PHOENIX See (Lake PHOENIX)

The consequences of the heavy rain event in July 2021 for the lake and its ecology

Patrick Volkens, Meike Wilbertz, Thomas Korte

22.09.2022, DGL Tagung, Konstanz

Location of the PHOENIX See

State: North Rhine-Westphalia

City: Dortmund

EGLV

Emscher restoration

A generation project

- Former open sewer
- 30 years of construction work
- Construction of an underground sewage channel (51 km)
- Free of waste water

- Restoration of Emscher and its tributaries
- Total costs: 5.5 billion €
- Impulse for construction of PHOENIX See

EGLV

History of PHOENIX See area

Hermannshütte
Steel production (160 years)

Recent photo of the PHOENIX See

PHOENIX See

General information

- Artificial lake
- Length: 1,2 km; max. width: 320 m; average depth: 2,5 m
- 600.000 m³ water volume + 240.000 m³ possible flood retention
- Flood retention basin for restored Emscher river
- Biodiversity: 709 taxa in and around the lake
- Recreation & attractiveness of surrounding residential area

PHOENIX See

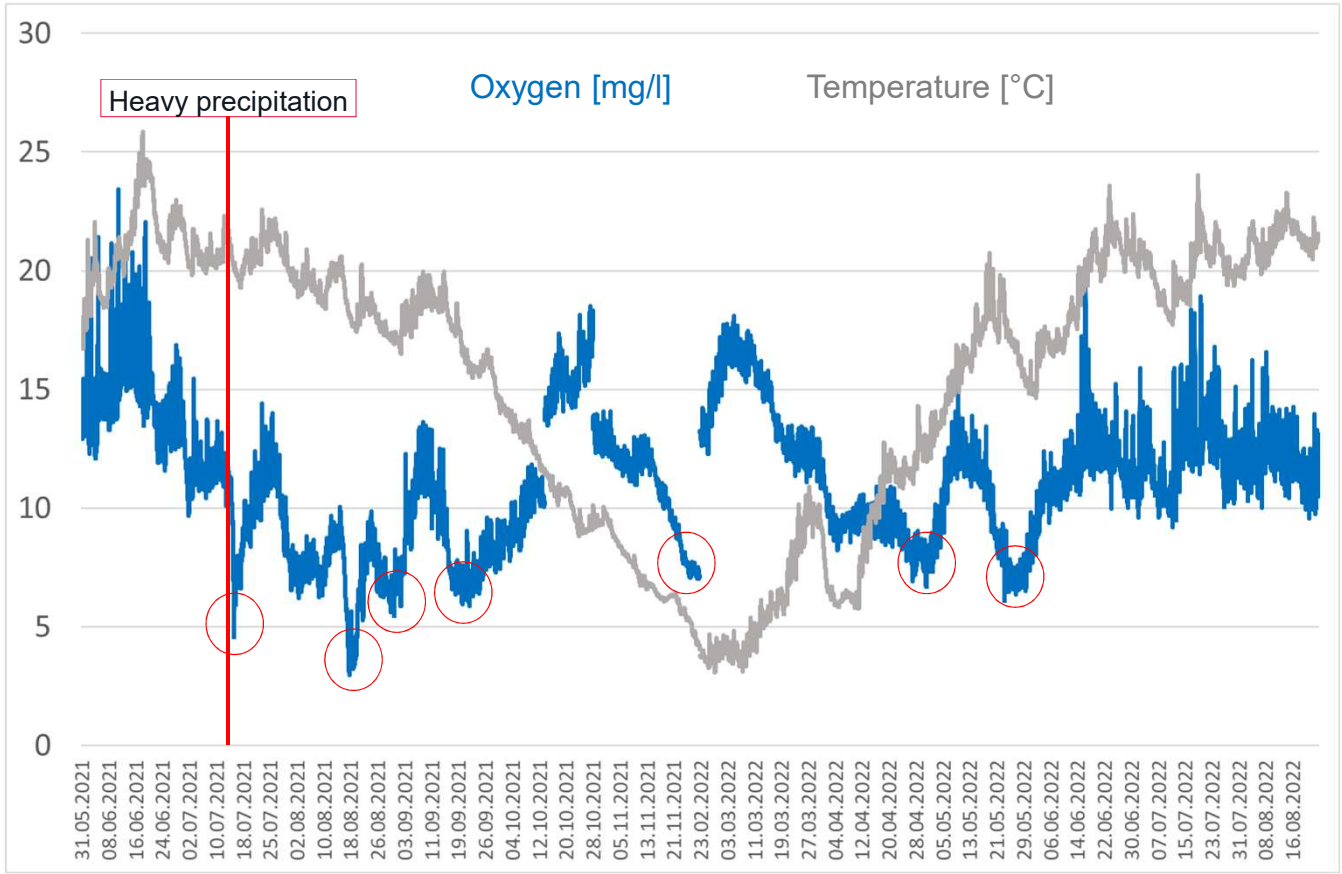
Monitoring

- Two sampling locations
  - 1. Westliches Ufer = western shore,
  2. Anleger Sportstützpunkt = boat dock
- Permanent monitoring via multiparameter probe
  - temperature, O_2, pH, Chl-a, conductivity, salinity, turbidity etc.
- Monthly sampling of plankton
  - March – October, December
- Monthly chemical sampling
  - temperature, O_2, pH, Chl-a, conductivity, phosphorus, nitrogen, turbidity, calcium, magnesium, chloride, sulfate etc.

Heavy precipitation in July 2021

- Low-pressure system „Bernd“ lead to heavy rainfalls in Germany and neighbouring countries (13/07/21-15/07/21)
- Dortmund was particularly affected (113 mm/24 h)
- Discharge of the Emscher river into PHOENIX See
- The flood retention volume was used to 68 % (160.000 m³)

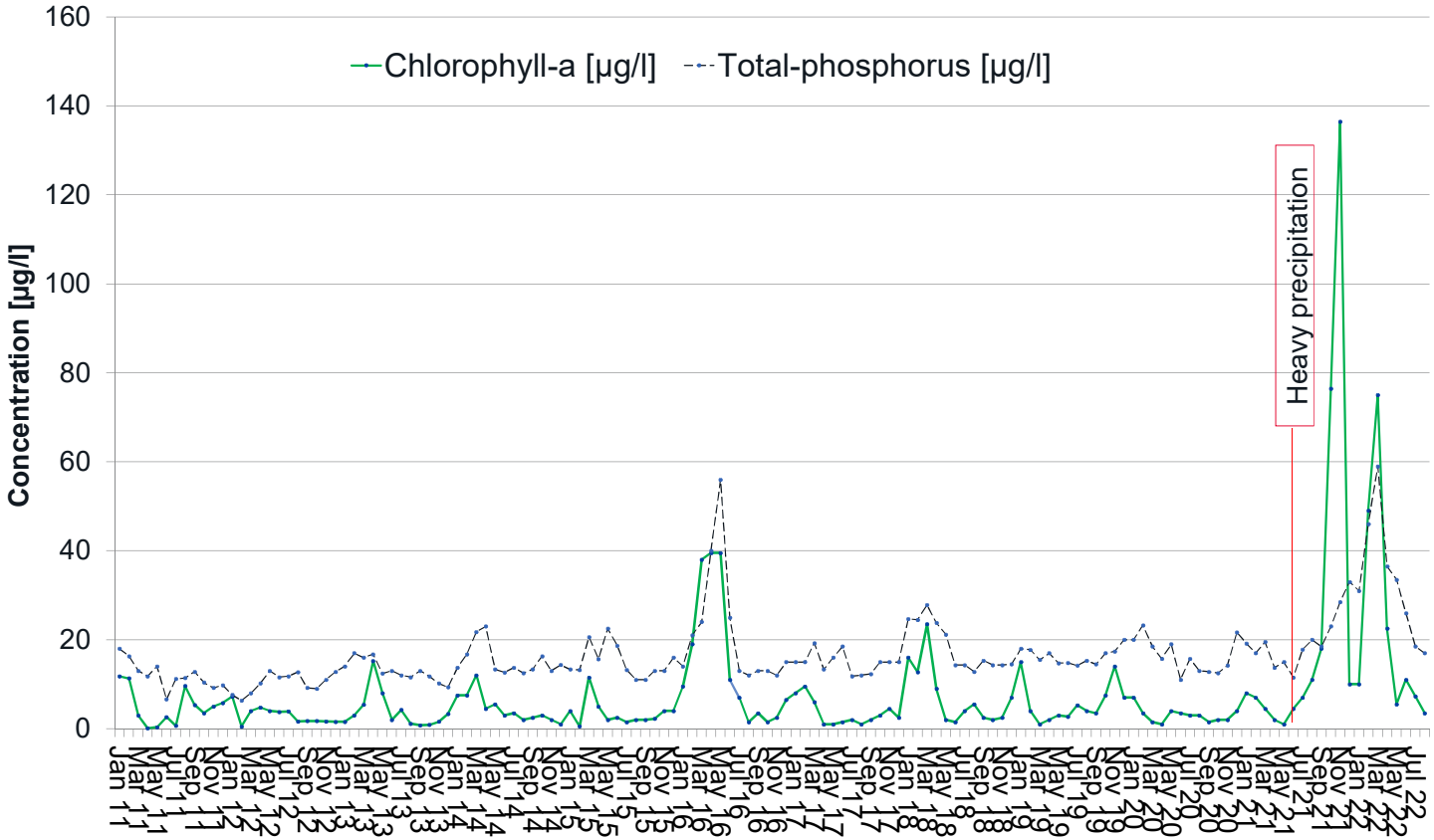
Oxygen concentration & temperature



- Decrease of oxygen concentration after heavy precipitation
- Minimum 2.96 mg/l (18/08/21)
- Low oxygen conentrations in November 21, April 22 and May 22
- Continuing process of normalisation of oxygen concentration in 2022

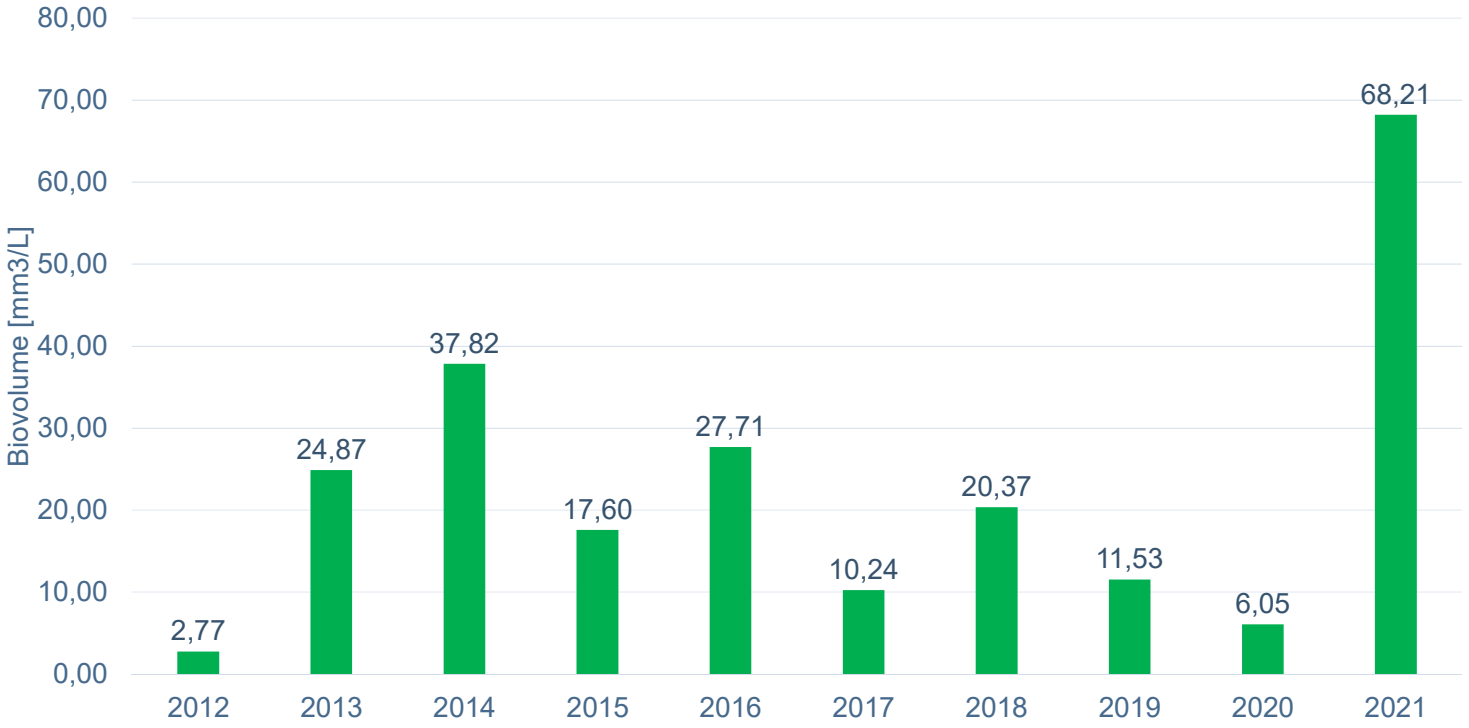
Averaged phosphorus and chlorophyll-a concentration

January 2011 – August 2022



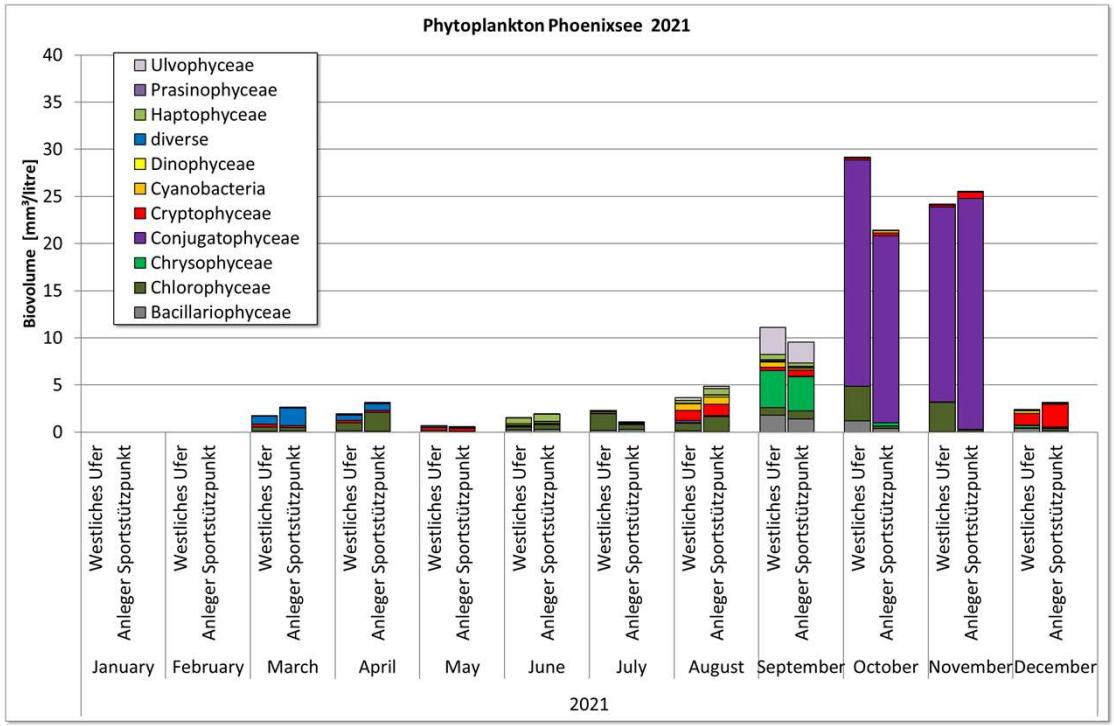
- Increase in phosphorous concentration (max.: 59 µg/l)
- Increase in Chlorophyll-a (max.: 136.5 µg/l)
- Since May 2022 comparable Chloro-a and T-P concentrations as before

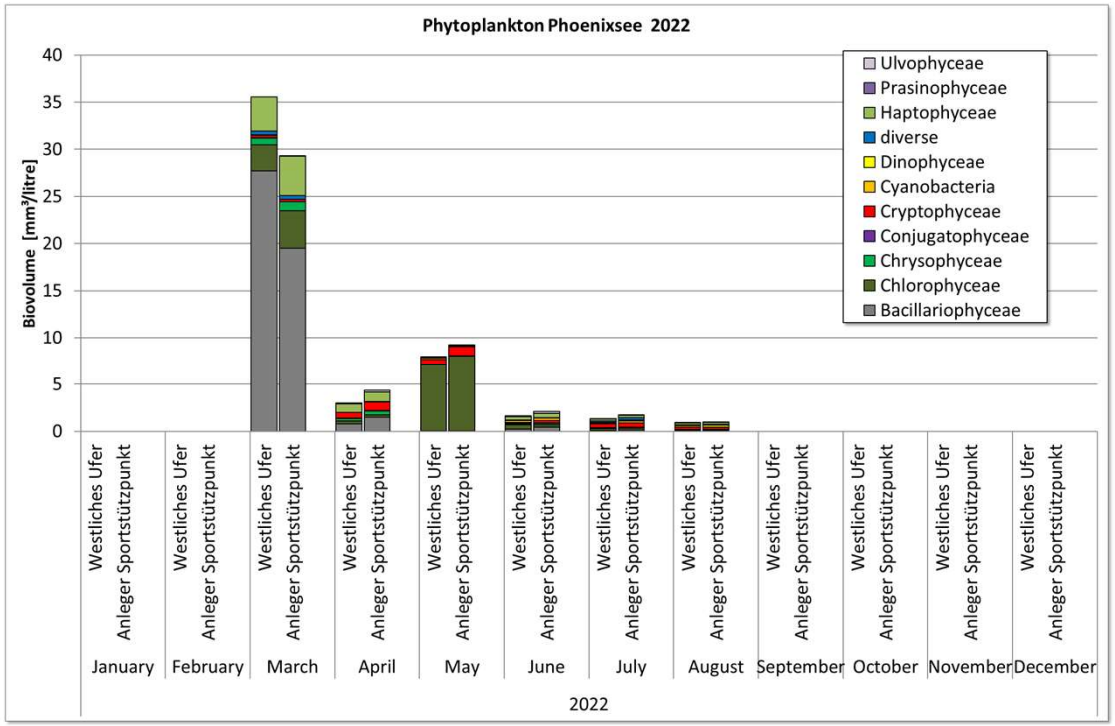
Sum Phytoplankton Biovolume/Year (2012-2021)



- Highest recorded total phytoplankton biovolume in long term comparison in 2021

Comparison Phytoplankton Biovolume (2021 and 2022)





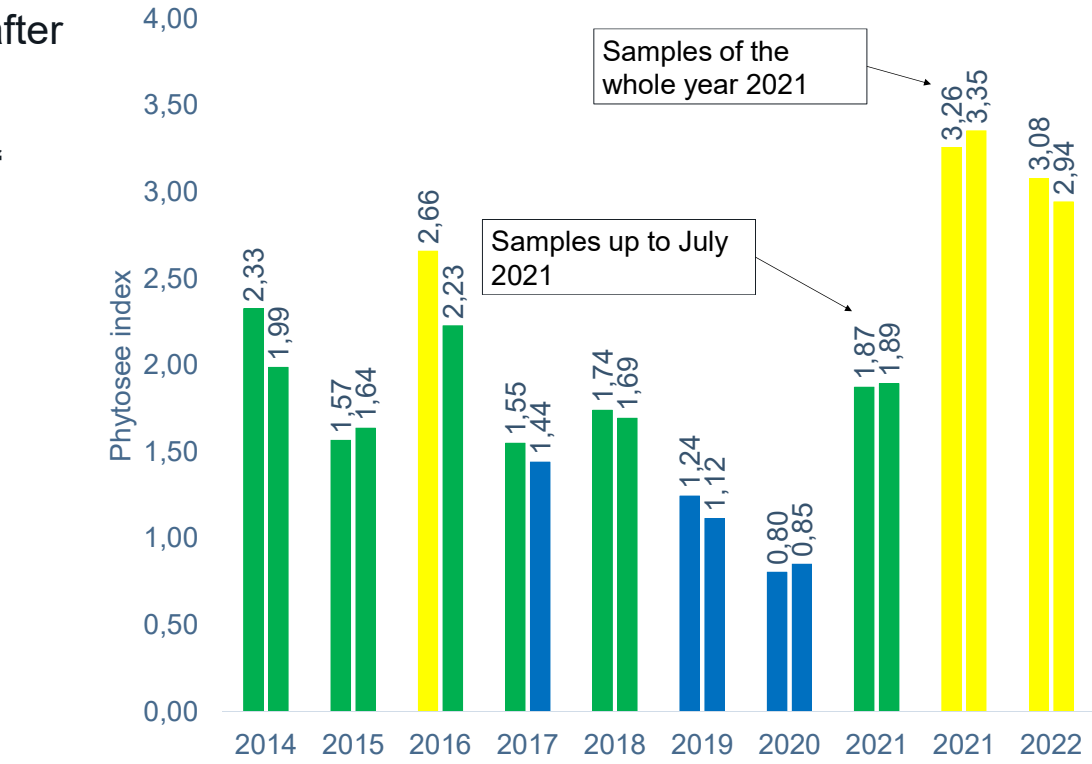
- Strong increase of phytoplankton Biovolume (highest summed up result since 2012)
- Especially in Oct./Sept. 2021 (Conjugatophyceae) and in Mar. 2022 (Bacillariophyceae)

EGLV

Assessment according to WFD - 2021

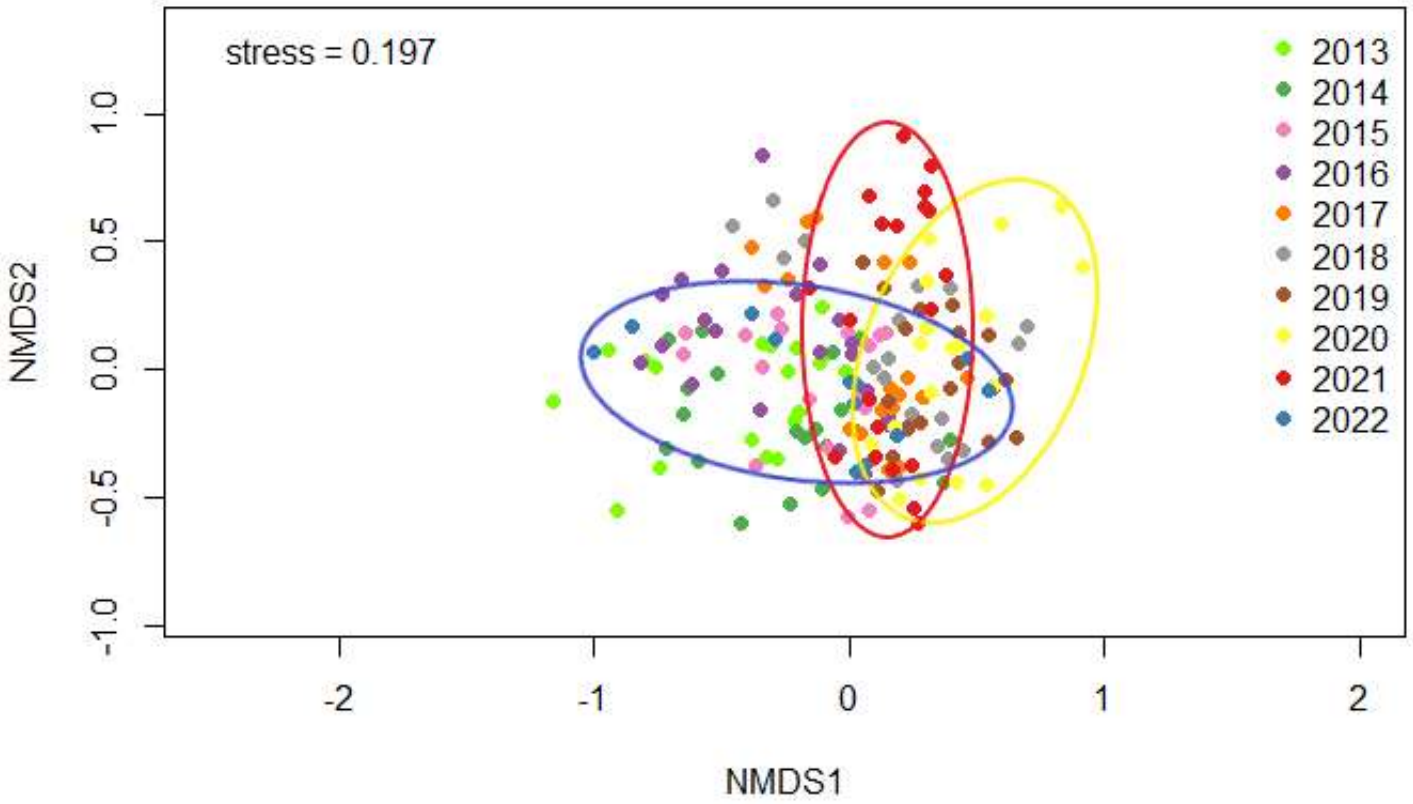
Evaluation using the „Phytosee“-software-tool

- Phytosee index deteriorated after Emscher river discharge
- Before mainly „good“ or „high“ results
- Re-Improvement in 2022



Nonmetric Multidimensional Scaling

Relative composition of phytoplankton community by years



- Relative phytoplankton composition differs from previous years
- Differences mainly occured in spring 2022

2020: n = 18

2021: n = 20

2022: n = 12

Summary

Heavy precipitation in July 2021:

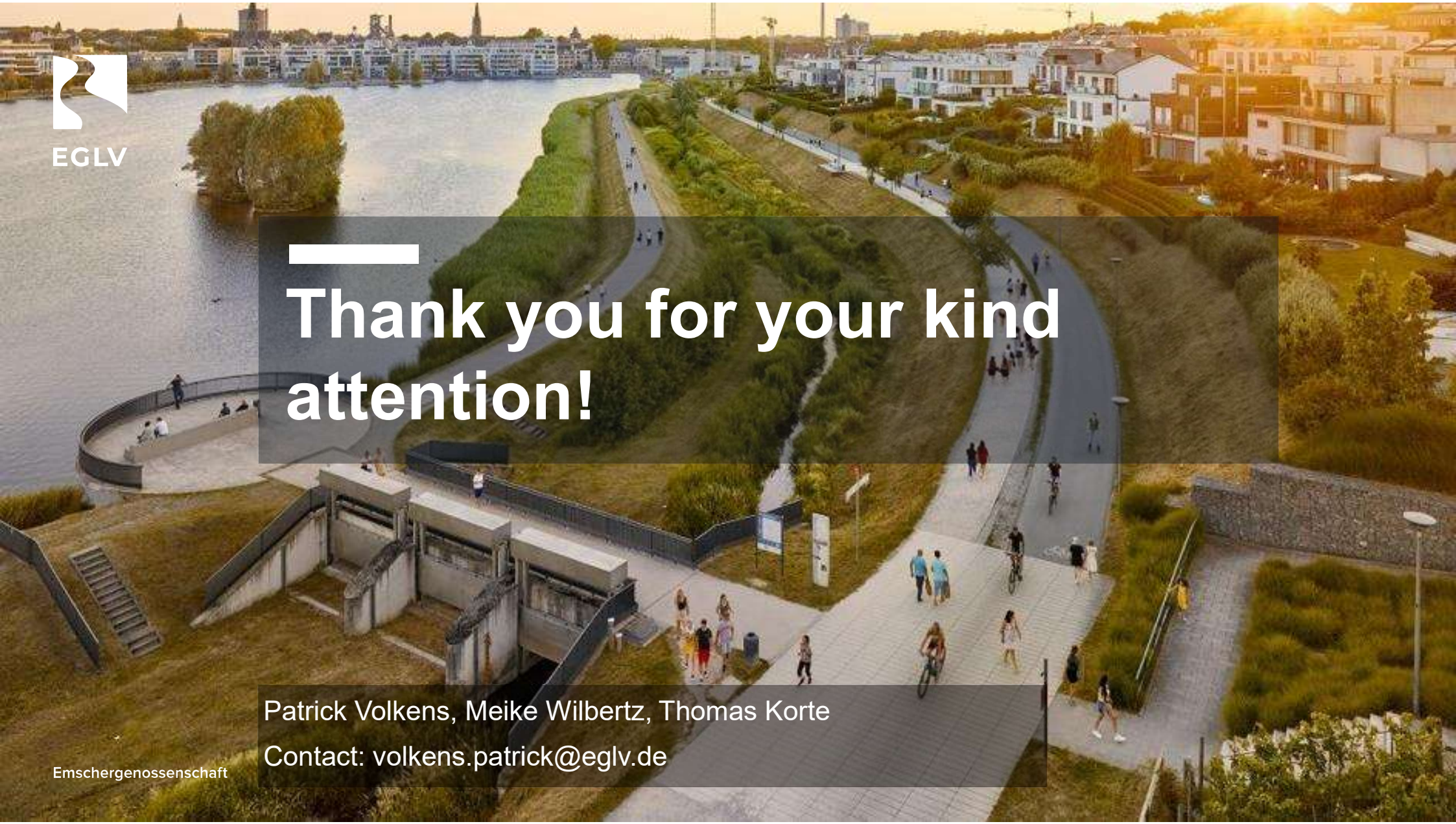
- Discharge of Emscher river in PHOENIX See
- Use of retention function
- Nutrient and fine sediment input

Consequences of the flooding:

- Increase of nutrient concentrations
- Decrease of oxygen concentration
- Higher primary production (Increase of phytoplankton biovolume)
- Deterioration of assessment according to WFD

Current trend:

- Return to former conditions (oxygen, nutrients, phytoplankton biovolume)
- Slight improvement of assessment according to WFD


EGLV
Thank you for your kind attention!
Patrick Volkens, Meike Wilbertz, Thomas Korte
Contact: volkens.patrick@eglv.de
Emschergenossenschaft