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2016 AQ Summit: Research Update by Ian Bricknell

Ian Bricknell
University of Maine - Main, ian.bricknell@umit.maine.edu

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Antifreeze for Salmon?

Deborah Bouchard, Gary Burr & Ian Bricknell
Superchill has been a huge issue in Maine

- In cold winters Farmed Atlantic Salmon will suddenly die
- Key temperature is -0.7°C
- This problem prevents an increase of aquaculture production in Maine
Why?

- As temperature cools to just below freezing salmon die
- As they cool they increase the amount of sodium chloride into the plasma
- This acts as a simple antifreeze
- Works very well in freshwater

www.collegegreenmag.com
Salt is Toxic

- Sea water freezes at $-10^\circ C$
- In theory adding salt should prevent freezing to below this temperature
- Problem is salt becomes toxic at 250mMol$^{-1}$
- So by preventing freezing the increasing salt is the problem

Salmonfarmingnews.com
Why do fish do this?

- Salt is readily available in the ocean
- Works perfectly in freshwater
How can Science help?

- Genetic modification (not well received by the public)
- Dietary supplements

www.naturesway.com
Can other molecules act as a natural antifreeze?

- Wood frogs use Urea to allow them to freeze solid in the winter.
- Glycerol and glycine are used by other organisms to survive extreme cold.
Can this work in salmon?

- In the lab yes
- Adding glycine and glycerol depress the freezing point of salmon tissue and plasma

www.scienceiscool.org
Next steps

- Awarded RRF grant for proof of concept study
- Full NRAC grant submitted to:
  - Formulate feeds with the most promising natural antifreezes
  - Test uptake in fish
  - Test temperature tolerance in aquariums
Questions?