Original Text:

Hvilket problem/behov skal prosjektet bidra til å løse?

En stor ulempe med oppdrettsfisker at de lever i et miljø der de er omringet av andre patogene som virus, bakterier og parasitter som lakselus. Sykdom er en betydelig tapsfaktor i oppdrettsindustrien, og et sterkt forsvarssystem er viktig for overlevelse.

Revised Text:

What problems/needs will the project help to solve?

Sea lice infestations of salmon farms have been devastating to the Norwegian aquaculture industry in recent years, and are notoriously difficult to control. Supplies of farmed salmon fell 9% worldwide from 2015-2016 – and Norwegian sea lice outbreaks accounted for 6% of the worldwide decrease alone, while the other 3% came largely from Scotland and Chile ('Salmon devotees to fork out more after prices leap', 2017, Financial Times). This has been the biggest decline in production in more than 25 years. For one giant salmon supplier in Norway, the costs of combating these parasites rose 32% in one year's time, from €59.2m in 2015 to €78.5m in 2016 ('Salmon Squeeze: The gross reason you'll be paying a lot more for salmon this year', 2017, Quartz). This is not the first year that such costs have increased, and the magnitude of such costs is not sustainable for the industry. This trend needs to be reversed. According to the Norwegian Seafood Council, production needs to increase by 200,000 tons a year in order for prices to remain stable, and Prime Minister Erna Solberg has committed to increased efforts in addressing this problem.

Not only is this a fiscal issue, but it has environmental consequences as well. Current treatment methods are full of harsh medicines and toxic chemicals that are destructive to the environment. Per Sandberg, the Minister of Fisheries, recently tightened regulations against the chemical delousing of salmon due to its environmental consequences. Furthermore, with the increase in density of salmon farms, large numbers of sea lice are being transferred from the farmed fish to wild fish, attaching to them in large numbers and killing them. This is especially risky for juvenile fish, and has the potential to change the underwater ecosystem permanently.

The ways in which sea lice are managed on fish farms fall into two categories: treatment of disease and prevention of disease. Common methods for treatment of disease include:

Antibiotics. The use of antibiotics in aquaculture is on the decline due to the risk of increased bacterial resistance in both fish and humans. They will likely be phased out entirely in years to come.

Toxic chemical treatments. Hydrogen peroxide baths in particular are currently popular in the treatment of sea lice. They are fairly efficient at causing sea lice to release from their hosts with only mild effects to the environmental, the fish, and the human handlers. But new research is showing that hydrogen peroxide may not be as harmless as once thought, and the restrictions on chemical treatments are increasingly being tightened.

Common methods for prevention of disease include:

Anti-parasitic drugs. These are widely used, but are constantly being discontinued and rotated due to increased parasitic resistance to the drugs. They are often applied by individual injection, which is

an expensive and time-consuming process that requires a specialized company contracted in for the job. It also creates unnecessary stress on the fish, which alone can lead to shock and death.

Immunostimulants. These are gentler on the animal and on the environment than antibiotics, toxic chemicals, and anti-parasitic drugs, and are the preferred method of protection in the aquaculture industry. They strengthen the immune response in Atlantic salmon, thereby reducing the number of sea lice infections, and are becoming an important part of the integrated pest management strategy against sea lice. But the active ingredients behind current solutions are complicated and expensive to develop, nearly impossible to improve, and their effects are of a short duration. Therefore, as it currently stands, today's immunostimulants are not a good enough solution to replace the other, less than ideal methods.

Clearly, the way in which this rampant disease is being treated is unsustainable, and will ultimately make a bad situation worse. A more long-term solution is necessary. Researchers agree that it will likely require a multi-pronged approach to provide gentle relief to the environment as well as the fish. Immunostimulants of the future are likely one faucet of this approach. In fact, a well-cited Elsevier article from Mark Fast (2014) states that, '…some form of immunological priming against the parasite will be an important component of the future of strategic pest management for parasitic copepods.'