

Experimental selection of a Ponto-Caspian gammarid

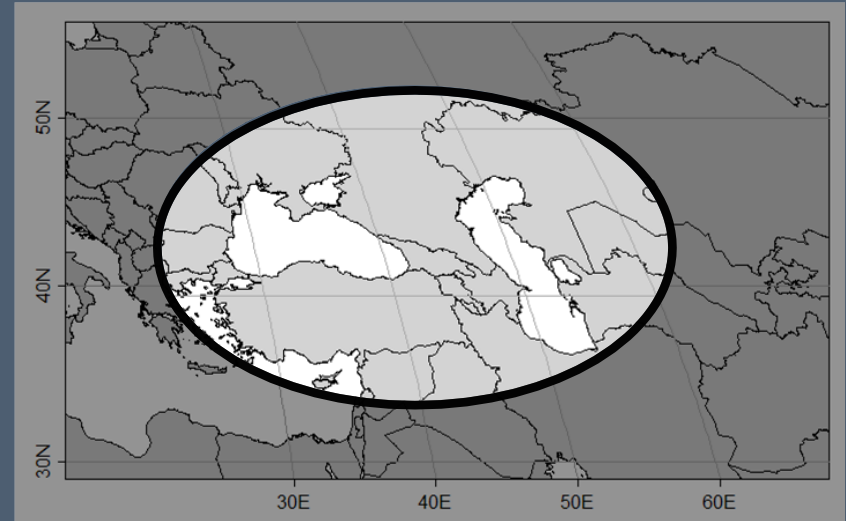


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The Ponto-Caspian region I

Black-, Caspian- & Azov Sea

- History of changing sea-level and salinity
 - Selection for euryhalinity
- Inherent predisposition for invasion success?
- Ancestry?
 - Freshwater vs. marine



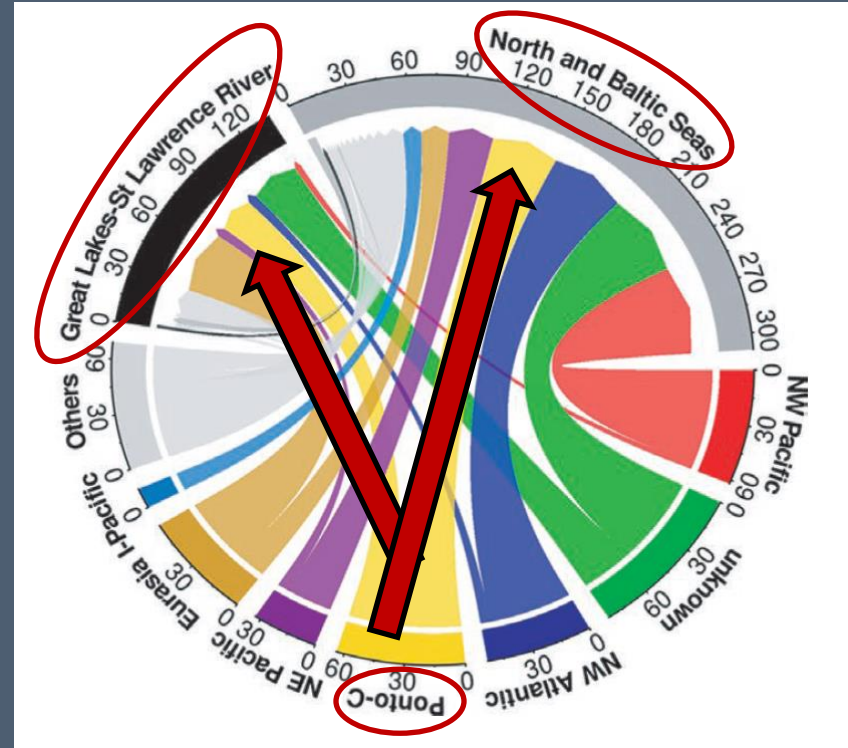
The Ponto-Caspian region II

Major donor area for

- Baltic Sea
- Great Lakes
- St Lawrence River

Baltic Sea

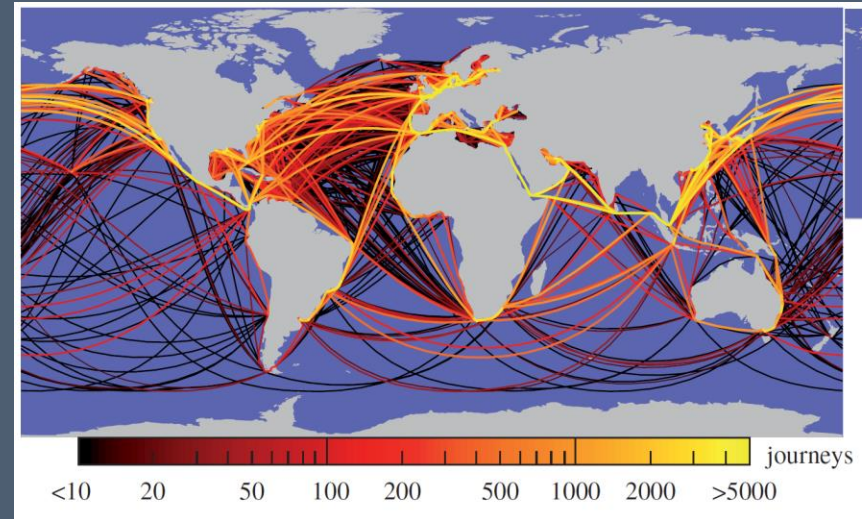
- > 65% of P-C. NIS in salinities <10 PSU
- Freshwater origin?



Casties et al. 2016, *Ecol. Evol.*

A Ponto-Caspian advantage?

- Shipping is main vector for aquatic species dispersal
- Many oligohaline and freshwater ports
→ Advantage for P.-C. species?



Kaluza et al. 2010, *J. R. Soc. Interface*

Objectives

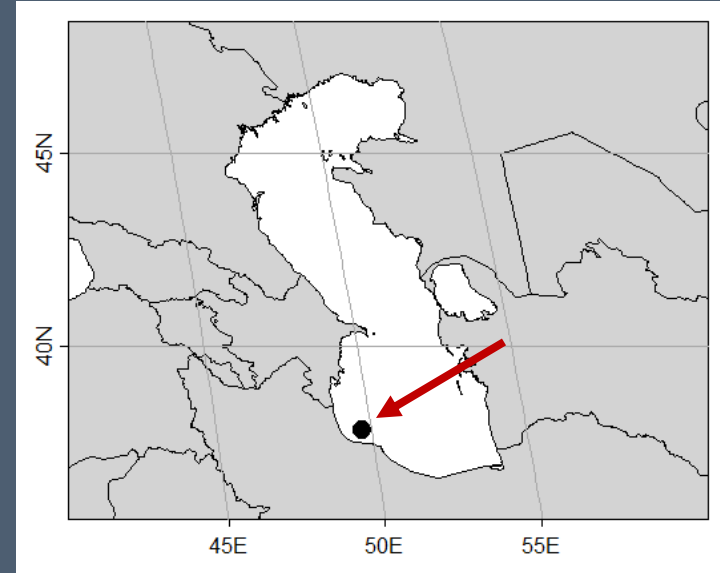
- I. Is it ***possible to select*** *P. maeoticus* to lower and higher salinities?
 - i. Is it ***easier*** to select *P. maeoticus* for ***low salinities***?
- II. How does ***fitness*** compare between differently selected populations?
- III. Does ***heritability*** differ among selected populations?

Study organism

Crustacea

Amphipoda

Pontogammarus maeoticus



Jafrud, Iran, Caspian Sea
10 PSU, 18°C

Experimental design

Selection

Low 4 PSU

Ambient 10 PSU

High 16 PSU

Salinity stress

Low

Control

High

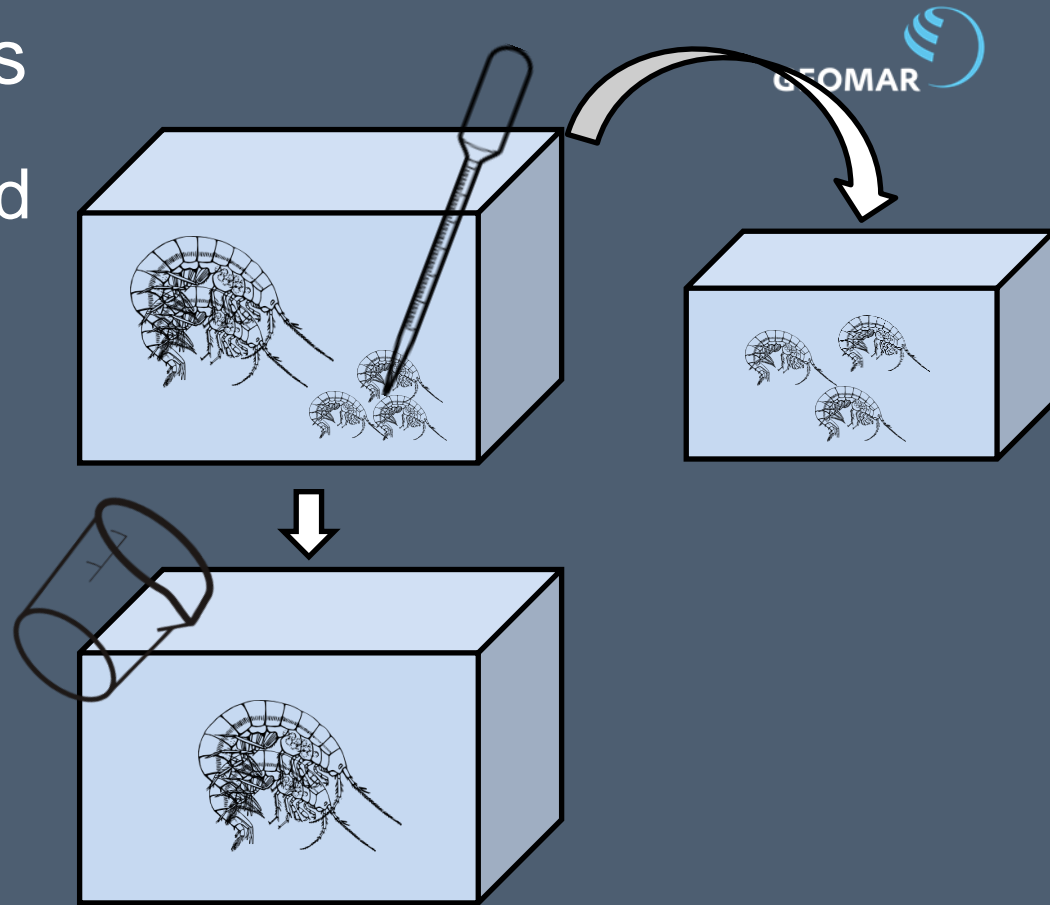
Salinity decrease
→ 0 PSU

Selection salinity

Salinity increase
→ 40 PSU

Procedure - Juveniles

1. Separation of hatched juveniles
 - Reared at hatching salinity
2. Water exchange
+ / - 2 PSU



<https://thenounproject.com>, <https://en.wikipedia.org/wiki/File:Beaker.svg>

Fitness parameters

I. Survival

- Adults
- Juveniles

II. Juvenile growth

- Cephalon length, proxy for total length

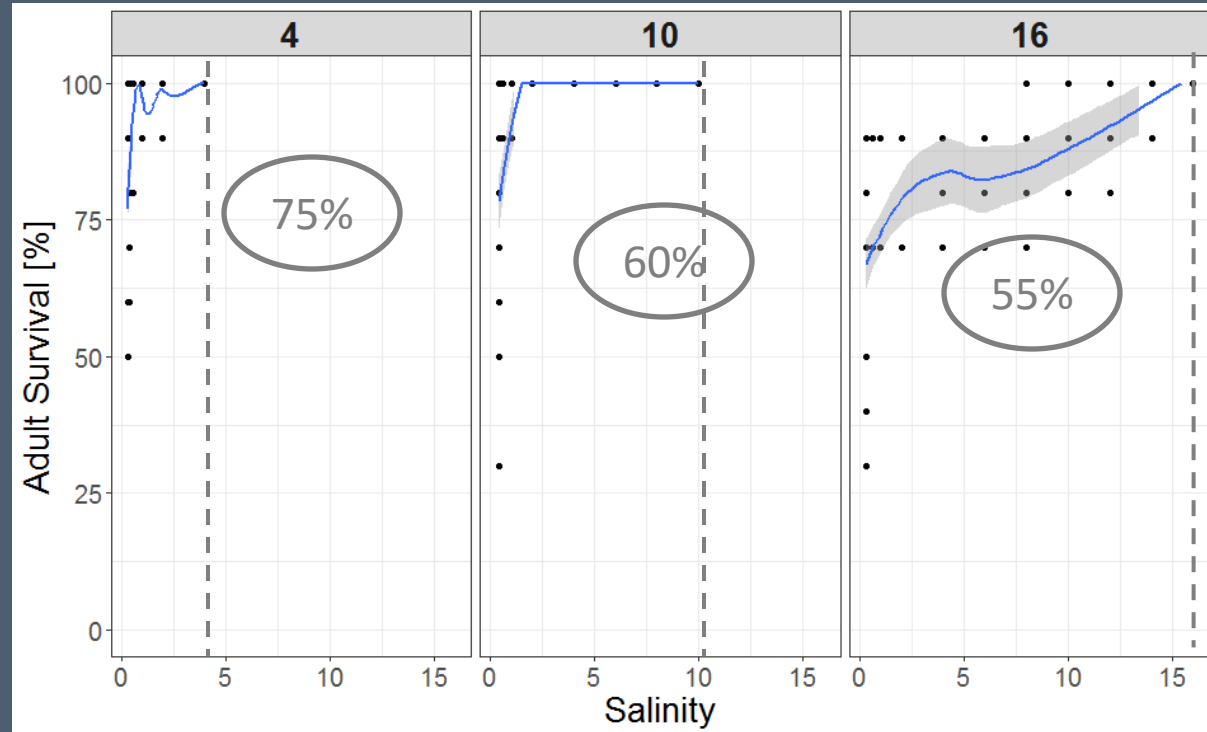


III. Hatching success

Adult survival

Low salinity stress

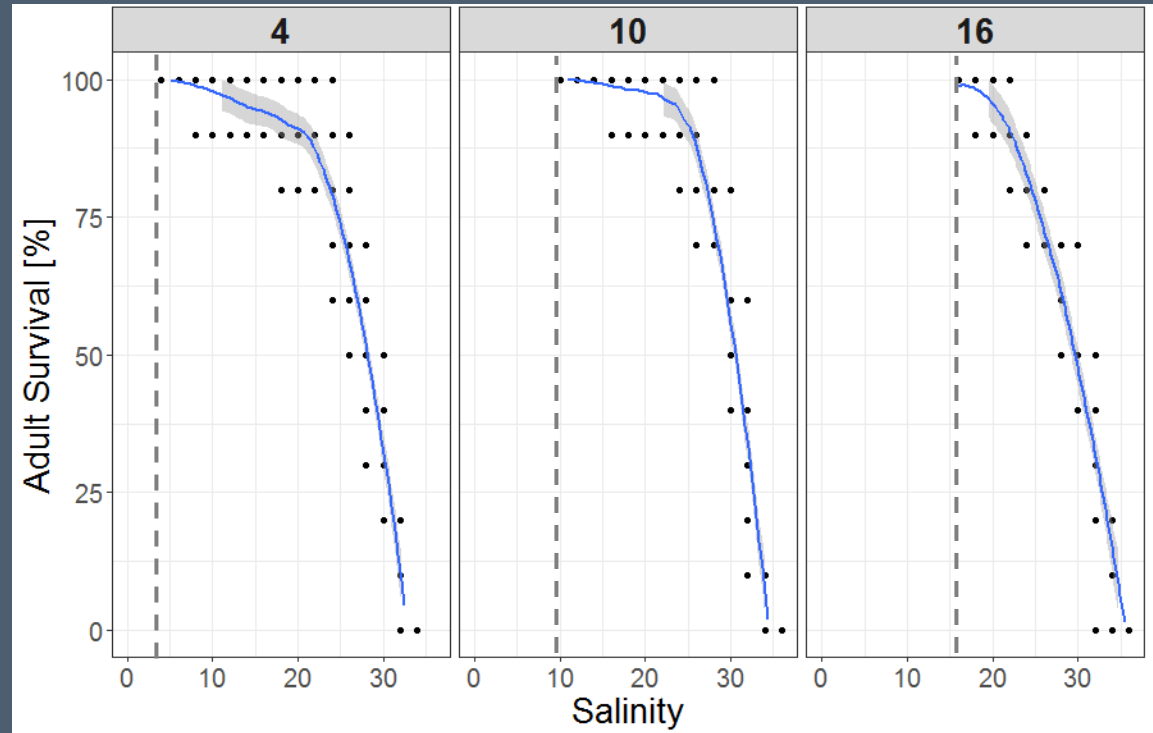
- Highest survival in low selected population



Adult survival

High salinity stress

- No survival above 34 PSU
- in all selection levels



Juvenile survival

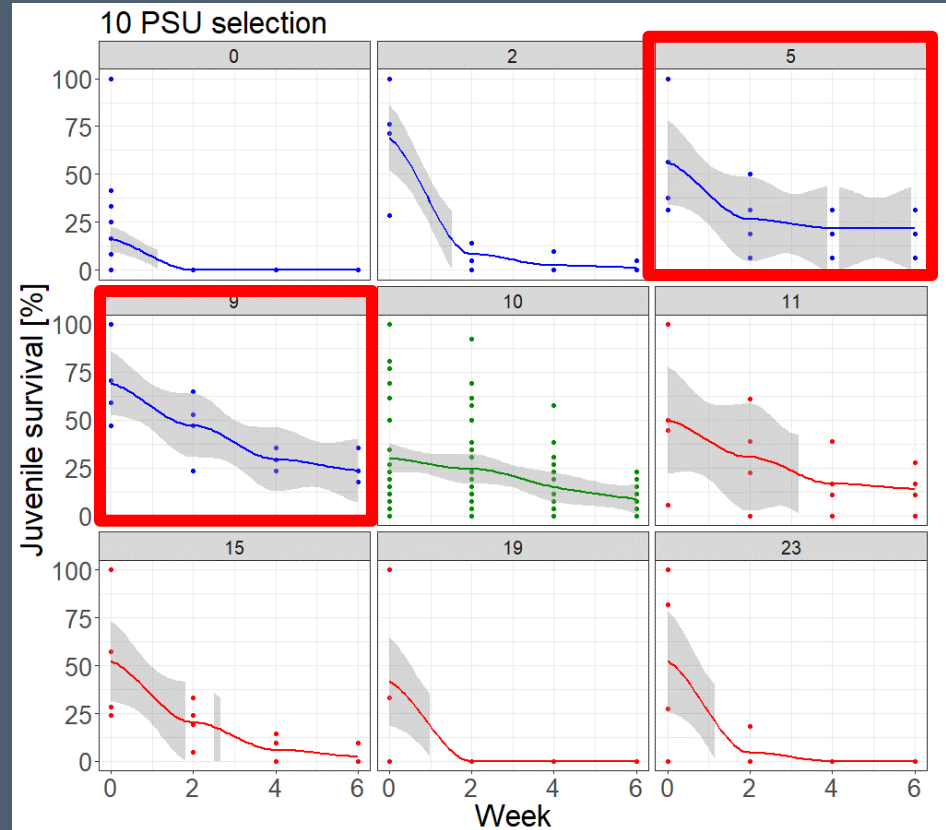
Hatching success:

- 0 - 33 ind./cohort
- 0 – 23 PSU

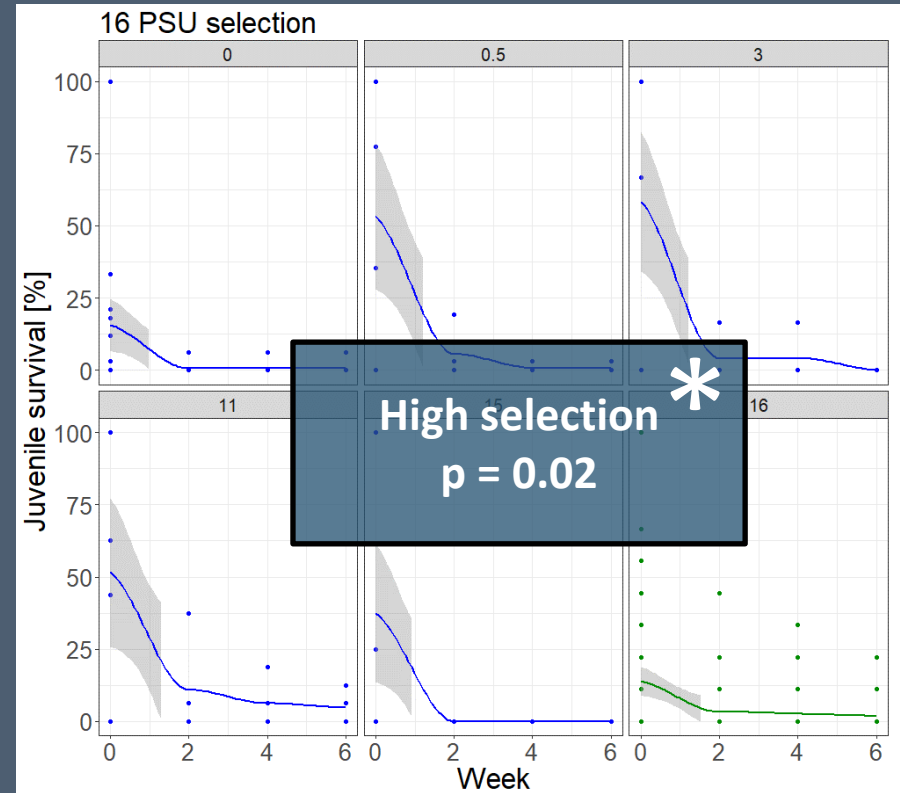
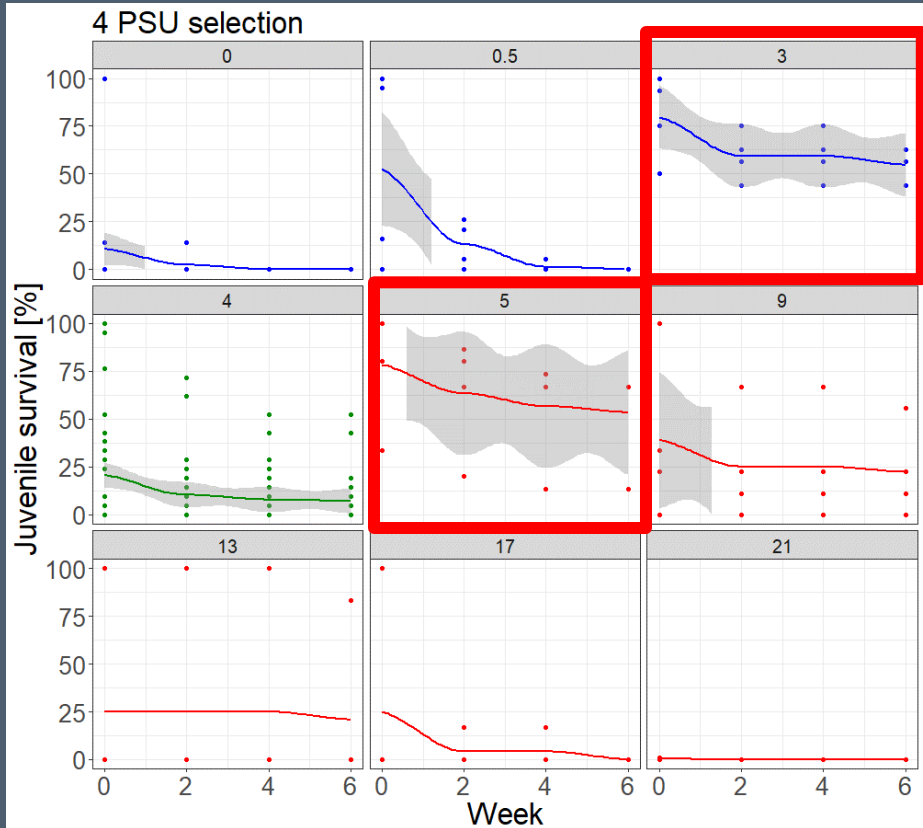
Effect of low salinity stress

$$p = 0.03$$

Highest survival



Juvenile survival in selected populations



Juvenile growth

Effect of high salinity stress

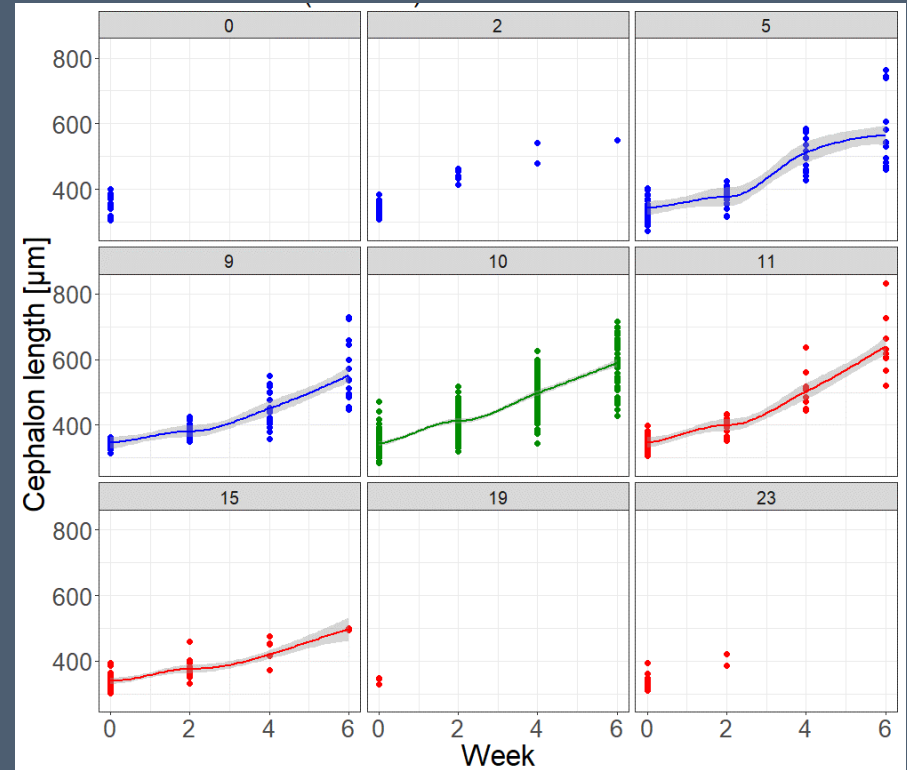
$p = 0.02$

Slow growth, low survival

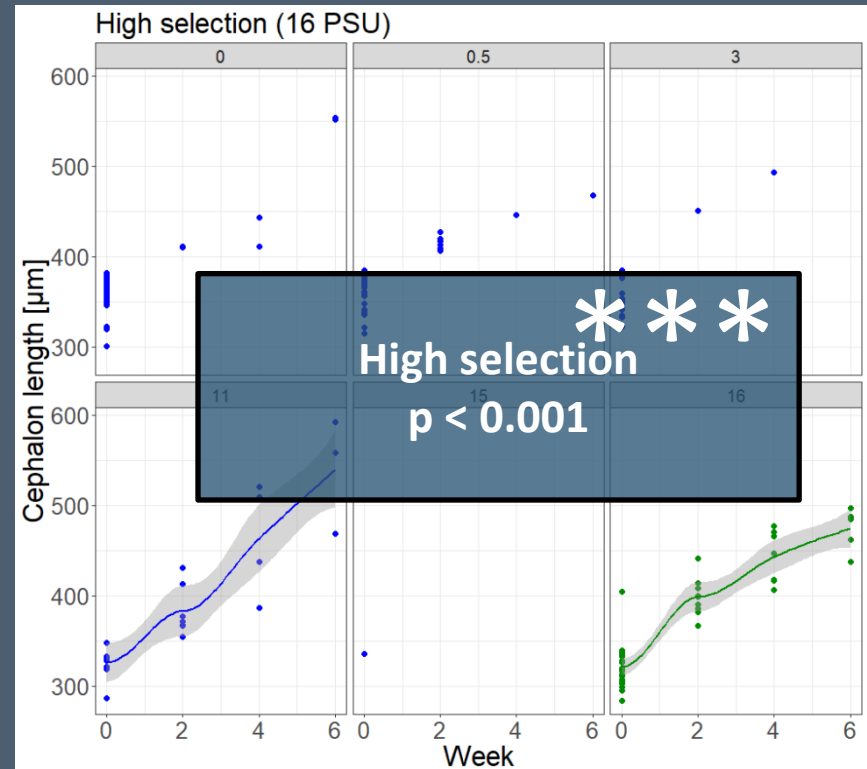
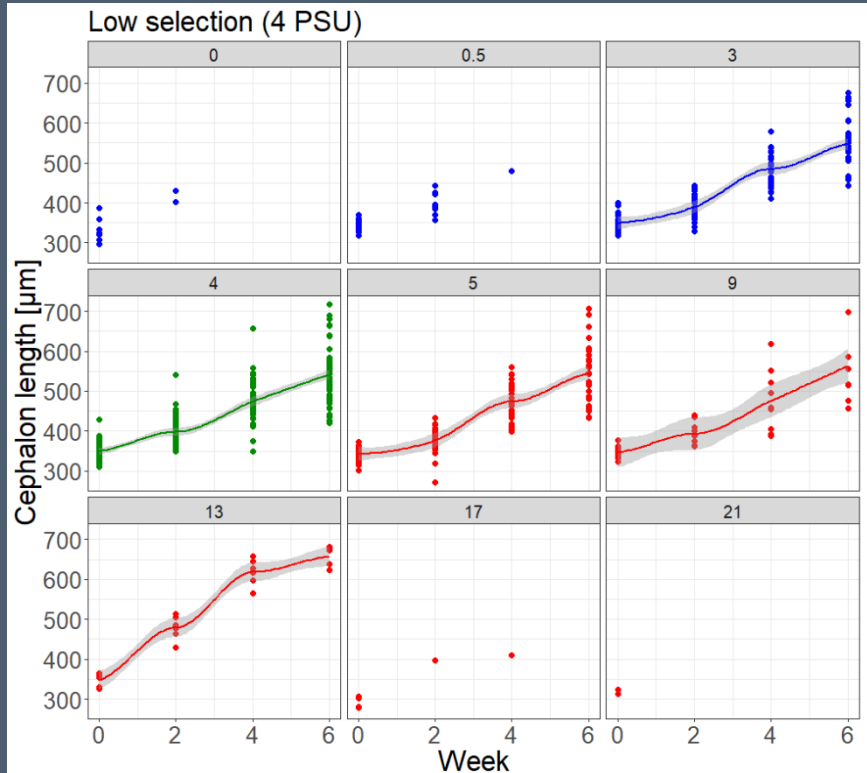
Control selection (10 PSU)

- Highest fitness at control salinity

$p < 0.001$

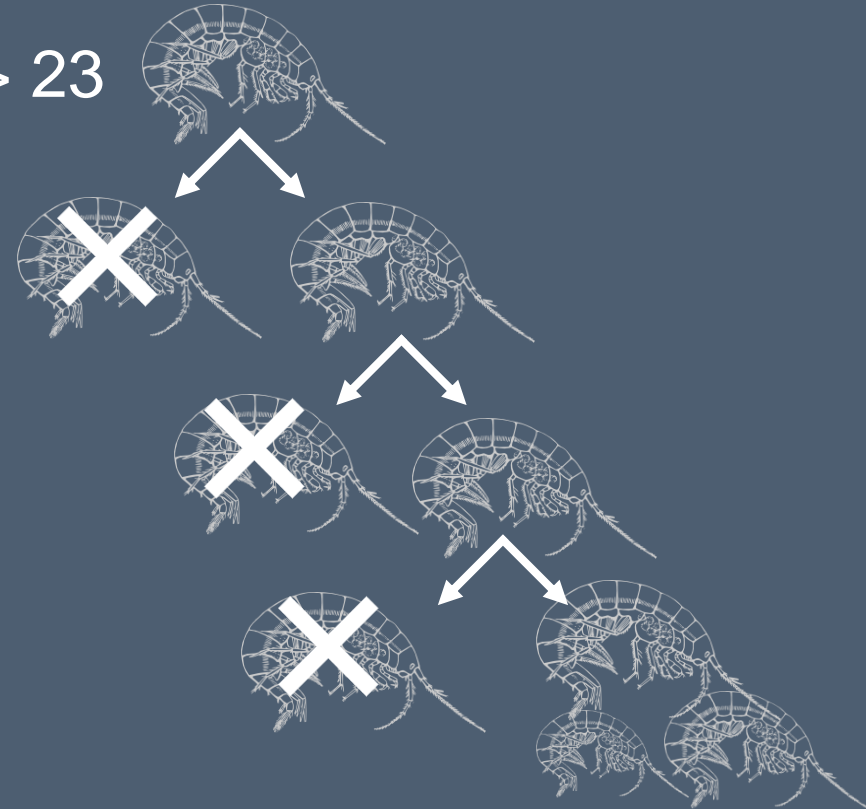


Juvenile growth in selected populations



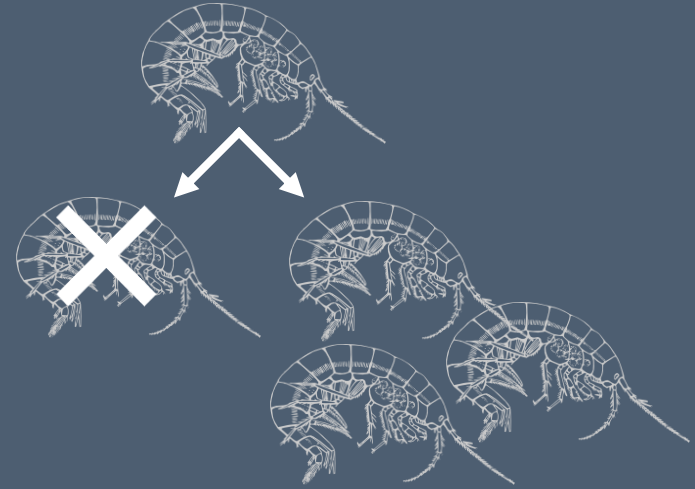
Conclusion – Selection for high salinity

- No successful reproduction > 23 PSU
 - High mortality > 20 PSU,
 - No survival above 34 PSU
-
- Low fitness
 - Selection not successful
 - more generations needed



Conclusion – Selection for low salinity

- High fitness
 - Low selection performed as good as control or better
 - Successful reproduction in freshwater
- Freshwater ancestry?



Freshwater ancestry

- Possible advantage e.g. over Baltic species
 - Also euryhaline, but less tolerant to freshwater
- Explanation for successful invasion of freshwater habitats
- Heritability work in progress

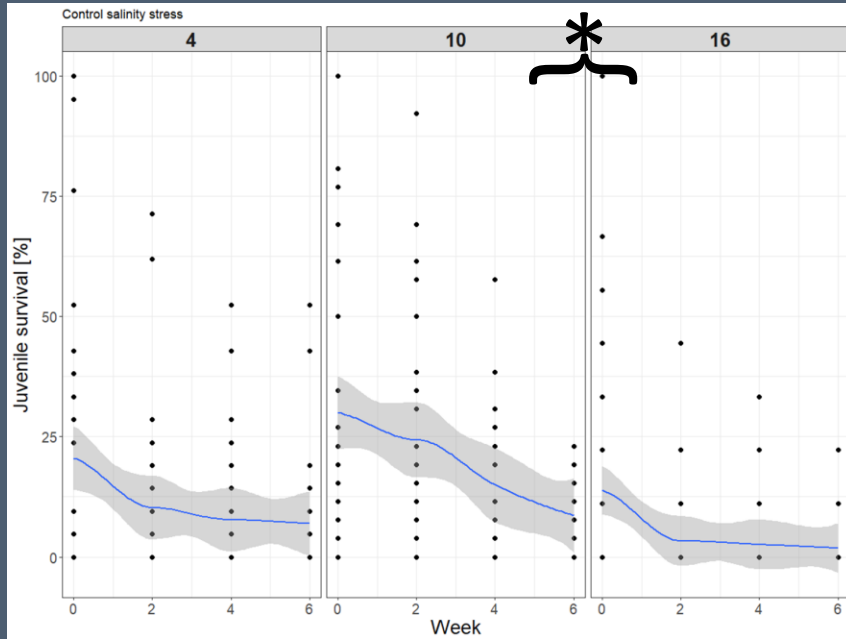
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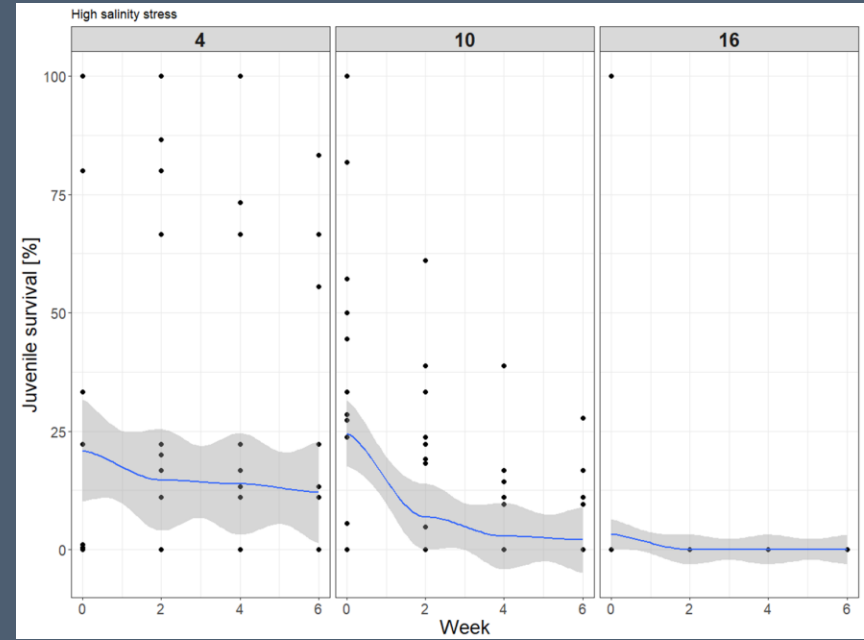
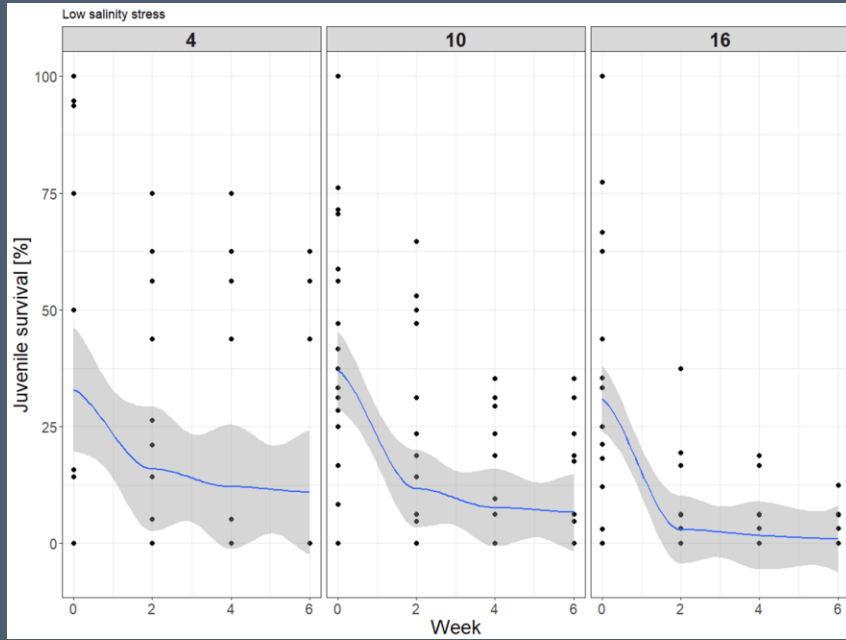


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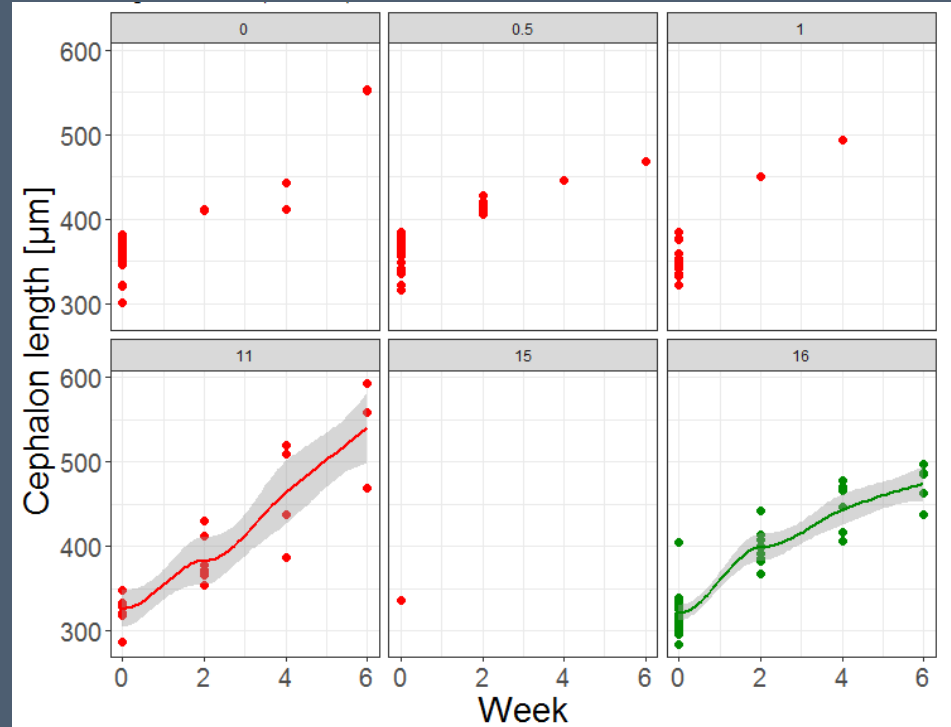




Juvenile growth

High selection (16 PSU)

- No difference between low salinity stress and control



Adult survival I

Effect of
selection*s. stress
 $p < 0.001$

- Low salinity stress
- Highest survival
in low selected
population

