Benten water solutions

Corina Carpentier

In situ Biomass Quantification of Microphyto-benthos: a First Step Towards an Alternative Method for Assessing Stream Eutrophication under the WFD

AquaLife Workshop
4-6 June
Kiel, Germany

Introduction

- WFD and microphytobenthos in rivers and streams
- Commonly used methods
  - EN 13946 / EN 14407
  - EN 15708
- *In situ* fluorescence measurements
- Nutrient – biomass relationships

WFD - Microphytobenthos

- Indicator for eutrophication in rivers and streams
- Organisms:
  - sessile
  - take up nutrients from water-phase
  - respond rapidly to changing conditions
- Ecology:
  - support lotic food webs – food source for grazers
  - attenuate current
  - stabilise sediments

Microphytobenthos Analysis

- Biodiversity assessment
  - EN 13946 / EN 14407: benthic diatoms
  - EN 15708: phytobenthos
- Calculation of index values:
  - diversity index: disturbance/stress
  - saprobic index: organic pollution
- Additionally:
  - evenness index: even distribution of abundance

Species Diversity Assessment

- Hungary: 6500 diatom species
- Germany: 1000 phytobenthos species
- France: 6500 diatom species
- Poland: 520 diatom species
- Czech Republic:
  - 252 blue-green algae species
  - 521 diatom species
  - 990 green algae species
  - 750 chromophyte species
  - 324 flagellate species
  - Total: 2,837 species

WFD Implementation

- Austria:
  - experts at eco-region level required
  - official registry of biological experts: 6
  - high quality guaranteed
- Biodiversity analysis very difficult as *routine* method
- > 120 river basins in Europe
  - minimum frequency: once every 3 years
  - provide “sufficient data for reliable assessment”
  - exclude seasonal and geographical variation

Alternative Method

- Suitable for routine analysis
- Practical
- Fast
- Affordable

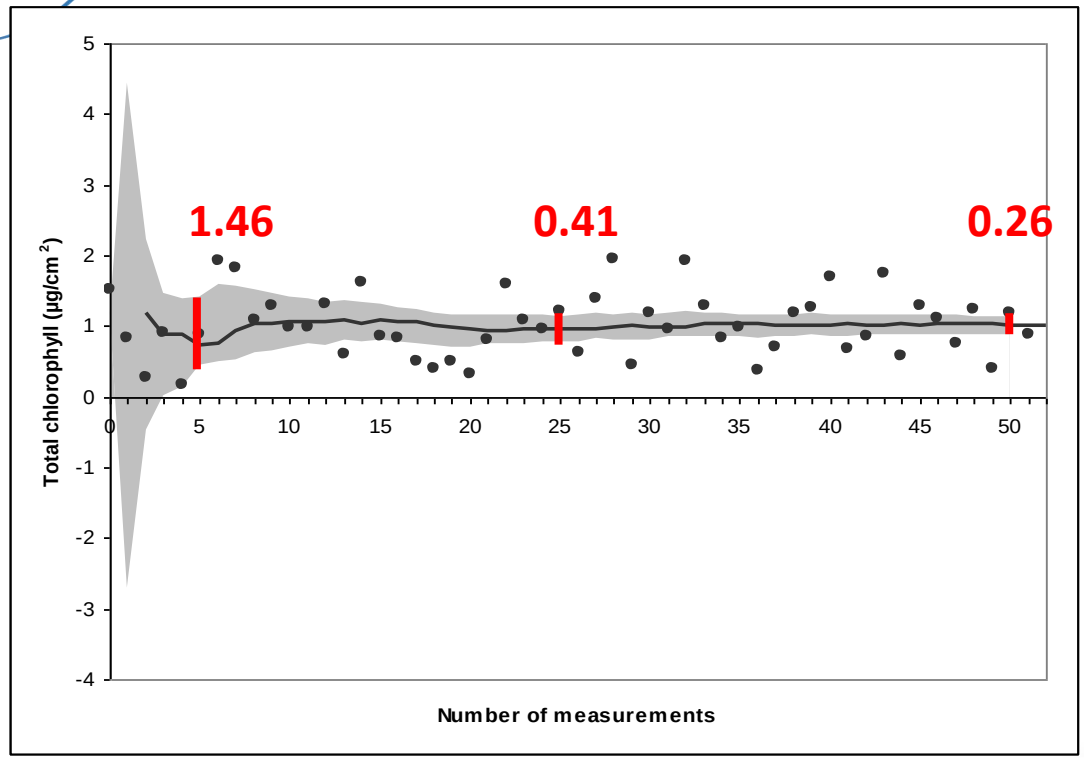
Sampling Errors

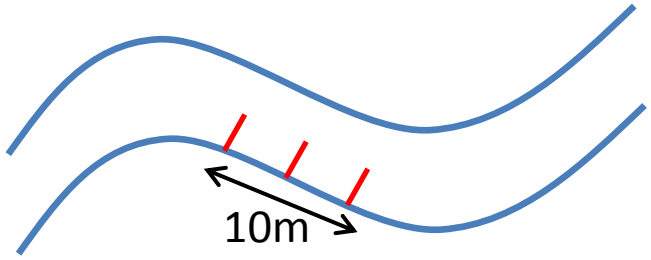
substrate	before (µg/cm^2)	after (µg/cm^2)	removal
cyanobacteria	1.20	0.45	62.4%
diatoms	0.17	0.15	13.4%

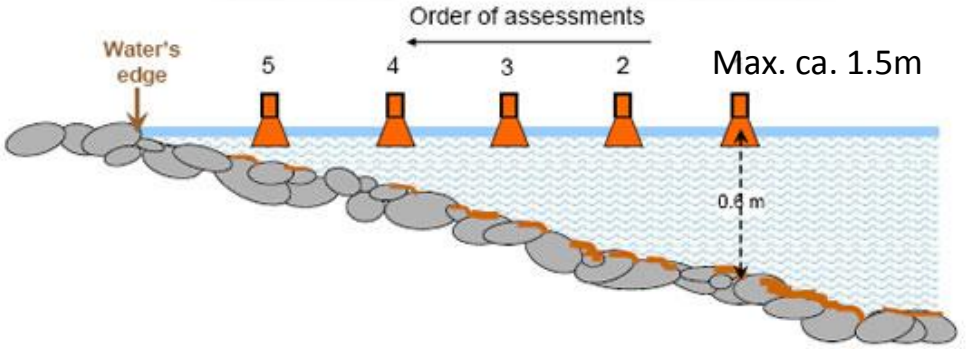
In Situ Fluorescence Method

- Easy and fast
- Large transects, in situ measurements
- General information on all algal groups
- No detailed information at species level
- Substratum variability solved by 700nm LED
- To be studied:
  - dark adaptation?
  - representativeness – patchy distribution

Representativeness







Sampling Sites

- Aim of study
- Select sites representative of river-stretch under investigation
- Avoid heavily shaded sites
- Check similar conditions for
  - light
  - current velocity
  - substratum
- Survey units of similar length (10m)
- Consider seasonal run-off

Microphytobenthos Biomass

- Current velocity
- Frequency of biomass-scouring floods
- Suspended sediment
- Shading
- Substratum type
- Grazing

Nutrient-Biomass Relationships

- Lakes:
  - nutrient loading
  - average residence time
- Streams and Rivers:
  - nutrient supply
  - frequency of flood disturbance
  - (if both low: grazing)

Example from Australia/USA

$$B^* = k_1 d_a + k_2 n + c$$

B* : mean monthly biomass of benthic algae

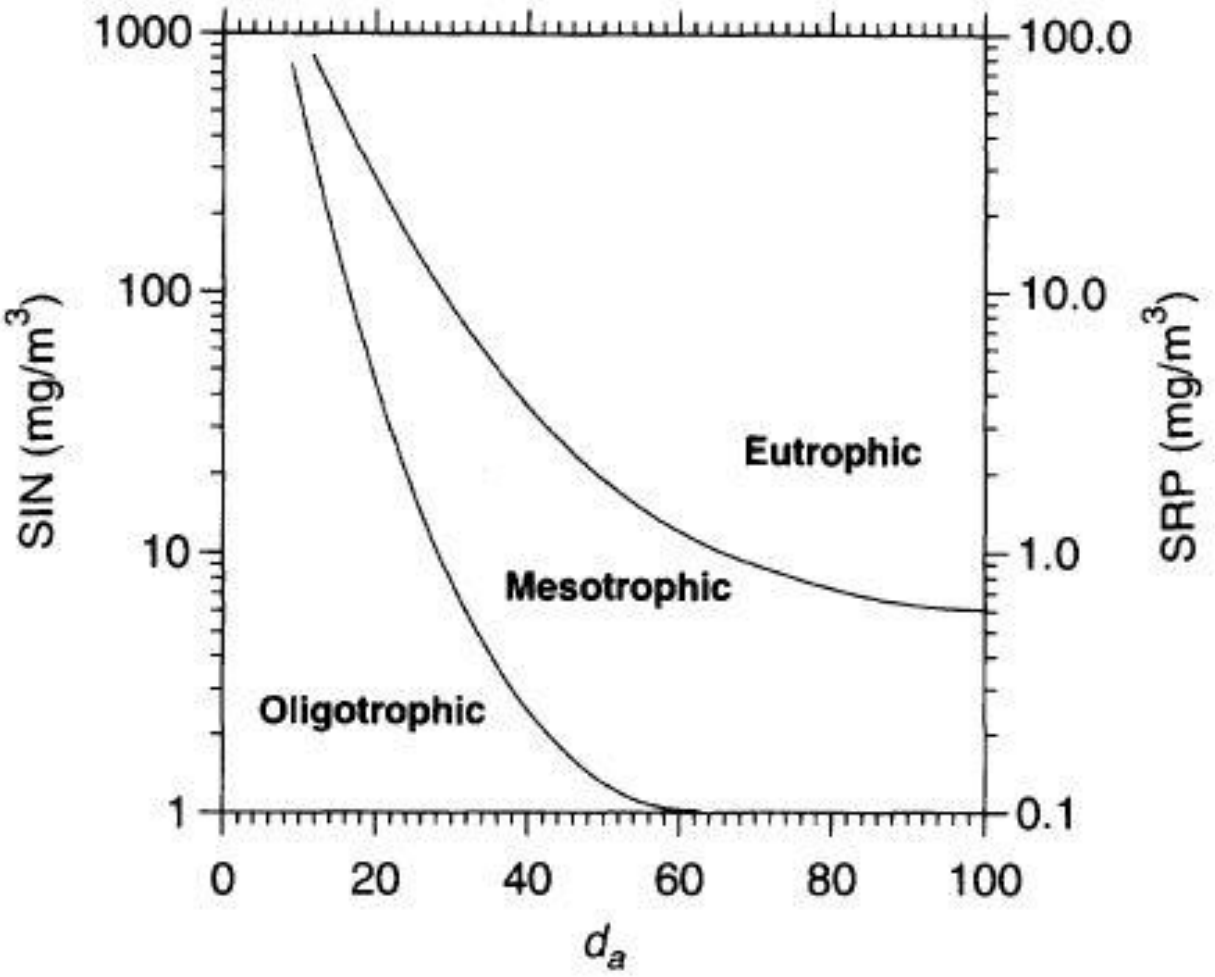
K_1 /k_2 : coefficients

d_a : number of days available for biomass accrual

n : measure of nutrient supply (mean monthly SRP/SIN)

c : empirical constant

Conditions resulting in max. phytobenthos biomass



O-M: 6 µg/cm^2

M-E: 20 µg/cm^2

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