Wisconsin Department of Agriculture, Trade and Consumer Protection
ADD Program
2006 GRANT FINAL REPORT

WDATCP Contract No.: **21051**

Project Title: Development and Evaluation of New Techniques for Intensive Yellow Perch Fingerling Production

Amount of Funding Awarded: $20,500

Organization: Willow Creek Aquaculture, LLC

Contact Person: Terence Barry

Email Address: yellowperch@charter.net

Report Submitted on: Sept. 11, 2008

Project goals

A major problem constraining the expansion of the Wisconsin yellow perch aquaculture industry is the low supply (and associated high cost) of feed-trained fingerlings. The purpose of the study was to attempt to solve this problem by evaluating a state-of-the-art method to intensively rear yellow perch larvae in tanks on a commercial scale. Our project sought to eliminate the problems of year-to-year and pond-to-pond variability associated with pond fingering production. A more reliable fingerling supply will translate into reduced fingerling costs for the expanding yellow perch aquaculture industry in Wisconsin.

The overall goal of this project is to improve the production of yellow perch fingerlings in Wisconsin, and hopefully solve a major bottleneck currently limiting the expansion of the yellow perch aquaculture industry in the state. The specific objectives are to evaluate (1) a state-of-the-art intensive yellow perch fry production method that relies on using "enriched" artemia and advanced larval fish diets (Otohime), and (2) the impact of genetic selection on early larval growth and survival during intensive commercial-scale larval yellow perch production.

Our project sought to develop a more reliable yellow perch fingerling production method, and demonstrate the importance of genetic superiority. Benefits were to include reduced fingerling costs for growout producers, which, in turn, would result in the expansion of the yellow perch aquaculture industry in Wisconsin. Intensive larval rearing methods would also facilitate current efforts to induce out-of-season spawning in yellow perch because it would permit larval production year round. The potential of the yellow perch aquaculture industry is large, as current estimates suggest that there is currently a market for over 50 million pounds of yellow perch per year in the Great Lakes region. The commercial fishery is currently not meeting this demand, nor is it likely to in the foreseeable future. The growth of this sustainable industry will provide jobs and income to rural residents of Wisconsin. It is not unreasonable to expect that the yellow perch industry in the mid-west could grow to rival the catfish industry of the south in terms of its economic impact on the rural economy. Like the catfish industry, finding solutions to a few critical problems (e.g., variable pond fingerling production) will eventually lead to the rapid expansion of the industry.

Accomplishments

We did the following: set up an collaboration with a highly experienced larval fish culturist (Ran Murashige) who taught us state-of-the-art larval fish culture procedures, built a small hatchery, built a brine shrimp (artemia) rearing system, and conducted two separate larval-rearing trials in two years designed to optimize the production of larval yellow perch. We also trained several students to help in these efforts. We did not achieve our goal of evaluating superior genetics as the surviving fish produced in year 1 where not ready to spawn in year 2. These fish, however, will be spawned in year 3 and the results shared with Wisconsin aquaculturists, as appropriate.

In year 1, approximately 10,000 newly hatched fish were stocked into each of 5 200-gallon tanks. The fish were fed according to the protocol provided by Mr. Ryan Murashige using "enriched" artemia and later transitioning to Otohime dry feeds. Algae were continually added to the tanks to create a "green water" system. The experiment began on May 1, 2007. The table below summarizes the results as of July 1, 2007. Overall, the experiment was a success in that we were able to produce some large healthy fish using intensive culture technologies. The trial was disappointing, however, because overall fish production was very low. Very few dead fish were every observed in the tanks which suggests that cannibalism may be the primary cause of fish mortality and low production numbers. Future efforts need to be directed at reducing cannibalism. All of the fish in tank C died overnight a few weeks into the trial. We have no explanation for this occurrence, but adjacent tanks were not affected. Interestingly, tanks A, B and C were on the opposite side of the room from tanks D and E. There was more light on the D and E side of the room suggesting that production may be improved by using higher levels of light above the tanks. Both artemia and larval perch are attracted to light, and therefore, fish reared in a higher light environment may have had easier access to concentrated food.

Table 1. Production of yellow perch fry using intensive larval rearing methods in year 1.

Tank	Fish number	# Deformed	% Deformed	Mean Length (cm)
A	94	29	31	2.1
B	47	20	43	1.7
C	0			
D	183	102	52	2.2
E	322	82	25	2.9

In year 2, we only stocked two 200-gallon tanks, each with approximately10,000 newly-hatched fry that were obtained from Coolwater Aquaculture, LLC. We had hope to breed survivors of the year 1 trial in hopes that such fish would be genetically predisposed to survive intensive larval rearing, and that they would pass on superior genes to their offspring. Unfortunately, the fish were not large enough to spawn in year 2 (note: these fish will be spawned in year 3 to test this hypothesis). Only two tanks were stocked so that we could give more focused attention to the fish. The tanks were on the "light" side of the room (tanks D&E). The fish were fed according to the protocol provided by Mr. Ryan Murashige using "enriched" artemia and later transitioning to Otohime dry feeds. Algae were continually added to the tanks to create a "green water" system. The experiment began on May 1, 2008. Table 2 below summarizes the results on July 1, 2008.

Table 2. Production of yellow perch fry using intensive larval rearing methods in year 2.

Tank	Fish number	# Deformed	Mean Length (cm)
D	31	20	2.2
E	26	17	2.9

Overall, the experiment was a failure and far fewer fish were produced in year 2 than year 1. There were also many more deformed fish in year 2. We do not have a good explanation for this result other than that there may be year-to-year variability in egg quality, perhaps due to broodstock nutritional status or other factors. All key water quality parameters such as temperature, dissolved oxygen concentration, pH, hardness and flow rate were excellent throughout the trial and cannot explain the low production numbers. Clearly, our method is not the answer for mass-producing larval yellow perch. Some fundamental factor, likely a key nutritional component or components, is missing from our protocol. Enriched artemia are used very successfully to mass-produce many larval marine fish species. We conclude, however, that enriched artemia are not a complete diet for larval yellow perch. Likewise, Otohime dry diet may not be a suitable larval perch feed. Otohime is a superior diet for marine fish, but may lack essential nutrients required by developing yellow perch fry. Alternatively, though not likely, Otohime may contain ingredients that are harmful to larval yellow perch development. We did not observe any cannibalism in the year 2 trials, but we still believe that this phenomenon is the best explanation for the steady decline in fish numbers with time. There was no possibility that fish went down the drain.

We produced a film in cooperation with James D. Held, UW Extension showing the step-by-step procedure for producing "enriched" artemia. This video will be posted as a pod-cast on line and will be useful for aquaculturists interested in learning how to rear larval fish for the first time. A video on a CD is included with this report.

Although we did not achieve our primary objective of mass producing larval yellow perch, I think we did accomplish an important goal is establishing what does not work, and pointing to the place where future efforts need to be focused in order to have the desired success.

Future work

- Define the nutritional requirements of larval yellow perch and use or develop a diet that matches the fish's requirements. Probably the best approach will be to do a complete nutrient analysis of the fry and larvae (e.g., fatty acid and amino acid analysis) and use diets that provide what is currently missing from enriched artemia and Otohime dry diet.
- Once the nutritional requirements of the fish are established, we need to work on improved culture methods that decrease the incidence of cannibalism. Ideas include using clay instead of green water to reduce visibility in the water so that the are less likely to see and eat each other. This approach works well in walleye culture.
- Improve other aspects of fish husbandry to improve production. For example, we need to determine the effect of stocking density, feeding rates, and feeding frequencies, etc.
- Investigate the effects of novel feed additives that may improve production. These could include anti-inflammatory agents, probiotics and antibiotics.

- Evaluate the effect of breeding survivor of

How Wisconsin yellow perch producers can use the results of the study

Although we did not achieve our primary objective of mass producing larval yellow perch, we did accomplish an important goal of establishing (1) what does not work, (2) a good starting point for futhre sand pointing to the place where future efforts need to be focused in order to have the desired success.

We produced a film in cooperation with James D. Held, UW Extension showing the step-by-step procedure for producing “enriched” artemia. This video will be posted as a pod-cast on line and will be useful for aquaculturists learning how to rear larval fish for the first time. A DVD of the video is included with this report.