Juno, Christiana, and Painter Lakes
Cass County, 7S/15W/36; 7S/14W/31; 8S/15W/1; 8S/14W/6
Saint Joseph River watershed, last surveyed 2017

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Environment

Christiana, Juno, and Painter Lakes are three lakes located in Ontwa, Mason, Jefferson, and Calvin Townships in Cass County. Juno Lake is connected to Christiana Lake by a wide strait and Painter is connected to Juno by a short channel (Figure 1). Combined the three lakes are 552 acres. Water, boats and fish can freely move between these lakes resulting in fish populations and management acting as one system. Christiana Creek flows into Painter Lake from the north and a stream flows from Lafferty Lake into Juno Lake through the wetlands on the eastern shore. Both creeks are classified as warm transitional streams. A dredged channel leads from the western shore of Christiana Lake to Eagle Lake. The culvert on Eagle Lake Road prevents movement of boats between the two lakes. Christiana Creek flows out of the southern end of Christiana Lake and outlets into the Saint Joseph River in Elkhart, IN. Approximate main lake surface area was measured using ArcMap GIS software. Christiana Lake is approximately 190 acres with a maximum depth listed of 43 feet (only 34 feet of depth found in 2017 survey). Juno Lake is approximately 220 acres. Painter Lake is the smallest and the shallowest of the lakes with a surface area of approximately 96 acres and a maximum depth of 28 feet. There is additional combined lake area in the connected channels. Lake areas reported vary depending upon where the divisions between lakes are drawn. The watershed of the three lakes is 57,965 acres and land use is primarily agricultural (58%), with a mix of forest (15%), wetland (14%) and urban (8%). The surficial geology is 82% ice contact and 16% moraine composed of glacial outwash sand and gravel and postglacial alluvium of coarse texture.

There is no legal lake level established for the three lakes, but Adamsville Hydroelectric Dam (NID ID: MI00729) is located on Christiana Creek approximately 1 mile south of Christiana Lake. The dam was constructed in 1865, has a height of 10.7 feet, and maintains a head of 8 feet. The dam is a hydroelectric dam operated by NIBCO, Inc. It is exempt from FERC licensure and is regulated under Part 315 (Dam Safety, Public Act 451 of 1994) as a run-of-the-river dam with a normal pool elevation of 797.8 feet NGVD29. The dam impounds Christiana Creek back to the outflow from Christiana Lake. There is an old bridge crossing that may also help regulate the outflow elevation. The current configuration results in a relatively stable water level in the lakes with some natural fluctuation.

There is a Department of Natural Resources (DNR) boat access site on a channel on the southern shore of Juno Lake with 16 parking spaces allowing the public to access all three lakes. The channels of Juno Lake and the channel connecting Juno to Painter Lake have no wake restrictions (R281.714.8 and R281.714.7 respectively). Painter Lake also has prohibitions on operating a vessel at high speeds and having a person in tow (via ski, sled, surfboard, or similar) from 6:30 PM to 10:00 AM the following day (R281.714.6).

History

Yellow Perch, Largemouth Bass, and Bluegill were stocked periodically into Christiana Lake from 1933 through 1941. Stocking was discontinued in 1941 and no DNR stocking has occurred since that time. Fall fingerling Walleye were stocked by private groups under DNR permits in 2004 (1,500 fish), 2005 (2,000 fish), 2006 (2,000 fish), 2008 (2,000 fish), and 2011 (1,000 fish). Stocked Walleye averaged 7 inches in length.

A Michigan Fish Commission report from 1887 reported Yellow Perch, Bluegill, Black Crappie, Largemouth Bass, bullhead, suckers, and shiners as abundant in a hook and line survey on Christiana, Juno, and Painter Lakes. The first comprehensive fish survey was conducted on Christiana Lake in July of 1938 (see Perry 1943). Experimental gill nets were set at six locations for various lengths of time from July 21 through 24, 1938 for a total of 133.4 hours of soak time. Fish were also collected with hook and line and four seine hauls were completed. At this time there were 38 cottages and 2 resorts on the lake and boats were available at two liveries. A dissolved oxygen profile was completed and oxygenated water (> 3 ppm) was observed down to 18 feet where the water temperature was 70 F making it suitable for warm water fish species. Native Water Milfoil was the most abundant vegetation species and pondweeds, Coontail, Yellow and White Waterlily, Arrow Arum, and Pickerel Weed were common. Bluegill was the most abundant fish species observed. Largemouth Bass were abundant, and a few Northern Pike were observed. Longnose Gar, Spotted Gar, and Bowfin were observed in abundance as well as prey fish, including Bluntnose Minnow, Golden Shiners, and Common Shiners. Lake residents were reportedly removing gar, Bowfin, and turtles despite DNR recommendations that prey fish were abundant, and these predators were important to preventing overcrowding and stunting of panfish. Walleye and Smallmouth Bass were reported as being caught in low numbers by anglers despite not being observed in the survey. Growth rates of all fish species were reported as above average. Bathymetric mapping of Christiana Lake was completed on July 25, 1938.

A creel survey was conducted on Christiana Lake through the winters of 1938-1939 and 1939-1940 as well as the summers of 1939 and 1940. This survey was part of a study on nine southern Michigan lakes to evaluate differences in harvest from summer and winter seasons (see Clark 1939, 1940, and 1941 and Perry 1943). The DNR was receiving requests to close winter fishing due to concerns of overharvest. Catch rates at Christiana Lake were slightly higher in the winter averaging 1.1 fish per hour compared to 0.7 fish per hour in summer. Catch rates were slightly below the average for the nine lakes of 1.5 fish per hour in the winter and 1.0 in the summer. Effort was higher in the summer as an average of 3,377 angler trips fished during summer months compared to 963 in winter months. Total harvest was almost twice as high in summer months than in winter (6,617 and 3,383 respectively). Anglers predominantly harvested Bluegill averaging 85% of the winter catch and 43% of the summer catch. Yellow Perch and Black Crappie were also harvested in the summer making up 17% and 20% of total catch respectively. Harvest was low for Warmouth, Largemouth Bass, Rock Bass, Northern Pike, and Pumpkinseed. An average of 46% of anglers harvested no fish. Seventy-seven percent of winter anglers and 86% of summer anglers were not Michigan residents, and many were from the Elkhart, IN area. Scales were collected from fish captured in the creel and age and growth was evaluated (see Beckman 1941). Growth rates for all fish species was above average with Christiana Lake having the second highest Bluegill growth of the six lakes that were examined for growth. Bluegill reached 6 inches by age three and were observed up to 9.5 inches and ten years old.

The most recent survey was conducted in 1978 and included all three lakes. This survey was a general survey to assess fish populations. A two-hour shoreline electrofishing transect was conducted on

Christiana Lake on October 26, 1978 and a two hour transect was conducted on Juno and Painter Lakes on October 24, 1978 for a total of four hours of electrofishing (time of day not specified). On the dates of the survey, the water was oxygenated (> 3 ppm) down to 20 feet in Juno and Christiana Lake, but only to 13 feet in Painter Lake. A total of 2,014 fish were caught (1,113 on Christiana and 901 on Juno/Painter) representing 20 species. Species captured and catch rates were similar between lakes as was expected due to the open connection between lakes. Bluegill were the most abundant species making up 41% of the total catch. Growth rates were reported as above average with 28% of fish captured being over 8 inches in length. The mean growth index was +0.8 with age 3 and age 4 fish being over 1 inch larger than the state average. Bluegill size structure index score (see Current Status for methods) was 6 and rated as excellent. Largemouth Bass and Northern Pike were the primary predators observed. Catch per effort (CPE) for Largemouth Bass was high at 69.5 fish per hour, but only 8 percent (21 fish) were greater than 14 inches with only 1 fish over 16 inches. Six of the seven Northern Pike captured were over 22 inches and growth was well above average for age 2 and age 3 fish examined. Black Crappie were growing well above the state average with the largest fish being age 4 averaging 11.4 inches. Catch rates for Black Crappie was 10.5 crappie per hour of electrofishing. Yellow Perch CPE was 26 fish per hour of electrofishing and averaged 6.6 inches. Ten Yellow Perch were over 10 inches (10% of total catch). Growth rates were similar to the state average. Good numbers of Pumpkinseed were also captured with a CPE of 43 fish per hour averaging 4 inches and ranging from 1-7 inches. Common Carp and Bowfin were observed but were not captured.

Current Status

The survey design followed standard methods for conducting a random lake survey as described in the Michigan Department of Natural Resources Status and Trends protocol (Wehrly et al. Draft). Netting efforts took place from May 22 through May 25, 2017. Three gill nets were set overnight on each of two nights (one net was only set one night) for a total of 5 net nights. Seven large-mesh fyke nets were set overnight on each of two nights and three nets were set an additional night (total of 17 net nights). Four small mesh fyke nets were deployed for one night (total of 4 net nights). Five beach seine hauls were conducted to quantify minnow and inshore prey species abundance levels. Four 10-minute nighttime electrofishing transects were conducted on the evening of May 25, 2017 (two Juno, one Christiana, and one Painter) for a total of 30 minutes of effort. All species were collected at three of the sites, and Largemouth Bass were only collected at one of the Juno sites. All fish were identified, counted, and measured (total length). Weights for all fish species were calculated using length-weight regression equations compiled by Schneider et al. (2000b). The relative stock density for each fish species was assessed using CPE calculated as the number of fish caught per net night (gill and fyke nets), per hour of electrofishing (boomshocker), or per haul (seine). CPE data from this survey were compared to a summary of CPE data from lakes surveyed in the Status and Trend Program from 2002 through 2007 on a statewide and regional (Southern Lake Michigan Management Unit (SLMMU)) level. Age structures (scales or spines) were collected from ten fish in each inch class for all sportfish. Weighted age compositions using length and age keys for each game fish species were calculated as described by Schneider (2000b). The difference between the state average mean length for each age class and mean length-at-age from surveys was used to calculate size differences for each age class. Age classes represented by a minimum of five fish were averaged to provide an index of fish growth (Schneider 2000b). Growth index scores between +1 and -1 are considered similar to the state average while scores less than -1 and greater than +1 are considered below or above the state average, respectively. Bluegill size structure was rated using an index based on the mean length, growth, and

the proportion of fish >6 inches, >7 inches, and >8 inches for different gear types (Schneider et al. 2000a, Schneider 1990). Mortality was estimated for Bluegill using catch curve analysis from relative age frequency determined from large mesh fyke net catch (Ricker 1975).

A fish habitat assessment of Christiana, Juno, and Painter Lakes was conducted on August 15, 2017. Shoreline surveys of the three lakes included 33 transects of 1,000 feet each with an additional 373 feet and 280 feet added to two transects for a total of approximately 33,653 feet. No transects were conducted in the connected channels. The number of docks (large and small), dwellings, submerged trees, and the percent of the shoreline that was armored (riprap or seawalls) were recorded for each transect. A temperature and dissolved oxygen profile was collected for 1-foot increments at the deepest spot in Christiana Lake. Detailed methods for limnological, shoreline, and fish sampling can be found in Wehrly et al. (Draft).

Total depth at the water column profile site on Christiana Lake was 34 feet. Surface water temperature was 77 F (Figure 2). Dissolved oxygen was adequate to support fish (>3ppm) down to a depth of 16 feet. The temperature at that depth was 72 F. Secchi depth was 8 feet indicating light could penetrate down to 16 feet of depth. The density of docks was 3.8 per 1000 ft of shoreline and dwellings was 4.1 per 1000 ft of shoreline. Dock density was average as it fell between the 25th percentile and median for SLMMU (1.45 and 5.3 docks per 1000 feet respectively) and between the median and the 75th percentile for statewide lakes (2.4 and 5.6 docks per 1000 feet respectively). The density of dwellings was also average, falling between the 25th percentile and median for SLMMU lakes (3.2 and 4.8 dwellings per 1000 feet respectively) and the median and the 75th percentile for statewide lakes (2.9 and 5.9 dwellings per 1000 feet respectively). An estimated 26% of the shoreline was armored which is between the median and the 75th percentile for the SLMMU (14% and 47% respectively) and statewide (8% and 31% respectively) and considered an average amount of armoring. Submerged trees density was high at 7.8 logs per 1000 ft of shoreline and is above the 75th percentile for SLMMU and statewide lakes (2.8 and 5.7 logs per 1000 ft of shoreline respectively). Submergent vegetation at net set locations included Yellow Waterlily, White Waterlily, Illinois Pondweed, Chara, Coontail, Flatstem Pondweed, Bladderwort and Curly Leaf Pondweed ranging from sparse to abundant. Bulrush, Cattail and Arrowhead, Pickerelweed, Swamp Loosestrife, and Purple Loosestrife were common emergent vegetation observed, especially on shorelines that were not developed.

EGLE conducted an aquatic invasive species (AIS) survey on Christiana, Juno and Painter Lakes in 2019. They found nine invasive species including Chinese Mystery Snail, Corbicula, Curly Leaf Pondweed, Eurasian Watermilfoil, Narrow Leaf Cattail, Phragmites, Purple Loosestrife, Starry stonewort, and Zebra Mussels. The EGLE survey also identified a diverse native vegetation community that should be conserved. The PJC Lake Association is currently evaluating options for invasive species prevention and control.

Species captured and catch rates were not significantly different among lakes (see Analysis below) because of the connectivity among lakes. Christiana, Juno and Painter Lakes have historically been managed as one system and the fish communities are well interspersed. As a result, survey data was combined for the three lakes. A total of 2,863 fish were captured across all gears representing 37 species and 803 pounds (Table 1). Herpetological captures include Snapping Turtle (n = 5), Eastern Spiny Softshell Turtle (4), Map Turtle (62), Painted Turtle (26), and Musk Turtle (13). The Michigan

Natural Features Inventory also lists Eastern Massasauga species occurrences in wetlands adjacent to the lakes.

Bluegill were the most abundant species captured representing 29% of the total fish catch. Bluegill averaged 4.4 inches in length across all gears and ranged from 1 to 9 inches. Bluegill growth was similar to the state average overall with a mean index score of +0.4, but fish of age 5 though 9 averaged over 1 inch bigger than the statewide average (Figure 3). Size structure index scores were 2.5 (Poor/Acceptable) from electrofishing catch, 4.25 (Satisfactory) for fyke net catch, and 4 (satisfactory) from the growth index score. CPE was 17.5 fish per net night in large mesh fyke nets which is below the 25th percentile for SLMMU lakes (29.33 fish per net night). CPE in small mesh fyke nets was 40.3 fish per net night which is above the median but below the 75th percentile for SLMMU lakes (35.2 and 95.7 fish per net night respectively). Bluegill length frequency shows that fish in the smaller size classes are present in average numbers, but fish 7-9 inches in length only made up 10 percent of the population (Figure 4). Bluegill annual mortality rate estimated from catch curve analysis of large mesh fyke net catch was estimated at 60% which was not exceptionally high, typically ranging from 59 to 87% (Coble 1998; Crawford and Allen 2006). There was a marked decrease in CPE between age 5 and 6 (Figure 5). It is unclear if this age distribution was due to mortality or recruitment variability.

Other panfish species were also abundant. A total of 206 Pumpkinseed were captured that averaged 7.4 inches and ranged from 3 to 8 inches in length. Pumpkinseed ages 1 through 7 were captured. Growth was well above the state average with a growth index score of +1.3. A total of 164 Black Crappie were collected ranging from 2 to 13 inches with an average length of 8 inches. Growth index was +0.7 and fish reached 10 inches by age 5 (Figure 6). Growth was similar to what was observed in past age and growth analyses. Black Crappie CPE from large mesh fyke nets was 2.1 fish per net night and between the 25th percentile and the median of SLMMU lakes (1.5 and 6.25 fish per net night respectively). Annual mortality was estimated at 35.8% which is low compared an average of 75% reported in a review by Allen and Miranda (1995) of annual mortality values from 14 lakes that ranged from 48 to 94%.

Yellow Perch were also common in Christiana, Juno, and Painter Lakes. A total of 118 fish were caught ranging from 2 to 10 inches with an average size of 5.5 inches. Growth index scores were -0.2 indicating average growth. Fish 8-10 inches represented 13% of the total catch. CPE was 2.8 fish per net night from gill nets and 166 fish per hour in electrofishing. Gill net CPE was right at the median for SLMMU lakes of 2.9 fish per net night, but electrofishing CPE was well above the 75th percentile of 63 fish per hour. Many of the Yellow Perch captured while electrofishing were smaller size classes indicating good recruitment in Christiana, Juno and Painter Lakes.

Spotted Gar were captured in high numbers (n = 145. In addition, four Longnose Gar and four Bowfin were also collected. Spotted Gar were the most abundant predator in Christiana, Juno, and Painter Lakes. They comprised 22% of the total fish biomass captured across all gears. These fish were relatively large ranging from 10 to 28 inches (average 21.3 inches). Spotted Gar CPE was 8.1 fish per net night in large mesh fyke nets, which is well above the 75th percentile for all status and trend surveys (3.3 per net night) and the second highest CPE recorded by the program (Palmer Lake CPE 10.4 per net night).

Largemouth Bass were the primary sportfish predator captured. A total of 110 Largemouth Bass were collected ranging from 3 to 18 inches. CPE from electrofishing was 134 fish per hour which is close to the 75th percentile for SLMMU (144 fish/hour) and much higher than the 75th percentile of statewide lakes (94 fish per hour). Thirty-one percent of the Largemouth Bass population was 13 and 14 inches (Figure 7). A total of 19.1% of fish captured were larger than the 14-inch minimum size limit, mostly due to the abundance of 14-inch fish. Growth index for Largemouth Bass was average at +0.2, but fish ages 1 through 5 had a greater length at age than the state average and older age classes had below average length at age (Figure 8).

Northern Pike were also caught in relatively low numbers (n = 15). Northern Pike that were caught were large in size ranging from 20 to 38 inches in length. Although not enough pike were caught to evaluate growth, the fish that were captured were age 2-5 with length at age being greater than the statewide averages for all age classes. In addition, tow age 9 fish were caught (31.6 and 38.1 inches in length). Northern Pike of age 3 averaged above legal size (24 inches) and 67% of fish captured were greater than the minimum size limit.

Three Walleye were captured that were 20.8, 22.8, and 23.9 inches in length. The two larger fish were aged as 6 years old fish originating from the most 2011 private stocking (no age structure taken on smallest fish). All three fish were above the state average length at age 6 for lakes statewide of 19.2 inches. One Smallmouth Bass was captured that was 13.3 inches in length.

Minnows, darters, and other small fish species were well represented making up 30 percent of the catch by numbers. Seine CPE averaged 92 fish per haul and was dominated by Sand Shiners (82% of catch). Starhead Topminnow is a species of special concern in Michigan and 12 were collected. Predators typically make up 20-50% of the biomass in lakes with desirable fish communities (Schneider 2000a). Predators made up 45% of the total biomass in the Christiana, Juno and Painter Lakes survey which is near the top end of the preferred range. Despite the abundance of small bodied prey, Bluegill, Yellow Perch, juvenile Largemouth Bass, and other panfish were the primary prey for larger predators. White suckers were collected, but in low numbers (n = 12).

Analysis and Discussion

Water temperatures in Christiana, Juno, and Painter Lakes support a warmwater fish community. Temperature was 72 F at the critical depth where oxygen becomes limiting for fish (16 feet). There is limited habitat for coolwater fish such as Walleye and Northern Pike, although they are present in these lakes. Shoreline surveys indicated that Christiana, Juno, and Painter Lakes have average numbers of dwellings, docks, and shoreline armoring compared to other lakes both regionally and statewide. Woody habitat was very abundant. Shoreline modification is limited on the main bodies of the lakes because much of the development has been on side channels that are connected to the lakes. These channels are heavily armored and docks are abundant, but were not included in the shoreline survey. Much of the western side of Christiana, the eastern shore of Juno and most of Painter Lake have wetland shorelines that remain unmodified resulting in good habitat for fish. Protecting these wetlands is a management priority for these lakes. The Southwest Michigan Land Conservancy owns a 73-acre parcel on the western shore of Christiana Lake providing wetland and shoreline protection for some of this critical habitat. Future protection will be provided through EGLE permit reviews to ensure the wetlands along the shorelines remain intact.

Small mesh fyke net catches of Bluegill were average compared to regional lakes, but large mesh fyke net catch was low. Small mesh nets target smaller sized Bluegill compared to large mesh nets. Length frequency of Bluegill captured also show lower abundance of larger Bluegill (6-9 inches) compared to smaller size classes. This results in size structure scoring ranging from poor to satisfactory. Growth rates for young Bluegill were average. This pattern indicates that there is not a resource limitation issue that is causing competition for food and reduced growth resulting in a stunted Bluegill population. We observed increased growth rates for Bluegill after age 5 that coincided with an apparent drop in survival. The low density of large Bluegill is most likely allowing for increased growth. It is unclear what is causing the low density of larger fish. The decrease in abundance observed between age 5 and 6 could be the result of one poor year class or an indication that harvest or predation increases at this stage. The average length at age 5 is 7.0 inches and at age 6 is 8.6 inches. Not only is this quite an increase in size over one year, it is occurring at a preferred size for Bluegill harvest. Past creel data has shown that angler pressure is high on Christiana, Juno, and Painter Lakes due to the proximity to Elkhart, IN. These lakes are also targeted heavily by ice anglers during the winter and these anglers primarily harvest Bluegill. Despite the low density, larger Bluegill are available for harvest and good growth rates should allow smaller fish to recruit to larger sizes when they are not harvested. The current population should be able to support harvest as mortality rates were not excessive at younger life stages.

Pumpkinseed, Black Crappie, and Yellow Perch populations provide acceptable fisheries on Christiana, Juno, and Painter Lakes. An abundance of snails and zebra mussels throughout the lakes serves as a valuable food source for Pumpkinseeds, and growth is rapid. Two master angler Pumpkinseed (10 and 9.75 inches) were submitted for Juno Lake in 2018. Yellow Perch were available in average numbers, but few large fish were present. Black Crappie growth was good and catch rates were similar to other regional lakes. There were good numbers of fish from 8 to 10 inches available that are large enough to harvest and support a fishery.

Spotted Gar were very abundant in Christiana, Juno and Painter Lakes. Within the state, Spotted Gar populations are limited to the southwestern region of the Lower Peninsula as it is the edge of the species range. Until 2018, Spotted Gar was listed as a species of Special Concern and there is discussion that it will be listed again in the near future. Harvest is restricted for this species because of the Special Concern status. DNR-Fisheries explored allowing harvest for Spotted Gar, but managers were uncomfortable allowing unlimited harvest (see Diana and Goniea DRAFT). Spotted Gar, along with Longnose Gar and Bowfin, are native to the waters of Michigan. These predators have evolved alongside the prey species present in Michigan lakes. They have been shown to be important for maintaining the balance in fisheries, specifically to prevent overcrowding and stunting of prey species such as Bluegill (Scarnecchia 1992). Research has shown that gar and Bowfin populations do not heavily compete with native predators and are important for ecosystem function and food web dynamics (Becker 1983, Scarnecchia 1992). Studies assessing diets of Longnose Gar and Bowfin have shown no predation of Walleye and Largemouth Bass, and prey consisted of crayfish, Brook Silversides, small Bluegill, Gizzard Shad and other shiners and minnows (Lagler and Hubbs 1940; Diana 1966; Bonham 1940; Tyler et al. 1994 Mundahl et al. 1998; VanMiddlesworth et al. 2016). Christiana, Juno, and Painter Lakes provide a unique fish population because of the abundance of Spotted Gar. Anglers are encouraged not to kill this fish needlessly, although they can provide good table fare. Specifically, gar backstraps can be high quality meat with some direction on cleaning

techniques. Spotted Gar may prey on some adult Bluegill and contribute to the low density. However, Spotted Gar do not get as large as other gar species and have been shown to prey more heavily on smaller Bluegill. This predation has yielded a population of young Bluegill that have average density and growth. Reducing the population of Spotted Gar could lead to stunting in Bluegill populations and is not advised.

Largemouth Bass were the most abundant sportfish predator captured during the 2017 survey. There was an abundance of fish in the 13.0-14.9 inch size range. Growth rates dropped once fish reached age 5 and 14 inches in length. A decrease in length-at-age for older fish could be a result of competition for resources and limited prey, or size selective harvest of older fish. Largemouth Bass up to age 9 were captured, but average length at age did not reach legal size (14 inches) until age 6. Despite reduced length-at age for fish age 6 and older, there are decent numbers of fish above the 14-inch size minimum size limit. This would suggest harvest is likely not causing poor survival to older age classes. Many of these fish are just above the 14-inch size limit but fish up to 18 inches were captured. Anglers report catches of larger Largemouth Bass and bass fishing tournaments are common on these lakes.

An average of 6.7 bass tournaments were registered annually for the Juno Lake Boating Access Site from 2016 through 2018 resulting in a ranking of 106 in terms of the number of tournaments on lakes statewide. This is an average of 0.012 tournaments per acre, which is above the statewide median (0.008 tournaments per acre) but below the 75th percentile (0.027 tournaments per acre). Only lakes with registered tournaments are included in the dataset. Less than 300 of the 11,000 inland lakes in Michigan had any bass tournaments during 2016-2018. Lakes in southern Michigan tend to have greater bass tournament pressure than Michigan lakes, and 15 of the top 20 lakes in terms of tournaments/acre during 2016-2018 were located in SLMMU. Largemouth Bass tournaments are generally catch and delayed release tournaments meaning that fish are captured and retained until a weigh-in but released alive after the tournament. It is rare for tournaments to impact bass fisheries (Allen et al 2004, Gwinn and Allen 2010, Diana et al 2016). The low mortality rate for Largemouth Bass in Christiana, Juno, and Painter Lakes coupled with the average tournament pressure, strongly suggests that tournament activity is not impacting the population.

Northern Pike and Walleye were captured in low numbers but were growing well. Coolwater habitat is limited, however these fish persist and are creating a low-density fishery. Wetland habitat for Northern Pike spawning is abundant and the population is supported by natural recruitment. Walleye are not reproducing in Christiana, Juno, and Painter Lakes as we only captured fish that correspond to the 2011 stocking. Although coolwater habitat is limited, we observed survival of these older fish. Walleye stocking could be considered to maintain a fishery but should be approached with caution. The predator to prey ratio in Christiana, Juno and Painter Lakes is approaching the upper limit of what is preferred primarily due to the abundance of Spotted Gar. Stocking additional predators could result in further reducing growth of Largemouth Bass and Northern Pike. There is no need for predator control for Bluegill as small fish densities are normal compared to other lakes. Because Christiana, Juno, and Painter Lakes are shallow and warm and the predator ratio is high, DNR-Fisheries does not recommend stocking at this time. SLMMU Walleye production is limited and adding additional lakes at this time is not possible. If the PJC Lake Association or other private organizations are interested in continuing to stock Walleye, a reduced stocking rate of 2 fish per acre (1,100 fish) on alternating years should not be exceeded.

Management Direction

DNR-Fisheries will continue to manage Christiana, Juno and Painter Lakes as a warmwater fishery. Bluegill, Black Crappie, Yellow Perch, Pumpkinseed and Largemouth Bass continue to be the primary game fish and natural reproduction is supporting these populations. The fisheries are of acceptable quality and there is no need for special regulations. Northern Pike will continue to produce a low-density fishery with good growth potential. We will continue to look for opportunities to conserve Spotted Gar populations through education and outreach as this native fish is unique to this part of the state of Michigan.

Christiana, Juno, and Painter Lakes have extensive areas of shoreline that are not developed resulting in a high abundance of woody habitat and adjacent wetlands. Conservation of these shorelines is recommended. DNR-Fisheries will continue to protect the riparian zone of these lakes through reviewing construction permits to limit impacts to the shoreline. DNR-Fisheries will continue to work with groups such as the Southwest Michigan Land Conservancy, PJC Lake Association, the Cass County Conservation District, and Southwest by Southwest CISMA to develop natural resource easements, implement best management practices, and to implement AIS detection and management to ensure these habitats remain intact. DNR-Fisheries will work with the PJC Lake Association and provide direction for implementing AIS management plans for these lakes.

DNR-Fisheries will not conduct Walleye stockings in Christiana, Juno, and Painter Lakes. If PJC Lake Association or other private groups are interested in continued stocking, the suggested stocking rate is 2 fish per acre on an alternate year basis. Stocking at greater densities could impact growth rates of Largemouth Bass and Northern Pike.

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Table 1: Fish species, total number and weight, mean length, and length range for fish captured in the 2017 survey of Christiana, Juno, and Painter Lakes.

Species	Total Number	Total Weight (lbs)	Mean Length	Length Range
Banded Killifish	18	0.08	2.2	1 - 2
Black Bullhead	1	0.21	7.5	7 - 7
Black Crappie	164	61.24	8.0	2 - 13
Blackchin Shiner	327	1.46	2.4	1 - 2
Blacknose Shiner	3	0.01	2.5	2 - 2
Blackstripe Topminnow	2	0.01	2.0	1 - 2
Bluegill	841	78.8	4.4	1 - 9
Bluntnose Minnow	70	0.42	2.4	1 - 3
Bowfin	4	14.1	21.0	18 - 26
Brook Silverside	16		3.5	3 - 3
Brown Bullhead	4	2.66	11.0	9 - 13
Central Mudminnow	1	0	1.5	1 - 1
Common Carp	7	7.11	12.4	9 - 14
Common Shiner	1	0	1.5	1 - 1
Golden Redhorse	9	14.88	15.7	6 - 19
Golden Shiner	23	1.81	6.0	3 - 8
Grass Pickerel	1	0.08	7.5	7 - 7
Hybrid Sunfish	25	9.46	7.8	6 - 9
Johnny Darter	1	0.01	2.5	2 - 2
Lake Chubsucker	9	3.05	7.4	3 - 10
Largemouth Bass	110	81.83	10.1	3 - 18
Longnose Gar	4	6.14	26.3	24 - 28
Mimic Shiner	5	0.01	2.1	1 - 2
Northern Pike	15	70.16	26.6	20 - 38
Pumpkinseed	206	60.79	7.0	3 - 8
Rock Bass	124	48.24	7.7	2 - 10
Sand Shiner	377	1.68	2.4	1 - 2
Smallmouth Bass	1	1.26	13.3	13 - 13
Spottail Shiner	3	0.04	3.5	3 - 3
Spotted Gar	145	179.85	21.3	10 - 28
Starhead Topminnow	12	0.04	1.8	1 - 2
Tadpole Madtom	1	0.01	2.5	2 - 2
Walleye	3	11.26	22.5	21 - 23
Warmouth	76	22.23	6.9	2 - 9
White Sucker	12	25.46	17.0	11 - 21
Yellow Bullhead	124	86.99	11.3	7 - 14
Yellow Perch	118	11.28	5.5	2 - 10
Grand Total	**2863**	**802.66**	**6.2**	**1 - 38**

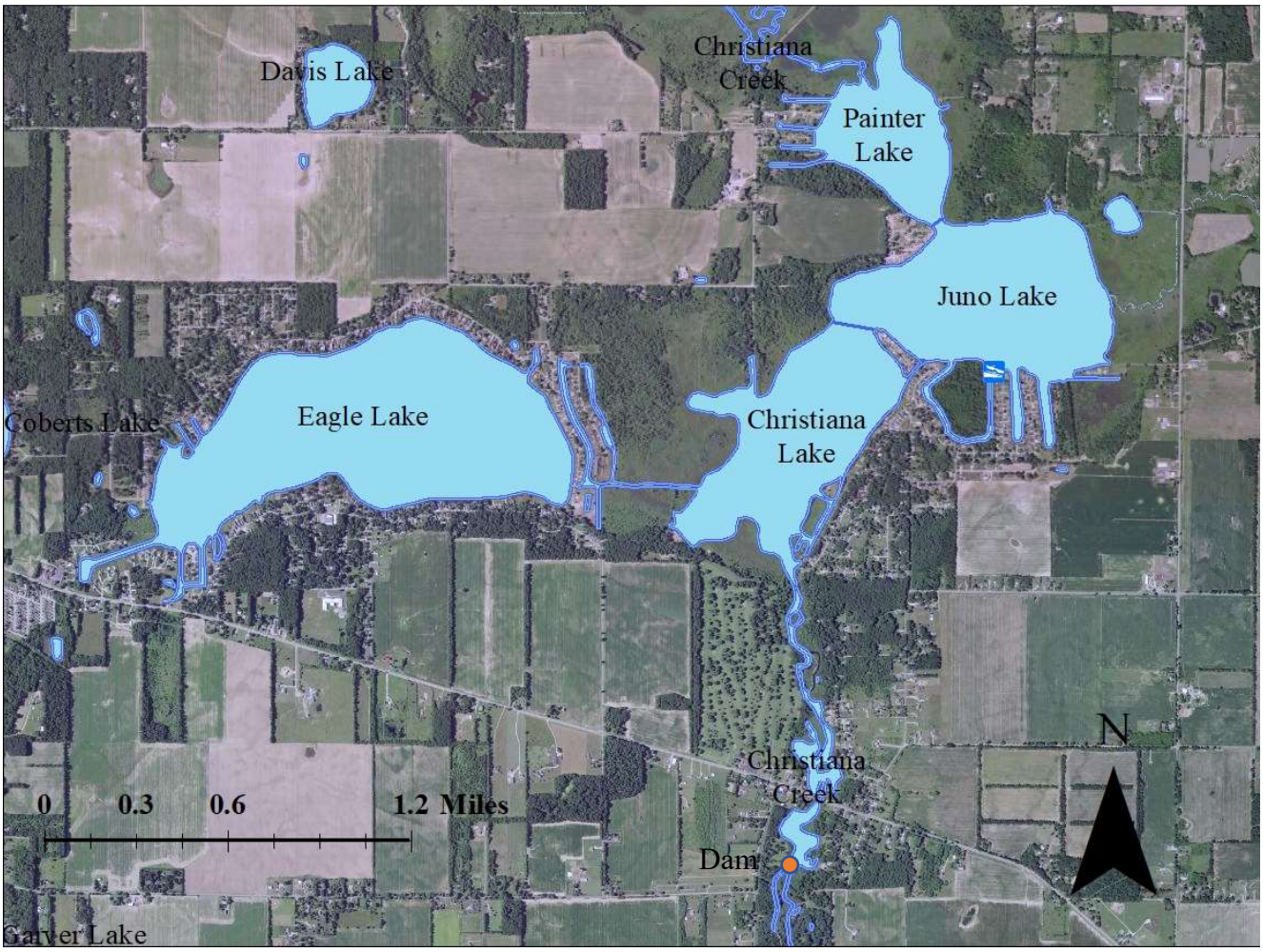

Figure 1. Map of Christiana, Juno, and Painter Lakes and the surrounding area.

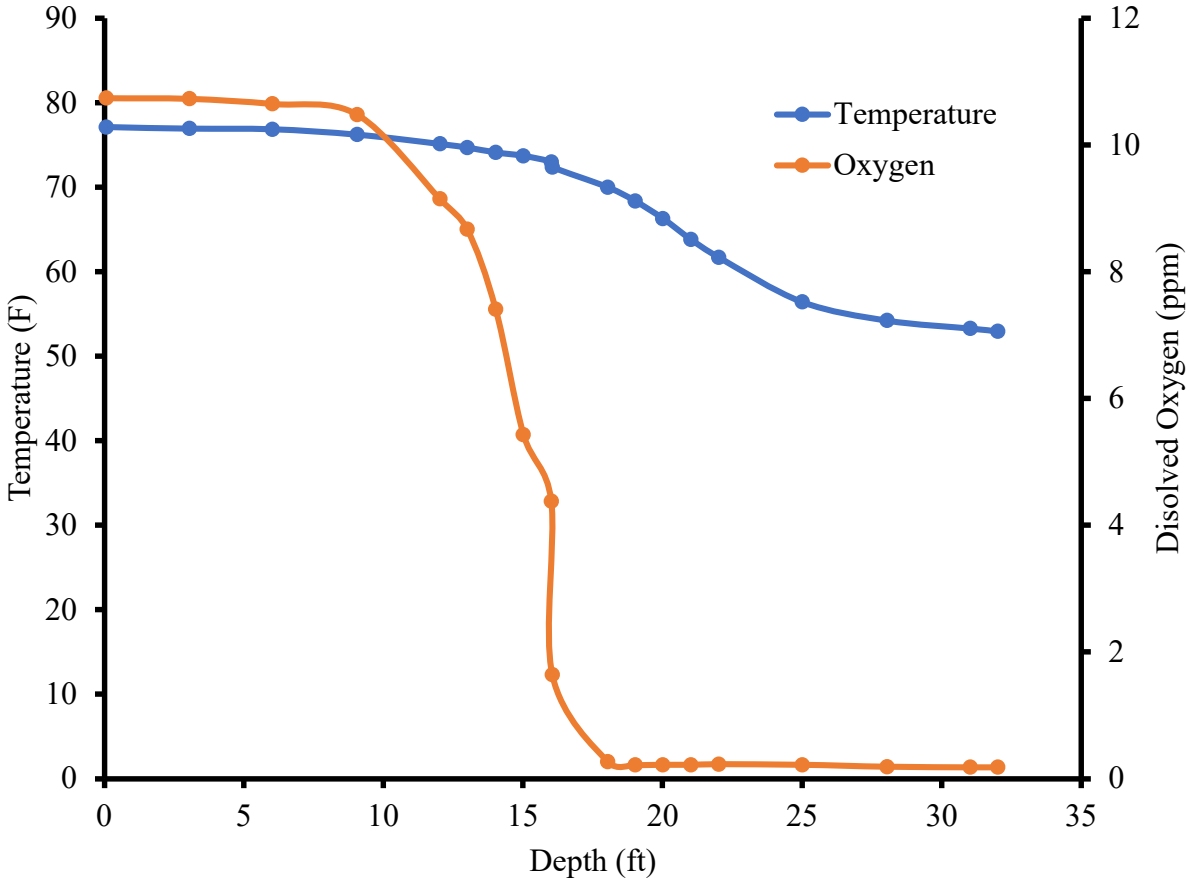

Figure 2. Temperature and dissolved oxygen profile for the deepest basin on Christiana Lake on August 15, 2017.

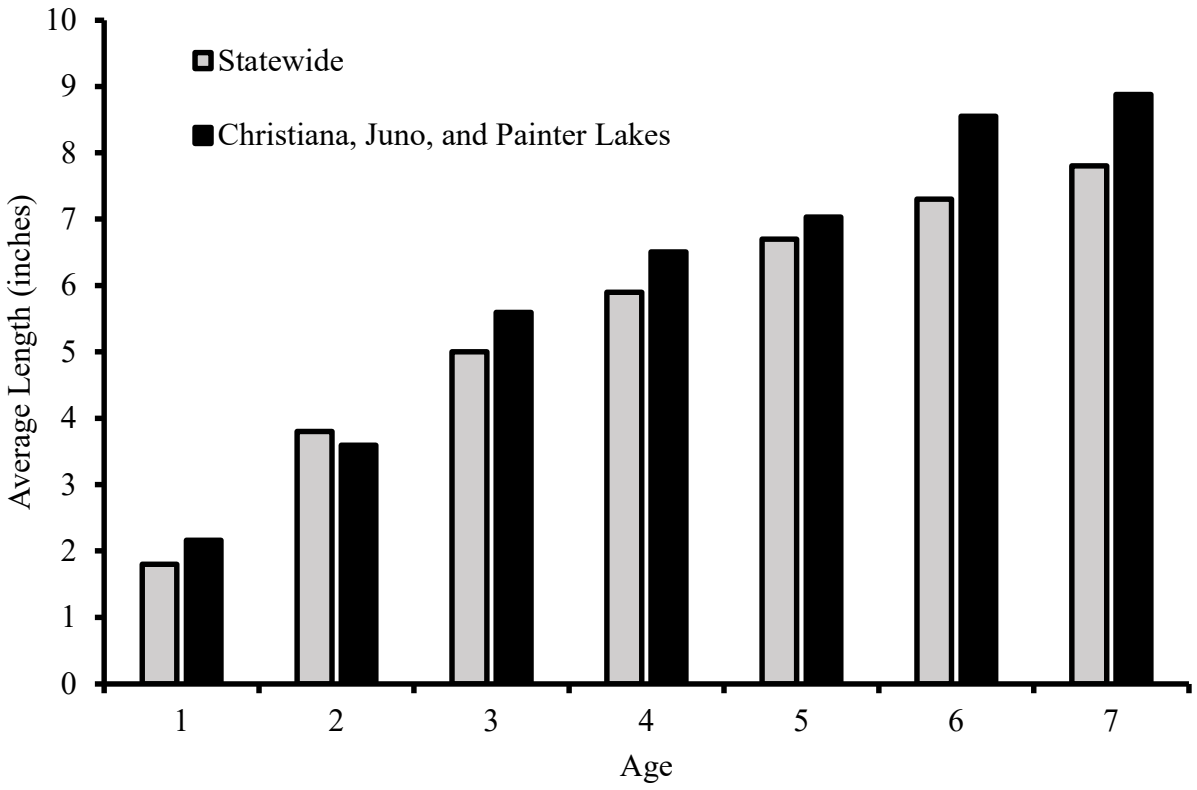

Figure 3. Length at age for Bluegill from fisheries surveys conducted on Christiana, Juno, and Painter Lakes in 2017 compared to the statewide average.

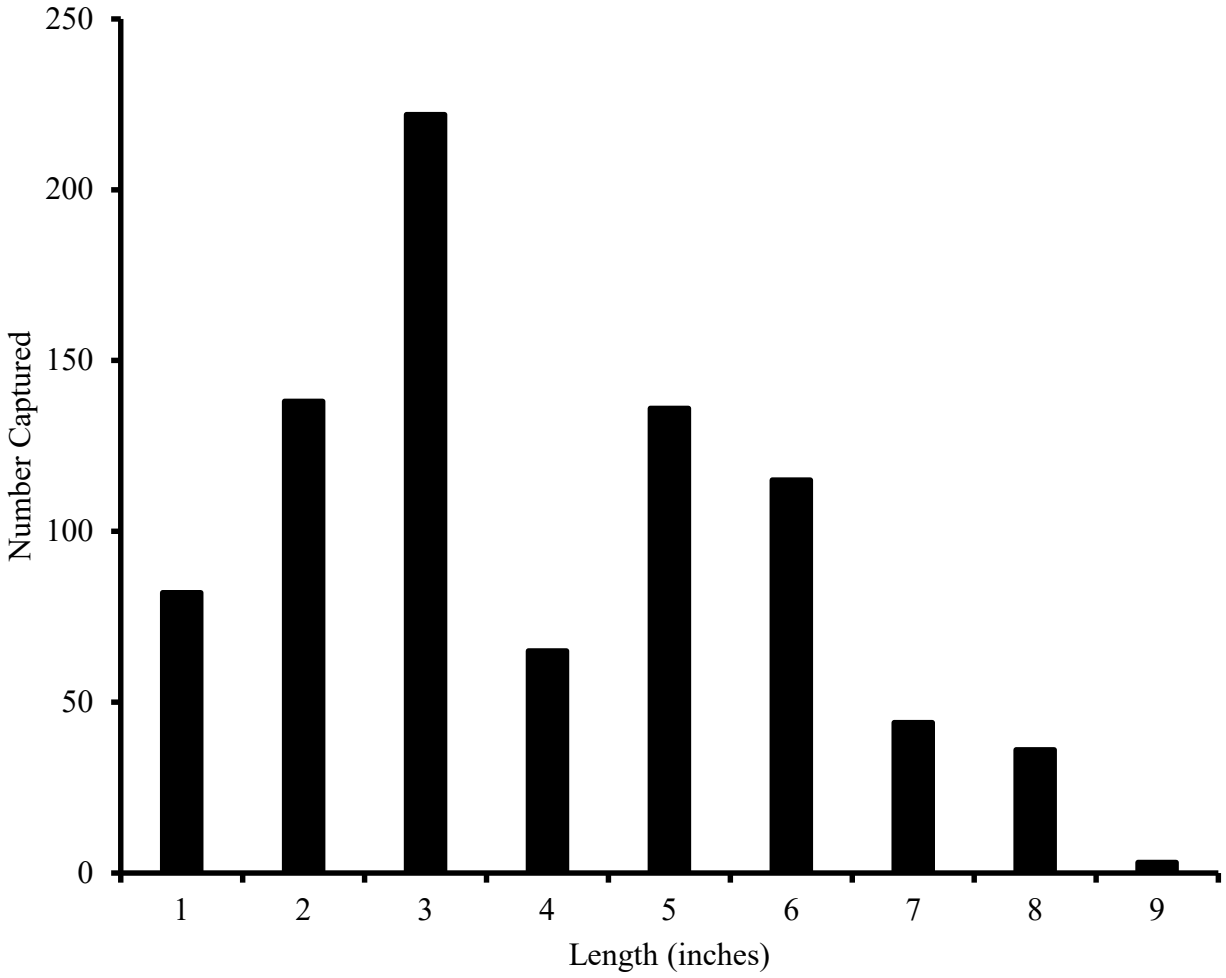

Figure 4. Length frequency of Bluegill captured across all gears in Christiana, Juno and Painter Lakes in the 2017 survey. Total length bins are denoted by the minimum size of each one-inch bin (e.g. 3 represents 3.0 to 3.9-inch fish).

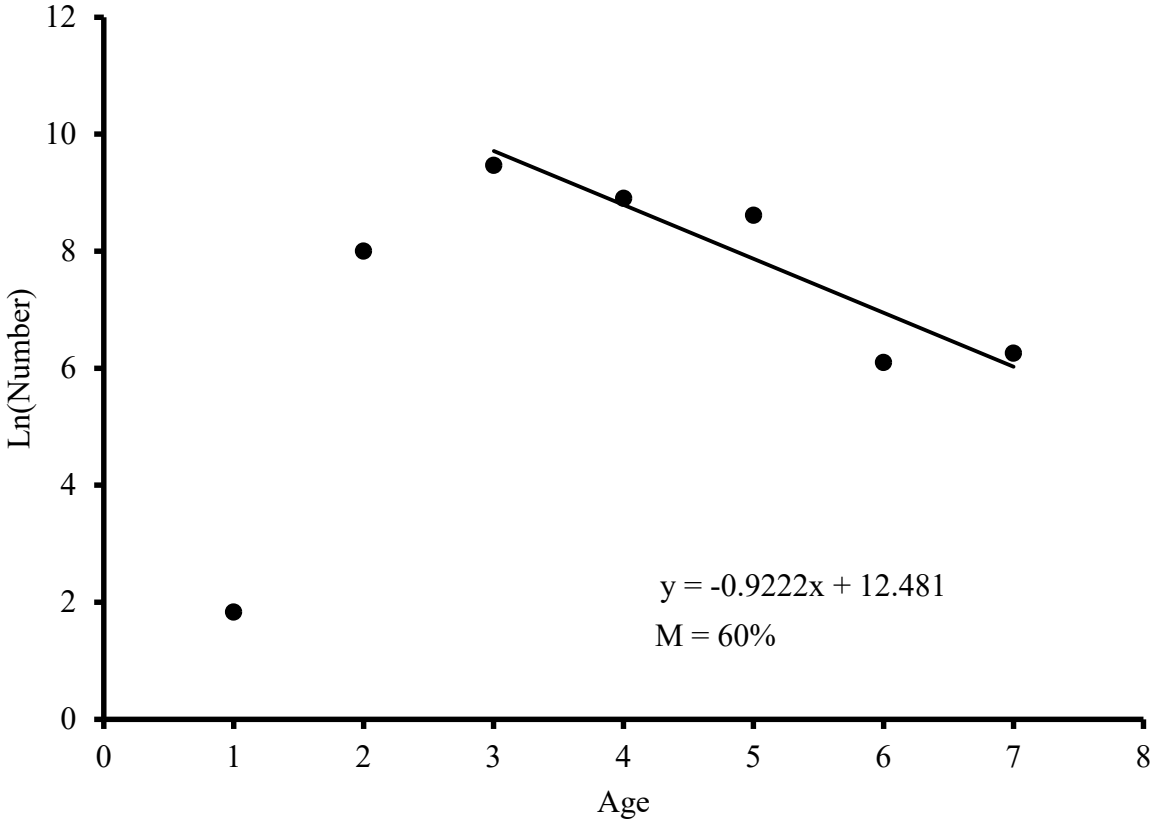

Figure 5. Annual mortality (M) for Bluegill in Christiana, Juno, and Painter Lakes estimated from large mesh fyke net surveys conducted in 2017. The y-axis represents the natural log of the total number of fish captured for each age.

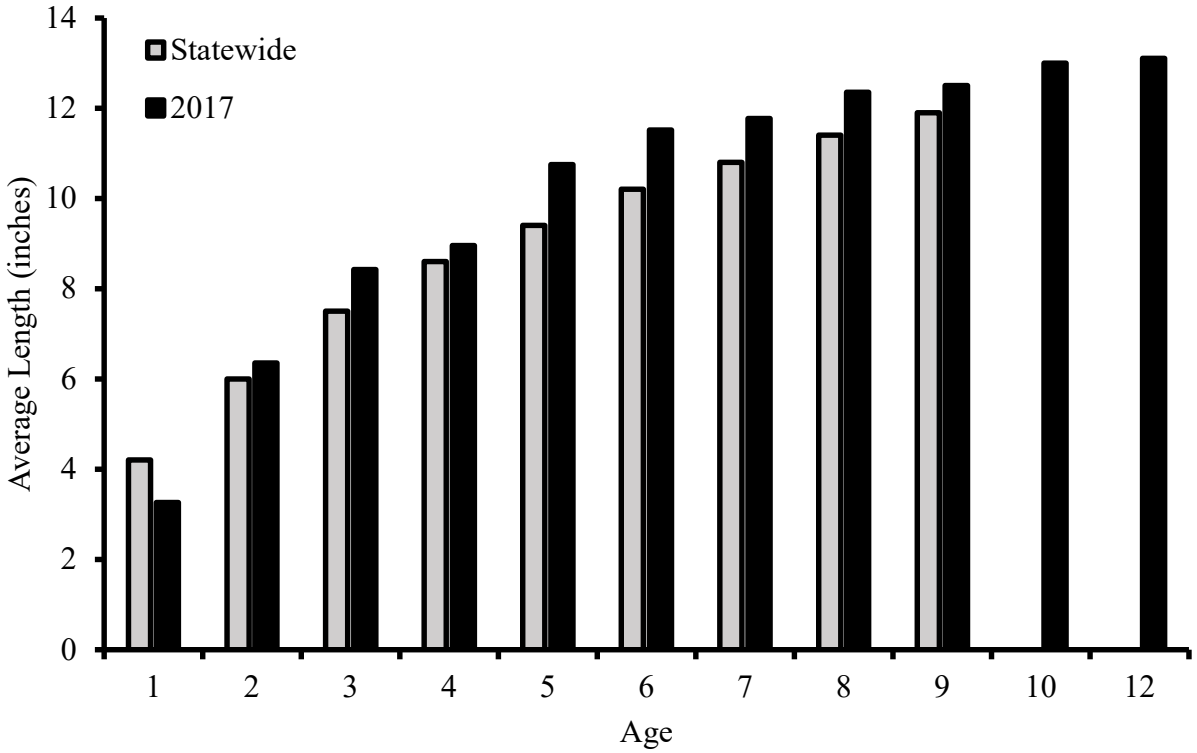

Figure 6. Length at age for Black Crappie from fisheries surveys conducted on Christiana, Juno, and Painter Lakes in 2017 compared to the statewide average.

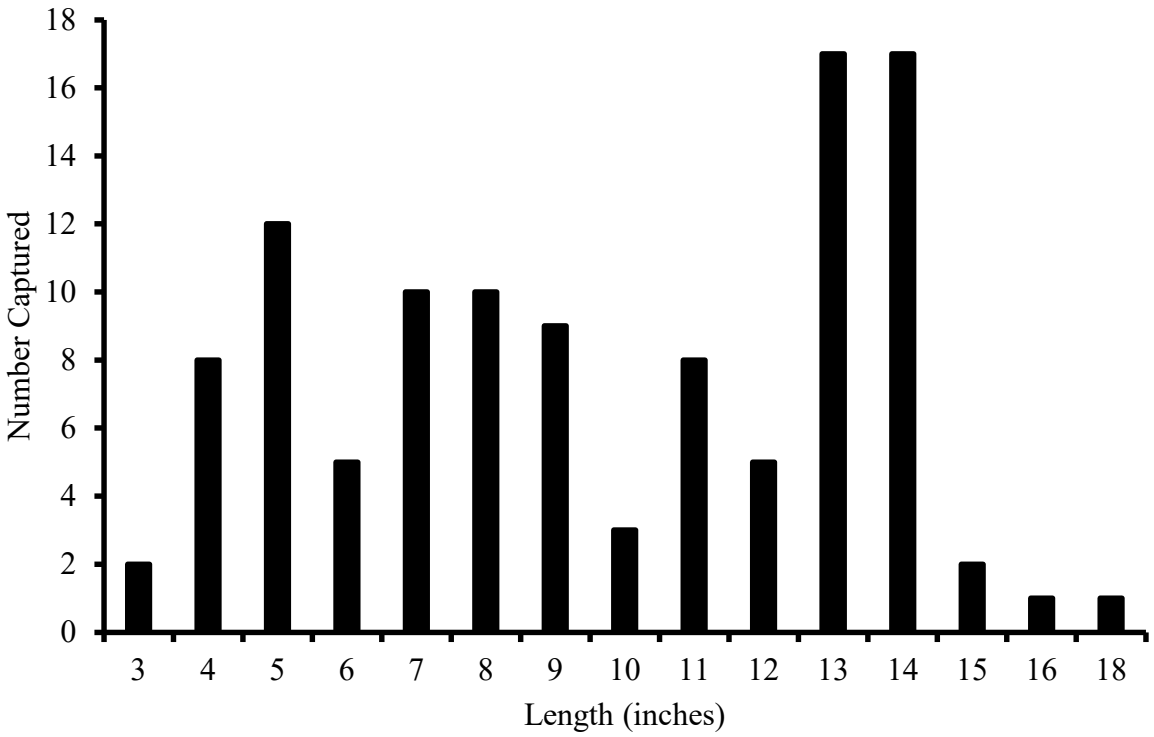

Figure 7. Length frequency of Largemouth Bass captured in surveys conducted on Christiana, Juno, and Painter Lakes in 2017 surveys. Total length bins are denoted by the minimum size of each one-inch bin (e.g. 3 represents 3.0 to 3.9-inch fish).

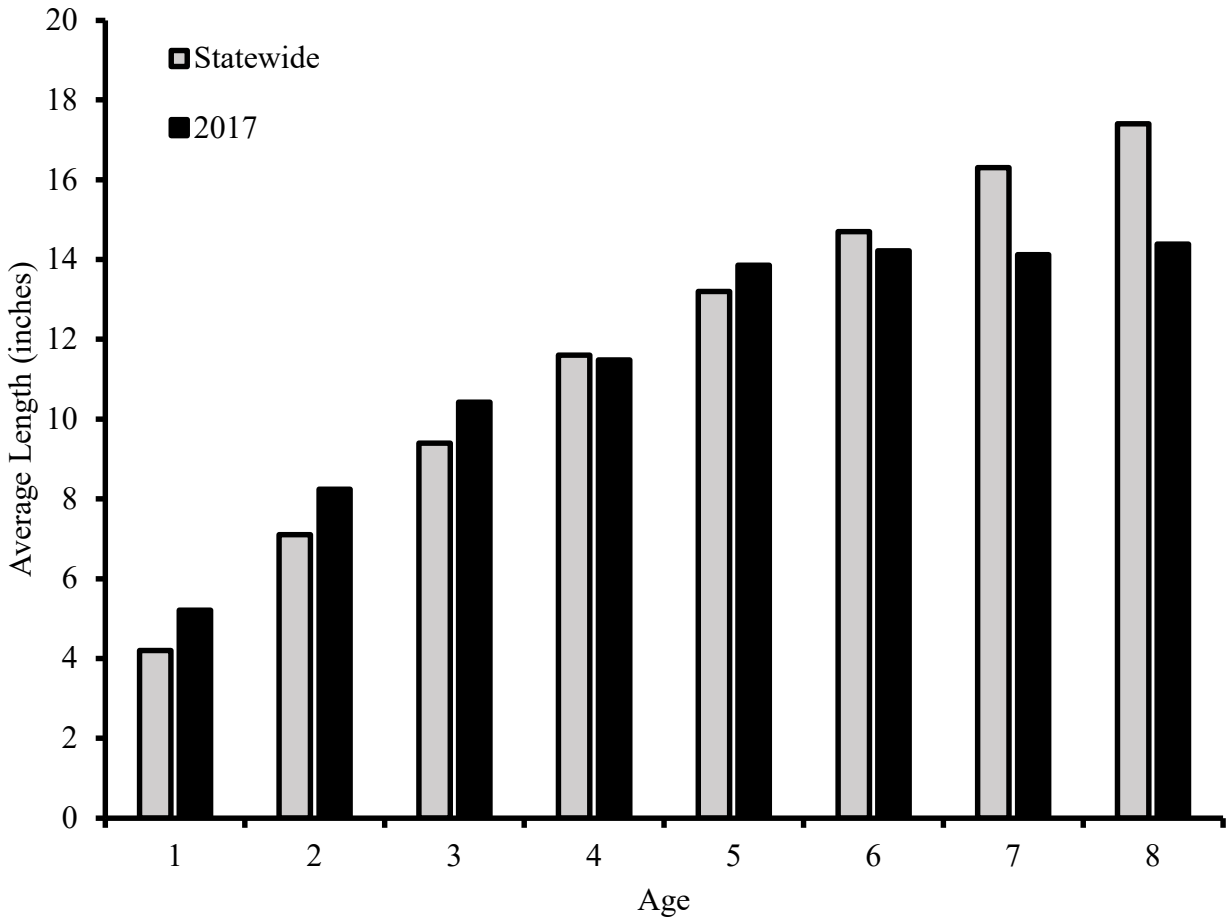

Figure 8. Mean length for each age class of Largemouth Bass captured in surveys conducted on Christiana, Juno, and Painter Lake in 2017 compared to statewide averages.