Effect of Vaccines against PD on Viral Shedding and Disease Transmission from Atlantic Salmon in Seawater Challenged with SAV, Subtype 2

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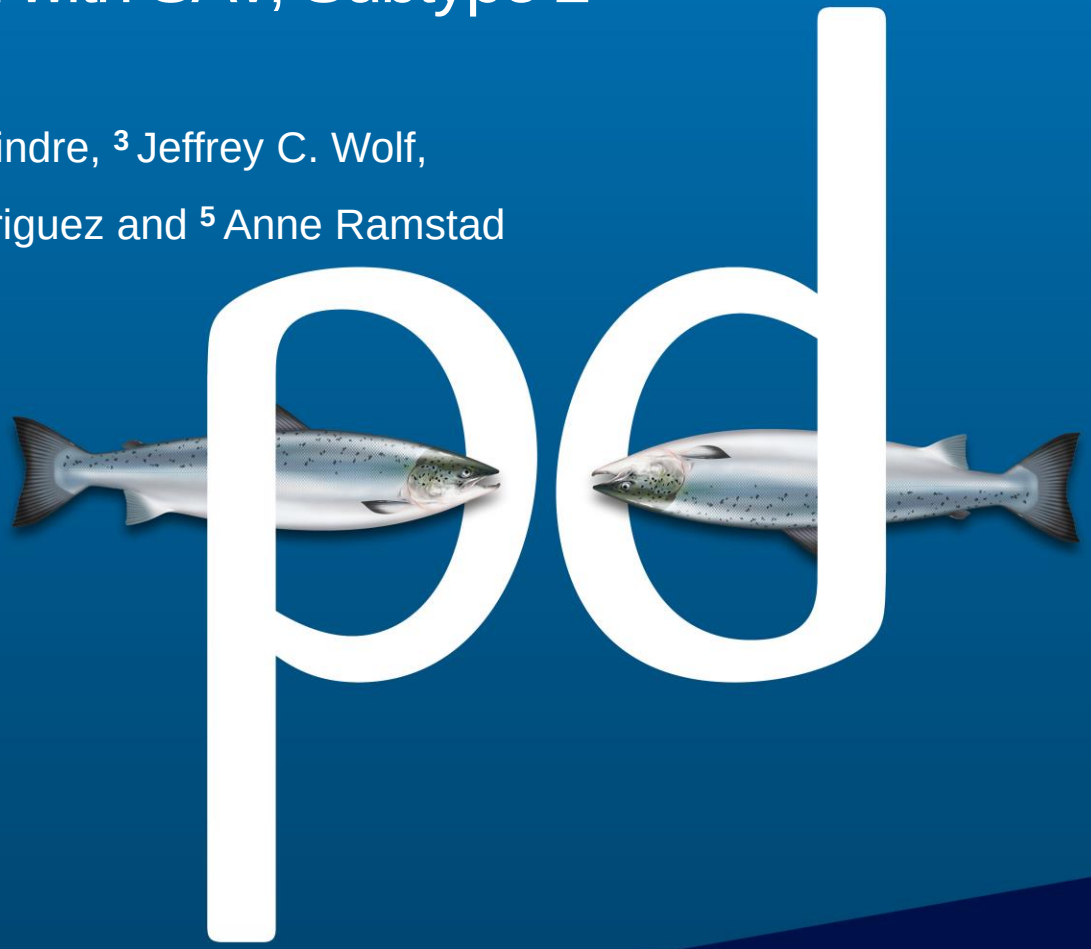

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[1] Elanco Animal Health

[2] Norwegian Veterinary Institute, Ås

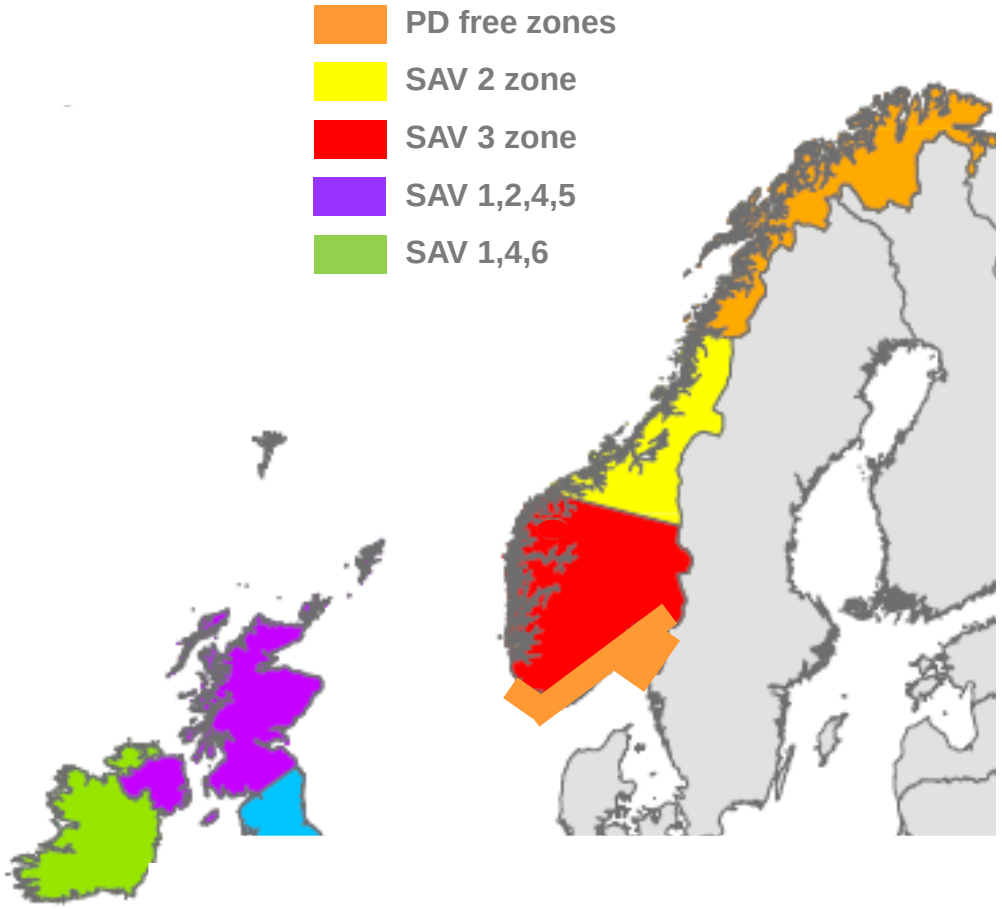
[3] Experimental Pathology Laboratories Inc., USA

[4] Norwegian University of Life Sciences, Oslo

[5] VESO Aqualab, Namsos

Background

- Distribution of SAV subtypes in European salmon farming[1]
- PD is a notifiable disease in Norway but not in UK and Ireland
- Aim of the Norwegian PD-regulation[2] is to:
  - ✓ reduce the consequences of the disease in PD-zones
  - ✓ prevent the disease from establishing in the two PD-free zones («Surveillance zones»)
  - ✓ limit the spread of the two subtypes of salmonid alphavirus (SAV)
- Vaccination against PD is an important contribution for each salmon producer as well as the industry to reduce the spreading of SAV



[1] Jansen, M.D. et al. 2017. The epidemiology of pancreas disease in salmonid aquaculture: a summary of the current state of knowledge, Journal of Fish Diseases 40(1), 141-155.

[2] Forskrift om tiltak for å forebygge, begrense og bekjempe pankreassykdom (PD) hos akvakulturdyr (https://lovdata.no/dokument/SF/forskrift/2017-08-29-1318)

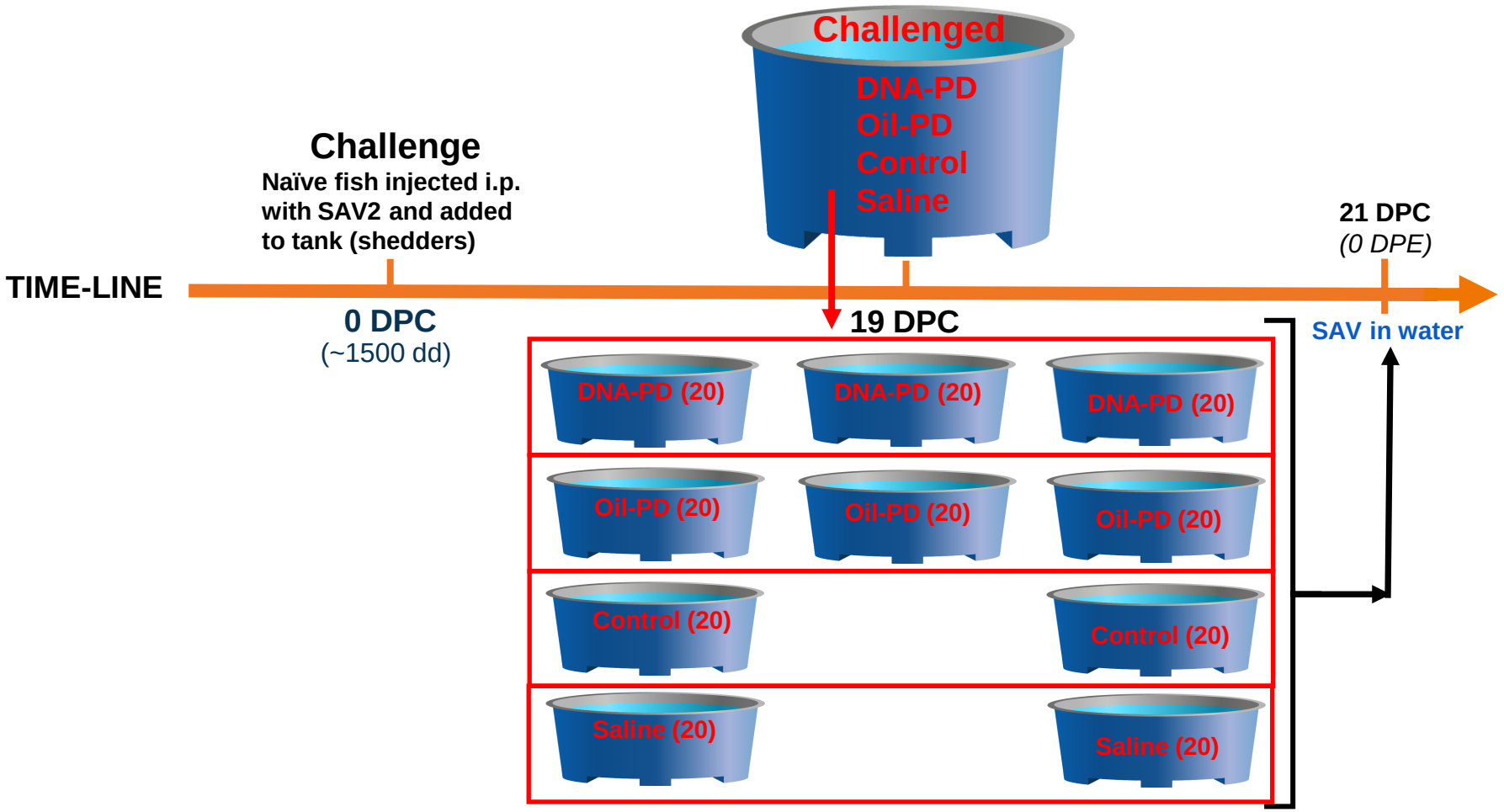
Study objective

To evaluate how commonly used PD vaccination strategies impact shedding and disease transmission of SAV2 in seawater

Treatment groups

Group ID	**PD vaccine** Clynav (i.m./0,05 ml)	**PD vaccine** AJm-1PD (i.p./0,05 ml)	**6-comp. vaccine** AJm-6 (i.p./0,05 ml)	**ERM vaccine** Alpha ERM Salar (i.p./0,025 ml)	**Saline** (i.p./0,05 ml)
DNA-PD	✓		✓	✓	
Oil-PD		✓	✓	✓	
Control			✓	✓	
Saline					✓

Exp. outline – viral shedding



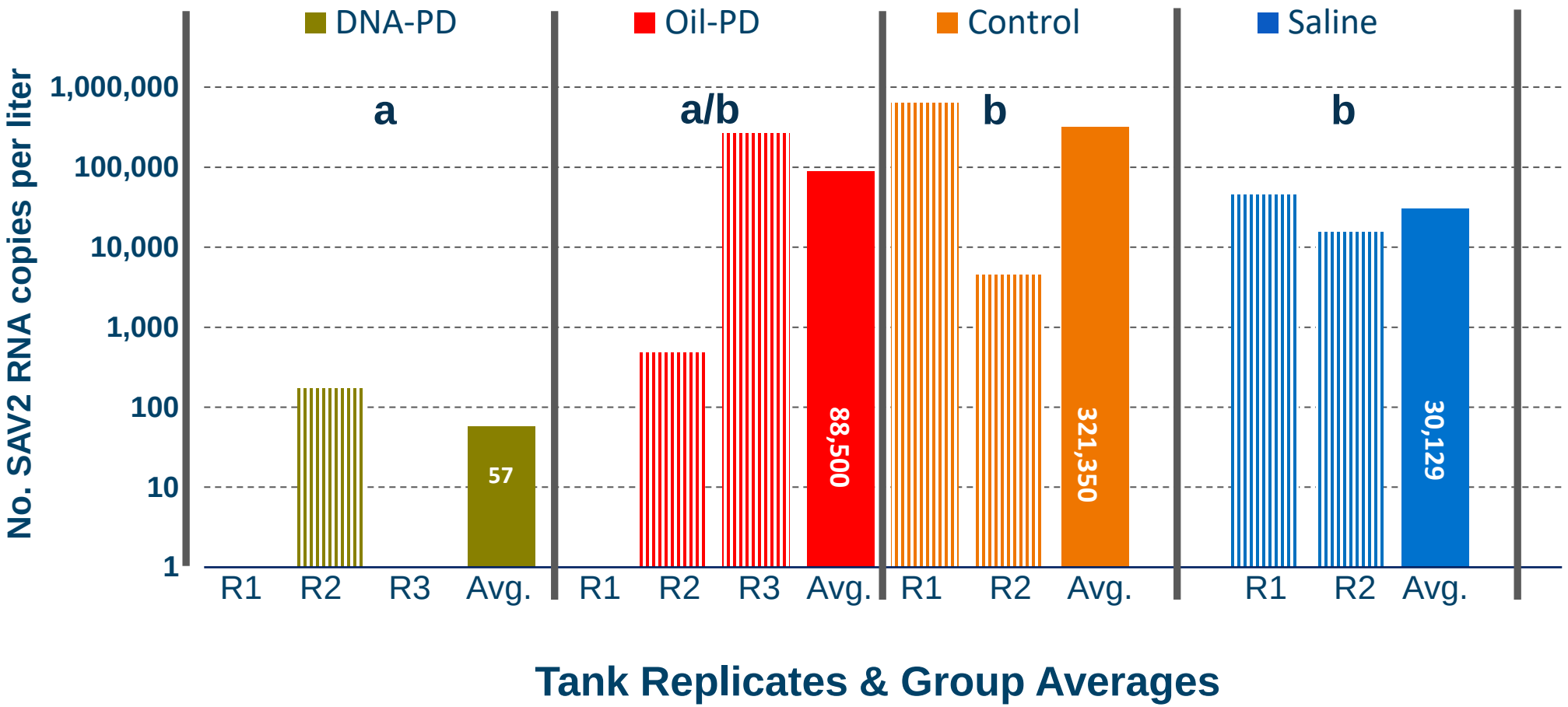
DPC = Days Post Challenge

DPE = Days Post Exposure

VIRUS IN WATER *

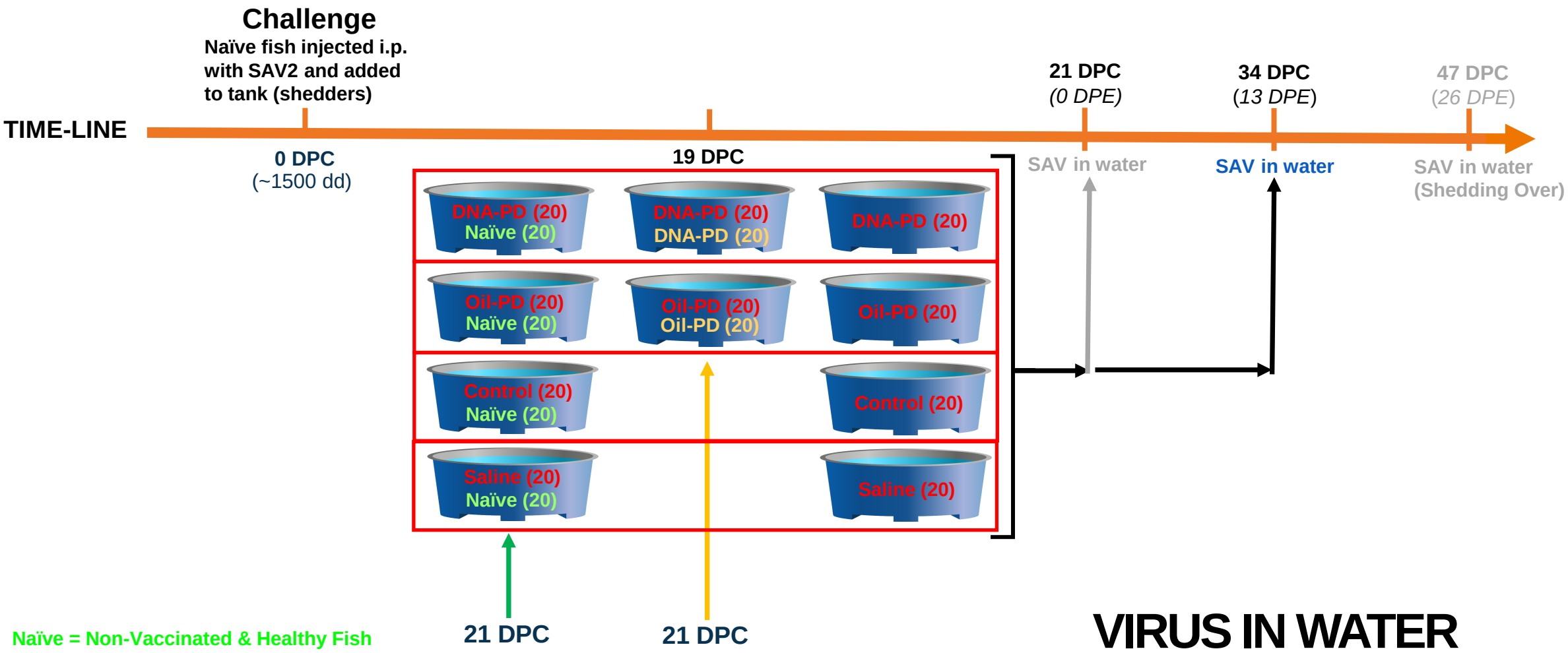
* RT-ddPCR according to Weli SC, et al, 2021. Development and evaluation of a method for concentration and detection of salmonid alphavirus from seawater. Journal of Virological Methods. 287, 1-6.

Virus in Water 21 DPC



Different letters (a and b) denote significant differences (Median Regression Analysis; $p<0.05$)

Exp. outline – viral shedding cont.



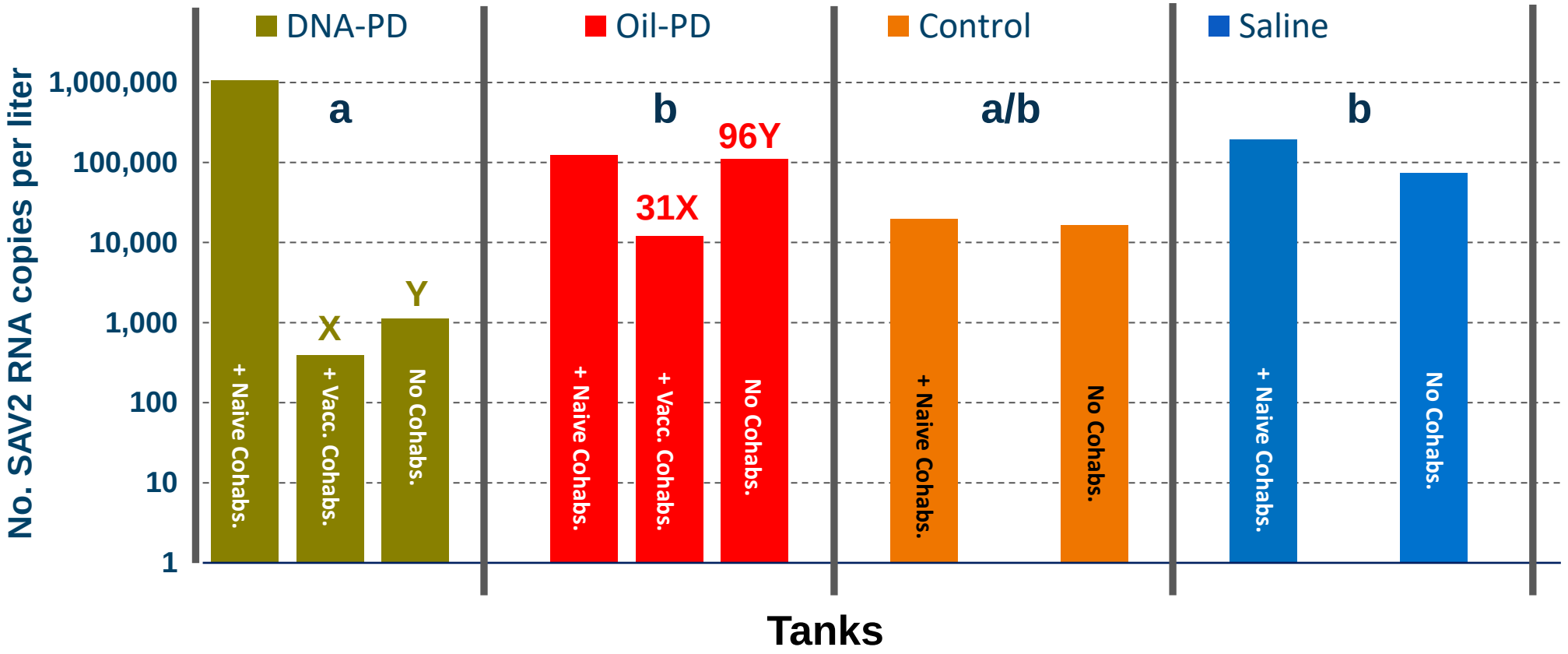
Naïve = Non-Vaccinated & Healthy Fish

DPC = Days Post Challenge

DPE = Days Post Exposure

Virus in water 34 DPC

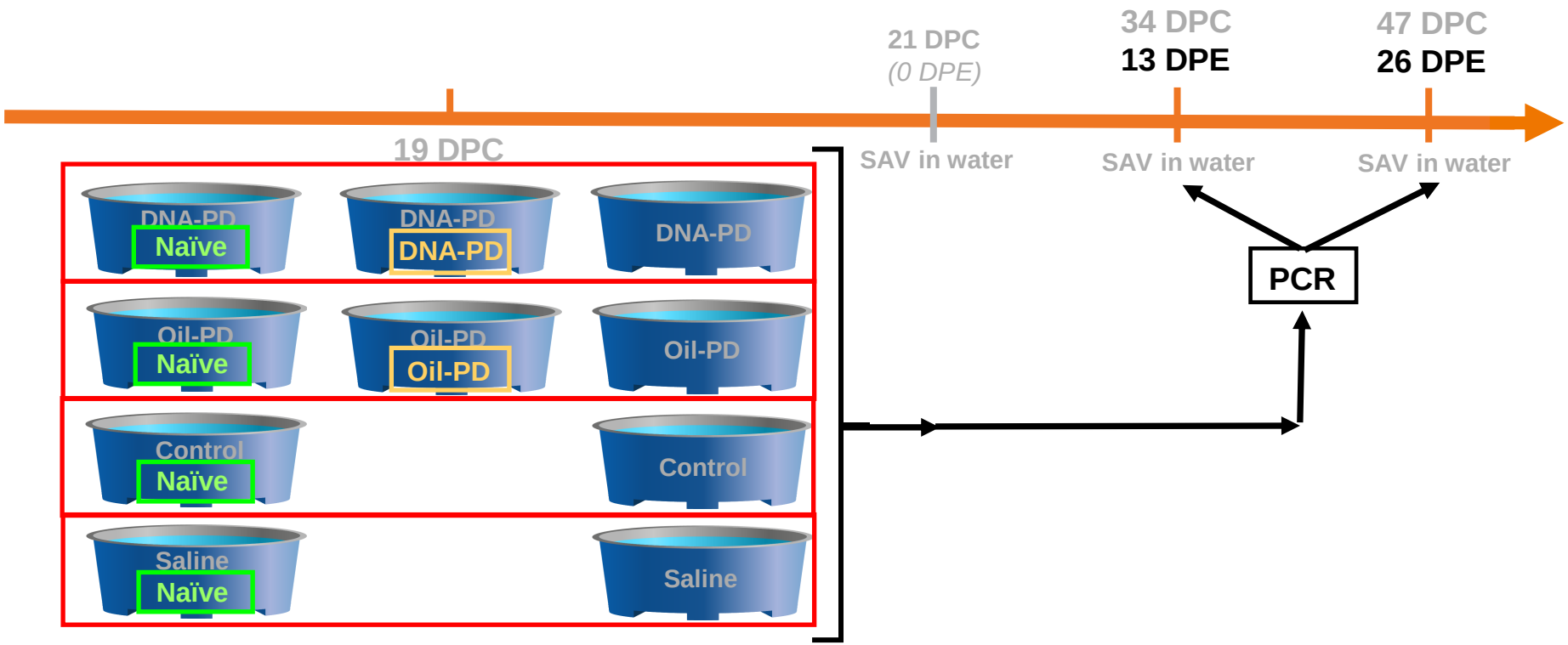
-Sampled 13 days after naïve or immunized cohabitant fish added



Viral shedding at 47 DPC was minimal (data not shown)

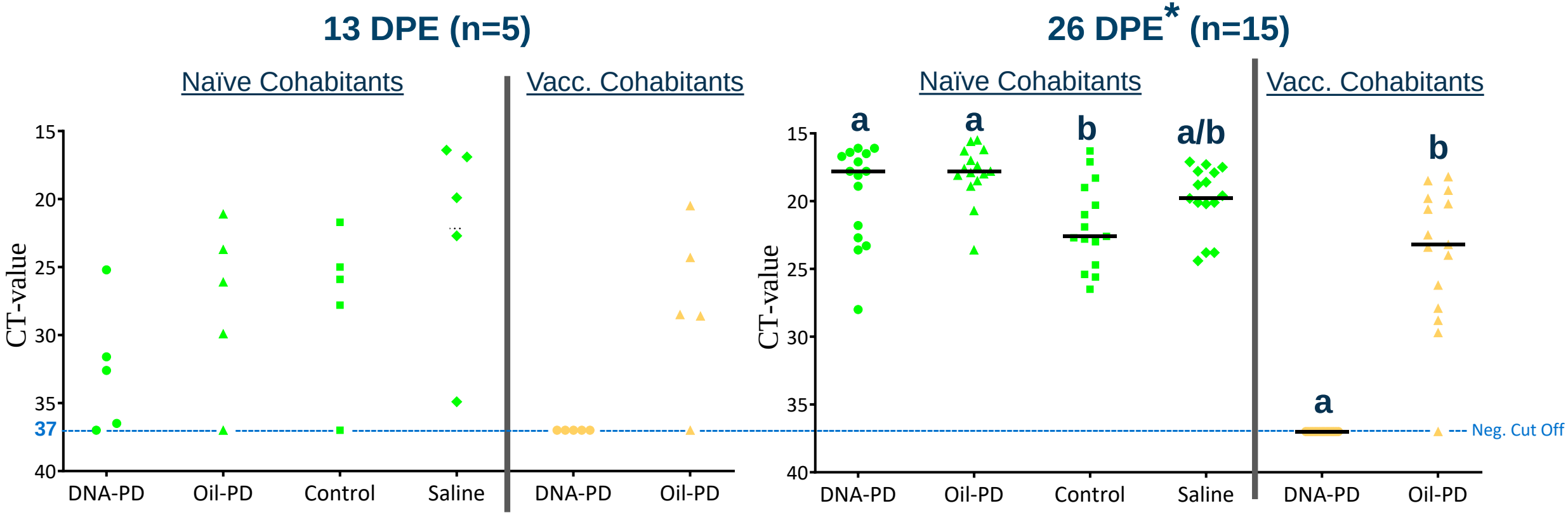
Different letters (a and b) denote significant differences (Median Regression Analysis; p<0.03)

Exp. outline - Viral transmission to cohabitant fish (PCR*)



* RT-qPCR of hearts analyzed by Patogen AS

Virus transmission to naïve and vaccinated cohabitant fish

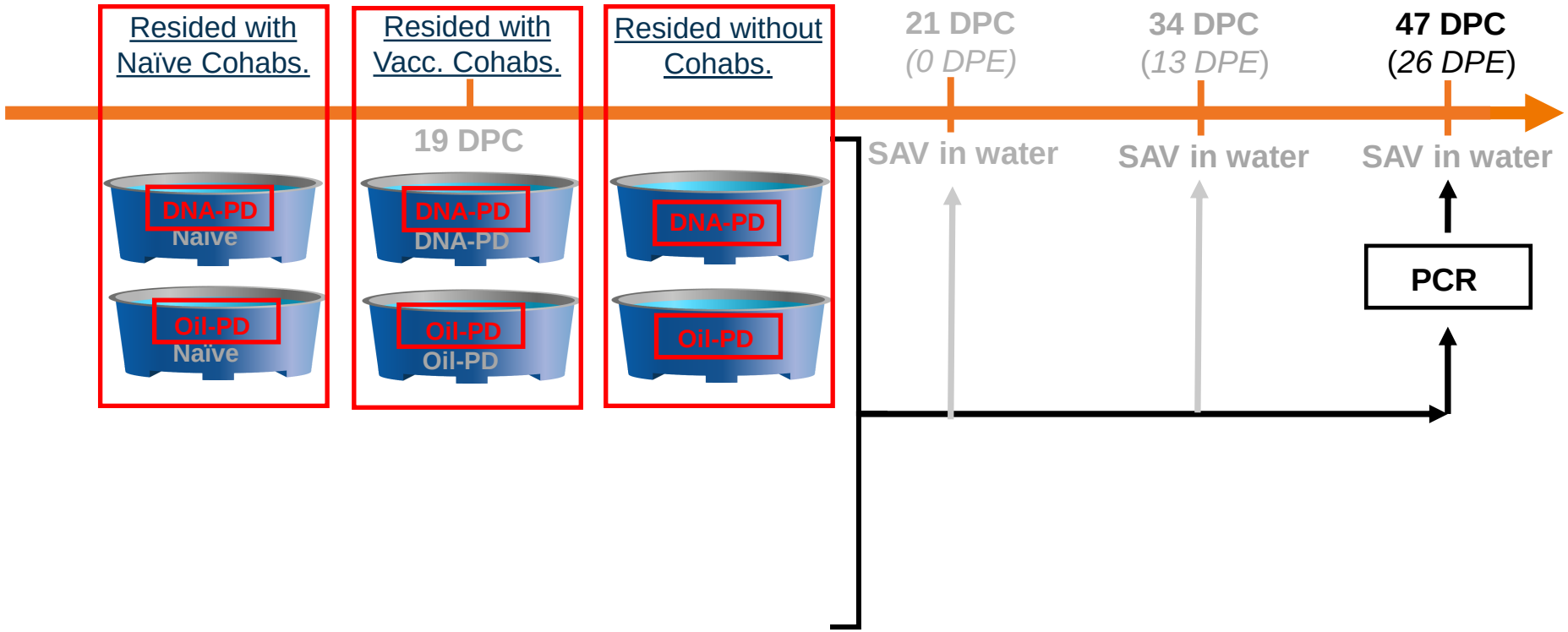


* The lines across the data for each group is the median

Different letters (a and b) denote significant differences (Median Regression Analysis; p<0.004)

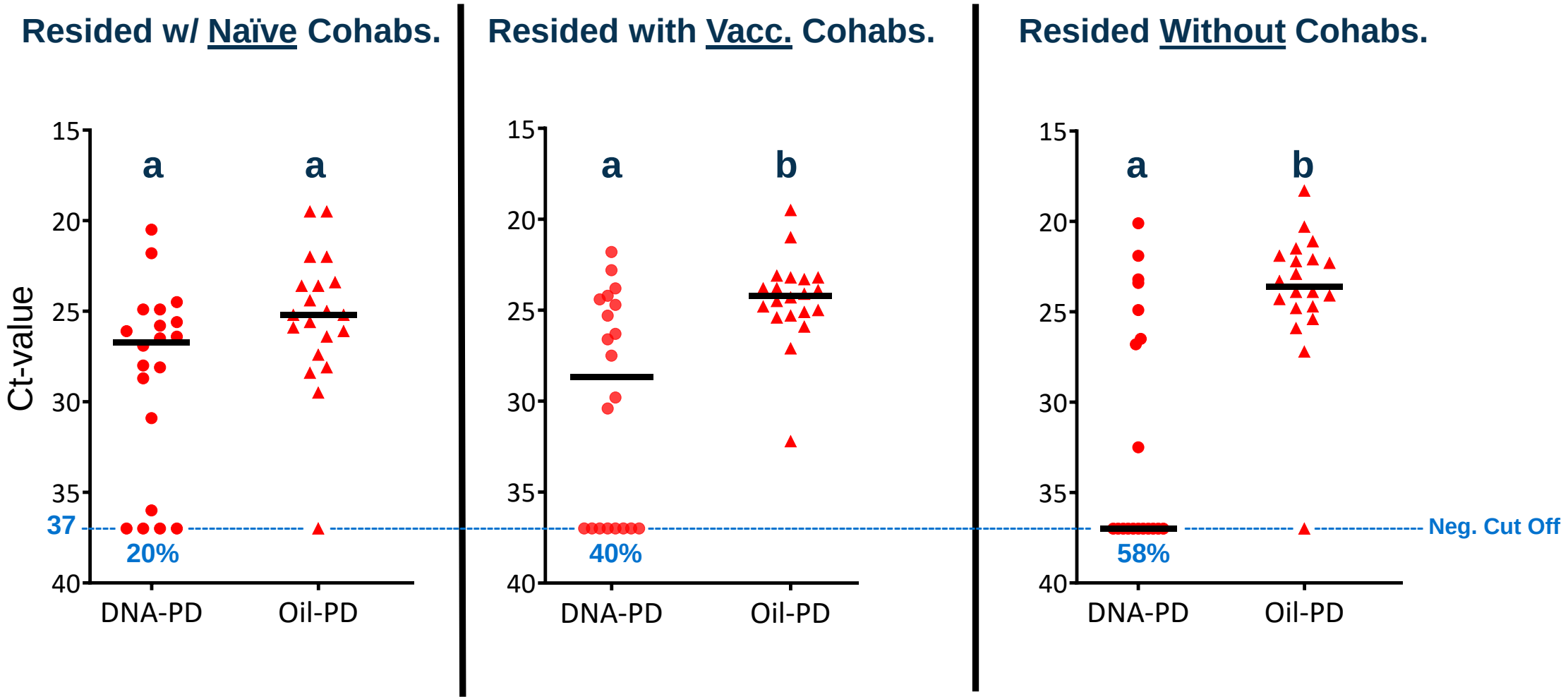
Exp. outline - Infection levels of PD vaccinated & challenged fish 47 DPC

n = 19-20 per group



PCR results of PD vaccinated and challenged groups 47 DPC

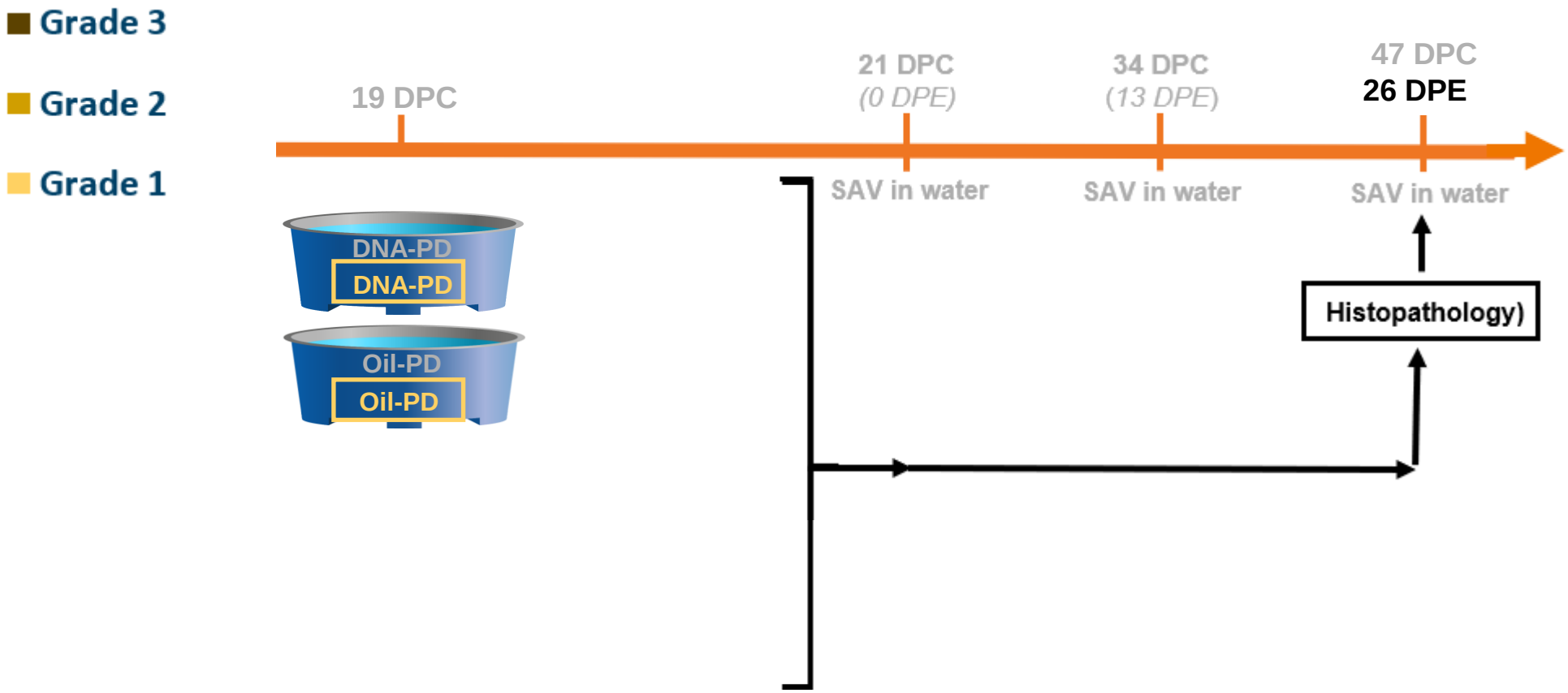
PCR hearts 26 days post exposure (DPE) to the challenged fish groups (n = 19-20 group)



Different letters (a and b) denote significant differences (Median Regression Analysis; p<0.001)

Exp. outline - Transmission to PD vaccinated cohabitant fish 26 DPE

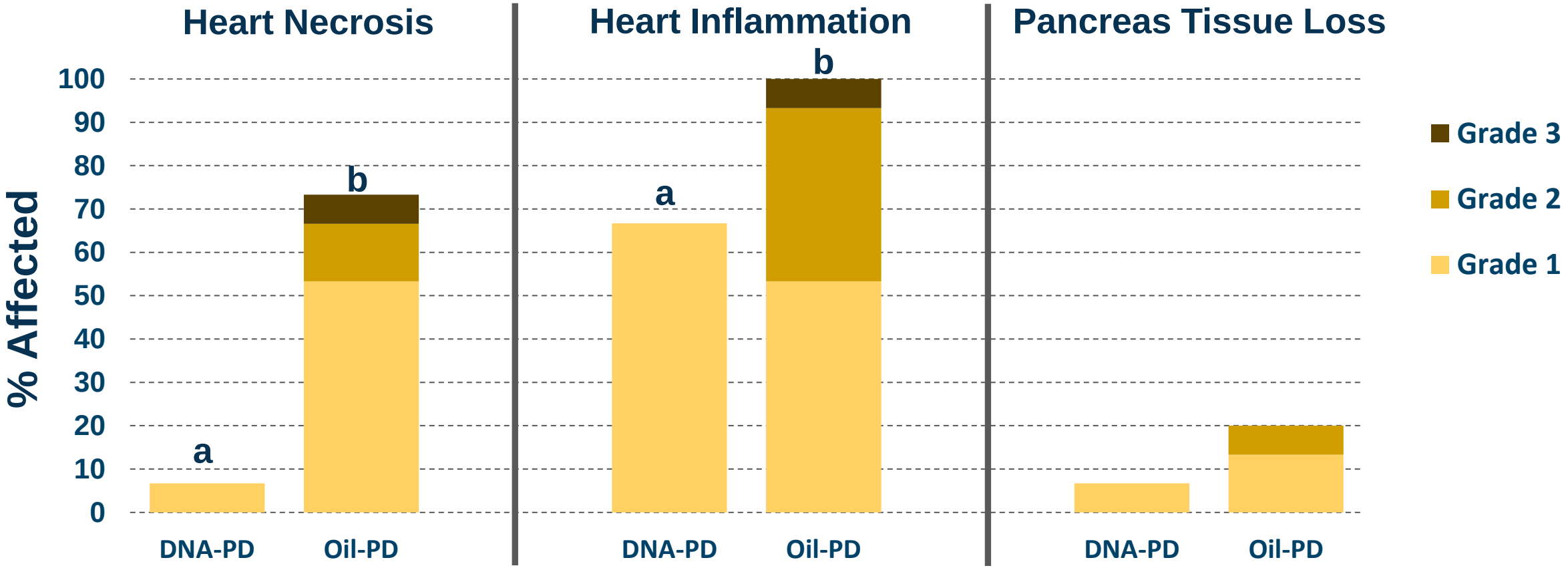
Histopathology severity scored blinded as previously published* (n = 15 per group)



* Thorarinsson, R et al, 2021. Effect of a novel DNA vaccine against pancreas disease caused by salmonid alphavirus subtype 3 in Atlantic salmon (Salmon salar). Fish & Shellfish Immunology, 108, 116–126.

Transmission to PD vaccinated cohabitant fish 26 Days Post Exposure

Histopathology scores (n = 15 per group per tank)



Different letters (a and b) denote significant differences (Ordinal logistic regression; p≤0.002)

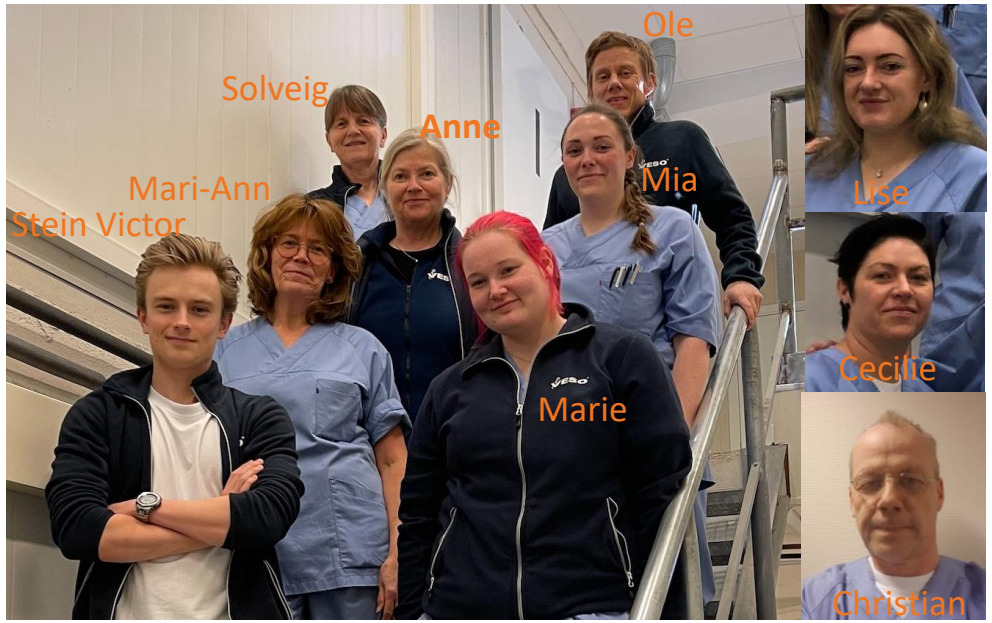
In summary

- The shedding, PCR and histopathological findings align
- Presence of SAV2 in the environment transmits the infection very effectively to non-protected fish
- More rapid clearance of SAV2 infection in the DNA-PD group in the absence of reinfection from naïve cohabitant fish
- Salmon immunized with the DNA-PD vaccine and challenged with SAV2 demonstrate significantly reduced
  - viral shedding
  - transmission of the infection
  - PD associated pathology in the heart
- Spreading of SAV2 from challenged DNA-PD vaccinated fish is further reduced if their cohabitants are immunized with the same vaccine
- These results align with an earlier shedding experiment* and may help explain the marked reduction of PD cases in Norway in 2021 recently published**

* Thorarinsson, R et al, 2021. Effect of a novel DNA vaccine against pancreas disease caused by salmonid alphavirus subtype 3 in Atlantic salmon. Fish & Shellfish Immunology, 108, 116–126.

** Norwegian Veterinary Institute's Fish Health Report for 2021 (https://www.vetinst.no/rapporter-og-publikasjoner/rapporter/2022/fiskehelserapporten-2021)

Acknowledgements



Sunniva Wannebo Kui

…and colleague Martin Næs

Thank you

Forever Salmon