

Executive Summary

Intensification of First Year Largemouth Bass (*Micropterus salmoides*) Using Alternative Pond-Based Production Systems

Largemouth bass (*Micropterus nigricans*; LMB) are one of the most popular sportfish in the United States. Whether cultured to a fingerling size for stock enhancement or to the food market size (~ 0.45 – 0.68 kg), cannibalism in low-density production ponds is a major problem for producers, especially during the early growth stage. The PIs proposed investigating intensified alternative production systems for LMB, which would promote (1) reduced cannibalism, (2) lowered feed conversion ratios, (3) improved opportunity for sheltering from piscivorous birds, and (4) increased yields. The alternative systems included a pond-side tank system, and a split-pond system where fish were kept in ~1/3 of the ponds' area. Both systems were designed to increase stocking density and promote improved water circulation and quality. The results of this study highlight the potential improvement in LMB production with split ponds, instead of traditional full ponds. The LMB reared in split ponds showed significantly less variation in size compared to the full ponds, while achieving similar growth, survival, and production efficiency. This more uniform growth can reduce losses associated with cannibalism and reduce labor costs associated with grading fish. Additionally, the split ponds promoted better water circulation and waste removal and provided more ideal water conditions for the LMB, compared to the traditional full ponds. This project provides LMB farmers with novel methods to improve uniform production of LMB fingerlings in the NCR. Scaling split ponds to large-scale commercial production is the next step for determining the utility of this approach.

Termination Report

Project Title: Intensification of First Year Largemouth Bass (*Micropterus Salmoides*) Using Alternative Pond-Based Production Systems [Termination Report]

Total Funds Committed: \$328,367

Initial Project Schedule: September 1, 2021-August 30, 2022 [Extended to August 31, 2025]

Current Project Year: September 1, 2024-August 31, 2025

Participants: James Garvey, Southern Illinois University-Carbondale; Robert Rode Purdue University; Paul Brown, Purdue University; Karolina Kwasek, University of New Hampshire

Extension Liaison: Paul Hitchens, Southern Illinois University-Carbondale

Industry Liaison: Stacey Sisk, Big House Fish Farm

Relevance: The benefit to the industry is to raise age-0 largemouth bass fry to fingerling size at maximum production. This project will provide us with data that we can use to compare production practices between traditional culture ponds, pond-side tank culture systems, and split-ponds for largemouth bass in research ponds at Purdue University and SIU-Carbondale. Largemouth bass farmers in the Midwest will have the opportunity to visit the research sites and the on-farm demonstration to learn about whether or not these production systems may be worth adopting on their farms. These systems could provide an opportunity for largemouth bass farmers to purchase smaller fingerlings from hatcheries. Additionally, farmers of other species can have the opportunity to learn about other potential production practices.

Response: Pond-side tanks and split ponds showed that age-0 largemouth bass raised in intensive culture produce more biomass than in whole ponds.

Results: Five distinct objectives were pursued in this project:

1. To evaluate two alternative pond-based production systems (split ponds and pond-side tank culture) in the Midwest on largemouth bass, *Micropterus salmoides*, quantified production parameters.

At the conclusion of Year-1, the only significant differences in split-pond vs. full pond comparisons existed within the coefficient of variation (CV) of final weight and CV condition factor (CF). Fish reared in the full ponds showed a significantly higher CV in both final weight and CF compared to the split-ponds. In Year-2, no significant differences were observed in the final weight, length, or CF between the three tested systems. The full ponds showed a significantly higher CV of final length than the split-ponds and tanks, and a significantly higher CV of final weight compared to the tanks. There were no significant differences in the CV of CF between groups. Additionally, there were no significant differences between groups in the SGR, production efficiency, and survival. In both years, the full ponds showed a significant deviation from homogeneous variance in total length. This suggests the dispersal and variation of fish lengths was significantly different between individual full ponds. Meanwhile, homogeneity of variance was not rejected for split-ponds or tanks, suggesting the size distribution among individual split-ponds and tanks was consistent. Overall, both split-ponds and pond-side tanks exhibited more uniform growth in producing LMB. Pond-side tanks, although performing the best at maintaining more uniformly sized fish, produced fish of smaller size. These results suggest that pond-side tanks are likely not viable, as we designed and implemented them, for rearing LMB as food fish. With improved size homogeneity and comparable production, split-ponds showed promise as an alternative pond-based production system for rearing LMB.



Asyeh Sohrabifar, masters student in civil engineering at Southern Illinois University, runs exclusion netting around s split-pond experiemental unit in Spring 2025. Netting was needed to reduce predation by mammals and birds on fingerling largemouth bass.

2. To investigate and compare changes in water quality and the aquatic food web in the pond-based production systems.
Mean values across the experiment showed split-ponds to have higher DO, pH and conductivity, as well as lower temperature compared to other systems. Full ponds mean values were highest among systems for ORP, N-ammonia, chlorophyll, and TOC and lowest for nitrite and pH. Tank mean values were highest for nitrite and lowest for chlorophyll, ORP, DO, un-ionized ammonia, and N-ammonia. Of the 11 variables assessed within models for “between system” comparisons, only N-ammonia and nitrate are suggested not to be significantly influenced by system-type. Compared to both split-ponds and tanks, full ponds showed a negative influence on nitrite and conductivity and a positive influence on ORP and TOC. Compared only to split-ponds, full ponds additionally showed a negative influence on un-ionized ammonia, DO and pH with a positive influence on temperature. Overall, both split-pond and tank systems more consistently exhibited nitrogen profiles indicative of effective nitrification than full ponds. Split-ponds maintained more desirable consistency across the experimental period for DO, temperature, and pH compared to tanks and full ponds.



Asyeh Sohrabifar stands next to two experimental fingerling largemouth bass from the “open pond” treatment. Fingerlings were started at identical sizes at the start of the experiment. The size disparity between the fish is typical of what occurs in traditional largemouth bass farming. Significant losses occur as large bass consume smaller ones. Both split pond and side tank treatments reduce these size differences and led to higher yield of fingerlings.

3. To investigate the effect of the two-alternative pond-based production methods (split ponds and pond-side tank culture) on LMB response to stress. The effect of these alternative production methods on stress in LMB was unable to be analyzed as part of this project. Gill, blood, and whole-body samples were collected from both years; however, the mishandling of samples by the shipping company led to a complete loss of usable samples.
4. To conduct an on-farm extension demonstration of the pond-side tank culture system. A pond-side aquaculture demonstration was conducted at Purdue University, with participation from fish farmers in Fall 2023. A second pond-side system is being built at Big House Farms in Carbondale, IL and should be ready for a demonstration in early Spring 2026.
5. To immediately disseminate results to industry via final termination report to NCRAC. Dissemination of project results were initiated by presenting relevant findings at two conferences: 2025 World Aquaculture Society (New Orleans) and 2025 American Fisheries Society (San Antonio). Additionally, two manuscripts have been prepared and will be submitted to peer-reviewed journals. Facility tours (upon request) have allowed local farmers and other officials within fisheries/aquaculture to examine the infrastructure and ask questions about the experiment. Further plans to disseminate this study’s findings exist by methods of social media and other electronic media.



Koaw Zacek, PhD student at Southern Illinois University, presents project research results at the 2025 World Aquaculture Society in New Orleans, LA.

Outreach Overview: Facility tours (upon request) have allowed local farmers and other officials within fisheries/aquaculture to examine the infrastructure and ask questions about the experiment. Further plans to disseminate this study's findings exist by methods of social media and other electronic media.

Impacts: Split-pond systems as alternative pond-based production systems may be a viable way for farmers to produce LMB of more uniform size compared to traditional full pond systems while not sacrificing biomass production. Improved size-homogeneity decreases intracohort cannibalism, a problem faced by any farmer producing cannibalistic fishes, which includes LMB. Additionally, the split-ponds showed the potential for a more efficient nitrogen cycle and greater consistency of physiochemical conditions for LMB. Ultimately, the split-ponds demonstrated in this study have the potential to be implemented on existing LMB farms, and improve uniform production of LMB as a food fish.

Targeted Audience: Farmers are the intended audience as we seek to learn more about the production feasibility of pond side tank culture and split-ponds using smaller feed habituated largemouth bass.

Recommended Follow-Up Activities:

- As LMB reared as food fish will require more than one grow out season, further studies should examine comparisons between maintaining cohorts in split-ponds for both growing seasons vs. cohorts reared in split-ponds for the first growing season and then

moved to full ponds for the second growing season. Examination should focus on whether size homogeneity is maintained across both growing seasons.

- For both split-pond and pond-side tank systems, larger scale infrastructure (especially bass-containing areas) should be utilized to mimic more closely what a typical farmer would use. With replicate treatments, different stocking densities could be utilized to determine a more optimal stocking density within these system types.
- Economic analysis should be conducted to determine the cost of large-scale implementation of the split-pond systems and the value added through the improved size uniformity and water quality.