

LARGEMOUTH BASS NUTRITION⁷

Project *Termination Report* for the Period
September 1, 2005 to August 31, 2009

NCRAC FUNDING: \$170,000 (September 1, 2005 to August 31, 2009)

PARTICIPANTS:

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REASON FOR TERMINATION

The objectives were completed and funds terminated.

PROJECT OBJECTIVES

- (1) Assess diet and environmental factors that affect growth and health of largemouth bass raised to 1.5 lb in ponds with formulated feed.
- (2) Develop cost-effective finisher diets that enhance health and growth of largemouth bass.
- (3) Conduct a region-wide workshop on raising largemouth bass to 1.5 lb in ponds based, at least, on the results of the research activities in Objectives 1 and 2.

⁷This 2-year project was chaired by Christopher C. Kohler and it began September 1, 2005.

PRINCIPAL ACCOMPLISHMENTS

On November 14, 2004 the aquaculture facility at Purdue University (Purdue) was destroyed due to a fire. As a result, all activities proposed by Purdue researchers for Objectives 1 and 2 as well as associated outreach activities by Morris in Objective 3 were postponed anywhere from two to three years.

OBJECTIVE 1

Research at Southern Illinois University- Carbondale (SIUC) included a temperature effect study on largemouth bass feeding and growth during the second growth season.

This study involved two treatments with four replicates for each treatment using eight 0.04-ha (0.1-acre) ponds and each treatment involved feeding fish at a particular time of day with the intent of fish being fed during different water temperatures. In treatment #1, fish were fed within an hour of sunrise each morning while in treatment #2 fish were fed within an hour of sundown each evening. Statistical analysis indicates that there were no significant treatment differences in overall growth, densities, or condition.

An over-winter study was completed including two treatments with four replicates for each treatment using eight 0.04-ha (0.1-acre) ponds to observe whether largemouth bass lose feed training over a winter period of not being fed. One treatment involved feeding largemouth bass 1% of wet body weight of a 45% crude protein commercial trout diet whereas the second treatment received no food. The trial's duration was the entire winter season between the second and third growth seasons. Twenty-five fish from each replicate per treatment were randomly selected and placed in an indoor recirculation system of the same temperature as the research ponds. Tank temperatures were raised 1.0–2.0°C/day (33.8– 35.6°F/day) to imitate spring temperature changes. Once spring temperatures were reached, fish were fed at 4% wet body weight and observations of feeding in each treatment were made. No differences in bass recommencing feeding on prepared diets were observed between treatments.

A study was also conducted to determine the effects of pellet size on largemouth bass growth during the third growth season. The pellet-size study included one treatment being fed a 7.5-mm (0.3-in) pellet and a second treatment a 9.5-mm (0.4-in) pellet.

Analysis included weight and length gain, as well as feed conversion comparisons between the two treatments. There were no significant differences detected in this study as both sizes of pellets yielded similar production data.

A final study was conducted to examine the effects of carbohydrate levels on growth in largemouth bass reared in an indoor recirculation system. Diets containing 0% (control), 10%, 20%, or 30% dextrin as a carbohydrate source (36% crude protein, 15% crude lipid) were fed to replicate tanks ($N = 3$) of juvenile largemouth bass (~22.0 g; ~.08 oz) in a recirculation system consisting of 12, 190-L (50-gal) aquaria and associated mechanical and biological filtration units for a period of 10 weeks.

In addition to routine measures of production performance, plasma insulin and glucose were monitored periodically throughout the trial. A slight, though significant increase in weight gain and specific growth rate was associated with the 30% dextrin feed, which was primarily associated with an increase in hepatosomatic index (result of excessive glycogen deposition in

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the liver). Although no diet- related differences in insulin or glucose were noted during the trial, fish fed the dextrin- supplemented feeds exhibited significant pulse in plasma glucose from 6–8 h after feeding. This pulse was not observed in the control group, and was not accompanied by an increase in plasma insulin. This data supports the hypothesis that largemouth bass are poorly suited to carbohydrate-rich diets, and that elevated blood glucose (as opposed to increased plasma amino acid content) is not as strong a trigger for insulin release in carnivorous fishes as it is in other vertebrates.

Complementary pond and laboratory studies were conducted by Purdue in 2007-2008 with largemouth bass to examine new practical dietary formulations and use of alternative protein feedstuffs. Modified practical diets fed to bass in earthen culture ponds resulted in no significant differences in weight gain or other production parameters. The modified diets, manufactured by Nelson and Sons, Inc, Murray, Utah, contained 35% soybean meal. Fish did not display negative influences of fish meal replacement with soybean meal even though diets contained up to 60% soybean meal.

OBJECTIVE 2

Research at Purdue was designed to address liver health of bass during the second year of growth. A commercial control diet (Nelson and Sons, Inc., Steelhead Diet) was used as a positive control diet and an experimental diet was developed in collaboration with a feed mill. The experimental diet contained more soybean meal (35%) and more choline than the commercial diet. Both diets were fed to 2+ year old bass raised in earthen culture ponds. Ponds were harvested in conjunction with an Extension Field Day (Objective 3). There were no differences in consumption, weight gain, or feed conversion rate of fish fed the two diets. None of the modified diets resulted in improved liver health. None of the fish displayed signs of ill health and all gained weight at rates comparable to other studies, but all livers appeared pale and mottled.

OBJECTIVE 3

The region- wide workshop on largemouth bass nutrition was hosted at Purdue on October 17-18, 2008. Speakers included Paul Brown (Purdue), James Tidwell (Kentucky State University), and Kwamena Quagraine (Purdue). The 20 attendees received supporting materials developed using information garnered from this project and also participated in fish harvests.

IMPACTS

These data indicate that largemouth bass are tolerant of soybean meal in diets and modifications can be made that would save considerable amounts of money on feed costs. However, poor liver health remains an issue.

Results from these studies clearly indicate that the nutritional research conducted over the past 12 years resulted in a sufficient level of knowledge to formulate diets for grow out of largemouth bass using ingredients other than fish meal. However, there are some ingredient limitations that need further research.

Information from this project will be used to develop extension materials in conjunction with James Tidwell (Kentucky State University). The associated DVD will contain voice-over

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PowerPoint presentations as well as footage from the October 2008 workshop.

Developing modified diets for emerging aquaculture species (such as largemouth bass) allows feed mills to react to price volatility of commodities and restrain feed costs during times of rapid escalation.

Moving toward diets that contain higher concentrations of regionally available ingredients increases the probability of regional manufacturing of diets.

Additionally, formulations containing optimal balance between energy and protein sources improve growth efficiency of aquatic livestock and minimize waste and effluent production.

RECOMMENDED FOLLOW-UP ACTIVITIES

Increased inclusion of carbohydrates, specifically dextrin, resulted in physiological dysfunction in largemouth bass. This appears to have been the result of insufficient insulin response to elevated circulating glucose levels. This effect may be attenuated by directly including known piscine insulinotropes (e.g., certain amino acids) in carbohydrate-rich feeds, thereby improving utilization of these feeds. Studies to address this hypothesis are recommended.

Although it is now possible to continue to define critical nutrient requirements for this species, more progress could be made by using alternative methods, i.e., metabolomics and proteomics analytical approaches, to compare wild fish to pellet-fed, cultured fish. These new methods may allow for improved feed formulations in a

shorter time period than is often the case in feed development.

SUPPORT

NCRAC funds provided \$170,000 which was the entire amount of funding allocated for this 2-year project.

PUBLICATIONS, MANUSCRIPTS, OR PAPERS PRESENTED

See the Appendix for a cumulative output for all NCRAC-funded Largemouth Bass activities.