

Public Abstract

First Name:Adam

Middle Name:Jonathan

Last Name:Doerhoff

Adviser's First Name:Robert

Adviser's Last Name:Hayward

Co-Adviser's First Name:

Co-Adviser's Last Name:

Graduation Term:FS 2007

Department:Fisheries & Wildlife

Degree:MS

Title:Establishing mostly-male bluegill groups and evaluating their growth benefits in indoor rearing systems

Bluegill *Lepomis macrochirus* and hybrid bluegill (F1: male bluegill x female green sunfish *Lepomis cyanellus*) are leading candidates for the culturing of large, food-size sunfish (>0.5 lb.; 225g) due to their acceptance of commercial feed, their fast growth, and palatability. Hybrid bluegill tend to grow faster and to larger sizes than do bluegill in ponds. However, recent evaluations in indoor tanks have shown that male bluegill grow faster than female bluegill and both sexes of the hybrid bluegill, indicating that male bluegill have the greatest potential to reach food-market size within the preferred grow-out periods of two years. A practical means to establish monosex or mostly-male bluegill groups at the juvenile stage currently does not exist, aside from treating young bluegills with androgens. However, such an ability would be useful to assist fish producers not able to carry out androgen treatment, but also to take advantage of the male bluegill's rapid growth.

The major goals of my research were to (1) develop techniques for establishing monosex or mostly-male groups of juvenile bluegill, and then to (2) compare growth rates of mostly-male and mixed-sex bluegill groups reared indoors in tanks, to determine whether the former exhibit faster growth to food-market weight, and greater numbers of large sunfish. Three experiments are aimed toward these goals, with the major objective being to increase the present capacity to rear bluegill to food-market size within grow-out periods of two years or less.

In Experiment 1 (Chapter 1), the inherent growth capacity (IGC) of individually-held (IH), age-1 bluegill was compared to growth rates of group-held (GH) bluegill subjected to agonistic social interactions. Both the IH and GH fish were fed ad libitum twice daily for 240 d. On day 240, the mean weight of IH fish (90 g) significantly exceeded that of the GH fish (57 g). Social interaction among the GH fish apparently reduced their growth but resulted in greater size separation between the sexes, which proved advantageous for forming mostly-male groups.

Data from this experiment enabled construction of a model that predicted the percentages of male fish occurring in the upper 50th and 25th percentiles of weight of a mixed-sex group of juvenile bluegills. The developed model was tested on distinct, mixed-sex groups of age 1, 2, and 3 bluegills. Predicted and observed percentages of male bluegill within each of the three age groups showed good agreement, indicating that the model had some ability for directing size-grading efforts to form subgroups of mostly-male bluegills from a larger, mixed-sex population.

In Experiment 2 (Chapter 2), trenbolone acetate (TBA) immersions provided an additional means of establishing mostly-male, juvenile bluegill groups through sex reversal. Additional benefits associated with the sex-reversing of fish sometimes include elevated consumption and growth rates, higher feed efficiency, and decreased gonadal growth.

Although the establishment of mostly-male groups via sex-reversal appears reliable and may also benefit growth, the technique required precise treatments and substantial time commitment. Moreover, sex reversal cannot be carried out in field settings as can the size-grading approach. Consequently, the size-grading approach for forming mostly-male bluegill groups appears the most likely to be adopted by fish producers as a practical means of forming mostly-male bluegill groups.

After developing an approach to forming mostly-male bluegill groups, the remaining obstacle appeared to be amelioration of the growth-rate-reducing effects of social interactions that occur among bluegills held in confined groups. Consequently, in Experiment 3 (Chapter 3), the growth of mixed-sex (MS) and mostly-

male (MM) groups in indoor tanks was compared in a 234-d study. Overall, the MM groups grew faster than the MS groups. Higher social costs within MM groups were not observed, and mean weights and growth rates were higher in the MM groups. The presence of more males in MM groups was expected to result in greater social costs and greater size variation among fish, but didn't. The additional males in the MM groups resided in the upper 50% of the size range. A method known as "topping off" involves removing the largest fish (e.g., the upper 10-20% by size) from a group being reared. By topping off, it is believed that intermediate and smaller fish are afforded a better opportunity to grow because they are somewhat released from the consumption inhibiting social influences of the most dominant fish. Minimizing such social costs is important for closing the gap between observed growth rates and realized IGCs in order to culture large numbers of bluegill to food size within two growing seasons.