



GlobalHAB symposium on automated *in situ*  
observations of plankton, Kristineberg Marine  
Research Station, Sweden

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# High frequency monitoring in Croatia

Ivan Vlašiček

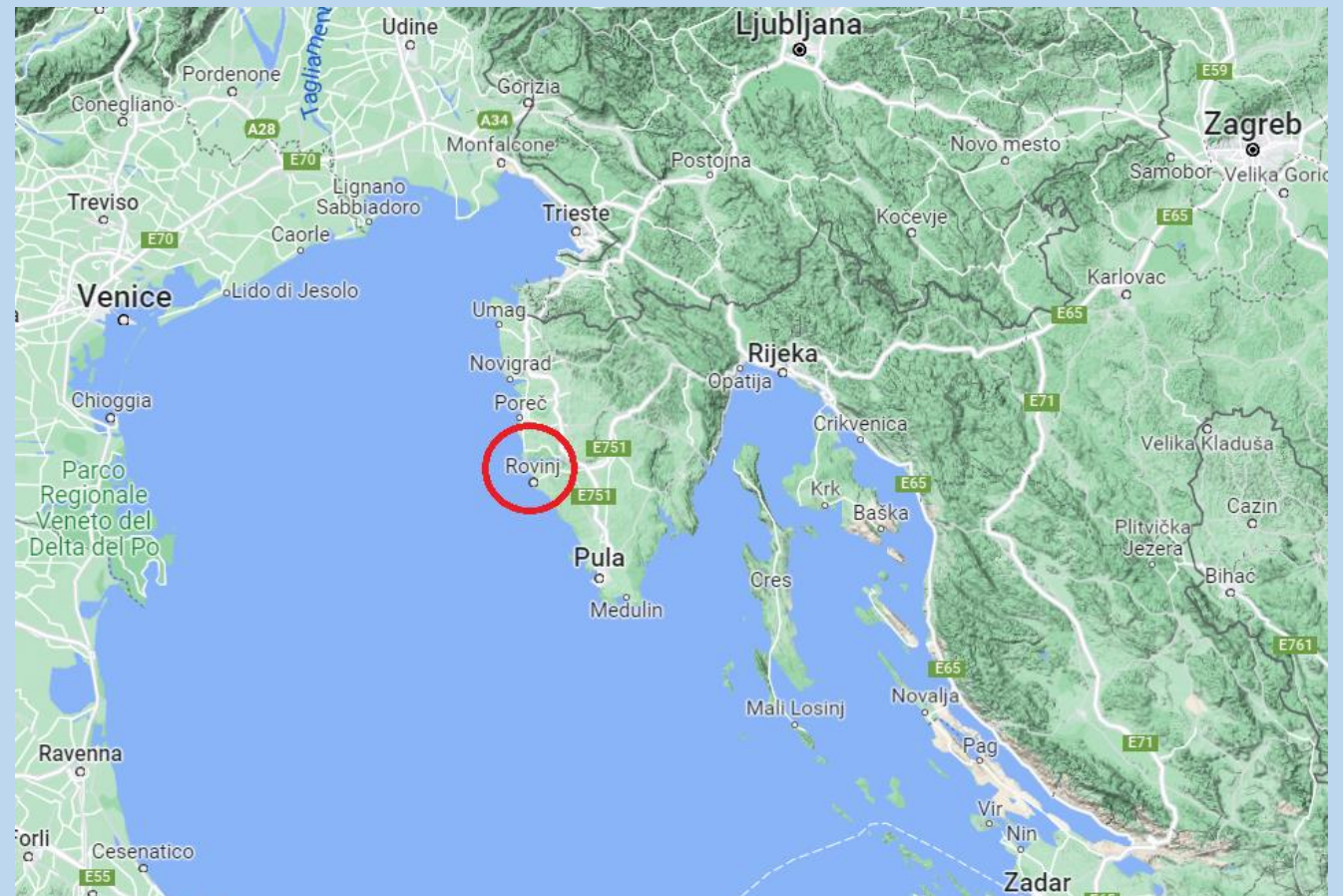
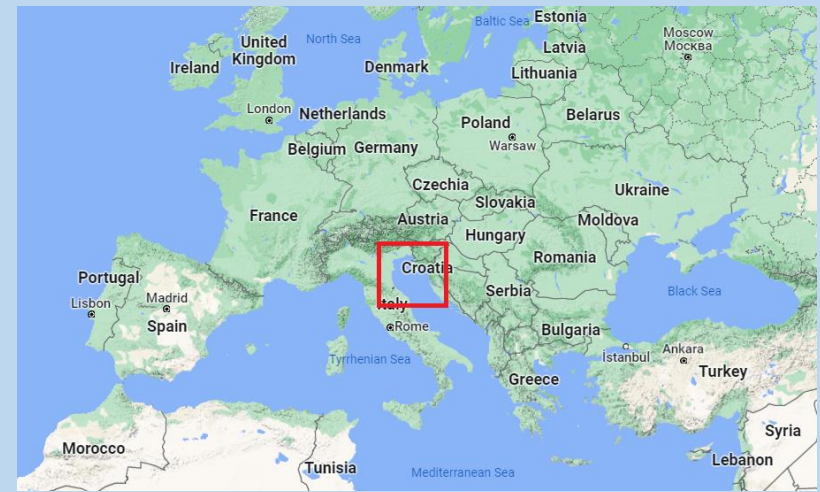
Center for Marine Research in Rovinj,

Ruđer Bošković Institute



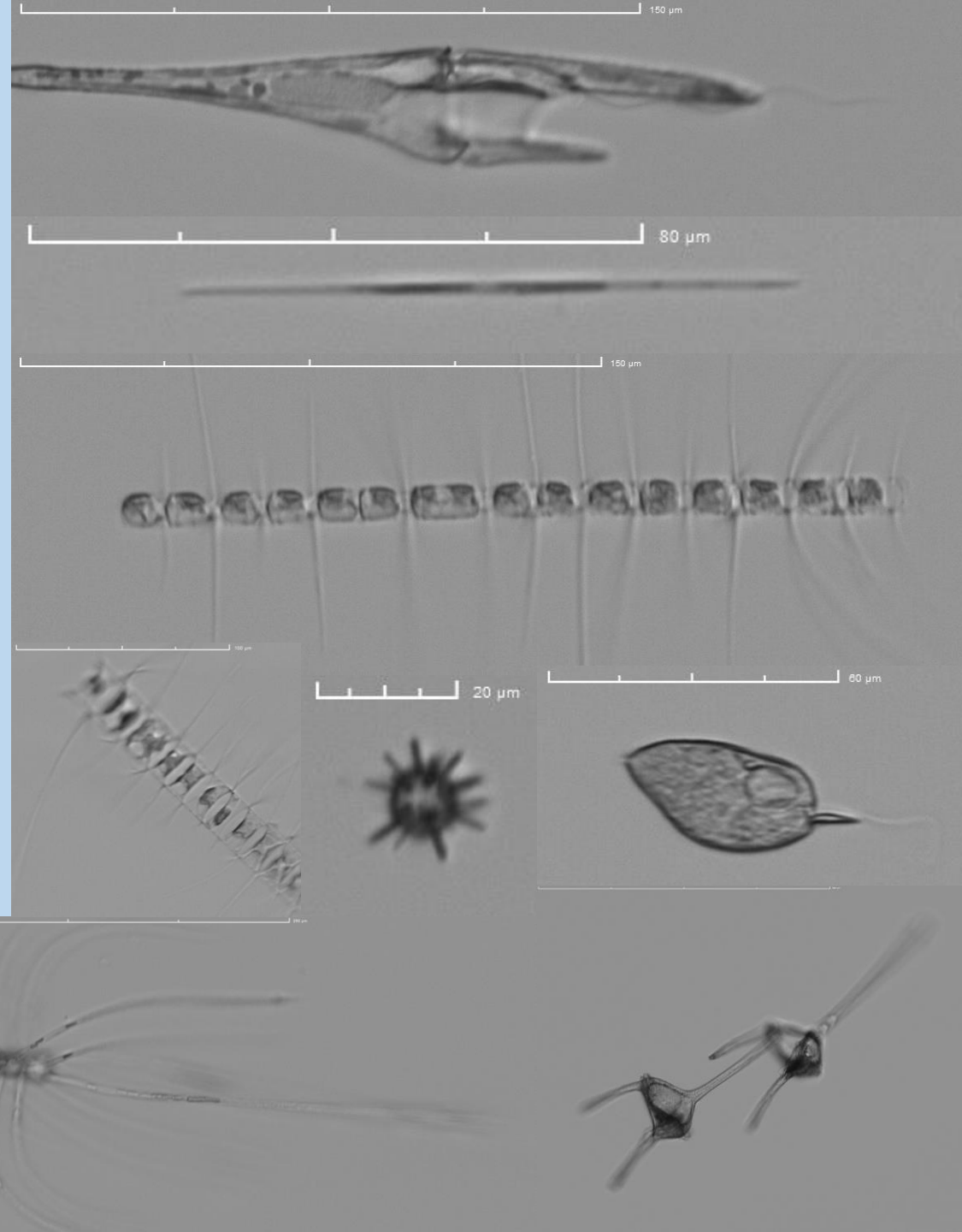
# Northern Adriatic (NA)

- Shallow, semi-enclosed sea (~30 m)
- Influenced by freshwater income (Po river)
  - Eutrophic waters
- Inbalance in N:P ratio, P limitation
- Winds: bura (bora), jugo (sirocco)
- Cyclonic circulation
  - Oligotrophic waters



# Phytoplankton community in NA

- Diatoms and dinoflagellates dominant groups
- Influenced by freshwater nutrient load
- Spring and autumn diatom bloom
- *Pseudo-nitzschia* spp.,  
*Skelletonema grevilei*,  
*Thalassionema nitzschioides*,  
*Chaetoceros* spp.





# Current monitoring techniques

- Cruises
  - Monthly ship based sampling
  - **40 year monthly dataset**
- Utermöhl method
- Phytoplankton net tow samples
- Metabarcoding
- Flow cytometry
  - Autotrophic and heterotrophic picoplankton



# High frequency monitoring

- 2 oceanographic buoys
  - 1 nmi and 6 nmi away from the coast
  - Remote control and wireless data transfer
  - wind, air T, visibility, air pressure, precipitation, dew point
  - irradiation, surface current, water current throughout the entire water column, red-blue-green fluorescence, blue-red reflection, water T, pH, salinity, O<sub>2</sub>, transparency throughout the water column
- Ferryboxes
- CytoSense
  - CytoSub





CytoClus4

File Cytogram Other Plots

Set Library

View Name

- Default (all)
- Small\_dino+diato
- Large\_diato+dino

Exclusive Sets

Database Set Library Set statistics

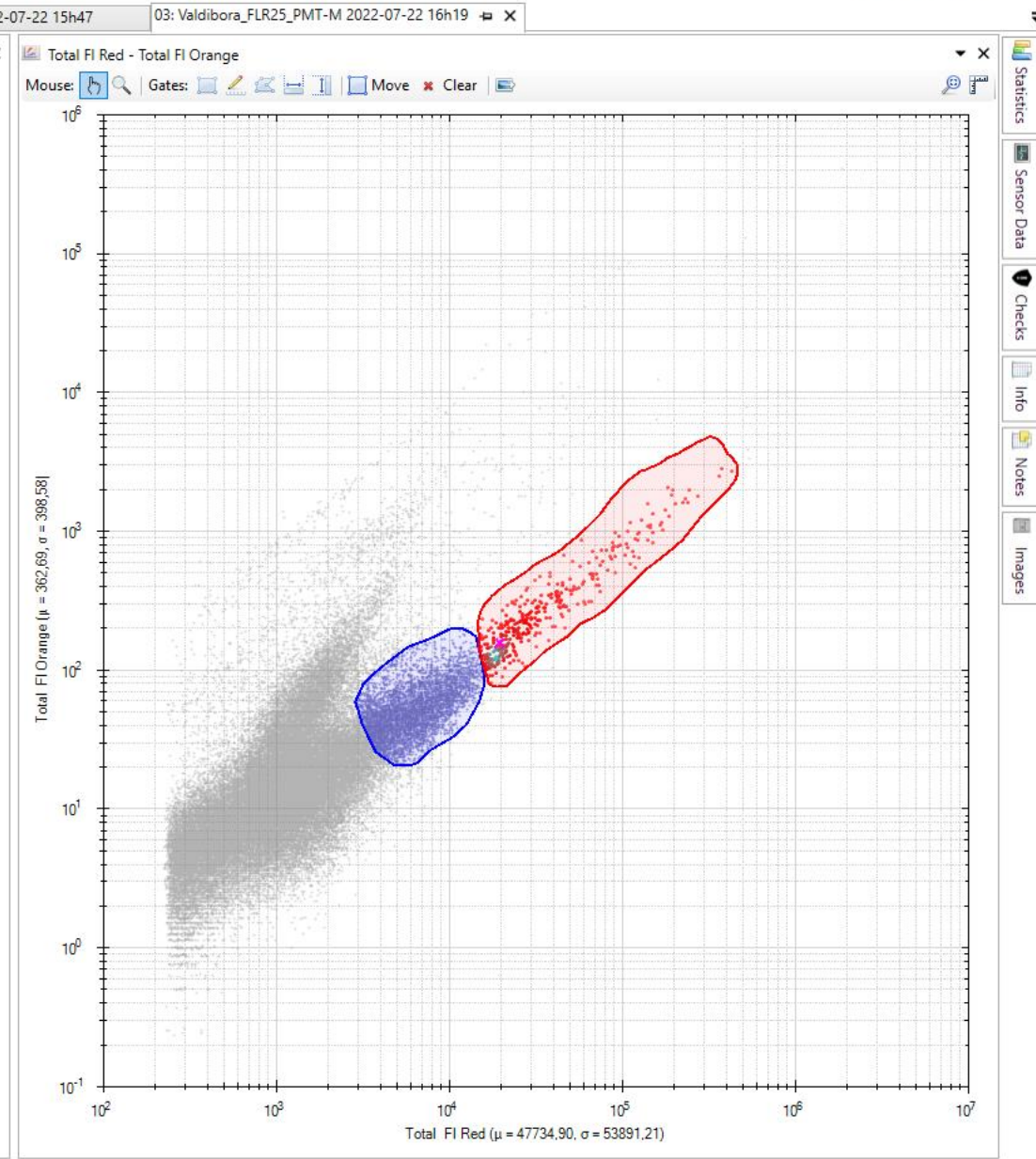
CS-2021-107 - CMR Rovinj

02: Valdibora\_FLR25\_PMT-M 2022-07-22 14h21 | 01: Valdibora\_FLR25\_PMT-M 2022-07-22 15h12 | 04: Valdibora\_FLR25\_PMT-M 2022-07-22 15h47 | 03: Valdibora\_FLR25\_PMT-M 2022-07-22 16h19

Image Overview - Largediatto+dino

16% Maximum Image Size: 8x Window Size

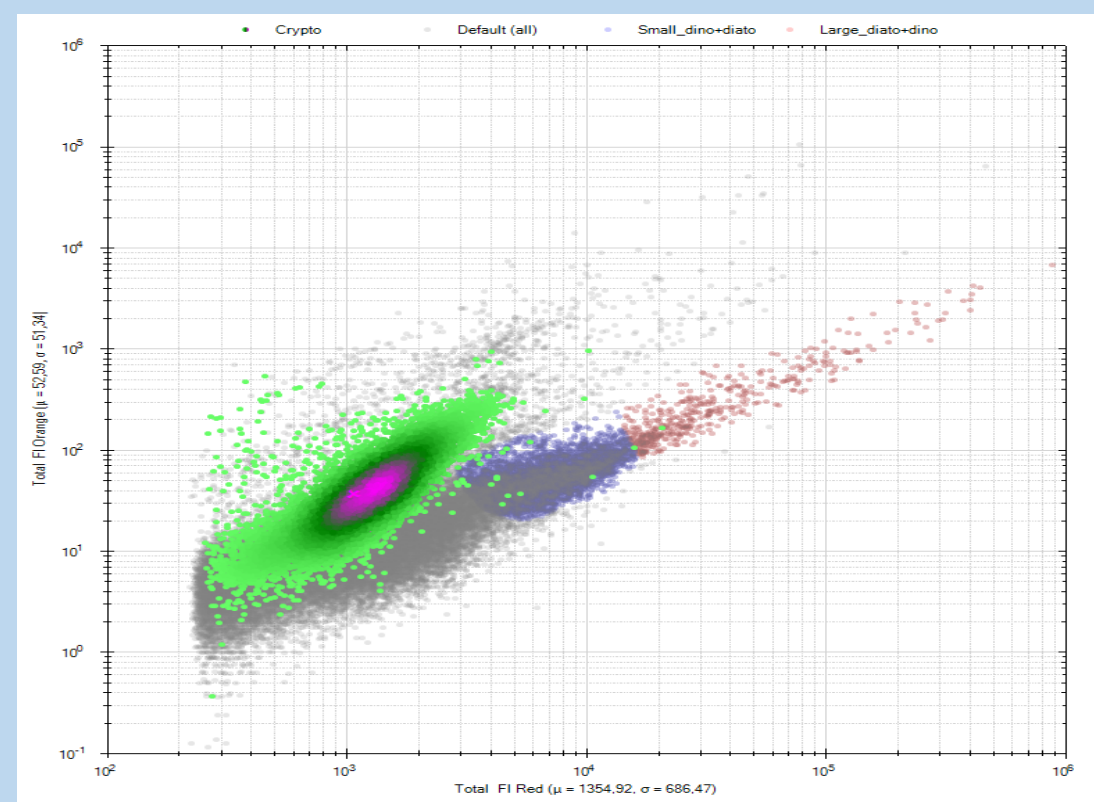
751  $\mu$ m



-FLRed: 25 mV  
 -Sample pump:  
 14  $\mu$ L/s  
 -30 min  
 -PMT – medium  
 (default settings)

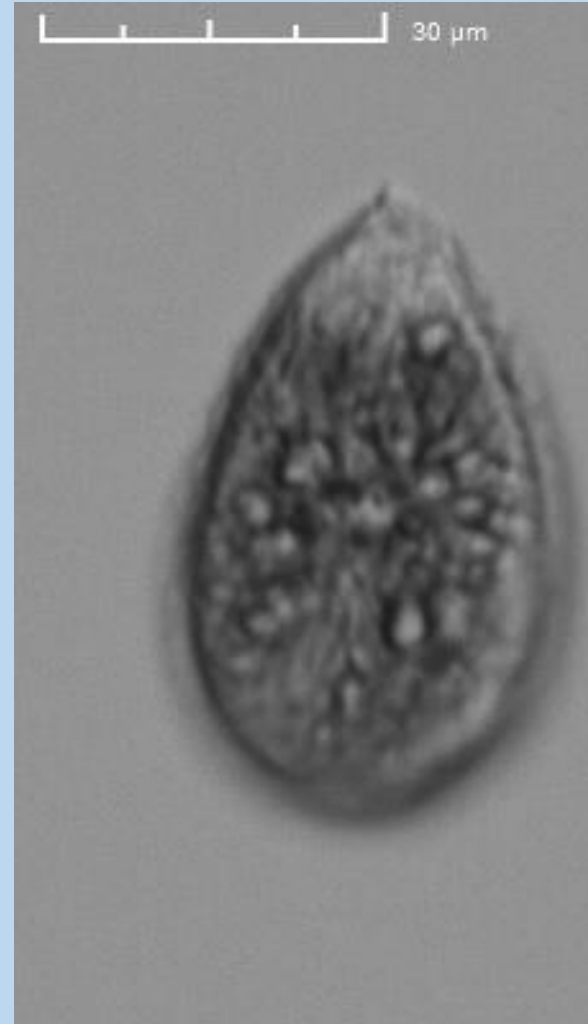
# Monitoring plan

- *In situ* monitoring and automatization
- Taxonomic discrimination
- Community succesion
- Monitoring of bloom
  - HAB alert
- *In vitro* experiments with monoclonal cultures
  - Detection and identification of contaminants/symbionts
  - Physiological measurements
    - P limited conditions
  - Morphology changes



# Monitoring of benthic communities

- Benthic dinoflagellates
  - *Ostreopsis* cf. *ovata*
  - Toxic blooms
- Epiphytic community
  - Macroalgae samples
  - Semi-quantitative
  - Analysis of cultures





CytoClus4

File Cytogram Other Plots

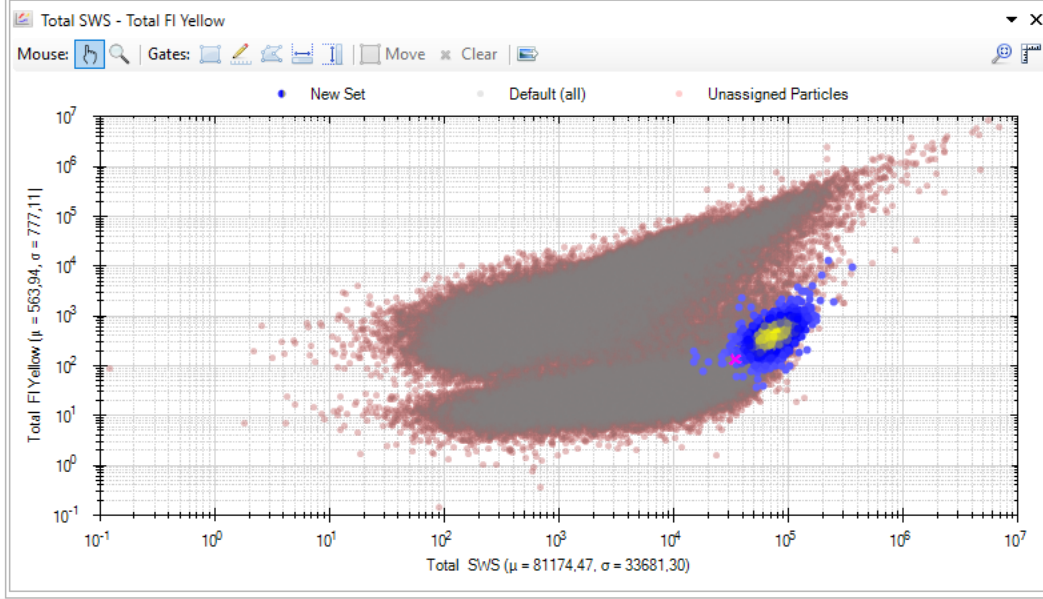
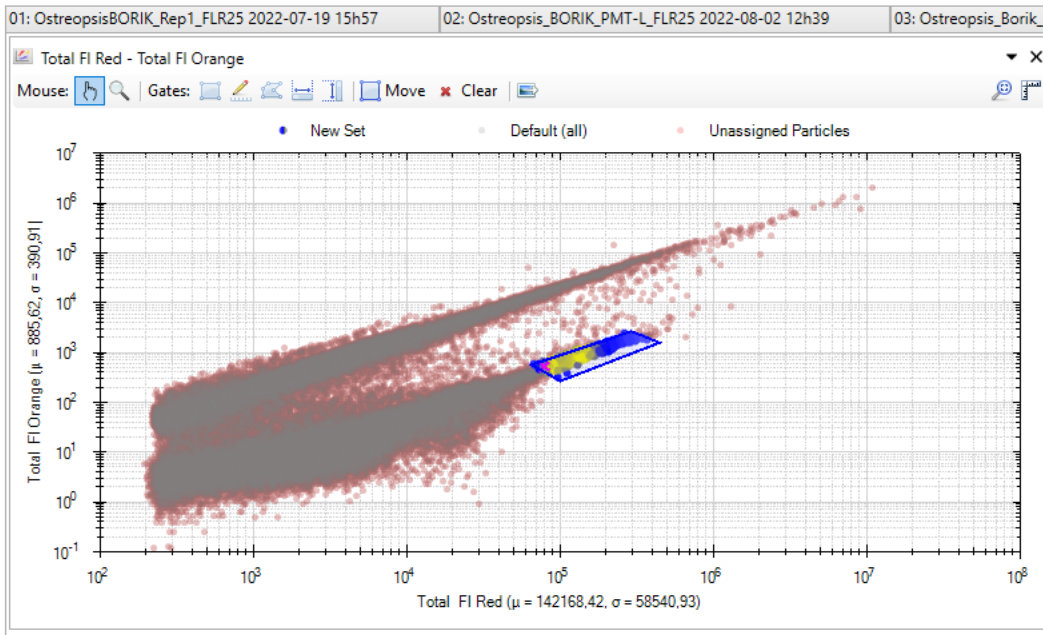
Set Library

View Name

- Default (all)
- New Set
- Unassigned Particles

-FLRed: 25 mV  
 -Sample pump:  
 4  $\mu\text{L/s}$   
 -3 min  
 -PMT – low  
 (default settings)

Database Set Library Set statistics



03: Ostreopsis\_Borik\_PMT-L\_FLR25 2022-08-16 16h07

04: Ostreopsis\_BORIK\_PMT-L\_FLR25 2022-08-02 13h21

Image Overview - New Set

700  $\mu\text{m}$  17% Maximum Image Size: 8x Window Size

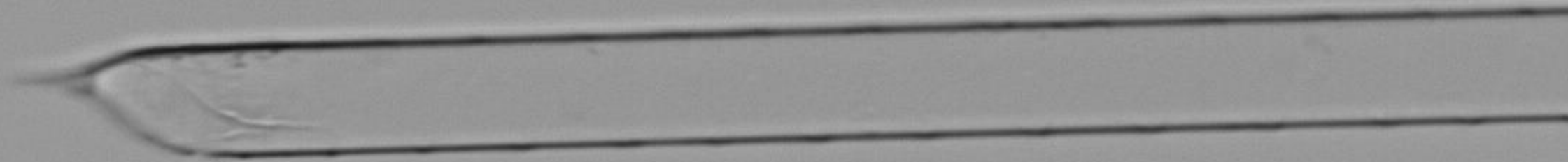
Statistics Sensor Data Checks Info Notes Images

# Literature

- Ivančić, I *et al.* (2012) 'Survival mechanisms of phytoplankton in conditions of stratification-induced deprivation of orthophosphate: Northern Adriatic case study', *Limnology & Oceanography*, 57.
- Kužat, N. *et al.* (2022) 'Morpho - physiological adaptations of *Leptocylindrus aporus* and *L. hargravesii* to phosphate limitation in the northern Adriatic', *Scientific Reports*, pp. 1–20.
- Kuzat, N. *et al.* (2021). A study on *Ostreopsis cf. ovata* along the eastern Adriatic coast. *Regional Studies in Marine Science*, 45, 101808.
- Marić, D. *et al.* (2012) 'Phytoplankton response to climatic and anthropogenic influences in the north-eastern Adriatic during the last four decades', *Estuarine Coastal and Shelf Science*, 115.
- Smodlaka Tanković, M. *et al.* (2018) 'Insights into the life strategy of the common marine diatom *Chaetoceros peruvianus* Brightwell', *PLOS ONE*. Edited by A. Ianora, 13(9), p. e0203634



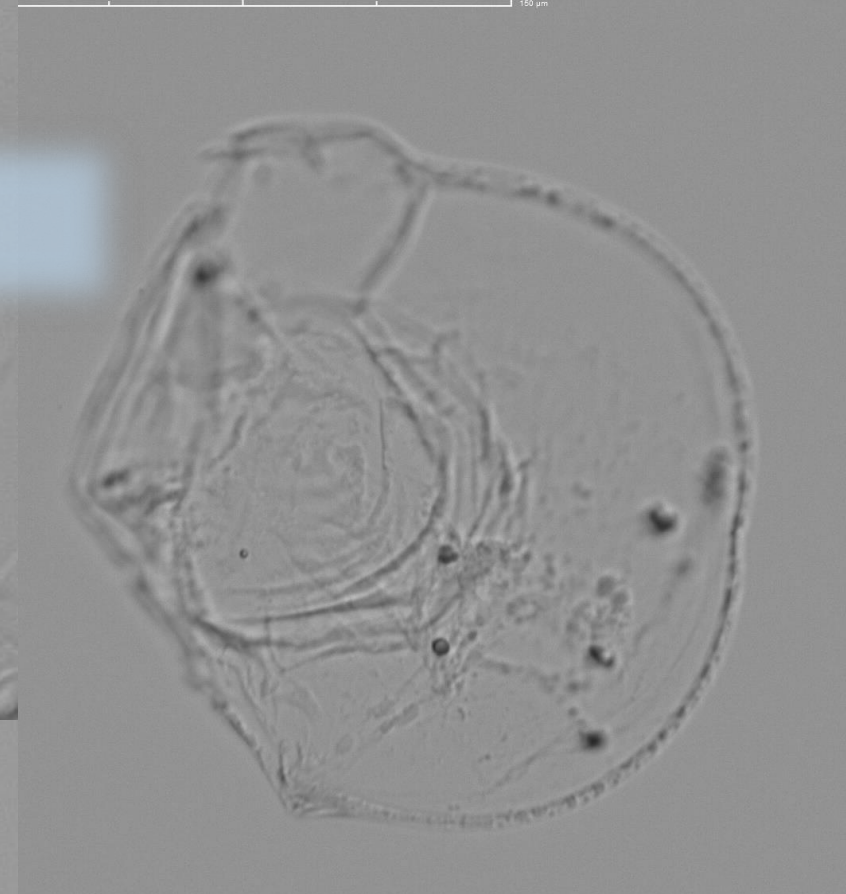
200 μm



100 μm



100 μm



100 μm

Thank you!