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)

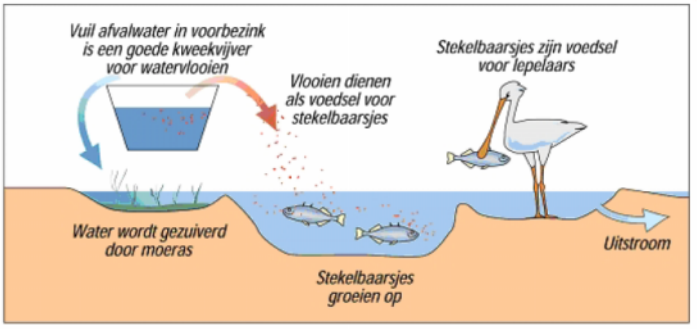
Everstekoog
on Texel

Sewage treatment plant
with constructed wetland for effluent polishing

Everstekoog
Texel

24 juni 2004

‘Kwekelbaarsjes’
‘Gricklebacks’
project HHNK



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

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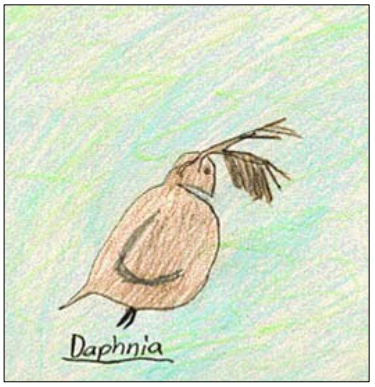
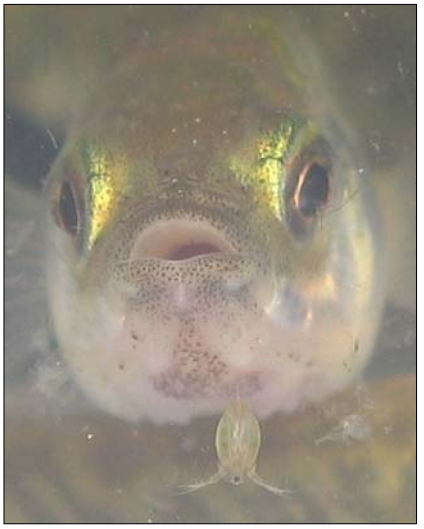
Daphnia as food for Sticklebacks





Experimental system

Bakken
Mesocosms

Vijvers
Ponds

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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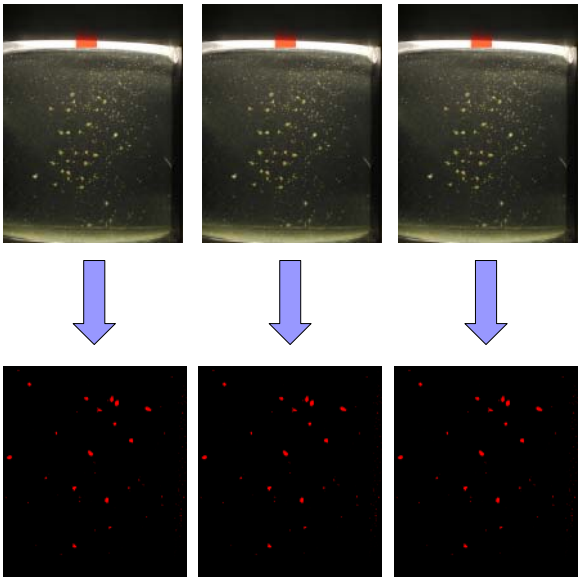
Toxicity test in 4.7 l round vessels with a black backside

Digital camera mounted in a device aimed on a vessel



3 pictures
Short time interval

LIVING DAPHNIA !

Digital imaging

substraction of
particles not moved

UFZ method

- Very useable method !
- Makes it possible to follow population dynamics on life Daphnia in groups
- Making the pictures is an easy job

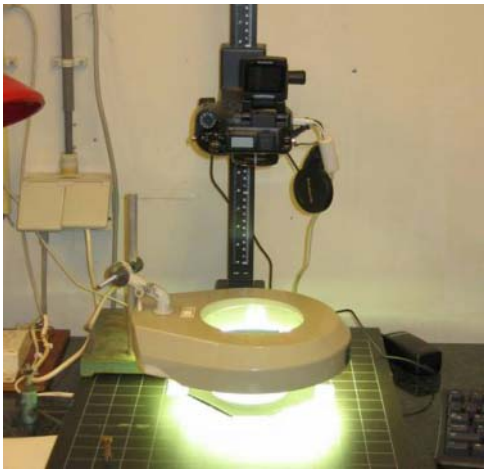
- But, processing data less easy
- Field samples ?

- Thesis Barry Pieters

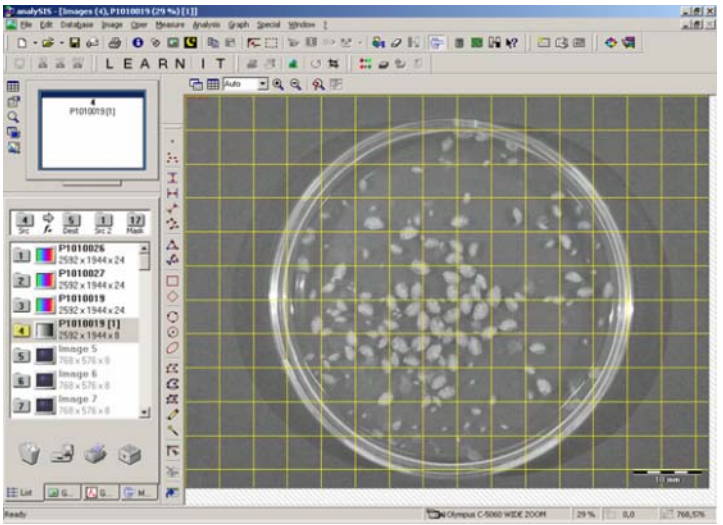
Counting fixated material (UvA)

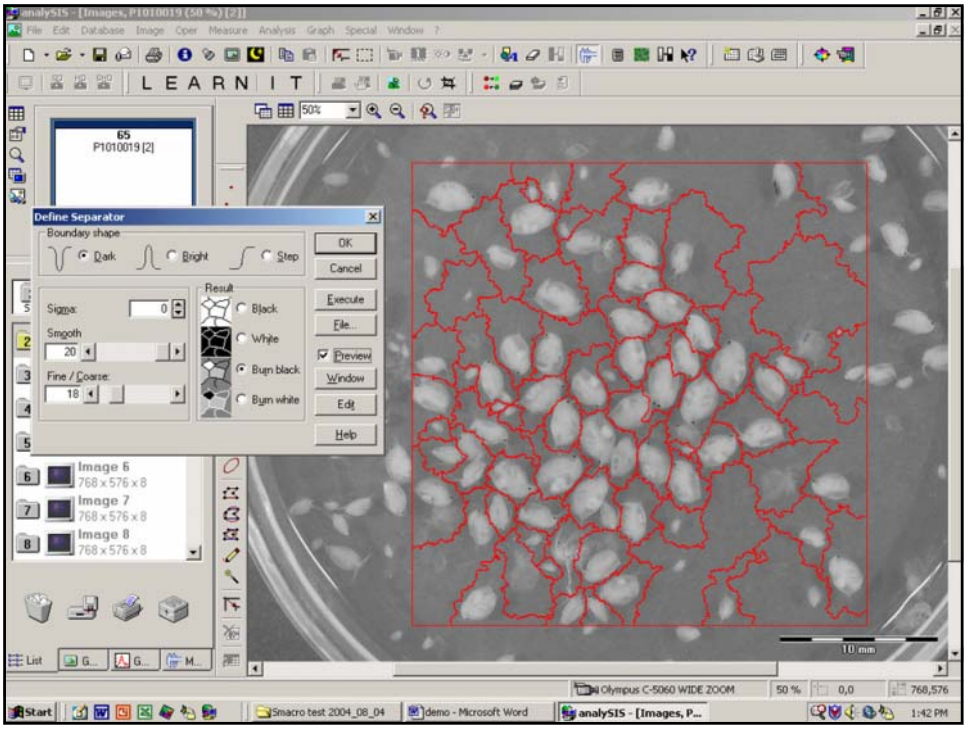
Sampling in the field
Fixation in ethanol
Analysis in laboratory

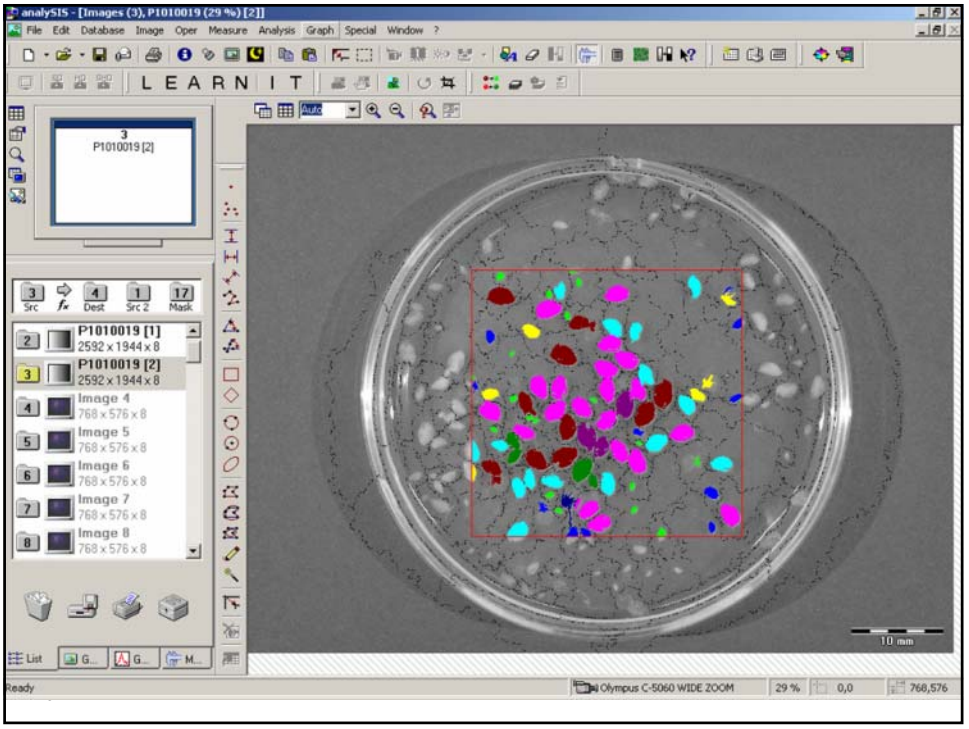
setup



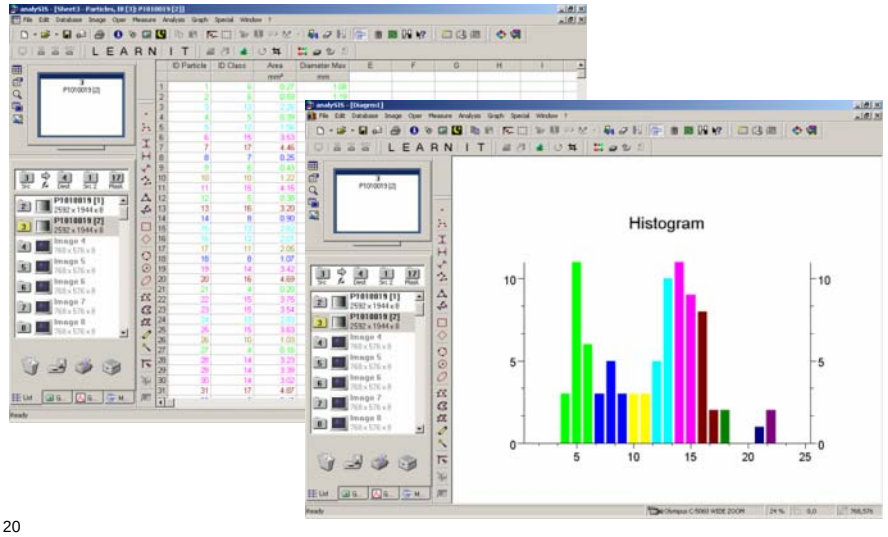
Standard software (Analysis FIVE)

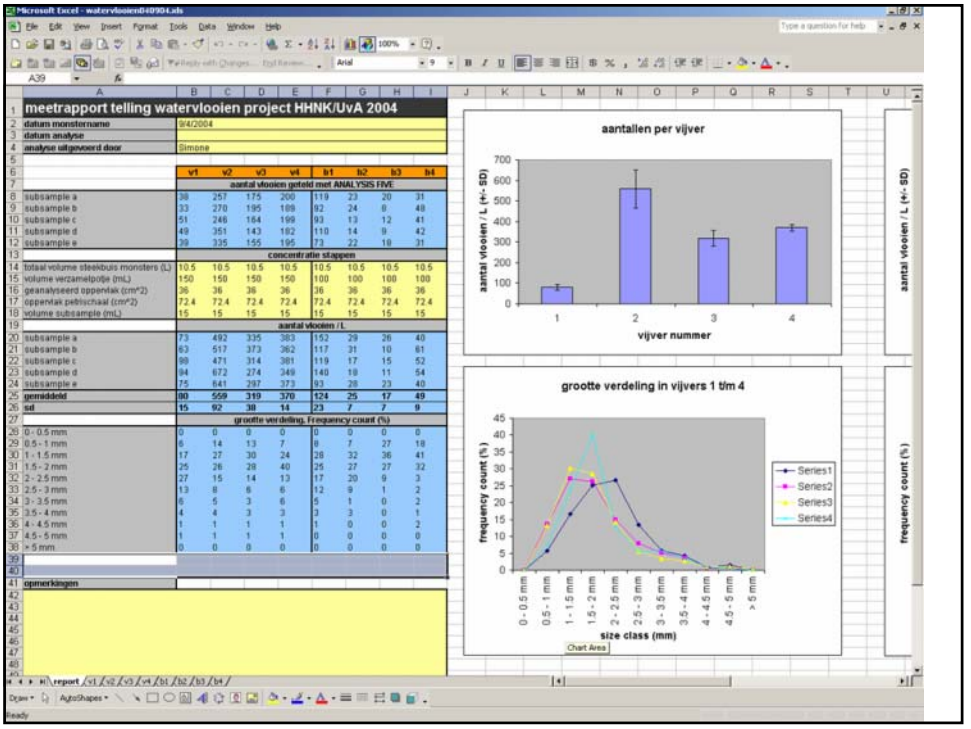






Output: numbers/size distribution





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UvA method

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

Application in the field

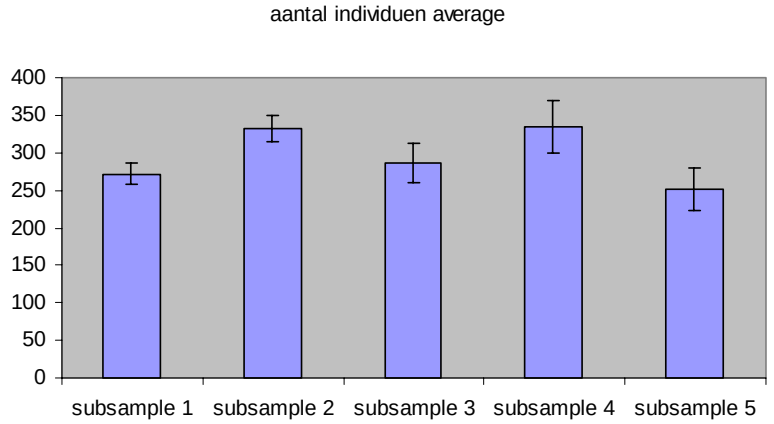
VU (adapted from UFZ)

VU (adapted from UFZ)

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

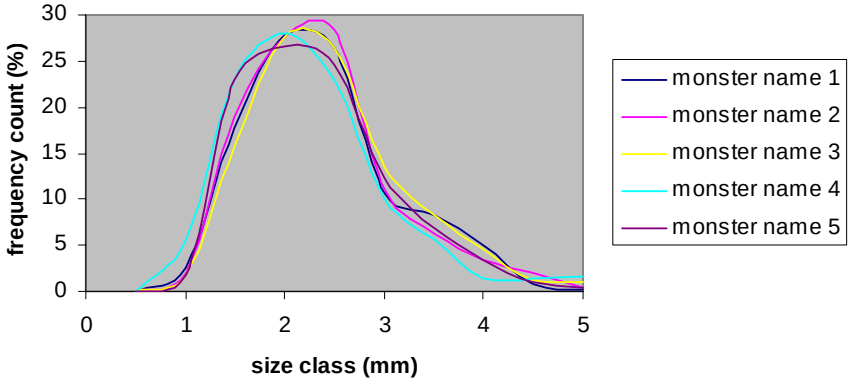
UvA method in the field
Shape/size recognition
is able to separate
Daphnia from 'noise'

Method evaluation



Manual counts, digital counts R^2=0.94

Method evaluation



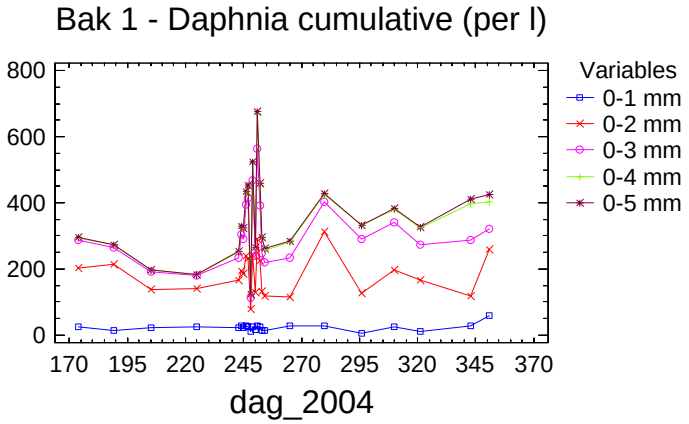
Daphnia in ‘Grickleback’ system

2004

Every two weeks

Week 36/37
each day

Daphnia in 'Grickleback' system



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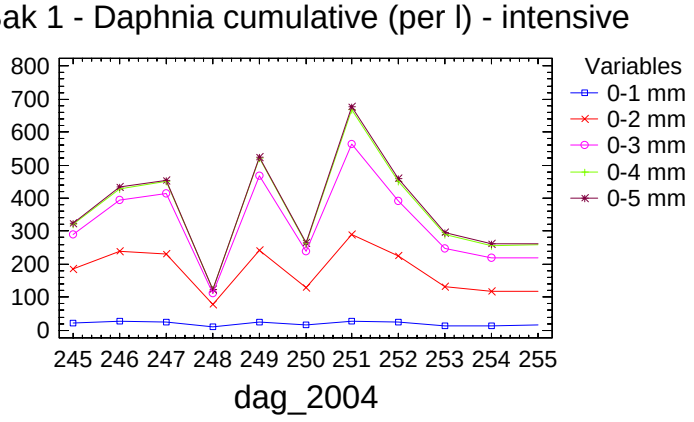
Daphnia in 'Grickleback' system



Potential other applications ?

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Potential other applications ?

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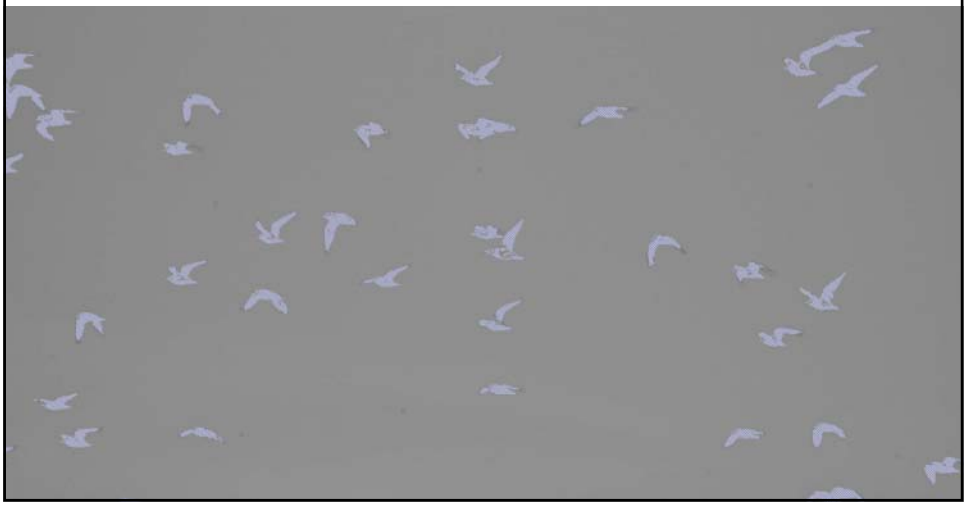
41 Golden Plovers



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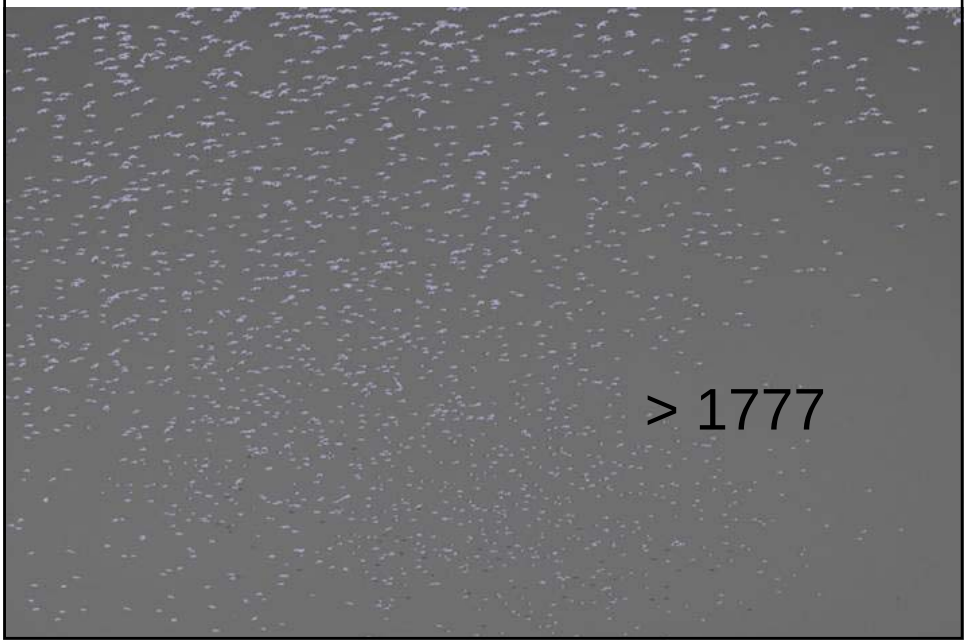
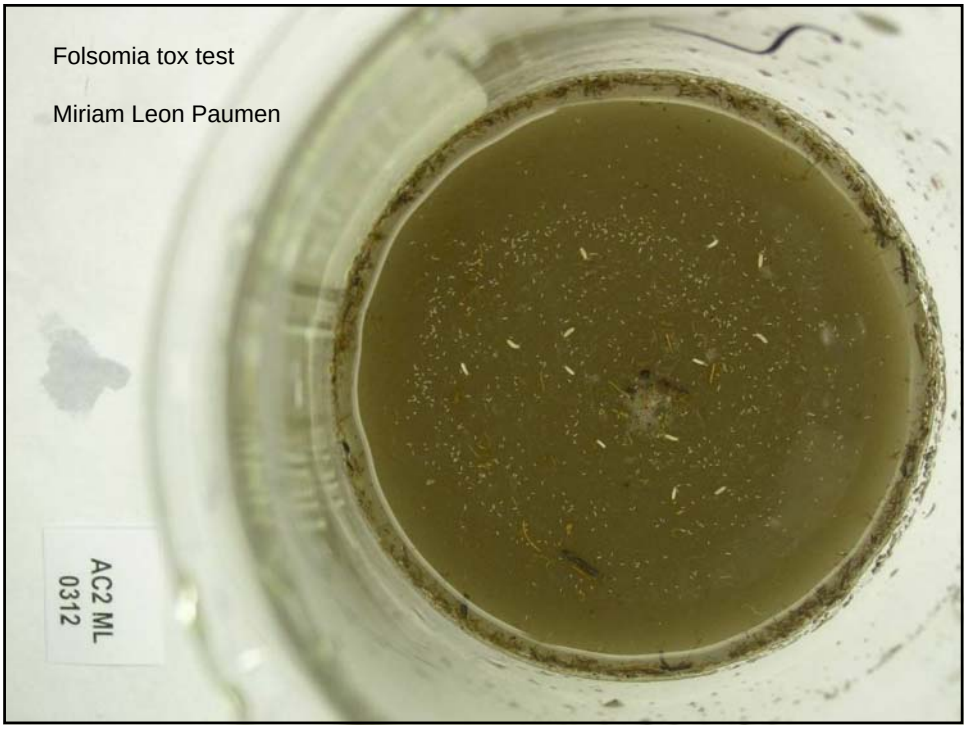
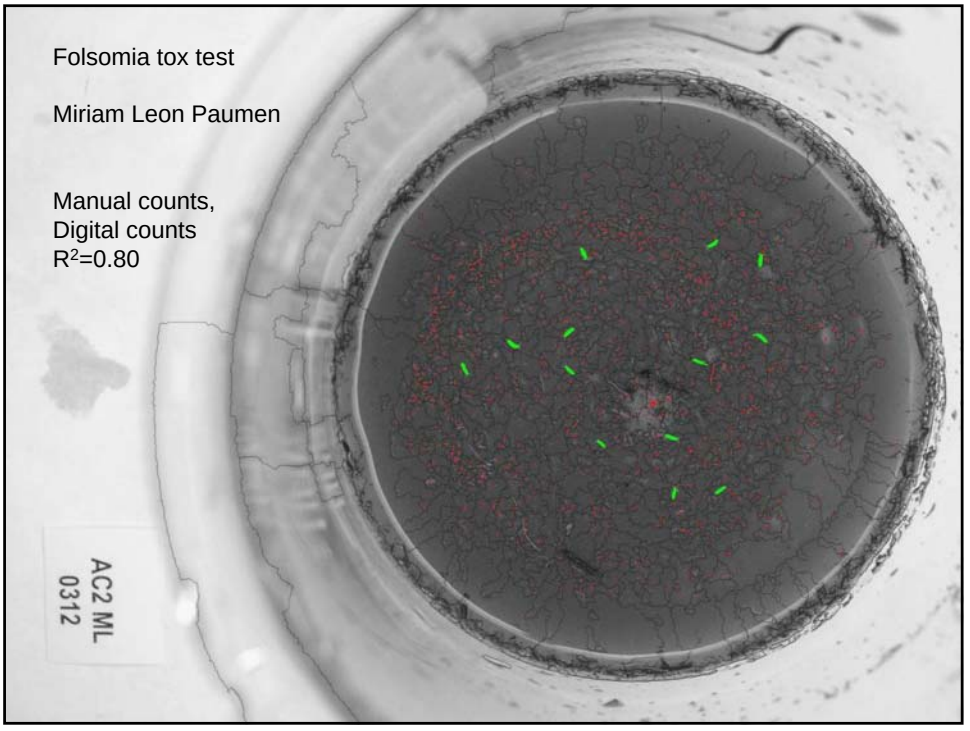
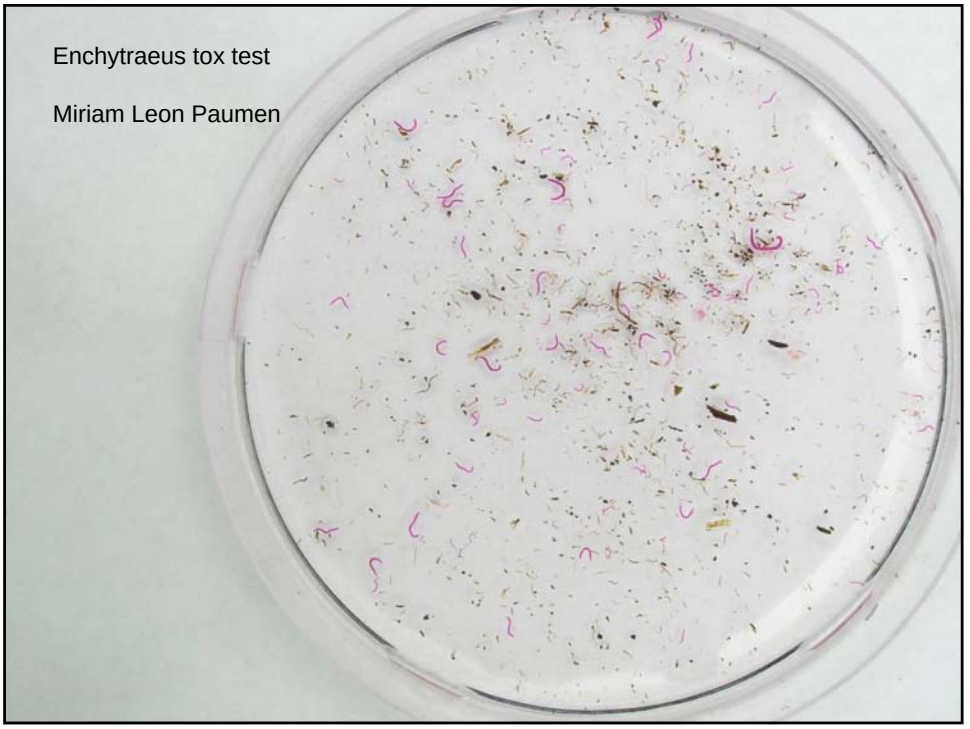
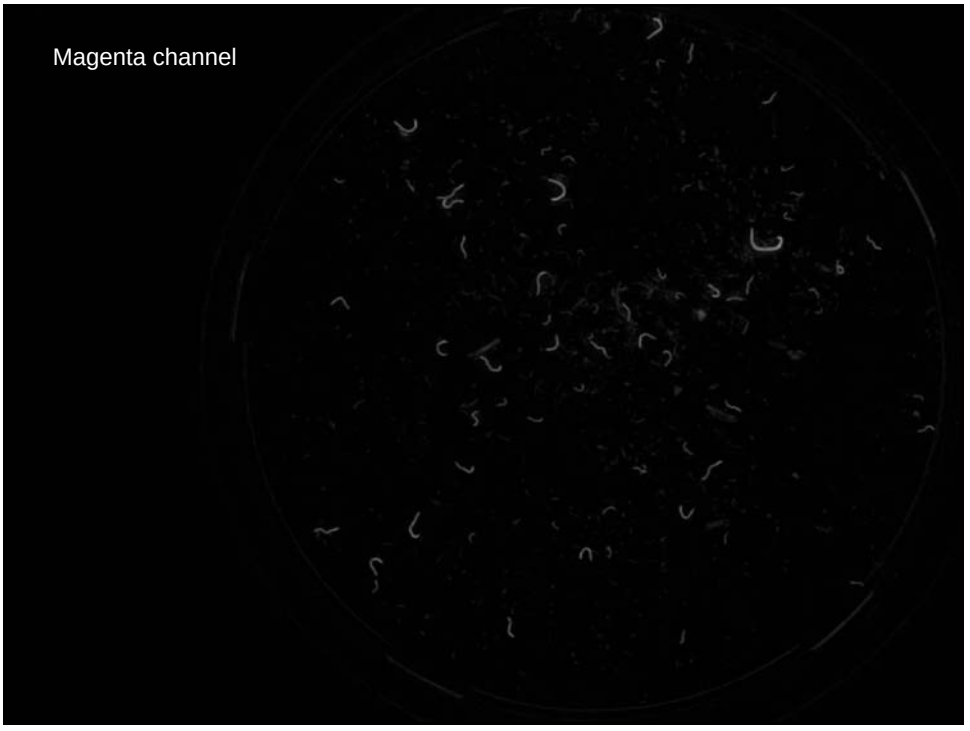
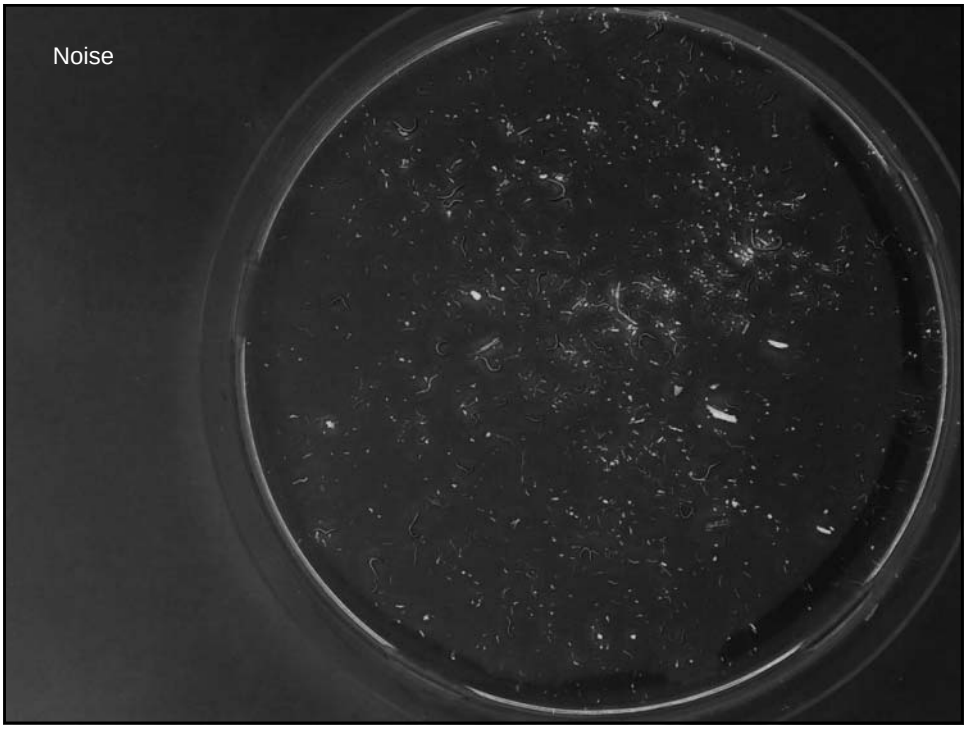


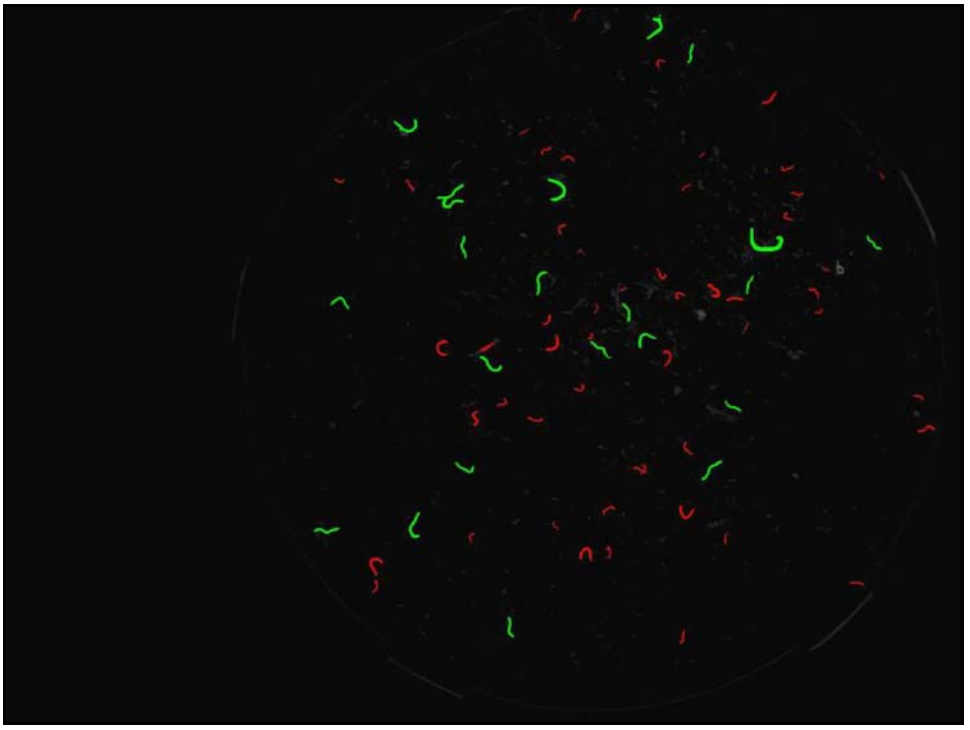

Folsomia tox test
Miriam Leon Paumen
AC2 ML
0312

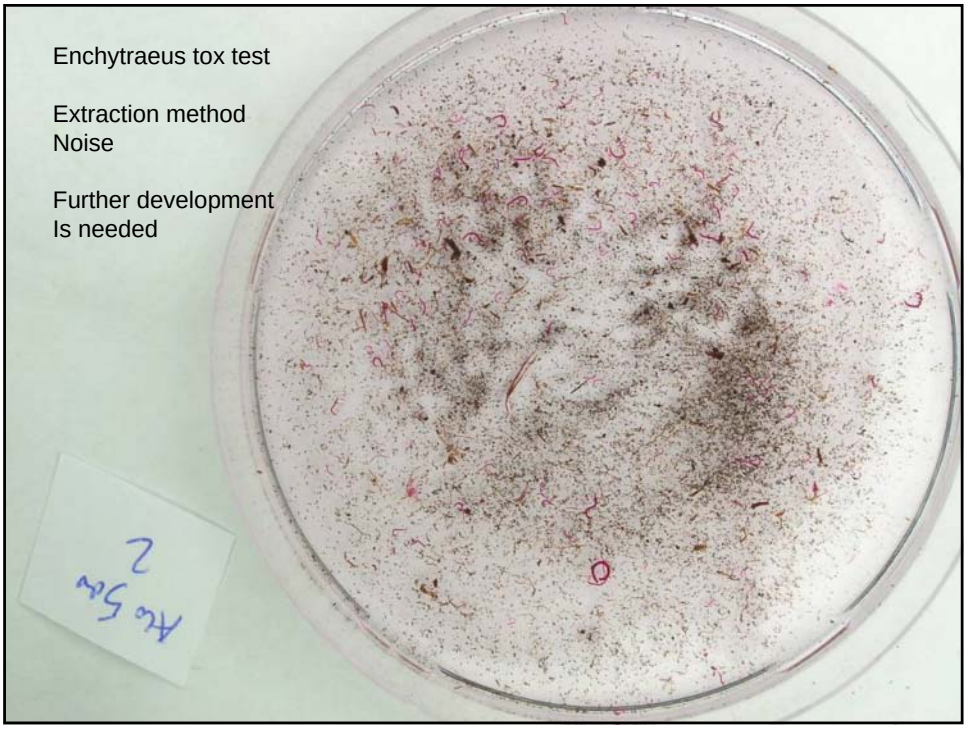

Folsomia tox test
Miriam Leon Paumen
Manual counts,
Digital counts
R2=0.80
AC2 ML
0312


Enchytraeus tox test
Miriam Leon Paumen


Magenta channel

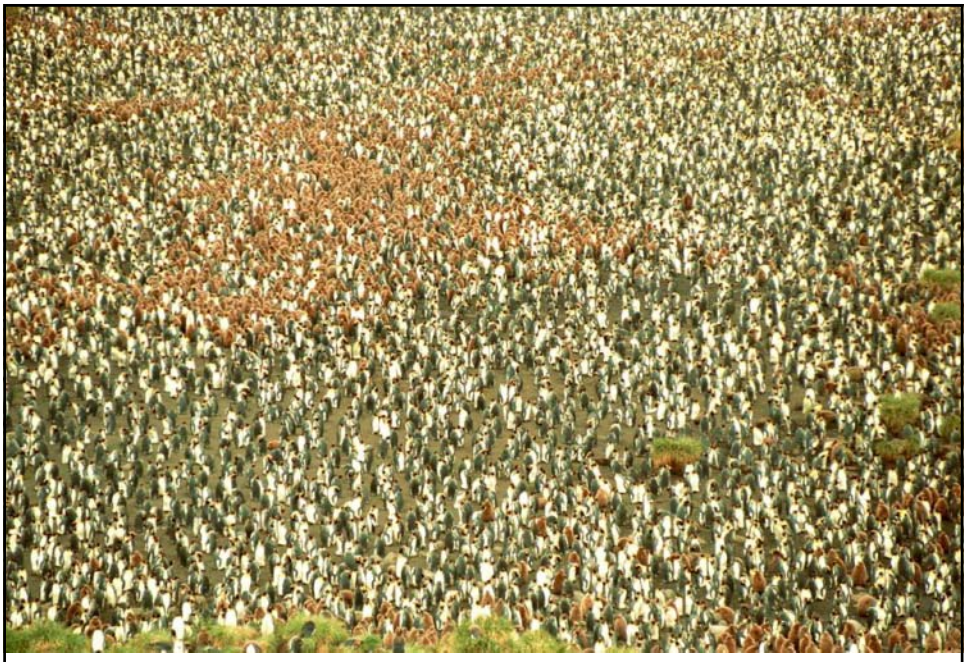

Noise





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



45 Photos: Ruud Kampf