YELLOW PERCH ASSESSMENT[1]

Project ***Progress Report*** for the Period
September 1, 2010 to August 31, 2011

NCRAC FUNDING: $67,926 (September 1, 2010 to August 31, 2011)

PARTICIPANTS:

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Bill Lynch	Mill Creek Perch Farms, LLC	Ohio
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Industry Advisory Council Liaison:

Laura Tiu	The Ohio State University	Ohio

OBJECTIVES:

1. Using consistent protocols assess survival and growth rate of two replications of first-year fingerlings of improved lines of yellow perch as compared to fingerlings from local brood stock (feed-trained fingerlings to be stocked at 30,000-60,000/acre (75,000-150,000 fish/ha)).
2. Using consistent protocols assess 2nd year survival, growth rate, and market parameters (production, fillet yields, percent market size) of both replications of improved lines of yellow perch as compared to local fish.
3. Disseminate results to industry and to end-user customers via fact sheets, scientific publications, and an on-farm field day.

ANTICIPATED BENEFITS

The impact of this project will be primarily through the delivery of superior yellow perch strains to farmers for use in a wide range of culture and exposure conditions across the NCR. The greatest return on investment for this project is the ultimate reduction in production costs due to increased growth rate and reduced feed costs by using genetically improved strains. At the completion of this project, multiplication stations will be established to produce enough fry/fingerlings from improved strains for fish farmers in the NCR. Success in this project should be similar to that achieved for striped bass, rainbow trout, and catfish. Improved strains should show increased growth by 20–25% per generation and have a tremendous positive impact on the NCR yellow perch aquaculture industry.

PROGESS AND PRINCIPAL ACCOMPLISHMENTS

OBJECTIVE 1

Using the previously developed 2nd generation of selected broodfish, the 3rd generation of selected lines was created via marker-assisted cohort selection (MACS). When a majority of the 2nd generation improved lines was reached harvest size, approximately 500 best fish were selected for selected lines based on their body weight and breeding value, and PIT tagged and genotyped at the OSU Aquaculture Genetics and Breeding Lab using microsatellite markers. Molecular genetic pedigrees were determined and a genetic relatedness charts were constructed for mating. Among the selected fish, about 300 pairs of the least-related fish having the highest breeding value were selected for factorial, mass and pair mating, and 215 survival families and a total of 1.2 – 1.5 million fry were produced. A control lines from Ohio local broodfish were produced at each testing site.

All the broodfish candidates were genotyped using eight microsatellite loci we developed and optimized. PCR was performed using BioRad PTC-200 DNA engine thermal cycler. Genotyping were performed using ABI 3130 DNA Sequencing and Genotyping System, and genotypes automatically scored using Genemapper. Parentage assignment of improved line and local fish in communal ponds was performed using microsatellite profiles for the 8 loci and the exclusion-based approach implemented in the program CERVUS 3.0.

Factorial and single-pair matings based on the genetic pedigree and relatedness chart were conducted in 50 cm-diameter tanks with flow-through water in March, 2011 when fish have reached a mature stage. One or two injections of HCG at the dosage of 200 - 600 IU/kg body weight based on females' need and maturity were used to synchronize spawning. The fertilized egg ribbon from each pair-mating was collected daily from spawning tanks starting 2 days post-injection.

One hundred egg ribbons were produced from improved line at Piketon Aquaculture Center. Twenty of them were delivered to Brehm's fish farm in Ohio on March 16, 2011. No ribbon was shipped to WI sites because transporting permit was not ready by March spawning time. At both Piketon and Brehm's farm, egg ribbons were incubated in tanks with flow-through well water. Two days post hatch, fry were siphoned and counted for stocking to the ponds for nursery. At the same time, 30 and 18 families from OH local strain were produced in Brehm's farm and Piketon, respectively, by mass spawning.

At Piketon, 320,000 improved fry were stocked to four 0.19 acre ponds for nursery, each having 80,000 fry (1,040,000/ha; 421,000/acre), and 50,000 local fry (650,000/ha; 263,000/acre) were stocked into an additional pond. In Brehm's farm, approximately 200,000 improved fry were stocked to two 0.2 acre ponds, and 200,000 local fry were stocked in other two similar ponds. All ponds were fertilized twice before stocking and once every week during nursery period. Fry at two locations were pond-reared until they reach 25-35 mm (~6 weeks), at which time they were harvested and moved into indoor tanks for feed-training.

Feed-training were conducted in 6 – 10' tanks with stocking density of 4 – 5 kg/m^3 fingerling at the temperature of 20- 24C for 3-4 weeks. Fish were fed AquaMax Fry Powder and Starter 100 with high protein using automatic feeders. Feeding rates were about 5% of body weight (BW) for the first 2 days, and then increased 7-8% BW.

For year 1 rearing, the two test sites conducted replicated tests of the improved fish vs. the local-strain using two types of rearing tests: 1) at Piketon station, the selected line of yellow perch and a local-strain (control) were reared in separate ponds, each having two replicates with density of 69,300/ha (28,000/acre); 2) In

Brehm's farm, the selected line and a local-strain were raised communally in two 0.2-acre ponds with density of 232900/ha (94,300/acre). AquaMax Starter 100 to AquaMax Grower 400 feed was used for all experimental ponds with a feeding rate of 3% BW (Piketon) and satiation feeding (Brehm's farm). Feeding amount and rates were adjusted monthly based on an assumed survival of 75% and calculated biomass using mean weight at Piketon site.

All the ponds were harvested at the end of October (Brehm's farm) and in the early of November, 2011 (Piketon station). 150 fish from each of separate ponds at Piketon and 500 fish from each of communal ponds in Jim's farm were sampled, individually weighed and fincliped. Finclip samples were preserved individually with 95-100% alcohol in small vials. Eight molecular markers were used to assign selected and local-strain yellow perch to their family of origin for communal rearing.

In Brehm's farm, improved yellow perch grew significantly larger than yellow perch from his farm in two communal ponds, where both improved and unimproved fish grew in the exactly same environment. The improved line outweighed the local strain by 32.00% on average at the end of the Year 1 test (October). Fingerling survival in Brehm's communal ponds with improved fish was as high as he has ever had.

In Piketon ponds, improved fish exhibited 27.16% higher survival rate and 22.01% higher production than local Ohio strain by the end of October of Year 1. Although the 27.16% higher survival rate of improved fish resulted in significantly higher density and lower feed rations (rations were calculated based on the same assumed survival rate for all the ponds) for improved fish, the improved line still had higher mean body weight (37.82 g) than local Ohio strain (37.62 g). A significantly greater reduction of CV_{wt} was observed for improved line than unimproved fish, indicating size variation of improved fish was smaller, and their percentage of marketable size would be higher by the end of year 2.

WORK PLANNED

OBJECTIVE 1

Both on-farm and on-station tests of selected lines with local control lines will be conducted at two locations in the state of Wisconsin using both separate rearing and communal rearing methods we performed in Ohio. The two sites are the University of Wisconsin-Stevens Point Northern Aquaculture Demonstration Facility and Coolwater Farms, LLC. Consistent and the same rearing protocols will be adhered to the two selected sites.

OBJECTIVE 2

In year 2, the selected and local lines of large yellow perch fingerlings will be reared in ponds in two Ohio sites. In the autumn of year 2, all of the ponds will be harvested and the key production parameters (e.g., survival, growth, feed conversion for separate rearing, fillet yield) will be evaluated. Differences between females and males will be carefully measured.

IMPACTS

The impact of this project will be primarily through the delivery of superior yellow perch strains to farmers for use in a wide range of culture and exposure conditions across the NCR. The greatest return on investment for this project is the ultimate reduction in production costs due to increased growth rate and reduced feed costs by using genetically improved strains. Success in this project should be similar to that achieved for striped bass, rainbow trout, and catfish. Improved strains should show increased growth by 20–25% per generation and have a tremendous positive impact on the NCR yellow perch aquaculture industry.

SUPPORT

NCRAC has provided $67,926, which is the total amount of allocated for year 1 of this project

PUBLICATIONS, MANUSCRIPTS, OR PAPERS PRESENTED

See the Appendix.