

USDA Stakeholder Listening Session – Salmonids

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Critical Priorities for USDA Research

Submitted by Steven Summerfelt, Superior Fresh LLC, Hixton, Wisconsin

There are a growing number of large investments in land-based farms that will substantially increase US production of market-size Atlantic salmon and rainbow trout. At Superior Fresh LLC in Hixton, Wisconsin, we are already marketing over a million pounds annually of 10-pound Atlantic salmon, 1- to 6-pound rainbow trout, baby lettuce, and head lettuce. We are currently expanding production capacity at our existing facility and looking for additional locations for even larger expansions. Simply put, Superior Fresh would not be possible without the strong USDA ARS support of production system research at the Conservation Fund's Freshwater Institute over the past three decades. They developed the technologies and practices that we currently use to produce fish and leafy greens. In addition, Whole Oceans, Atlantic Sapphire, and Nordic Aquafarm are all moving forward with large investments to dramatically increase domestic production of Atlantic salmon. Superior Fresh and these other new farms really need additional USDA research support to meet the great potential offered with domestic production in land-based RAS.

Overall goal: To develop technologies and practices that will increase commercial production of market-size rainbow trout and Atlantic salmon in RAS in the USA.

Following are the critical priorities that should be emphasized, which includes research on production systems, breeding and genomics, disease, feeds, and product quality.

- Conduct a Genotype x Environment study with various strains of Atlantic salmon cultured in different environments
 - one goal is to determine the effects of breeding programs on performance in different environments (involve USDA NCWMAC, Riverence, and Freshwater Institute)
 - breed for Atlantic salmon and rainbow trout production in RAS environments
- Optimize the production system environment for Atlantic salmon performance & reduced maturation in RAS:
 - Photoperiod, temperature, salinity, swimming speed, water quality (clarity), hormones, density
- Develop and improve off-flavor purging technologies and practices (as Freshwater Institute has been funded by Sea Grant proposal)
- Develop technologies and practices to prevent, detect, and control disease in Atlantic salmon cultured in RAS
 - Improve biosecurity practices and assess risk factors in Atlantic salmon cultured in RAS
 - Develop strategies to minimize Saprolegnia infections in Atlantic salmon cultured in RAS (as Freshwater Institute has been funded by Sea Grant proposal)
 - Pathogen monitoring technologies and surveys
- Develop production technologies for sterile fish, e.g., the Wong-Zohar technology vs CRISPR or other technology, as well as long-term evaluations of the sterile fish produced in this manner.
- Develop production technologies to create all-females to avoid neo-males, e.g., gynogenesis or other technology, as well as long-term evaluations of the triploid fish produced in this manner.

- Develop technologies to improve water quality in salmonid recirculating aquaculture system (RAS) and their effluent
- Develop operation/management BMP's that integrate with cyber-enabled SCADA technologies to minimize risk and optimize production performance in salmon RAS
- Develop machine vision technologies to accurately estimate biomass (size distribution) in RAS
- Identify BMP's, feed supplements, or other environmental factors that can be used to minimize cataracts and fin erosion
- Develop feed formulations that can produce intact fecal pellets even when the ingredient mix of the formulation changes
- Develop feed formulations using novel fishmeal and oil ingredients that can meet the protein/amino acid and fatty acid requirements of the fish without compromising fish performance, fillet flavor or texture, or EPA-DHA content.
- Optimize zinc removal from RAS using ozonation when feeding formulations with excess zinc to counter fin erosion in trout
- Develop technologies to increase energy efficiency
 - Energy Conservation - Heat Recovery in RAS Buildings Using CO2 Scrubbing in a centralized closed-air-handling system

Background

The NOAA Fisheries and Aquaculture Report with data from 2009 to 2015 provides a great perspective on why this USDA research is critical. Over the entire period reported, Atlantic salmon was the only **marine finfish** species produced in aquaculture with production numbers large enough to report, i.e., the US barely farms the oceans for finfish. From 2009 to 2010 Atlantic salmon production jumped from 31 to 43 million pounds, respectively. However, marine Atlantic salmon production remained flat at approximately 40-42 million pounds from 2011-2014 but did grow in 2015 to approximately 47.5 million pounds (22,000 MT annually). Value did rise substantially over the same period because prices for Atlantic salmon went up. Meanwhile, freshwater aquaculture production in the US has slowly declined because it is dominated by catfish. Catfish production has declined from 2009 to 2015 while trout production has gone up, i.e., catfish down from 476 to 317 million pounds while trout up from approximately 37 to 46 million pounds (21,000 MT annually). Value of trout also rose considerably over the same period because both production and prices for rainbow trout went up.

Note that the new RAS facilities that are currently in production or under construction could readily increase production of Atlantic salmon by 50-100% to 10,000 to over 20,000 MT annually.