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LITHUANIAN FUND FOR NATURE

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Monitoring of the Thick Shelled River Mussel *Unio crassus* (Philipsson, 1788) in Lithuania

International seminar:
Monitoring and restoration of freshwater (mussel) habitats

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dr. Grita Skujienė
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U. crassus discovery in Lithuania untill 2007

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H. Schlesh and C. Krausp (1937):

1) **Nemunas** and **Neris** River near Kaunas,
2) **Nemunas** River in the Alytus district and at Druskininkai,
3) **Nevėžis** River near Muniškiai;
4) **Laukesa** River near Zarasai.

P. Šivickis (collected 1929-1962):

- Shells of 13 individuals.

Since 2003 UCRA was included to the Lithuanian Red Book

3 (Rare) category (with low populations due to their biological characteristics).

Untill 2007 it was detected in 38 points (Fig. 2)

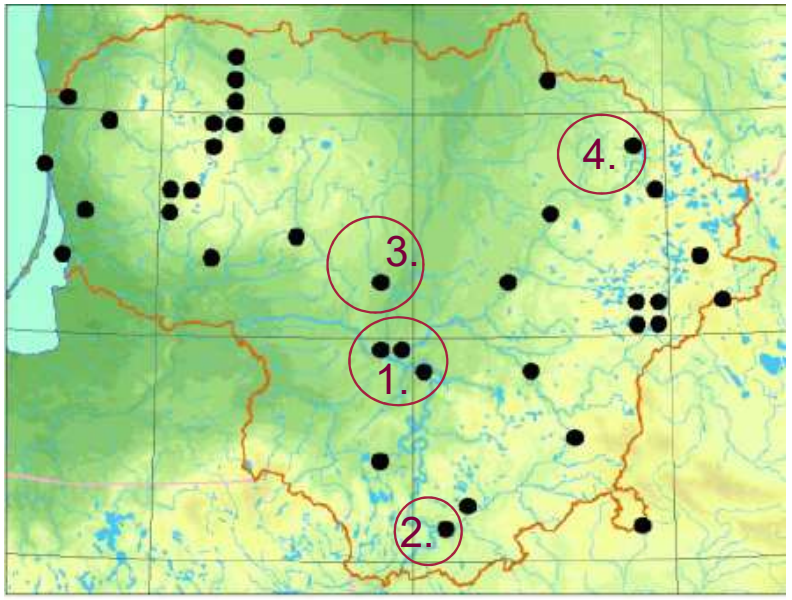

Fig 2. *Unio crassus detection untill 2007* (Lithuanian Red Book, 2007)**.**

Protection in Lithuania

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2010 July 15 Order No D1-621 "On Approving the Methodology for Calculation of Damage Caused to Lithuanian Protected Species and their Habitats", the basic damage calculation rate for the damaged molluscs and their habitats was established - 15 euros.

According Natura 2000 - 20 BAST teritories were established for the protection of *U.crassus.*

2017 June 28 Order No D1-553*:*

Unio crassus is protected in accordance with the legislation in force, only the construction of artificial dams and the destruction of river beds in or around the molluscs is restricted.

In planes: to maintain the current population level by regulating the activity of beavers and protecting habitats from potential pollution, in some places regulating water tourism.

The management work should be carried out only in areas where the conservation status of the molluscs are bad only in some fragments of rivers (Minija, Žeimena, Ula, Babrungas and other rivers) where the local population is an important part of the population monitoring of Lithuania.

Management plans were drawn up for only four rivers.

Monitoring methodology in Lithuania (Balčiauskas *et al.*, 2016)

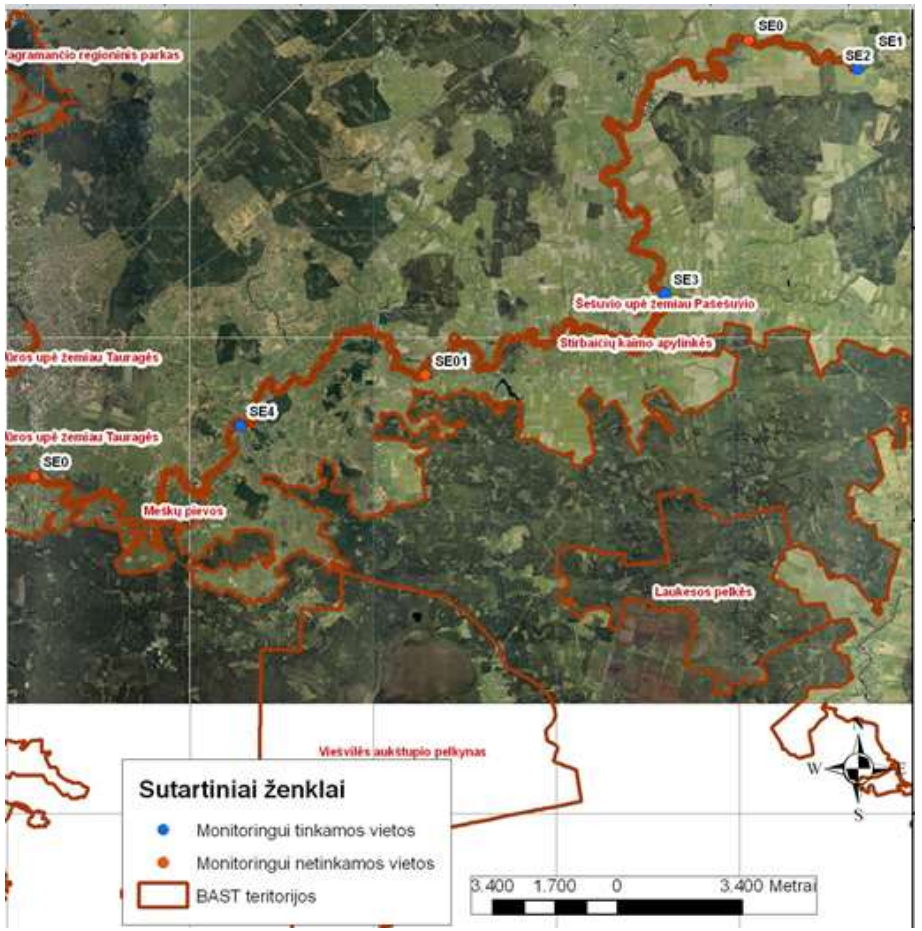
- Does not limited the amount of monitoring points, but not described how much;
- Recomend to select place with alive or died molluscs and collect specimens from 10 m^2 (not deeper than 0.1-0.6 m and not closer than 1 meter away) and repeat this collection in 3-5 sites not closer than 200 meters.

Problem:

- When river is more than 20 km - monitoring in 3-5 sites will cover only 1 km of river length !

For example:

Fig. 3. Šešuvis is 115 km long and its basin size is 1,916 km^2. Blue dots – good sites for monitoring; red dots – bad sites.



Recommendations:

How to make monitoring in one place (one site) - 10 study square meters were arranged not closer than per meter:

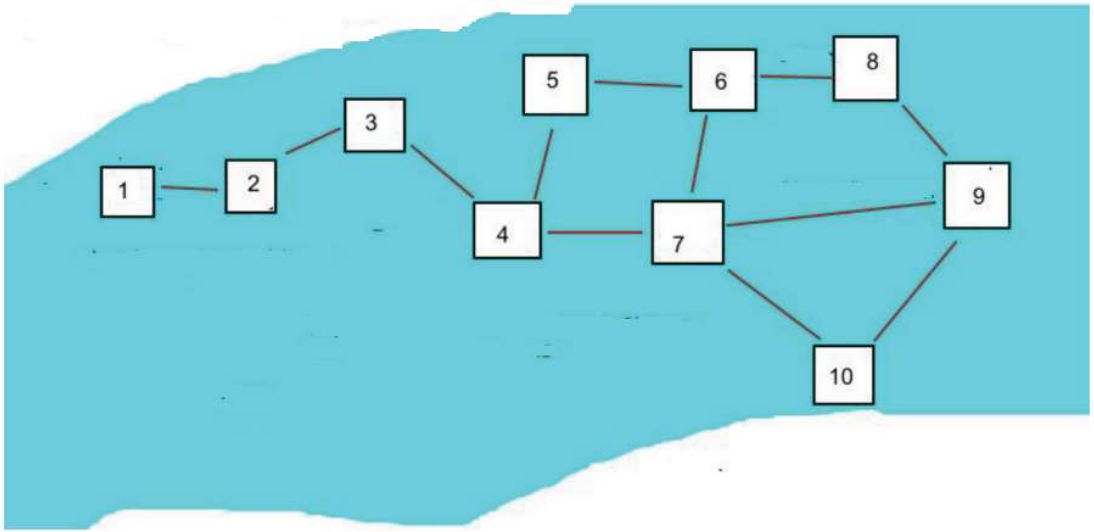


Fig. 4. Scheme of layout of squares of one site for observation of the UCRA (an example of arrangement) (diagram by Giedrius Vaivilavičius).

How to make analysis of results?

$$B_B = \sum_1^n Bn \ / \ n$$

The general scores are calculated by adding the scores for all criteria (features) and dividing them from the number of criteria used (in the case of an environmental features of 7 (Table 1).

n is the number of criteria, *Bn* is the score of the environment feature, B_B is the general score (average); *Pn* is the population condition criterion value, P_B is the general estimate of population abundance

$$P_B = \sum_1^n Pn / n$$

When BB, PB value is between 1-1.5, the state is considered to be excellent when BB, PB is 1.6-2.5 condition is good when BB, PB value> 2.5 is bad.

Table 1. **Registration of favourable, satisfactory, and bad abundance and environment features**

Score	Good conditions - 1 point	Satisfactory: 2 points	Bad conditions: 3 points
B1. River bed structure	Sand, gravel, without sludge	sludge layer < 5 cm	sludge layer > 5 cm
B2. Water quality	colourless / pale yellow; odourless	brown; can feel the smell of sludge	brown; has a chemical smell by pollution
B3. Water and riverside lightening	70 %-90 %	40-70 %	< 40 % or > 90 %
B4. Riverbed overgrowth plants	plants are absent	Overgrowth of aquatic plants < 10 %	Overgrowth of aquatic plants > 10 %
B5. Water flow regulation	is absent	variable natural affluent	artificial, stable barriers artificial coasts, fortifications
B6. Recreation	is absent	The river is used for tourism (several boats per day)	The river is used for tourism, fishing, has equipped beaches
B7. Fish	You can see it in small groups	Some individual fish	You can‘t see any fish
Abundance			
P1. UCRA ind./m^2	≥ 10 ind.	3-9 ind.	0–2 ind.

Results 1: First monitoring in 2008

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***U. crassus* was investigated in 7 Natura 2000 sites**

Average abundance:

1) Regional park of Labanoras:

- 2,14 (ind./ m^2);

2) Riešė River:

- 0 (ind./ m^2);

3) Šešuvis River:

- 1,2 (ind./ m^2);

4) Veiviržas River:

- 2,9 (ind./ m^2);

(5) Šalpės River:

- 11,9 (ind./ m^2);

(6) Zalvė River:

- 10,5 (ind./ m^2);

7) Žeimena River:

- 3,4 (ind./ m^2);

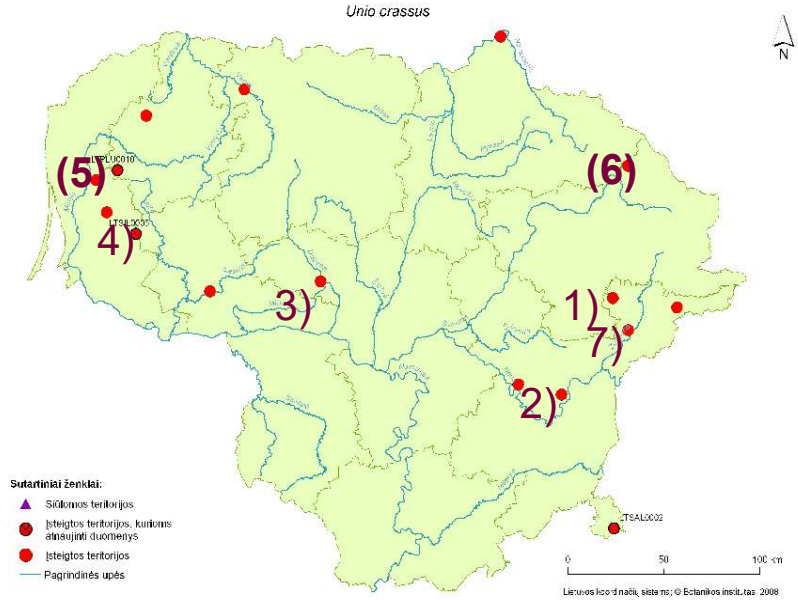

Fig 5. It was established 16 Natura 2000 sites for UCRA in Lithuania.

Favourable: more than 10 ind./ m^2 Satisfactory: 5-10 ind./m^2 Bad: 0-4 ind./ m^2

- **Species listed in Annex II of Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora**

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A)  B)  C) 

Fig. 6. UCRA in Labanoras regional park in Luknelė river:
A) is still found, but only old (0,3 ind/m^2); B-C) was not found.

It was found that the overall conservation status of this species was insufficient for the following reasons:

1) **it was not coordinated fish management with *U. crassus* conservation.**
2) **it was detected significant changes in the rivers' regimes by beavers (Fig. 6);**
3) **it was not correctly established protected areas (Fig. 7, Fig. 8).**

D)  E) 

Fig. 7. UCRA in Riešė river: D-E) was not found

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Main problems:

First, in some cases, the territory simply fell into private holdings and people people who do not have money - they are polluting and fishing too extensively; people who have money - they pay punishment and change and manage the river by themselves (Fig. 4).

Secondly, in some other cases, attempts have been made to reconcile several protected areas and territories have been reduced to one another without considering whether or not this place should be protected;

Thirdly, some areas of the big rivers have been isolated, where the sinking mollusc shells were found, and the mollusks lived much higher (Fig. 8).

Fig 8. UCRA in Šešuvis river under the Dacijonai bridge: (A) it hasn't been found alive UCRA; B) shells of dead Unionidae.

Problem: When Šešuvis became larger – (A-B) it is protected, but it is not under protection smaller rivers that flow into it. In this way, the largest population part remain completely unprotected.

The total population size of *U. crassus* was decided to be satisfactory for Lithuania, since the average abundance was low (only 4 ind./m^2) and some facts about species extinction in some rivers were obvious.

IUCN report: ,, Only in the Baltic countries and European Russia does the situation appears to be still relatively good for the species.“

Results 2: Monitoring in 2014-2015

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The state monitoring evaluated the status of *U.crassus* population in Lithuania in 20 BAST and 8 territories outside the BAST.

In 2014-2015 molluscs were found in state monitoring at the 18 rivers: Luknelė, Žeimena, Nemunėlis, Venta, Dubysa, Minija, Šešuvis, Veiviržas, Ančia, Šalpė, Aitra, Peršokšna, Uošnas, Babrungas, Šaltuona, Dūkštai, Lakaja, Jūra rivers.

Molluscs were not detected in the 6 rivers (Žvelgsa,Sėtikė, Aitra, Viešvilė, Pievis, Alantas, Trumpė) in 2015, and habitat conditions in these rivers were satisfactory.

State conclusion: monitoring of *U.crassus* in 2008 and 2015, show that slight population fluctuations have been observed, but the results obtained are within tolerable margins. Long-term observations are only from several rivers.

Results 3:
Inventory of *U.crassus* in 2016:

Aim:

1. To examine molluscs structure and abundance (number of individuals per square m^2) and to make habitat assessment in selected rivers.
2. To improve monitoring methodology☺

Fig. 9. Sedimentary rocks on UCRA from the river Pyvesa, Pasvalys‘ district

- Study on UCRA was carried out according to the contract No. VPS-2016-105-EU between Lithuanian Fund for Nature and the Lithuanian Ministry of Environment.
- Study was financed by the European regional development Fund of the Republic of Lithuania and the State budget, by the European Union's program of investment funds 5 priority "Environment, sustainable use of natural resources and adaptation to climate change“ 05.5 .1-EPMA-V-018 instrument for biodiversity protection.

Fig. 10. Map of Lithuania with selected areas for *UCRA* study in 2016

A total of 58 areas (not shorter than 20 km) were studied.

The first improvements:

1) not less than 3-5 sites per one river,
2) including checking the origins and junctions;
3) monitoring was starting to do after detection of alive mussels;
4) a mapping method was used for selection of the most similar and suitable for molluscs habitat areas per river for next place.

Fig. 11. Searching.

- *U. crassus* was inspected in 236 localities

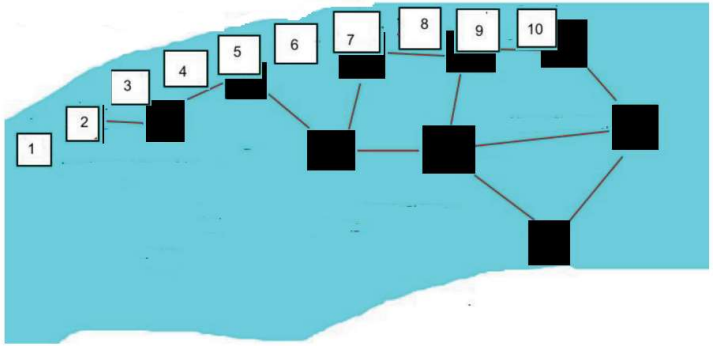

Fig. 13. The second improvement of monitoring: collecting by linear transect.

Fig. 12. Collecting.

Fig. 14. Grouping and identification.
From the left: *U. tumidus, U. pictorum and U. crassus*.

Results

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- The total length of studied rivers 3955.3 km, but appropriate for UCRA only 889.7 km (that is 22.5% of the surveyed rivers),
- The total habitat B_B = 1.7
- The total population status P_B = 2.4.
- The overall mean density of UCRA in these suitable for UCRA river parts is ≈ 8.7 ind./m^2.

$$B_B = \sum_1^n Bn / n$$

A)

B)

C)

Fig. 15. Some researchers (A) and *U.crassus* in Baltoji Ančia (max 168 ind./m^2) and in Strauja (max 423 ind./m^2). Photo by Remigijus Karpuška

Favorable situation:

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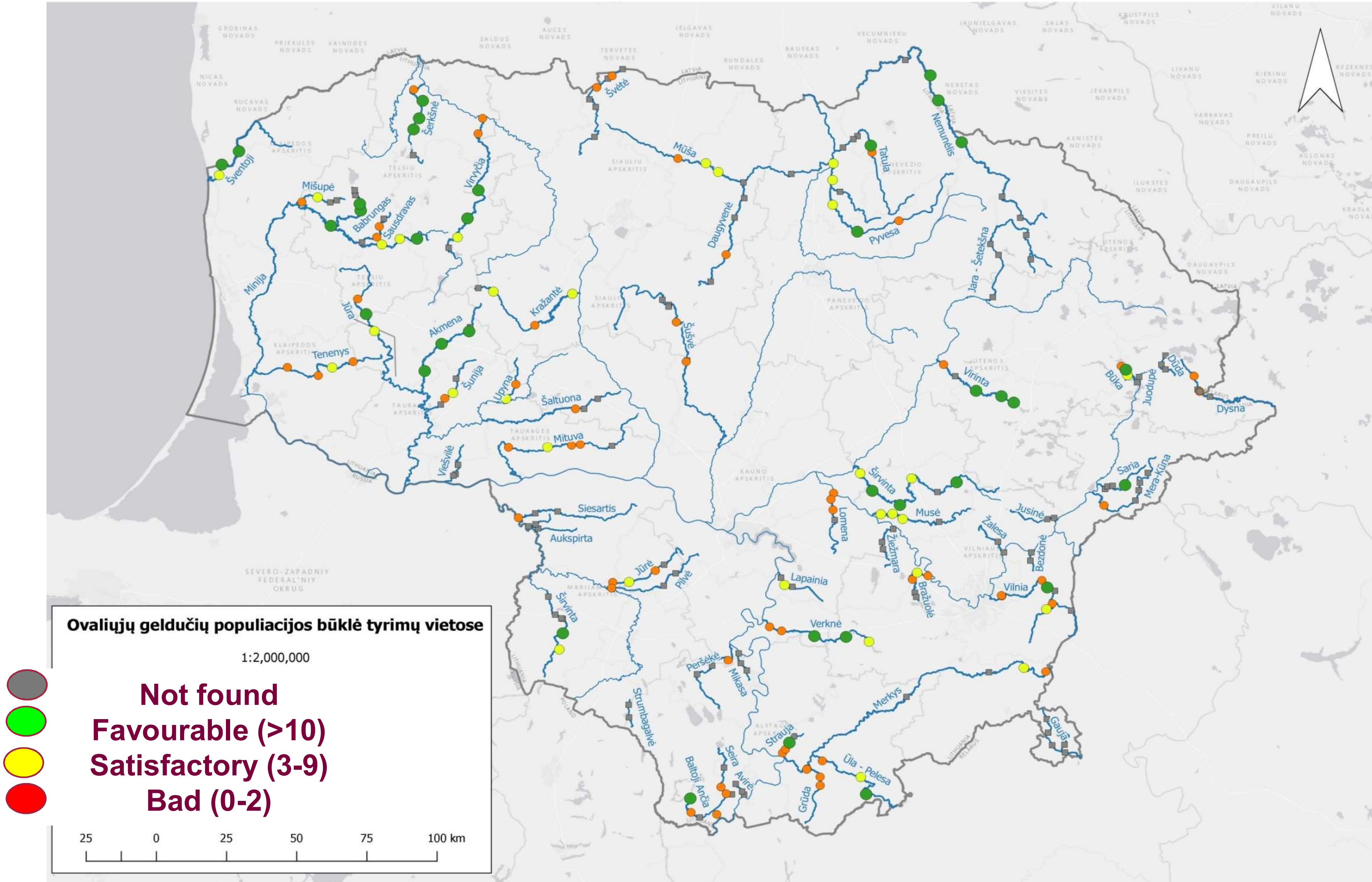
Strauja – only 14.3 km long, but UCRA - 72 ind./m^2.

The biggest abundance have been found in rivers of 51-75 km long:
Baltoji Ančia (82.2 ind./m^2), Virinta (37.6 ind./m^2), Šerkšnė (26.05 ind./m^2), Babrungas (21.8 ind./m^2), Šventoji (near Baltic Sea) (18.4 ind./m^2);

Less or the same abundance have been detected in longer rivers:
Virvytė (18.85 ind./m^2), Pyvesa (16.4 ind./m^2), Nemunėlis (16.1 ind./m^2), Akmena (16.6 ind./m^2), Šventoji (18.6 ind./m^2).

Fig. 16. Some researchers (A) and *U. crassus* in Virvytė. Photo by Remigijus Karpuška



Ovaliųjų geldučių populiacijos būklė tyrimų vietose
1:2,000,000
Not found
Favourable (>10)
Satisfactory (3-9)
Bad (0-2)
25 0 25 50 75 100 km
Šventoji
Mišupė
Babrungas
Sausdravas
Šerkšnė
Virvyčia
Minija
Jūra
Tenenys
Akmena
Šunija
Kražantė
Upyna
Šaltuona
Mituva
Viešvilė
Švėtė
Mūša
Daugyvenė
Šušvė
Tatula
Pyvesa
Nemunėlis
Jara - Šetekšna
Virinta
Būka
Dūda
Juodupė
Dysna
Širvinta
Musė
Lomena
Žiežmara
Bražuolė
Žalesa
Jusinė
Bezdonė
Vilnia
Saria
Mera-Kūna
Siesartis
Aukspirta
Jūrė
Pilvė
Lapainia
Verknė
Perškė
Mikasa
Strumbagalvė
Merkys
Gaujа
Strauja
Baltoji Ančia
Seira
Avirė
Grūda
Ūla - Pelesa

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Conclusions:

- When in 2016 *U. crassus* has been observed in 58 rivers in Lithuania, the disadvantages have been noted of monitoring methodology. Even when freshly-died molluscs populations were found, the results of the visual assessment of earlier mentioned factors were not different from the data in the places where the mussels were alive and abundant.
- We realized that new results by the ,,new“ monitoring methodics depends on the qualifications and good intentions of the researcher :)
- As factors of environmental features were described inaccurately, just only out of sight, we understand that ,,protective measures“ in some cases can totally destroy U.crassus populations.
- The real situation of *U.crassus* is not so good as it was describe by Lithuanian authority for IUCN

IUCN report: ,, Only in the Baltic countries and European Russia does the situation appears to be still relatively good for the species.“ Is it true?

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Thanks:
Danas Augutis[2], Remigijus Karpuška[2], Alvydas Gintaras[2], Dalia Bastytė[2], Giedrius Vaivilavičius[3], Jonas Skuja[1]

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