#### SUSCEPTIBILITY TO SALMONID ALPHAVIRUS (SAV) OF DIFFERENT SALMON BREED LINES

Noelia Nuñez-Ortiz, Rasmus Skern, Stig Mæhle, Lindsey J. Moore, Tom J. Hansen, Per Gunnar Fjelldal, Tomasz Furmanek, Rolf B. Edvardsen, Samuel A.M. Martin, Sonal Patel.



Study of the impact of genetics on the susceptibility to Salmonid alphavirus subtype 3 (SAV3)

1. Triploid and Diploid salmon Bath challenge

-Differences in susceptibility to SAV3 -Immune transcriptomic responses to SAV3 infection

2. Isogenic (L69 and L70) and two commercially available outbred salmon lines Vaccination and i.m. challenge



-Differences in susceptibility to SAV3

### 1. Triploid and Diploid salmon



AquaGen<sup>®</sup> QTLinnOva <sup>®</sup> IPN/PD



 $71.6 \pm 19.0$  g



### **EXPERIMENTAL SET-UP**



• Gill Na+, K+-ATPase (NKA) activity in all diploid and triploid fish was tested



- Shedder fish injected 1 week before the start of the experiment. Infected tanks: fish bath challenged with SAV3 (4 groups in duplicate tanks)
- Sampling times: 8 fish per tank





#### % PREVALENCE IN HEART

#### HISTOLOGY AT 14 DPI



## **RNA-seq**



Differentially expressed genes (NOISeqBIO)

KEGG pathway analysis

Clustering (K-Means)

### KEGGSALMON

					Triploids (3N) Diploids (2N) Days post-infection (DPI)			
Pathway	3N 14 DPI		3N 21 DPI		2N 14 DPI		2N 21 DPI	
	Up	Down	Up	Down	Up	Down	Up	Down
NOD-like receptor signaling pathway	17	52	3	55	0	0	82	18
RIG-I-like receptor signaling pathway	3	39	0	31	0	16	18	16
T cell receptor signaling pathway	18	23	2	19	0	0	71	1
Toll-like receptor signaling pathway	4	27	1	22	0	13	29	11
Natural killer cell mediated cytotoxicity	13	32	2	22	0	1	64	6



#### KEGG Pathways





## GENE EXPRESSION CLUSTERING

- K-means clustering tool: group genes with same pattern of gene expression in clusters
- Detect interesting clusters.
- Analysis of immune response genes in selected clusters





#### **GENE EXPRESSION CLUSTERING**

Triploids (3N) Diploids (2N)

Days post-infection (DPI)

C3N C2N 2N ЗN 2N C3N C2N 2N 3N 2N C3N C2N C3N C2N ЗN ЗN 2N 3N 2N C3N C2N C3N C2N ЗN 14DPI 14DPI 14DPI 21DPI 21DPI 14DPI 21DPI 21DPI 14DPI 21DPI 21DPI 14DPI **CLUSTER 23 CLUSTER 17 CLUSTER 14** 



#### 2. Isogenic and outbred salmon lines

#### Salmon lines:

- Isogenic lines: L69 and L70
- Commercial salmon lines: Aquagen and StofnFiskur

#### **Experimental set-up:**



#### WEIGHT











## Summary

- Diploid and triploid smolts of good quality which gained weight during the infection and showed similar PD-associated lesions.
- Slower accumulation of positive fish in triploid group
- Antiviral immune genes and Pattern recognition receptors (PRRs) are higher up-regulated in Triploids at 21 DPI than Diploids
- Different response to vaccination and suscetibility to SAV3 of isogenics and outbred salmon lines



# Acknowledgments:

- The Norwegian Research Council (224885/E40)
- Ministry of trade, industry and fisheries through Aquaculture program, IMR
- Petter Frost (MSD Animal Health)
- Co-authors
- Joachim Nordbø
- Stig Mæhle
- Ingrid Uglenes Fiksdal
- Ivar Helge Matre

