BOOK OF ABSTRACTS
AQUACULTURE CANADA 2025

ORAL PRESENTATIONS

ABDALLAH, ABDELMONEM

CONTROL AND MITIGATION OF INFECTIOUS SALMON ANAEMIA VIRUS IN FARMED SALMON: PROTOCOL FOR SCOPING REVIEW

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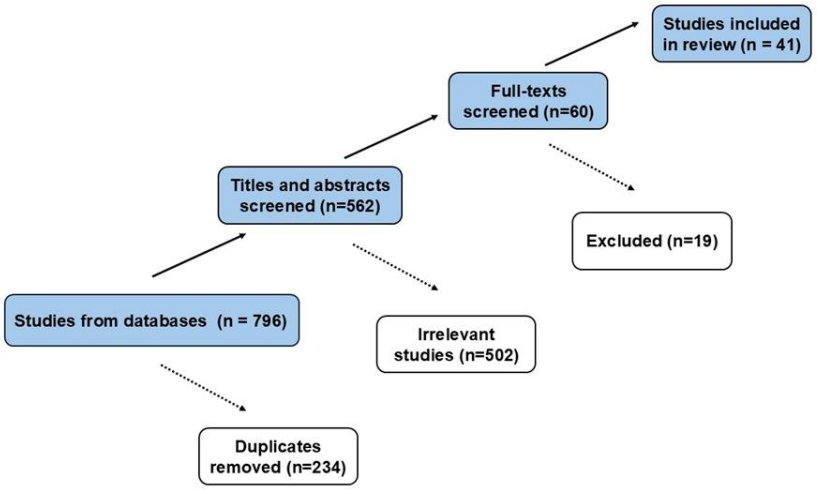
Infectious salmon anaemia (ISA), caused by the infectious salmon anaemia virus (ISAV), is a notifiable disease under the World Organisation for Animal Health (WOAH). It poses a significant threat to farmed Atlantic salmon, often resulting in considerable economic losses due to increased mortality and trade restrictions. This scoping review aims to systematically map and evaluate existing control strategies for ISAV, identify knowledge gaps, and highlight best practices. We analyze peer-reviewed studies and gray literature covering prevention strategies (e.g., vaccination, selective breeding), biosecurity measures (e.g., fallowing, disinfection), and management approaches (e.g., depopulation, movement controls).

Our methodology follows the PRISMA-Scoping Review guidelines, with literature searches conducted across PubMed, Scopus, CAB Abstracts, and the Earth, Atmospheric & Aquatic Science Collection. Included sources consist of analytical studies, review articles, government reports, and other gray literature addressing ISA control measures. Two independent reviewers screened titles and abstracts; full-text screening is ongoing, with discrepancies resolved by additional reviewers.

Data extraction focuses on the types of control measures implemented, their reported effectiveness, and associated challenges. The findings aim to provide insight into current ISA control practices and outcomes, contributing to a clearer understanding of the most effective strategies for preventing and managing ISAV detection and subsequent disease.



AHMED, TANVEER

Moringa oleifera AS A DIETARY SUPPLEMENT: IMPACT ON GROWTH METRICS AND PHYSIOLOGICAL HEALTH OF *Cirrhinus mrigala*

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This study was designed to determine the effects of adding various amounts of *Moringa oleifera* including 0%, 5%, 10%, 15% on growth performance, hematological indices and biochemical profile of freshwater fish, *Cirrhinus mrigala*. For this purpose, a 70 days experimental trial was conducted in glass aquarium at laboratory conditions. The experimental group was given a diet treated with *M. oleifera* leaf powder at a certain concentration, while the control group was given a conventional diet. Various Fish growth parameters including specific growth rate, weight gain, feed conversation ratio was measured on fortnight bases. Similarly, various hematological parameters including WBC, RBC, PCV, Hb and biochemical profile including Cholesterol, total protein, and albumin were also analyzed after the completion of experimental trial. Fish fed with 10% MOLM showed notable improvements in final weight as compared to other groups. Nonetheless, there were non-significant alterations in the biochemical profile and a substantial decrease in Cholesterol, albumin, protein, ALT, AST, and ALP. It was shown that a 10% MOLM-based diet achieved minimum feed conversion ratio (FCR) 1.50±0.016, maximum weight gain (WG) 12.93±0.11 and weight gain percentage (WG%) 190.2±2.35. The findings of this study suggest that *M. oleifera* can be used as a sustainable and eco-friendly dietary supplement in aquaculture, particularly for Mrigal carp farming

Conclusion

Based on inferences, it is concluded that feed of *C. mrigala*a that contain 10% *M. oleifera* leaf is best.

AKBARZADEH, SAJJAD

ARTIFICIAL HYBRIDIZATION BETWEEN FEMALE STELLAT STURGEON, *Acipenser stellatus* AND MALE PERSIAN STURGEON, *Acipenser persicus*; POSSIBILITY OF F1 TRIPLOID PRODUCTION

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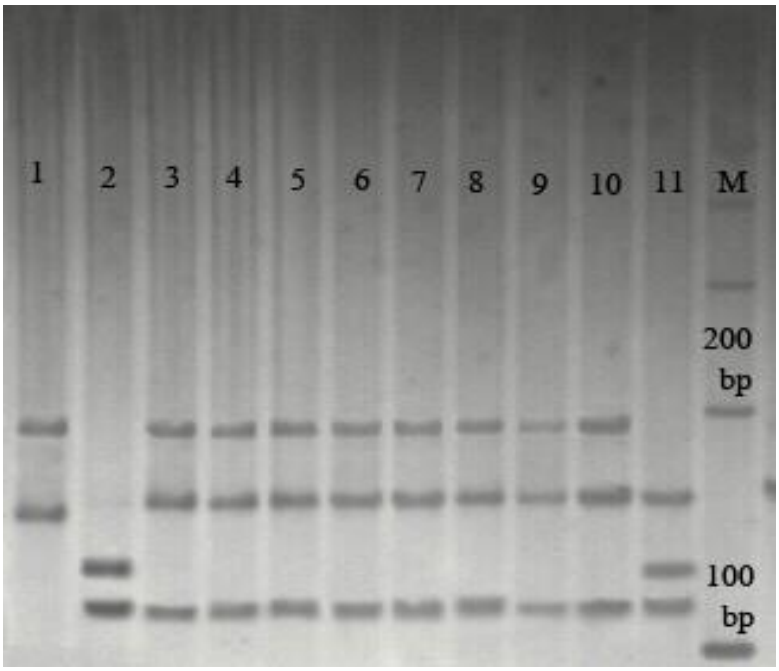
Artificial hybridization was carried out between two economical species (female stellate sturgeon and male Persian sturgeon) with the aim of heritability manner of hybrid genome and to determine the most appropriate type of thermal shock and duration of induced shock after fertilization. For this purpose, eggs of Stellate Sturgeon and sperm of Persian Sturgeon were used from propagation and cultivation site of International Sturgeon Research Institute (Rasht-Iran). For application of thermal cold shock (1˚C) was used for duration of 30 minutes respectively. Thermal shock was applied at 15 min after fertilization. Three experimental groups were designed including: normal group, triploid group and haploid group. Fertilization rate was 97% and hatching rate was 78 percent. Also, AFUG 63 and LS 68 microsatellite markers have verified F1 progenies. These markers present that F1 has inherited two loci of paternal breeder and one locus of maternal breeder. So, there is possibility of triploidization in the hybrid progenies.



DNA band pattern:
1: Male parent
2: Female parent
3-11: Hybrid Offspring
M: Molecular Marker

ALLEN, MELISSA

FROM HUNDREDS TO MILLIONS: SCALABLE SNP GENOTYPING SOLUTIONS FOR OYSTER BREEDING

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The development of reliable and cost-effective genotyping tools is essential for advancing genetic research and breeding programs in aquaculture. Developing such tools in oyster species presents unique challenges due to their highly polymorphic and repetitive genomes. In Eastern (Crassostrea virginica) and Pacific oysters (Crassostrea gigas), we have developed and evaluated a suite of SNP panels across a range of marker densities to support breeding efforts. These include low- to medium-density panels with 192 to 3,000 SNPs, optimized for parentage assignment, traceability, and diversity monitoring, as well as high- to ultra-high-density arrays and whole-genome sequencing (WGS) technologies for use in genomic selection and high-resolution genome-wide association studies. In this presentation, we will discuss the challenges, development, validation, and comparative utility of these panels, highlighting their applications in breeding programs and outlining future directions for integrating imputation-based genotyping approaches. Our results demonstrate that tailoring SNP panel density to specific breeding objectives offers a cost-effective balance between genotyping resolution and program needs.

BAKER, CHRISTOPHER

THE EFFECT OF DIETARY SUPPLEMENTATION OF ASTAXANTHIN ON ACUTE HYPOXIA AND THERMAL TOLERANCE IN TRIPLOID AND DIPLOID BROOK CHARR *Salvelinus fontinalis.*

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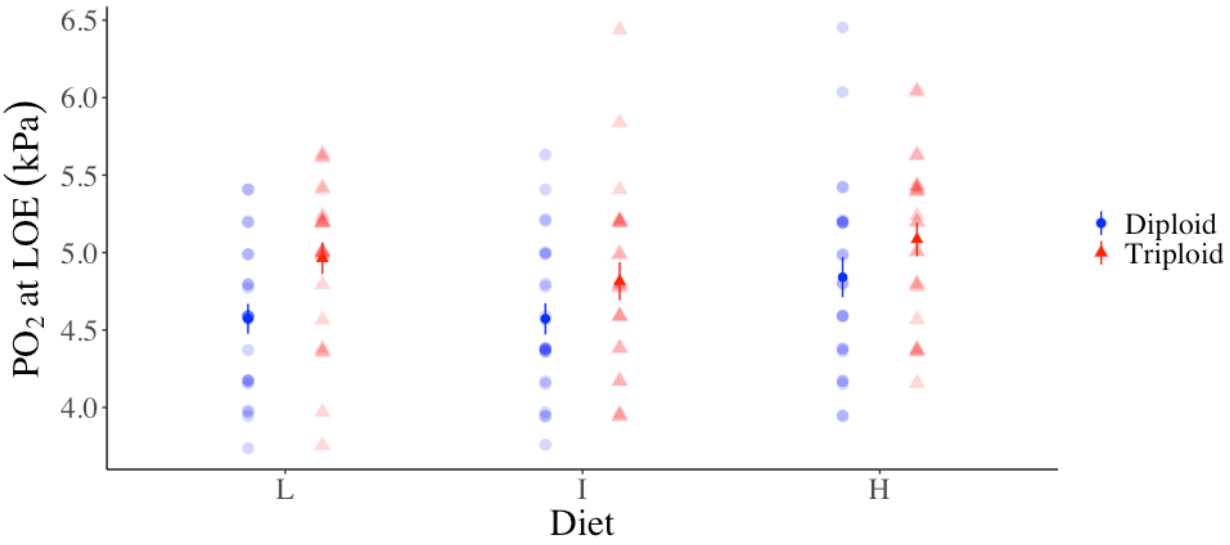
Triploid fish could be beneficial for increasing aquaculture sustainability due to their reproductive sterility which prevents the risk of interbreeding between wild and escaped farmed fish. However, research has shown that they are less tolerant than diploids of environmental stressors such as high temperatures and low dissolved oxygen. This study investigated whether dietary supplementation with the carotenoid astaxanthin (AX) improves the acute hypoxia and temperature tolerance of both triploid and diploid brook charr (*Salvelinus fontinalis*). Fish were fed diets with three levels of AX supplementation (18, 80, 190 mg/kg) for 8 weeks and then assessed for acute hypoxia tolerance by rapidly reducing oxygen content of the water and then determining the oxygen concentration at loss of equilibrium (LOE) and the time taken to reach LOE. Using a similar approach, I then determined critical thermal maximum (CTmax) tolerance of different groups of triploid and diploid charr fed the same AX diets by rapidly increasing the temperature of the water and then determining the temperature at LOE and the time taken to reach LOE. Triploids were less hypoxia tolerant then diploids, but ploidy did not affect CTmax, and AX supplementation also did not affect either hypoxia tolerance or CTmax.



BAKI, AZEEZ OLALEKAN

DIFFERENT LEVELS OF WATER EXCHANGE ON THE GROWTH, SURVIVAL AND HAEMATOLOGY OF *Clarias gariepinus* FINGERLINGS

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Water determines the success or failure of an aquaculture operation to a greater extent. In dry season and regions with low accessibility to water, productivity tends to reduce. The main objective of this study was to determine the effect of different levels of water exchange required for producing African mud catfish. One hundred eighty *Clarias gariepinus* fingerlings (2.69±0.94 gfish^{-1}) were randomly distributed at 15 fish per tank into four treatments with three replicates. Each treatment was named according to the daily water level renewal, namely T_0 (Complete renewal), T_1 (Quarter renewal), T_2 (Half renewal) and lastly, T_3 (three-quarters renewal). The experiment lasted eight weeks, twice daily feeding with commercial feed at 5% body weight. The results showed no significant differences in the water quality parameters. However, T_2 had the highest final weight of 52.06±1.01g and weight gained 6.73±3.96. T_2 retained the highest specific growth rate 6.01±1.42 gday^{-1}. The most increased FCR was recorded in T_0 (0.64±0.30) and the least in T_1 (0.61±0.28). All the experimental groups had high survival at the end of the experiment, with the highest value in T_0 and T_1 (100%) and the lowest in T_2 (90%). The result showed that PCV and haemoglobin were significantly (*p*-value <0.05) higher in T_2 (31.00±0.00 and 10.30±0.00) and T_1 (31.00±1.41 and 10.50±0.70) than in T_0 (26.00±1.41 and 9.00±0.00) and T_3 (23.50±0.70 and 8.00±0.00). Red blood cells were significantly higher in T_0 (2.15±0.07) and least in T_2 (1.00±0.00). This study showed that daily water exchange to half the water level volume produced the best result in terms of growth performance. Minimal stress on fish should be prioritized during daily water exchange for optimal growth.

Keywords: Aquaculture, *Clarias gariepinus*, Water level, Haematology, African mud catfish

BARDON-ALBARET, AGNÈS

PERFORMANCE EVALUATION OF DIPLOID AND TRIPLOID ARCTIC CHARR

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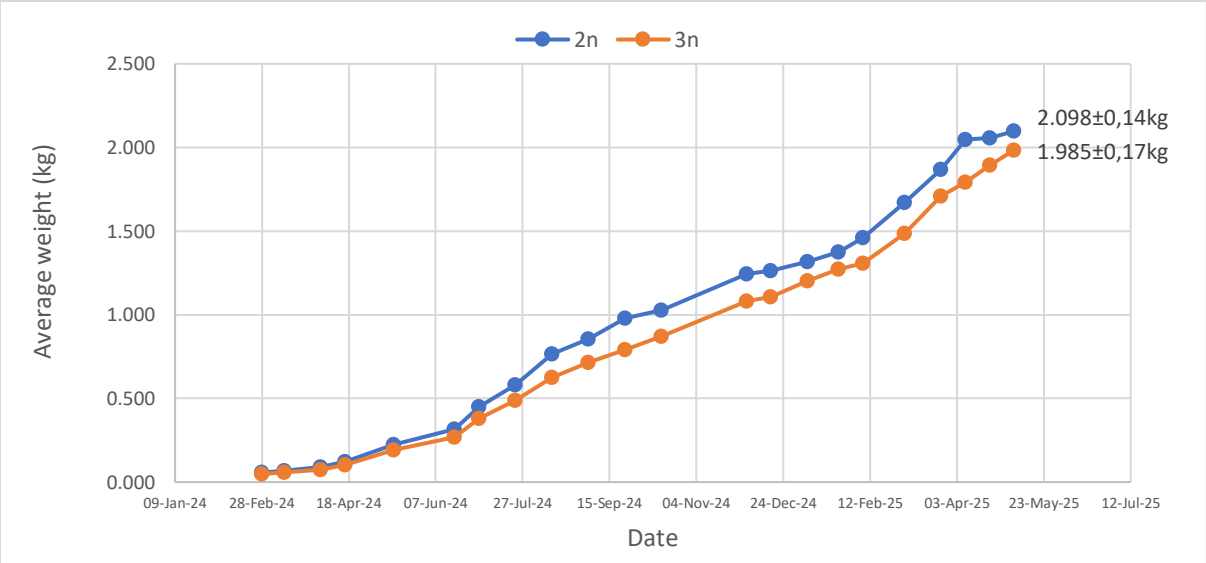
Valorēs implements a breeding program to enhance the performance of Artic charr in commercial aquaculture, now advancing into its 10th generation of selection this fall. Diploid progeny face hurdles in attaining marketable size due to premature sexual maturity, impacting flesh quality and feed conversion. To counter this, Valorēs began producing triploid Artic charr in 2016. Triploids, being sterile, channel energy away from gonad development into growth, offering advantages like reduced escapement risks and safeguarding intellectual property. Despite potential benefits, the financial viability of triploid production remains unexplored. This project is divided in two phases: separate rearing of diploids and triploids until market size, followed by performance assessment during harvest and processing. Metrics include survival rates, growth, feed conversion, maturation rate, and product quality (fillets yields, pigment, lipid and protein contents). This project evaluates triploid fish performance under modern aquaculture conditions. Results will benefit stakeholders invested in Artic charr aquaculture, ensuring the success and viability of Arctic charr breeding program and its industry.



THE PHYSIOLOGICAL RESPONSE OF JUVENILE DIPLOID AND TRIPLOID ARCTIC CHARR (*Salvelinus alpinus*) TO EXHAUSTIVE EXERCISE

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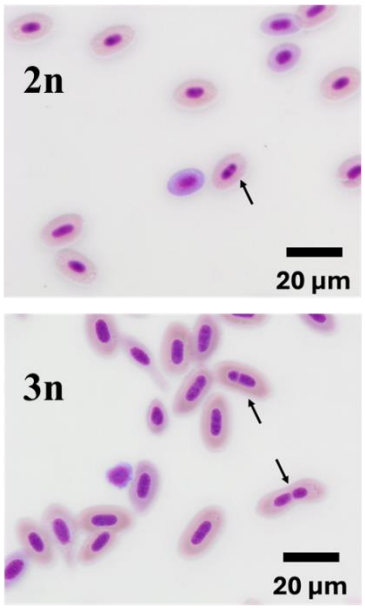
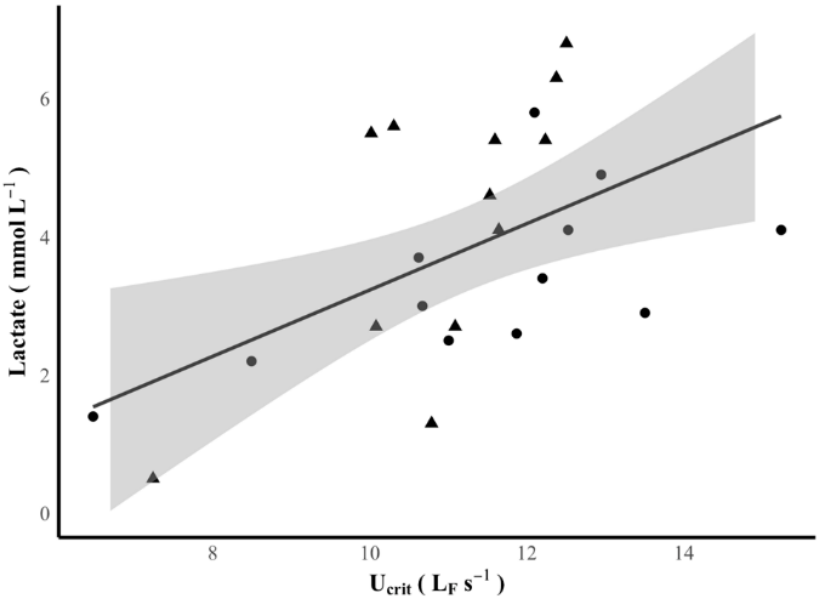
Triploidy is an effective tool for producing sterile fishes but often results in impaired performance in commercial aquaculture. In light of this, our study compared the physiological response to exhaustive exercise in juvenile diploid and triploid Arctic charr, a cold-water species with great potential for aquaculture. A standard ramping swimming protocol revealed no significant difference in critical swimming velocity (U_{crit}) between ploidies. There was also no effect of ploidy on post-U_{crit} blood glucose, lactate, or hematocrit. However, triploids had a significantly higher frequency of erythrocyte nuclear segmentation (ENS; Fig. 1). Independent of ploidy, there was also a significant positive correlation between blood lactate levels and U_{crit} (Fig. 2). We conclude that triploidy does not impair the response to exhaustive exercise in juvenile Arctic charr.



g. 1. Arrows showing examples of NS in diploid (2n) and triploid (3n) ythrocytes from juvenile brook arr, *Salvelinus fontinalis*.



g. 2. Correlation between U_{crit} (L_F = fork length) and post-exercise blood ctate in juvenile diploid (circles) and triploid (triangles). Solid line is linear gression (r = 0.541, p < 0.01, y = 0.4803x – 1.5706) with 95% confidence erval shaded.

Acknowledgments. We thank Heather Burke, Abigail Concannon, Megan Fraser, Chandler Stairs, Katie Theriault, and Jacob Wickens for assistance with data collection and fish care, and Katy Haralampides and Dennis Connor for the loan of equipment. This research was funded by the Natural Sciences and Engineering Research Council of Canada. We respectfully acknowledge that UNB's Fredericton campus stands on unsurrendered and unceded traditional Wolastoqey land.

BETANCOURT, JESÚS LUIS

IMMUNOMODULATORY AND ANTIBACTERIAL EFFECTS OF PACAP IN WHITE SHRIMP *Litopenaeus vannamei*

Jesús Luis Betancourt*, Tania Rodríguez-Ramos, Ijeoma Ihedimbu, Daniel Eduardo Coronado-Molina, Yamila Carpio, Yovana Rodríguez, Mario Pablo Estrada, Jorge Hernández-López, Laida Ramos and Brian Dixon

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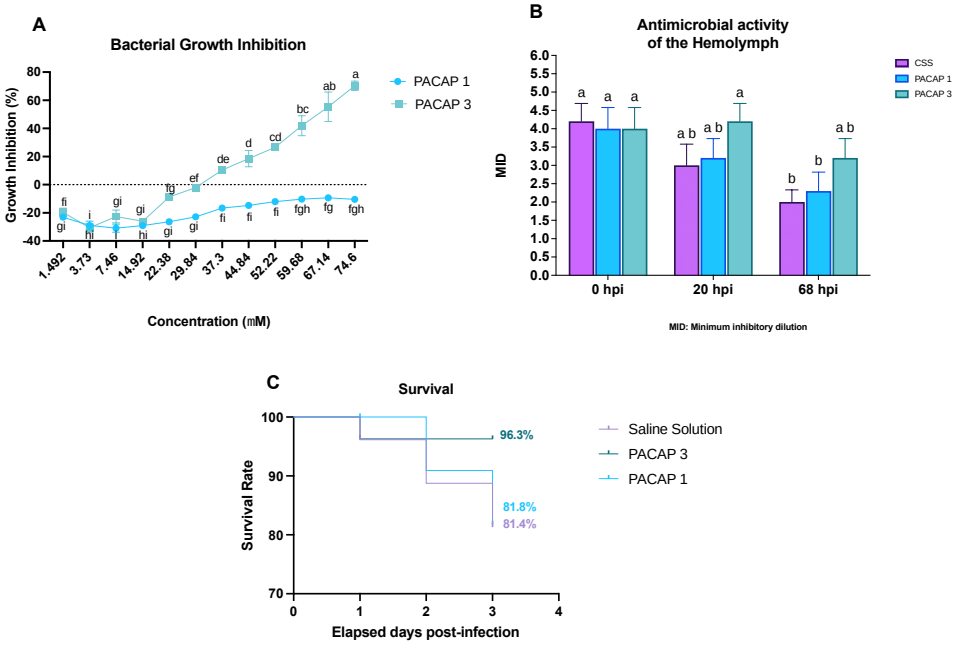
Disease outbreaks in aquaculture are a major challenge, often leading to the widespread use of antibiotics. However, excessive and improper antibiotic use drives antimicrobial resistance, posing risks to both aquatic species and human health. As alternatives, researchers are exploring antimicrobial peptides such as pituitary adenylate cyclase-activating polypeptide (PACAP), known for its antimicrobial and immunomodulatory properties. To date, only a few studies have investigated PACAP in shellfish species. In this context, PACAP and three modified PACAP sequences were evaluated as immunostimulants in *Litopenaeus vannamei* shrimp. Two bioassays were performed to assess the effects of a single administration and multiple doses on shrimp immune parameters. Results showed that PACAP and its variants modulated hemolymph immune markers and immune-related gene expression in hemocytes, gill, and hepatopancreas, with effects depending on peptide sequence, dose, and tissue. Based on these findings, the immunostimulatory and antibacterial activities of PACAP and the best-performing modified sequence were further examined during a *Vibrio parahaemolyticus* infection. Immune status was assessed through hemolymph immune indicators and RT-qPCR. PACAP improved shrimp immune responses, and the modified peptide revealed strong antibacterial activity against *V. parahaemolyticus*. These results highlight PACAP's potential as an alternative to antibiotics in shrimp aquaculture.



BEZNER, SAMANTHA

GROWTH PERFORMANCE, FILLET COLOURATION, AND ANTIOXIDANT CAPACITY OF RAINBOW TROUT *Oncorhynchus mykiss* FED MICROALGAL, BACTERIAL, AND SYNTHETIC ASTAXANTHIN PIGMENTS

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Salmonid fillet pigmentation is formed by feeding and retaining astaxanthin from the diet, which provides a vibrant red hue and increased antioxidant capacity within fish. Aquafeeds typically utilize synthetic astaxanthin, though they are derived from petrol and expensive. The aim of this study was to investigate organic, alternative sources of astaxanthin to pigment the fillet of rainbow trout. Over three-months, rainbow trout initially weighting 323.1 ± 14.4g were fed one of five diets: **CON -** control (no astaxanthin); **SAX -** synthetic; **BAX –** bacteria (*Paracoccus carotinifaciens*); **MAP -** microalgal powder; or **MAO -** microalgal oil (*Haematococcus pluvialis*). Growth performance, carcass proximate nutrient composition, and plasma antioxidant capacity were not statistically significant ($p > 0.05$). Fillet colouration was assessed via Salmofan ranking and L*a*b colourimeter quantification, which found that all pigmented diets significantly improved the colouration of the fillet compared to CON ($p < 0.001$), but similarly to each other. Astaxanthin concentration was analyzed using high-performance liquid chromatography and was significantly higher in MAP and SAX, followed by MAO and BAX, when compared to CON ($p < 0.05$). This study demonstrated that both microalgae and bacteria are viable, organic astaxanthin alternatives to pigment fillets of rainbow trout.

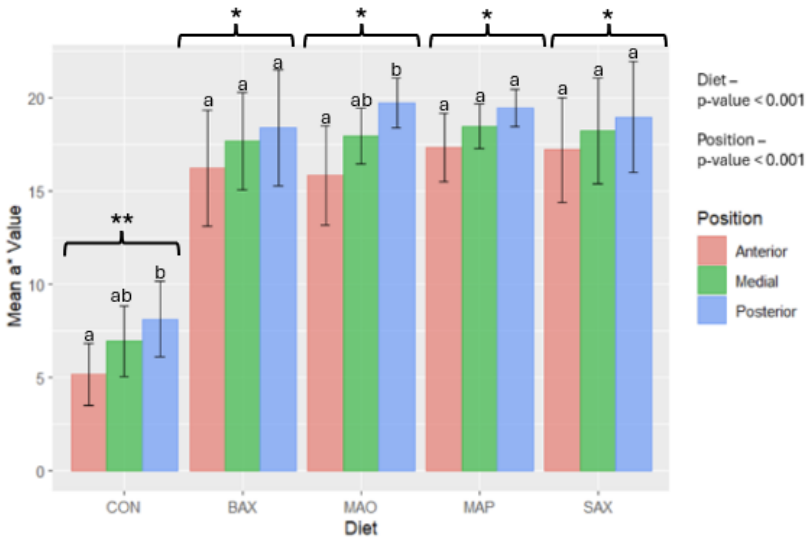

Figure 1. a* (red-green) value ± standard deviation in the fillet of rainbow trout (n = 9 / diet) fed each dietary treatment after 84 days, **CON:** control (no astaxanthin added); **BAX:** bacterial astaxanthin; **MAO:** microalgae oil astaxanthin; **MAP:** microalgae powder astaxanthin; **SAX:** synthetic astaxanthin.

BIRD, ADAM

APPLYING AI TO AUTOMATE BIOMASS MONITORING IN LAND-BASED AQUACULTURE: OPERATIONAL AND ORGANIZATIONAL IMPACT

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ReelData's AI-powered biomass camera system offers land-based aquaculture producers a fully automated method for estimating fish biomass with high accuracy and zero physical handling. Using underwater computer vision models trained to detect, track, and estimate fish size in real-time, this technology eliminates the need for manual sampling and the stress events that often accompany it in challenging land-based conditions. The result is a scalable solution that supports both animal welfare and production goals in high stocking density and low light environments.

Beyond the tank, the implications of precise, continuous biomass data extend into nearly every function of the business. Real-time growth monitoring supports feed optimization and harvest planning, while enhanced forecasting accuracy enables improved financial modeling, logistics coordination, and sales planning. Operations teams gain better control over production targets, and finance teams benefit from stronger biological-to-financial data alignment.

This presentation will explore how an applied AI system, when designed with both land-based aquaculture realities and enterprise integration in mind, becomes not just a sensor, but a cornerstone of smarter farming infrastructure. We'll outline how the technology works, its key design principles, and its role in shifting land-based aquaculture from reactive management toward predictive, data-driven operation.

BOAHENG, JOSEPH

THE WELLFISH TECH EXPERIENCE: DEPLOYING MACHINE LEARNING TECHNIQUE FOR SUSTAINABLE FISH HEALTH MANAGEMENT

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This paper describes a comprehensive Machine learning pipeline developed to support predictive analytics in fish health monitoring at WellFish Tech. The system integrates multi-source data inputs originating from the farm level, including clinical biochemistry data, production records, and environmental parameters. The system ingests and aligns these heterogeneous datasets through a structured data pre-processing pipeline comprising data merging, exploratory data analysis (EDA), cleaning, and feature standardization.

The system processes and structures the data, subjects it to a modeling phase where it selects optimal machine learning algorithms based on the problem domain. This phase involves data splitting, model training, and model evaluation/testing using established performance metrics. The resulting models enable real-time prediction and forecasting across multiple fish health indicators: mortality, disease outbreak risk, overall fish health, gill health, metabolic stress, and myopathy.

The system finally integrates the model outputs into Power BI Service and Tableau dashboards to facilitate operational deployment and visualization, allowing customers to interactively assess predictive insights and implement evidence-based interventions. The entire pipeline emphasizes scalability, automation, and accuracy, with the goal of reducing fish mortality, improving fish health surveillance, and enhancing sustainable fish farm management (Figure 1).

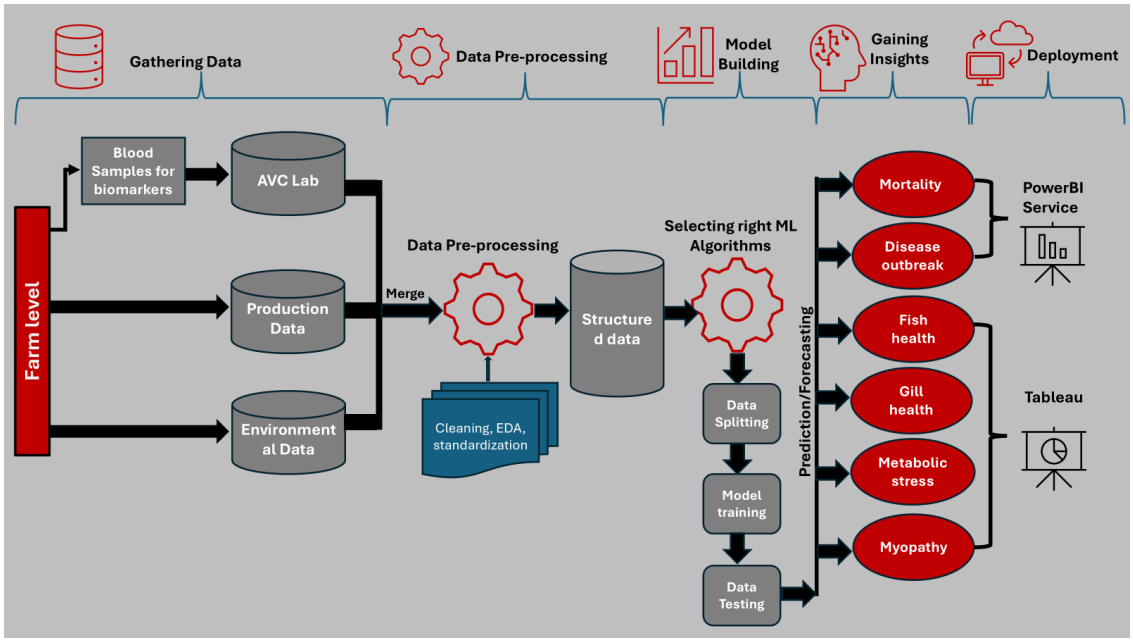

Figure 1: WellFish Tech Machine Learning Processes

BRIDIER, GUILLAUME

ACCLIMATION *VS* THERMAL SHOCK: PHYSIOLOGICAL RESPONSES OF THE GIANT SCALLOP (*Placopecten magellanicus*) TO WARMER TEMPERATURES

Guillaume Bridier*, Jeff C. Clements, Thibault Androuin, Rémi Sonier, Ramón Filgueira, Luc Comeau, and Réjean Tremblay

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This study investigates the physiological responses of giant scallops, a key commercial species in Atlantic Canada exposed to ocean warming, exposed to different ambient temperatures (13, 17, 21°C) and acute thermal shocks (17-21°C, 21-25°C). We compared two populations: (1) Nova Scotia, the main area of Canada's scallop landings, and (2) Northumberland Strait, a less-exploited but climate-sensitive region due to its shallow waters. Oxygen consumption rates were measured via respirometry, and fatty acid profiles were analyzed across different tissues to assess metabolic and physiological responses to thermal stress. Our results revealed significant differences in fatty acid composition among tissues, highlighting their distinct physiological roles. Neither fatty acid profiles nor oxygen consumption rates varied across thermal conditions, suggesting that scallops were already experiencing thermal stress at the lowest temperatures tested. However, high inter-individual variability emerged under extreme heat stress. Contrary to Nova Scotia scallops, which exhibited uniform metabolic responses, Northumberland scallops displayed two distinct strategies: some individuals maintained a stable metabolism across conditions, while others significantly increased their metabolic rate at the highest temperature. This divergence suggests the existence of two phenotypes, one adapted to the colder waters of the St. Lawrence and the other able to cope with sudden temperature changes.

CARNEGIE, RYAN

WHAT CAN WE LEARN FROM THE EXTRAORDINARY MSX OUTBREAK IN OYSTERS FROM CHESAPEAKE BAY, USA, IN 2023-2024?

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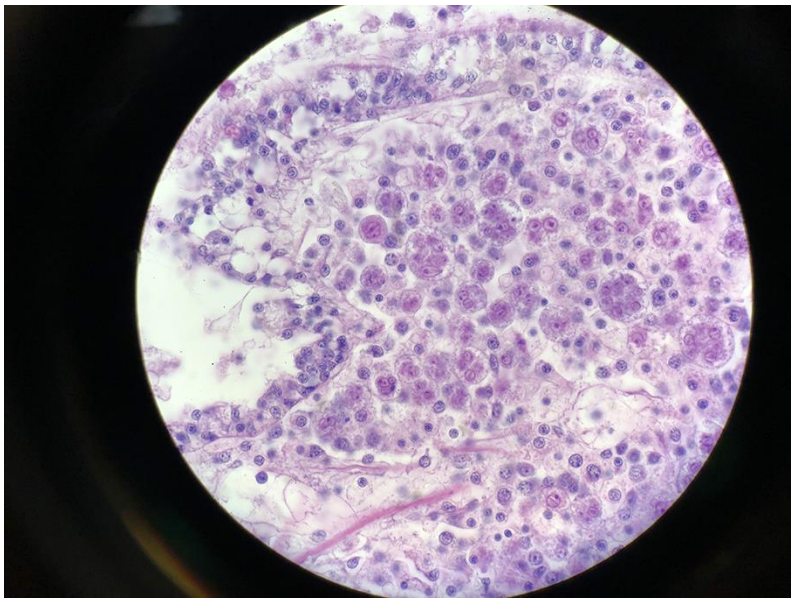
The oyster aquaculture industry around Chesapeake Bay has become a national leader, and oyster restoration there a global model, because of successful management of the oyster diseases dermo and MSX. Aquaculture relies on hatchery production of disease-resistant seed. Aquacultured oyster lines originate from disease-resistant natural populations, sustainable management of which underpins restoration success. Nevertheless, the pathogens occasionally intensify to cause substantial oyster mortality, as occurred in Chesapeake Bay in late 2023-early 2024. Elevated mortality affected wild oysters mid-estuary, where lower salinities normally prevent serious infection--oysters in these areas may have reduced natural disease resistance, so when drought elevates salinities it can elevate infection and mortality. Especially noteworthy, however, was the impact of the event on aquacultured oysters that should have been strongly disease-resistant. Reduced MSX infection pressure over recent years likely led to erosion of resistance in aquacultured oysters. We now recognize that breeding programs should not just measure survival, but understand infection pressure more specifically so they can appreciate *why* oysters are alive—because they are resistant, or because they simply did not receive a disease challenge in their production cycle. Better understanding infection pressure on breeding populations will ensure the most disease-resistant stocks are available for aquaculturists.



MSX plasmodia (large eosinophilic, or pinkish, spheres) in a histological oyster section at the microscope

CARPIO, YAMILA

ORAL ADMINISTRATION IN-FEED OF *Clarias gariepinus* PITUITARY ADENYLATE CYCLASE-ACTIVATING (PACAP-38) BOOST ANTIBACTERIAL DEFENSES IN TELEOST

Yamila Carpio*, Janet Velázquez, Laura Isabel Acosta, Tania Rodríguez-Ramos, Laura Rivera, Eyesun Fajei, Fidel Herrera, Patricio Dantagnan, Mark Fast, Brian Dixon, Mario Pablo Estrada

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Pituitary adenylate cyclase-activating polypeptide (PACAP) is a multifunctional neuropeptide belonging to the glucagon/secretin superfamily. Its role in fish growth and immunity has been previously demonstrated using different administration routes such as injection or immersion bath. The present research evaluated the impact of "water in oil" (W/O) formulation containing *Clarias gariepinus* synthetic PACAP-38 added to fish feed in different teleost species. The results showed an improvement in antibacterial defenses and survival in species of aquaculture relevance such as *Clarias gariepinus*, *Oreochromis niloticus* and *Salmo salar*. This improvement seems to be mediated by a regulation of inflammatory response and expression of antimicrobial peptides. The PACAP-38 formulation is an simple W/O formulation, conceived for the addition in the oily phase of pelleted extruded feed; thus it could be a suitable alternative to overcome bacterial infections in aquaculture practices and to avoid the excessive use of antibiotics and consequently, their impacts in the environment and the antimicrobial resistance phenomena.

CAVARLÉ, VALENTIN

EXPLORING BENEFITS OF SEAWEED CO-CULTURE ON BIVALVE GROWTH AND QUALITY THROUGH ORGANIC MATTER TRANSFER

Valentin CAVARLÉ*, Éric TAMIGNEAUX, Lucie BEAULIEU, Fanny NOISETTE

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Seaweed can modify their chemical environment, creating more favorable conditions for bivalve growth when they are cultivated together. However, less is known about trophic benefits from seaweed in a co-culture context. By fragmenting and degrading, seaweed release particulate and dissolved organic matter (POM and DOM, respectively) into the surrounding water, likely providing additional food supply for bivalves. Our study investigated the effects of co-cultivating the sugar kelp *Saccharina latissima* with bivalves (*Mytilus edulis* and *Crassostrea virginica*) on bivalve growth and tissue quality. Conducted in partnership with Ferme Marine du Grand Large in Carleton-sur-Mer (Quebec, Canada), this study compares biometric and tissue compounds of oysters and mussels from a monoculture system and a co-culture system. Organic matter inputs in the water column (POM, DOM and chl a concentration) were quantified in the two systems, six times over the growth period of summer of 2024. After 6 and 10 weeks of growth, biometric measurements (shell mass and size, tissue mass) and nutritional analyses (isotopes, protein, lipid, and carbohydrate content) were performed to evaluate the potential benefit of seaweed-derived organic matter on bivalves. Preliminary findings suggest that the presence of seaweed increased the organic matter content in the water column. Isotopic analyses are expected to confirm the ingestion and assimilation of seaweed-derived organic matter by bivalves. Co-cultured bivalves would likely have a greater quality in terms of lipids diversity and quantity compared to those in monoculture conditions, advocating in favor of co-culture systems to support sustainable aquaculture.

CHILVERS, VIOLET

EVALUATING THE GROWTH AND SURVIVAL OF DIPLOID AND TRIPLOID *Mytilus edulis* LARVAE FROM DIFFERENT SOURCES REARED AT CONSTANT AND FLUCTUATING THERMAL REGIMES

Violet Chilvers*, Eric Ignatz, Flavie Perron, Shelby B. Clarke, Tiago S. Hori, Ramón Filgueira

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Farming triploid bivalves has gained favour due to their enhanced growth rate and effective sterility; however, their suspected lower upper thermal tolerance may increase mortality, an industry concern worsened by climate change. Mussels in Sober Island Pond, Nova Scotia (NS) experience elevated temperatures in summer, exhibiting a higher thermal tolerance compared to mussels from Georgetown, Prince Edward Island (PE). This study aimed to assess the performance of *Mytilus edulis* larvae using a fully factorial design incorporating: 1) source (NS vs. PE); 2) ploidy (diploid vs. triploid); and 3) thermal regimes (constant 18 ºC vs. semidiurnal 16-20 ºC fluctuations). Flow cytometry confirmed triploidization, while survival and growth were measured until settlement. This experiment found that: i) PE larvae have a lower survival rate and larger mean length, suggesting a trade-off between growth and survivability; ii) triploid treatments had a lower survival and comparable mean lengths to diploid treatments, suggesting that expected growth enhancement does not manifest at larval stages; iii) triploid percentage decreased under fluctuating thermal regime, indicating that triploids are more sensitive to thermal stress. These insights serve as the foundation for producing climate-resilient blue mussels and promoting aquaculture sustainability.

CLARKE, SHELBY

FARMING BIVALVES UNDER CLIMATE CHANGE SCENARIOS: THE EFFECTS OF HEATWAVES AND TUNICATES ON MUSSEL *Mytilus edulis* AQUACULTURE IN ATLANTIC CANADA

Shelby B. Clarke*, Jasmine Talevi, Luc A. Comeau, John Davidson, Andre Nadeau, Ramon Filgueira

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With the rapid establishment of tunicates in Atlantic Canada and the increasing frequency of marine heatwaves, mussel aquaculture could be affected, and ripple effects could have implications on the local environment. This study investigated the effects of tunicates, heatwaves, and their interaction on the performance of a mussel sock, which represents the functional unit of a farm. Using a dockside experiment in Georgetown, PEI, a 50 cm piece of a mussel sock was suspended in a 291L chamber for 9 days with either the presence or absence of heatwaves and tunicates in a fully crossed factorial design. Oxygen consumption and feeding rate at the mesocosm level were measured daily, and valve behaviour at the individual level was measured continually at 10 Hz. Using metabolic and feeding data, the scope for growth of mussel socks was compared between treatments. Results show that heatwaves can negatively affect the performance of mussel socks, and the presence of tunicates may further exacerbate these negative effects. These findings provide insight into what could happen on a farm during a heatwave event with or without tunicates, which could help inform carrying capacity models and assist in formulating more ecologically relevant predictions for the industry.

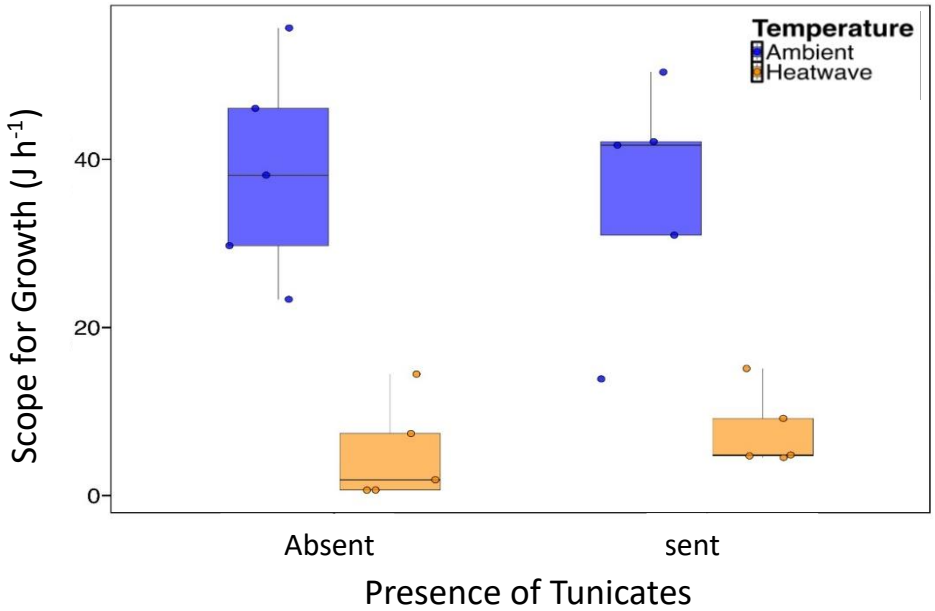

Figure 1. Boxplots showing the effect tunicates and temperature on scope for growth of mussel socks. Solid lines within boxplots represent the median value for each treatment. Average values for individuals are overlaid on the boxplot.

CONCANNON, ABIGAIL

GROWTH AND SURVIVAL OF MIXED-SEX DIPLOID AND ALL-FEMALE DIPLOID AND TRIPLOID RAINBOW TROUT (*Oncorhynchus mykiss*) IN VARIABLE-TEMPERATURE SEAWATER

Abigail V. Concannon*, Tillmann J. Benfey, René M. Malenfant, William D. Robertson, and Amber F. Garber

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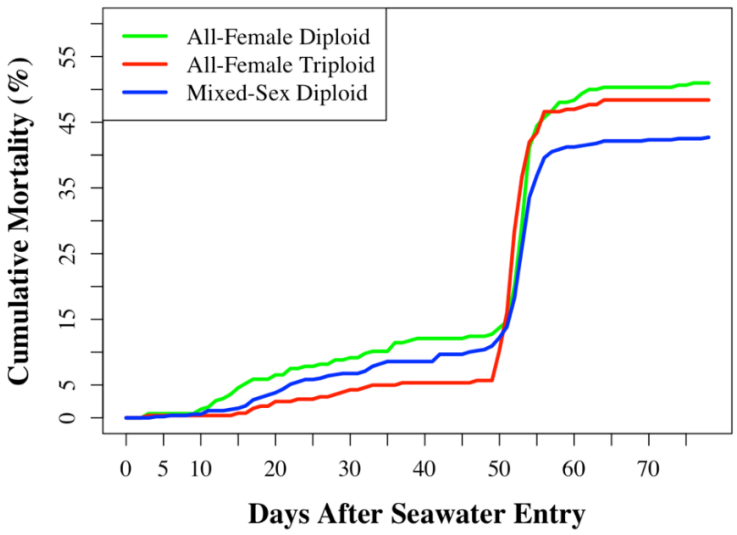
This study is examining the effects of family, sex ratio, and ploidy on tolerance of rainbow trout to full strength seawater at variable temperature. Triploidy, characterized by three complete chromosome sets, renders fish sterile and offers advantages in net-pen production, but triploids often have lower thermal tolerance than diploids. Conducted at the Huntsman Marine Science Centre (Saint Andrews, NB), this experiment used fish of the same age from 48 mixed-sex diploid families, 15 all-female diploid families, and 12 all-female triploid families, with each fish individually PIT-tagged for tracking purposes. After a two-month freshwater acclimation period, fish were transitioned to seawater at ambient temperature (13±1 °C). Temperature was then gradually increased to 21°C at 1°C per day, decreased and held at 18°C for 10 days, and finally decreased at 1°C per day back to ambient temperature (7±1°C). Growth was assessed at three time points: PIT-tagging, 30 days after seawater entry, and at mortality or the end of the experiment. The experimental findings revealed low levels of fish mortality after seawater entry. Mortality increased as temperature increased (see figure). Statistical analysis of growth rates and survival by ploidy and family with associated heritabilities will be discussed. This experiment seeks to evaluate the performance of sterile triploids under variable temperature conditions that may occur within marine net-pens, while also considering the potential to breed for improved performance based on family-level variations in response.



CONCANNON, ABIGAIL

OSMORESPIRATORY COMPROMISE IN TRIPLOID RAINBOW TROUT (*Oncorhynchus mykiss*)

Abigail V. Concannon*, Amber F. Garber, René M. Malenfant, William D. Robertson, and Tillmann J. Benfey

University of New Brunswick, P.O. Box 4400, Fredericton, New Brunswick E3B 5A3
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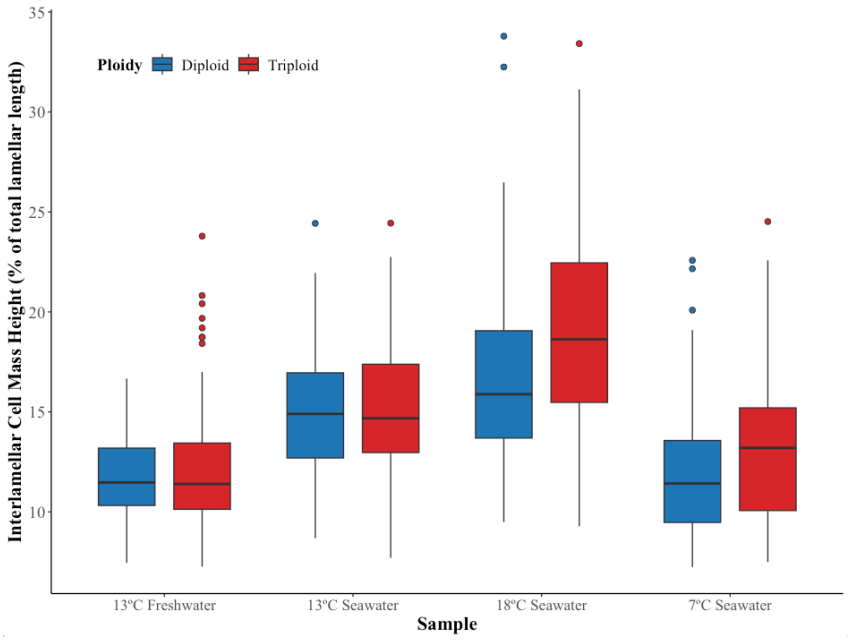
This study examines the effects of family and ploidy on salinity tolerance of all-female populations of rainbow trout for net-pen aquaculture in Atlantic Canada. Triploidy renders fish sterile and ensures that escaped fish cannot successfully breed in the wild, but triploids often have lower thermal tolerance than diploids. Conducted at the Huntsman Marine Science Centre (Saint Andrews, New Brunswick), this experiment used similarly aged sibling diploid and triploid females from the same eight families. After a two-month freshwater acclimation period at 13±1°C, fish were transitioned to seawater. Temperature was then gradually increased to 21°C at 1°C per day, decreased and maintained at 18°C for 10 days, and finally decreased at 1°C per day back to ambient temperature (7±1°C). Preliminary observations suggest that all fish experienced reduced osmoregulatory ability in seawater at high temperatures. Ploidy did not appear to affect total plasma osmolality or specific ion levels, but triploids appeared to reduce their functional gill surface area (i.e., larger interlamellar cell mass) more than diploids in high-temperature seawater, which could influence their aerobic capacity (see figure). Additionally, there was variation among families in osmoregulatory ability for both diploids and triploids, and corresponding heritability estimates will also be presented. This study provides valuable insight into the physiological responses of sterile triploids to temperature and salinity challenges that can be encountered in aquaculture.



COUTURIER, CYR

RAPID EVOLUTION IN ARTIFICIAL INTELLIGENCE AND PRECISION/SMART FARMING OF AQUATIC ORGANISMS

Cyr Couturier

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Food production sectors (e.g., dairy, crops) on land have been integrating AI for well over a decade. For ocean industries, AI, machine learning, and ocean farming (aquaculture) of aquatic organisms are advancing rapidly as well. With the advent of improved sensor and communication technology, some aquatic farmers are able to manage systems efficiently from egg to plate, in real time, to meet market demands. In the ocean space, AI combined with various environmental sensor inputs are increasingly being employed for improving farming efficiencies, animal or plant health, and growth, while affording farmer a decision support system on best practices. There is room for eDNA technology to contribute to the environmental mitigation and adaptation strategies for ocean farming and AI to assist with this, including restorative aquaculture. Finally, cyber security, data ownership / management are major concerns nowadays with this type of technology and the farming sector.

DÉSILETS-MAYER, FRANCIS

INNOVALGUE: EXTRACTING THE FULL VALUE FROM QUÉBEC'S CULTIVATED SEAWEEDS

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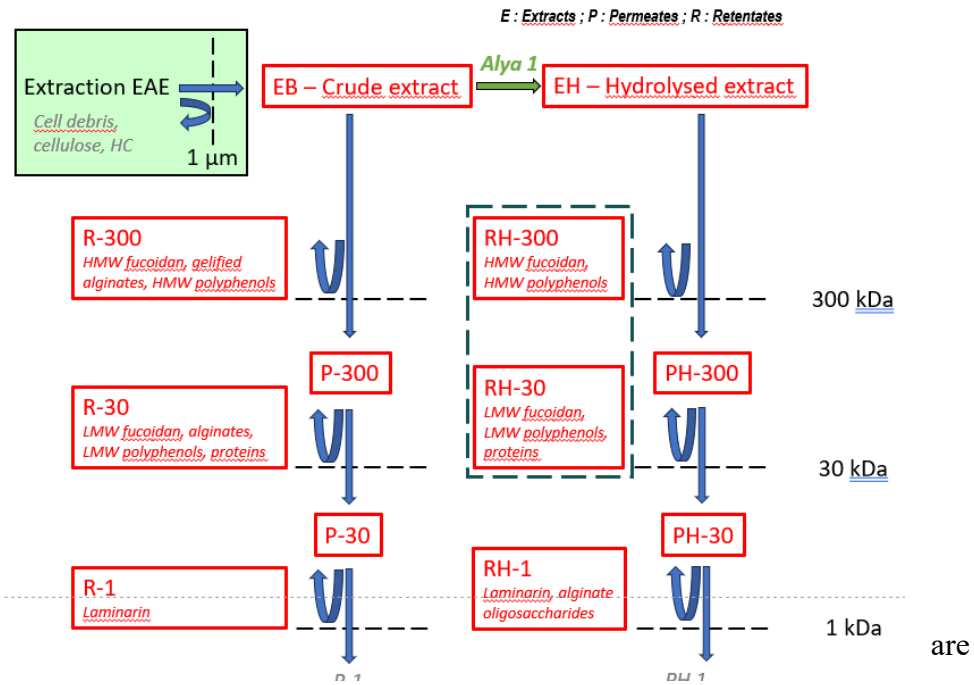
'*Wildemania amplissima* conchocelis

Despite a thriving seaweed farming industry, some Canadian-based cosmetic and food companies still import cultivated seaweeds from Asia and Europe, because these biomasses are well-characterized and reliable. Nevertheless, these clients would be eager to source seaweed from local farms that promote sustainable practices.

To allow this, our project gathered five R-D teams to fill the knowledge gaps on Québec's seaweeds. That included: Genetic identification of cultivated species; growth tests of new candidate species; extraction of valuable fractions using "green", solvent-free processes; development of analytical and screening platforms fitting with the unusual properties of seaweeds' macromolecules; and identification of samples with bioactivities of potential interest.



'*Membrane fractionation of brown seaweed extracts*

Amongst various results, we confirmed that Québec seaweeds are of the same species as found on international markets, so they comply with regulatory listings. In-lab cultivation of brown *Agarum clathratum* and red *Wildemania amplissima* species was successfully initiated. Step-by-step chemical fractionation generated different extracts and displayed excellent yields, while enzyme-assisted extraction of carbohydrates proved feasible, but with lower yields. Some extracts, despite being unrefined, showed antimicrobial bioactivites that could be exploited in ecofriendly disinfectants. Prebiotic potential of the saccharide extracts will be tested in 2025.

DUCHESNE, ELISA

COMPARING RESPONSES OF JUVENILE DIPLOID AND TRIPLOID BLUE MUSSELS *Mytilus edulis* TO HEATWAVES

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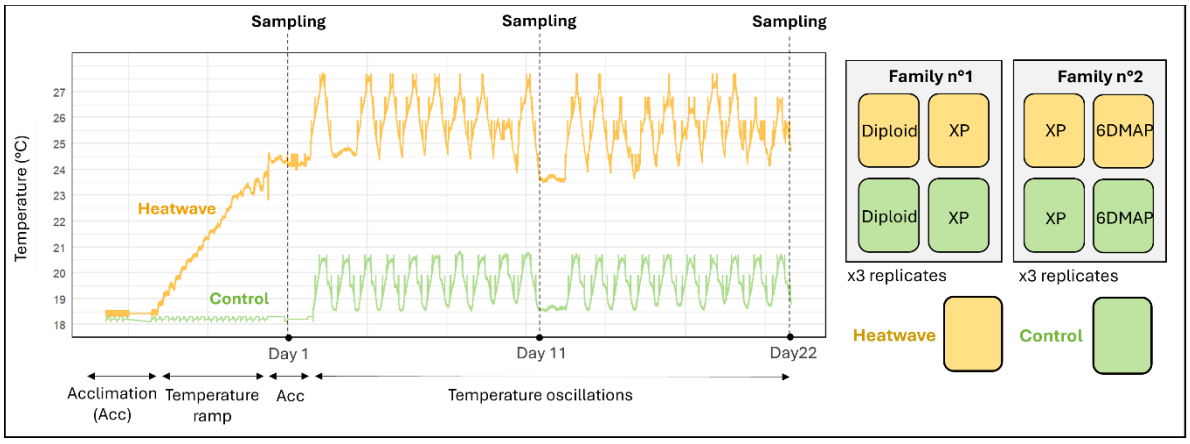
Triploidy induction is used in aquaculture to reduce fertility and redirect energy from gonadal development to somatic growth. However, the impact of triploidization on resistance to stressors in mussels remains unclear. Heatwaves can cause physiological and molecular stresses in bivalves, leading to mass mortality in extreme cases. As such events become more frequent and prolonged due to climate change, understanding the response of triploid mussels to heatwaves is crucial for shellfish mariculture. This study analyzes the metabolic and metabolomic responses of juvenile diploid and triploid *Mytilus edulis* families to heatwave conditions. It also compares the responses of triploids produced in different ways, using pressure shock or chemical treatment.

Two mussel families were produced: one containing triploids obtained by pressure treatment (XP) and its diploid control, and the other including triploids from both chemical (6DMAP) and pressure treatments. Mussels were exposed to heatwave and control scenarios for three weeks. Oxygen consumption rates were measured at three time points, and liquid chromatography-tandem mass spectrometry was used to analyze their metabolomic profiles.



No significant mortality was observed. Diploids and pressure-induced triploids showed comparable responses to heatwave exposure, with long-lasting heatwaves promoting increased ATP production via both aerobic (TCA cycle) and anaerobic (glycolysis) pathways.

DUGLAS, SATHEES

COMPARATIVE IMMUNE RESPONSE OF ATLANTIC SALMON PRIMARY MACROPHAGES AND ATLANTIC SALMON HEAD-KIDNEY CELL LINE TO *Vibrio anguillarum* SEROVARS O1 AND O2 INFECTION

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A cellular model for bacterial infection and immune response studies is essential to understund fish diseases. We compared the immune response of Atlantic salmon primary macrophages and head-kidney (ASK) cell line to *Vibrio anguillarum* O1 and O2 infection. Virulence prediction model indicated that O1 has higher virulence, correlating with its higher infection level (Figure 1).
Transpritomic showed that at 1 hour-post-infection (hpi) macrophages have a lower gene response than ASK to O1. In contrast, macrophages had a higher response than ASK to O2. At 2 hpi, ASK cells exhibited a higher gene response to both *V. anguillarum* serovars.Macrophages showed strong immune response to O1, including high expression of cytokines and TLR4 related genes at 1 hpi. In contrast, O2 at 1 hpi caused structural cellular modification and T-cell activation. At 2 hpi both serovars induced an acute infallamtory response. ASK cells had a higher response to O1 and a modest response to O2 (Figure 2).
The chemokine *cxcr3*, the resposne regualtor *nf-Kb*, and the permiablility factor *pf2* were upregualted in both cells and infection treatments. Overall, macrophages had a stronger innate immune response with dominant TLR signaling, while ASK cells showed broader pathway activation, emphasizing cellular signaling and adhesion.

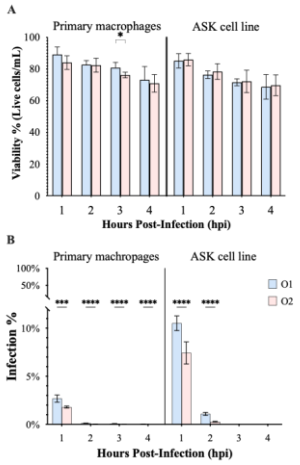

Figure 1. **Infection kinetics of *V. anguillarum* O1 and O2 in Atlantic salmon primary macrophages and Atlantic salmon headkidney (ASK) cell line. A.** Viability; **B.** Infection kinetics of *V. anguillarum*.

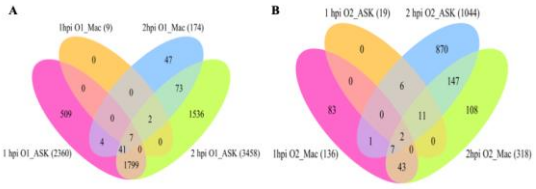

Figure 2. **Venn diagram DEGs. A.** *V. anguillarum* O1; **B.** *V. anguillarum* O2

ELLIOTT, GRACE

DRIVING SUSTAINABLE GROWTH: KEY FACTORS SHAPING BLUE MUSSEL AQUACULTURE IN THE NORTH ATLANTIC

Grace Elliott*, Ramon Filgueira, & Peter Tyedmers
Dalhousie University, School for Resource and Environmental Studies, Master of Environmental Studies
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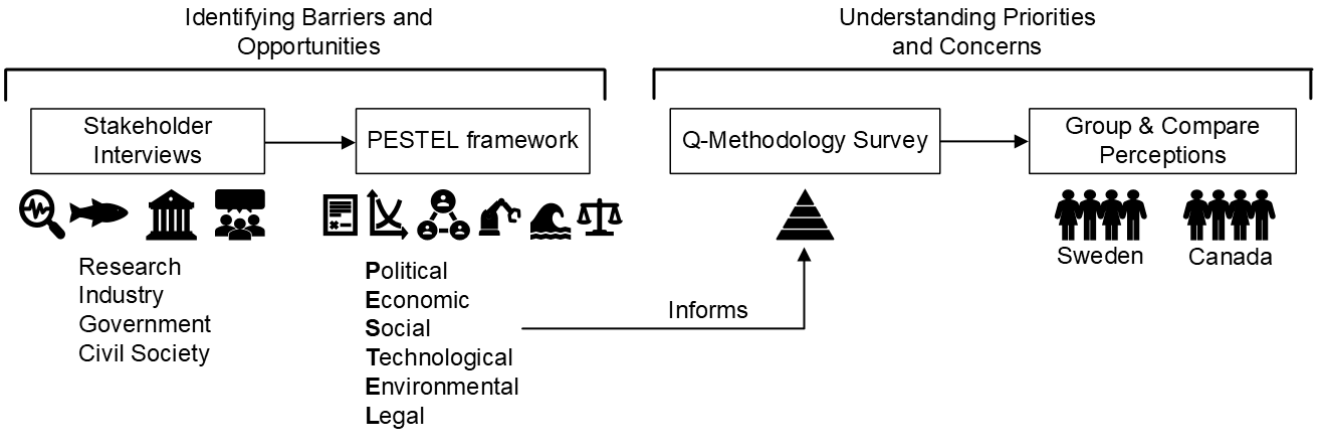
The global food system faces increasing pressure to adopt sustainable practices in response to climate change and population growth. Blue mussel aquaculture presents a promising solution, offering a nutrient-dense, low-impact protein source that supports food security, environmental remediation, and coastal economic development. Despite high biophysical suitability and strong sustainability credentials, expansion of the blue mussel industry remains limited. Economic risk, shifting environmental conditions, and complex socio-political dynamics contribute to widespread hesitancy. These challenges underscore the need for integrated site-selection resources that consider all dimensions of sustainable and equitable development. This study uses a mixed-methods approach to examine stakeholder perspectives across the North Atlantic, focusing on opportunities and barriers to industry growth. Consultations with key-player stakeholders, including representatives from government, industry, NGOs, and research, will capture a wide range of insights and concerns regarding aquaculture development. Comparative analysis will explore patterns across stakeholder groups and geographies. Findings will advance the current understanding of site suitability and inform strategic decision-making to cultivate responsible industry expansion. By addressing critical uncertainties and promoting inclusive planning, this research supports the development of a climate-resilient, forward-thinking aquaculture sector that could contribute meaningfully to sustainable food security and coastal community wellbeing.



FERREIRA, YANN MALINI

ONE SIZE DOESN'T FIT ALL: A STANZA-BASED GROWTH MODEL FOR THE SHRIMP SPECIES *Penaeus vannamei* USING A MACHINE LEARNING APPROACH

Yann Malini Ferreira*, Dan Tulpan and Dominique P. Bureau

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Conventional growth models may oversimplify the complex, episodic growth patterns seen in farmed shrimp [1]. This study evaluated the predictive performance of a stanza-based Thermal Growth Coefficient (TGC) model for *Penaeus vannamei*, compared to the conventional TGC model [2]. Growth curves compiled through a meta-analysis of 139-peer-reviewed studies was segmented into stanzas using two statistical methods (Change Point Detection, Piecewise regression) and two Machine Learning approaches (Gaussian Mixture Models, Hidden Markov Models).

$$W_f = ({W_0}^{1-b} + \frac{TGC\ x\ Temp\ x\ t}{1000})^{\frac{1}{1-b}}$$

TGC and weight exponent (b) were calculated for each stanza, with b estimated using five techniques: ordinary least squares, weighted least squares, nonlinear least squares, power-law regression and curve fitting. Model performance was evaluated using mean absolute error, mean square predictive error, and the weighted concordance correlation coefficient (CCC). Stanza-based models outperformed the conventional TGC, particularly those based on GMM and Piecewise methods. Curve-fitting and power-law regression produced more biologically realistic b value estimates. Ensemble learning approaches evaluated with mean, median, and weighted-CCC were also applied, with the median ensemble achieving the most robust predictions. These findings highlight the value of flexible, stanza-based, and species-specific growth modeling approaches. Incorporating biological processes into model design enhances both predictive accuracy and the realism of growth forecasts in aquaculture systems.

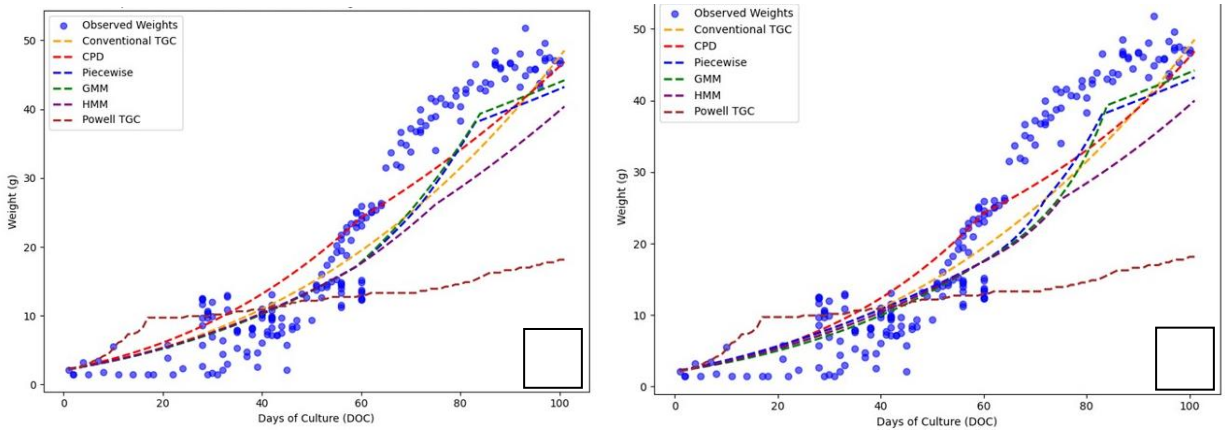

Figure 1: Comparison of stanza-based TGC models for shrimp growth using different methods to calculate the weight exponent (A) curve fitting and (B) power-law regression. Abbreviations: TGC – Thermal Growth Coefficient; CPD – Change Point Detection; GMM – Gaussian Mixed Models; HMM – Hidden Markov Models.

[1] Powell CD, Tansil F, France J, Bureau DP. Growth trajectory analysis of Pacific whiteleg shrimp (Litopenaeus vannamei): Comparison of the specific growth rate, the thermal-unit growth coefficient and its adaptations. Aquac Res. 2019; 00:1–10. https://doi.org/10.1111/are.14391

[2] Iwama, G.K., & Tautz, A.F. A simple growth model for salmonids in hatcheries. Canadian Journal of Fisheries and Aquatic Sciences. 1981; 38(6), 649–656. https://doi.org/10.1139/f81-088

FRABOULET, ERWANN

MARINE BYPRODUCTS VALORIZATION IN QUEBEC: DEVELOPMENT OF ACENTRAL PORTAL FOR INFORMATION

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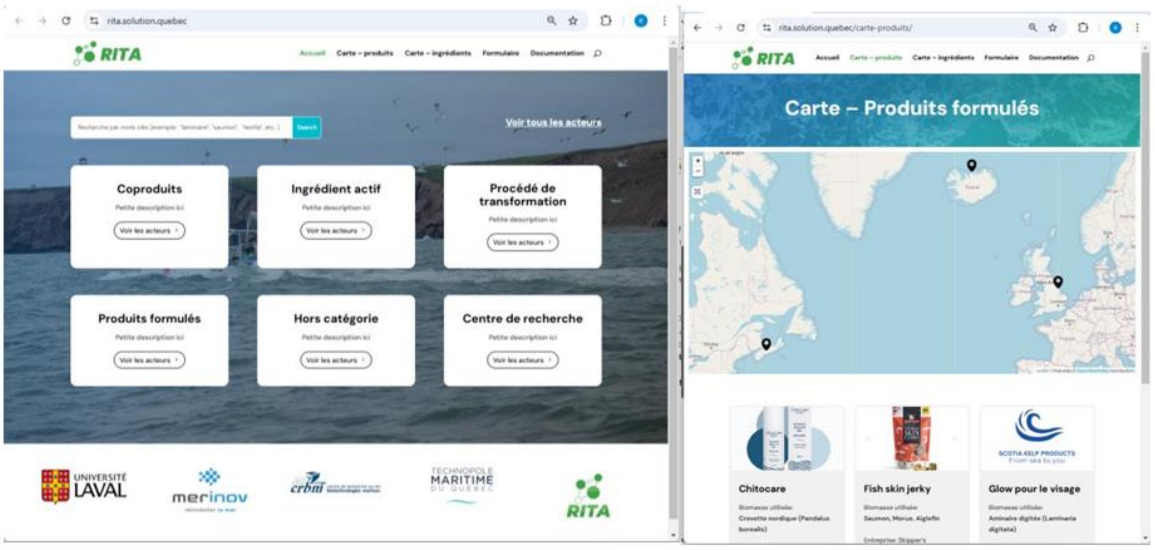
The quantity of byproducts generated by the marine product processing industry, whether fished or produced by aquaculture, is considerable. In Quebec, despite more than 30 years of research on potential ways to valorize marine co-products, initiatives that allow the commercialization of high value-added products from byproducts are limited. While the problem is multifactorial, producers or users of byproducts most often face a lack of centralization of knowledge and successful valorization pathways.

The project aims to provide industry stakeholders with up-to-date information in an accessible format and to structure a common approach to monitoring opportunities in marine biotechnologies. As part of a collaborative project supported by the RITA consortium, various actions have helped to design a web platform that aims to centralize information about the valorization of marine byproducts: consultations on the industry's needs and monitoring methods, reviews and analyses of gray literature, research reports and products made from byproducts, etc. The exercise was mainly conducted with information on large crustaceans and groundfish but is intended to be adaptable to all fisheries and aquaculture resources. With examples from North America and Europe, the platform will be enriched with links to other initiatives and benefit stakeholders across various sectors.



Views of the byproducts web portal during its developments

GAGNÉ, EVIE

INSPIRING THE FUTURE: ENGAGING THE PUBLIC, POLICY MAKERS AND THE NEXT GENERATION IN SALMON SCIENCE AND AQUACULTURE

Evie Gagné

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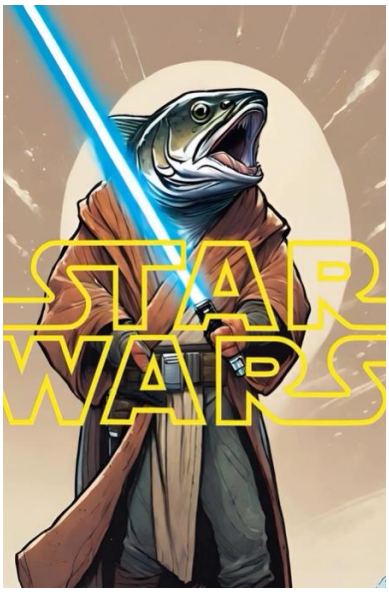
Find out how The Atlantic Canada Fish Farmers Association (ACFFA) is inspiring the next generation of salmon scientists and aquaculture professionals through hands-on learning experiences and strategic outreach.

Effective outreach is essential to building public understanding and trust - key components of social license for ocean farms to operate. By making aquaculture science accessible and relatable, ACFFA helps create informed communities that support responsible ocean farming. Community outreach also serves as a catalyst for innovation by encouraging fresh perspectives, interdisciplinary collaboration, and early interest in aquaculture research and development.

By connecting youth and communities with the science behind ocean farming, we highlight its essential role in building sustainable food systems and help advance the future of aquaculture through education, meaningful engagement, and evidence-based dialogue.



HADI HOSSEINI, S

IMPACT OF DIETARY SHRIMP AND MACROALGAE EXTRACTS ON LIPID PROFILE AND GENE EXPRESSION IN LUMPFISH (*Cyclopterus Lumpus*)

S. Hadi Hosseini[1*], M. Emam[1], S. Ahmadkelayeh[2], K. Hawboldt[2], D. Dave[3], M.L. Rise[1], C.C. Parrish[1]

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[2]Department of Engineering and Applied Science Memorial University, St. John's, NL
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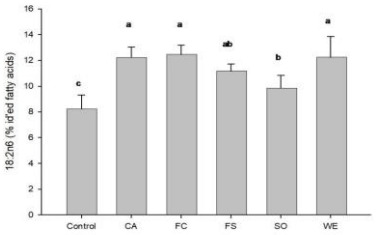
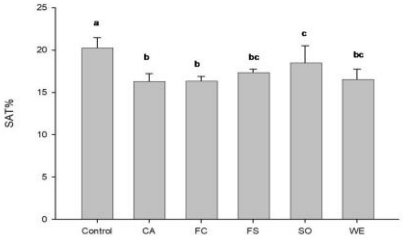
Use of lumpfish (*Cyclopterus lumpus*) as a cleaner fish In salmon farms expanded greatly in recent years. Our study explored how diets enriched with salmon waste oil (SO), canola oil (CO), fucoidan combined with canola oil (FC), fucoidan combined with salmon oil (FS) and shrimp processing by-product extract (WE) influence lumpfish lipid profile and expression of immuno-related genes.

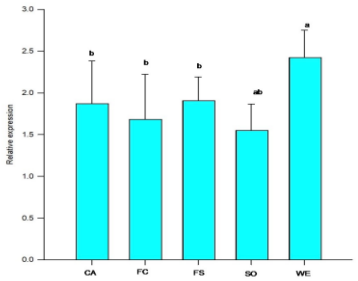


Linoleic acid (18:2ω6) in the liver was significantly higher in the **CA**, **WE,** and **FC** groups than initially.

Fish were fed five experimental aquafeeds varying in fatty acid profile and lipid composition in triplicate tanks (20 fish per tank) for 21 days. After termination of the feeding trial and collection of samples, there was a significant increase in hepatic and muscle lipid levels as well as in omega-6 fatty acids. Total lipid in the liver was significantly higher in the WE and FC groups than initially. Preliminary head kidney gene expression analysis revealed significant changes in immune and lipid-related genes (e.g., *irf2, irf4a, nlrc, ppargc1, foxc1a, socs5b, ch25ha*) particularly in WE and FC fed fish injected with PBS. This will be compared with immunostimulated fish. Our study is the first to show lumpfish responses to dietary fucoidan extracted from macroalgae and shrimp processing by-products extract, including molecular mechanisms for potential immunity and dietary optimization targets in this species.



Saturated fatty acids (SAT) proportions in the liver decreased over the trial.



irf2 expression (RQ) in the head kidneys significantly increased with **WE** after phosphate-buffered saline (PBS) treatment.

HORRICKS, RYAN

IMPACT OF FINFISH FARMS IN EASTERN CANADA (NOVA SCOTIA) ON AMERICAN LOBSTER (*Homarus americanus*) AND ROCK CRAB (*Cancer irroratus*) MOVEMENTS

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There are concerns about the potential effect of finfish aquaculture sites on lobster distribution patterns and changes in food sources that may impact their condition, biology, and catchability. This study assessed the abundance and movement of American lobsters (*Homarus americanus*) and rock crabs (*Cancer irroratus*) near two salmonid aquaculture leases in Liverpool Bay and Port Mouton, Nova Scotia using direct observation and acoustic telemetry. The study was done over a full 3-year Atlantic salmon (*Salmo salar*) production cycle in Liverpool Bay and 4 years after Rainbow trout (*Oncorhynchus mykiss*) production in Port Mouton. 50 lobsters and 50 crabs were tagged with acoustic transmitters and released within an acoustic array each year of the study. Lobster and crab movement varied spatially across years. Lobsters travelled throughout Liverpool Bay and showed little affinity to the farm (Fig. 1). Rock crabs seem to be associated with the farm in Liverpool Bay, even in the fallow year. Lobsters had a significantly higher walking speed in the study area than crabs while crabs stayed longer and travelled a greater total distance.

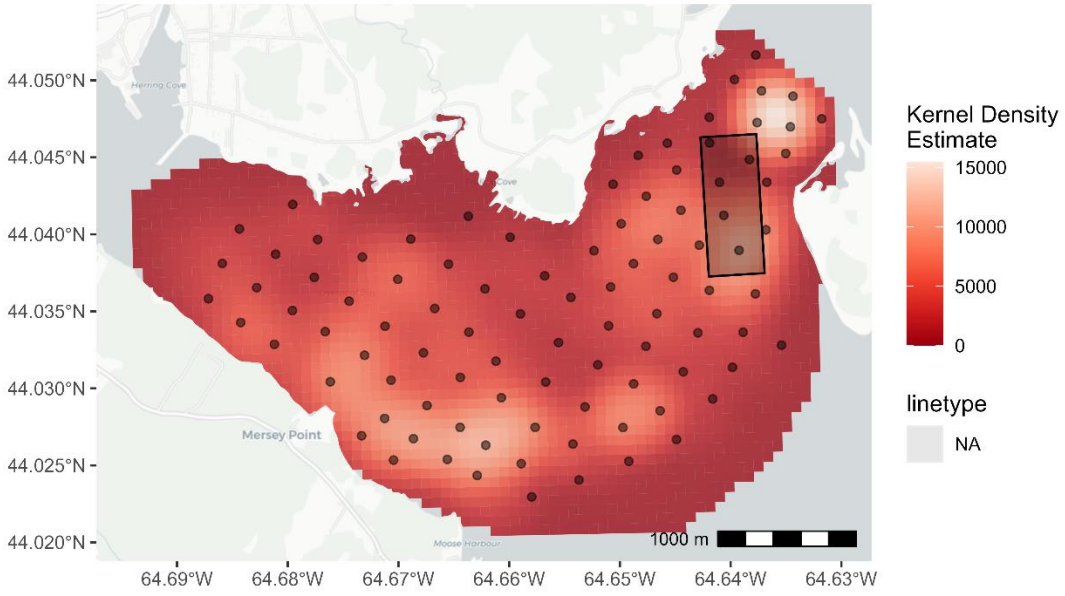

Figure 1: Estimated lobster density distribution within the acoustic array in 2020 , Production Year I.

HUYBEN, DAVID

IMPACT OF DIETARY HUMIC ACID ON RAINBOW TROUT PERFORMANCE AND GUT HEALTH

Marcia Chiasson, Anne Easton, Heindrich Snyman and David Huyben*

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This study evaluated the effects of dietary humic acid (HA) on growth performance, gut pH, intestinal morphology, and the gut microbiome of rainbow trout (Oncorhynchus mykiss). At ~20 g, trout in triplicate tanks were fed one of four diets: a control (Skretting, top-coated with water) and three treatments (Skretting, top-coated with HA at 5, 10, and 15 mL/kg). Fish were fed for 140 days, with biomass recorded biweekly and individual body weight and length measured at trial initiation and completion. Fish fed HA outperformed controls in both weight and length. Stomach pH (2.79) differed significantly from proximal and distal intestine pH (7.53, $p<0.001$), but treatment had no effect on gut pH. Histological analysis revealed enhanced distal intestinal villus length at 5 mL/kg ($p<0.001$), while villus width varied by region ($p<0.001$). Microbiome analysis showed that HA at 15 mL/kg significantly increased Lactobacillus and Clostridium abundance ($p<0.05$) and overall diversity ($p=0.035$). HA at 5 mL/kg improved growth and intestinal morphology, while higher doses modulated the microbiome, suggesting a dose-dependent impact on trout performance and gut health. These gut health improvements could enhance growth, disease resistance, and feed efficiency in aquaculture.

IGNATZ, ERIC

COMPARATIVE FIELD TRIAL ASSESSMENTS OF OYSTER (*Crassostrea virginica*) SURVIVAL IN MSX-INFECTED AREAS

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The eastern oyster (*Crassostrea virginica*) is an iconic species native to Atlantic Canada that is vital for the economic stability of coastal communities and benefits local ecosystems through nutrient remediation. However, the detection of *Haplosporidium nelsoni*, the deadly parasite that causes Multinucleate Sphere Unknown X (MSX) disease, in all Maritime provinces poses a major threat to the oyster industry. A reciprocal transplant of oysters in Cape Breton, as well as involvement in a series of field trials across Prince Edward Island, will help assess summer growth and mortality in oysters exposed to *H. nelsoni*. At each site, a comparison of bottom versus surface cage culture techniques will be used to inform farm management practices. Environmental data (e.g., water temperature, oxygen, salinity, turbidity, etc.) will also provide insight into disease pathogenesis. Gill tissue collected from all deployed oysters will be used to conduct a genome-wide association study (GWAS) to try and identify genetic markers of disease resistance/tolerance. This information will be critical for the ongoing development of oyster breeding programs in the region. Altogether, the results from these field trials are expected to provide practical knowledge to oyster farmers and fishers that can aid in mitigating the impacts of MSX.

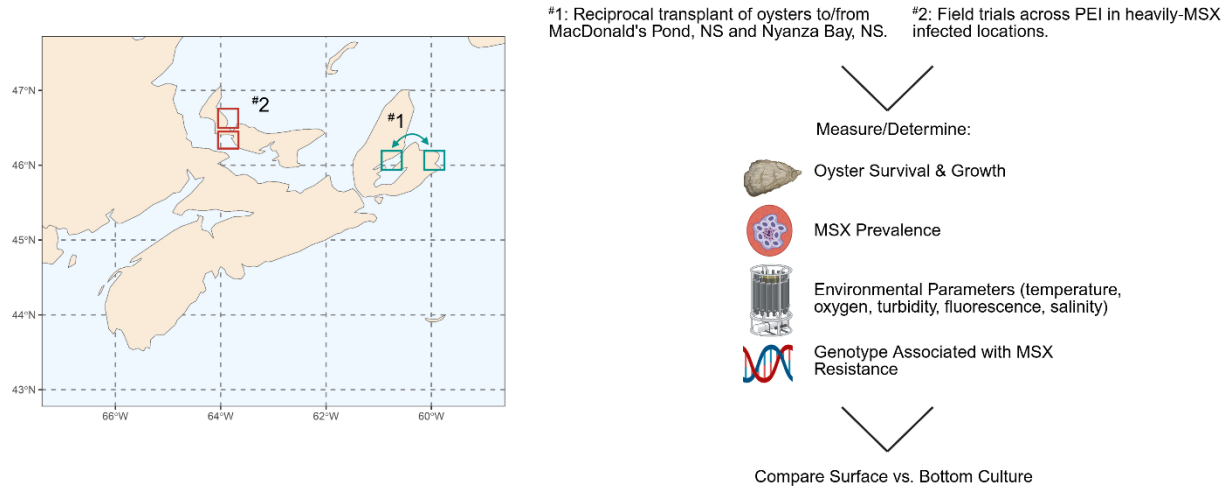

Figure 1. Overview of the experimental design used to assess the growth and survival of oysters exposed to MSX in Nova Scotia and Prince Edward Island. Created using BioRender.com.

IGNATZ, ERIC

MUSSEL (*Mytilus* spp.) POPULATION GENETICS ACROSS THE NORTH ATLANTIC

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An incomplete mussel (*Mytilus* complex) distribution map, particularly in eastern Canada, makes it difficult to discern between phenotypically and genetically similar species. To address this, mussel DNA samples from across Québec, New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland in eastern Canada, as well as Norway, the Netherlands and Spain in Europe, were genotyped using a panel of 69 single nucleotide polymorphisms (SNPs) that originated from recent research on the population structures of *Mytilus* spp. in other parts of the world. These findings helped delineate *M. edulis*, *M. trossulus, M. galloprovincialis* and hybrid zones across the North Atlantic, which is valuable in understanding population dynamics within current and potential future aquaculture sites. Additionally, HiFi-sequenced samples from Prince Edward Island, Nova Scotia and the Netherlands were consecutively mapped to the phased genome to recursively assemble a *M. edulis* pangenome. Subsequently, the HiFi samples were re-mapped to the pangenome to assess individual gene presence-absence variation (PAV). A high degree of PAV was identified across samples, with core and dispensable genes assessed by gene ontology to infer putative function. Ultimately, this work will help inform breeding strategies as PEI develops the first *M. edulis* breeding program in Canada.

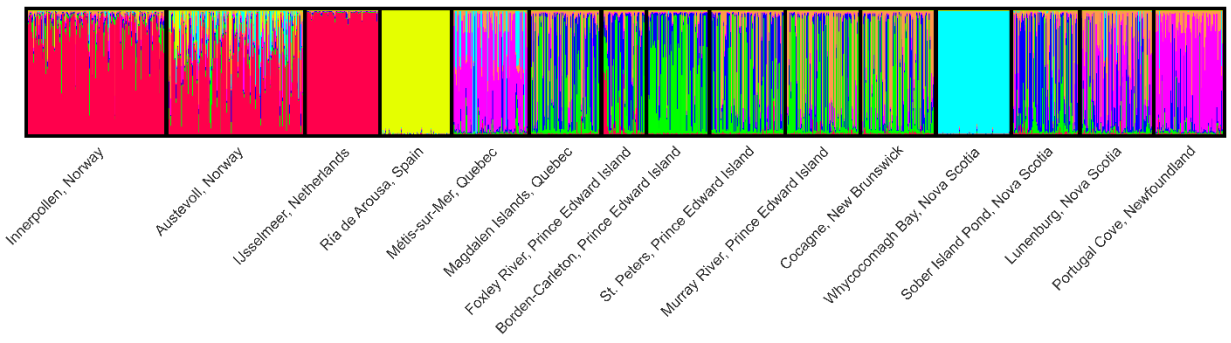

Figure 1. Genetic admixture of 1531 mussel samples collected from 15 locations across the North Atlantic screened using a panel of 69 SNPs (k=7).

JANSSEN, GERARD

SEDATION IMPROVES FISH WELFARE

Dr Gerard Janssen

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Consideration of animal welfare is a fundamental and growing requirement in the aquaculture industry. Many unavoidable handling activities in aquaculture can cause extensive stress to aquatic animals, including disease treatment, transport, handling, broodstock stripping, grading, and slaughter. Sedation during handling events improves fish welfare by reducing physiological stress and physical injury, resulting in less fatigue and damage to the animals and fewer mortalities. Sedation also allows more flexibility and control during aquaculture operations. The level of sedation can be adjusted to meet the fish handling requirements. This can range from light sedation, where fish retain their swimming coordination but lose any startle reflex (often used in crowding or disease treatment), to deep anaesthesia, where fish movement and ventilation rates are heavily depressed (for surgical or euthanasia purposes). Sedation is not limited to aquaculture operations; it is also a helpful tool for any fish handling activity from environmental monitoring, academic research, or aquarium practices. This presentation will cover the fundamentals of fish sedation in aquaculture and present data demonstrating improved fish welfare.

The public and industry alike are increasingly concerned about the welfare of farmed fish. There are both practical and moral reasons for taking fish welfare seriously. Good production and good flesh quality often follow good welfare and are all integral to the success of the farm. Most importantly, optimizing fish welfare is the ethical thing to do for the fish in our care. It is essential that staff managing farmed fish are aware of the importance of welfare as an integral part of production.

Introductory paragraph from the 2021 Canadian National Farm Animal Care Council 'Code of Practice. For The Care And Handling Of Farmed Salmonids'. The word 'welfare' appears 174 times in the 82 page document.

JIA, BEIBEI

CRITICAL APPRAISAL OF EVIDENCE: A SCOPING REVIEW OF LINKING SALMON AQUACULTURE ON WILD POPULATIONS OF SALMONIDS IN BRITISH COLUMBIA, CANADA

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One of the major limiting factors of salmon aquaculture in British Columbia (BC) is ongoing opposition rooted in advocacy narratives. Such narratives often employ decontextualized causality framing with questions like 'What is the potential impact of farmed salmon on wild Pacific salmonids?', which presupposes threat while neglecting critical ecological, temporal, and methodological context. A scoping review was conducted for peer-reviewed journal articles (1980 – 2025) to evaluate the validity of claims attributing wild salmonids decline to aquaculture in BC. The review focused on identifying biases in linking wild salmonid declines to three aquaculture-related stressors: sea lice dynamics, infectious agents, and escaped farmed salmon. A framework was applied integrating biological plausibility, experimental design rigor, and ecological context. Key findings include (1) Advocacy questions prime audiences to mis-perceive and accept aquaculture as a primary driver of wild salmon declines, completely against the consensus that climate change and predation are top threats at present and over the next decade. (2) Recurring methodological gaps are misattribution of causation, citation bias and selective usage of evidence, failure to distinguish causation from association and correlation. (3) Some studies overgeneralized the localized and time-wise ecological interactions while neglecting confounding variables such as habitat destruction and historical overfishing.

JYOTI, SUMIT

COMPARISON OF LETHAL AND NONLETHAL SAMPLING METHODS FOR ASSESSING SEA LICE INFESTATION IN WILD SALMON POPULATIONS ON THE PACIFIC COAST OF CANADA

Sumit Jyoti[1*], Krishna K. Thakur[1]

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Monitoring sea lice in wild salmon populations provides important insights into infestation levels and associated risks, particularly in juvenile migrating salmon. On the Pacific coast of Canada, multiple research groups are involved in sea lice monitoring using different sampling protocols. In this study, we compared sea lice prevalence and counts across these groups by categorizing them into two methodological approaches: lethal laboratory-based and nonlethal field-based sampling protocols. To ensure comparability, we selected a geographic region common to all groups and divided the study period into three intervals: 2003 to 2009, 2010 to 2012, and 2016 to 2023, based on differences in sampling activity among groups. We applied mixed effects logistic regression and mixed effects negative binomial regression models to examine the prevalence and counts of motile and nonmotile sea lice stages. The results consistently showed higher odds and counts of both motile and nonmotile stages when using the nonlethal field-based protocols, compared to the lethal laboratory-based protocols, across twelve models. These findings suggest that nonlethal field sampling may overestimate sea lice burdens, highlighting the need to refine these methods to enhance the accuracy and reliability of sea lice monitoring in wild salmon populations.

KHIARI, ZIED

UP-CYCLING FARMED SALMON BY-PRODUCTS INTO PH SENSITIVE FILMS AS INDICATORS FOR FRESHNESS OF SEAFOOD PRODUCTS

Zied Khiari*, Graham MacDonald

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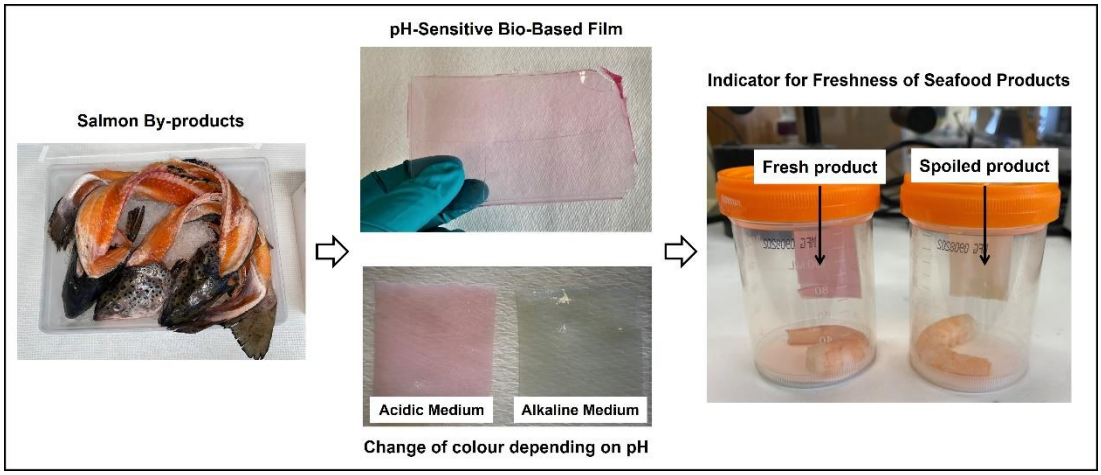
The "Aquaculture and Fisheries Waste-Stream Valorization" research program at NRC focuses on developing innovative solutions for the transformation of waste-streams into value-added products, and addressing the environmental and economic sustainability needs of the aquaculture and fisheries industries. This presentation will showcase a research project that has been jointly developed by NRC and Verschuren Centre in Nova Scotia. The project is aimed at developing pH sensitive biodegradable films, using gelatin extracted from farmed salmon by-products (heads and racks), which can visually monitor the freshness of seafood products. The pH sensitivity is obtained through natural plant pigments (anthocyanins) that can be sourced from fruit and berry processing by-products and act as color indicators. Unlike chemical dyes, which are widely used in the food industry but can pose severe toxicity and environmental risks, these natural pigments offer a safer and eco-friendly alternative. Likewise, the use of gelatin extracted from farmed salmon by-products may offer benefit such as reduction of the environmental pollution. In addition, it is is widely accepted across different cultures and does not pose dietary restrictions compared to traditional sources of gelatin conventionally extracted from cattle and swine by-products. The project could, therefore, provide a sustainable solution for upcycling aquaculture by-products into value-added products that ensure food safety and quality.



KORUS, JENNIE

OPERATIONAL TOOLS FOR SALMON AQUACULTURE: ENVIRONMENTAL MONITORING, MANAGEMENT AND MITIGATION

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Environmental factors impact fish stress and welfare in salmon aquaculture. Sub-optimal conditions can intensify health issues and simultaneously increase fish stress. Continuous environmental and water quality monitoring allows farmers to gain an in-depth understanding of their site at the pen level and enables them to determine critical risk periods for their fish. Novel, industry-specific tools, such as pen-level oxygen forecasting, have been developed to allow farmers to make proactive decisions instead of just reactionary ones. Additionally, it enables them to optimize feeding schedules and mitigate the risks associated with low oxygen events. Further, the data from these tools can interface with automated mitigation systems, like aeration and oxygenation systems, to improve oxygen, break up stratification, and turn on and off individual diffusers as necessary to improve pen conditions. This talk will explore the effectiveness of these proactive strategies and highlight where farms can further enhance and optimize their operations.

KPORDZAXOR, YOHANNES

THE DYNAMICS OF MICROBIAL DIVERSITY IN INTEGRATED MULTI-TROPHIC AQUACULTURE (IMTA) OF *Paracentrotus lividus, Mugil cephalus,* AND *Ulva fasciata* FOR SUSTAINABLE MARICULTURE

Yohannes Kpordzaxor*, Dzung Nguyen, Lisa-Marie Streb, Schloter Michae, Anat Ben Zvi & Lior Guttman

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Understanding microbial community dynamics is essential for advancing sustainable aquaculture practices. This study investigated the structure and functional roles of microbiomes within an Integrated Multi-Trophic Aquaculture (IMTA) system comprising *Paracentrotus lividus* (sea urchin), *Mugil cephalus* (fish), and *Ulva fasciata* (macroalgae) over 12 weeks. Host-associated (gut and thallus) and in-situ water samples were analyzed using 16S rRNA amplicon sequencing and multivariate ecological assessments.

Microbial communities exhibited strong compartmentalization, primarily driven by host identity and water quality. Alpha diversity was highest in water samples, whereas host-associated microbiomes were taxonomically distinct and functionally specialized. Beta diversity analyses confirmed significant separation between host and environmental microbiomes, with *Ulva* thalli hosting the greatest number of unique taxa, particularly those associated with biofilm formation and nitrogen cycling. Redundancy analysis revealed that fish gut microbiomes were shaped by total suspended solids (TSS) and biological oxygen demand (BOD), while ammonia and phosphorus levels significantly influenced *Ulva*-associated communities. Notably, opportunistic pathogens such as *Vibrio* were significantly less abundant in *Ulva* habitats, highlighting *Ulva*'s potential role in biofiltration and pathogen suppression. Additionally, predatory bacteria such as *Halobacteriovorax* and *Peredibacter* were detected within the *Ulva* thallus microbiome, a new finding in this context.

The study demonstrates that environmental gradients and host physiology jointly shape microbial assemblages in IMTA systems. These findings emphasize the ecological importance of microbiomes in nutrient transformation, host health maintenance, and natural biocontrol, providing insights for the development of more sustainable and resilient aquaculture systems.

LE SOURD, FREDERIC

THE USE OF DNA BARCODING FOR MARINE AND AQUACULTURE PRODUCTS AUTHENTICATION: MACROALGAE AND FISH AS TWO CASE STUDIES IN QUEBEC

Frederic Le Sourd*, Ph. D., Marie-Ève Gauthier, M. Sc., Thi Thanh My Pham, Ph. D., Nadia Besbes, Ph. D. and Josée Bouchard, Ph. D.

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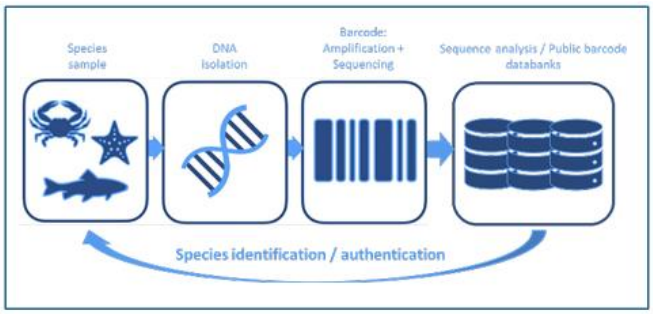

DNA barcoding provides a rapid and reliable tool for detection and identification of species. Beyond its interest in sciences (phylogenetics, environment, ecology), it stands an asset on wild resources and aquaculture and other markets, by certifying the authenticity of commercialized products and/or that of ingredients.

The Marine Biotechnologies Research Center has recently been involved on two projects with the mandate of implementing the DNA barcoding methodology respectively applied to (i) macroalgae of market value in Quebec (Innovalgue Project), and (ii) marine products sold on the Quebec and Tunisian markets (call for projects Quebec – Republic of Tunisia 2023 2024). For macroalgae, specimens from the red and brown families were accurately identified to species level. Applying the method to multi-species samples (metabarcoding) has also produced promising results. However, further optimization is still required, the main challenge being the choice of a short, NGS-compatible barcode that works equally well for red and brown algae. Among a selection of fish products that were analysed, our results highlighted an incorrect or imprecise label for up to 40% of commercial products. This illustrates how a standardized and formalized method could provide better protection for the seafood market and its consumers.

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Pêches et Océans Canada
Fisheries and Oceans Canada

LEADBEATER, STEVEN

A STUDY EXPLORING THE POTENTIAL FOR PROBIOTICS TO SUPPORT THE HEALTH OF ATLANTIC SALMON IN AQUACULTURE.

Steven Leadbeater*, Christine Liu, Andrew Swanson

Fisheries and Oceans Canada, Saint Andrews Biological Station, 125 Marine Science Dr., Saint Andrews NB, E5B 0E4. Steven.Leadbeater@dfo-mpo.gc.ca

Probiotics can be employed to improve salmonid health and could help to decrease overall usage of antibiotics in aquaculture. Vaccinated Atlantic salmon smolt were fed a standard salmonid diet top coated with *Lactobacillus rhamnosus* GG (LGG) at a rate of 10^{10} CFU on 300 g feed once weekly for 30 weeks. Changes in growth, skin mucus, and faecal microbiomes were examined. An exposure trial using *Aeromonas salmonicida* via cohabitation model followed. Results showed no significant change in weight or length of Atlantic salmon or their resilience to infection after LGG feeding, however, presence of LGG from faecal swabs following infection suggests attachment to salmon intestine even at low dietary inclusions levels. Skin mucus and faecal microbiomes of infected fish changed significantly: *Clostridium sp.* increased from 3.14% to 9.20% in skin mucus and 1.39% to 3.74% in faeces. *Aeromonas* increased from 0.02% to 0.60% in faeces. *Photobacterium* increased from not detected (0%) to 52.16% and *Aliivibrio* decreased from 67.21% to 0.71% in faeces. After infection, *Lactococcus* (9.93%) and *Lactobacillus* (2.11%) in skin mucus of the LGG group were significantly higher than in the skin mucus from the rest of the groups (4.14% and 1.08%, respectively).

LIU, ANGELA

EVALUATING THE DIETARY INCLUSION OF A THYMOL-BASED BLEND TO MODULATE RESISTANCE AND SURVIVAL AGAINST *Yersinia ruckeri* IN RAINBOW TROUT

Angela Liu*, Jordan Poley, Fabrizio Caruso, Geronimo Leonardi, Ester Grilli

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Yersinia ruckeri, the causative agent of enteric redmouth disease (ERM), is a common pathogen that causes substantial economic losses in salmonid aquaculture. This study evaluated the efficacy a thymol-based blend – Prototype TCS – in reducing mortality on juvenile rainbow trout in following immersion challenge with *Yersinia ruckeri*. Two practical diets were manufactured to contain 2000 ppm of Prototype TCS and no additive (Control) and fed to 320 trouts divided in 16 tanks (*n*=8). After four weeks of feeding, the fish were challenged with *Y. ruckeri*. Fish fed diets containing Prototype TCS effectively reduced post-challenge mortality by 15.6% and hazard ratio by 29.3% (P<0.05 -Figure 1). Additionally, fish fed Prototype TCS had a significantly lower prevalence (P<0.05) of pathological signs in survivors, supporting enhanced disease robustness. Our results demonstrated that including Prototype TCS in rainbow trout diets significantly increased resistance against ERM. This additive could therefore serve as promising alternatives to reduce antibiotic reliance and support more sustainable aquaculture practices.

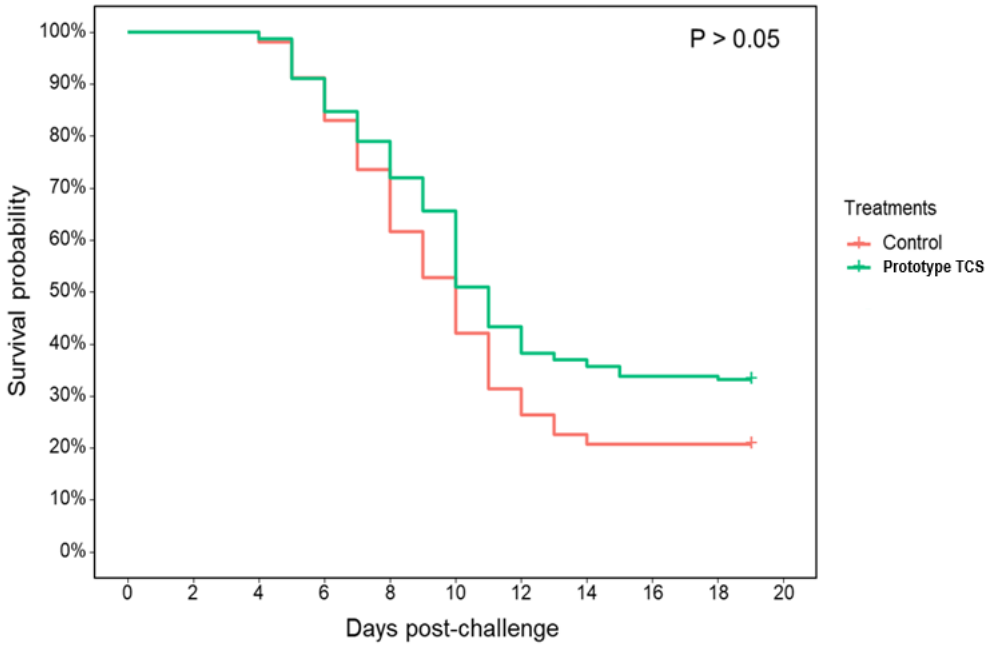

Figure 1. Survival curves of rainbow trout challenged with *Y. ruckeri* fed diets containing botanical-based blend.

LUCATELLI, DEBORA

STORM EXPECTATIONS AND AQUACULTURE UNDER A CHANGING CLIMATE IN ATLANTIC CANADA

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Severe storms have always been a concern for aquaculture, resulting in structural damage and loss of product, such as with Fiona in 2022. Storm trends are hard to predict due to long cycles and various influences in Intensity, Duration and Frequency (IDF). Such as, multi-year or decade atmospheric phenomena like the Atlantic Multidecadal Oscillation and El-Nino Southern Oscillation. Climate change has been an increasing industry concern, especially seawater warming which can augment conditions for storm genesis. In the wider North Atlantic, the number of severe storms is increasing as well as their strength, due to warming ocean temperatures in the tropical zone (where they develop). Storm tracks are also expanding their path further North, reaching some areas with higher intensity. However, a shift in average storm tracks might provide some relief to Atlantic Canada by the 2nd half of the century. This presentation reviews storm status and trends with a focus on Nova Scotia, future projections, and potential outcomes for aquaculture.

MAITLAND, DANIELLE

COMMERCIAL FEED TRIAL OF AQUAPONICS FISH FEED FOR KOI AND CANNABIS

Danielle Maitland*, Emma Hornby, Stefanie Colombo.

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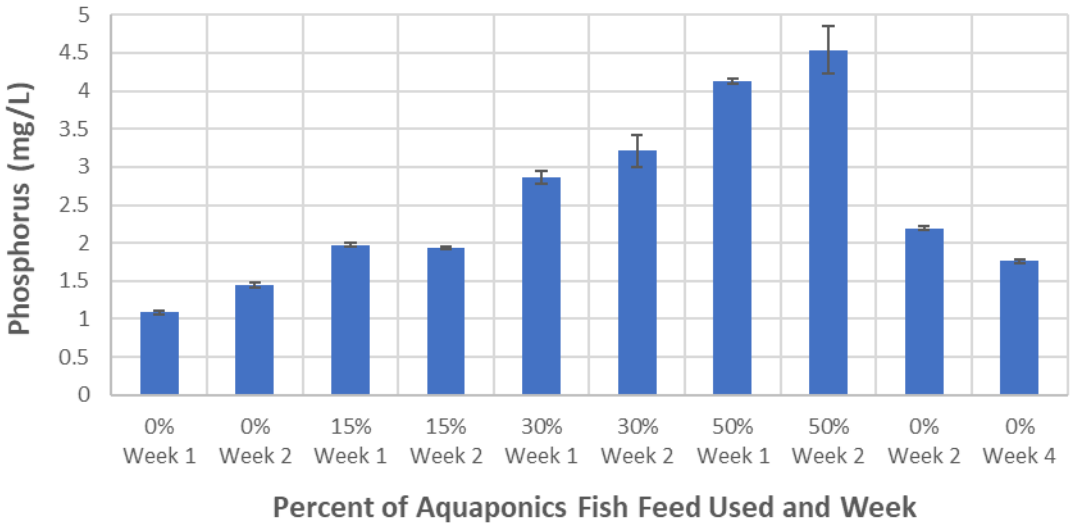
As an emerging, sustainable food production method, a primary hurdle to the optimization and commercial-scale success of aquaponics is the difficulty encountered trying to balance the quality and concentration of natural fertilizers produced by the fish with the plants' macro- and micro-nutrient needs. One contributing factor to these deficiencies is that currently available aquaculture feeds have been designed over several decades to limit the nutrients released by farmed fish to decrease the environmental impact of traditional fish farming. This is especially true for the phosphorus content of fish feed.

We designed an aquaponics-specific koi diet with the goal of creating a nutrient solution targeted at the flowering crop phase of cannabis. In a 60,000L commercial, decoupled aquaponics system, we trialed this feed as an increasing portion of the koi's diet, starting at 0% inclusion for 2 weeks, and increasing to 15% for 2 weeks, then 30% then 50%, before returning to 0%. We compared nutrient generation, fish behaviour/feed palatability, and cannabis yield.

Increasing levels of the "aquaponic" diet corresponded to increasing levels of dissolved phosphorus in the system water, improved koi feeding behaviour, and a >10% increase in commercial cannabis yield.



MANNING, ANTHONY

BACTERIAL KIDNEY DISEASE IN NEW BRUNSWICK: EVIDENCE FOR INCREASED VIRULENCE.

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Over the past five years, *Renibacterium salmoninarum* (*Rsal*) infections have been of increasing concern on New Brunswick salmon farms. A 2016 publication reported that copy number variation (CNV) can occur for two virulence genes identified for *Rsal*: major soluble antigen (*msa* gene) and the p22 protein (*p22* gene). A study was developed to examine CNV in these genes for 2021 *Rsal* isolates followed by *in vivo* virulence testing at DFO-SABS, St Andrew's, NB.

Isolates were collected by project partners and comparisons were made featuring some archived isolates, including a standard isolate used for *in vivo* challenges. Real-time PCR was used to assess CNV in gene targets using the $\Delta\Delta C_T$ method with the reference gene *lepA,* and a control wild-type ATCC isolate having two *msa* gene copies and one *p22* gene copy. Results suggested some 2021 isolates have three copies of *msa* genes and two or more copies of the *p22* gene. *In vivo* virulence trials were performed and increased mortality was seen for five 2021 isolates compared to the standard challenge isolate, which had demonstrated wild-type status by CNV testing (Figure 1). We propose that results for 2021 isolates forewarned of the increasing disease severity currently observed in the field.

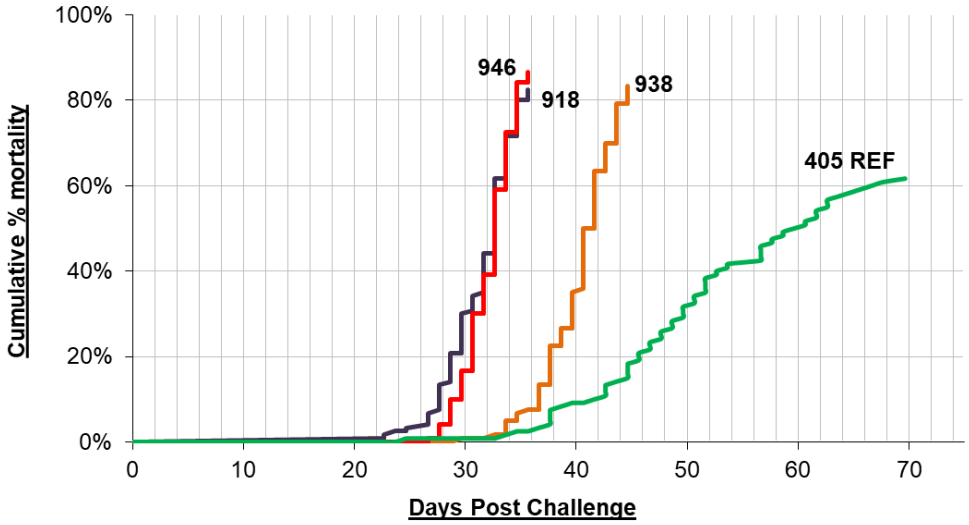

Fig 1. Cumulative % mortality curves in Atlantic salmon in a laboratory trial testing three 2021 isolates (918, 938, 946) and a standard challenge isolate (405 -Ref-green). Dosing was ~ 10^6 colony-forming units per fish administered i.p..

MAQSOOD, AQSA

EXPLORING THE IMMUNOMODULATORY AND CELLULAR EFFECTS OF *Aeromonas salmonicida* MELANIN IN ATLANTIC SALMON.

Aqsa Maqsood*, Sathees Duglas, Thurka Paramanathan, Rebbeca Kwabiah, Ignacio Vasquez, Robert Gendron, Erling Olaf Koppang, Javier Santander.

Marine Microbial Pathogenesis and Vaccinology Laboratory, Department of Ocean Sciences, Memorial University of Newfoundland, NL, Canada. *email: amaqsood@mun.ca

Aeromonas salmonicida subspecies salmonicida (hereafter *A. salmonicida*) is a marine pathogen that secretes melanin, a dark pigment with a complex molecular structure, formed by polymerizing phenolic and/or indole monomers, which act as antioxidants, radical scavengers, photo-protectors, and organic semiconductors. This study evaluated the impact of *A. salmonicida* melanin on Atlantic salmon immunity. Atlantic salmon (n=24) were intraperitoneally injected with 100µg/dose of melanin per 100g of fish, while a control received Tris-OH 20 mM pH 8.0 buffer. Head kidney samples for transcriptomics and histology were taken at 6, 24, 48, 168, and 336 hours post-injection. High-quality RNA was purified and sequenced using NovaSeq (Illumina). Transcriptomics analysis at 6 hpi showed 92 upregulated and 136 downregulated genes. At 24 hpi, 141 genes are upregulated and 153 are downregulated. At 48 hpi, 34 genes are upregulated and 36 are downregulated. At 6 and 24 hpi, the B-cell receptor CD22 and hsc70 genes were upregulated. At 48 hpi, the response reduces, but at 168 h, more gene upregulation, suggesting that the melanin is still in the system. The time course study indicates that *A. salmonicida* melanin may have an immunomodulatory or cellular effect, as transcriptome profiling revealed the expression of several cellular and biological processes.

MOHAGHEGHI SAMARIN, AZIN

OOCYTE AGEING IN FISH: FROM APPLIED TO BASIC INSIGHT

Azin Mohagheghi Samarin*, Swapnil Gorakh Waghmare, Fabian Schumacher, Burkhard Kleuser, Trine Kastrup Dalsgaard, Marianne Danielsen, Hanne Søndergaard Møller, Tomas Policar, and Azadeh Mohagheghi

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Oocyte ageing in fish and its consequences on progeny have been studied in my research group for the last twenty years at both basic and applied aspects in 15 fish species. In addition, we have studied the probable mechanisms behind the progress of oocyte ageing in our working group. Examining the oxidation products, antioxidant enzyme activities, and the mRNA abundance of selected transcripts revealed that oxidative stress is unlikely to be the initiator of the oocyte ageing process, but most likely appears in the later stages as a consequence of post-ovulatory ageing. We have also assessed the epigenetic mechanisms of DNA methylation and hydroxymethylation during oocyte ageing. The genome-wide DNA hydroxymethylation decreased significantly in embryos originating from aged oocytes. Investigating the modifications in specific histone acetylation revealed a significant increase in H4K12 acetylation in aged oocytes. Furthermore, the activity of histone acetyltransferases showed an upward trend during oocyte ageing. Studying the apoptotic signaling pathways indicated an increase in proapoptotic transcripts, elevated caspase protein amount, and activation of a key apoptotic player known as caspase 3 in aged oocytes. Expression of apoptotic genes and caspase enzyme activity revealed that the apoptosis was triggered in the advanced stage of oocyte ageing.

NESS, MICHAEL

Yersinia ruckeri IN CANADA: ISOLATE CHARACTERIZATION, VACCINE SAFETY AND CHALLENGE STUDIES

Michael Ness*, Monica Gausdal Tingbø, Ane Sandtrø, Glenn Buene, Randy Peach, Mats Martin Sekkelsten-Kindt

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Yersinosis or Enteric Red Mouth (ERM) disease in fish caused by *Yersinia ruckeri* (*Y. ruckeri)*, is a common bacterial septicemia that has been found in most areas of the world where salmonids are cultured in cold or temperate waters.

In recent years *Y. ruckeri* detections and yersiniosis outbreaks have been an increasing problem in larger fish in the sea, particularly in Norway. This disease pattern has also been reported as an increasing concern in Canada.

In this study we have characterized several Canadian *Y. ruckeri* field isolates from multiple regions in both Western and Eastern Canada using Western blotting. Secondly, in the laboratory and field we have assessed the safety profile when PHARMAQ's water-based yersiniosis vaccine (ALPHA ERM Salar) is co-injected with oil-based commercial vaccines. Furthermore, we have analyzed the cross-protection of ALPHA ERM Salar against various *Y. ruckeri* serotypes in laboratory challenges.

Our results show that Canadian *Y. ruckeri* field isolates are more heterogenous than those found in Norway. The laboratory and field safety studies show that ALPHA ERM Salar is safe to use in combination with other commercial oil-based vaccines. Lastly, PHARMAQ's ALPHA ERM Salar vaccine demonstrated excellent cross-protection against 01a serotype (biotype 1 and 2).

NORMANDEAU, MACKENZIE

THE LATEST DEVELOPMENTS IN ROV-BASED SYSTEMS FOR NET INTEGRITY AND MORT RETRIEVAL

Mackenzie Normandeau

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Deep Trekker is collaborating with Underwater Contracting (UCO) to support the development and deployment of specialized aquaculture tools integrated with our PIVOT remotely operated vehicle (ROV). UCO is leading R&D efforts on compact, ROV-mounted systems designed to improve site maintenance and reduce the need for diver intervention. One such tool, the UCO NetFix, is an in-situ net repair solution engineered for precision and reliability. Integrated with the Deep Trekker PIVOT, the system enables fast, effective containment repairs at depth without interrupting operations. It has already been used successfully across several commercial sites. UCO is also actively developing the Mini Foover, a lightweight mort and debris removal tool designed to mount directly onto the PIVOT platform. While still in the testing phase, early results indicate promising performance for targeted mort removal in constrained environments, with daily iterations improving reliability and efficiency. These developments showcase the potential of combining purpose-built aquaculture tooling with flexible, portable ROV platforms. By supporting UCO's tool integration work, Deep Trekker aims to help operators reduce operational costs, improve safety, and maintain better control over critical infrastructure tasks.

PANKRATZ, STAN

INTEGRATING ALGAE CULTIVATION INTO RAS – NEW POSSIBILITIES

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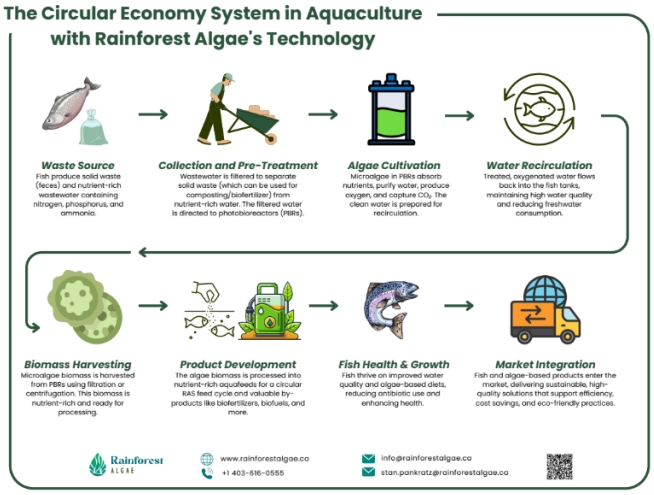
Integration of algae cultivation in the context of a recirculating aquaculture system (RAS) has the potential to close the loop for a circular economy and address both economic and environmental sustainability. This approach leverages recirculating aquaculture system (RAS) principles to transform nutrient-laden effluent from fish farming into valuable algae biomass. The algae serve as a sustainable aquafeed supplement, improving feed conversion ratios (FCR), enhancing fish health, and reducing the need for antibiotics and chemical treatments. Additionally, the system contributes to direct-air-carbon capture (DAC) by sequestering CO_2 through algae cultivation plus providing a positive ROI on the capital investment.

Normal mortality rates for well-managed inland fish farms typically range between 10-20% over the production cycle. Water quality is a primary driver of mortality in aquaculture. Literature estimates that 40-60% of mortality events in inland fish farms can be attributed directly or indirectly to poor water quality. Specific issues include low dissolved oxygen, high ammonia or nitrite levels, pH imbalances, temperature fluctuations and high organic load or turbidity.



A solution involving the integration of algae cultivation is proposed to address key water quality issues that may still be experienced by RAS facilities. Where fish require oxygen and respire CO_2, acidifying the water, algae use the CO_2 as its key nutrient and returns oxygen to the water, thus also mitigating the pH decline from carbonic acid and enriches dissolved oxygen (DO) levels. Algae also require nitrogen, thus reducing ammonia and nitrates in the aquaculture effluent water. Highly nutritious algae that is grown in this water is harvested and may be pelletized to be fed to the fish. Coupled with solutions that effectively clarify water and destroy harmful bacteria and viruses, fish benefit from a healthier environment, nutrients for improved health and reduced stress. Happy fish are made for happier farmers.

PARAMANATHAN, THURKA

REVERSE VACCINOLOGY: A GAME-CHANGER IN VACCINE DEVELOPMENT AGAINST PISCINE FRANCISELLOSIS

Thurka Paramanathan*, Ignacio Vasquez, Trung Cao, Vimbai I. Machimbirike, and Javier Santander

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Francisella noatunensis subsp. *noatunensis* (*F. noatunensis*) is a Gram-negative, facultative intracellular bacteria that causes francisellosis in Atlantic cod (*Gadus morhua*). Traditional inactivated or formalin-killed vaccines are often ineffective against *F. noatunensis*, as they fail to induce a strong cellular immunity essential for combating intracellular infections. Besides, the antibiotic resistance of *F. noatunensis* justifies further attention to explore novel vaccine candidates. The complete bacterial genome sequencing has enabled all potential antigens available for vaccine development. This study utilized a reverse vaccinology approach to develop a multi-epitope vaccine against francisellosis in Atlantic cod. *F. noatunensis* genome was sequenced using Oxford Nanopore Ligation Sequencing. The proteome was screened against various filters to prioritize proteins based on features associated with subcellular localization, transmembrane helices, antigenicity, non-homology with the host proteome, virulence, and stability, which identified several potential proteins. The epitopes were passed through a filtering immuno-informatics pipeline that included binding affinity, immunogenicity, proteasome score, TAP score, and antigenicity to identify epitopes capable of eliciting T cell-mediated immune responses. Molecular docking simulations with Atlantic cod MHC-I identified several high-affinity 9-mer epitopes with strong binding affinities and low dissociation-constants. These selected epitopes are promising vaccine candidates, requiring further in-vivo testing to assess immunogenicity and protective efficacy.

PARRISH, CHRISTOPHER

THRAUSTOCHYTRIDS AND ALGAE AS SUSTAINABLE SOURCES OF LONG-CHAIN OMEGA-3 FATTY ACIDS FOR AQUAFEEDS

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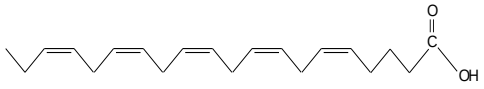
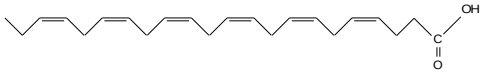
Seafood is our key source of omega-3 fatty acids such as EPA and DHA. Aquaculture is expected to meet rising global demand; however, marine fish have high dietary EPA and DHA requirements themselves. This was traditionally met using unsustainable dietary fish oil and fish meal, but limited supply and environmental concerns have dictated research on replacements. Among the industrial sources of EPA and DHA, microalgae and especially thraustochytrids stand out as resources with high concentrations. Although unicellular, thraustochytrids are not microalgae as they are not photosynthetic but instead are microheterotrophs. This removes the light requirement and facilitates high yields of monoculture for the production of single-cell oils.

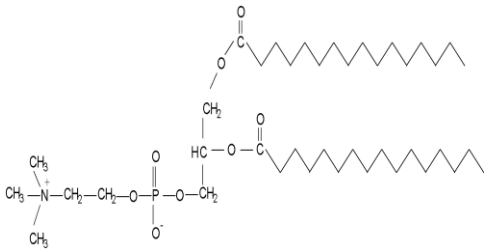
The availability, in high concentrations, of usually one or the other essential fatty acid permits a calibration of the EPA and DHA dose, which is especially useful as their effects have mainly been considered together in medical and aquaculture research. EPA and DHA have different effects on cell function and are precursors of different bioactive compounds. Using thraustochytrids, microalgae, and heterotrophic dinoflagellates, the importance of DHA has been investigated. DHA was essential for optimizing the growth of the early life stages of scallops and finfish and was preferentially incorporated into fish membrane phospholipids.



Eicosapentaenoic acid (EPA, 20:5ω3) – a C_{20} long-chain ω3 essential polyunsaturated fatty acid.



Docosahexaenoic acid (DHA, 22:6ω3) – a C_{22} long-chain ω3 essential polyunsaturated fatty acid.



Phospholipid – a structural component of cell membranes

PERRON, FLAVIE

IMPACTS OF THERMAL STRESS ON THE PHYSIOLOGY OF DIPLOID AND TRIPLOID BLUE MUSSELS WITH DIFFERENT GROWTH PHENOTYPES

Flavie Perron*, Eric H. Ignatz, Rebecca Lawson, Hugo Flávio, Shelby Clarke, Jasmine Talevi, Tiago S. Hori and Ramón Filgueira

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Mussels (*Mytilus edulis*) can show wide growth variability, even among same-aged individuals reared under similar conditions. Triploidy can influence growth rates as energy can be diverted from reproduction to somatic growth. Furthermore, the response of triploid mussels to heat stress remains poorly understood. This study investigated how growth phenotype (i.e., slow versus fast growers) and ploidy (i.e., diploids versus triploids) influence how mussels respond to thermal stress. Within each ploidy group, slow and fast growers (bottom and top 20% by size) were characterized across three mussel families. Each family was tested separately, where mussels were placed in individual respirometry chambers and exposed to thermal stress starting at an acclimation temperature of 18°C. Temperature was increased by 2°C every three days until reaching a sub-lethal temperature of 26°C. Shell lengths were measured at the start and end of the experiment, while feeding rates were assessed at 18, 22, and 26°C, and respiration rates continually every 2h. Throughout the experiment, samples were collected for genotyping, RNA-sequencing, metabolomics, gill histology, and flow cytometry. This study aims to better understand how growth phenotype and ploidy influence mussel responses to thermal stress, with potential applications in mussel aquaculture through the selection of resilient growth lines.

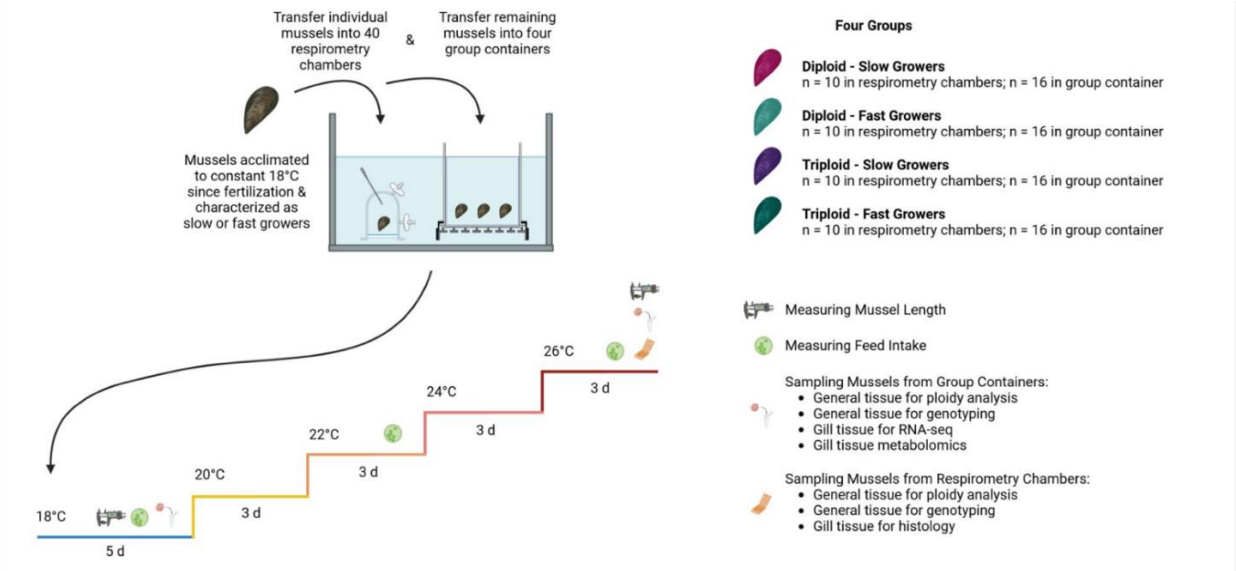

Figure 1. Experimental design of the temperature ramp (from 18 to 26°C) for slow and fast grower from both diploid and triploid mussels across 3 families with morphological and tissue sampling denoted.

PERRY, GUY

A SELECTIVE BREEDING PROGRAM FOR MULTINUCLEATE SPHERE X (MSX) RESISTANCE IN EASTERN OYSTERS

G.M.L. Perry*[1], A. Desbarats[2]

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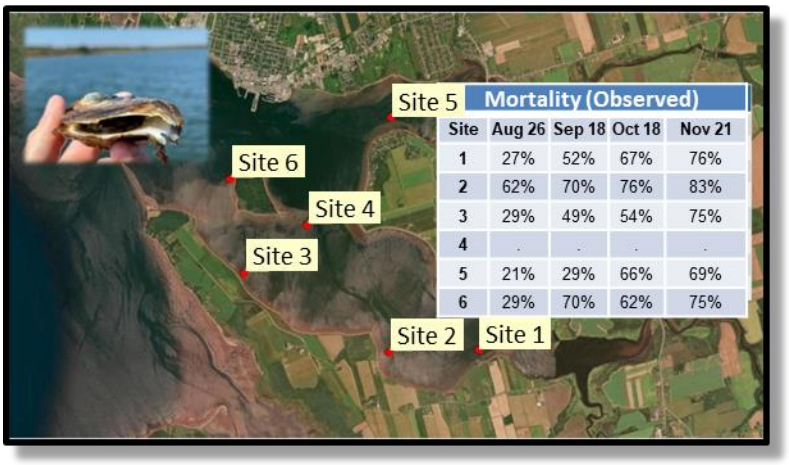
The Eastern oyster (*Crassostrea virginica*) industry in Prince Edward Island is under threat by the recent arrival of the haplosporidean parasite *Haplosporidium nelsoni* (Multinucleate Sphere unknown X). MSX has caused extreme losses to oyster aquaculture in the American Eastern Seaboard, and to Bras D'Or, NS. In PE, MSX has already resulted in significant (>80% mortality) damage in one major oyster bay. The history of MSX outbreaks illustrates that the only viable response to the parasite is breeding for genetic resistance.

The Bideford Shellfish Hatchery (BSH; Tyne Valley, PE) is undertaking the goal of selective breeding for MSX resistance (MSXR) in PE Eastern oysters for the purposes of general industry outreach. It is our objective to achieve significant and rapid (1-2 yr) gains to MSXR in our broodstock line, including pedigreed effects, genomics and advanced endogenous genetics. Our first-round breeding response to MSX includes 337 mixed Bedeque and Bedeque-Malpeque hybrids, and 370 Bedeque mortalities and survivors for binary genomewide association mapping (GWAS). Without immediate and major improvements to MSXR for oysters in this region, the future of the industry may be bleak.

Figure 1. Eastern oyster MSX mortality, Bedeque Bay, PE (courtesy A. Ramsey, Department of Fisheries and Communities, PE).



PLOUFFE, DEBBIE

HOW MANY MARKERS DO I NEED? OPTIMAL MARKER DENSITY AND GENOTYPING TOOL CHOICE FOR LONG-TERM GENETIC SUCCESS IN AQUACULTURE BREEDING PROGRAMS

Debbie Plouffe*, Christina Kriaridou**,** Klara L Verbyla, Alejandro P Gutierrez

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Achieving sustained genetic progress in aquaculture breeding depends on selecting genotyping tools with the optimal number of markers for a given breeding strategy. This presentation explores key factors influencing marker density requirements, including the number of traits, genome size, linkage disequilibrium (LD) breakdown, recombination rate, genotype-by-environment interactions (GxE), and the need for precise selection over multiple generations.

Multi-trait breeding programs require higher marker densities to capture genetic variation across traits such as growth, disease resistance, quality, and reproduction. Genome size also impacts marker density needs, influencing genome-wide coverage. LD breakdown and recombination rates affect marker effectiveness, requiring strategic placement to ensure critical trait regions are adequately covered. Balancing marker density with LD decay and recombination events is essential for long-term breeding program success.

This presentation highlights the importance of an adaptive approach to marker density planning, ensuring genotyping tools align with breeding program goals. By optimizing marker selection, aquaculture breeding programs can enhance genetic improvement efficiency, maximize selection accuracy, and sustain progress over generations.

PLOUFFE, DEBBIE

UNLOCKING COMMERCIAL SCALE GENOME EDITING

Debbie Plouffe*, John T. Buchanan, Matthew Josephson, Ashutosh Pudasaini, Yehwa Jin, Stephan Samu, Brandon Tsai

The Center for Aquaculture Technologies
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Genome editing technologies hold transformative potential for aquaculture by enabling precise and efficient modifications to key traits, thereby driving advancements in commercial-scale production. These technologies offer unique opportunities to enhance economically valuable characteristics, including sterility, growth rate, and thermal tolerance, which are crucial for addressing challenges in sustainable aquaculture. However, achieving large-scale adoption requires overcoming significant technical, regulatory, and societal barriers.

Here, we present results demonstrating high-throughput microinjection delivered genome editing in tilapia, achieving over 95% editing efficiency in somatic cells across thousands of embryos per day. Additionally, we showcase methods to utilize genome editing for the mass production of sterile fish, directly addressing environmental, regulatory, and societal concerns about genetically engineered organisms.

This work highlights recent progress, innovative strategies for scaling genome editing, and the critical role of interdisciplinary collaboration in unlocking its full potential, ultimately fostering a more sustainable and resilient aquaculture industry.

POLEY, JORDAN

EFFICACY OF DIFFERENT VACCINE ADMINISTRATION STRATEGIES AGAINST NORTH AMERICAN AND EUROPEAN GENOTYPES OF INFECTIOUS SALMON ANEMIA VIRUS (ISAV) IN ATLANTIC SALMON (*Salmo salar* L.)

Nasif Sarowar[1], Sean Andrew[1], Marius Karlsen[2], Mike Ness[2], Randy Peach[2], Jordan Poley[1]

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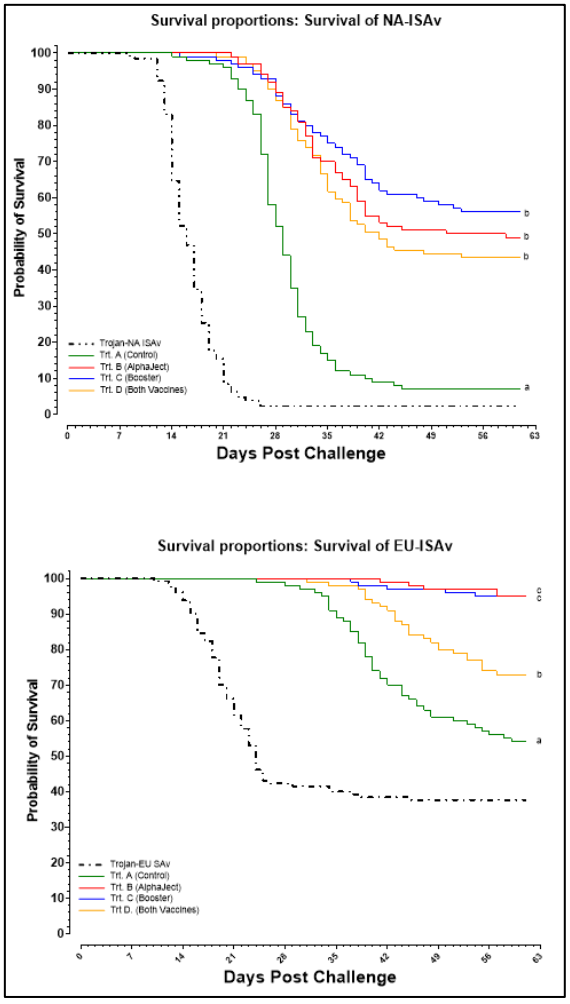
The study evaluated efficacy of two vaccination strategies using two commercial multivalent vaccines with ISA components in Atlantic salmon challenged with North American (NA, HPR4) or European (EU; HPRnew) genotypes of ISAv. Both isolates were recovered from confirmed cases from Eastern Canada. The treatment regimens included ALPHA JECT micro 7 ISA (AJ-7; Trt. B), AJ-7 followed by a booster of a similar competitor vaccine (Trt. C), and a simultaneous injection of AJ-7 and the competitor vaccine (Trt. D). Efficacy was measured relative to a sham control group (Trt. A) injected with saline.



Unvaccinated Atlantic salmon parr (St. John River stock, average weight 36.62 g) received the treatments. Post-seroconversion periods, unvaccinated fish (Trojans) were injected with either NA-ISAv or EU-ISAv and mixed into respective tanks. All vaccinated groups exhibited significantly higher survival compared to the unvaccinated control. Significant difference in survival was not observed among the vaccinated groups against NA-ISAv, although the booster dose group showed the highest survival. When challenged with EU-ISAv, AJ-7 alone (Trt. B) or with competitor booster (Trt. C) had significantly higher survival than fish injected with both vaccines simultaneously (Trt. D) and controls (Trt. A) . The treatments did not differentially affect growth or Speilberg scores, indicating the safety of all tested vaccine administration strategies.

RANDALL, KIRA

RESPONSE OF ATLANTIC SALMON *Salmo salar* EPIDERMAL GOBLET CELL SIZE AND DENSITY AND SKIN MUCOSAL SURFACE TISSUE GENE EXPRESSION TO IMMUNOSTIMULATION

Kira Randall*, Albert Caballero-Solares, Christopher Parrish, Matthew Rise

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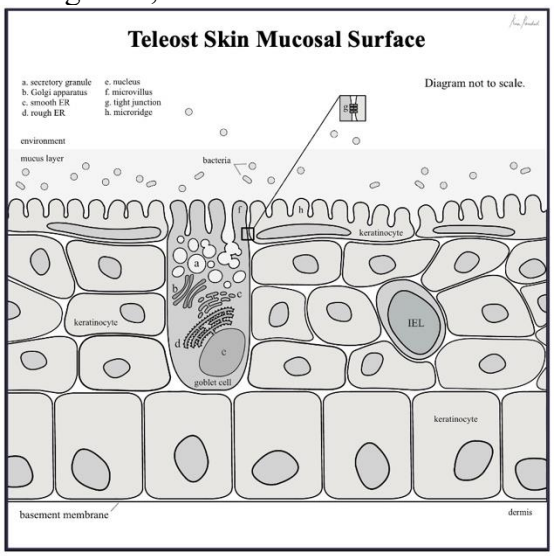
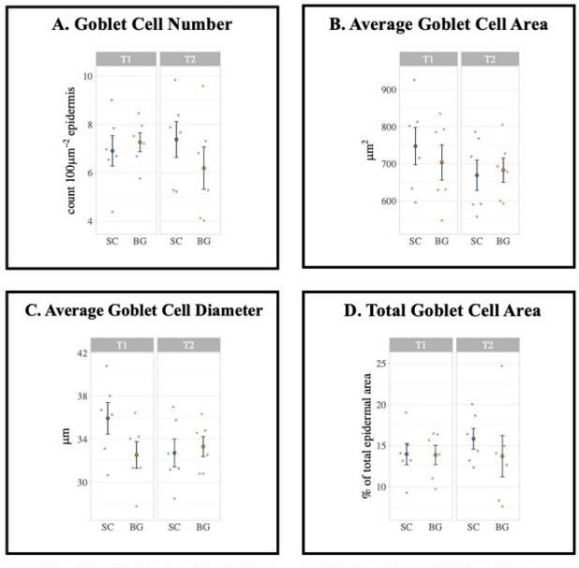
Mucosa-associated lymphoid tissues have a mucus layer and epithelial cells with tight junctions acting as a physical barrier, an array of bioactive compounds and innate and adaptive immune cells modulating microbe-host interactions, and polymeric immunoglobulin receptors transporting secretory immunoglobulins across epithelial cells. These features permit colonization by commensals while constraining invasion by opportunistic or obligate pathogens. The major structural and functional components of the mucus layer are mucins, high-molecular-weight proteins produced by goblet cells in Atlantic salmon. This study explores the response of Atlantic salmon epidermal goblet cell size and density and skin mucosal surface (SMS) tissue gene expression to immunostimulation. Post-smolts (n=24) were biopsied—2cm^2 skin caudal to the dorsal fin—2d and 10d post-intraperitoneal injection with phosphate-buffered saline (control) or beta-1,3/1,6-D-glucan (immunostimulant), a naturally occurring polysaccharide derived from yeast. The number, area, and maximum diameter of goblet cells and epidermal area were calculated using whole slide analysis (QuPath). No significant differences were found between groups for goblet cell number (100µm^{-2} epidermis), average goblet cell area (µm^2) and diameter (µm), or total goblet cell:epidermal area (%).The relationship of these data to SMS tissue gene expression (RNA-seq), where upregulation of immune-related transcripts is expected in response to beta-glucan, will be examined.



Abbreviations: ER, endoplasmic reticulum; IEL, intraepithelial lymphocyte.



Abbreviations: BG, beta-glucan injected; SC, saline control; T1, 2d post-injection; T2, 10d post-injection.

RAQUIB, AHSAN

TRANSMISSION DYNAMICS OF INFECTIOUS SALMON ANEMIA VIRUS: A SYSTEMATIC REVIEW

Ahsan Raquib1,2*, Persia Carol Thapa1, 2, K Larry Hammell1,2, Krishna Kumar Thakur1,2 1.

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2. Centre for Veterinary Epidemiological Research (CVER), Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, Prince Edward Island C1A 4P3, Canada Presenting author's email: araquib@upei.ca

In the absence of an effective vaccine, developing successful prevention, surveillance, and intervention plans requires an understanding of the transmission dynamics of ISAV. This systematic review aims to evaluate the methods, parameters, and validation approaches used in modeling ISAV spread and to summarize the effectiveness of different control strategies. Four databases and Google Scholar were searched using a set of predefined keywords to find scientific literature published until 28th June 2024. Studies were screened independently by two authors based on predetermined eligibility criteria. The search identified 898 studies from databases and Google Scholar, with five additional government reports added through manual reference checks. After title and abstract screening and full-text screening, 24 studies were included in the final systematic review. The highest number of studies was conducted in Canada and were published between 2010-2020. We categorized the objective of the modeling into four categories, and of them, most studies tried to predict disease spread and estimate parameters. A descriptive synthesis was conducted, and findings were summarized based on the modeling objectives used. This systematic review will offer a comprehensive overview of ISAV transmission dynamics models and support the improvement of prevention and control strategies.

RAQUIB, AHSAN

SPACE-TIME CLUSTERING AND RISK FACTORS FOR THE TIME TO FIRST DETECTION OF INFECTIOUS SALMON ANEMIA VIRUS (ISAV) IN ATLANTIC CANADA AND MAINE, USA

Ahsan Raquib1,2*, K Larry Hammell1,2, Allyson Brown3, Leighanne Hawkins4, Sonja Saksida1,2, Krishna Kumar Thakur1,2

1. Department of Health Management, Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, C1A 4P3, PE, Canada

2. Centre for Veterinary Epidemiological Research (CVER), Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, Prince Edward Island C1A 4P3, Canada 3. Kelly Cove Salmon Ltd, Blacks Harbour, New Brunswick, Canada 4. Aquaculture veterinarian, Department of Agriculture, Aquaculture and Fisheries Presenting author's email: araquib@upei.ca

This study aimed to identify space-time clusters of HPR0 and HPR-deleted ISAV variants and the factors influencing stocking time to their first detection in Atlantic salmon sites across eastern Canada and Maine, USA. This study used ISA surveillance data (2010–2022) from 86 Atlantic salmon sites covering 254 production cycles. Space-time cluster analysis was conducted using a Bernoulli model in SaTScan with a 20% maximum cluster size and 50% temporal window. A multivariable Cox analysis (2010–2022) will be done to identify factors associated with time to first detection of two ISAV variants. During the study period, 63 and 77 marine production cycles had HPR0 and HPR-deleted cases, respectively. One significant space-time cluster for HPR deleted cases between January 2021 and October 2021 in Grand Manan, New Brunswick. Genotyping revealed that all the infected marine sites within the cluster were infected with the same HPR-deleted variant. Survival analysis revealed that the incidence rate for HPR0 and HPR deleted cases were 1.13 and 1.18 cases per 100 sites per month, respectively. In conclusion, these findings—alongside ongoing multivariable Cox analysis—will help identify risk zones and factors linked to disease occurrence, supporting policymakers in improving control efforts for this economically significant disease.

REID, GREGOR

CLIMATE CHANGE AND AQUACULTURE: WHERE ARE WE AND WHAT DO WE DO?

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It is widely acknowledged that climate change is happening now, and aquaculture is not immune. What do we do about it? How do we navigate the complex web of understanding trends, prediction uncertainty, mitigation responsibilities, and adaptation pathways?

There are few long-term, high-resolution, water quality data sets for Atlantic aquaculture areas, which are needed to tease out climate trends. Offshore data trends are more defined, but do not fully reflect coastal areas. Despite impressive advances in ocean model projections, most are still not applicable to coastal aquaculture locations. There are also major limitations understanding future changes to intensity, duration and frequency (IDF) of climate change stressors (Exposure) such as temperature and ocean acidification but also understanding how culture species will respond (Sensitivity) to these changes.

Fortunately, viable adaptation pathways can still be pursued even under great uncertainty. Here we will discuss current climate knowledge gaps, considerations for operators to expand Adaptive Capacity, and discussion of priority research needs.

RIESENBACH, CARMI

USING BIOCHEMISTRY TO EXPLORE TRENDS AND GENERATE NOVEL INSIGHTS IN THE AQUACULTURE INDUSTRY

Carmi Riesenbach*, Katrina MacNeill, Joseph Boaheng, Lesley Clark, Ye Zhang, Mark Braceland

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Blood biochemistry offers a powerful, non-destructive approach to monitoring the health of fish stocks in a proactive and data-driven manner. By enabling earlier detection of physiological stress and subclinical disease, biochemical profiling improves treatment success, reduces mortality and morbidity, and ultimately enhances fish welfare. WellFish Tech has developed robust protocols for assaying key health markers in fish serum and plasma, generating actionable insights to inform on-farm management decisions.

Several case studies demonstrate the utility of this approach in commercial aquaculture. In one, a large database of biochemical data from farmed Atlantic salmon across a range of sizes and temperatures was analyzed to test a common assumption: that age, size, or temperature markedly shift serum biochemistry. Surprisingly, the results showed that core biochemical profiles remain relatively stable, challenging industry perceptions and supporting broader standardization of reference ranges. Another case study explores biochemical signatures that differentiate viable from non-viable fish eggs, offering a tool for early-stage quality assessment in hatcheries. A third examines the biochemical profiles of salmon before and during a disease outbreak, comparing apparently healthy individuals, those showing early clinical signs, and moribund fish. This work demonstrates how blood chemistry can be used to track disease progression and guide timely interventions.

Together, these examples highlight how biochemical tools can enhance health monitoring, decision-making, and welfare outcomes throughout the aquaculture production cycle.

SALEM, SHIMAA

NUTRITIONAL STRATEGIES TO IMPROVE ATLANTIC SALMON *Salmo Salar* LIVER LIPID HOMEOSTASIS IN THE WINTER

Shimaa Salem*, Rebeccah Sandrelli, Kathy Clow, Isis Rojas, Christopher Parrish, and Anthony Kurt Gamperl

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We examined the efficacy of increased levels of dietary betaine, taurine, and long-chain omega-3 (ω3) polyunsaturated fatty acids (PUFA) in maintaining hepatic lipid homeostasis in Atlantic salmon (*Salmo salar*) and reducing the severity of 'Winter Syndrome' and associated fatty liver disease (FLD). Post-smolt salmon were exposed to a gradual reduction in water temperature from 8 to 2°C (at 0.6°C $week^{-1}$) and were then maintained at this temperature for 3 weeks. These temperature changes simulate those observed at cage sites in Newfoundland. Liver samples (0.25 g) were taken at 3 sampling points for lipid class and fatty acid analysis. Prolonged exposure of salmon fed the control diet (A) to 2°C increased the amount of total liver lipid and favored the deposition of triacylglycerol, monounsaturated FA, and short-chain PUFA, while reducing the liver's phospholipid, sterol, saturated FA, and long-chain PUFA content. Livers of salmon fed betaine (20 g kg^{-1}) and taurine (15 g kg^{-1}) supplemented diets showed the same response as diet A to cold exposure. This temperature effect was reversed in salmon fed a high ω3 PUFA (25% DHA+EPA increase) and low total lipid (20% less) diet (B). Diet B also significantly reduced the liver's phospholipid: sterol ratio as compared to the other diets at 2°C. In conclusion, reducing dietary total lipid by 20% and adding 25% more ω3 PUFA mitigated the incidence of fatty liver by preserving normal hepatic lipid homeostasis and improving cell membrane fluidity by maintaining ω3 PUFA levels and their phospholipid to sterol ratio.

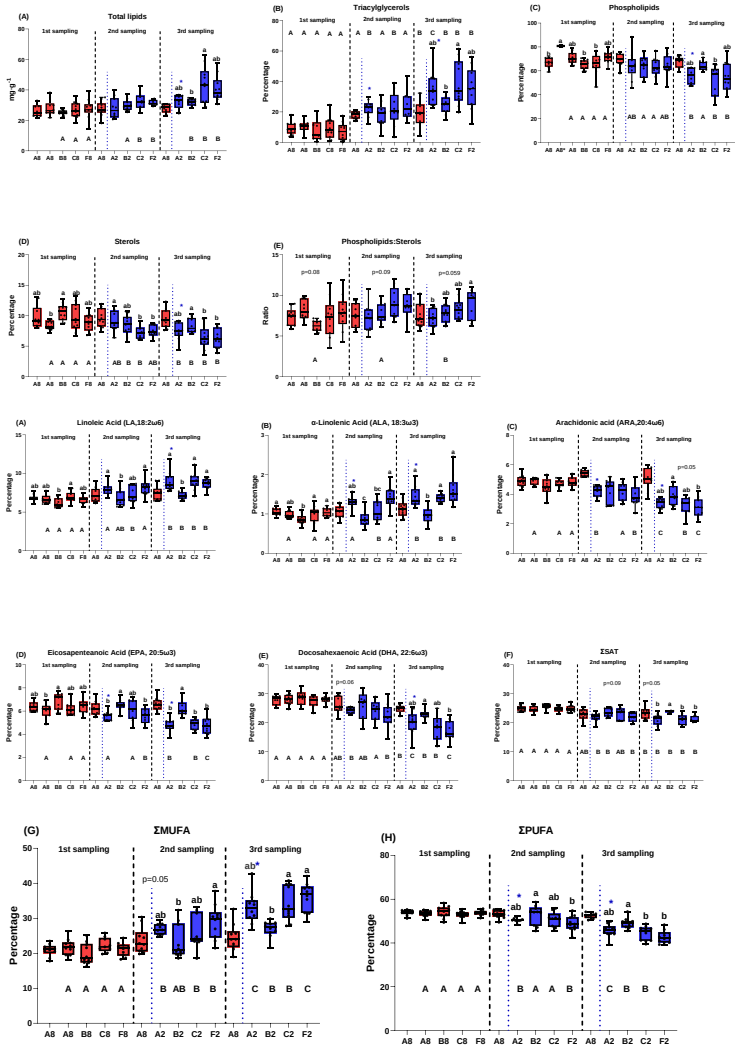

Figure 1. Lipid class and fatty acid levels in Atlantic salmon (*Salmo salar*) liver on feeding a control (A) diet and three experimental diets (B, C, and F) at three sampling points. 1st sampling: fish-fed diets A, B, C, and F at 8°C (red bars) for 4 weeks. 2nd sampling: fish-fed diet A at 8°C, and diets A, B, C, and F at 2°C (blue bars) after a gradual reduction of water temperature from 8°C to 2°C over 10 weeks (0.6°C week^{-1}). 3rd sampling fish-fed diet A at 8°C and diets A, B, C, and F at 2°C for 3 weeks. Lipid class and fatty acid levels are a percentage of the total lipids (mg g^{-1}) (n=10 per group). Lowercase letters indicate a significant difference ($p < 0.05$) between groups within the sampling, while uppercase letters indicate a significant difference in groups between samplings. A box and whisker plot shows the values of the group's data: minimum, 25th lower quartile, median, 75th upper quartile, and maximum. (*) A2°C differs statistically from A8°C.

- **Design of Experimental Diets**

Diet	Control (Winter)	Betaine (g kg^{-1})	Taurine (g kg^{-1})	Total lipid PUFA (%)	Oil source
A	-	-	-	-	Canola
B	-	-	-	+ 25% EPA+ DHA 20% less total lipid	Fish
C	-	+ 20	-	-	Canola
F	-	-	+15	-	Canola

+ Supplement - Not supplemented

SAMWAYS, KURT

TURNING THE TIDE: RESTORING ENDANGERED ATLANTIC SALMON THROUGH MARINE CONSERVATION REARING

In Atlantic Canada, the rate at which wild Atlantic salmon populations are facing extirpation exceeds the pace at which management interventions can address declines. Despite considerable efforts, enhancement methods are either abandoned in the absence of demonstrable population improvement or continued for decades without clear links to effectiveness. Reduced to less than 250 wild adults, the inner Bay of Fundy (iBoF) Atlantic salmon population was listed as endangered under the Canadian *Species at Risk Act* in 2003. Fundy Salmon Recovery is a true collaboration of federal and provincial governments, First Nations, aquaculture industry, law enforcement, and academia, all united by a common goal; to restore historic wild Atlantic Salmon populations to the iBoF. Fundy Salmon Recovery is the first to create and implement a new and innovative approach to salmon conservation, where it captures wild Atlantic salmon seaward migrating smolts from iBoF rivers, rears them at the World's First Wild Salmon Marine Conservation Farm, and subsequently releases them back into their natal river to spawn naturally. Since it began in 2015, over 12000 wild origin adult Atlantic Salmon have successfully been released to iBoF rivers. Rivers supported by FSR have seen a 30-year high in adult Salmon returns (accounting for greater than 80% of the entire iBoF salmon population), as well as record numbers of smolts, increasing wild juvenile salmon densities, and improved ecosystem productivity and function. The potential effects of adult supplementation on fish fitness and ecosystem health are widely applicable to all salmon rivers suffering from low numbers.

SANTANDER, JAVIER

DYNAMICS OF MICROBIAL COMMUNITIES IN FARMED ATLANTIC SALMON AND SEA LICE DURING WINTER CONDITIONS REVEALS THE PRESENCE OF MULTIPLE COLD-WATER PATHOGENS

Javier Santander*, Thurka Paramanathan, Aqsa Maqsood, Oluwatoyin Onireti, Trung Cao, Ahmed Hossain, Ignacio Vasquez, Sathees Duglas, Raja Gurung, Rebecca Kwabiah, Jaime Soto-Neira, Vimbie I. Machimbirike, Nicole O´Brien, Andrew Swanson

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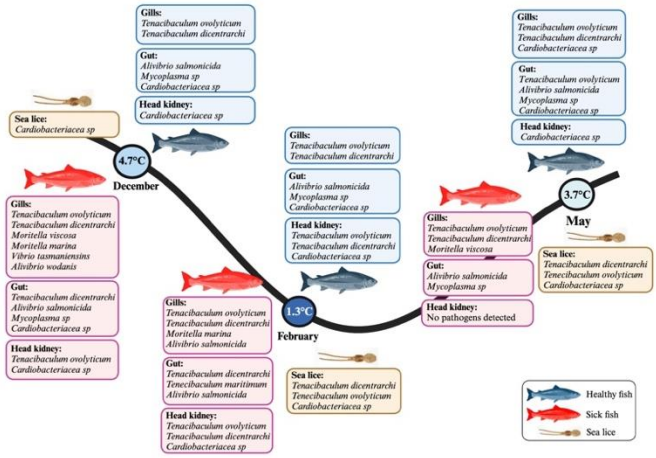
Winter mortalities of farmed Atlantic salmon are becoming frequent. Low temperatures negatively impact fish health and opportunistic pathogens might cause mortalities. Fish microbiota have beneficial microbes and opportunistic pathogens that cohabitate in homeostasis, but it is unknown how low temperatures modulate this equilibrium in the farm. Therefore, we characterized the microbiome of gills, gut, and head-kidney of healthy and sick farmed salmon, and sea-lice, during winter conditions. Fish kept *ex-situ* under similar-to-field temperatures were used as control. Tissues were analyzed for bacterial loads, histopathology, and metagenomics. Fish were sampled in winter at 4.7, 1.3, and 3.7°C. Cultivable bacteria were detected in tissues, with obvious intracellular bacteria. *Tenecibaculum* spp predominanted in gills. *Moritella* spp, *Vibrio tasmaniensis* and *Alivibrio wondalis* were detected in gills of sick fish. *Mycoplasma* sp, *Aliivibrio salmonicida*, and *Cardiobacteriaceae* sp predominanted in the gut. *Tenecibaculum* spp were found in the gut of sick fish. In the head-kidney *Cardiobacteriaceae* sp predominanted, and *Tenecibaculum* spp were detected in sick fish. In sea-lice *Cardiobacteriaceae* sp, *Aeromonas salmonicida*, *Tenecibaculum* spp, and *Moritella* spp were detected. Farmed salmon are expose to several pathogens in winter that infected the head-kidney during the coldest period, with sea-lice potentially playing a role in pathogen transmission, causing dysbiosis.



Graphical abstract. Pathogenes detected by metagenomics analysis in gills, gut, and head kidney of farmed Atlantic salmon in the south coast of NL during winter 2023-24.

SHARPE, HANNAH

MSX IN PRINCE EDWARD ISLAND: PROVINCIAL SURVEILLANCE AND MONITORING

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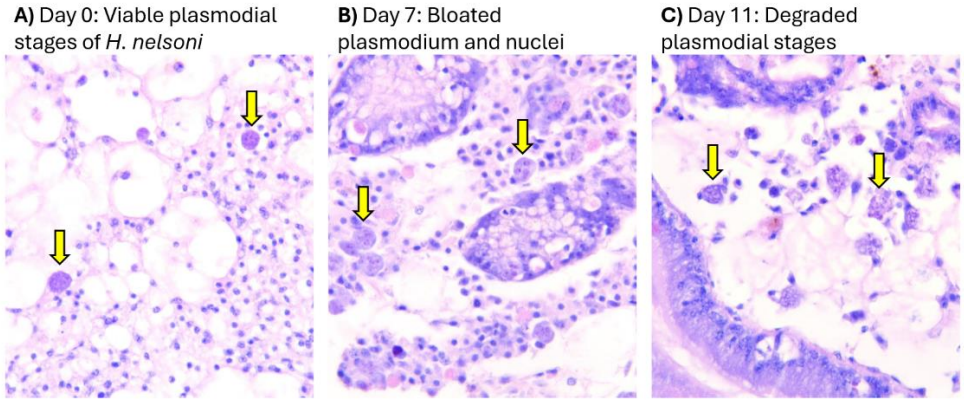
Multinucleate Sphere Unknown (MSX) is a disease known to cause up to 95% mortality in Eastern oysters (*Crassostrea virginica*) within two years of infection. In June 2024, MSX was first documented in Prince Edward Island following a mortality report in Bedeque Bay. Highly infected oysters were monitored to assess MSX prevalence, sporulation, infection severity, and mortality. Histological analysis indicates a dramatic increase in MSX prevalence in mature oyster populations from July (average 26%) to August (average 93%), and estimated mortalities climb to an average of 77% by December 2024 (see Table). Field trials indicate that naïve juveniles reach 100% MSX prevalence by PCR after 1.5 months of exposure. Efforts to understand the role of salinity on oyster survivability are investigated through low salinity immersion trials (parasite degradation observed after 11 days at 8-10 ppt, see Figure) and the long-term characterization of salinity gradients in local brackish systems (distance to mouth, surface vs bottom, seasonality). Preliminary results from spring sampling (April and May 2025) of the Oyster Disease Surveillance program (>60 sites, wild and cultured oysters) are provided as an appreciation of the spread and severity of MSX across the island, following the first overwintering season since MSX detection.

Average of 5 sites in Bedeque Bay (2024)	Jul	Aug	Sep	Oct	Nov	Dec
Estimated Mortality	-	34%	54%	65%	76%	77%
MSX Prevalence (Histology)	26%	93%	92%	93%	95%	93%
Sporulation	-	21%	33%	19%	15%	10%
Infection Severity (0-3)	-	1.6	2.1	2.0	1.8	1.8



SOTO-DÁVILA, MANUEL

THE IMPACT OF REARING TEMPERATURE ON VACCINE INDUCED ANTIBODY PRODUCTION IN ATLANTIC SALMON: IMPLICATIONS FOR VACCINE EFFICACY

Manuel Soto-Dávila*, Ruth Quispe*, Shawna L. Semple, Taylor Wheatley, Frederick von Rönge, Andrew Swanson, Shona K. Whyte, Mark D. Fast

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Vaccination is crucial for Atlantic salmon farming, protecting against common bacterial infections and even OIE-notifiable diseases like infectious salmon anemia. Efficacious vaccines reduce antibiotic use, ensure healthier farmed populations and promote more sustainable production. Salmon immune responses are highly temperature-dependent and optimal water temperatures are expected to impact vaccine efficacy, while those out of the optimal range may weaken immunity and compromise protection. To assess the impact of temperature on commercial vaccination, we evaluated two market-available vaccines in salmon reared at 8°C, 12°C, and 15°C. Fish were intraperitoneally injected with 100 µL of either vaccine 1 (V1) or vaccine 2 (V2). Half of each group received a booster after, between 700-750-degree days (dd). After an additional 1200-1400 dd post boost (approx. 2000 dd post first vaccination), ten fish from each group was terminally sampled for serum IgM detection. One week later, unvaccinated donor fish were infected with ISAv (ISAV-HPR4 at TCID50 of $1x10^5$/ml) and introduced to cohabitation tanks at a 6.5:1 ratio of cohabitants to donors. Post-infection, survival rates were recorded. Preliminary results show fish boost-vaccinated with either vaccine at 15°C had higher ISAv-specific IgM levels in the serum compared to PBS controls, whereas fish boost-vaccinated at 8°C did not. Ongoing analyses focus on detecting antibodies against other vaccine components, such as *Aeromonas salmonicida* and *Vibrio anguillarum*. These findings highlight the importance of temperature in optimizing vaccine efficacy for Atlantic salmon production.

SUDPRASEART, CHIRANAN

THE EFFECT OF PURPLE NON-SULFUR BACTERIA ON GROWTH PERFORMANCE AND INNATE IMMUNITY IN RED TILAPIA (*Oreochromis mossambicus X Oreochromis niloticus*)

Chiranan Sudpraseart*[1,2], Prawporn Thaijongrak[1], Dominique P Bureau[2], and Wanna Sirimanapong[1]

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Red tilapia (*Oreochromis mossambicus* × *Oreochromis niloticus*) is a key aquaculture species in Thailand, valued for its fast growth and adaptability. However, disease outbreaks, particularly Streptococcosis caused by *Streptococcus agalactiae*, pose serious economic threats to this industry. This study aimed to investigate the effects of *Cereibacter johrii* isolated from an earthen tilapia pond on growth performance and innate immunity in red tilapia. Fish were fed diets supplemented with alive *C. johrii* at 0 (Control), 10^6, 10^7, and 10^8 CFU/mL for 28 days. Fish receiving the diet with 10^8 CFU/mL of *C. johrii* showed significantly improved final weight and feed conversion ratio (FCR) compared to the control ($P < 0.05$; Table 1). In addition, feeding this diet significantly increased the survival of the fish following *S. agalactiae* challenge (Figure 1). Innate immune responses: % trypsin inhibition, plasma peroxidase, total protein, and lysozyme activity were activated by day 7 and declined by day 14 in the dietary experiment, while responses in the post-challenge test peaked earlier (day 3) and subsided by day 7. These results demonstrate the potential of *C. johrii* as a functional feed additive to enhance growth performance and disease resistance of red tilapia.

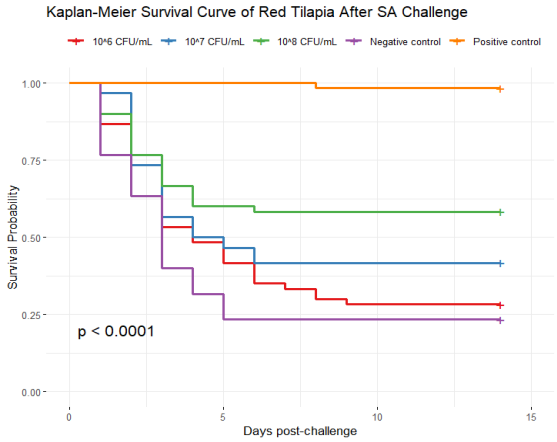

Figure 1 Kaplan–Meier survival analysis of red tilapia post-challenge with *S. agalactiae*.

Table 1 The effect of feed supplemented with *Cereibacter johrii* on growth performance of red tilapia after 28 days treatment. (n = 40 fish; 4 replicates per group)

Parameter	Treatment			
	0 CFU/mL (Control)	10^6 CFU/mL	10^7 CFU/mL	10^8 CFU/mL
Initial body weight; D0 (g)	8.6 ± 0.3	9.0 ± 0.6	9.0 ± 0.5	8.8 ± 0.7
Final body weight; D28 (g)	23.0 ± 0.7^{c}	28.0 ± 2.9^{b}	29.7 ± 3.6^{ab}	32.5 ± 2.5^{a}
Feed conversion ratio (FCR)	1.41 ± 0.22^{b}	1.17 ± 0.07^{b}	1.05 ± 0.13^{ab}	0.84 ± 0.07^{a}
Survival rate (%)	97. ± 1	98 ± 2	98 ± 2	99 ± 1

Values (mean ± SD) with different superscripts in the same row indicate significant differences ($p < 0.05$) between them

TALEVI, JASMINE

THE EFFECT OF EXTENDED HYPOXIA ON JUVENILE AND ADULT OYSTERS (*Crassostrea virginica*)

Jasmine Talevi*, Anne Dalziel, John Davidson, Luc A. Comeau, André Nadeau, Tiago Hori, and Ramón Filgueira.

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Hypoxia, defined as a dissolved oxygen concentration (DO) below 2 mg L-1, can be a significant stressor to aquatic organisms, such as sessile marine bivalves. Wild and cultured oysters in eutrophic coastal environments may experience hypoxia as anthropogenic nutrient loading fosters algal blooms that deplete oxygen upon decay. Furthermore, ocean warming exacerbates the challenges of hypoxia for bivalves as their metabolic demand rises with temperature, yet oxygen solubility decreases. Figure 1. The change in specific growth rate (mm d-1) of adult and juvenile oysters after a prolonged (30 days) exposure to hypoxia or normoxia. Environmental stressors like hypoxia may affect life stages differently, so exploring the response of different life stages is imperative. The aim of this study is to explore the response of juvenile and adult eastern oysters (*Crassostrea virginica*) to extended hypoxia under warm water temperatures. Juvenile and adult oysters were held under either normoxic or hypoxic conditions for a month at temperatures reflective of relatively warm summer water conditions in Atlantic Canada (~25ºC). Oyster growth rate

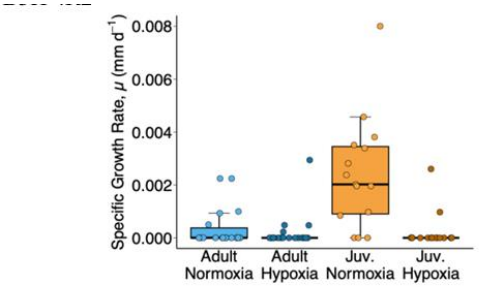

Figure 1. The change in specific growth rate (mm d^{-1}) of adult and juvenile oysters after a prolonged (30 days) exposure to hypoxia or normoxia.

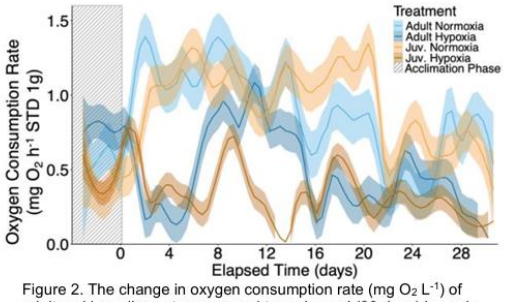

Figure 2. The change in oxygen consumption rate (mg O_2 L^{-1}) of adult and juvenile oysters exposed to prolonged (30 days) hypoxia or normoxia.

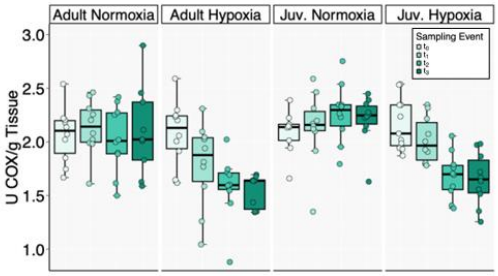

Figure 3. The change in gill cytochrome C oxidase (COX) enzyme activity (U g^{-1}) in adult and juvenile oysters exposed to prolonged (30 days) hypoxia or normoxia. Four sampling events occurred during this time: t_0) last day of acclimation, t_1) one day after exposure, t_2) 15 days after exposure, and t_3) 30 days after exposure.

TANKOVSKI, IVAN

EVALUATION OF CANOLA MEAL IN ATLANTIC SALMON DIETS: EFFECTS ON NUTRIENT DIGESTIBILITY, GROWTH AND HEALTH PERFORMANCE

Ivan Tankovski*, Angela Liu, Van Pham Thi Ha To, Essi Evans, Ellen McNabb, Chris Manchur, Curtis Rempel

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Canola meal (*Brassica napus*) is a promising, cost-effective ingredient for salmon feeds, with an amino acid profile comparable to fish meals. Two trials were conducted to evaluate solvent-extracted canola meal (CM; 42% protein) in Atlantic salmon. In a freshwater digestibility trial (passive collection) study, a reference diet was replaced with 10, 20, 30, and 40% of CM. The apparent digestibility coefficient (ADC) of nutrients was positively correlated with CM inclusion. At 40% CM, energy, protein, and essential amino acids ADC were 57.7%, 77.1%, and 83.0–93.9%, respectively. In a 103-day saltwater grow-out trial, post-smolt Atlantic salmon (245.6 ± 2.8 g) were fed four diets containing 0, 5, 10, or 15% canola meal. Growth and feed conversion ratio were comparable between the control group and the fish fed 5 and 10% CM (Table 1). Whole-body composition (protein, lipid, and ash) and plasma chemistry (e.g., immunoglobulin, lysozyme, glutathione peroxidase, catalase, and thyroid hormones) were similar across all diets (P>0.05). Intestinal morphology also did not exhibit any significant changes. In conclusion, 5% to 10% CM can be incorporated into Atlantic salmon diets as a cost-effective raw material.

Table 1. Initial body weight (IBW), final body weight (FBW), weight gain (WG), feed input (FI), feed conversion (FCR), thermal unit growth coefficient (TGC), and specific growth rate (SGR) of Atlantic salmon fed graded inclusion levels of canola meal (CM) after a 103-day culture period.

Diet	IBW (g fish^{-1})	FBW (g fish^{-1})	WG (g fish^{-1})	FI (g fish^{-1})	FCR	TGC [g$^{1/3}$ (^{o}C d^{-1})]	SGR (%/day)
CM0	245.7 (2.9)	717.0 (32.5)^{a}	471.3 (33.9)^{a}	451.3 (26.3)	0.96 (0.02)^{b}	0.201 (0.011)^{a}	1.04 (0.05)^{a}
CM5	245.4 (3.8)	685.3 (14.6)^{ab}	439.9 (10.9)^{ab}	420.8 (7.2)	0.96 (0.02)^{b}	0.191 (0.002)^{ab}	1.00 (0.01)^{ab}
CM10	244.4 (2.9)	664.3 (23.8)^{ab}	419.9 (22.5)^{ab}	414.5 (14.3)	0.99 (0.02)^{ab}	0.185 (0.007)^{ab}	0.97 (0.03)^{ab}
CM15	246.8 (2.9)	655.7 (10.7)^{b}	408.9 (8.8)^{b}	421.1 (5.3)	1.03 (0.01)^{a}	0.180 (0.003)^{b}	0.95 (0.01)^{b}
P-value	**0.8304**	**0.0382**	**0.0326**	**0.0761**	**0.0043**	**0.0302**	**0.0297**

TIBBETTS, SEAN

NUTRITIONAL EVALUATIONS OF MADE-IN-CANADA MICROBIAL SINGLE-CELL PROTEIN (PSOMI™) MEALS FOR ATLANTIC SALMON *Salmo salar* L. AQUAFEEDS.

Sean M. Tibbetts*, Shane J.J. Patelakis, Marta J. Piercey, Roberto E. Armenta, Brianna Orr Stratton, Talia Boates, André Dumas, Ivan Tankovski, Van Pham Thi Ha To, Noppawan Chimsung, Stefanie M. Colombo

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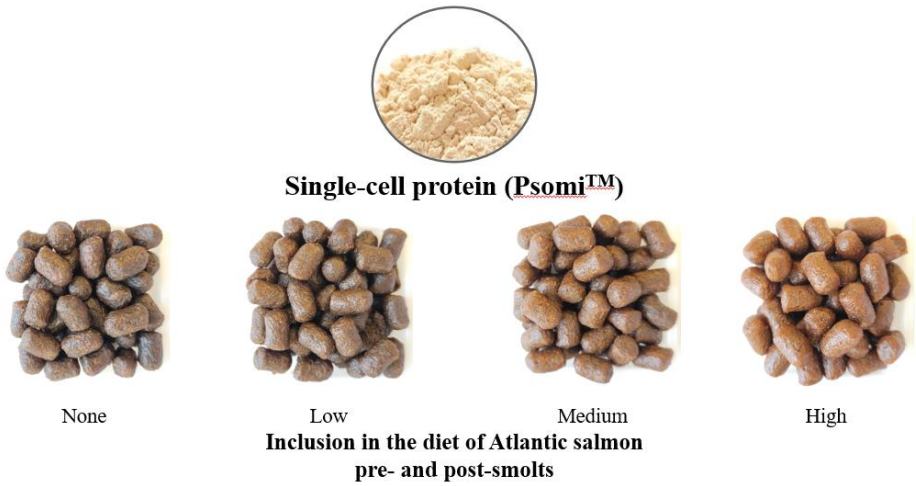
Scalable fermentation of naturally-occurring methylotrophic (methanol-oxidizing) bacteria is a promising way to convert single-carbon (C_1) feedstocks into protein-rich biomass. This biomass has good potential to increase the novel feed ingredient basket to support salmon aquaculture sustainability. Results will be presented from several nutritional evaluation trials of *Methylovorous menthalis* microbial single-cell protein (Psomi™) meal as low-trophic ingredients for pre- and post-smolt Atlantic salmon. Pre-smolt trials established single-ingredient apparent digestibility coefficients (ADCs), measured dietary ADCs at partial or full substitution of plant-proteins, and evaluated impacts of graded inclusion (up to 30%) at partial or full substitution of marine and terrestrial ingredients on feed intake, growth, nutrient utilization, and fish health. Post-smolt trials evaluated nutritionally-balanced low fishmeal diets containing graded Psomi™ levels (up to 30%) at partial or full substitution of soy protein concentrate for medium- and large-sized fish by evaluating feed intake, growth, nutrient utilization, fish health, and fillet quality. DeNova's microbial single-cell protein meal (Psomi™) can be included in Atlantic salmon pre- and post-smolt aquafeeds at up to 20% in substitution of conventional marine and terrestrial plant-protein ingredients with minimal or no impacts on feed intake, digestibility, production performance, whole-body composition, nutrient utilization, intestinal histopathology, fish health, or fillet nutritional quality.



TYMOSHUK, KIT

THE EFFICACY OF SEEDING FROM GAMETOPHYTES IN NOVA SCOTIAN SUGAR KELP AQUACULTURE

Tymoshuk K1, Buchwald C1

1Dalhousie University, Halifax, Nova Scotia, Canada, B3H 4R2

Optimizing nursery protocols and reducing risk to farmers is crucial to increasing seaweed cultivation. In Nova Scotia, it is difficult to find spawning seaweed earlier than October, resulting in a delayed nursery phase and a shortened growing season. Seeding spools from sugar kelp (*Saccharina latissima*) gametophyte cultures decouples the nursery phase from the timing of maturing kelp, allowing farmers more flexibility in starting their crop in the fall. This method also reduces the length of the nursery phase, with the potential to obviate the nursery process altogether. In this study we will compare the biomass of sporophytes grown from gametophyte cultures and traditional seeding methods using wild mature kelp tissue. Gametophyte biomass was homogenized and sprayed onto nylon twine using a paint spray gun. Gametophyte spools were deployed on November 27th, and traditional spools on December 16th, in Mahone Bay, Nova Scotia. Both treatments were deployed after a six-week nursery phase. Preliminary out planting results suggest that the gametophyte grown sporophytes have a significantly higher width to frond ratio compared to the spore grown sporophytes, and that sporophytes length and density is impacted by proximity to shore and location on the line. This study involves novel methods that will provide baseline data on the effectiveness of using gametophyte cultures in kelp aquaculture. Increasing the accessibility around, and reducing the risks involved in, kelp aquaculture can help encourage uptake of environmentally conscious aquaculture systems in Nova Scotia.

VANDERSTEEN, WENDY

DEVELOPMENT OF A GUT DYSBIOSIS ASSAY FOR CHINOOK SALMON *Oncorhynchus tshawytscha*

Wendy Vandersteen*, Barb Cannon, Gary Marty, Barry Milligan, Ahmed Siah

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The gut microbiome is an important component of health status through interaction with the immune system, nutrient metabolism, behaviour, and other physiological pathways. Enteritis is a condition impacting the production of salmon. Although the cause of the enteritis is not always known, it is believed that a dysbiosis in the gut microbial communities underlies its development. Aside from impacting aquaculture production through reduced growth and increased mortality, gut enteritis is a fish welfare issue and an environmental issue through reduced absorption of nutrients from food, increased sensitivity to environmental stressors, and increased susceptibility to pathogens.

Despite the importance for overall fish health and welfare, there is limited understanding of the functional and taxonomic composition of a healthy microbiome. The overall objective of this project is to provide proof-of-concept of a test to assess gut dysbiosis from a fecal sample. This test will be validated as a screening tool to help fish health professionals make informed decisions on treatment strategies. In addition, the test will facilitate further work to assess the effectiveness of probiotics or other nutritional supplements on maintaining healthy gut microbiomes and allow for further progress towards sustainable use of resources and optimal fish health and welfare.

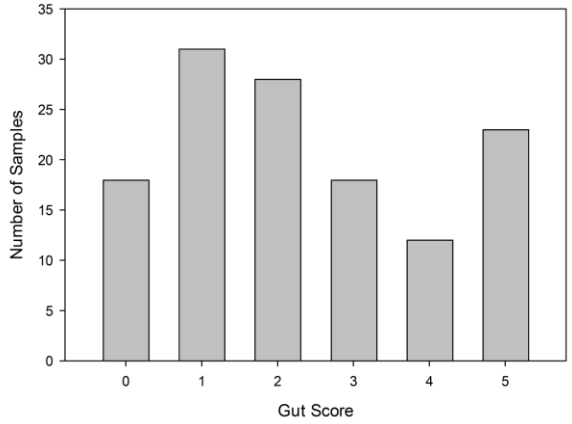

Figure 1. Distribution of visual gut enteritis scores from 100 fish (0 = none present; 5 = severe).

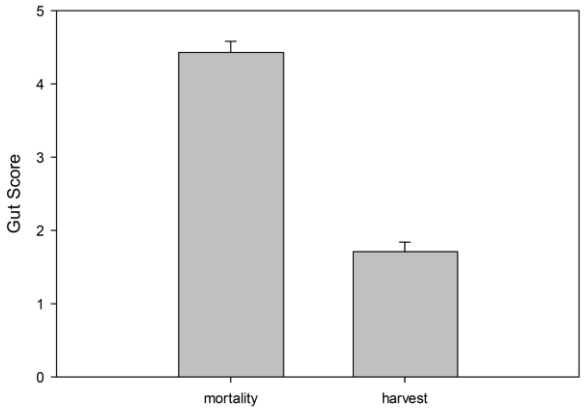

Figure 2. Mean gut score was higher (more severe enteritis) in fresh mortalities relative to fish sampled for harvest.

VASQUEZ, IGNACIO

MICROBIOME OF EARLY LIVE STAGES IN SPOTTED WOLFISH REVEAL POTENTIAL VERTICAL TRANSMITED PATHOGENS

Ignacio Vasquez*, Oluwatoyin Onireti, Trung Cao, Denise Tucker, Danny Boyce, Javier Santander

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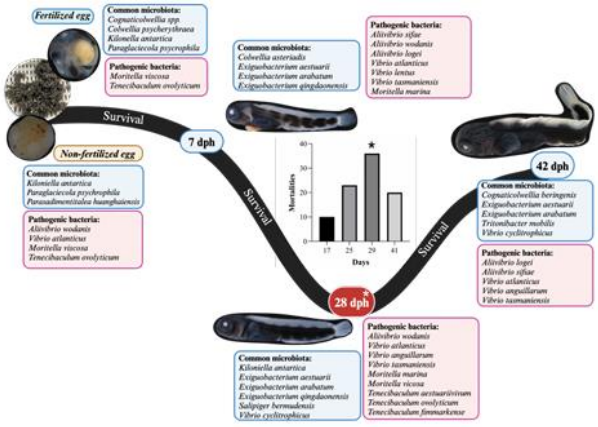
Spotted wolfish is an emerging cold-water aquaculture industry. However, early larval mortality, potentially caused by vertically trasmitted pathogens from broodstok to the offspring, poses a challenge to its large-scale production. This study characterized the microbiota shifts associated to health outcomes and identify potential vertical transmited pathogens causing larvae mortalities. Here we evaluated the viable-cultivable microbial loads and microbiome composition in ovarian fluid, sperms, non-fertilized and fertilized embryos, and larvae stages at 1, 7, 14, 21, 28, 35, and 42, days post-hatch (dph) (n=10 per time point). Total oligotrophic bacteria in the ovarian fluid and sperm was 101 and 102-105 CFU/mL, respectively. Bacterial loads were found across stages, with significant differences observed at 28 dph, coinciding with the highest larvae mortality rate observed. Microbiome analysis identified *Kiloniella spp., Paraglaciecola spp., Cognaticolwellia spp. and Exiguobacterium spp.* as native microbiota of wolfish in early life stages. However, opportunistic pathogens such as *Moritella spp, Aliivibrio spp., Vibrio spp.* and *Tenecibaculum spp.,* were present across stages, becoming more dominant after 7 dph. Pathogenic bacteria found in the eggs microbiome, suggest that these pathogens could be vertically transmitted and might cause the peak in mortality observed at 28-29 dph.



Graphical abstract. Microbiome of spotted wolfish in early developmental stages.

WAGNER, BRETT

ENGINEERING INSPECTIONS FOR MARINE FINFISH FARMS: ADVANCING BEST PRACTICES

Brett Wagner*, Dean Steinke, Colin Wilson, Josh Jacoby

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Marine finfish farming is a critical part of the global agriculture and seafood industry, providing sustainable sources of protein to meet the growing demand. However, the structural integrity of these aquaculture systems is critical to prevent fish escapes and ensure sustainability of the sector. To ensure that moorings, nets, and structures are in suitable condition, systematic and repeatable inspections are used to mitigate risk. This presentation focuses on the current state, technologies-used, and role of comprehensive engineering inspections in Canada.

Figure 1 Fish farm inspection in British Columbia

By employing a systematic approach, these 3rd party inspections assess various components including plastic collar net-pens, steel structures, mooring systems, connection points, and underwater infrastructure. Through real-world examples and case studies, this presentation highlights typical issues encountered during inspections, such as corrosion, excessive structural loading, and insufficient freeboard. The inspections provide farm operators with actionable insights to enhance farm performance, reduce maintenance costs, and mitigate environmental impacts. These inspections often help increase the typical recommended lifespan of these systems beyond 20 years. By integrating engineering inspections into routine farm management, stakeholders are in alignment with standards such as NS9415. This presentation underscores the importance of integrating engineering inspections as a best practice for sustainable and efficient marine finfish farming.

WATSON, KIERSTEN

ADAPTIVE CAPACITY FOR FINFISH AND SHELLFISH AQUACULTURE UNDER A CHANGING CLIMATE

Kiersten Watson*, Gregor Reid, Leah Lewis-McCrea

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Adaptive Capacity is an important consideration for the assessment of climate change vulnerability. Adaptive Capacity measures how much a system, such as aquaculture, can adjust to climate change over the long term. An increase in Adaptive Capacity can reduce Exposure and Sensitivity to climate change stressors. CMAR has undergone three climate change vulnerability assessments for aquaculture, which include the assessment of Adaptive Capacity. There are many options for aquaculture adaptation to climate change, from simple management changes to complex engineering or biotechnology solutions that can be applied at the farm management level or driven by wider governance initiatives. There appears to be excellent industry-wide global awareness of climate change and a good mix of traditional scientific research and industry innovation in the development of adaptive solutions. Technology for many climate change adaptation approaches already exists, but there are challenges with cost and attainability, such as shellfish hatchery and nursery development. Research needs include enhanced ocean data collection, coastal climate projections, early warning of deleterious events (e.g. HABs), alternative species culture, triploid stock, precision fish farming, and offshore aquaculture development. This presentation discusses advances in aquaculture Adaptive Capacity, priority needs, implications and a case for cautious optimism."

WEITZMAN, JENNY

LARGE-SCALE SUITABILITY ASSESSMENTS FOR POTENTIAL AQUACULTURE DEVELOPMENT IN NOVA SCOTIA: PROJECT UPDATE

Jenny Weitzman*, Laila Nargis, James Cunningham, Therese Wilson, Leah Lewis-McCrea, Gregor Reid

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Effective spatial planning is critical for sustainable aquaculture development and management. To promote holistic siting and zoning, identifying suitable areas for aquaculture is paramount, requiring comprehensive evaluations to account for multiple biophysical and ocean use factors. The Centre for Marine Applied Research is completing large-scale assessments of the potential suitability of coastal waters for aquaculture in Nova Scotia1 (Fig 1). Through an evidence-based and collaborative process, this project will identify and assess factors that influence aquaculture suitability, in consideration of critical needs for species health and welfare, potential area-use overlap with other marine users, and proximity to important coastal habitats. Drawing on Geographic Information Systems and Multi-Criteria Decision Analysis (GIS MCDA) methods, suitability will be mapped across the area of assessment, considering the combination of factors, as well as critical constraints and limitations. Derived suitability maps can identify areas with potential for sustainable aquaculture development, unique to different types of aquaculture.

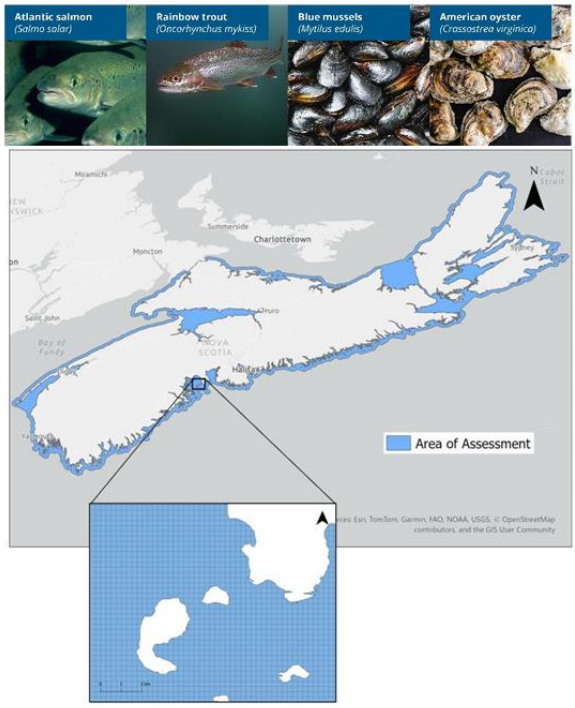

Fig 1. Suitability for aquaculture development will be assessed for four cultured species across coastal waters within 3km off Nova Scotia.

This project is also developing an online mapping platform to provide stakeholders and the public interactive access to these findings. By embracing spatial planning perspectives, the integrated GIS-MCDA approach coupled with an interactive mapping platform can help support evidence-based and holistic aquaculture decision-making.

1Developed for the Nova Scotia Government - https://novascotia.ca/coastal-classification-system engagement/

WHITE, MEREDITH

PRODUCING MSX AND DERMO RESISTANT OYSTER SEED FOR PRINCE EDWARD ISLAND

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The presence of MSX, caused by the protozoan *Haplosporidium nelsoni,* was confirmed on Prince Edward Island (PEI) in summer 2024. Outbreaks of MSX cause up to 95% mortality in Eastern oyster (*Crassostrea virginica*) populations. A second oyster pathogen, *Perkinsus marinus* (Dermo), was detected across the Northumberland Strait in New Brunswick in November 2024. Dermo outbreaks can cause 50-75% mortality in oyster populations. These diseases represent a significant threat to the PEI wild and cultured oyster industries, which landed nearly 77 million pieces in 2023, valued at $23,790,000.

When MSX outbreaks have occurred in regions of the United States, the industry recovered by using disease resistant oyster seed. There are two approaches to producing disease resistant seed: a long-term approach (5-8 years) of developing a local oyster breeding program to select for disease resistance, and a short-term approach (feasible summer 2025) to import disease resistant seed from US hatcheries, or disease resistant broodstock from US Oyster Breeding Programs. Atlantic Aqua Farms, Ltd., a PEI-based shellfish producer and distributor, believes that both approaches are necessary for the PEI oyster industry to survive the threat of these pathogens. We present on possible solutions offered by importation of disease resistant seed and/or broodstock.

WILLIAMS, DANIELLE

CANADIAN FOOD INSPECTION AGENCY DISEASE CONTROL FOR MSX & DERMO IN ATLANTIC CANADA

Dr. Danielle Williams, DVM, BSc(Agr)*

Canadian Food Inspection Agency, 21 Hallett Cres. St. John's,
NL. danielle.williams@inspection.gc.ca

This presentation will seek to share Canadian Food Inspection Agency strategies for long term disease control in an aquatic environment. The acute disease control response, including Movement Control and Primary Control Zones will be outlined in brief, followed by a more detailed discussion of the Domestic Movement Control Program, which is the strategy employed for long term disease containment in Canada. The types of movements permitted and requirements for permitting under the Domestic Movement Control Program and our future surveillance will be outlined as well.

WILSON, THERESE

NAVIGATING COEXISTENCE: PRELIMINARY FINDINGS ON PUBLIC SUPPORT FOR CO-LOCATED OFFSHORE WIND AND AQUACULTURE IN NOVA SCOTIA

Therese Wilson*, Gregor Reid, Mark Flaherty (University of Victoria), Jacob Ladenburg (Technical University of Denmark).

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twilson@perennia.ca

With the production of sustainable food and renewable energy an international priority, combining offshore wind (OSW) farms with offshore mariculture has seen growing interest. While there is presently no offshore commercial aquaculture in Nova Scotia waters, OSW development is moving forward. It is, therefore, timely to consider the potential of shared multi-use spaces combining OSW and aquaculture. While OSW perception and opinion studies have been widely conducted internationally to assess social acceptance and guide sustainable development, public support for marine multi-use spaces remains largely underexplored. To investigate people's perceptions of OSW energy production and marine multi-use spaces, a public survey combining traditional survey questions and visual preference elements was developed and distributed to Nova Scotians. This presentation will focus on preliminary results of public support for multi-use spaces and how factors like socio-demographics, familiarity with the concept of multi-use spaces, and perception of OSW development influence support. This study will help improve the knowledge of public sentiment to better understanding of offshore development planning, in support of informed decision-making for aquaculture.

XUEREB, AMANDA

THE *Haplosporidium nelsoni* GENOME, AN IMPORTANT TOOL TO ADVANCE THE UNDERSTANDING AND MANAGEMENT OF MSX DISEASE IN THE EASTERN OYSTER *Crassostrea virginica*

Amanda Xuereb*, Martin Mallet, Brian Boyle, Eric Normandeau, Tiago Hori, Rod Beresford, Claudio Slamovits, Jean-Sébastien Moore

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Canada's Eastern oyster industry is a cornerstone of sustainable seafood production in Atlantic Canada, but is now threatened by the discovery of Multinucleate sphere X disease (MSX) disease in Prince Edward Island (PEI) in summer 2024. Research on MSX disease is hampered by a lack of genomic resources for the causative agent, *Haplosporidium nelsoni*, for which only a handful of sequence fragments are publicly available. The lack of a genome greatly complicates the understanding of the population structure and dynamics of *H. nelsoni*, a full characterisation of its biology and lifecycle, and the development of better and more sensitive diagnostic tools. Our project aims to assemble the first complete chromosome-level *H. nelsoni* genome. To that end, isolated *H. nelsoni* DNA from infected oyster tissues and employed a hybrid approach using high coverage (150X) short-read sequencing and long-read (PacBio) sequencing to capture large genomic regions and structural variants. Development of a high-quality genome assembly represents a significant step towards better understanding *H. nelsoni* and MSX, providing foundational bioinformatic tools for a wide array of research questions and innovations including studies of parasite gene expression in infected tissues, targets for improved diagnostic and detection methods with greater sensitivity, and detailed epidemiological studies.

ZHANG, JUNYU

EVALUATING THE EFFECTS OF BLACK SOLDIER FLY, PROBIOTIC AND PREBIOTIC YEAST, AND SODIUM BUTYRATE ON GROWTH, NUTRITION, GUT MORPHOLOGY, AND MICROBIOME COMPOSITION IN ADULT ZEBRAFISH

Junyu Zhang*, Nancy Gao, Cody Anderson, Madeline Borland, Ilan Carmi Riesenbach, Niel Karrow, Terry Van Raay, and David Huyben

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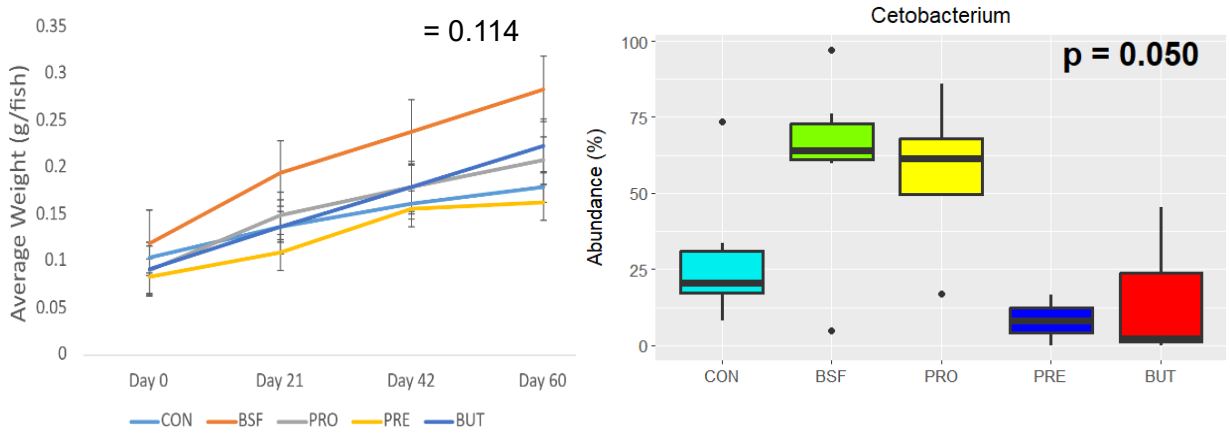
The need for sustainable alternatives to fishmeal in aquafeeds that improve fish growth and health has driven interest in black soldier fly (BSF) larvae, probiotic yeast (PRO), prebiotic yeast (PRE), and sodium butyrate (BUT) as functional ingredients. The aim of this study was to evaluate their effects on growth performance, nutrient retention, intestinal morphology, and microbiome composition in adult zebrafish (*Danio rerio*) as a model for Ontario farmed salmonids species, such as rainbow trout. A 9-week feeding trial was conducted at 27.8°C in the Hagen Aqualab (Guelph, ON) using diets containing BSF, PRO, PRE, or BUT, with each assigned to triplicate tanks of 50 fish. While BSF, PRO, and BUT diets led to higher weight gain (Fig. 1A) and protein retention, the differences were not statistically significant. All diets improved intestinal morphology numerically, but no significant enhancements were observed. Microbiome analysis revealed that BSF increased overall microbial diversity, with *Cetobacterium* dominating in BSF- and PRO-fed fish (Fig. 1B), suggesting a potential benefit in vitamin B12 synthesis. Additionally, all diets, particularly PRE, reduced *Aeromonas*, a common aquaculture pathogen. These findings highlight the potential of BSF, PRO, PRE and BUT in aquafeeds to improve the growth and health of zebrafish as a model for farmed fish



ure 1. A) Average body weight (g/fish) and B) relative abundance of *Cetobacterium* in zebrafish fed the control diet ON), black soldier fly meal (BSF), probiotic yeast (PRO), prebiotic yeast (PRE), and butyrate (BUT) (n= 2-3/diet).

POSTER PRESENTATIONS

BEAUDREAU, NICHOLAS

EXPLORING ACOUSTIC SIGNALS IN FARMED FISH: DIVERSITY OF RESPONSES AND PERSPECTIVES

Nicholas Beaudreau*, Stéphanie Pieddessaux, Désirée Stockermans, Mark Wood, Morgyn Hynes, Pedro Machado

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The production of healthy, high-quality farmed fish depends on rigorous monitoring of environmental conditions, health status, and feeding behavior, among other factors. For aquaculture farmers, adopting AI-driven continuous monitoring tools can optimise operations by enabling real-time adjustments to these critical parameters. This advancement is of great interest to the aquaculture industry, regulatory bodies, and consumers alike. The aquatic soundscape is rich with untapped acoustic information communicated by fish and could potentially inform decision-making. Passive hydroacoustic monitoring has the potential to capture biologically relevant signals relating to fish behaviour, health, nutrition and more. Hydrophones were secured inside separate land-based rearing tanks containing either adult striped bass (Morone saxitilis) or adult spotted wolffish (Anarhichas minor) over a two-week period to estimate the diversity of routine sounds expressed by each species. We present preliminary annotated data suggesting that, with improved capabilities and specificity, passive acoustic monitoring may constitute a cost-effective tool for optimization of fish farming operations both land based and at sea.

DAS, AMIT

VARIATIONS IN NUTRITIONAL AND BIOACTIVE PROPERTIES OF NORTH ATLANTIC SEA CUCUMBER *(CUCUMARIA FRONDOSA)*: ROLE OF SEASONALITY, LOCATION, AND PROCESSING

Amit Das *, Abul Hossain, Heather Burke and Deepika Dave

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Sea cucumbers are valued as traditional and luxury seafood, known for their rich nutritional and bioactive profiles. However, the effects of seasonality, geographical location, and processing methods on these qualities remain underexplored. This study assessed the nutritional and bioactive profiles of *Cucumaria frondosa* across different seasons, geographical zones (Eastern and Western St. Pierre Bank, NL, Canada), and processing methods (hot air drying and boiling). The findings revealed that the hot air drying and boiling significantly enhanced protein, lipid, carotenoid, and phenolic contents compared to fresh samples, with notable variations observed among body parts (body wall, aquapharyngeal bulb, internal organs). Among the treatments, hot air drying depicted higher ash and phenolics content, while boiling combined with hot air drying resulted in higher protein content. In the case of lipid and carotenoids, both treatments represented better results than the non-treated fresh samples. Seasonal differences were minimal, but samples collected in August showed higher nutritional values. These findings provide valuable insights for optimizing processing techniques and harvesting strategies, enabling the development of high-quality, nutrient-rich sea cucumber products for functional food and nutraceutical applications.

ESLAMLOO, KHALIL

REPRODUCTIVE PERFORMANCE OF ATLANTIC SALMON UNDER ELEVATED TEMPERATURE

Khalil Eslamloo*, Eric H. Ignatz, Leah Lewis-McCrea, Gregor K. Reid

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27 Parker Street, Dartmouth, Nova Scotia, Canada B2Y 4T5
keslamloo@perennia.ca

We conducted a survey on the current knowledge of the effects of elevated water temperatures on Atlantic salmon (*Salmo salar*) reproductive performance. Under current and projected climate change, wild and farmed populations of Atlantic salmon, including their offspring, will experience elevated temperatures. Generally, chronic exposure to excessively elevated temperatures can severely disrupt the gonadal development and spawning of Atlantic salmon. In cases of lower severity, elevated temperatures reduce fertility, egg size and survival. Populations of farmed Atlantic salmon broodstock adapted to the southern hemisphere exhibit a higher tolerance to elevated temperatures compared to their northern counterparts, possibly due to acclimatization to warmer temperatures over time. Also, the maiden broodstocks of Atlantic salmon show a higher thermal sensitivity compared with the repeat spawners. In addition to the age- and population, the duration and timing of exposure to elevated water temperatures influence the magnitude of the effects, with the thermal sensitivity of female broodstock peaking in the last stages of vitellogenesis. However, changes to fish husbandry practices may help mitigate any potential negative effects. Given population-associated responses to elevated temperatures, and variability of projected temperature change in coastal waters, further investigations are warranted.

HORNBY, EMMA

COMPARISON OF WATER CHEMISTRY, FISH GROWTH, AND PLANT YIELD FOR AQUAPONICS FISH FEED AND COMMERCIALLY-AVAILABLE FEED FOR GROWING KOI AND GREEN ONIONS

Danielle Maitland, Emma Hornby*, Stefanie Colombo.

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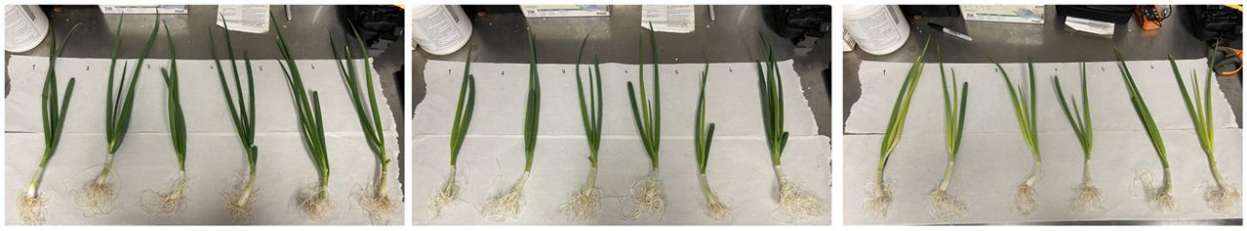
Email: ehornby@finleaftech.com

As an emerging, sustainable food production method, a primary hurdle to the optimization and commercial-scale success of aquaponics is the difficulty encountered trying to balance the quality and concentration of natural fertilizers produced by the fish with the plants' macro- and micro-nutrient needs. One contributing factor to these deficiencies is that currently available aquaculture feeds have been designed over several decades to limit the nutrients released by farmed fish to decrease the environmental impact of traditional fish farming. This is especially true for the phosphorus content of fish feed.

We designed an aquaponics-specific koi diet with the goal of increasing nutrient availability and crop growth. Using three small-scale coupled aquaponics systems, systems were randomly assigned to contain fish fed the aquaponics-specific fish feed, fish fed the commercially available fish feed, or no fish/fish feed. 6 green onions were planted in each system. Three temporally-spaced repeats were completed. We compared dissolved nutrient generation, fish growth, green onion growth/yield, and plant nutrient content.

The "aquaponics" diet corresponded to a more concentrated nutrient solution, improved fish growth, and increased green onion yield, compared to the commercially available diet. Both diets outperformed the water-only control.



AQUAPONICS FISH FEED COMMERCIAL FISH FEED WATER ONLY CONTROL

ISSA, ZEENTA

EFFECTS OF LIFE-STAGE, NUTRITION AND GENETIC FAMILY ON GROWTH PERFORMANCE AND GUT MICROBIOTA IN RAINBOW TROUT *Oncorhynchus mykiss*

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Gut microbiota play a critical role in fish nutrition, yet their development and interaction with host genetics and age remain poorly understood. This study aims to investigate how genetic lineage and life-stage influence nutritional and gut microbial composition of rainbow trout and whether prebiotic yeast supplementation will enhance growth performance and gut health.

Rainbow trout from 12 hatchery-reared families will be produced using half- and full-sibling design. Gut samples will be collected from parents (0months), fry (4months), fingerlings (8months), juveniles (12months) to track microbial development (n=5 per family/stage). At the fingerling stage, 720 fish will be PIT-tagged and assigned to six 1500L tanks (3 control, 3 prebiotic) for a 16-week feeding trial at the Ontario Aquaculture Research Centre (Elora, ON). Growth performance will be recorded, carcasses, intestinal content and fin clips will be collected. Nutrition, gut microbiome and genotypes will be analyzed using proximate analysis, 16S-rRNA gene sequencing, and SNP genotyping (n=20 per family/diet).

Firstly, it is expected that nutritional and gut microbiome composition will vary by genetic lineage and life-stage. Secondly, prebiotics may increase nutrient digestibility, growth and microbial diversity of rainbow trout. Correlating these performance and genetic traits will provide insights for improved aquaculture breeding and feeding strategies.

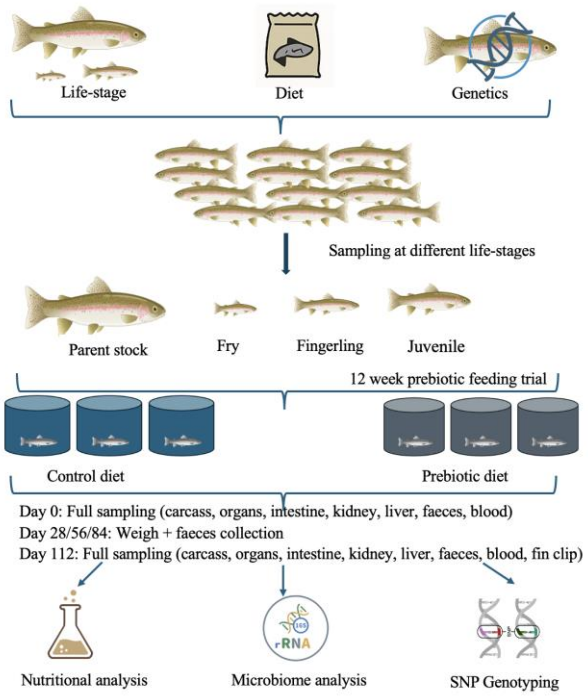

Figure 1. Experimental timeline and methodology for assessing life-stage, dietary and genetic effects on rainbow trout gut microbiota.

LEEFE, LAUREN

BUILDING A RISK FRAMEWORK FOR DERMO DISEASE (*Perkinsus marinus*) IN NOVA SCOTIAN OYSTER FARMS

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In Nova Scotia, the sustainability of the oyster aquaculture industry faces a threat due to the recent detection of *Perkinsus marinus,* the parasite commonly known for causing dermo disease in eastern oysters (*Crassostrea virginica*). Dermo poses no risk to human health; however, it can affect oyster growth and cause mass oyster mortalities. Dermo development is influenced by environmental conditions, primarily temperature and salinity, as their increase have been shown to increase the severity of dermo and lead to higher mortalities in infected oyster populations. Modelling can be useful in exploring the potential impact of parasitic diseases, such as dermo, on oyster farms under varying environmental scenarios. This project aims to create a model that examines the risk of dermo causing oyster mortality based on initial parasitic load, oyster density, water temperature and salinity as the primary variables. A sensitivity analysis will also be conducted to examine the relative influence of each parameter on oyster mortality. This project aims to support the Nova Scotian oyster aquaculture industry by providing a tool to assess the risk of local conditions on oyster mortality and to inform future oyster site management decisions related to dermo disease.

MISK, EHAB

THERMAL MODULATION OF GENETIC RESISTANCE TO INFECTIOUS SALMON ANEMIA VIRUS: DIFFERENTIAL GENE EXPRESSION ANALYSES IN ATLANTIC SALMON FAMILIES (*SALMO SALAR*) AT 10°C AND 20°C

Ehab Misk*, Laura G Roves, Shona K Whyte, Sara L Purcell, Dylan Michaud, Wenlong C Cai, Amber F Garber, Mark D. Fast
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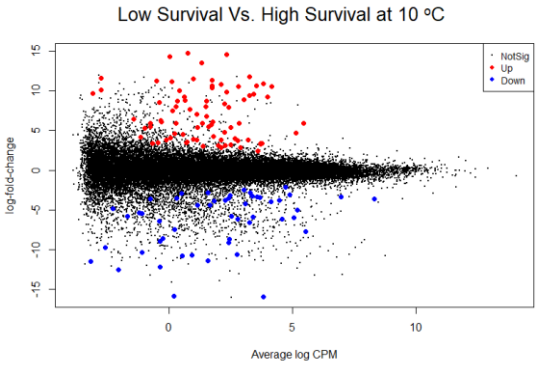
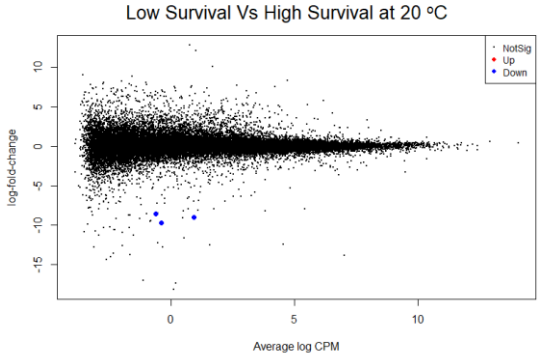
Infectious Salmon Anaemia Virus (ISAv) poses a significant threat to Atlantic salmon aquaculture, yet the interplay between genetic resistance and environmental temperature remains poorly understood. This study investigates how thermal stress modulates transcriptomic responses in ISAv-resistant and susceptible Atlantic salmon (Salmo salar) families. Head kidney RNA-seq data from resistant (high survival) and susceptible (low survival) families infected with ISAv at 10°C and 20°C were analyzed using EdgeR to identify differentially expressed genes (DEGs) and functional pathways.





Resistant families exhibited 134 DEGs compared to susceptible families at 10°C, enriched in pathways critical to muscle contraction, calcium signaling, and immune response (e.g., C-type lectin receptors, complement system). Strikingly, only three DEGs were detected at 20°C, indicating minimal transcriptional divergence. Resistant families displayed pronounced temperature sensitivity, with 329 DEGs between 10°C and 20°C, including heat shock proteins and MAPK signaling components. In contrast, susceptible families showed no significant transcriptomic response to temperature shifts, highlighting their limited adaptive capacity. Functional clusters revealed temperature-dependent regulation of energy metabolism, protein folding, and immune pathways in resistant families, aligning with their survival advantage (81–93% vs. 32–54% in susceptible families).

These findings underscore the critical role of temperature in shaping genetic resistance to ISAv. Resistant families leverage dynamic transcriptomic adjustments to mitigate infection under thermal stress, while susceptible families lack this plasticity. This study provides novel insights into the molecular mechanisms underlying temperature-genetic interactions and advocates for integrated breeding strategies that account for environmental variability to enhance disease resilience in aquaculture.

PARAMANATHAN, THURKA

BLACK GOLD OF THE OCEAN: EXTRACTION AND CHARACTERIZATION OF MARINE MICROBIAL MELANIN

Thurka Paramanathan[1]*, Ignacio Vasquez[1], Sathees Duglas[1], Aqsa Maqsood[1], Raja Gurung[1], Jaime Soto-Neira[1],Vimbai I. Machimbirike[1], Céline Schneider[2], and Javier Santander[1]

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2-Core Science Facility, Memorial University of Newfoundland, Canada

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Melanin is a dark pigment with diverse structures derived from the oxidation and polymerization of tyrosine or phenolic compounds. It is produced by various organisms, including bacteria, and has attracted significant interest due to its structural stability, thermostability, electrochemical and biological properties. This study focuses on extracting and characterizing melanin from *Aeromonas salmonicida* subsp. *salmonicida* J223, a marine bacterium that produces extracellular melanin. The pigment was extracted via acid-hydrolysis and analyzed using UV–Visible spectroscopy, Near-Infrared Spectroscopy (NIR), Elemental Analysis (EA), X-ray Diffraction (XRD), Thermogravimetric Analysis (TGA), Solid-state ^{1}H and ^{13}C NMR, and Scanning Electron Microscopy (SEM). It was insoluble in water, ethanol, and HCl but dissolved in DMSO and NaOH. Oxidation with H_2O_2 and bleach, along with precipitation by acid and $FeCl_3$, further confirmed its chemical properties. EA revealed 56.4% C, 4.8% H, 8.4% N, 1.9% S, and 28.5% O, with a high carbon-to-hydrogen ratio indicating aromatic richness. UV–Visible spectra confirmed eumelanin dominance (A650/A500 ratio: 0.43–0.53). TGA demonstrated high thermal stability, retaining 50% mass at 550°C, while XRD confirmed its amorphous nature. Alamar-Blue assay confirmed melanin is non-cytotoxic. These findings highlight *A. salmonicida* as a promising source of natural-melanin with properties comparable to natural and synthetic counterparts.

RAQUIB, AHSAN

A SYSTEMATIC REVIEW OF RISK FACTORS OF INFECTIOUS SALMON ANEMIA VIRUS IN ATLANTIC SALMON AND RAINBOW TROUT

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1. Department of Health Management, Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, C1A 4P3, PE, Canada

2. Centre for Veterinary Epidemiological Research (CVER), Atlantic Veterinary College, University of Prince Edward Island, Charlottetown, Prince Edward Island C1A 4P3, Canada
Presenting author's email: araquib@upei.ca

This article presents a systematic review aimed at identifying risk factors associated with outbreaks or mortality associated with ISAV infection, as well as those influencing the time from stocking to ISAV detection or related mortality. This systematic review was designed and reported following the PRISMA guidelines. The existing scientific literature in four databases was searched using predefined search terms for each database to find scientific literature published until 28th June 2024. Two authors independently screened articles and extracted data. A total of 514 studies were identified through the search in four databases and Google Scholar. Twenty-four studies were included for full-text screening following title and abstract screening. After full-text screening, 10 studies were included in the final systematic review. The greatest number of studies (four) were conducted in Norway, followed by three in Canada, and two each in the USA and Chile. Most (5) studies were published between 2000-2010, and only 1 study has been published since 2020. This systematic review will provide a compilation of identified risk factors for ISA and will facilitate the further refinement of the prevention and control strategies against this disease.

REHMAN, ATTIQ

DEVELOPMENT AND VALIDATION OF A MULTIPLEX QUANTITATIVE POLYMERASE CHAIN REACTION (MQPCR) FOR THE DETECTION AND QUANTIFICATION OF THREE PARASITES MSX, SSO AND DERMO OF OYSTERS.

Rebecca Liston; Eric Johnsen; Nara Surtt; Rebecca Jensen, Diane Botelho & Attiq Rehman*

New Brunswick Research and Productivity Council (RPC)
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Haplosporidium nelsoni (MSX), *Haplosporidium costale* (SSO), and *Perkinsus marinus* (Dermo disease) have been causing significant oyster mortality along the North American east coast since the 1950s. Since July 2024, both MSX and Dermo disease outbreaks pose a severe threat to the Atlantic Canadian oyster industry, warranting the need for rapid detection and reporting.
Compared to histopathological diagnostics, MQPCR is a tool not only for the detection of three targets simultaneously but has applications in:

i. rapid diagnostic testing,
ii. investigation of point sources of contamination,
iii. routine screening at seeding, harvest and various levels of product handling,
iv. surveillance, inspection and certification, and
v. research.

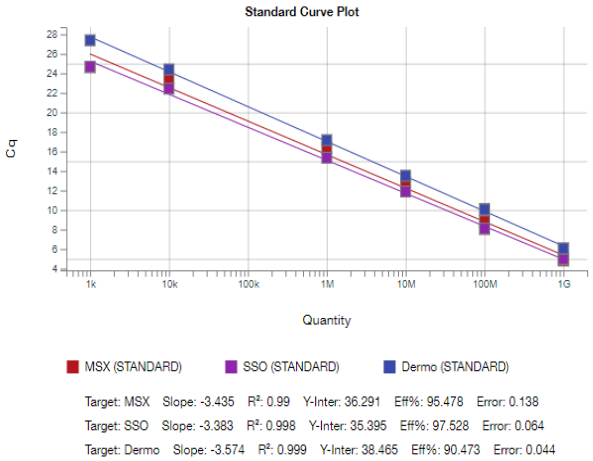

Figure1: Standard Curve of MSX, SSO and Dermo

The objective of this research was to provide the oyster industry with a cost-effective, rapid diagnostic molecular tool for simultaneous detection of three parasites in a single PCR reaction. The assay exhibited no cross-reactivity between three species with an efficiency of > 90% & R^2 of > 0.99 (Figure 1). The assay limit of detection was as low as 3.0 gene copies/µl for each target. The results from artificial spikes exhibited accuracy and precision in the range of > 98-99%. The assay automation will further improve diagnostic testing, providing better monitoring and management of oyster diseases.

RIVERA-MÉNDEZ, LAURA

OREOCHROMICIN-2 AS AN ALTERNATIVE TO ANTIBIOTICS: TEMPERATURE-DEPENDENT EFFECTS AGAINST *Flavobacterium columnare*

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The intensification of fish farming has led to frequent outbreaks of infectious diseases, causing significant economic losses in the aquaculture industry. Antibiotics have been extensively used to mitigate infections; however, the rise of antibiotic-resistant bacteria has demanded the search for alternative treatments. Antimicrobial peptides (AMPs) have emerged as promising candidates due to their broad-spectrum antimicrobial properties and ability to modulate the immune response. In Nile tilapia (*Oreochromis niloticus*), a novel AMP, named Oreochromicin-2, has been identified in the gills and has demonstrated potent antimicrobial activity against bacterial pathogens. Since fish are ectothermic organisms, temperature plays a crucial role in their immune response and disease resolution. Higher temperatures have been associated with improved infection outcomes. *Flavobacterium columnare* is a major bacterial pathogen in freshwater fish, responsible for columnaris disease, which leads to severe skin and gill lesions, high mortality rates, and significant economic losses in aquaculture. This study aims to evaluate the effect of Oreochromicin-2 at different temperatures (18°C, 21°C, 28°C, and 30°C) against *Flavobacterium columnare*. By understanding the temperature-dependent antimicrobial efficacy of Oreochromicin-2, this research provides insights into future cellular and *in vivo* experiments to optimize treatment conditions in aquaculture, enhancing disease management strategies while reducing antibiotic dependency.

ROMERO-ROSALES, VERONICA

THE CHARACTERIZATION OF THE ZEBRA MUSSEL (INVASIVE SPECIES) FOR DETECTION THROUGH ARTIFICIAL VISION

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Zebra mussels are an invasive aquatic species that appeared in the Great Lakes and the St. Lawrence River in 1986, causing a rapid decline in populations of several native freshwater mussel species grouped under the term 'mulettes' (Gillis & Mackie, 1994). The difficulty in establishing an effective detection program and population control comes mainly from the fact that current methods require skilled labor, which is relatively rare and expensive.

The goal of this project is to acquire the basic knowledge needed to develop algorithms for an automated solution that utilizes artificial intelligence—not only for detection (Galloway et al., 2022; Ling et al., 2016) but also for controlling zebra mussel populations. The characterization of the zebra mussel is a crucial step, as it will serve as the foundation for defining an algorithm for visual recognition.

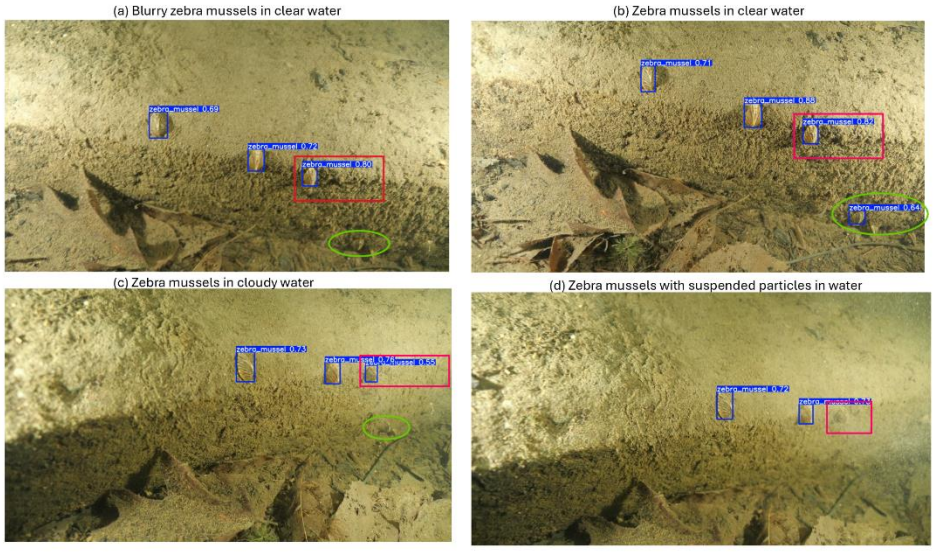

Fig. 1 Zebra mussels detection performance under varying water turbidity conditions

Zebra mussels have distinctive features that make them stand out from their environment, and visual recognition should easily achieve at least 90% accuracy under optimal visibility conditions (depending on light levels, turbidity, etc.)

SALVO, FLORA

DEVELOPMENT OF AN INTERACTIVE GIS TOOL FOR MACROALGAE AQUACULTURE SITE SELECTION

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Table 1: List of selected parameters for selecting potential sites for seaweed projects.

Factor	Impact	Source
Bathymetry	Infrastructure	Canadian Hydrographic Service
Current	Infrastructure	Fisheries and Oceans Canada
Swell	Infrastructure	N/A
Nature of the seabed	Infrastructure	Fisheries and Oceans Canada
Temperature	Biological	Fisheries and Oceans Canada Bio-ORACLE marine data layers
Salinity	Biological	Fisheries and Oceans Canada Bio-ORACLE marine data layers
Turbidity	Biological	Fisheries and Oceans Canada Bio-ORACLE marine data layers
Port facilities	Usage	Transportation and Sustainable Mobility Quebec Economy, Innovation and Energy Quebec
Vessel track lines	Usage	Transportation and Sustainable Mobility Quebec Fisheries and Oceans Canada
Mariculture activity	Usage	Agriculture, Fisheries and Food of Quebec

Parks and protected areas	Usage	Environment, Fight Against Climate Change, Wildlife and Parks Quebec
Mining activities	Sanitation	Natural Resources and Forests Quebec
Contaminated site	Sanitation	Finance Quebec
Ice thickness	Infrastructure	Bio-ORACLE marine data layers
Nitrate	Biological	Bio-ORACLE marine data layers
Dissolved oxygen	Biological	Bio-ORACLE marine data layers

Seaweed farming is rapidly expanding worldwide due to its diverse applications, environmental benefits, and growing economic potential. At the same time, kelp forest restoration is being pursued to enhance marine biodiversity and support carbon sequestration efforts. In Quebec, identifying suitable sites for seaweed aquaculture and/or reforestation is a key step in developing this sector.

This project focused on developing an interactive tool using QGIS software to support informed site selection for seaweed farming in the Quebec region. The tool integrates data on 16 key environmental and biological factors relevant to kelp farming, including ocean currents, hydrography, topography, and species-specific requirements. All data were centralized and processed into compatible raster or shapefile formats for use within QGIS.

The tool enables users to import, overlay, and analyze different spatial layers, facilitating the creation of customized maps. It was tested using *Saccharina latissima* as a model species and successfully identified areas with varying degrees of suitability for macroalgae cultivation.

While the tool provides valuable guidance for early-stage planning, field validation remains necessary as much of the data were interpolated over a coarse mesh grid. Nonetheless, the tool provides a flexible and scalable approach for early-stage planning and can be adapted for other species. Its effectiveness depends also on data quality but offers strong support for decision-making in site selection for the seaweed sector.

Table 2: Various threshold applied in the tool for cultivating Saccharina latissima. Source : Tamigneaux, É., Pedneault, E., & Gendron, L. (2014). RRD 14-04, Comparaison des rendements de l'algue brune Saccharina longicruris cultivée en milieu ouvert en Gaspésie et en lagune aux Îles-de-la-Madeleine, Merinov, p. 24

Factor	Optimal value
Bathymetry	9 - 35 m
Current	0.25 - 1.5 m/s
Temperature	0 - 13 °C
Salinity	23 - 35 PSU
Turbidity (water transparency)	0,2125 - 0,2833 m^{-1}

THAPA, PERSIA CAROL

GLOBAL GENETIC DIVERSITY OF INFECTIOUS SALMON ANEMIA VIRUS (ISAV): A SCOPING REVIEW

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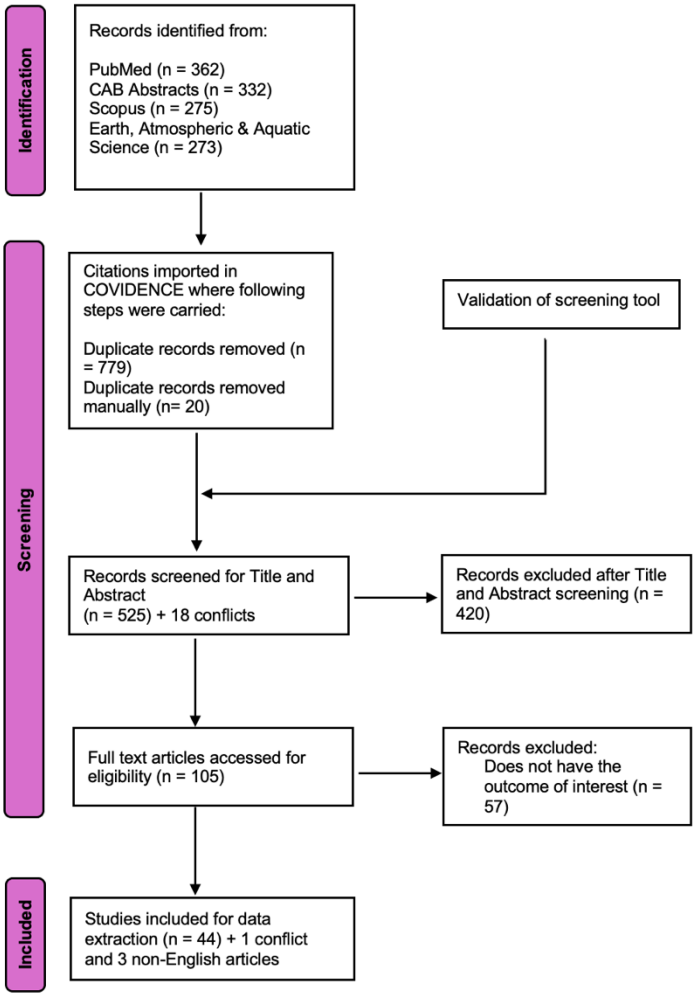
Understanding the genetic diversity of RNA viruses where mutation occurs frequently, leading to emergence of new variants is important to the control of their potential impact. Infectious salmon anemia virus (ISAV), which causes infectious salmon anemia in Atlantic salmon, exhibits differences in segments 5 and 6 of the viral genome, contributing to variability in its virulence and mortality.



Although disease caused by ISAV is associated with significant economic losses worldwide, decisions on surveillance and control are complicated by the variation in genetic diversity and the resultant clinical effects. To address these concerns, we have initiated a scoping review summarizing global variants of ISAV (focusing on segment 5 and 6).

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) will be followed and four databases were used for literature searches with no language and geographical area restrictions. Two co-authors independently screened, and currently extracting data from the identified studies.

This scoping review will inform our understanding of ISAV genetic diversity, customize mitigation strategies based on variants involved and may contribute to the development of a system of standardized nomenclature.

VASQUEZ, IGNACIO

TEMPERATURE-DRIVEN MICROBIOME DYNAMICS IN SPOTTED WOLFFISH (*ANARHICHAS MINOR*)

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Ocean warming poses a major challenge to the cold-water emerging aquaculture species like spotted wolffish. This study evaluates the effect of three seawater temperatures (3°C, 8°C, and 14°C) on the intestinal microbiome and histology of juvenile wolffish. Following a three-week acclimation period at 10°C, fish were gradually adjusted to the respective target temperatures. Microbiome profiling of hind-gut samples revealed temperature-dependent shifts, where *Mycoplasma spp., Malacoplasma spp., Photobacterium spp., Clostridium spp.,* and *Shewanella spp*. were identified as native microbiota, while higher temperatures (8°C; 14°C) favored opportunistic pathogenic bacteria, including *Aliivibrio spp., Vibrio spp.,* including *Moritella spp*. present only at 14°C. Histological analyses indicated chromatin changes in epithelia at 3°C and 14°C, whereas goblet cell density markedly increased at 14°C, pointing to mucosal stress response or microbial dysbiosis. Immunohistochemestry showed elevated expression of Sox9, Sox6, PCNA and CD14 at 14°C, suggesting changes in cell proliferation and large vascular structures in epithelia and lamina propria. Increased CD10 expression at 8 and 14°C further suggested elevated B cell proliferation in epithelia and/or underlying the brush-border the intestinal epithelium. Our findings underscore thermal sensitivity of spotted wolfish and the importance of temperature-optimized rearing strategies to prevent intestinal microbial imbalance and further opportunistic bacterial pathogen proliferation during production.