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ELEVATOR PITCH Category

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EXTRACTION IMPROVEMENT OF THE BLUE-GREEN PIGMENT “MARENNINE” FROM DIATOM *Haslea ostrearia* CULTURE SUPERNATANT: A SOLID-PHASE ON-LINE METHOD FOR BIOTECHNOLOGY USE

William Bélanger[1]

[1]Université du Québec à Rimouski, Institut des Sciences de la mer, 310 des Ursulines, Rimouski, QC, G5L 3A1, Canada; william.belr@gmail.com (W.B.)

The compound “marennine” is a blue-green pigment produced by the benthic microalgae *Haslea ostrearia*, demonstrating interesting pathogenicity reduction activities against some bacteria. After many decades of research, the chemical family of this compound still remains unclear. We developed a novel extraction method using a graphitic stationary phase, which provides various advantages over the previous procedure using tandem ultrafiltration. Our method is faster, more versatile, provides a better crude yield (66.1%, compared to 56.6% for ultrafiltration) and is compatible with continuous photobioreactor cultivation. In regards to the unique interactions provided by the graphitic matrix, the effects of organic modifiers, pH and reducing agents were studied and discussed. With this progress on marennine purification, isolation of a sulfated polysaccharide related to the marine drug fucoidan, a well known antiviral found in brown algae, was achieved. NMR and UV-Visible characterization of the isolated fucoidan-like fraction suggest that polysaccharides are an important component of marennine extracts. The identification of sulfated polysaccharides is a major breakthrough for marennine purification, providing targeted isolation techniques. Likewise, the full valorization potential of *Haslea ostrearia* and the role of sulfated polysaccharides in previous marennine chemical characterization and bioactivity studies remain to be determined.

OPTIMIZING AQUAPONICS WITH DESIGNER FISH FEEDS (*Maitland*)

Name: Danielle Maitland
Email: dn773249@dal.ca (Dalhousie University)

Description:
Aquaponics combines aquaculture (fish farming) and hydroponics (soilless plant cultivation) in a recirculating, engineered ecosystem. Fish eat and produce waste which is used to grow plants; the plants uptake the waste nutrients and clean the water, which can then be returned to the fish. Aquaponics systems offer the potential for faster growth and higher yields of both plants and fish, reduced water consumption and lower environmental impact.

In an optimized aquaponics system, the only required inputs are high-quality fish feed, light, and small amounts of make-up water, but unfortunately, many aquaponics systems are nutrient deficient compared to ideal hydroponic fertilizer solutions. One contributing factor to these deficiencies is that most aquaculture feeds have been designed over several decades to limit nutrient release by farmed fish to decrease traditional fish farming's (e.g. open net pens) environmental impact.

This means that the fish feed currently available for purchase at commercial volumes cannot be efficiently utilized in many aquaponics systems. The purpose of my PhD is to develop a highly digestible fish diet, which meets the fish's nutritional needs, while producing adequate, balanced nutrient waste for the plants. This could improve aquaponic plant growth efficiency and yields, and simplify and optimize aquaponics processes.

Title: THE EFFECT OF CHRONIC HYPOXIA AND TEMPERATURE ON HYPOXIA TOLERANCE IN BROOK CHARR (*Salvelinus fontinalis)*

Sarah McGeachy
University of New Brunswick
sarah.mcgeachy@unb.ca

Short Description:

There are several advantages to using triploid (sterile) fish in aquaculture facilities, primarily because they are less likely than escaped diploid (fertile) fish to outcompete native fish (Benfey, 2016). Despite these advantages, triploids are still not widely used because they often do not perform well. Optimizing environmental conditions, such as ways to minimize oxygen and temperature stress, are key in developing ways to improve the use of triploids in aquaculture.

The goal of my MSc is to develop a better understanding of the biological requirements of triploids (specifically hypoxia tolerances), and thereby provide advice to the aquaculture industry on how to improve triploid performance. Hypoxia tolerance studies are relevant to the aquaculture industry since both land-based recirculating facilities (Damsgaard et al., 2020) and sea cages for Atlantic salmon often experience hypoxic conditions (Burt et al., 2012; Stehfest et al., 2017). I will be looking specifically at hypoxia tolerance in brook charr as a proxy for the widely cultivated Atlantic salmon. Both species are salmonids, with brook charr being more suited to the smaller aquatic facility we have at UNB Fredericton.

References

Benfey 2016. Effectiveness of triploidy as a management tool for reproductive containment of farmed fish: Atlantic salmon (*Salmo salar*) as a case study. *Reviews in Aquaculture* 8:264-282.

Burt et al. 2012. Environmental conditions and occurrence of hypoxia within production cages of Atlantic salmon on the south coast of Newfoundland. *Aquaculture Research* 43: 607-620.

Damsgaard et al. 2020. Ion-regulation, acid/base-balance, kidney function, and effects of hypoxia in coho salmon, *Oncorhynchus kisutch*, after long-term acclimation to different salinities. *Aquaculture* 735571.

Stehfest et al. 2017. Response of Atlantic salmon *Salmo salar* to temperature and dissolved oxygen extremes established using animal-borne environmental sensors. *Scientific Reports* 7:1-10.

TITLE: PLASMA MARKERS OF SUBLETHAL AND LETHAL COLD STRESS IN CULTURED ATLANTIC SALMON (*Salmo salar*).

Émile Vadboncoeur, evadboncoeur@mun.ca; Memorial University of Newfoundland

Large numbers of mortalities can occur in salmon sea-cages in Atlantic Canada due to cold temperatures (i.e., 'winter chill'). In this collaborative project with Cooke Aquaculture, domesticated salmon will be held under 2 different long-term temperature regimes (3 tanks per group): a constant temperature of 6ºC; and a seasonal decline in temperature until mortalities reach 50% (i.e., over ~ 1 month). Blood sampling will occur at 6, 3, 2, 1, 0 and -1? ºC. In addition, two acute temperature decreases (from 3°C to -0.5°C for 4 hours; and 3°C to -0.5°C for 24 hours) will be performed to investigate whether it is exposure to sub-zero temperatures, or the length of exposure that is the most damaging. In this experiment, sampling will occur at 6, 18, 48 and 96 hours after the fish have been returned to 3ºC. In both experiments, plasma will be analyzed for concentrations of lactate, lactate dehydrogenase (LDH), aspartate aminotransferase (AST), cortisol, heat shock protein 70 (HSP 70), heat shock protein 47 (serpin H1) and cold inducible RNA-binding protein (CIRBP). The timing (temperature) of changes in these molecules will be compared to assess which are biomarkers of sublethal and lethal temperature effects, and the potential causes of mortality at cold temperatures.

N-3 LC-PUFA synthesis in Landlocked salmon compared to farmed Atlantic salmon (*Zhang*)

Zeyu Zhang, Matthew L. Rise, Brian Peterson, Jennifer Hall, Gary Burr, Mohamed Elsayed Emam, Stefanie M. Colombo*

Department of Animal Science and Aquaculture, Faculty of Agriculture, Dalhousie University
Truro, NS, B2N 5E3. zeyu.zhang@dal.ca

Farmed Atlantic salmon require 1-2% of n-3 long-chain polyunsaturated fatty acids (LC-PUFA) in their diet, which is mainly sourced by fish oil (FO). Terrestrial plant oils have been used to replace FO; however, they do not supply LC-PUFA (EPA and DHA). Freshwater landlocked Atlantic salmon may have a higher capacity for LC-PUFA biosynthesis compared with the commercial Saint John River (SJR) strain. This trait could be highly valuable as a genetic resource for the commercial strain to reduce FO as a source of LC-PUFA. The objective of this study is to determine if landlocked salmon have a higher capacity to synthesize LC-PUFA without dietary LC-PUFA. Freshwater strain and SJR strain salmon parr were fed FO-free diet and control diet for 16 weeks. Diet and strain were significant factors in salmon final weight and weight gain. SJR salmon gained significantly more weight than freshwater strain; both strains fed FO-free diets gained significantly more weight than FO-control diet. Principal coordinates ordination revealed strong separation in fatty acids due to diet, with n-3 LC-PUFA associated with salmon fed the FO-control diet. A permutational multivariate analysis of variance revealed that diet, strain and interaction effect were significant factors in determining salmon liver fatty acid profiles.