Crandell Lake 2017 Survey Report

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Introduction

Crandell Lake is a former aggregate mining pit on the north side of M-50 about 3 miles east of the city of Charlotte. The lake has a surface area of approximately 160 acres and includes two basins. The west basin is the larger of the two basins, has a maximum depth of 38 feet, and has steep drop-offs (Figure 1). The east basin has a maximum depth of 20 feet and more gradual drop-offs. There are no inlets or outlets. Sand and gravel are the dominant substrates in the nearshore zone.

The Crandell Lake watershed lies within deposits of glacial outwash sand and gravel covered by loamy soils of the Marlette and Capac series. Darcy groundwater models indicate the potential for groundwater inputs along the north shore of the lake. The surrounding topography is flat. The landscape to the east of Crandell Lake has been heavily altered due to gravel mining activities. Farms and woodlots are the major land uses to the north and west, whereas most of the residential development within the watershed is on the south side of M-50.

In 2016, Eaton County acquired a 432-acre parcel that includes the entire shoreline of Crandell Lake. This property has become Crandell Park. The park has a small parking lot and the rest of the property is an undeveloped natural area. There is carry-in access for small watercraft. Motors (both gas and electric) are prohibited on Crandell Lake.

The Michigan Department of Natural Resources (DNR) has not stocked fish or issued any public waters stocking permits for Crandell Lake. Stocking of several species apparently occurred around 2011 while the lake was still private. The lake currently is open to the public for catch and immediate release fishing.

Materials and Methods

The first fisheries survey on Crandell Lake was conducted by the DNR during May 30-June 1, 2017. The sampling effort included four overnight trap net sets, two overnight sets of small mesh fyke nets, and two overnight sets of graded mesh gill nets. Total lengths were recorded for all fish. Spine or scale samples for age determination were collected from 10 fish per inch group for Bluegills, Pumpkinseeds, Yellow Perch, and Largemouth Bass. Weights for all fish species were calculated using the length-weight regression coefficients compiled by Schneider et al. (2000b). Weighted age frequencies and weighted mean lengths at age were derived using the procedures described by Schneider (2000b). State average lengths for game fish species are grouped by season (e.g., January-May and June-July). Because most of the scale and spine samples from Crandell Lake were collected on May 31, the January-May state averages were used for this analysis.

Catch-per-effort (CPE) in specific gear types provides indices of relative abundance. CPEs for Bluegill, Largemouth Bass, and Yellow Perch in trap nets and graded mesh gill nets were calculated using the 2017 Crandell Lake catch data. These CPEs were compared to values reported for Michigan lakes surveyed as part of the DNR's Status and Trends Program (STP) during 2002-2007.

Results

Eight fish species (plus hybrid sunfishes) were collected during the 2017 survey (Table 1). Bluegill (n = 242) was the most abundant species, composing 39% of the catch by number and 7% of the catch by weight. Only 20% of the Bluegills were 6 inches or larger (Figure 2). Yearlings (age 1 fish) made up 74% of the catch (Figure 3). Mean lengths at age for Crandell Lake Bluegills were similar to the state averages for yearlings and age 2 fish and were more than an inch above average for age 3-4 Bluegills (Figure 4). Only one Bluegill older than age 4 was captured during the survey.

In contrast to the Bluegill catch that was dominated by juveniles, most of the Green Sunfish (n = 73) and Pumpkinseeds (n = 56) collected were adults. Seventy-one percent of the Green Sunfish and 55% of the Pumpkinseeds were 6 inches or larger (Figure 5). Only two of the Pumpkinseeds were younger than age 4 (Figure 6). The mean growth index for Pumpkinseeds was +0.3 which is indicative of average growth (Figure 7).

Most of the Yellow Perch collected during the survey were 6-8 inches in length (Figure 8). Six year classes were represented in the catch (Figure 9). Mean lengths at age were comparable to state averages through age 5, whereas mean lengths at age for age 6 and age 7 Yellow Perch were below the state averages by 1.3 inches and 1.6 inches, respectively (Figure 10).

Largemouth Bass are the top-level predators in Crandell Lake. Eighty-one percent of the Largemouth Bass collected during the survey were 9-12 inches in length (Figure 11). The oldest bass was age 6 and most were ages 3-4 (Figure 12). Mean lengths for Largemouth Bass ages 2-5 were within one inch of statewide averages (Figure 13).

Analysis and Discussion

The steep drop-offs in Crandell Lake reduce the utility of nearshore nets (i.e., trap nets and fyke nets) and increase reliance on offshore gill net sets. The Crandell Lake Bluegill CPE in trap nets was below the 25th percentile for STP lakes in southwest Michigan (Table 2). Thus, the trap net CPE suggests Bluegill abundance is relatively low in Crandell Lake. However, Bluegill CPE in graded mesh gill nets was above the 75th percentiles for both the statewide and southwest Michigan categories. Viewed together, this information suggests that Bluegill abundance in Crandell Lake is about average and that Bluegill distribution in Crandell Lake is skewed (relative to most inland lake populations in Michigan) towards water deeper than 5 feet.

The Largemouth Bass distribution also was skewed towards deep water. The trap net CPE was between the 25th and 75th percentiles for southwest Michigan and statewide (i.e., about average), yet the gill net CPE was markedly higher than the 75th percentiles. Both the trap net and gill net CPEs for Yellow Perch were well above the 75th percentiles for STP lakes, suggesting that Yellow Perch abundance is high in Crandell Lake relative to other lakes in the state and region.

Schneider (2000a) observed that predators typically make up 20-50% of the fish biomass in lakes with strong fisheries. Largemouth Bass composed 43% of the fish biomass during the 2017 survey. Thus, the predator:prey balance in Crandell Lake is within the target range.

The presence of juveniles in the catch indicates that there is some natural recruitment of Bluegill, Largemouth Bass, Pumpkinseed, and Yellow Perch, and Green Sunfish in Crandell Lake. The distribution of juvenile fish is patchy. For example, 186 Bluegills were collected in one small mesh fyke net and only three Bluegills were collected in the other small mesh fyke net. Thus, we can only draw tentative

conclusions about juvenile fish abundance based on the limited sampling performed in 2017. Most of the spawning and nursery habitat is located in the eastern basin where the shoreline slope is fairly gradual and there is more opportunity for growth of rooted plants.

In southwest Michigan lakes, Bluegill, Pumpkinseed, Largemouth Bass, and Yellow Perch populations typically are able to persist with no supplemental stocking. Green Sunfish are common in warmwater streams, but they do not compete well with other panfish in lake ecosystems. The Green Sunfish population in Crandell Lake is expected to decline over time. In the long-term, Bluegills will be the dominant panfish species in the lake with Pumpkinseeds, hybrid sunfish (natural crosses between Bluegills and Pumpkinseeds), and Yellow Perch present at lower densities.

Because fish were only introduced into the lake several years ago, the age and length distributions for all species in Crandell Lake were truncated. The growth patterns for Yellow Perch and Largemouth Bass suggest that Crandell Lake has limited potential for producing “trophy” fish. However, mean lengths at age for adult Bluegills were above average. The observed increase in growth of Bluegills between ages 2 and 3 likely is the result of a change in foraging strategy. Juvenile Bluegills are confined to vegetation to avoid predators, whereas adult fish often forage on zooplankton (e.g., *Daphnia*) in open water (Spotte 2007). Similar growth patterns have been observed in other southwestern Michigan lakes (Gunderman 2015a; Gunderman 2015b).

The existing regulations on Crandell Lake prohibit harvest of any fish species. While catch-and-release fishing for Largemouth Bass is a very popular activity, Bluegills are the top species in terms of harvest on most inland lakes in southern Michigan (Gunderman 2010; Gunderman 2015b), and Reed and Parsons (1999) found little support for low daily possession limits or catch-and-release only regulations among Bluegill anglers on four Minnesota lakes. As catch-and-release only regulations likely have caused some harvest-oriented anglers to avoid Crandell Lake, it is important for DNR and Eaton County to weigh the benefits of the existing regulations versus this loss of harvest opportunity.

Schneider (1971) evaluated panfish population dynamics in Mill Lake (Washtenaw County, Michigan) during and immediately after a 5 year fishing closure. In the first three days after the lake was reopened to fishing, anglers harvested 61% of the Yellow Perch (7 inches or larger) and 13% of the Bluegill standing stock (6 inches or longer). Fishing pressure was extremely high during those three days and Schneider (1971) estimated it was equivalent to one-third of the pressure the lake would normally receive in an entire year. With a surface area of 136 acres, Mill Lake is comparable in size to Crandell Lake.

Mid Lake (surface area = 12 acres) in central Wisconsin was opened to public fishing after a 20 year closure. In the first month after the lake was opened to fishing (May 1976), anglers harvested 86% of the Yellow Perch and 35% of the Bluegill standing stock (Goedde and Coble 1981). After the fishing closure was lifted, the panfish size structure shifted toward smaller and younger individuals. Between May 1976 and May 1979, the harvest per angler hour declined by 82% for Yellow Perch and 27% for Bluegills. The daily possession limit for panfish was 50 fish during the study.

In April 1990, Bluegill regulations on Williams Lake in Barry County (Michigan) were changed from a 25 fish per day possession limit to catch-and-release only fishing. Michigan DNR conducted several spring trap net surveys from 1989 through 2000 to assess the effects of the regulation change on the size structure of the Bluegill population. The mean length for Bluegills captured in trap nets in 1989 (i.e., pre-regulation change) was 6.1 inches. By 1992, the mean length had increased to 7.4 inches. Mean Bluegill

lengths remained between 7.2 inches and 7.6 inches through 2000. Thus, the Bluegill size structure in Williams Lake improved substantially after implementation of catch-and-release only regulations.

Rypel (2015) evaluated the effects of reducing the panfish daily possession limit from 25 fish to 10 fish on Bluegill populations in seven Wisconsin lakes. Mean total length for Bluegills was greater in lakes with the 10 fish possession limit than in control lakes with the 25 fish limit. Relative to the control lakes, the average gain in mean total length in the treatment lakes was 0.83 inches.

Coarse woody habitat is lacking in Crandell Lake. Logs provide shade and hiding places for many fish species, spawning substrate for Yellow Perch and amphibians, food and attachment sites for aquatic invertebrates (i.e., fish food), and basking areas for turtles. Removal of coarse woody habitat from a Wisconsin Lake resulted in declines in Yellow Perch abundance and decreased growth rates for Largemouth Bass (Sass et al. 2006; Gaeta et al. 2014). Whereas the addition of coarse woody habitat has been shown to attract fish (and subsequently anglers) to a particular region of a lake, the effects of coarse woody habitat additions on lakewide fish production are uncertain (Sass et al. 2019).

Management Recommendations

The addition of coarse woody habitat to the nearshore zone of Crandell Lake likely would improve catch rates for game species. The “Fish Sticks” manual produced by Wisconsin DNR (2014) is a good template for designing habitat structures. If there is interest from Eaton County, Michigan DNR – Southern Lake Michigan Management Unit staff are willing to work with the County to identify the best sites for placement of habitat structures and discuss potential funding sources for habitat improvement projects.

Public fishing lakes are a rare resource in Eaton County. The DNR supports Eaton County’s decision to allow fishing on Crandell Lake. At present, the County has rules prohibiting harvest, but there are no State regulations that preclude harvest of fish from Crandell Lake. If the County decides to retain catch-and-release only regulations, the DNR should codify these regulations in Fisheries Order 206 in April 2021 and include them in the Michigan Fishing Guide.

References

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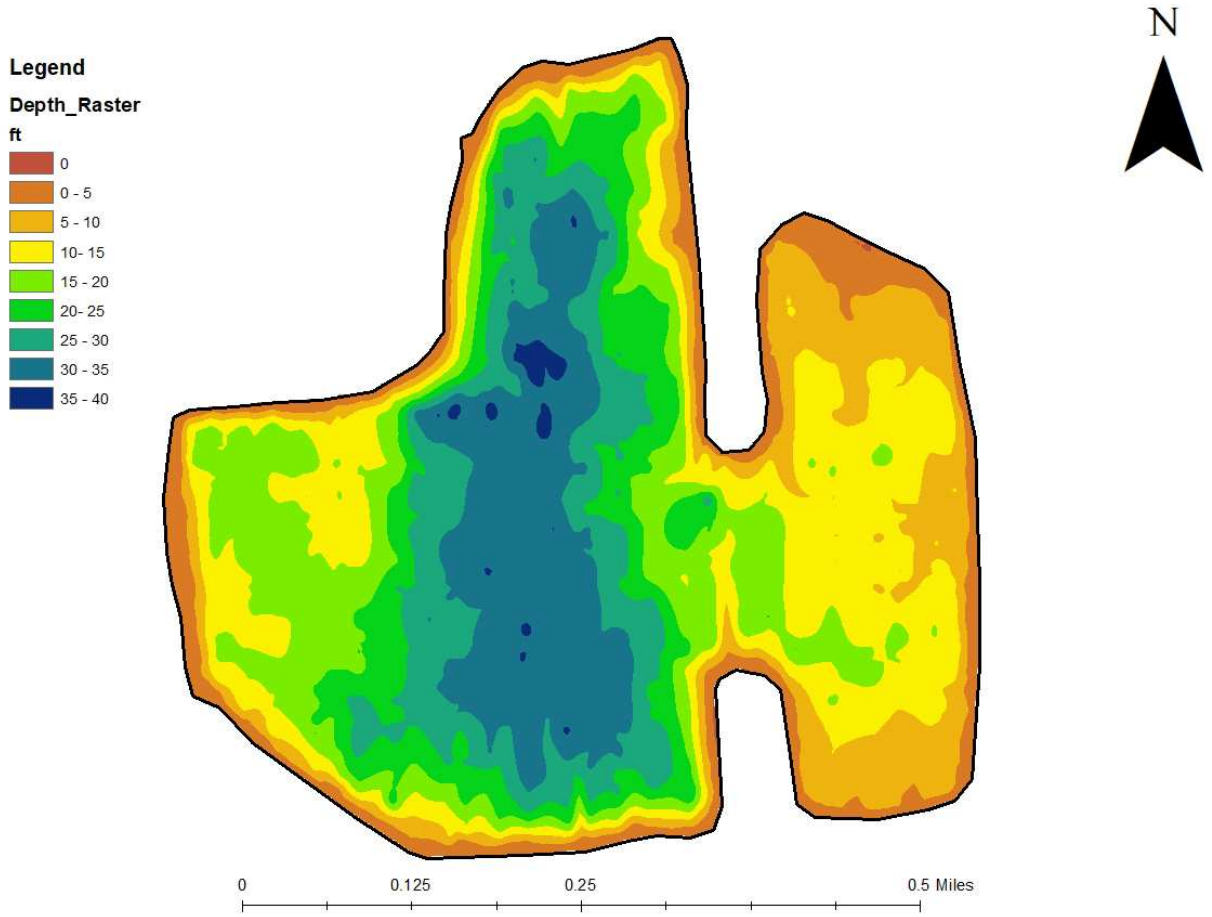
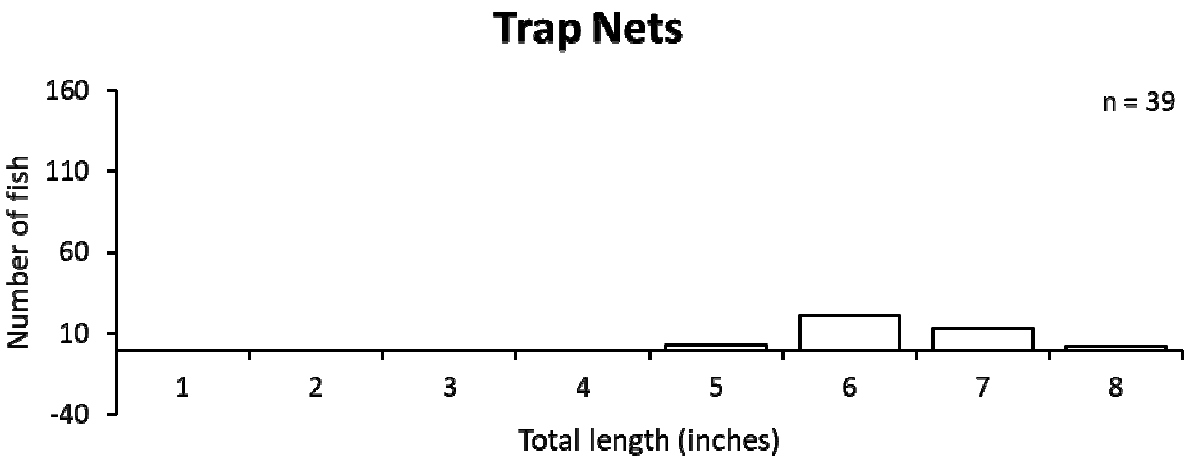
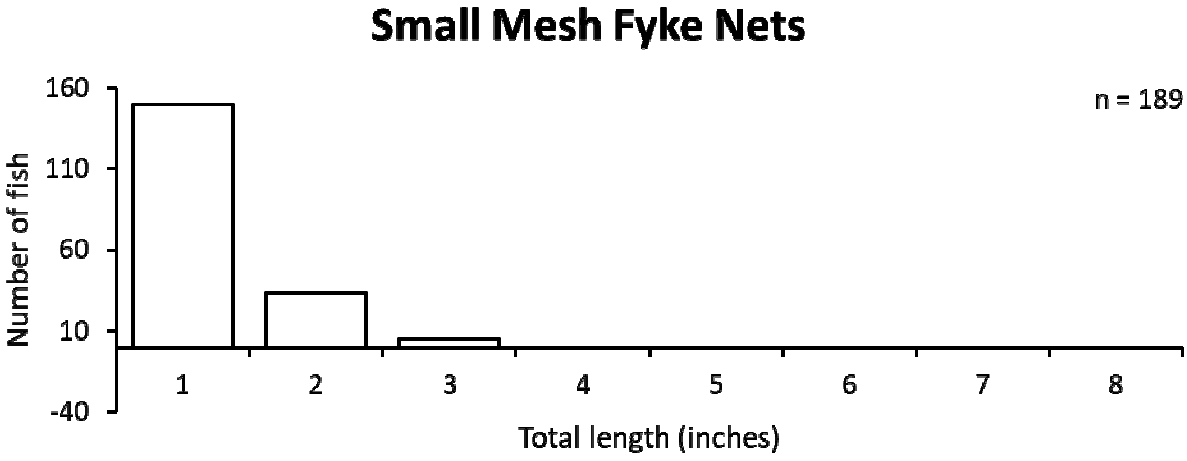


Figure 1.–Bathymetry of Crandell Lake as measured during a hydroacoustic survey by Michigan Department of Natural Resources – Fisheries Division in October 2019.





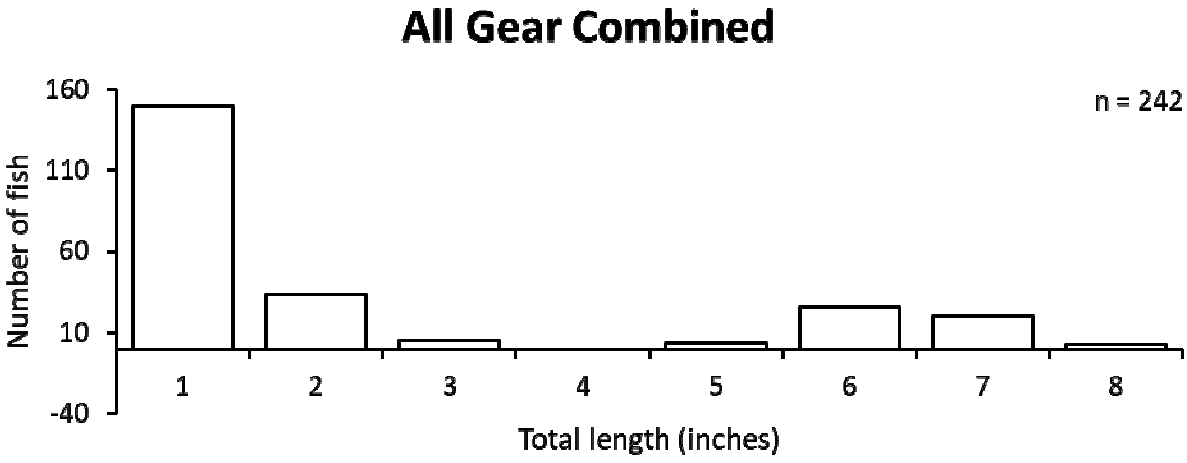


Figure 2.–Length frequency distributions for Bluegills captured in Crandell Lake using trap nets, small mesh fyke nets, and all gear types during May 30-June 1, 2017.

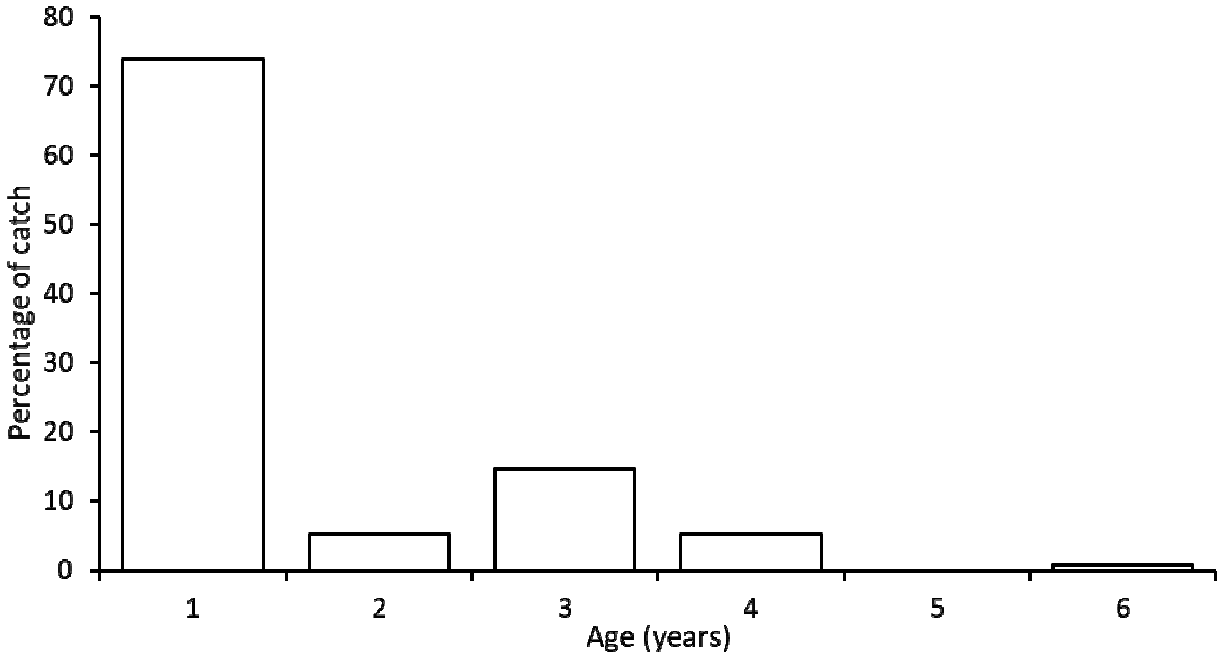


Figure 3.–Age frequency distribution for Bluegills captured in Crandell Lake during May 30-June 1, 2017.

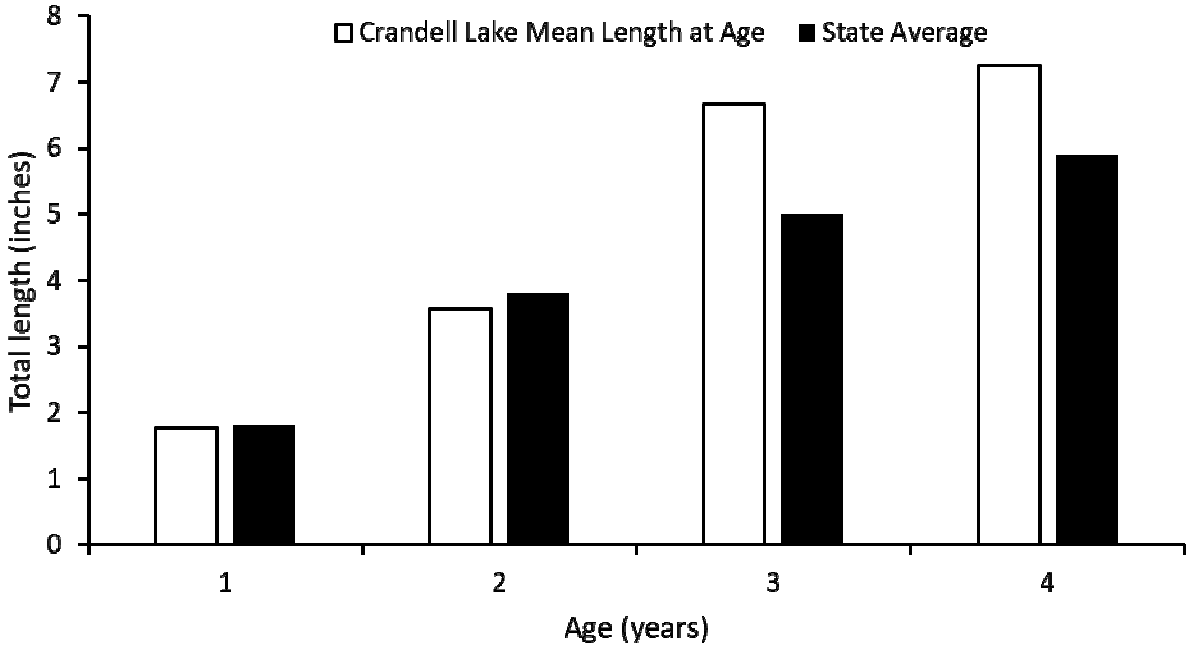
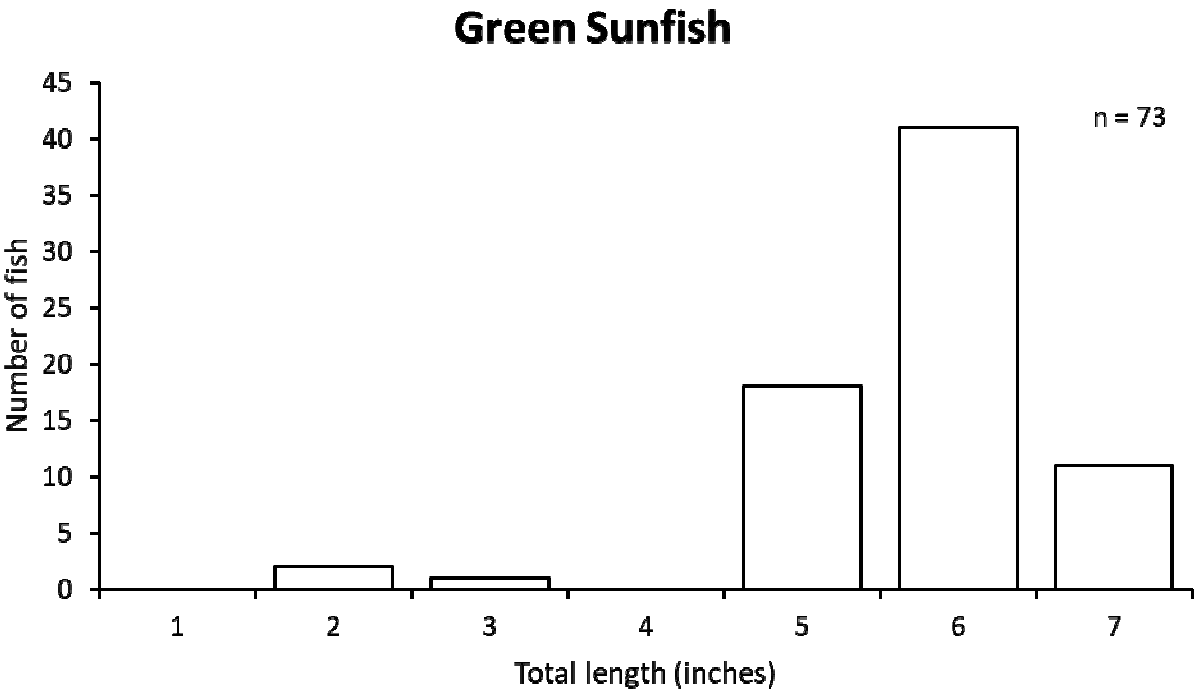


Figure 4.–Growth of Bluegills in Crandell Lake, as determined from scale and spine samples collected during May 30-June 1, 2017. State average lengths are from Schneider et al. (2000a).



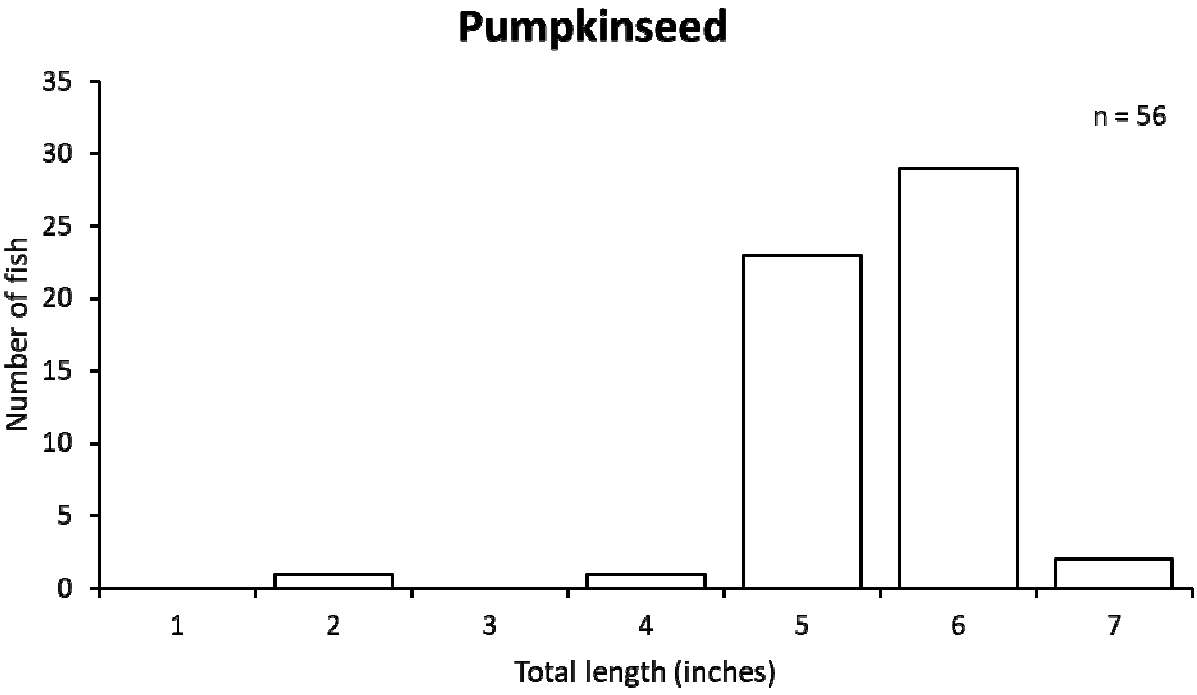


Figure 5.–Length frequency distributions for Green Sunfish and Pumpkinseeds captured in Crandell Lake during May 30-June 1, 2017.

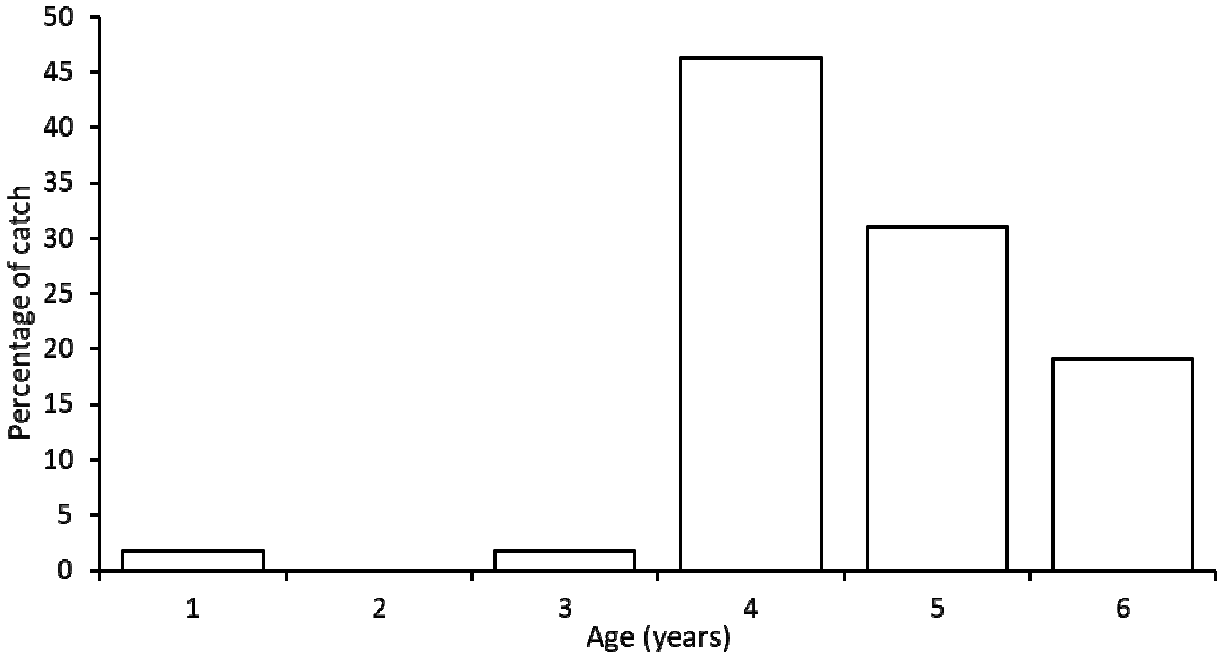


Figure 6.–Age frequency distribution for Pumpkinseeds captured in Crandell Lake during May 30-June 1, 2017.

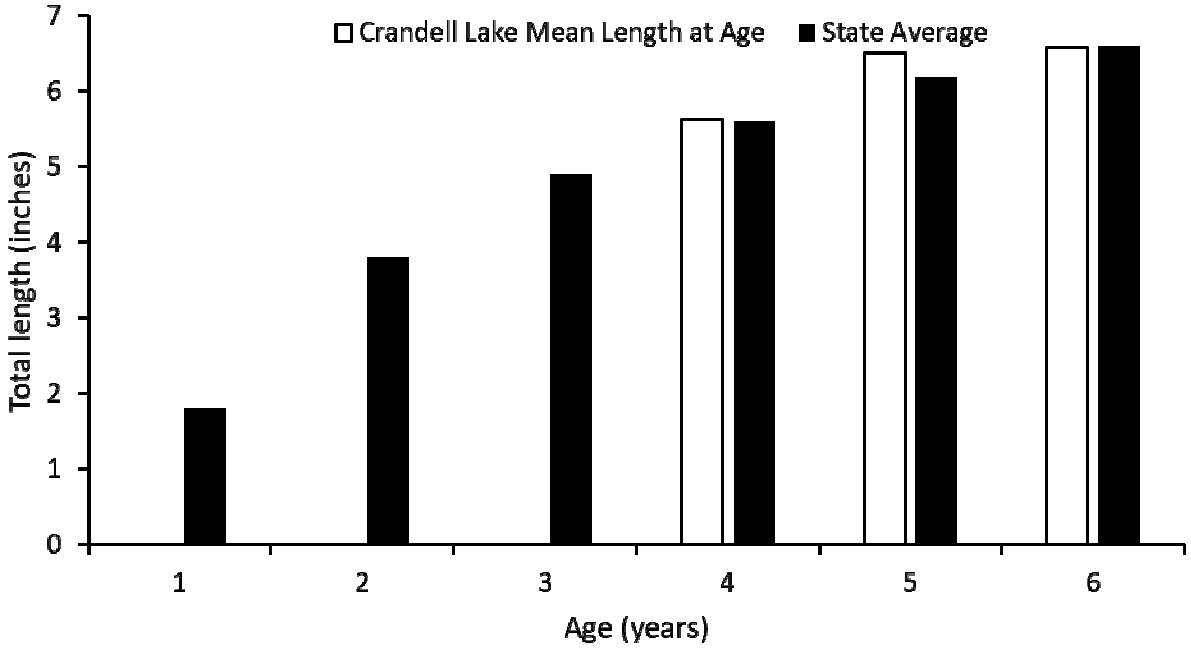


Figure 7.–Growth of Pumpkinseeds in Crandell Lake, as determined from scale and spine samples collected during May 30-June 1, 2017. State average lengths are from Schneider et al. (2000a).

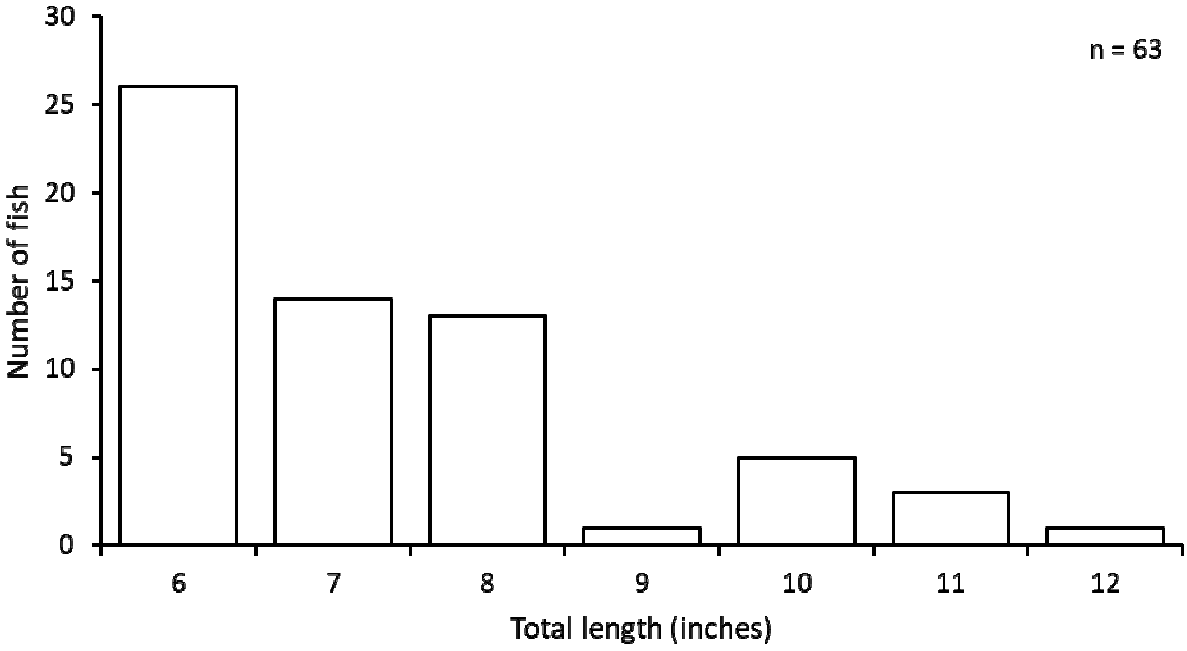


Figure 8.–Length frequency distribution for Yellow Perch captured in Crandell Lake during May 30-June 1, 2017.

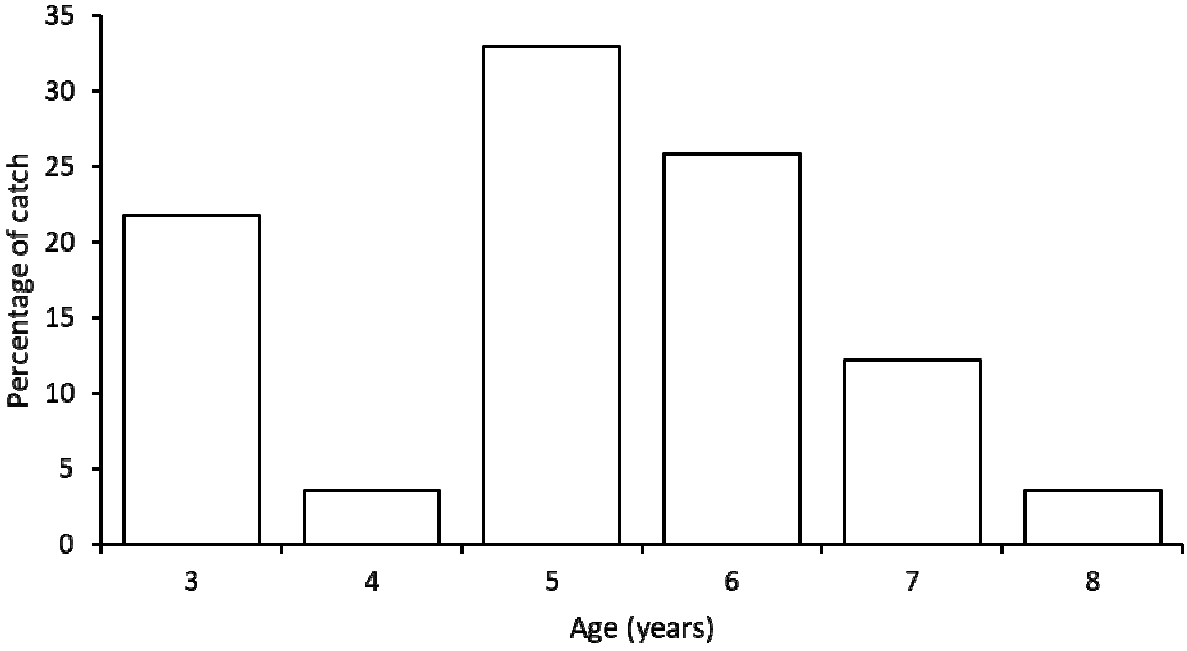


Figure 9.–Age frequency distribution for Yellow Perch captured in Crandell Lake during May 30-June 1, 2017.

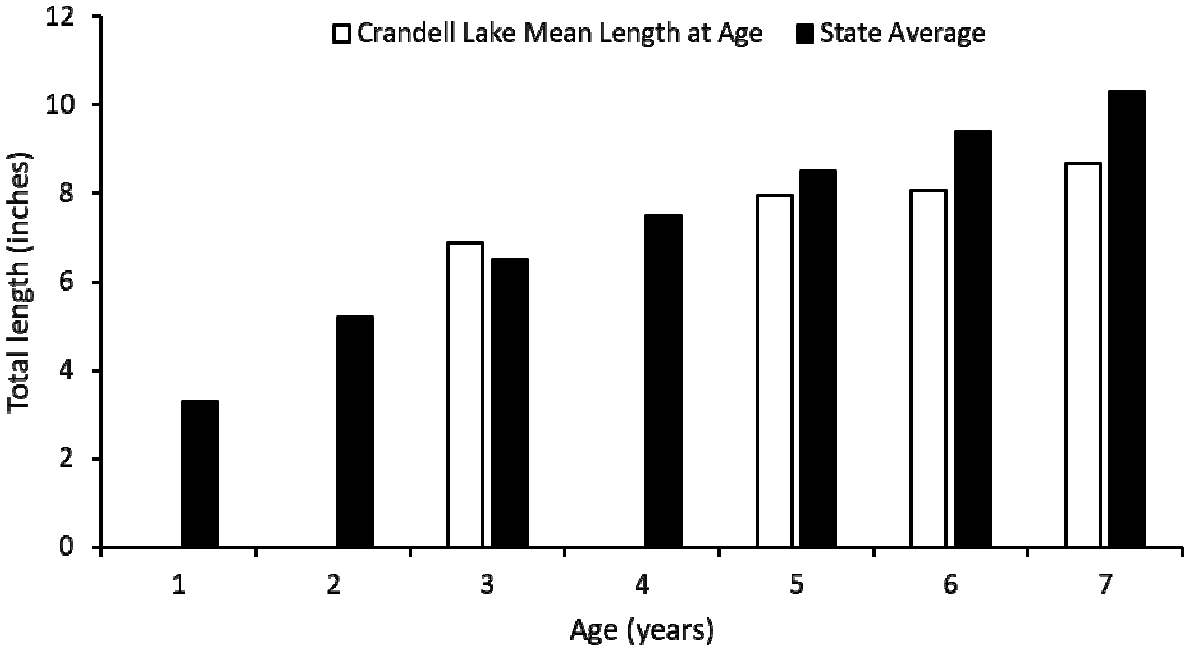


Figure 10.–Growth of Yellow Perch in Crandell Lake, as determined from scale and spine samples collected during May 30-June 1, 2017. State average lengths are from Schneider et al. (2000a).

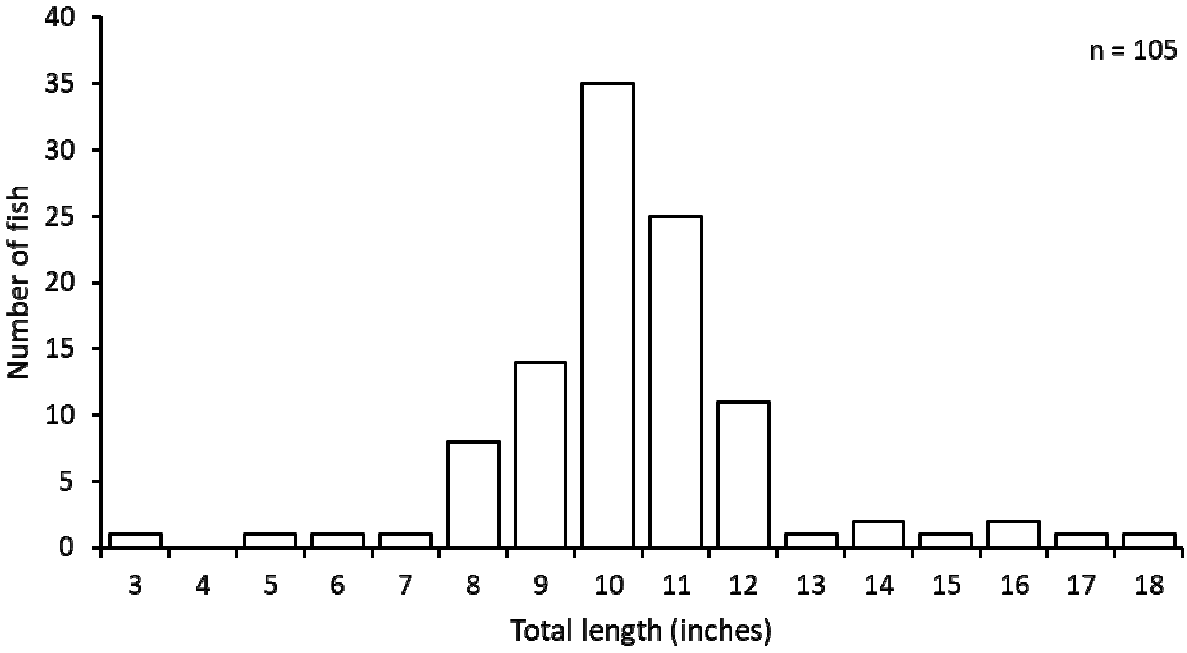


Figure 11.–Length frequency distribution for Largemouth Bass captured in Crandell Lake during May 30-June 1, 2017.

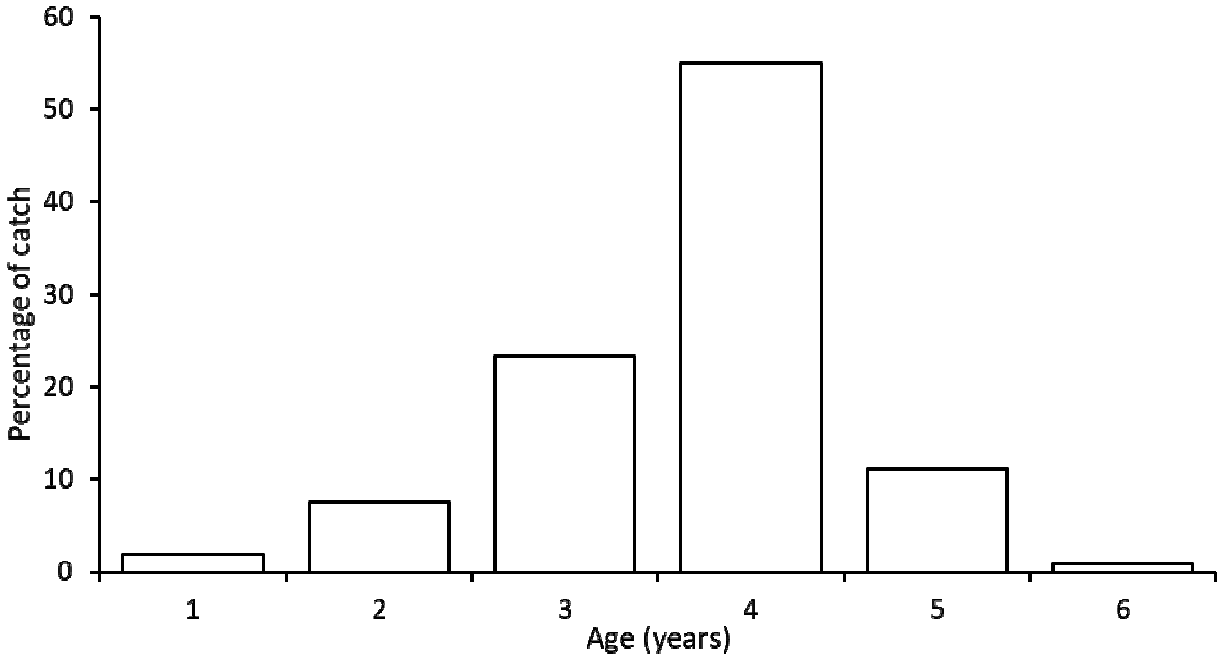


Figure 12.–Age frequency distribution for Largemouth Bass captured in Crandell Lake during May 30-June 1, 2017.

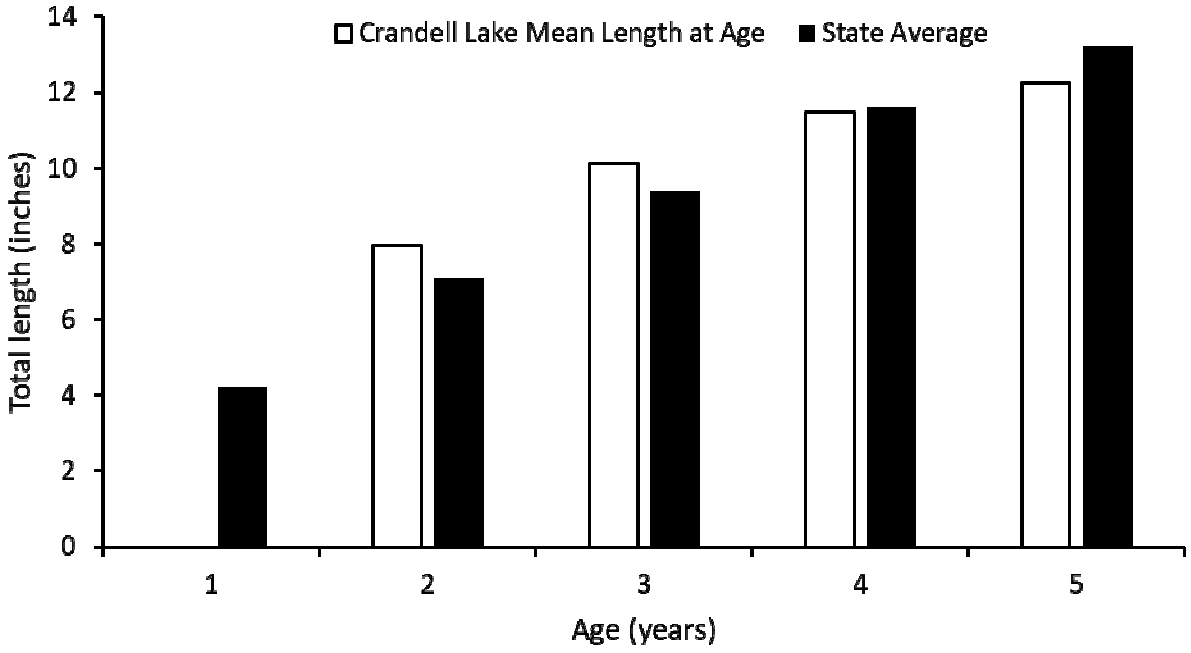


Figure 13.–Growth of Largemouth Bass in Crandell Lake, as determined from scale and spine samples collected during May 30-June 1, 2017. State average lengths are from Schneider et al. (2000a).

Table 1.–Numbers, weights, and lengths for fish species collected during the fish community survey on Crandell Lake during May 30-June 1, 2017. Fish were captured using trap nets, small mesh fyke nets, and graded mesh gill nets.

Species	Number	Percent by number	Weight (lbs)	Percent by weight	Length range (inches)	Percent legal or harvestable[1]	Growth index[2]
Bluegill	242	38.9	13.3	7.4	1-8	20	+1.0
Largemouth Bass	105	16.9	76.6	42.6	3-18	7	+0.2
Green Sunfish	73	11.7	13.6	7.5	2-7	71	---
Yellow Perch	63	10.1	14.5	8.1	6-12	59	-0.8
Pumpkinseed	56	9.0	10.4	5.8	2-7	55	+0.3
Golden Shiner	32	5.1	5.0	2.8	6-8	---	---
Yellow Bullhead	28	4.5	13.5	7.5	6-13	---	---
White Sucker	14	2.3	31.1	17.3	16-19	---	---
Hybrid Sunfish	9	1.4	1.8	1.0	2-7	67	---
Total	622		179.7				

[1] Harvestable size is 6 inches for Bluegills, Pumpkinseeds, Green Sunfish, and Hybrid Sunfish, and 7 inches for 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.