SUNFISH[(7)]

Project Component Termination Report for the Period
September 1, 1999 to August 31, 2002

NCRAC FUNDING LEVEL: $168,000 (September 1, 1999 to August 31, 2002)

PARTICIPANTS:

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REASON FOR TERMINATION

Work on the objective was completed.

PROJECT OBJECTIVE

Conduct field trials of bluegill and F_1 hybrid sunfish (female green sunfish × male bluegill) in commercial size production facilities defined as ponds >0.04 ha (0.1 acre) and indoor recycle systems in the upper and lower portions of the North Central Region (NCR). A minimum of three replicates will be used in all pond and recycle system studies; commercial feeds to be used will be those identified in previous studies.

PRINCIPAL ACCOMPLISHMENTS

POND STUDIES

Pond studies were conducted by researchers at Southern Illinois University-Carbondale (SIUC) and Morris of Iowa State University (ISU) representing the lower and upper portions of the NCR, respectively.

Bluegill showed poor growth in both sets of ponds used by SIUC and ISU researchers through the end of the second growing season. This was attributed, at least in part, to increased competition for resources in the ponds as the number of young fish increased with each reproductive cycle during the growing season. During the second year, young-

of-the-year (YOY) bluegill became abundant in the ponds stocked with bluegill, whereas the ponds stocked with hybrid sunfish had few or no YOY. Bluegill growth may be improved under a strategy where YOY fish are removed. The production of edible-size bluegill using a 3-year production cycle did not prove to be promising in ponds used by SIUC researchers even though those same researchers had shown hybrid sunfish reaching an edible-size (>227 g; 0.5 lb) during the third year of a 3-year production cycle in previous studies.

Conversely, hybrid sunfish showed better promise even though they didn't reach edible market size (227 g; 0.5 lb) by the third year of a 3-year production cycle. During the first two years of production, the hybrid sunfish grew about 76 g (0.17 lb) per year. However, their growth rates were unexpectedly lower during the third year and didn't reach the 227 g (0.5 lb) market size. The slower growth during the third year of production was attributed to increased competition due to YOY and 1-year old fish that were found at the time of final harvest. It was suspected that this problem had not been a factor for the hybrid sunfish during the first two years of production because they grew sufficiently during that period. Results from the ISU study indicate hybrid sunfish will have a skewed population towards males that consume relatively greater amounts of prepared and natural feeds compared to bluegill; acceptance of prepared feeds is critical in intensive-pond production where natural feed organisms are rapidly depleted. Stocking the top 70% (in regard to size) of both bluegill and hybrid sunfish does not appear to produce marketable sizes within a 2-year production cycle. It also appears from these studies that production of edible-size bluegill or hybrid sunfish using a 3-year production cycle is not too promising unless YOY fish are systematically removed.

Another component of this project was for SIUC to evaluate production of bluegill and hybrid sunfish fingerlings that had been spawned out of season at ISU. Brood fish provided by SIUC to Morris at ISU during 1999 died due to equipment failure. In 2000, SIUC was unable to secure sufficient numbers of brood fish in time for ISU to spawn them. Therefore, as an alternative, SIUC researchers evaluated growth of black crappie in ponds, cages, and raceways.

In May 2001, YOY black crappie (40-50 mm [1.6-2.0 in], 1g [0.035 oz]) were stocked into a 1,040-L (275-gal) raceway at a density of about 6 g/L (0.05 lb/gal) for feed training. The crappie showed a strong feeding response to freeze-dried krill, essentially the first time it was offered. Within three days, the majority of the fish were actively feeding. At this point, a small amount of high-krill Biodiet© was fed along with the krill. Once fish were eating Biodiet©, transitions to larger pellet sizes were not a problem. Overall training success was 80%. Of the non-feeders, 75% died and the other 25% were emaciated.

The 80% training success by SIUC is similar to the best results obtained by others in previous studies. Furthermore, krill is a much more convenient first feed to use as compared to other types of feed (i.e., carp eggs) that have achieved similar success. Additional data from ISU also supported this feed training technique, however, improved fish growth was not evident until 30 days after the initiation of the study.

Another study was initiated by SIUC researchers to assess growth of this species on prepared diets in a pond setting. A growth comparison was made of black crappie held in 1,425-L (376-gal) cylindrical cages with those held in those same size cages for only 30 days before being released into a 0.04-ha (0.1-acre) pond. Growth and survival were similar for both culture methods. Surprisingly, crappie released into the pond remained on feed but did not grow well. In the absence of a natural food source, it is possible to keep black crappie on prepared diets. However, the prospect of growing black crappie to market size during one growing season does not appear to be promising at this time.

SIUC researchers also compared growth of black crappie on two different diets (Silvercup™ trout feed and Fishbelt™ catfish pellets) in indoor recycle systems. Growth was low for all fish in this study and no difference was found between the black crappie fed different diets. There was a clear delineation between fish that remained on feed and those that became emaciated and starved during this study. Low growth in this study was attributed to competition for food and space.

INDOOR RECYCLE SYSTEMS

ISU investigators found that it is difficult to raise either bluegill or the hybrids to a market size (227 g; 0.5 lb) within 30 months in an indoor recycle system (six, 1,135-L [300-gal], circular fiberglass culture tanks). After a total of 17 months in ponds and 12 months indoors at favorable growing temperatures (about 25°C [77°F]), fish had not reached marketable food size even with repeated grading. Thus, these studies indicate a serious practical problem for intensive culture of bluegill and hybrid sunfish in indoor recycle systems at 25°C (77°F) under conditions when water quality should not have been a limiting factor. However, bluegill did appear to grow better and perhaps reach marketable size in the significantly larger (18,925 L [5,000 gal]) indoor recycle system located at North Dakota State University (NDSU).

Findings from this project also demonstrated that hybrid sunfish growth rates were inversely related to tank density during the second year of production. Hybrid sunfish fingerlings may be more expensive than bluegill because the producer must have separate ponds for bluegill and green sunfish brood stock to produce the hybrids. The only advantage of the hybrids might be a higher resistance to disease.

The trial at UM was delayed while awaiting the completion of another NCRAC project (Wastes/Effluents) using the production facilities. Bluegill and hybrid sunfish had been obtained from Osage Catfisheries in Osage Beach, Missouri at the beginning of the funding cycle. The two strains were held at ambient well water at a temperature of 12°C (54°F) and fed a maintenance ration until they were stocked in the production tanks in the summer of 2001.

Consultations with the staff at Osage Catfisheries indicated that holding fish back at low temperatures and feeding levels would not impact their growth potential. To verify this, additional fish with a normal production history were obtained from the same source for a concurrent growth comparison.

In late October, there appeared to be far fewer fish in some of the tanks than were originally distributed to them, yet this was puzzling because no substantial mortality was observed by UM researchers. Perhaps because of cloudy water, there were far more post-handling mortalities than were observed. Upon draining the tanks it was determined that there were significantly fewer fish than had been previously stocked; remaining monies from this portion of the project were then made available to other project participants to pursue additional related sunfish studies.

The work at UM, based on rough projections of growth rates, indicates that male bluegill possess the inherent capacity to grow to marketable food size within two years while female bluegills and both sexes of the hybrid sunfish fall substantially short of this time-frame even under the best of growing conditions. These data provide evidence that efforts to rear *Lepomis* species to marketable food size within an established 2-year grow-out time-frame should focus on male bluegills.

Conclusions for these studies are: (1) male bluegill have the capacity to substantially outgrow female bluegills as well as both sexes of the hybrids; (2) there is a tendency for hybrid sunfish to grow better in ponds due to, in part, the bluegill's tendency for substantial in-pond reproduction as well as a higher social cost and their better ability to utilize natural feeds; (3) bluegill appear to grow better than hybrid sunfish in larger indoor recycle systems (UM and NDSU studies); and (4) merit continues to exist concerning the use of black crappie as a food fish in the NCR.

IMPACTS

- Bluegills showed better growth in UM and NDSU indoor tank studies and male bluegills were noted for having greater growth capacity than females or either sex of the hybrid sunfish in UM studies.
- It does not appear possible to successfully rear edible market-size, >227 g (0.5 lb) bluegill or hybrid sunfish, in a 3-year production cycle. However, information garnered from UM researchers indicates that the use of male bluegills in these same systems holds a good potential to achieve a market-size fish in the same time period.
- It was determined that grading sunfish of either taxa at either pond site or over a repeated number of times in indoor systems did not significantly increase the number of food-size sunfish of either taxa in ISU studies.

RECOMMENDED FOLLOW-UP ACTIVITIES

- Future studies should focus on the production of male bluegill, which then could be used to produce edible market-size sunfish in either ponds or indoor systems in a more efficient manner.
- Given the inherent ability of bluegill to reproduce in ponds, the use of a predator, e.g., largemouth bass, to control excess bluegill production should be investigated as a practical method of excessive sunfish reproduction.

- Given the initial success of feed training black crappie using the methodology described above, additional research is needed to raise these feed-trained fish under commercial-scale aquacultural operations. For instance, what are the nutritional requirements of these fish?
- Although black crappie still have potential for aquaculture, further research efforts should focus on stocking densities and feed rations.

PUBLICATIONS, MANUSCRIPTS, AND PAPERS PRESENTED

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

SUPPORT

YEARS	NCRAC-USDA FUNDING	OTHER SUPPORT					TOTAL SUPPORT
		UNIVER-SITY	INDUSTRY	OTHER FEDERAL	OTHER	TOTAL	
1999-02	$168,000	$189,862				$189,862	$357,862
TOTAL	$168,000	$189,862				$189,862	$357,862