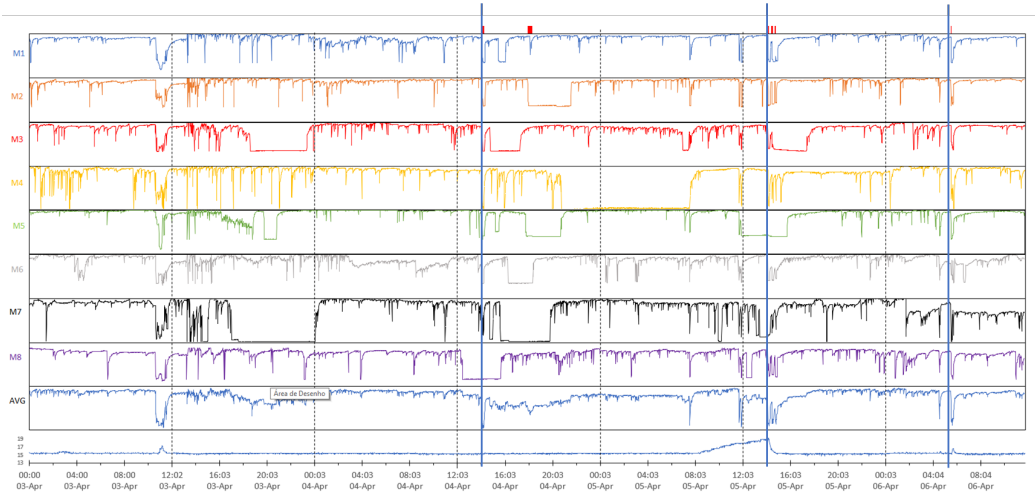

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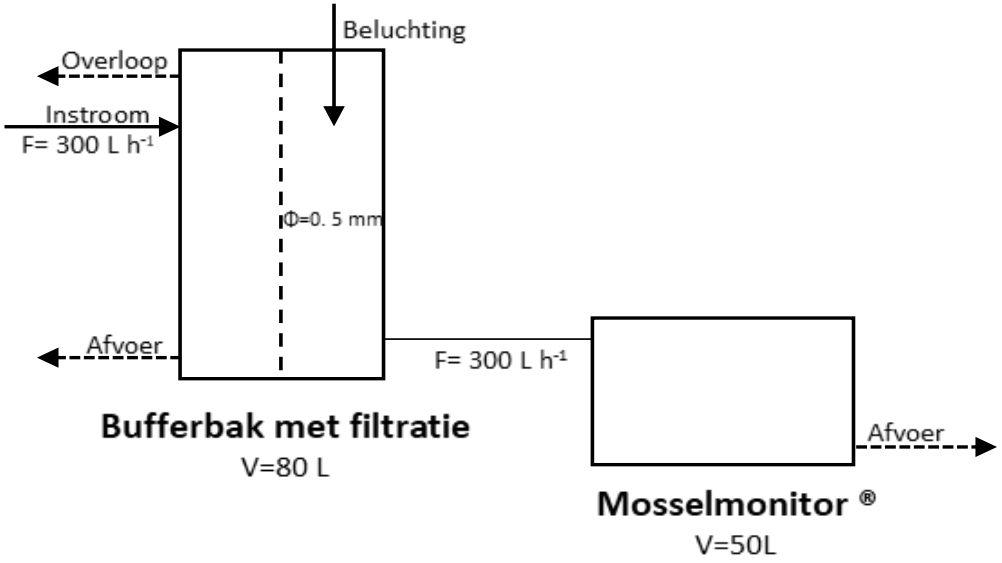
Musselmonitor onsite tests

sitech services

1. Stable functioning MOSSELMONITOR® under normal conditions?
2. Sensitivity? What disturbance will generate an alarm?
3. What are, for the Sitech case, proper alarm settings?

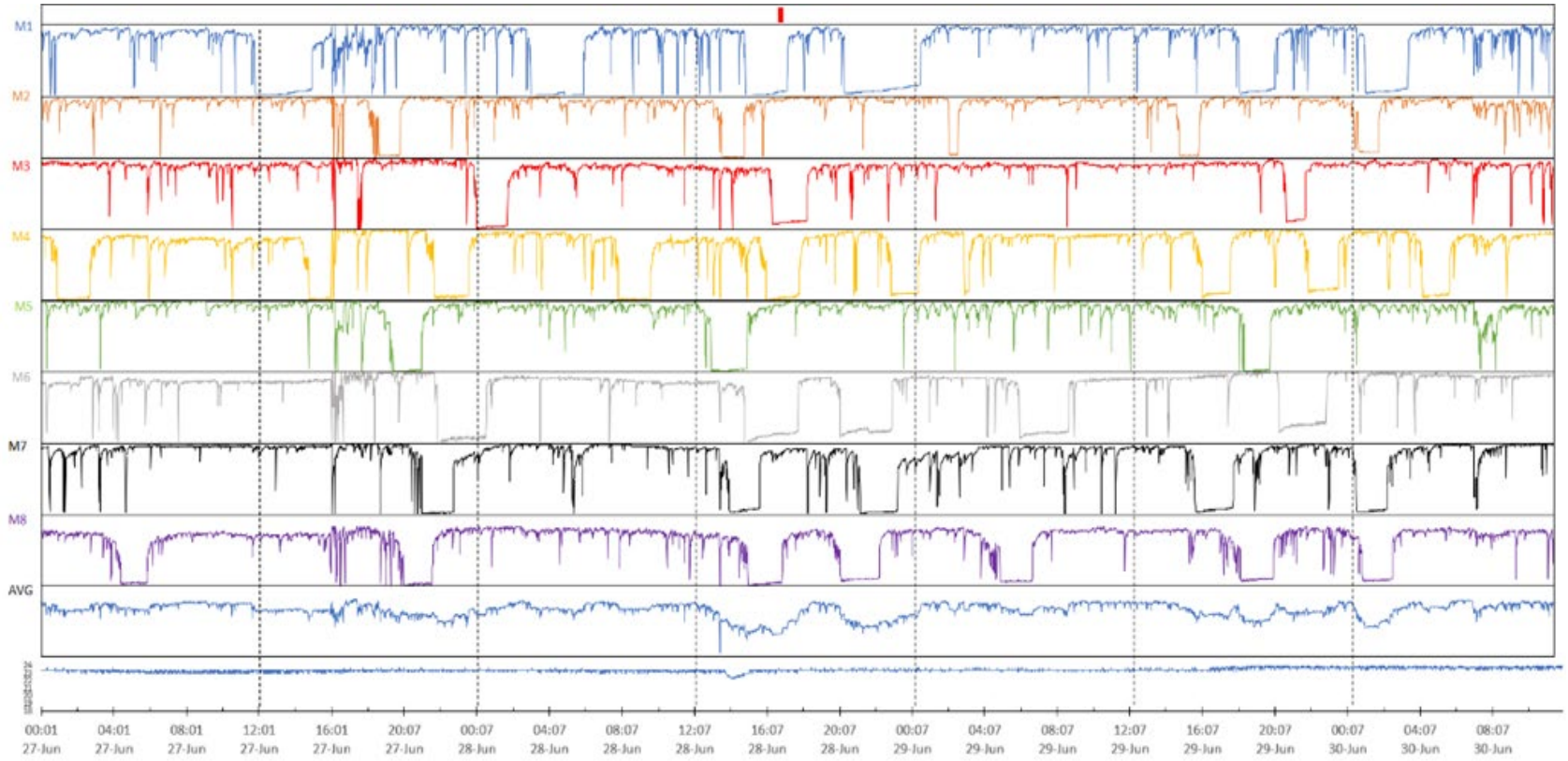
Experimental setup onsite tests

- Continuous monitoring April – July 2019
- Effect of dosing influent (## % v/v) to effluent = feedwater MM

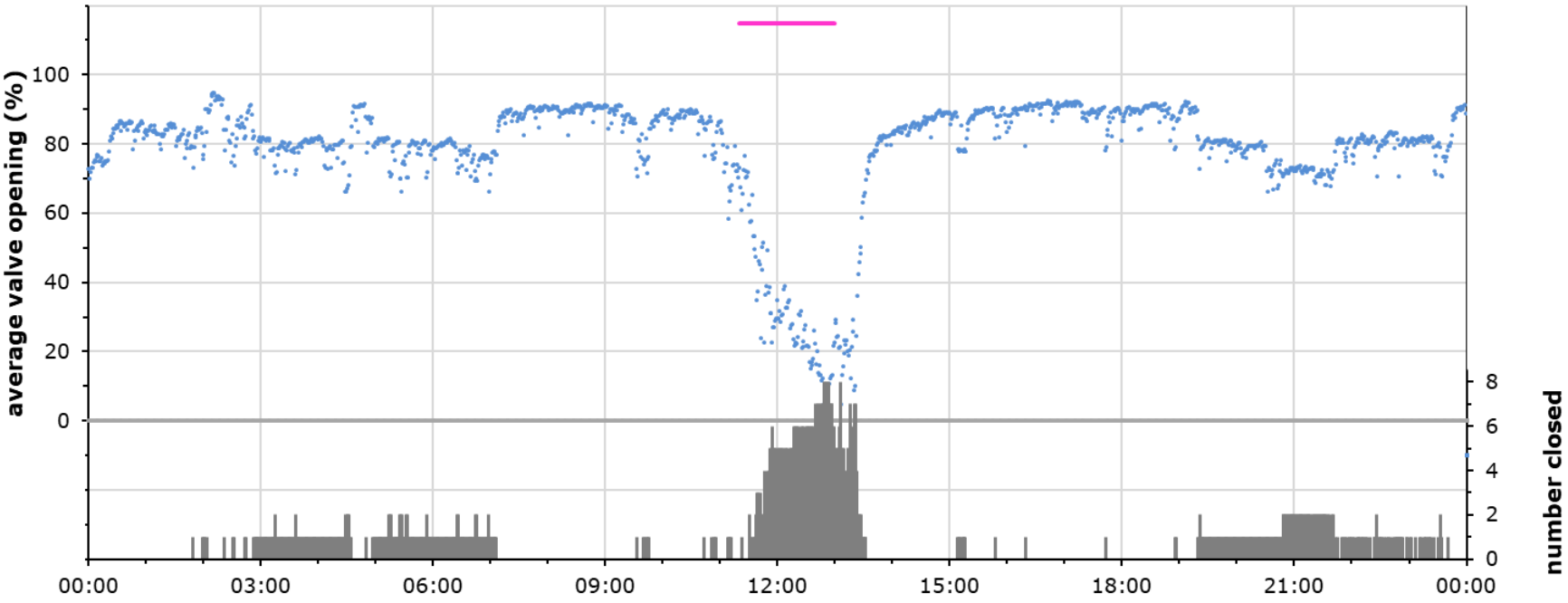


Quagga mussel (*Dreissena rostriformis bugensis*)

Stable operation

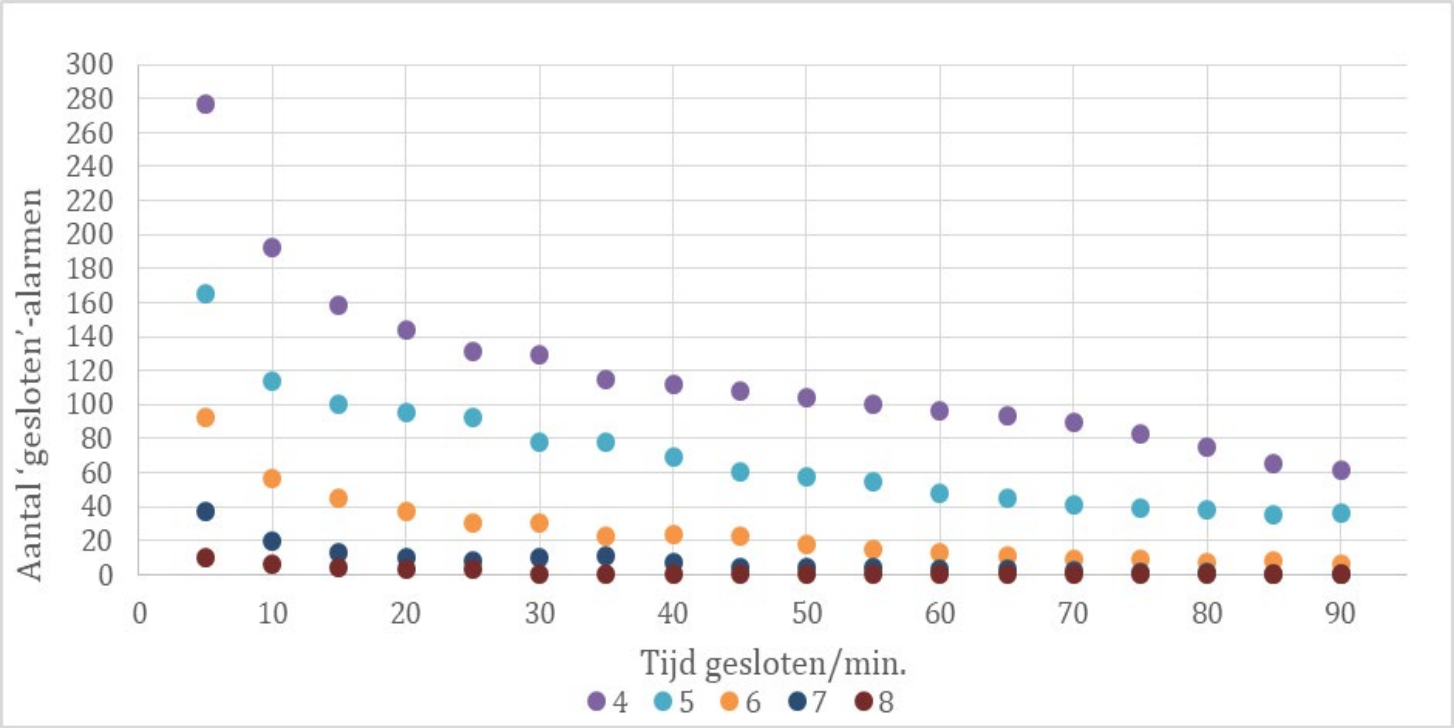


Sensitivity



Effect of dosing influent (3% v/v) to effluent = feedwater MM

Alarm settings (close alarm)



Relation between:
A. Alarm settings 'number of mussels closed at same time' and 'duration of closing' and
B. Number of alarms generated during research period (15 weeks).

Evaluation

1. MOSSELMONITOR®: stable functioning on Sitech IAZI effluent Mussel replacement frequency: once every 6 weeks.
2. Sensitivity: abnormal behaviour at small ammounts of influent dosed (1 – 3 % v/v).
3. Sensitivity is determined by alarm settings. Sensitivy and ‘false alarm risk’ decrease when number of mussels closed increases (setting 1) and when the closing time (setting 2) increases.

In general:

A. Applicability of biomonitors depends on specific local conditions.
B. Development needed in directions: simplicity, robustness, trustability.

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