



VOLUME II ISSUE I

WINTER 2009

Inside this issue:

<i>Congresswoman Kaptur visits BGAC</i>	1
<i>YY-male Bluegill Produced by OSU</i>	1
<i>OARDIP Achievements and Impacts for 2008</i>	2
<i>Construction at Piketon Aquaculture Center</i>	3
<i>Spotfin Brood Fish Conditioned for Spawning at BGAC</i>	3
<i>ODA Director Addresses Aquaculture Industry</i>	4
<i>Hocking College Students Assist with Fish Harvest</i>	4
<i>Journal Publications</i>	5-6

The Ohio Aquaculture Research and Development Integration Program Newsletter is published biannually to share the Program highlights

For more information on OARDIP, contact Dr. Han-Ping Wang at wang900@ag.osu.edu.



Ohio Aquaculture Research and Development Integration Program (OARDIP) Newsletter

The Ohio State University

Congresswoman Marcy Kaptur visits Bowling Green Aquaculture Center

Congresswoman Marcy Kaptur, a long-time supporter of aquaculture in Ohio, visited Bowling Green Aquaculture Center (BGAC) on December 3rd, 2008 and February 3rd, 2009. She was especially interested in the aquaponics research system there and discussed the project with Shawn McWhorter, BGAC Research Associate and Facility Manager, and its potential feasibility for urban locations.

The aquaponics system, combining fish and plant culture, was put through its first successful research trials in the fall of 2008 and winter of 2009. Tomatoes, cucumbers, basil and chives were produced, using the effluent water from fish culture tanks as one of the nutrient sources.



Congresswoman Marcy Kaptur during a visit to OSU's Bowling Green Aquaculture Center (l-r Bob Calala, Calala's Water Haven; Congresswoman Kaptur; Shawn McWhorter; & Dan Kaiser, Meiring Fish Farm).

YY-male bluegill have been produced by OSU scientists

Creating all-male populations, monosex male culture, holds considerable potential as a method to increase the efficiency and profitability of bluegill aquaculture, as males grow twice as fast as females. Furthermore, monosex populations can eliminate the problem of prolific reproduction, precocious maturity and their consequences in aquaculture ponds and natural water bodies.



To develop so called YY-males in bluegill, which can produce all male offspring in normal matings, Ohio State University South Centers (OSUSC) initiated a YY-male selection project in 2004.

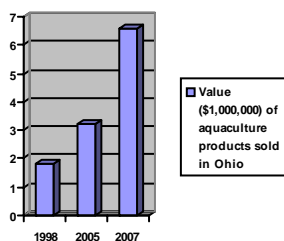
For the first two years, they developed an all-female population and cultured them to maturation. These phenotypically female fish were physically female, having ovaries, but genetically males, with XY chromosomes. In the fall of 2008, OSUSC scientists successfully induced those phenotypic females to spawn by crossing them with regular males (XY). This produced about 30,000 surviving progeny. Among this population, 75% are males including 25% YY-males and 50% XY-males, which has been verified by progeny sexing. All male populations will be produced by the end of 2009 by crossing the YY-males with regular XX-females.

OARDIP Achievements and Impacts 2008 Report

Impact

Ohio Aquaculture continues to Grow!

The 2007 census of agriculture was published this week by the USDA National Agriculture Statistics Service. Ohio fish farmers reported 6.6 million dollars in sales for 2007. This is up from 1.8 million in 1998 and 3.2 million in 2005. The largest volume of sales belonged to farms selling sportfish and gamefish with 75 farms reporting \$2,455,000 in sales. You can find a copy of the census here (http://www.agcensus.usda.gov/Publications/2007/Full_Report/usv1.pdf) with the aquaculture table starting on page 436.



Growth of Ohio Aquaculture in recent years

O’GIFT (Ohio Genetic Improvement of Farmed-fish Traits) Program: Ten improved lines of yellow perch have been developed. The testing data show that the improved lines grew 28% - 54% faster than unimproved fish. ~60,000 improved perch fry and fingerlings were distributed to fish farmers. The 2nd generation of improved fish were created in 2008. Two mapping families have been developed and induced to produce F₂ for quantity trait loci mapping. Two projects on genotype by environment interactions on growth performance of cross-bred yellow perch families have been completed and two manuscripts on these have been accepted by scientific journals. For bluegill, success of sex-reversing regular fish to all females was published in *Aquaculture*. About 15,000 all-male and 5,000 super male populations, which would grow 40-50% faster than a mixed-gender population, have been generated for developing all-male broodstock. In addition, two strains of largemouth bass have been obtained for its selective breeding. *The O’GIFT program is expected to increase aquaculture production of perch, bluegill and bass by 35-50% by developing genetically improved broodstocks.*

Bowling Green Aquaculture Program (BGAC): BGAC established an algal and zooplankton culture lab (for first feeding) and produced 50,000 juveniles for grow-out trials with a private cooperator. BGAC organized a Baitfish Grower’s Alliance and provided a Baitfish Culture manual and technical assistance. Golden shiners were sold at \$3.00 per pound, with an average return of \$3,000 per acre. Largemouth bass and yellow perch were cultured together to market size in one year using indoor recirculating systems, substantially reducing production costs and traditional grow-out time by 9 months. *BGAC directly supports over 30 aquaculture operations in northern Ohio through technical consultations, demonstrations, and dissemination of research results.*

Fish Production Improvement Program: A practical strategy for establishing mostly-male bluegill groups that can gain 61.0% more weight than the mixed-sex control was published in *North American Journal of Aquaculture*. Bluegill and perch in communal rearing grew 62.5% and 33.1% faster than in monoculture, respectively. *These findings will have important practical significance for producers by increasing perch and bluegill production efficiency and lowering production costs.*

Fish Muscle Growth and Nutrition Program: *Breakthrough* proteomic methodology combining electrophoretic, statistical and mass spectrometric techniques to identify muscle proteins associated with body weight and length in yellow perch was published in 2008 *Proteomics*. *These results will have important applications for breeding strategies based on selecting genes for faster growing fish.*

Aquaculture Technology Transfer (AT²) and Dissemination: *Over 1000 clients took advantage of the aquaculture outreach services at OARDIP including: three electronic list serves, personalized response to information requests and guided tours of the facility. Sixteen clients received individual business planning assistance designed to enhance the success of their business ventures. Several state-wide workshops were conducted, and multiple presentations were made around the state and at regional and national meetings.*

New Aquaculture Genetics and Breeding Lab (AGBL): *This is the first lab of its type in the Midwest and crucial to the success of the GIFT program. In this lab, genetic relatedness analysis of 07 selected brood fish was completed, and relatedness chart and genetic pedigree were constructed for 2008 breeding. Parentage analysis technique using eight molecular markers has been optimized and family identification for the selected brood fish was completed. Nine sex-specific markers were identified and a linkage mapping of bluegill was completed for selective breeding. Additional 21 new genetic markers have been developed for perch genetic mapping for traits of growth and VHS resistance.*

New Tank System and Pond Construction at Piketon

Two new upgrades have been made to the Piketon aquaculture facility in support of the research being conducted through OARDIP. A large 50 foot by 80 foot concrete pad (pictured to the right) was poured on the west side of the Aquaculture Wet Lab. The concrete pad will support 60 new culture tanks, which will house a number of the improved lines of yellow perch and bluegill that are being developed through OARDIP research.

The outside tank system will allow improved perch and bluegill broodstock to condition for spawning under ambient light and temperature regimes, which previous research has shown to be critical for proper gamete development. The outside pad will eventually be covered with a large hoop-house structure.

A half-acre earthen pond was also constructed next to the concrete pad and tank system (pictured to the right). The new pond will serve as a water reservoir for the concrete pad tank system. The pond will be set up to recycle and condition the tank water to increase the efficient use of our water supplies. The pond has also been fitted with an external catch basin, to demonstrate this technology for those interested in freshwater prawn culture.



Spotfin broodfish are being conditioned for spawning in BGAC

One objective of the Bowling Green Aquaculture Center (BGAC) is to support the development of techniques to culture spotfin shiners as a potential aquaculture species in Ohio.

The BGAC aquaculture research facility has been retrofitted with the addition of a new set of culture tanks for grow-out studies on the spotfin shiner, and the addition of a second egg incubation and hatching system. Spotfin brood fish are being conditioned over the winter for early season and normal season spawning, which will begin in late January. The new algae and rotifer lab will be used to culture the algae *Nanochloropsis* and zooplankton rotifers for the spotfin first-feeding trials.

Researchers hope to see commercial production of this species in 2010.



Dr. Bobby Moser, Vice President and Dean, CFAES, inspects the algal culture system.

Ohio Department of Agriculture Director Addresses Ohio Aquaculture Industry

Director Robert Boggs of the Ohio Department of Agriculture was the keynote speaker for the annual Ohio Aquaculture Association meeting and banquet. Over 80 fish farmers, industry suppliers, researchers and specialists gathered at the Ohio Department of Agriculture's campus in Reynoldsburg Ohio on January 17, 2009, to share information and network.



ODA Director Robert Boggs was the keynote speaker during OAA's annual banquet.

Presentations on biosecurity, prawn culture, introductory aquaculture, and research updates filled the morning. An afternoon business session included presentations about grant

funding, financing aquaculture, aquaculture insurance and a marketing forum. The evening was capped off with a seafood cooking demonstration featuring Ohio-raised freshwater prawn.

Director Boggs then took the floor and highlighted the many accomplishments of the Ohio Aquaculture Industry in recent years, citing the many collaborative efforts with the Ohio Department of Agriculture, including the 2008 Biosecurity Workshop and the Fish Health Taskforce. Director Boggs stressed that he felt that aquaculture was an important contributor to agriculture in Ohio and he looked forward to supporting the growth of the industry. The partnership between the Ohio State University, the Ohio Department of Agriculture and the Ohio Aquaculture Association will continue to support the sustainable development and promotion of aquaculture in Ohio.

Hocking College Students Help with Annual Fish Harvest

Every fall, about thirty students from the Fish Management and Aquaculture Program at Hocking Technical College, descend on Ohio State University's Aquaculture Facility to supply the manpower to harvest ongoing research experiments. The students get to tour the facility and observe the latest research in progress, as well as participate in collecting data by actually seining the ponds and sampling the fish.

This experience is just one of the many that these students are exposed to as Hocking College prepares them to work at either public or private water resource management, fish management or propagation agencies. This program is for students primarily interested in seeking employment in fisheries management or fish propagation after acquiring their 2-year Associate Degree.

Right after graduating, grads find jobs in both the public sector, working with agencies that use, regulate, or alter the public waters. In the private sector, many become self employed, or seek a job with a consulting firm or commercial fish farmer. Specifically, grads work as: fish management technicians, fish hatchery technicians, soil and water conservation service technicians or water resource management technicians. Starting salaries typically range from \$8.00 - \$15.00 per hour.

This partnership between Ohio State University and Hocking College has been beneficial to all involved. In fact, we have two Hocking College graduates currently working for the OSU South Centers Aquaculture Program. We also host a Hocking College Aquaculture Intern each year. In spring, as a follow-up, OSU Aquaculture Extension Specialists participate in Hocking's School of Natural Resources Career Day, helping students understand job requirements and opportunities in aquaculture.

For more information on the Hocking College Program, check out the website: http://www.hocking.edu/academics/academicPrograms/fish_management_aquaculture/default.aspx.



Hocking students take a quick lunch break during an OSU fish harvest

New Scientific Journal Publications

Isolation and Characterization of Novel Microsatellite Markers for Yellow Perch (*Perca flavescens*)

A. Zhan, W. Yao, B. Brown and H. P. Wang

Abstract: To perform whole genome scanning for complex trait analysis, we isolated and characterized a total of 21 novel genomic-SSRs and EST-SSRs for yellow perch (*Perca flavescens*), using the methods of construction of SSR-enrichment libraries and EST database mining of a related species *P. fluviatilis*. Of 16 genomic-SSR primer pairs examined, eight successfully amplified scorable products. The number of alleles at these informative loci varied from 3 - 14 with an average of 8.5 alleles per locus. When tested on wild perch from a population in Pennsylvania, observed and expected heterozygosities ranged from 0.07 - 0.81 and from 0.37 - 0.95, respectively. Of 2,226 EST sequences examined, only 110 (4.93%) contained microsatellites and for those, 13 markers were tested, 12 of which exhibited polymorphism. Compared with genomic-SSRs, EST-SSRs exhibited a lower level of genetic variability with the number of alleles of averaging only 2.6 alleles per locus. Cross-species utility indicated that three of the genomic-SSRs and eight of the EST-SSRs successfully cross-amplified in a related species, the walleye (*Sander vitreus*). *International Journal of Molecular Sciences* (2009), 10: 18-27.

Unidentified cells reside in fish skeletal muscle

M. V. Dodson, A. Kinkel, J. L. Vierck, K. Cain, M. Wick and J. Ottobre

Abstract: Cell cultures were established from the skeletal muscle tissue of 6–13 months old rainbow trout and 12–14 months old yellow perch. Approximately $27,000 \pm 5,000$ cells/g (trout; N = 5) and $5,000 \pm 1,200$ cells/g of tissue (perch; N = 4) were obtained. Isolation and propagation were qualitatively greater for both species when the cells (younger fish producer more cells than older fish) were exposed to DMEM + 15% FBS, rather than L-15 + 15% FBS, at 20°C (trout) and at 24°C (yellow perch). Two morphologically distinct cell types were observed in cultures of both species, some of which eventually formed very small myotubes, which displayed immunocytological reactivity for myogenin, myosin heavy chain, and α -actinin; the second population of cells remained unstained. Successful cryopreservation was achieved using a 5% DMSO and 95% serum mixture, but post-thawing viabilities were low 5–27% (trout) and 14–30% (perch). Further research is needed in order to determine cell type specificity of isolated cells.

Cytotechnology (2008) 56:171–178.

Establishment of mostly-male groups of bluegill by grading selection and evaluation of their growth performance

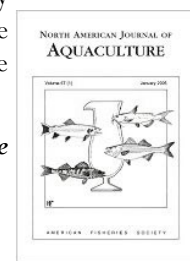
H. P. Wang, G. Wallat, R. Hayward, L. G. Tiu, P. O'Bryant and D. Rapp

Abstract: Concerns over economic feasibility of commercial bluegill *Lepomis macrochirus* aquaculture production have heightened the need for strategies to enhance growth. Recent studies have shown that individually-reared bluegill males can grow twice as fast as females, resulting in increased interest in development of mostly or all male populations. In this study, we developed a practical procedure to establish mostly male bluegill groups through grading selection, and tested their growth against a normal population. A single cohort of bluegill juveniles was cultured in a pond for a year, and then graded and divided into two mostly male groups (top 25% and top 50% of fish) and a mixed-sex control group when the fish reached a mean weight of 30.1 g.

The mixed control group contained 50.0% males; the top 25% group had 75.4% males and the top 50% group had 69.7% males. Weight gain per fish in the top 25% group was significantly greater ($P < 0.05$) than the mixed group throughout most of the experiment. There were no significant differences detected in survival among the three groups, although the top 25% group had survival of 96.0%, compared to 90.6% and 90.5% for the top 50% group and the mixed control, respectively. The top 25% group had the highest percentage (46.3%) of fish reaching 150 g at the end of the experiment, followed by the top 50% group (28.3%), and the mixed control group (12.7%).

The coefficient of variation (CV) for weight decreased in all three groups over time, with the mostly male groups maintaining lower initial and final CV values than the control group. Results indicate that mostly male bluegill groups are able to grow faster than typical mixed-sex populations, and social interaction costs among communally reared males did not significantly decrease growth of mostly male populations in the aquaculture settings.

North American Journal of Aquaculture (2009): in press.



Continued on page 6

New Journal Publications *(continued from page 5)*

Evaluation of relative growth performance and genotype by environment effects for cross-bred yellow perch families reared in communal ponds using DNA parentage analyses

H.P. Wang, L. Li, G. Wallat, B. Brown, H. Yao, Z. Gao, L. Tiu, P. O'Bryant, D. Rapp and R. MacDonald

From 24 mating sets, 6300 fingerlings of yellow perch (*Perca flavescens*) were stocked into one pond and equal numbers of progeny from six representative sets out of the 24 were stocked into each of two other ponds. After communal rearing for 21 months, total length and body weight were assessed for n=300 fish in each of the three ponds and molecular pedigrees were performed for each sampled individual to assign the progeny back to the original parents. The overall average number of alleles per locus was $A = 16.4$ and observed and expected heterozygosities were $H_o=0.88$ and $H_e=0.77$, respectively. The mean weight of random samples and the top 10% fast-growing fish from the pond

with all sets was significantly greater than those from either of the two replicate ponds with six crosses. For the two replicate ponds, no significant differences were found in family rankings and assignment of the top 10% fast-growing fish, indicating that families with superior growth performance in one pond also exhibited the same superior growth performance in the replicate pond. However, there were no significant correlations detected in family mean weights of the top 10% fish between any two of the three ponds.

Aquaculture Research

(2009): *in press*



Acknowledgements

OARDIP is currently supported by these major contributors:

- USDA Cooperative State Research, Education & Extension Service
- North Central Region Aquaculture Center (NCRAC)
- Ohio Agriculture Research and Development Center (OARDC)
- The Ohio State University Extension
- Ohio Sea Grant