

### **Alma Impoundment**

Gratiot County, T11N, R3W, Secs. 3,4 5, and 8  
Pine River Watershed, Last Surveyed 2014

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### **Environment**

The Pine River originates just south of Remus in Mecosta County and flows approximately 99 miles to its confluence with the Chippewa River near Midland. There are two impoundments on the River, the Alma Impoundment (most upstream) and the St. Louis Impoundment (Figure 1). Alma Impoundment is formed by the State Street dam located on the Pine River in Gratiot County in the city of Alma. The dam was built in 1938 and is owned by the city of Alma. It is a controlled gravity structure built and used for municipal water supply. The dam has a crest length of 355 feet and a height of 18 feet which creates 9 feet of head and impounds approximately 140 acres of water.

The surrounding countryside is mostly level. Land use is agricultural and urban around the city of Alma. There are several large concentrated animal feeding operations (CAFO) in the watershed and many residences are on septic systems. Alma Impoundment is just past the transition area from the Michigan Northern Indiana Till Plain to the Huron Erie Lake Plain (MDEQ, 2002). The soils, likewise, transition from excessively well drained sandy soils and loamy glacial outwash with glacial till deposits to soils that are very poorly drained to somewhat poorly drained outwash deposits. The area occupied by the Alma Impoundments marks the transition where run-off becomes dominated by overland flow and the impoundment receives water input from overland surface flow and is less influenced by groundwater. The topography is level to slightly sloping and the river is slow and gently meandering. The immediate shoreline is level to gently sloping with sandy soil types. The bottom is mostly clay and marl. Vegetation is abundant in the littoral zone and the entire impoundment is shallow and largely weed choked.

Limnological parameters were measured in August, 2014 and included temperature, oxygen, and pH (Table 1). The impoundment temperature, oxygen and pH profile showed no thermocline or variation. Critical oxygen concentrations for fish (< 3 ppm) were not observed and the water was well oxygenated throughout the water column. The water is quite turbid in Alma Impoundment the secchi depth was 3.8 feet. Alkalinity was measured as 216 ppm. Parameters such as total phosphorous, chlorophyll a, and secchi depth can be used to calculate a Carlson's Trophic State Index. Alma Impoundment calculated out as 48.1 which placed it in the category of "mildly eutrophic". The description for a "mildly eutrophic" lake is one that has decreased transparency, anoxic hypolimnion, macrophyte problems, warm water fisheries, and is supportive of all swimmable/aesthetic uses.

Unlike the St. Louis Impoundment downstream, Alma Impoundment was not contaminated by chemical production. Alma Impoundment only has some county-wide restrictions. These restrictions exist for many waters in the area and are contaminants from atmospheric deposition. There currently is a restricted consumption advisory on carp (PCB), and on smallmouth bass, largemouth bass, and sucker (mercury) in the Alma Impoundment (MDCH 2014). The St. Louis Impoundment has more water quality and point-source contamination issues which were discussed in the 2010 St. Louis

Impoundment survey analysis. Fish were collected to monitor contaminant levels for mercury during the 2014 Alma survey. Results are in progress and not presently available.

Aquatic vegetation was abundant and provided cover for fish in Alma Impoundment. Other habitat characteristics were evaluated during the limnological survey in August 2014. Twenty-one transects were analyzed covering approximately 4 miles of shoreline. This basically was all the navigable shoreline. Much of the impoundment is too shallow and weedy to navigate. There were 18 submerged trees, 11 small docks, no large docks, and 48 dwellings on the lake. Approximately 17% of the shoreline has been armored with either rock riprap or some form of seawall.

### **History**

Fisheries Management in Alma Impoundment and the Upper Pine River was the responsibility of a variety of management units in the past due to its central location in the state and frequent redistricting done by the Department of Natural Resources, Fisheries Division. When District 11 managed the Pine River, the management emphasis was on brown trout and work done on Alma Impoundment was included to compliment this. Fisheries management by the Department of Natural Resources on the Pine River began in 1955. In 1956 department surveys found large carp and sucker populations in Alma Impoundment. As a result, Alma Impoundment was chemically reclaimed from the impoundment to 10-miles upstream to eradicate these rough fish. Smallmouth bass, bluegills, and northern pike were subsequently restocked. A northern pike marsh was also experimentally operated in 1959. Reports indicate it was installed but failed to operate properly. Historic files also indicate that adult pike were stocked in Alma Impoundment in 1958 but the hatch and young were only moderately successful. These adult pike were purchased from Saginaw Bay commercial fishermen and were infected with red sore disease which may have compromised survival (unpublished files). Surveys conducted in 1959, only two years later, and again in 1963 and 1964 showed carp and suckers as the predominant species and minnows were abundant. To once again combat these rough fish, in 1964, the stream was re-treated from Briggs Rd. downstream through the impoundment and this time tributaries were included. Subsequent restocking was done with largemouth bass, smallmouth bass, rock bass, pumpkinseed sunfish, and northern pike. There is one record indicating the desire to develop and operate a cooperative northern pike marsh upstream of Alma Impoundment near Tyler Road, but no additional documentation of whether the marsh actually was constructed. Additional surveys were conducted in 1969 and 1971 to check success, and these again showed the dominance of rough fish. In 1971 public meetings were held to discuss the situation and possible plans for additional chemical reclamations. Plans were to use anyimycin as a toxicant to remove rough fish but the project was abandoned in 1972 as the stream was being used for public water supply. The Pine River Recreation club pressured MUCC for another meeting and pleaded for the Department to chemically treat the upper Pine River and re-stock the stream with trout in 1978. This was done in the upper stretches, well upstream of Alma Impoundment in 1979. Alma was subsequently managed for species present. Fish division again surveyed the impoundment in 1990. Twelve species were collected. Black crappie and rock bass were most abundant and the majority of these desirable or legal size. Trout management previously limited to the Upper Pine was also discontinued in 1993. In 1994 and 1995, fall fingerling and yearling channel catfish were stocked in Alma Impoundment to increase diversity and enhance the warmwater fishery.

The most recent survey of Alma Impoundment was conducted in 1995. Again, suckers were the dominant species. Other species included black crappie, pumpkinseed sunfish, bluegill, largemouth

bass, carp, yellow perch, and northern pike. One large channel catfish was captured, but unlikely resulting from the recent stocking due to its size.

The Michigan Department of Environmental Quality (MDEQ) has done additional work on habitat and fish above the impoundment and also below. The surveys above the impoundment are used as controls for comparison with the impairments to the downstream area. These show much of the habitat is good to above average. Procedure 51 surveys done by WRD (formerly SWQD) of the MDEQ have shown some excessive loading of nutrients to tributaries to Alma Impoundment. These efforts also identified a population of reproducing brown trout in the North Branch Pine River and the Pony Creek above the impoundment at Alma.

### **Current Status**

Alma Impoundment was surveyed using a variety of gear types set forth in the Status and Trends protocol. Efforts included seining, boomshocking, trap netting, fyke netting, gill netting, and limnological surveys (Figure 2). The netting and boomshocking surveys were conducted from 5/27/2014 through 5/29/2014, and the limnological survey was conducted on 08/21/2014. Water temperatures ranged from 66-70 °F during netting. Each gear type was subject to certain biases and these must be considered when reviewing the survey catch. Trap and fyke nets were used to sample fish moving through the littoral zone. Gill nets sample fishes that occupy offshore waters and are particularly effective at capturing perch and northern pike. Seine hauls are designed to net fish in the shallows and nursery areas and target young fish and some minnow species. Electrofishing is designed to catch fish moving into the shallows at night, and typically samples both small and large fish. Some electrofishing was done in the daytime due to the turbidity. Collectively, the catch from all these gears allow for reasonable interpretation of the fish community.

A total of 940 fish representing 17 species were collected from survey efforts. Golden Redhorse were the most abundant species, comprising 36% of the total catch by number and 54% by weight (Table 2). Other fish species collected in appreciable numbers included pumpkinseed sunfish and bluntnose minnows. In lesser abundance were gamefish including rock bass, black crappie, largemouth bass, smallmouth bass and northern pike. Rough fish and minnows were also captured in low numbers.

A total of 269 pumpkinseed sunfish averaging 6.4 inches comprised 29% of the total survey catch (Table 2). Pumpkinseed ranged from 3 to 8 inches with 79 % of the fish meeting or exceeding the acceptable harvest size of 6 inches. Age-growth data indicates pumpkinseed sunfish are growing 1.0 inch above State average (Table 3). Age distribution indicates sufficient recruitment with good representation of pumpkinseed sunfish aged 2 through 8.

Only 15 bluegill were captured which was very different from the St. Louis Impoundment downstream where bluegill were dominant. Bluegill ranged from 1 to 7 inches and averaged 4.0 inches. Most of the bluegill were age 1 and small. Bluegill had a mean growth index of -0.2 and were growing below State average although the sample size was low.

A total of 36 black crappie averaging 11 inches comprised 3.8 % of the total survey catch (Table 2). Black crappie ranged from 6 to 13 inches with 97% of the fish meeting or exceeding the acceptable harvest size of 7 inches. Growth data indicate black crappie in Alma Impoundment are growing above

the State average with a mean growth index of 1.2 (Table 3). Age distributions indicate sufficient recruitment to the fishery with good representation of fish ages 2 to 10.

Thirty rock bass averaging 5.8 inches comprised 3.2% of the total survey catch (Table 2). Rock bass ranged from 1 to 10 inches. Sixty-seven percent of the fish meeting or exceeding the acceptable harvest size of 6 inches. Rock bass are growing above State average with a mean growth index of 1.2 (Table 3). Age distribution indicates sufficient recruitment to the fishery with representation of age groups' 4 to 8.

Both largemouth and smallmouth bass were found in relatively low numbers representing only .4% and .5 % of the catch by number, respectively (Table 2). Smallmouth averaged 17 inches and ranged from 13 to 18 inches. Largemouth bass averaged 14.4 inches and ranged from 11 to 16 inches. Insufficient numbers were captured to analyze growth.

Only 15 northern pike were captured representing 1.6 % of the survey catch (Table 2). Northern pike ranged from 1 to 37 inches and averaged 25.6 inches. Forty-seven percent of the northern pike met or exceeded the minimum harvest size of 24 inches. Northern pike were represented by age classes 2-10. Inadequate numbers of pike were captured to calculate a growth index.

### **Analysis and Discussion**

Bluegill are often abundant in southern Michigan lakes, and play a key role in establishing community structure and overall sportfishing quality (Schneider 1981). This however is not the case for Alma Impoundment. The dominant panfish species were pumpkinseed sunfish. This differed from St. Louis Impoundment, immediately downstream, where bluegills were dominant. During this survey many anglers were observed fishing for pumpkinseed sunfish. Pumpkinseed sunfish, rock bass and black crappie were the only panfish exhibiting growth rates above the State average.

Bluegill were present in lower numbers and did reach desirable sizes but are growing below State average indicating sub-optimal conditions. Bluegill were represented almost exclusively by small age 1 fish and few larger, older fish were captured. Rock bass were available in fair numbers and these help to diversify the fishery. Rock bass growth, year class distribution, and sizes were indicative of a healthy population and many reached desirable sizes for the fishery.

A few larger predators were collected. These included largemouth bass, smallmouth bass, channel catfish and northern pike. Excessive vegetation made capturing larger predators more difficult. Northern Pike were the dominant predator and multiple age classes were represented indicating consistent recruitment patterns. Low sample sizes made further interpretation of predator populations impossible.

Rough fish (such as carp, catfish, bullheads and suckers) do not appear overabundant or stunted.

### **Management Direction**

Overall, the fish community and recreational fishery of Alma Impoundment is adequate. There is ample opportunity to catch pumpkinseed, black crappie, rock bass and the occasional bass or northern

pike. These together with the rough fish species like suckers and bullhead provide diverse fishing opportunities in a county where these are few inland lakes.

### **References**

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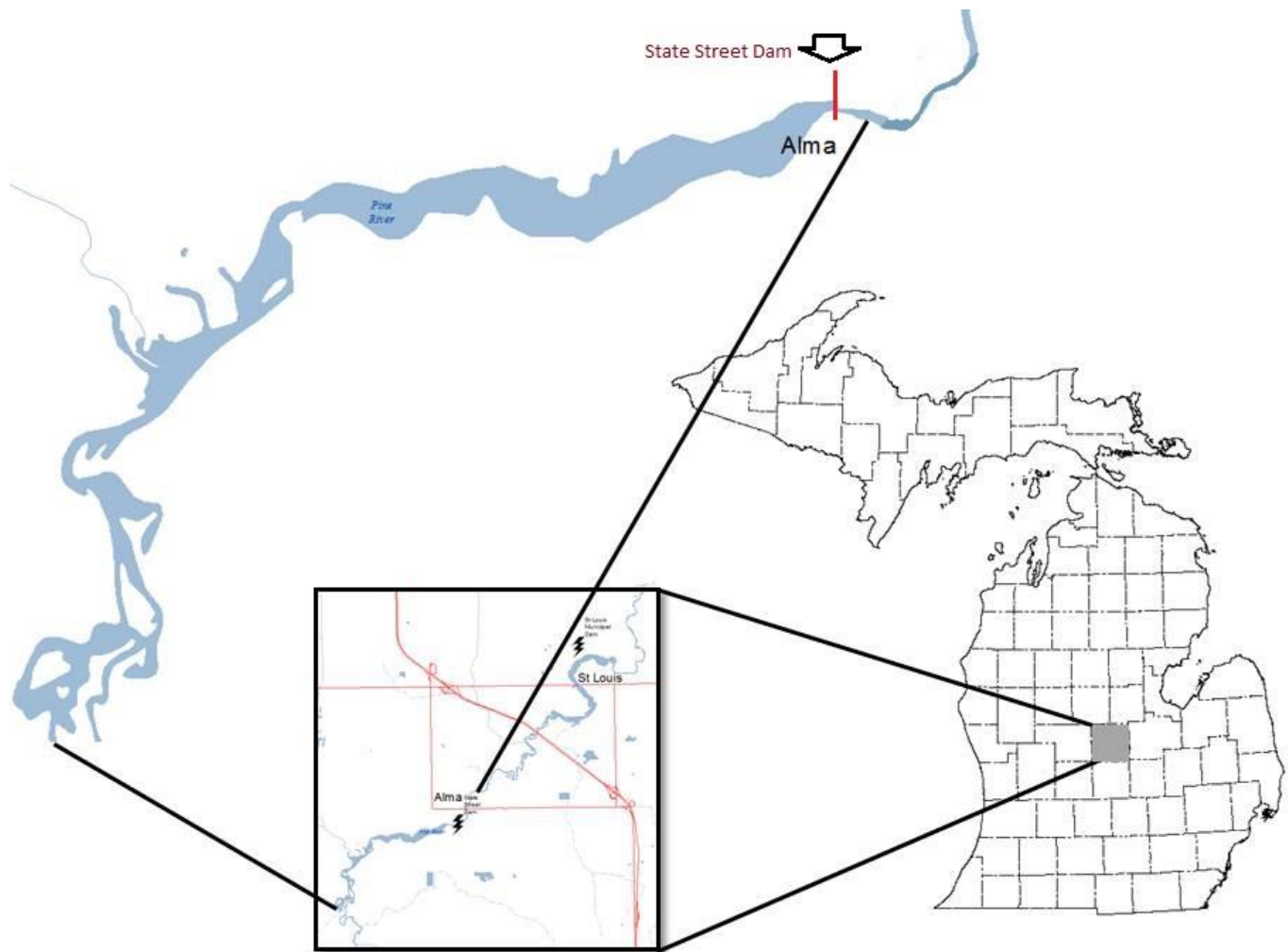
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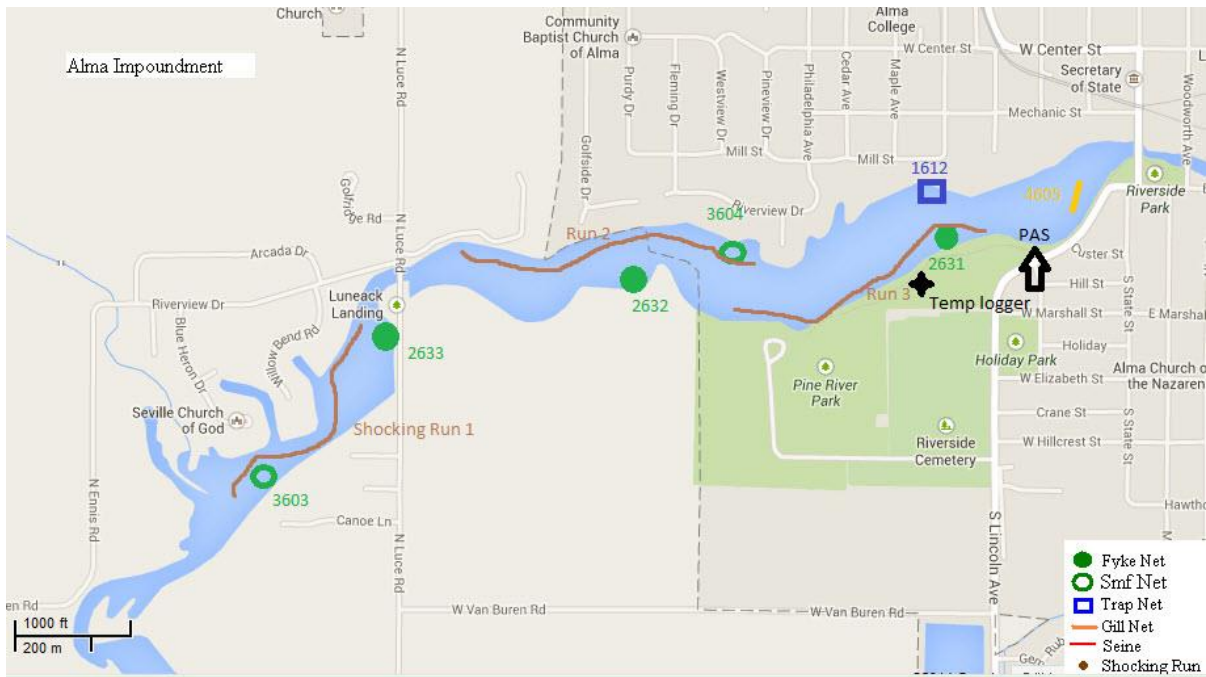
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**Figure 1. Physical location of Alma Impoundment in Gratiot County.**



**Figure 2. Survey locations 2014 for Alma Impoundment, Gratiot County**



**Table 1. Limnological Parameters of Alma Impoundment, August, 2014**

| <b>Depth<br/>(ft.)</b> | <b>Temperature (F)</b> | <b>Oxygen (mg/l)</b> | <b>pH</b> | <b>SpCond.<br/>(uS/cm)</b> |
|------------------------|------------------------|----------------------|-----------|----------------------------|
|                        |                        |                      |           |                            |
| 1                      | 70.56                  | 7.83                 | 7.62      | 550                        |
| 2                      | 70.43                  | 7.89                 | 7.65      | 549                        |
| 3                      | 70.44                  | 7.90                 | 7.66      | 549                        |
| 4                      | 70.36                  | 7.92                 | 7.67      | 548                        |
| 5                      | 70.36                  | 7.92                 | 7.68      | 548                        |
| 6                      | 70.32                  | 7.89                 | 7.68      | 548                        |
| 7                      | 70.32                  | 7.75                 | 7.68      | 548                        |
| 8                      | 70.32                  | 7.75                 | 7.68      | 548                        |



**Table 2. Alma Impoundment number length and weight by species.**

|                            | Number | Percent<br>by<br>number | Weight<br>(lb.) | Percent<br>by<br>weight | Length          | Average         | Percent         |
|----------------------------|--------|-------------------------|-----------------|-------------------------|-----------------|-----------------|-----------------|
| Species                    |        |                         |                 |                         | range<br>(in.)* | length<br>(in.) | legal<br>size** |
| Black crappie              | 36     | 3.8                     | 27.1            | 3.0                     | 6-13            | 11.0            | 97              |
| Bluegill                   | 15     | 1.6                     | 0.7             | 0.1                     | 1-7             | 4.0             | 13              |
| Bluntnose minnow           | 158    | 16.8                    | 0.4             | 0.0                     | 1-2             | 1.7             | 100             |
| Bowfin                     | 1      | 0.1                     | 3.1             | 0.3                     | 20-20           | 20.5            | 100             |
| Brown bullhead             | 12     | 1.3                     | 7.7             | 0.8                     | 6-13            | 10.4            | 92              |
| Common carp                | 16     | 1.7                     | 134.3           | 14.8                    | 21-30           | 26.6            | 100             |
| Channel catfish            | 4      | 0.4                     | 23.3            | 2.6                     | 23-28           | 25.2            | 100             |
| Chestnut lamprey           | 2      | 0.2                     | 0.0             | 0.0                     | 4-6             | 5.5             | 100             |
| Common shiner              | 10     | 1.1                     | 0.2             | 0.0                     | 2-4             | 3.4             | 100             |
| White sucker               | 25     | 2.7                     | 70.4            | 7.7                     | 16-21           | 19.0            | 100             |
| Golden redhorse            | 336    | 35.7                    | 492.5           | 54.1                    | 10-20           | 16.2            | 100             |
| Golden shiner              | 2      | 0.2                     | 0.1             | 0.0                     | 4-4             | 4.5             | 100             |
| Largemouth bass            | 5      | 0.5                     | 8.6             | 0.9                     | 11-16           | 14.4            | 80              |
| Northern pike              | 15     | 1.6                     | 56.2            | 6.2                     | 1-37            | 20.2            | 47              |
| Pumpkinseed                | 269    | 28.6                    | 68.6            | 7.5                     | 3-8             | 6.4             | 79              |
| Rock bass                  | 30     | 3.2                     | 7.0             | 0.8                     | 1-10            | 5.8             | 67              |
| Smallmouth bass            | 4      | 0.4                     | 10.1            | 1.1                     | 13-18           | 17.0            | 75              |
| <b>All species totals:</b> | 940    | 100                     | 910.2           | 100                     |                 |                 |                 |

\* Note some fish may be measured to 0.1 inch, others to inch group.

\*\* Percent legal or acceptable size for angling.

**Table 3. Weighted Mean Length and Age Composition, Alma Impoundment Survey 2014.**

| Species / Age   | No. aged | Length range (in.) | State avg. length (in.) | Weighted mean len. (in.) | Weighted age freq. | Mean growth index* |
|-----------------|----------|--------------------|-------------------------|--------------------------|--------------------|--------------------|
| Black crappie   |          |                    |                         |                          |                    | +1.2               |
| Age II:         | 2        | 5.20-6.10          | 6.0                     | 5.65                     | 8.75%              |                    |
| Age III:        | 4        | 7.60-8.80          | 7.5                     | 8.08                     | 14.22%             |                    |
| Age IV:         | 8        | 8.90-9.80          | 8.6                     | 9.42                     | 27.90%             |                    |
| Age V:          | 8        | 9.90-11.80         | 9.4                     | 10.64                    | 21.99%             |                    |
| Age VI:         | 7        | 11.40-12.20        | 10.2                    | 11.71                    | 16.85%             |                    |
| Age VII:        | 2        | 11.40-12.60        | 10.8                    | 12.26                    | 1.53%              |                    |
| Age VIII:       | 3        | 12.30-13.10        | 11.4                    | 12.69                    | 5.84%              |                    |
| Age IX:         | 1        | 13.20-13.20        | 11.9                    | 13.20                    | 1.46%              |                    |
| Age X:          | 1        | 13.80-13.80        |                         | 13.80                    | 1.46%              |                    |
| Bluegill        |          |                    |                         |                          |                    | -0.2               |
| Age I:          | 8        | 1.10-1.90          | 1.8                     | 1.64                     | 88.89%             |                    |
| Age IV:         | 1        | 7.90-7.90          | 5.9                     | 7.90                     | 5.56%              |                    |
| Age VI:         | 1        | 7.70-7.70          | 7.3                     | 7.70                     | 5.56%              |                    |
| Largemouth bass |          |                    |                         |                          |                    |                    |
| Age III:        | 1        | 11.20-11.20        | 9.4                     | 11.20                    | 25.00%             |                    |
| Age IV:         | 2        | 14.80-15.40        | 11.6                    | 15.00                    | 37.50%             |                    |
| Age V:          | 1        | 15.50-15.50        | 13.2                    | 15.50                    | 12.50%             |                    |
| Age VII:        | 1        | 16.90-16.90        | 16.3                    | 16.90                    | 25.00%             |                    |
| Northern pike   | 0        | 0                  |                         |                          |                    | --                 |
| Age II:         | 3        | 16.30-19.90        | 17.7                    | 17.10                    | 22.73%             |                    |
| Age III:        | 1        | 19.00-19.00        | 20.8                    | 19.00                    | 4.55%              |                    |
| Age IV:         | 2        | 21.30-22.00        | 23.4                    | 21.65                    | 18.18%             |                    |
| Age V:          | 3        | 25.90-27.50        | 25.5                    | 26.60                    | 27.27%             |                    |
| Age VI:         | 2        | 31.00-35.00        | 27.3                    | 33.00                    | 18.18%             |                    |
| Age X:          | 1        | 37.00-37.00        |                         | 37.00                    | 9.09%              |                    |
| Pumpkinseed     |          |                    |                         |                          |                    | +1                 |
| Age II:         | 14       | 3.50-4.90          | 3.8                     | 4.17                     | 39.31%             |                    |
| Age III:        | 11       | 4.90-6.80          | 4.9                     | 5.69                     | 17.46%             |                    |
| Age IV:         | 13       | 5.90-7.40          | 5.6                     | 6.75                     | 17.32%             |                    |
| Age V:          | 8        | 6.80-8.20          | 6.2                     | 7.41                     | 8.93%              |                    |
| Age VI:         | 8        | 7.90-8.30          | 6.6                     | 8.14                     | 16.64%             |                    |
| Age VIII:       | 1        | 8.30-8.30          | 7.5                     | 8.30                     | 0.33%              |                    |
| Rock bass       |          |                    |                         |                          |                    | +1.2               |
| Age II:         | 4        | 4.00-4.20          | 3.9                     | 4.10                     | 19.87%             |                    |
| Age III:        | 5        | 5.20-6.50          | 5.1                     | 5.68                     | 16.89%             |                    |
| Age IV:         | 12       | 6.00-7.90          | 6.1                     | 6.79                     | 45.03%             |                    |
| Age V:          | 5        | 7.40-10.60         | 6.9                     | 9.26                     | 15.73%             |                    |
| Age VI:         | 1        | 8.40-8.40          | 7.8                     | 8.40                     | 2.48%              |                    |
| Smallmouth bass |          |                    |                         |                          |                    | --                 |
| Age IV:         | 1        | 13.60-13.60        | 12.6                    | 13.60                    | 25.00%             |                    |
| Age VI:         | 2        | 17.30-17.40        | 15.3                    | 17.35                    | 50.00%             |                    |
| Age IX:         | 1        | 18.30-18.30        | 18.1                    | 18.30                    | 25.00%             |                    |

\*Mean growth index is the average deviation from the state average length at age and requires a minimum of 5 samples in an age group.