



## Inovace studia hydrobiologických disciplín s důrazem na rozšíření možností uplatnění absolventů biologických oborů PřF UP v praxi.

reg. číslo: CZ.1.07/2.2.00/28.0173

# Nutritional state of *Dreissena* reflects to environmental condition in Lake Balaton



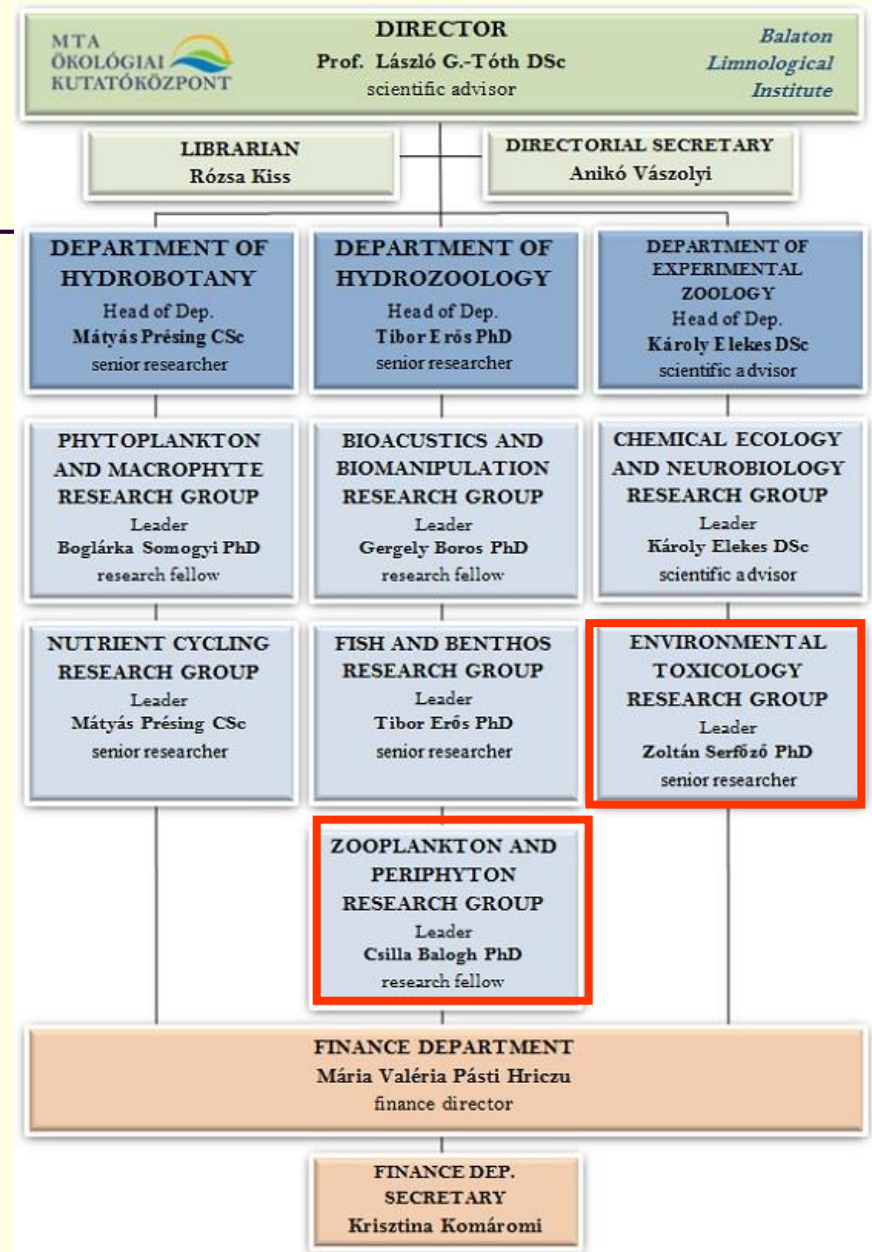
19. 5. 2015

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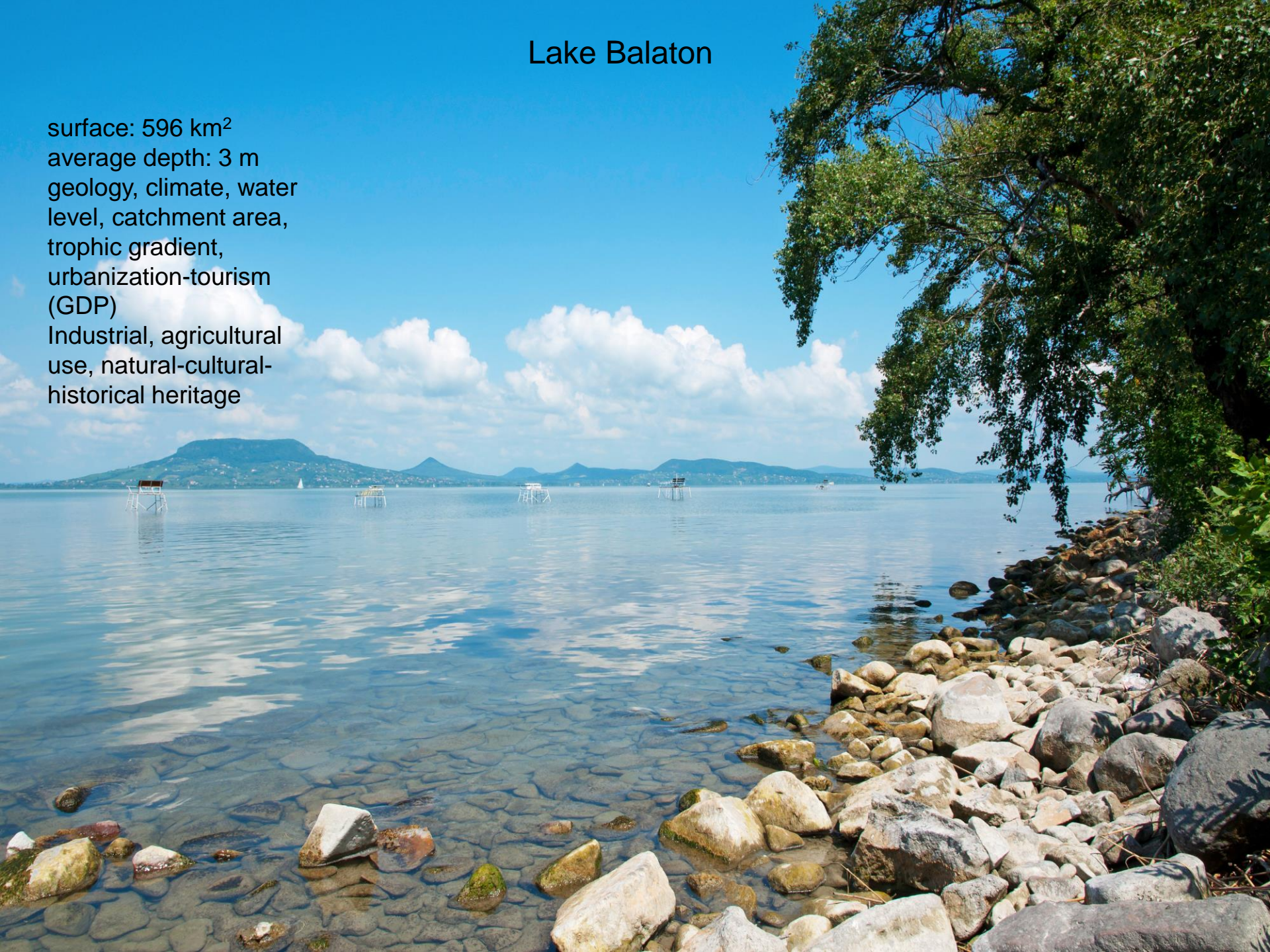
Balaton-monitoring program of the HAS  
TÁMOP-4.2.2.A-11/1/KONV-2012-0038  
TÁMOP-4.2.2.A-11/1/KONV-2012-0064

Balaton Limnological Institute  
 Centre for Ecological Research  
 Hungarian Academy of Sciences

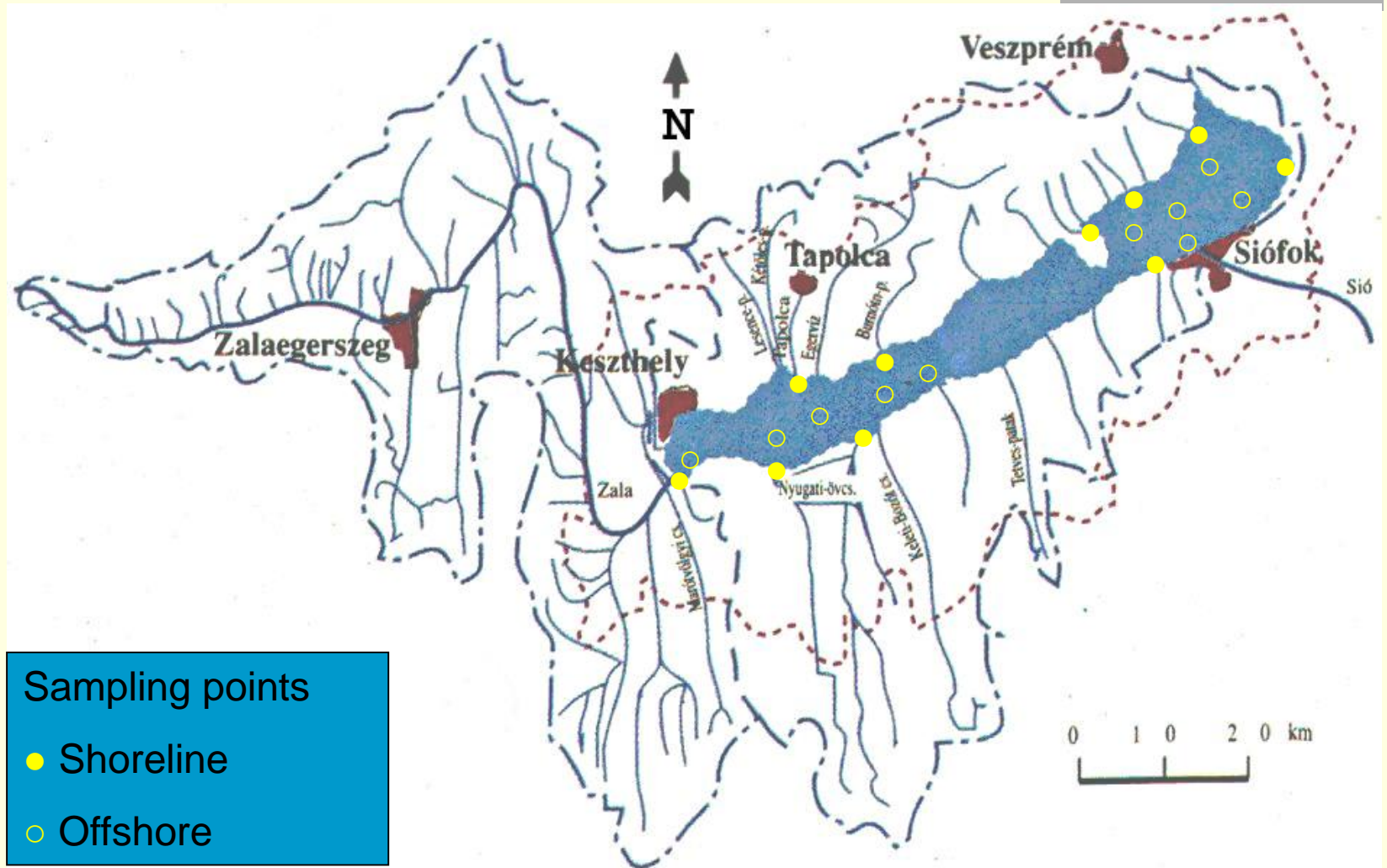


# Lake Balaton

surface: 596 km<sup>2</sup>  
average depth: 3 m  
geology, climate, water  
level, catchment area,  
trophic gradient,  
urbanization-tourism  
(GDP)  
Industrial, agricultural  
use, natural-cultural-  
historical heritage



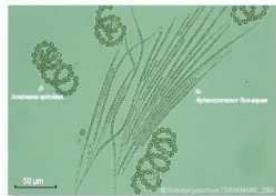
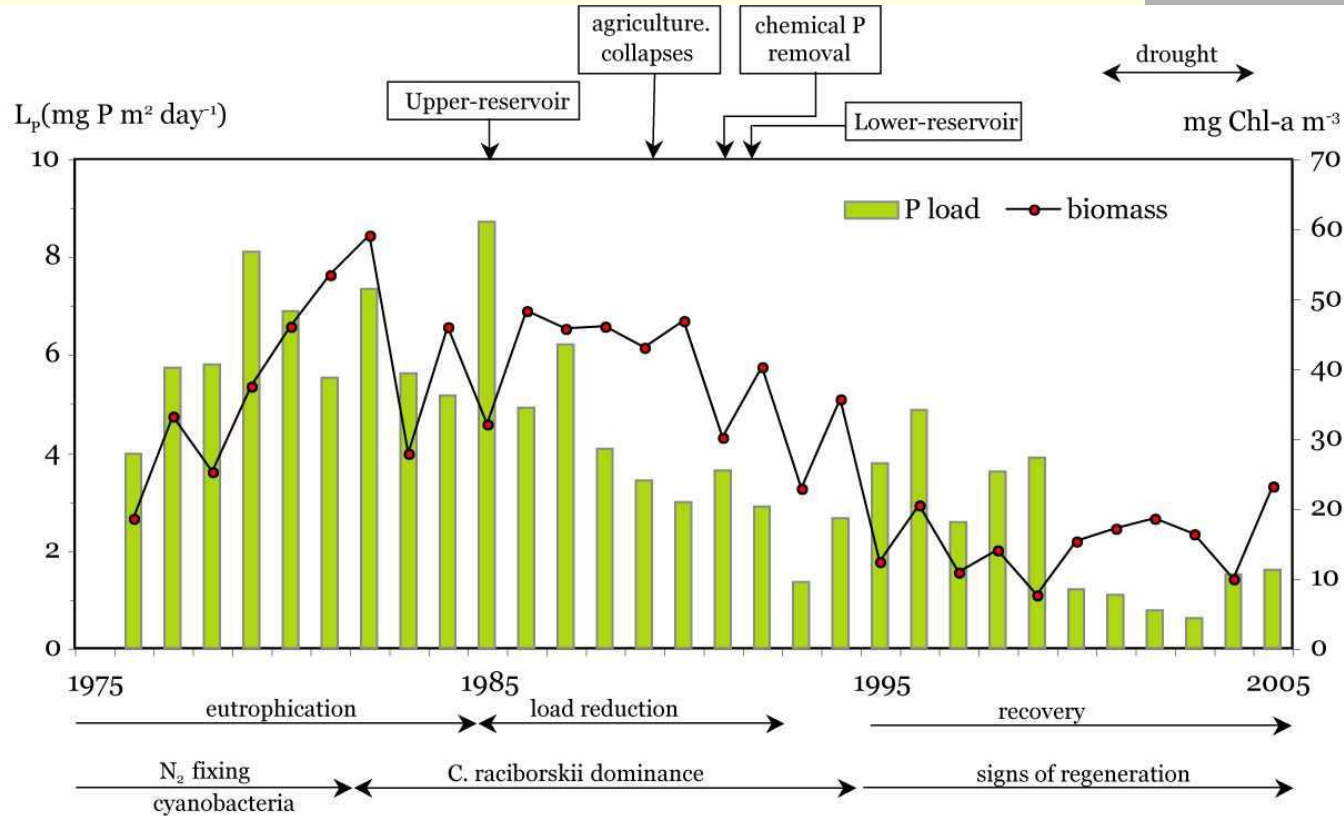
## Lake Balaton catchment area and sampling points



## Space view of Lake Balaton in springtime



# Recent ecological history of Lake Balaton



## Water level fluctuation



2009



2012

## Dreissena as an indicator of the environment



**endurable** factors:

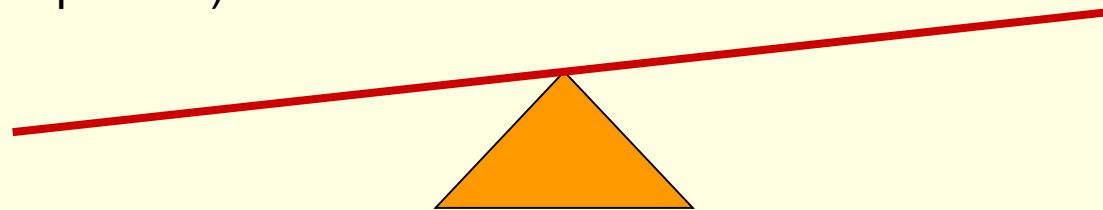
natural parameters

Biological stress (predators,  
parasites, competition)

pollutants

**favoured** factors:

nutrient load



animal distribution

Why exactly Dreissena?

middle at the food chain (top-down sensitising)













common (easy to find, non-protected, tolerant)

filter feeder (direct contact, accumulation)



Primary goal:  
Comprehensive assesment of the ecological state of Lake Balaton  
(Dreissenid watch program)

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- Water chemistry 
- Water/sediment inorganic/organic pollutant
  - (heavy) metal 
  - PAH, PCB 
  - PPCP 
- Algae (nutrient) composition
  - chlorophyll-A content 
  - species and frequency 
- Community structure of macrozooplankton and benthos 
- Dreissenids fitness
  - condition index 
  - nutrient storage 
  - pollutant accumulation 
  - stress and protection gene profile 
- Seasonal variability 

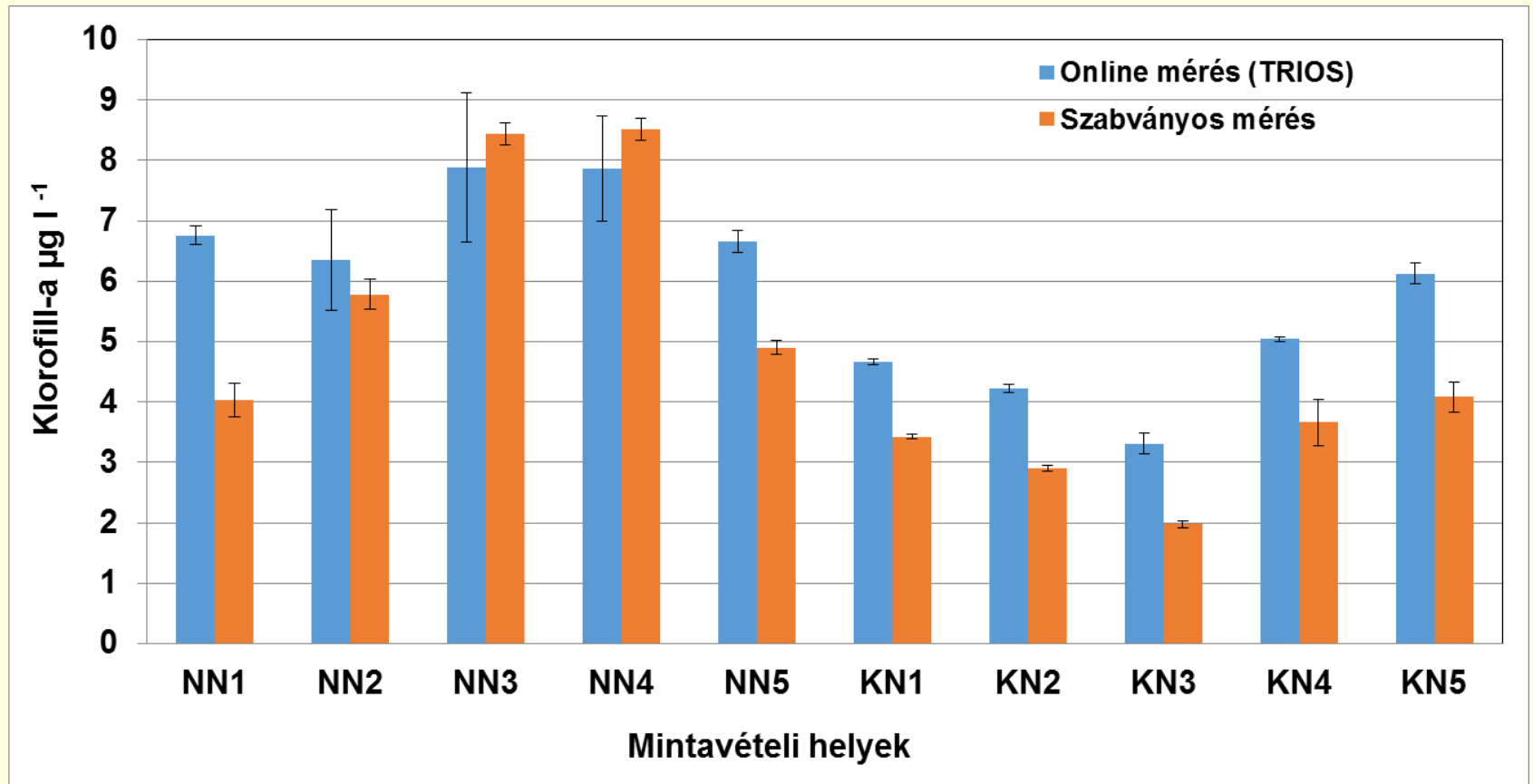
## Issues

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How *Dreissena* enjoys itself in Lake Balaton?

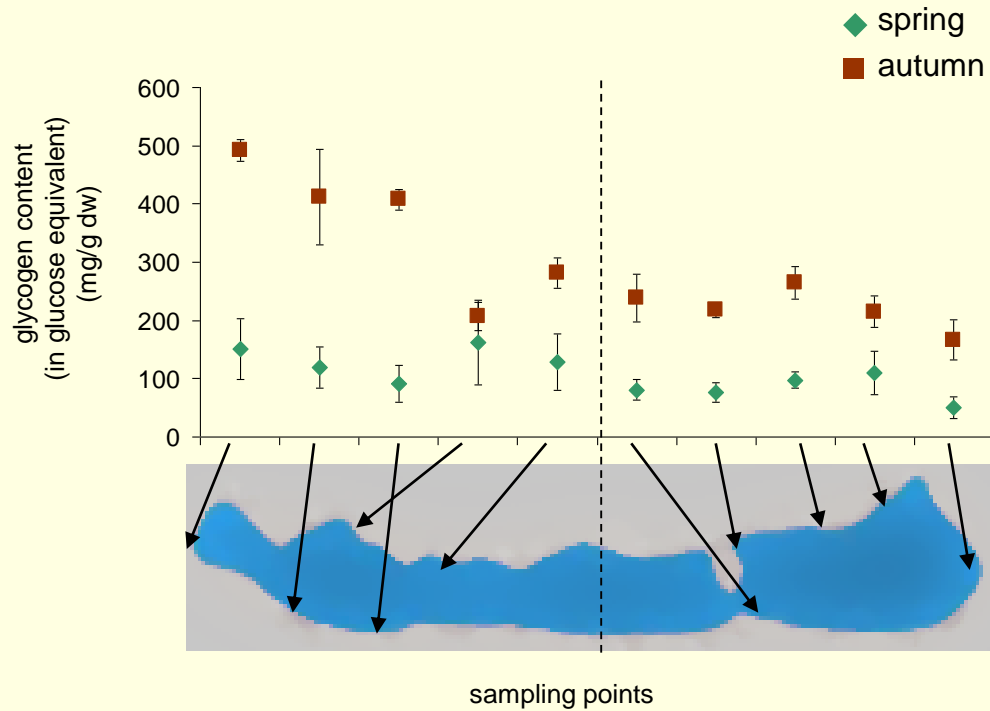
In turn, can *Dreissena* fitness refer to environmental state?

# Chlorophyll-A content

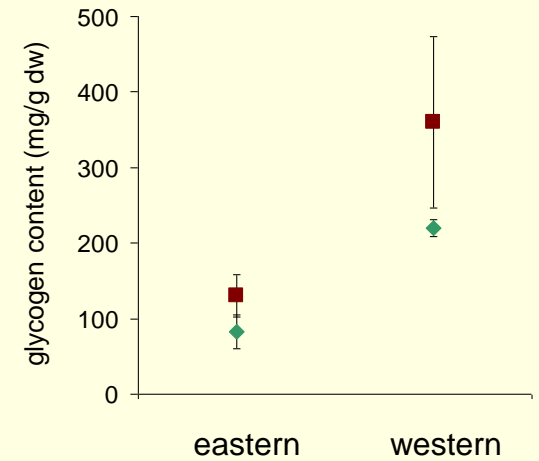


# Dreissenid fitness

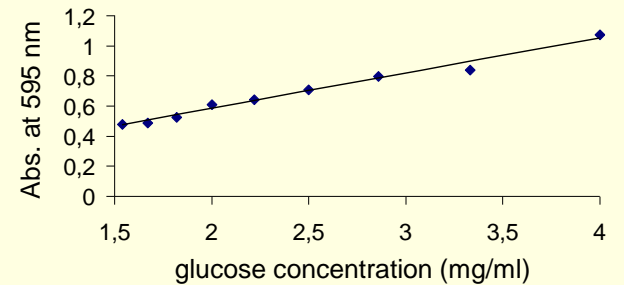
nutrient storage – 1. glycogen



Glycogen content (mean/SD) in the two basins of Lake Balaton



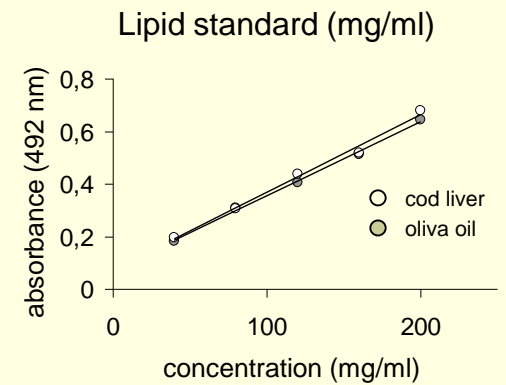
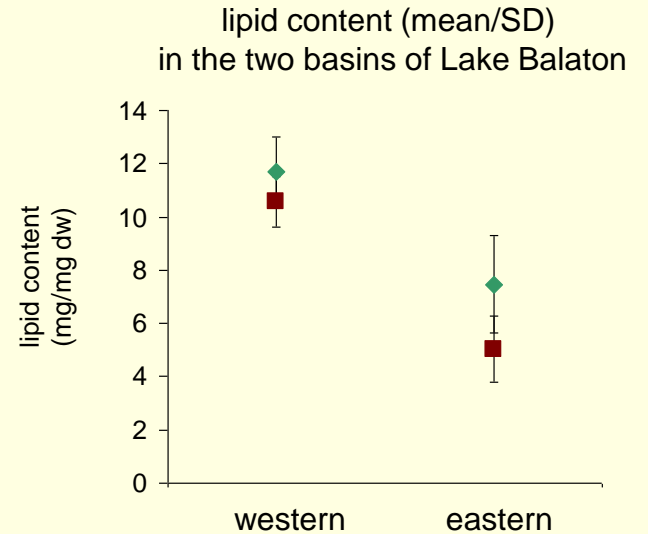
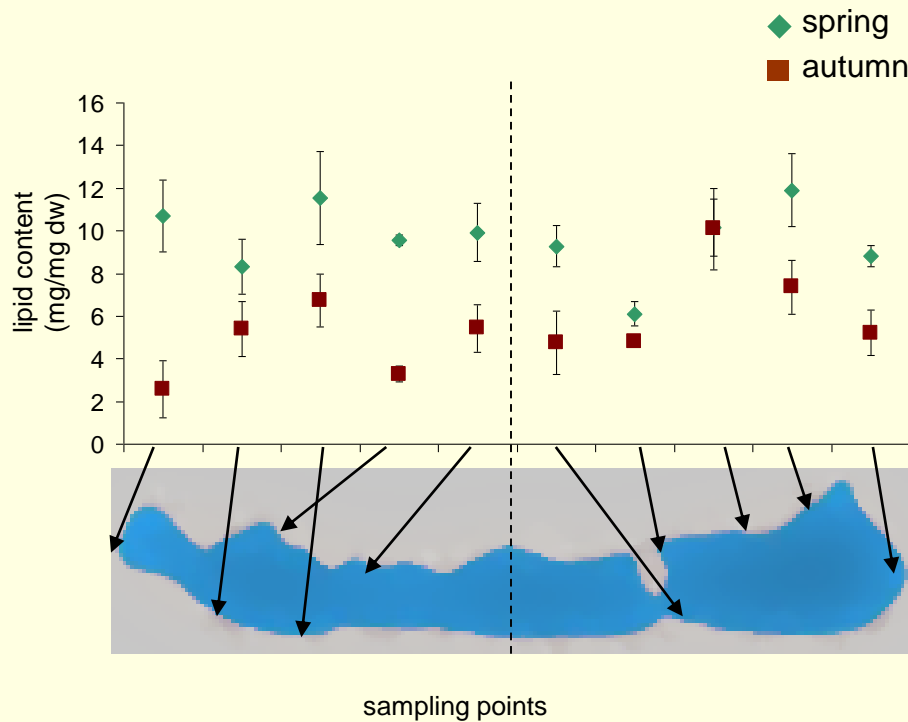
glucose-anthrone standard (average of 18 measurements)



Van Handel, 1965

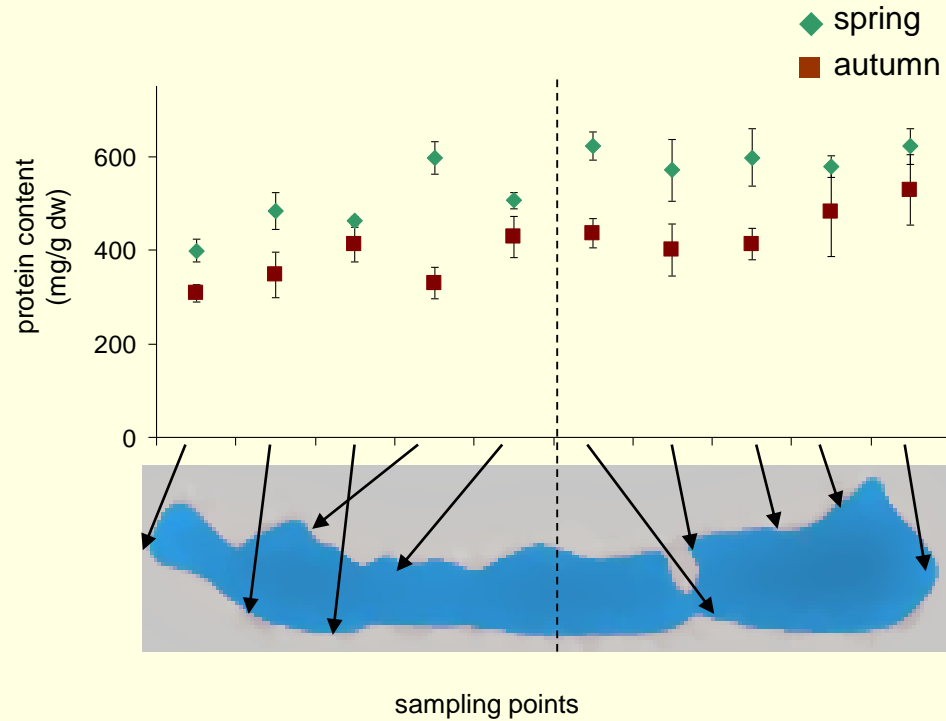
# Dreissenid fitness

## nutrient storage - 2. lipid

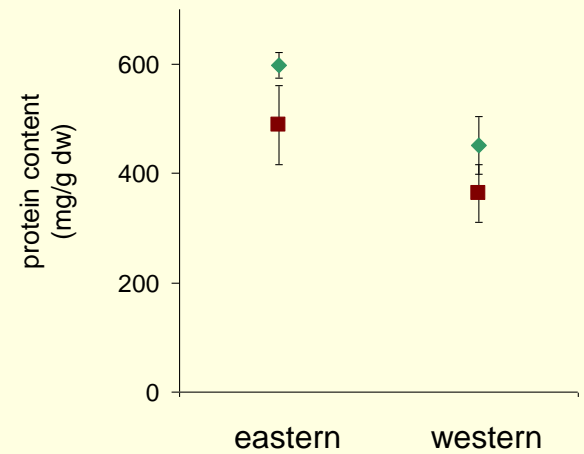


# Dreissenid fitness

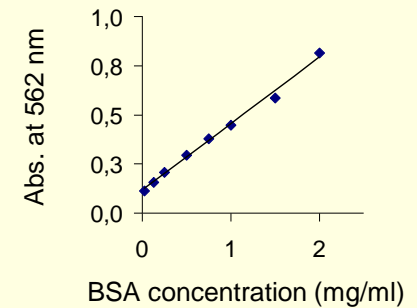
nutrient storage – 3. protein



Protein content (mean/SD) in the two basins of Lake Balaton



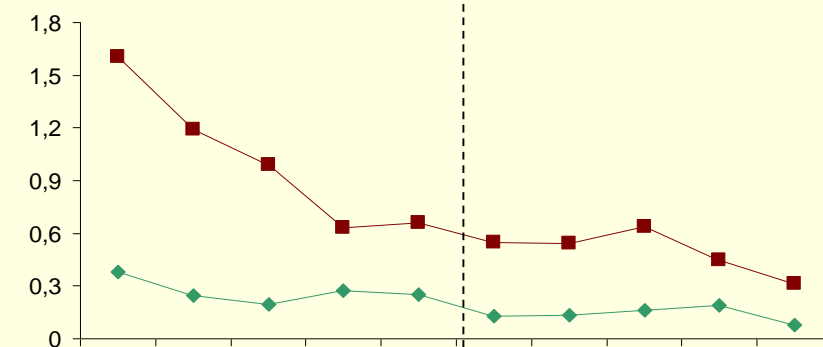
BCA reaction BSA standard average



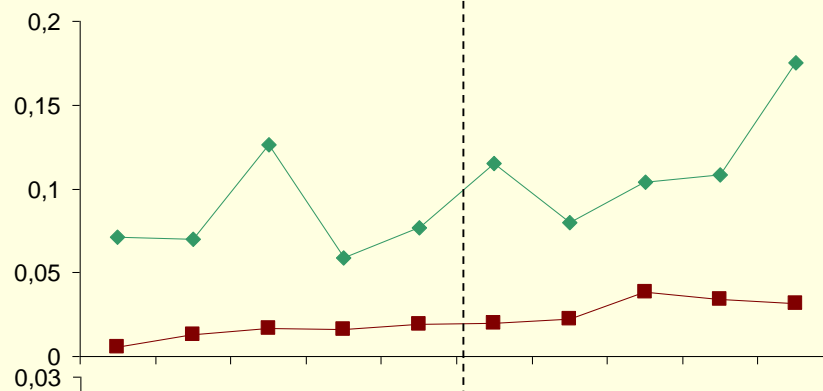
# Condition index (ratio)



glycogen/protein

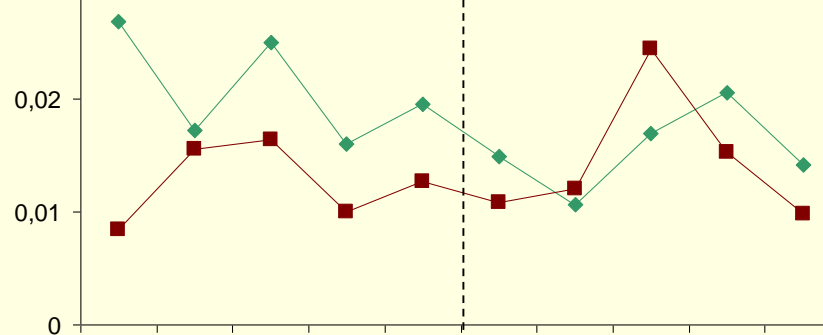


lipid/glycogen



◆ spring  
■ autumn

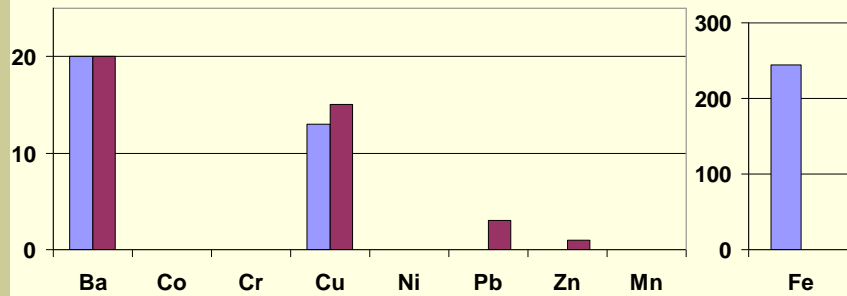
lipid/protein



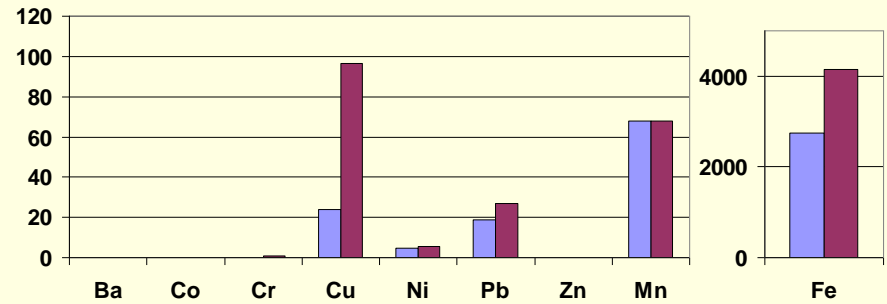
# Metal concentration (ICP-OES)

■ western basin  
■ eastern basin

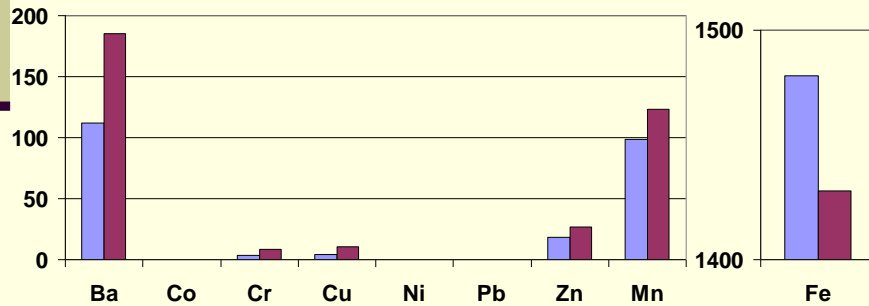
water (µg/L)



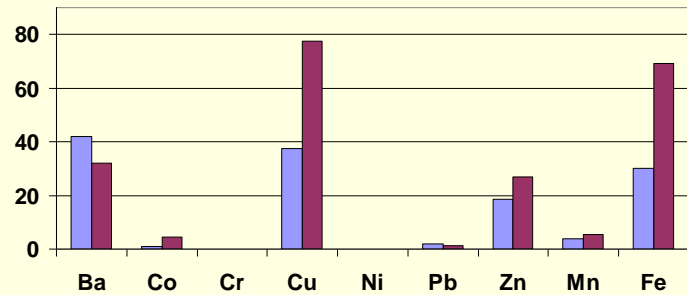
soft tissue (µg/g d.w.)



sediment (µg/g d.w.)



shell (µg/g d.w.)



Environmental mobility of elements: Mn>Cd>Cu>Pb>Ni>Cr>Zn>Fe

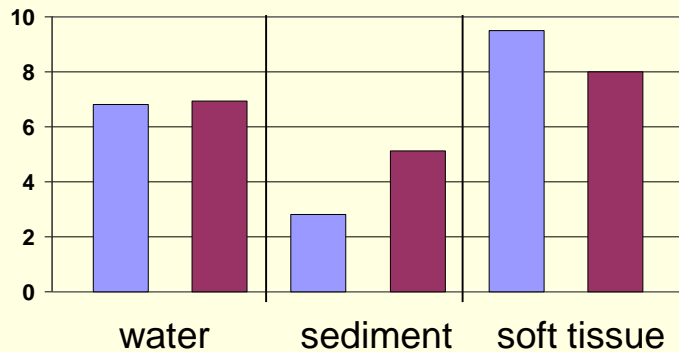


# Organic pollutants concentration (GC-MS; GC-MS/MS)

western basin  
eastern basin

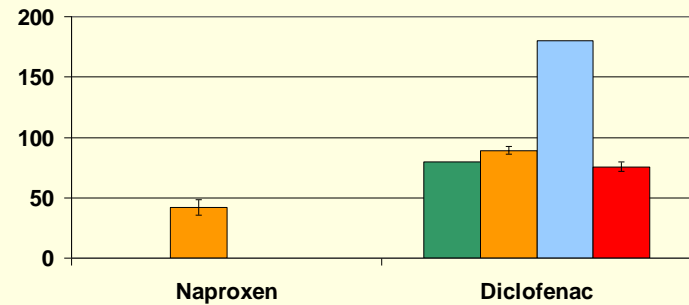
western water  
eastern water  
western suspended m.  
eastern suspended m.

PAH ( $\mu\text{g/L}$ ;  $\mu\text{g/g d.w.}$ )

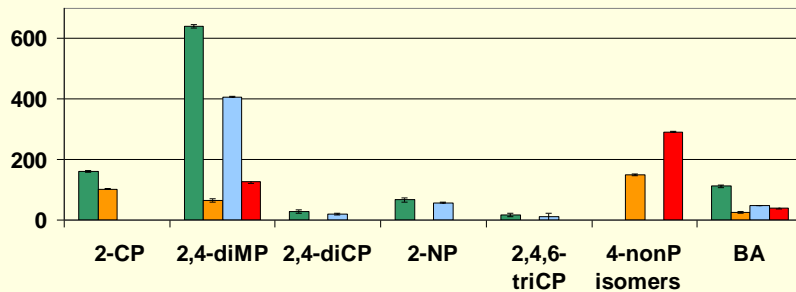


PCB (only in eastern basin)  
PCB28: 14,2 ng/L  
PCB52 2,13 ng/L

non-steroid anti-inflammatory drugs  
(ng/L; ng/g d.w.;  $\pm\text{RSD}\%$ )

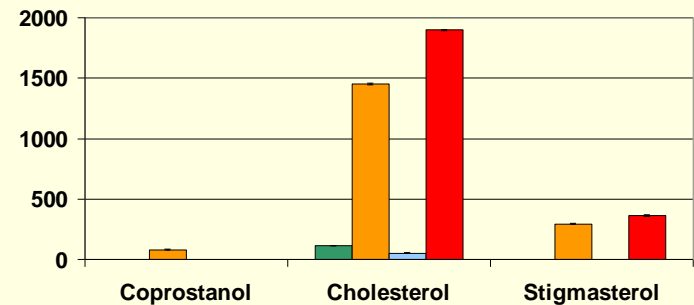


Phenolic compounds (ng/L; ng/g d.w.;  $\pm\text{RSD}\%$ )



Faludi et al., EHS, in press

steroid (ng/L; ng/g d.w.;  $\pm\text{RSD}\%$ )



# Summary



- Chlorophyll-A concentration and condition index of *Dreissena* were significantly higher in the Western basin.
- Macromolecular content shows seasonal variability.
- Heavy metals, in general, were at the low geochemical background level in the sediment, with a slight but significant increment in the Eastern basin.
- PAH concentration of the water, sediment and tissue were at the low  $\mu\text{g/L}$ , and  $\mu\text{g/g}$  level, with a slight Western-basin dominance. The PAH level was moderate but higher than earlier, and in comparison to other lakes.
- Two PCB congeners could be measured only in the water of the Eastern basin but at a surprisingly high concentration.
- The concentration of substituted phenol derivatives was always higher in the Western-basin, but they were only at the low  $\text{ng/L}$  and  $\text{ng/g}$  level in the water and the sediment, respectively. Among pharmaceuticals, naproxen and diclofenac could be measured at a low  $\text{ng/L}$  range with a slight elevated concentration in the Western basin.
- Steroids, such as cholesterol, coprostanol, and stigmasterol were also found mainly in the sediment.

## Conclusion

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- The current status of Lake Balaton can be characterized with a low nutrient load, and a little anthropogenic impact.
- Dreissena can be a suitable indicator of environmental status referring to algae availability..
- Differences in the element concentrations and biotic values between the two basins can be explained by the different agricultural activity and agglomeration around the basins.