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Possible impact of climate change and fish farming on Atlantic salmon

A combination of climate change and the introduction of farmed salmon into wild populations is shaping regional genetic patterns of Atlantic salmon in northern Spain. This is the conclusion of new research that has attempted to disentangle the importance of these two factors on regional populations.

The invasion of freshwater ecosystems by exotic fish species is a worldwide problem and often occurs after their introduction by humans. In the second half of the twentieth century farmed salmon and trout from central and north European countries have been transplanted to south European rivers where native populations existed. These native species are declining, particularly at the periphery of their range, and research indicates that climate change increases their sensitivity to invasions.

The research studied the Atlantic salmon in northern Spain. Data on salmon DNA, stocking of fish for farming and climate change were analysed from five rivers at four times over 20 years to determine the relative importance of climate and stocking practices on the population structure and genetic patterns. The study was financially supported by EU INTERREG projects[1].

Results identified two distinct periods with different stocking strategies. From 1981 to 1992 there was intense importing of young fish from commercial hatcheries in other countries. In the second period from 1992 to 2007 the percentage of young fish that were imported was less and there were greater number of young fish that had been bred from native fish via artificial spawning and then released back into the river of the parents (so-called supportive breeding). There were also some young fish that had been transferred regionally between rivers. During the different time periods there were also changes in the percentage of immigrants i.e. the number of fish straying from their birth rivers: 2.16 per cent in 1988, 6.81 per cent in 1996, 2.96 per cent in 2002 and 1.31 per cent in 2007.

There were continuous changes in the structure of genetic populations with the result that by 2007 the genetic diversity between the populations had lessened i.e. the salmon had become homogenised with less room for adaption. Although to some extent the genetic population patterns are associated with stocking strategy and migration of fish between rivers, climate change appeared to be the main factor in determining genetic diversity between populations. Climate was measured by the North Atlantic Oscillation Index[2], and indicated that the warmer the conditions, the less diverse the populations. From the study it was not possible to determine the exact moment or life stage in the salmon when this occurred and, to do this, would require long datasets of well-monitored populations. However, it does indicate that the introduction of captive-bred animals into the wild introduces an artificial change in genetic populations and climate change adds to (and probably enhances) this homogenisation. This in turn is likely to disrupt the capacity of natural populations to adapt to changing climate conditions.

On the basis of their findings, the researchers suggest that conservation programmes should be planned on a case-by-case basis and the genetic population model assessed for each species.

1. INTERREG projects 040(ASAP), 203(ASAP-2) and AARC. See http://i4c.eu/
2. See http://www.cpc.ncep.noaa.gov/products/precip/CWlink/pna/nao_index.html

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