

# A digital tool to monitor population dynamics

development of counting methods for Daphnia populations and possible use for other organisms

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Eversteoog  
on Texel

Sewage treatment  
plant  
with constructed  
wetland for effluent  
polishing





Eversteekoog  
Texel



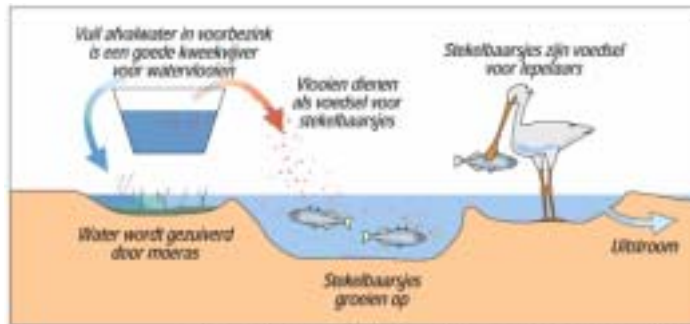
3



4

24 juni 2004

# 'Kwekelbaarsjes' 'Gricklebacks' project HHNK



17882 © de Volkskrant. Bron: Hengeloort waterloop van Utrechtse Stroom, Holland Nieuwskwater



## Daphnia as food for Sticklebacks



7

## Experimental system



Bakken  
Mesocosms



Vijvers  
Ponds

8

## Counting of Daphnia

- Ecotoxicological testing, 'Grickleback' project
  
- By hand
  - Labor intensive > expensive
  - Destructive methods > population dynamics / scale of experiments
  
- Need for a better method !

## Aim of this project

- Development of a digital tool to count Daphnia
  - UFZ (living material)
  - UvA (fixated material)
  
- Monitor Daphnia populations in experimental setup 'grickelback' project

## Eco-toxicological Research UFZ

- Method developed by the Effect Propagation group department of Chemical Ecotoxicology of UFZ Centre for Environmental Research Leipzig-Halle
- M. Liess and B. Pieters, in cooperation with UvA

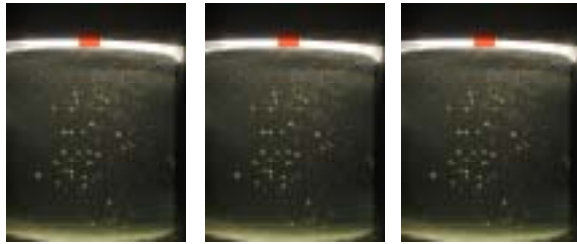


11

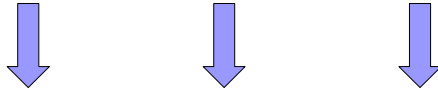


Toxicity test in 4.7 l round vessels with a black backside  
Digital camera mounted in a device aimed on a vessel

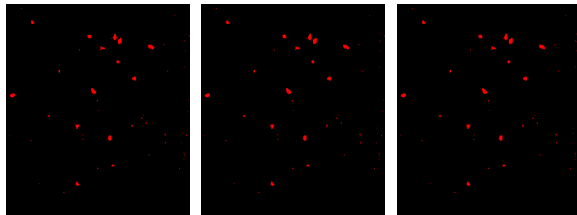
12



3 pictures  
Short time interval



LIVING DAPHNIA !



Digital imaging  
substraction of  
particles not moved

13

## UFZ method

- Very useable method !
- Makes it possible to follow population dynamics on life Daphnia in groups
- Making the pictures is an easy job
- But, processing data less easy
- Field samples ?
- Thesis Barry Pieters

14



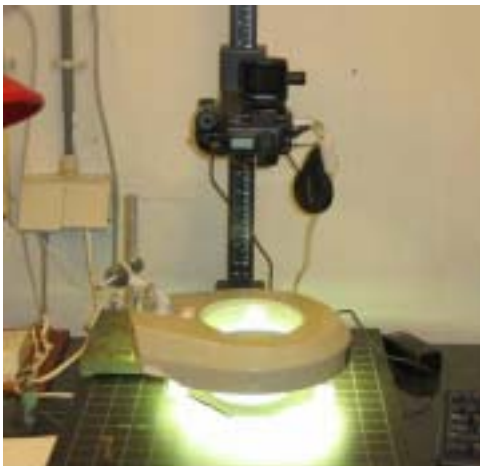
## Counting fixated material (UvA)



Sampling in the field  
Fixation in ethanol  
Analysis in laboratory

15

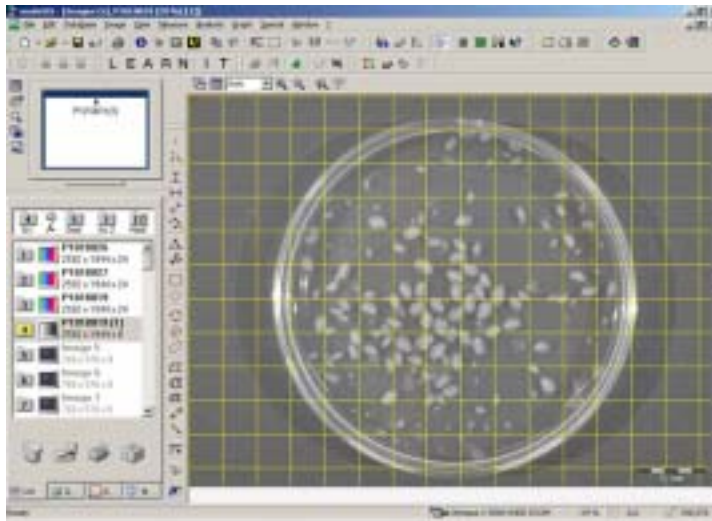
## setup



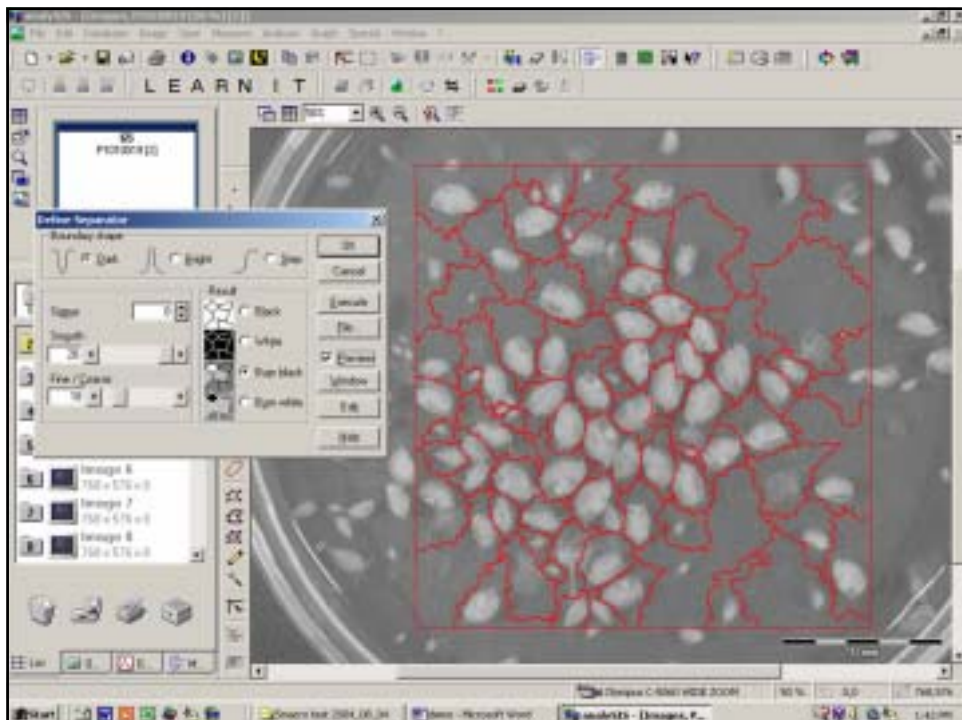
16

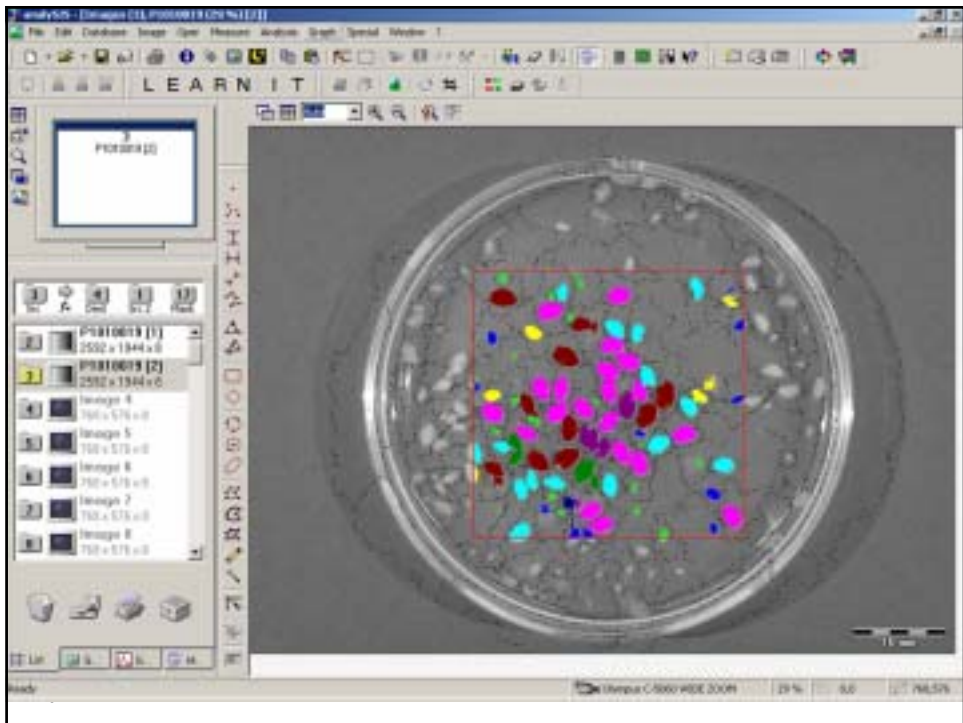


# Standard software (Analysis FIVE)

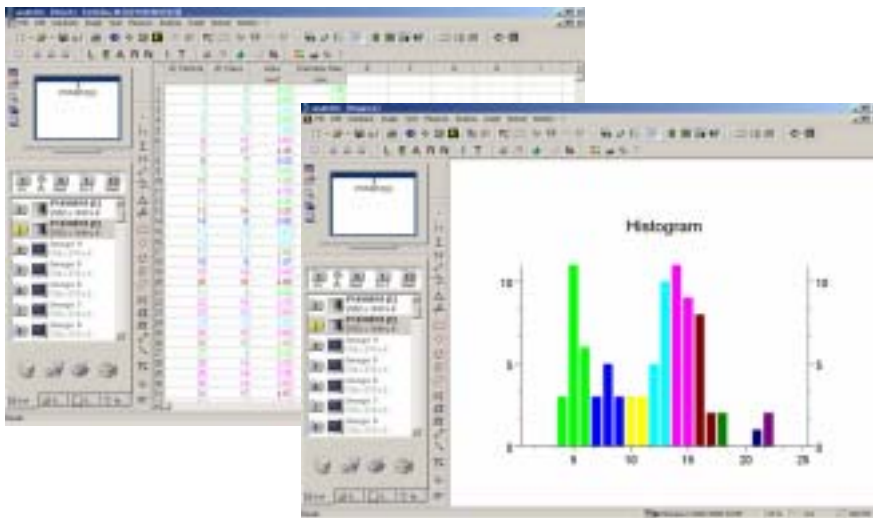


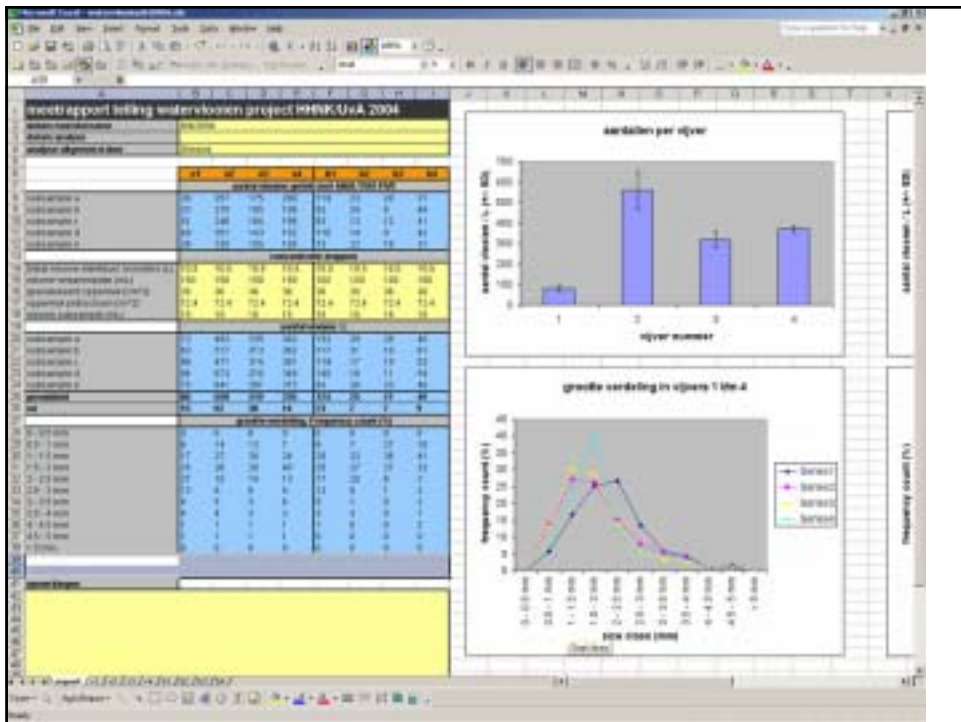
17





## Output: numbers/size distribution





## UvA method

- Works quick and easy
- Software easy to use (macro)
- Database
- Separate Daphnia from 'noise' (shape, size)

## Application in the field



23

## VU (adapted from UFZ)



24

## VU (adapted from UFZ)

- Counting living Daphnia
- Field method based on work of UFZ works,
- BUT, problems with
  - 'front - side' effect
  - suspended solids, noise

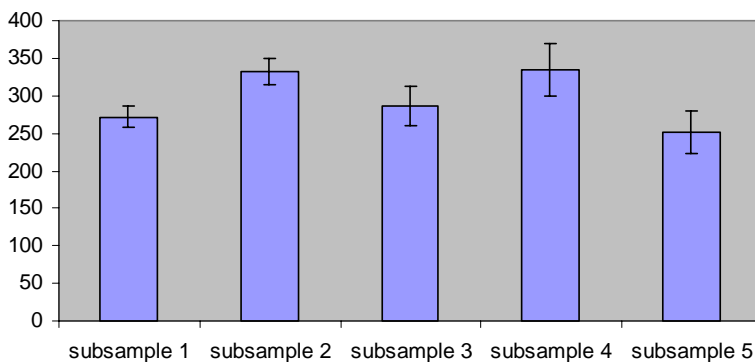
UvA method in the field  
Shape/size recognition  
is able to separate  
Daphnia from 'noise'



25

## Method evaluation

aantal individuen average

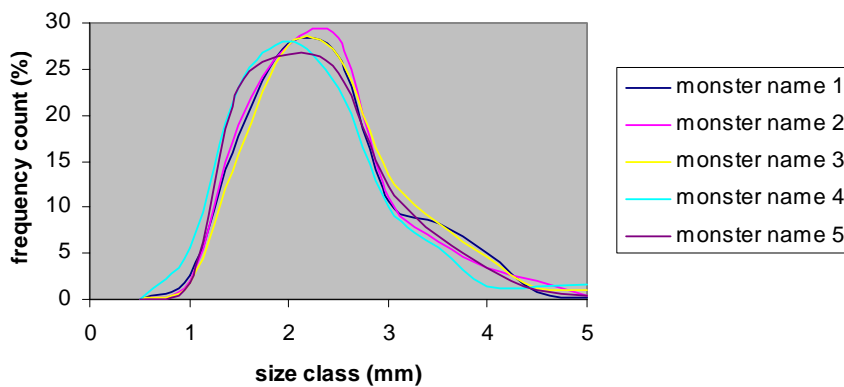


Manual counts, digital counts  $R^2=0.94$

26



## Method evaluation



27

## Daphnia in 'Grickleback' system



2004

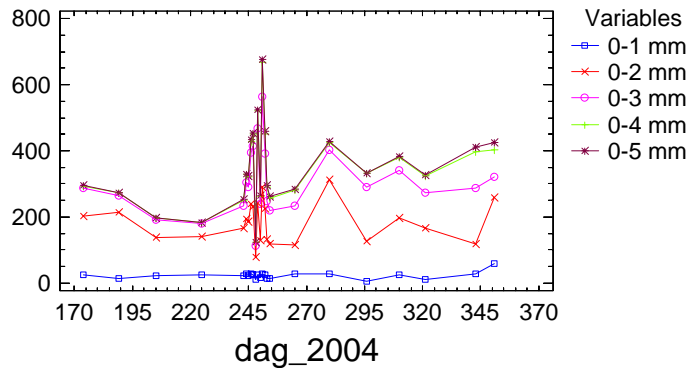
Every two weeks

Week 36/37  
each day

28

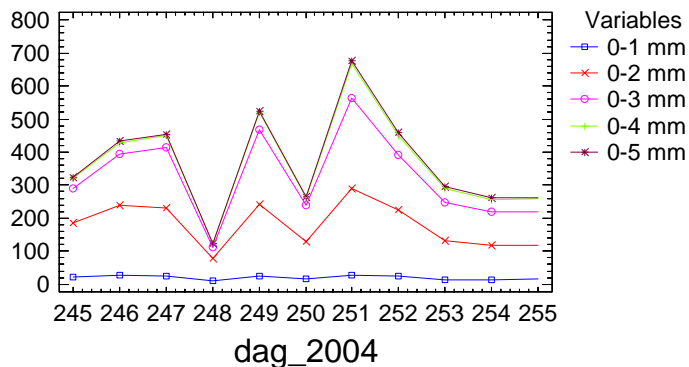
# Daphnia in 'Grickleback' system

Bak 1 - Daphnia cumulative (per l)



# Daphnia in 'Grickleback' system

Bak 1 - Daphnia cumulative (per l) - intensive





## Potential other applications ?



31

## Potential other applications ?

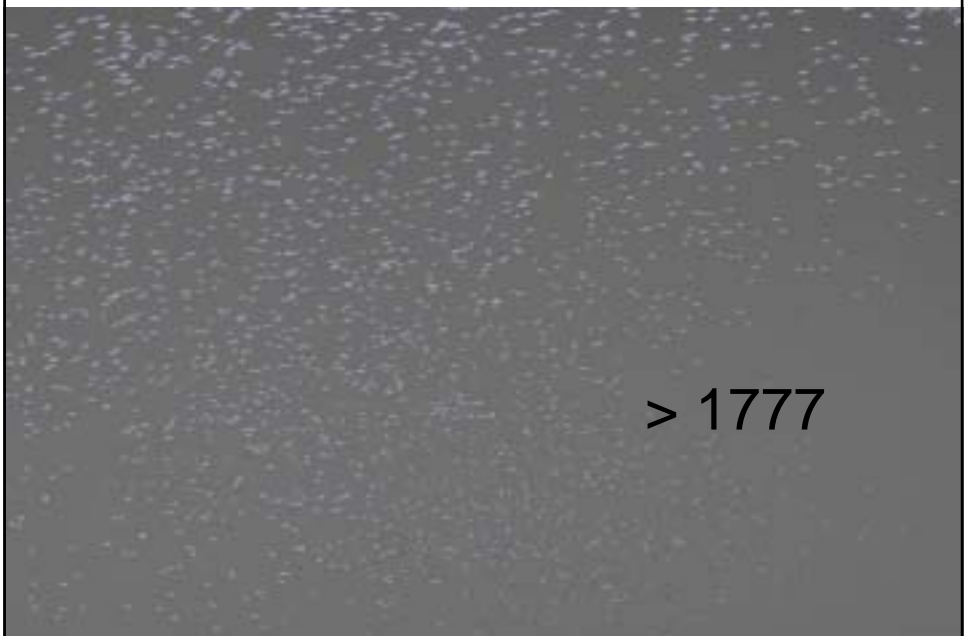


32



41 Golden Plovers





> 1777

Folsomia tox test

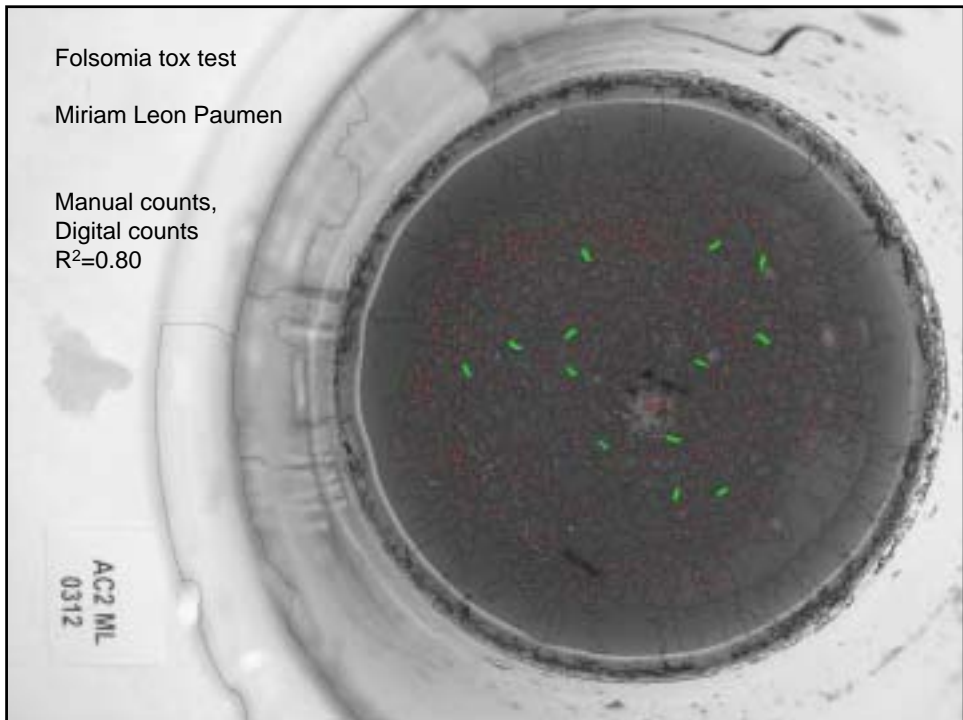
Miriam Leon Paumen



Folsomia tox test

Miriam Leon Paumen

Manual counts,  
Digital counts  
 $R^2=0.80$

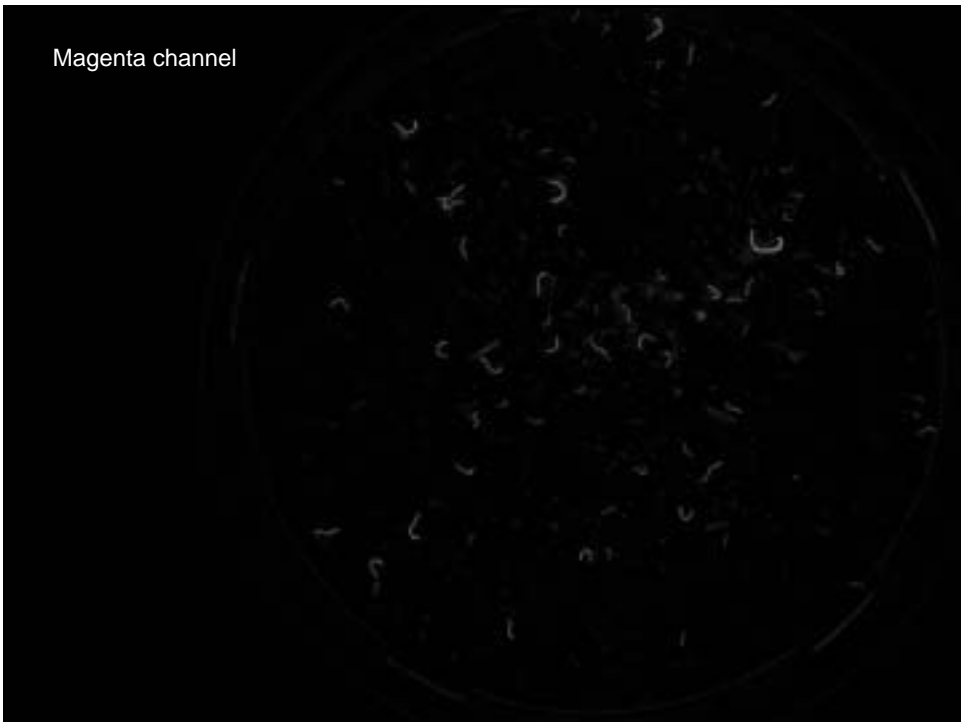


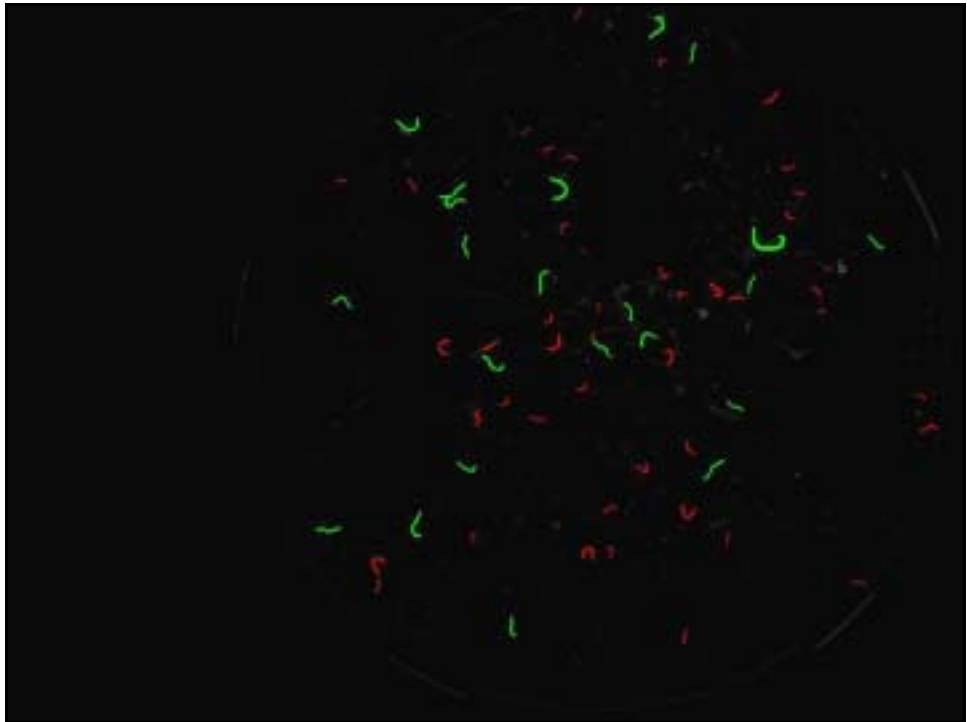
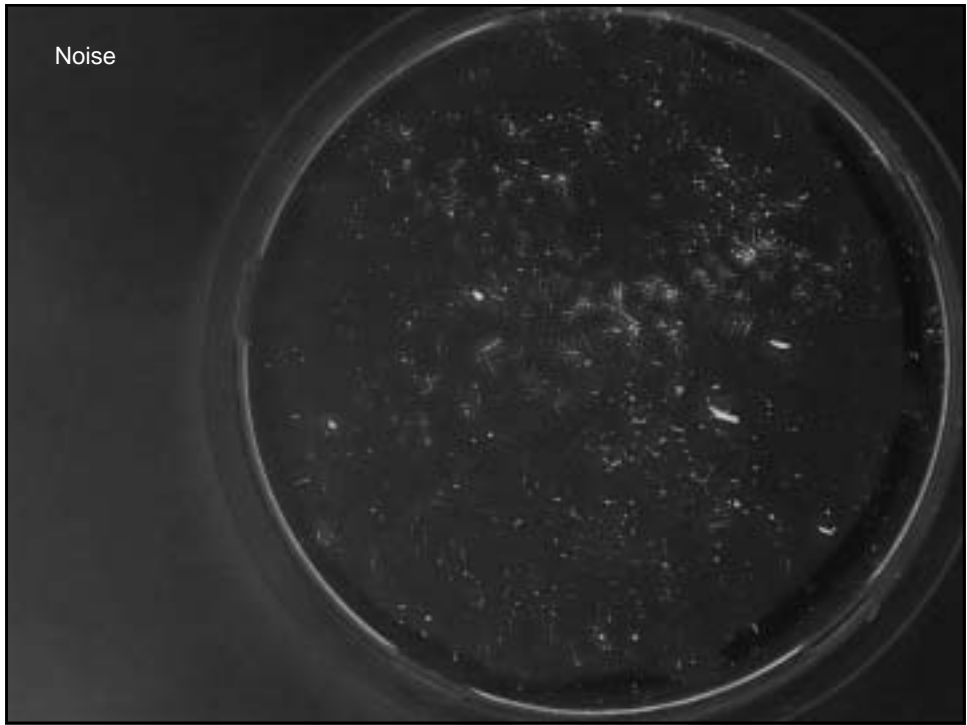
Enchytraeus tox test

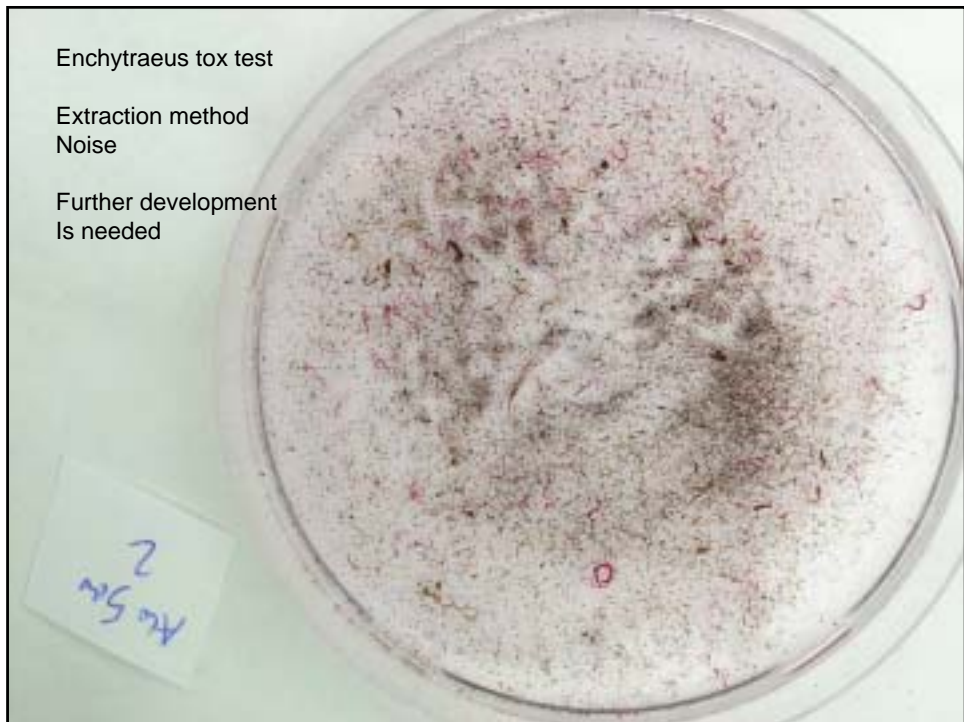
Miriam Leon Paumen



Magenta channel







## Conclusions

- New counting tools for Daphnia are available
- Reliable counts of numbers, size distributions
- Monitor population dynamics in lab and field situations, using living and fixated individuals
- Useable for other organisms. E.g. birds, springtails



