

Freshwater net pen aquaculture in Ontario has potential for sustainable growth. Recent efforts have focused involving stakeholders in shaping research to minimize environmental impacts of the industry. To that end, we convened two workshops engaging stakeholders including representatives from First Nations, NGOs, regulators, universities, commercial fisheries, and industry to discuss Ontario net pen aquaculture. Goals included sharing research findings, fostering collaboration, and identifying research priorities. This report summarizes research priority outcomes from workshops sponsored by OMAFRA held on November 3rd, 2023, at the Manitoulin Hotel and Conference Centre and November 9th, 2023, at the University of Guelph.

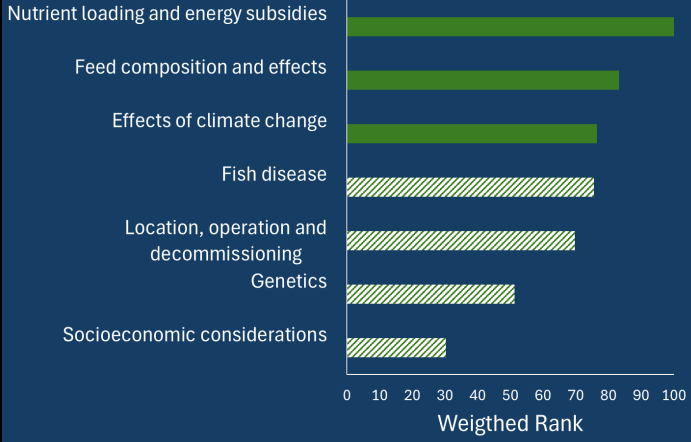


Post Workshop Survey

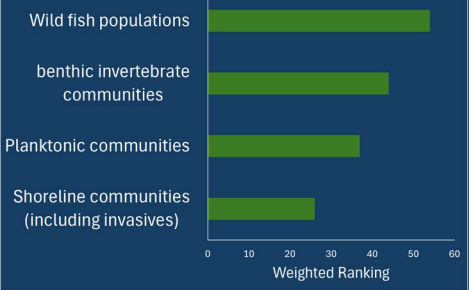
After the workshop concluded, participants were tasked with **prioritizing research areas** (Right) concerning the environmental impacts of freshwater net pen aquaculture. The top 3 research areas (solid bars) were explored further for potential research projects.

The importance of specific research projects within these top three research areas as indicated by workshop participants are show below. These results form the basis for our **proposed** research program (based on solid bars) that will be pursued through an NSERC Alliance grant proposal (See over).

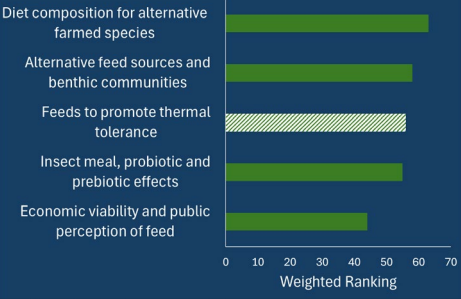
Prioritized Research Areas



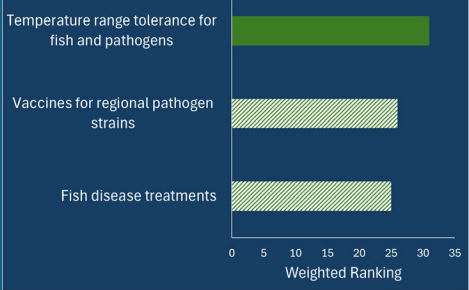
Nutrients and Energy Subsidies



Feed Composition and Effects



Effects of Climate Change



Research Team

Dr. Neil Rooney is in the School of Environmental Sciences at the University of Guelph who researches the effects of human stressors on freshwater ecosystems.

Dr. Tim Johnson is with the OMNR and investigate the effects of ecosystem change on the structure and function of aquatic food webs in the Great Lakes.

Dr. Joey Berhardt is an ecologist in the Department of Integrative Biology at the University of Guelph who has expertise in phytoplankton community ecology in the Great Lakes.

Dr. Aaron Fisk is in the Department of Biology at the University of Windsor, and his work focuses on fish diet and movement (using telemetry) in the Great Lakes.

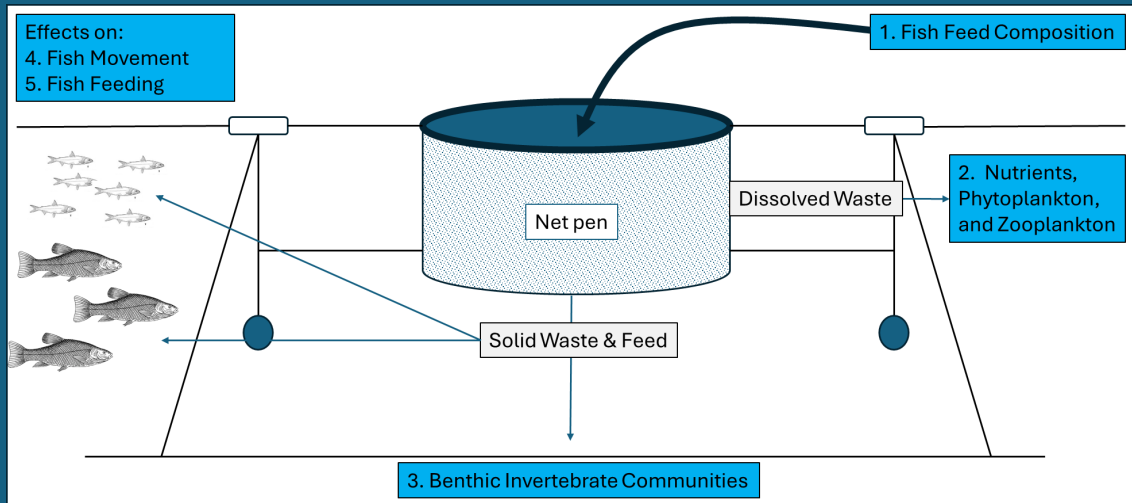
Dr. Marcia Chiasson is manager of the Ontario Aquaculture Research Centre and specializes in fish genetics and breeding.

Dr. David Huyben is in the Department of Animal Biosciences at the University of Guelph researching the nutrition, microbiome and health of farmed salmonid fishes.

Dr. Ryan Prosser is an ecotoxicologist working in freshwater ecosystems in the School of Environmental Sciences at the University of Guelph.

Dr. Bob Hanner is molecular ecologist in the Department of Integrative Biology at the University of Guelph who uses environmental DNA (eDNA) to characterize biodiversity.

Proposed Research Program 2024-2029



Based on the prioritization outcomes from the two workshops, our research team proposes the following projects for an NSERC Alliance Grant. This encourages researchers to collaborate with partner organizations, which can be from the private, public, or not-for-profit sectors. Funded projects focus on the partners' goals, with at least one partner sharing in the costs of research (for our purposes, that includes OMAFRA, the Great Lakes Fisheries Commission (GLFC) and the Ontario Aquaculture Association).

The projects corresponding to the figure above are:

- 1. Assessing the Sustainability and Performance of Insect Meals as Alternatives to Fish Meal in Freshwater Aquaculture.** Building on the current OMAFRA funded "Upper Limits for Insect Meal in Salmonid Diets" grant, this facet of the proposal will focus on diet composition for alternative farmed species (e.g., whitefish and arctic char) and the effects of these alternative feed sources on benthic communities. Trials will be carried out at the Ontario Aquaculture Research Centre. (Huyben, Chiasson, and Rooney)
- 2. Net Pen Effects and Lake Pelagic Ecosystems.** This project will employ high temporal and spatial resolution sampling to quantify the effects of fish farms on nutrient dynamics, phytoplankton community structure (including harmful algae) and zooplankton community composition. (Bernhardt and Rooney)
- 3. Metabarcoding and Ecotoxicological Analysis of Net Pen Aquaculture Effects on Invertebrate Communities.** Again building on an OMAFRA funded study, this section of the grant proposal will focus on quantifying the effects of fish farm waste on benthic communities. By developing ecotoxicological and metabarcoding techniques, the goal of this project is to design rapid, efficient, and accurate protocols for long term monitoring. (Hanner, Prosser, and Rooney)
- 4. Investigating the Influence of Freshwater Aquaculture on Wild Fish Movement Patterns.** Expanding on a project funded by the GLFC, this project will deploy an array of acoustic receivers in Parry Sound and acoustic tags that will be implanted in local wild fish species (lake trout, lake whitefish, yellow perch, and white sucker). (Fisk, Johnson, and Rooney)
- 5. Biomarker Investigations into Wild Fish Energetic Gain from Fish Farms.** Pairing with the telemetry study, this project will use biomarker analysis (stable isotopes, fatty acids, and DNA barcodes) of tagged fish to estimate the degree to which these species obtain energy from feed waste and faeces originating from fish farms. (Johnson, Fisk, and Rooney)

Questions?

- The full report on the November Workshops can be found at: <https://drive.google.com/drive/folders/XXXXXX>
- We can be reached by email at: nrooney@uoguelph.ca