VHSV in Herring *C. harengus* does it have any importance?

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VHSV in herring

- European herring *Clupea harengus*
  - Low prevalence 0-16% detected in healthy fish
    - Baltic Sea, Kattegat, Skagerrak, North sea, English Channel, Norway
    - Manly genotype Ib, 4x genotype II, 1x genotype III (4p168)
    - No earlier challenge trials
- North American herring *Clupea pallasii*
  - High and low prevalence detected in sick and healthy herring in Alaska and Canada
    - Genotype IV
    - Challenge trials show high mortality rate

The worlds most northern detection of VHSV

www.fishpathogens.eu

Screening of 3000 fish from 43 different species
VHSV only detected in herring
Low prevalence (3 positive fish, <1%)
Genotype Ib, 99-100% identity to earlier Norwegian herring isolates
(Sandlund *et al* in prep)

High prevalence of VHSV genotype Ib detected in Atlantic herring. Importance for herring? Importance for farmed fish?

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High prevalence of viral haemorrhagic septicaemia virus (VHSV) in Norwegian spring-spawning herring

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Summary of paper:

Table 1. *Clupea harengus*. Pooled samples and individual organs from Atlantic herring found viral haemorhagic septicaemia virus (VHSV)-positive by cell culture and real-time RT-PCR (rRT-PCR). Parentheses: prevalence of positive samples; NS: not sampled; *: specific sequence data (n = 16) obtained from the indicated VHSV-positive sample types for verification

Sampling date 2010	No. of fish sampled	No. of pools[a]	No. of positive pools[a]		No. of positive organs from individual fish by rRT-PCR				
			Cell culture	rRT-PCR	Brain	Spleen	Kidney	Gills	Gonads
25 Feb	40	8	0	2	1	1	0	12 (30%)	0 / 40
19 Mar	20	4	1	2*	4	3*	5	19* (95%)	2 / 20
12 Apr	15	3	0	0	1	0	2	14* (93%)	NS
16 Apr	15	3	0	0	1	2	1*	13* (87%)	NS
22 Apr	15	3	3	3*	6	7*	6	14* (93%)	NS
Total	105	21	4 (19%)	7 (33%)	13 (12%)	13 (12%)	14 (13%)	72 (69%)	2 (3%)

[a]Brain, spleen and kidney tissues pooled from 5 fish

Pools of organs from 5 fish tested with BF-2 cells and rRT-PCR
Individual organs tested with rRT-PCR
Conclusion: rRT-PCR on pooled organs provides the highest detection rate of 33%
Gills only tested by rRT-PCR and had a prevalence of 69%. Exogenous in the mucosa?

Genotype Ib in herring is not unusual, but this high prevalence has not been detected earlier.
High prevalence related to spawning?

Keeping wild herring for trial

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Challenge trial

NO-F/2009, genotype Ib

- 30 fish
- 30 fish
- 50 fish

4p168, genotype III

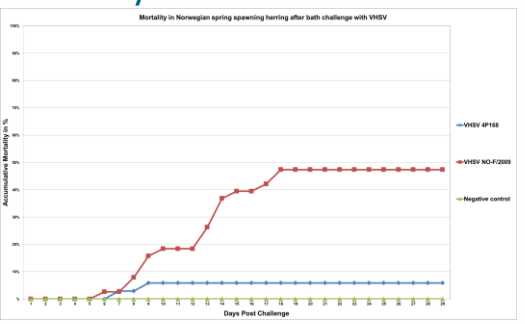
- 30 fish
- 30 fish
- 50 fish

Negative control

- 30 fish

10^5 TCID/ml for 2 hours followed by partial water change

Mortality rate



Clinics

Gross pathology

PCR

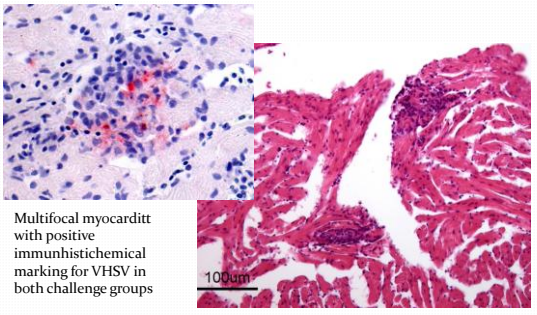
- Single positive samples on day 4-5 PI both virus isolates
- Until day 20 for both virus isolates, increasing number of positive samples.
- More positive samples with lower CT values for NO-F/2009.
- Day 20 to 30 decreasing number of positive samples.
- A tendency that more hearts than kidney and gills are positive by PCR and heart also shows lower CT values.
- Diseased fish highly positive by PCR for VHSV by low CT values.

Immunohistochemistry

	NO-F/2009	4p168
7 day PI	+	+
9 day PI	+++ (✞)	
21 day PI	++	++
30 day PI	++	++

- ✞ VHS pathology in disaesed fish
- Mainly heart inflamation in fish with no clinical signs of disease
- Lowgrade gill inflammation in all groups, but no VHSV antigen detected by IHC.

Histopathology and immunohistochemistry



Multifocal myocarditt with positive immunhistichemical marking for VHSV in both challenge groups

Virus re-isolation

- At termination day 30 PI virus was re-isolated from both groups on BF-2 cells:
- 4p168 11/15 positive
- NO-F/2009 2/4 positive

Importance to herring

- VHSV genotype III (4p168) did not cause high mortality in herring
- VHSV genotype Ib (NO-F/2009) caused high mortality in herring
  - Probably a primary herring strain
  - May have an effect on wild herring populations
  - Further investigation on the effect on wild fish are needed

Importance to rainbow trout

- Earlier challenge trials with marine VHSV have shown low mortality in rainbow trout
  - Genotype alone is not sufficient to determine susceptibility to different species
  - Need more information on virulence factores
- Few outbreaks of VHS in rainbow trout related to marine VHSV
  - Norway 2007-2008, genotype III
  - Sweden 1998-2000, genotype Ib

Thanks for the attention

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