LVĢMC

EEE PARAMA LIETUVAI:
partnerystė vertybėms kurti ir išsaugoti

PHYTOBENTHOS AND MACROPHYTE RESEARCH IN LITHUANIAN WATERBODIES, AND ASSESSMENT OF ECOLOGICAL QUALITY ACCORDING TO *MACROPHYTE REFERENCE INDEX*

JĀNIS ŠĪRE
HEAD OF INLAND WATERS DIVISION
LATVIAN ENVIRONMENTAL, GEOLOGY AND METEOROLOGY CENTRE

TOPICALITY AND AIM OF THE PROJECT

According to the Water Framework Directive the member states of the European Union are obliged to **assess and report on the ecological status** of all water bodies, and water bodies must achieve at least good water ecological quality status until 2015

Macrophytes and phytobenthos are biological quality elements that have to be used to asses ecological quality of water bodies according to WFD

The aim of this project - research macrophyte and phytobenthos species composition and abundance 152 rivers and 269 lakes and ponds in the period 2014-2015, as well as assess ecological quality of water bodies according to *Macrophyte Reference Index*

MAIN TASKS

I. Perform phytobenthos research in surface water bodies:

collect 1 sample of phytobethos (diatom) in each water body and describe each study site, determine species composition and abundance. In rivers additionaly collect 1 sample (composed of 5 subsamples) of phytobenthos (benthic macroalgae)

II. Perform macrophyte research in surface water bodies:

perform field survey estimating macrophyte species composition and abundance in each water body and describing each study site

III. Assess ecological status of lakes according to MEI, to indicate the cause of worse than good ecological status if possible

IV. Calculate MEI for rivers

V. Reporting on performed research

TIME SHEDULE AND PROJECT PHASES

PART I. 20.06.2014 - 20.02.2015

	June	July	August	September	October	November	December	January	February
Field work									
Laboratory work									
Work on the report									
Translating the report									
Preparing all materials to submitting									
Planning/Organizing									

PART II. 01.03.2015 – 01.02.2016

	March – June	July	August	September	October	November	December	January
Field work								
Laboratory work								
Work on report								
Translating the report								
Preparing all materials to submitting								
Planning/Organizing								

Project phases in each part:

1) Field work in Lithuaninan water bodies, performing macrophyte research and phytobenthos sampling;
2) Laboratory work – treatment and analyses of phytobenthos samples (bethic macroalgae and diatoms);
3) Working on the report - summarization of the results, assessment of ecological quality and analyses.

EXPERT TEAM AND DONE WORK

Our expert team:

- Key expert on macrophytes (1)
- Key expert on phytobenthos (1)
- Expert on river macrophytes (1)
- Experts on lake/pond macrophytes (6)
- Experts on phytobenthos (3)
- Tehnical support team (6)
- Cartographer (1)
- Administration divison
- Project manager (1)

What we have done in these 2 years:

- Spent 3 days in training
- Spent 345 human days in field work (7 experts)
- Filled 2253 field protocols (1528 – lake macrophyte, 152 – river macrophyte, 269 – lake diatom, 152 river diatom, 152 – river macroalgae)
- Collected 421 diatom sample
- Spent 623 human days in laboratory (3 experts)
- Spent 334 human days working for reports (2 experts)
- Took 5183 photos
- Collected 797 herbarium samples




RESULT - TWO REPORTS, including

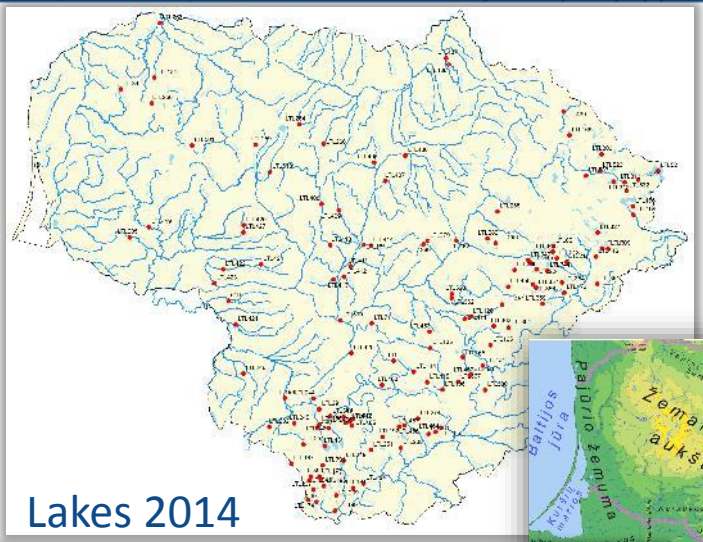
Electronic materials:

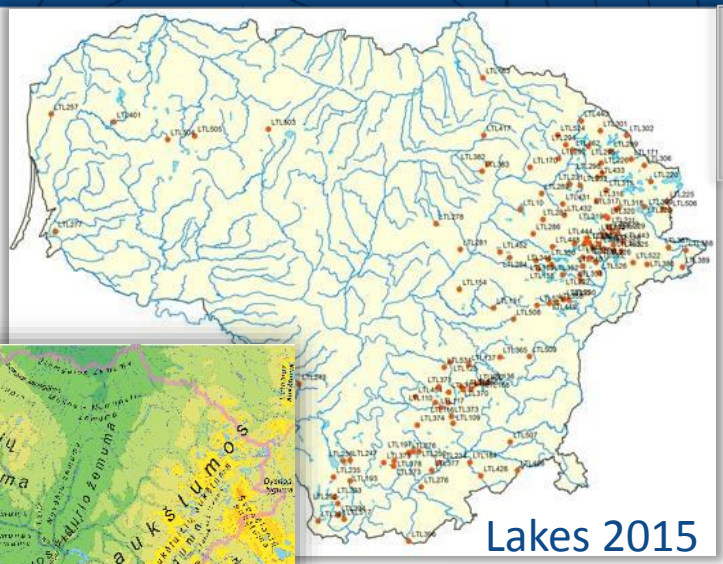
- **Field protocols of macrophytes** – 269 MS Excel files for lakes/ponds, 152 MS Excel files for rivers;
- **Field protocols of diatoms** -269 MS Excel files for lakes/ponds, 3 MS Excel files for rivers;
- **Laboratory protocols of diatoms** – 269 MS Excel files for lakes/ponds, 2 MS Excel files for rivers;
- **Field protocols of river benthic macroalgae** - 3 MS Excel files
- **Laboratory protocols of river benthic macroalgae** - 2 MS Excel files
- **Assessment of ecological quality** – 223 MS Excel files and 6 summary MS excel files for lakes, 4 MS Excel file for rivers;
- **Morphology of rivers** – 10 MS excel files
- **Summary of macrophyte species composition** – 10 MS Excel files for lakes
- **Photos of research places** - 4474 JPG files for Lakes/ponds; 409 JPG files for rivers

Report:

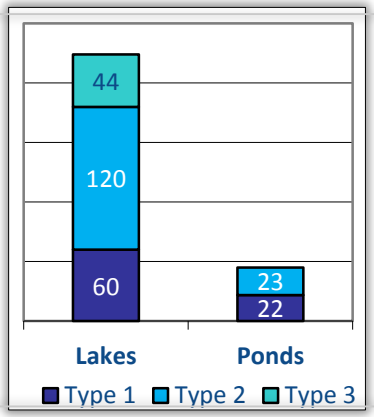
- 904 pages in 2014,
- 1131 pages in 2015

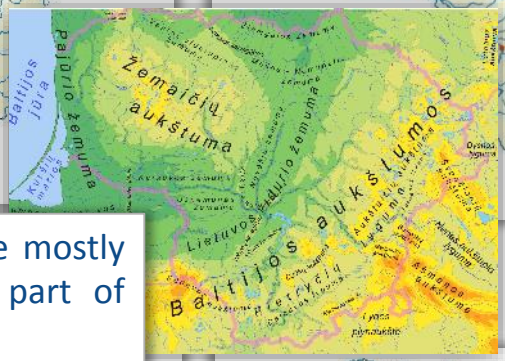
MONITORING STATIONS OF SURVEYED WATER BODIES





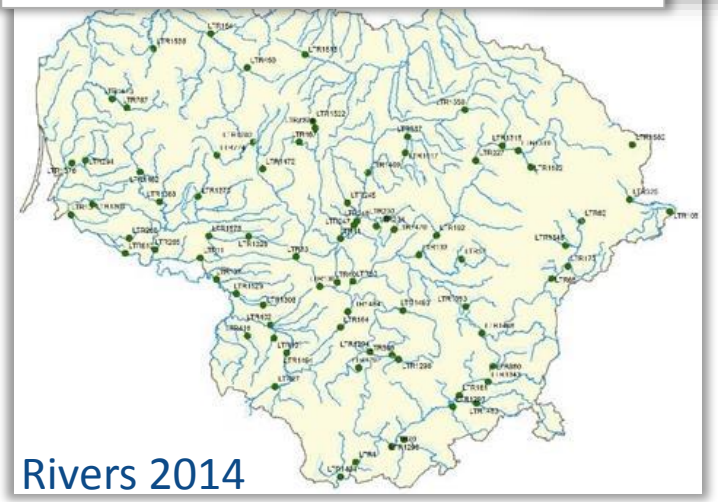
Most represented are lakes with average depth 3 – 9 m (type 2)

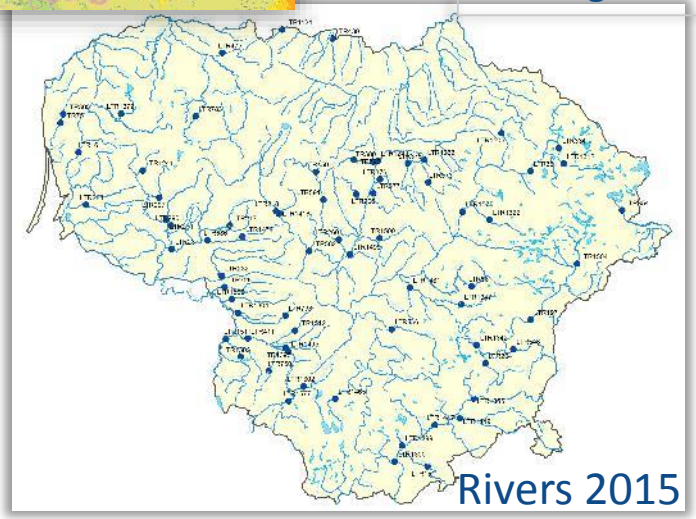


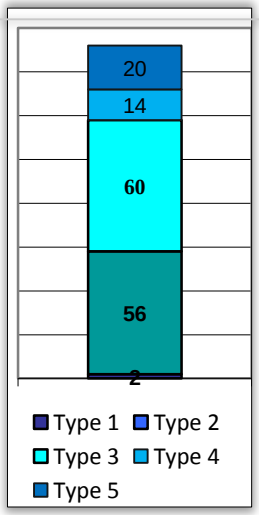


Researched lakes and ponds are mostly concentrated in South – East part of Lithuania - Baltijos aukštumos

Most represented are rivers with drainage basin 100-1000 km^2 (type 2,3)



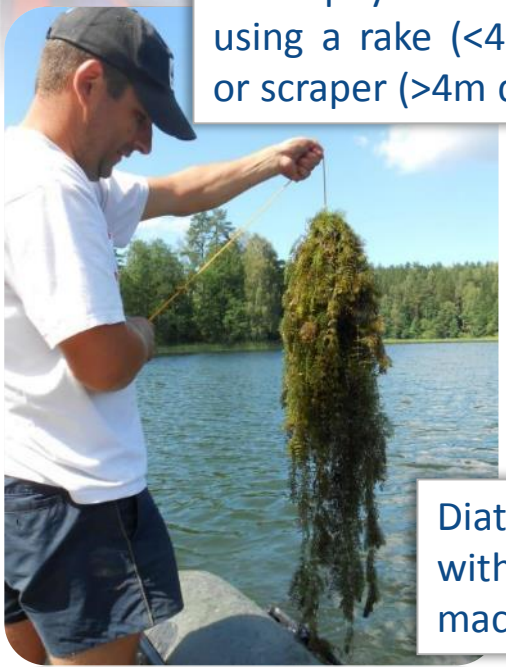




FIELD AND LABORATORY WORK WE ALREADY SHOWED IN PREVIOUS YEAR

Macrophyte sampling by using a rake (<4m depth) or scraper (>4m depth)

Exploring sumberged vegetation by using hydroscope



Diatom sampling from stones with toothbrush, from macrophytes using a jar

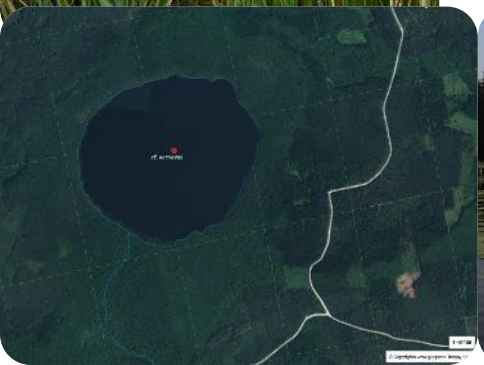
Diatom analyses in laboratory

SOME PROBLEMS ALSO OCCURED





Unpleasant weather and rain, absence of water, total overgrowth, borders, limited accessability, broken boats and complete tiredness after hard working day ☺




MOST COMMON MACROPHYTE SPECIES IN LAKES

	Type 1	Type 2	Type 3	Total
2014	100	105	81	**117**
2015	74	99	83	**112**

Phragmites australis

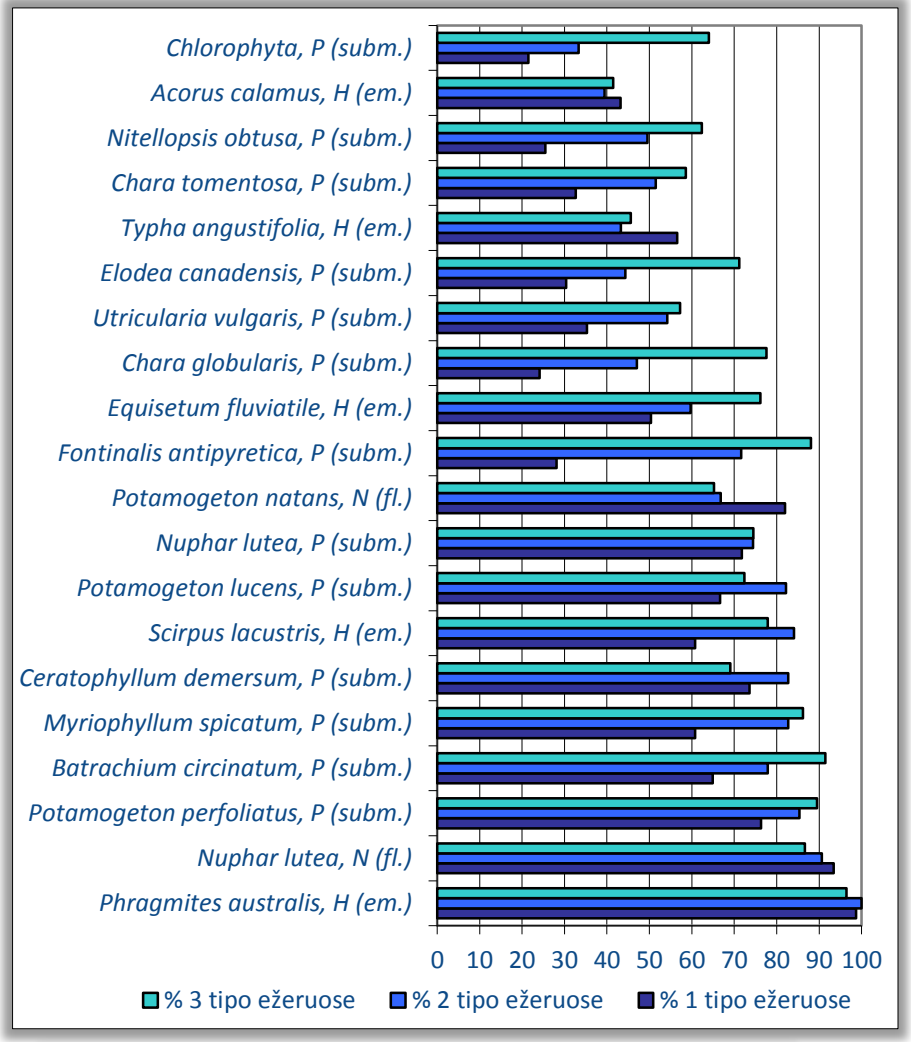
Nuphar lutea

Potamogeton perfoliatus

Batrachium circinatum

Scirpus lacustris

Potamogeton lucens



Deeper lakes have more well developed submerged vegetation

MOST COMMON MACROPHYTE SPECIES IN PONDS

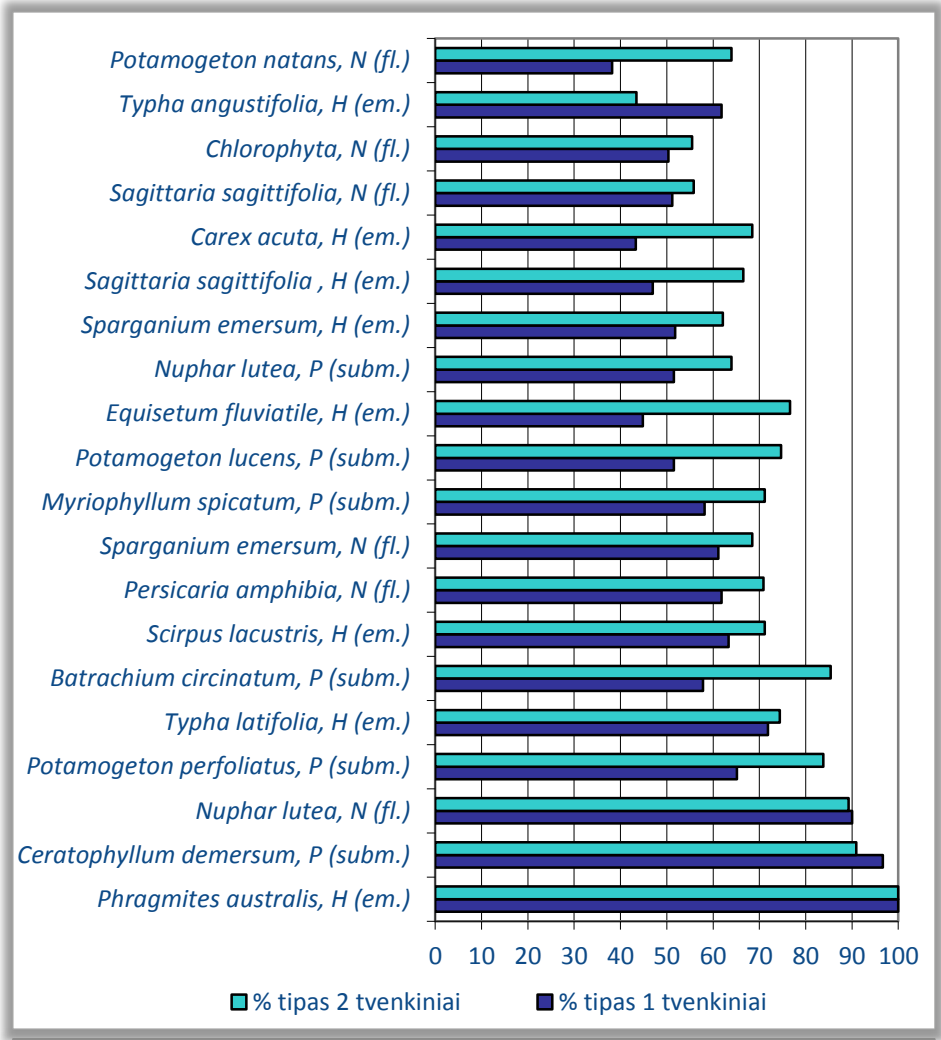
	Type 1	Type 2	Total
2014	64	69	**79**
2015	56	70	**76**

Freely floating *Lemna minor* and *Spirodela polyrhiza*

Chlorophyta

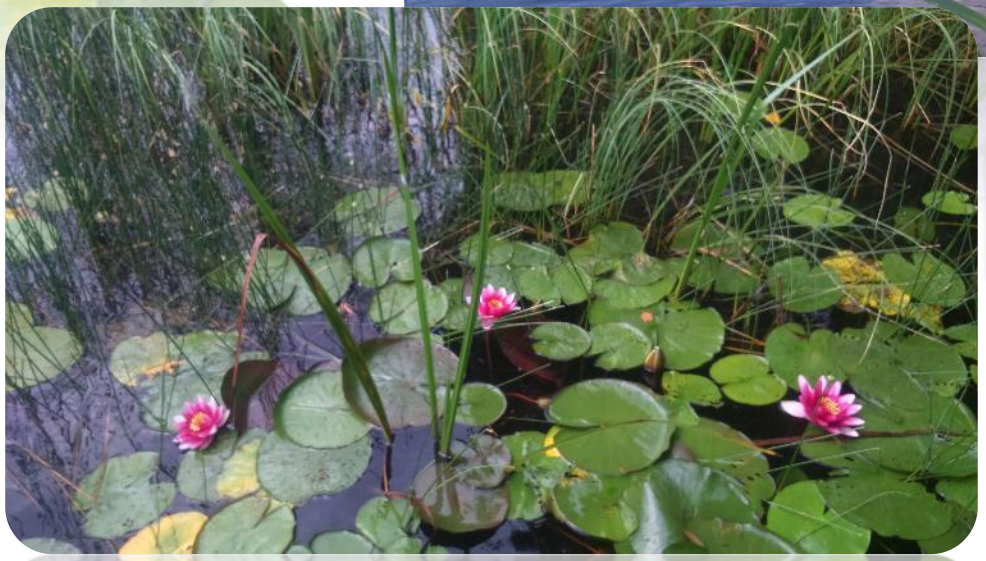
Typical view near river inflow - pathces of helophytes along with total overgrowth with eutrophic, pollution indicator species

Ceratophyllum demersum



More eutrophic species than in lakes, especially near the river inflow.

IN LAKES AND PONDS CULTIVATED WATER LILIES ALSO ARE FOUND



You can plant flowers not only in garden ☺

MOST COMMON MACROPHYTE SPECIES IN RIVERS

In 2014 – 49 macrophyte species were found, in 2015 – 47 macrophyte species.

Most common species in middle-sized rivers (type 2.,3) are *Lemna minor, L. trisulca, Cladophora* spp., *Fontinalis antipyretica, Sagittaria sagittifolia*, *Nuphar lutea, Spirodela polyrhiza* un *Potamogeton crispus*.

Most common species in large rivers (type 4.,5) are *Potamogeton perfoliatus, P. pectinatus, Myriophyllum spicatum*, *Fontinalis antipyretica*, *Nuphar luteum.* Also *Spirodela polyrhiza*, *Batrachium fluitans*, *Lemna minor, Sagittaria sagitifolia* and *Scirpus lacustris* are found.

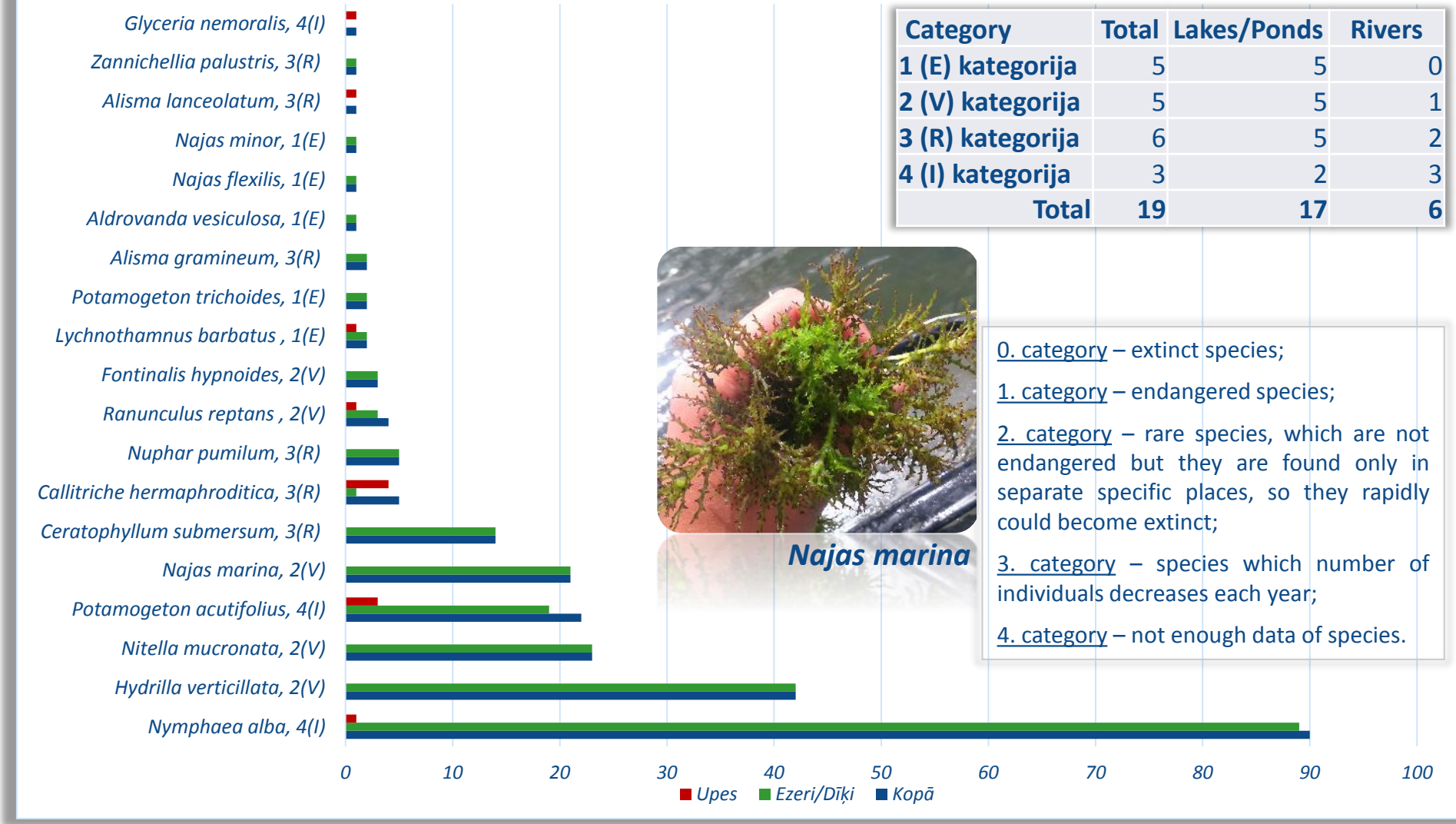
Nuphar lutea

Potamogeton perfoliatus

Sagittaria sagittifolia

In 39% of the river sites of type 2 and 47% of type 3 the plant cover (including algae) was estimated ≥25%. Plant cover exceeding 20-30% of the rivers width and length, is associated with eutrophication.

RARE AND PROTECTED MACROPHYTE SPECIES



Category	Total	Lakes/Ponds	Rivers
1 (E) kategorija	5	5	0
2 (V) kategorija	5	5	1
3 (R) kategorija	6	5	2
4 (I) kategorija	3	2	3
Total	**19**	**17**	**6**

Najas marina

0. category – extinct species;

1. category – endangered species;

2. category – rare species, which are not endangered but they are found only in separate specific places, so they rapidly could become extinct;

3. category – species which number of individuals decreases each year;

4. category – not enough data of species.

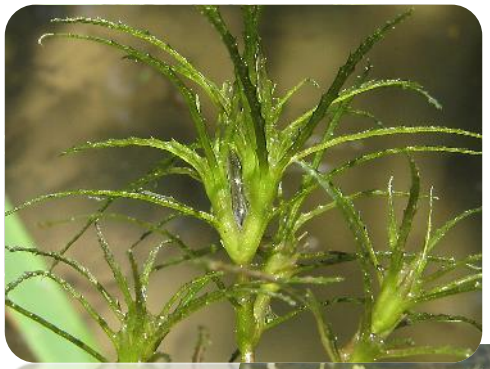
Number of waterbodies where species were found

MOST VALUABLE MACROPHYTE SPECIES – 1 (E) kategorija - endangered

Species	Site name	Site code
Aldrovanda vesiculosa	Apvardai	LTL225
Lychnothamnus barbatus	Liškiavis Lake	LTL194
Lychnothamnus barbatus	Balsys (Žalieji ežerai)	LTL509
Najas flexilis	Dringis	LTL229
Najas minor	Dūkštas	LTL313
Potamogeton trichoides	Dūkštas	LTL313
Potamogeton trichoides	Antanavo HE tvenkinys	LTL243

Lychnothamnus barbatus is one of the rarest and the most threatened Charophyta species in the world. In Lithuania it occurs northernmost in the Europe. Occurrence of *L. barbatus* indicates low trophic state of waters.

Najas flexilis



Najas minor

Potamogeton trichoides

Aldrovanda vesiculosa is a rare freely floating aquatic carnivorous plant. It's found in mesotrophic waters. Species has serious decline during this century, it's almost extinct in Western Europe.

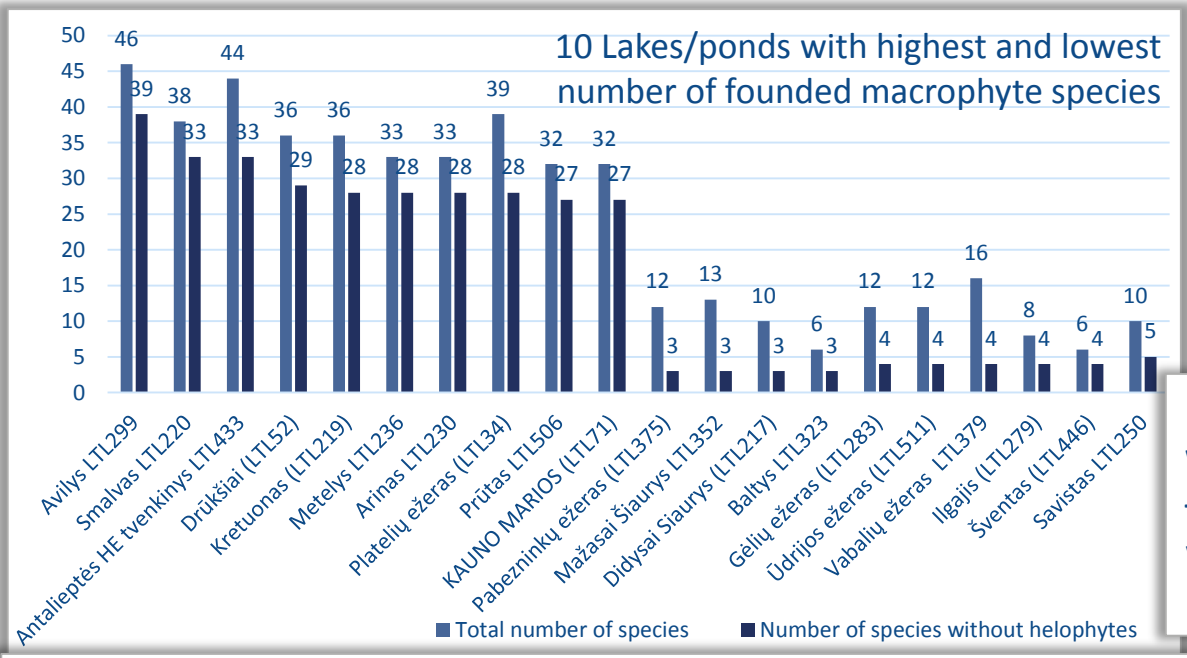
MOST COMMON BENTHIC MACROALGAE IR RIVERS

Most common taxons are *Ulothrix*, *Phormidium, Mougeotia*, *Cladophora*, *Rhizoclonium*, *Oedogonium*. Dominant species is *Cladophora glomerata.*
The greatest variety of benthic algae have been found on a hard substrate (stones). Limitating factors for the growth of algae - flow rate, sandy substrate, great depth and shading.



In monitoring site Jūra ties Mociškiais and Širvinta pasienyje, aukščiau Lauckaimio rare species *Thorea hispida* was found. It's species of Red List of threatened algae, in some countries it's critically endangered.
Thorea hispida is valuable indicator of waters with low organic pollution.


NUMBER OF MACROPHYTE SPECIES IN LAKES AND PONDS



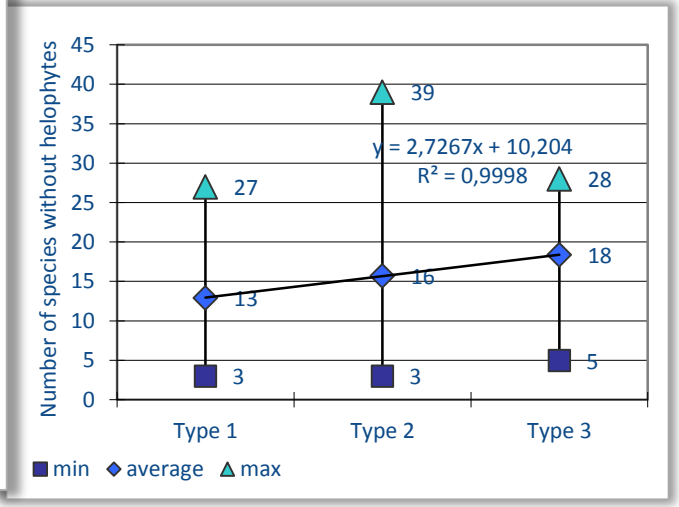
Number of macrophyte species increases with increasing average depth of the lake – sumberged macrophytes, which are more widely found in deeper lakes are richest macrophyte group in number of species

There is significant positive correlation

- between total number of macrophyte species without helophytes and *EKS.* Well developed sumberged vegetation characterizes lakes with good ecological status.
- between water transparency and maximum depth of plant grow and between maximum depth of plant grow and number of species.

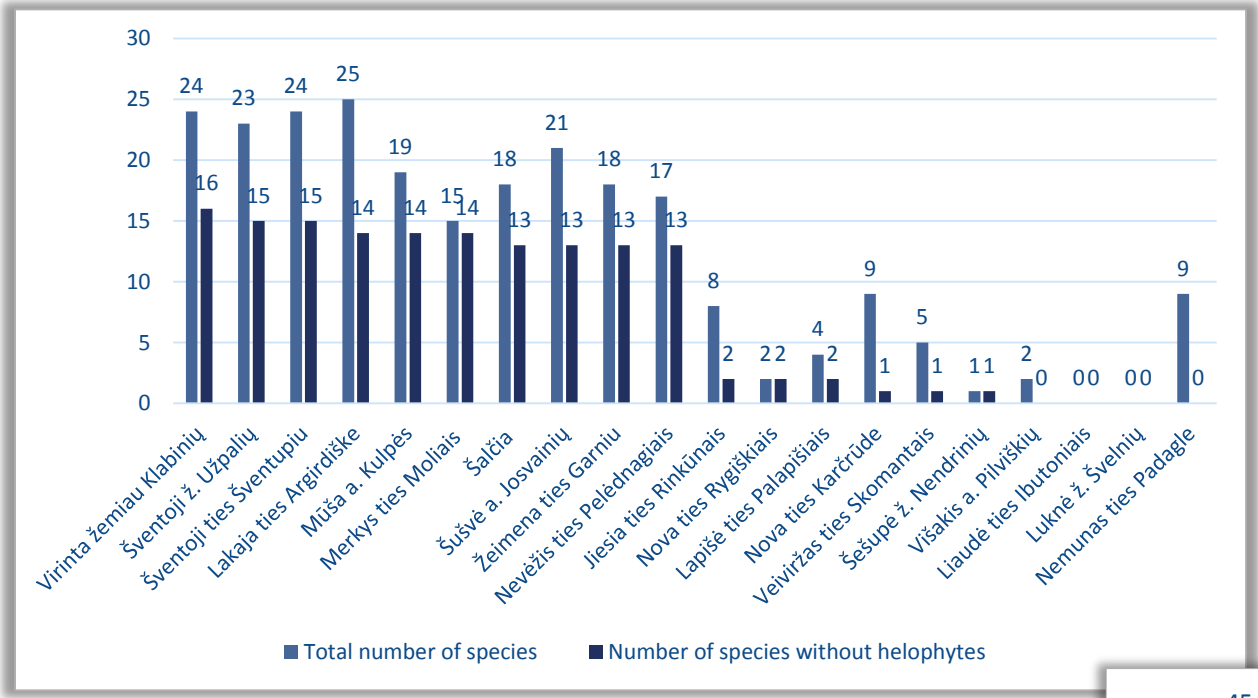
Light availability is a key factor, which determines macrophyte growth. Higher water transparency leads to colonisation of macrophytes to greater depths.

1-m increase in water transparency is accompanied by the addition of 1.6 macrophyte species.



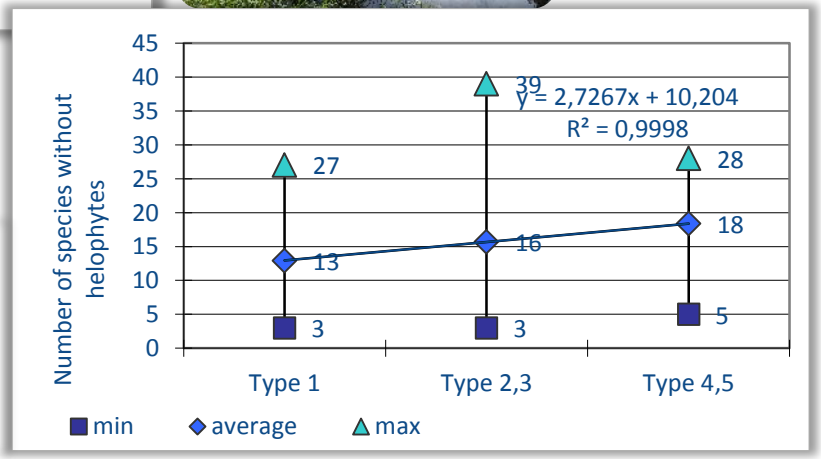
NUMBER OF MACROPHYTE SPECIES IN RIVERS

10 rivers with highest and lowest number of founded macrophyte species



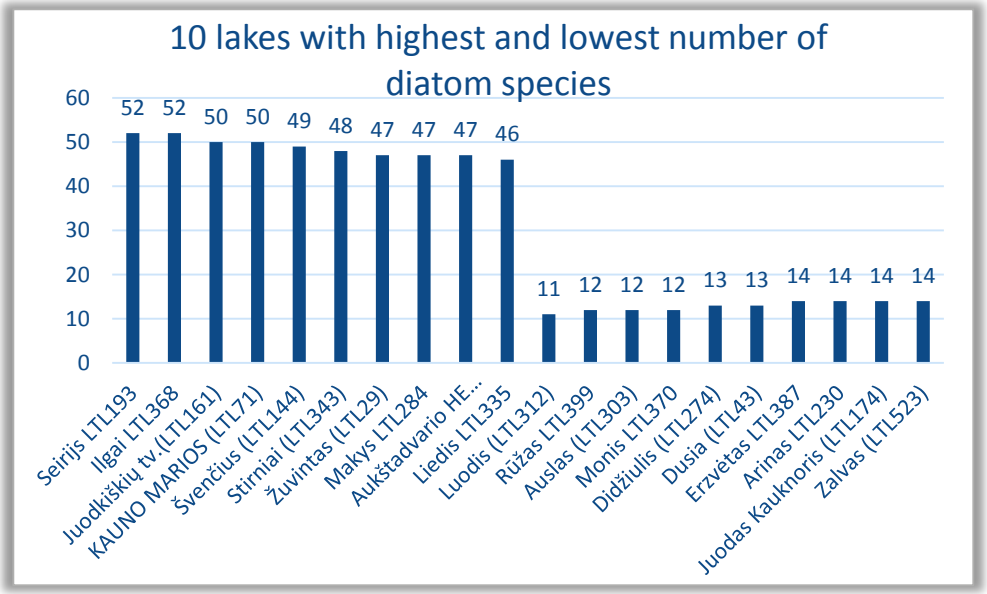
Large rivers have higher diversity of macrophytes than small rivers.

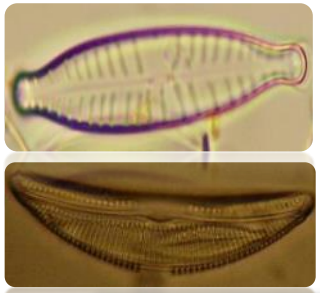
Among the all factors, substrate type and shading has the most significant impact on the number of macrophyte species and cover in the middle-sized rivers, but the mean depth was the limitating factor in large rivers.

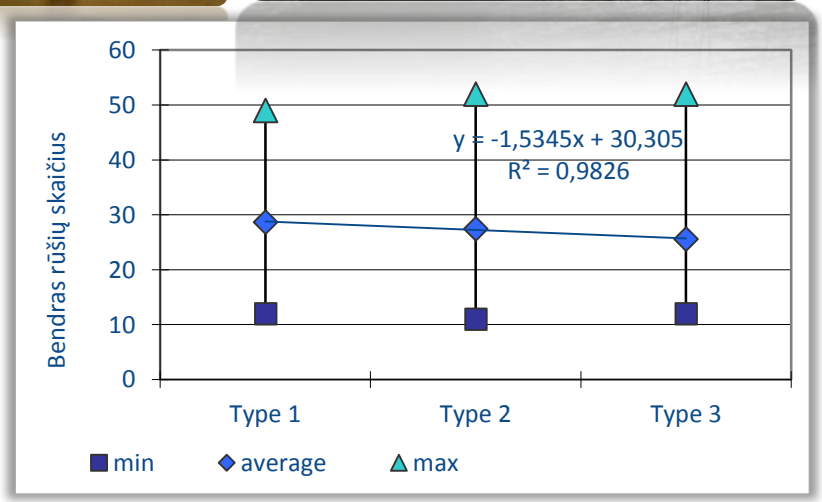


DIATOM SPECIES COMPOSITION AND ABUNDANCE

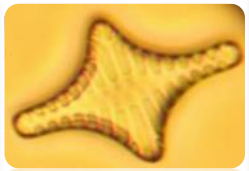
- Most common species in lakes were *Achnanthidium minutissimum, Amphora pediculus, Encyonema minutum, Epithemia adnata, Gomphonema parvulum*, *Navicula radiosa* and *Rhopalodia gibba.*
- Most common species in ponds were *Achnanthidium minutissimum, Amphora pediculus, Cocconeis pediculus, Cyclotella meneghiniana* and *Nitzschia dissipata.*
- Most common species in rivers were *Achnanthidium minutissimum, Amphora pediculus, Cocconeis placentula incl. varieties, Fragilaria capucina, Gomphonema parvulum Navicula cryptocephala ,Navicula* spp., *Nitzschia* spp., *Nitzschia dissipata* and *Rhoicosphenia abbreviate.*





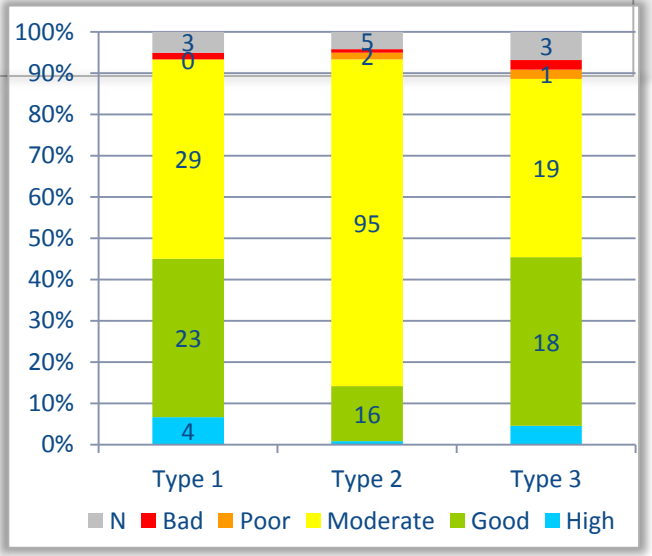


No correlation were found between number of diatom species and number of macrophyte species and ecological quality.

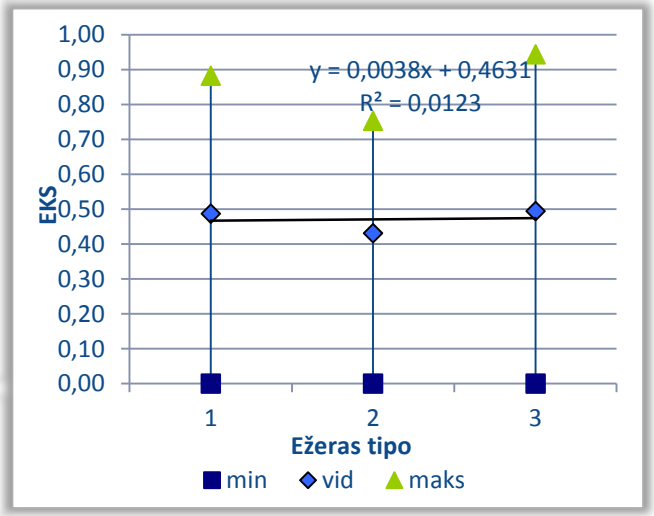


ECOLOGICAL QUALITY OF LAKES

Overall, 3% of lakes have high ecological quality, 25% - good, 64% - moderate, 1% - poor, 1% - bad, 5% of lakes are without assessment.



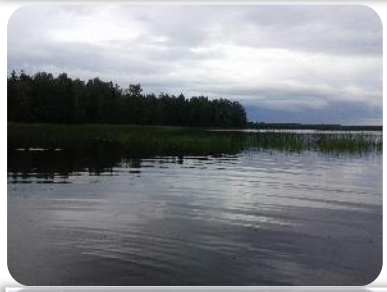
- Most common possible reasons for not achieving good status:
  - **Agriculture** (surface runoff, melioration canals), for example, Svėdasas, Babrų, Vidinkstas, Lamėstas, Erzvėtas, Lėnas.
  - Impact from **agglomeration**, along with pressure from **recreation**, for example, Vievis, Vilnoja.
  - **Impact from rivers**, for example, Liedis, Utenas, Utenykštis.
  - **Historical pollution**, Glūkas, Baltas, Mažasai Šiaurys.
- Most common reason that causes absence of macrophytes and incalculable *EKS* :
  - Steepness of the shore, connected with the origin of the lake , for example, Nečiūnu, Ilgis (LTL394), Ilgis (LTL306), Ilgys, Ligajai.
  - High water chromaticity, for example, Pabezninku.



Results of 2014 showed trend that ecological quality increases with increasing depth of lakes, results of 2015 doesn't show such correlation.

LAKES WITH HIGHEST AND LOWEST ECOLOGICAL QUALITY

Nr.	Lake	MEI	EKS	Quality
1	Gludas LTL501	78.04	0.89	High
2	Ilgutis LTL380	76.45	0.88	High
3	Germantas LTL256	55.1	0.78	High
4	Viešintas LTL383	51.83	0.76	High
5	Kertuojai LTL227	37.91	0.69	Good
6	Draudenių LTL205	35.54	0.68	Good
7	Amalvas LTL244	36.96	0.68	Good
8	Prūtas LTL506	25.92	0.63	Good
9	Siesikų LTL280	26.26	0.63	Good



Type 1

Germantas

Nr.	Lake	MEI	EKS	Quality
1	Kavalys LTL465	-40.81	0.3	Moderate
2	Jiezno LTL463	-100	0	Bad

Kavalys

Nr.	Lake	MEI	EKS	Quality
1	Snaigynas LTL252	50.68	0.75	High
2	Obelija LTL247	31.86	0.66	Good
3	Zalvas LTL523	32.02	0.66	Good
4	Glėbas LTL377	25.19	0.63	Good
5	Metelys LTL236	24.56	0.62	Good

Type 2

Snaigynas

Nr.	Lake	MEI	EKS	Quality
1	Vilnoja LTL365	-34.2	0.33	Moderate
2	Kavišķis LTL395	-34.41	0.33	Moderate
3	Kernavas LTL507	-42.99	0.29	Moderate
4	Didysai Siaurys LTL217	-58.06	0.21	Poor
5	Atesys LTL248	-60.29	0.2	Poor
6	Didžiulis LTL134	-100	0	Bad

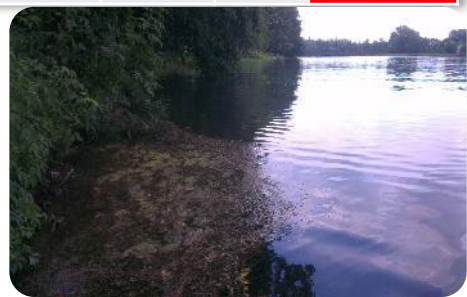
Atesys

Nr.	Lake	MEI	EKS	Quality
1	Šlavantėlis LTL515	76.57	0.88	High
2	Aviris LTL181	67.27	0.84	High
3	Dusia LTL43	40.74	0.7	Good
4	Luokesai LTL158	37.57	0.69	Good
5	Akmena LTL460	31.82	0.66	Good
6	Vencava LTL226	31.26	0.66	Good
7	Baluošas LTL211	28.84	0.64	Good
8	Balsys LTL509	27.76	0.64	Good
9	Šlavantas LTL177	27.74	0.64	Good

Type 3

Balsys

Nr.	Lake	MEI	EKS	Quality
1	Giluitis LTL500	-34.66	0.33	Moderate
2	Karvys LTL363	-37.39	0.31	Moderate
3	Luka LTL468	-47.62	0.26	Moderate
4	Glūkas LTL234	-71.55	0.14	Poor
5	Totoriškių LTL467	-100.00	0.00	Bad

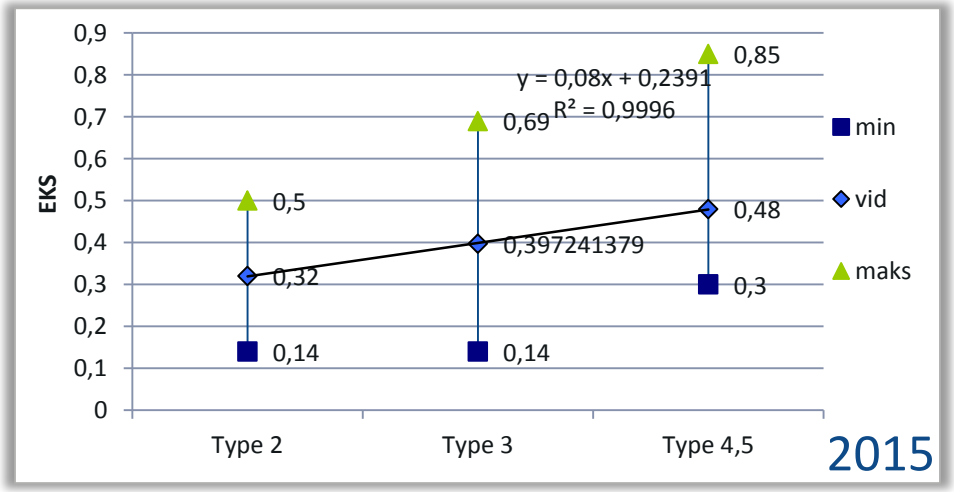


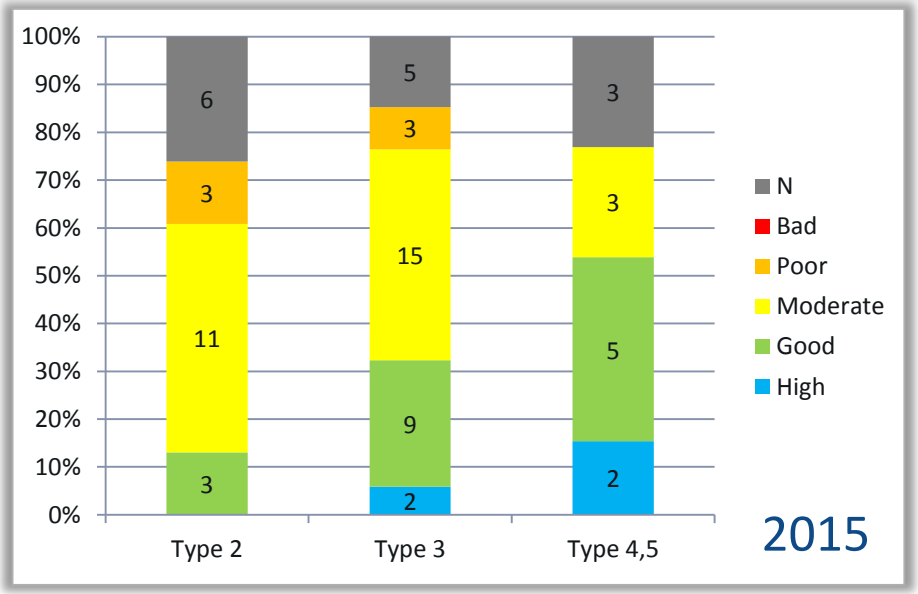
Luka

ECOLOGICAL QUALITY IN RIVERS (2015)

In 2015 EPA has corrected/specified the methodology for river MRI calculation and ecological status classes boundaries. So results of 2014 and 2015 are not comparable in one graph.

Overall, in 2015 6% rivers have high ecological quality, 24% - good, 41% - moderate, 9% - poor, 0% - bad, 20% are without assessment.





In the further surveys would be recommended to choose possibly less shaded sites on the rivers to avoid the lack of macrophyte and algae species.

RIVERS WITH HIGHEST AND LOWEST ECOLOGICAL QUALITY (2015)

Nr.	Monitoring station		RI	EQR	Quality
1	Nedzingis ties Burokraisčiu	LTR1299	67,5	0.69	High
2	Grūda ties Puvočiais	LTR1300	29,6	0.65	High
3	Jara-Šetekšna ties Gučiūnais	LTR1505	0	0.5	Good
4	Tenenys ties Miestaliais	LTR284	40	0.55	Good
5	Širvinta aukščiau Širvintų	LTR56	0	0.5	Good
6	Šešuvis ties Taubučiais	LTR217	0	0.5	Good
7	Dabikinė žemiau Akmenės	LTR475	-0,58	0.5	Good
8	Dysna ties Mieliatilčiu	LTR354	-3,7	0.48	Good
9	Upytė ties Margioniais	LTR376	-2,6	0.48	Good
10	Vokė ties keliu Nr. E28	LTR204	24,1	0.47	Good
11	Šventoji ties Dusetomis	LTR334	-5,5	0.47	Good

Dabikinė žemiau Akmenės

Monitoring station		RI	EQR	Quality
Šventoji žemiau Kavarsko	LTR1575	100	0.85	High
Merkys ties Moliais	LTR1447	21,4	0.61	High
Šušvė aukščiau Josvainių	LTR260	28,3	0.49	Good
Nevėžis ties Naujamiesčiu	LTR1249	-7,1	0.46	Good
Neris ties Saidžiais	LTR1342	-7,1	0.46	Good

Nevėžis ties Naujamiesčiu

Type 4,5

Šventoji žemiau Kavarsko

Type 2,3

Nr.	Monitoring station		RI	EQR	Quality
1	Pilvė ties Antanavu	LTR1395	-43	0.28	Moderate
2	Obelis ties Žemaisiais Kapliais	LTR1500	-44,3	0.28	Moderate
3	Siesartis ties keliu Nr. 3806	LTR1509	-43,8	0.28	Moderate
4	Šventoji žemiau Užpalių	LTR351	-46,7	0.27	Moderate
5	Širvinta pasienyje, aukščiau Lauckaimio	LTR1511	-56,1	0.22	Poor
6	Akmena-Danė žemiau Kretingos	LTR75	-63,3	0.18	Poor
7	Kiršinas žemiau Sidabravo	LTR795	-67,3	0.16	Poor
8	Babrungas žemiau Plungės tvenkinio	LTR1379	-67,5	0.16	Poor
9	Šešupė žemiau Aukštosios Butkos	LTR1577	-72,5	0.14	Poor
10	Mituva Jurbarke	LTR232	-72,7	0.14	Poor

Kiršinas žemiau Sidabravo

Šešupė žemiau Aukštosios Butkos

FEW NUMBERS ABOUT LAKES

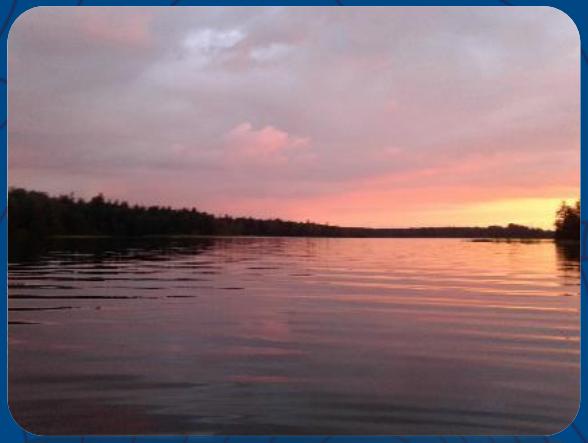
- Largest water body – Kauno Marios 47.5 km^2
- Water body with longest shoreline – Sartai 79 km (distance Panevėžys – Šiauliai)
- Water body with greatest maximum depth - Asveja 50.2 m
- Water body with greatest average depth – Šakarvai 16.5 m
- Water body with highest ecological quality - Gludas EKS 0.89
- Water body richest in number of macrophyte species - Avilys 46 species
- Water body richest in number of protected macrophyte species– Ilgis (LTL273), Avilys and Sausvingis 4 species
- Water body richest in number of diatom species – Seirijs and Ilgai (LTL368) 52 species
- Water body with highest number of transects – Kauno Marios 19 transects

Kauno Marios

Avilys

Sausvingis

THANK YOU FOR YOUR ATTENTION!


Contact person
Lauma Vizule - Kahovska
LVĢMC Inland waters division
lauma.vizule-kahovska@lvgmc.lv