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Effects of non-native salmonids on native fish fauna in Chile and the Falkland Islands



Photo: Kyle Young



Photo: Dan Fowler

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Summary

The deliberate introduction of non-native salmonids into the S. Hemisphere for sport fishing, and more recently accidentally through aquaculture, is thought to have caused severe impacts upon native fish fauna. However, much of the evidence is circumstantial and attributed singularly to predation. This study examines the spatial distribution, relative abundance and resource overlap of non-native salmonids and native galaxiid fishes in streams in Chile and the Falkland Islands. In three Chilean streams around Lake Llanquihue, brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) found in sympatry with native galaxiids constituted 76% of the total fish biomass. The relative abundance of salmonids increased significantly with distance from the river mouth, and their abundance was negatively correlated to that of native fish (*Galaxias plateii* -Puye grande, *Galaxias maculatus* - Puye chico, and *Trichomycterus aerolatus*). Analysis of resource overlap suggested that rainbow trout and puye grande competed for the same habitats and prey items, though the niche of rainbow trout was wider, and thus more generalist than that of puye grande. In East Falkland, brown trout and the two native galaxiids, puye chico (called there Falklands minnow) and zebra trout (*Aplochiton zebra*) were only found in complete allopatry. Falkland streams contained either brown trout or galaxiids, but not both (complementary distributions). Zebra trout and brown trout fed on similar preys, but the niche breadth of zebra trout was much narrower, denoting a more specialized diet. As in Chile, no evidence was found of predation by salmonids on native galaxiids, though the salmonids examined were mostly small (< 250 mm). Thus, while salmonid predation may be important amongst the larger size classes, resource competition, and in particular competition for food, appears to be main cause for the apparent displacement and decline of native galaxiids.

Key words: Salmonid aquaculture; Falkland Islands; Chile; Galaxiidae; Salmonids; non-native introductions; competition.



Conclusions

From this study the following preliminary conclusions can be drawn with regards to the deliberate (sport fishing) and accidental (aquaculture) introductions of non-native salmonids into Chile and the Falkland Islands:

1. Non-native salmonids were the dominant species in three sampled streams in Chile (76% of biomass) and in one of the three streams sampled in the Falklands (100% of biomass).
2. The median size of salmonids significantly exceeded that of native galaxiids in all streams where the two families coexisted. However, I found no evidence of salmonid predation upon native galaxiids in Chile or in the Falklands.
3. In Chile, non-native salmonids were significantly more abundant with increasing distance from the sea, in contrast to galaxiids which seemed to be restricted to the lower stream sections.
4. In general, non-native salmonids occupied a wider, and therefore more generalist, niche than native galaxiids, which may be a characteristic of successful invaders.
5. Substantial niche overlap in habitat and diet was estimated between non-native salmonids and native galaxiids (but not between galaxiids), suggesting that there may be scope for direct resource competition.
6. Taken together, the results of this study suggest that the plasticity of salmonids may have conferred them a competitive advantage over native galaxiids, and this could perhaps explain their rapid spread and colonization of new habitats in the S. Hemisphere.
7. As salmonid farming continues to expand into the S. Hemisphere, it will inevitably bring about further non native introductions. However, as some salmonids are already naturalized in many freshwater systems, the potential impact of aquaculture escapees cannot be established without first studying the interactions between naturalized fish and native fish species.