

Sludge particles as a food source for Daphnia

Use of treated waste water for nature

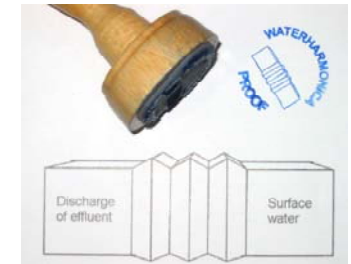
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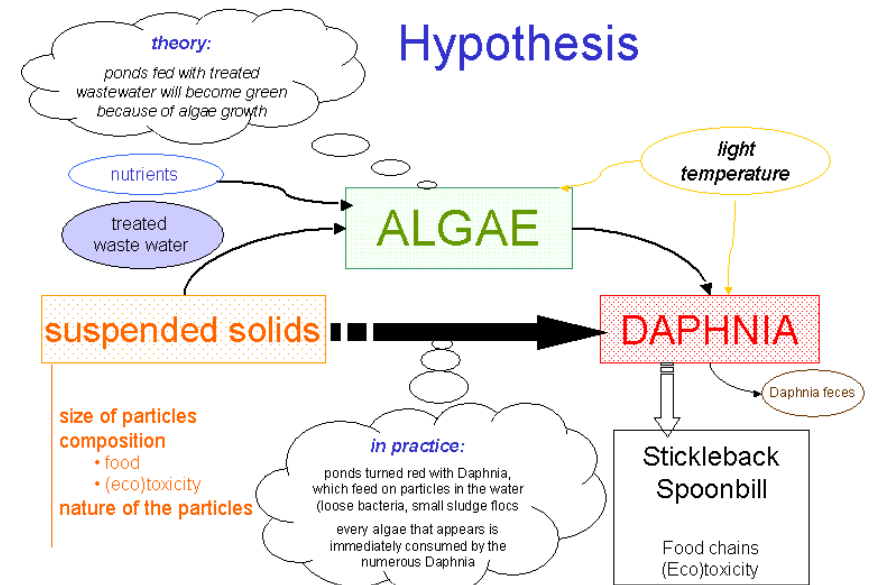
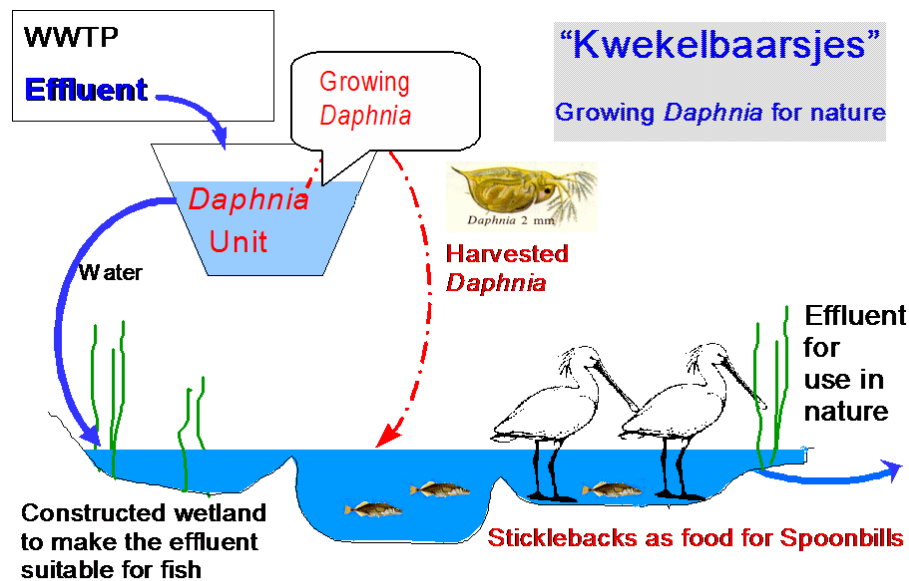
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The Eversteekoog constructed wetland (Island of Texel, The Netherlands) receiving well treated waste water: massive growth of Daphnia in the 4.400 m³ pond



Integrating our approaches to Wetland Science
1st Annual Meeting of the Society of Wetland Scientists – Europe
Bangor, Wales, UK, January 5th – 7th 2006



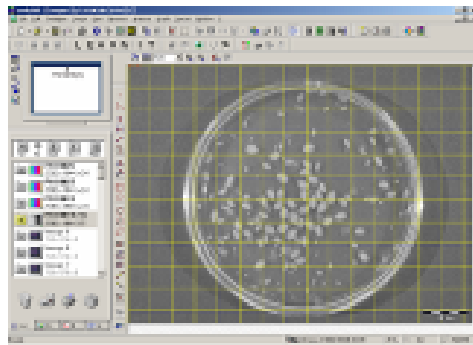
“Kwekelbaarsjes”: growing Daphnia on treated wastewater to grow Sticklebacks as food for Spoonbills
Gricklebacks = Growing Sticklebacks

Studies on laboratory, mesocosms and semi-technical scale since 1998, leading to the development of the “Grickleback process”

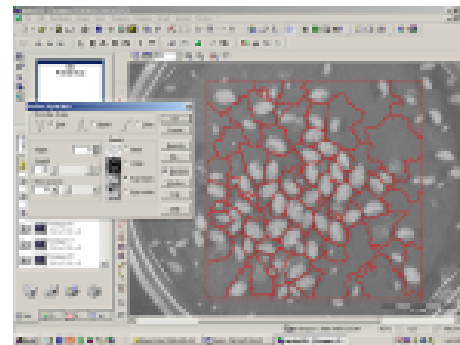


Experiments on the STP Eversteekooig with ponds and mesocosms, adjacent to the constructed wetland

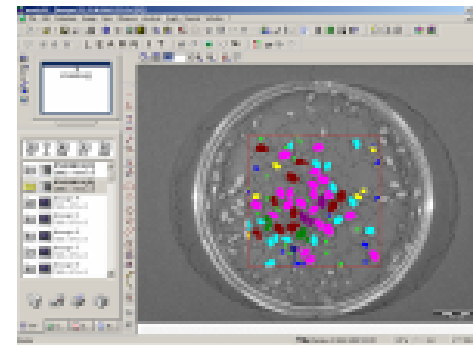
A digital tool to monitor dynamics of Daphnia populations (software Analysis FIVE, Olympus)



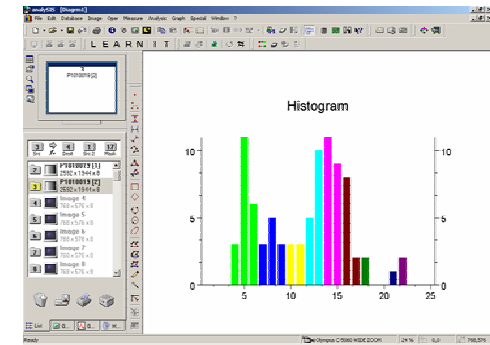
Digital photo



Programme recognises shape of Daphnia



calculates the size classes

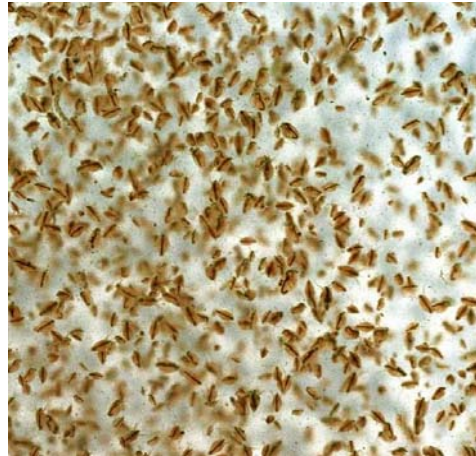


And gives a size distribution

Newly developed digital Daphnia counting method: provides not only quick and cheap counts but also produces data on their size distribution within the population, giving a good insight of the population dynamics. Especially when following daphnid populations over time this gives much more insight in the dynamics than abundance only.



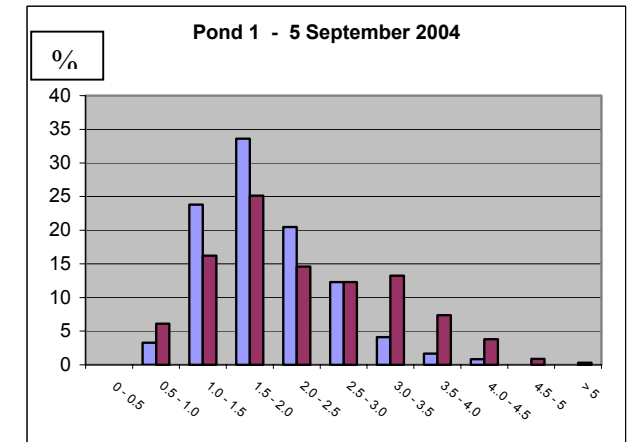
Sampling of Daphnia



Cloud of Daphnia



Digitizing in the lab

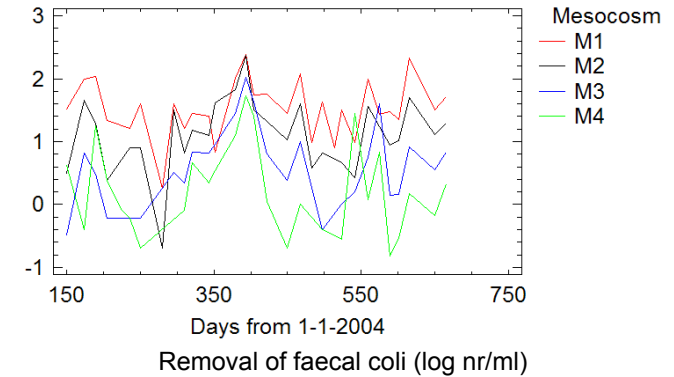
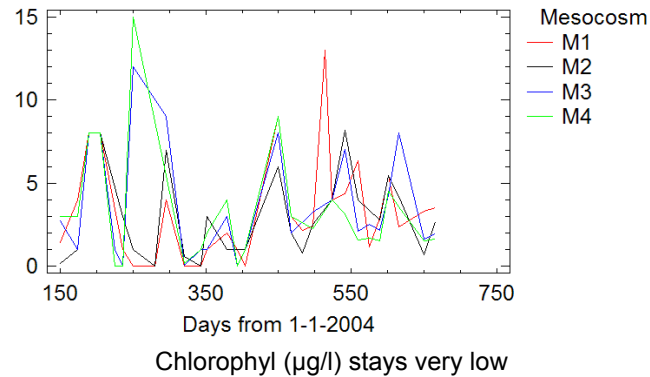
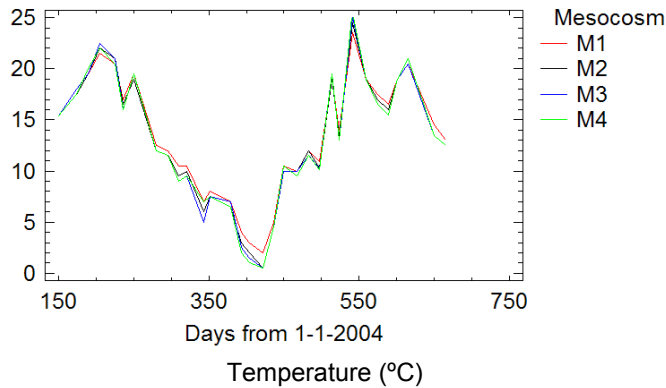


Size distribution (%) of two samples

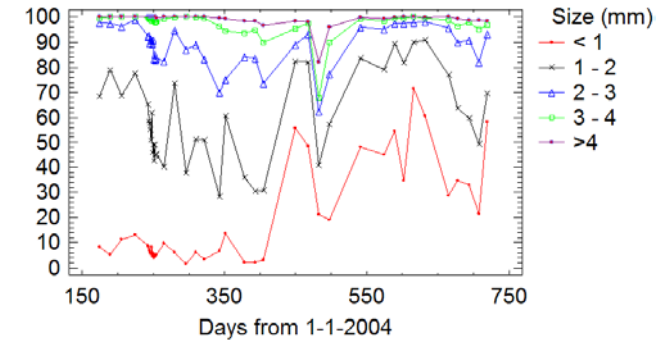
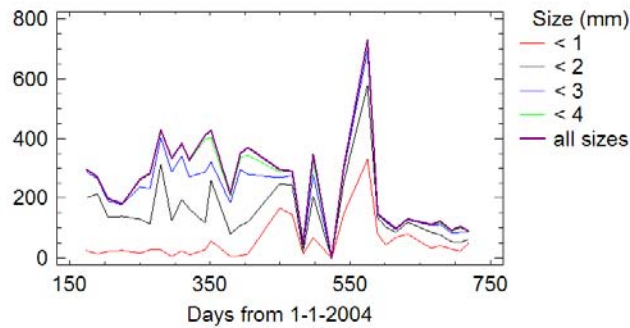
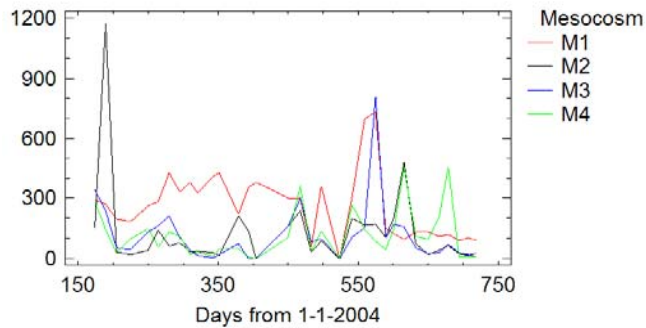
Daphnia are not evenly distributed in a pond. The blue boxes are the size distribution of 34 Daphnia/l. A sample close to the inlet (red) not only gave 676 Daphnia per liter, but also bigger Daphnia.

Some results of the mesocosm experiments

M1 – M4 (period: 2004- 2005, four cells in series, each 1 day hydraulic retention time)



- Daphnia in ponds are very effective in removing coliform bacteria within a hydraulic retention time of as low as 4 days;
- Reactor configuration is very important, a plug flow regime of ponds in series is much more effective, because of separation of different environments;
- Sludge particles appear to be the main food source for Daphnia in the first ponds. Contrary to the expectations the ponds stay clear with low algae numbers, because of the indistinctive feeding behaviour of the Daphnia.



Number of Daphnia in mesocosms 1 - 4

Number of Daphnia per liter (M1) for different size classes

Relative distribution of the different size classes (M1)

Plans for 2006/2007

- Continuation of experiments in mesocosms and ponds on Eversteekoog, Texel

Broadening the scope:

- Experiments on a semi-technical scale and monitoring of Daphnia in the first “Grickleback” constructed wetland system “Aqualan” in Grou (under construction by Wetterskip Fryslân) and the ecological filter, to convert effluent of the upgraded Ootmarsum (in preparation by the waterboard Regge en Dinkel). Both are activities within the the Interreg Urban Water Cycle project
- Daphnia in ponds fed with treated waste water under different climatically circumstances in ponds on the Empuriabrava WWTP of the Consorci de la Costa Brava in Spain
- On the Horstermeer WWTP near Amsterdam processes like sand filtration or membrane filtration to fulfil the new foreseen standards of the European Water Framework Directive are under investigation by DWR, Witteveen + Bos and the Technical University Delft . It will be interesting to compare filtration by Daphnia with these technical filtration processes? Is membrane filtration needed or Is converting treated effluent into a “usable surface water” with biological methods enough? What is more important a “living water” or a “dead” water meeting all the chemical standards? Crucial is to obtain more knowledge about particles in the effluent and which particles are eaten by Daphnia

References

Kampf, R. & Claassen, T. (2005). The use of Treated Wastewater for Nature: The Waterharmonica, a Sustainable Solution as an Alternative for Separate Drainage and Treatment. *Proceedings of the 2nd IWA Leading-Edge Conference on Water and Wastewater Treatment Technologies - Prague 2004 and Water Intelligence Online @ IWA Publishing 2005*

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