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Interspecific Interactions between Native Brown Trout and Invasive Brook Trout

Insight into Behaviour and Morphology

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Abstract

The introduction of non-native species represents a global threat to ecosystems and biodiversity. In Europe, the introduction of the invasive brook trout (*Salvelinus fontinalis*) has led to species displacement and local extinction of native brown trout (*Salmo trutta*) populations. Additionally, several studies have documented a convergence in feeding niche, where brown trout in sympatry with brook trout utilise terrestrial insects to a larger extent. This conflicts with the competitive exclusion principle, as competition should increase divergence between species. In this thesis, I examine behavioural interactions between invasive brook trout and native brown trout at various life stages, and investigate the convergence in feeding niche and its possible effect on morphology and development.

As the juvenile stage constitutes a major bottleneck for salmonid populations, we conducted two experiments assessing the association and territoriality between juvenile brown trout and brook trout, and the influence of inter- and intracohort competition between the species. The results showed that brown trout do not discriminate against either conspecific or heterospecific groups, and that brook trout had a tighter group structure than brown trout groups. Additionally, juvenile brown trout were competitively inferior against brook trout when contesting a territory and took longer to feed and spend more time further away in presence of an adult brook trout. Moreover, as terrestrial insects are more common during the day, we investigated whether the converging feeding niche in sympatry could be explained by differences in diel activity between sympatric and allopatric brown trout. Indeed, sympatric brown trout was more active during the day than allopatric brown trout and showed a stronger association towards other individuals in sympatry. Compared to allopatric brown trout, sympatric brown trout also had a head morphology more typical for drift feeding, suggesting an adaptation to forage on terrestrial insects. Furthermore, terrestrial and aquatic insects differ in relative content of certain omega-3 fatty acids, vital for development of neural tissues. Thus, we examined the relative contribution of aquatic and terrestrial prey in the diet and if this could affect brain volume. Here, we found that brain volume was negatively correlated with higher consumption of omega-3 deprived terrestrial prey.

Collectively, the results show that invasive brook trout have a major impact on native brown trout at an early life-stage and that the change in feeding niche may affect development of neural tissues in brown trout. As most studies have focused on the direct competition between brown trout and brook trout, future studies should focus on direct and indirect effects on other species as well as ecosystem effects. Additionally, a management plan to eradicate or reduce brook trout populations in key ecosystems should be implemented in Sweden.