

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-80-R-6

Study No.: 230669

Title: Prey selection and predation rate of piscivorous fish

Period Covered: October 1, 2004 to September 30, 2005

Study Objective: To estimate survival of juvenile bluegills in ponds as a function of bluegill size and density, and predator size and density; and to concurrently measure predator survival and growth.

Summary: Under Job 1, adult walleye were stocked in ponds in late fall 2004 to begin an experiment. Another group of walleye were stocked in spring 2005 to begin another experiment. Under Job 3, several ponds were drained to prepare for, and then conclude, the attempted experiments with adult walleye. Under Job 5, experiments with adult walleye were attempted. In the first attempt, adult walleye were available too late in the season to fully evaluate the hypothesis that food availability before winter would influence fecundity the following spring. We were able to conclude that adult walleye in good condition can easily survive in the Saline ponds from November to the end of March and still have large amounts of visceral fat and large gonads. For the second attempted experiment, not enough adult female walleye were available to implement the full experiment. Job 6 is to prepare this progress report. Under Job 8, a successful lab experiment was conducted in summer 2005 to evaluate largemouth bass growth in length and weight in relation to body size and feeding regime of predators. A poster describing results and preliminary analysis of the 2004 laboratory experiment was presented at the 2005 meeting of the American Fisheries Society. Analysis of the new lab experiment is beginning and will be presented at the Midwest Fish & Wildlife Conference in Grand Rapids, Michigan, in December 2005.

Findings: Jobs 1, 3, 5, 6, and 8 were scheduled for 2004-05, and progress is reported below.

Job 1. Title: Stock ponds.—Adult walleye were stocked into four ponds at the Saline Fisheries Research Station on November 2, 2004. Each pond received 17 adult walleye. (Adult walleye were not available in September 2004, as originally planned.) The four ponds had been drained previously to remove other fish. This experiment is described under Job 5. The intended purpose of the pond experiment was to evaluate walleye fecundity in early spring in relation to forage availability in late fall and winter.

A second group of 56 male and 20 female walleye were stocked into four outdoor raceways on April 23, 2005. These fish were retrieved from the raceways a few days later and stocked into experimental ponds. Unfortunately, insufficient numbers of females survived to implement the planned experiment.

We continue to hold reproducing populations of largemouth bass and bluegill at the Saline Fisheries Research Station. Predators and prey will be available for future experiments.

Job 3. Title: Drain ponds.—The four ponds stocked with adult walleye on November 2 were partially drained on December 17, 2004, to determine survival and tag loss to that point for a collaborating investigator. The four ponds were completely drained in April 2005 to determine survival and gonad weight.

Job 5. Title: Conduct strong test of predation model.—A pond experiment was attempted twice under Job 5 (in fall 2004 and spring 2005) to measure the growth and fecundity of predators provided food at two levels. Unfortunately, the first group of walleye was available too late in the season to provide a full test of the hypothesis, and the second group of walleye had insufficient numbers of females surviving to conduct a successful experiment.

The plan was to stock 20 adult walleye per pond into 4 ponds (2 ponds per feeding level) starting in October, when Saline pond temperatures typically have cooled to a range conducive to good walleye growth. We planned to add 1.7 kg of fathead minnows as forage fish every two weeks to 2 ponds, and not add forage fish to the other 2 ponds. We were able to stock fathead minnows into Pond 13 to establish a population for such a use. In January we planned to sample three female walleye per pond by hook and line to measure length, weight, condition, and gonad development. We planned to terminate the experiment shortly after ice-out in the spring by draining the ponds and measuring length, weight, condition, and gonad development of the remaining fish. We planned to compare observed growth and condition with predictions from a model of fish growth. In addition to providing a test of the growth model, this experiment would have provided information about the potential effect on walleye fecundity of forage levels the previous fall.

On November 2, 2004 we were able to obtain 68 adult walleye, and stocked 17 into each of four ponds. Fathead minnows were added as forage fish to two of the ponds in mid November. The ponds were sampled by seining on December 17, 2004. The four ponds were drained on April 25 and 27, 2005.

Of the 68 adults stocked into the four ponds in November, 36 survived to April. Special notice was made that 6 of the 8 fish recovered from Pond 16 had lots of lipid visible in the viscera. Based on this observation, it is unlikely that any fish died of starvation during their almost 6 months in the ponds. Of the 36 survivors, 16 were female, 20 were male. Gonad weight as a percentage of body weight (gonadosomatic index, GSI) was $2.1\% \pm 0.2\%$ (mean \pm SE) for 20 males, $22.4\% \pm 2.2\%$ for 9 females with intact ovaries, and $1.6\% \pm 0.5\%$ for 7 females with flaccid ovaries (it appeared that these females had already released their eggs). It is clear that despite having only a modest amount of food from November to April, these female walleye could produce a large amount of eggs.

In April 2005 we were able to obtain 56 male and 20 female walleye, which were held at the Saline Fisheries Research Station for a few days in outdoor raceways before being stocked into ponds. The focus of this hypothesis is fecundity of females. Unfortunately, insufficient numbers of females survived to implement the planned experiment.

Job 6. Title: Prepare annual progress report.—This annual progress report was prepared.

Job 8. Title: Conduct lab experiment on predator growth.—A lab experiment was conducted in summer 2005 to measure the amount of growth in length and weight for largemouth bass that differ in starting size and daily feeding regime. The experiment used a 3x4 cross-classified

design, involving fish grouped into three size classes fed at one of four feeding regimes for 8 weeks.

Fish were randomly assigned to one of four feeding regimes. One regime was to feed 1 minnow every day, for a total of 4 minnows every 4 days (1, 1, 1, 1). A second regime (2, 2, 2, 2) was to feed 2 minnows every day, for a total of 8 minnows every 4 days. A third regime (4, 0, 0, 0) was to feed 4 minnows on one day, then nothing for the next three days, for a total of 4 minnows every 4 days. The fourth regime (4, 0, 4, 0) was to feed 4 minnows on one day, nothing on the next day, 4 minnows the next day, and nothing on the next day, for a total of 8 minnows every 4 days. The intent was to compare growth in length and weight and the relative weight attained when food consumption differed in total amount offered or in timing of the amount offered. I hypothesized that fish might be able to extract more energy from a meal if it remained longer in the digestive tract, and meals might remain in the digestive tract longer if no additional food was consumed the next day. This would suggest that fish with feeding regimes with 2 or 3 days of no food in a 4-d cycle might have higher assimilation efficiency and therefore a higher growth rate than fish fed a similar total amount of food but fed as an equal amount of food each day.

Three replicate fish at each of the twelve treatment combinations made a total of 36 fish. Fish were held in individual aquaria. Length (nearest mm) and weight (nearest 0.1 g) were measured weekly. A data logger recorded water temperatures hourly for two aquaria on opposite sides of the lab. Wet weight (nearest 0.01 g) of fathead minnows added to each tank was measured daily, as well as the wet weight of any unconsumed minnows from the previous day. On several occasions throughout the experiment, a subsample of minnows was measured for length, wet and dry weight (dried 24 h at 60°C). The experiment started on June 30 and concluded on August 25, 2005. After 56 d, all fish were sacrificed and measured for length, weight, liver and gonad weight, and then frozen for subsequent determination of dry weight.

Analysis of this experiment is underway. Modifications will be proposed to models of fish growth to explain the observed results and allow prediction of ration- and size- and condition-dependent growth in both length and weight.

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