

# A digital tool to monitor population dynamics

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

Harm van der Geest (UvA)  
Simone Lucker (UvA)  
Miriam Leon Paumen (UvA,VU)  
Ruud Kampf (HHNK,VU)  
Barry Pieters (UvA,UFZ)



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Eversteoog  
on Texel

Sewage treatment  
plant  
with constructed  
wetland for effluent  
polishing



2



Eversteekoog  
Texel



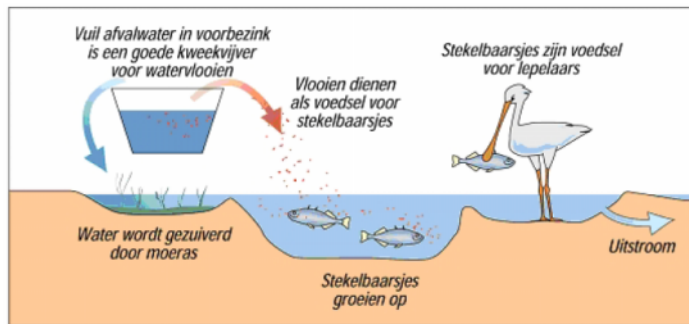
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24 juni 2004

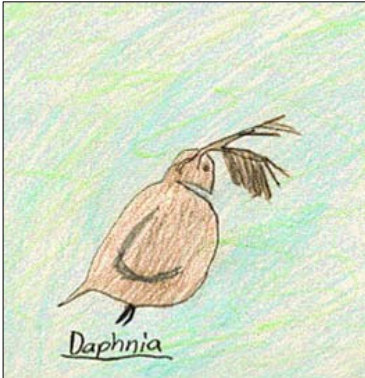
# 'Kwekelbaarsjes' 'Gricklebacks' project HHNK



170802 © de Volkskrant. Bron: Hoogheemraadschap van Uitwaterende Sluizen, Hollands Noorderkwartier



## Daphnia as food for Sticklebacks



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## Experimental system



Bakken  
Mesocosms



Vijvers  
Ponds

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## 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

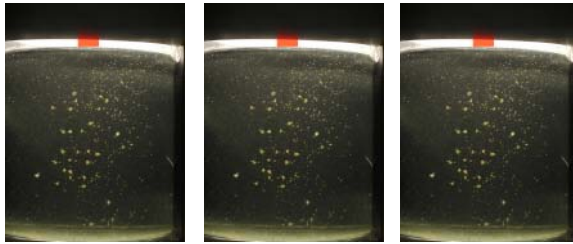


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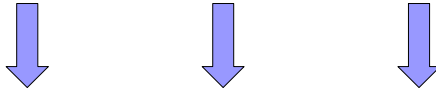


Toxicity test in 4.7 l round vessels with a black backside  
Digital camera mounted in a device aimed on a vessel

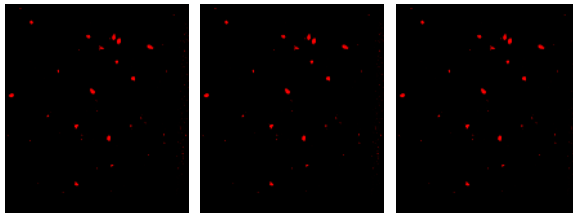
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3 pictures  
Short time interval



LIVING DAPHNIA !



Digital imaging  
substraction of  
particles not moved

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## 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

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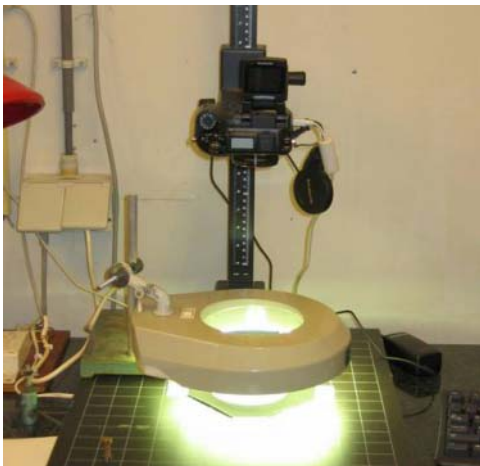
## Counting fixated material (UvA)



Sampling in the field  
Fixation in ethanol  
Analysis in laboratory

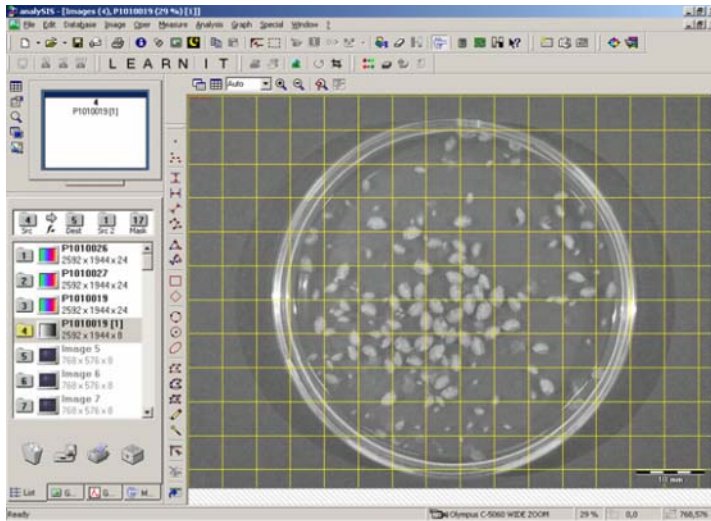
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## setup

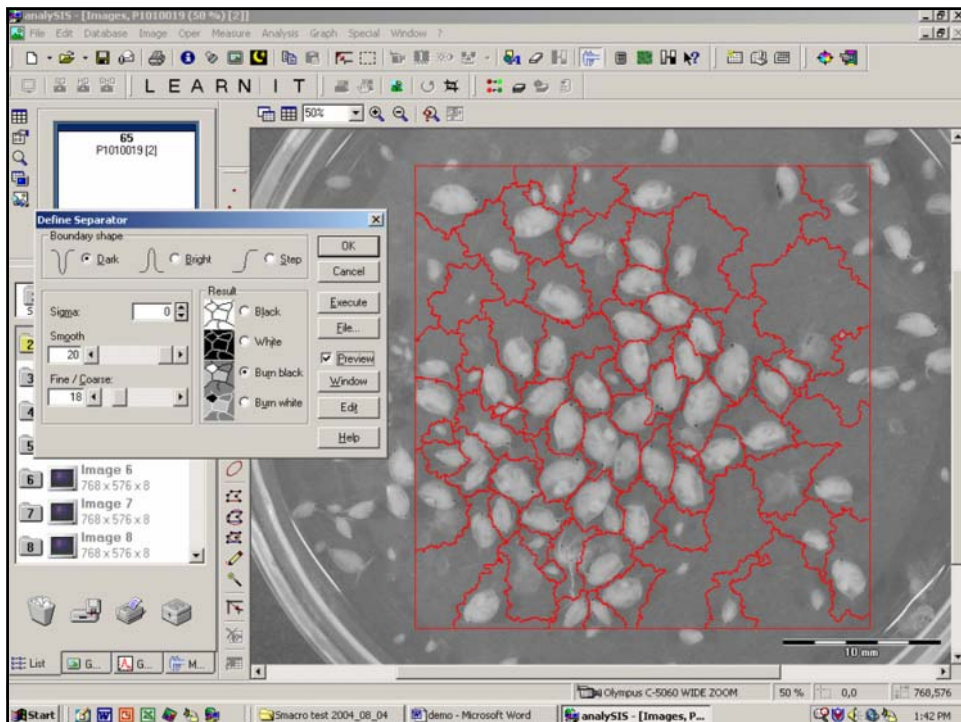


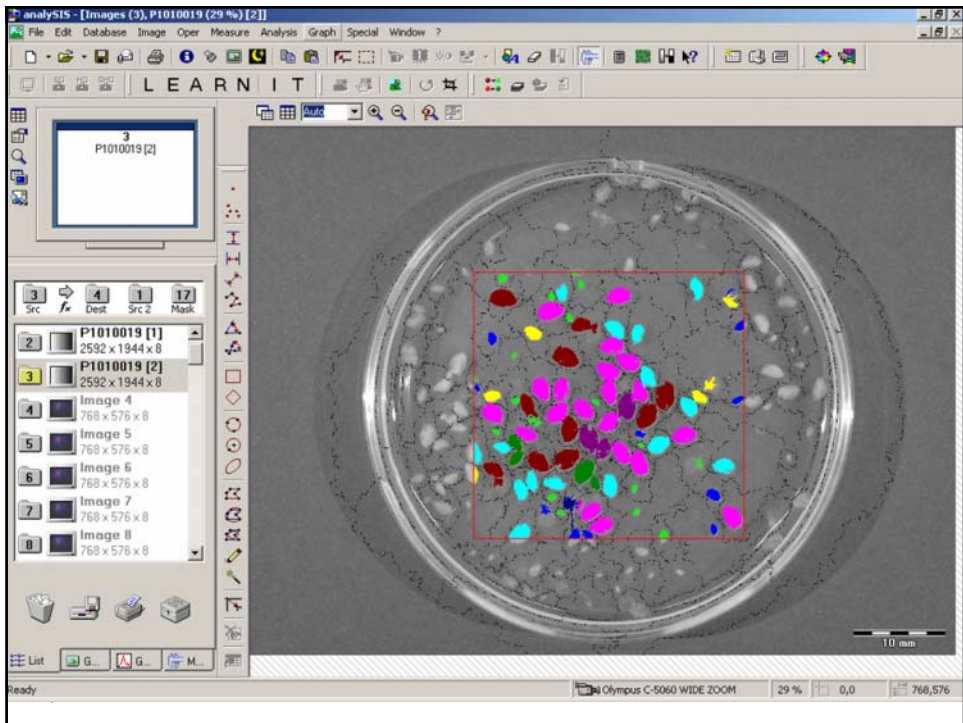
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# Standard software (Analysis FIVE)

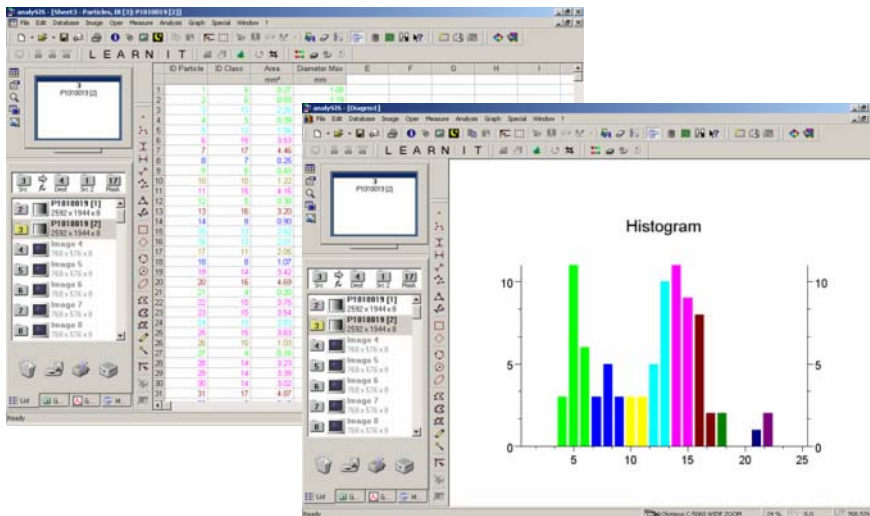


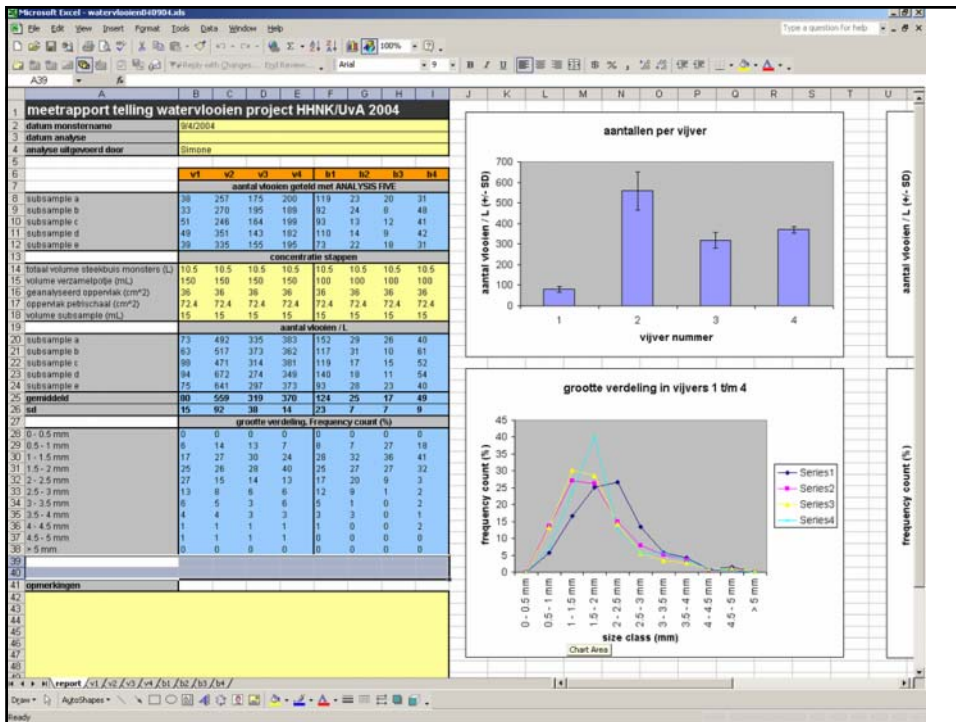
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## Output: numbers/size distribution





## UvA method

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

## Application in the field



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## VU (adapted from UFZ)



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## VU (adapted from UFZ)

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

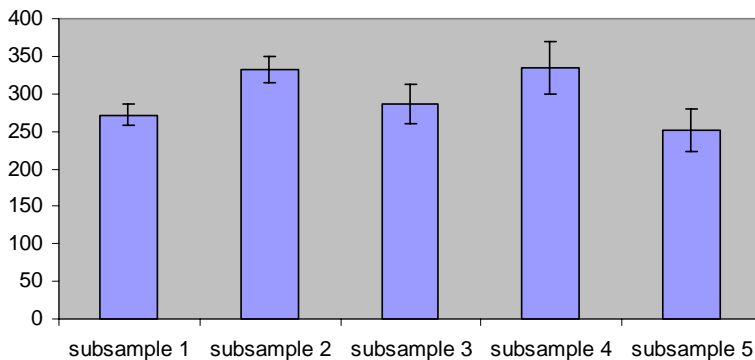
UvA method in the field  
Shape/size recognition  
is able to separate  
Daphnia from 'noise'



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## Method evaluation

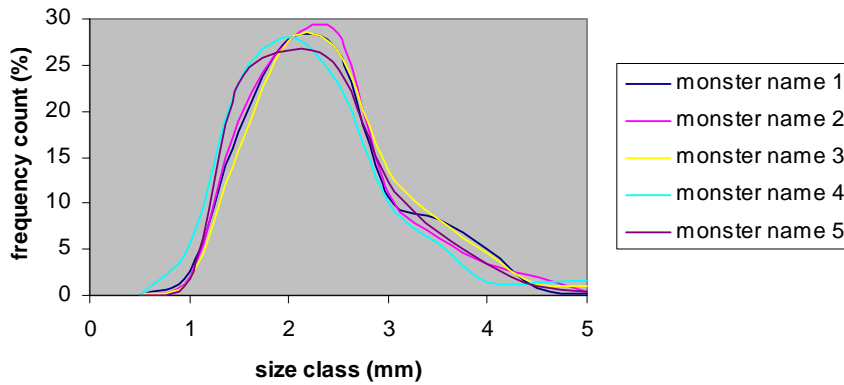
aantal individuen average



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

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## Method evaluation



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## Daphnia in 'Grickleback' system



2004

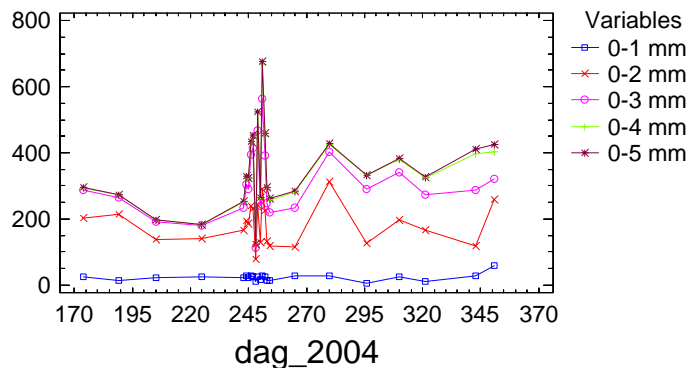
Every two weeks

Week 36/37  
each day

28

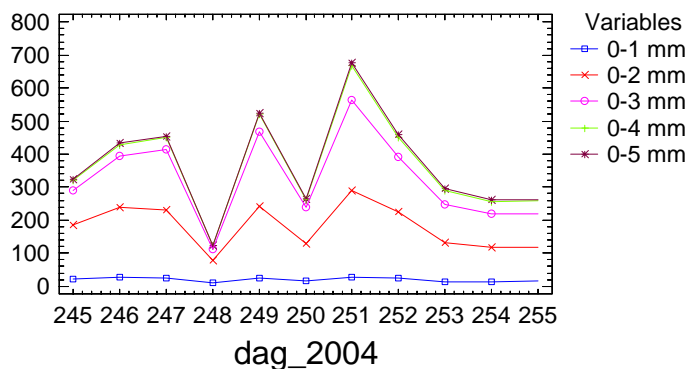
## Daphnia in 'Grickleback' system

Bak 1 - Daphnia cumulative (per l)



## Daphnia in 'Grickleback' system

Bak 1 - Daphnia cumulative (per l) - intensive



## Potential other applications ?



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## Potential other applications ?

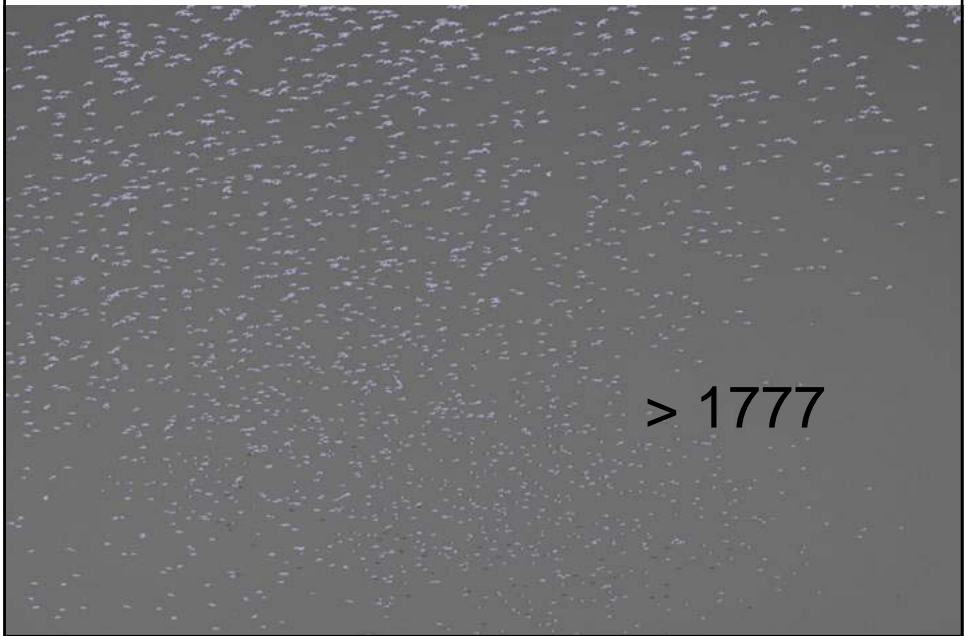


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41 Golden Plovers





Folsomia tox test

Miriam Leon Paumen

AC2 ML  
0312

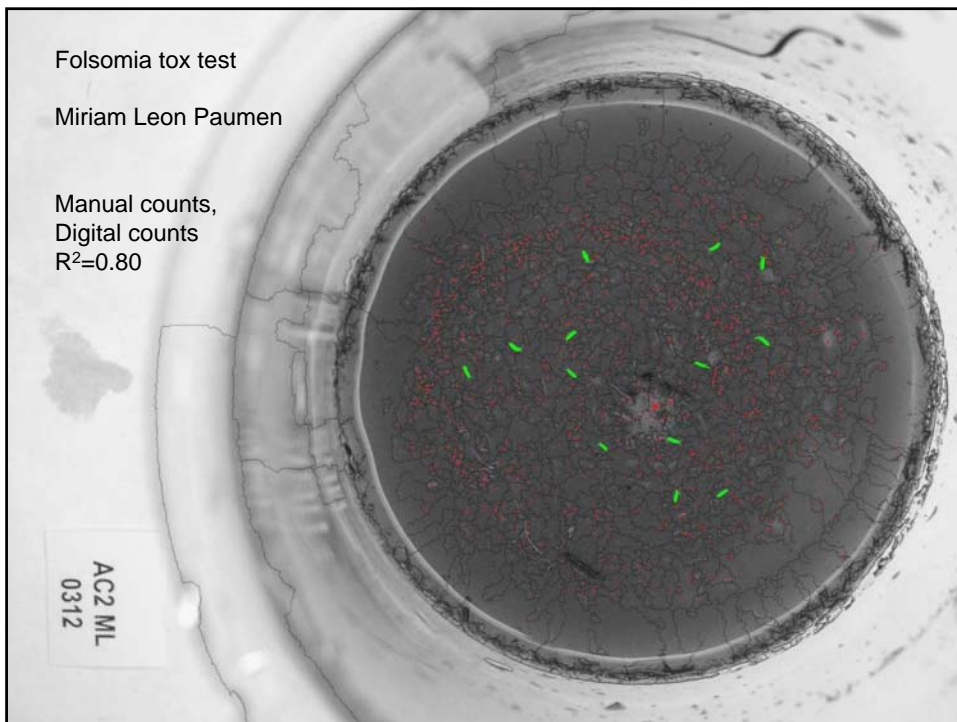


Folsomia tox test

Miriam Leon Paumen

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

AC2 ML  
0312

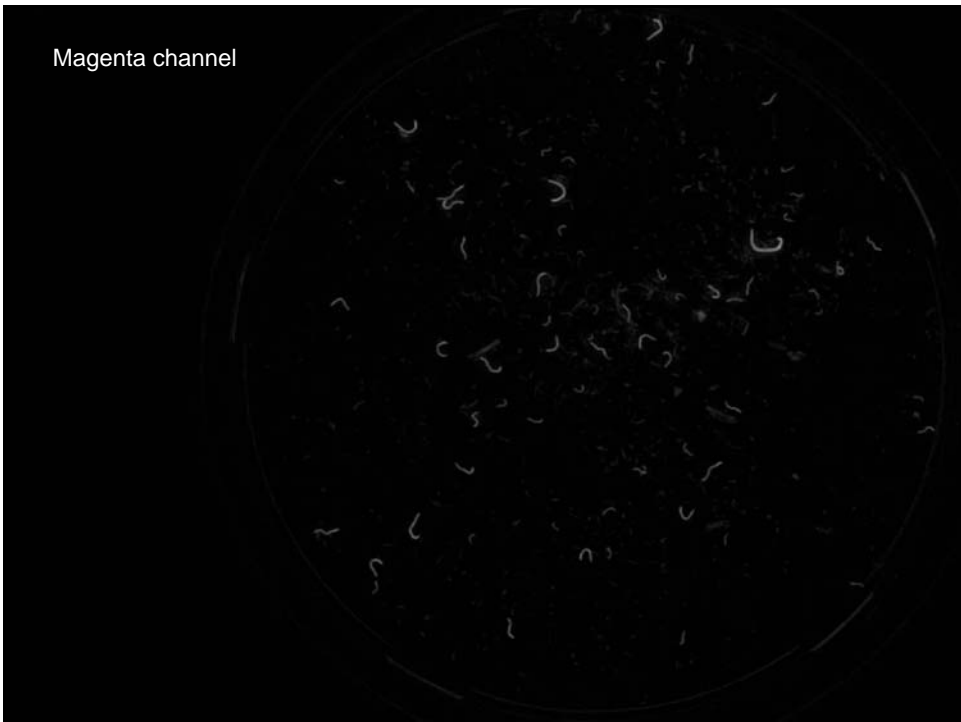


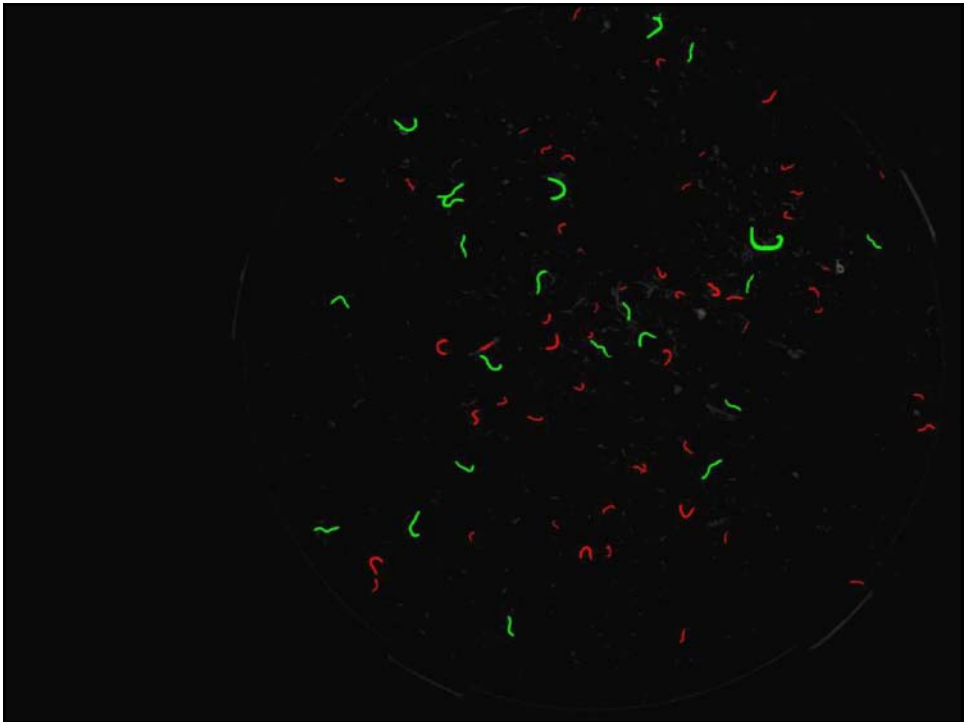
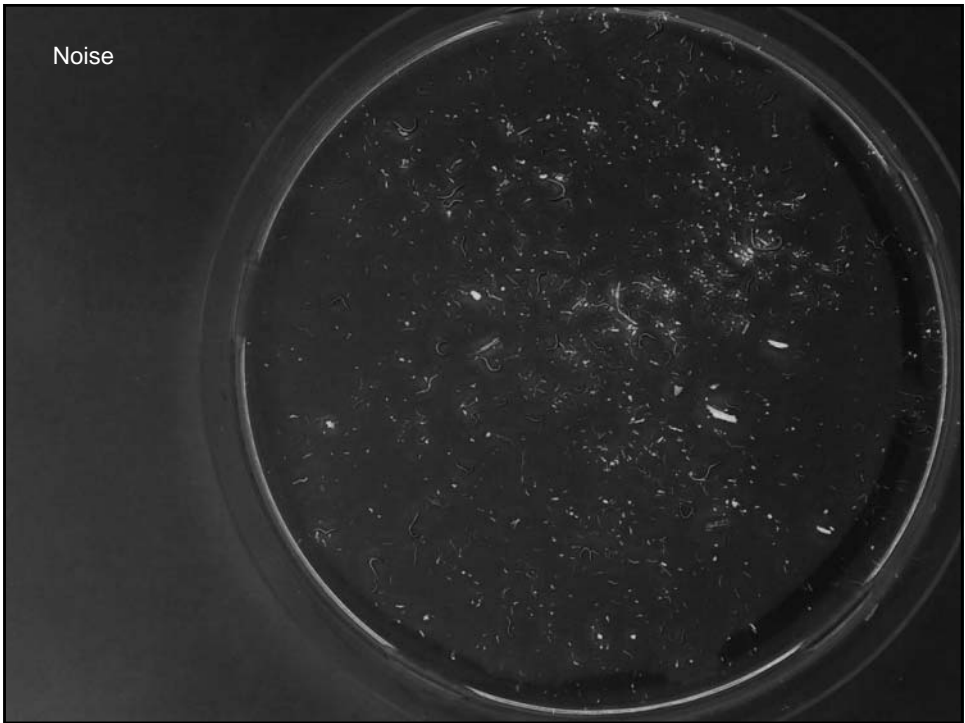
Enchytraeus tox test

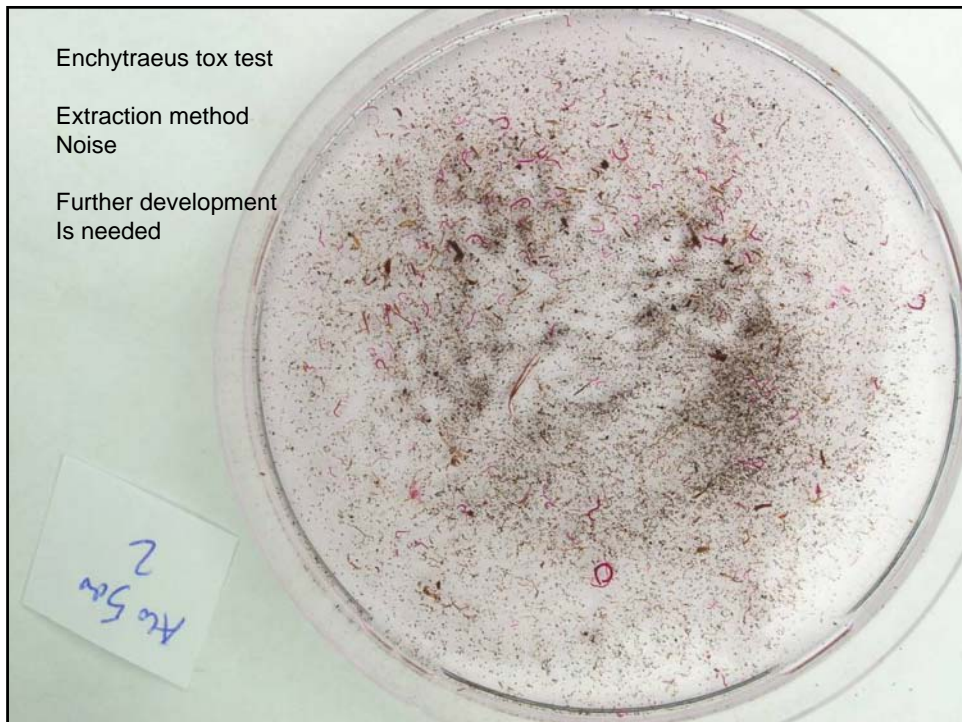
Miriam Leon Paumen



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

