Sturgeon Lake 2011 Survey Report

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Introduction

Sturgeon Lake is a 250-acre natural lake located on the north side of the village of Colon. The St. Joseph River flows into the east side of Sturgeon Lake and exits at the northwest corner of the lake (Figure 1). The other inlet to Sturgeon Lake is an unnamed tributary that flows into the northeast end of the lake. The water level in Sturgeon Lake fluctuates with the discharge of the St. Joseph River, and no bathymetric maps of the lake are available. Soundings recorded during fisheries surveys suggest that the maximum depth is approximately 20 ft at normal water levels. The predominant substrates in shoal areas are sand and organics.

Sturgeon Lake is surrounded by deposits of glacial outwash sand and gravel and postglacial alluvium. Well-drained soils of the Coloma-Spinks-Oshtemo series are common around the lake, whereas a variety of sandy loams and loams occur upstream of Sturgeon Lake (Wesley and Duffy 1999). Agriculture is the predominant land use in the upper St. Joseph River watershed. Residential and vacation home development around Sturgeon Lake primarily is limited to the southern end of the lake. Forests and wetlands cover nearly the entire northern half of the shoreline. The 2011 habitat survey revealed a total dwelling density of 12.6 dwellings/mile (7.8 dwellings/km), which is low relative to most lakes in southwest Michigan. Only 15% of the shoreline is armored with seawalls or riprap. Large woody structure is common outside of the heavily developed areas at the south end of the lake. Recent quantitative data regarding the abundance and distribution of aquatic plants in this system are not available. The Michigan Department of Natural Resources (DNR) boat launch on the southeast shore provides public access to Sturgeon Lake.

Limnological sampling was conducted at the deepest point in Sturgeon Lake on September 13, 2011. Thermal stratification was weak (Figure 2). The epilimnion extended from the surface to a depth of 8 ft. Water temperatures in the epilimnion ranged from 68.4 ^{o}F to 68.7 ^{o}F. The metalimnion (zone of thermal change) encompassed a narrow band from 8 ft to 10 ft. Water temperatures declined from 68.7 ^{o}F to 65.6 ^{o}F. Although the change in water temperature within the metalimnion was small, the oxygen concentration dropped significantly from 11.7 ppm at 8 ft to 4.9 ppm at 10 ft (Figure 2). From 10 ft to the bottom of the lake, water temperatures were relatively uniform. Dissolved oxygen concentrations decreased with increasing depth, reaching a low of 1.7 ppm at 18 ft. The total alkalinity was 168 mg/L, which is indicative of a hardwater lake with substantial buffering capacity.

The biological productivity of a lake is strongly dependent on its supply of two key nutrients: phosphorus and nitrogen. Nitrogen is the limiting nutrient when the ratio of total nitrogen to total phosphorus is <10:1, and phosphorus is the limiting nutrient when this ratio is >15:1 (Shaw et al. 2004). In Sturgeon Lake, the ratio of total nitrogen to total phosphorus was 16:1, which suggests that phosphorus is the limiting nutrient in this system. The total nitrogen concentration was 915 μg/L and the total phosphorus concentration was 57.6 μg/L. The chlorophyll a concentration, which provides an index of algal biomass, was 13.9 μg/L. The Secchi disk depth (an index of water clarity) was 4.0 ft. All of these water quality parameters indicate that Sturgeon Lake is a eutrophic or highly productive system (Carlson and Simpson 1996).

The first fisheries survey of Sturgeon Lake was completed in 1887. Black crappie, largemouth bass, bluegill, northern pike, and suckers were collected in this initial assessment. During 1934 through 1945, bluegills, largemouth bass, smallmouth bass, and yellow perch were stocked in Sturgeon Lake (Table 1). Throughout the state, annual stocking programs for these species were discontinued after fisheries managers determined that such programs were unnecessary and could have undesirable effects on the receiving populations (e.g., reduced growth due to increased competition for forage).

Conservation officers recorded catch and effort data for anglers encountered on Sturgeon Lake during 1954-1963. These qualitative creel reports indicated that bluegill was the primary game species in this system, followed by pumpkinseed, largemouth bass, yellow perch, black crappie, and northern pike. The first electrofishing survey of the lake was conducted in August 1965. The catch was low due to the timing of the survey, and suckers composed about 70% of the biomass in the sample.

Since 1993, nearly 180,000 spring fingerling walleyes have been stocked in Sturgeon Lake (Table 1). Electrofishing surveys conducted in 1995 and 1998 indicated acceptable survival and average growth of stocked walleye. The most recent walleye stocking occurred in 2006. In 2007, the DNR's walleye stocking program was interrupted due to the discovery of viral hemorrhagic septicemia virus (VHSv) in the Great Lakes. Full production of spring fingerling walleyes did not resume until 2011.

Materials and Methods

A variety of methods were used to evaluate the fish community in Sturgeon Lake during June 2011. Fish were captured with trap nets, fyke nets, gill nets, seines, and nighttime electrofishing gear (Table 2). Total lengths were recorded for all fish captured during the survey. For game fish species, dorsal fin ray or scale samples were collected from 10 fish per inch group for age determination.

Results

Thirty-seven fish species were collected during the 2011 survey (Table 3). Bluegill (n = 2,178) was the most abundant species, composing 68% of the catch by number and 31% of the catch by weight. Eighty-one percent of the bluegills were 6 inches or larger. Size structures of bluegill populations can be challenging to interpret because each gear type exhibits some degree of size selectivity (Figure 3). In an effort to minimize the subjectivity associated with analyses of bluegill catch data, Schneider (1990) developed a standardized scoring system for interpreting length-frequency distributions of bluegills collected with various types of sampling gear. The size scores for the Sturgeon Lake bluegill population were 5.0 (good) based on the trap net and fyke net samples and 4.8 (satisfactory-good) based on the electrofishing sample (Schneider 1990).

The mean growth index for bluegills was +0.5, which is indicative of average growth (Figure 4). Nine year classes of bluegills were collected (Figure 5). Age 4 fish were particularly abundant, composing 45% of the bluegill catch. Annual mortality was estimated to be 76% (ages 4-8; Figure 6).

Other panfish species were minor components of the fish community. Cumulatively, yellow perch, black crappies, pumpkinseeds, and redear sunfish composed 4% of the total catch by number and 1% of the catch by weight. Growth was above average for redear sunfish and average for the other panfish species.

Numerically, largemouth bass (n = 65) were the most abundant predators in the catch. Young-of-year fish composed 38% of the sample (Figure 7). No fish older than age 6 were captured. Only 5% of the largemouth bass were of legal size (≥ 14 inches), and the largest bass collected was 14.6 inches (Figure 8). The mean growth index was -0.4, which is indicative of average growth (Figure 9). Most largemouth bass in Sturgeon Lake reach legal size at age 6.

Though less abundant numerically, channel catfish (n = 32) were the most important predator in terms of biomass. Seven year classes were represented in the catch. All of the channel catfish were larger than the minimum size limit (12 inches), and the largest catfish collected was 26 inches. Growth was above average (mean growth index = +1.0) for this species.

Twelve northern pike were captured during the survey, including fish from five different year classes (ages 2-6). Two-thirds of the pike collected were larger than the minimum size limit of 24 inches. The limited data available suggest above average growth of northern pike in Sturgeon Lake.

Eight walleyes were collected during the survey. The catch included one young-of-year fish and adult walleyes from the 2000, 2003, and 2004 year classes. The sample size was small, but the available data indicate rapid growth of walleyes in this system.

Analysis and Discussion

Compared to most other lakes in southwest Michigan, Sturgeon Lake supports a very diverse fish community. This high species diversity is a result of the lake's location. Sturgeon Lake is located on the St. Joseph River, so both lacustrine and riverine fish species are included in the fish community. In addition, fish from Sturgeon Lake have unrestricted access to several miles of the St. Joseph River upstream and downstream of the lake and many additional miles of tributary streams. Thus, there is substantial movement of fish into and out of Sturgeon Lake. During the 2011 survey, predators (largemouth and smallmouth bass, channel catfish, spotted and longnose gar, northern pike, walleye, and bowfin) made up 21% of the biomass. Schneider (2000) observed that predators typically compose 20-50% of the biomass in lakes with desirable fish communities. Based on this standard, Sturgeon Lake appears to have an acceptable predator:prey ratio.

Bluegill is the primary game species in Sturgeon Lake. Catch-per-effort (CPE) with specific gear types provides an index of relative abundance of bluegills. During the 2011 survey, 88% of the bluegills were collected in fyke nets, and the fyke net CPE was 146.8 bluegills/net night. For lakes surveyed as part of Fisheries Division's Status and Trends Program during 2002-2007, the statewide average was 22.6 bluegills/net night (K. Wehrly, MDNR – Fisheries Division, unpublished). Thus, it appears that the population density for bluegills in Sturgeon Lake is high relative to most other populations in Michigan.

Annual total mortality for adult bluegills was near the upper end of the range of mortality estimates reported by Schneider (2000). High fishing mortality could have produced the observed population age structure; however, no creel survey data are available to test this hypothesis. Another possible explanation is that bluegill reproductive success was higher in 2007 than in successive years. Such recruitment variability would lead to overestimation of annual total mortality.

The 2011 survey provided the first documentation of redear sunfish in Sturgeon Lake. This species probably moved into Sturgeon Lake from Long and Palmer lakes. Redear sunfish were stocked in Long Lake during 1999-2002, and the outlet from Long and Palmer lakes flows into the St. Joseph River less than a mile upstream of Sturgeon Lake.

Largemouth bass abundance in Sturgeon Lake appears to be low. The electrofishing CPE for Sturgeon Lake was 0.8 fish/minute, which is below the statewide average of 1.1 fish/minute and the average of 1.6 fish/minute for lakes in southwestern Michigan (K. Wehrly, MDNR – Fisheries Division, unpublished). The fyke net CPE for largemouth bass in Sturgeon Lake also was well below the statewide and regional averages. Few largemouth bass larger than 14 inches were captured during the 2011 survey. The sample size was too small to facilitate estimation of annual mortality, but the age structure suggests high annual mortality for adult bass. These results must be interpreted with caution, as there were caveats associated with the sampling methodology. Water temperatures at the time of the survey were above the optimal range for collecting largemouth bass. In addition, nighttime electrofishing typically is the most effective method for capturing bass, but high turbidity limited electrofishing efficiency in Sturgeon Lake.

Sturgeon Lake appears to be providing good fishing opportunities for channel catfish. This species was not recorded during previous surveys. Since 1975, channel catfish have been stocked at various locations upstream and downstream of Sturgeon Lake. Most of the catfish captured during the survey were from the 2000-2004 year classes (Figure 10). Yearling channel catfish were stocked in Union Lake during 2001-2005, and no catfish have been stocked upstream or downstream of Sturgeon Lake since 2005. The scarcity of young channel catfish in the catch suggests that natural recruitment is limited in this portion of the St. Joseph River.

Before the walleye stocking program was interrupted, anglers reported good fishing for walleyes in Sturgeon Lake and the upper St. Joseph River. Forage is abundant, and walleyes grow rapidly in this system. Seven out of the eight walleyes captured during the 2011 survey were from years in which stocking occurred in or near Sturgeon Lake. The presence of one young-of-year fish in the sample indicates that some natural reproduction occurs in the St. Joseph River., but the absence of fish from the 2005-2010 year classes suggests that natural recruitment to the Sturgeon Lake population is minimal. Continued stocking is necessary to maintain the walleye fishery in this lake.

The wetlands at the north end of Sturgeon Lake provide spawning habitat for northern pike and yellow perch. These wetlands also serve as nursery areas for juvenile fish of many different species. Because these wetlands are so important to the continued health of the fish, reptile, and amphibian communities, they should be protected from future draining, filling, or development.

Management Recommendations

Four fisheries management goals have been developed for Sturgeon Lake. Goal 1: Protect and rehabilitate habitat for fish and other aquatic organisms. Goal 2: Restore and maintain the walleye fishery in Sturgeon Lake. Goal 3: Enhance the channel catfish fishery in this system. Goal 4: Maintain a healthy predator-prey ratio within the fish community.

At least three different methods will be used to accomplish Goal 1. Fisheries Division personnel will continue to review Michigan Department of Environmental Quality permit applications for potential effects on aquatic resources. If a proposed project is likely to degrade the aquatic habitat, Fisheries Division staff will object to the proposal and suggest feasible alternatives. Fisheries Division will work with the Sturgeon Lake Association and other organizations to educate riparian landowners on the effects of various practices (e.g., chemical weed treatments and seawall construction) on aquatic ecosystems. As opportunities arise, Fisheries Division also will provide technical assistance to local units of government interested in establishing ordinances that protect aquatic habitats from pollution or unwise development.

The walleye fishery in Sturgeon Lake has declined in recent years due to the interruption of the stocking program. Walleye stocking resumed in 2012. Stocking generally will occur on a biennial schedule and will coincide with stocking in the St. Joseph River upstream and downstream of Sturgeon Lake. The recommended stocking density for Sturgeon Lake is 50 spring fingerlings/acre (12,500 fish).

Previous stocking of channel catfish upstream and downstream of Sturgeon Lake created a strong population in this system, but natural recruitment appears to be minimal. Biennial stocking of channel catfish in Sturgeon Lake will enhance the existing population and provide additional fishing opportunities. The recommended stocking density is 10 yearlings/acre (2,500 fish). The preferred size at stocking is $\geq$ 8 inches.

Goal 4 is related to Goals 2 and 3. During the 2011 survey, predators composed about 21% of the biomass in the catch. This is at the low end of the desirable range (Schneider 2000). The proposed walleye and channel catfish stocking programs are not expected to increase the predator:prey ratio above the recommended range for three reasons. (1) Forage currently is abundant in Sturgeon Lake. (2) Sturgeon Lake is an open system. Both prey fish and predators have the opportunity to move in and out of the lake to find suitable forage. (3) Channel catfish are opportunistic feeders, and other organisms such as aquatic insects and mollusks often are a substantial component of their diet.

References

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Table 1.–Fish stocking in Sturgeon Lake, 1934-2011.

Year	Species	Life stage	Number	Number/acre	Average length (inches)
1934	Bluegill	Fall fingerling	15,000	60	---
1935	Bluegill	Fall fingerling	20,000	80	---
	Yellow perch	Fall fingerling	5,000	20	---
1936	Bluegill	Fall fingerling	23,000	92	---
	Largemouth bass	Fall fingerling	500	2	---
	Smallmouth bass	Fall fingerling	2,000	8	---
1937	Bluegill	Fall fingerling	30,000	120	---
	Largemouth bass	Fall fingerling	500	2	---
1938	Bluegill	Fall fingerling	80,000	320	---
	Largemouth bass	Fall fingerling	1,000	4	---
	Smallmouth bass	Fall fingerling	1,500	6	---
	Yellow perch	Fall fingerling	15,000	60	---
1939	Bluegill	Fall fingerling	80,000	320	---
	Largemouth bass	Fall fingerling	2,000	8	---
	Smallmouth bass	Fall fingerling	2,000	8	---
	Yellow perch	Fall fingerling	10,000	40	---
1940	Bluegill	Fall fingerling	40,000	160	---
		Yearling	1,000	4	---
	Largemouth bass	Fall fingerling	2,000	8	---
		Yearling	1,000	4	---
	Smallmouth bass	Fall fingerling	4,000	16	---
1941	Bluegill	Fall fingerling	120,000	480	---
	Largemouth bass	Fall fingerling	500	2	---
	Smallmouth bass	Fall fingerling	2,000	8	---
1942	Bluegill	Fall fingerling	30,000	120	---
	Largemouth bass	Fall fingerling	1,000	4	---
	Smallmouth bass	Fall fingerling	6,000	24	---
1943	Bluegill	Yearling	4,000	16	---
	Largemouth bass	Fall fingerling	1,500	6	---
	Smallmouth bass	Fall fingerling	1,500	6	---
1944	Bluegill	Fall fingerling	20,000	80	1.50
	Largemouth bass	Fall fingerling	2,500	10	3.00
1945	Bluegill	Fall fingerling	15,000	60	2.00
	Largemouth bass	Fall fingerling	2,000	8	3.00
1993	Walleye	Spring fingerling	14,002	56	2.17
1994	Walleye	Spring fingerling	11,968	48	1.80
1995	Walleye	Spring fingerling	12,950	52	1.76
1996	Walleye	Spring fingerling	14,305	57	2.48
1997	Walleye	Spring fingerling	6,508	26	1.58

Table 1.–Continued.

Year	Species	Life stage	Number	Number/acre	Average length (inches)
1998	Walleye	Spring fingerling	13,327	53	0.48
2000	Walleye	Spring fingerling	37,146	149	1.40
2002	Walleye	Spring fingerling	30,512	122	1.24
2004	Walleye	Spring fingerling	24,583	98	1.17
2006	Walleye	Spring fingerling	13,968	56	1.19

Table 2.–Sampling effort during the fish community survey on Sturgeon Lake, June 2011. Each net night equals one overnight set of one net.

Sampling period	Gear	Effort
June 13-16	Trap net	3 net nights
June 13-16	Fyke net	13 net nights
June 13-16	Graded-mesh gill net	6 net nights
June 21	Electrofishing	30 minutes
June 21	Seine	4 hauls (25 ft each)

Table 3.–Numbers, weights, lengths, and growth indices for fish species collected during the fish community survey on Sturgeon Lake, June 2011. Fish were captured using trap nets, fyke nets, gill nets, seines, and nighttime electrofishing gear.

Species	Number	Percent by number	Weight (lbs)	Percent by weight	Length range (inches)	Percent legal or harvestable[1]	Growth index[2]
Bluegill	2,178	67.7	443.8	30.5	1-8	81	+0.5
Silver redhorse	99	3.1	244.5	16.8	12-22	---	---
Hybrid sunfish	86	2.7	24.1	1.7	2-8	94	---
Gizzard shad	82	2.5	77.8	5.4	6-15	---	---
Largemouth bass	65	2.0	29.9	2.1	0-14	5	-0.4
Yellow perch	59	1.8	1.4	0.1	1-7	2	-0.4
Bluntnose minnow	58	1.8	0.4	0.0	1-3	---	---
Mimic shiner	50	1.6	0.2	0.0	1-2	---	---
Golden redhorse	44	1.4	62.7	4.3	10-19	---	---
Spotted sucker	43	1.3	44.8	3.1	4-24	---	---
Spotfin shiner	42	1.3	0.2	0.0	1-3	---	---
Channel catfish	32	1.0	131.0	9.0	14-26	100	+1.0
Yellow bullhead	31	1.0	21.9	1.5	9-13	---	---
Common carp	29	0.9	172.6	11.9	19-28	---	---
Warmouth	27	0.8	8.4	0.6	2-8	89	---
Spotted gar	26	0.8	23.5	1.6	11-24	---	---
Black crappie	25	0.8	8.8	0.6	2-11	64	+0.1
Pumpkinseed	22	0.7	4.8	0.3	2-7	59	+0.9
Brook silverside	15	0.5	0.0	0.0	2-3	---	---
Northern pike	12	0.4	50.5	3.5	20-36	67	---
Longnose gar	12	0.4	16.3	1.1	14-35	---	---
White sucker	12	0.4	15.8	1.1	1-18	---	---
Common shiner	10	0.3	0.0	0.0	1-2	---	---
Walleye	8	0.2	33.6	2.3	2-28	88	---
Redear sunfish	8	0.2	3.5	0.2	6-9	100	---
Shorthead redhorse	7	0.2	15.1	1.0	15-19	---	---
Logperch	7	0.2	0.1	0.0	3-3	---	---
Bowfin	4	0.1	17.5	1.2	20-25	---	---
Golden shiner	4	0.1	0.1	0.0	3-4	---	---
Smallmouth bass	4	0.1	0.1	0.0	1-4	0	---
Johnny darter	3	0.1	0.0	0.0	1-1	---	---
Blacknose shiner	2	0.1	0.0	0.0	2-2	---	---
Banded killifish	2	0.1	0.0	0.0	1-1	---	---

Table 3.–Continued.

Species	Number	Percent by number	Weight (lbs)	Percent by weight	Length range (inches)	Percent legal or harvestable[1]	Growth index[2]
Rock bass	1	0.0	0.2	0.0	6	100	---
Grass pickerel	1	0.0	0.0	0.0	3	---	---
Green sunfish	1	0.0	0.0	0.0	3	0	---
Creek chub	1	0.0	0.0	0.0	2	---	---
Sand shiner	1	0.0	0.0	0.0	2	---	---
Total	3,113		1,453.6				

[1] Harvestable size is 6 inches for bluegill, pumpkinseed, green sunfish, redear sunfish, hybrid sunfish, warmouth, and rock bass, and 7 inches for black crappie and yellow perch.
[2] Average deviation from the state average length at age. Mean growth indices <-1 indicate below average growth, indices between -1 and +1 indicate average growth, and indices >+1 indicate growth is faster than the state average.

Figure 1.–Aerial view of Sturgeon Lake and the surrounding area. Image from www.bing.com/maps.

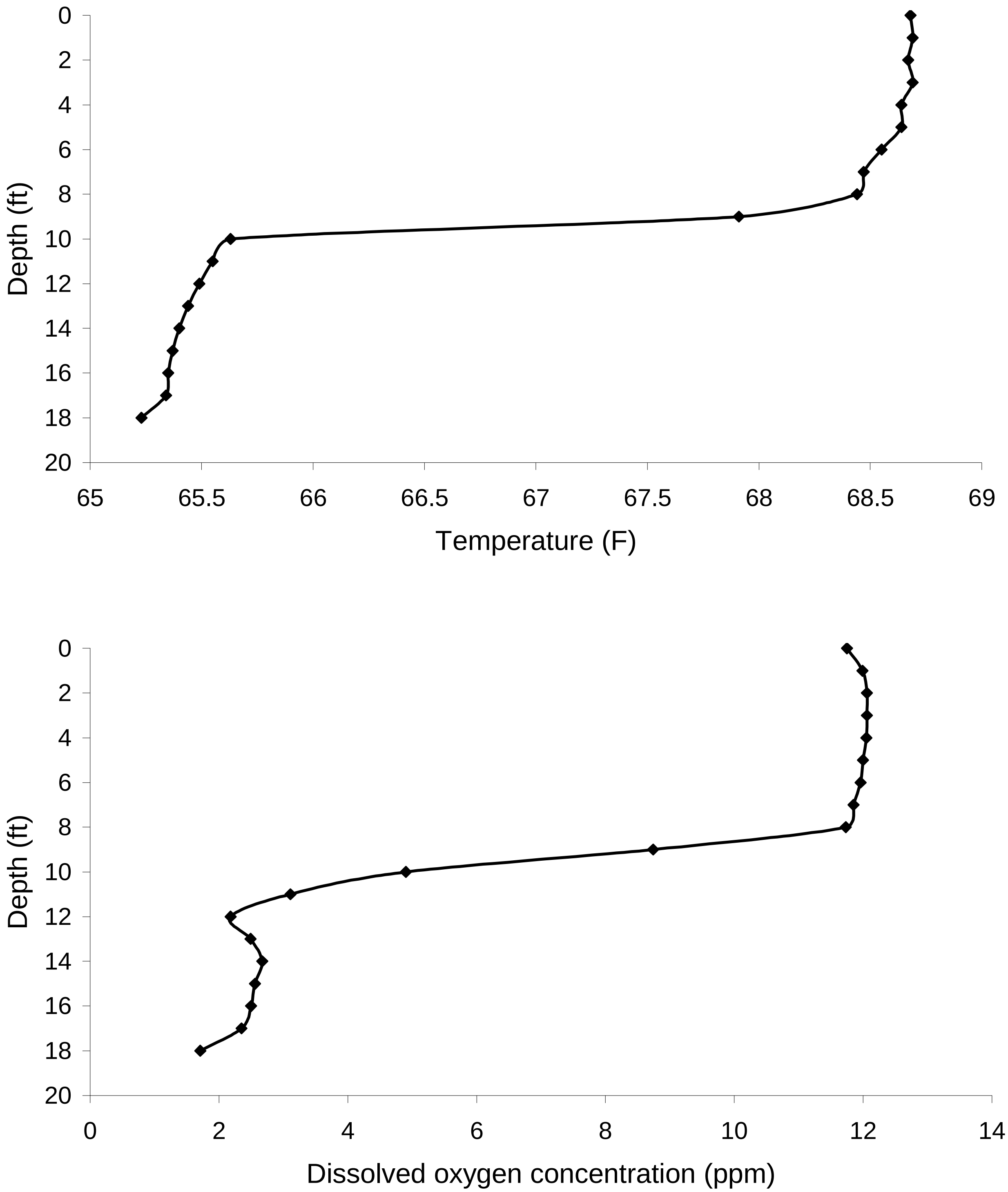

Figure 2.–Temperature and dissolved oxygen profiles for Sturgeon Lake on September 13, 2011.

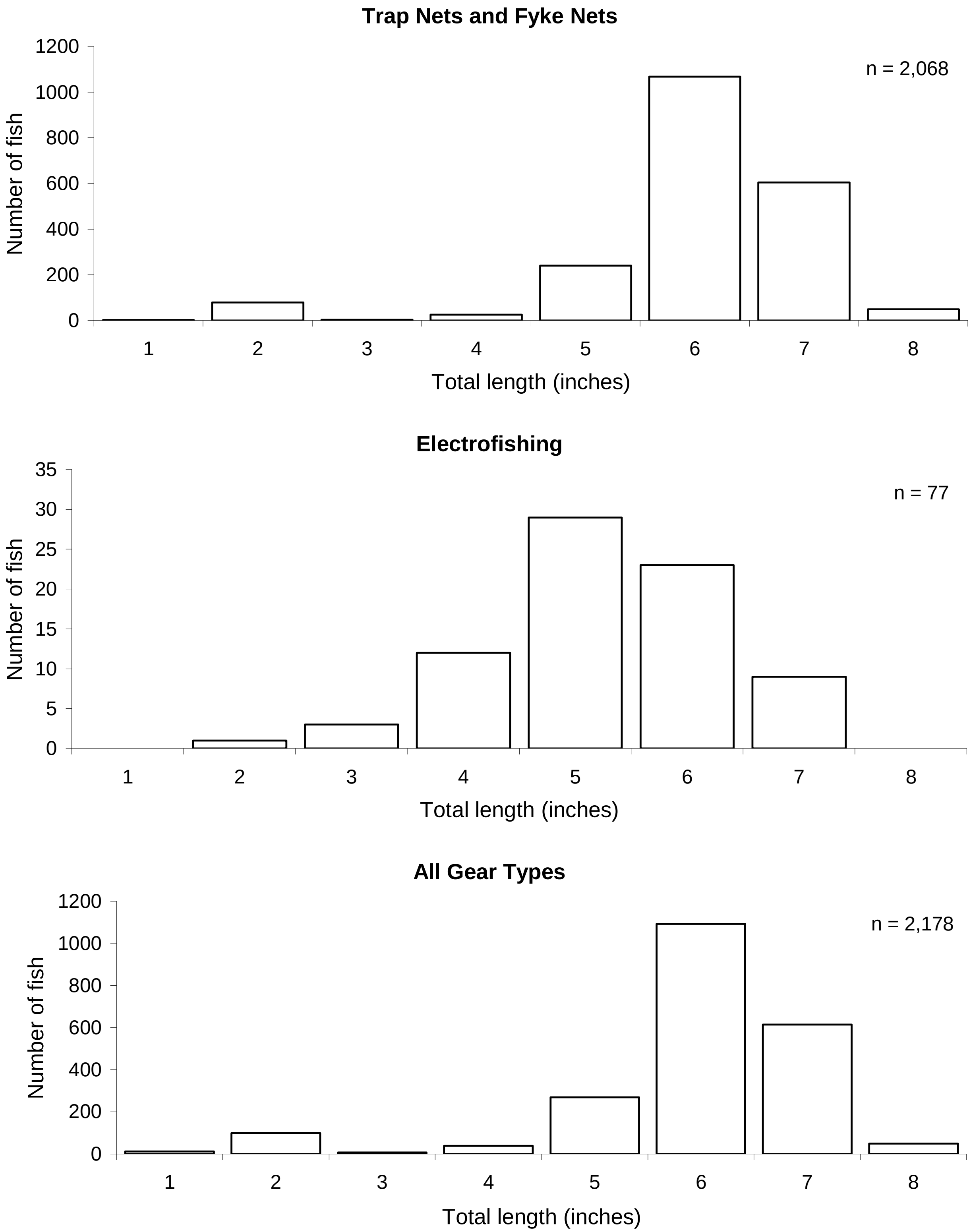

Figure 3.–Length frequency distributions for bluegills captured in Sturgeon Lake using trap nets and fyke nets, electrofishing gear, and all gear types, June 2011.

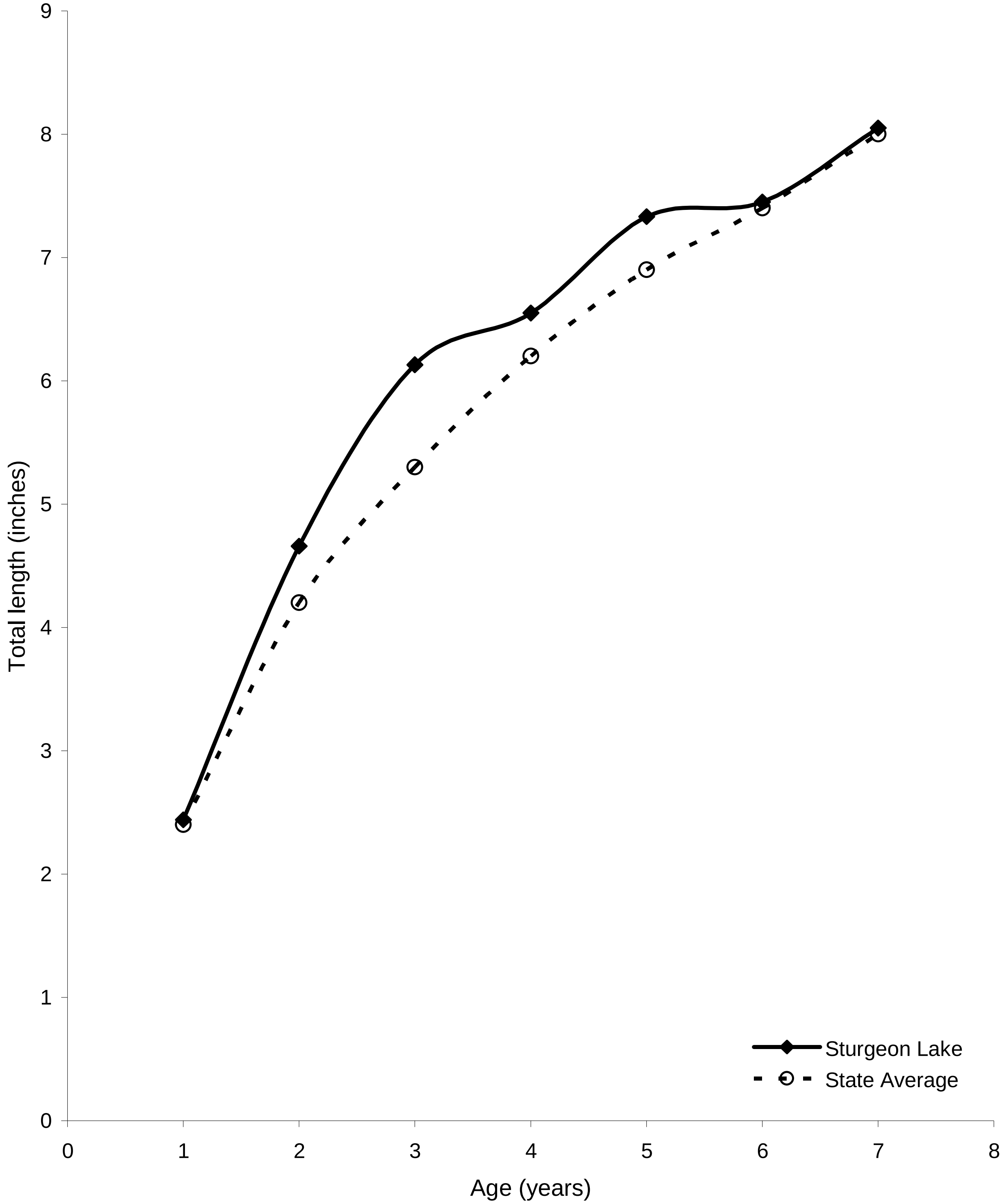

Figure 4.–Growth of bluegills in Sturgeon Lake, as determined from scale and dorsal spine samples collected during June 2011. State average lengths from Schneider et al. (2000).

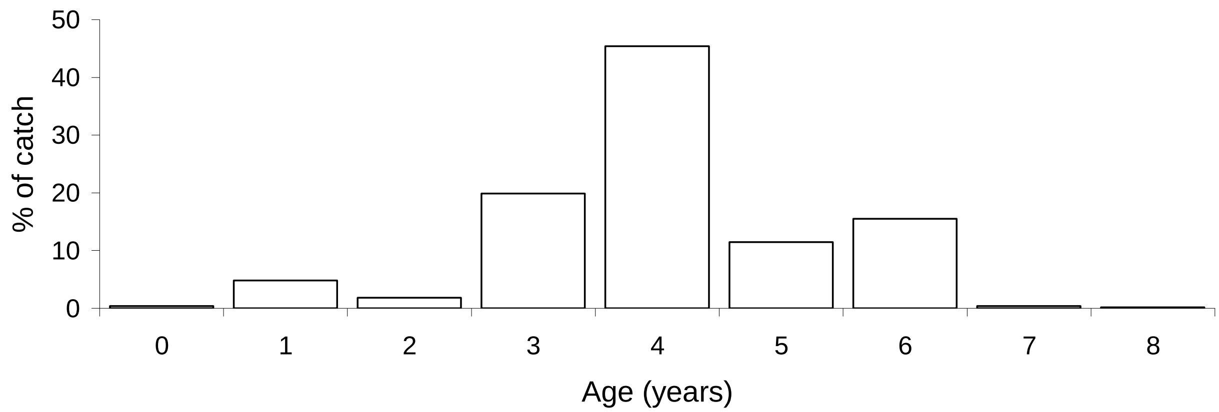

Figure 5.–Age frequency distribution for bluegills captured in Sturgeon Lake during June 2011.

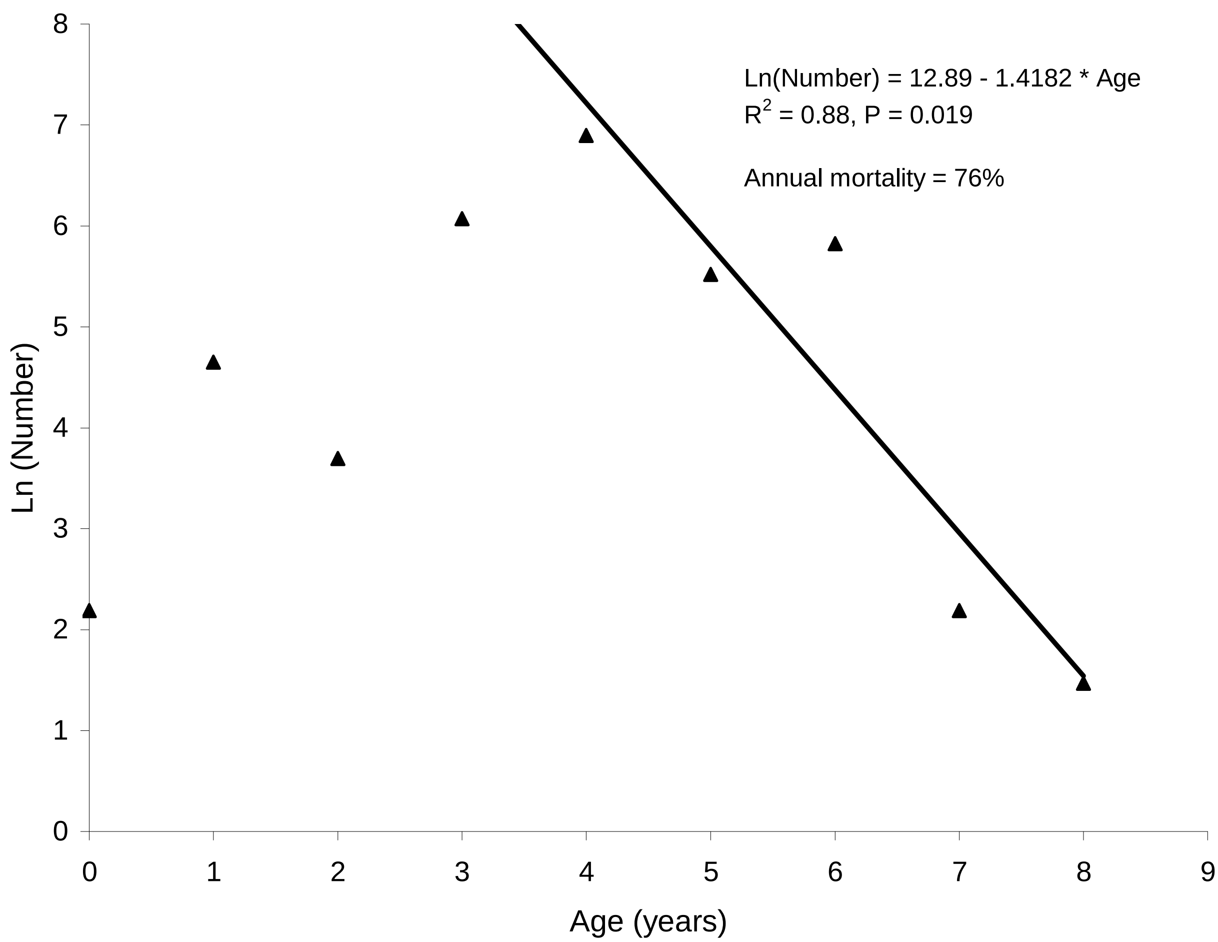

Figure 6. – Observed ln(number) versus age for bluegills captured in Sturgeon Lake during June 2011.

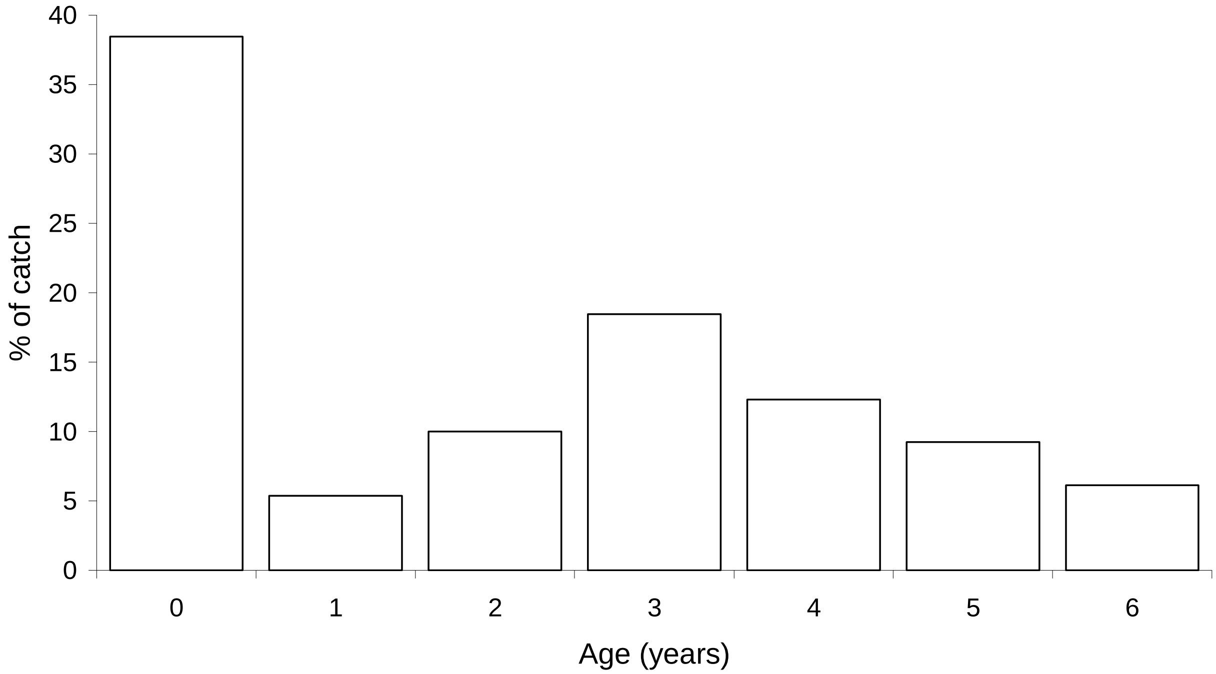

Figure 7.–Age frequency distribution for largemouth bass captured in Sturgeon Lake during June 2011.

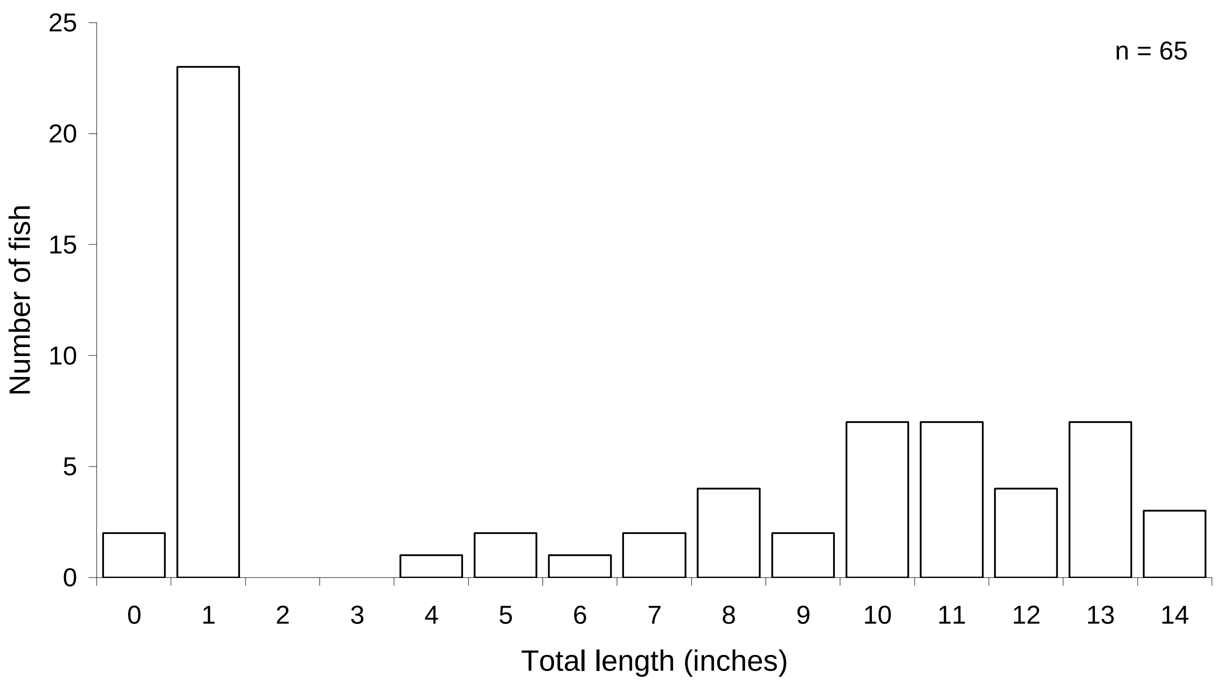

Figure 8.–Length frequency distribution for largemouth bass captured in Sturgeon Lake during June 2011.

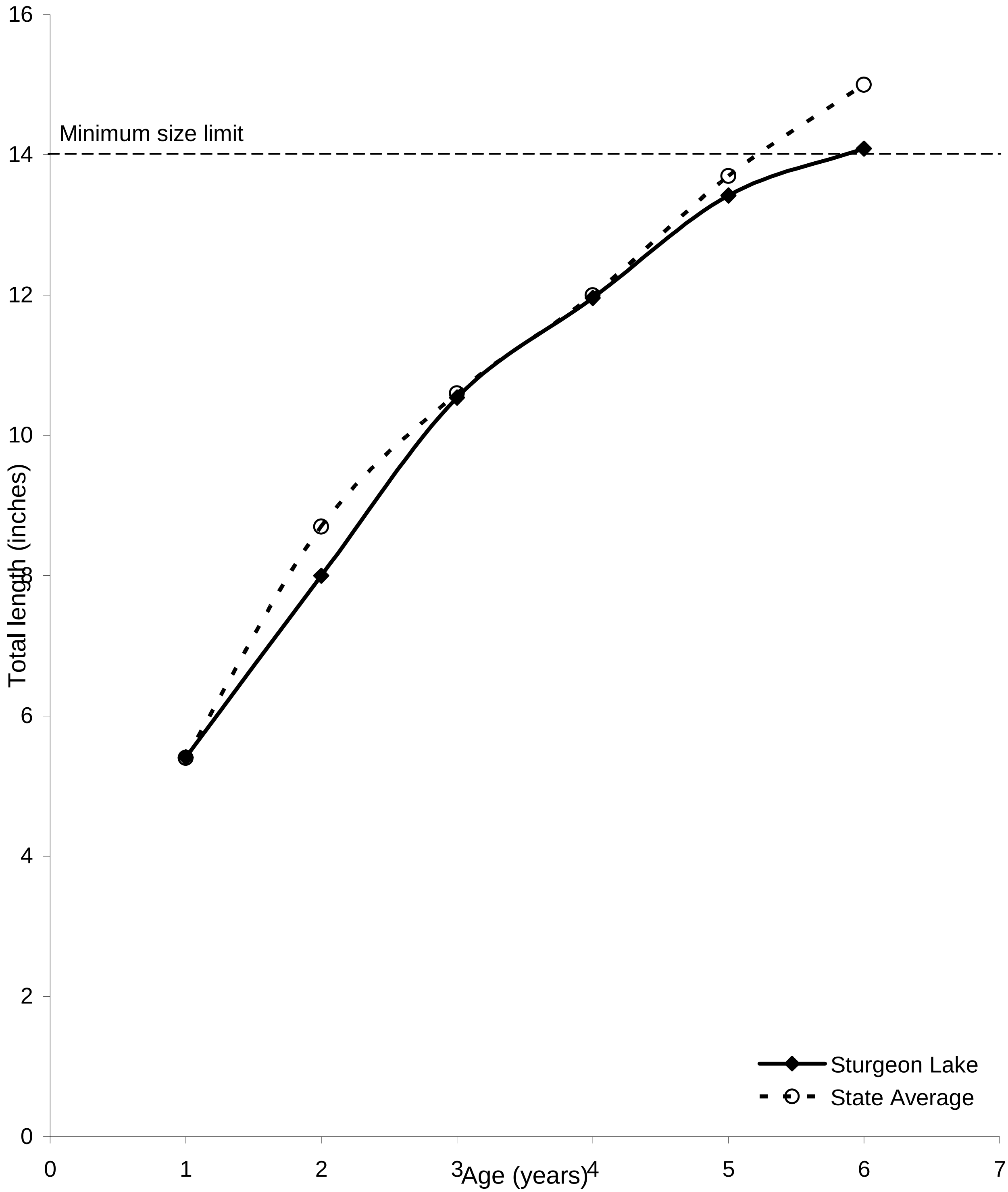

Figure 9.–Growth of largemouth bass in Sturgeon Lake, as determined from scale and dorsal spine samples collected during June 2011. State average lengths from Schneider et al. (2000).

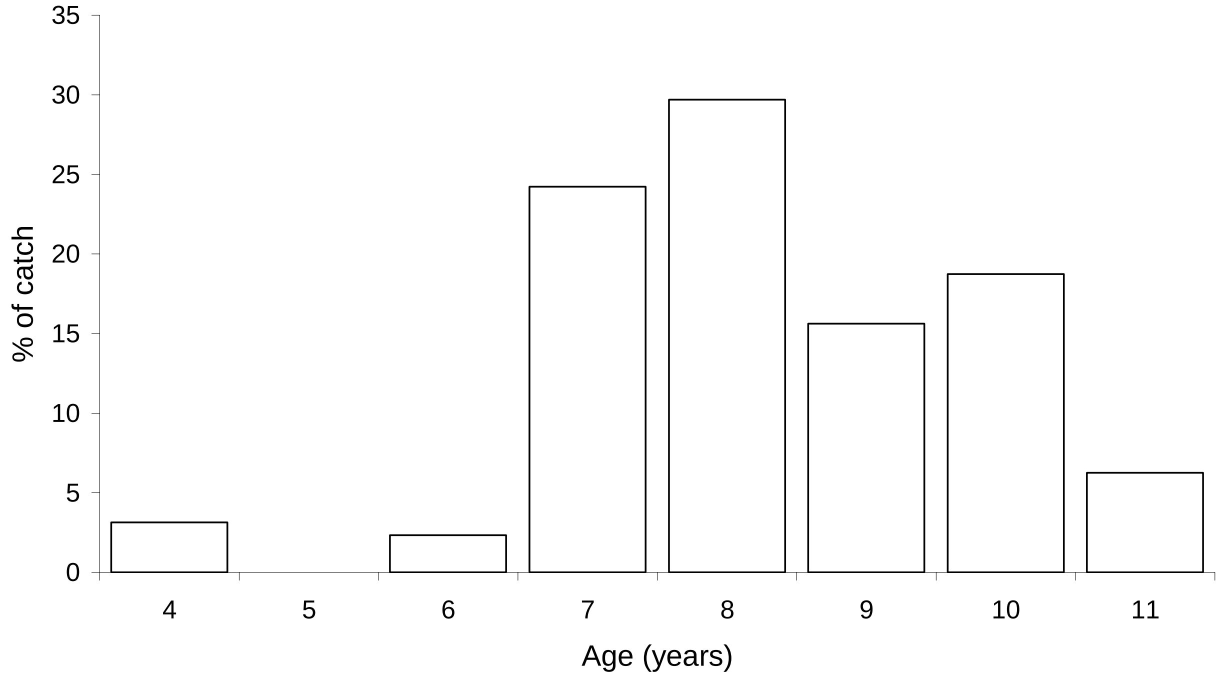

Figure 10.–Age frequency distribution for channel catfish captured in Sturgeon Lake during June 2011.