Benten water solutions

Corina Carpentier

A nutrient-biomass model for phytobenthos based on data from the Joint Danube Survey 3

AquaLife Workshop
3-4 June
Kiel, Germany

Introduction

- Joint Danube Survey 3:
  international longitudinal ship survey of the Danube River and major tributaries
- Mid August – End of September 2013
- Dataset used to determine nutrient -biomass relationships for phytobenthos

Joint Danube Survey

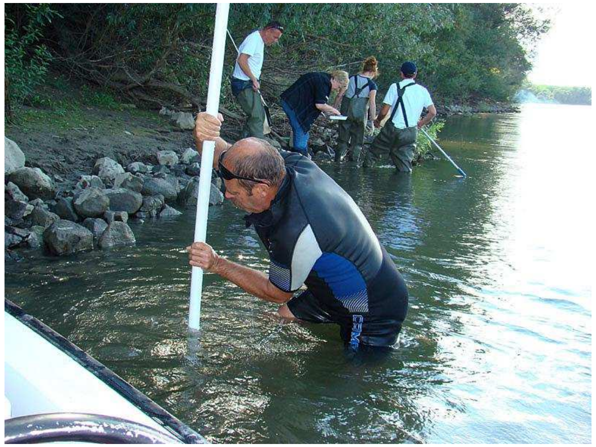
JDS in figures

- 2,500 km of river
- 100 sampling points
- left and right bank
- 280 individual chemical, physical, biological and hydromorphological parameters
- 6 weeks of continuous sampling

Biological parameters investigated

Phytobenthos biodiversity

Phytobenthos biomass

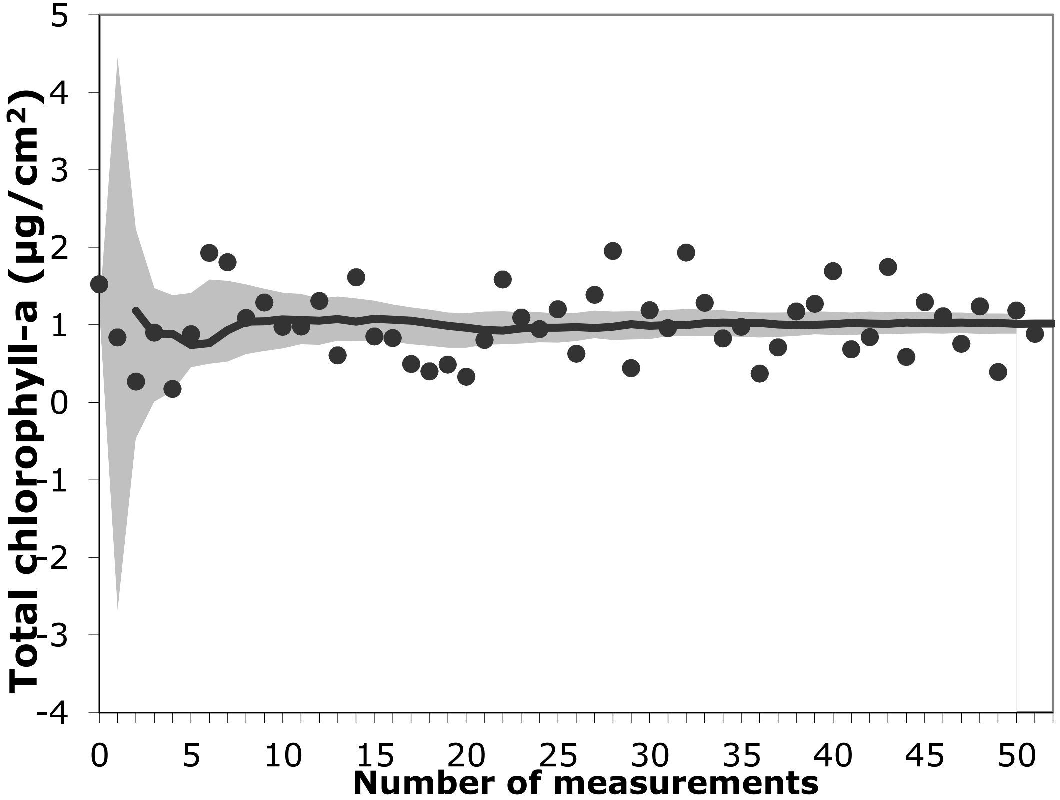


Benthic invertebrates

BenthoTorch measurements

- 96 suitable sampling locations
- 25 measurements per location

→ **2,400 datapoints**



Nutrient-biomass relationships

- Lakes:
  - nutrient loading
  - average residence time
- Streams and rivers:
  - nutrient supply
  - frequency of flood disturbance

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

Biggs, B.J.F. 2000. Eutrophication of streams and rivers: dissolved nutrient-chlorophyll relationships for benthic algae. *J. North Am. Benthol. Soc.*, **19**(1), 17-31.

Adjustment to Biggs' model

- Number of days available for biomass accrual:

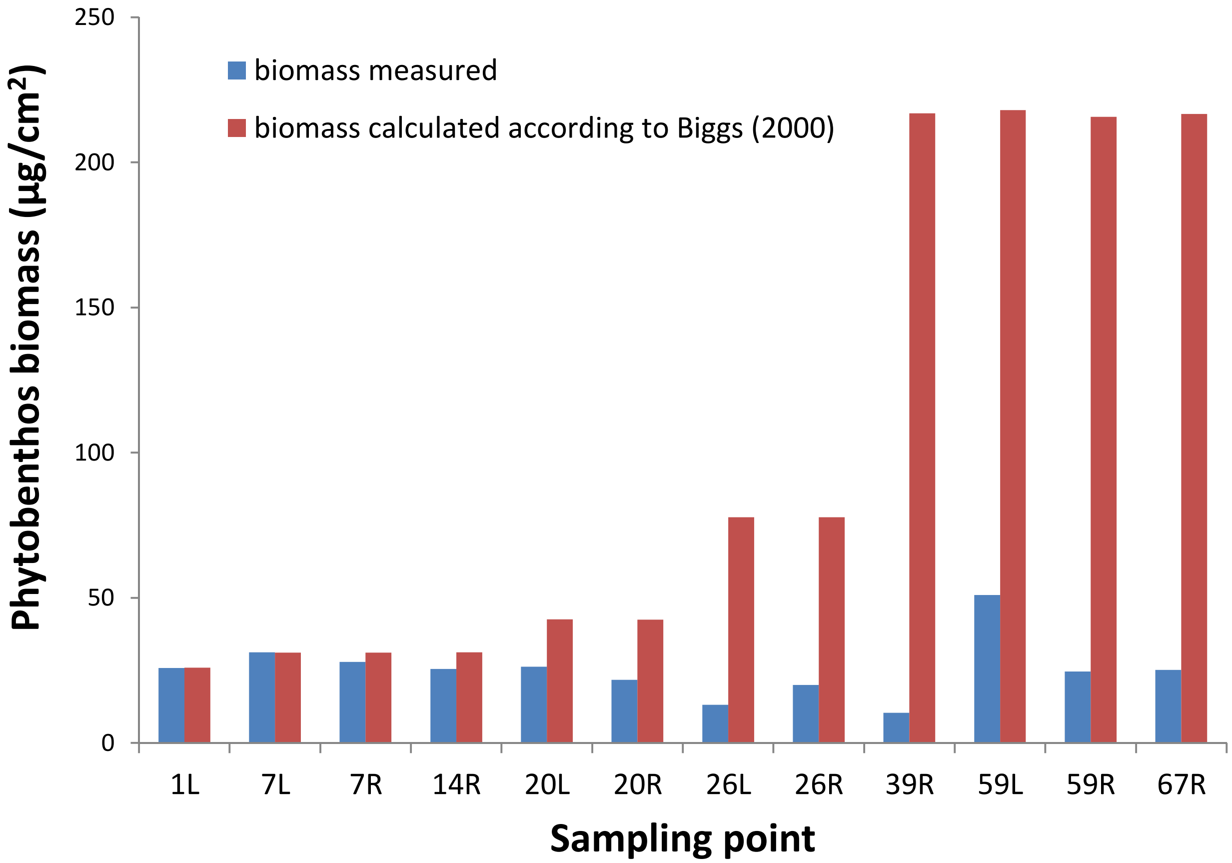
$$\frac{1}{\text{mean frequency of events per year} > \text{3x median flow}} \times 365\ days$$

  - Small streams
  - Frequent flooding

- For the Danube River (median flow = 4,000 m^3/s):

$$\frac{1}{\text{mean frequency of events per year} > \text{2x median flow}} \times 365\ days$$

Biomass for 12 Danube sampling locations

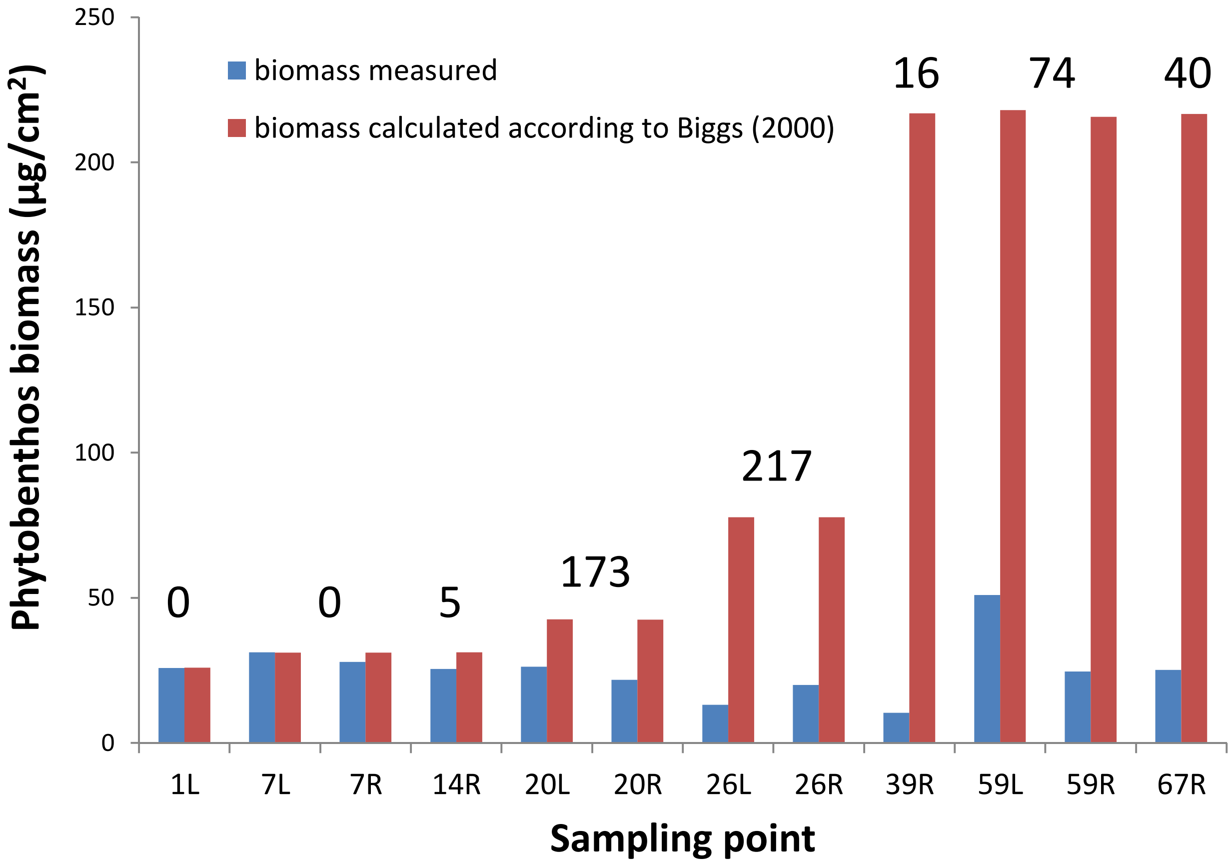


Benthic invertebrate grazers

Theodoxus fluviatilis
Picture: Vollrath Wiese

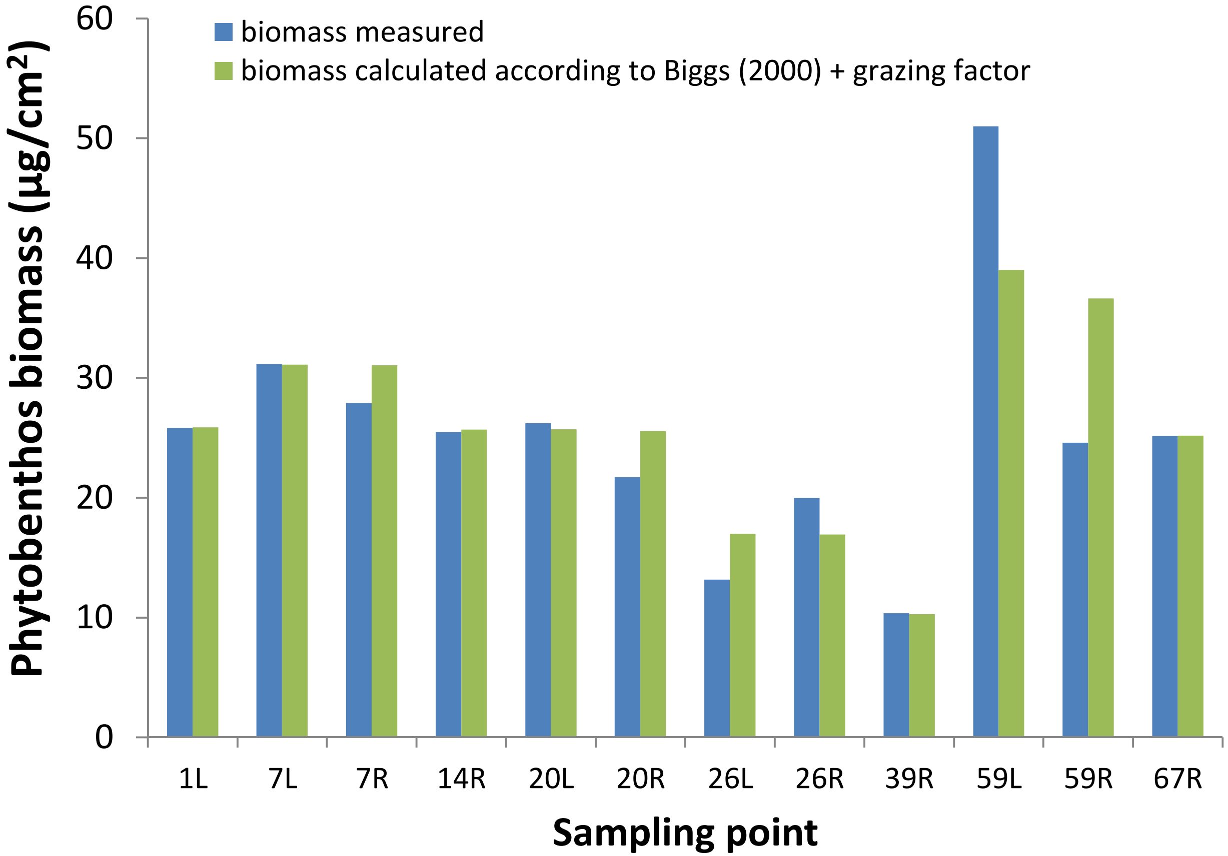
Viviparus viviparus

Biomass for 12 Danube sampling locations



Grazer-factor included

$$B^* = k_1 d_a + k_2 n + c - g(TV)$$



Conclusions

- Variation in phytobenthos biomass development in the Danube River can largely be explained by
  - nutrient conditions
  - flood regimes (>2x median flow)
  - grazing

- Model can be used to determine expected biomass development

Next steps

- Refine model, quantify constants
- Collect data-sets from other rivers and streams
- Verify model
- Integration into larger ecosystem model for rivers and streams to support ecological status assessments (WFD)

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