



Decline and conservation of the southern Finnish *Margaritifera margaritifera* populations

Jouni Taskinen

University of Jyväskylä, Finland

Hanna Suonia, Jukka Pakkala, Eero Mäenpää, Anu Suonpää, Juha-Pekka Vähä, Esko Vuorinen, Panu Oulasvirta & Per Jacobsen

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FRESHABIT LIFE IP (LIFE14 IPE/FI/023)



Photo: Panu Oulasvirta





Status of freshwater pearl mussel *Margaritifera margaritifera* populations

1. Glochidium production, host fish infestation, juvenile & adult survival ok

- Proportion of juvenile mussels 'high'
- *Viable*

2. Glochidia are produced but no/few recruits

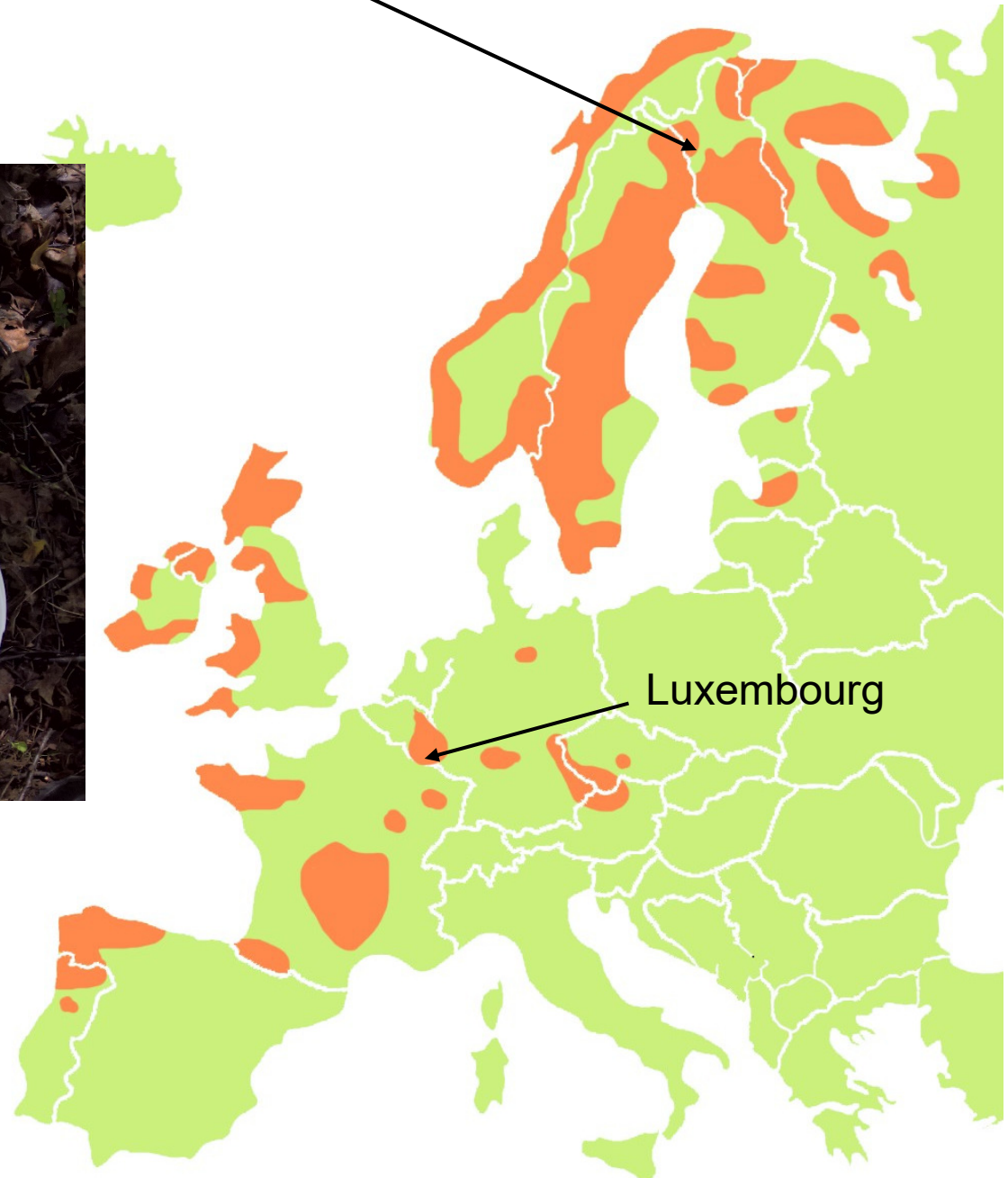
- Proportion of juveniles mussels low
- High mortality of excysted juveniles (sedimentation etc.)
- Slow decline
- *Maybe viable, non-viable/partly viable*

3. Glochidium production has stopped

- No juvenile mussels, no young mussels, very old individuals
- Steep decline
- *Dying out*
- → extinct in near future
- **Can larval production be restored?**

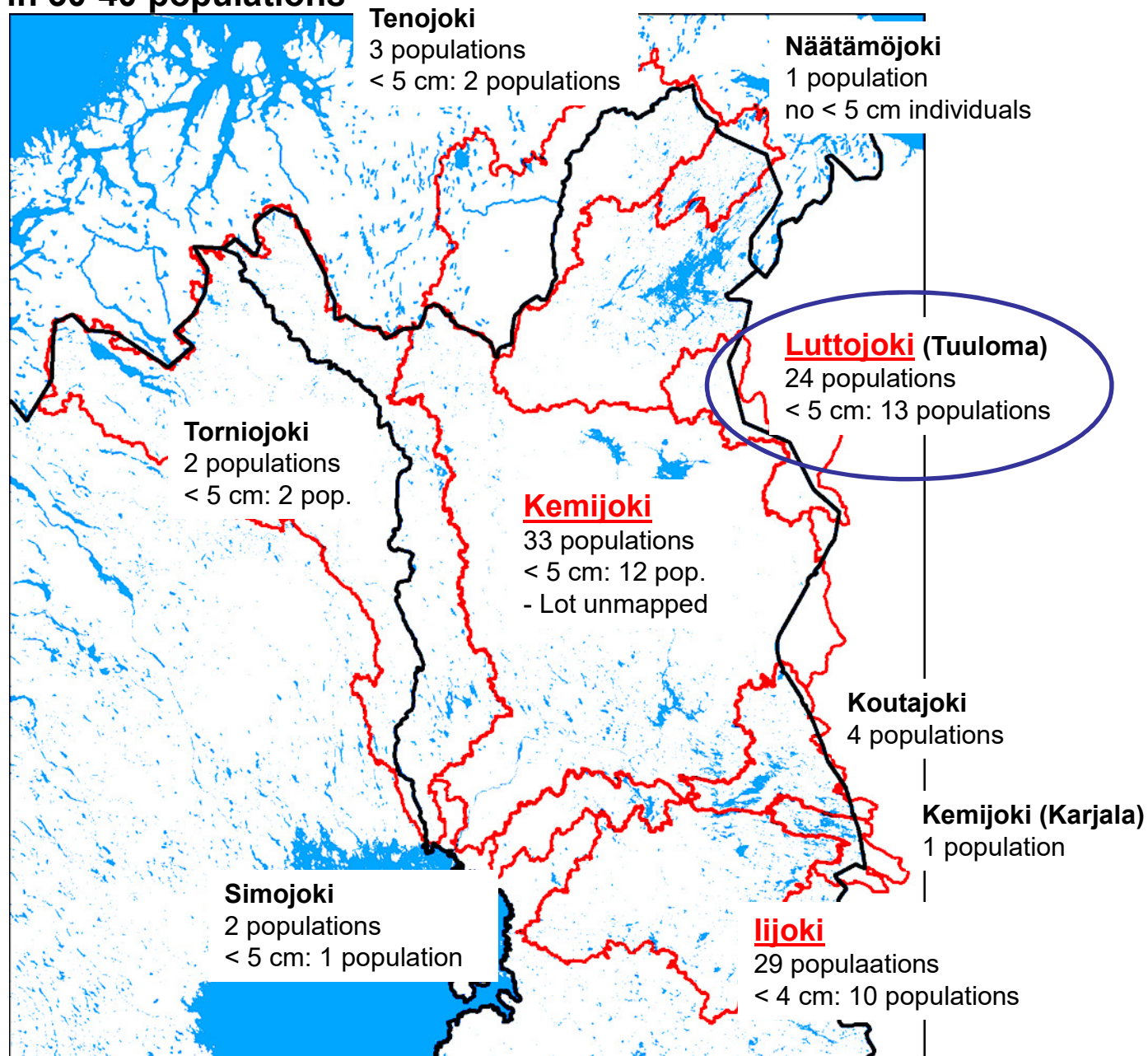
***M. Margaritifera* in Finland**

- 120 populations
- 2×10^6 mussels



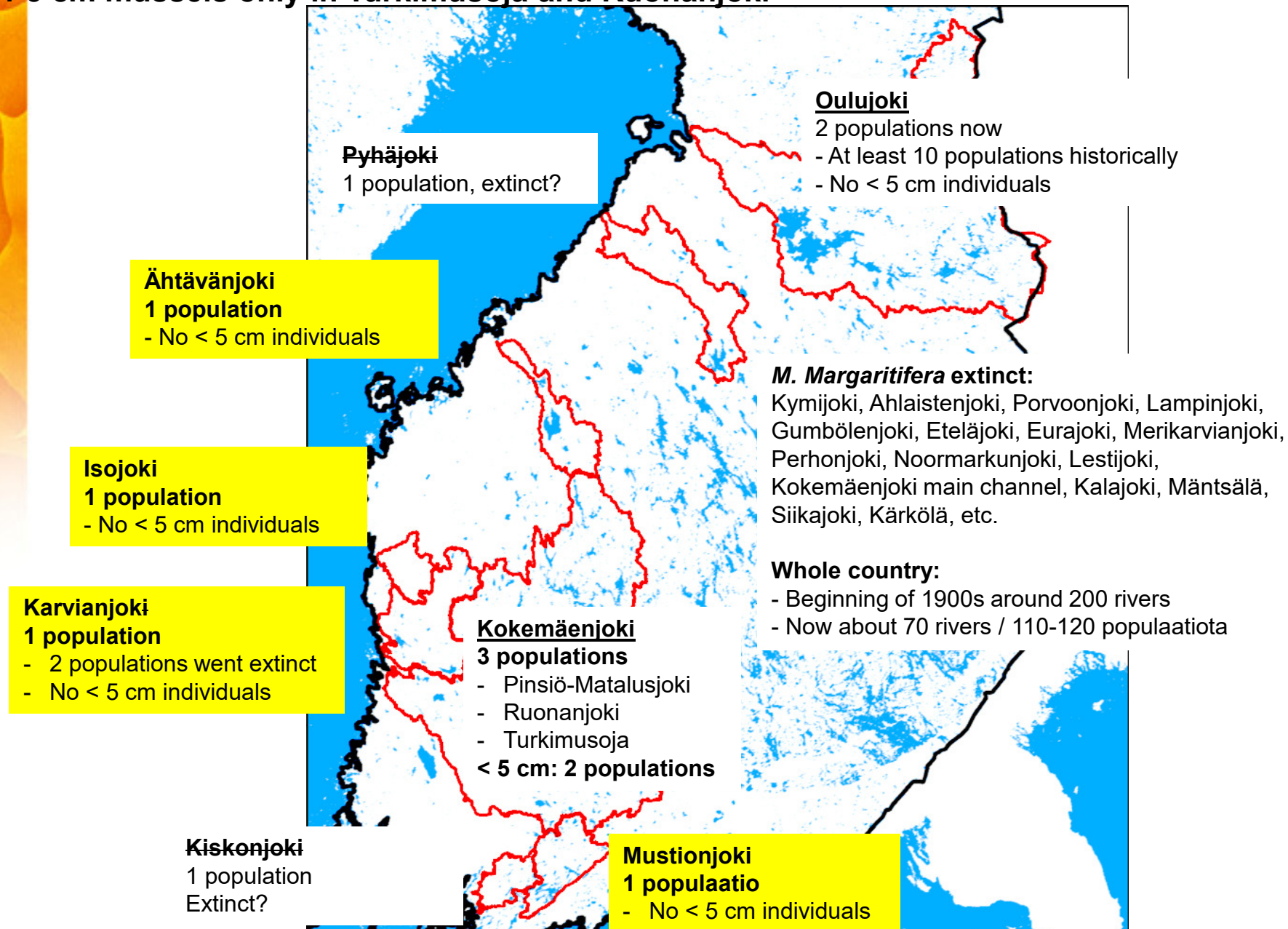
Northern Finland: 110 populations (e.g., Oulasvirta 2010 Tox & Env Chem)

- Small (1-2 cm) *M. margaritifera* in 5 populations
- < 4-5 cm mussels in 30-40 populations



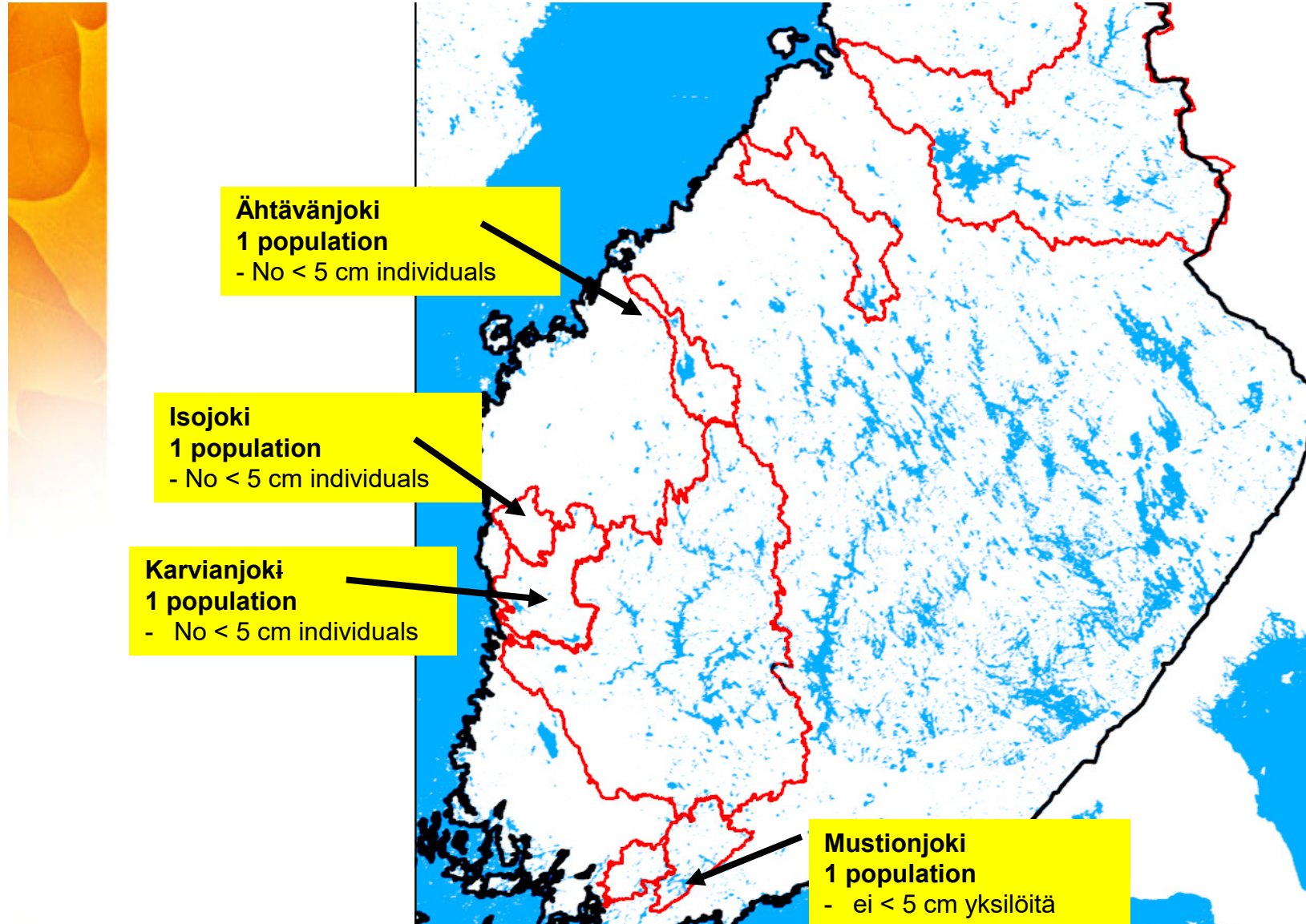
Southern Finland: 7 populations (Oulasvirta 2017 Biol Bull 44: 81-91)

- Small *M. margaritifera* (1-2 cm) only in Turkimusoja
- < 4-5 cm mussels only in Turkimusoja and Ruonanjoki



Last southern Finnish (coastal) *M. margaritifera* populations:

- River Ähtävänjoki (Esse å) ~ 500 individuals
- River Isojoki ~ 100 individuals
- River Karvianjoki ~ 300 individuals
- River Mustionjoki (Svart ån) ~ 1000 individuals



River Ähtävänjoki and River Mustionjoki dying out:

1. Populations decline rapidly

Estimated numbers of *M. margaritifera* (SCUBA diving; random transects on mussel beds).

River	1987	2003	2010	2016
Ähtävänjoki	50.000	10.000	3.500	500
Mustionjoki	-	-	2700	1000

2. Glochidia production has ended

Glochidia production of *M. margaritifera* (keeping in buckets, caging of hosts fishes).

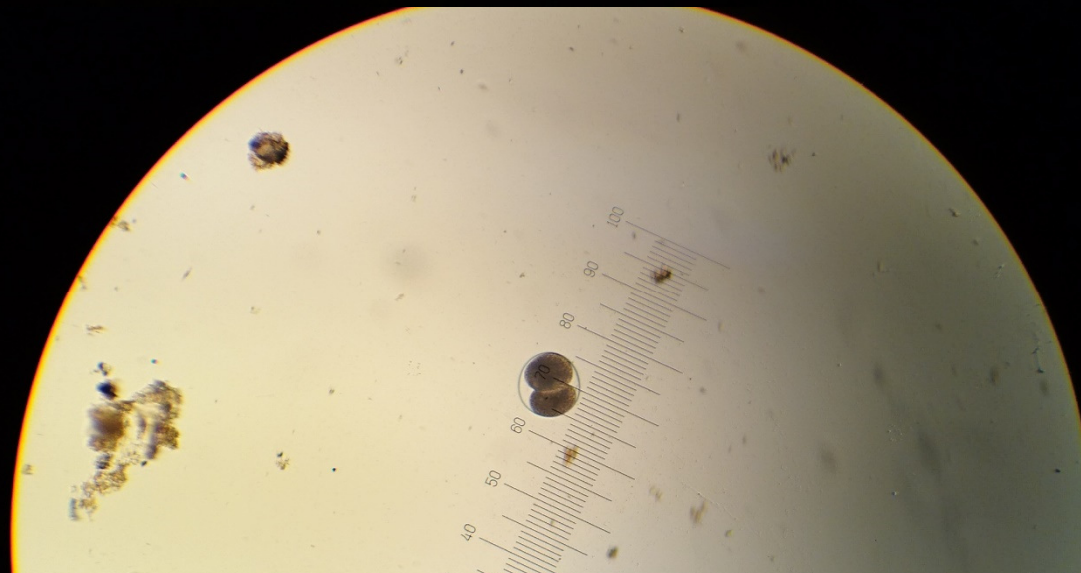
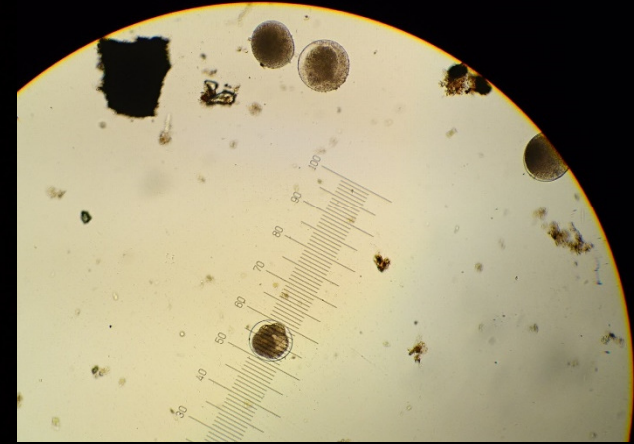
River	1987	2003	2010	2015	2016	2017	2018
Ähtävänjoki	Yes	Yes	?	No	No	No	No
Mustionjoki	Yes*	-	?**	No	No	-	-

**Based on current size distribution of mussels

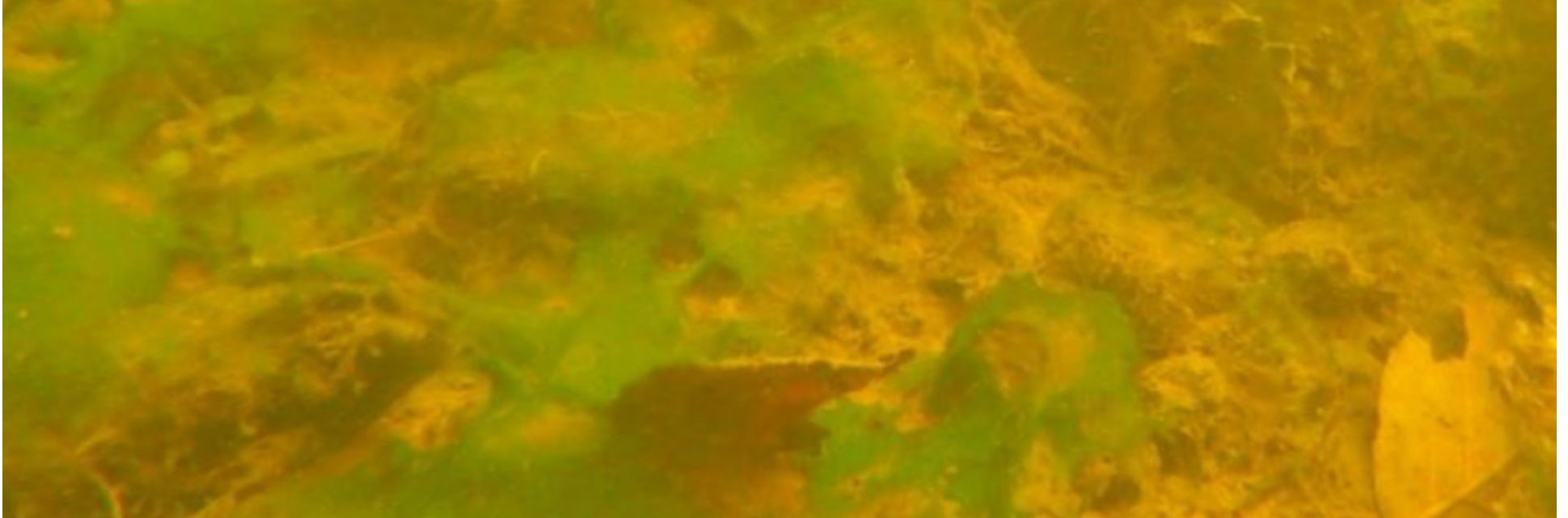
*Signs of gravidity observed in 2 specimens when gently opened

3. Individuals are very old

River Ähtävänjoki



River Mustionjoki



Is captive breeding too late? What can be done?

Call this guy ...



Prof. Per Jacobsen
(showing how to collect
good detritus!)

... and start captive feeding!

Adult *M. margaritifera* were transported to Konnevesi Research Station, University of Jyväskylä, in 2016 and 2017:

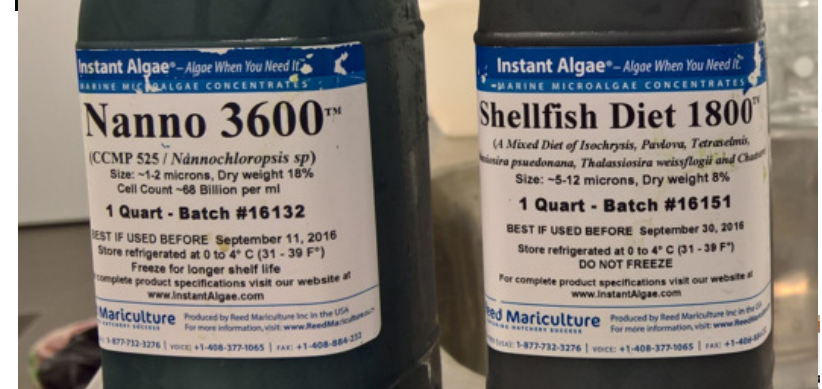
<u>River</u>	<u>Date</u>	<u>N of mussels</u>
Mustionjoki	4.11.2016	110 ind.
Ähtävänjoki	7.10.2016	66 ind.
Ähtävänjoki	20.10.2016	40 ind.
Ähtävänjoki	27.10.2016	46 ind.
Ähtävänjoki	10.10.2017	50 ind.
(Ähtävänjoki tot. 202 ind.)		
Karvianjoki	14.9.2017	100 ind.
Isojoki	14.9.2017	48 ind.

- In total, 470 freshwater pearl mussels



Conditions and maintenance

- 4 m² tank
- 10 cm gravel + some marbel gravel
- Flow though, Lake Konnevesi water (9 m / 3 m)
- Additional oxygenation (bubbles)
- Feeding with ShellFishDiet 1600 ja Nanno39600 –microalgae products (Reed Mariculture, USA)
- Feeding: Water flow turned off, feed added, pumps on to create water flow—start in the morning and stop in the evening.
- Pumps keep water flowing during the feeding
- Cleaning
- Temperature was increased to 17 degrees C in June, decreased slowly in September-October



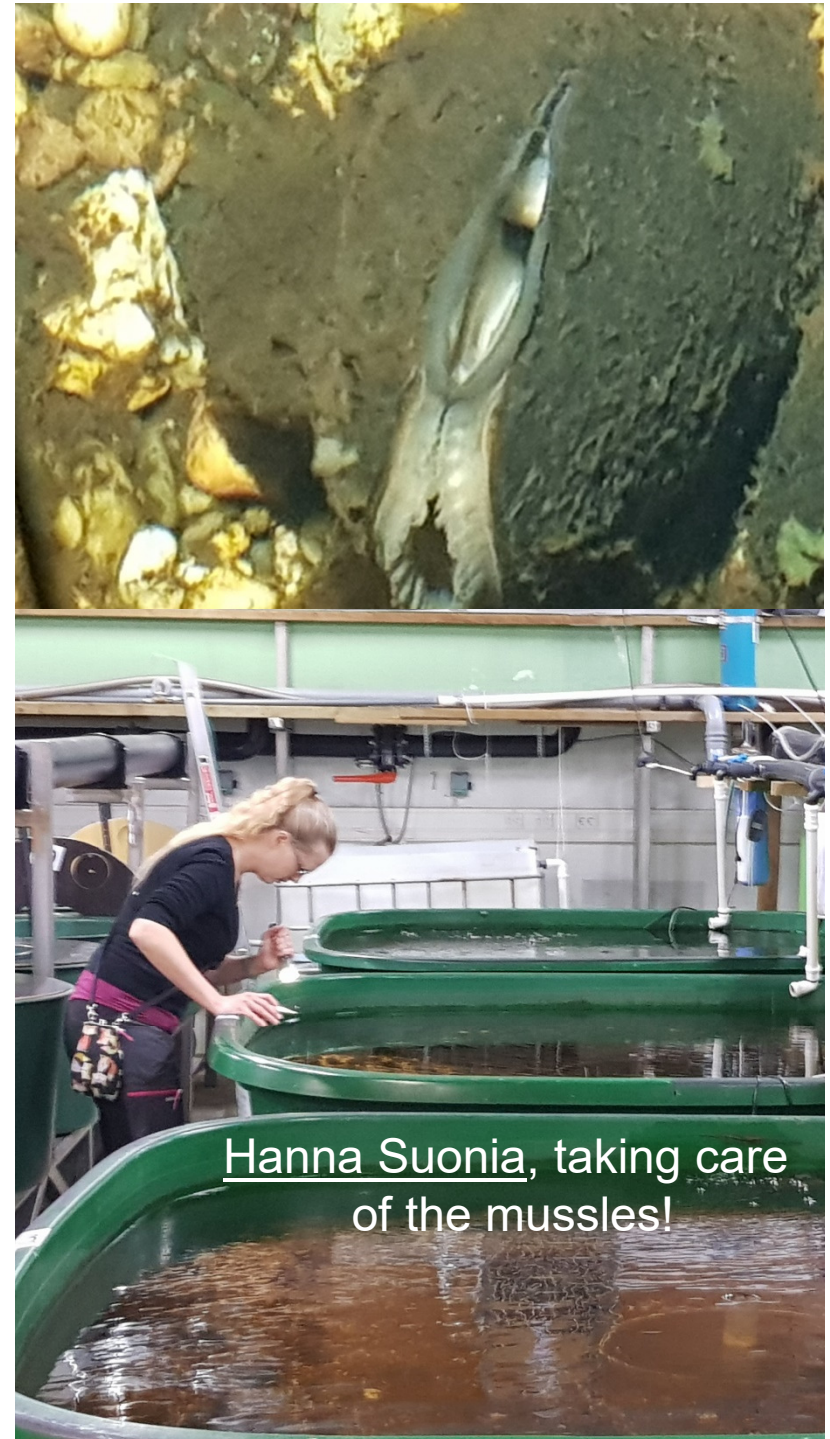
Results, 1st year (2016-17)

- No glochidia
- Condition of mussels become better (response to disturbance, moving & filtering activity)
- Partly high mortality (River Ähtävänjoki 4%, River Mustionjoki 14 % y^{-1})



Changes for the 2nd year

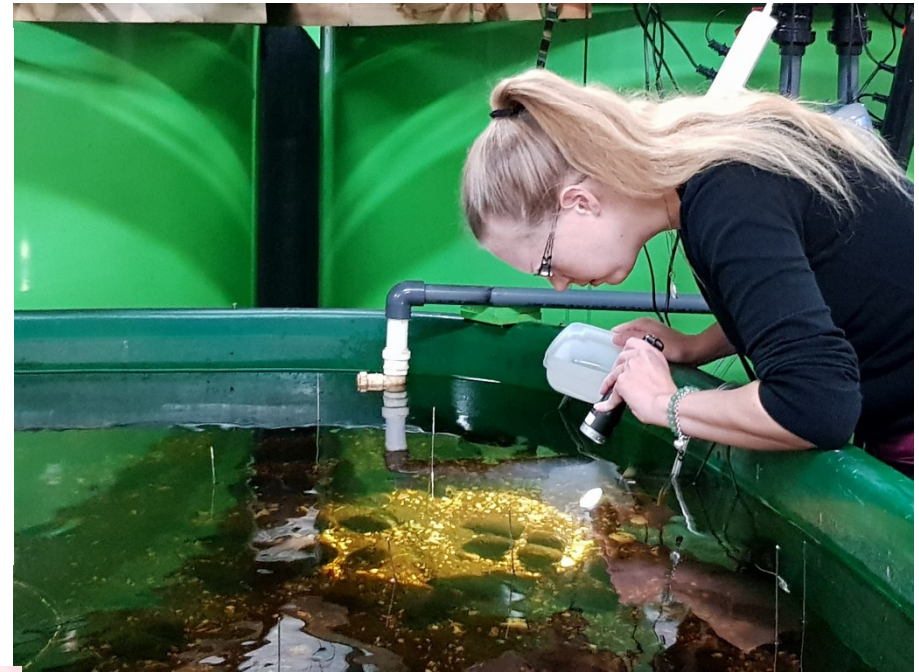
- Temperature increased to 17 C in June but kept 17 C until the end of October (varied 17,0-18,5 C)
- New pipe line to get water from surface (1 m) Lake Konnevesi (warm, contains natural food)
- Bigger pumps to create stronger current during feeding
- Feeding 5 days a week during winter, every day during summer
- Individual care: weak mussels in up right position, inhalent siphons against flow

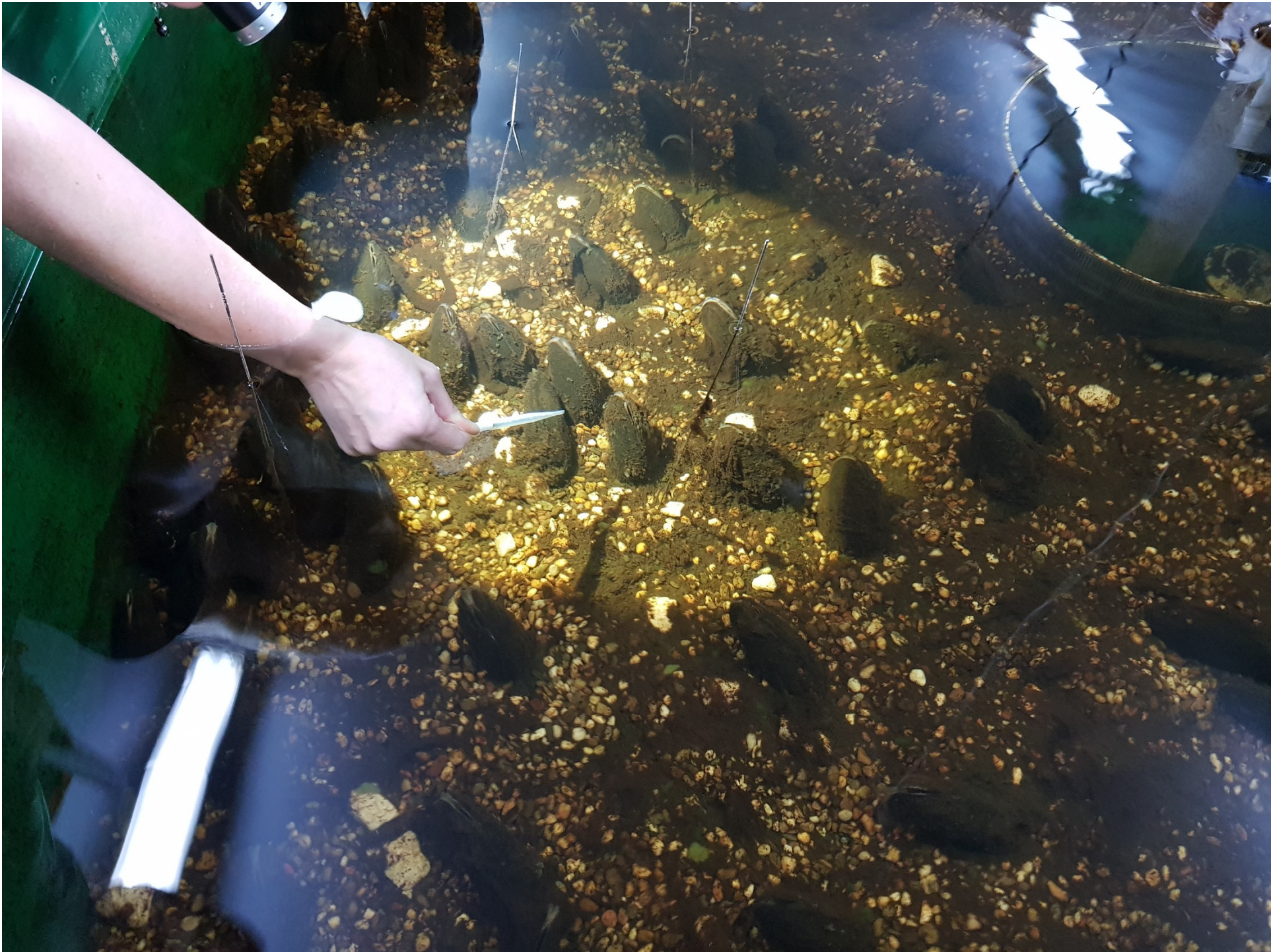


Hanna Suonia, taking care of the mussels!

Results, 2nd year (2017-18)

- Condition of mussels become even better (response to disturbance, moving & filtering activity)
- Mortality decreased (River Mustionjoki from 14 % to 8 % y^{-1})
- **Glochidia release started in autumn 2018!**

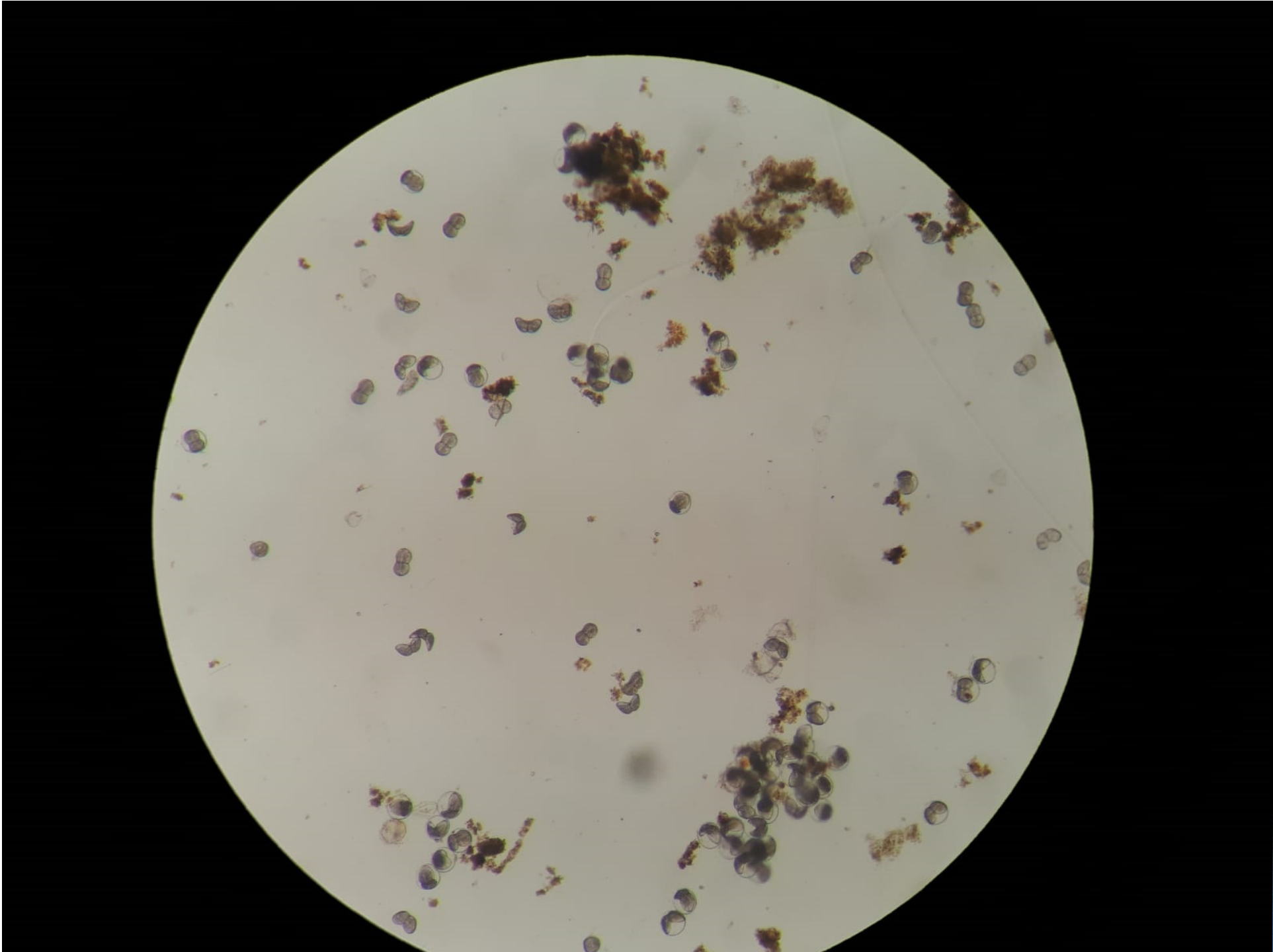


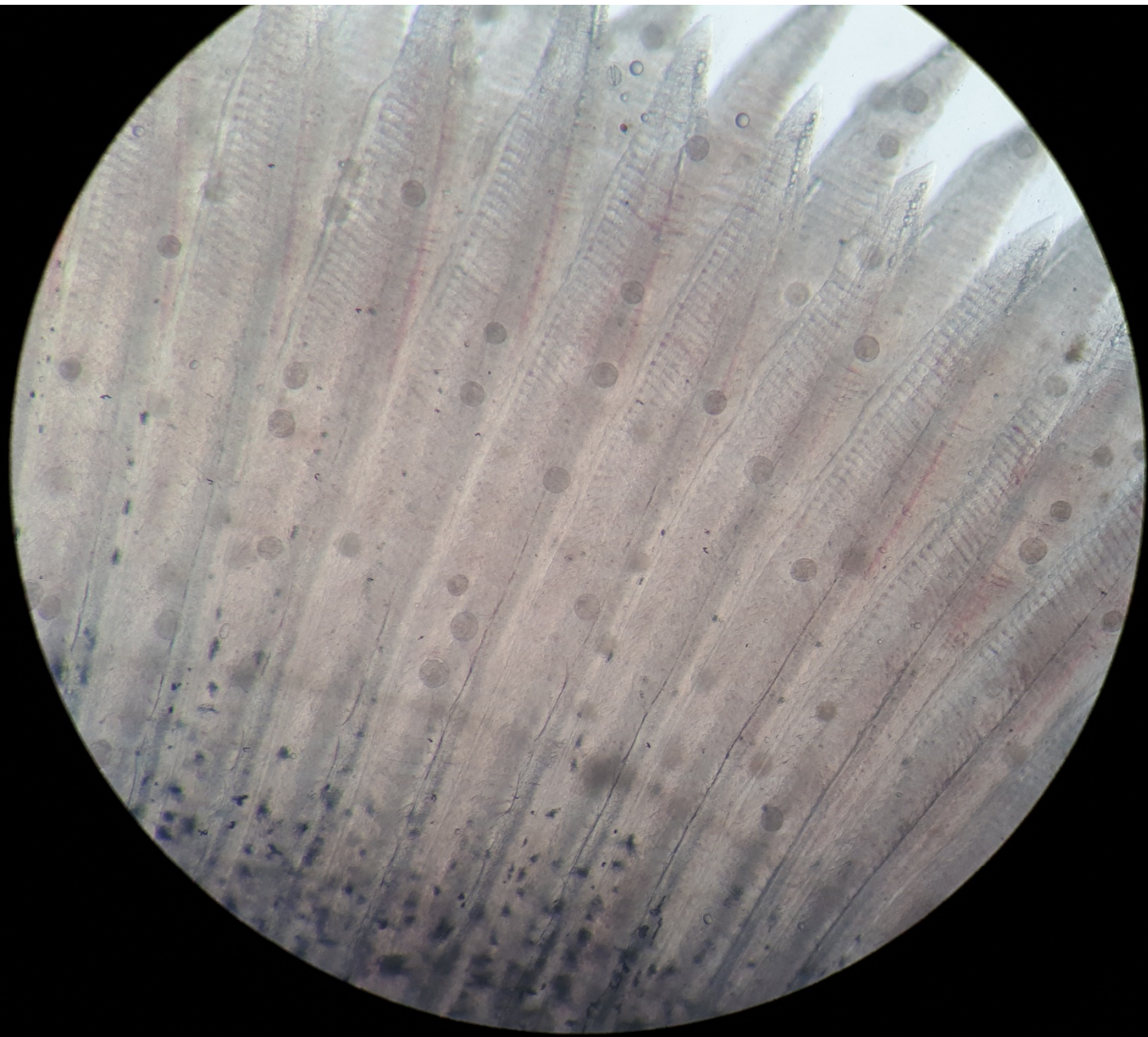












Shedding of glochidia

<u>River</u>	<u>Period</u>	<u>Duration; n collected</u>	<u>Shedding-%</u>
Isojoki	28.8.-11.9.	14 days; 2,0 x 10 ⁶ gl.	14/45 (31%)
Ähtävänjoki	14.9.-14.10.	30 days; 6,5 x 10 ⁶ gl.	40/188 (21 %)
Mustionjoki	7.10-18.10.	11 days; 2,2 x 10 ⁶ gl.	10/87 (11 %)
Karvianjoki	No glochidia (1st year of rehabilitation)		

Total 10 x 10⁶ glochidia collected

Field control: No glochidia release in nature / River Ähtävänjoki 2018

Infestation of fish (0-y and 1-y salmon and brown trout)

- Isojoki	36 x salmon	86 x trout	Tot. 122 fish
- Ähtävänjoki	146 x salmon	134 x trout	Tot. 280 fish
- Mustionjoki	65 x salmon	65 x trout	Tot. 130 fish
- In total	532 fish		

Mortality

	<u>2016-2017</u>	<u>2017-2018</u>
Isojoki		(3/48) 6 %
Ähtävänjoki	(6/152) 4 %	(8/196) 4 %
Mustionjoki	(15/110) 14 %	(8/95) 8 %
Karvianjoki		(14/100) 14 %

Summary, conclusions

- *M. margaritifera* spawned in tanks
- Rehabilitation of poor-condition mussels is possible with captive feeding
- If very poor condition, takes > 1 y
- Glochidia production of *M. margaritifera*, if ended in the nature, can be restored in captivity
- Even dying out populations can be saved?

Thank you for attention!



Per Jacobsen



Hanna Suonia