



Environmental Impacts of Fish Farming



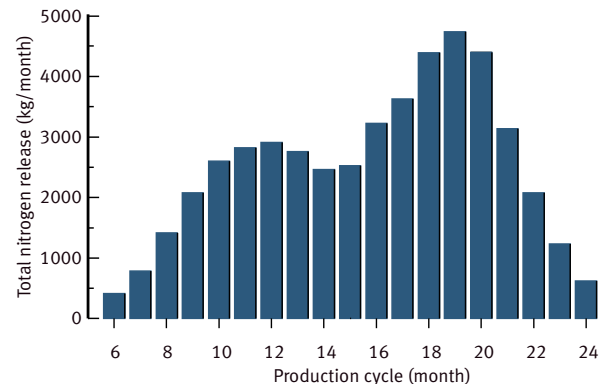
Introduction

The fish farming industry in Scotland is dominated by salmon farming, much of which takes place in the sheltered sea lochs of the west coast and islands (see *Scottish Fish Farm Production Survey*). Salmon farming can have a variety of effects on the marine environment, through the discharge of nutrients, solid waste, medicines and antifoulants. Fisheries Research Services (FRS) has a strong programme of research investigating these effects and provides both the Scottish Executive and the Scottish Environment Protection Agency (SEPA) with advice on applications for the leases and discharge consents necessary for fish farming development.

Nutrients

The process of fish farming releases nutrients such as nitrogen and phosphorus, from fish feed into the marine environment in a soluble form. These nutrients can enhance the growth of marine plants and algae. FRS has developed mathematical models to predict the levels of nutrient enhancement in sea lochs arising from fish farming. The results of these models are used to provide advice on the amount of fish that can be farmed on a particular site. Recently FRS has conducted field surveys to measure the levels of nutrients in sea lochs and record any effects on phytoplankton or seaweed on the shoreline.

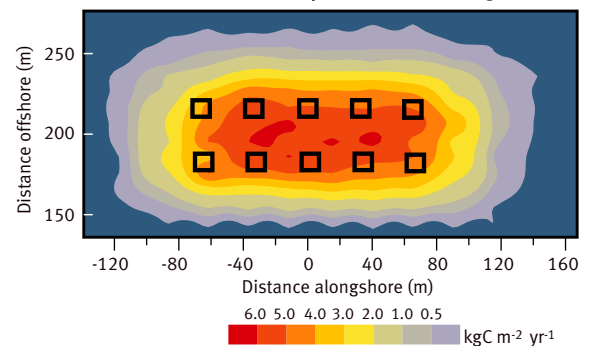
Predicted nutrient nitrogen discharge from a farm producing 1,000 tonnes of salmon over a full production cycle



Effects on the seabed

Waste feed and faeces from fish farms can collect on the seabed under fish cages. This increase in organic matter has an impact on this benthic environment, affecting the nature and chemistry of sediments, and can reduce the diversity of animals living there.

Predicted carbon deposition below fish cages





Scientists at FRS use models to predict the area of seabed under fish farms that is likely to be affected. These results are used to advise the Scottish Executive and SEPA on fish farming developments.

Medicines and sea lice

A number of medicines are used on fish farms to maintain fish health. The application of antibiotics to treat bacterial diseases has declined in recent years due to effective vaccination programmes.

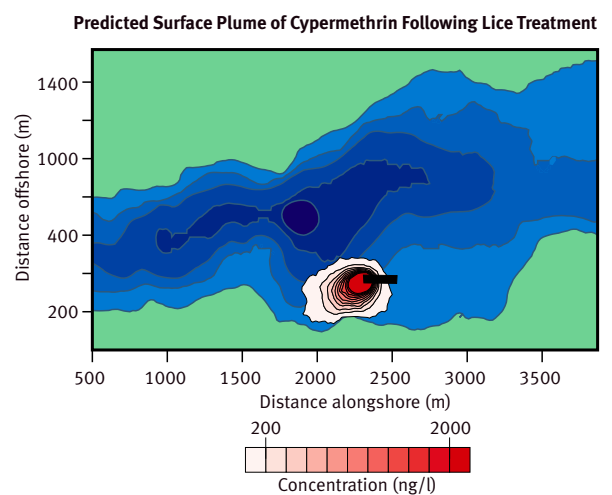
Farmed salmon are susceptible to infestations of parasitic sea lice that cause considerable stress to fish and economic losses to the industry. Sea lice on farmed fish could potentially be transferred to wild salmon and sea trout. FRS has an on-going project in Loch Torridon to record the prevalence of larval stages of sea lice in the loch to understand what factors, such as the presence of fish farms, might control their abundance.

Young sea lice (free-swimming copepodid and nauplius stages)



The fish farming industry control sea lice using chemicals that can be toxic to marine invertebrates. The quantities of chemicals used is carefully regulated by SEPA to ensure that levels in the marine environment are safe and below

environmental quality standards (EQS). Some sea lice treatments, for example Excis® (cypermethrin) and Salmosan® are applied as a bath and then discharged into the surrounding water. FRS uses hydrographic models to predict the dispersal of these chemicals and their concentrations in the marine environment.



Antifoulants

Antifoulants used on fish farm cage nets can affect the marine environment. Tributyltin (TBT) was commonly used as an antifoulant until 1987, when its use for this purpose was prohibited. FRS still monitors the marine environment for the effects of TBT in selected areas (see FRS fact sheet: *Effects of TBT Contamination of the Sea*).

Farming new species

New species of fish are being targeted by the industry for culture. Cod, halibut and turbot are now being farmed at a few sites in Scotland. These species produce different amounts of waste to salmon and will therefore have a different level of environmental impact. Work is underway at FRS to estimate these differences and advise how the results should be used in regulating the industry.