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Comparison of redox enzyme activities in two Atlantic salmon (*Salmo salar* L.) populations: Insight to the trade-offs between physiology and survival during early life stages

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Introduction

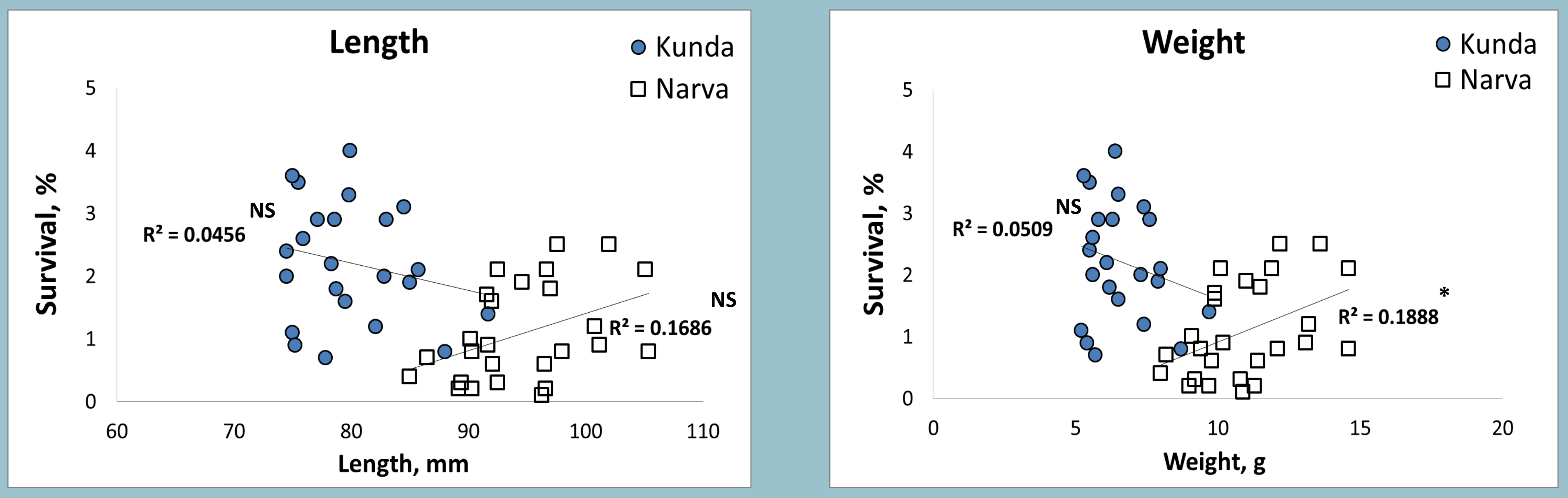
- Oxidative stress (OS) is an imbalance of prooxidants and antioxidants
- OS during early development may have long term consequences on various fitness related traits and ultimately affect their survival
- Currently very little is known about the heritability of OS and the relationships between OS, fitness and survival of natural populations in wild

Aims

1. Assess the survival and growth of 0+ salmon in multiple natural environment
2. Determine the heritability of three redox enzyme activities (Glutathion Reductase; GR, Glutathion-S-Transferase; GST and Superoxide Dismutase; SOD) in pre feeding fry of two genetically different Baltic Sea salmon populations
3. Evaluate the possible linkage between the physiological traits (e.g. redox status/oxidative stress) and fitness (survival, growth) in wild

Results

1. Significant differences in growth and survival were found after first summer in wild; p-values are marked as bold stars, NS - no significance

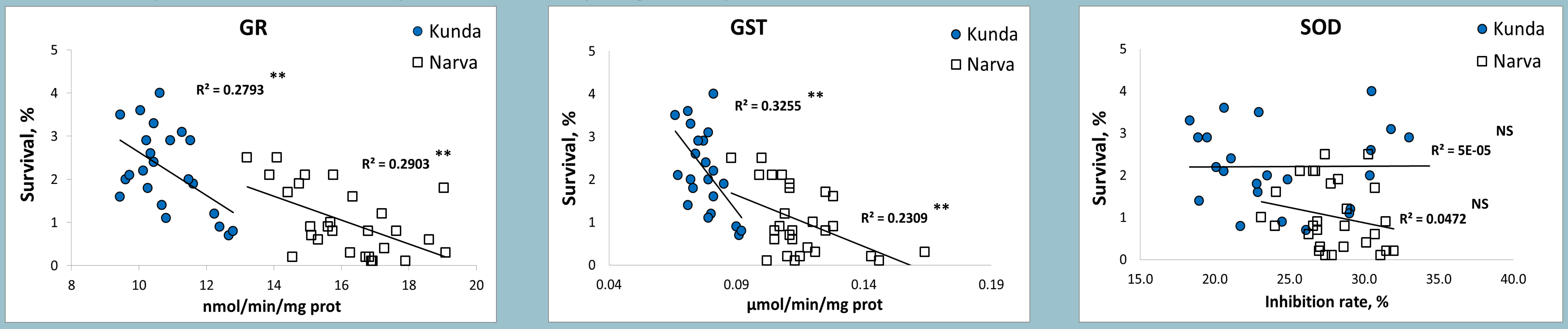


2. The narrow-sense heritability (h^2) estimates for three redox enzyme activities in two Baltic salmon population

Population	Enzyme	Model	DIC	h2	p value
Kunda	GR	Vp = Va + Vy + Vr	1533	0,08	NS
Kunda	**GST**	**Vp = Va + Vr**	**-2559**	**0,31**	***
Kunda	SOD	Vp = Va + Vy + Vr	2733	0,07	NS
Narva	**GR**	**Vp = Va + Vy + Vr**	**1451**	**0,26**	***
Narva	**GST**	**Vp = Va + Vr**	**-2714**	**0,72**	***
Narva	SOD	Vp = Va + Vy + Vr	2840	0,10	NS

The variance components reported are total phenotypic variance (Vp), additive variance (Va), variance described by yolk sac area (Vy) and residual variance (Vr). The best model (shown in bold text) was chosen according to DIC – Deviance Information Criterion calculated from MCMCglmm run.

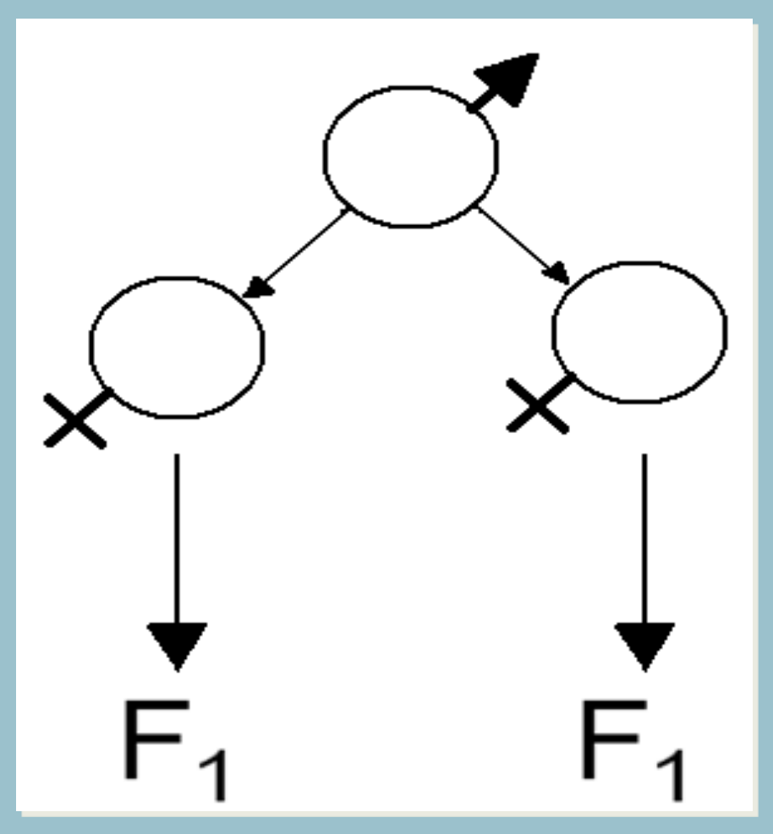
3. Relationships between redox enzyme activities (fry stage) and parr survival



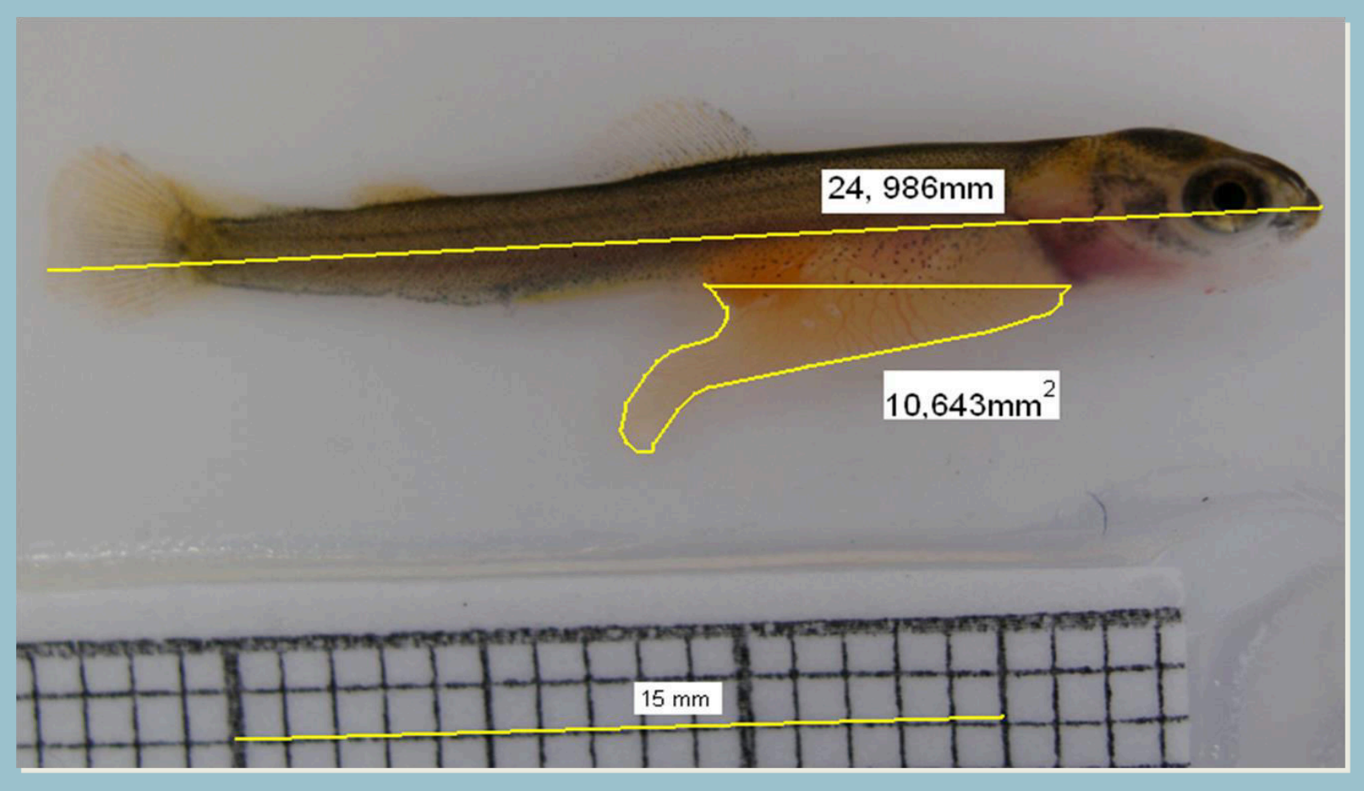
Conclusions

- Two studied salmon populations differ significantly already in their early developmental period in terms of redox enzyme activities
- Heritable genetic variation exists in two redox status/oxidative stress related enzymes (GR and GST but not in SOD) in pre feeding fry
- GR and GST enzyme activities are negatively correlated with growth and survival in natural habitat
- The inter-population differences in redox status during early life stages may explain considerable proportion of variation in fitness and survival in wild

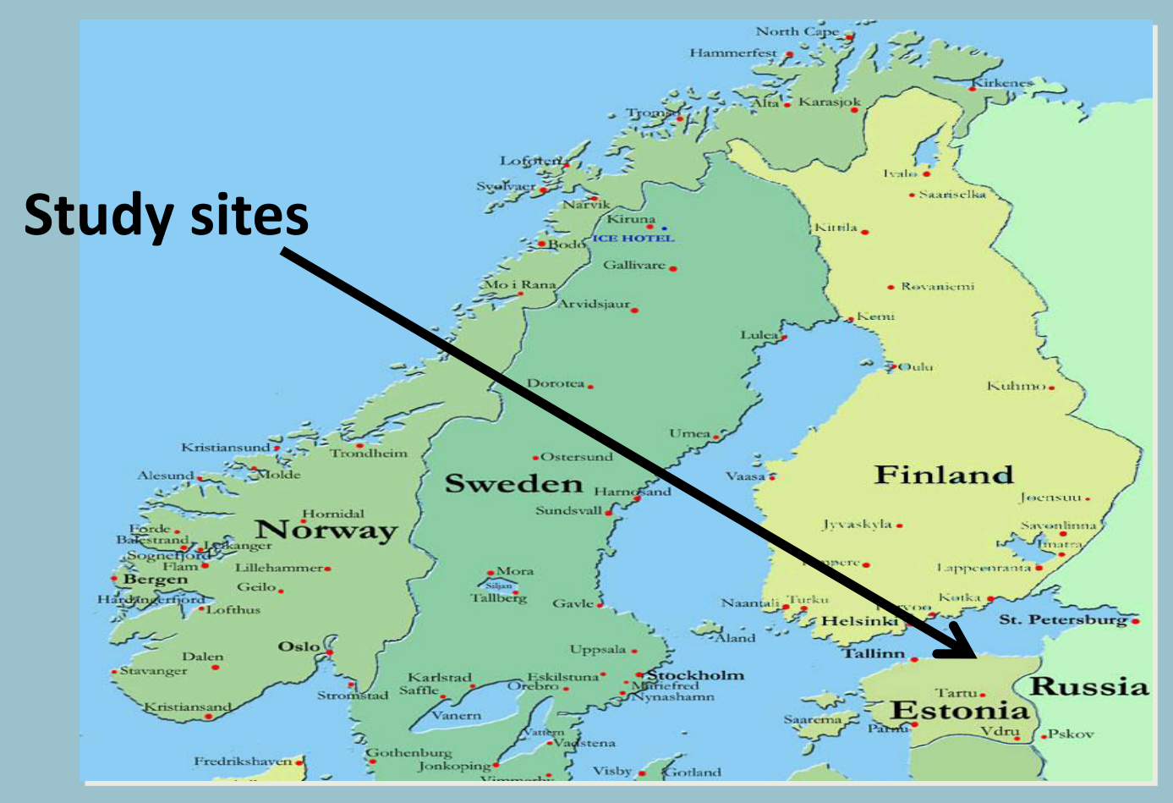
Experimental design

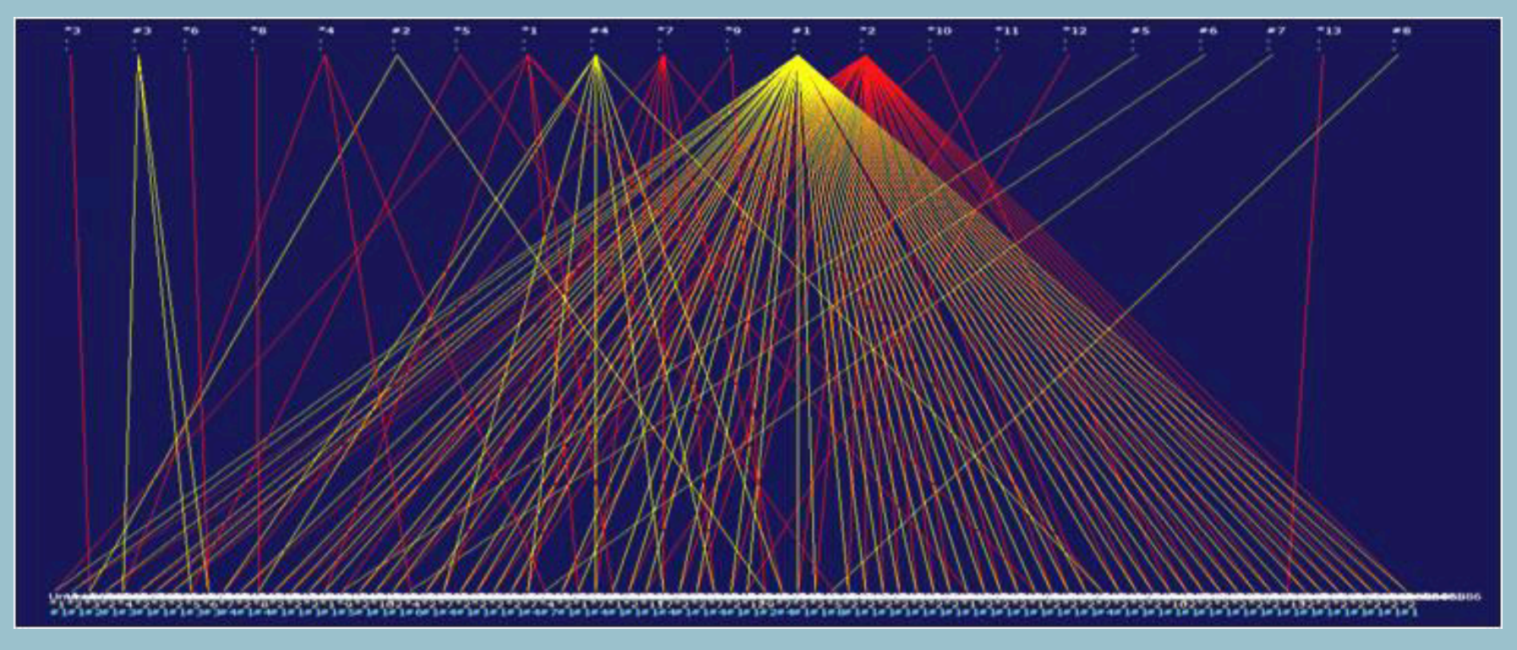


- 52 half-sib families were created
- Length and yolk-sac area was measured in 20 unfed fry per family
- Enzyme activities were measured in quadruplicates in 384-well plate format



- ~ 221 000 pre feeding fry in total were stocked into 2 natural rivers (2 different sites per river)
- 1869 0+ salmon parr were sampled in total after one summer in wild
- Individuals were finclipped for DNA analyses and later assigned to famlies utilizing 18 microsatellite markers





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