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Sterile fish – the solution to the problem of escapees?

Both the authorities and fish farmers are currently working hard to make it more difficult for fish to escape from cages. However, we know that it will hardly be possible to prevent all escapes. The best way of guaranteeing that farmed salmon do not spread their genes in the wild is to make them sterile, which prevents them from reproducing, even if they do escape.

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Triploidisation is a widely accepted method of sterilising fish for aquaculture, and is currently the only method available in practice. Triploid fish have three sets of chromosomes instead of the normal two (diploid fish), and the method is extensively used in various parts of the world. Currently the most common practice is to induce triploidy by applying high pressure to newly fertilised eggs. This has been used on rainbow trout, Atlantic salmon and cod. The methods employed are easy to use, require relatively cheap and simple investments, and are used commercially in the farming and management of a number of species in the US and Europe. In commercial aquaculture, the technique is often combined with sex reversal techniques (for example producing only females).

The Institute of Marine Research is currently carrying out experiments on sterile, triploid salmon and cod.

Figure 1
Sterile, triploid salmon with deformities in the middle section of its spinal column.

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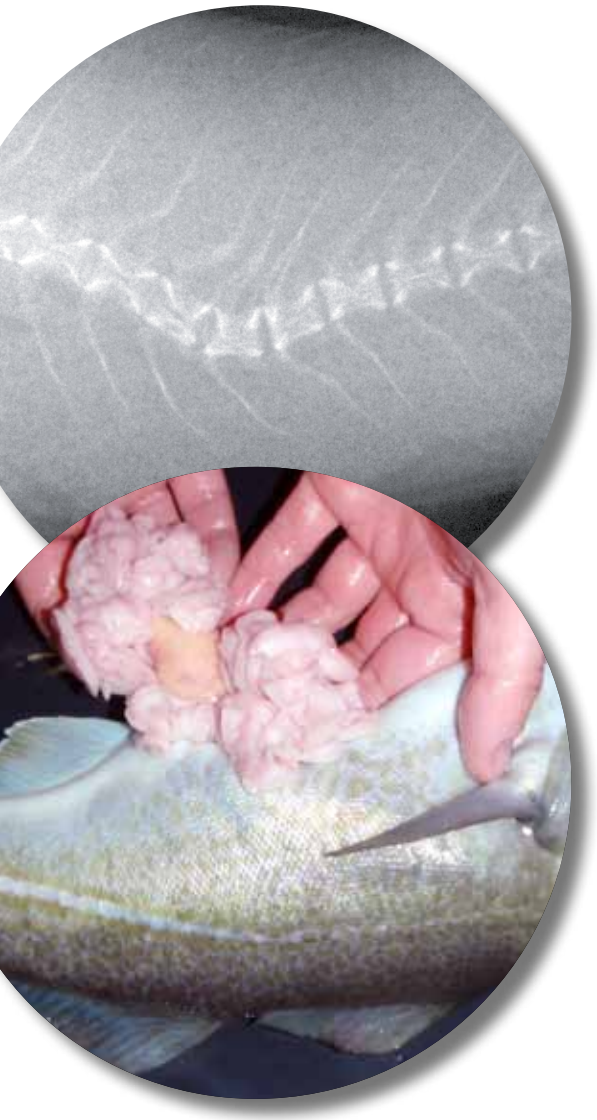

Figure 2
X-ray of triploid cod with curvature of the spine (lordosis) towards the front of its tail.

Figure 3
Photo of cod with both roe (orange) and milt (greyish white).

Figur 4
Institute of marine research, Austevoll research station.

The sterile, triploid salmon are kept at the Institute of Marine Research's research station at Matre, and form part of the EU project "SALMOTRIP". Provisional results show that triploid salmon grow better in fresh water, but that they are somewhat more likely to develop deformities. The project will also involve a full production cycle at a commercial fish farm. The smolt that will be used in the commercial test are currently under production, and will be released into a cage in autumn 2009.

The sterile, triploid cod are kept at the Institute of Marine Research's research station at Austevoll. Preliminary results show that triploid cod grow somewhat slower than normal cod, but this may change when the fish reach sexual maturity in the winter of 2010. We have, however, found a significantly higher proportion of deformities in triploid cod, may be because the triploid fish need to be raised in a special environment.

At Austevoll we also have a population of cod with modified sexual characteristics. These cod were treated with testosterone during an important phase of their development known as sexual differentiation. Cod are approx. 12 mm long when this phase begins, and a variant of testosterone (a male sex hormone) was added to their feed until they reached lengths of 16-21 mm. As a result, a large proportion of the females developed both roe and milt. The milt was used to fertilise normal cod eggs. Provided that the cod have the expected XY sex determination system, the offspring of such fertilisation will all be females. In Austevoll we now have three populations that are the offspring of the sex-reversed cod, which are thought to consist only of females. This will be verified when they are old enough to be sexed. Farming exclusively female populations may reduce the problems associated with early sexual maturation in cod, and can prevent fertilised cod eggs from being spread from fish farms.

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