



## 3<sup>rd</sup> Webinar

# *Planktothrix rubescens*

**bbe - the company for advanced algae  
and cyanobacteria measurement**



biological · biophysical · engineering

**bbe**  
moldaenke

# Welcome



**Detlev Lohse**



**Frederike Lohse**



**Sönke Kobarg**

## bbe Team



# Webinar – *Planktotrix rubescens*

- Part 1**      **Presentation**      **15 min**
- Part 2**      **Demonstration**      **3 min**
- Part 3**      **Interview**              **10 min**

Process State

Alarm

Green	0	µg/l
Bluegr.	0	µg/l
Diat.	0	µg/l
Crypt.	36.39	µg/l
Y.S.	0	r.u.
total	36.39	µg/l

01.08.2006  
13:58:36

follow cursor

Idle

**Feedback**  
**Follow up**



# MONITORING THE APPEARANCE OF THE CYANOBACTERIA *PLANKTOTHRIX RUBESCENS*

Detlev Lohse  
from the bbe Moldaenke company, Germany



## North Rhine-Westphalia

16,6 Mio. inhabitants (2013)

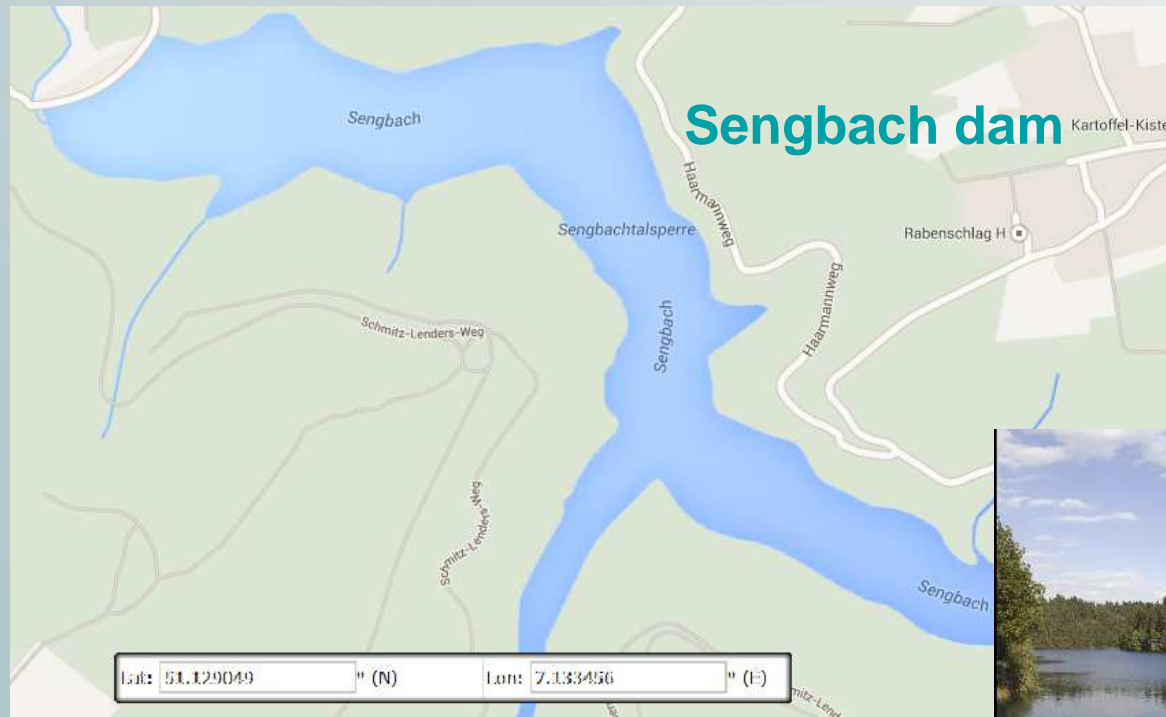
Water consumption 130 l/day

= 2,2 Mio. m<sup>3</sup>/day total





## The area of interest in 2013



20 ha  
2,8 Mio. m<sup>3</sup>  
Maximum depth 36 m





# Extraction for drinking water processing

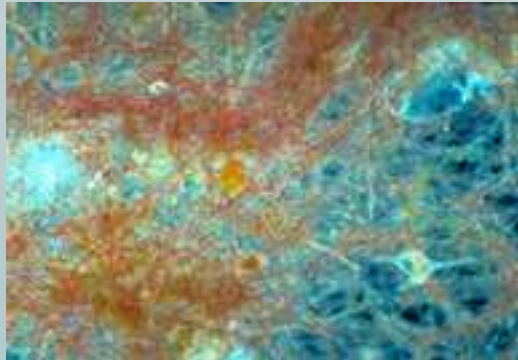


*Planktothrix rubescens*

massive dam with waterworks Glüder



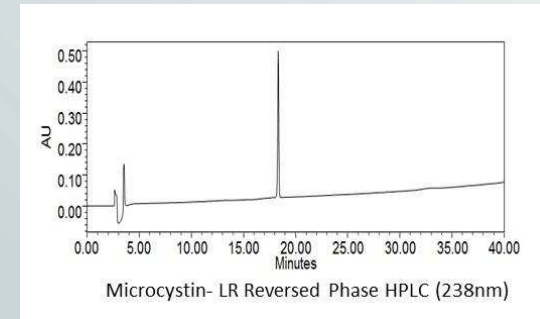
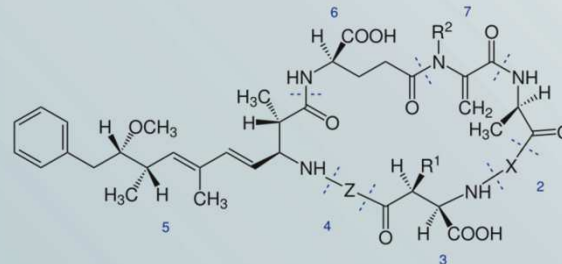
# The threat of the Planktothrix



*Planktothrix rubescens*

→ **Cyanotoxin** →

- Reduce water quality
- Raise health risks
- Additional counteractions**
- Raise costs**
- Close of extraction**

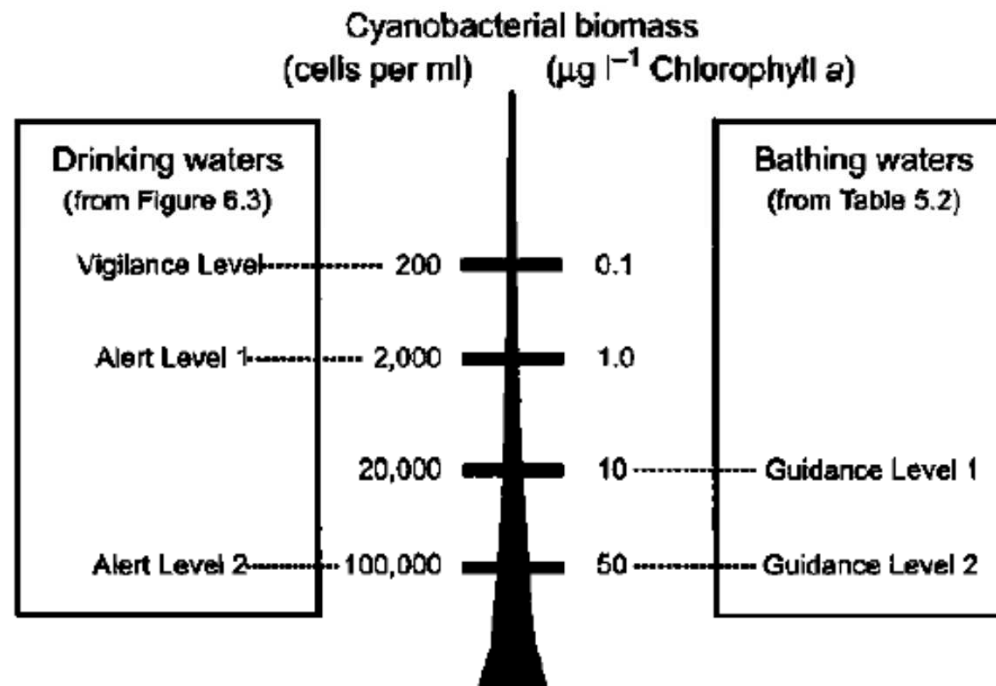






# WHO Guidelines 1999

Figure 6.5 Summary of managerial action levels for drinking waters (see Alert Levels Framework decision tree in Figure 6.3) and for bathing waters (see Guidance Levels in Table 5.2). Note that for bathing waters, the special Guidance Level 3 (scum formation) can be achieved during calm weather conditions at open water biomass levels similar to Guidance Level 1



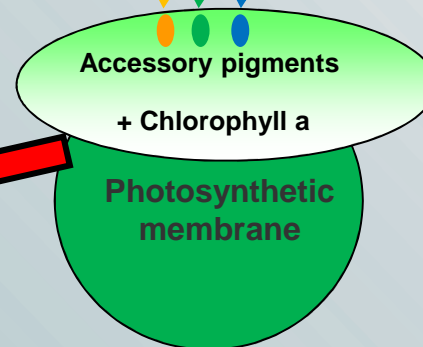


# How it works: fluorometric measurement of algal and cyanobacterial microplankton

Excitation of pigments with light of different wavelengths



Light emission



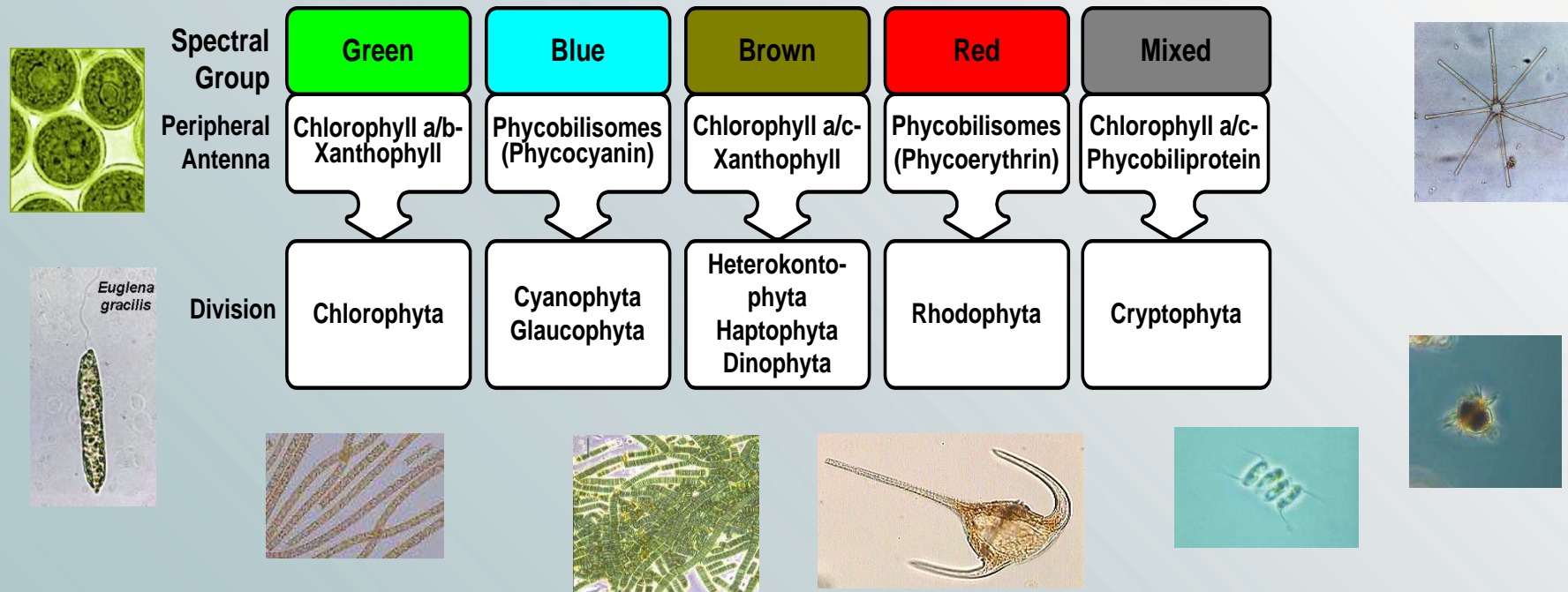
Determination of the red chlorophyll fluorescence





# What are the Algae classes?

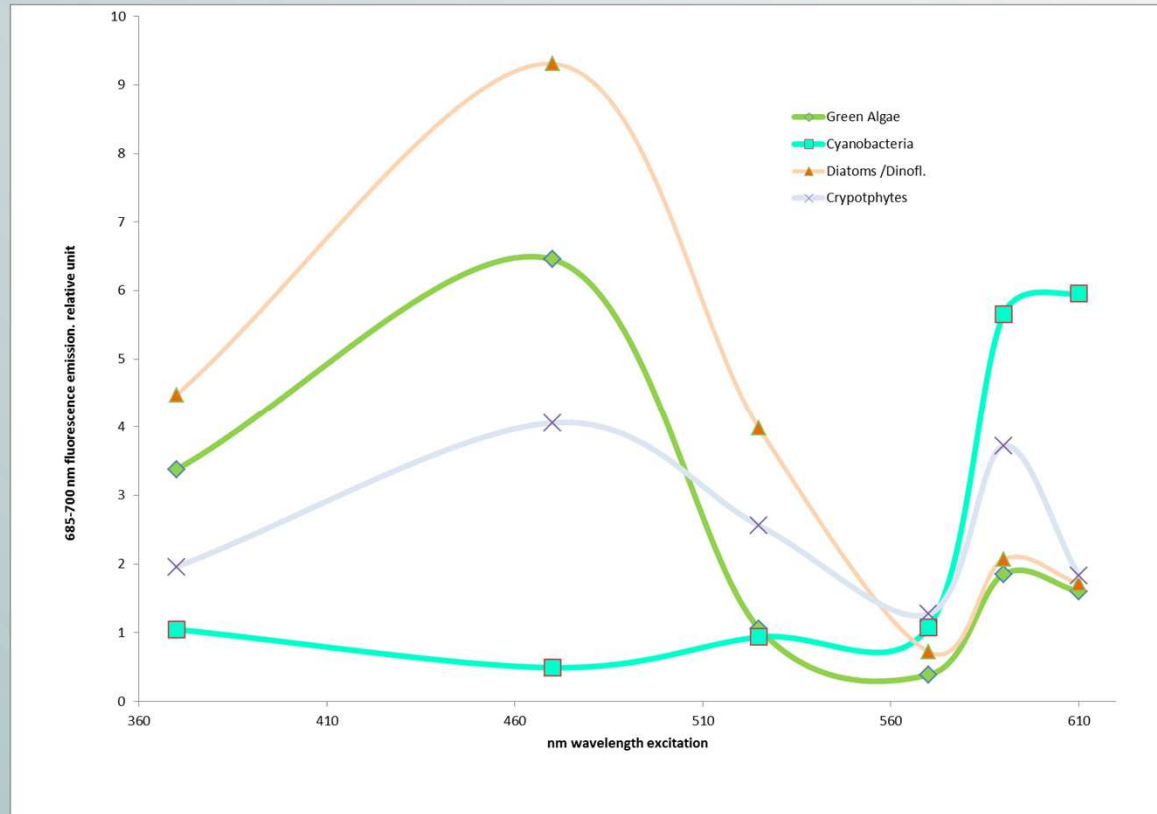
## Algae classes contain different accessory pigments



...which affect the chlorophyll fluorescence emission in characteristic pattern



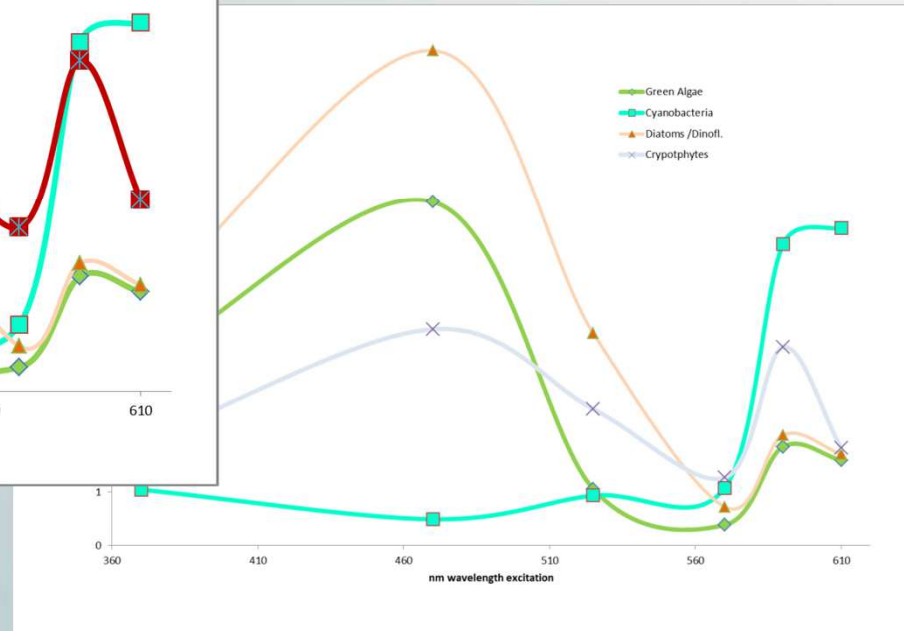
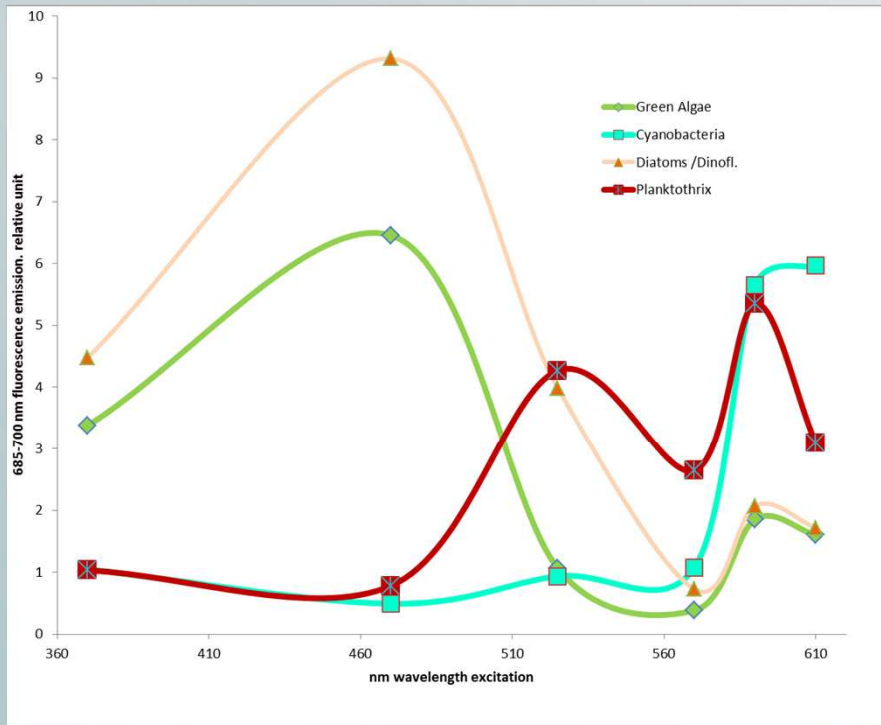
## Who is who in algae: norm spectra



... represent characteristic red fluorescence of algal cells on excitation with different wavelengths

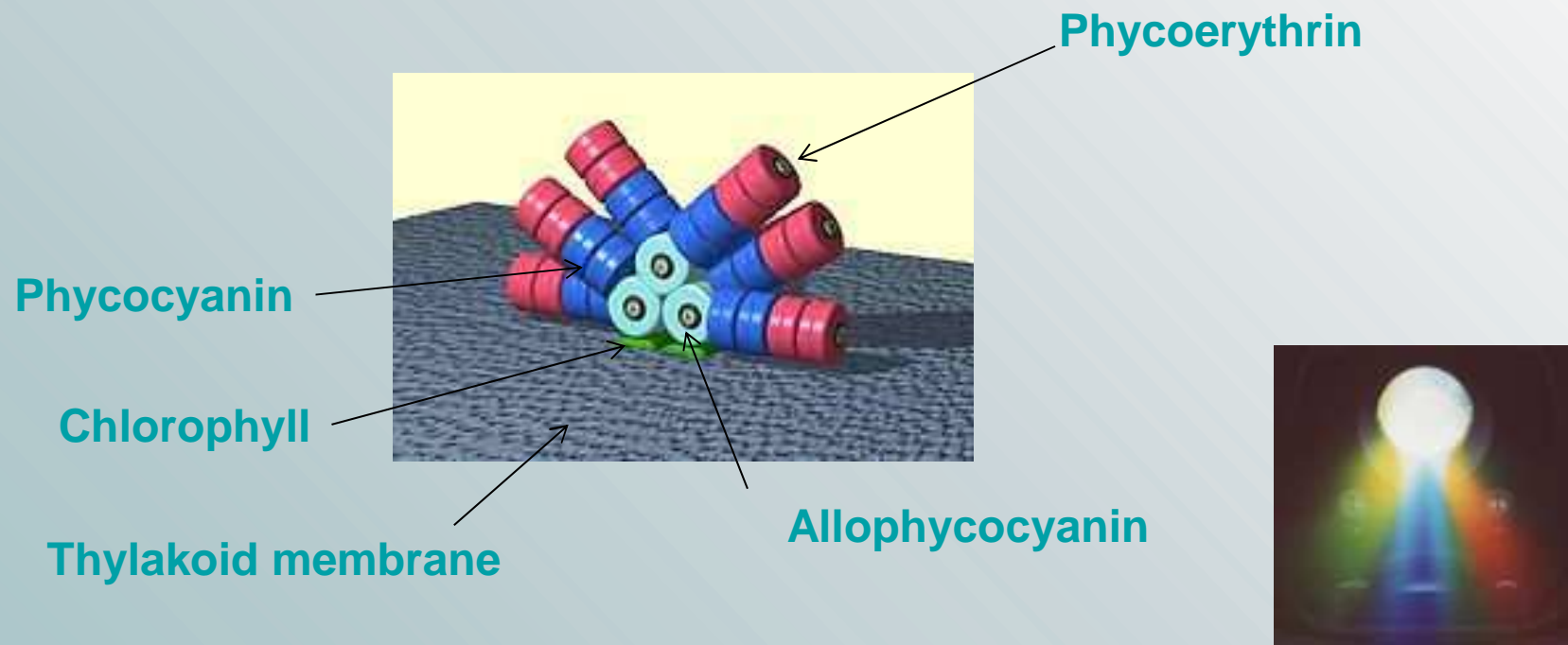


# Addition of *Planktothrix rubescens* spectrum



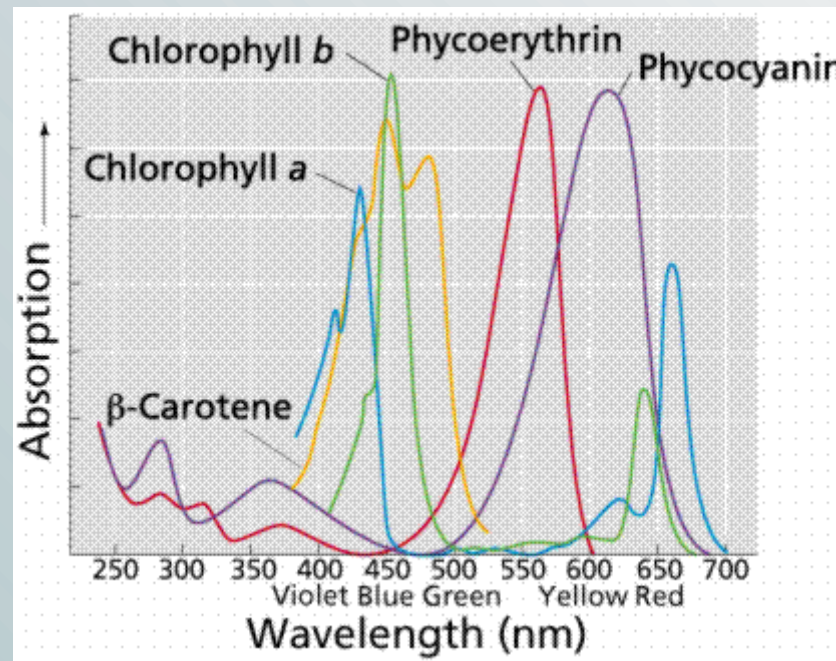


# Structure of phycobilisomes





## Spectral features of the *Planktothrix rubescens*

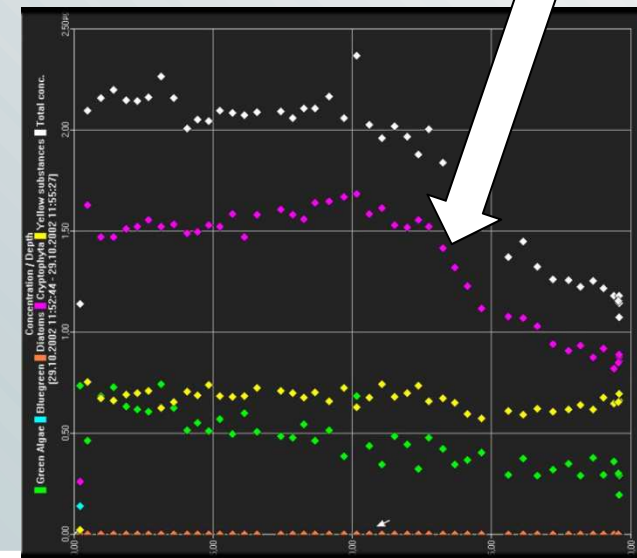
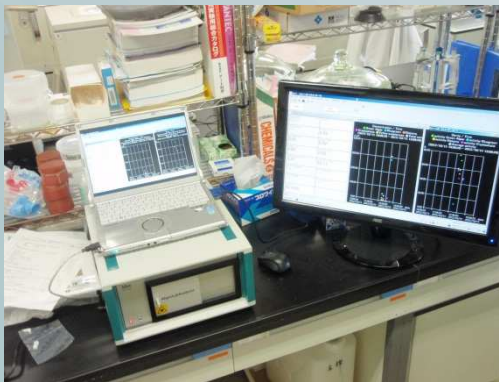


- phycobilins close the „gap“ in the absorption spectra of chlorophyll and carotenoids and act as antenna pigments
- redish cyanobacteria contain phycoerythrin (*Planktothrix rubescens*)



# What can multispectral fluorometry accomplish?

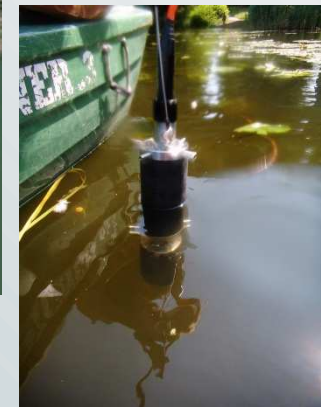
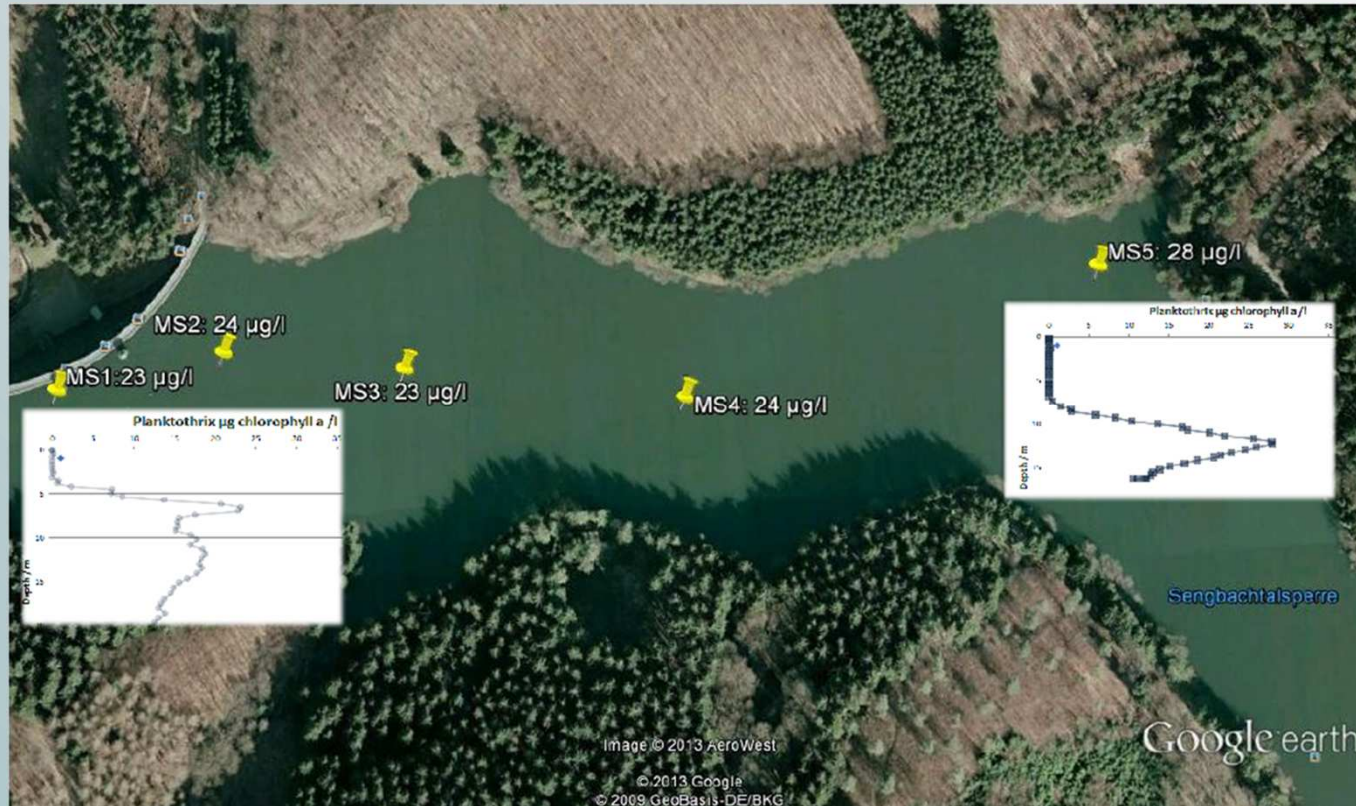
- Differentiation of algal classes in a complex mixture
- Determination of cyanobacteria i.e. *Planktothrix rubescens*
- Determination of chlorophyll content
- Correction for fluorescent interfering substances
- Field measurement

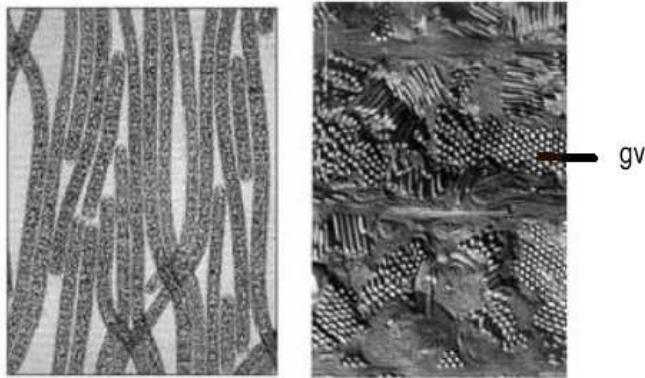






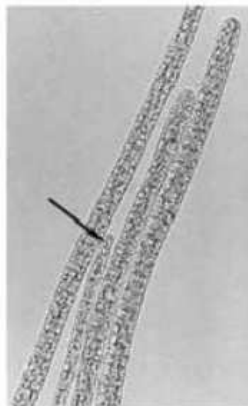
# Depth analysis: distribution of *Planktothrix rubescens*



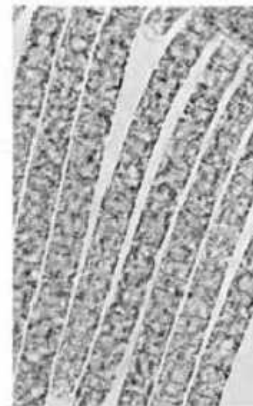


*P. mougeotii*

gas vesicles in cells



*P. agardhii*



*P. rubescens*

*Planktothrix* with gas vesicles

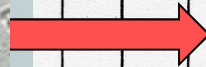
Walsby 1994, Microbiol. Rev. 58:94

## Gas vesicles

- Protein cylinders
- Hollow, gas filled
- Water (cytoplasm) exclusion
- Sensitive to outer pressure
- Sensitive to high photosynthesis rate



# Scheme of main types of active movements in cyanobacteria

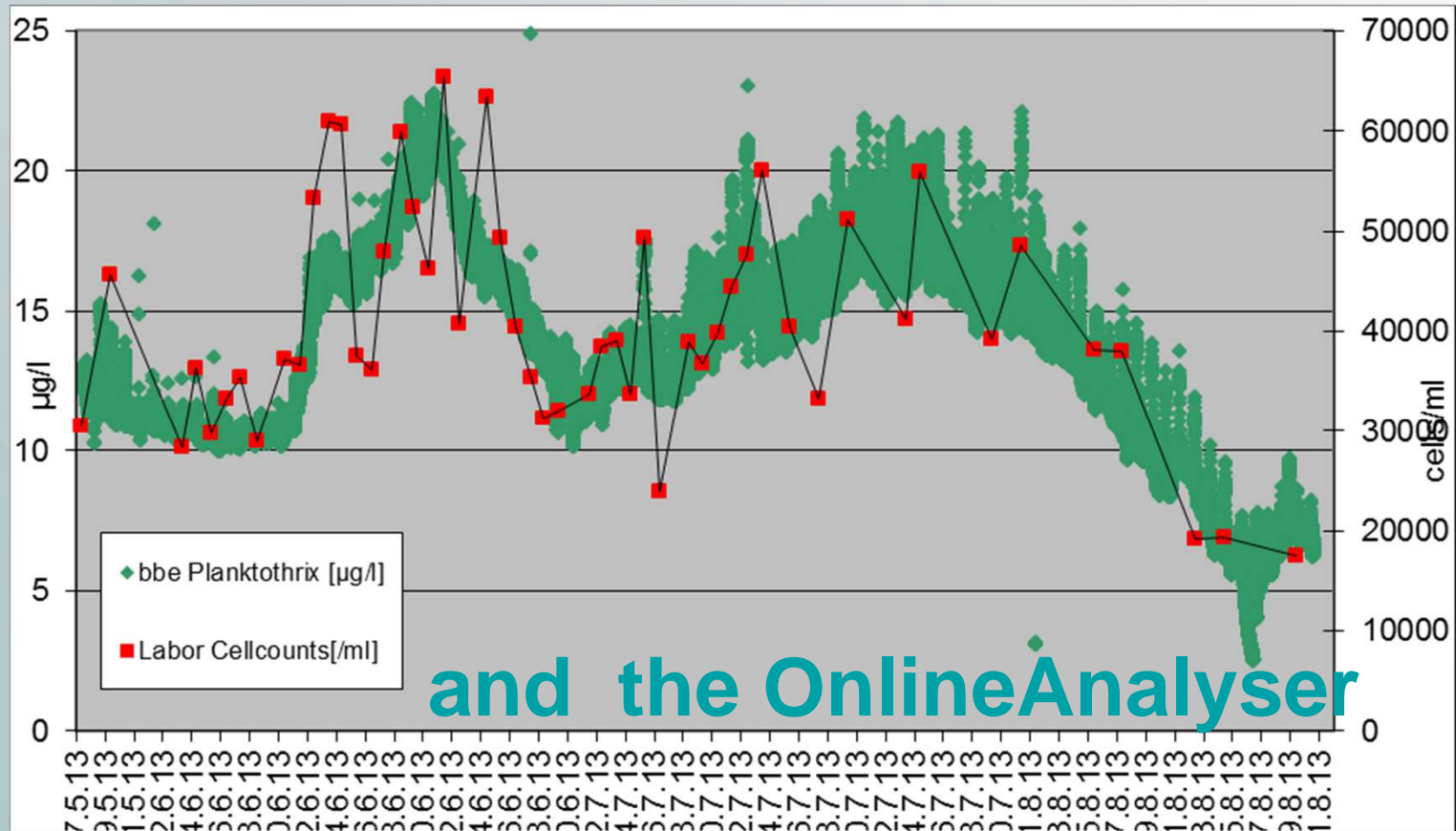


gliding (forwards or backwards)	trembling (forwards or backwards)	irregular trembling	zig-zag movement	waving (oscillation)	rotation (clockwise or anticlockw.)	creeping
Examples: Phormidium	Pseudanab. Limnothrix Planktothrix	unicellular genera		Phormidium Oscillatoria	Phormidium Arthrospira Spirulina	Spirulina (?)

Komarek & Anagnostidis 1988, Algal. Stud. 50-53

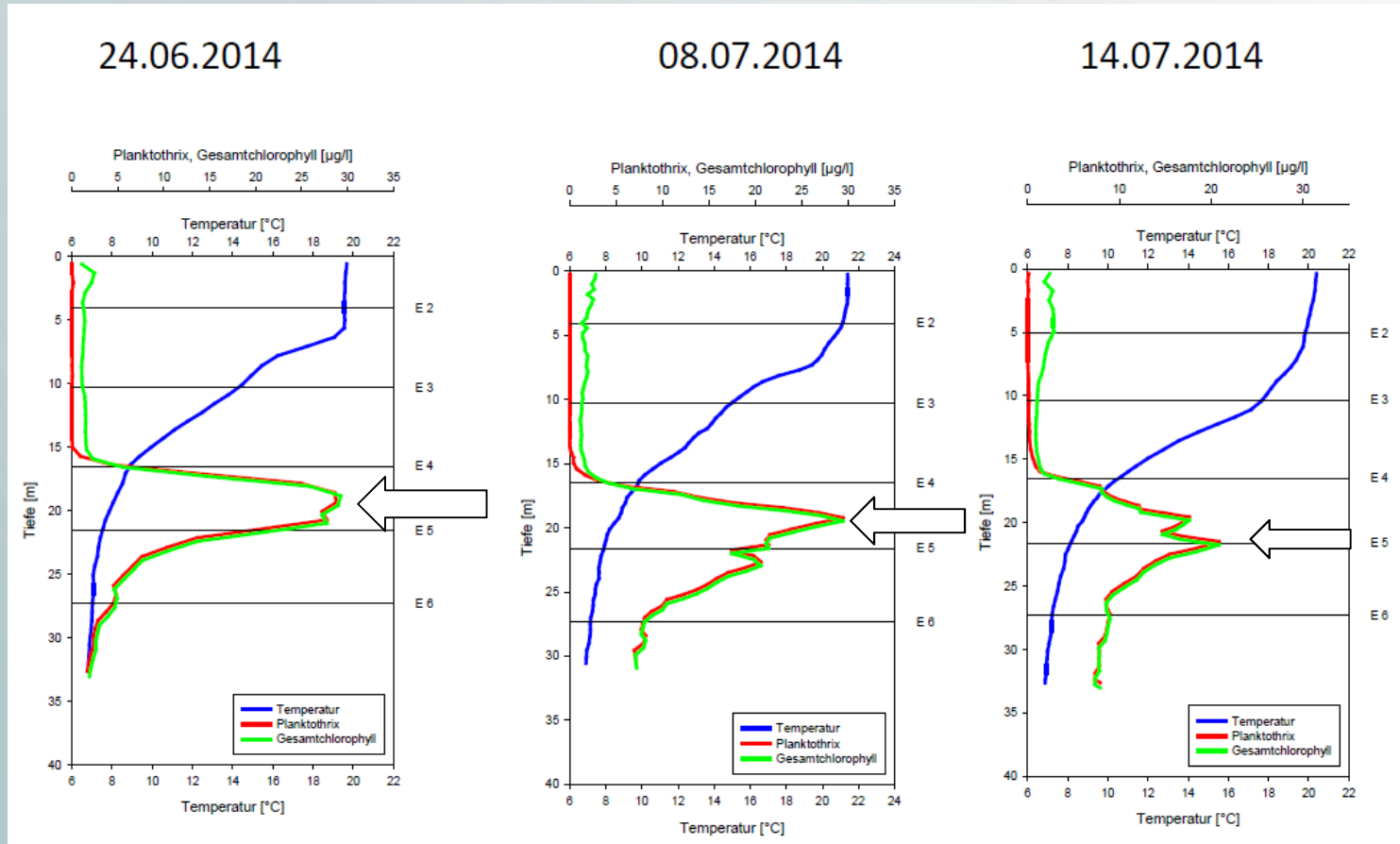


# The point of extraction: compare the cell counts





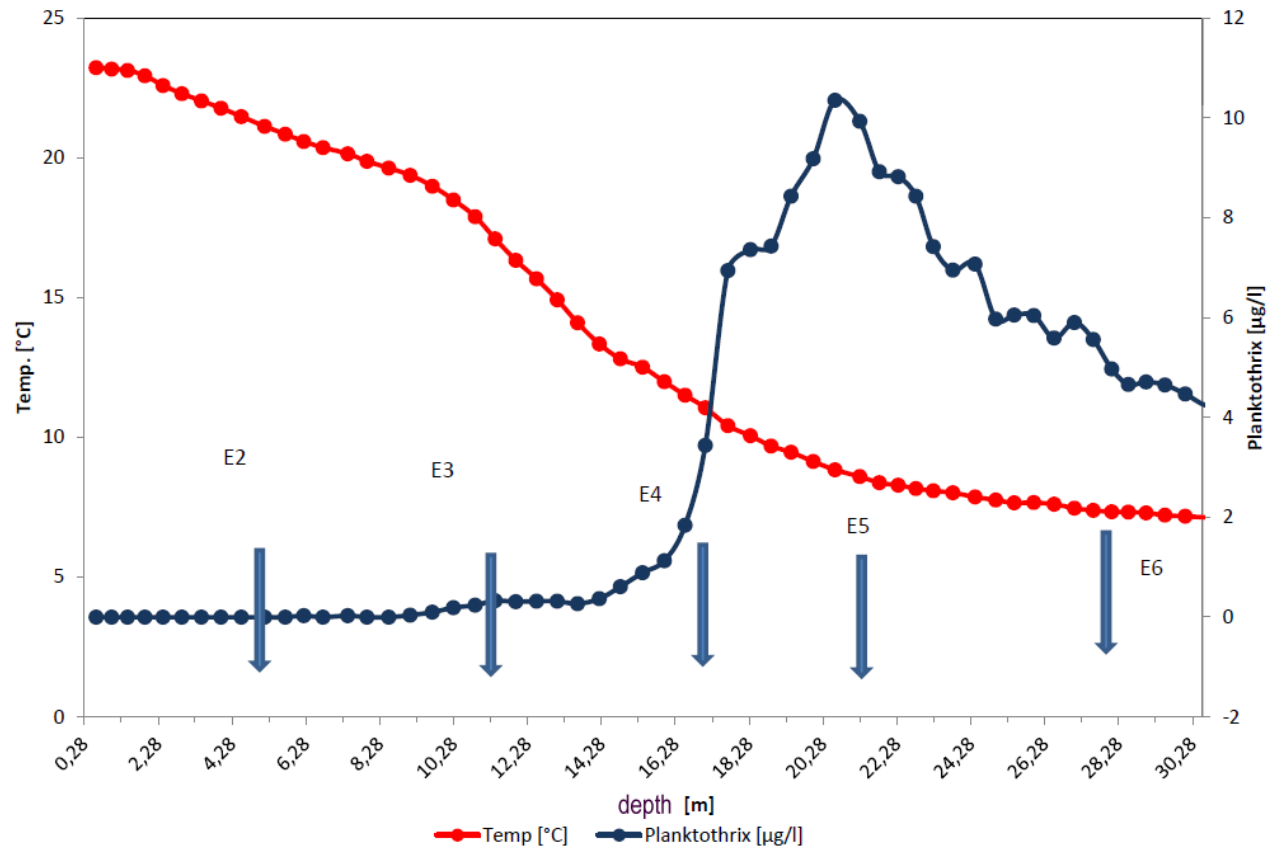
# FluoroProbe profiles in a German river dam



E2 – E6 = raw water extraction points



### Distribution Planktothrix 22.07.2014





## Conclusion

**Fluorometric depth profiling and flow through online analysis are a sensitive and rapid tool for the detection of upcoming Plankthotrix**



## Acknowledgement

Public Services Solingen

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