Project Title: Evaluate Phase II Production of Bluegill Sunfish Comparing a Least-Cost Diet Utilized in the Phase I Verification Study Compared to an "Industry Standard" for One Production Cycle [Termination Report]
Key Word(s): Nutrition/Diets
Total Funds Committed: $75,000
Initial Project Schedule: September 1, 2012 to August 31, 2013
Current Project Year: September 1, 2014 to August 31, 2015
Participants: Christopher F. Hartleb, University of Wisconsin-Stevens Point, Wisconsin; Charles E. Hicks, Lincoln University, Missouri; James Wetzel, Lincoln University, Missouri
Extension Liaison: Charles E. Hicks, Lincoln University, Missouri
Industry Liaison: Paula Moore, Jones & Eaker Farms, Missouri
Reason for Termination: Project objectives completed and funds have been terminated.

Project Objectives

1. Using consistent protocols, evaluate/determine performance of age-2 bluegill fed the diet (41% protein/<8.3% lipid) previously developed by a NCRAC funded project compared to an "industry standard" diet used in the on-going project at two distinct latitude locations in ponds for one growing season.
2. Coordinate dissemination of project results with the NCRAC Technical Committee/Extension Subcommittee. The expected deliverable will be a technical bulletin containing such detailed information as growth, production parameters, size composition, and survival using data collected over grow out to market size, i.e., the first year from the on-going plus this year's project.

Project Summary

Growth in the North Central Region's (NCR) aquaculture industry mirrors, and is driven by, broader U.S. and worldwide changes in the seafood industry. However domestic aquaculture production has remained about the same for the last 5 years (NMFS 2009). Aquaculture-related business in the NCR continues to be an "emerging" industry in that selection of appropriate species and associated culture practices including feed selection is evolving. As with any animal industry, feed costs can be a considerable component. Feeds often account for ≥50% of the variable costs in aquaculture budgets. To reduce variable costs there have been numerous research efforts in the NCR as well as nationally addressing the possible uses of lower-cost foodstuffs, e.g., vegetable or animal by-product as a major component of fish feeds. Clearly, substantial need exists to reduce costs and develop nutritionally adequate diets for Sunfish and other species cultured in the NCR.

Technical Summary and Analysis

Researchers from two NCR universities, Lincoln University of Missouri (LU) and the University of Wisconsin- Stevens Point (UW-Stevens Point) compared age- 2 bluegill production at densities of 7,674 sunfish/ha (2,800/acre) using two diets, the recently developed open formula versus an industry standard diet (40% crude protein and 10% lipids); both diets were produced by one common facility and distributed among the two locations. The standard diet is a commercial trout chow and the test diet is the open formula diet (Appendix 1) developed by Robert Hayward, University of Missouri-Columbia. The Phase II least cost diet test for bluegill sunfish indicated that feed formulated with lower cost formulations can show similar results as using a currently available diet developed for salmonids which currently dominates the market.

Principal Accomplishments
Earthen ponds at LU and UW-Stevens Point (0.10-ha; 0.25-acre) were used for part or all of the study described below. Fish were stocked in (LU) ponds (6) the last week of March and feeding commenced 1 April 2012. Feeding rings were placed in each pond and fish were fed by hand twice daily except once on Saturday and no feeding on Sunday. Dissolved oxygen and water temperature were recorded daily and water quality measurements were conducted weekly.

All fish at (LU) were harvested 10/25- 26/2012. Total pond fish weights and numbers were determined and 105 fish from each pond were individually weighed and measured. Fillet weights, liver, viscera, and gills and viscera weights were determined for each fish. Thirty (30) fillet samples were taken from pond and pooled. Eighty (80) gram subsamples of fillet tissue from each pond and submitted to a Laboratory at the University of Missouri for moisture, crude protein, lipid and ash analysis. A summary of the information is included in Table 1.

Impacts
The cost differential between the two feeds would justify using the least cost diet to reduce the cost per pound of producing bluegill. The same approach to developing formulations could enable a future reduction in the reliance on marine fishery sourced feed-stuffs.

Recommended Follow-Up Activities
In year 2, there were no differences in the growth or survival of bluegill fed the standard or the least-cost diet. Therefore, by definition, the least cost diet would provide a benefit to bluegill producers by providing similar fish growth at a lower cost. The problem we encountered in year 2 was finding a feed manufacturer that would produce the least cost diet. Future follow-up activities should focus on that problem – finding a feed manufacturer that is interested and willing to produce the diet for the bluegill industry sector.

Publications, Manuscripts, Workshops, and Conferences
See the Appendix for a cumulative output for all NCRAC-Funded Nutrition activities.

Technical Update

Table 1. Summary of Phase II bluegill production and dressout data.

Location	Pond	TRT	Stocked Wt.	End Wt. (kg/ha)	Gain	Stocked (#/ha)	Harvest (#/ha)	% Surv.	Mn Individual Wt (0.1g)	TL mm	% On-Round	%Fillet
LU	4	IS	188.4	1263.4	65.2	7672	5502	71.7	238.5	207	89.5	23.5
LU	7	IS	189.9	1353.1	81.7	7672	5973	77.9	229.0	204	88.7	22.6
LU	12	IS	202.1	1316.2	62.1	7672	5677	74.0	241.2	207	88.9	20.6
LU	8	LC	184.6	1539.4	124.4	7672	6751	88.0	226.2	203	89.2	24.6
LU	9	LC	190.7	861.9	-17.7	7672	3650	47.6	228.2	203	89.7	21.3
LU	11	LC	171.6	1027.7	34.7	7672	4680	61.0	221.1	204	89.2	24.3
WI	PB	LC		753.7	41.3	7672	3498	45.6	214.7	201		38.6
WI	PR	IS		753. 1	39.8	7672	3314	43.2	229.5	201		35.5
WI	PF	LC		1124.8	56.0	7672	6537	85.2	171.5	225		37.4
WI	B3	LC		599. 3	45.0	7672	6475	84.4	185.3	196		36.5
WI	B4	IS		561.8	38.5	7672	5171	67.4	212.8	201		36.4
WI	B5	IS		603.8	39.3	7672	4135	53.9	208.9	200		36.7

Table 2. Summary of bluegill fillet proximate composition.

Location	Pond	TRT	Moisture	%CP	%LIPID	%ASH	LSI	VSI
LU	4	IS	76.6	20.9	1.9	1.3	1.8	8.1
LU	7	IS	78.0	20.1	1.3	1.3	1.7	8.5
LU	12	IS	76.5	21.0	1.7	1.7	1.7	8.9
LU	8	LC	77.4	20.7	1.3	1.3	1.9	7.9
LU	9	LC	77.7	20.3	1.5	1.4	1.9	7.9
LU	11	LC	76.5	20.8	2.1	1.5	1.9	8.1
WI	PB	LC	78.3	18.7	2.7	1.1		11.8
WI	PR	IS	78.1	18.3	3.1	1.1		11.9
WI	PF	LC	79.2	18.2	2.0	1.2		12.4
WI	B3	LC	77.8	18.7	3.0	1.2		11.9
WI	B4	IS	77.9	18.9	2.8	1.2		11.9
WI	B5	IS	77.3	19.3	3.1	1.2		11.8

VSI= Visceral Somatic Index LSI= Liver Somatic Index