STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-80-R-6

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

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

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 2004-05, Jobs 1, 2, 3, 4, and 5 were active this year. This year we were not able to stock fish (Job 1) to start a new outdoor experiment because age-0 lake sturgeon were not available from Wolf Lake Hatchery, as had been expected. A new program of streamside rearing began this year, so future availability of young lake sturgeon for research will be different in the past. Under Job 2, we continued to monitor growth and survival of survivors from the 2004 raceway experiment. Although survival was poor, growth in the raceways was good. Under Job 3, we periodically drained the raceways containing lake sturgeon in fall 2004 and in 2005, to monitor growth and survival (Job 2). Mortality continued. As of September 30 (65 days after stocking), 8 of those 26 (31%, or 5.7% of the initial number) were still surviving. Seven of these 8 survived until December 3, 3 survived to April 5, and 1 survived to July 28, 2005. 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. The single survivor had grown to 293 mm and 79 g wet weight by July. Under Job 4, we had intended to conduct a laboratory experiment to evaluate the vulnerability of larval and early juveniles to predators, but insufficient larval lake sturgeon were available this year. We had collected and preserved a size range of age-0 lake sturgeon; several of these were stained and cleared so that we can quantify the development of scutes, their main defense against predators. The 2004 outdoor-raceway experiment demonstrated that most individuals (81% of those stocked) were lost in the first two weeks following stocking; all but one of the stocked individuals died over the subsequent 366 days, for a total of 0.7% survival. We attribute this to crayfish predation on the 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 1–5 were scheduled for 2004-05, and progress is reported below.

Job 1. Title: Stock ponds.–We had intended to stock additional outdoor raceways to begin a new experiment on growth and survival, but age-0 lake sturgeon were not available because of the start of a new program to conduct streamside rearing of age-0 lake sturgeon. Instead, we continued to monitor the growth of survivors from the 2004 raceway experiment.

A digital temperature recorder recorded water temperatures in the lower end of the third pair of raceways. The data will be used in evaluation of fish survival and growth.

Job 2. Title: Monitor growth of lake sturgeon.–The raceway containing the lake sturgeon was drained four times during this reporting period (twice during fall 2004 and twice in 2005) to monitor survival and growth in length and weight (Table 1). Mortality continued during age 1. After almost exactly 1 year in the raceways, only one fish survived, representing a survival rate of

0.7% of the initial 140 fish. Growth in length and weight was slow in late fall and over winter, but the single survivor showed rapid growth between April 5 and July 28 (Table 1). According to Baker (1980), mean length of wild lake sturgeon is 152 mm (6.0 inches) at age 1, with an expected weight of 17.3 g (estimated from Baker's length-weight regression). The age-0 fish in our experiment clearly exceeded these values, reaching 192 mm and 27.9 g by December. According to Baker, age-2 fish average 279 mm (11.0 inches), with an estimated weight of 116 g. The surviving age-1 lake sturgeon in our experiment had already exceeded that average value for length, but is much smaller in weight (79 g). It is not clear if Baker's estimated age-2 weight is high (e.g., perhaps due to extrapolation from a length-weight regression dominated by much larger fish), or if the growth in weight for the lone survivor was low. In summary, growth in length was very good in these raceways, but it is not clear if growth in weight was fast or slow.

While draining a pond, we found one lake sturgeon that was a survivor from one of the pond experiments done several years ago. This individual was now 730 mm in length and appeared to be in very good condition. This reflects rapid growth in length, because it exceeds the Michigan average length of an age-8 fish, which is 699 mm, according to Baker (1980).

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 future analysis we will be able to follow the growth of individual fish over the course of the experiment.

Job 3. Title: Drain ponds.–The raceways were drained periodically in fall 2004 and 2005 to monitor survival and growth in length and weight. The results are discussed under Job 2.

Job 4. Title: Evaluate vulnerability to predators.–We did not conduct additional lab studies during 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 have been 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, we were not able to obtain larval fish.

In 2004 we collected and preserved a size range of juvenile lake sturgeon in order to quantify the development of scutes, the major defense against predators. Several of these fish have been stained and cleared in order to make precise measurements of the size of the scutes for small age-0 fish. Measurements of the scutes have not yet been made.

Additional fish were collected for staining at Wolf Lake Hatchery in 2004, and these were retrieved in 2005. We intend to stain and clear additional fish in order to measure the scute size of larger age-0 fish (from about 65 to 150 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.

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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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 (Day 0), into six outdoor raceways at the Saline Fisheries Research Station and measured on ten subsequent dates.

Day	Date	Number	Percent (%)	Length (mm)	Weight (g)
0	7/27/04	140	100	78±10	1.60±0.66
14	8/10/04	26	18.6	99±19	3.64±1.96
23	8/19/04	13	9.3	122±19	6.66±2.71
36	9/01/04	13	9.3	143±23	10.8±4.4
45	9/10/04	11	7.9	160±23	14.8±5.0
55	9/20/04	8	5.7	174±23	18.4±5.4
65	9/30/04	8	5.7	179±22	21.0±5.6
92	10/27/04	8	5.7	186±21	24.7±6.3
129	12/3/04	7	5.0	192±23	27.9±7.1
252	4/5/05	3	2.1	198±12	30.6±3.8
366	7/28/05	1	0.7	293	79.0