

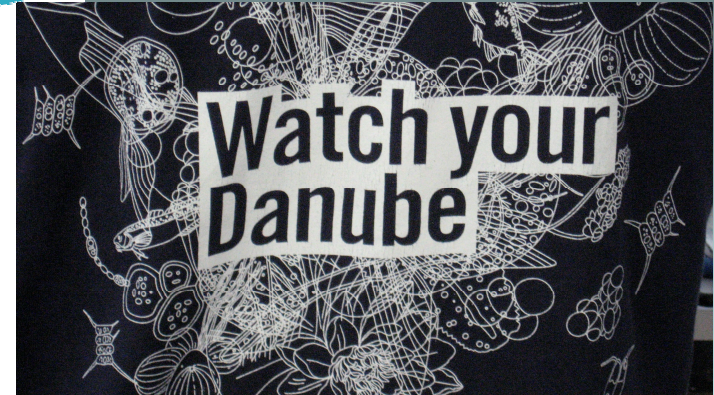


# JOINT DANUBE SURVEY 2

**icpdr iksd**

International  
Commission  
for the Protection  
of the Danube River

Internationale  
Kommission  
zum Schutz  
der Donau



## Measurement of the Phytobenthos Biomass in the Danube and its Tributaries

### Joint Danube Survey 2 (2007)

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<sup>1</sup> Water Research Institute, Slovak Republic, <sup>2</sup> Kiwa Water Research, The Netherland

## General objectives of JDS2

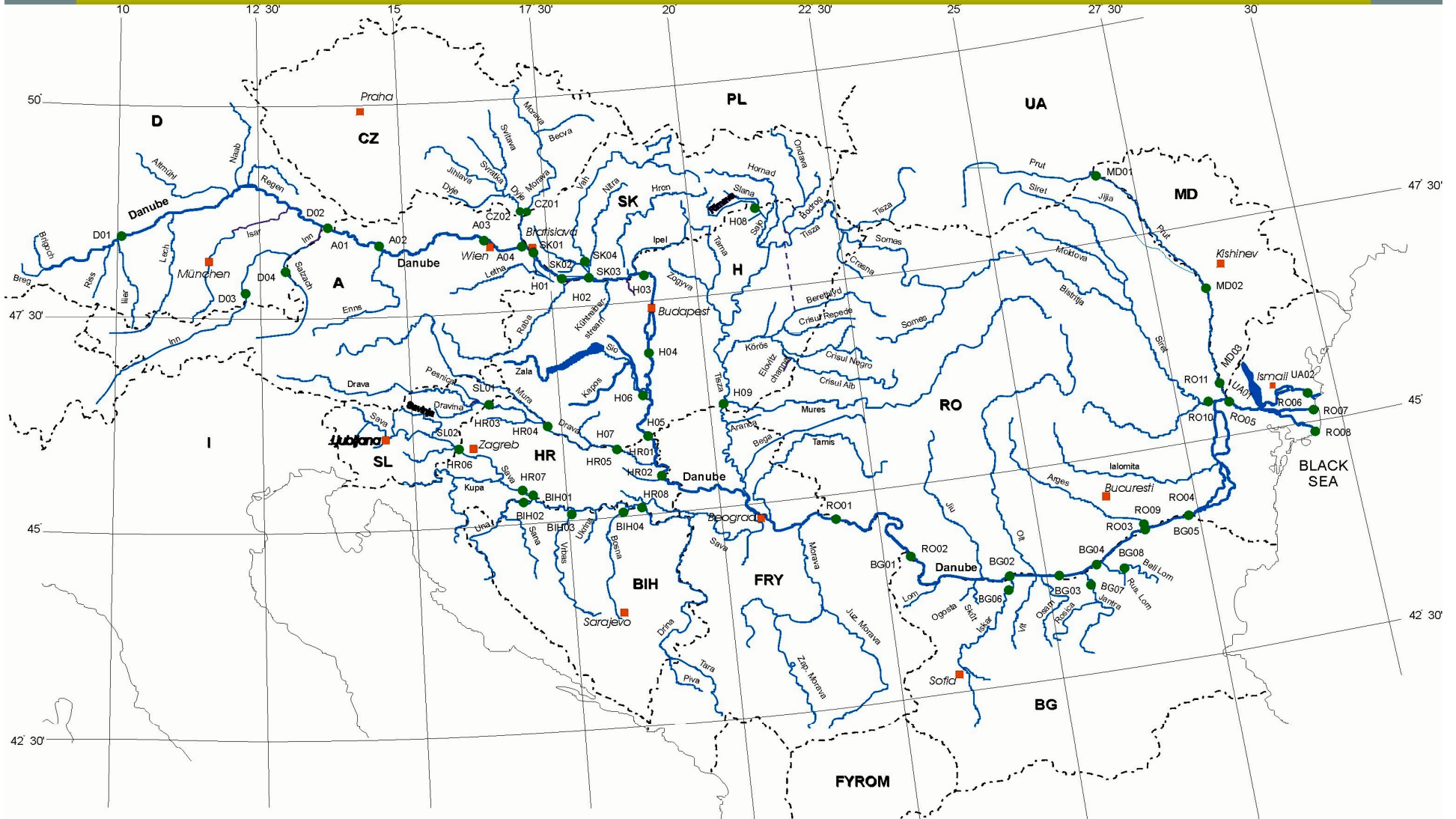
- Obtain homogenous database of results for the Danube (based on sampling, laboratory analysis of specific parameters and biological quality elements)
- Screening priority pollutants and other relevant substances (WFD)
- Microbiological analysis
- Create forum for participation of Danubian countries on sampling and comparison of results
- Training and increasing of experiences of Danubian experts
- Public participation



## Specific objectives of JDS2

- Comparing of the results of JDS 2 and JDS1
- Biological validation of Danube typology
- Ecological assessment of the Danube (WFD)
- Evaluation and confirmation of pressures and measures from Roof Report 2004
- Contribution to the intercalibration process of large rivers
- General overview of hydromorphology of the Danube
- Analysis of radioisotops

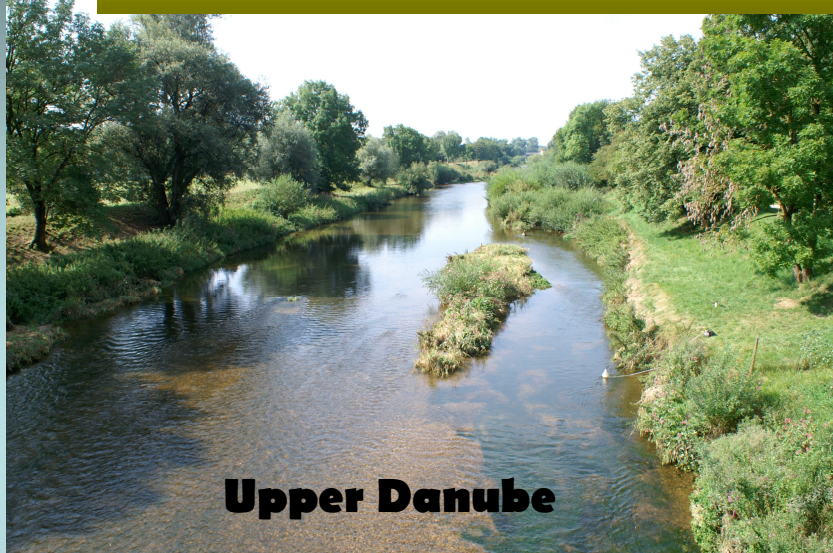
# Joint Danube Survey 2



**The Danube basin is the most international river basin in the world shared by 19 countries;**



# Joint Danube Survey 2 – investigated stretch



**Upper Danube**



**Middle Danube**



**Black Sea**

**96 sites along a 2,600 km stretch of the Danube**



# Joint Danube Survey 2

Technical realisation:

- Icebreaker Széchenyi (HU)
- Laboratory Argus (SR)
- Fish boat Vienna 115 (SK)





# Joint Danube Survey 2 – core team



## Joint Danube Survey 2 – core team

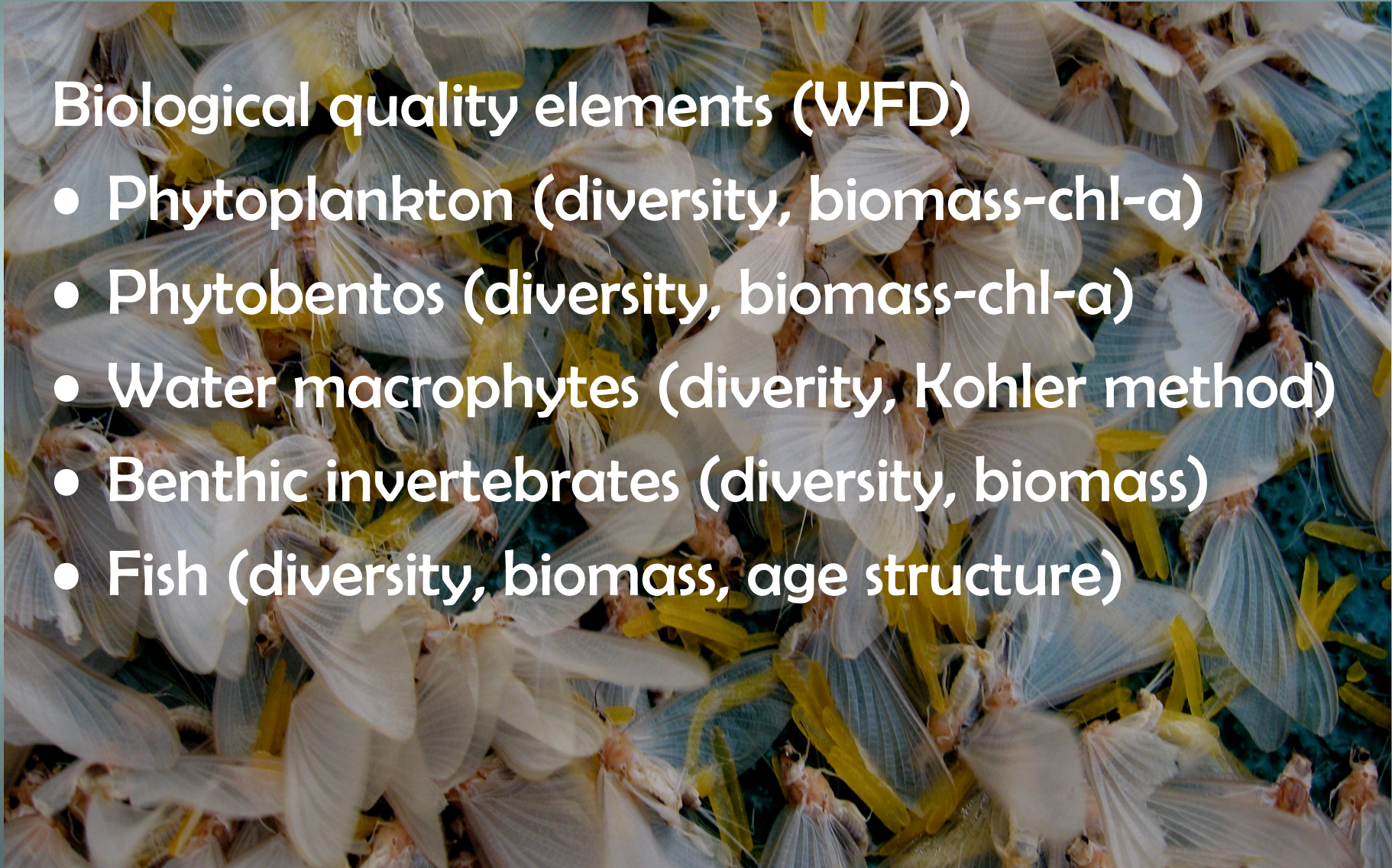
- Phytoplankton (Martin Dokulil, Kristina Kaiblinger)
- Phytobentos (Jarmila Makovinská)
- Water macrophytes (Brigitte Schmidt)
- Benthic invertebrates (Patrick Leitner, Wolfram Graf, Gabriel Chiriac, Momir Paunovic, Béla Csanyi)
- Fish (Christian Wiesner, Grigore Davideanu, Nikolaus Schotzko, Gábor Guti, Jaroslav Cerný )
- Hydromorfology (Wolfgang Kraier)
- Chemistry (Carmen Hamchevici, Mary Craciun, Hana Hudcová)
- Microbiology (Branko Velimirov, Alexander Kirschner)
- Airlift (Richard Niederreiter, Stefan Steiner)



## Joint Danube Survey 2 - BQE

### Biological quality elements (WFD)

- Phytoplankton (diversity, biomass-chl-a)
- Phytobentos (diversity, biomass-chl-a)
- Water macrophytes (diversity, Kohler method)
- Benthic invertebrates (diversity, biomass)
- Fish (diversity, biomass, age structure)





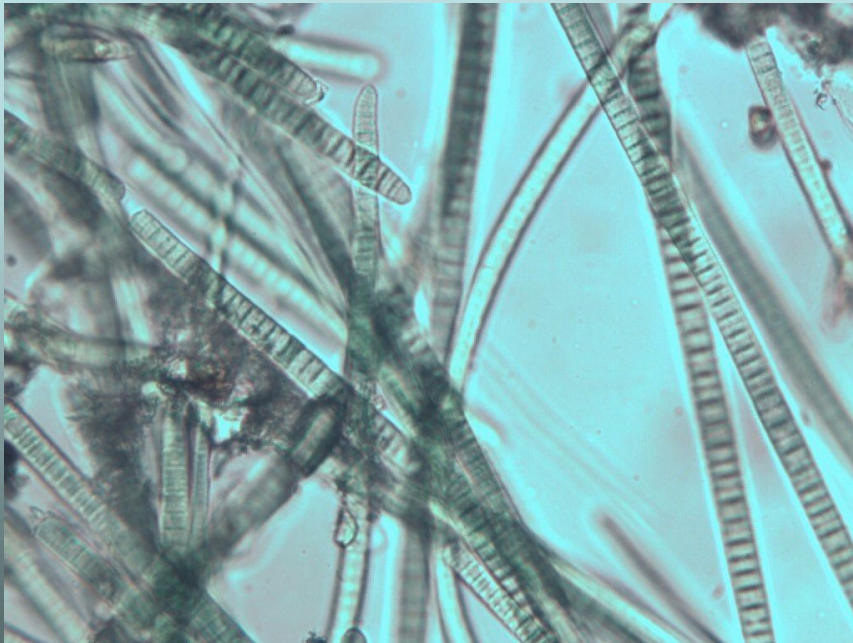
## Joint Danube Survey 2 – other parameters

- Physico-chemical, nutrients, silicates....
- Specific pollutants (PP, RS)
- Heavy metals
- Radioisotops (Cs, Sr, Ra, Rn, K, U, Pb, N, O)
- Microbiological det. (E. coli, fecal coli, enterococci, DNA analysis, abundance and biomass, secondary bacterial production)
- Ecotoxicity of sediments
- Hydromorphology (Danube)



# Phytobenthos

- Living phytobenthos excl. diatoms
- Benthic diatoms
- Phytobenthos biomass (chlorophyll-a)



# Phytobenthos

## Sampling:

**EN 13946: Water quality. Guidance standard for the routine sampling and pre-treatment of benthic diatoms from rivers**

**CEN/TC 230 N 0540: Water quality. Guidance standard for the surveying, sampling and laboratory analysis of phytobenthos in shallow running water**

**Fluorescence measurements –  
chlorophyll-a**

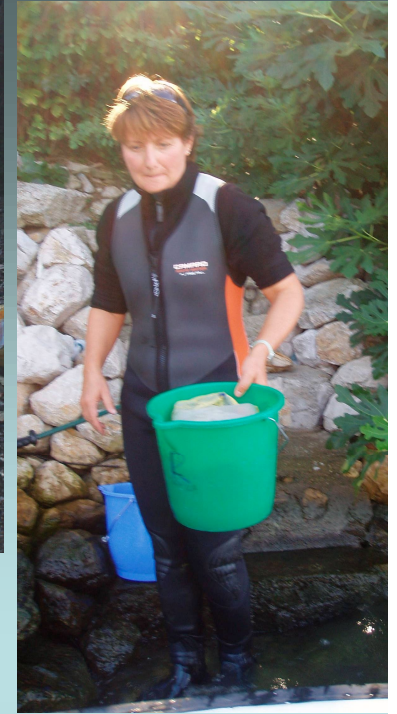
(using the Benthofluor® fluorometer  
(bbe Moldaenke, Kiel, Germany))





**Benthofluor® fluorometer**  
**bbe Moldaenke, Kiel, Germany**







# Phytobenthos - sampling

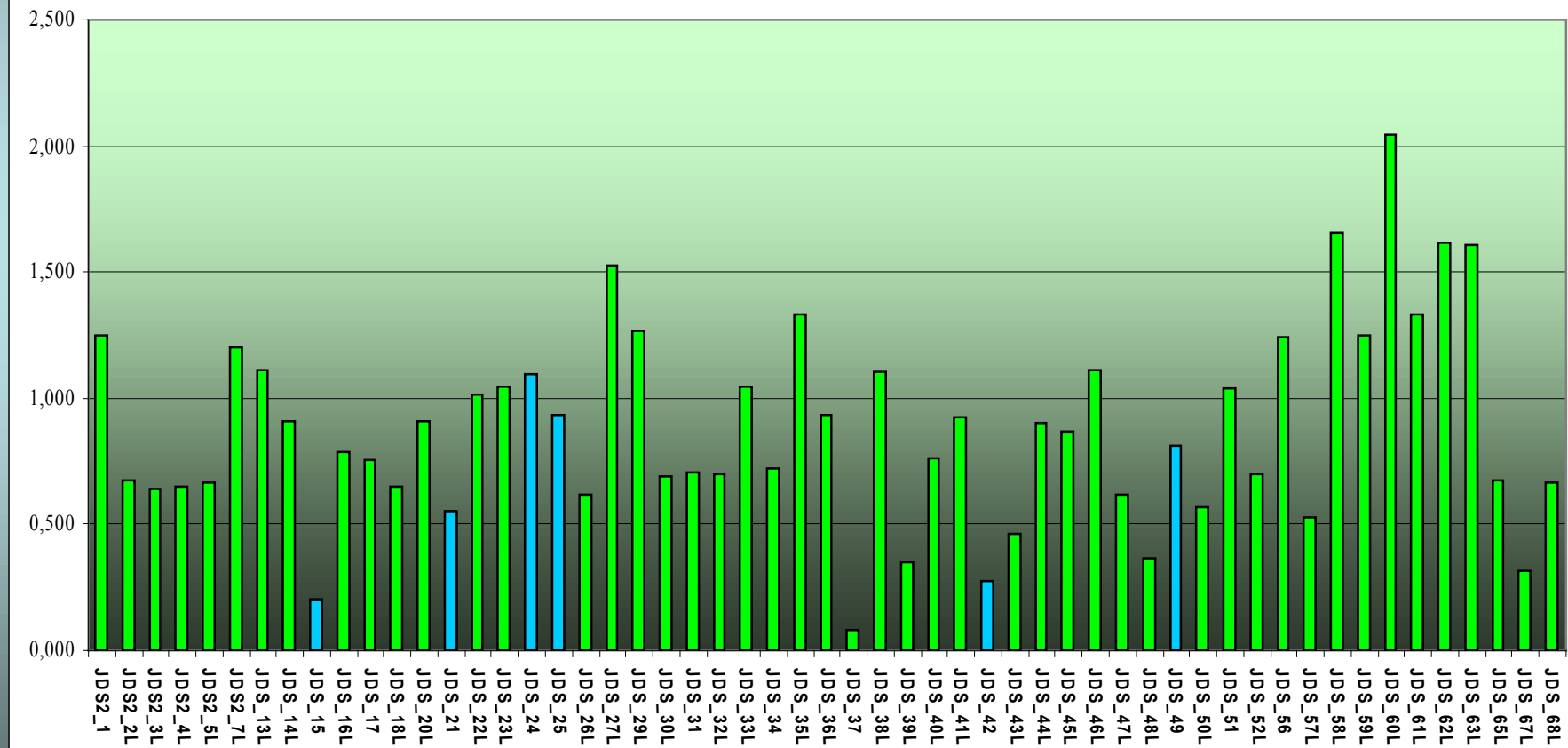
- Epilithon (5 boulders or more pebbles)
- Epiphyton (where epilithon was absent)
- First of all - measurement of chlorophyll-a  
(five areas were measured, each measurement was done 3 - 4 times)
- Area of minimum 10 cm<sup>2</sup> was brushed from each stone
- Samples:
  - living phytobenthos (microscopy)
  - preserved benthic diatom  
(EN 14407 )



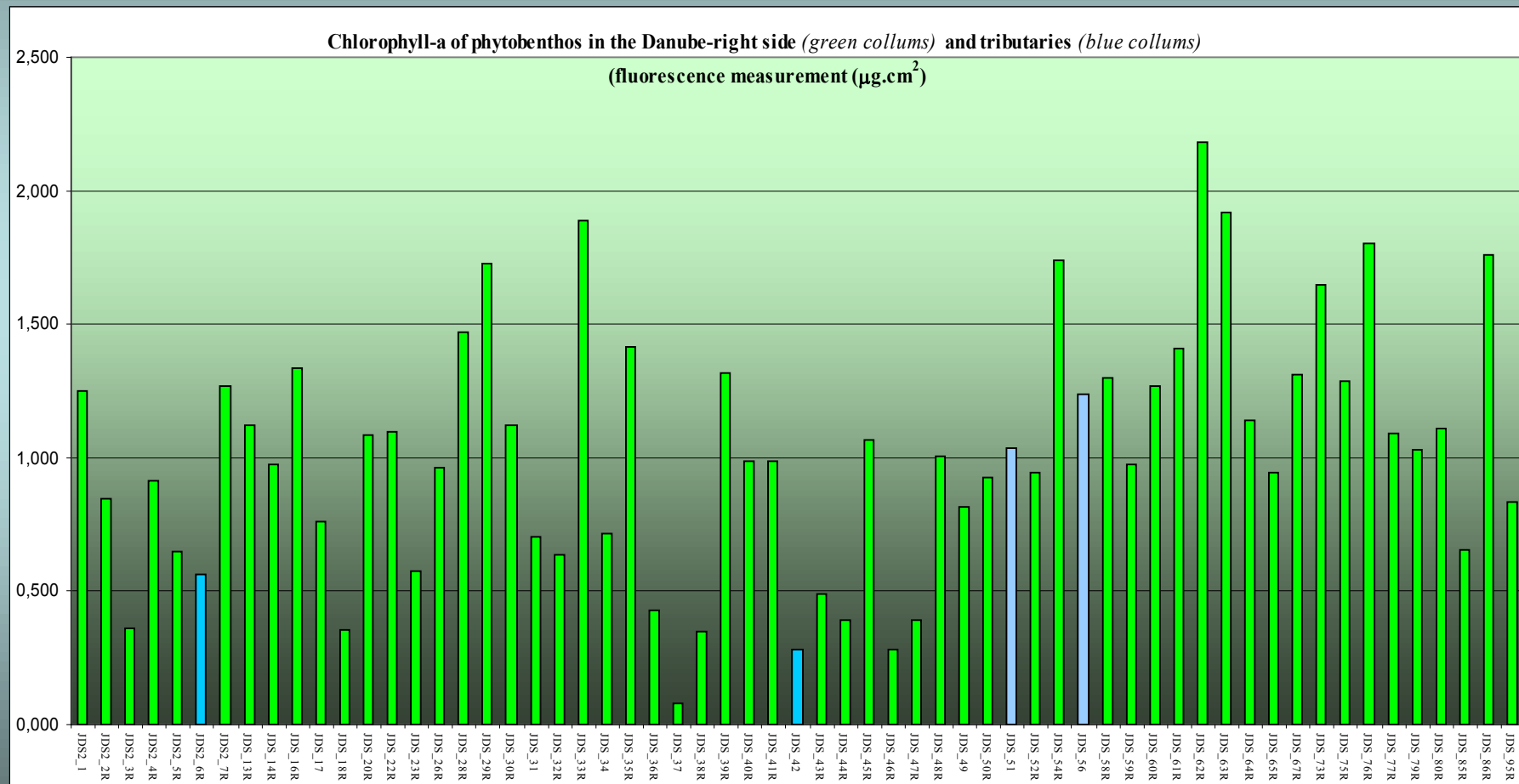


# Phytobenthos biomass

Chlorophyll\_a of phytobenthos in the Danube-left side (*green collums*) and tributaries (*blue collums*)  
(fluorescency measurements) ( $\mu\text{g}\cdot\text{cm}^2$ )

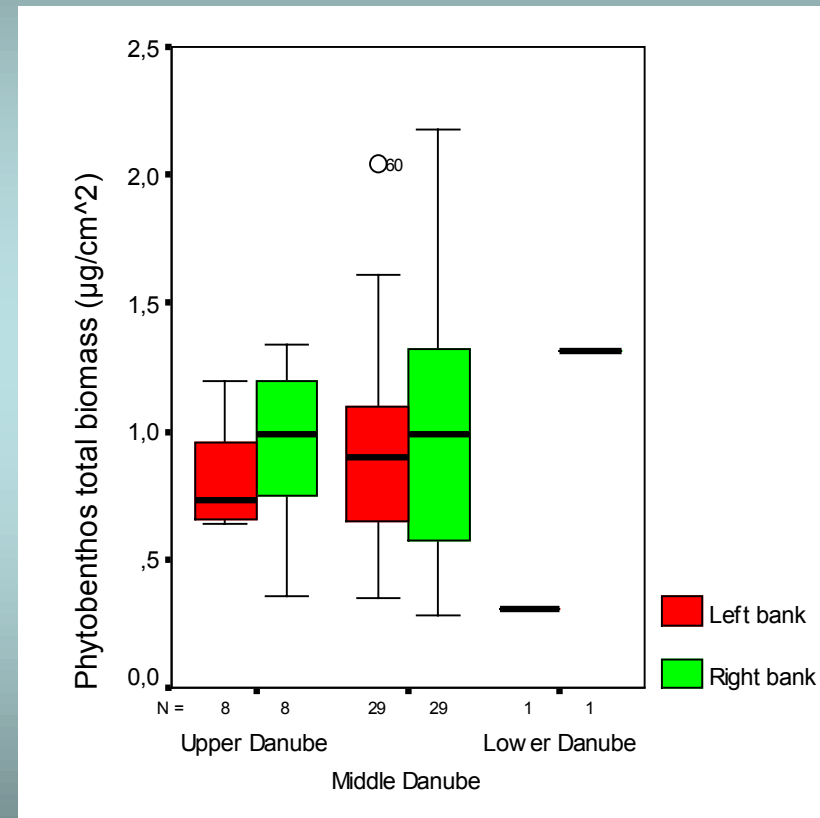
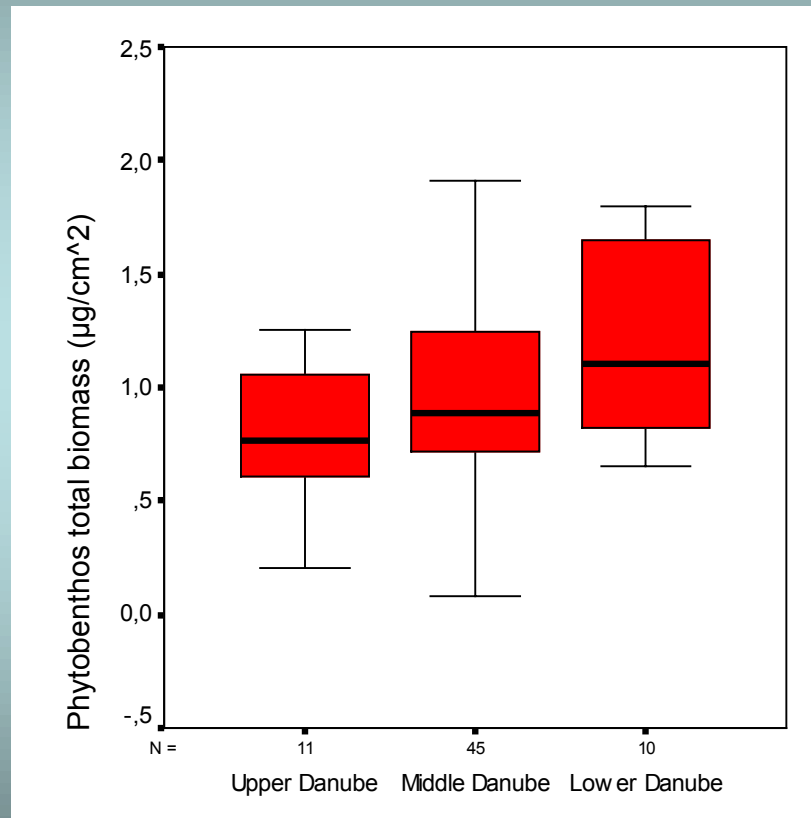


# Phytobenthos biomass



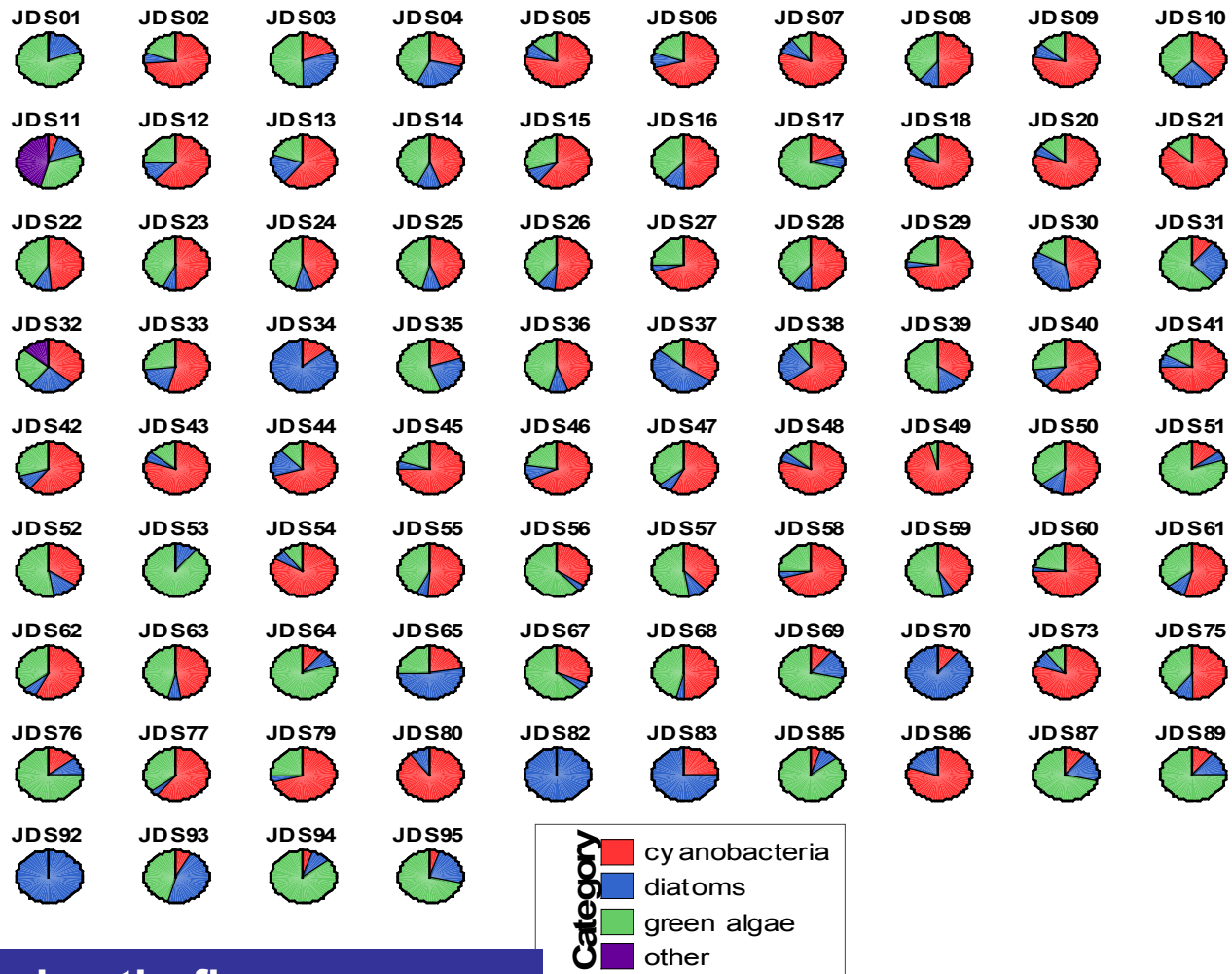


# Phytobenthos biomass



**Total phytobenthos biomass –chlo-a and differences between left and right bank in the Upper, Middle and Lower Danube**

# Phytobenthos (% CYA:CHLO:DIAT:OTHER)

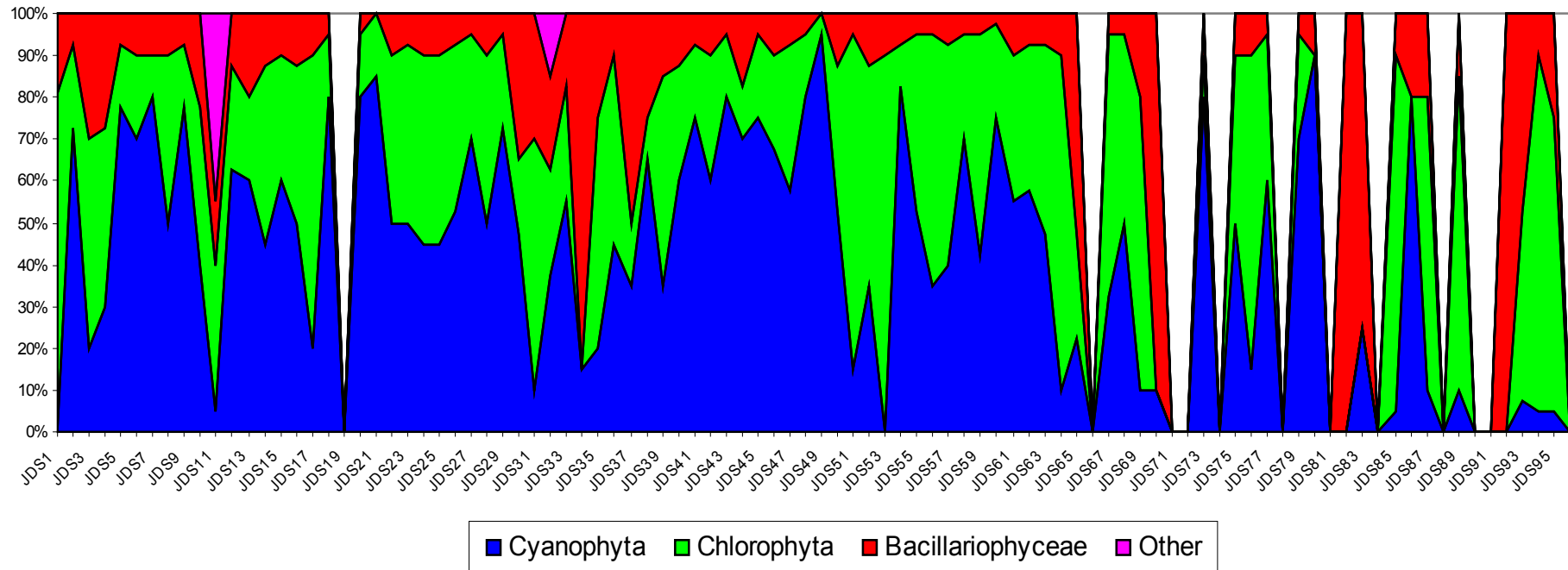


Measured by benthofluor



# Phytobenthos (% CYA:CHLO:DIAT:OTHER)

Estimation of relative abundance of phytobenthos groups



**Ratio of the individual of cyanobacteria, diatoms and green algae in the living samples for each sampling site, the 'other' group includes Rhodophytes (JDS11) and bacteria (JDS32) – (Sampling + microscopy)**

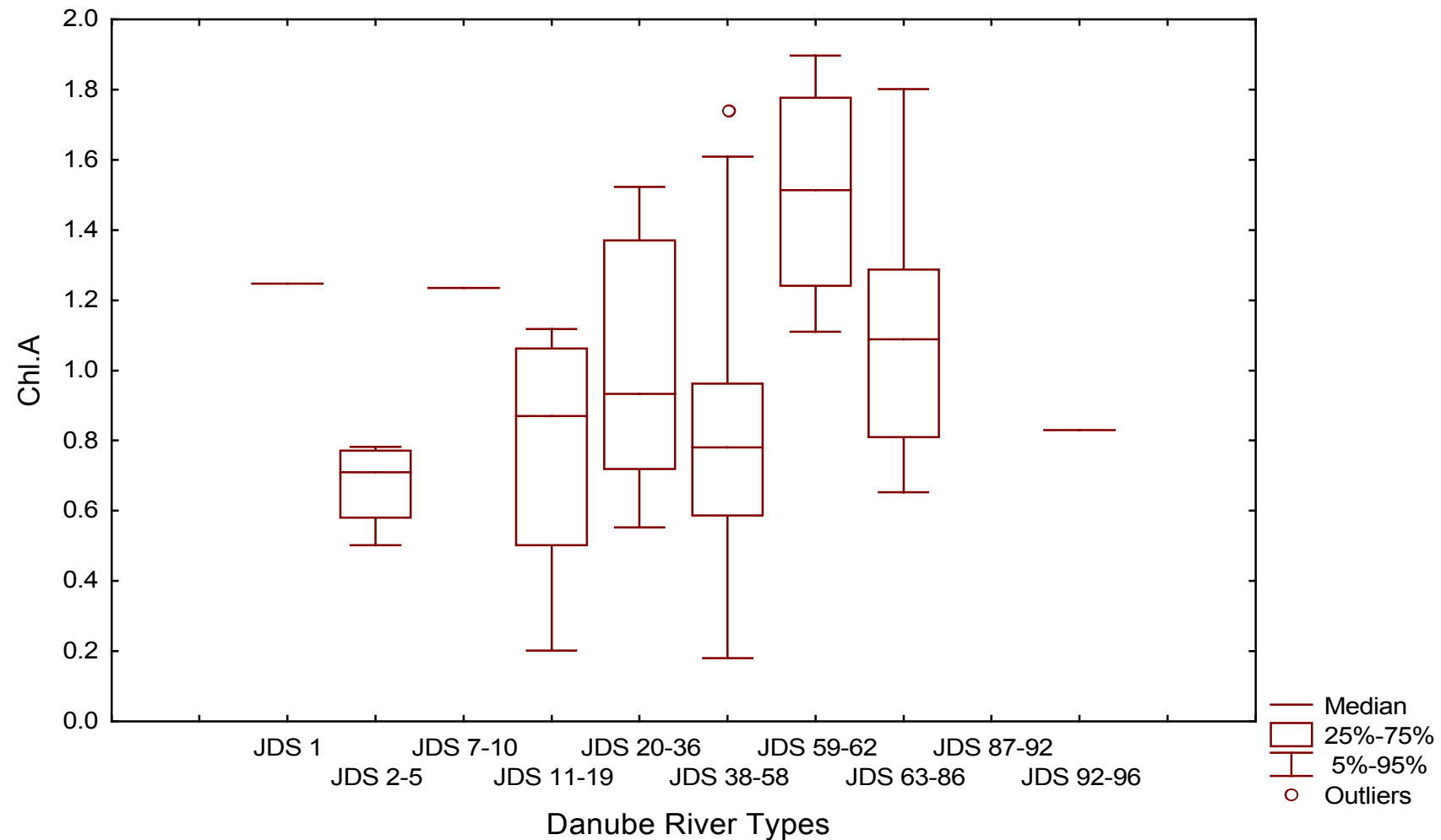
# Biomass in living samples

Biomass (%)	Green algae	Cyanobacteria	Diatoms
Sampling + microscopy (estimation)	34	50	16
Fluorometry (measurement)	30	68	2

- Match: ~ 30%
- Reasons:
  - Fluorometry overestimates cyanobacteria
  - Sampling + microscopy overestimates diatoms

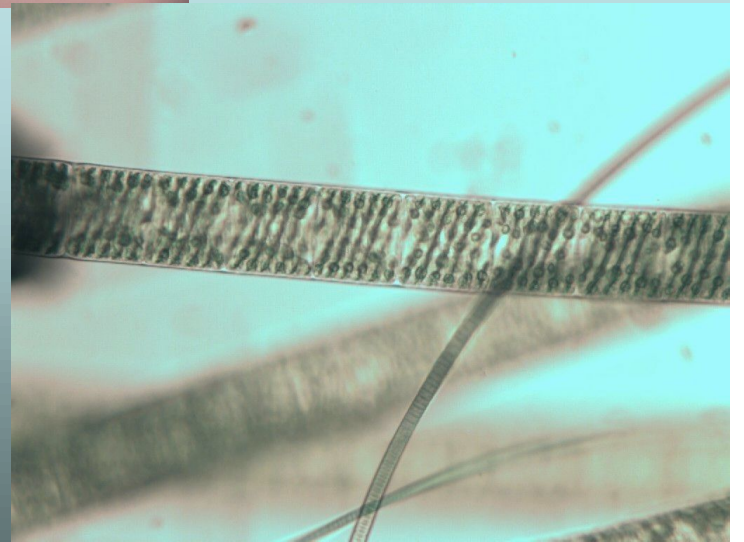
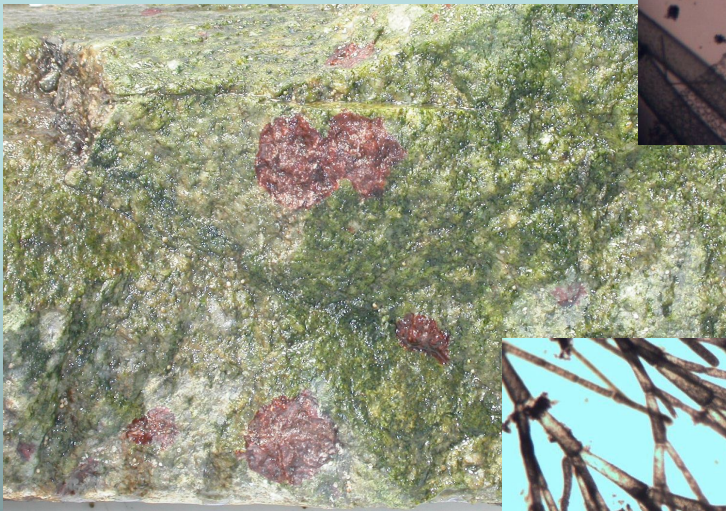
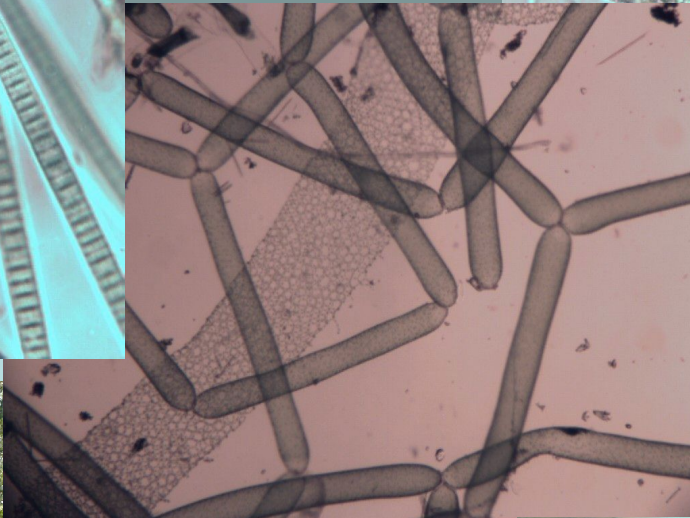
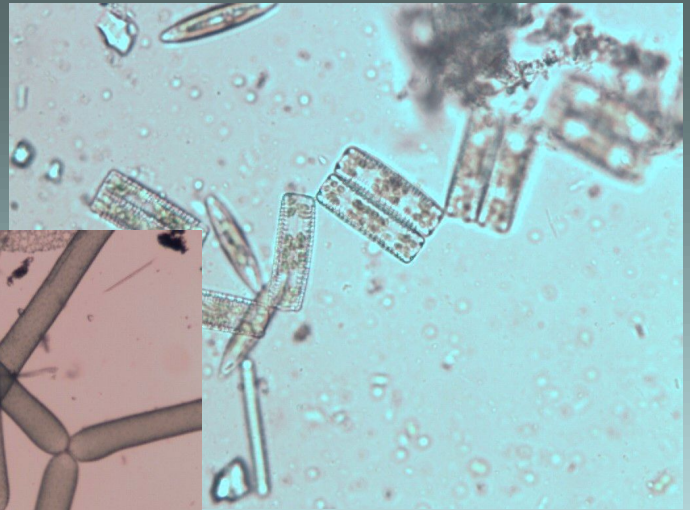
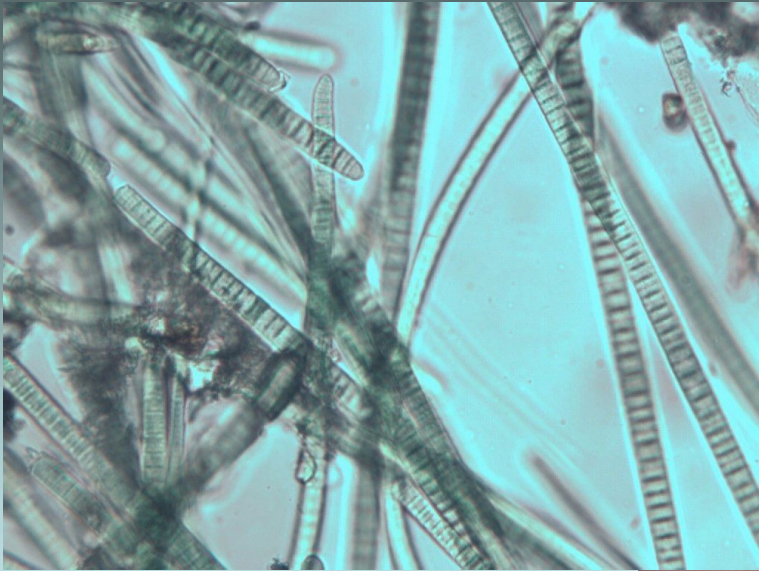


# Phytobenthos biomass



# Species diversity

- Based on results of JDS2 the species diversity of the phytobenthos was high, in total, 438 taxa were identified
- 2 new species were found
- Many first records for e.g. Slovak stretch of the Danube

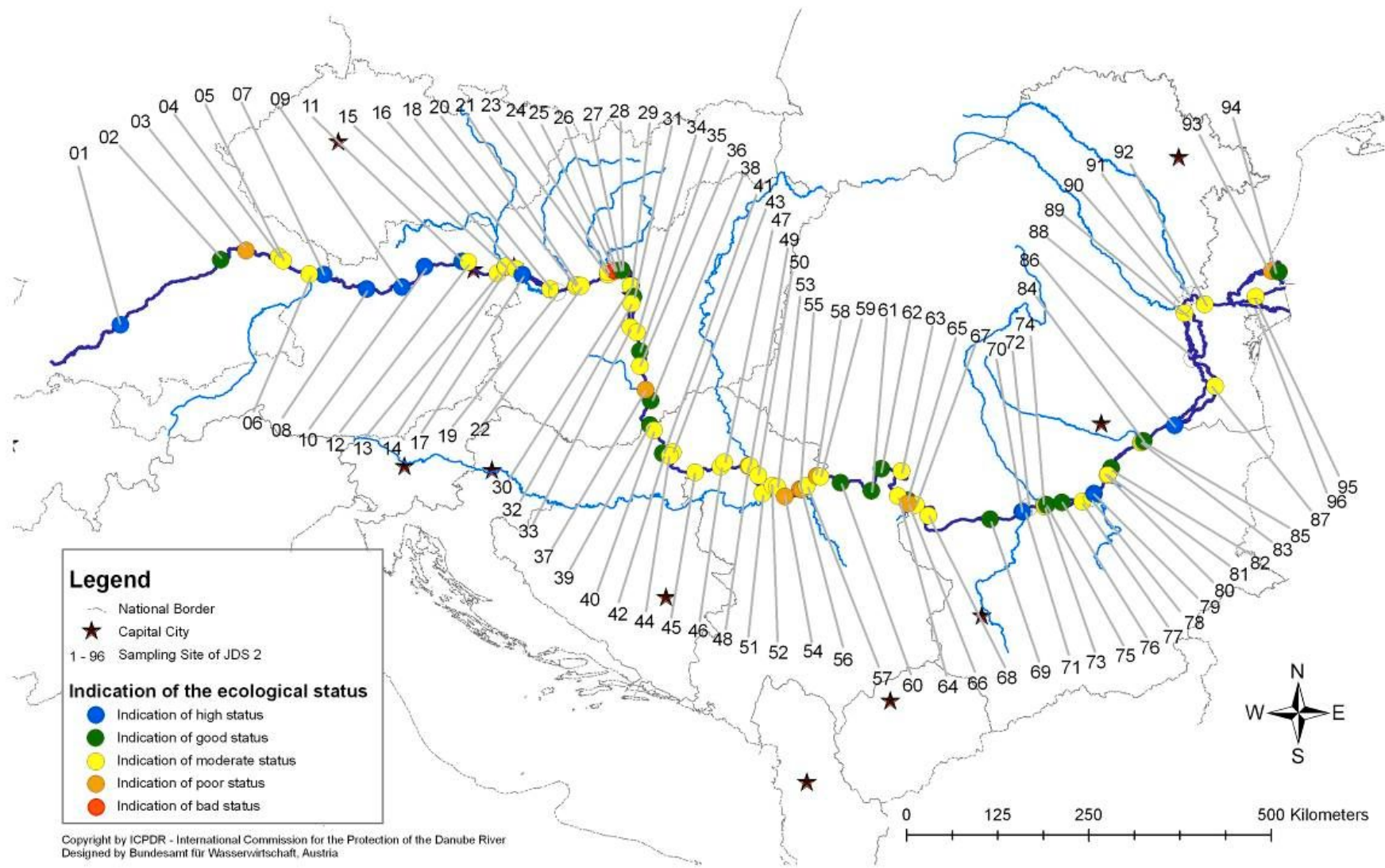




Phytobenthos  
indication of ecological status

**For the assessment of the indication of the  
ecological status  
we used the diatom-based Pollution  
Sensitivity Index (IPS) in combination with  
reference values and class boundaries  
adopted in the Slovak classification system**

# Danube - Indication of the ecological status by Phytobenthos



# Benthofluor

- Very good tool for measuring the phytoplankton biomass in the field
- Additional phytobenthos metric (quantitative) (metrics used are less confidence e.g in case of large rivers)
- It needs many more results (from the whole gradient of pollution) for preparation of classification scheme



**Thank you for attention**

