

MASTER OF SCIENCE in AQUACULTURE



~AN INTERDISCIPLINARY NON-THESIS PROGRAM~

AUGUST 2005

ORDER NO. 05-002

WHAT IS AQUACULTURE?

Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. This agribusiness sector produces food and food additives, pharmaceuticals, cosmetics and nutraceuticals for the world's consumers. Farming implies individual or corporate ownership of the stock being cultivated and distinguishes aquaculture from the wild harvest fishery.

INDUSTRY NEED

In less than a decade, the Canadian aquaculture private sector has built an industry now worth over \$585 million to the national economy, and has produced 14,000 new jobs (direct and indirect) for Canadian workers. Presently, the industry is concentrated on both coasts of Canada, primarily British Columbia and New Brunswick as well as right here in Ontario. There is an urgent need for co-operation between industry, government, and universities to assist in the orderly development of this dynamic new industry.

THE PROGRAM

The primary purpose of this unique and exciting program is to provide an advanced, interdisciplinary, field of study leading to a M.Sc. degree in Aquaculture. The M.Sc. (Aquaculture) degree is characterized by:

- A non-thesis, course-work-based curriculum (6.5 course credits, 12 courses) in an array of disciplines encompassing aquaculture-related topics including:
 - Nutrition
 - Fisheries & Aquatic Sciences
 - Disease Management & Fish Husbandry
 - Business & Economics (in concert with the MBA program)
 - Extension Studies
- Integration of hands-on practical experiences at state-of-the-art research facilities
- A special research project, meeting the student's particular research interests, in any of the vast number of issues related to aquaculture.

THE GOAL

The ultimate goal of the M.Sc. (Aquaculture) program is to produce students who have an integrated knowledge of the concepts of animal production, and an understanding of the key issues surrounding aquaculture, including advanced scientific technology. It is the objective of this program to provide graduates with the knowledge and skills to enter the industry as team leaders.



Arctic charr being sampled for growth rate.

INTERDEPARTMENTAL PARTICIPATION

COURSES

Students enjoy the flexibility of choosing courses offered by a large number of academic departments on the University of Guelph campus. In addition, the following specialized courses are designed specifically for the M.Sc. (Aquaculture) program:

AQUA 6000

Special Project in Aquaculture

- ✓ An intensive learning opportunity focusing on an applied problem in the aquaculture industry
- ✓ Completion of a literature review and project in concert with hand-on experience with live animals, in either a research project or commercial setting
- ✓ Completion of a final report and oral presentation.

AQUA 6100

Science & Technology in Aquaculture

- ✓ A formal lecture, student seminar and essay course designed to examine the role of science and technology in the aquaculture industry.

AQUA 6200

Practicum in Aquaculture: Culture of Salmonids

- ✓ Using a problem-solving approach, students will complete a series of modules at the Alma Aquaculture Research Station covering topics in water management, hatchery operations, propagation techniques, feeding and nutrition, health and disease, economics and regulatory issues.

Recording oxygen injection levels in recirculation module.



Measuring alkalinity of water samples.

M.Sc. Aquaculture Grads

GORDON DURANT M.Sc. (Aquaculture)

Current Status: Fish culture coordinator for the Ontario Ministry of Natural Resources, Peterborough, Ontario.

Special Project: *Waste control methodologies for the Chatsworth fish culture station.*

PAULINE CHAN M.Sc. (Aquaculture)

Current Status: Regulatory Affairs, Novartis Animal Health, Inc.

Special Project: *Investigation of consumer awareness of arctic charr & an evaluation of the potential for marketing non-pigmented farm-raised arctic charr in Ontario.*

RICHARD BUSSANICH M.Sc. (Aquaculture)

Current Status: Environmental consultant with LGL Limited.

Special Project: *The potential for a total quality management philosophy & strategy involving the development of a quality assurance & control inspection system for the Ontario trout farming industry.*

JOSHUA NEWLANDS M.Sc. (Aquaculture)

Current Status: Potentiometric test team leader for I-STAT Canada Ltd.

Special Project: *The effect of feeding on aggressive behaviour & growth in juvenile rainbow trout.*

GREGOR REID M.Sc. (Aquaculture), Ph.D

Current Status: Post-doctoral Fellow, Dept. of Animal and Poultry Science, University of Guelph.

Special Project: *A multi-media extension tool for the "Getting Started in Aquaculture" seminar produced by the Aquaculture Extension Centre Seminar: a proposal.*

JOEL KEENE M.Sc. (Aquaculture)

Current Status: Environmental consulting, Guelph.

Special Project: *The efficiency of clove oil as an anesthetic for rainbow trout, *Oncorhynchus mykiss*.*

PAMELA WHITE M.Sc. (Aquaculture)

Current Status: Employed with New Brunswick provincial government.

Special Project: *Studies on the detection of *Yersinia ruckeri* in rainbow trout (*Oncorhynchus mykiss*) infections.*

GEORGE RIGOS M.Sc. (Aquaculture), Ph.D

Current Status: Fish Nutrition & Pathology Lab, Attiki, Greece.

Special Project: *The effect of antibiotic treatment on the persistence of asymptomatic infections in fish with *Yersinia ruckeri*.*

GREGORY PAGE M.Sc. (Aquaculture), Ph.D

Current Status: Fish nutritionist with Maple Leaf Foods, Ag Research, Guelph, Ontario.

Special Project: *The effects of long-term feeding of high levels of dietary carbohydrates on non-specific immune parameters in rainbow trout (*Oncorhynchus mykiss*).*

M.Sc. Aquaculture Grads

FIONA DARKIN M.Sc. (Aquaculture)

Current Status: Account manager with EWOS.

Special Project: Pigmentation of arctic charr (*Salvelinus alpinus*) fed diets containing various levels of astaxanthin.

REGINALD WADE M.Sc. (Aquaculture)

Current Status: Employed with New Brunswick provincial government.

Special Project: Determination of the heat production of rainbow trout (*Oncorhynchus mykiss*) fed different levels of digestible carbohydrate.

ROWENA LINEHAN M.Sc. (Aquaculture)

Current Status: Senior policy analyst for the Canadian Food Inspection Agency.

Special Project: Systemic absorption of oxytetracycline administered by short-exposure bath to rainbow trout, *Oncorhynchus mykiss* R.

JULIAN GRUSH M.Sc. (Aquaculture)

Current Status: Quality control manager with Wheels Group.

Special Project: The efficiency of clove oil as an anaesthetic for zebra fish (*Danio rerio*).

ROXANNA BAHRAMI M.Sc. (Aquaculture)

Current Status: Self-employed.

Special Project: A multi-criteria decision-making scheme for sustainable aquaculture development.

KYLA MATHESON M.Sc. (Aquaculture)

Current Status: Hatchery manager with Haliburton Fish Hatchery.

Special Project: Strain specificity of *Yersina ruckeri* for different salmonid species.

EMMA VALLIANT M.Sc. (Aquaculture)

Current Status: Employed by Ontario Ministry of Natural Resources, Peterborough, Ontario.

Special Project: The evaluation of carbon dioxide & argon gas as humane euthanizing agents for fish.

GEOFFERY BELL M.Sc. (Aquaculture)

Current Status: Project manager at GRACE Bioremediation Technologies.

Special Project: Phosphorus removal using calcium hydroxide as a precipitating agent.

DOUGLAS LAING M.Sc. (Aquaculture)

Current Status: New York Aquarium, New York.

Special Project: Utilization of open-pit mines for aquaculture: nutrient loading and modelling sustainability.

STEPHEN REES M.Sc. (Aquaculture)

Current Status: Director of operations, Wipeco Industries Inc., Montreal, Quebec.

Special Project: Evaluation of polymerase chain reaction as a method of detecting the fish pathogen *Aeromonas salmonicida* in non-lethal samples from *Oncorhynchus mykiss* and the aquatic environment.

PAST STUDENTS

Since the inception of the M.Sc. (Aquaculture) program, 25 students have successfully graduated! Of these, 4 have gone on to complete their Ph.D and the others have proceeded to a wide variety of careers.

OUR STUDENTS IN ACTION

HANDS ON DECK AT ALMA!



Top photo: Collecting eggs from rainbow trout.

Located only 35 km NW of the University of Guelph, the Alma Aquaculture Research Station (AARS) is a state-of-the-art aquaculture facility built by the province for joint research and development between industry, academia and government. For the M.Sc. (Aquaculture) program, AARS serves as an excellent venue for education and training.



Right photo: Hand feeding rainbow trout during growth study.

MAKING THEIR MARK

Students in the M.Sc. (Aquaculture) program are strongly encouraged to submit research findings of their major projects and participate actively in the aquaculture industry. Here are just a few examples:

PAPERS PUBLISHED - Special Projects Work

- **Grush, J.**, D.L.G. Noakes and R.D. Moccia. 2004. The efficacy of clove oil as an anesthetic for the Zebrafish, *Danio rerio* (Hamilton). *Zebrafish* 1:46-53.
- **Page, G.I.**, K.M. Hayworth, R.R. Wade, A.M. Harris and D.P. Bureau. 1999. Non-specific immunity parameters and the formation of advanced glycosylation end-products (AGE) in rainbow trout (*Oncorhynchus mykiss*), fed high levels of dietary carbohydrates. *Aquaculture Res.* 30: 287-297.
- **Keene, J.L.**, D.L.G. Noakes, R.D. Moccia, C.G. Soto. 1998. The efficiency of clove oil as an anesthetic for rainbow trout, *Oncorhynchus mykiss*. *Aquaculture Res.* 29: 89-101.

POPULAR PRESS ARTICLES

- **Sohail Siddiqui.** September 2003. *Wastewater treatment technology in aquaculture.* *World Aquaculture.*
- **Doug Laing.** November 2002. *Troubled Waters For Ontario's New Aquaculture Licencing System.* *Northern Aquaculture.*
- **Michael Lau.** June 2002. *Ontario's North Wind Fisheries: Cool, clear water and an effective waste-capture system make for a productive trout farm at a cage site near Manitoulin Island.* *Northern Aquaculture.*
- **Bridget Mooney.** April 2001. *Fishing is for the Burds! Fee-fishing in Ontario.* *Northern Aquaculture.*
- **Stephen Rees.** December 2000. *Ontario's Moose Mountain Fisheries.* *Northern Aquaculture.*
- **Rowena Linehan.** *Avoiding Aquaculture Accidents: Workshop Promotes Producer Safety.* *Aquataalk Vol. V No. 1.*
- **Pauline Chan.** *The White Stuff: Pigmenting Arctic Char is Unnecessary say U of G Researchers.* *Aquataalk Vol. II No. 3.*

PRESENTATIONS

Students have presented their Special Project in Aquaculture at a variety of conferences and workshops.

AQUACULTURE ACCOLADES

RECENT REVIEW OF THE UNIVERSITY OF GUELPH M.Sc. (AQUACULTURE) PROGRAM

External appraisers for the Ontario Council on Graduate Studies (OCGS) conducted a review of the M.Sc. (Aquaculture) program. After a two-day, on-campus evaluation of the program, which included meetings with involved faculty, former and current graduate students and travel to the Alma Aquaculture Research Station, the examiners agreed that the M.Sc. (Aquaculture) program is "an excellent graduate program meeting an identified and critical need for Ontario, Canada and the world community." When commenting on the program's curriculum and its ability to prepare students for the workplace, the examiners felt strongly that "the combination of course work, research project and practicum at Alma makes for an excellent experience that gives the students an ability to work in aquaculture and other fields. The focus on problem solving in inter-disciplinary studies gives the students abilities that go well beyond aquaculture."

CORE FACULTY RECOGNIZED FOR OUTSTANDING EFFORTS IN TEACHING, RESEARCH AND EXTENSION

Several core faculty of the M.Sc. (Aquaculture) program have received distinguished awards for excellence in research, teaching and extension education.



M.Sc. Aquaculture Grads

KATHELINE HUA M.Sc. (Aquaculture), Ph.D

Current Status: Post-doctoral Fellow, Dept. of Animal and Poultry Science, University of Guelph.

Special Project: *Contribution of prevalence levels of Yersinia ruckeri to fish pathogen transmission.*

DEENA BERLINGERI M.Sc. (Aquaculture)

Current Status: Secondary school teacher, Guelph, Ontario.

Special Project: *Biochemical oxygen demand of fecal waste produced by rainbow trout fed four different diets: modeling environmental loading of waste outputs and BOD in freshwater ecosystems.*

MICHAEL LAU M.Sc. (Aquaculture)

Current Status: Secondary school teacher, United Kingdom.

Special Project: *The efficacy of argon gas as a pre-slaughter sedative for rainbow trout (Oncorhynchus mykiss) (Walbaum).*

SOHAIL SIDDIQUI M.Sc. (Aquaculture)

Current Status: Employed by Ontario Ministry of Natural Resources, Peterborough, Ontario.

Special Project: *Development of a bioenergetics-based feed requirement model for tilapia (Oreochromis niloticus).*

NICOLA CROSS M.Sc. (Aquaculture)

Current Status: Employed by Shur-Gain, St. Andrews, New Brunswick.

Special Project: *Market strategy and feasibility of grain-fed rainbow trout production in Ontario.*

HERNAN RUIZ CASTRO M.Sc. (Aquaculture)

Current Status: Employed at University of Manitoba, Manitoba.

Special Project: *Production of rainbow trout (Oncorhynchus mykiss) with all-plant diets.*

INTERESTED IN PARTICIPATING IN THE M.Sc. (AQUACULTURE) PROGRAM?

Please see our website at:

<http://www.aps.uoguelph.ca/~aquacentre/>

Or Contact:

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