**STUDY PERFORMANCE REPORT**

**State:** Michigan **Project No.:** F-80-R-5

**Study No.:** 230682 **Title:** Pond rearing of juvenile lake sturgeon

**Period Covered:** October 1, 2003 to September 30, 2004

**Study Objective**: To determine the relationship between initial size, rearing density, and growth rate and survival of age-0 lake sturgeon in rearing ponds, and to measure size-dependent vulnerability to piscivores such as walleye.

**Summary**: According to the study as amended in 2000-01, Jobs 1, 2, 3, 4, and 5 were active this year. This year we conducted an outdoor-raceway experiment. The goals of this experiment were to monitor survival of juvenile lake sturgeon to determine when most mortality occurs and to monitor growth to confirm suitability of the raceways for juvenile sturgeon. We also attempted to determine effects of stocking density on growth. On July 27, 2004, six raceways were stocked with age-0 lake sturgeon (mean ± SD weight: 1.60±0.66 g; mean ± SD total length: 78±10 mm; N = 140); two raceways each received 10, two received 20, and two received 40 lake sturgeon. Each raceway had been stocked earlier with 3 adult largemouth bass to help control the abundance and behavior of crayfish. We drained these six raceways after 14 days and found that substantial mortality had occurred; the number of survivors was 0/10, 0/10, 0/20, 6/20, 6/40, and 14/40, or a total of 26 of 140 (19% survival). As of September 30 (65 days after stocking), 8 of those 26 (31%, or 5.7% of the initial number) were still surviving. As of September 30, the eight survivors had an average weight of 21.0±5.6 g and an average length of 179±22 mm. We intended to conduct a laboratory experiment to evaluate the vulnerability of larval and early juvenile stages to predators, but insufficient larval lake sturgeon were available this year from the Black River sampling. We collected and preserved a size range of juvenile lake sturgeon so that we can stain and clear the fish to quantify the development of scutes, their main defense against predators. The outdoor-raceway experiment demonstrated that most individuals (81% of those stocked) were lost in the first two weeks following stocking; an additional 13% of the stocked individuals died over the subsequent seven weeks. We attribute this to crayfish predation on the small juveniles. Using digital photographs we were able to identify individual fish over the course of the experiment to monitor individual growth in length and weight.

**Findings:** Jobs 1, 2, 3, 4, and 5 were scheduled for 2004-05, and progress is reported below.

**Job 1. Title:** **Stock ponds.**–We started the current outdoor raceway experiment on July 27, 2004, using age-0 lake sturgeon reared at Wolf Lake Hatchery. The age-0 lake sturgeon came from eggs and milt obtained from lake sturgeon captured in the Sturgeon River in Michigan's Upper Peninsula. The fertilized eggs were taken to Wolf Lake Hatchery, incubated at 10.6-11.3°C, and were 100% hatched by May 20, 2004. They were reared at 18-20°C until being transported to the Saline Fisheries Research Station on July 27.

The goals of this experiment were to monitor survival of juvenile lake sturgeon to determine when most mortality occurs and to monitor growth to confirm suitability of the raceways for juvenile sturgeon. On July 27, 2004, six raceways were stocked with age-0 lake sturgeon (mean weight ± SD: 1.60±0.66 g; mean length ± SD total: 78±10 mm; N = 140). We also attempted to determine effects of stocking density on growth. Two raceways each received 10, two received 20, and two received 40 lake sturgeon. The raceways had been stocked earlier with 3 adult

largemouth bass to help control the abundance and behavior of crayfish. Adult largemouth bass directly reduce the number of crayfish through predation. In the presence of adult largemouth bass, crayfish were expected to be less active and spend more time in burrows or emigrate, further reducing the encounter rate between crayfish and lake sturgeon. Based on previous laboratory experiments, we did not expect largemouth bass to ingest many (if any) lake sturgeon.

A digital temperature recorder was deployed in early spring 2004 in the lower end of the third pair of raceways. The data will be retrieved in fall 2004 and used in evaluation of fish survival and growth.

**Job 2. Title: Monitor growth of lake sturgeon.**–The raceways were drained every 9-14 days to monitor survival and growth in length and weight. Most of the mortality occurred during the first 14 days. Growth in length and weight was rapid (Table 1). According to Baker (1980), mean length of wild lake sturgeon at age 1 is 152 mm (6.0 inches), with an estimated weight of 17.3 g. The surviving age-0 lake sturgeon in our experiment have already exceeded that average value. The rapid growth suggests that the mortality is not due to low food availability.

Table 1.–Total number of survivors, percent of initial number, average length (±SD), and average weight (±SD) of 140 juvenile lake sturgeon stocked on July 27, 2004, into six outdoor raceways at the Saline Fisheries Research Station and measured every 9-14 days.

| Day | Number | Percent | Length (mm) | Weight (g) |
|---|---|---|---|---|
| 0 | 140 | 100% | 78±10 | 1.60±0.66 |
| 14 | 26 | 18.6% | 99±19 | 3.64±1.96 |
| 23 | 13 | 9.3% | 122±19 | 6.66±2.71 |
| 36 | 13 | 9.3% | 143±23 | 10.84±4.36 |
| 45 | 11 | 7.9% | 160±23 | 14.77±5.04 |
| 55 | 8 | 5.7% | 174±23 | 18.36±5.41 |
| 65 | 8 | 5.7% | 179±22 | 21.00±5.61 |

A digital photograph was taken of each individual at stocking and at subsequent monitoring times. We are able to identify individual fish by careful observation of the pattern of natural spots on the head, body, and fins. In this way we are able to monitor the growth of individual fish over the course of the experiment.

**Job 3. Title: Drain ponds.**–The raceways were drained every 9-14 days to monitor survival and growth in length and weight. We intend to continue monitoring growth and survival monthly until the raceways freeze, and then again in spring 2005.

**Job 4. Title: Evaluate vulnerability to predators.**–We did not conduct additional lab studies this reporting period. We had planned to use larval lake sturgeon from a study that is being conducted on Black River, the major tributary to Black Lake, Cheboygan County. The purpose of the planned lab studies would be to see if very small lake sturgeon are taken by fish predators or rejected because of mechanical defenses such as sharp scutes. Previous experiments have used fish about 75 mm and larger, with relatively well-developed scutes. Unfortunately, insufficient numbers of small lake sturgeon were captured in the Black River this spring to be able to conduct this experiment. We hope to be able to conduct these experiments next year.

We collected and preserved a size range of juvenile lake sturgeon in order to quantify the development of scutes, the major defense against predators. Additional fish are being collected at Wolf Lake Hatchery. We intend to stain and clear these fish in order to make precise measurements of the size of the scutes for fish from about 65 to 150 (or more) mm TL.

We continue to suspect that crayfish are primarily responsible for the mortality of the small lake sturgeon in the Saline raceways. Although we attempted to reduce the number of crayfish and keep them low by stocking adult largemouth bass, some crayfish were present in each of the raceways. The small size of the lake sturgeon at stocking (78±10 mm) probably made them quite vulnerable to crayfish. The rapid sturgeon growth could explain the decrease in mortality later in the experiment.

When the temperature data become available, we will evaluate the possibility that a period of high temperature limited the survival of lake sturgeon in the Saline raceways (Wehrly 1995). The raceways are several degrees cooler than the ponds, so temperature limitation should be reduced in the raceways relative to previous experiments in the ponds.

**Job 5. Title: Write progress report.**–This progress report has been prepared.

**Literature Cited:**

Baker, J. P. 1980. The distribution, ecology, and management of the lake sturgeon (*Acipenser fulvescens* Rafinesque) in Michigan. Michigan Department of Natural Resources, Fisheries Research Report 1883, Ann Arbor.

Wehrly, K. E. 1995. The effect of temperature on the growth of juvenile lake sturgeon, *Acipenser fulvescens*. Michigan Department of Natural Resources, Fisheries Research Report 2004, Ann Arbor.

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