CYANOBACTERIAL BLOOMS IN KAUNAS RESERVOIR - a threat or an aesthetic problem?

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Kaunas Reservoir

- The Kaunas Reservoir was created in 1959 by damming the Nemunas river. More than 35 villages were flooded.
- Classified as a medium-sized water reservoir according to the classification of artificial water bodies in the world.
- Belongs to Kauno Marios Regional Park.

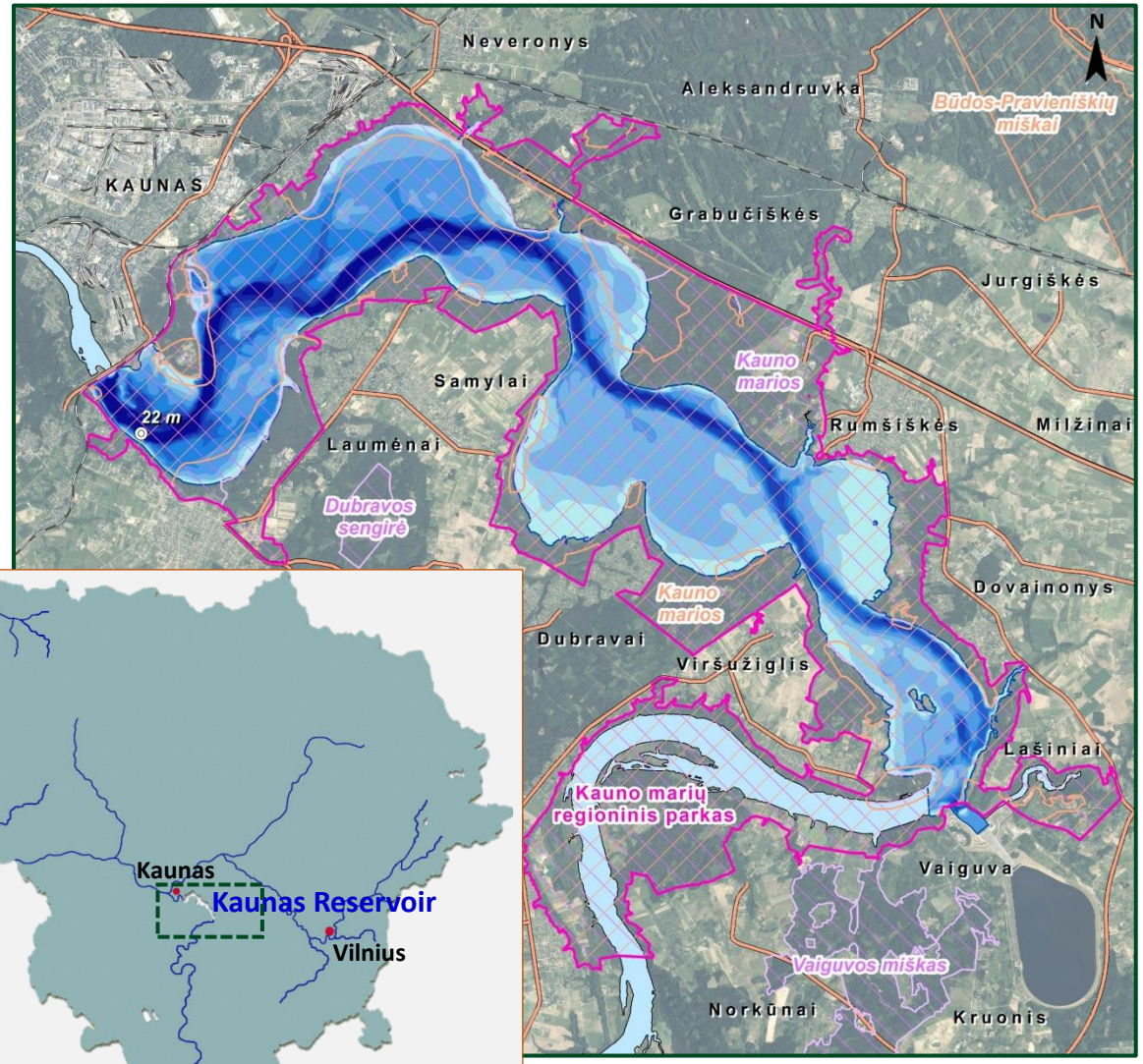
Villages in the Nemunas river valley


Kaunas hydroelectric power plant

The Kaunas Reservoir

Kaunas Reservoir

- The largest artificial water body in Lithuania
- Area 65.4 km^2, length 85 km. Depth - max 24.6 m, average 9–12 m
- Nemunas river and 43 other tributaries
- Catchment area 45 800 km^2
  (about 700 times larger than the water body itself).



Recreational and environmental importance of the Kaunas Reservoir

Social component

- 8 official recreational areas and campsites
- 2 official bathing sites
- Yacht club (international sailing Regatta, sailing club)
- Recreational fishing (commercial fishing has been prohibited since 2013)

Environmental component

- Hatching and feeding sites for waterbirds
- Sites for migratory birds

Cyanobacteria blooms in the Kaunas Reservoir

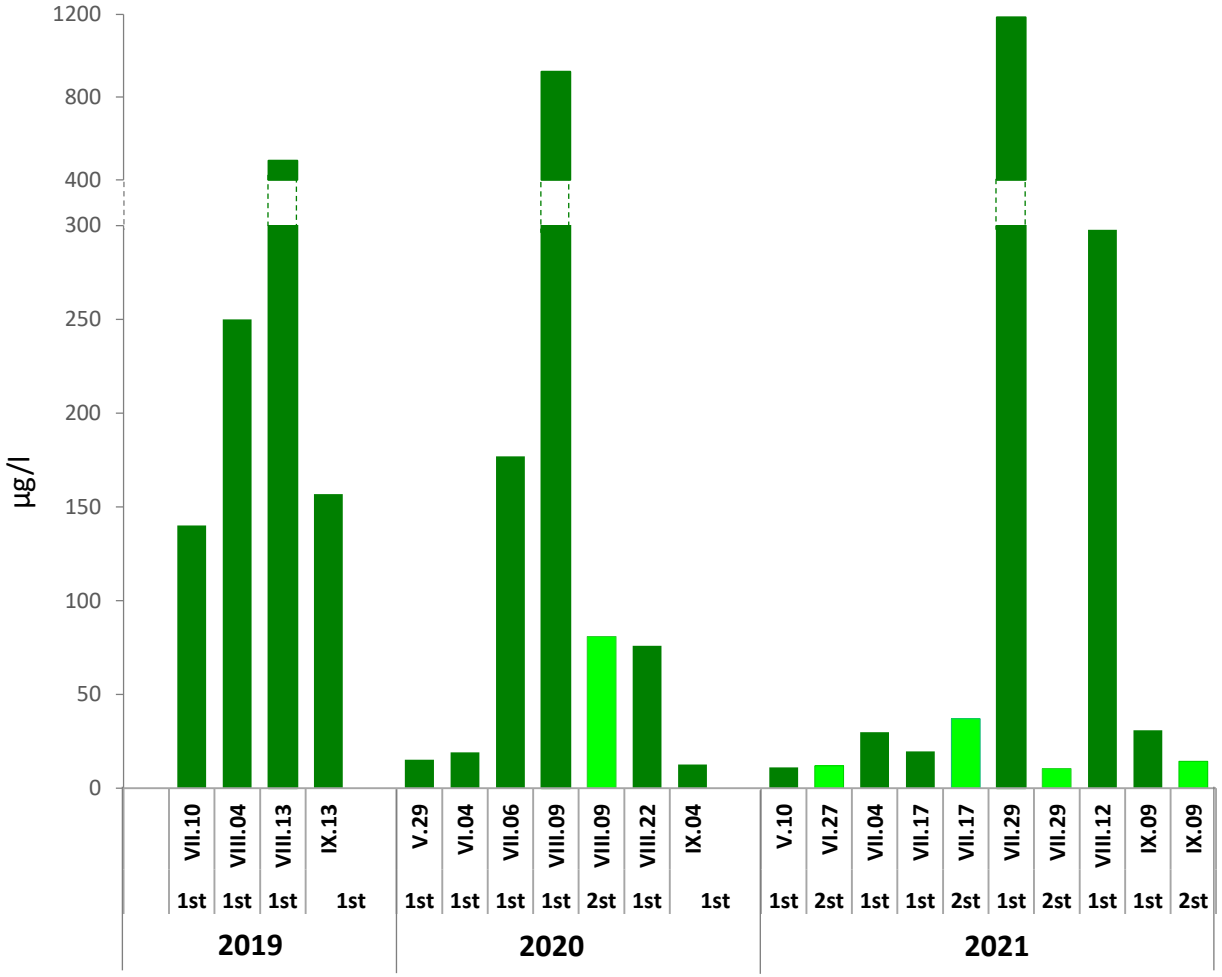
Ecological status of the Kaunas Reservoir

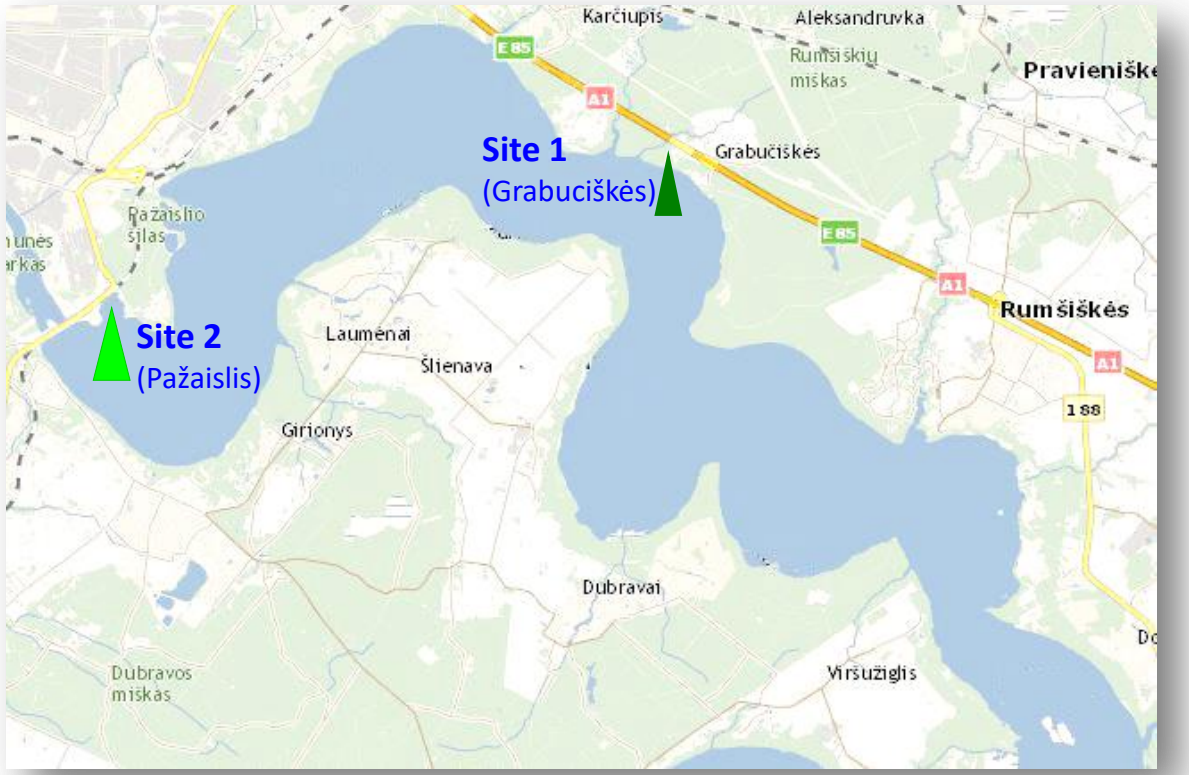
Year	PHYSICAL-CHEMICAL PARAMETERS				BIOLOGICAL PARAMETERS
	Water transparency	Total nitrogen	BDS7	Total phosphorus	Lakes phytoplankton index (EFPI)
2020					no data
2019					
2018					
2017					
2016					

According to EPA, https://aaa.lrv.lt/lt/

Ecological status: *Very good* *Good* *Moderate* *Bad* *Very bad*

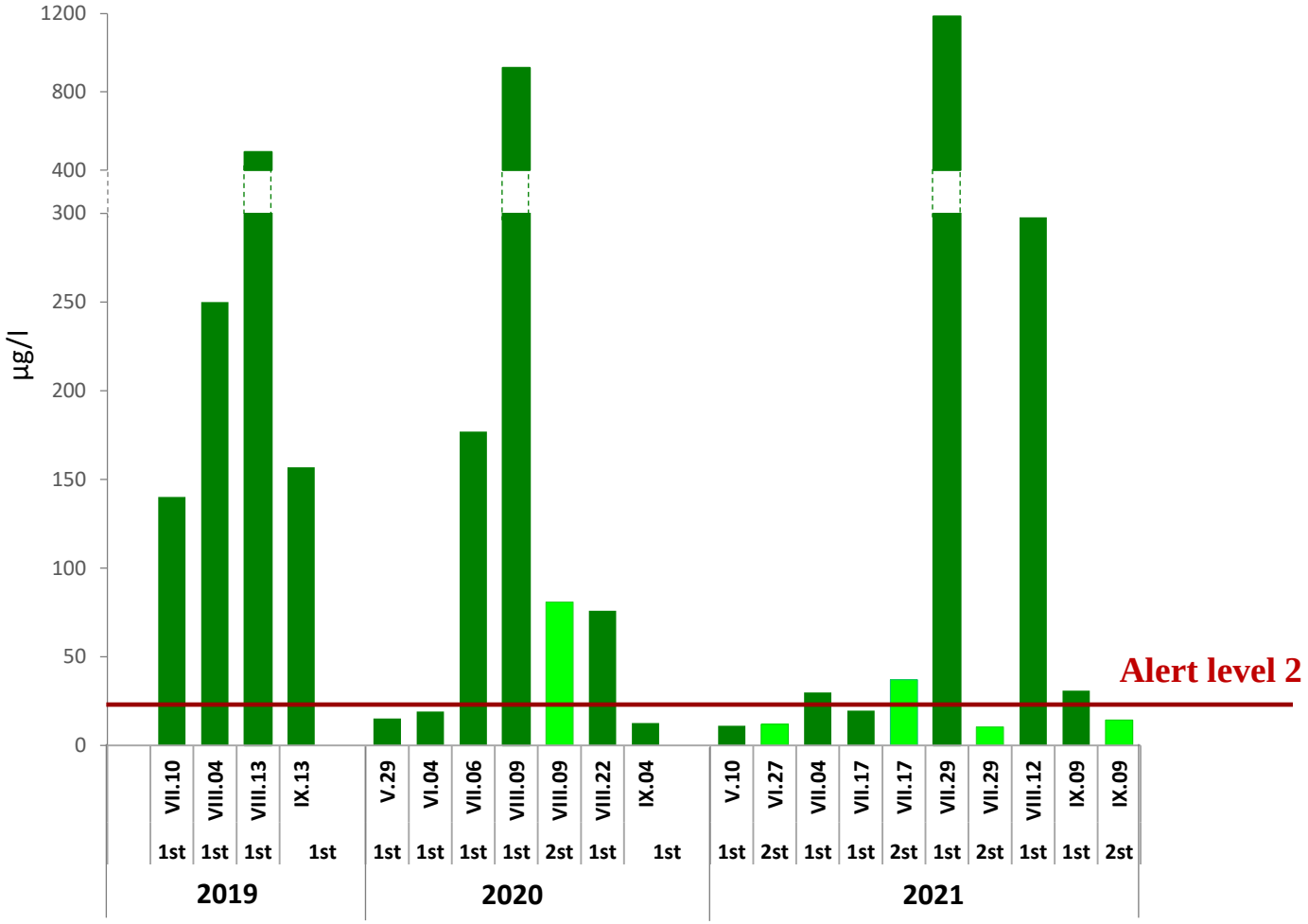
Chlorophyll-a concentration in the Kaunas Reservoir 2019-2021





Sampling sites

Chlorophyll-a concentration in the Kaunas Reservoir 2019-2021

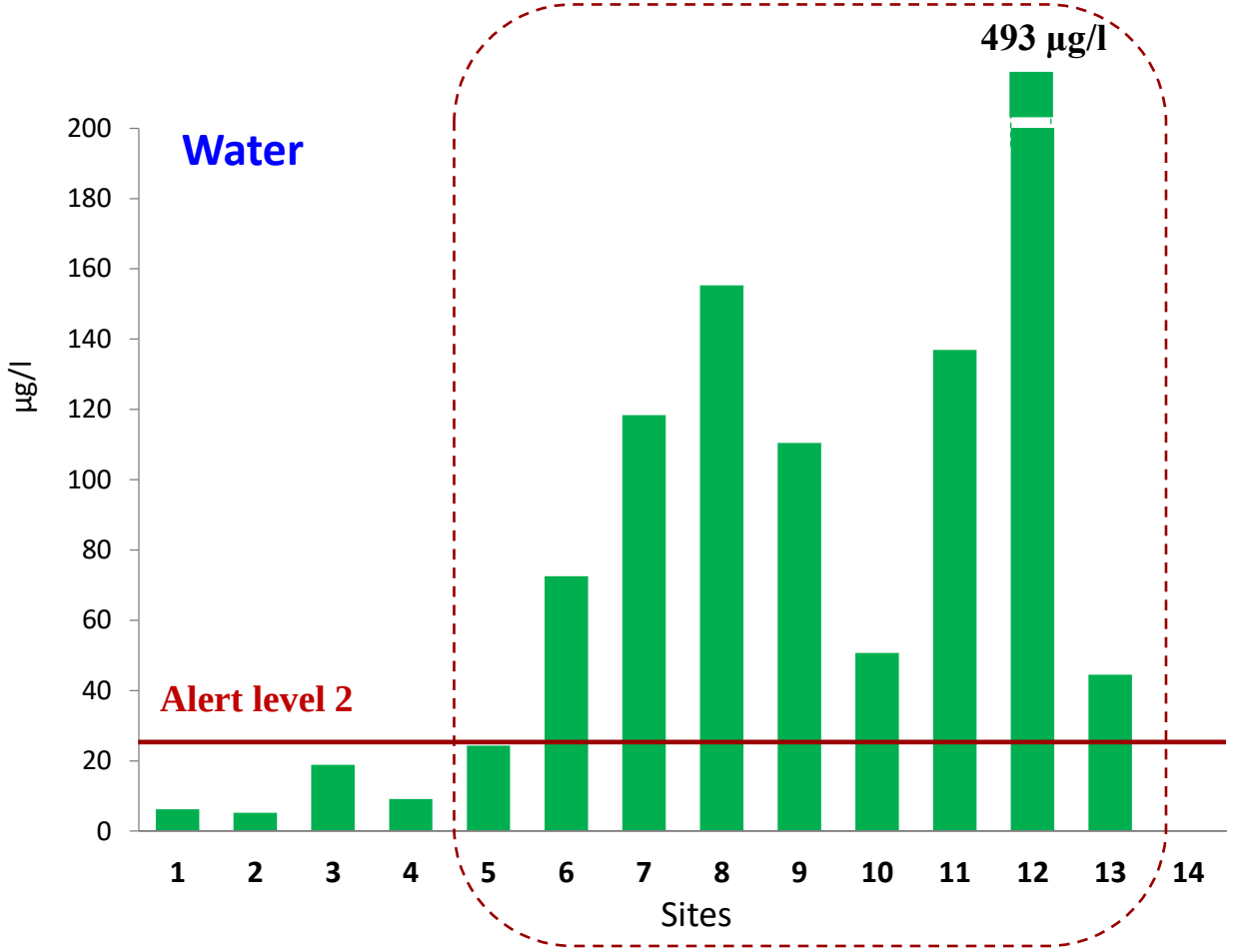


Alert level for monitoring cyanobacteria (WHO, 2021)

VIGILANCE LEVEL	13-12 µg Chl-a/L
ALERT LEVEL 1	12-24 µg Chl-a/L
ALERT LEVEL 2	>24 µg Chl-a/L

Chlorophyll-a concentration in the Kaunas Reservoir 2020-09-04

Up to 20 times exceed the threshold value of Alert level 2



Alert level: *(WHO, 2021)*

- *Vigilance level* *3-12 µg Chl-a/L*
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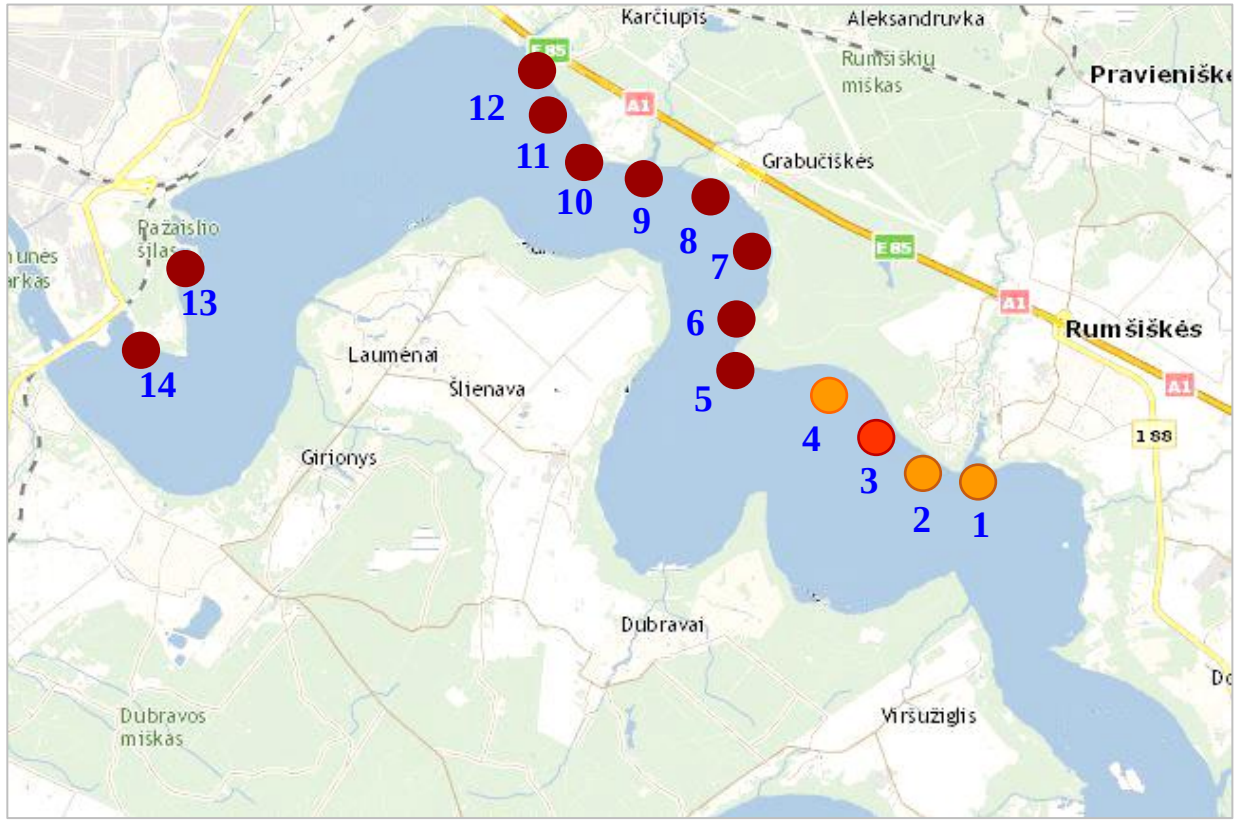


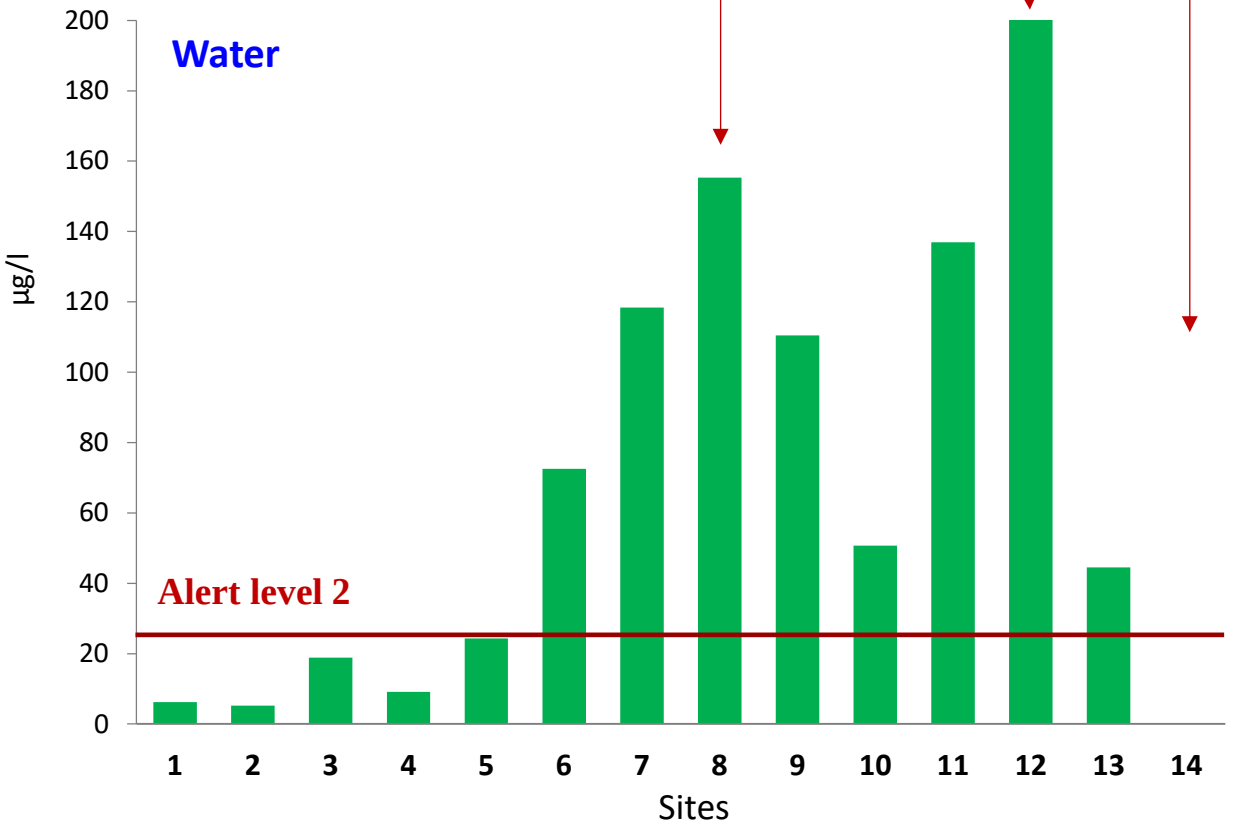
Sampling sites

Chlorophyll-a concentration in the Kaunas Reservoir 2020-09-04

1000-1500 times exceed the threshold value of Alert level 2

Scums

21296 µg/L 35600 µg/L 35800 µg/L



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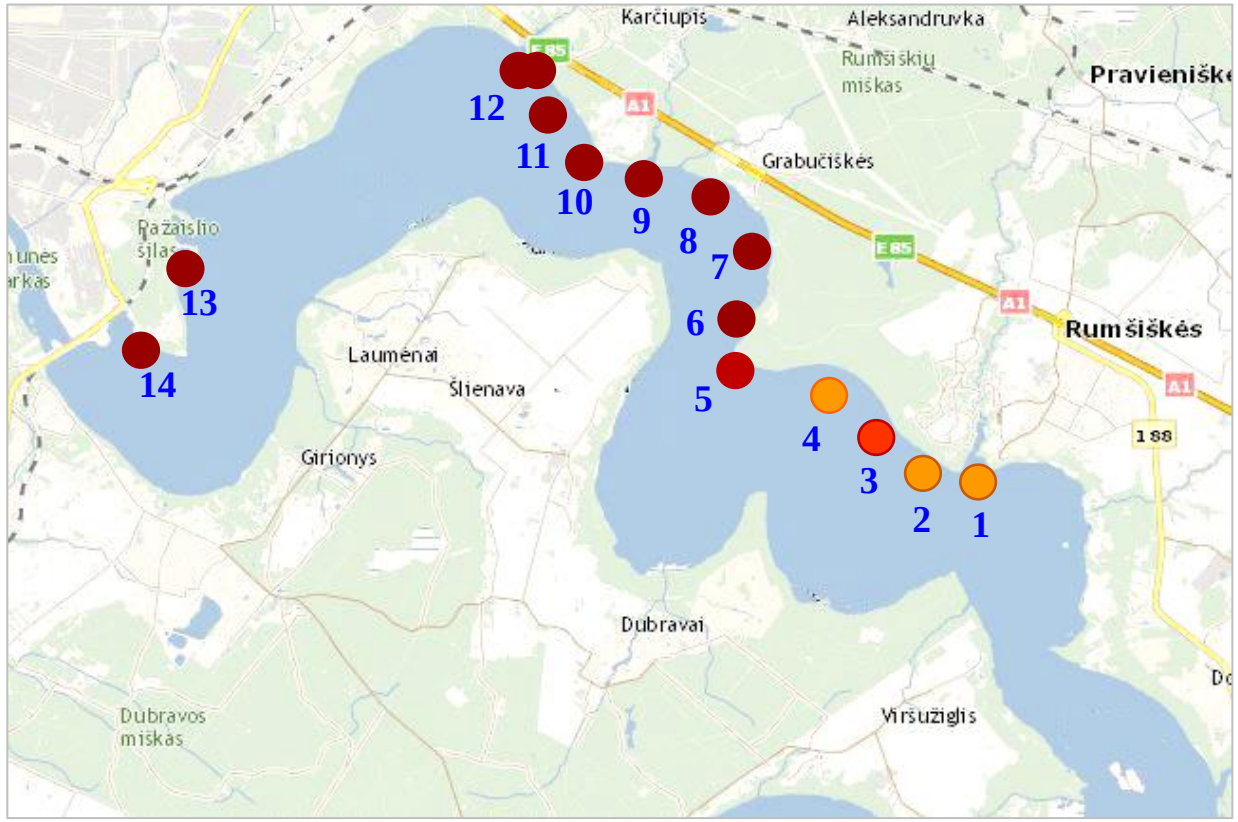
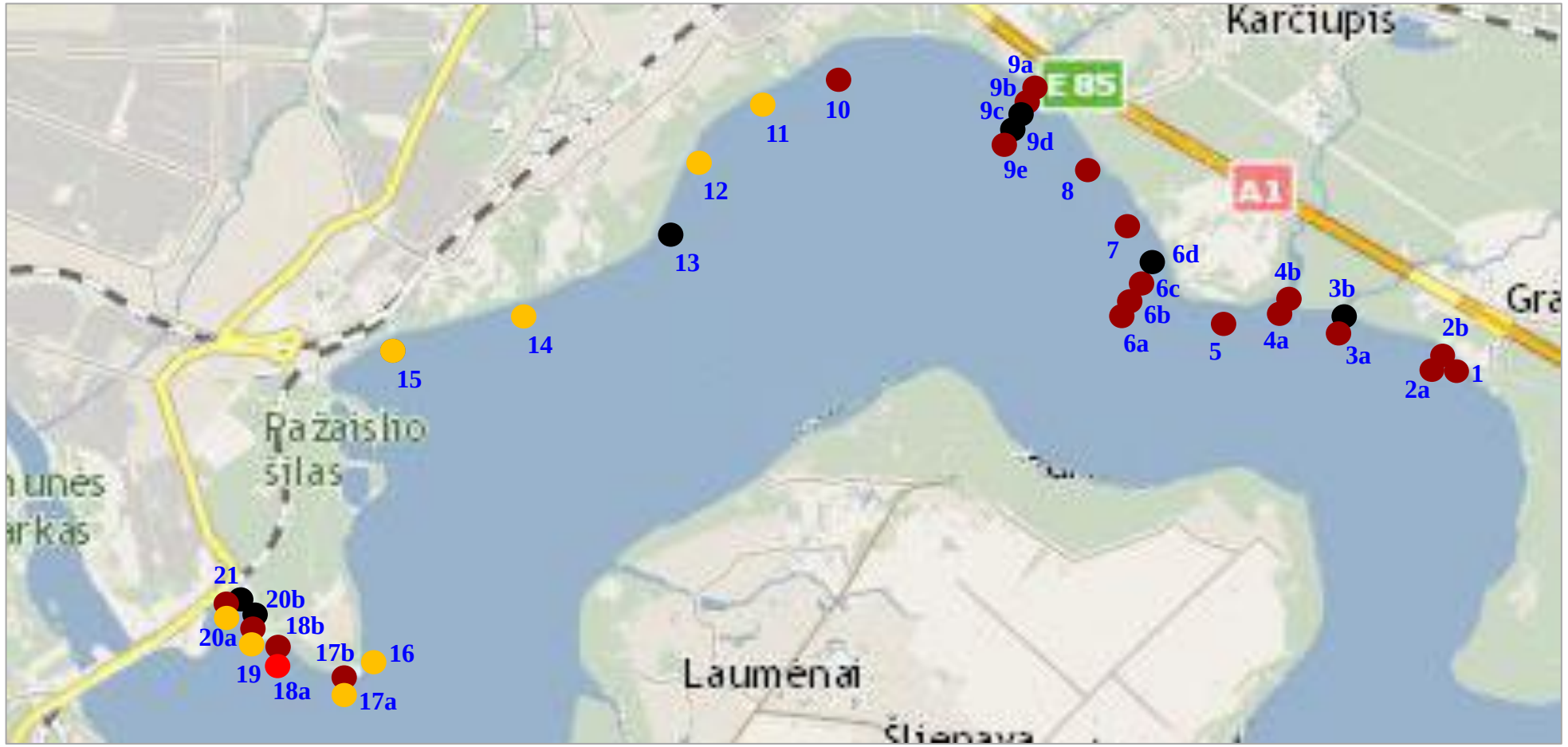


Sampling sites

Spatial distribution of chlorophyll-a in the Kaunas Reservoir 2021-09-09



Alert level: *(WHO, 2021)*

- *Vigilance level*
  3-12 µg Chl-a/L
- *Alert level 1*
  12-24 µg Chl-a/L
- *Alert level 2*
  >24 µg Chl-a/L
- *>100 times higher chlorophyll-a values than the threshold values of Alert level 2*

Cyanobacteria bloom in the Kaunas Reservoir

VIGILANCE LEVEL

Cyanobacteria bloom in the Kaunas Reservoir

ALERT LEVEL 2






Cyanobacteria bloom in the Kaunas Reservoir

ALERT LEVEL 2

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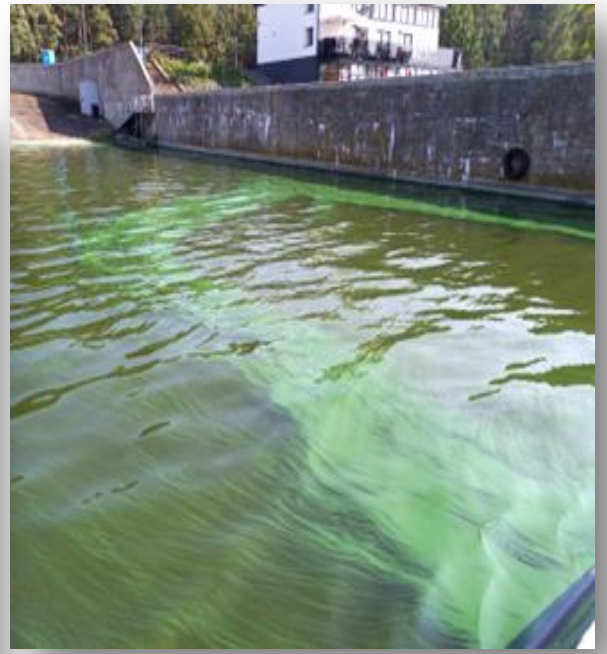
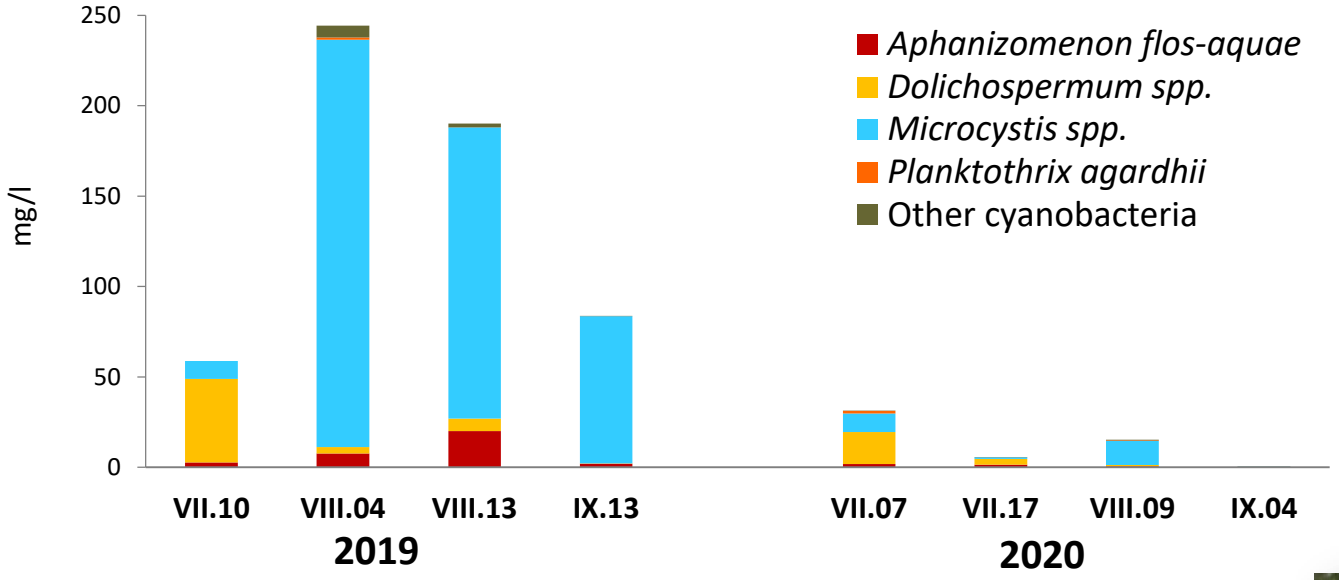
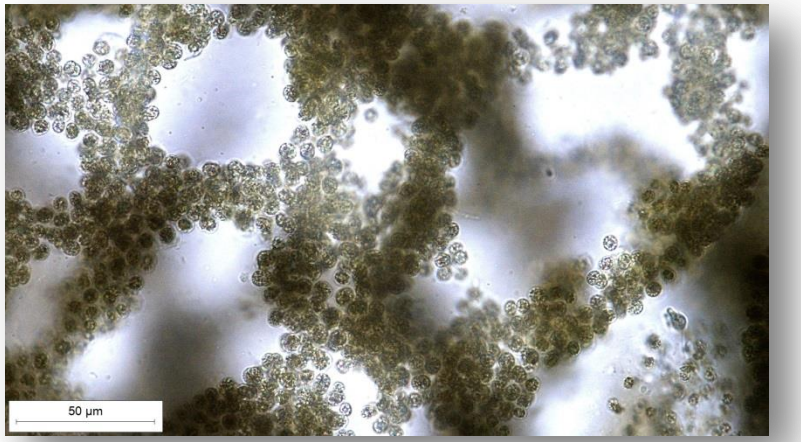
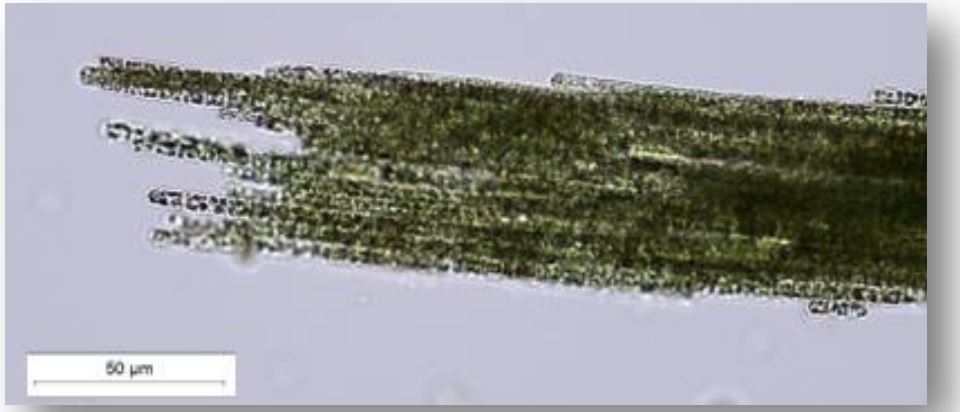


Cyanobacteria causing blooms in the Kaunas Reservoir





Microcystis aeruginosa



Aphanizomenon flos-aquae

Dolichospermum sp.

Cyanotoxins in the Kaunas Reservoir 2019-2021

	CYANOTOXINS* (µg/L)	IN WATER: Grabuciškės 2019-2021	IN WATER: Pažaislis 2019-2021	IN WATER: Kaunas reservoir 2021.09.09 profile	IN SCUM: Grabuciškės 2019-2020
HEPATOTOXINS	Microcystins*	1.62-202.9** (80.1±91.5)	0.09-74.37 (19.1±26.38)	59.75-5291.56 (1230.6±1687.75)	922.5-1247.5 (1085.0±229.8)
NEUROTOXINS	Anatoxin-a*	0.00-0.30 (0.08±0.11)	0.19	0.09-1.13 (0.50±0.41)	0.15-0.18 (0.17±0.02)
NEUROTOXINS	Saxitoxin*	0.00	0.00	0.0-0.076 (0.033±0.028)	0.00

*extracellular & intracellular cyanotoxins amount
** min-max (average±SD)

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GUIDANCE LEVEL for recreational waters *(WHO, 2021)*

Microcystin-LR	**> 24 µg/l**
Anatoxin-a	> 60 µg/l
Saxitoxin	> 30 µg/l

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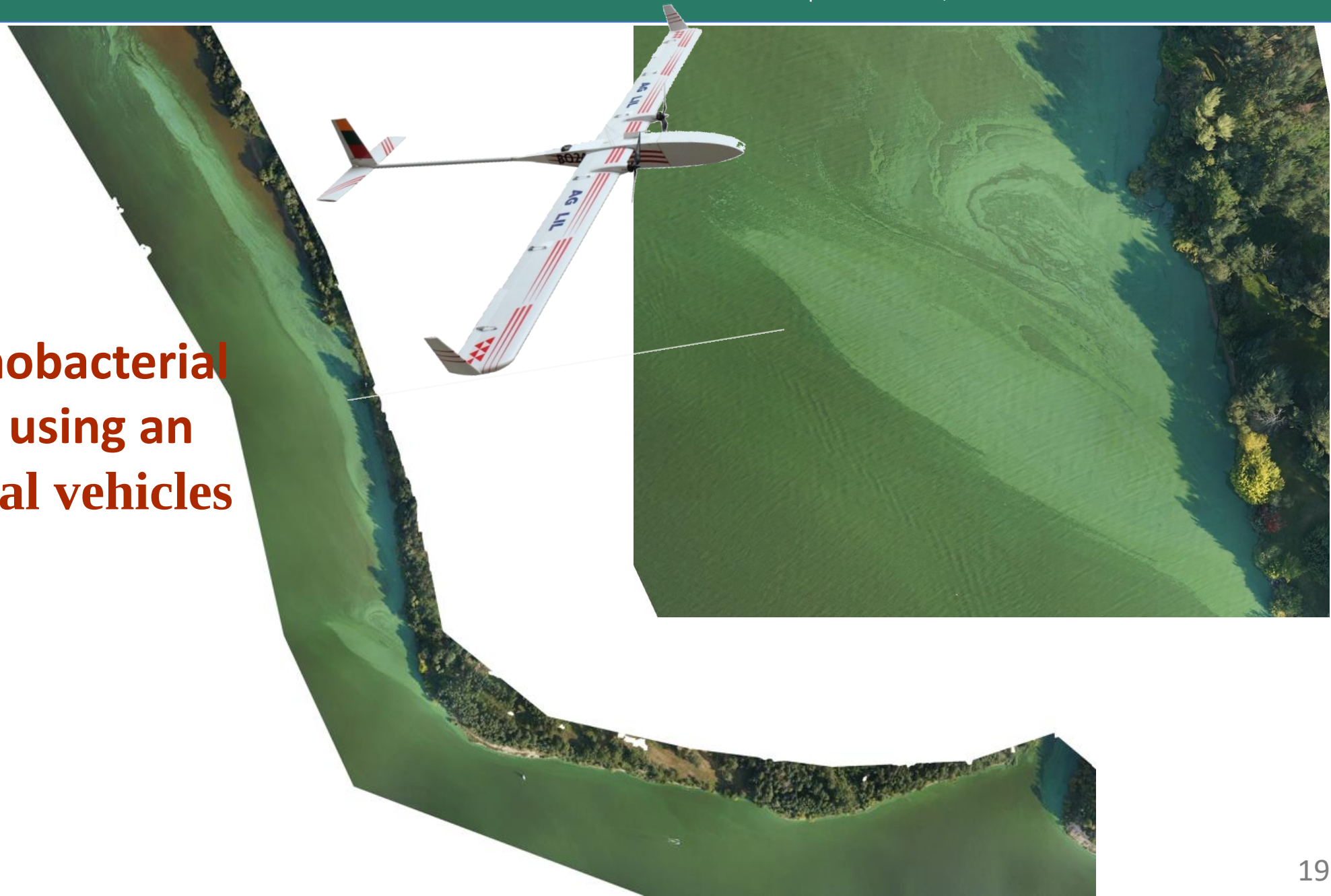
** min-max (average±SD)

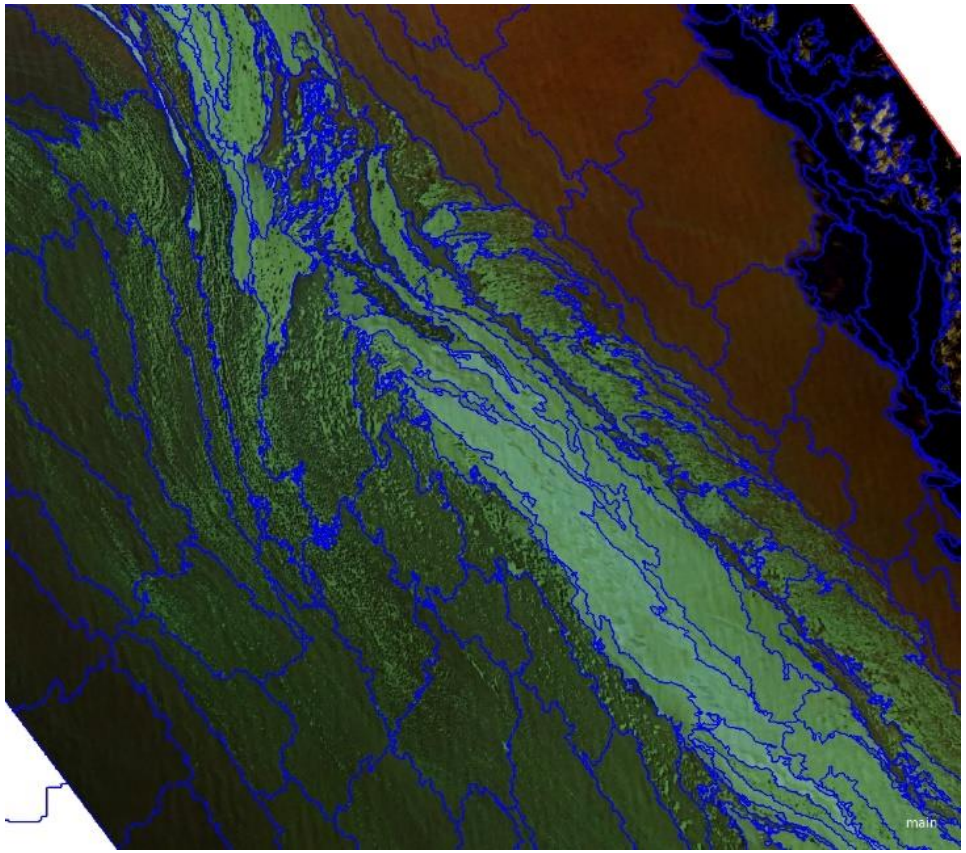
Analysis of cyanobacterial agglomerations using an unmanned aerial vehicles (UAV)

2021 09 04

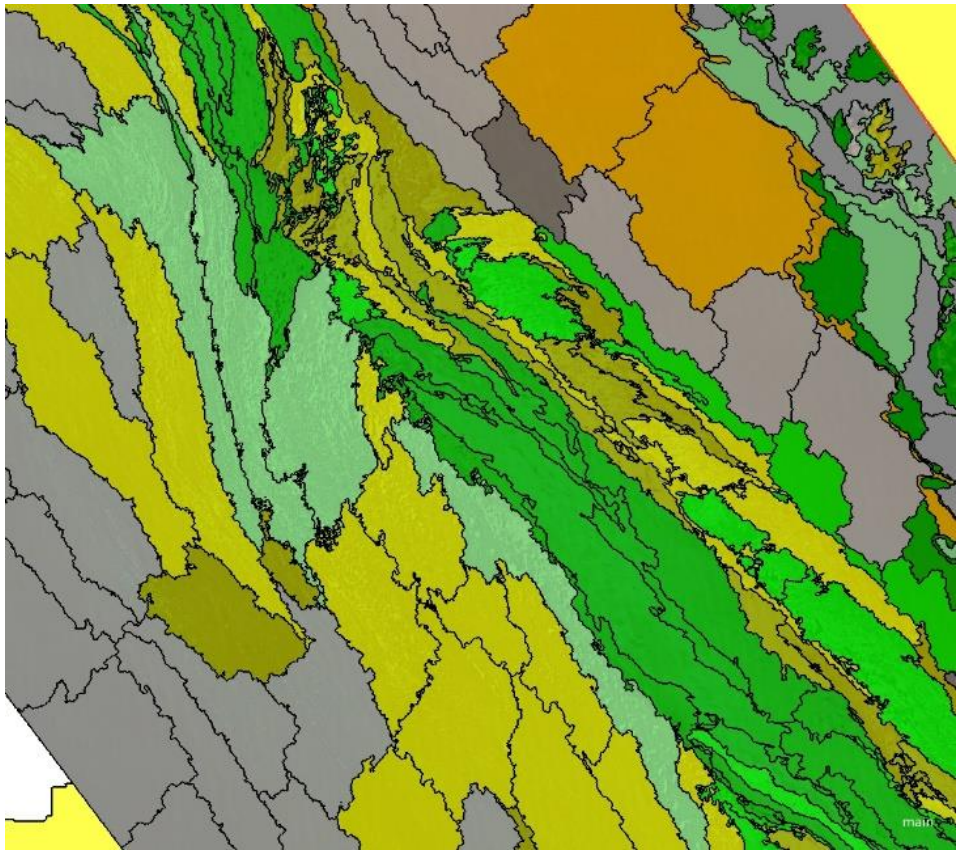


Analysis of cyanobacterial agglomerations on the water surface based on images from UAV

A. Fragmentation of orthophotos for raster analysis



B. Classification of extracted raster areas



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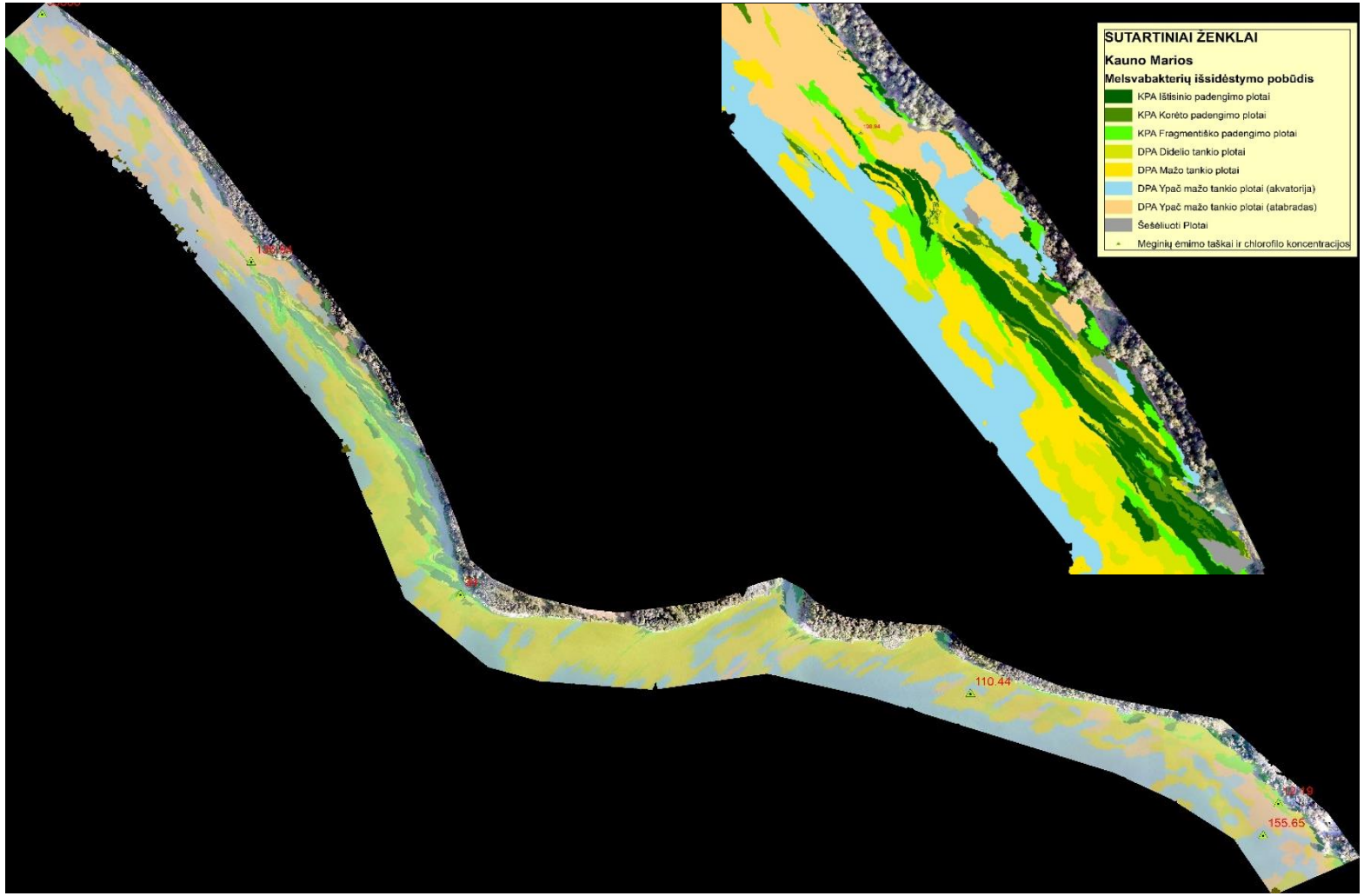

Type of cyanobacteria agglomerations

- Entire cyanobacteria coverage areas
- Honey-comb type coverage areas
- Fragment type agglomerations
- High density areas
- Low density areas
- Very low density areas (water)
- Very low density areas (near bank)
- Shaddows

Types of cyanobacteria agglomerations and bloom density


Concentrated bloom areas


Dispersed distribution areas


Low density areas

BLOOM DENSITY, area	AGLOMERATION TYPE	Area
Concentrated bloom areas	High density area	0.089 km^2 (13.41%)
0.284 km^2 (42.64%)	Low density area	0.195 km^2 (29.23%)
Disperse distribution areas	Entire coverage areas	0.029 km^2 (4.35%)
0.072 km^2 (10.73%)	Fragmented area coverage	0.026 km^2 (3.91%)
	Honey-comb type coverage	0.016 km^2 (2.47%)
Low density areas	Water area	0.212 km^2 (31.85%)
0.310 km^2 (46.62%)	Bank area	0.098 km^2 (14.77%)
Shadows 0.014 km^2 (2.10%)		
TOTAL: 0.666 km^2		

~ 1% of evaluated reservoir area:
up to 19 t biomass is accumulated

THANK YOU for your Attention