



# Lake Rauwbraken

beach bath and playground  
underwater park (dive lake)

## Problem

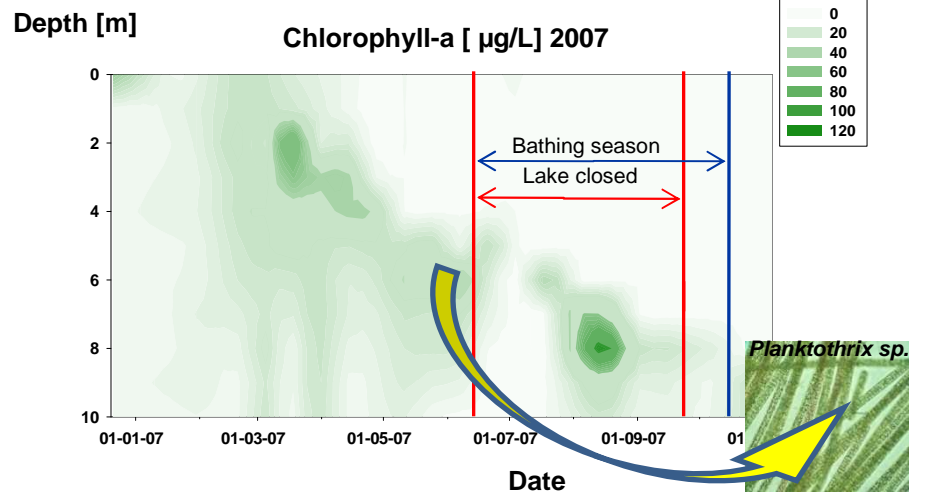
Blooms of Cyanobacteria  
*Planktothrix*  
*Aphanizomenon*

Toxic  
Foul odour

## Main features

sand excavation (4 Ha., max. depth 15 m)  
standing water  
stratifying  
eutrophic to hyper-eutrophic

# Baseline



## Treatment

### 'Flock and Lock'

In-lake phosphorus binding.



Applying Flock and Lock

Day 1: dephosphatising by application of 4 tonnes Lanthanum modified clay (Phoslock®).

Day 2: flocculation, 200 kg of Poly Aluminium Chloride (2 tonnes PAC 10%), buffered with 75 kg Ca(OH)<sub>2</sub>.

Day 3: sediment capping by an addition 16 tonnes of Lanthanum modified clay (Phoslock®).

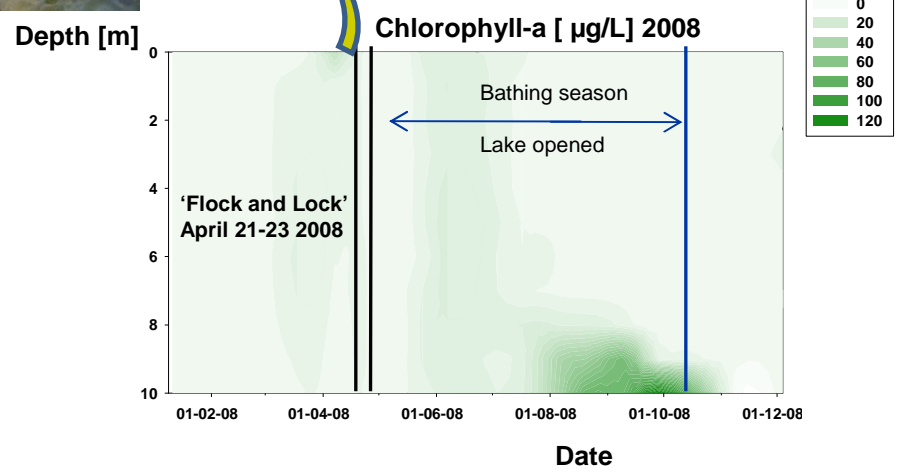


Shortly after 'Flock and Lock'

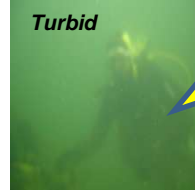
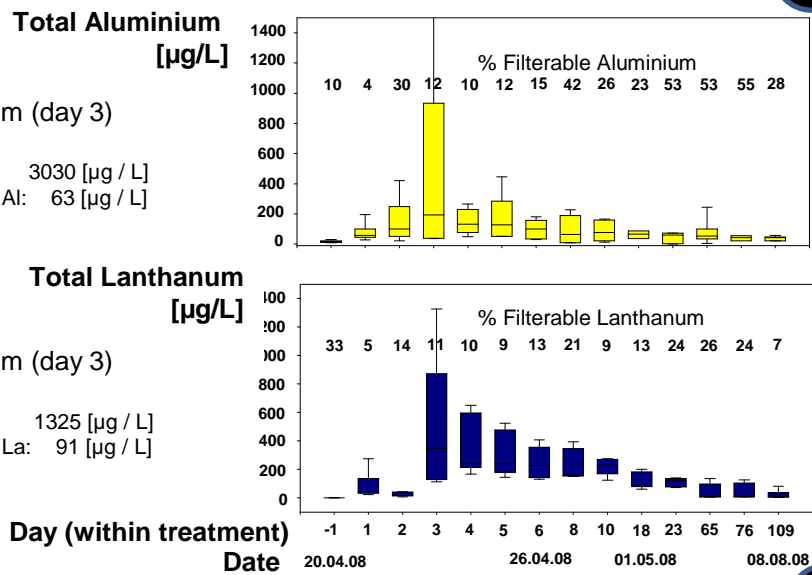


*Aphanizomenon* sp.  
Scum in spring

## Treatment effect

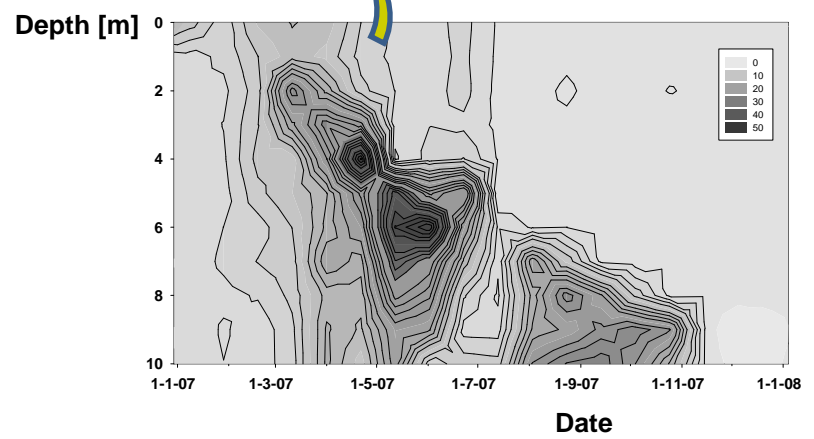


## Aluminium and Lanthanum

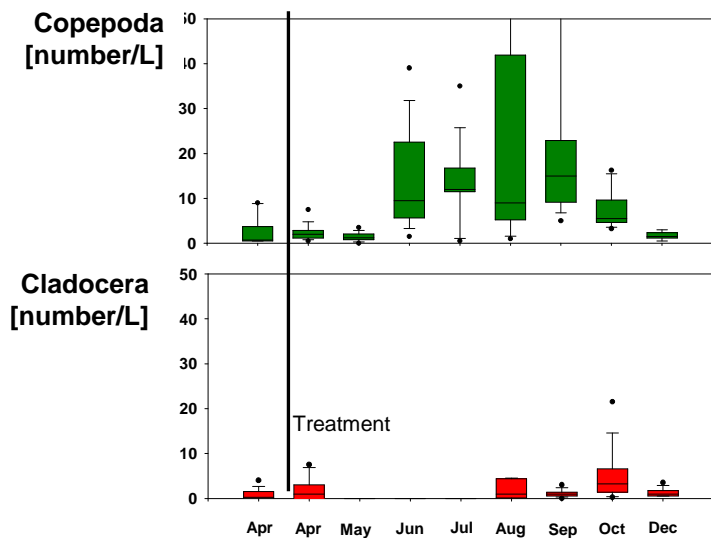


Turbid

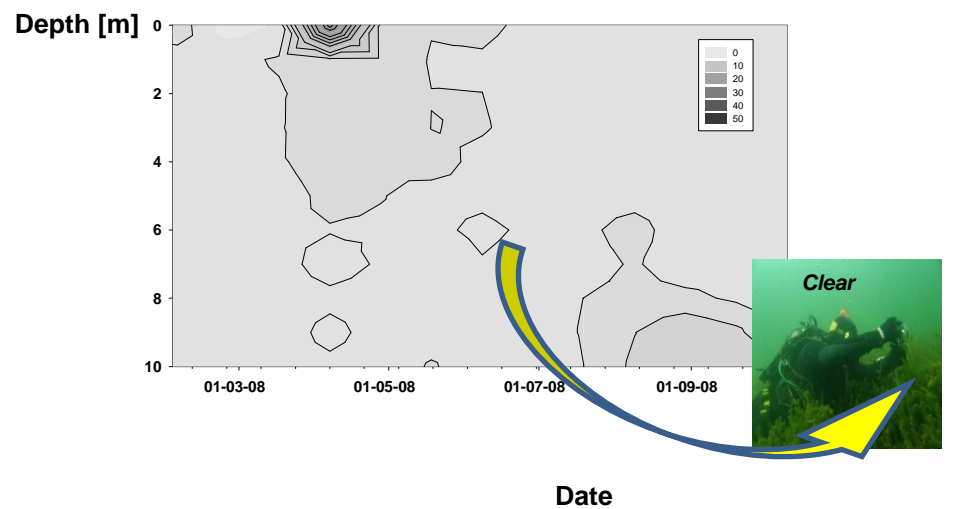
## 2007 Turbidity [NTU]



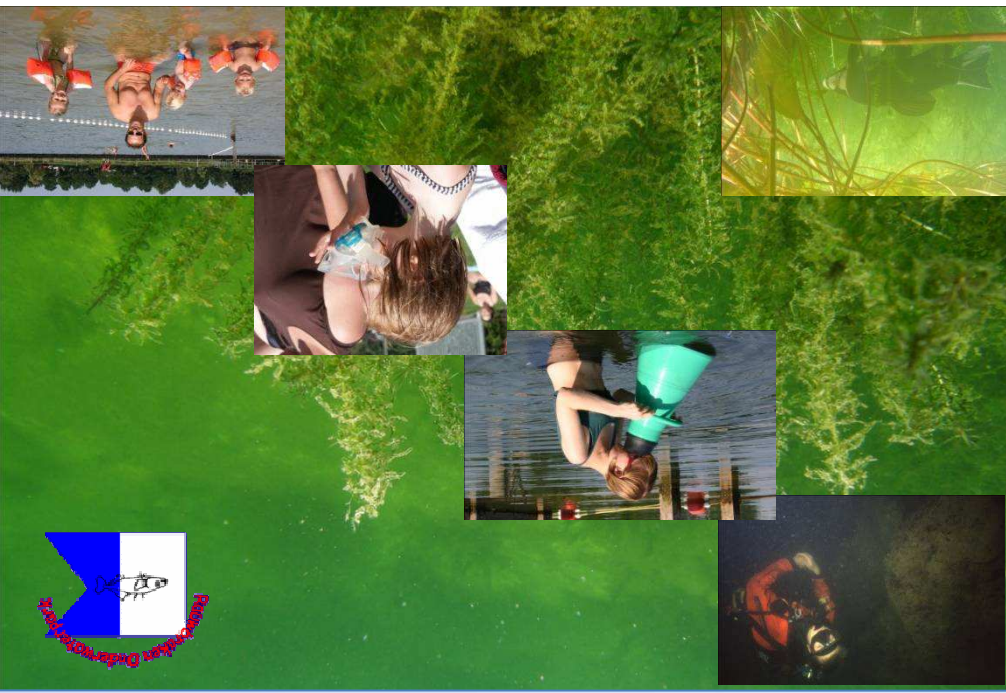
## Zooplankton



## 2008 Turbidity [NTU]



Clear



**Lake Rauwbraken** (Tilburg, The Netherlands) has a history of severe blooms of Cyanobacteria, subsequently closure of the lake for all recreation. After 2 years of intensive monitoring by the Department of Aquatic Ecology and Water Quality Control of Wageningen University (the Netherlands), it was decided that 'Flock and Lock' was the most promising treatment for this lake. Pre-treatment total Phosphorus ranged from 4 – 944 µg/L, mean 150 µg/L (sediment 1 g/kg). In April 2008, the lake was struck by a bloom of *Aphanizomenon* sp. Much of its biomass accumulated in heavy scums, which resulted in lower total-P, chlorophyll-a values and turbidity [NTU] as observed during the monitoring program. Due to the bloom of *Aphanizomenon* sp no recreational use was anticipated in Spring 2008. However, Lake Rauwbraken could open to the public, free of Cyanobacteria, just 2 days after the flock and lock treatment. Post treatment total Phosphorus fell below 10 µg/L. The lake remained open for the entire 2009 swimming season.

**2 years monitoring** (2006, 2007), continued (2008-2009)

- Temperature, oxygen, pH, turbidity, Secchi-depth;
- Suspended solids, chlorophyll-a;
- Nutrients: N,P, C (total and dissolved)
- Phytoplankton composition

Total chlorophyll-a (fig 2,4) and turbidity (fig .6,8): bi weekly depths 0 ,1,2, ..10 [m]  
 Aluminium and Lanthanum (fig. 5) statistics based on depths 1,3,5,7,10 [m]  
 Zooplankton (fig. 7) statistics based on median per month , depths 0,1,2,...10 [m]

Photography: Miquel Lurling, Frank van Oosterhout, Vincent van Hoof.

**Colofon:**

Rauwbraken Underwater Park is an initiative by the Dutch Underwater Parks Foundation, a non-profit organization to promote water related recreation, natural history education and research in the field of aquatic ecology.

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Phoslock® is developed by the Australian Water and Rivers Commission (WRC) and their research partner, the Commonwealth Scientific and Industrial Research Organization (CSIRO). In Germany Phoslock® is marketed under the name Bentophos. Application of Phoslock® can be considered an *in situ* dephosphatation measure.

Institut Dr. Nowak  
 Analytik - Beratung - Gutachten

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