



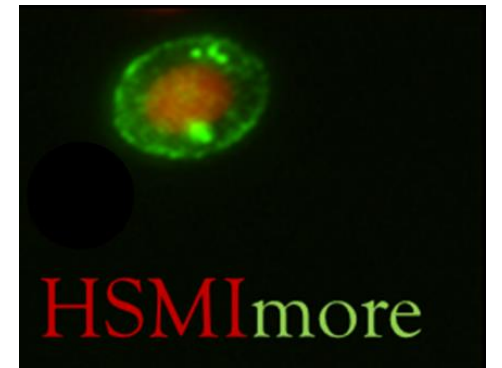
Veterinærinstituttet  
Norwegian Veterinary Institute



# PRV-infection reduces the tolerance to hypoxic stress in Atlantic salmon

PD TriNation  
Bergen  
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Morten Lund  
PatoGen AS



# *Piscine orthoreovirus* (PRV1)

- Non-enveloped
- Segmented, dsRNA genome
- Ubiquitous
- British Isles, North America, Chile, Iceland
- Infects and replicates in the Atlantic salmon erythrocytes
- Heart and skeletal muscle inflammation

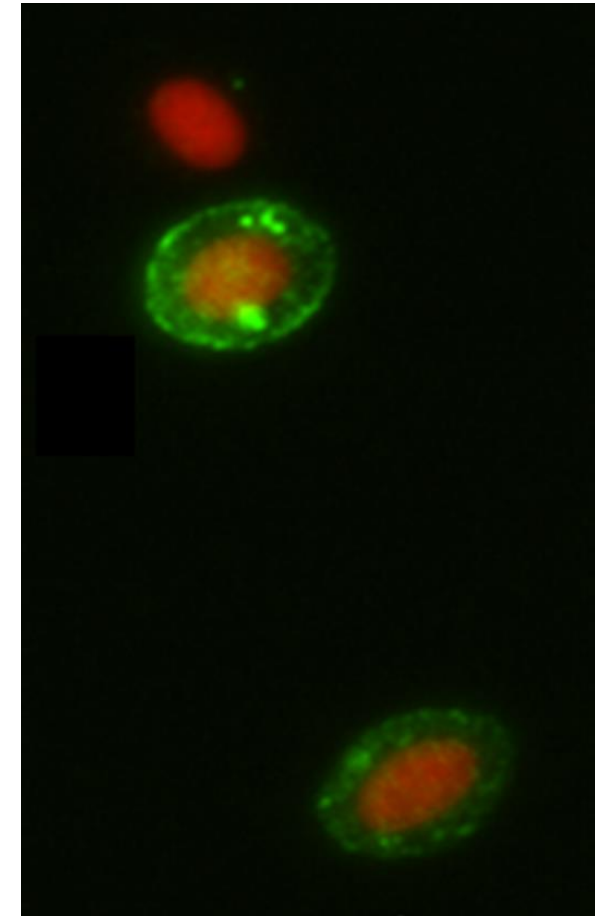
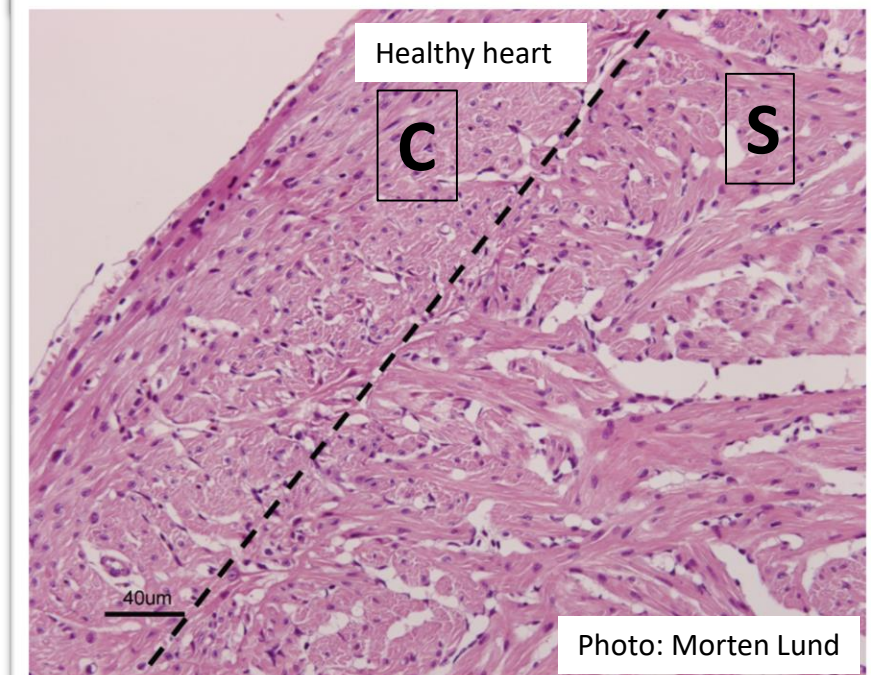
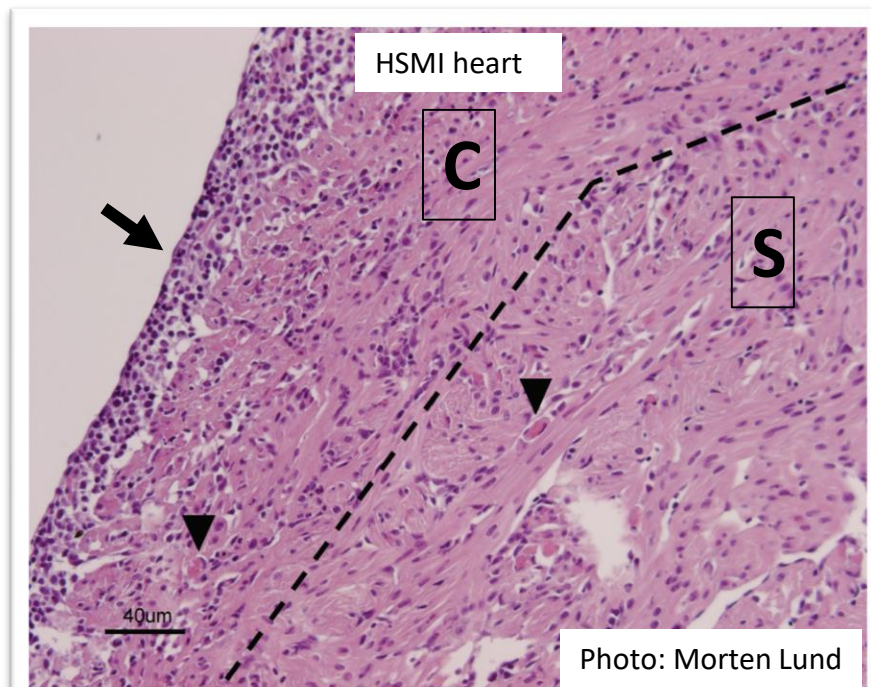


Photo: Øystein Wessel, NMBU

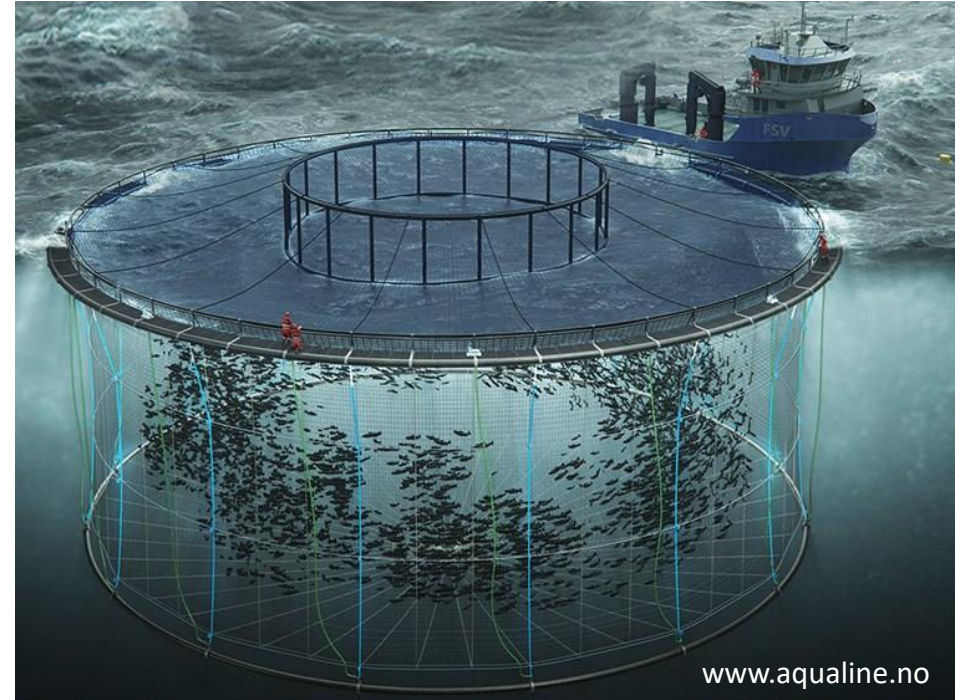
# Heart and skeletal muscle infl

- Important virus disease
- Seawater and freshwater phase
- Pale heart, pericardial fluid, ascites
- Epicarditis, panmyocarditis and skeletal myocytes
- Varying mortality



# Hypoxia in salmon aquaculture

- Hypoxia
  - Oxygen  $\rightarrow$  aerob ATP  $\rightarrow$  cellular fuel
  - ↓ cellular metabolism
- Environmental hypoxia in aquaculture
  - Oxygen levels fluctuates (30-120% O<sub>2</sub> sat)
  - Blood oxygen  $\approx$  oxygen content in the water
- Atlantic salmon is hypoxia intolerant





HSMI heart - 10 WPC

PRV/HSMI



### Hypothesis:

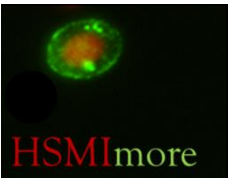
- The hypoxia tolerance is affected in PRV-infected Atlantic salmon
- The cardiac performance is affected during HSMI
- The oxygen carrying capacity of the PRV-infected erythrocytes is altered
- Hypoxic stress affects the PRV infection and development of HSMI



Photo: Morten Lund

100um

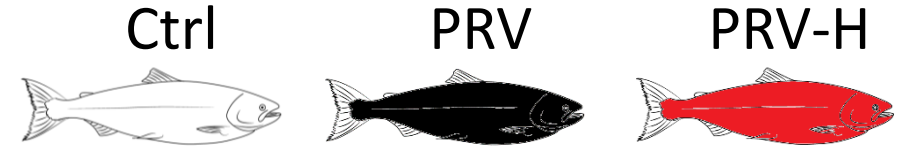
Photo: Øystein  
Wessel, NMBU



# Study design

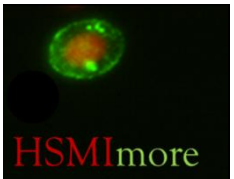
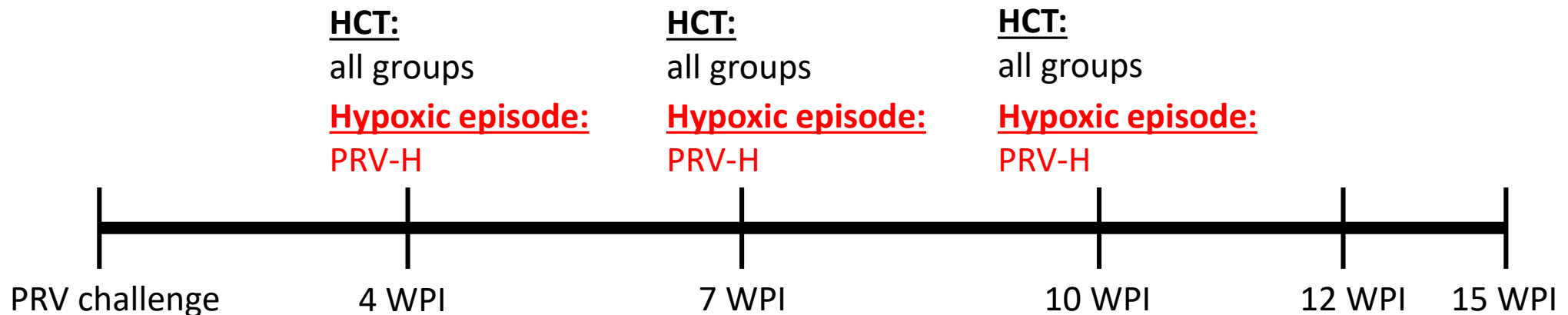
- 15 week cohabitation trial
- Physiological tests and measurements
  - **Hypoxia episodes** – 40 % oxygen saturation, 4 hours
  - Hypoxia challenge test (HCT)
  - Maximum heart rate
  - Hemoglobin-oxygen affinity

Experimental groups:



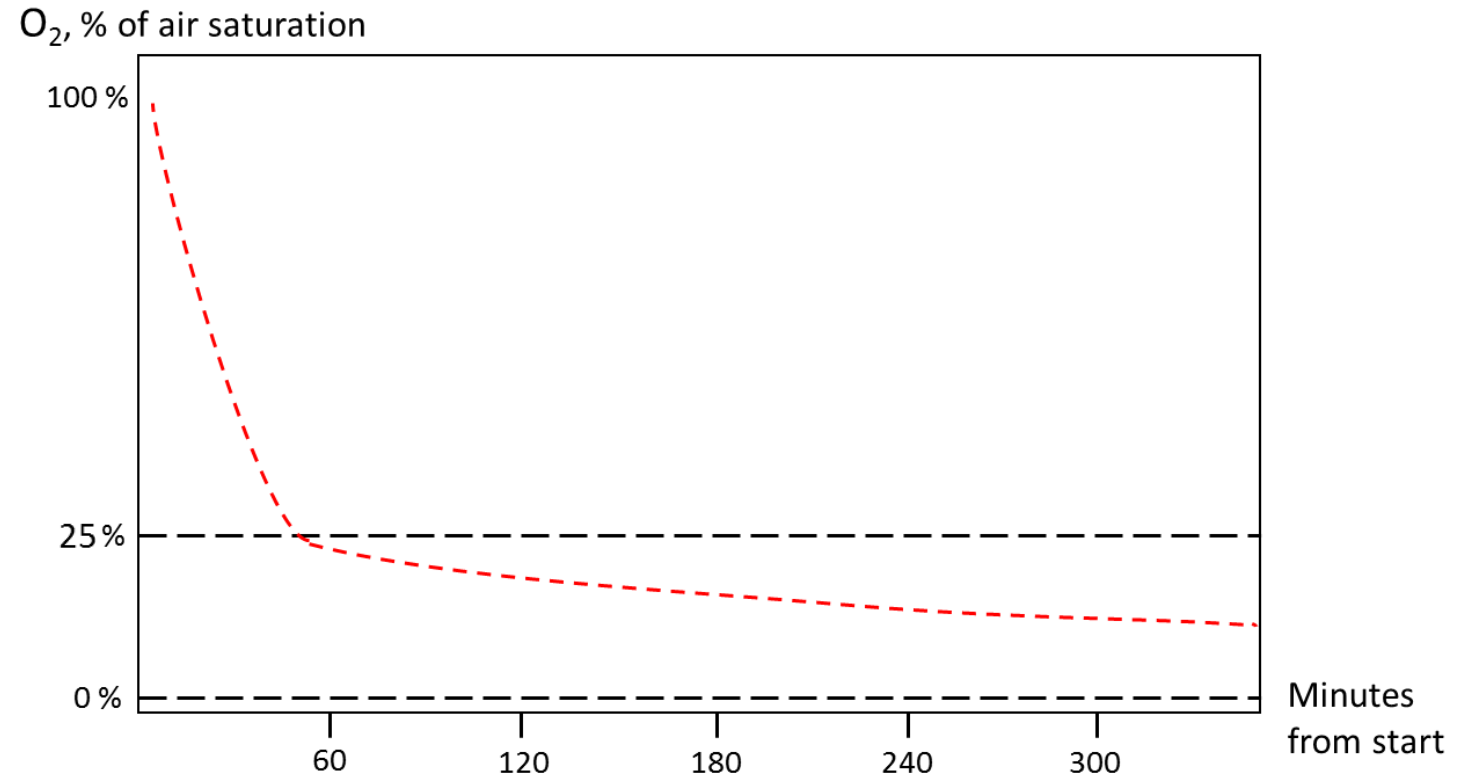
Hb-O<sub>2</sub> affinity: PRV-H and Ctrl

Heart rate: all groups

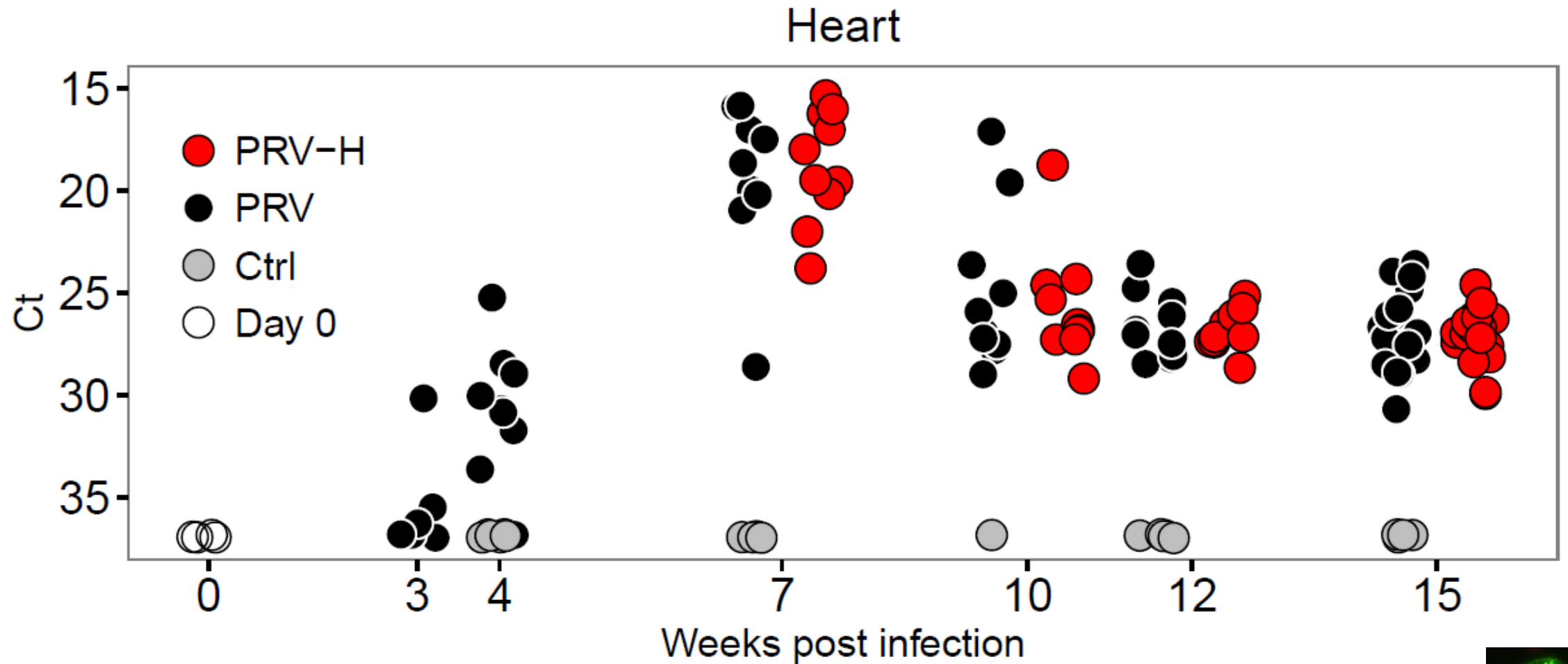


# The hypoxia challenge test (HCT)

- 30 fish from each group
- Controlled reduction of oxygen saturation
- The incipient lethal oxygen saturation (ILOS)

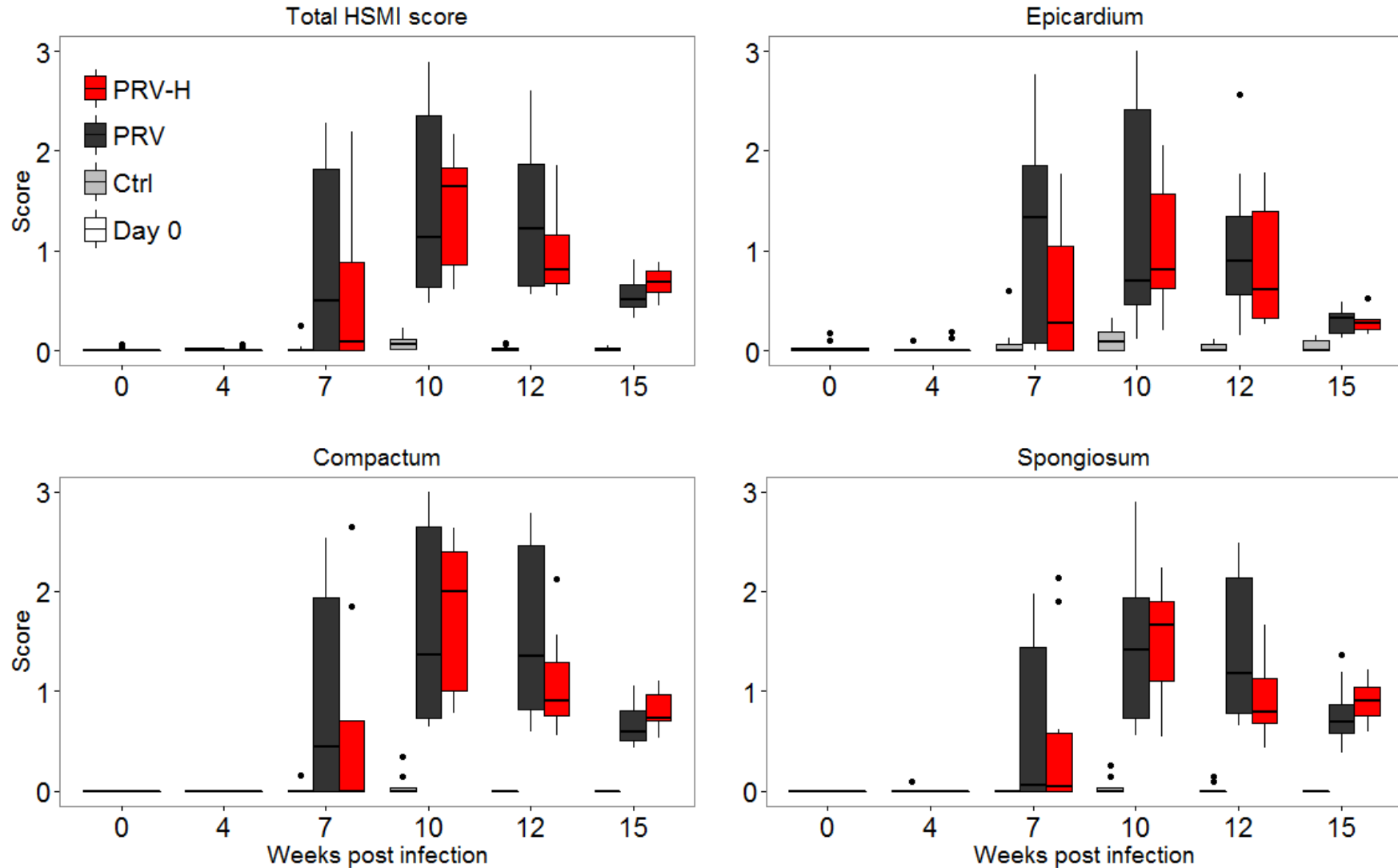


# No effect on PRV infection

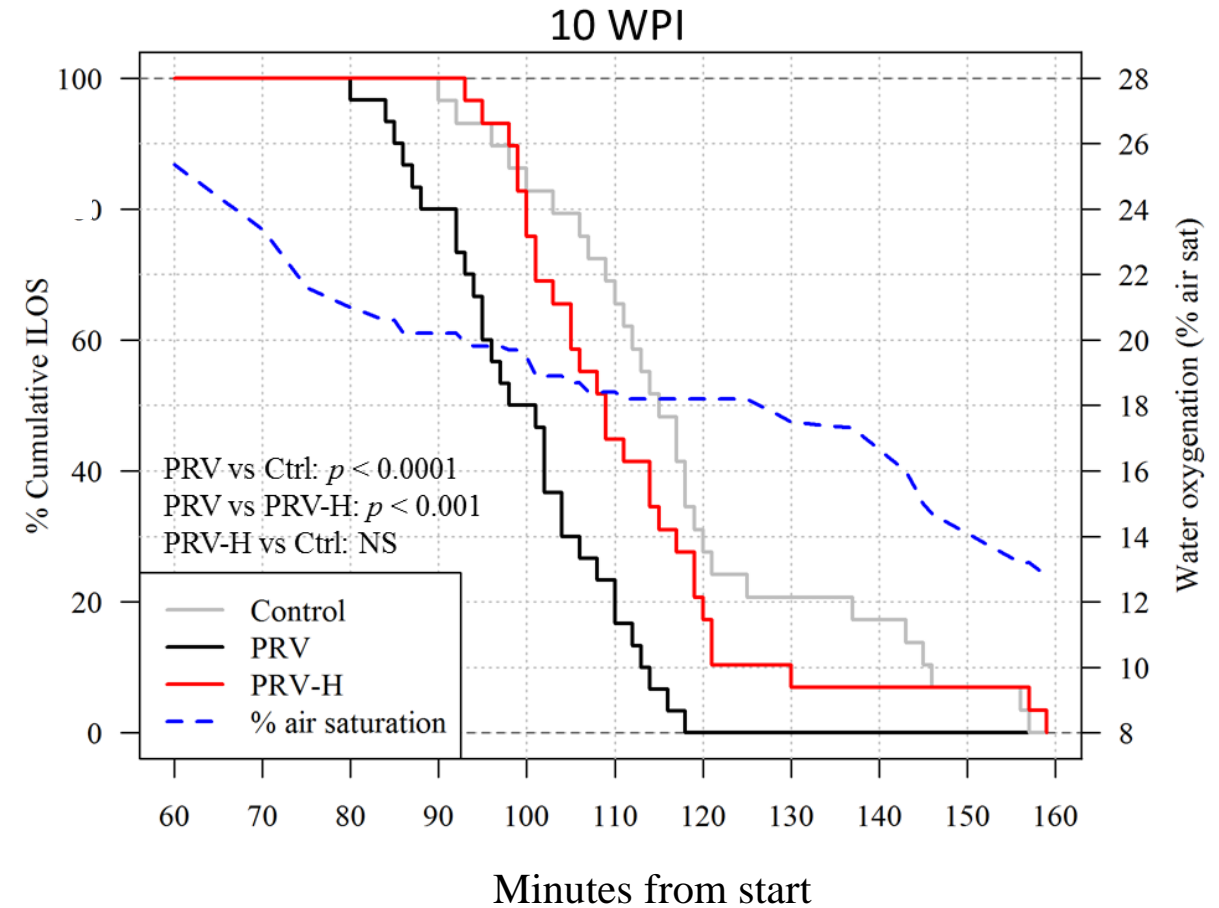
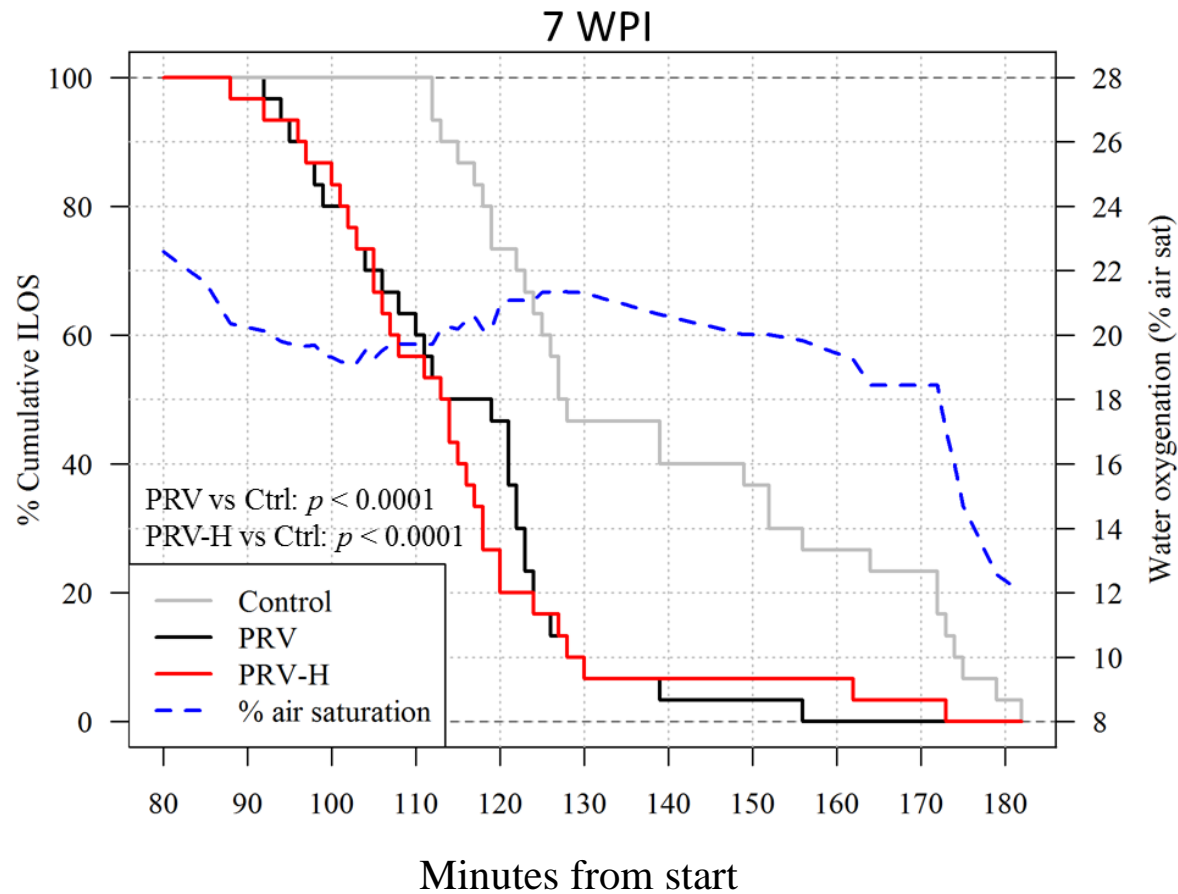




# No effect on HSMI development



# Reduced hypoxia tolerance during PRV infection



# Conclusions

- Reduced hypoxia tolerance due to PRV infection and HSMI
- Reduced cardiac performance in HSMI diseased fish at 19°C
- Preconditioning effect of the transient hypoxia episodes
- Reduced Hb-O<sub>2</sub> affinity in PRV infected blood → reduced oxygen carrying capacity

Magnus  
Røsæg  
PhD-  
student

Øystein  
W Finstad  
Post-doc

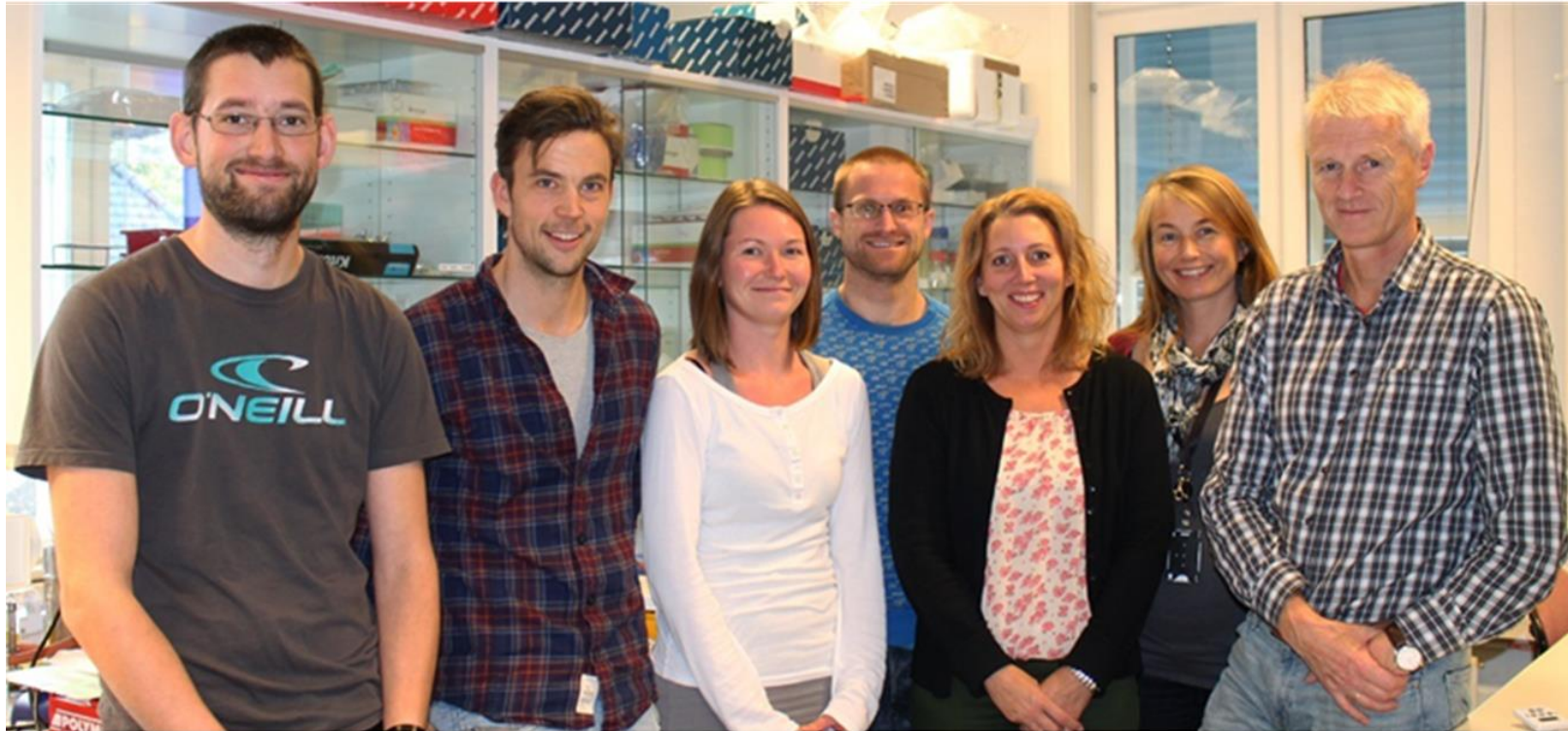
Hanne  
Haatveit  
PhD-  
student

Morten  
Lund  
PhD-  
student

Ingvild  
Nyman  
Engineer

Maria K  
Dahle  
Senior  
researcher

Espen  
Rimstad  
Prof.  
virology



Sven Martin Jørgensen (NOFIMA, currently FHF)



Mark Powell (UIB/NIVA, currently UIB/HI)



Gerrit Timmerhaus (NOFIMA)

Christian Wallace – VESO Vikan, Marta Alarcon – NVI Harstad (currently FVG), Anja Kristoffersen – NVI Oslo

