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Aquatalk
AQUACULTURE NEWS AT THE UNIVERSITY OF GUELPH

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Light means life for charr fry

Continuous illumination and feeding decrease mortality and increase growth

BY JUHIE BHATIA

Increased exposure to light and feed may be the solution to overcoming at least one obstacle in raising arctic charr in aquaculture: that is, their high mortality rate during early life. An Alma Aquaculture Research Station (AARS) study, headed by manager Michael Burke and University of Guelph researcher Prof. Richard Moccia, shows that continuous (i.e., 24-hour-a-day) light and feeding reduces mortality among arctic charr fry nearly five-fold.

"Arctic charr breeding success in southern Ontario has been poor," says Burke. "The problem is further exacerbated by high fry mortality rates. When reproduction is already low, the loss of fry on top of that can be devastating for fish farmers."

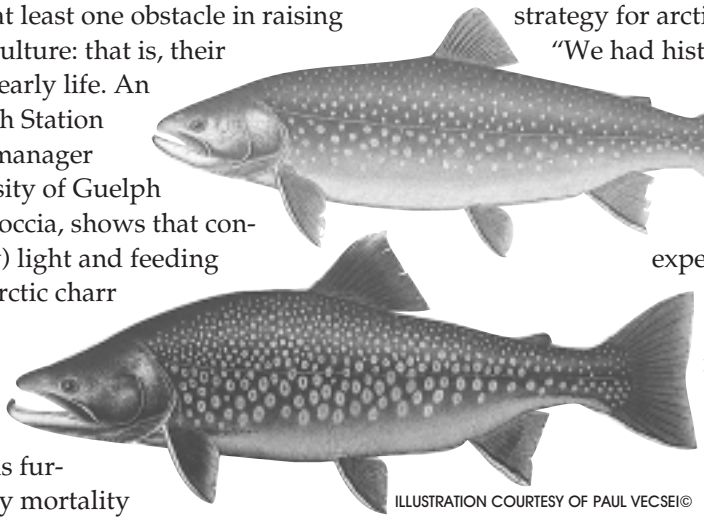

ILLUSTRATION COURTESY OF PAUL VECSEI©

IMPROPER EARLY FEEDING

Hatchery environments for arctic charr typically involve feeding during daylight hours, about 8-10 hours per day. But the researchers noticed that up to 35 per cent of the fry died in the first few months of life. Most of these deaths are very small fry or "pin-head" mortalities; this suggests many fry do not eat enough or perhaps do not learn how to feed properly.

Day length and light intensity are well known to influence feeding behaviour in other fish species. In response, the researchers tested a 24-hour feeding and lighting strategy for arctic charr in 1999-2000.

"We had historical, anecdotal evidence that indicated continuous lighting and feeding were beneficial in raising arctic charr," says Moccia. "But we needed rigorous, experimental trials to validate our earlier impressions and make us confident that this knowledge would really help fish farmers."

The researchers carried out these trials last year to determine whether lighting, availability of feed or a combination of the two could decrease fry mortality. They raised 24,000 fry in each of two growth rooms — one with 24-hour lighting, and the other with simulated, natural daylength. Each group of fish was then divided into two different feeding regimens: one group was fed over 24 hours and the second group was fed during daylight hours only for a 12-week trial.

LIGHTING IS THE KEY

Results showed that fry exposed to 24-hour lighting had at least a five-fold lower mortality rate when compared with fish living under natural lighting, regardless of when they were fed. Though light exposure was the major factor in decreasing fry mortality, feed availability also helped increase survival.

The researchers also found 24-hour lighting and feeding significantly increased the arctic charr's growth rate.

"Many fish farmers don't feed at night and turn off the lights to reduce electrical consumption," says Burke. "Our

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research shows that something as simple as automated feeding and leaving the lights on at night can make a huge difference in the survival and growth of young arctic charr."

The researchers will publish a paper later this year and also make available a fact sheet for hatchery managers.

This research was sponsored by the Ontario Ministry of Agriculture, Food and Rural Affairs.

Figure 1

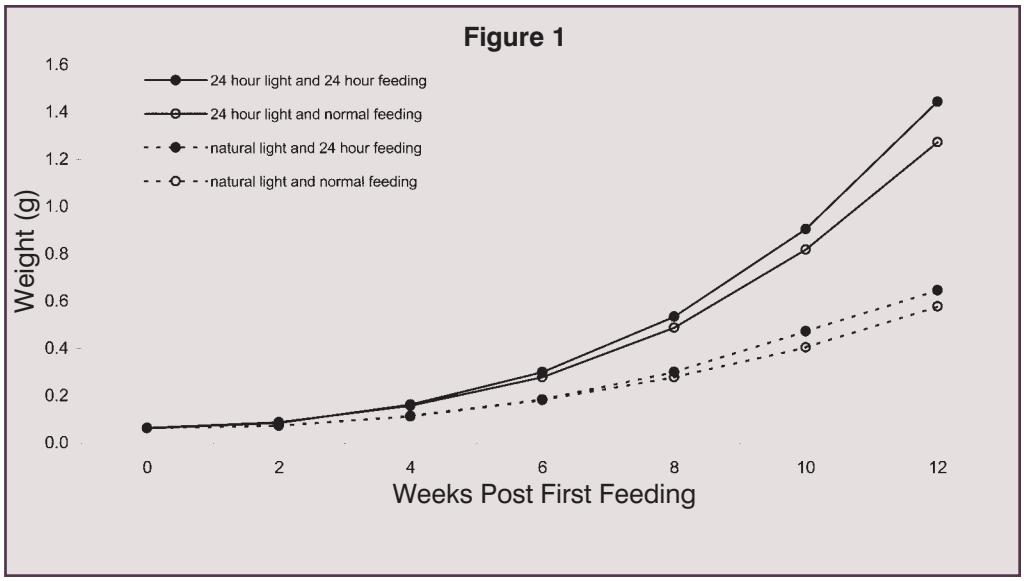
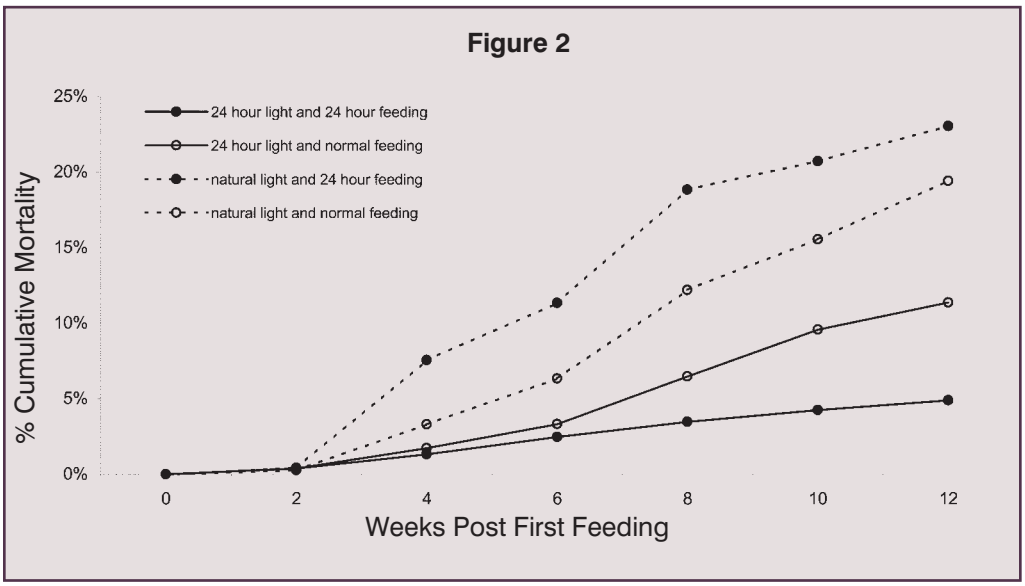


Figure 2



University of Guelph and Alma Aquaculture Research Station researchers have found that 24-hour lighting and feeding not only increases the growth rate of arctic charr fry (Figure 1) but also decreases their early life mortality (Figure 2).

FISH BITS

New faculty position

The Ontario Ministry of Natural Resources is sponsoring the establishment of a new faculty position at the University of Guelph. This position, housed in the Department of Animal and Poultry Science, will be dedicated to research and education in the field of fish nutrition, and will enhance the delivery of services to the government as well as to the private aquaculture industry.

Ontario production approaches 4,000 tonnes

In 1999, Ontario fish farmers produced nearly 4,000 tonnes of fish for human consumption. Rainbow trout is the predominant species farmed in the province, but tilapia and arctic charr also are grown in smaller quantities for the food marketplace. Watch for our Aquastats 1999 publication to be mailed soon.

AquaNews anyone?

Using a free, email distribution list, the Aquaculture Centre distributes a variety of information items and popular press articles related to the aquaculture industry. If you want to be added to our distribution list for a trial period, please send your email address to aquacntr@uoguelph.ca. Indicate 'Add AquaNews' in your email subject line.

Marking for faster growth

Genetic technique helps track high-performance growth genes in trout

BY KRISTY NUDDS

MARTIN SCHWALBE

Graduate students Kathleen O'Mally and Christopher Martyniuk are identifying genes in rainbow trout to help select for faster growing fish.

The selection of faster growing rainbow trout may become easier and more effective, thanks to a new genetic technique being explored by University of Guelph researchers.

Profs. Roy Danzmann and Moira Ferguson, and graduate students Christopher Martyniuk and Kathleen O'Mally, Department of Zoology, are identifying and mapping the location of fast-growth genes in rainbow trout, using molecular markers — pieces of amplified DNA that can act as "internal genetic tags" — called microsatellites.

"This technology may help farmers select potential broodstock more efficiently and quickly when combined with established breeding methods," says Ferguson. "By marking and identifying genes for economically important traits such as growth, producers may be able to selectively breed for faster growing fish in fewer generations."

INCREASED PRODUCER PROFITS

Rainbow trout is the most commonly cultured freshwater fish species in Ontario. Getting these fish to market size more quickly — using a combination of molecular genetics and conventional breeding — would increase profits for aquaculture producers.

The use of microsatellite markers in experimental fish has identified several regions of DNA containing quantitative trait loci (QTLs) — segments of DNA containing genes believed to control certain traits — including growth genes in rainbow trout. "Since microsatellite markers are inherited with QTLs, they can be used to determine whether or not the QTLs are being passed from the parent to offspring and if they play a role in faster fish growth," says Ferguson

PROMISING RESULTS

To verify that these QTLs are useful in identifying faster growing fish, researchers crossed rainbow trout obtained from two commercial breeders in Ontario, Spring Valley Trout Farm and Rainbow Springs Hatchery. They are now compiling genetic data on the growth of the second generation of these fish. Initial results look promising; they indicate that the same DNA regions were inherited by the faster growing rainbow trout.

"If we know that certain QTLs are contributing to growth, we can look for the markers when the fish are extremely young," says Ferguson. "With marker-assisted selection, producers could choose broodstock with the same genetic potential and breed them, creating a stock with enhanced growth several generations earlier than could be done using traditional breeding strategies alone."

APPLICATIONS EXTENDED ELSEWHERE

Researchers also plan to explore the application of this technique to other situations...for example, if there are any differences in the inheritance of QTLs between male and female fish, and whether there is a correlation between fast growth and early sexual maturity.

This research is sponsored by the Natural Sciences and Engineering Research Council and the Ontario Ministry of Agriculture, Food and Rural Affairs.

Breeding trials were conducted at the Alma Aquaculture Research Station.

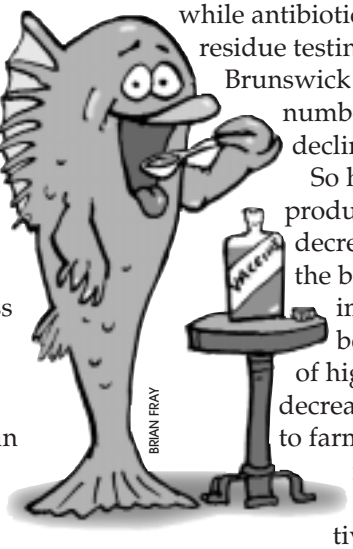
Antimicrobial resistance: there's nothing fishy about it

The Canadian aquaculture industry has worked hard to prevent antibiotic overuse

BY KRISTY NUDDS

Canadian researchers and fish farmers have worked hard to find ways of reducing antimicrobial use to enhance production…and in doing so are keeping consumers buffered from potential exposure to resistant bacteria.

In some agricultural domains, the use of antimicrobials for purposes other than to treat infection — for example, as a growth promotant — has contributed to an unwanted side effect: bacterial resistance. Constant exposure to low levels of antimicrobials allows bacteria to adjust their genetic makeup in such a way that they can survive treatment. And worst of all, they may pass resistant genes on to other bacteria.



PROBLEMS WITH RESISTANCE

The inadvertent development of bacteria that can withstand antimicrobial therapy has become a big problem for the human health care industry, says Prof. Richard Moccia, from the Aquaculture Centre at the University of Guelph. Some livestock sectors have been incorporating antimicrobials into feeds for decades, to ensure efficient growth by reducing the chance of infection. But there may be a problem: resistant bacteria may be transferred to humans through consumption of animal products, and pass their resistance to the normal flora in the gastrointestinal tract. If a person becomes ill, the resistance can be passed yet again to the infectious bacteria. Then it too becomes unresponsive to treatment.

The human connection has become such a concern that a conference was held last fall in Toronto to investigate the role that agriculture has played in the creation of resistant bacteria.

MINIMAL ANTIMICROBIAL USE

Moccia, an invited speaker, explained that in North America and Europe, there are very few antimicrobials commonly used in fish culture. And the ones that are used, are primarily for short-term, therapeutic intervention . . . never for growth promotant purposes. In fact, recent studies by the Department of Fisheries and Oceans Canada (DFO) demonstrated that less than 1.6 per cent of aquaculture feed used in eastern Canada contains antimicrobial medication.

However, the industry isn't totally exonerated. Moccia says antimicrobials have been used in the past to help keep fish healthy, but the practice was short. Statistics bear him out — for example, for Norwegian farmed salmon, fish production increased by 300,000 tonnes from 1987-1997, while antibiotic use declined by 250,000 kg. Drug residue testing by the DFO on salmon raised on New Brunswick farms shows that from 1991-1997, the number of samples above the maximum limit declined to less than three per cent.

So how has the world's fastest growing food production sector managed to flourish with decreased use of antimicrobials? Moccia says the biggest reason — besides constantly improving husbandry techniques — has been the development and administration of highly effective vaccines. They have decreased the amount of antimicrobials given to farmed salmonids by more than 90 per cent in the last 14 years.

Public perception and producer incentives have been major factors as well. Moccia says widespread antimicrobial use would "negatively impact the 'healthy food' marketing image" relied on by most seafood products. The voluntary adoption of codes of practice by producers that are predicated on low (or no) antimicrobial applications are also contributing to reduced use throughout the industry.

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Executive Editor: Prof. Richard Moccia
Editor: Owen Roberts, Office of Research
Project co-ordinator: Juhie Bhatia, SPARK (Students Promoting Awareness of Research Knowledge), Office of Research
Design: Brian Fray Designs Inc.

Please address correspondence to Prof. Richard Moccia, Aquaculture Centre, Department of Animal and Poultry Science, University of Guelph, Guelph, Ontario N1G 2W1
Phone: (519) 824-4120 Ext. 6216 fax: (519) 767-0573
e-mail: aquacntr@uoguelph.ca