Craig and Morrison Lakes

Branch County (T5S, R6W, Sections 29 and 32 and T6S, R6W, Section 5)
St. Joseph River Watershed, 2012

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Environment

Craig and Morrison lakes are part of the Randall Chain of Lakes located in Branch County near the city of Coldwater. The Randall Chain includes seven interconnected lakes with a combined surface area of approximately 1,100 acres (Figure 1). The Coldwater River flows into the southern end of the Randall Chain at South Lake and flows out of Craig Lake at the northern end of the Chain. Other major tributaries to the Chain include the Sauk River, Cold Creek, and the Miller Lake outlet. The watershed includes a drainage area of more than 170 square miles as measured at the outlet of Craig Lake (Hanshue 2003). The water levels in the Randall Chain are controlled by the Hodunk Dam. The legal lake levels are 924.0 ft (above sea level) in summer and 923.0 ft in winter. The lakes are accessible to the public, as the Michigan Department of Natural Resources (MDNR) maintains public access sites on Craig and Randall lakes.

The Randall Chain is surrounded by deposits of glacial outwash sand and gravel and postglacial alluvium. Loamy sands of the Spinks-Houghton-Boyer series are common around the lakes, whereas loams of the Barry-Locke-Hatmaker series predominate in the southern and eastern portions of the watershed. Eighty-three percent of the soils within the watershed are classified as "Hydrologic Group B" soils (Wickerham 2006), which allow moderate infiltration of precipitation. Wickerham (2006) noted that "only 63% of the Hydrologic Group B's occur naturally. Another 20% exhibit properties of Group B soils because they have been intentionally tiled and drained." In most instances, wetlands were drained to facilitate agricultural production. Seventy percent of the land within the watershed is used for agriculture, including 57% for row crops and 13% for hay and pastures (Wickerham 2006).

Located at the northern (i.e., downstream) end of the Chain, Craig Lake covers 122 acres and has a maximum depth of 25 ft. There are several islands within the lake, and 57% of the lake (by area) is less than 10 ft deep (Smith 2007). Marl and fibrous peat are the most common substrates in Craig Lake. The 2012 habitat survey revealed a dwelling density of 12.7 dwellings/mile, which is low for lakes in southwest Michigan. The actual dwelling density is somewhat higher than reported, as the 2012 survey did not include the canals which connect to Craig Lake. About 25% of the shoreline is armored with seawalls and riprap. Several wetland complexes remain along the shoreline, with the largest wetlands located at the northern end of the lake. Large woody cover is common along the shoreline and is particularly abundant near the islands.

At 288 acres, Morrison Lake is larger and more open than Craig Lake. Morrison also is a relatively deep lake, with an average depth of 21 ft and a maximum depth of 46 ft (Smith 2007). Sand and marl are the predominant substrates in nearshore areas. Morrison Lake is more heavily developed than Craig Lake. The shoreline dwelling density in 2012 was 37.5 dwellings/mile, which is about average for lakes in this region. Approximately 45% of the shoreline is armored with seawalls or riprap, and wetlands are limited to the channels at the northern and southern ends of the lake. Large woody cover is common along the islands and undeveloped portions of the shoreline.

Limnological sampling was conducted at the deepest basin in each lake on August 23, 2012. As expected, Morrison Lake was thermally stratified (Figure 2). The epilimnion extended from the surface to a depth of 12 ft. Water temperatures within the epilimnion were relatively uniform, ranging from 74.9 F to 73.8 F. The metalimnion (zone of thermal change) extended from 12 ft to 34 ft. Water temperatures declined from 73.8 F at the top to 48.9 F at the bottom of the metalimnion. The cold waters of the hypolimnion extended from 34 ft to the bottom of the lake. The oxygen distribution within Morrison Lake followed a clinograde curve, with the highest oxygen concentrations occurring near the surface (Figure 2). The dissolved oxygen concentration remained above 3 ppm to a depth of 17 ft.

Thermal stratification was less obvious in Craig Lake (Figure 3). Water temperatures varied from 77.1 F at 3 ft to 66.9 F at 17 ft. The oxygen distribution within Craig Lake also followed a clinograde curve, but the layer of oxygenated water was narrower than that observed for Morrison Lake. The dissolved oxygen concentration only remained above 3 ppm to a depth of 9 ft (Figure 3).

Craig Lake is more acidic than Morrison Lake because the abundant peat deposits within and adjacent to Craig Lake release organic acids. The average pH in Craig Lake was 6.5 (range = 5.6-6.7), whereas the average pH in Morrison Lake was 7.2 (range = 6.7-8.1). Total alkalinities were 154 mg/L for Craig Lake and 138 mg/L for Morrison Lake. These values are indicative of hardwater lakes with substantial buffering capacity (Shaw et al. 2004).

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). The ratios of total nitrogen to total phosphorus were 19:1 and 51:1 in Craig and Morrison lakes, respectively. Thus, phosphorus appears to be the limiting nutrient in both lakes.

The total phosphorus concentration in Craig Lake was 0.0477 mg/L. The chlorophyll a concentration, which provides an index of algal biomass, was 0.0093 mg/L. These values indicate that Craig Lake is a eutrophic or highly productive system (Carlson and Simpson 1996). Morrison Lake had a total phosphorus concentration of 0.0172 mg/L and a chlorophyll a concentration of 0.0027 mg/L. Thus, Morrison Lake is best classified as mesotrophic or moderately productive system (Carlson and Simpson 1996).

History

Brief fishery surveys were conducted on Morrison Lake in 1886 and 1927, but the first intensive fish community surveys on this system were not completed until the 1930s-1940s.Thirty two fish species were collected during these surveys. Yellow perch, bluegills, largemouth bass, and black crappies were the most abundant game species in the catch. Local anglers reported that the lakes received heavy fishing pressure for bluegills and northern pike during the winter.

Bluegills, largemouth bass, smallmouth bass, and yellow perch were stocked in Craig and Morrison lakes during 1933-1942 (Table 1). These stocking programs were discontinued after research indicated that they had minimal effects on the quality of the fishery (Cooper 1948). No fish have been stocked in any of the lakes within the Randall Lake Chain since 1942.

The first electrofishing surveys on Craig and Morrison lakes were completed in 1965. Bluegills, largemouth bass, and pumpkinseeds were the most common species in the catch. Growth was average for bluegills and largemouth bass. These surveys provided the first official documentation of common carp in this system.

The next fishery survey on the lakes occurred in 1980. MDNR personnel used trap nets to capture 5,443 fish during late May-early June. Bluegill was the most abundant species, composing 68% of the catch by number and 38% of the catch by weight. Black crappies also were common, but less than half of the crappies collected were 7 inches or larger. Common carp and bullheads made up 39% of the biomass in the catch. Growth was average for largemouth bass and pumpkinseeds and slightly above average for bluegills and crappies. Anglers reported excellent fishing for panfish in recent years.

In June 1990, six trap nets and two graded-mesh gill nets were deployed in Craig and Morrison lakes for one night. Weather conditions were not favorable, and the catch was low for most species. Bluegill was the dominant species, composing 79% of the catch by number and 28% by weight. As noted during the previous survey, common carp and bullheads also were major components of the fish community. These species made up 43% of the total biomass in 1990. Mean lengths-at-age for bluegills were slightly lower in 1990 than in 1980 and were within the average range for Michigan populations. Angler reports indicated that the lakes still were supporting good fisheries for bluegills and largemouth bass.

A variety of sampling methods were used to collect fish in Craig and Morrison lakes during June-August 2000. Once again bluegill was the most abundant species, making up 71% of the catch by number and 32% by weight. For both lakes, the average size of bluegills captured in trap nets declined from 1990 to 2000. During the same period, mean lengths-at-age for bluegills decreased by 0.6 inches in Morrison Lake and 1.0 inch in Craig Lake. Another major change in the fish community was a decline in the relative abundance of carp and bullheads. These species only composed 12% of the catch by weight in 2000. The 2000 survey also provided the first documentation of redear sunfish in this system. Redear sunfish previously had been introduced into the Coldwater-Marble Chain of Lakes and may have moved into the Randall Chain via the Coldwater or Sauk rivers (Hanshue 2003).

Additional sampling was conducted in April 2007 to evaluate growth, mortality, and abundance of northern pike in Craig and Morrison lakes. A large amount of netting effort was expended, but the total number of pike collected was too small to facilitate quantitative estimates of instantaneous mortality or total abundance. The low catch rates during the survey suggested that the northern pike population density was low in this system (Smith 2007). Ecological conditions were conducive to growth of northern pike and the mean lengths-at-age were nearly 3 inches larger than the statewide averages.

Current Status

A variety of methods were used to evaluate the fish community in Craig and Morrison lakes during June 2012. Fish were captured with trap nets, fyke nets, gill nets, seines, and nighttime electrofishing gear (Table 2) as part of MDNR's Status and Trends Program. This program involves standardized sampling in randomly selected lakes to provide information regarding spatial and temporal trends in Michigan's fish communities. Total lengths were recorded for all fish. For game fish species, spine or scale samples for age determination were collected from 10 fish per inch group in each lake.

Twenty-four fish species (plus hybrid sunfishes) were collected during the 2012 survey (Tables 3-5). The species composition of the catch and mean lengths-at-age for game fish were similar in both lakes. Thus, the two lakes will be treated as one system for the remainder of the report.

Bluegill (n = 3,032) was the most abundant species, composing 65% of the catch by number and 41% of the catch by weight. Fifty-seven 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 4). 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 bluegill population in Craig and Morrison lakes were 4.6 (satisfactory-good) based on the trap and large-mesh fyke net samples and 3.6 (acceptable-satisfactory) based on the electrofishing sample.

The mean growth index for bluegills was 0, which is indicative of average growth (Figure 5). Nine year classes of bluegills were collected (Figure 6). Age 6 and older bluegills made up less than 5% of the catch. Annual total mortality was estimated to be 74% for adult bluegills (ages 4-9; Figure 7).

Redear sunfish (n = 171) and pumpkinseeds (n = 106) composed 7% of the total fish biomass in the catch. Ninety-eight percent of the redear sunfish and 80% of the pumpkinseeds were 6 inches or larger (Figure 8). Mean lengths-at-age for redear sunfish were similar to statewide averages (Figure 9), whereas mean lengths-at-age for adult pumpkinseeds were slightly above average (Figure 10). The redear sunfish population was dominated by the 2009 year class (3-yr olds in 2012) and the pumpkinseed population by the 2008 year class (4-yr olds in 2012; Figure 11). Redear sunfish and pumpkinseeds often hybridize with bluegills and with each other. Hybrid sunfish (n = 173) composed 5% of the total fish biomass during the 2012 survey.

Yellow perch (n = 104) were common, but only 17% of the perch collected were 7 inches or larger (Figure 12). Young-of-year fish made up 59% of the catch (Figure 13). The mean growth index for yellow perch was -0.6, which indicates that growth of yellow perch is within the average range for Michigan populations (Figure 14). Black crappies (n = 31) were a minor component of the catch. The limited length-at-age data available suggest average growth for this species.

Largemouth bass (n = 610) were the most abundant predators in the catch. Legal-sized fish (14 inches and larger) composed a low proportion (2%) of the sample (Figure 15). Mean lengths-at-age for largemouth bass were below state averages (Figure 16). Young-of-year fish made up 59% of the largemouth bass catch (Figure 17). All of the young-of-year bass were captured in Craig Lake. Total annual mortality of largemouth bass ages 5 to 10 was estimated to be 52% (Figure 18).

Although less abundant numerically, northern pike (n = 24) composed a slightly greater percentage of the total biomass than did largemouth bass (Table 5). Only two of the northern pike collected were smaller than the legal minimum size limit of 24 inches, and nearly a third (29%) of the pike were 30 inches or larger (Figure 19). Fish from 10 different year classes were captured during the survey (Figure 20). The mean growth index for northern pike was +1.3, which is indicative of above average growth (Figure 21).

Analysis and Discussion

Predators (largemouth bass, northern pike, bowfin, and gar) composed 32% of the total fish biomass during the survey. Schneider (2000) observed that predators typically make up 20-50% of the biomass in lakes with desirable fish communities. Based on this standard, Craig and Morrison lakes appear to have a healthy predator-prey ratio.

Relative abundance of common carp and bullheads in 2012 was similar to that observed in 2000 and much lower than recorded during surveys conducted in 1980 and 1990. Elimination of point source discharges and implementation of best management practices within the watershed resulted in improvements in water quality within the Randall Chain of Lakes from 1980 to 2000 (Limno-Tech, Inc. 1999; Hanshue 2003). These water quality changes increased habitat suitability for several game fish species and reduced the competitive advantage for carp and bullheads that are tolerant of high turbidity and low dissolved oxygen concentrations.

Bluegills are the primary game fish in Craig and Morrison lakes. Catch-per-effort (CPE) with specific gear types provides abundance indices that can be compared to values for lakes sampled as part of the Status and Trends Program during 2002-2007 (K. Wehrly, MDNR - Fisheries Division, unpublished). For Craig and Morrison lakes the large-mesh fyke net CPE was 93.9 fish/net night, which was substantially above the statewide median value and about average for lakes in southwest Michigan.With electrofishing gear, the bluegill CPE for Craig and Morrison Lakes was in the top 20% statewide and the top 25% for southwest Michigan lakes. Thus, it appears that bluegill abundance in Craig and Morrison lakes is average to slightly above average relative to other lakes in southwest Michigan.

The size structure of the bluegill population in this system is considered satisfactory based on criteria provided by Schneider (1990). Small "keeper" bluegills in the 6.0-7.9 inch range are common, but fish 8 inches or larger are rare. The scarcity of large fish in the population appears to be the result of high adult mortality (Figure 7). The total annual mortality estimate for the Craig and Morrison lakes population was near the top of the range reported by Schneider (2000) for Michigan bluegill populations. High fishing mortality could have produced the observed population age structure. However, no creel data are available to test this hypothesis. Another possible explanation is that bluegill reproductive success was high in 2008 relative to successive years. Such recruitment variability would lead to overestimation of total annual mortality.

The redear sunfish population has expanded since the last survey. Only four redear sunfish were captured in Craig and Morrison lakes in 2000, whereas 93 fish were collected in 2012. It is not uncommon for redear sunfish to attain total lengths greater than 10 inches, and these large fish frequently are targeted by anglers. Assuming average growth, the strong 2009 year class should provide increased opportunities for capturing these "trophy" panfish beginning in 2015.

Yellow perch occupy offshore areas during the period when Status and Trends surveys are conducted, and perch typically compose a small percentage of the total fish biomass in the catch. Yellow perch populations exhibit wide annual variation in natural recruitment (Forney 1971). The age frequency distribution of the catch suggests that a strong year class was produced in 2012 (Figure 13). Based the growth data for Craig and Morrison lakes, these fish are expected to reach harvestable size (i.e., 7 inches) in 2016.

Relative to past surveys, the black crappie catch was substantially lower in 2012. Weather conditions probably were responsible for the poor catch. The period from March through May of 2012 was the warmest spring on record in southwest Michigan (Marino 2012). The abnormally high water temperatures forced black crappies to move offshore earlier in the season, which made them less vulnerable to our sampling gear.

Nighttime electrofishing typically is the most effective method for capturing adult and sub-adult largemouth bass. The largemouth bass CPE for Craig and Morrison lakes was 3.1 fish/minute, which is in the top 10% of the values recorded during the 2002-2007 Status and Trends surveys cataloged by Wehrly (MDNR - Fisheries Division, unpublished). The CPE for young-of-year largemouth bass in small-mesh fyke nets also was high relative to other lakes in the area. These data indicate that largemouth bass are abundant in Craig and Morrison lakes.

Two factors probably were responsible for the slow growth of largemouth bass in Craig and Morrison lakes. (1) By age 1, mean lengths of largemouth bass already were below statewide averages. This suggests a scarcity of forage for young-of-year bass. Largemouth bass generally make a diet shift from macroinvertebrates (e.g., mayfly and dragonfly larvae) to fish sometime during their first year of life. The timing of this shift is influenced by the abundance of invertebrate prey. Olson (1996) found that largemouth bass with high consumption rates of invertebrate prey grew faster and were able to start feeding on bluegills earlier than largemouth bass in lakes with less invertebrate prey. (2) Another apparent decline in growth rate occurred at around 5 years of age. Based on the overall predator-prey ratio in the catch, this decline probably was not caused by a shortage of prey fish. With normal growth largemouth bass reach the legal minimum size limit at age 5, and selective harvest of fast-growing individuals could produce an apparent decline in growth rate with increasing age (Figure 16). Some harvest of largemouth bass undoubtedly occurs, but no creel data or population estimates are available to facilitate calculation of fishing mortality. Total annual mortality for adult bass in Craig and Morrison lakes was in the middle of the range reported by Allen et al. (2008) for North American largemouth bass populations.

Northern pike abundance in Craig and Morrison lakes is about average for lakes in Michigan. The gill net CPE for northern pike was 1.9 fish/net night in 2012, which is almost identical to the statewide median value for Status and Trends lakes reported by Wehrly (MDNR - Fisheries Division, unpublished). The scarcity of smaller fish in the catch suggests poor recruitment during 2009-2011. A variety of factors influence northern pike recruitment, including temperature, water level fluctuations, and abundance of suitable prey for larval fish (Hassler 1970). The wetlands adjacent to Craig and Morrison lakes 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 Direction

Two fisheries management goals have been developed for Craig and Morrison lakes. Goal 1: Protect and rehabilitate habitat for fish and other aquatic organisms. Goal 2: Maintain a healthy predator-prey ratio within the fish community.

Several different methods will be used to accomplish Goal 1. Fisheries Division personnel will continue to review Michigan Department of Environmental Quality (MDEQ) 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 lake association and other organizations to educate riparian landowners on the effects of various practices (e.g., chemical weed treatments, seawall construction, and removal of large woody cover) on aquatic ecosystems. The water quality in Craig and Morrison lakes is influenced by land use practices on tributary streams. Fisheries Division will collaborate with MDEQ, United States Fish and Wildlife Service, Branch County Drain Commission, Friends of the St. Joseph River, and other partners to help riparian landowners restore wetlands and utilize best management practices to reduce inputs of sediment, nutrients, and other pollutants to tributary streams.

Anglers frequently express interest in walleye stocking. This activity would not be compatible with Goal 2 and is not recommended. Predators currently compose 32% of the fish community biomass, which is in the middle of the target range proposed by Schneider (2000). Stocking additional predators could skew this balance. The addition of walleyes would be expected to reduce bluegill abundance and decrease growth rates for largemouth bass and northern pike.

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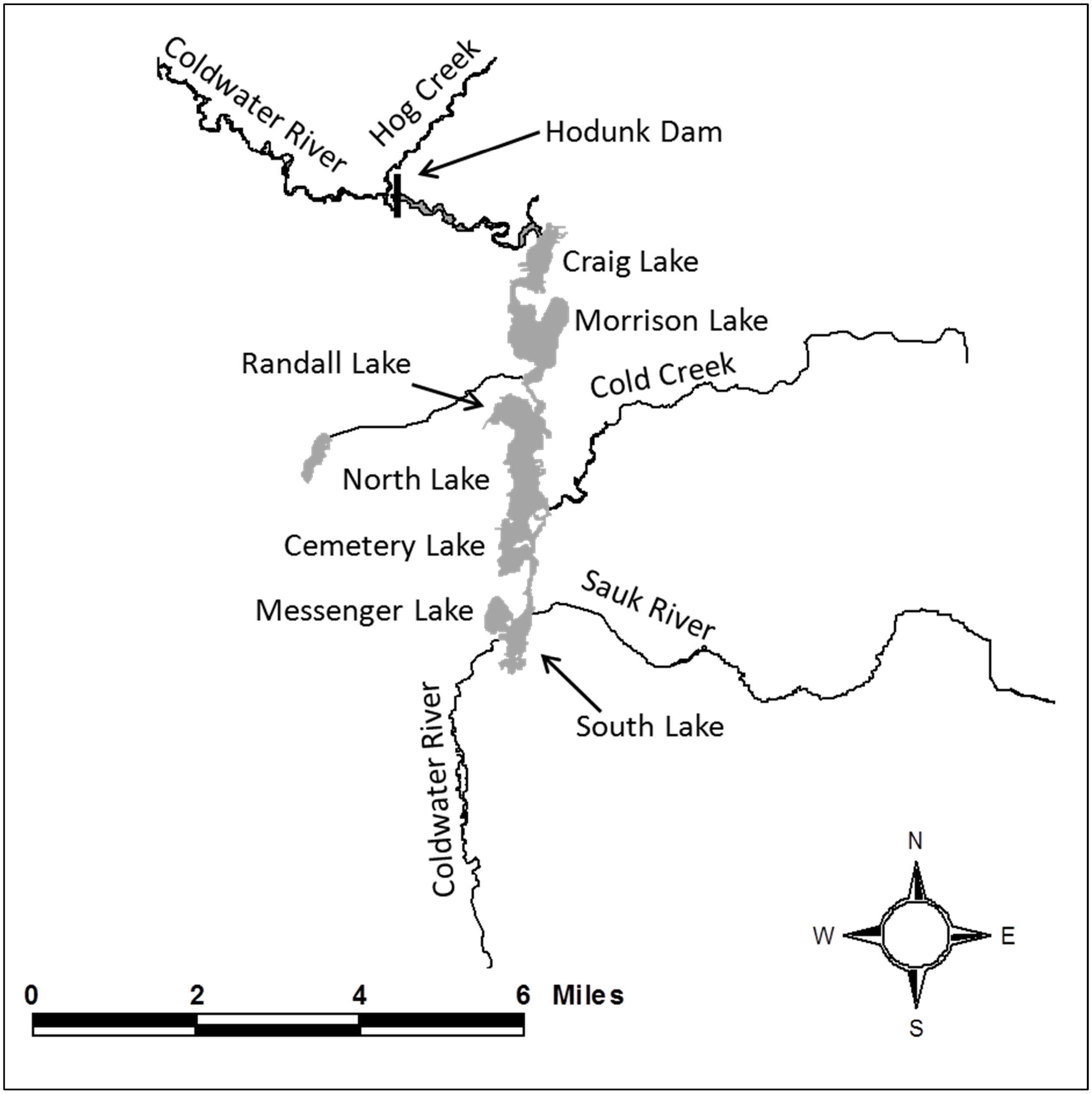


Figure 1.–The Randall Chain of Lakes and major tributary streams.

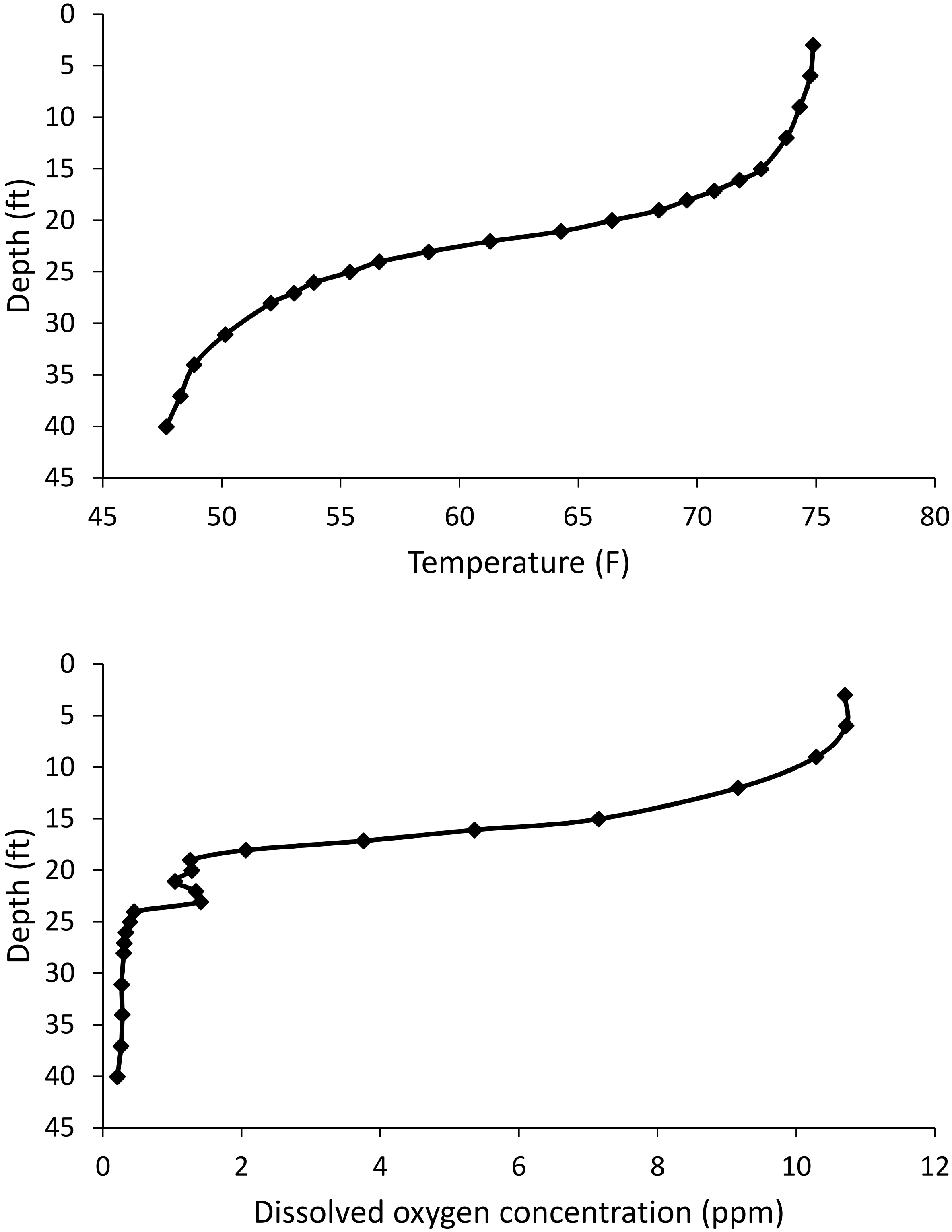


Figure 2.–Temperature and dissolved oxygen profiles for Morrison Lake on August 23, 2012.

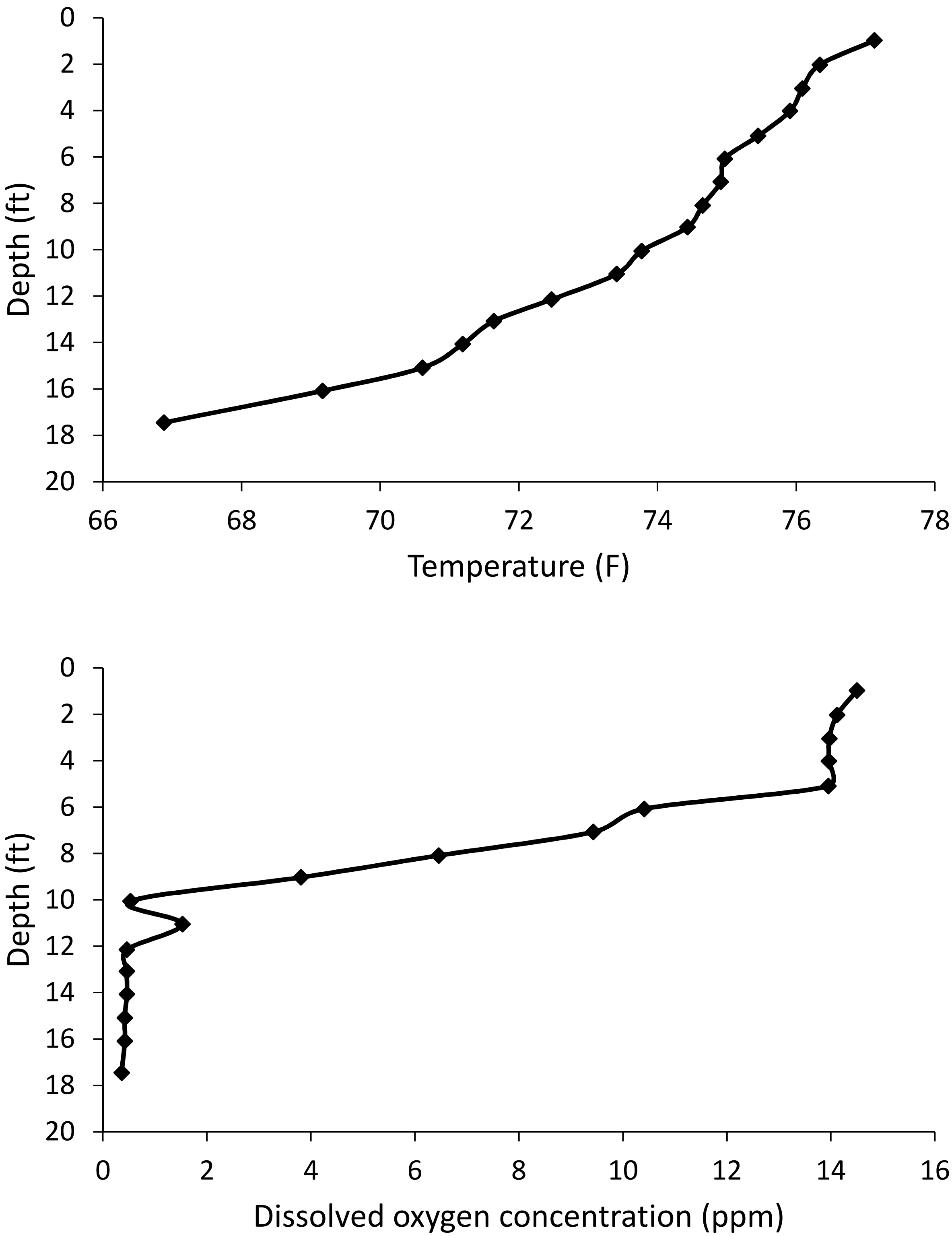


Figure 3.–Temperature and dissolved oxygen profiles for Craig Lake on August 23, 2012.

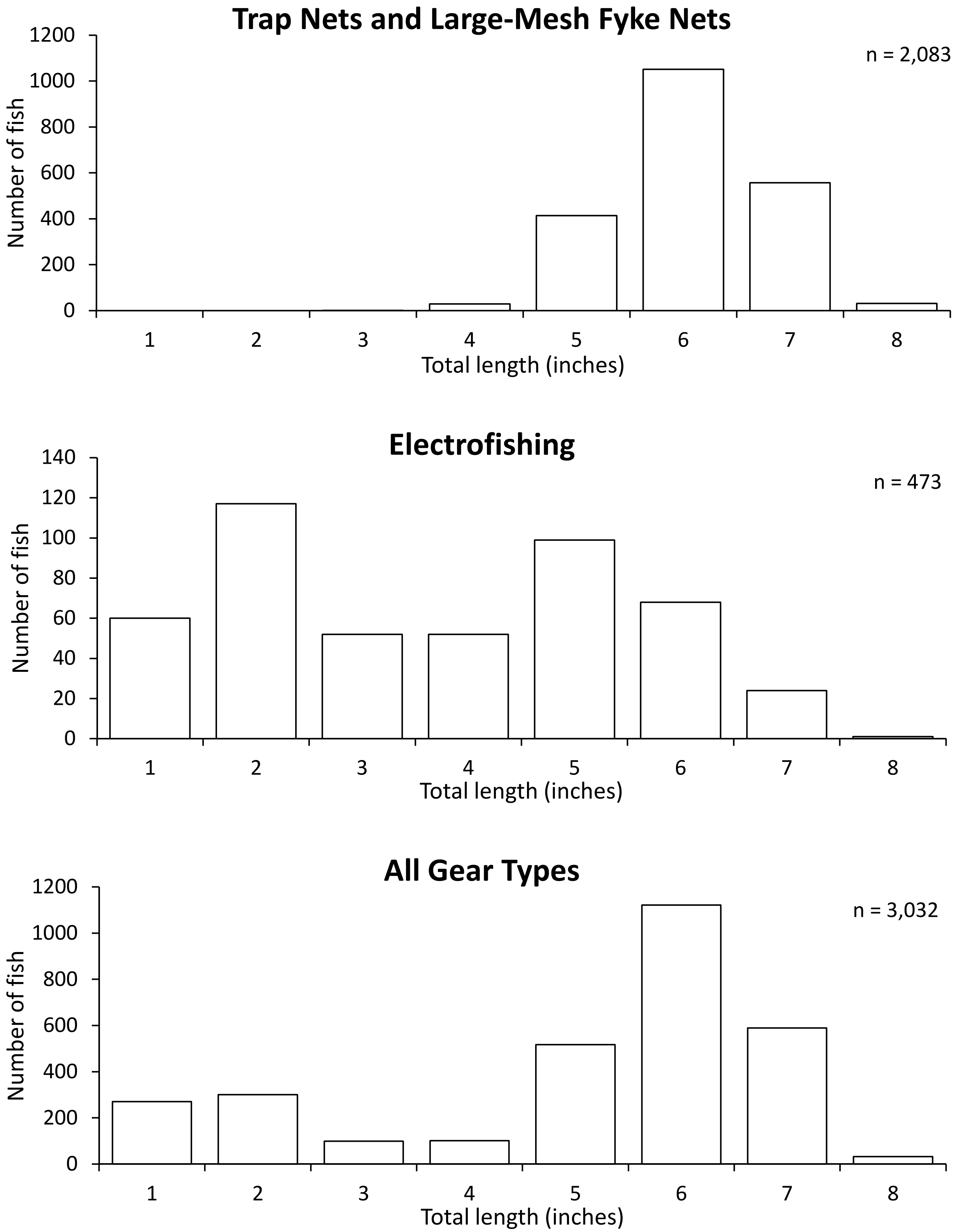


Figure 4.–Length frequency distributions for bluegills captured in Craig and Morrison lakes using trap nets and large-mesh fyke nets, nighttime electrofishing gear, and all gear types during June 2012.

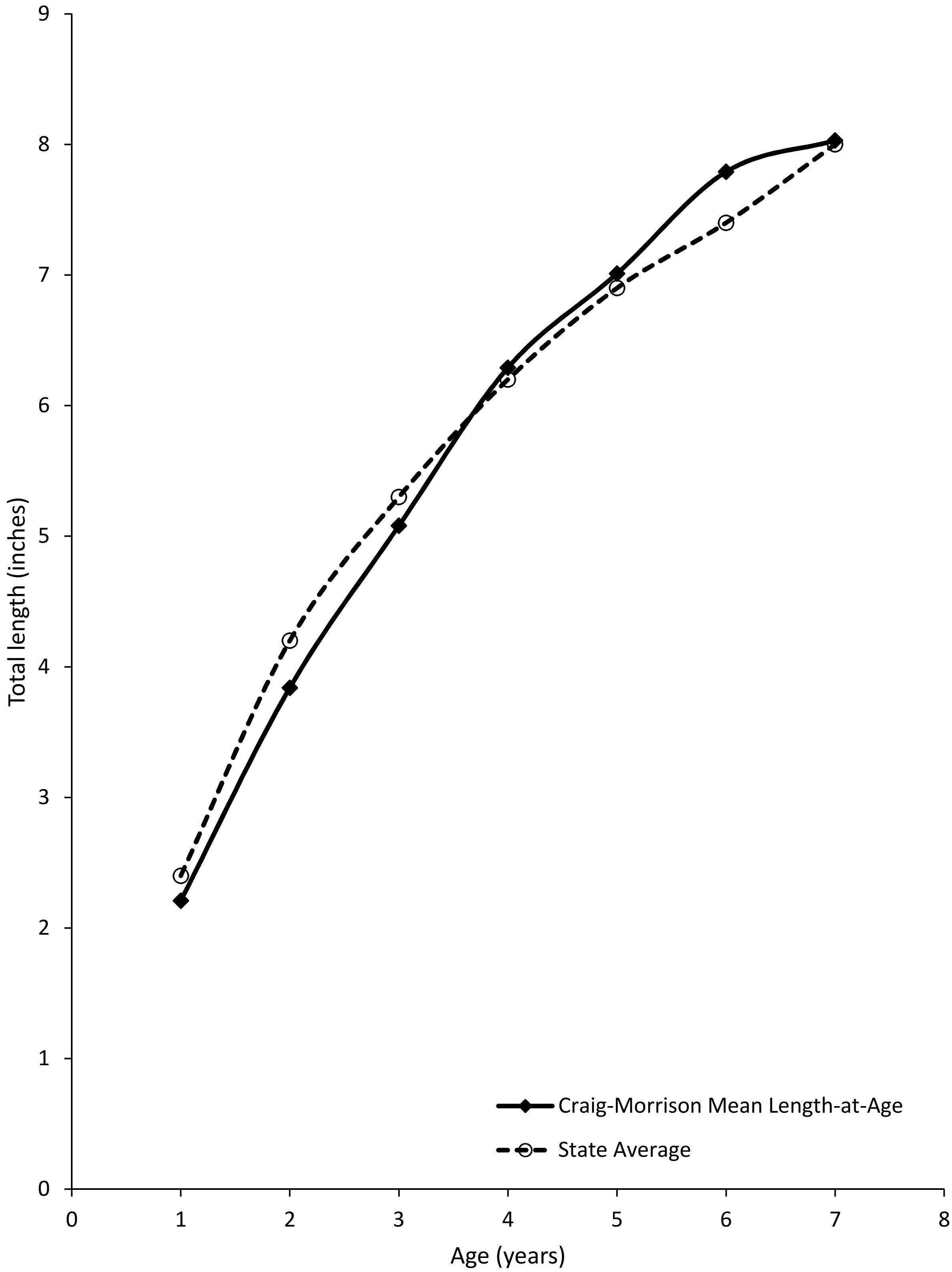


Figure 5.–Growth of bluegills in Craig and Morrison lakes, as determined from scale and dorsal spine samples collected during June 2012. State average lengths from Schneider et al. (2000).

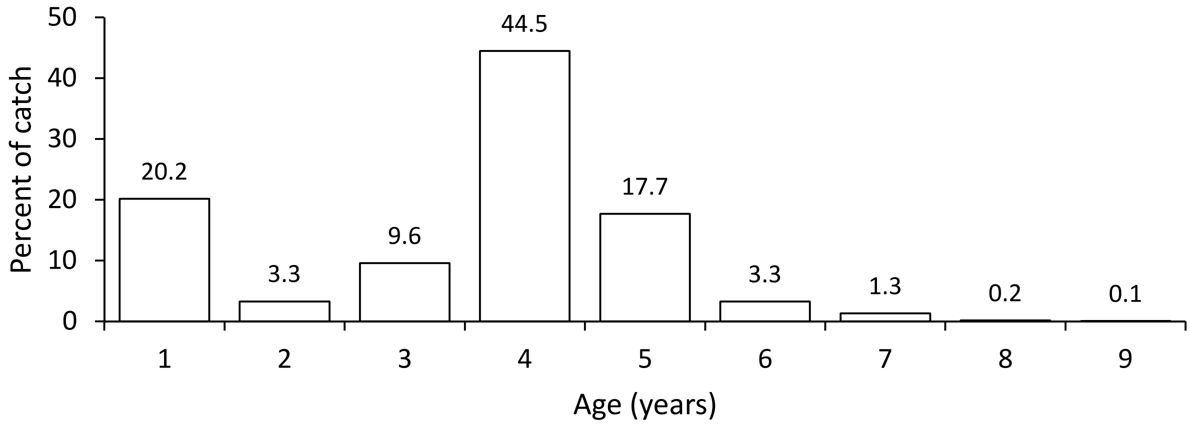


Figure 6.–Age frequency distribution for bluegills captured in Craig and Morrison lakes during June 2012.

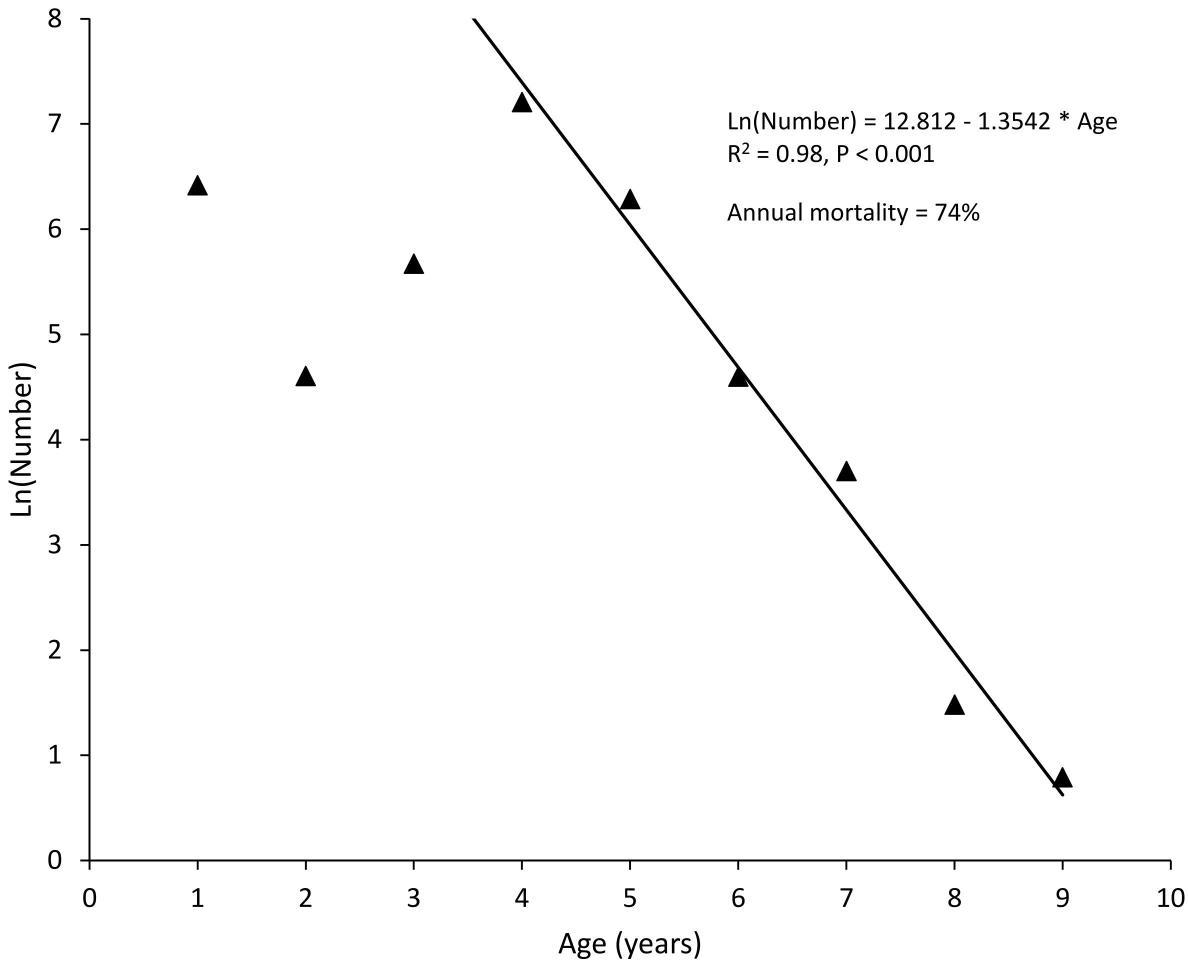
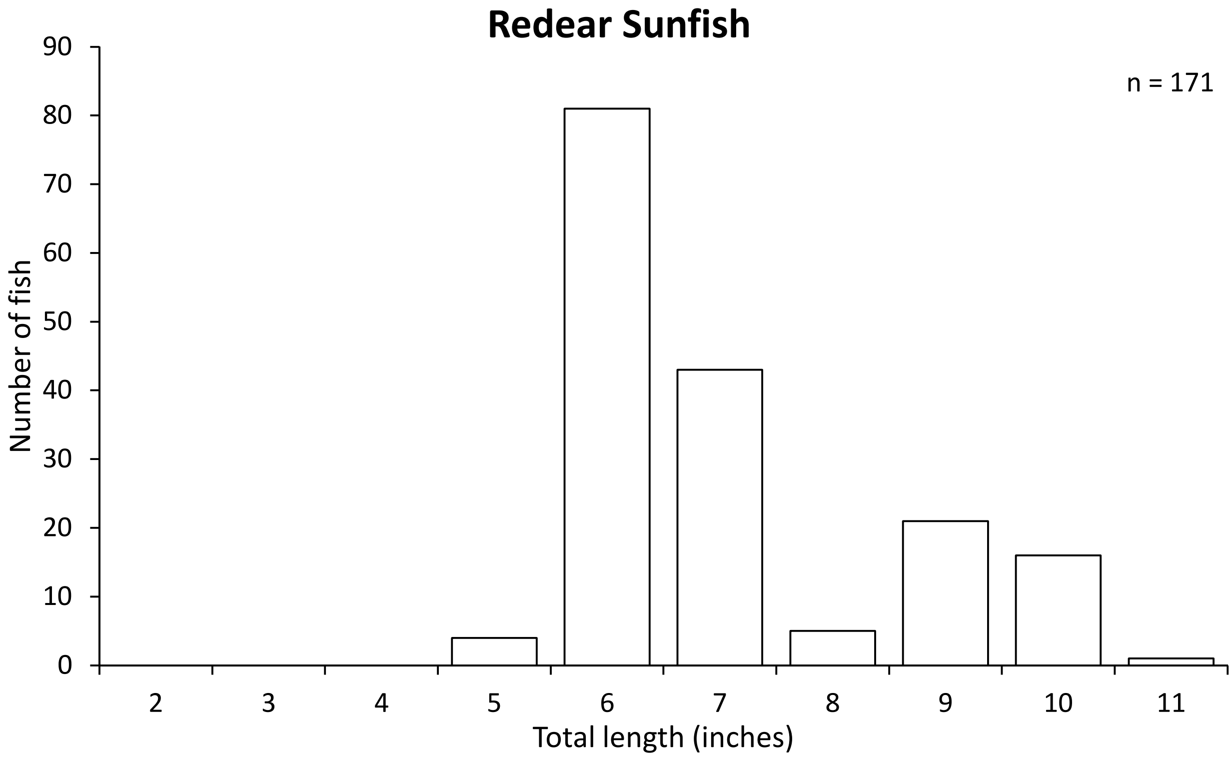


Figure 7.–Natural log of observed numbers of fish versus age for bluegills captured in Craig and Morrison lakes during June 2012.



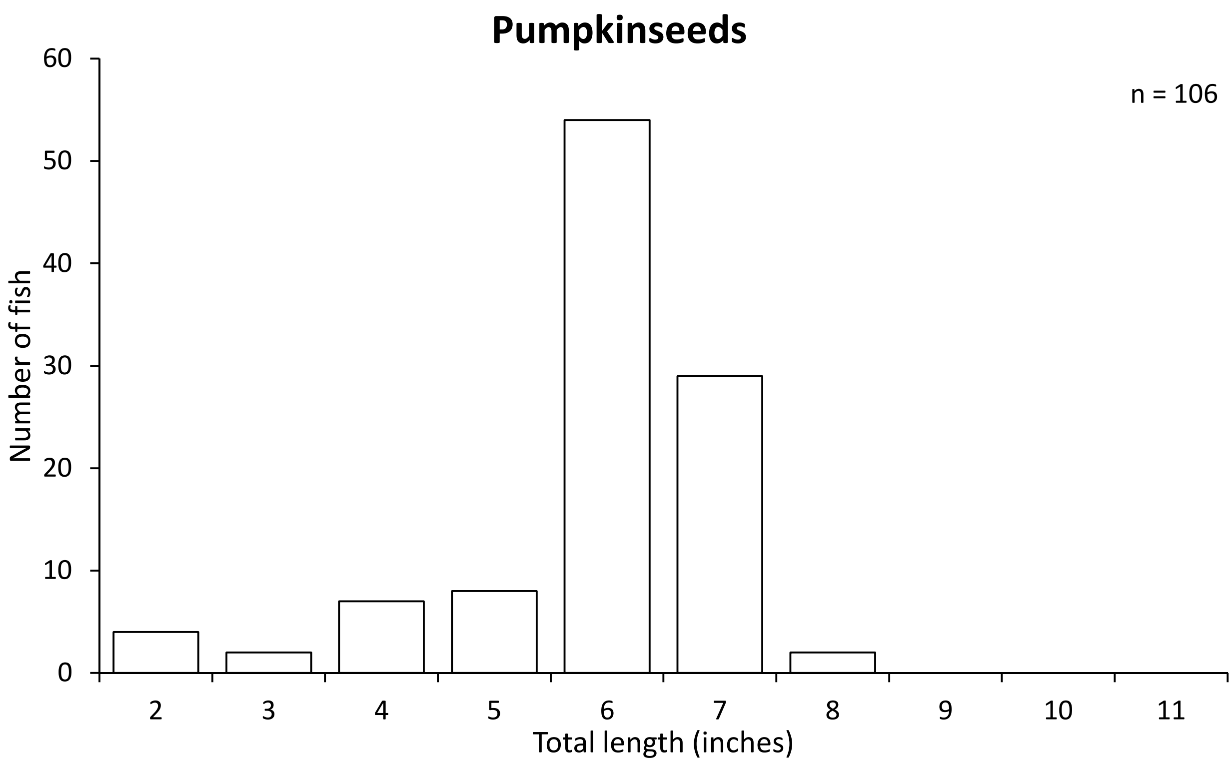


Figure 8.–Length frequency distributions for redear sunfish and pumpkinseeds captured in Craig and Morrison lakes during June 2012.

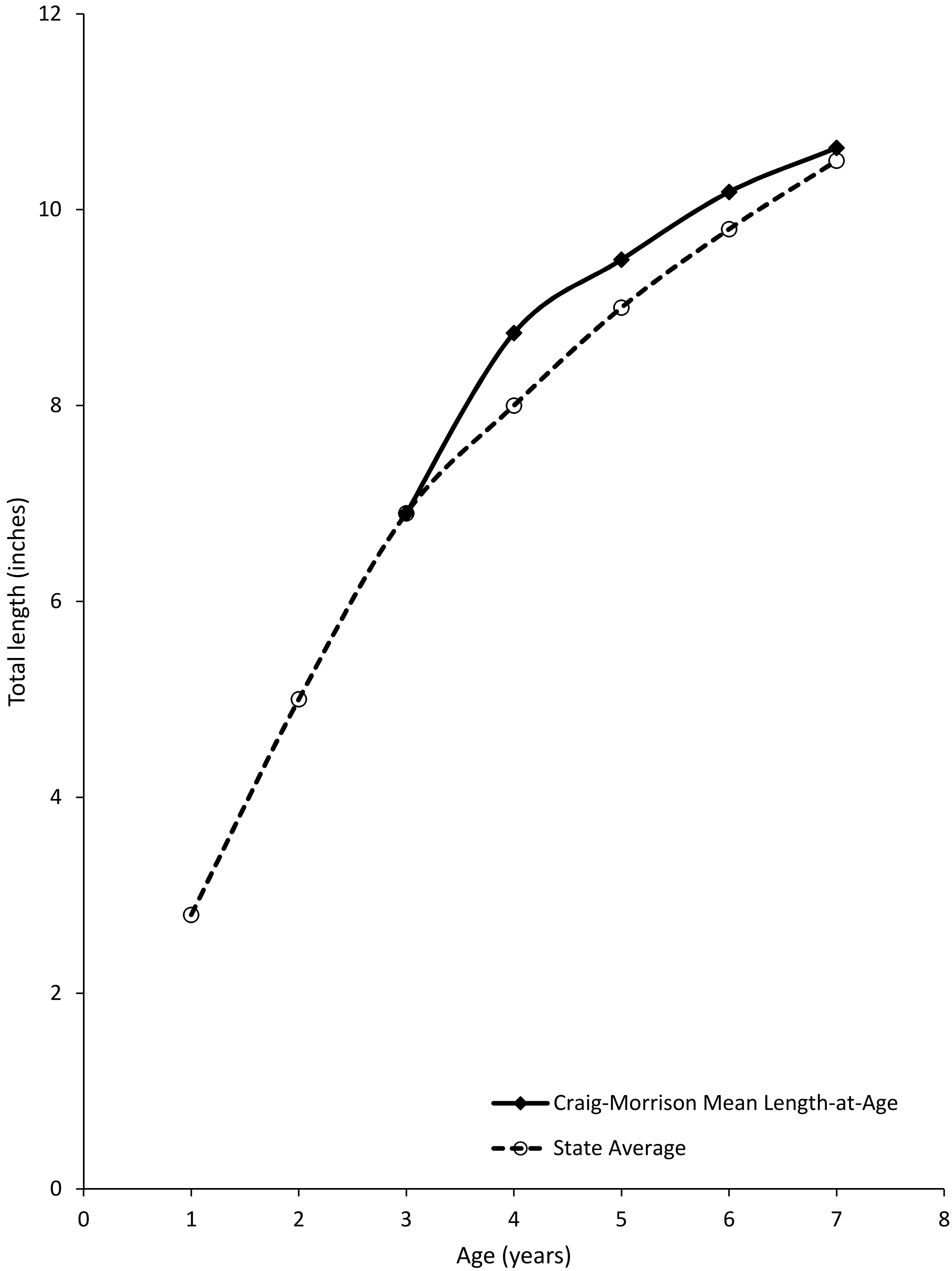


Figure 9.–Growth of redear sunfish in Craig and Morrison lakes, as determined from dorsal spine samples collected during June 2012. State average lengths from Schneider et al. (2000).

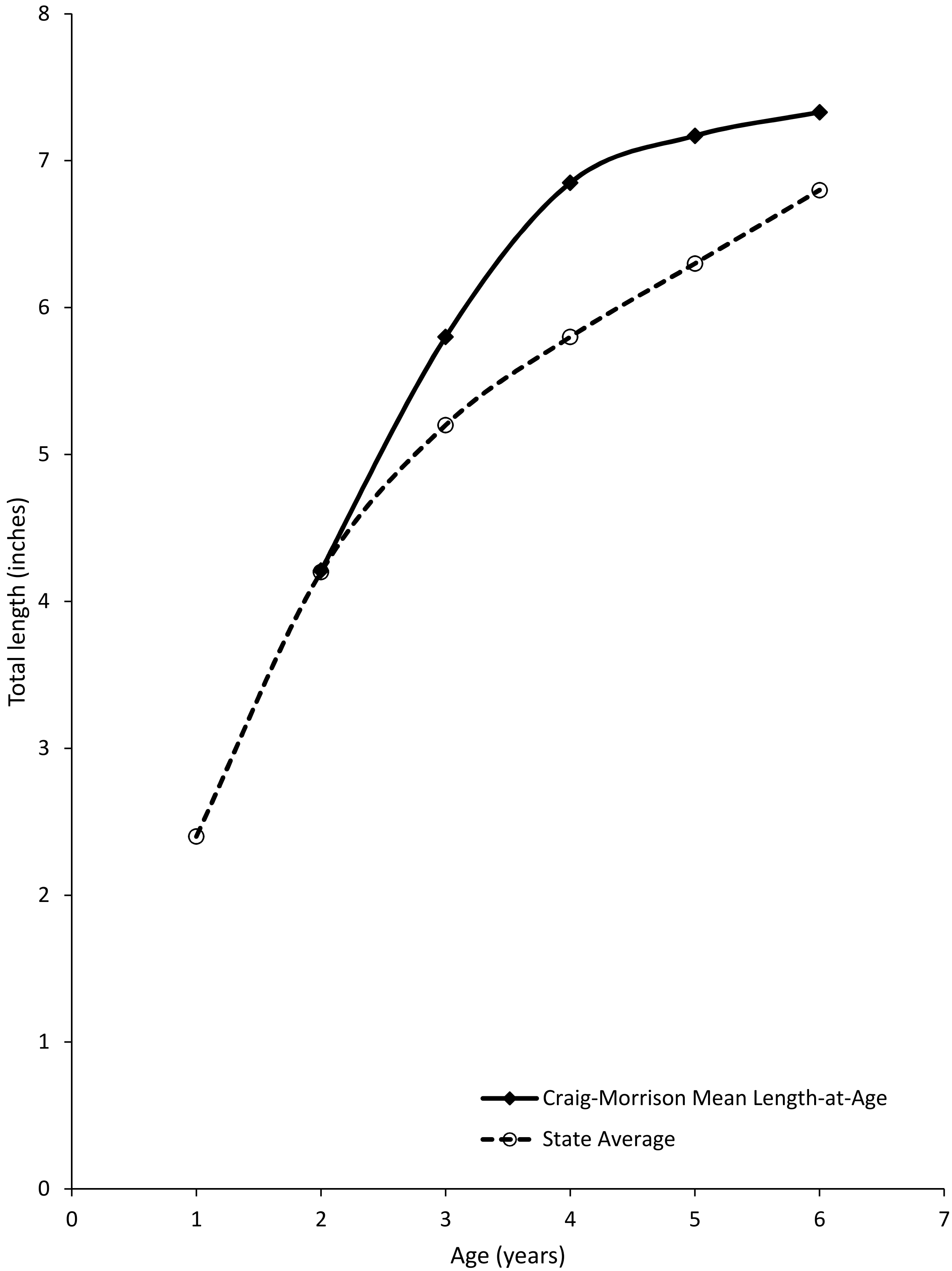


Figure 10.–Growth of pumpkinseeds in Craig and Morrison lakes, as determined from scale and dorsal spine samples collected during June 2012. State average lengths from Schneider et al. (2000).

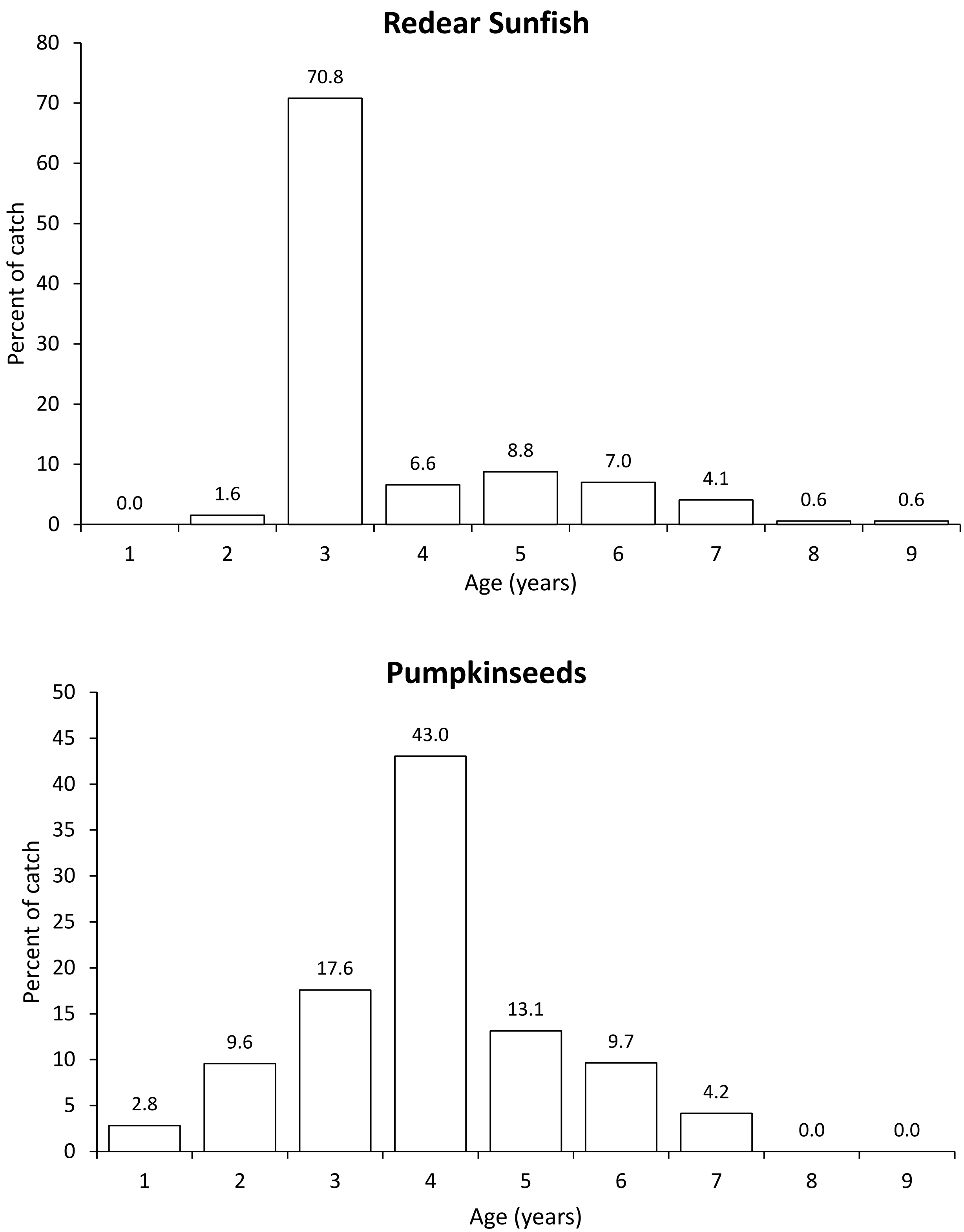


Figure 11.–Age frequency distributions for redear sunfish and pumpkinseeds captured in Craig and Morrison lakes during June 2012.

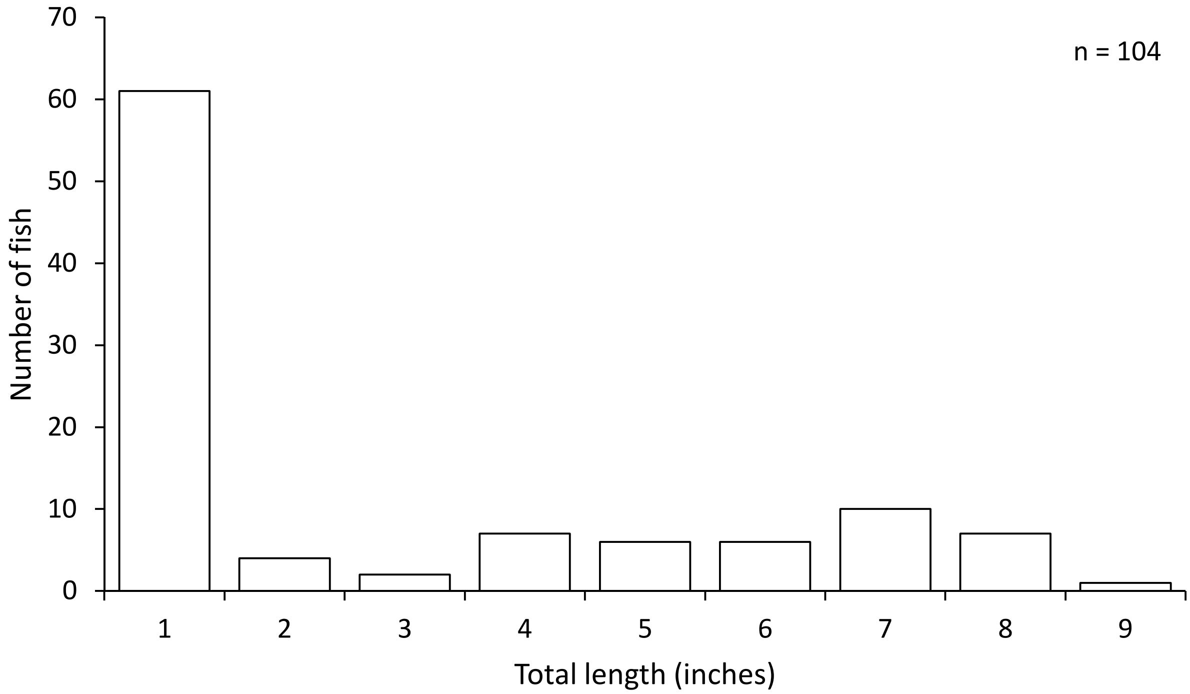


Figure 12.–Length frequency distribution for yellow perch captured in Craig and Morrison lakes during June 2012.

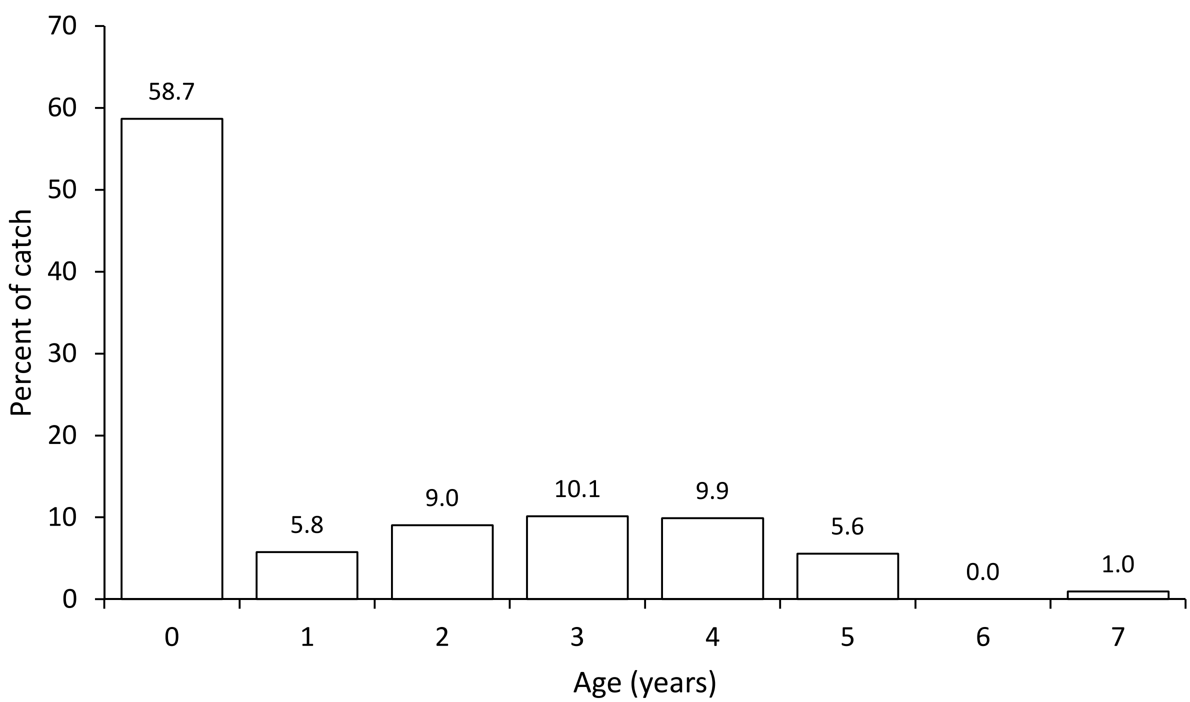


Figure 13.–Age frequency distribution for yellow perch captured in Craig and Morrison lakes during June 2012.

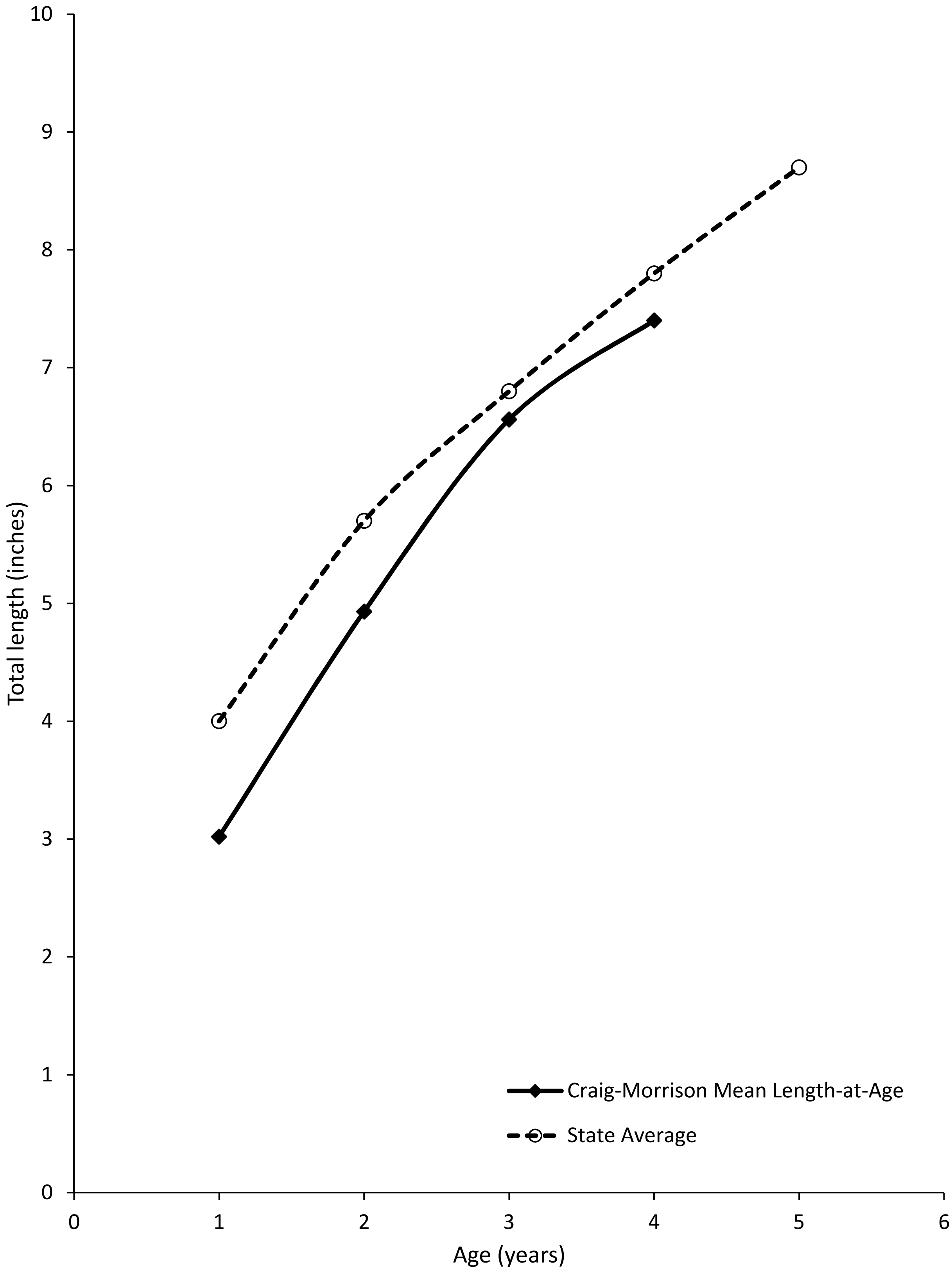


Figure 14.–Growth of yellow perch in Craig and Morrison lakes, as determined from scale and dorsal spine samples collected during June 2012. State average lengths from Schneider et al. (2000).

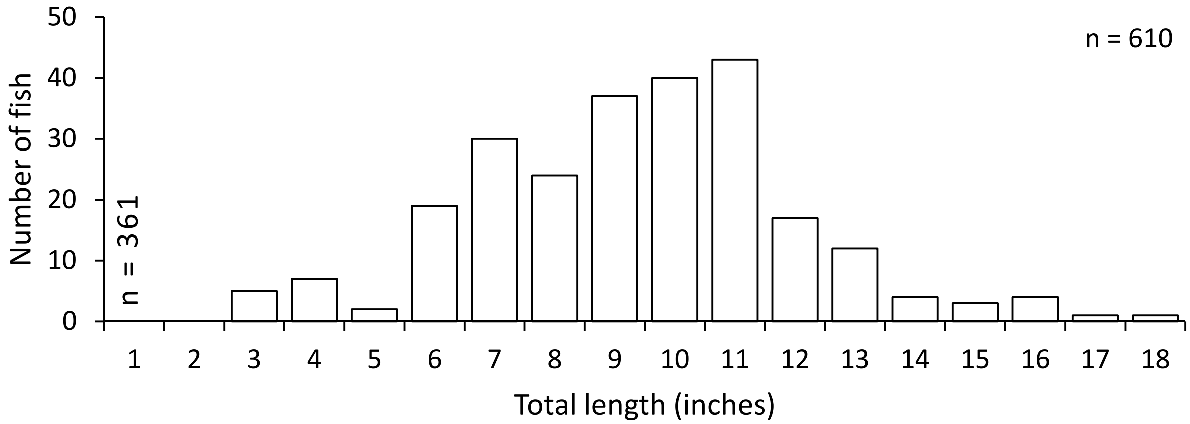


Figure 15.–Length frequency distribution for largemouth bass captured in Craig and Morrison lakes during June 2012.

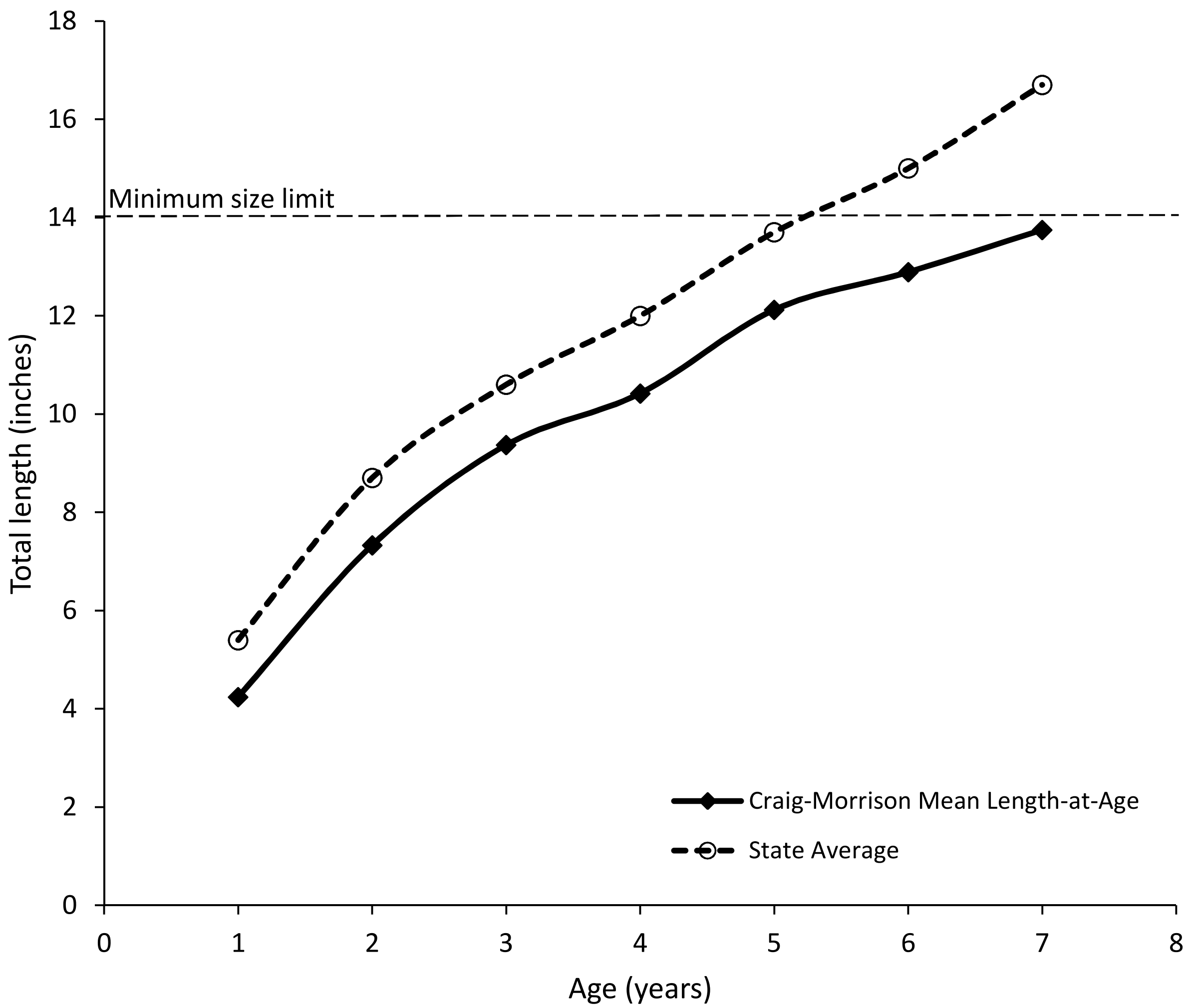


Figure 16.–Growth of largemouth bass in Craig and Morrison lakes, as determined from scale and dorsal spine samples collected during June 2012. State average lengths from Schneider et al. (2000).

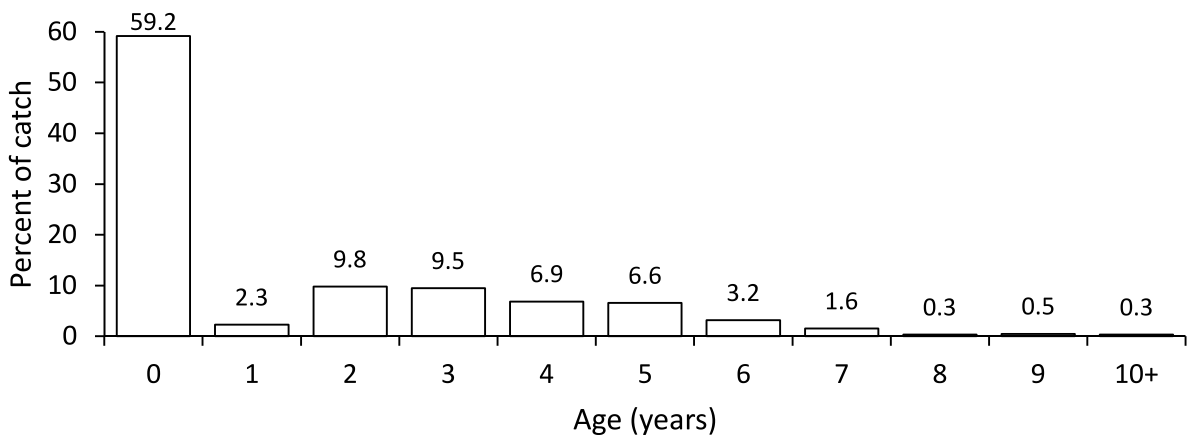


Figure 17.–Age frequency distribution for largemouth bass captured in Craig and Morrison lakes during June 2012.

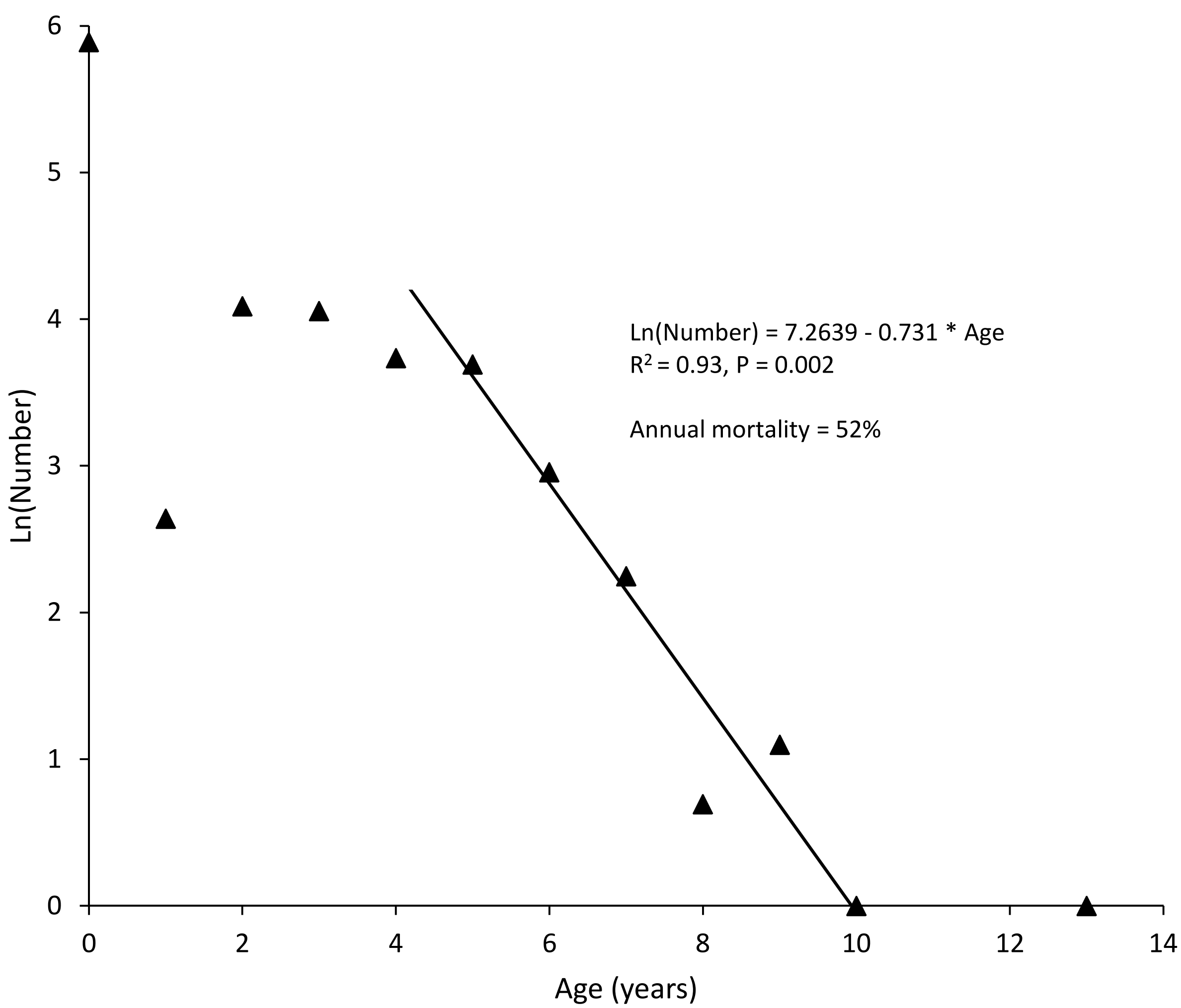


Figure 18.–Natural log of observed numbers of fish versus age for largemouth bass captured in Craig and Morrison lakes during June 2012.

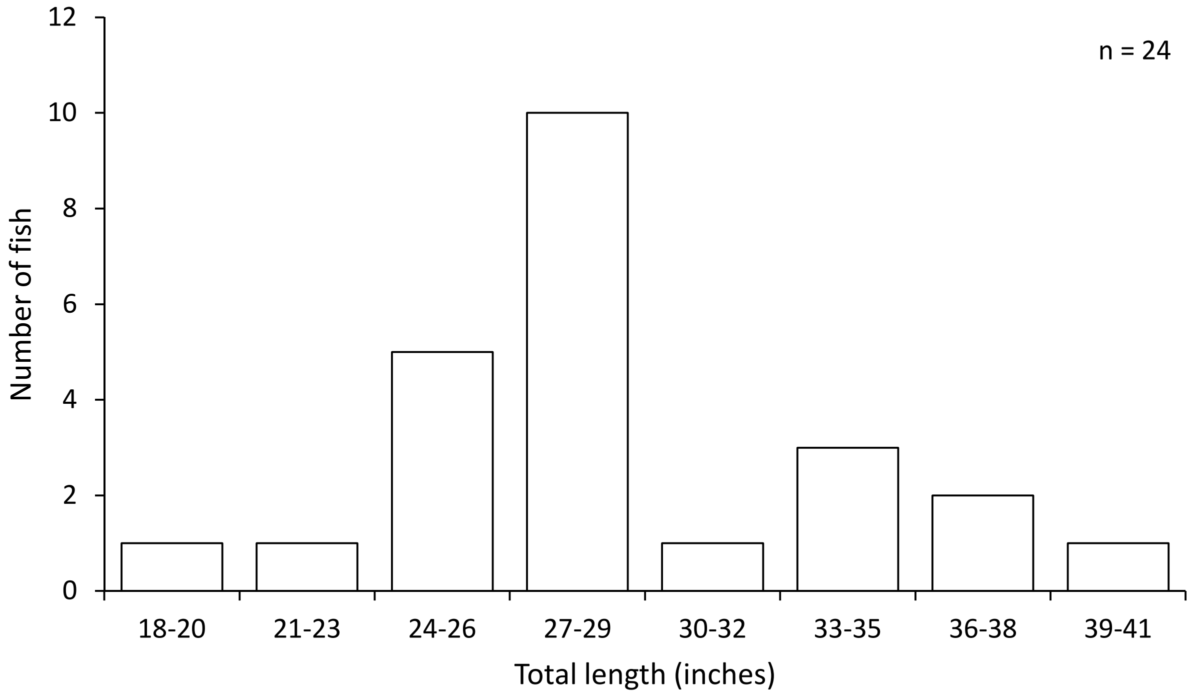


Figure 19.–Length frequency distribution for northern pike captured in Craig and Morrison lakes during June 2012.

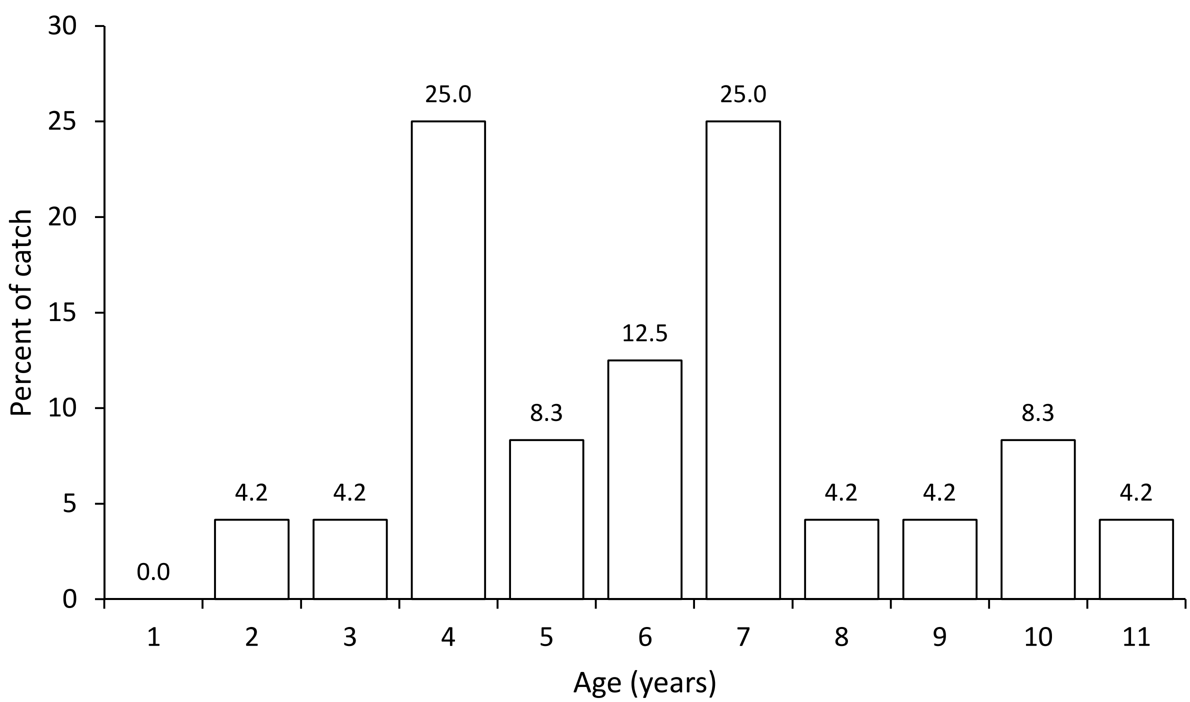


Figure 20.–Age frequency distribution for northern pike captured in Craig and Morrison lakes during June 2012.

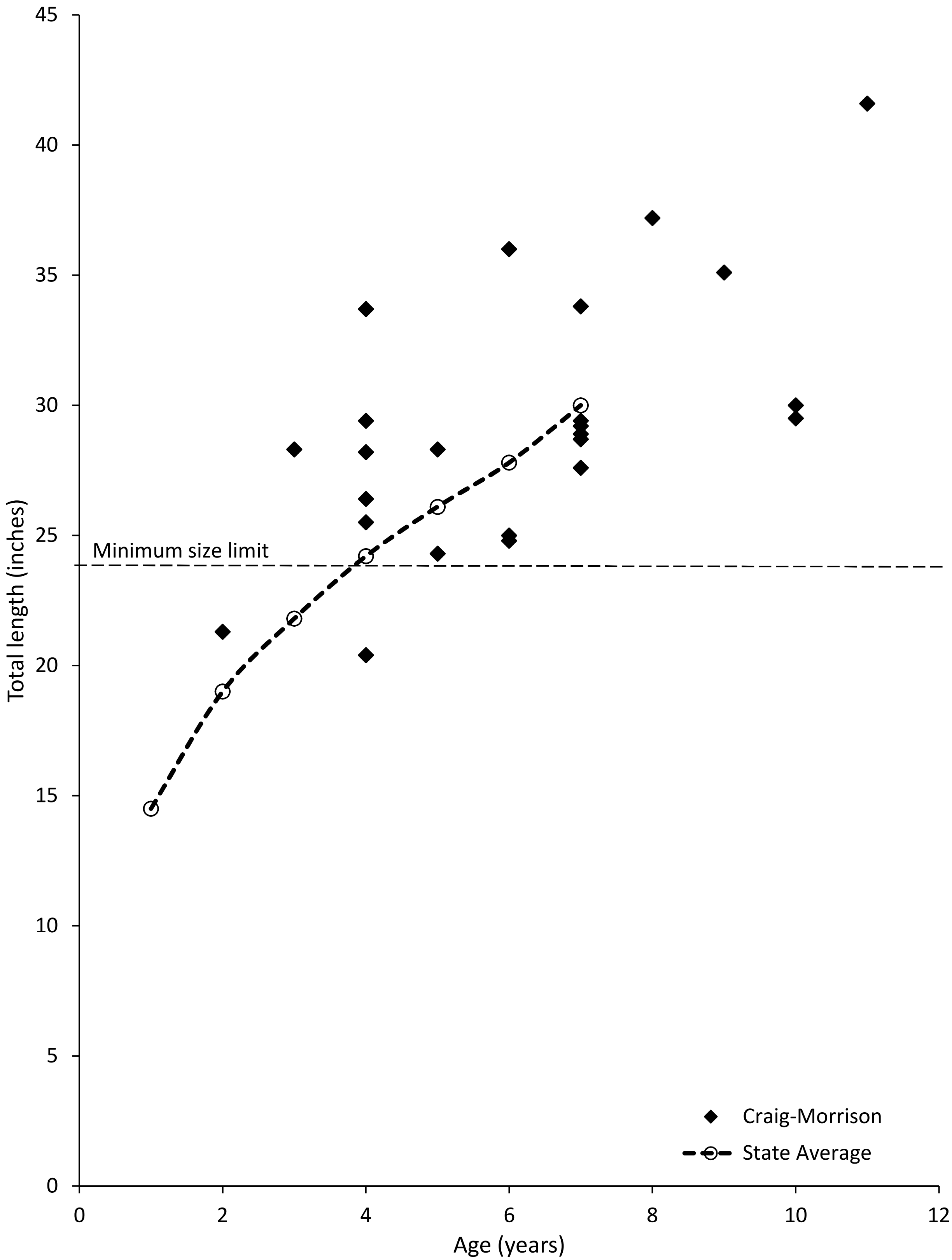


Figure 21.–Growth of northern pike in Craig and Morrison lakes, as determined from dorsal fin ray samples collected during June 2012. State average lengths from Schneider et al. (2000).

Table 1.–Fish stocking in Craig and Morrison lakes, 1933-1942.

Year	Species	Life stage	Number
Craig Lake			
1933	Bluegill	Fall fingerling	10,000
1934	Bluegill	Fall fingerling	20,000
1935	Bluegill	Fall fingerling	20,000
	Largemouth bass	Fall fingerling	500
1936	Bluegill	Fall fingerling	3,000
		Yearling	2,000
	Largemouth bass	Fall fingerling	2,000
1937	Bluegill	Fall fingerling	20,000
	Smallmouth bass	Fall fingerling	2,000
1938	Bluegill	Fall fingerling	25,000
	Yellow perch	Fall fingerling	10,000
1939	Bluegill	Fall fingerling	30,000
	Largemouth bass	Fall fingerling	500
	Yellow perch	Fall fingerling	10,000
1940	Bluegill	Fall fingerling	20,000
	Largemouth bass	Fall fingerling	2,000
1941	Bluegill	Fall fingerling	75,000
	Largemouth bass	Adult	50
1942	Bluegill	Fall fingerling	20,750
	Largemouth bass	Fall fingerling	500
Morrison Lake			
1933	Bluegill	Fall fingerling	20,000
	Largemouth bass	Fall fingerling	1,000
1934	Bluegill	Fall fingerling	40,000
	Largemouth bass	Fall fingerling	1,000
1935	Bluegill	Fall fingerling	20,000
	Largemouth bass	Fall fingerling	1,500
1936	Bluegill	Fall fingerling	3,000
		Yearling	2,000
	Largemouth bass	Fall fingerling	1,000
1937	Bluegill	Fall fingerling	20,000
	Smallmouth bass	Fall fingerling	1,000
1938	Bluegill	Fall fingerling	25,000
	Largemouth bass	Fall fingerling	3,000
	Yellow perch	Fall fingerling	10,000
1939	Bluegill	Fall fingerling	30,000
	Largemouth bass	Fall fingerling	5,500
	Smallmouth bass	Fall fingerling	1,000

Table 1.–Continued.

Year	Species	Life stage	Number
Morrison Lake (cont.)			
1939	Yellow perch	Fall fingerling	10,000
1940	Bluegill	Fall fingerling	20,000
	Largemouth bass	Fall fingerling	4,500
	Smallmouth bass	Fall fingerling	1,000
1941	Bluegill	Fall fingerling	77,000
	Largemouth bass	Adult	100
	Smallmouth bass	Fall fingerling	1,500
1942	Bluegill	Fall fingerling	21,250
	Largemouth bass	Fall fingerling	500
	Smallmouth bass	Fall fingerling	1,500

Table 2.–Sampling effort during the fish community survey on Craig and Morrison Lakes, June 2012. Each net night equals one overnight set of one net.

Sampling period	Gear	Effort
Craig Lake		
June 4-7	Large-mesh fyke net	9 net nights
June 4-6	Small-mesh fyke net	4 net nights
June 4-7	Graded-mesh gill net	6 net nights
June 7	Seine	4 hauls (25 ft each)
June 8	Nighttime electrofishing	30 minutes
Morrison Lake		
June 4-7	Large-mesh fyke net	9 net nights
June 4-6	Small-mesh fyke net	4 net nights
June 4-6	Trap net	4 net nights
June 4-6	Graded-mesh gill net	4 net nights
June 7	Seine	4 hauls (25 ft each)
June 7	Nighttime electrofishing	30 minutes

Table 3.–Numbers, weights, lengths, and growth indices for fish species collected during the fish community survey on Craig Lake, June 2012. Fish were captured using fyke nets, gill nets, seines, and electrofishing gear.

Species	Number	Percent by number	Weight (lbs)	Percent by weight	Length range (inches)	Percent legal or harvestable[1]	Growth index[2]
Bluegill	1,317	57.9	183.3	35.9	1-8	52	-0.1
Largemouth bass	485	21.3	78.3	15.4	1-18	1	-1.9
Redear sunfish	93	4.1	29.1	5.7	5-10	98	+0.2
Hybrid sunfish	91	4.0	27.4	5.4	3-10	92	---
Pumpkinseed	67	2.9	16.7	3.3	2-7	85	+0.8
Warmouth	52	2.3	11.1	2.2	3-8	54	---
Bluntnose minnow	27	1.2	0.2	0.0	2-3	---	---
Yellow bullhead	25	1.1	13.8	2.7	7-12	---	---
Brown bullhead	17	0.7	12.3	2.4	8-14	---	---
Lake chubsucker	17	0.7	3.3	0.6	5-9	---	---
Black crappie	15	0.7	5.3	1.0	5-10	87	+0.2
Yellow perch	10	0.4	1.5	0.3	2-8	50	---
Northern pike	9	0.4	66.3	13.0	25-41	100	---
Bowfin	9	0.4	23.4	4.6	11-22	---	---
Spotted gar	8	0.4	7.5	1.5	14-22	---	---
Common carp	7	0.3	24.9	4.9	9-22	---	---
Rock bass	6	0.3	1.4	0.3	2-8	83	---
Golden shiner	6	0.3	0.6	0.1	4-7	---	---
Grass pickerel	3	0.1	0.6	0.1	9-10	---	---
Brook silverside	3	0.1	0.0	0.0	2-3	---	---
Green sunfish	2	0.1	0.1	0.0	1-5	0	---
Logperch	2	0.1	0.0	0.0	1-1	---	---
Longnose gar	1	0.0	2.9	0.6	31	---	---
Tadpole madtom	1	0.0	0.0	0.0	2	---	---
Fathead minnow	1	0.0	0.0	0.0	1	---	---
Total	2,274		510.0				

[1] Harvestable size is 6 inches for bluegills, pumpkinseeds, rock bass, redear sunfish, green sunfish, hybrid sunfish, and warmouths, and 7 inches for black crappies 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.

Table 4.–Numbers, weights, lengths, and growth indices for fish species collected during the fish community survey on Morrison Lake, June 2012. Fish were captured using trap nets, fyke nets, gill nets, seines, and electrofishing gear.

Species	Number	Percent by number	Weight (lbs)	Percent by weight	Length range (inches)	Percent legal or harvestable[1]	Growth index[2]
Bluegill	1,715	70.7	287.5	43.8	1-8	61	-0.1
Largemouth bass	125	5.2	70.4	10.7	3-17	5	-1.6
Yellow perch	94	3.9	3.9	0.6	1-9	14	-0.6
Hybrid sunfish	82	3.4	26.6	4.0	4-9	91	---
Redear sunfish	78	3.2	31.5	4.8	5-11	97	+0.6
Bluntnose minnow	75	3.1	0.4	0.1	0-3	---	---
Pumpkinseed	39	1.6	8.6	1.3	2-8	72	+0.7
Yellow bullhead	35	1.4	24.2	3.7	8-13	---	---
Rock bass	30	1.2	6.7	1.0	2-8	70	-0.3
Warmouth	29	1.2	6.3	1.0	4-9	66	---
Logperch	28	1.2	0.0	0.0	1-1	---	---
Black crappie	16	0.7	7.8	1.2	6-11	94	-0.1
Northern pike	15	0.6	84.6	12.9	20-37	87	---
Spotted gar	14	0.6	19.8	3.0	1-26	---	---
Brook silverside	13	0.5	0.0	0.0	2-3	---	---
Brown bullhead	12	0.5	10.2	1.6	9-13	---	---
Lake chubsucker	7	0.3	1.5	0.2	6-8	---	---
Common carp	6	0.2	49.4	7.5	16-33	---	---
Bowfin	6	0.2	16.7	2.5	14-22	---	---
Golden shiner	5	0.2	0.5	0.1	3-8	---	---
Green sunfish	2	0.1	0.2	0.0	4-5	0	---
Total	2,426		656.8				

[1] Harvestable size is 6 inches for bluegills, pumpkinseeds, rock bass, redear sunfish, green sunfish, hybrid sunfish, and warmouths, and 7 inches for black crappies 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.

Table 5.–Numbers, weights, lengths, and growth indices for fish species collected during the fish community survey on Craig and Morrison lakes, June 2012. Fish were captured using trap nets, fyke nets, gill nets, seines, and electrofishing gear.

Species	Number	Percent by number	Weight (lbs)	Percent by weight	Length range (inches)	Percent legal or harvestable[1]	Growth index[2]
Bluegill	3,032	64.5	470.8	40.3	1-8	57	0
Largemouth bass	610	13.0	148.7	12.7	1-18	2	-1.7
Hybrid sunfish	173	3.7	54.0	4.6	3-10	92	---
Redear sunfish	171	3.6	60.6	5.2	5-11	98	+0.3
Pumpkinseed	106	2.3	25.3	2.2	2-8	80	+0.6
Yellow perch	104	2.2	5.4	0.5	1-9	17	-0.6
Bluntnose minnow	102	2.2	0.6	0.1	0-3	---	---
Warmouth	81	1.7	17.4	1.5	3-9	58	---
Yellow bullhead	60	1.3	38.0	3.3	7-13	---	---
Rock bass	36	0.8	8.1	0.7	2-8	72	-0.1
Black crappie	31	0.7	13.1	1.1	5-11	90	0
Logperch	30	0.6	0.0	0.0	1-1	---	---
Brown bullhead	29	0.6	22.5	1.9	8-14	---	---
Northern pike	24	0.5	150.9	12.9	20-41	92	+1.3
Lake chubsucker	24	0.5	4.8	0.4	5-9	---	---
Spotted gar	22	0.5	27.3	2.3	1-26	---	---
Brook silverside	16	0.3	0.0	0.0	2-3	---	---
Bowfin	15	0.3	40.1	3.4	11-22	---	---
Common carp	13	0.3	74.3	6.4	9-33	---	---
Golden shiner	11	0.2	1.1	0.1	3-8	---	---
Green sunfish	4	0.1	0.3	0.0	1-5	0	---
Grass pickerel	3	0.1	0.6	0.1	9-10	---	---
Longnose gar	1	0.0	2.9	0.2	31	---	---
Tadpole madtom	1	0.0	0.0	0.0	2	---	---
Fathead minnow	1	0.0	0.0	0.0	1	---	---
Total	4,700		1,166.8				

[1] Harvestable size is 6 inches for bluegills, pumpkinseeds, rock bass, redear sunfish, green sunfish, hybrid sunfish, and warmouths, and 7 inches for black crappies 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.