

Maintaining clearance of PD caused by SAV2 in Mid-Norway

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Introduction

- During 2017, SAV2 infection of sea farmed Atlantic salmon (*Salmo salar*) spread to the Northern coastal area of Trøndelag county, Mid-Norway (PO7).
- SAV monitoring by qRT-PCR, and removal of groups with clinical PD was imposed by the Veterinary authorities to stop further spread.
- A voluntary PD vaccination campaign was launched by the local industry to improve control with SAV2.



Figure 1: Red star shows the area endemic of SAV-2, green star shows area with free-status for SAV-2 and orange shows the Northern costal area in this study.

The history of PD in PO7

• **2012**:

- First detection
- 1 site
- Stamping-out
- 2016-17:
 - 13 sites
 - Stamping-out transitioned into an endemic situation in 2017



Relapse of PD in 2019-2020

- Relapse of SAV2 in one zone ("Vikna sør") during 2019-2020.
- No spread to other zones in the area.
- After the infected zone was fallowed in August 2020 there has not been any more cases of PD in PO7.



Figure 2: Infection status for SAV2 in PO7 during the period 2019-2020. The red star shows the zone where SAV2 relapsed, green stars show zones without SAV2.

Methods

- Data from PD/SAV surveillance collected by Emilsen Fisk AS.
- Number of sites with suspicion of (PCR positive only) or clinically apparent PD collected from publicly available sources.
- Data on carcass quality at harvest from Emilsen Fisk and SinkabergHansen.
- Harvest and productivity data from similar cage populations immunized with different PD vaccines were obtained from Emilsen Fisk AS.
- Calculations of fish health economics with Aquatools performed by Aquamedic and NMBU.

Results (1)

- Vaccination, supported by improved management and biosecurity, has by large prevented recurrence of infection in subsequent yearclasses.
- SAV2 relapsed in one zone ("Vikna sør") in 2019.



Figure 2: Infection status for SAV2 in PO7 during the period 2019-2020. The red star shows the zone where SAV2 relapsed, green stars show zones without SAV2.

Results (2)

• The zone "Vikna sør" and the entire production area has maintained clearance of SAV2 since September 2020.

Table 1: Epidemiological overview of 3 yearclasses of salmon reared in the relapse zone "Vikna sør".

Ongrowth period	PCR positive only	Sites with clinical observations of PD
2017-2018	1	5
2019-2020	4	5
2021-2022	0	0

Results (3)

- Spinal deformities («cross-stitch») and cartilagenous proliferation («hunchback»).
- Cartilageous proliferation along the vertebral column has given reduced harvest quality (albeit variable) in certain PD vaccinated groups.



Prevalence of «hunchback»

- Higher in intensively produced SO (Autumn) than in S1 (Spring) smolts.
- Highest prevalence coincided with dual injection into the abdominal cavity.
- Increased occurence also noted in S0 vaccinated with Clynav (2020).



Cost-benefit calculation model

- AquaTools* developed by Arnfinn Aunsmo, NMBU.
- Basic input parameters (costs, revenues) from Emilsen Fisk.
- Our own downgrading data due to «hunchback» deformity.
- Spinal deformities: 6 % (vaccine A) vs. 1 % (vaccine B).
- Protection estimates taken from (Røsæg et al. 2021).

*https://spillfree.no/en/aquatools/



Further input variables used in the model

- Number of smolts: 1 mill.
- Accumulated mortality: 8 %
- Cost of PD vaccination: NOK 1,90 vs. NOK 4,90,- per fish
- Salmon sales price: 70 NOK/kg
- Stamping-out upon relapse of PD or SAV at 3 kg live weight
- Low probability of infection (20% = 1 in 5 smolt outputs)
 = PO7 farmers nevertheless wish to continue the «vaccination barrier» against spread of PD northwards

Benefit-cost scenarios of PD vaccination in PO7(1)

- Based on differences in price, downgrading and protection against SAV2 in two PD vaccines.
- Largest biological losses with Micro1 (Vaks A), highest cost with Clynav (Vaks B).

Cost of disease in mill NOK (y axis). 10 NOK = 1 € or \$



Blue= biological losses,;Orange= increased costs SAV 2= relapse of PD or SAV infection

Costs and losses by vaccination in PO7 (2)

- Based on differences in price, downgrading and protection between two PD vaccines
- Better operating profit <u>with</u> vaccination, than <u>without</u>
- Similar benefit-cost ratio (5 vs. 4)

Modelled operating profit



Budget=no PD, noSAV 2= relapsePD vaccination

Discussion – vaccination against PD

- Continuing vaccination against SAV2 is an «insurance» both individually and collectively - for the fish farmers in PO7.
- Reduces the risk of detection of clinical SAV2 i PO7.
 - (should be documented experimentally)
- Increases the probability of being allowed to keep the fish to normal slaughter size.
- Reduces the probability of spreading waterborne infection further north.
- Reduced growth in Micro1 vaccinated fish compared to Clynav (Røsæg et al., 2021) should be examined further
 - Due to SAV infection or adverse effects of the vaccine?







Summary

- Vaccination, biosecurity and measures related to management are fundamental in the combat and control of PD in PO7.
 - An inspiration for control with PD!
- The adverse effects related to certain PD vaccines and fish groups may reduce the benefits and result in an additional "insurance premium".
- Perform cost-benefit calculations when choosing vaccines and vaccination strategies!

Thank you for your attention!

Foto: Emilsen Fisk AS