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DERES REF.: EPOST FRA JACOBSEN 21.9.23 VÅR REF.: 23/14536 ÅS, 25.09.2023

Bestilling av kunnskapsstøtte i forbindelse med mistanke om PD utenfor endemisk sone.

On the 21st September 2023, the Norwegian Veterinary Institute (NVI) received a request from the Norwegian Food Safety Authority (NFSA) for an assessment of transmission of Salmonid alphavirus (SAV) from location 45003 Ystøya to surrounding locations in order to establish a control area. Suspicion of Pancreas Disease (PD) at the location was raised due to detection of SAV2 in samples collected 12th September. NFSA performed sampling 20th September 2023, and PD was confirmed 22nd September 2023 by NVI (Norwegian Ref Lab) based on detection of SAV by PCR, histological investigation and sequencing that demonstrated the presence of SAV2. The location lies outside of the endemic zone for PD. The source of the infection is yet unknown.

The NFSA has informed us that the index location 45003 Ystøya presently has around 900000 fish that are 2.5-3 kg in size and that the fish will be slaughtered in approximately 14 days. In addition to 45003 Ystøya, increased mortality that might be associated with PD is reported at location 18936 Igerøy. A vessel that was used for delousing at 45003 Ystøya in mid-August went to 18936 Igerøy after the operation at Ystøya. SAV has not been detected during routine surveillance in 18936 Igerøy from samples taken 7th August 2023.

In connection with the detection of PD in 45003 Ystøya, the NFSA has asked for scientific-based advice to establish a control area. Therefore, we are addressing the following general question:

1. What is the probability of PD (SAV) spread to other locations from 45003 Ystøya in the current production system?

NVI has agreed on a deadline of 25th September before midday to an immediate reply.

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Reply from the Norwegian Veterinary Institute

Based on the biomass data from the Norwegian Department of Fisheries from August 2023, there are 43 active salmonid locations within 100 km seaway distance of 45003 Ystøya. There are 11 locations with fish within 30 km (10447, 38057, 18936, 36217, 11015, 45050, 31217, 10961, 38037, 34197, 10989), eight within 20 km (10447, 38057, 18936, 36217, 11015, 45050, 31217, 10961), and one within 10 km (10447).

The Norwegian Veterinary Institute has simulated the spread of PD (SAV) based on a compartmental model developed by the Norwegian Computing Center and the production histories of the locations. The model gives the probability of PD (SAV) spread to locations within 100 km of an index location based on seaway distance, the number and size of fish on the locations, the month of introduction, and the time to slaughter of the index farm. A full description of the model used for the simulations can be found in Bang Jensen et al. (2021)[1].

To simulate the spread of disease forward in time, we copied the production histories from the latest available month of the reported biomass data, August 2023. We assumed that the average size of the fish in 45003 Ystøya for September was 2.5 kg based on the information given by the NFSA. For the purpose of the simulation, we assumed that PD (SAV) was introduced in August 2023 and that the fish will stand infected for two months before being slaughtered. We simulated the model 1000 iterations and summarized the probability that a location is infected with PD (SAV) as the number of simulations the location becomes infected over the total number of simulations.

On this basis, we estimated that two locations had a 5-8.5% probability of being infected (10447, 18936), five locations had a 2-4% probability (11015, 36217, 31217, 38057, 45050), and four locations had a 0.5-2% probability (10961, 34197, 31637, 33297) (see Figure 1). The two locations with the greatest probability of infection lie within 9 and 11 km respectively of the initial infected location. All of the locations with greater than 1% probability of infection were within 20 km of 45003 Ystøya.

[1] Bang Jensen et al. (2021) “Realtime case study simulations of transmission of Pancreas Disease (PD) in Norwegian salmonid farming for disease control purposes.” Epidemics 37: 100502. https://doi.org/10.1016/j.epidem.2021.100502

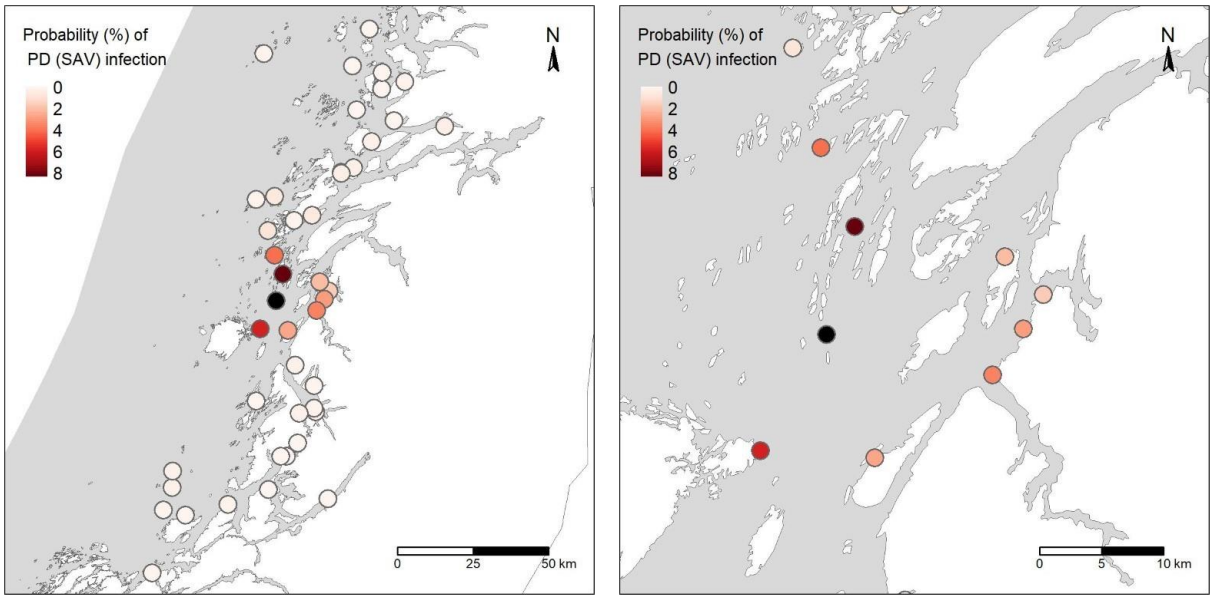

Figure 1. (left) Map of the active salmonid locations (colored circles) within 100 km of 45003 Ystøya (black circle) used in the simulation model. The fill color represents the probability that the location becomes infected based on the simulations. (right) Map of the active salmonid locations (colored circles) within 30 km of 45003 Ystøya (black circle) used in the simulation model. The fill color represents the probability that the location becomes infected based on the simulations.

The model does not directly account for all possible infection routes of PD (SAV). The model uses seaway distance between farms to account for the horizontal spread of PD (SAV). Therefore, it does not account directly for increased contact between farms due to boat movements, which have been shown to be an important transmission route[2]. The model also does not account for water currents that may increase or decrease the rate of transmission in some areas. It is important to note that the model results are sensitive to the underlying biomass data. Results may be subject to change as new data become available, due to reporting delays or updates. We can periodically update the model with new data or upon request. Especially of interest will be the results from site 18936 Igerøy and the mortality history from 45003 Ystøya indicating any SAV introduction prior to August.

Med vennlig hilsen

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[2] Haredasht et al. (2019) "A stochastic network-based model to simulate the spread of pancreas disease (PD) in the Norwegian salmon industry based on the observed vessel movements and seaway distance between marine farms." Preventative Veterinary Medicine 167: 174-181. https://doi.org/10.1016/j.prevetmed.2018.05.019