Identification of SNPs Associated with Bacterial Cold Water Disease and Spleen Index in Rainbow Trout

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Bacterial Cold Water Disease (BCWD)

• Also called rainbow trout fry syndrome
• Caused by *Flavobacterium psychrophilum*
• Frequent cause of elevated mortality in rainbow trout
• BCWD Signs: Fry - lethargy, lack of feeding, darkened skin, enlarged spleen, anemia and high mortality
• No licensed commercial vaccine
• Use of antibiotics is a concern for emergence of antibiotic resistant pathogen
• NCCCWA initiated a selective breeding program for BCWD resistance in 2005
Spleen Size Predicts BCWD resistance

Hadidi et al. (2008) The Journal of Immunology, 180: 4156-4165
QTL for BCWD resistance and SI on Omy19 identified in mapping family 2008132

Wiens et al. 2013 PLoS ONE 8(10): e75749
2012 QTL Validation Mapping Populations
Two Separate QTL for BCWD Resistance and SI

Vallejo et al. (2014) Aquaculture 432: 139-143
Objective

Identify SNPs associated with BCWD resistance and SI using GWAS and QTL mapping approaches
Materials and Methods

- **Mapping families**
  - 2012473 100 fish for BCWD challenge
  - 2012474 100 fish for BCWD challenge and 98 fish for spleen index
- **RAD genotyping**
  - SbfI digestion Novoalign and perl scripts
- **Genetic mapping**
  - MULTIPLATFORM LOD10 SNPs were mapped to the reference genome
  - Sex-specific linkage maps
- **GWAS**
  - Grammar-Gamma method implemented in the R package GenABEL
- **Half-sib QTL mapping**
  - GridQTL
SNP Identification and Linkage Mapping

• 7,849 SNPs were identified
• 7,595 SNPs were assigned to chromosomes
• Female map  638 SNPs  5483  8.6/SNP
• Male map   438 SNPs  2964  6.8/SNP
GWAS for Survival Status with GenABEL-Grammar-Gamma
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QTL for BCWD resistance identified by half-sib QTL mapping

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Conclusions

• 18 SNPs associated BCWD resistance and 20 SNPs associated with spleen index were identified. However, there is no shared significant SNPs for these two traits.

• In addition to the significant QTL for BCWD resistance on chromosome Omy19, two significant BCWD QTL on chromosomes Omy8 and Omy25 derived from the sires were identified.

• There was no QTL for spleen index derived from the dam 2008132002 on chromosome Omy19, which confirms previous finding that two separate QTL on chromosome Omy19 control BCWD resistance and spleen index, respectively.
Acknowledgements

NCCCWA

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Guangtu Gao  Kristy Shewbridge
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Yniv Palti  Travis Moreland
Gregory D Wiens  Joel Caren

University of Illinois at Urbana-Champaign
Alvaro G Hernandez

Funding
USDA CRIS Projects 8082-32000-006 and 8082-31000-012
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QTL for BCWD resistance identified by half-sib QTL mapping