Changes in the abundance of young brown trout *(Salmo trutta)* following the recovery and re-establishment of Atlantic salmon *(Salmo salar)* in limed Norwegian rivers

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INTRODUCTION

Brown trout (Salmo trutta) and Atlantic salmon (Salmo salar) are the two dominant fish species in Norwegian rivers accessible for anadromous fish. During the 1900s a large number of rivers in southern Norway lost their Atlantic salmon populations due to acidification. Brown trout, being less sensitive to acidification, survived in all rivers. Improvement in water quality due to liming between1985 and 1999 allowed Atlantic salmon to be restored or re-established in 21 rivers. What happens with the abundance of young brown trout following the recovery of Atlantic salmon after liming?

METHODS

Young brown trout and Atlantic salmon was sampled with a portable back-pack electric fishing apparatus in 14 rivers during a 14-year-period (1991-2004) (***Figure 1***). Juvenile densities (fish per 100 m²) were estimated at six to 20 stations in each of the rivers (i.e. a total of 143-184 stations). The fish were classified as either fry (age 0+) or older parr (age ≥1+) on the basis of length-frequency distributions. The official rod catch statistics is used to describe the development in the number of adult Atlantic salmon and sea trout.

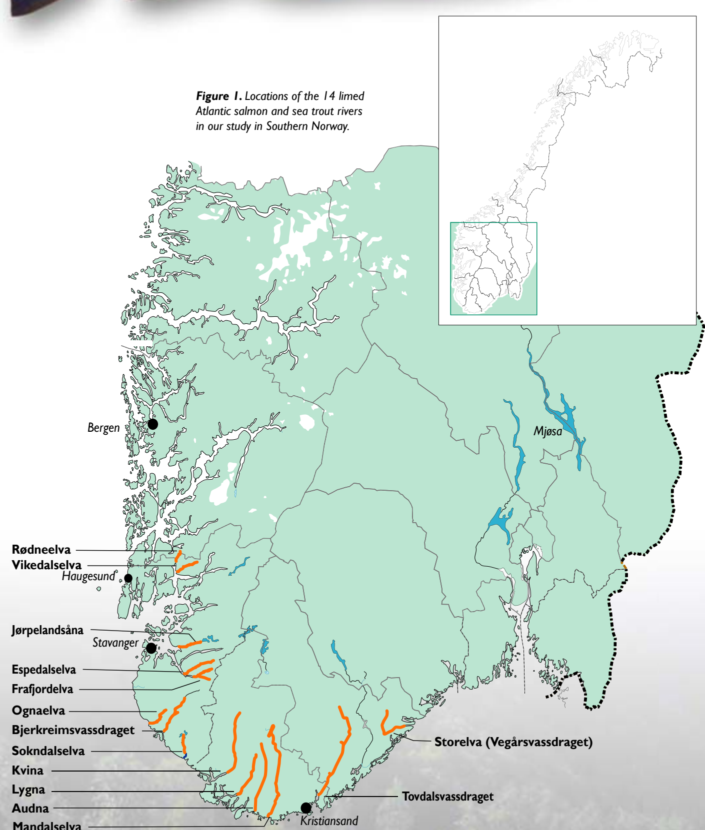

Figure 1. *Locations of the 14 limed Atlantic salmon and sea trout rivers in our study in Southern Norway.*

Electrofishing in one of the study rivers.

RESULTS

- Fry and older parr of brown trout were caught in all 14 rivers prior to liming.
- Densities of brown trout fry remained unchanged during the first four years after liming when densities of Atlantic salmon were still low (***Figure 2***).
- When a period of 10 years after liming is considered, densities of brown trout fry decreased significantly, on average by 29 % (p<0.05). Densities of older parr decreased by 44 % during the same period (p<0.01) (***Figure 2***).
- Densities of brown trout parr were inversed correlated with densities of Atlantic salmon parr (p<0.05), but less so between trout fry and salmon fry (p = 0.20) (***Figure 3***).
- The mean density of brown trout parr decreased on average from 6 to 4 individuals per 100 m² when densities of Atlantic salmon parr increased from 4 to 17 individuals per 100 m². Brown trout fry decreased from 17 to 14 individuals per 100 m² when densities of Atlantic salmon fry increased from 9 to 50 individuals per 100 m² (***Figure 3***).
- The number of adult sea trout increased during the first four years after liming when the number of Atlantic salmon were still low. The catch of sea trout then tends to level off, with a subsequent reduction when the catches of salmon exceeds 25 tonnes (***Figure 4***).

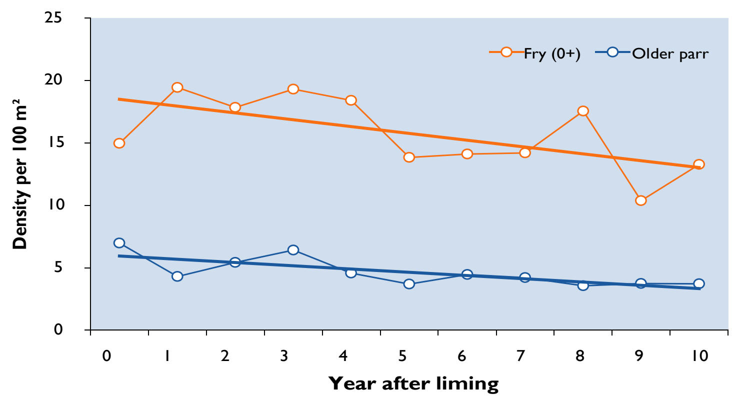

Figure 2. *Mean densities of brown trout fry and older parr in limed rivers during a period of 10 years after liming.*

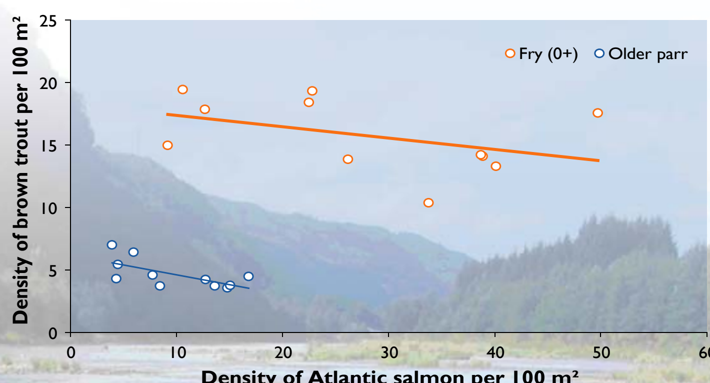

Figure 3. *The correlation between densities of brown trout fry and older parr with densities of Atlantic salmon fry and older parr, respectively.*

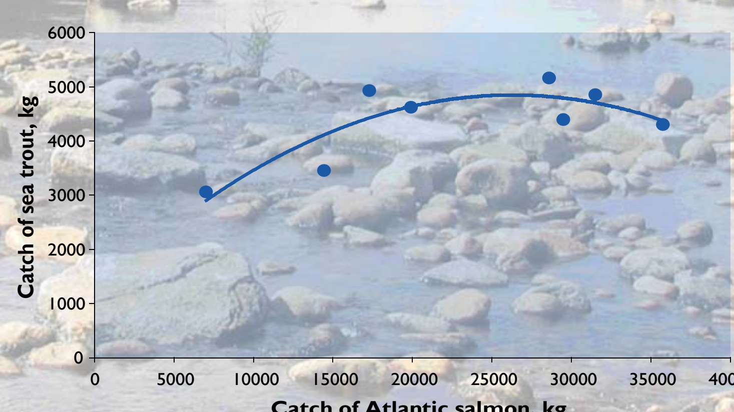

Figure 4. *The development in the catches of sea trout and Atlantic salmon in a period of seven years after liming.*

CONCLUSION

The decrease in densities of young brown trout at increasing densities of young Atlantic salmon is considered to be an effect of interspecific competition. Atlantic salmon are more aggressive and tolerate a wider range of habitat types in terms of water velocities and depths than brown trout. We assume that the relative abundance of trout and salmon after liming will, in years to come, be similar to that found prior to acidification; i.e. a normal situation.