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INFLUENCE OF THE EXCYSTMENT TIME ON THE BREEDING SUCCESS OF JUVENILE FRESHWATER PEARL MUSSELS (*MARGARITIFERA*

Methods experiment 1:

-Infection: August 2010, 250 brown trout, 1000 glochidia/fish.

-brown trout stayed in a pond over the winter.

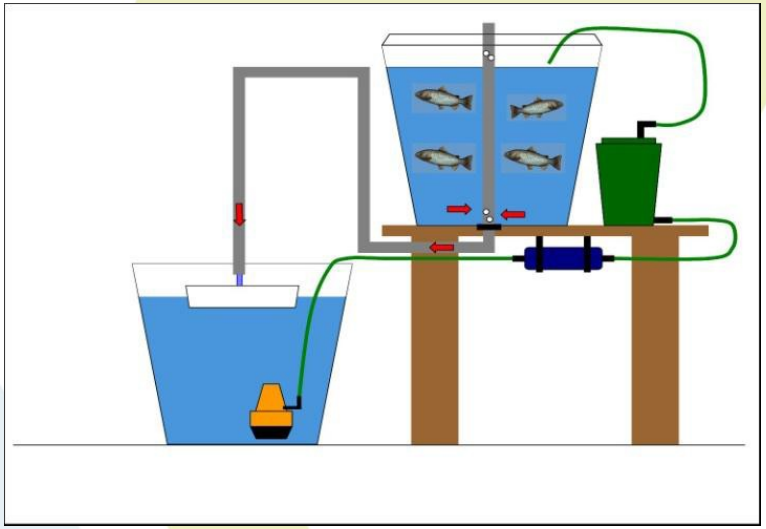
Preterm excystment period (January):

-70 brown trout were caught randomly and set in a „juvenile mussel collection station".

-Water heated from 2.3 up to 17 degree within 10 days.

-First drop-off : After 18 days at 17 degrees,
January (21th).

-Fish were not fed



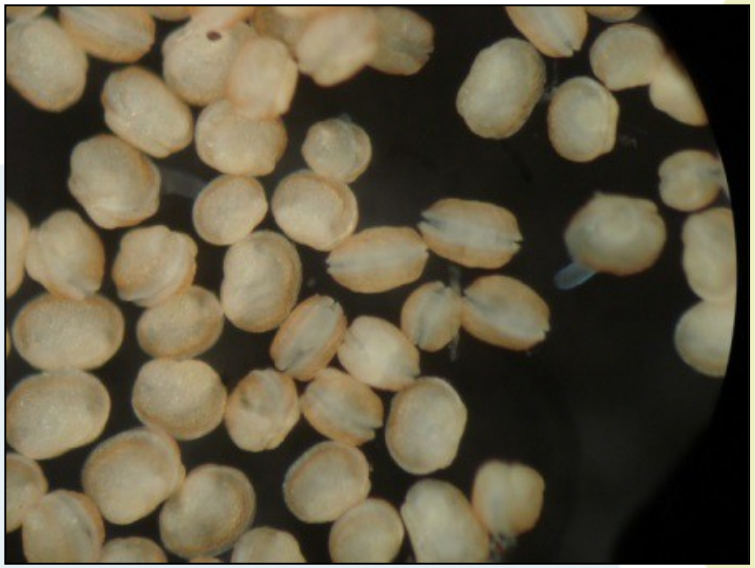
Juvenile mussel collection station

Natural excystement period (May):

-70 fish were caugth randomly and set in a „juvenile mussel collection station“.

-First drop-off: in May (16th), without artificial heating.

-Fish were not fed.



Juvenile mussels after drop-off

-Collection every 2-3 days.

-Mussels of one collection day were set in one 500 ml-plastic box with river water

-with a maximum of 100 individuals per plastic box (to avoid food competition).

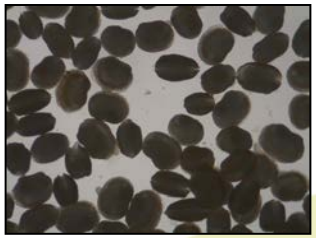
-Food: Detritus and algae (Eybe et al., 2013).

-Every box was observed for 110 days.

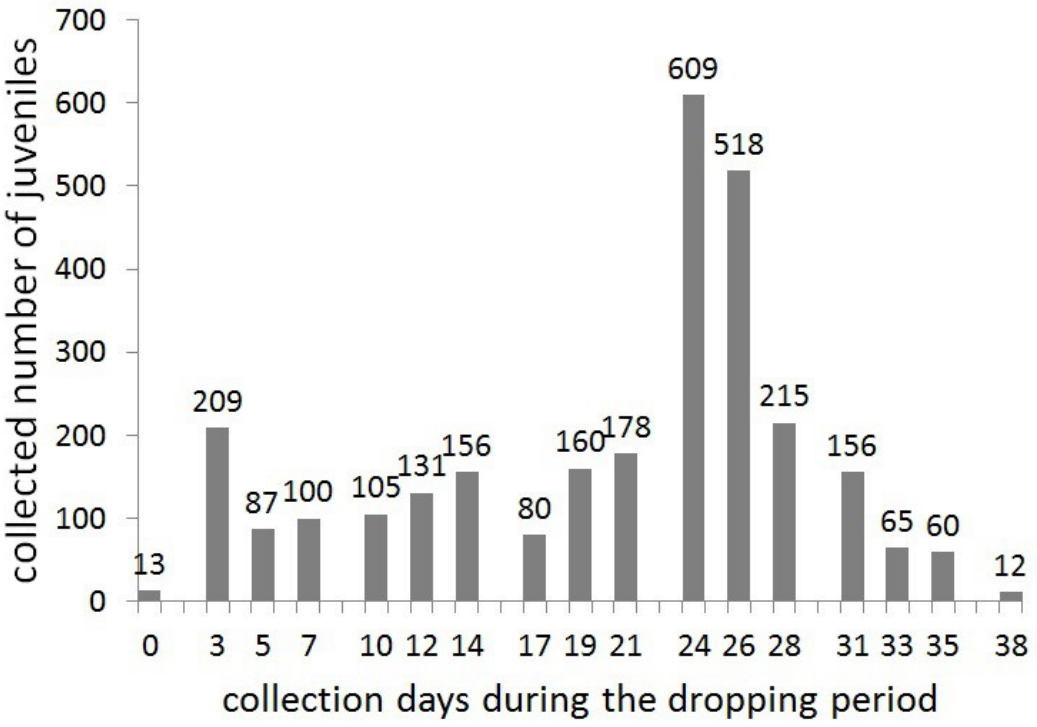
Detritus and algae: Shellfishdiet and Nanno

Results:

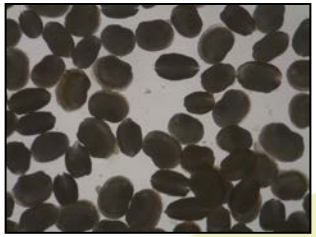
Preterm excystment period (January):



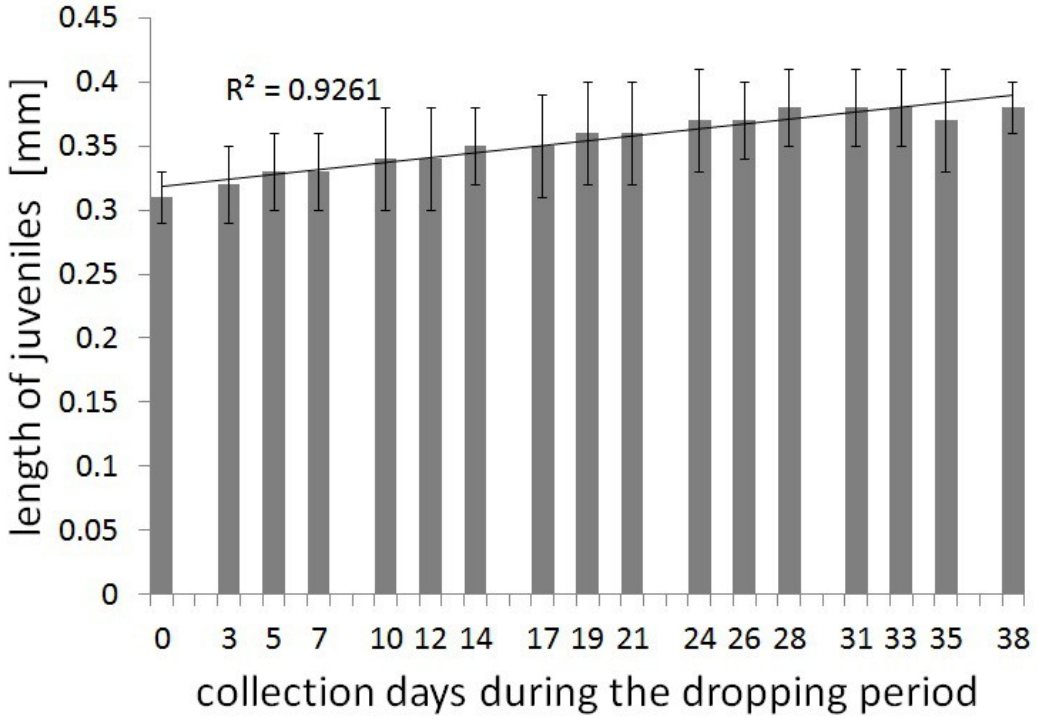
Number of juvenile mussels collected on each day



-Duration: 39 days.
-Peak on day 24
-Total number of 2854 juvenile mussels

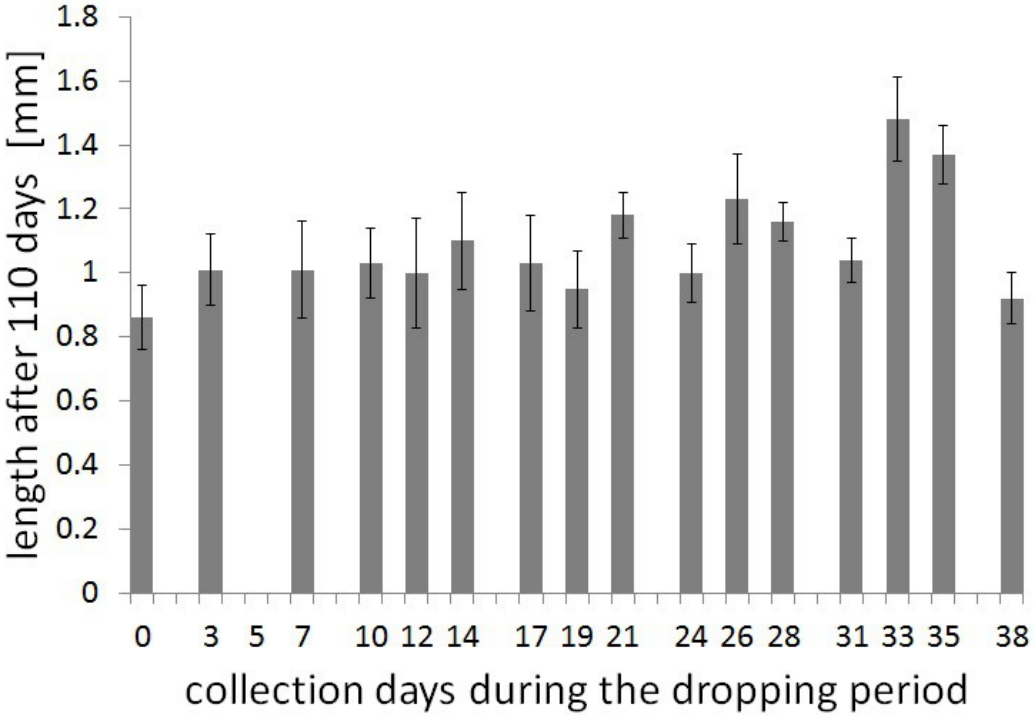


Body-length of juvenile mussels on different collection days

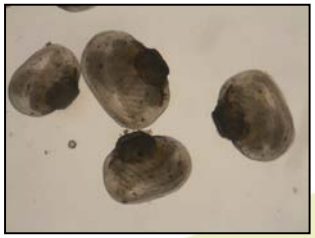


-The first juvenile mussels: average length of 0.32 mm
-Tallest mussels: average length of 0.38 mm
-Significant correlation between the drop-off day and the length of dropping mussels

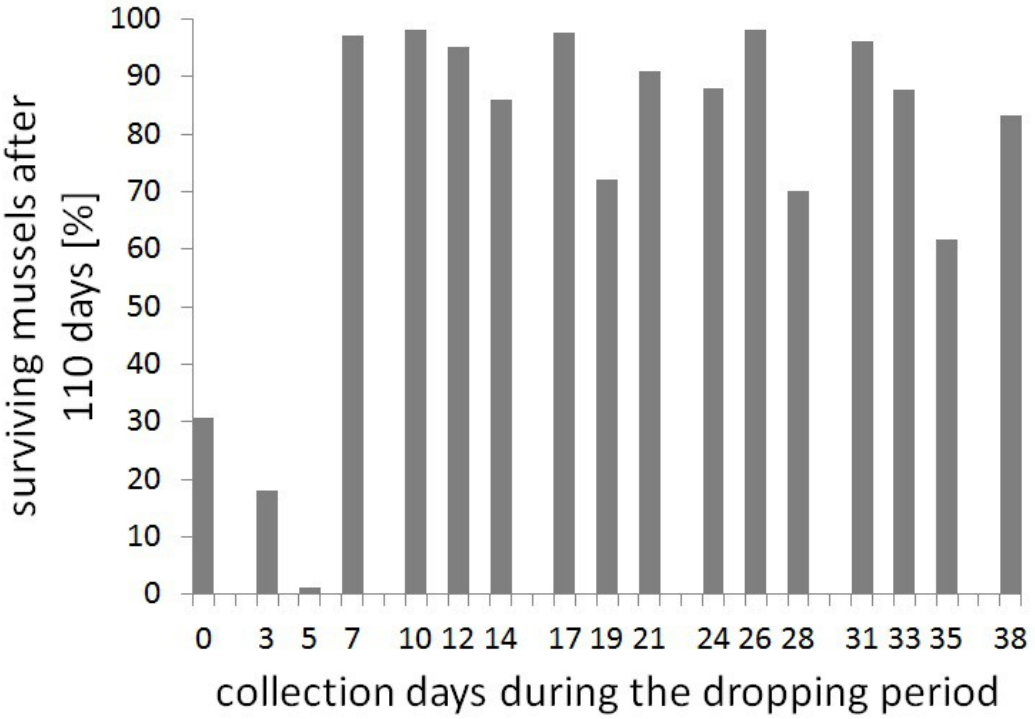
Body-length of mussels at the age of 110 days



-Smallest mussels: 0.86 mm (first day) and 0.92 mm (last day)
-All others ≥1 mm
-Tallest mussels: 1.48 mm
-Although host fish were not fed and their condition factors sank significantly, the growth rates of „later" mussels were good.

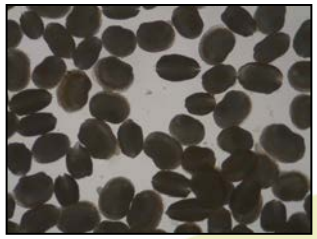


Number of mussels surviving after 110 days

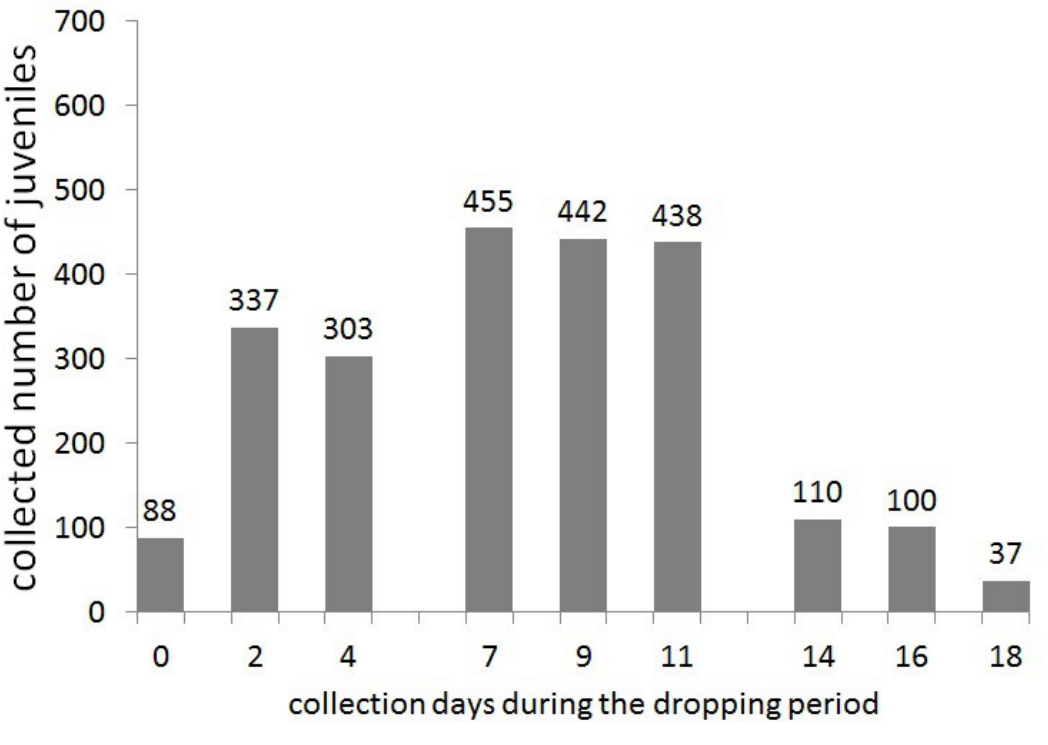


-Bad survival rate for the „early“ mussels
-Day 7 and later: 62-98 % survival
-the „length of mussels after excystment“ had a significant effect on the survival rate
-Although host fish were not fed, the survival rates of „later“ mussels were good.

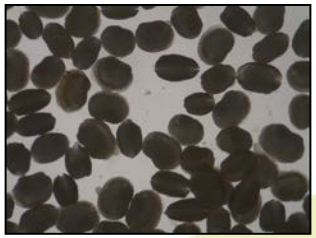
Natural excystment period (May):



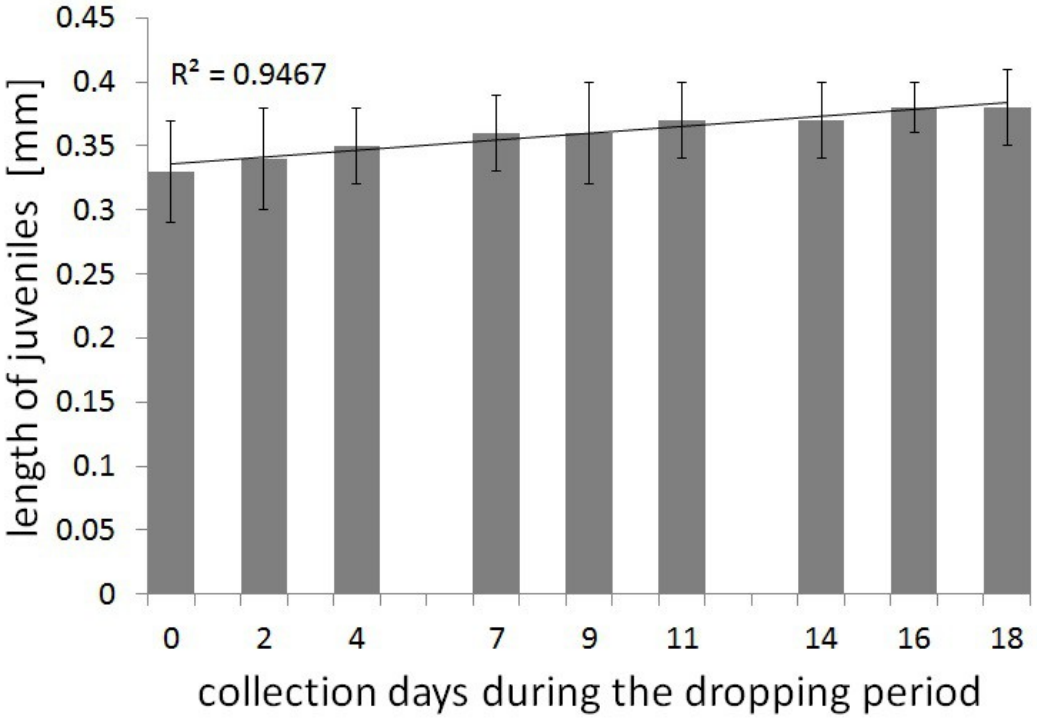
Number of juvenile mussels collected on each day



-Around 50% shorter (19 instead of 39 days)
-Total number of 2310 juvenile mussels (2854 in January)

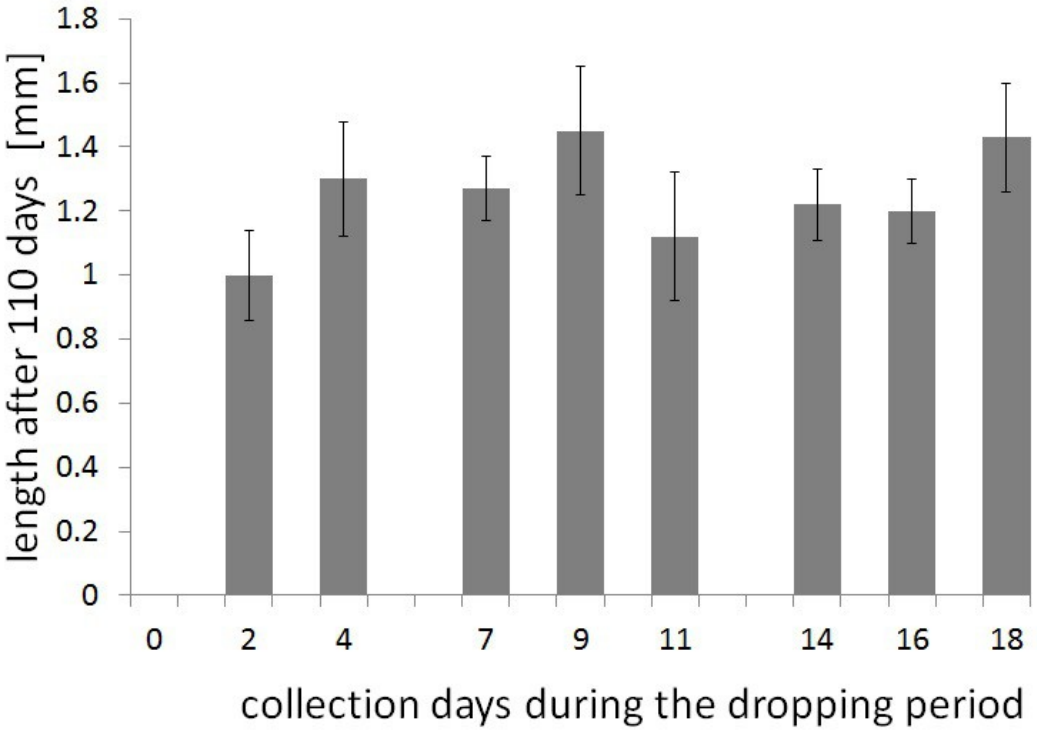


Body-length of juvenile mussels on each day



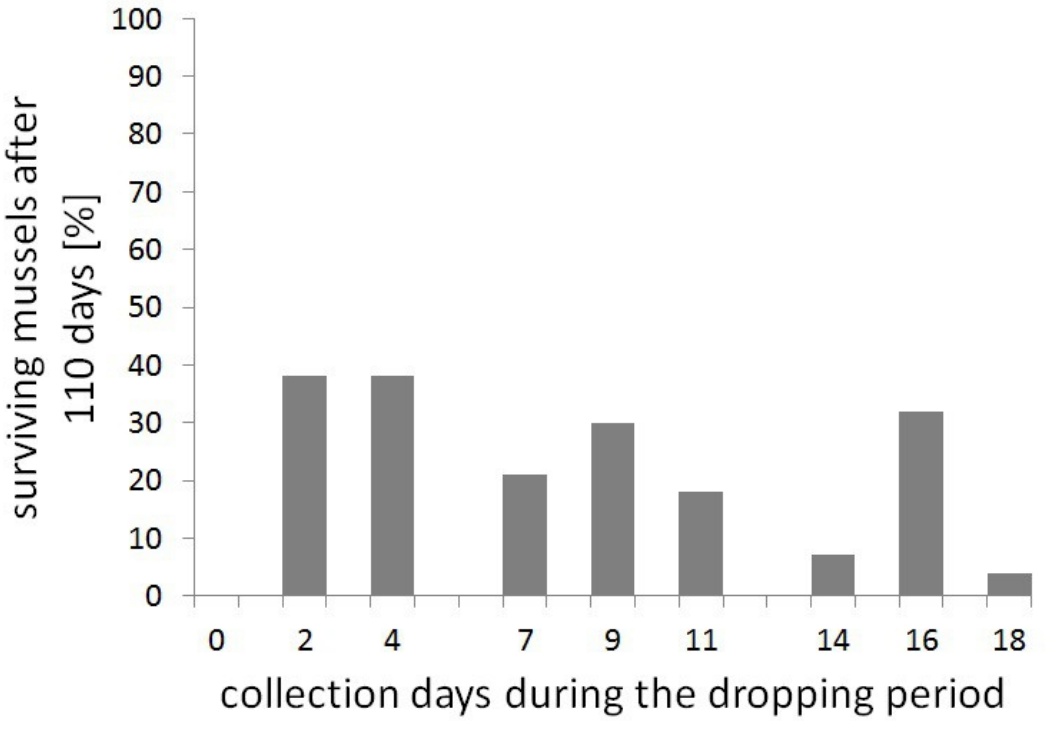
-First mussels: Average length of 0.33 mm
-Tallest mussels: 0.38 mm (day 16 and 18)
-Length of dropping mussels increased too

Body-length of the mussels at the age of 110 days



-No survival for mussels from day 0
-Smallest mussels: 1.0 mm (day 2)
-All other mussels ≥1 mm
-Tallest mussels: 1.45 mm (1.48 in January)

Number of mussels surviving after 110 days



-The „early“ mussels had a bad survival too
-Best survival rate: 38%
-The mussels from January hat a significant better survival (up to 98 %)

Why is the survival rate in January better?
Possible reasons:

-Mussels drop-off before pesticides and liquid manure are used in the catchment area.

Different water parameters, measured weekly during breeding time:

Water parameter	**Preterm excystment period (January)**				**Natural excystment period (May)**			
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
pH	7.3	0.2	6.7	7.6	7.7	0.2	7.3	8.0
Conductivity in µS cm^{-1}	158.7	10.3	148.0	181.0	186.5	10.1	163.9	207.0
PO_4^{3-} in mg L^{-1}	0.11	0.05	0.09	0.29	0.21	0.04	0.14	0.29
NO_2^- in mg L^{-1}	0.04	0.02	0.03	0.12	0.04	0.02	0.03	0.12
NH_4^+ in mg L^{-1}	0.05	0.03	0.04	0.16	0.05	0.01	0.04	0.09
NO_3^- in mg L^{-1}	19.20	5.71	7.50	26.10	5.96	2.55	2.40	11.30

<u>Methods experiment 2</u>:
Developement of the infestation rate from FPM glochidia on two different strains of brown trout

-Brown trout strains:
„Wilwerrath“ from the German Eifel and
„Lintgen“ from rivers in Northern Luxembourg

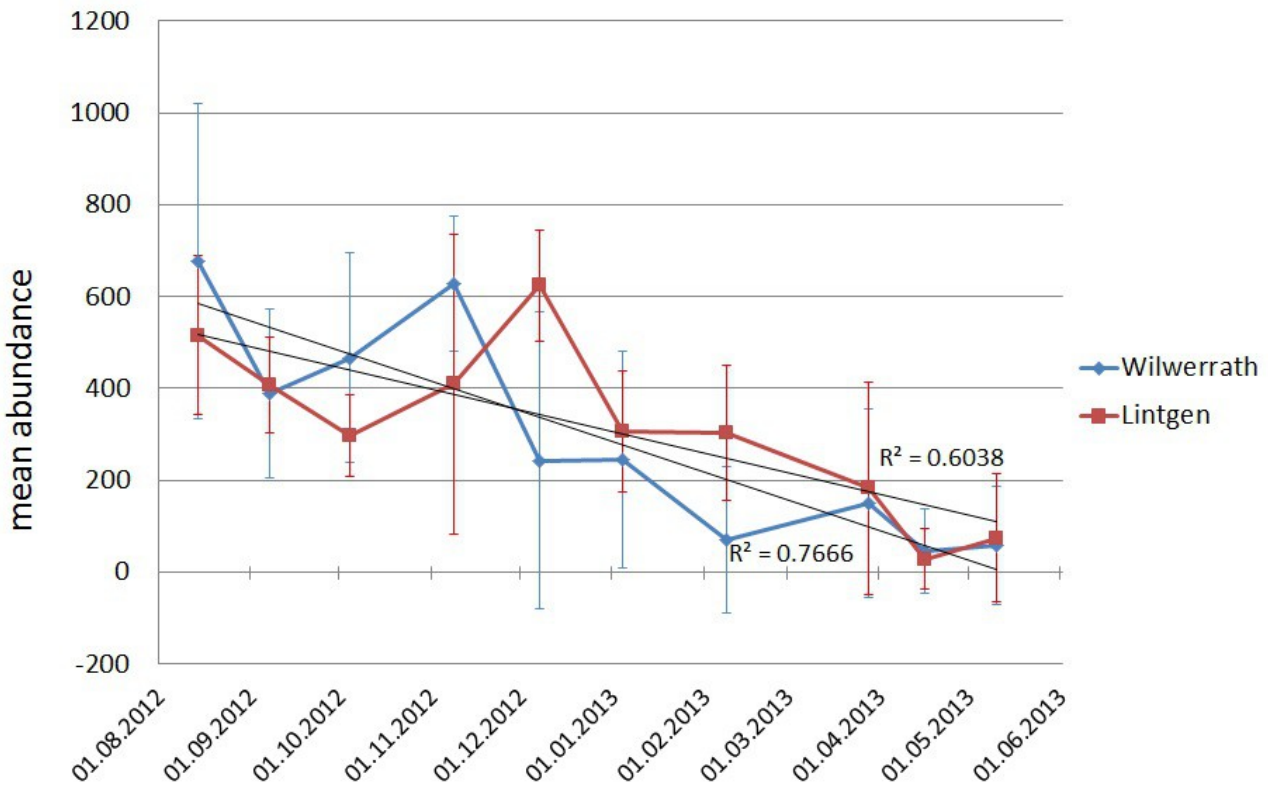
-Infection:
200 fish of both strains, under the same conditions , 1000 glochidia/fish

-Determination of: **mean abundance** and **prevalence** of glochidia, every month (August – May)

-First examination 3 days after infection (n=5)

Results:

Mean abundance from FPM glochidia on two different strains of brown trout during nine month.



-No significant difference in both strains

-The loss of glochidia was lower in January.

-Prevalence until October: 100 % in both strains.

January: 80-100% in both strains.

May: 20-40% in both stains.

→ Obvious lost of glochidia in both strains.

Mean abundance: mean number of glochidia on all host fish
Prevalence: Percentage of infected host fish

Conclusion:

-The „early“ mussels in both excystment periods had a bad survival chance and their growth was lower
→ less time intensive systems.

-The feeding stop of the fish showed no negative influence on the mussels.

-A preterm excystment period in January seems not to harm the mussels as they had a better survival and a similar growth rate.

Advantages of a preterm excystment period:

-More juvenile mussels can be collected for artificial rearing as the loss on the host fish is lower until January.

-It can be advantageous when the river water conditions become worse in spring (e.g. pesticides and liquid manure) → higher survival chance.

-Mussels have a longer growth period untill the next winter → higher survival chance.

Thank you, Merci, Danke, Kiitos, Takk, Tack, Obrigada, Gracias,...

Eybe T, Thielen F, Bohn T, S[illegible]2013. The first millimetre – rearing of juvenile freshwater pearl mussels (*Margaritifera margaritifera*) in plastic boxes. *Aquatic Conservation: Marine and Freshwater Ecosystems* **23**:964-975.

Eybe T, Thielen F, Bohn T, Sures B. 2014. Influence of the excystment time on the breeding success of juvenile freshwater pearl mussels (*Margaritifera margaritifera*). Aquatic Conservation: Marine and Freshwater Ecosystems. Article in press.