

PRV in Europe

Annual Workshop of the National Reference Laboratories

May 30-31st 2017

Niccoló Vendramin

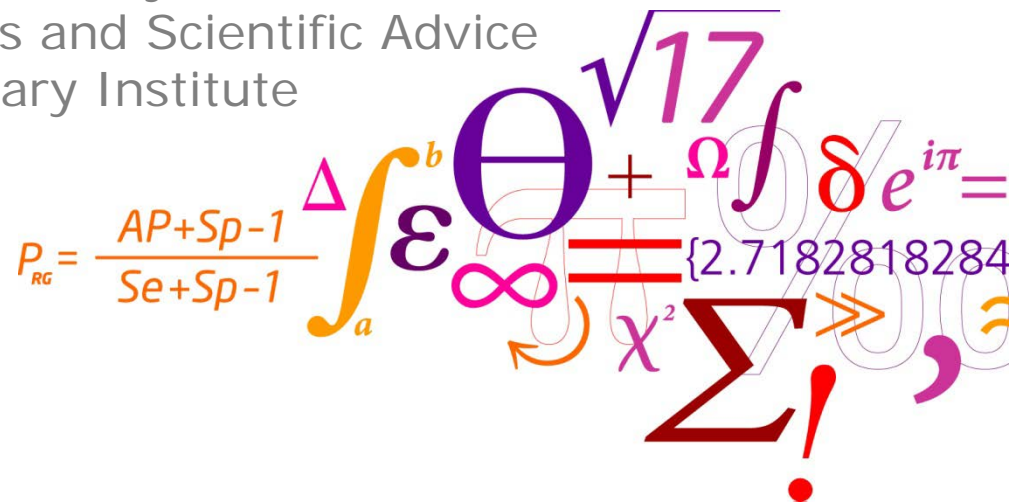
PhD student

Aquatic Animal Diseases Unit

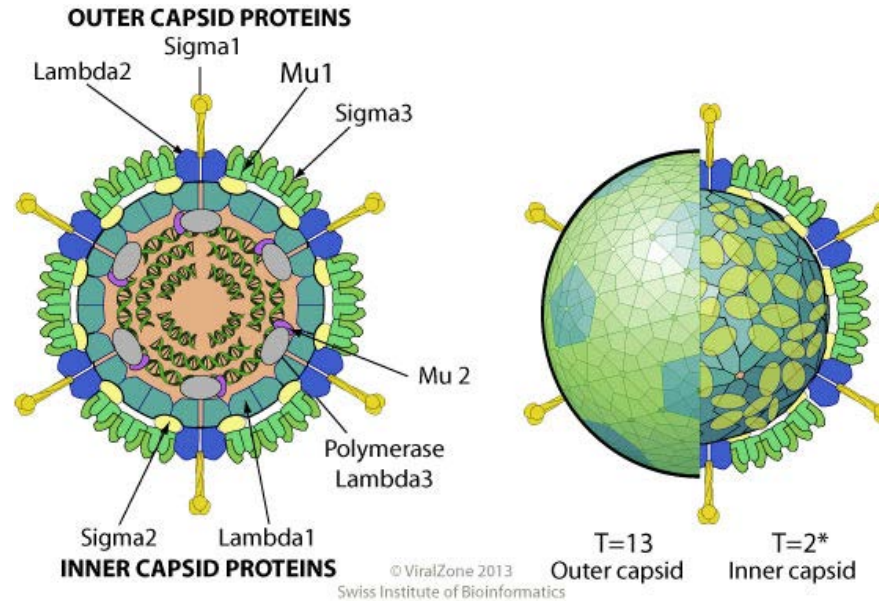
European Reference Laboratory for Fish Diseases

Section for Diagnostics and Scientific Advice

DTU Veterinary Institute



Piscine Orthoreovirus -PRV



dsRNA virus segmented non-enveloped RNA virus

Belongs to the Reoviridae Family

Contains 10 segments L1 for qPCR diagn S1 for sequencing

Possible to cultivate ex vivo but no cell lines available!

PRV or PRVs?



Proposal for nomenclature

PRV-1 – Atlantic salmon – **HSMI (1999)**

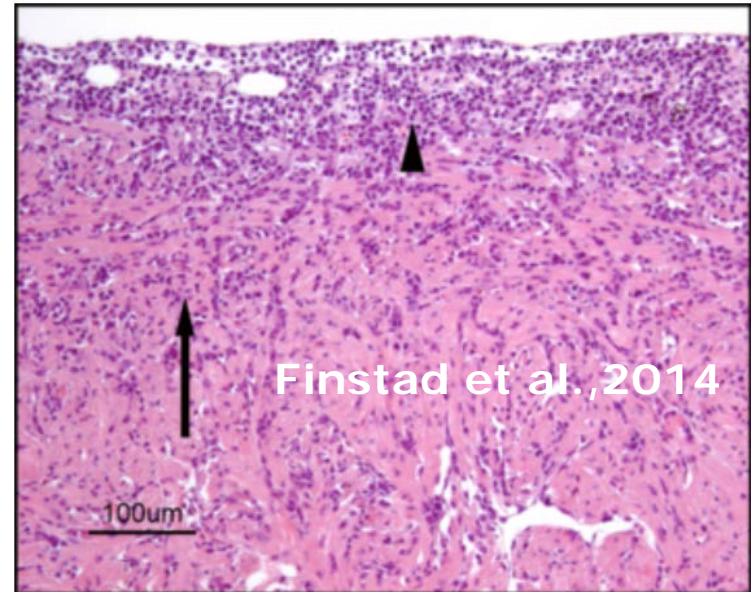
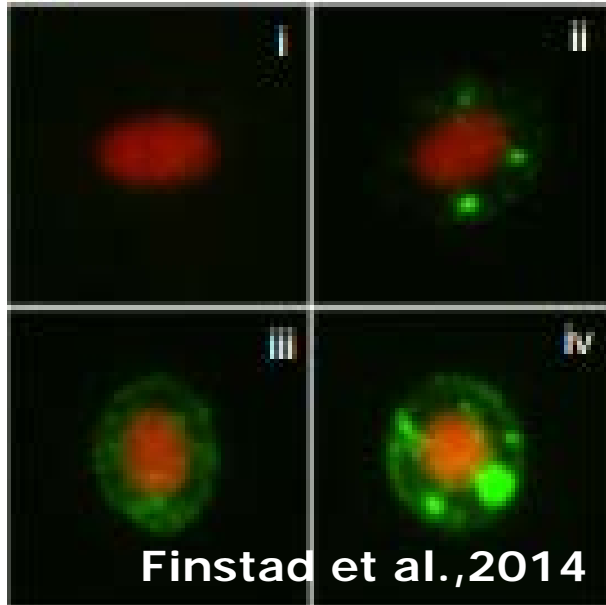
PRV-2 – mainly *Onchorynchus* (+ *S.salar*) – **EIBS (1982)**

PRV-3 – PRV-Om – Virus Y- Rainbow trout – heart pathology (2013)

Old stories, new protagonists

PRV-1 HSMI

Infects RBC



Epidemiology

Farmed fish



The **disease** HSMI was first reported in farmed Atlantic Salmon in Norway in 1999 (Kongtorp et al. 2004)

The disease has also been reported in farmed Atlantic Salmon in Scotland (Ferguson et al. 2005)

Chile (Godoy et al. 2016)

France (2016 Pers comm. Bigarre, Boitard and Jamin)

Canada (Di cicco et al.2017)

The **Virus PRV-1**

Has also been reported in Iceland and Faroe Island



Epidemiology

PRV in wild salmon ?



Country	Year	Sample size	+Ve
SWEDEN	2016	95	1
BELGIUM	2016	20	0
IRELAND	2016/2017	34 + 88	n/a*
FRANCE	2017	12	0
NORWAY (landlocked)	2016	20	0



Epidemiology



PRV in wild danish salmon ?

Year	2013	2014	2015
Sample size	184	181	166
Positive	11+ve	21 s + 4 +ve	3 +ve



PRV 1 and PRV 3 in farmed trout in DK? **NO**

Screened 6 farms -180 fish. Pool of 2. Farms selected considered "high risk" take water from river where we have detected PRV. Test samples for PRV-1 and PRV-3



Epidemiology



Future work

Increase sample size + sequencing + phylogenetic analysis Wild-Farmed interaction



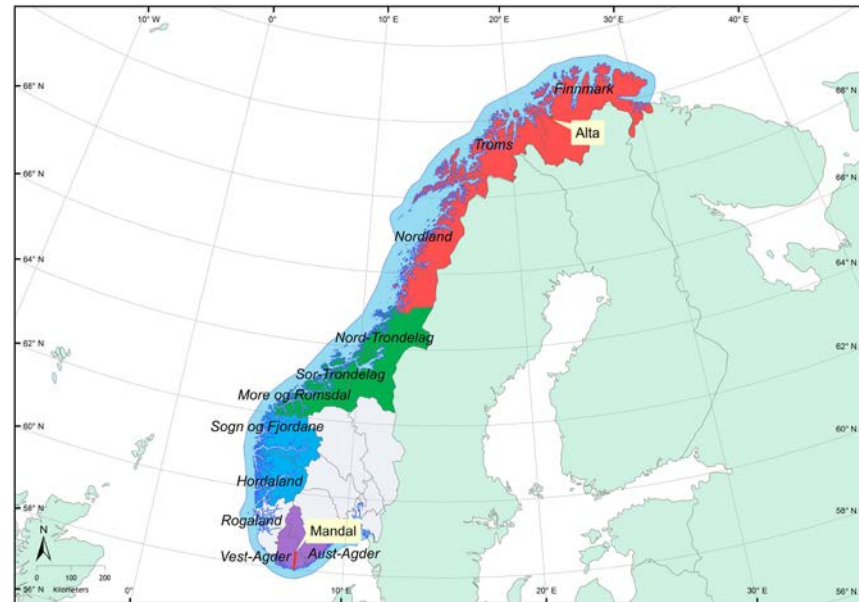
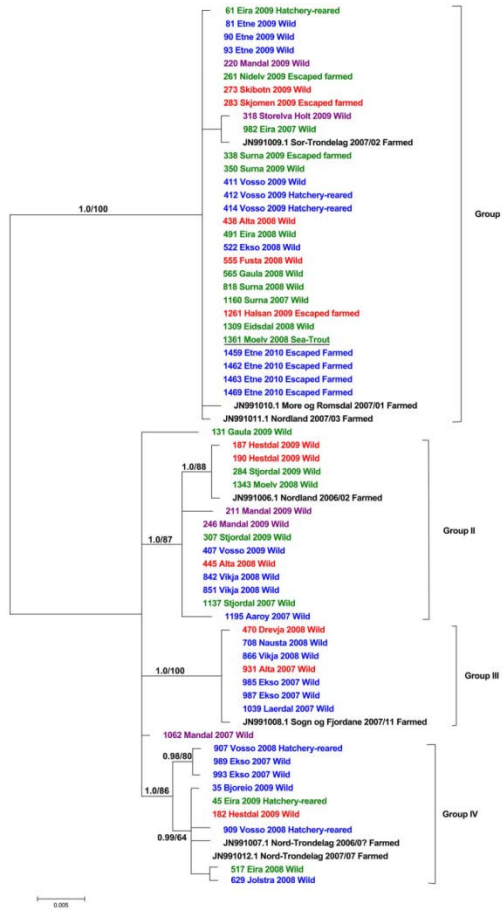


Epidemiology



In Norway AS prevalence 10%
ST prevalence 1%

FROM GARSETH et al., 2013

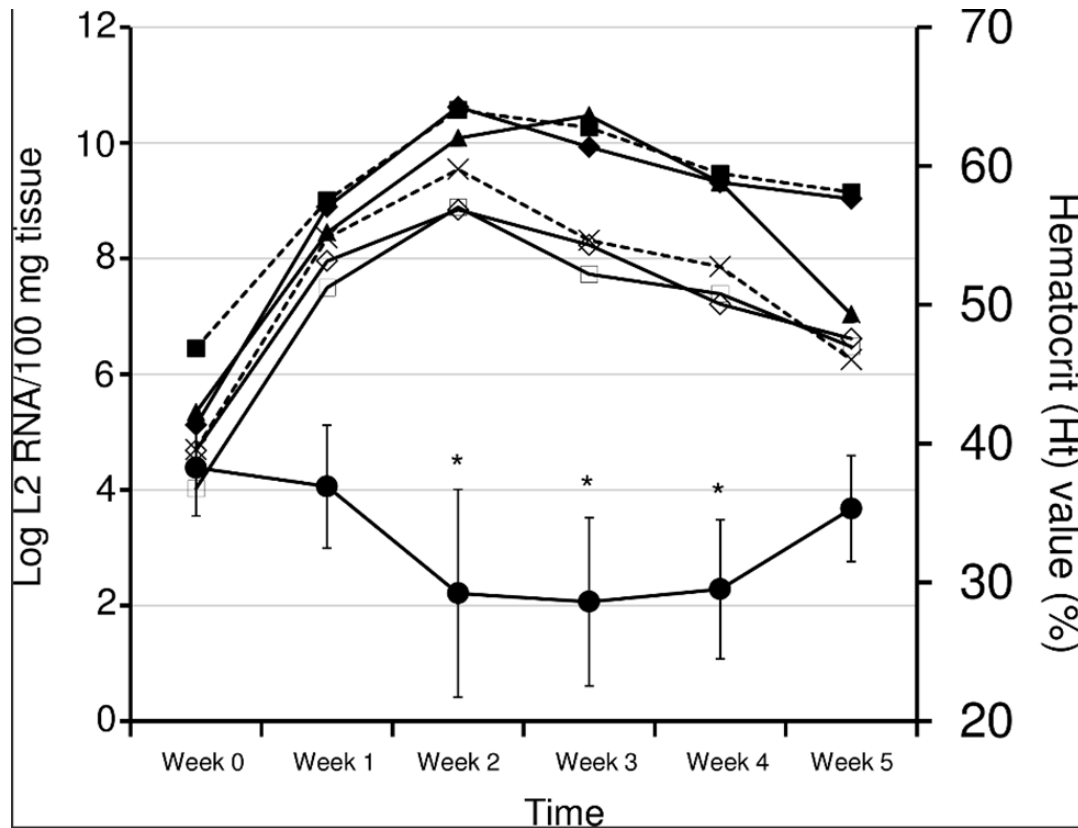


PRV2- EIBS

RESEARCH ARTICLE

Full-Genome Sequencing and Confirmation of the Causative Agent of Erythrocytic Inclusion Body Syndrome in Coho Salmon Identifies a New Type of Piscine Orthoreovirus

Tomokazu Takano^{1*}, Akatsuki Nawata², Takamitsu Sakai¹, Tomomasa Matsuyama¹, Takafumi Ito¹, Jun Kurita¹, Sachiko Terashima¹, Motoshige Yasuike³, Yoji Nakamura³, Atushi Fujiwara³, Akira Kumagai², Chihaya Nakayasu^{1a}



PRV2 – phylogenetic position



0.2

Phylogenetic analysis of the RNA-dependent RNA polymerase (RdRp) of the novel virus, PRV, and members of the subfamily *Spinareovirinae*.

Takano et al., 2017

PRV-2 Epidemiology

FROM Takano et al.

The disease was first described in 1982 in juvenile chinook salmon (*O. tshawytscha*) reared in a freshwater hatchery in Washington, US

Mass mortality from erythrocytic inclusion body syndrome (EIBS) occurs frequently and causes severe economic losses on coho salmon (*Onchorhynchus kisutchi*) farms in Japan.

Variable susceptibility among salmonid fish species, including chum salmon (*O. keta*), rainbow trout (*O. mykiss*), and masou salmon (*O. masou*), was demonstrated by their artificial infection with infected blood homogenates.

Infection with the EIBS-like virus has also been reported in farmed Atlantic salmon (*Salmo salar*) in **Ireland, Norway, and Scotland**

PRV-2 in Europe ?

Journal of Fish Diseases (1998) 21, 101–111

Observational study of erythrocytic inclusion bodies in farmed Atlantic salmon, *Salmo salar* L., in the British Isles

H D Rodger and R H Richards

Institute of Aquaculture, University of Stirling, Stirling, Scotland

The status of erythrocytic inclusion body syndrome (EIBS) in Scottish salmon, *Salmo salar* L., has been unknown, although there have been anecdotal reports of erythrocytic inclusions, similar to those described as associated with EIBS in Atlantic salmon (D. A. Smail, personal communication). EIBS-like virus has been reported in farmed Atlantic salmon in **Ireland** and **Norway** (Lunder, Thorud, Poppe, Holt & Rohovec 1990; Rodger, Drinan, Murphy & Lunder 1991)

Diagnosis was performed by assessing presence of inclusion bodies in erythrocytes in blood smears by different stainings.

PRV-3 /PRV – Om / Virus Y

- Firstly identified in 2013 in disease outbreak in Rainbow trout
- Histopath. Lesions in heart resembling HSMI
- Circulatory failure. Ascitis . Pale gills.



RESEARCH ARTICLE

First Description of a New Disease in Rainbow Trout (*Oncorhynchus mykiss* (Walbaum)) Similar to Heart and Skeletal Muscle Inflammation (HSMI) and Detection of a Gene Sequence Related to Piscine Orthoreovirus (PRV)



Anne Berit Olsen^{1*}, Monika Hjortaas², Torstein Tengs², Hege Hellberg^{1na},
Renate Johansen^{2nb}

PRV-3 cooperative project

DTU-VET NVI NMBU

1 Infection experiments with novel *Piscine orthoreovirus* from
2 rainbow trout (*Oncorhynchus mykiss*) in salmonids

3 Short title: Experimental trials with PRV-*Om* in salmonids

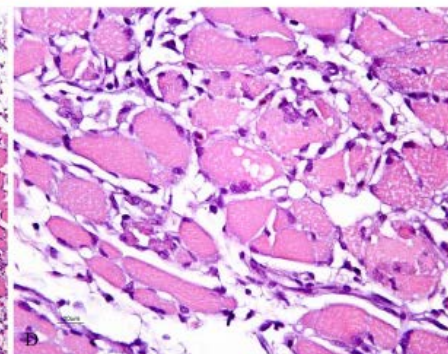
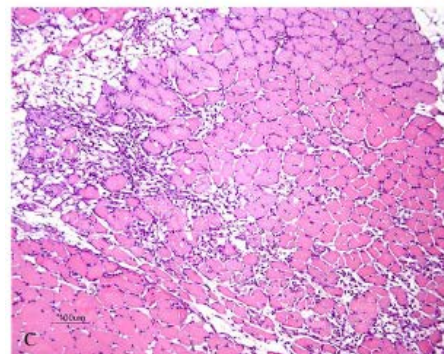
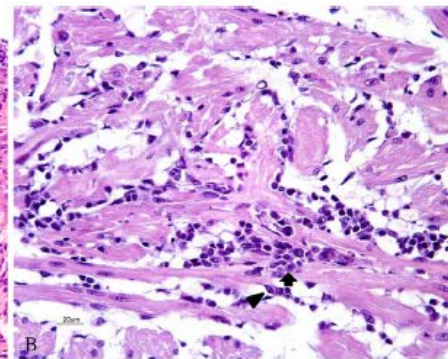
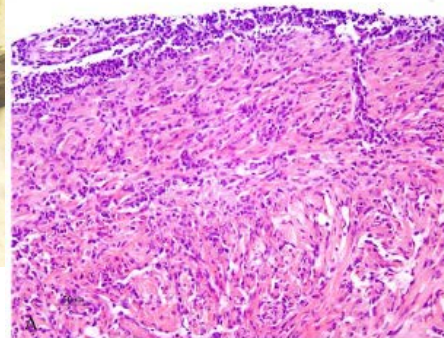
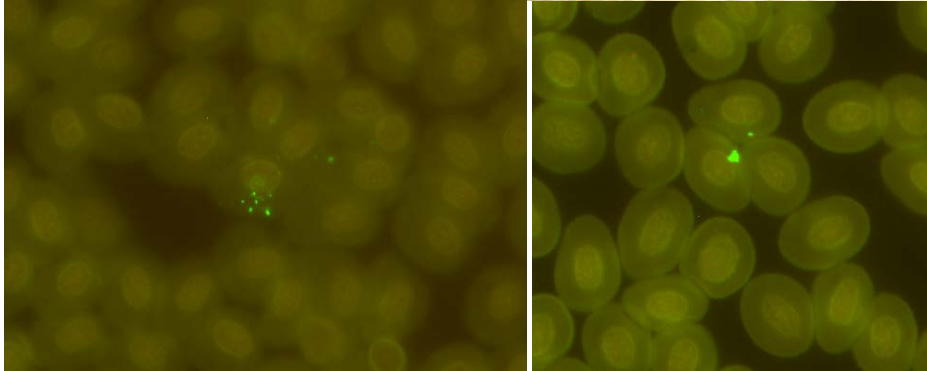
4

5 Helena Hauge^{1¶}, Niccolo Vendramin^{2¶} Torunn Taksdal¹, Anne Berit Olsen¹, Øystein Wessel³,

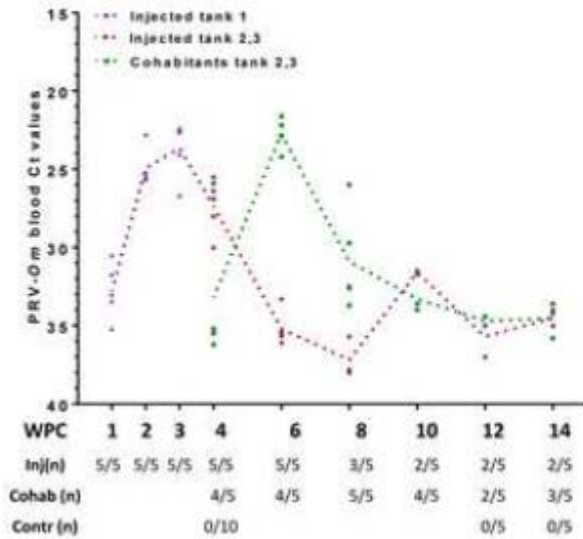
6 Susie Sommer Mikkelsen², Anna Luiza Farias Alencar², Niels Jørgen Olesen², Maria K

7 Dahle^{1*}

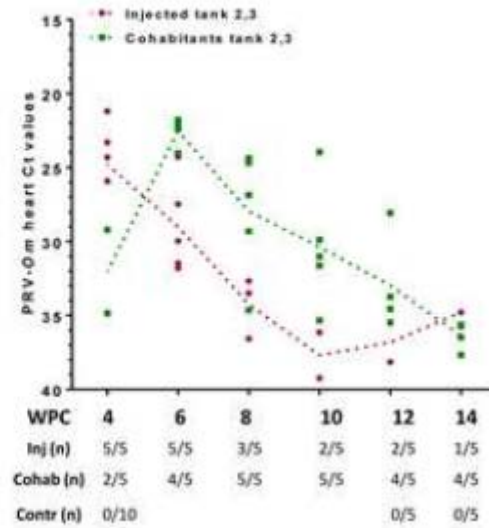
PRV-3 /PRV – Om / Virus Y



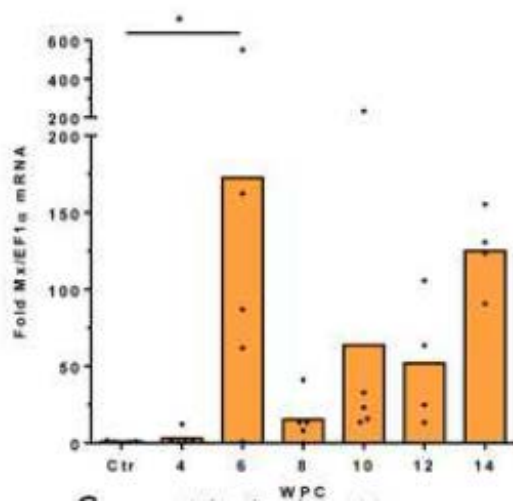
A Blood



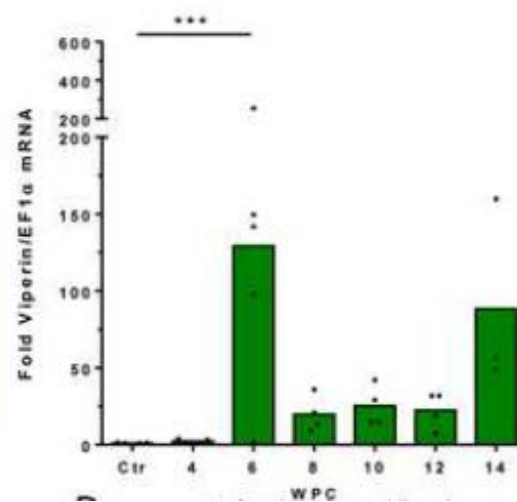
B Heart



A Rainbow trout Mx



B Rainbow trout Viperin



PRV 3

Rainbow trout

- Under experimental conditions is an acute infection which peaks and is cleared by the host
- Low (**very low**) mortality
- Infects red blood cells
- Causes heart pathology
- Induce iper expression of MX and Viperin genes

Atlantic salmon

- 50% of fish get infected at peak
- No mortality
- Infects red blood cells
- Causes heart pathology (less than RT)
- No iper expression of MX and Viperin genes

PRV 3 in Europe

- Original case detected in Norway
- 15 detection in 2015 and 2016 in NO (from S&D)
- 1 disease outbreak with very closely related virus in France in Brown trout 2016 Pers comm. Bigarre, Boitard and Jamin
- PRV 3 in farmed trout in DK? NO
- Screened 6 farms -180 fish. Pool of 2. Farms selected considered "high risk" take water from river where we have detected PRV. Test samples for PRV-1 and PRV-3

Country	Year	Sample size	+Ve
SWEDEN	2016	95	0
BELGIUM	2016	20	0
IRELAND	2016/2017	34 + 88	0
FRANCE	2017	12	0

TAKE HOME MESSAGE

if you observe unexplained increased mortality with circulatory failure collect blood, heart, spleen, kidney and test for Piscine orthoreovirus(es)

Acknowledgements

- NMBU (Espen Rimstad, Øystein Finstad and all the team)
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Thanks for your attention

