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**University of Wisconsin-Stevens Point** Northern Aquaculture Demonstration Facility

Greg Fischer, Assistant Director/Research Program Manager

Mission: Support sustainable aquaculture through public education and advance the discovery, dissemination and application of knowledge for aquaculture in a northern climate



Aquatic Barn The facility's mission is to promote public education and advance the discovery, dissemination and application of knowledge for sustainable aquaculture in a northern climate.

This is accomplished by:

•Demonstrating production-scale aquaculture.

•Conducting applied research on commercial scale.

•*Providing outreach and extension services.* 

Providing training, workshops and educational opportunities.
Building and strengthening cooperative relationships among commercial

aquaculturists, tribal, state and federal agencies.

•Working with fish growers on fish health issues, assessments, training and permitting.

•Developing best management practices for an environmentally, economically sustainable industry.











2017-2020 Sea Grant Research Project Overcoming barriers to support the growth of land-based Atlantic salmon production in the Great Lakes region



## Funded By: NOAA's National Sea Grant College Program

### **Investigators:**

Principal Investigators: Jim Hurley, Wisconsin Sea Grant Gregory Fischer, University of Wisconsin-Stevens Point, Northern Aquaculture Demonstration Facility

Co-Principal Investigator: Christopher Hartleb, University of Wisconsin-Stevens Point, Department of Biology, Northern Aquaculture Demonstration Facility

Co-Principal Investigator: Steven Summerfelt, Superior Fresh LLC

Co-Principal Investigator: Brian Vinci and Christopher Good, The Conservation Fund Freshwater Institute

Associate Investigator: John Davidson, The Conservation Fund Freshwater Institute

Associate Investigators: Kendall Holmes and Emma Wiermaa, University of Wisconsin-Stevens Point, Northern Aquaculture Demonstration Facility



# Strong Support from Industry and Partners

### CONSERVATION FUND

JOSEPH A. HANKIN VICE PRESIDENT and DIRECTOR, THE FRESHWATER INSTITUT 1096 TUNNER ROAD SHEPHERDSTOWN, WEST VIRGINIA 2544 VOICE 304-870-231 FAX: 304-870-230 Ihankins@conservationfund.or

20 April 2017

James P. Hurley, Ph.D. Director, University of Wisconsin Aquatic Sciences Center UW Sea Grant; UW Water Resources Institute President, Sea Grant Association (2017-18) Assoc. Professor, Civil and Environmental Engineering Chair, Environmental Chemistry and Technology Program

#### Re: NOAA Sea Grant 2017 Aquaculture Initiative and project proposal Overcoming barriers to support the growth of land-based Atlantic salmon production in the Great Lakes region

### Dr. Hurley

Please accept this letter as indication of our full support for your NOAA See Grant 2017 Aquaculture Initiative project proposal <u>Overcoming barriers to support the</u> growth of land-based Atlantic salmon production in the <u>Great Lakes region</u>. The work outlined in this proposal is of great interest to our Freshwater Institute aquaculture program. The Freshwater Institute is regularly engaged in advising highly intensive aquaculture farmers on the production of food sized salmon in land-based RAS systems. The challenges identified in the proposal are real and identification of practical solutions would be of great interest and benefit to current and future farmers and could allow more efficient use of capital assets and increase productivity.

The Conservation Fund's Freshwater Institute confirms our intention to participate as a co-investigator sub-recipient as described in the proposal. Dr. Steven Summerfelt, Director of Aquaculture Systems Research, will lead our team. Subject to funding availability and to facility capacity we can provide the culture systems to produce Atlantic salmon fry/parrysmoit to supply the research described. This work would be subject to the development, submission and approval of a detailed experimental protocol to our Animal Care and Use Committee (ACUC). Dr. Christopher Good (Ph.D., D.V.M.) our Aquatic Veterinarian and Epidemiologist will be available to supervise the study and protocol implementation. We have highly skilled and experienced senior associates and research technicians to engage in animal care and experiental systems maintenance throughout the study.

We will require that any salmonid eggs brought into our facility comply with applicable federal and state regulatory requirements regarding disease status and transfer of livestock or genetic material as wildlife or human food.

We estimate that our sub-recipient budget for this collaboration would be approximately \$110,000 per year for two years. The Conservation Fund is



RIVERENCE

April 19, 2017

James P. Hurley, Ph.D. Director, University of Wisconsin Aquatic Sciences Center UW Sea Grant; UW Water Resources Institute

Dear Dr. Hurley,

Riverence LLC is writing this letter in support of the proposed National Sea Grant Aquaculture Project titled "Overcoming barriers to support the growth of land-based Atlantic Salmon production in the Grant Lakes Region". This proposal pulls together several very experienced and seasoned research entities; the Conservation Fund Preshwater Institute and the University of Wisconsin Stevens Point Northern Demonstration Facility and pairs them with several US. commercial Atlantic salmon enterprises to solve some critical ongoing production in suces with landbased Atlantic salmon production. Atlantic salmon Sular is the primary prentium salmonid product in the world.

Land-based, closed containment fish farm operations utilizing water recirculation aquaculture system (RAS) tochnologies offer the industry a viable and sustainable means to expand domestie production, while expiralizing on the numerous benefits to this approach. Continued research and development in closed containment aquaculture production will also facilitate domestic agricultural economic contribution, job growth, and food security. Land-based production of market size Altantic salmon is currently being attempted in the Great Lakes region, specifically in Wisconsin in what is currently the largest land-based salmon aquaponics operation in the world (Superior Fresh LLC, llixton, WI); other land-taised salmon farms are either in operation or being planned in other regions of the country.

This project will help to address two of the major challenges faced by our industry with rearing land-based Atlantic salmon to market size. These two challenges addressed are 1. managing saprolegnissis (commonly termed "fungus") during the part – smolt early life stages, and 2. ensuring the flavor profile of the harvested fish.

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#### April 26, 2017

James P. Hurley, Ph.D. Director, University of Wisconsin Aquatic Sciences Center UW Sea Grant; UW Water Resources Institute

#### Dear Dr. Hurley,

We are writing this letter in support of the proposed National Sea Grant Aquaculture Project tiled "Overcoming barriers to support the growth of land-based Atlantic Salmon production in the Great Lakes Region". This proposal pulls together several very experienced and seasoned research entities; The Conservation Fund's Freshwater Institute and the University of Wisconsin Stevens Point Northern Aquaculture Demonstration Facility and pairs them with several U.S. commercial private Atlantic salmon production enterprises in attempting to solve some critical ongoing production issues with land-based Atlantic salmon production. Atlantic salmon Salmo Salmo salar is the primary premium salmoid product in the world.

Land-based, closed containment fish farm operations utilizing water recirculation aquacultures system (RAS) technologies offer the industry a viable and sustainable means to expand domestic production, while capitalizing on the numerous benefits to this approach. Continued research and development in closed containment aquaculture production will also facilitate domestic agricultural economic contribution, job growth, and food security. Land-based production of market size Atlantic salmon is currently being attempted in the Great Lakes region, specifically in Wisconsin in what is currently the langest land-based salmon aquaponics operation in the world (Superior Fresh LLC, Histon, Wi): other land-raised salmon farms are planned in other regions of the country.

This project will help to address two of the major challenges faced by our industry with rearing landbased Atlantic salmon to market size. These two challenges addressed are (1) managing saprolegniasis (commonly termed "fungus") during the parr – smolt early life stages, and (2) ensuring the flavor profile of the harvested fish.

The aquaculture industry is poised for growth, not only with expansion of existing facilities, but with continued investment in new facilities, new jobs and increased sales of locally grown fish. The University of Wisconsin-Stevens Point Northern Aquaculture Demonstration Facility and The Conservation Fund's Freshwater Institute have been strong supporters of the aquaculture industry for over 15 years and have worked closely with us to advance land-based RAS production in the US.

With this in mind, we strongly support this project and are dedicated to provide assistance as needed and will implement the solutions to these challenges that are facing our industry as soon as possible.

Sincerely

### Brandon J. Gottsacker, Chief Operations Officer

W15506 Superior Fresh Drive Hixton, WI 54635 715.984.2598 www.superiorfresh.com



## 2017-2020 Sea Grant Project

Overcoming barriers to support the growth of land-based Atlantic salmon production in the Great Lakes region

### Partners

- Wisconsin Sea Grant
- **Conservation Fund Freshwater Institute**
- **Superior Fresh** .
- Riverence

**Objectives:** We propose to examine two critical barriers to land-based salmon production in order to support the growth of this industry in the Great Lakes region and beyond:

- Saprolegniasis 1)
- High and low dosages of both hydrogen peroxide ٠ and peracetic acid
- Two age groups of fish
- Early, low immunocompetence life-stage (<5g) ٠ fish
- Post smoltification ( <100 g) fish ٠
- Two facilities with different water quality (soft vs ٠ hard)





## 2018 Sea Grant Project-Ongoing

Overcoming barriers to support the growth of land-based Atlantic salmon production in the Great Lakes region

## 2) Off-flavor

The flavor profile of farmed fish must be flawless, without earthy or musty flavors (i.e., "off-flavor").

We propose to test two practices to depurate off-flavors from Atlantic salmon before slaughter:

- (i) we will examine the effect of swimming speed (<0.5 body length/sec (BL/s) versus 1.5-2 BL/s) and dissolved oxygen concentration (60-70% vs 100% saturation) on the kinetics of geosmin removal from market-size Atlantic salmon, and
- (ii) we will test different makeup water flushing rates on the kinetics of geosmin removal from different biomasses of market-size Atlantic salmon
- (iii) Field studies are conducted at both the UWSP NADF facility in Wisconsin and at the Conservation Fund Freshwater Institute in West Virginia.





# UWSP NADF Off Flavor Study

- Atlantic salmon (<2 kg) were obtained several months prior to study from Superior Fresh, Hixton, WI and transported to UWSP NADF in Bayfield, WI for continued rearing and growout in RAS systems.
- Once fish were considered market size (~4kg) they were placed into a tank with elevated levels of geosmin and held in a static bath for several hours.
- Salmon were then randomly distributed to six tanks that had been cleaned with Hydrogen Peroxide and a power washer.





# UWSP NADF Off Flavor Study



- Six 8 ft dia. (5.0m<sup>3</sup>) round fiberglass, double drain tanks supplied with aeration, oxygen, adjustable flow valving, temperature monitoring, alarm systems and with fresh 8°C wellwater were utilized for study.
- > Dissolved oxygen was continuously monitored with optical DO probes provided for each tank.
- Testing: Is a hydraulic flushing rate of fresh well water = 900 liters per kilogram of fish for 7 days adequate to remove off flavor?
- Two treatments : Flow rates of 2.8LPM and 6.3LPM based on total fish weights of 31.5Kg and 70Kg respectively
- Exchange rates : (Low) 2.8lpm = 168 liters per hour = 1.0 exchange every 31.4 hours.

(High) 6.31pm = 378 liters per hour = 1.0 exchange every 14.0 hours.









## **UWSP NADF Off Flavor Study**

- At day 0, seven fish were removed from the concentrated geosmin tank and fillet sample was collected following study protocol.
- At day 7, nine fish were removed directly from each tank and fillet sample was collected following study protocol.
- ➢ Sex, size and fillet color was recorded for each fish.
- Fillets were collected from each fish, wrapped in aluminum foil, placed in Ziploc bags and frozen.
- ➢ Fillet tissues from a total of 61 fish were collected to be assayed for off-flavor
- ➢ In addition, water samples were collected from each tank throughout the study period and sent to Casey Grimm, USDA Scientist, for geosmin quantification.











# **UWSP NADF Results**

- Water samples collected, sent to USDA lab and analyzed for geosmin.
- Fillets collected but not analyzed due to Covid.
- Hoping to get results from lab this fall so we can analyze results and publish information from UWSP NADF.
- Thank you for your time. I can be reached at <u>gfischer@uwsp.edu</u> with any questions or comments.
- Our team has one publication from this project on off- flavor mitigation which author, John Davidson, from the Freshwater Institute will present on next.
- John Davidson is a Research Scientist at the Conservation Fund's Freshwater Institute. John will be discussing past and present research on off-flavor remediation from RAS-produced Atlantic salmon.





University of Wisconsin-Stevens Point College of Letters & Science