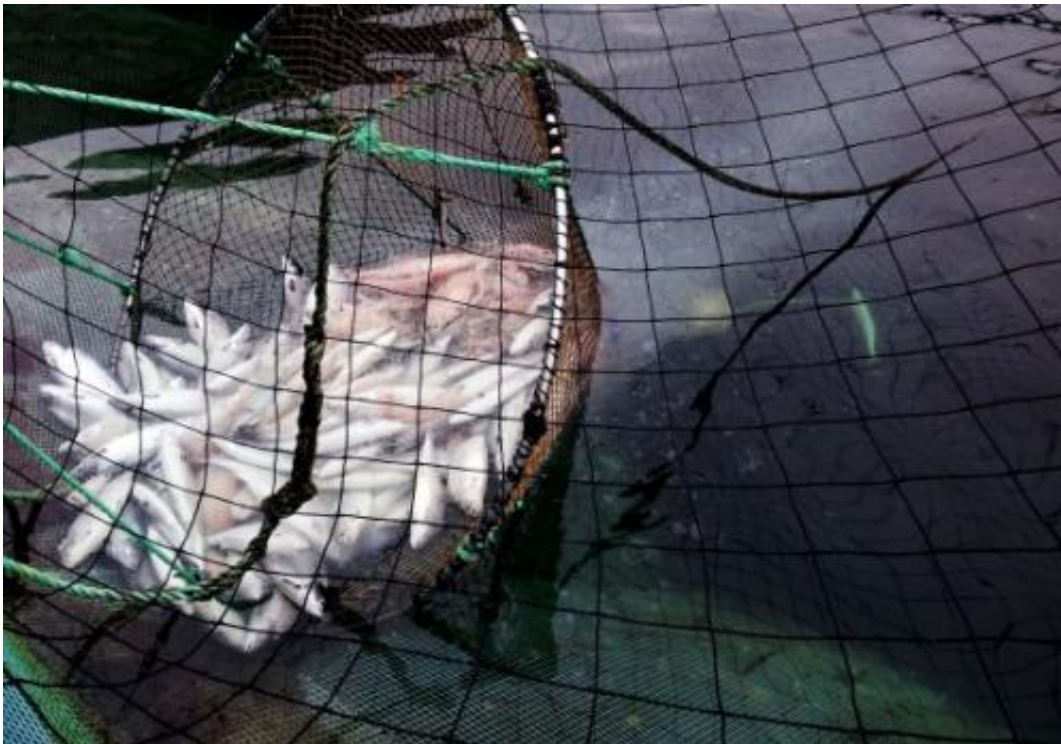


Surface water is a key factor in the transmission of pancreas disease in salmon

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Landing net with dead fish Credit: Stein Erich Solevåg

Anne Stene's PhD thesis explains how environmental factors affect the outbreak and transmission of pancreas disease (PD) in farmed salmon.

Both infected and dead [salmon](#) can shed the salmonid pancreas disease virus into the sea and the virus particles can be spread by the wind and ocean currents from one fish farm to the next along the coast.

Pancreas disease (PD) is currently the most serious of the viral infections affecting Norwegian farmed salmon. The disease leads to increased mortality, weight loss and low fish product quality. It therefore has a significant influence on fish welfare and on profitability in the aquaculture industry.

Coastal currents are a key factor in disease transmission

The PD virus can survive for long periods of time outside the salmon host in cold, clean seawater and it therefore has a strong infective potential along the Norwegian coast. Using a hydrodynamic model developed by SINTEF (www.sintef.no/home/), Stene was able to demonstrate that the transmission of the disease between fish farms at different locations is primarily caused by the direction of ocean currents near the surface of the water. Her findings also show that fish farms located in close proximity to infected/diseased salmon and fish farms owned by companies with many other infected farms have an increased risk of their stocks becoming infected with PD.

In addition to identifying risk factors for the transmission of PD, Stene focused on risk factors for outbreaks of the disease. Her doctoral project, which was carried out at the Norwegian Veterinary Institute, shows that salmon become infected with PD when the sea's temperature rises over a period of time. The reason for this may be that the increase in water temperature leads to a state of chronic stress in the fish, which in turn has a negative effect on their immune defence system. An outbreak of the disease usually occurs when there is a high concentration of the virus in the fish. This can result in extensive shedding of the virus, which in turn leads to a high infection pressure in the sea.

An important finding in Stene's study is that fat from infected and [dead fish](#) at the bottom of the cages also contains the virus. Some of this fat

will float to the surface and can potentially infect salmon that come into contact with it. This floating layer of fat can spread to other fish farms by means of [ocean currents](#) near the surface. This underlines the need to remove dead fish as quickly and efficiently as possible.

Important knowledge to prevent infection

Stene's thesis shows that the virus does not pose a problem during the smoltification of salmon in fresh water. Rather, the most important factor is the transmission of infection during the growth phase in salt water. If it is possible to slaughter infected fish before the temperature rises, outbreaks of PD can be limited and this will reduce concentrations of the [virus](#) in the sea. And when fewer viruses are carried by the currents, the risk of infection will decrease. Knowledge about water-borne transmission and the risk of outbreaks is an important tool in when it comes to production planning with a view to preventing infection.

Stene's research therefore provides fish farmers with new information, when they are considering locations for releasing young salmon, as regards the direction of predominant surface currents in relation to farms containing infected fish. Similarly, the slaughter of fish can be planned in relation to the location's [infection](#) status, outbreak [risk](#) and the probability of [disease transmission](#) to neighbouring farms with fresh [fish](#). Such measures must of course be weighed up against concerns regarding commercial viability for the individual farm and for the industry as a whole in each area. The costs can be high in the short term but must also be appraised in a more long-term perspective.

Anne Stene defended her doctoral research on 23rd October 2013 at the Norwegian School of Veterinary Science with a thesis entitled "Transmission of Pancreas Disease in marine salmon farming in Norway".

Provided by Norwegian School of Veterinary Science

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