

Ontario Aquaculture Research Priorities Roundtable 2019



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Executive Summary

On Feb 1, 2019, the Livestock Research Innovation Corporation (LRIC) conducted a facilitated session to consider research priorities and areas of industry focus for the aquaculture sector in Ontario in partnership with the Ontario Aquaculture Association (OAA).

As suggested by UofG, OAA and OMAFRA, each group discussed technical opportunities and barriers, specific to: Open Water Net Pens, Recirculating Aquaculture System (RAS) & Land-based Farming, Alternative Technologies (ie – Aquaponics) and Alternative Species. Further discussions considered:

- A. Genetics
- B. Nutrition
- C. Health and Welfare
- D. Environmental Impacts
- E. Economics and Market Development
- F. Social License

The Ontario farmed seafood sector is 94% production by volume and 91% of farm gate sales rainbow trout (Aquastats 2017), primarily produced in open water net systems, which was reflected in the overarching priorities. However, there is significant investment opportunity in other systems and species with indications of growth potential in all areas should advancements be made that reduce the costs of the technology, and some regulatory issues are addressed.

Overall, the following outcomes were gleaned from the all the discussions.

Outcomes

1. To grow the net pen industry in Lake Huron and Lake Superior to between 30,000 and 50,000 MT in the next ten years.
2. Develop a formal breeding program for Ontario rainbow trout through a partnership between industry and government. A first step would be assessing the amount of genetic diversity in existing lines of rainbow trout and then initiating a family-based breeding program. This approach would combine new and existing tools and techniques.
3. Development of engineering and multidisciplinary technology for:
 - recirculating aquaculture systems, multi-trophic aqua and aquaponics that can be developed into commercially scalable and economical systems, creating opportunities for expansion in Ontario.
 - phosphorus binding and effluent control and/or divergence of waste products to usable resources for any/all types of aquaculture systems
 - Alternative usages for systems waste components

- Systems for offshore operations to handle severe weather and mitigate climate change impacts by moving to cooler water environments.
4. Development and implementation of a science-based benthos and sediment monitoring protocol for freshwater net pen systems.
 5. Development of best practices and protocols for the humane culture, euthanasia, slaughter and shipping of fish livestock
 6. Development of nutritional diets across any of the technology systems employed in aquaculture that are cost effective, sustainable, and could use local (Ontario or Canadian sourced) and/or novel (not displacing anything used in/for human diets ie. insect larve, black soldier flies etc.) components, that have nutraceutical properties, and improve immunity.
 7. Development of a model for assimilative capacity and mass balance for off-property (stream) discharge of land-based farms that regulators will recognize for licensing and monitoring.
 8. Updated discharge standards for RAS that distinguish between mass loading and concentration with the ability to incorporate alternative waste usages.
 9. Area of social license and education for OAA to facilitate were identified as follows:

Communication

- Environmental Impact – Science
- Industry Transparency
- Industry Successes
- Positive impact on local ecosystem/wild fish
- Knowledge Translation and Transfer (KTT) - Research results shared
- Media friendly/open
- How people perceive aqua story
- Government to message the benefits of aquaculture

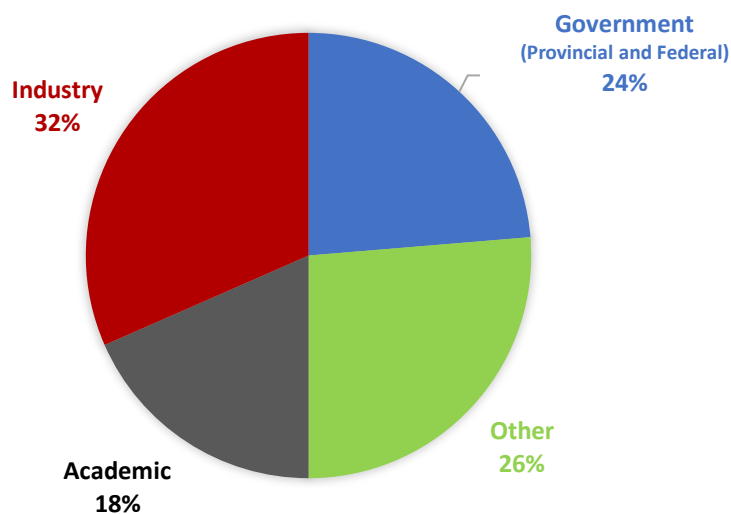
Education

- Next generation – benefits of fish farming
- Strategy
- Positive messaging to farmed fish opposition

Background

In September, 2014, key stakeholders in Ontario aquaculture met at a facilitated workshop. The key goals of the workshop were to: I. to establish research themes, and identify the desired outcomes within each of those themes, and II. identify areas of focus around those desired outcomes to mobilize research action. Significant change and expansion has occurred in the industry since that time.

On Feb 1, 2019 a second facilitated session was held to again consider research priorities and areas of industry focus. The meeting had 39 attendees depicted in the representation below:



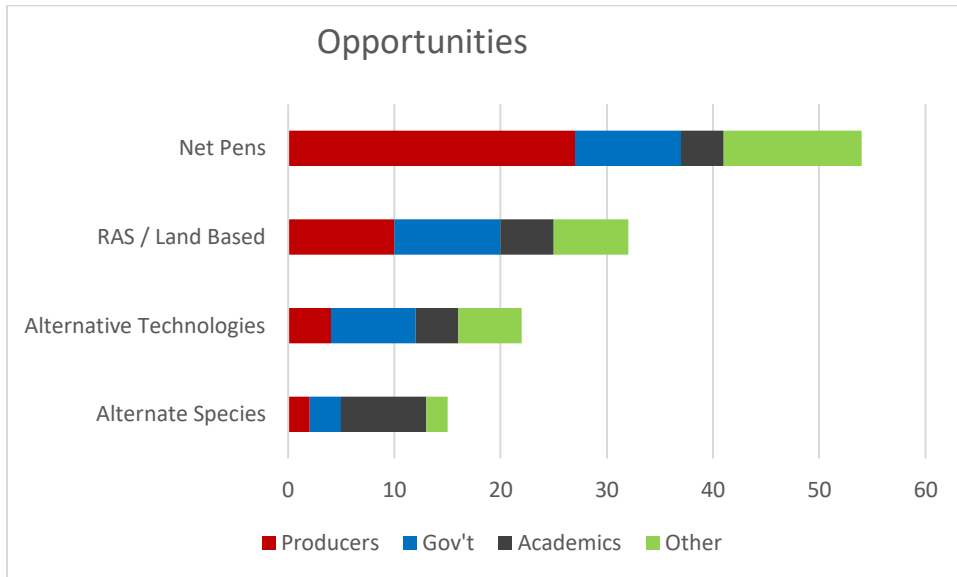
RJ Taylor, Managing Director of the Ontario Aquaculture Association, provided an overview of the industry, with Rich Moccia of the University of Guelph presenting an overview of aquaculture research and capacity in Ontario. Neil Rooney also from the University of Guelph provided an overview of a collaborative research model, and Gavin Christie for the Federal Department of Fisheries and Oceans presenting on federal research projects and capacity. The remainder of the day was spent in facilitated discussions, with the group divided into 6 clusters all with a mix of a least one person from each participant group represented.

Discussion Areas

Opportunities and Barriers

- A. Net-pen farming
- B. Recirculating Aquaculture System (RAS) & land-based farming
- C. Alternative technologies (ie – Aquaponics)
- D. Alternative species

Following discussion, the participants were invited to score the opportunities which they believed will have the greatest potential to effectively take the industry forward.



Below is the summary of the results for those areas that scored above 20 points.

Net Pens

Opportunity

To grow the net pen industry in Lake Huron and Lake Superior to 30,000 to 50,000 MT in the next ten years.

Barriers/Gaps:

Genetics

- Egg/fingerling Supply
- All-female Populations
- Triploid Induction Techniques

Regulatory

- License more farms
- Being Recognized as Agriculture

Environmental

- Sediment Requirements for Fresh Water Systems

Social License

- Public Perception

RAS/Land Based

Opportunity

1. Development of a model for assimilative capacity and mass balance for off-property (stream) discharge of land-based farms that regulators will recognize for licensing and monitoring.

Barriers/Gaps

Regulatory

- Model acceptance and recognition by regulators

2. RAS in Ontario are expanded, with continually improvement for fish health and divergence of waste products that are developed into marketable or usable resources.

Barriers/Gaps:

Economics

- Costs
- Energy efficiencies

Regulatory

- Resistance to adoption
- Difficult to bring fish health products to Canada
- Registration of new products

Social License

- Public perception
- Marketing

Education

- Training on proven models
- Farm diversification promotion
- Knowledge capacity

Alternative Technologies and Species

Opportunity

A multidisciplinary approach for opportunities for an economic multi-trophic aquaculture, aquaponics and/or hybrid model for any/all types of systems provides phosphorus binding and effluent control and would be economically viable are probed. Consideration to both new and native species, through genetic and new consumer products.

Barriers/Gaps

Animal and Plant, Health and Biology

- Unclear if there are coexisting species for freshwater culture
- Capital costs
- Genomic tools and technologies including biotechnology

Engineering

- Technology - demonstrated
- Plant and fish species alternatives

Regulatory

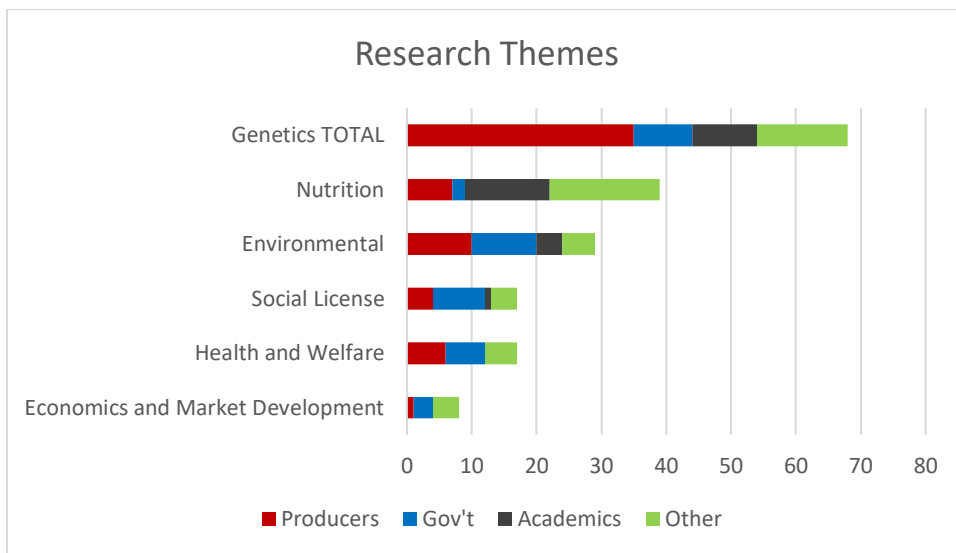
- Barriers from existing regulations

Research Themes

Further discussions were held on research opportunities within the following areas

- Genetics
- Nutrition
- Health and Welfare
- Environmental Impacts
- Economics and Market Development
- Social License

Following discussion, the participants scored the research which they believed to have the greatest potential to effectively take the industry forward.



The below summary focuses on the results for areas that scored above 20 points.

Genetics

Opportunities

- Production of all-female populations

- Production of sterile populations (e.g. triploid induction)
- Pedigree
- Quantitative genetic/genomic mapping
- Formal ON breeding program
 - Assess existing genetic diversity
 - Specific traits to be determined - eg
 - Growth
 - Maturation
 - Thermal tolerance
 - Resilience
 - Feed Efficiency
 - Health – disease tolerance
 - etc.
- Global collaboration for strain development
 - Long term – importing genetics

NOTE: Establishment of an overarching program is important prior to deciding on program details

Nutrition

Opportunities

- Functional Feeds
 - Nutraceuticals
 - Improve immunity
- Ingredient Opportunities
 - Lentils
 - Black Soldier Flies
 - ON/CAN sourced
- Cost Effective Diets
 - Use of inexpensive local ingredients
 - Use of Novel Feed ingredients – ones that are not used in/for human diets
- Precision Diets
- Diet impacts on thermal tolerance/growth in high temps – seasonal diets/ starve periods/fish size

Environment

Opportunities

- Sediment/Benthos/Discharge
 - Licensing and monitoring system needs to be science-based
 - Monitoring protocol development is needed
 - Development of an assessment guide for provincial staff receiving monitoring reports
 - Quantifying extent of cage footprints and land-based discharge plumes, developing protocols to undertake this work

- Existing provincial monitoring protocols and thresholds need to be reconciled with upcoming federal Aquaculture Activity Regulation requirements
- Research to understand assimilation of waste in the environment
 - rates of degradation and assimilation and environmental controlling factors
 - fallowing – for how long
- Improve technical merit /transparency of use of data requirements for licensing of new sites and changes to existing
- Incorporate ecosystem assimilation capacity into nutrient management
- Development and testing of a large-scale assimilative capacity model to predict cumulative effects of nutrient additions from multiple farms
- Develop evidence based discharge standards for RAS facilities
 - Mass loading vs concentration-based discharge limits
 - Incorporate alternative waste use
 - Nutrient recapture/reuse

Conclusion

The outcomes are summarized in the executive summary. Following topic discussions, and identifying focus areas each participant was provided with 5 coloured stickers to use to indicate the areas that held the highest priorities to them. The color of the sticker indicated the participants affiliation within the industry. The information from all discussions as prioritized are distilled and found in the full report.

The industry currently operates in an environment where it cannot supply the demand for farm raised trout. Changes to licensing requirements and developing science-based regulations, for Ontario lake and land-based production systems would send a positive signal for increased investment in the sector. Development of value added and new products are not a focus in the short term.

Alternate species were identified, and there is some investment in other species with indications of potential growth potential if economic viability can be achieved. This is not identified as area for industry funding to be applied at the current time. It does however provide an opportunity for “blue sky” research that has the potential to drastically change the industry by increasing the ‘local’ farmed seafood offerings.

It is important to review these outcomes in the next 3 – 5 years and **not later than February 2024**. This will insure accurate priorities that are focussed for continual advancement and growth of the industry to its full potential.