Almost all what you need know about cyanobacterial blooms and their management

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WHAT is the cyanobacterial BLOOM?

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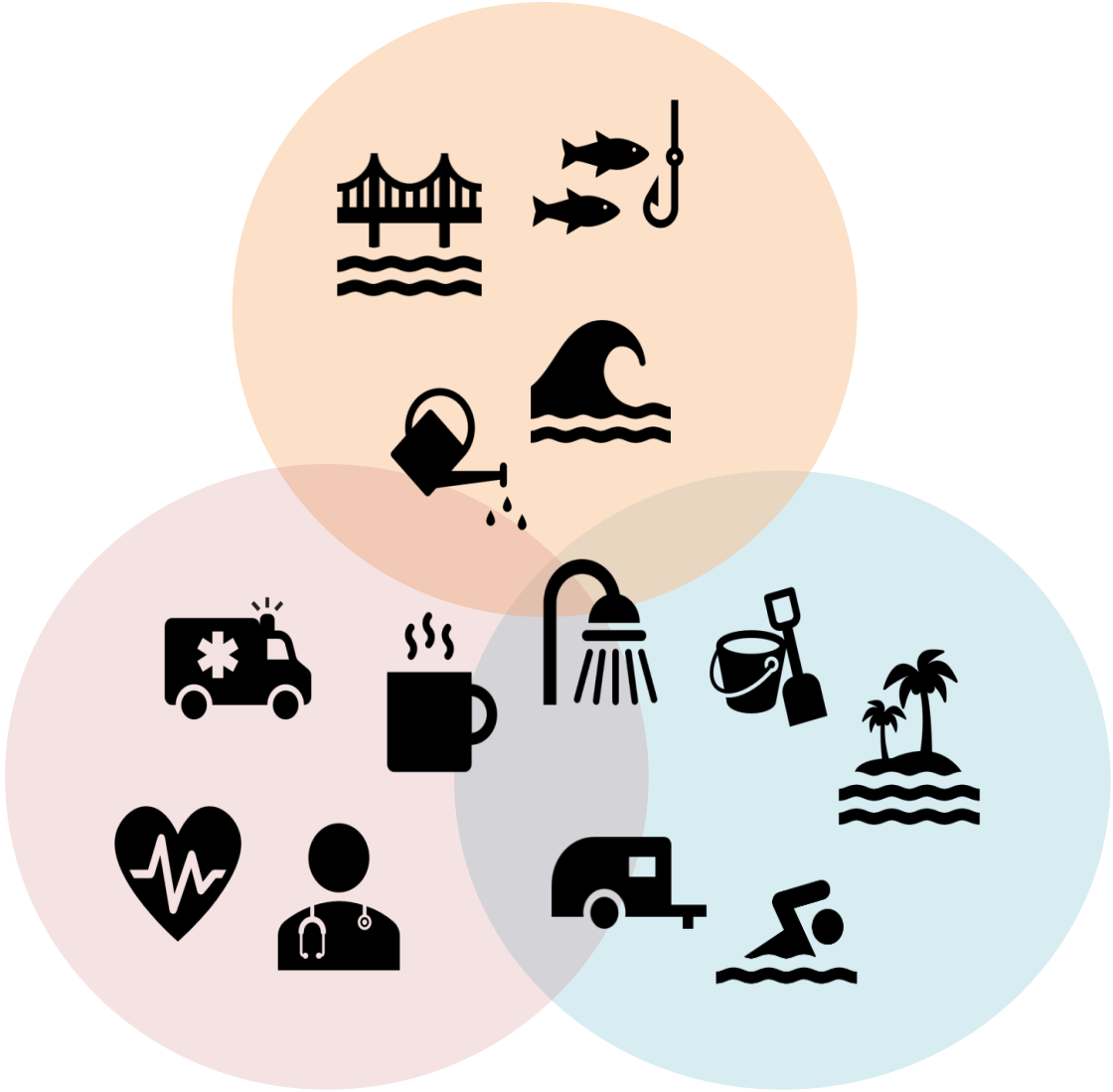
Review Article | Published: 26 June 2018

Cyanobacterial blooms

GLOBAL ENVIRONMENTAL PROBLEM



The most important factors responsible for the frequency and duration of cyanobacteria blooms

ANTHROPOPRESSURE

- Urban pollution
- Influx of nitrogen and phosphorus compounds from agriculture
- Artificial transformation of reservoirs, etc.

+

CLIMATE CHANGE

- Increase in temperature
- Changes in stratification
- Changes in light penetration
- Changes in biogeochemical cycles

INCREASE OF FREQUENCY AND DURATION OF CYANOBACTERIAL BLOOMS

FUTURE

?

ENVIRONMENTAL changes caused by CYANOBACTERIAL BLOOMS

Increase of sedimentary detritus

Decrease of water transparency

Release of toxic compounds

Oxygen depletion in the decomposition of organic matter

Deteriorating conditions of existence for the remaining phyto- and zooplankton species

Shellfish poisoning, fish mortality, birds and mammals

The formation of oxygen deficits in the bottom layers

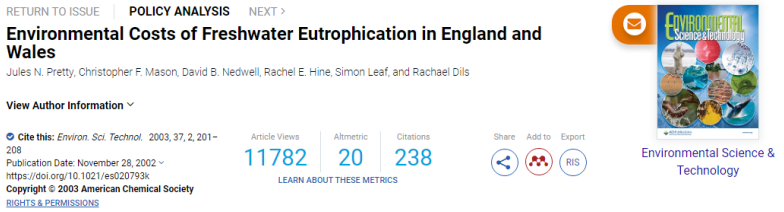
Deterioration of conditions of fish and benthic fauna

Effects of toxins on the human body

Release from the boottom sediment into water
PO_4^{3+}, NH^{4+}, N_2, H_2S

ECONOMIC COSTS of blooms

1. Increased costs of drinking water (water treatment costs)
2. Reduced value of aquatic water bodies used for commercial uses
3. Reduced value of aquatic water bodies used for recreation (e.g.angling, swimming)
4. Net economic losses for tourist industry
5. Net economic losses for aquaculture (e.g. fish farms)
7. Health costs to humans
8. Health costs to livestock and pests
9. Negative effects on aquatic ecosystems (changes in biodiversity)
10. Reduced value of near-shore homes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Environmental Costs of Freshwater Eutrophication in England and Wales

Jules N. Pretty, Christopher F. Mason, David B. Nedwell, Rachel E. Hine, Simon Leaf, and Rachael Dils

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Publication Date: November 28, 2002

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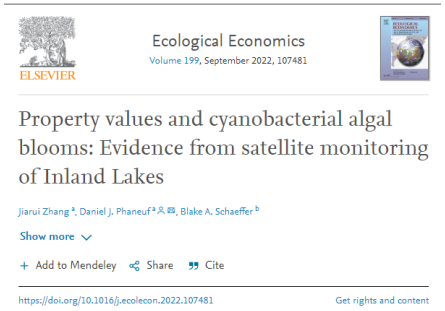
Ecological Economics

Volume 199, September 2022, 107481

ELSEVIER

Property values and cyanobacterial algal blooms: Evidence from satellite monitoring of Inland Lakes

Jiarui Zhang [a], Daniel J. Phaneuf [a], Blake A. Schaeffer [b]

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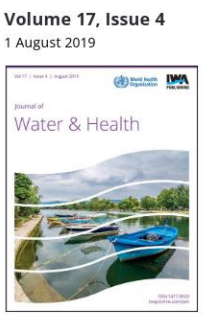
Volume 17, Issue 4

1 August 2019

Journal of Water & Health

Example: human illness

for digestive illness:
-$86 (mild), $1,015 (moderate) and $12,605 (severe) cases,
for respiratory illness:
$86 (mild), $1,235 (moderate) and $14,600 (severe) cases.


RESEARCH ARTICLE | MAY 17 2019

Economic impact of harmful algal blooms on human health: a systematic review

Christian R. C. Kouakou; Thomas G. Poder

Check for updates

J Water Health (2019) 17 (4): 499–516.

https://doi.org/10.2166/wh.2019.064 Article history

Example: Canadian lake Erie


Harmful Algae

Volume 87, July 2019, 101624

ELSEVIER

Estimating the economic costs of algal blooms in the Canadian Lake Erie Basin

Robert B. Smith [a], Brad Bass [b], David Sawyer [c], David Depew [d], Susan B. Watson [a]

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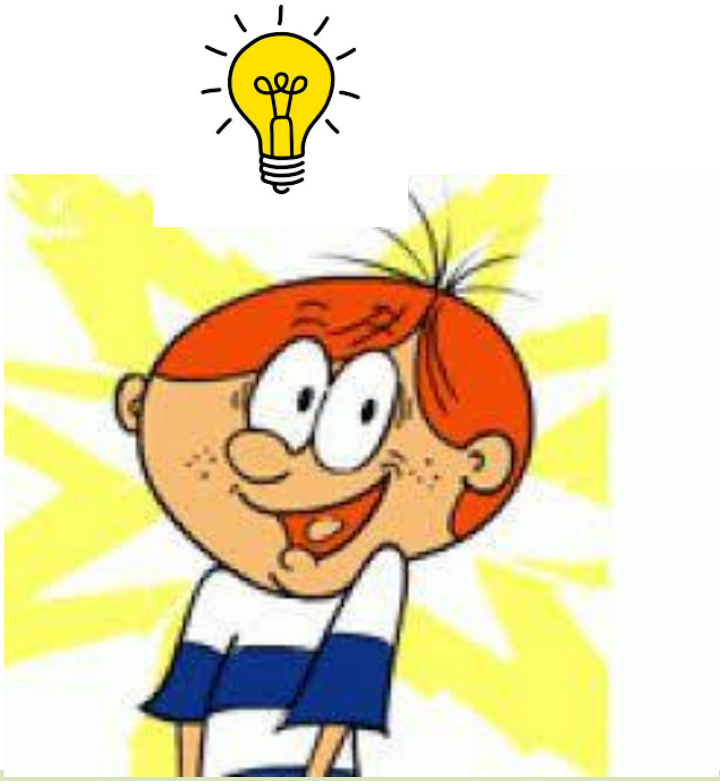
Uncontrolled, algal blooms on Lake Erie might cost Canada $5.3 mld over 30 years

What to do?

...



Clean and protect of catchments

Educate of society

Apply the principles of sustainable agriculture

Keep away from polluting

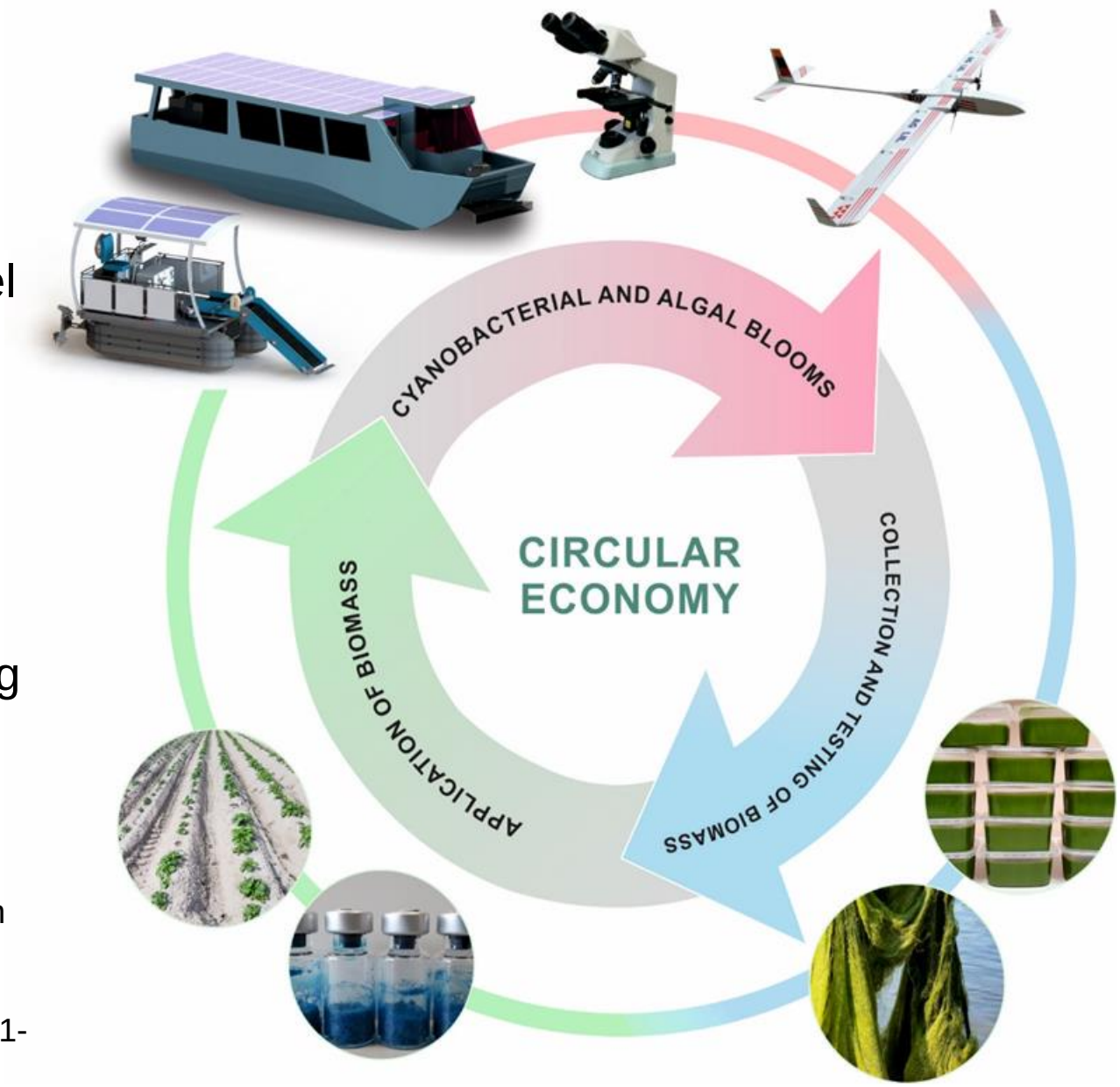
Restore of lakes and reservoirs

Punish of polluters

Circular economy

‘a production and consumption model that involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products for as long as possible’

- Circular Economy: Definition, Importance and Benefits | News | European Parliament." www.europarl.europa.eu. 2015-02-12. Retrieved 2021-10-07



PLACES

Tyniec oxbow lake, Podgórki Tynieckie

Podkamycze ponds

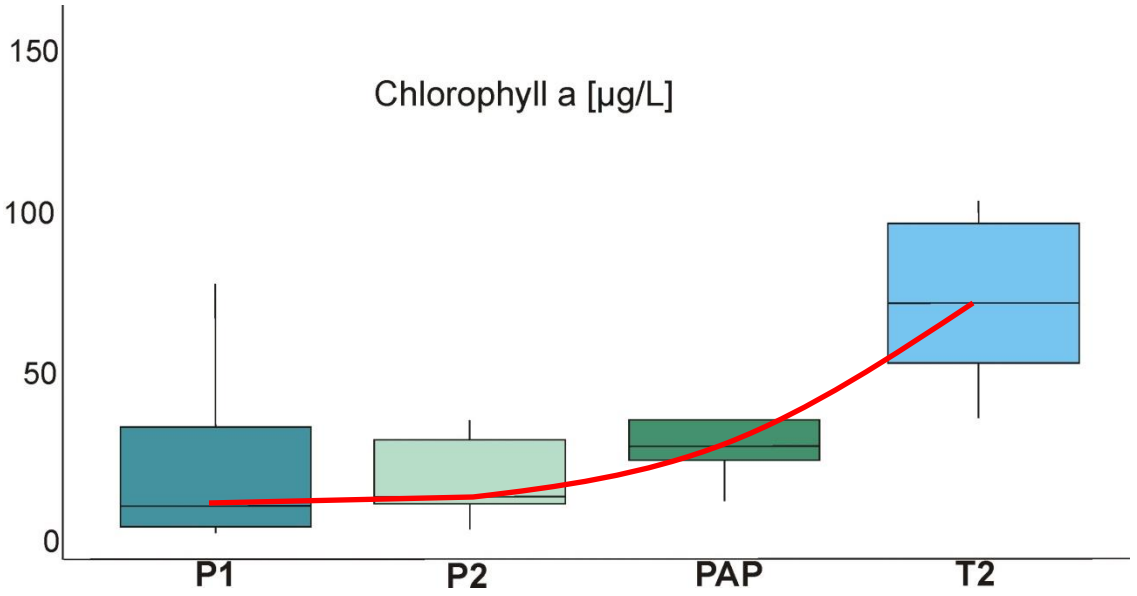
Paprocany, Tychy

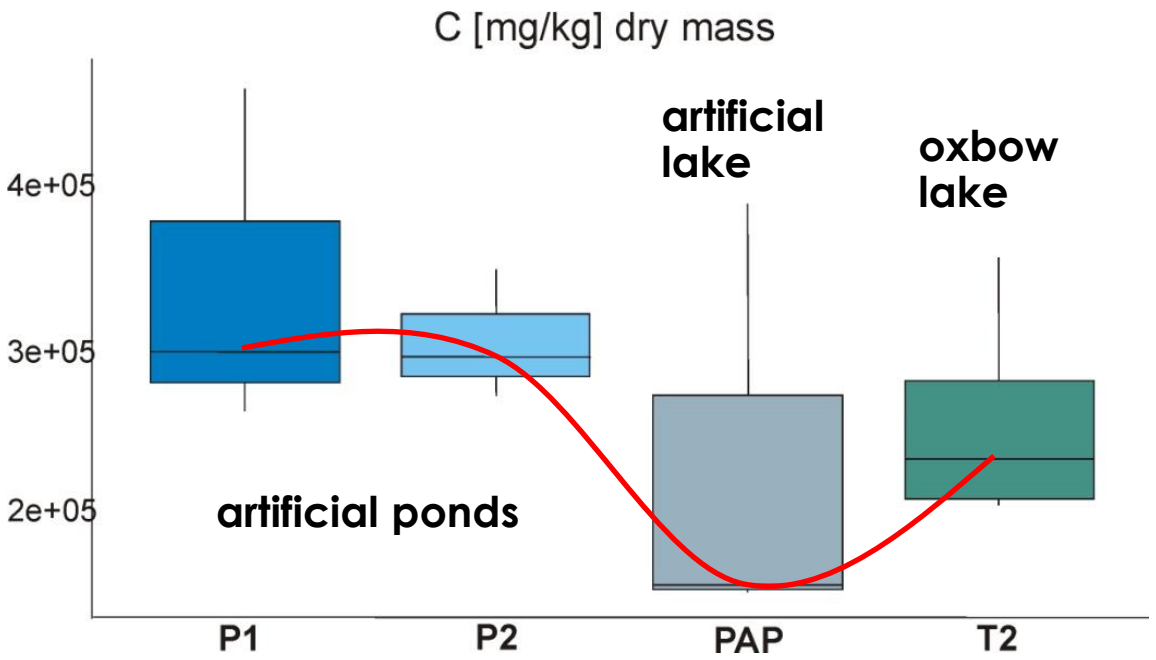
C.1. Monitoring of impact of the project action on ecological and economic benefits based on harvested algal biomass

B.1. Biomass quality testing

CARBON

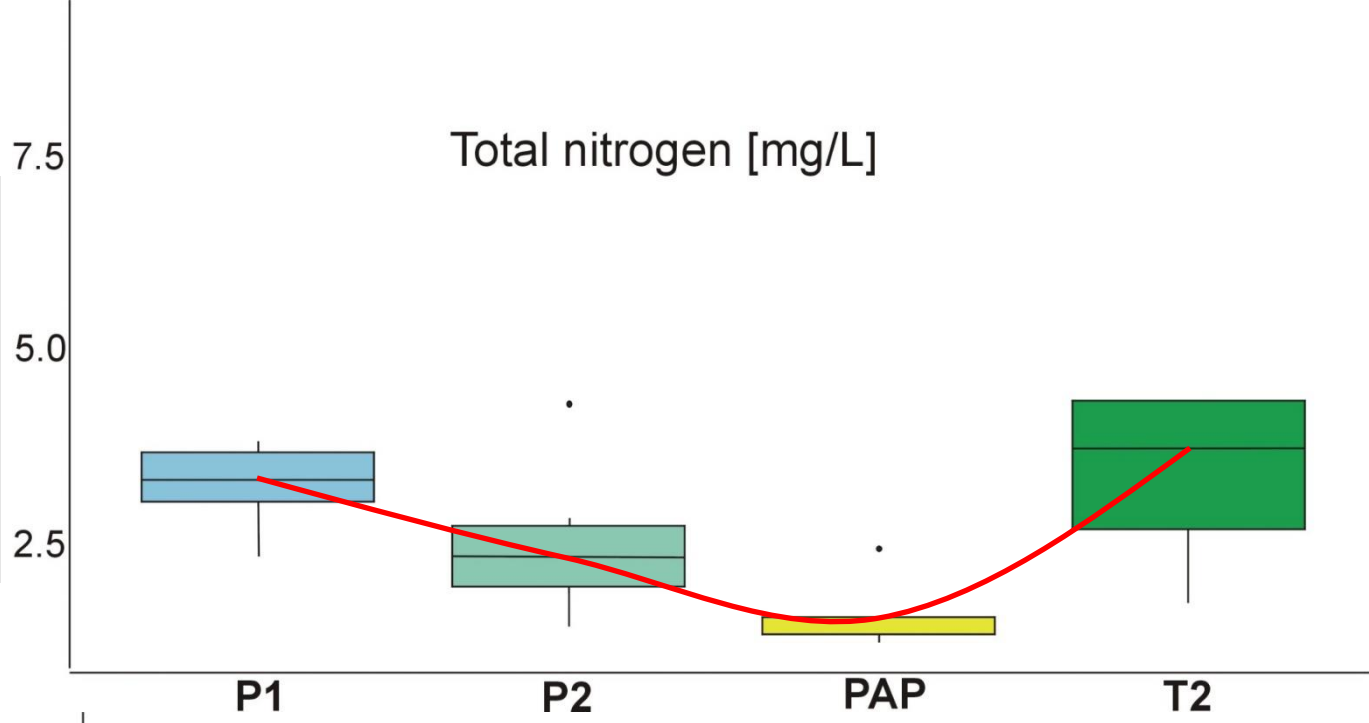
Biomass quality carbon (C), [mg/1 kg dry mass of phytoplankton]

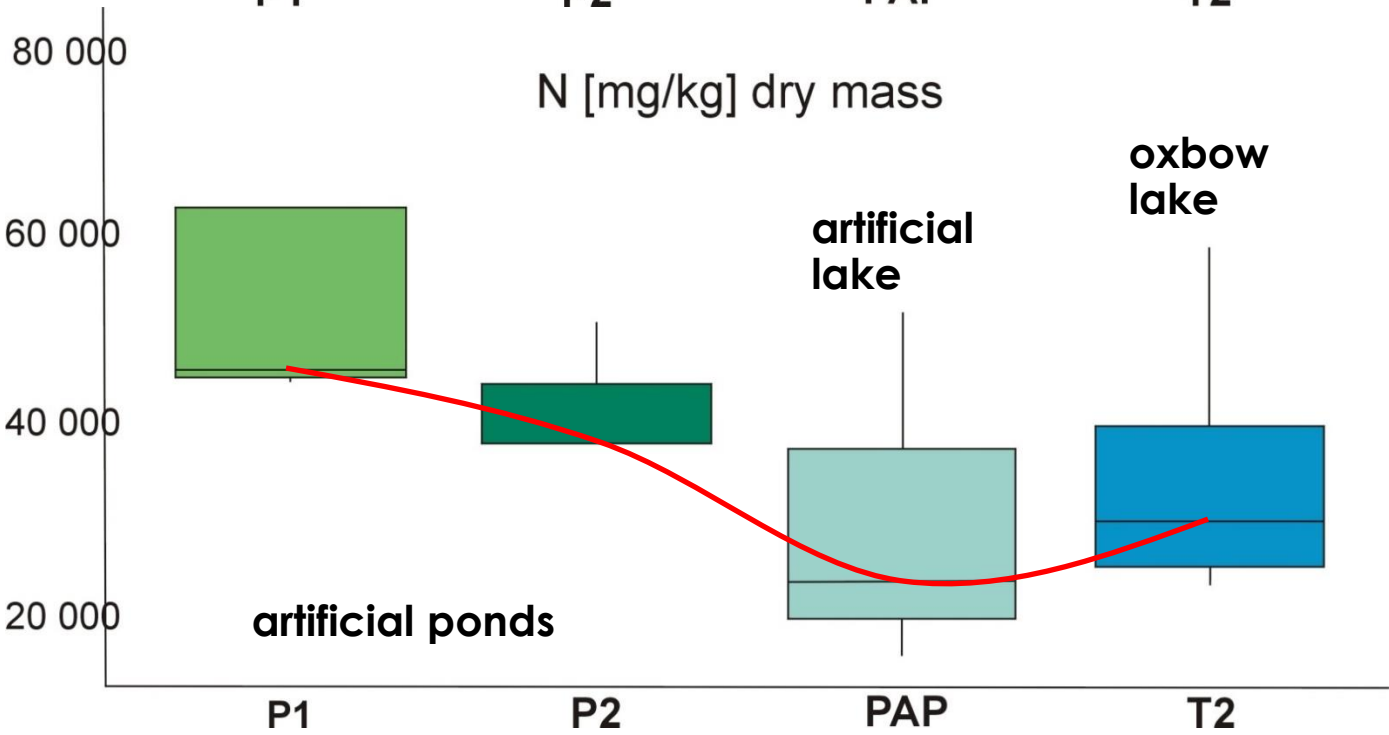




NITROGEN

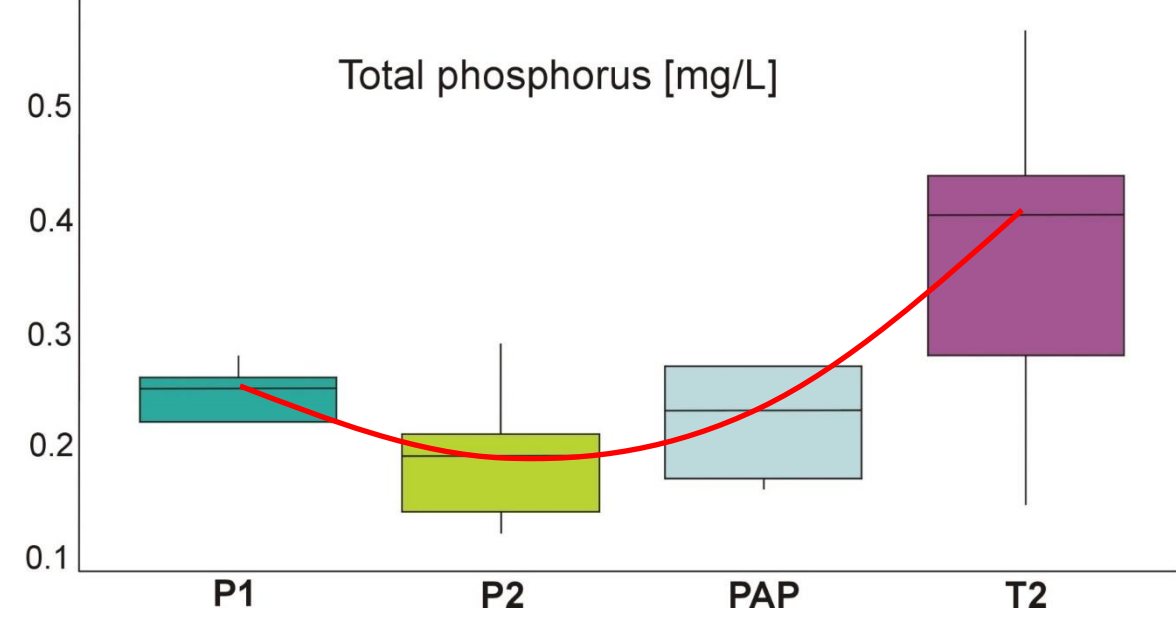
Biomass quality nitrogen (N) [mg/1 kg dry mass of phytoplankton]



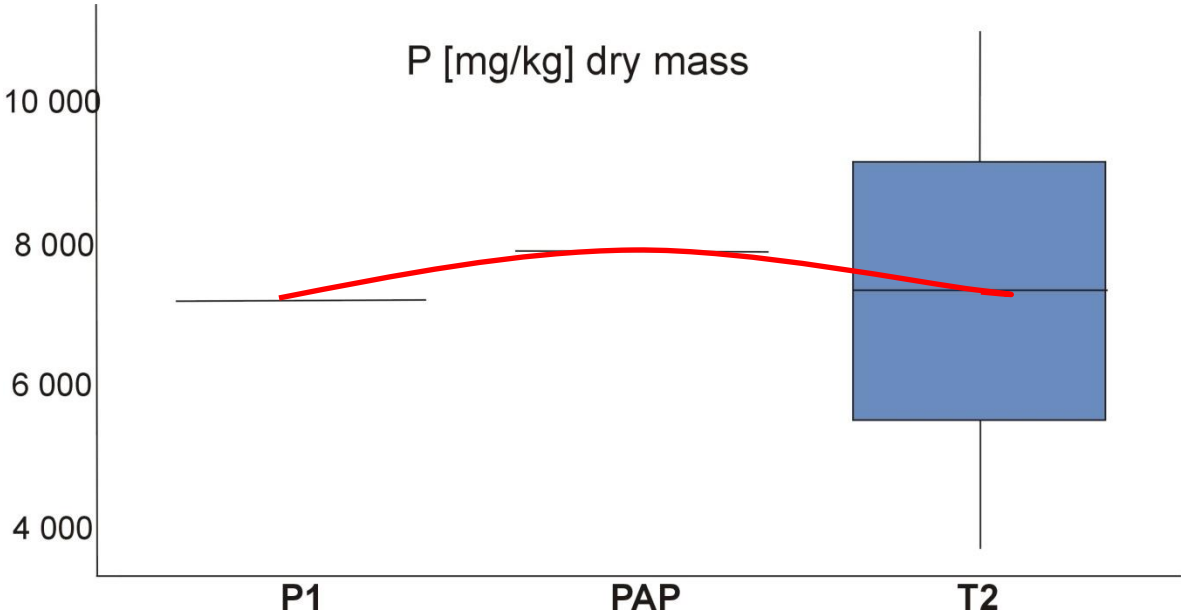


PHOSPHORUS

Biomass quality phosphorus (P) [mg/1 kg dry mass of phytoplankton]



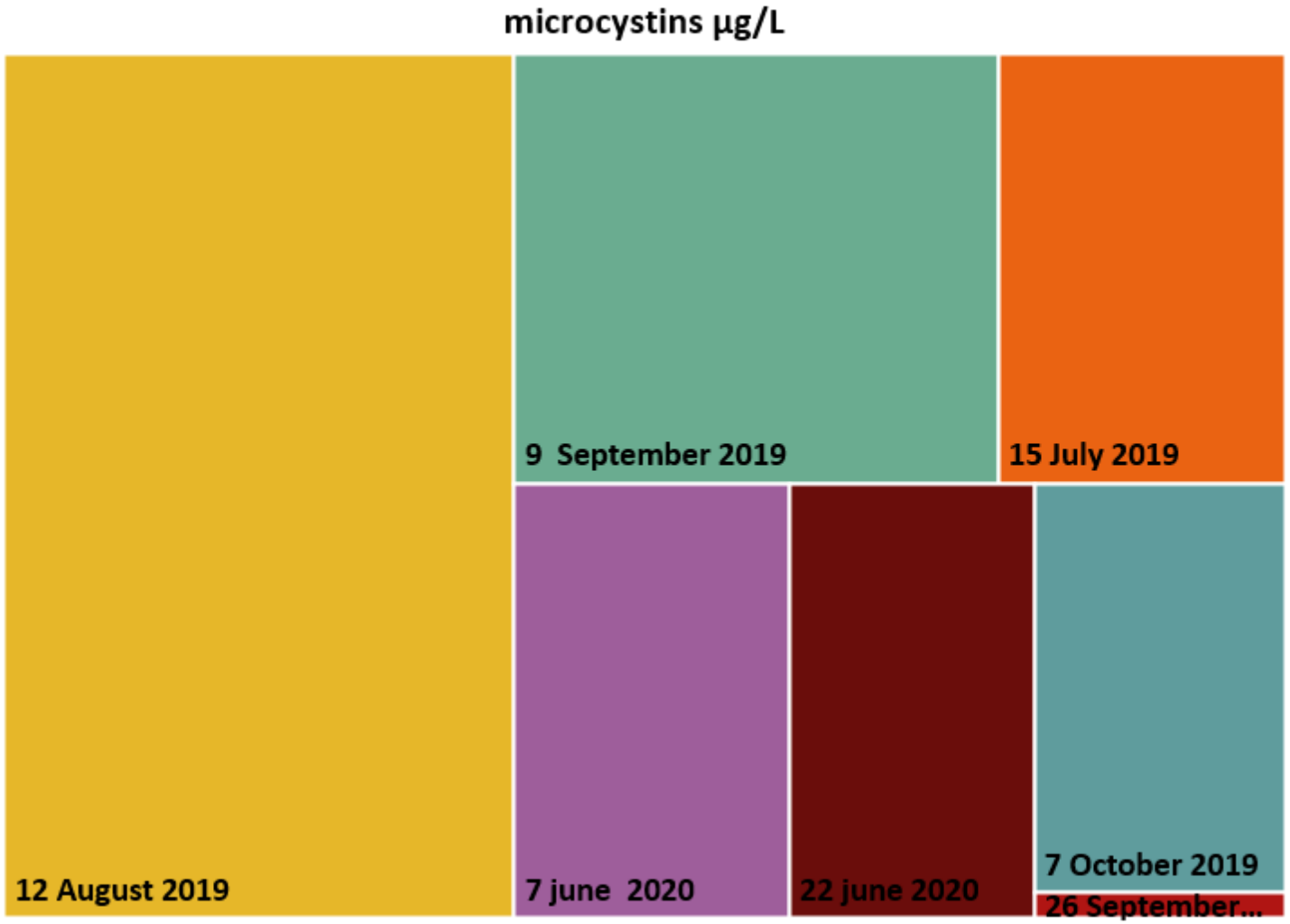
artificial ponds **artificial lake** **oxbow lake**



B.1.2. Biomass quality testing

Toxins analyses

only microcystins were detected, no cylindrospermopsins nor anatoxins



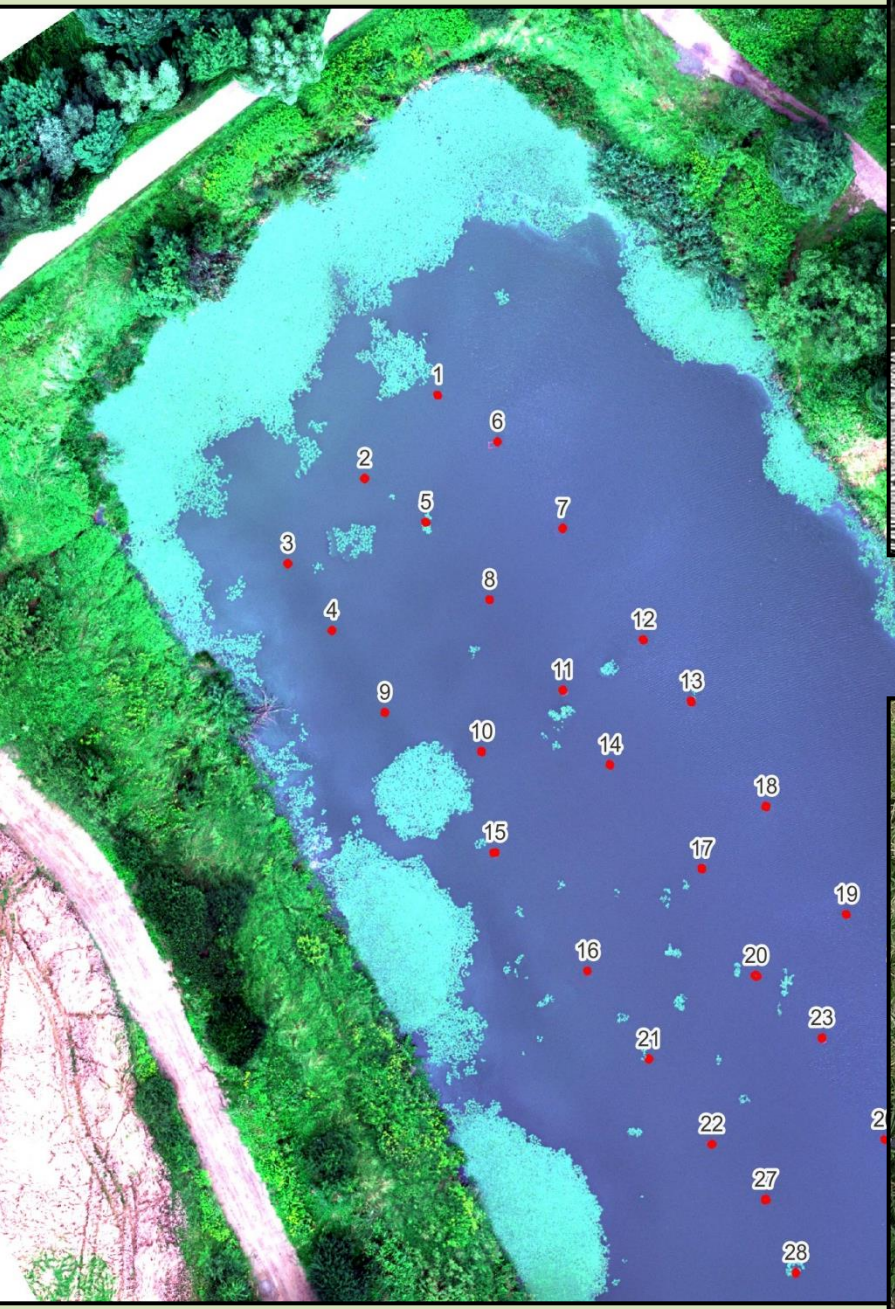
B. 2. Developing an UAV method of monitoring of cyanobacterial blooms in freshwater ecosystems (together with Łukasiewicz - Institute of Aviation, Warsaw)

OBJECTIVE:

- Development of remote sensing index designed for cyanobacterial blooms identification

METHODS:

- 30 styrofoam frames (60 x 60 cm)
- Measurment of chlorophyll a (Chla) and phycocyanin (PC) concentration:
  - ***In situ*** – inside of each frame deployed on the surface of the water
  - **Densed** – material densed with use of plankton net (10 µm)
- YSI ProDSS with TAL-PC sensor
- UAV multispectral measurments with use of MicaSense RedEdge-MX Dual sensor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BARK

Results

- Key spectral bands:
  - Near-Infrared (NIR; 842 nm)
  - Red Edge (740 nm)
  - Red Edge (717 nm)
  - Blue (475 nm)
  - Red (668 nm)

- 4 indexes developed

Results – Chlorophyll *a*

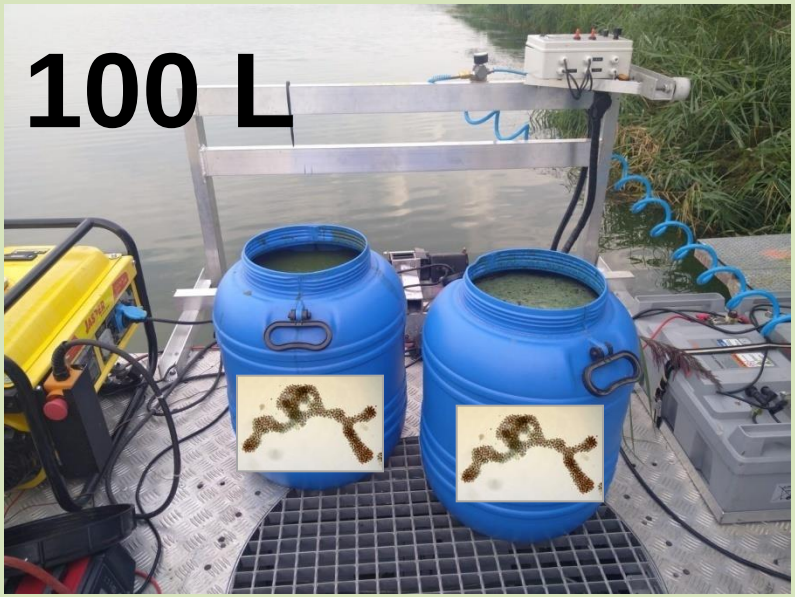
- *In situ:*
  - $I_{chl-s} = RE_{717\,nm} - 4\,NIR_{842\,nm}$
  - **Correlation: + 75%**

- Densed:
  - $I_{chl-W} = R_{668\,nm} - NIR_{842\,nm}$
  - Correlation: + 54%

Results – Phycocyanin

- *In situ:*
  - $I_{pc-s} = RE_{740\,nm} - 3\,RE_{717\,nm} - 6\,NIR_{842\,nm}$
  - **Correlation: + 70%**

- Densed:
  - $I_{pc-w} = B_{475\,nm} + 2\,NIR_{842\,nm} - 2\,RE_{740\,nm}$
  - Correlation: + 59%


100 L


200 L

Together with Ecotechnologies Laboratory Poznań University of Life Sciences

D.1. Raising awarness and dissemination of the project results on national and international levels

6. LIFE thematic day, Warszawa, June 2022

5. LIFE thematic day, Warszawa, September 2021

4. Mid-term meeting, Kraków, August 2021

3. Spotkanie międzyresortowej grupy roboczej gospodarka wodno-ściekowa Sieć „Partnerstwo: Środowisko dla Rozwoju” Krajowa sieć organów środowiskowych i instytucji zarządzających funduszami unijnymi, July 2021

2. Communication event with stakeholders “Demonstration of algae harvesting in the River Šventoji” LIFE17 ENV/LT/000407 project ”ALGAE – ECONOMY BASED ECOLOGICAL SERVICE OF AQUATIC ECOSYSTEMS”, Anykščiai, Lithuania, August 2020

1. LIFE thematic day, Warszawa, May 2019

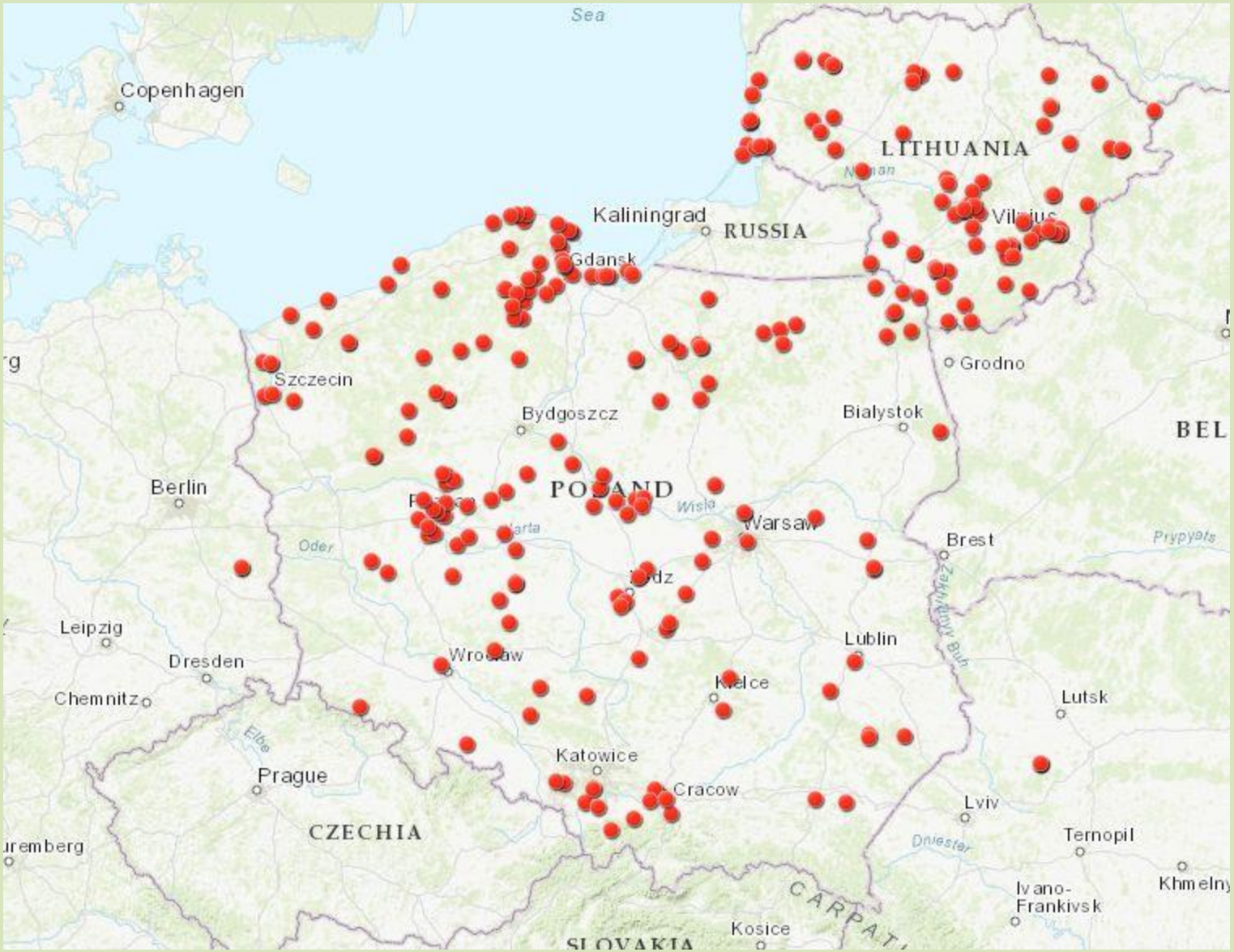
D1.

1. Wilk-Woźniak E., Koreivienė J., Krztoń W., Walusiak E., Kustosz D., Łaciak M., Karosienė J., Kasperovičienė J., Messyasz B., Łęska B., Pankiewicz R., Juškaitė L., Zagorskis A., Gulbinas Z., Valskys V. 2020.
Sinice i glony pomogą złagodzić skutki globalnego ocieplenia - projekt LIFE. Chrońmy Przyrodę Ojczystą 76 (1): 66-76

2. Jak pozbyć się sinic i makroglonów? Naukowcy mają na to patent: kombajn wodny - TVN24

August 2022

D1.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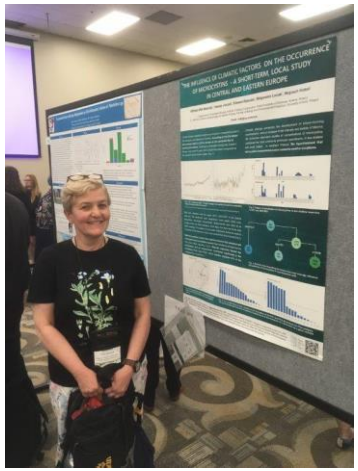
Dniester
Ternopil
Ivano-
Frankivsk
Khmelny
Kosice

D.2. Replication and transfer of the project results

6. 22nd Symposium of the International Association of Cyanophyte/Cyanobacteria Research, Ceske Budejovice, Czech Republic, August 2022

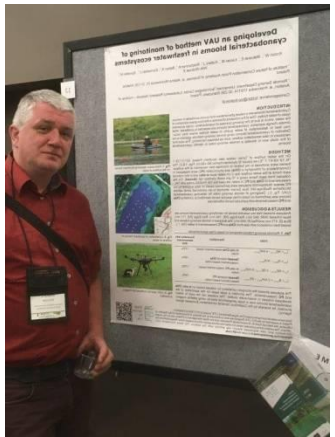
5. 12th International Conference on Toxic Cyanobacteria, The University of Toledo, Toledo, Ohio, USA, May 2022



4. 40th EARSeL Symposium, June 2021

3. Natural Toxins Environmental Fate and Safe Water Supply, MUNI RECETOX, Brno; University of Kopenhagen, Brno, Czech Republic, September 2020

2. 39th International Conference of the Polish Phycological Society, Gdynia –Łeba, September 2021



1. 38th International Conference of Polish Phycological Society, Kielce-Sandomierz, June 2019

THANK YOU!

Algae Service for Life

The **„Algae Service for LIFE”** project (LIFE17 ENV/LT/000407) is supported by the EU LIFE Programme and co-financed by the Ministry of Environment of the Republic of Lithuania, the National Fund for Environmental Protection and the Water Management in Poland, and by the project partners. The content of this publication does not reflect the official opinion of the European Union. Responsibility for the information and view expressed therein lies entirely with the authors.

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„Algae - Economy Based Ecological Service of Aquatic Ecosystems/ Glony - Gospodarka ekologiczna"

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