

Tuscarora Lake Fisheries Survey 2021

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Abstract

A fisheries survey of Tuscarora Lake in Madison County was conducted in 2021, consisting of two sampling efforts, a nighttime electrofishing sample in May and a gill net sample in October. The survey was conducted to evaluate age, growth, condition, and relative abundance of the reservoir's sportfish community, and to determine if fingerling walleye stocked by the Tuscarora Lake Association (TLA) were recruiting to the fishery. Overall, 458 fish were caught, representing 13 species. Smallmouth bass were the most numerous species with 85 caught (19% of catch) followed by largemouth bass (n=81, 18% of catch). Other gamefish caught were chain pickerel (n=23, 5% of catch), walleye (n=7, 2% of catch), and black crappie (n=11, 2% of catch). Overall, with a few exceptions, by New York standards the sportfish community had average growth rates, were in good condition and found in moderate to high abundance. Though very few walleye were collected it does appear that the walleye stocking is contributing to the fishery. Recommended management actions based on these surveys are to continue with statewide fishing regulations and suggest TLA continue with their walleye stocking if desired.

Introduction

Tuscarora Lake, also called Erieville Reservoir (ONT-66-11-P26-37-47-P153A), is a 307-acre waterbody located in the Town of Nelson, Madison County. Like most of the area waters it was created to supply water for the Erie Canal. It has a maximum depth of 42 ft and a mean depth of 14 ft and is characterized as mesotrophic with moderate productivity, based on water clarity, algae levels (chlorophyll a), and phosphorous levels (Citizens Statewide Lake Monitoring Program [CSLAP] Tuscarora Lake 2018) The current sport fishery is comprised of smallmouth bass (*Micropterus dolomieu*), largemouth bass (*Micropterus salmoides*), walleye (*Sander vitreus*), chain pickerel (*Esox niger*), black crappie (*Pomoxis nigromaculatus*), and a variety of panfish species such as bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), rock bass (*Ambloplites rupestris*), and yellow perch (*Perca flavescens*). Statewide fishing regulations apply for all species on Tuscarora Lake.

There is limited open water access to the lake provided by a few "unofficial" shore fishing locations. Anglers also launch kayaks, canoes, and small car-top boats at those sites; no formal trailered launch exists. Tuscarora Lake is a popular ice fishing location as it's typically one of the first waters in the area to have safe ice. Though no formal angler survey has been done on the lake, this early ice fishing pressure can be quite intensive at times. It is especially noticeable on years when it has fishable ice and few other area waters do, especially Oneida Lake (personnel observation). Tuscarora Lake has been stocked almost annually since 2005 by the Tuscarora Lake Association (TLA) with fall fingerling walleyes (Appendix 1). They hold a large ice fishing derby in February to help raise money for the stocking effort and often have 200+ entrants (personnel communication with member of lake association).

The survey was conducted to provide information on the current status of the sportfish community as the last state survey was conducted in 1935 by the New York State Conservation Department, predecessor to the New York State Department of

Environmental Conservation (NYSDEC). Objectives of this survey were to evaluate age, growth, condition, and relative abundance of the reservoir's sportfish community, and to determine if walleye stocked by the TLA were recruiting to the fishery.

Methods

Water Chemistry

Surface water temperature, air temperature, pH, Secchi depth, dissolved oxygen (DO) and conductivity were recorded on May 24 and 25, 2021, prior to electrofishing. Those same measurements, minus Secchi depth, along with DO and water temperature taken at five-foot intervals to 20 ft were taken during the October netting survey. A Professional Plus model YSI meter was used for all water chemistry.

Electrofishing

Tuscarora Lake was boat electrofished on the nights of May 24 and 25th following protocol outlined in the new NYSDEC Bass and Sunfish Sampling Manual (Brooking et al. 2018). Ten sites (Figure 1) covering almost the entire shoreline was fished for a total of 3.35 hours of "on-time." The boat used was our recently reconditioned SR-18 with a MLES Infinity 307 box and two 6-dropper umbrella arrays extending 6 ft in front of the boat as anodes. Direct current half-wave (60 pulses per second) at 6 amps and 250 volts was used. Sampling was conducted along the shoreline in 1 to 5 ft of water with a speed of approximately 1-1.5 mph. The crew consisted of a driver and two netters. Five half-hour gamefish only runs were conducted with walleye, largemouth bass, smallmouth bass, chain pickerel and black crappie as the targets. Five 10 minute all-fish runs were conducted; attempts (within reason) were made to collect every fish that was shocked.

Collected fish were identified to species and lengths (mm) and weights (gm) were recorded. Scale samples were collected for age determination from five individual fish per 10 mm size increments of largemouth bass, smallmouth bass, walleye, bluegill, pumpkinseed, black crappie, and yellow perch that were >100 mm. No scales were collected from chain pickerel or rock bass. Age structure of the unaged sample of fish was estimated based on the frequency of known age fish in each 10 mm size increment.

Gill netting

Four DEC standard inland gill nets were set over night on October 4 (Figure 1). The standard gill net is 6 ft deep with 25 ft panels of 1.5, 2.0, 2.5, 3.0, 3.5 and 4.0 in stretch mesh monofilament netting. All four of the nets were set on the bottom perpendicular to shore starting at a nearshore depth of 12 to 14 ft and the outer end of the nets were 20 to 25 ft. Gill nets were fished for 18.75 hours.

Collected fish were identified to species and lengths (mm) and weights (gm) were recorded. Scale samples were collected for age determination from pumpkinseed, bluegill, black crappie, largemouth bass, yellow perch, and walleye >100 mm. Otoliths were also collected from the four walleye to aid in age determination. Age structure of the unaged sample of fish was estimated based on the frequency of known age fish in each 10 mm size increment.

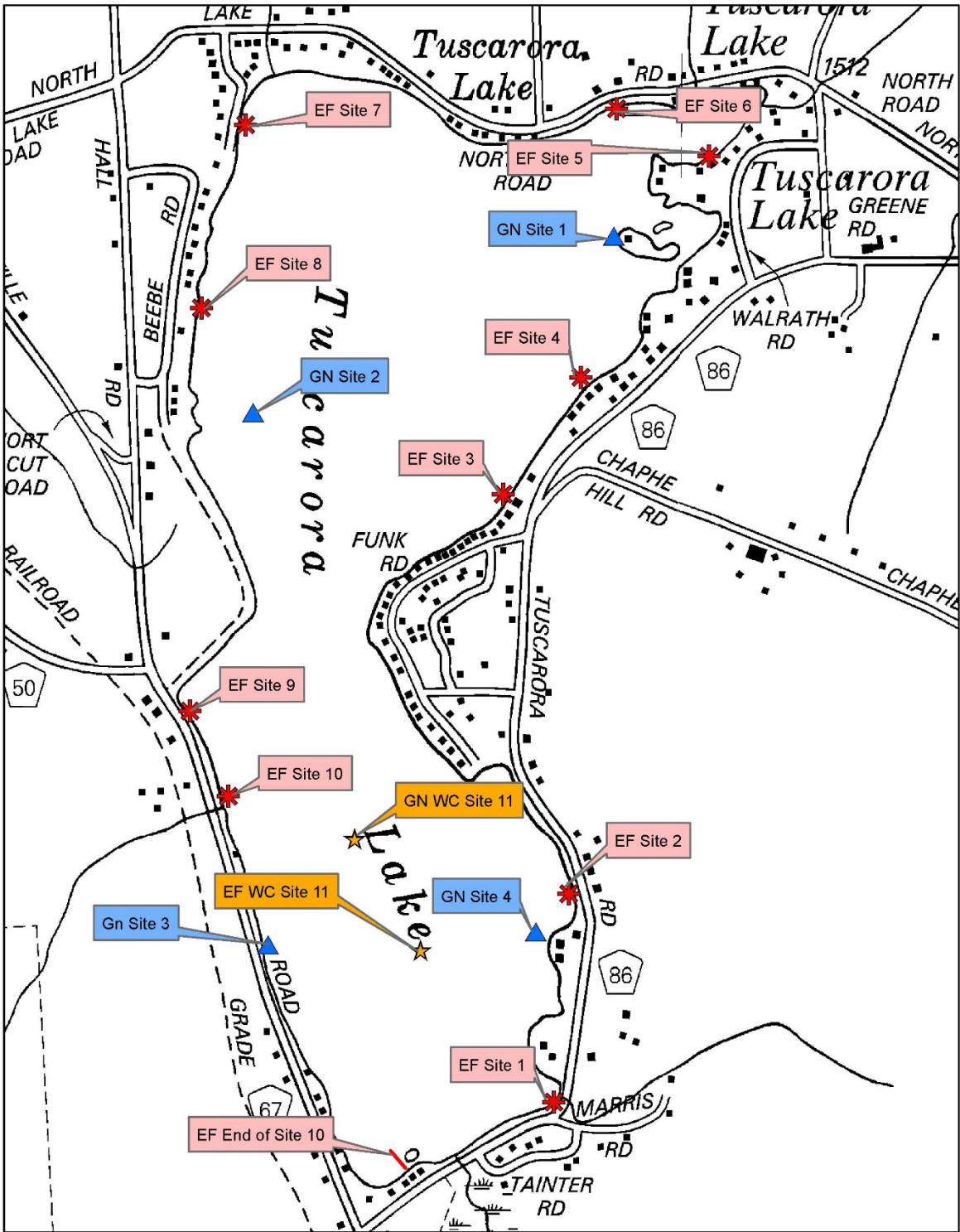


Figure 1. Site locations for gill net (GN), water chemistry (WC), and the starting point for electrofishing (EF) runs on Tuscarora Lake during May and October 2021 sampling efforts.

Fish Indices

Indices used to assess the quality of the fish population in Tuscarora Lake included electrofishing and gill net catch rates, growth rates, proportional stock density (PSD), relative stock density (RSD), and relative weight (Wr). PSD is expressed as the percentage of the stock that is of “quality” size; and RSD is expressed as the percentage of the stock that is of “preferred” size (Anderson 1980). It should be noted that captures from both gears were combined to calculate PSD and RSD and that these indices may have been influenced by the different size selectivity of these gears. Lengths used for stock, quality, preferred, memorable, and trophy sizes for all species are from Gablehouse (1984) and can be found in Appendix 2. Wr is an index of condition that compares the actual weight with a standard weight for fish of the same length (Anderson 1980). Abundance estimates for largemouth and smallmouth bass were derived from regression equations based on spring nighttime electrofishing catch rates from Green (1989). Abundance estimates for walleye and yellow perch were derived from electrofishing and gill net catch rates, and mean length at age-4 (Forney et al. 1994).

Results

Water Chemistry

During the May 24 and 25th electrofishing survey the surface water temperature was 65 and 66° F, respectively. During the gill net survey on October 4th the surface water temperature was 63° F and at 20 feet it was 62° F (Table 1).

Table 1. Water chemistry data from May and October 2021 for Tuscarora Lake, Madison County.

Date	Depth (Feet)	Water Temp. (Fahrenheit)	DO (ppm)	pH	Conductivity (umho/cm ³)	Secchi Depth (Feet)
5/24/2021	0	65.7	10	7.5	182	16
5/25/2021	0	65.3	10.8	7.7	181	14
10/4/2021	0	62.8	9.6	8.2	164	
	5	62.7	8.8			
	10	62.7	9			
	15	62.7	8.9			
	20	62.4	7.5			

Species Collected

Overall, 458 fish were caught, representing 15 species (Table 2). Smallmouth bass were the most numerous with 85 caught (19% of catch). The next most numerous species was largemouth bass (n=81, 18% of catch), followed by yellow perch (n= 67, 15% of catch). Other gamefish caught were walleye (n=7, 2% of catch), black crappie (n=11, 2% of catch), and chain pickerel (n=23, 5% of catch).

Table 2. Species caught by electrofishing (EF), and gill net (GN) during May and October 2021 on Tuscarora Lake, Madison County.

Species	Scientific Name	EF	GN	Total	Freq
Chain Pickerel	<i>Esox niger</i>	17	6	23	5%
Golden Shiner	<i>Notemigonus crysoleucas</i>	3	4	7	2%
Emerald Shiner	<i>Notropis atherinoides</i>	2		2	0%
Rudd	<i>Scardinius erythrophthalmus</i>		1	1	0%
White Sucker	<i>Catostomus commersonii</i>		3	3	1%
Yellow Bullhead	<i>Ameiurus natalis</i>	1	3	4	1%
Brown Bullhead	<i>Ameiurus nebulosus</i>	16		16	3%
Rock Bass	<i>Ambloplites rupestris</i>	28		28	6%
Pumpkinseed	<i>Lepomis gibbosus</i>	55	6	61	13%
Bluegill	<i>Lepomis macrochirus</i>	60	2	62	14%
Smallmouth Bass	<i>Micropterus dolomieu</i>	85		85	19%
Largemouth Bass	<i>Micropterus salmoides</i>	75	6	81	18%
Black Crappie	<i>Pomoxis nigromaculatus</i>	1	10	11	2%
Yellow Perch	<i>Perca flavescens</i>	23	44	67	15%
Walleye	<i>Sander vitreus</i>	3	4	7	2%
Total		369	89	458	

Gamefish

Smallmouth Bass

A total of 85 smallmouth bass were caught, all by electrofishing. The electrofishing catch per unit effort (CPUE) by run ranged from 0 to 54 fish per hour (fish/h) for all size smallmouths with an average of 25.4/h (4 standard error, SE; Table 3). The average CPUE for quality (≥ 11 in.) bass was 20.0/h (SE=3). The CPUE for bass ≥ 10 in. was 20.9/h (SE=3). Using Green's (1989) formula and these electrofishing CPUE results yields a first order density estimate of 3.3 smallmouth bass ≥ 10 in. per acre. Lengths ranged from 6.8 to 16.3 in., with 13-inch smallmouth bass being most frequent (Figure 2). The resulting PSD was 80 and the RSD₁₄ (smallmouth bass ≥ 14 in.) was 30 (Table 4). No smallmouth bass were of memorable (≥ 17 in.) or trophy lengths (≥ 20 in.) (Table 4). The smallmouth bass average W_r was 86 (SE=1; Table 5). Smallmouth had average growth rates by New York State (NYS) standards (Figure 3). Smallmouth bass ages ranged from 2 to 9, with age-5 being the most frequent age class collected (Figure 4).

Largemouth Bass

A total of 81 largemouth bass were caught with the two gears. Electrofishing accounted for the majority with 75 fish. The electrofishing CPUE by run ranged from 6 to 53 fish/h, with an average of 22.4/h (SE=5) for all size largemouth bass (Table 3). The average CPUE for quality (≥ 12 in.) largemouth bass was 13.1/h (SE=3). The CPUE for bass ≥ 10 in. was 16.4/h (SE=4), which according to Green (1989) yields a first order

density estimate of 7.8 largemouth bass ≥ 10 per acre. Six largemouth bass were caught in gill nets for an average CPUE of 1.5/net night (SE=1). Largemouth bass lengths ranged from 6.3 to 17.5 in., with 13-inch bass being most frequent (Figure 5). The resulting PSD for largemouth bass was 75 and the RSD_{15} was 9 (Table 4). The largemouth bass average W_r was 105 (SE=1; Table 5). Largemouth bass were slightly slow growing, by NYS standards, with the average age to reach legal size (≥ 12 in.) occurring at age-5; NYS mean is age-4 (Brooking et al. 2018; Figure 6). Age-6 largemouth bass were the most frequent age class collected (Figure 7).

Table 3. Spring night-time boat electrofishing catch from Tuscarora Lake, Madison County, on May 25-26, 2021. CPUE values are mean catch rates by run, with standard error in parenthesis.

Species	Total Catch	Time (h)	Mean CPUE (fish/h)			
			All Sizes	\geq Stock	\geq Quality	\geq Preferred
Chain Pickerel	17	3.35	5.1 (1)	4.2 (1)	2.7 (1)	0.3 (0)
Golden Shiner	3	0.85	3.5 (4)	-	-	-
Emerald Shiner	2	0.85	2.4 (0)	-	-	-
Yellow Bullhead	1	0.85	1.2 (1)	1.2 (1)	1.2 (1)	1.2 (1)
Brown Bullhead	16	0.85	18.8 (15)	18.8 (15)	18.8 (15)	18.8 (15)
Rock Bass	28	0.85	32.9 (7)	28.2 (6)	12.9 (3)	2.4 (2)
Pumpkinseed	55	0.85	64.7 (15)	57.6 (12)	36.5 (9)	10.6 (5)
Bluegill	60	0.85	70.6 (28)	62.4 (29)	15.3 (5)	2.4 (1)
Smallmouth Bass	85	3.35	25.4 (4)	25.1 (4)	20.0 (3)	7.5 (1)
Largemouth Bass	75	3.35	22.4 (5)	17.6 (4)	13.1 (3)	1.2 (1)
Black Crappie	1	3.35	0.3 (0)	0.3 (0)	0.3 (0)	-
Yellow Perch	23	0.85	27.1 (12)	22.4 (12)	16.5 (10)	14.1 (9)
Walleye	3	3.35	0.9 (0)	0.9 (0)	0.3 (0)	-
Total	369					

Table 4. Number of fish caught of stock, quality, preferred (Pref), memorable (Mem), and trophy lengths and resulting PSD and RSDp in May and October 2021 on Tuscarora Lake, Madison County.

Species	Total	Stock	Quality	Pref	Mem	Trophy	PSD	RSDp
Chain Pickerel	22	19	13	1	0	0	68	5
White Sucker	3	3	3	3	3	0	100	100
Yellow Bullhead	4	4	4	3	1	0	100	75
Brown Bullhead	16	16	16	16	0	0	100	100
Rock Bass	28	24	11	2	0	0	46	8
Pumpkinseed	61	55	36	11	0	0	65	20
Bluegill	62	55	15	3	0	0	27	5
Smallmouth Bass	85	84	67	25	0	0	80	30
Largemouth Bass	81	65	49	6	0	0	75	9
Black Crappie	11	11	4	1	1	0	36	9
Yellow Perch	67	63	52	34	3	0	83	54
Walleye	7	7	4	0	0	0	57	0

Table 5. Mean relative weight (Wr) by size categories for fish sampled on Tuscarora Lake, Madison County, in May and October 2021. N is number of fish in the size category and standard error is in parenthesis. Pref=preferred and Mem=memorable.

Species	N	Wr									
		All	≥Stock<Quality		≥Quality<Pref		≥Pref<Mem		≥Mem<Trophy		
		N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Chain Pickerel	17	93 (2)	4	97 (25)	12	93 (3)	1	76	0	-	
White Sucker	3	99 (1)	0	-	0	-	0	-	3	99 (1)	
Yellow Bullhead	3	100 (5)	0	-	1	94	2	102 (7)	0	-	
Rock Bass	24	98 (2)	13	97 (3)	9	102 (3)	2	96 (7)	0	-	
Pumpkinseed	31	103 (9)	12	101 (15)	14	105 (15)	5	106 (24)	0	-	
Bluegill	53	109 (2)	38	109 (5)	12	109 (2)	3	109 (4)	0	-	
Smallmouth Bass	85	86 (1)	17	94 (2)	42	86 (1)	25	83 (2)	0	-	
Largemouth Bass	81	105 (1)	16	112 (2)	43	101 (1)	6	99 (8)	0	-	
Black Crappie	11	102 (2)	7	100 (1)	3	105 (9)	0	-	1	108	
Yellow Perch	40	90 (3)	5	81 (18)	15	94 (10)	19	90 (10)	1	76 (43)	
Walleye	7	87 (3)	3	94 (2)	4	82 (2)	0	-	0		

Walleye

A total of seven walleye were caught. Three were caught by boat electrofishing with an average CPUE of 1/h (SE=1; Table 3). The four caught by gill net yielded an average CPUE of 1/net night (SE=1). Lengths ranged from 11.2 to 19.2 in., with 16-inch

walleye being most frequent (Figure 8). The average walleye W_r was 87 (SE=3; Table 5). As only a few age classes were caught, mean length at age was spotty. Because of that, back calculated length at age was used to help estimate mean length at age. Walleye were slightly slow growing by NYS standards, and on average were reaching legal size (≥ 15 in) between age-3 and age-4 (Figure 9). The NYS average is 15 in. at age-3 (Forney et al. 1994). Only three age classes were represented, 2, 3 and 6 (Figure 10).

Scales were taken from all walleye and to better determine age, otoliths were also collected from the four walleye that were caught with gill nets. These otolith ages were compared to the ages derived from reading scales for those same fish and results can be seen in Table 6.

Table 6. Tuscarora Lake walleye age comparison between scale and otolith aging.

Length (in)	Age (years)		
	Scale	Otolith	Difference
16.9	6	6	0
17.3	5	6	1
14.8	4	2	2
19.4	6	3	3

Chain Pickerel

A total of 22 chain pickerel were caught, 17 by electrofishing and five from gill nets. The electrofishing CPUE for all size chain pickerel ranged from 0 to 10/h with an average of 5.1/h (SE=1; Table 3). The average gill net CPUE was 1.5/net night (SE=0). Lengths ranged from 6.3 to 21.6 in., with 18-inch chain pickerel being most frequent (Figure 11). The resulting PSD was 68 and the RSD_{20} was five (Table 4). The chain pickerel average W_r was 93 (SE=2; Table 5).

Black Crappie

A total of 11 black crappie were caught, with gill-netting accounting for ten fish yielding an average CPUE of 2.5/net-night (SE = 1). The electrofishing CPUE for the one black crappie caught was 0.3/h (SE=0; Table 3). Black crappie lengths ranged from 6.0 to 11.9 in. with fish in the 6.0-inch range most common (Figure 12). Black crappie PSD was 36 and RSD_{10} was 9 (Table 4). Black crappie had an average W_r of 102 (SE = 2; Table 5). Except for age 2 and 3 fish, black crappie had average growth rates by NYS standards (Figure 13). Age-2 black crappie were most frequent age class collected (Figure 14).

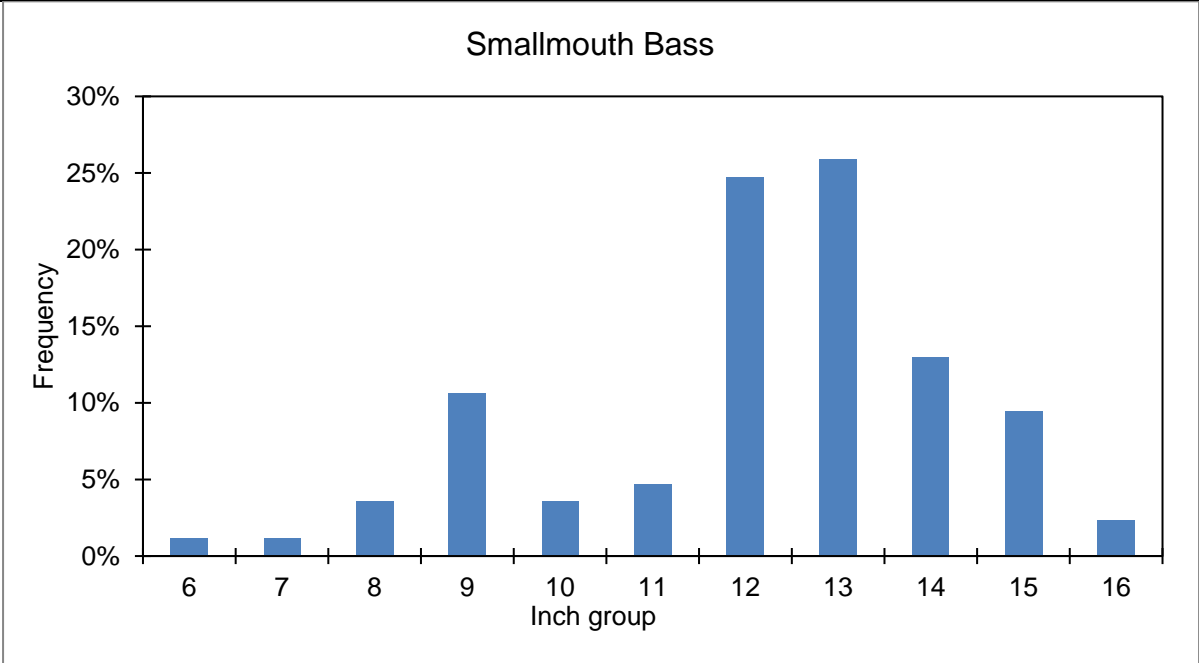


Figure 2. Length frequency distribution of smallmouth bass caught in Tuscarora Lake in May and October 2021.

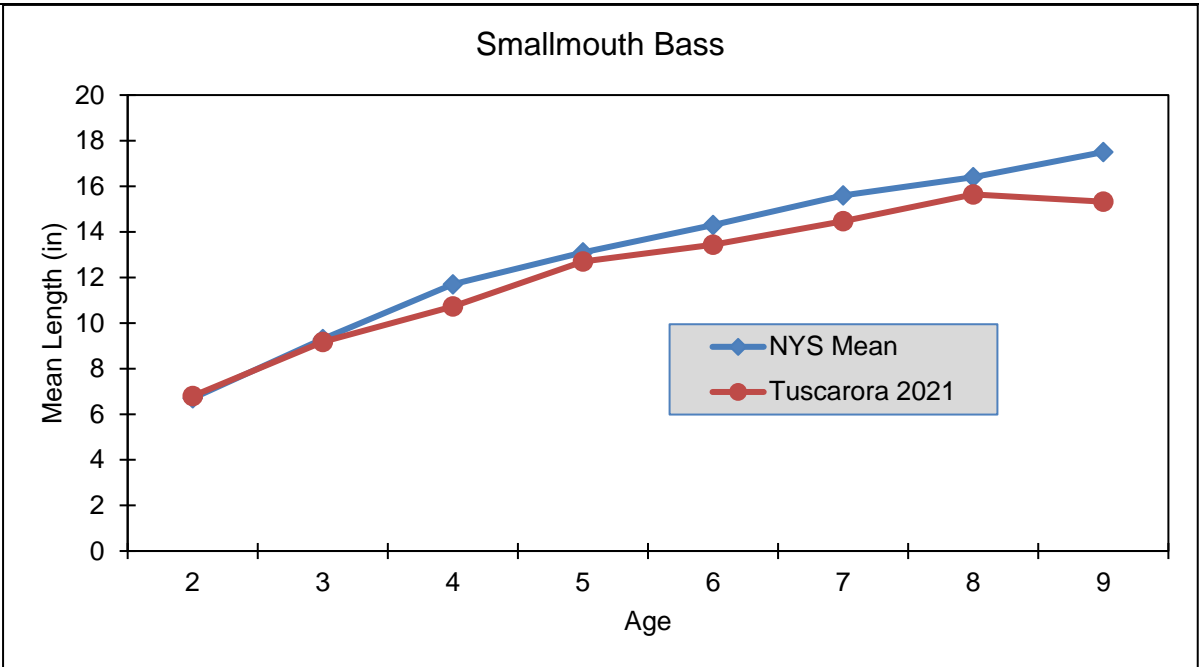


Figure 3. Observed mean length at age of smallmouth bass caught in Tuscarora Lake in May and October 2021 and the NYS mean (Brooking et al. 2018).

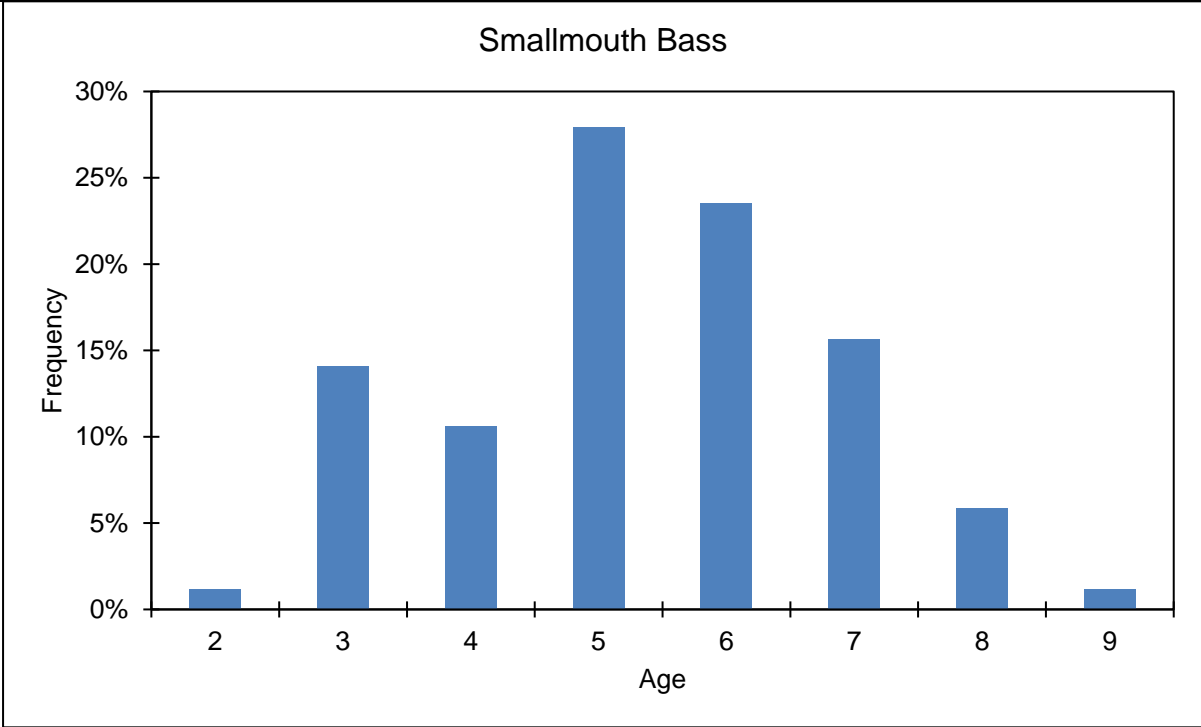


Figure 4. Age frequency distribution of smallmouth bass caught Tuscarora Lake in May and October 2021.

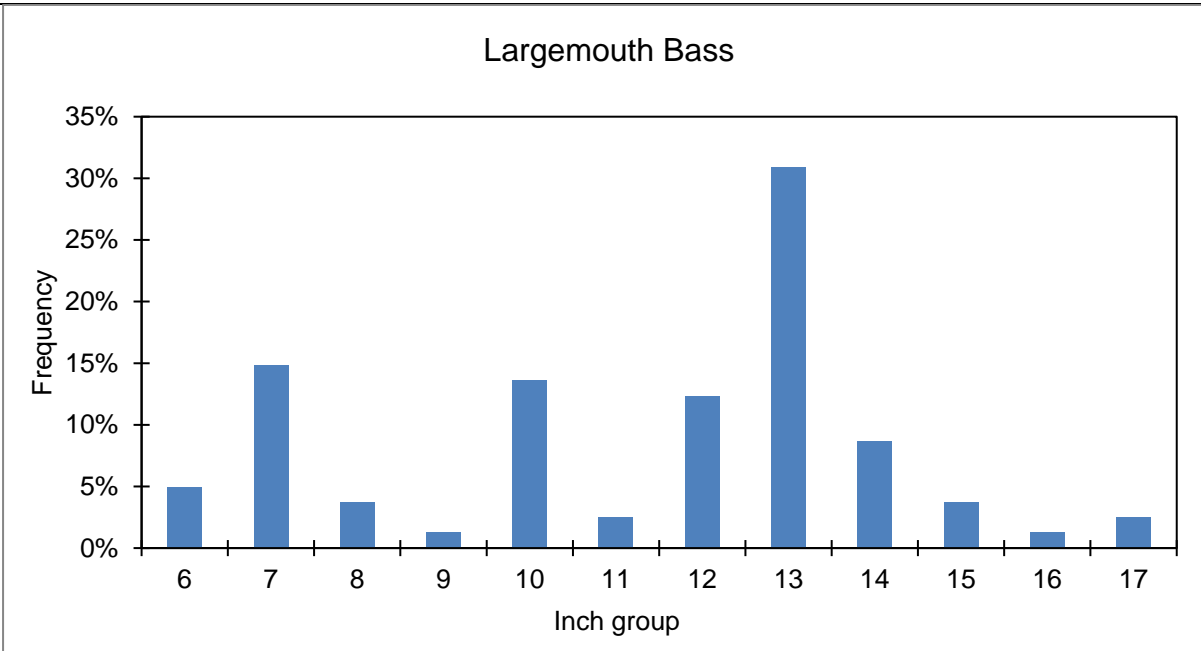


Figure 5. Length frequency distribution of largemouth bass caught in Tuscarora Lake in May and October 2021.

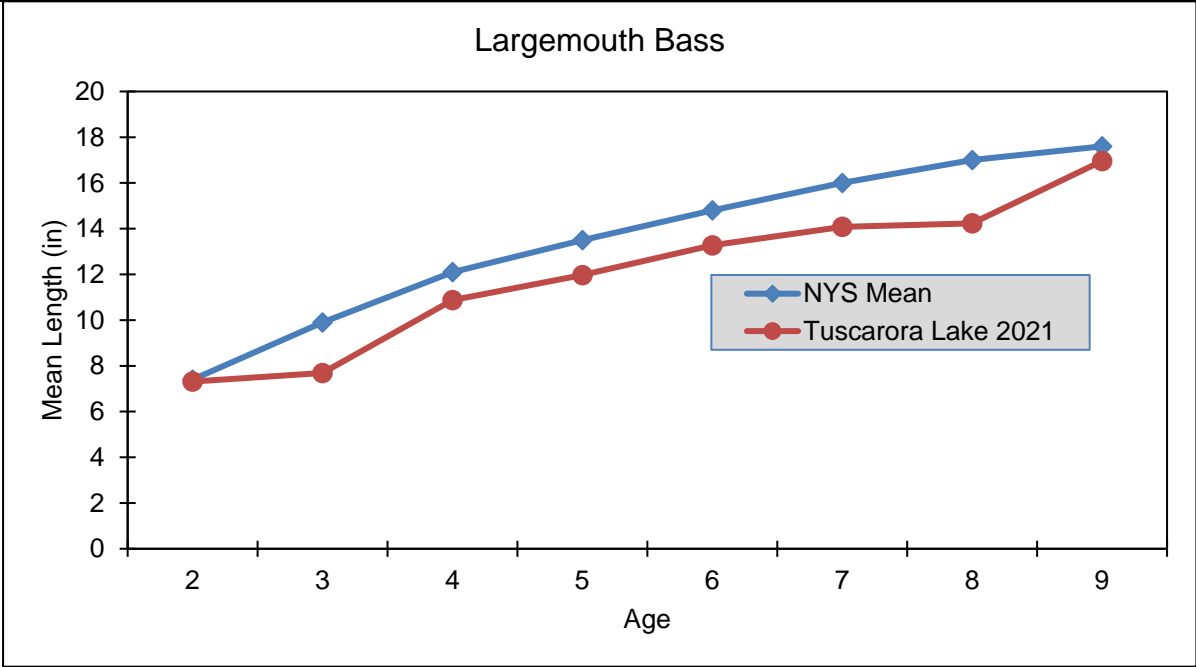


Figure 6. Observed mean length at age of largemouth bass caught in Tuscarora Lake in May and October 2021 and the NYS mean (Brooking et al. 2018).

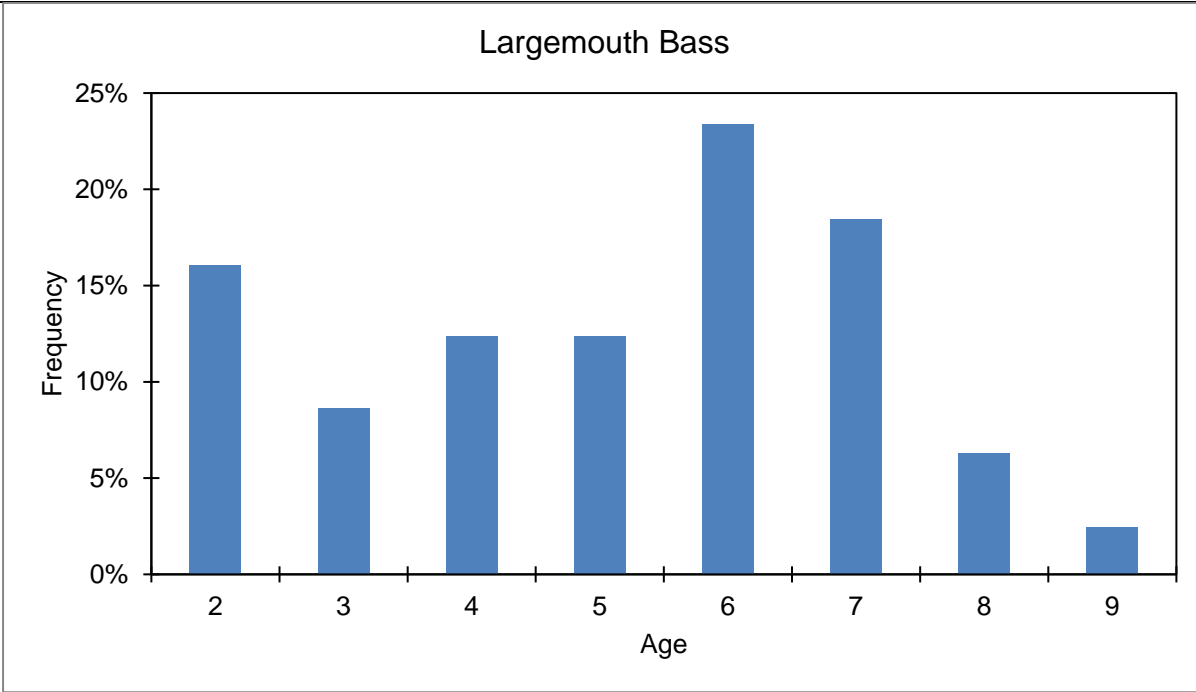


Figure 7. Age frequency distribution of largemouth bass caught in Tuscarora Lake in May and October 2021.

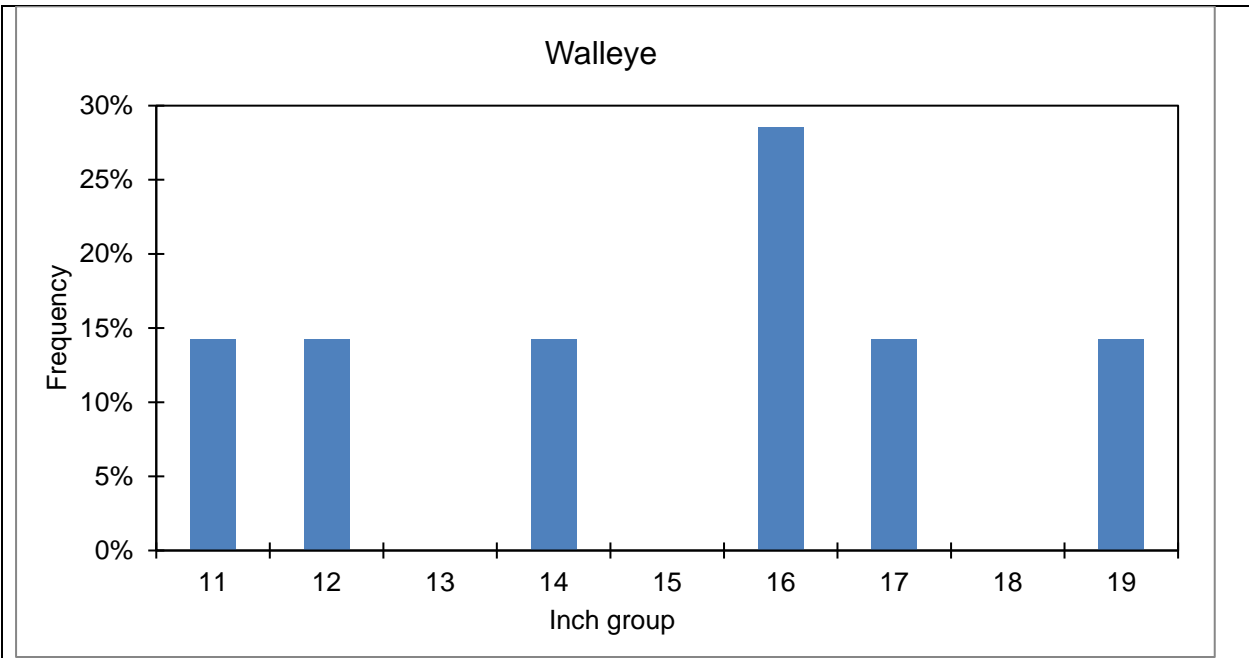


Figure 8. Length frequency distribution of walleye caught in Tuscarora Lake in May and October 2021.

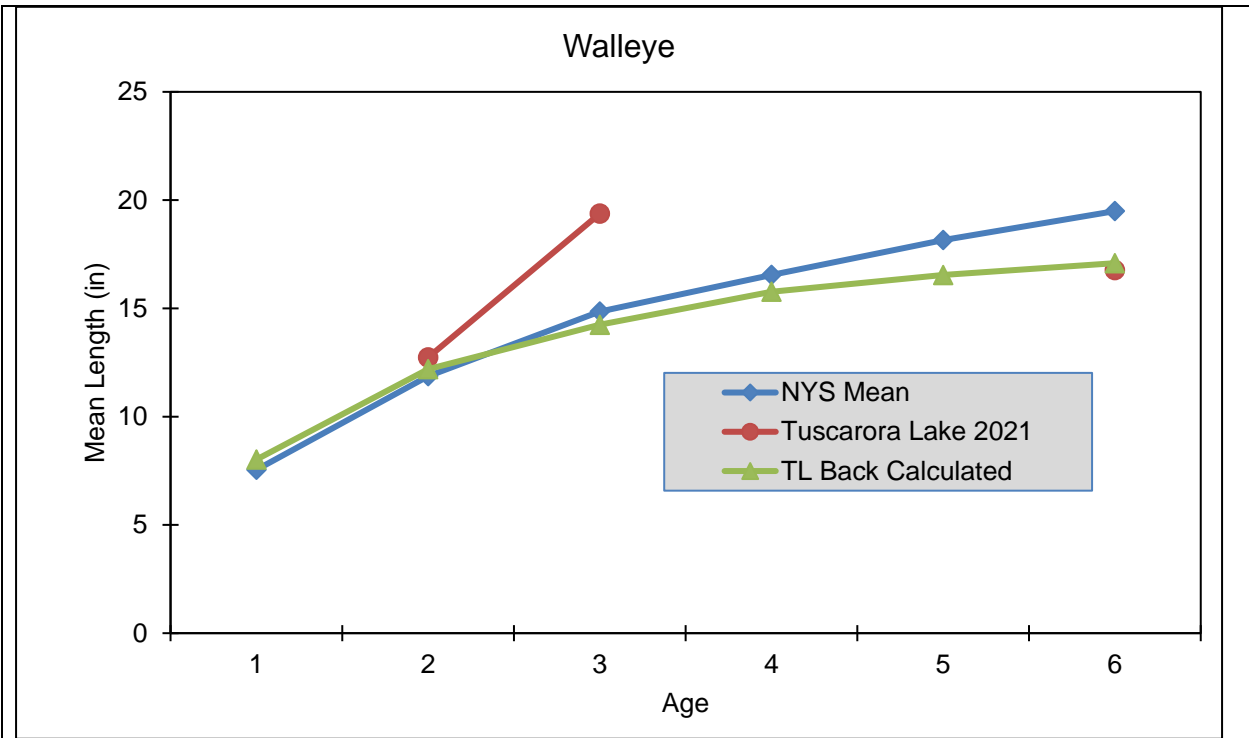


Figure 9. Observed and back calculated mean length at age of walleye caught in Tuscarora Lake in May and October 2021 and the NYS mean (Forney et al. 1994).

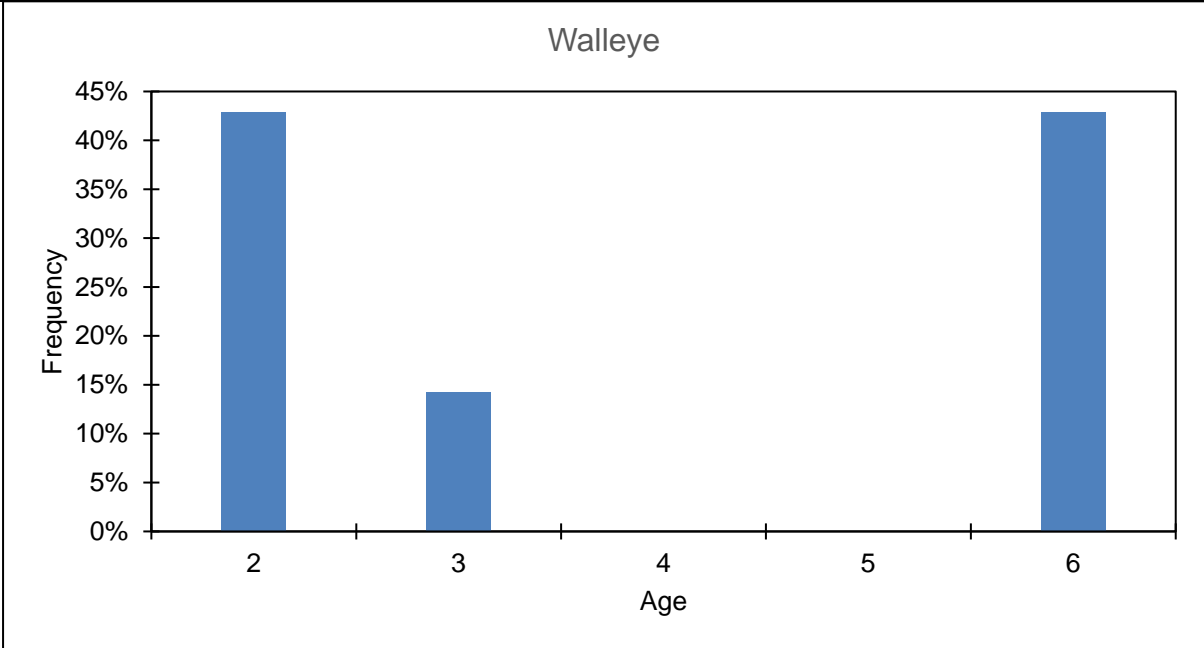


Figure 10. Age frequency distribution of walleye caught in Tuscarora Lake in May and October 2021.

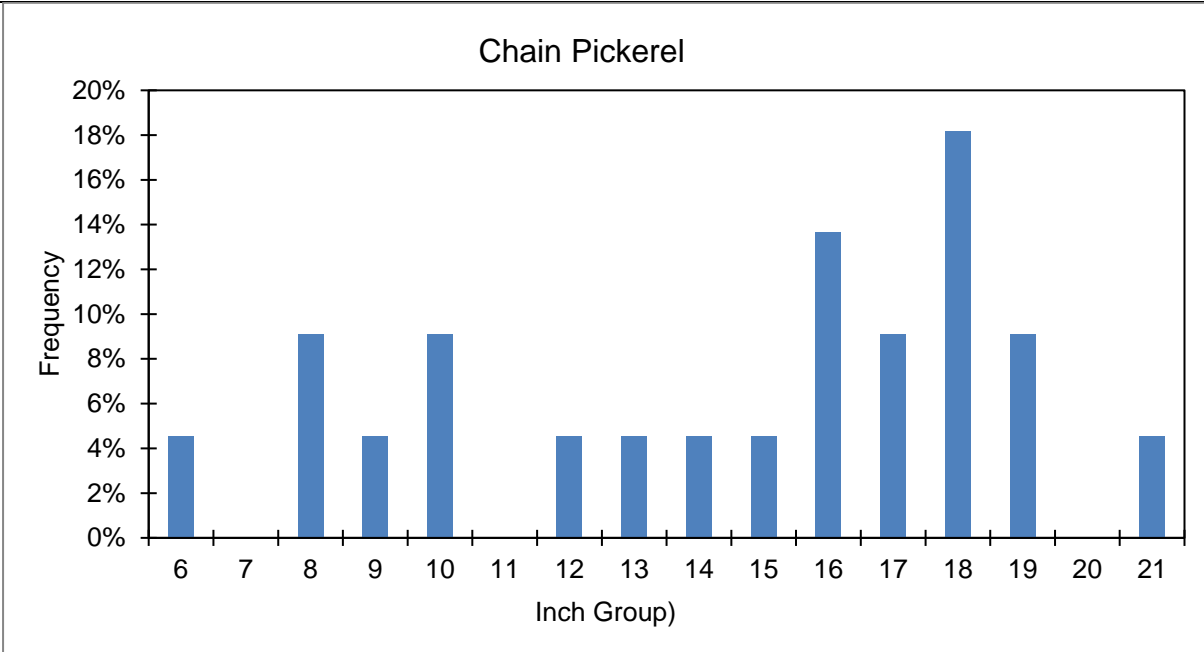


Figure 11. Length frequency distribution of chain pickerel caught in Tuscarora Lake in May and October 2021.

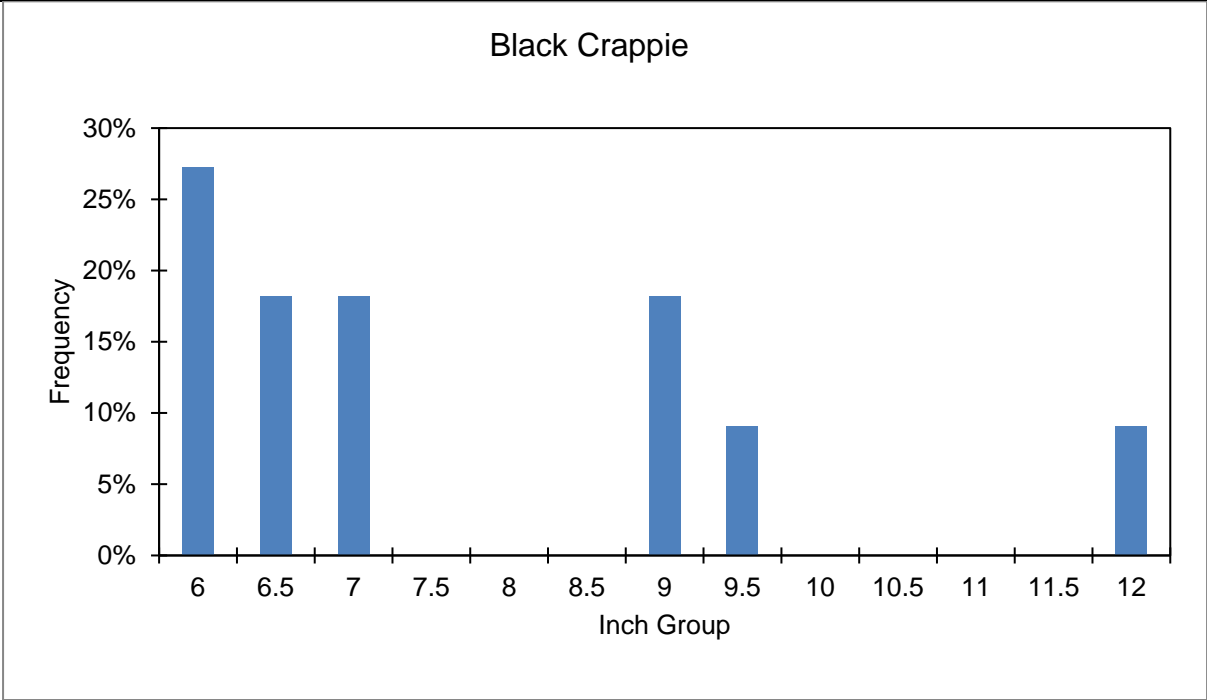


Figure 12. Length frequency distribution of black crappie caught in Tuscarora Lake in May and October 2021.

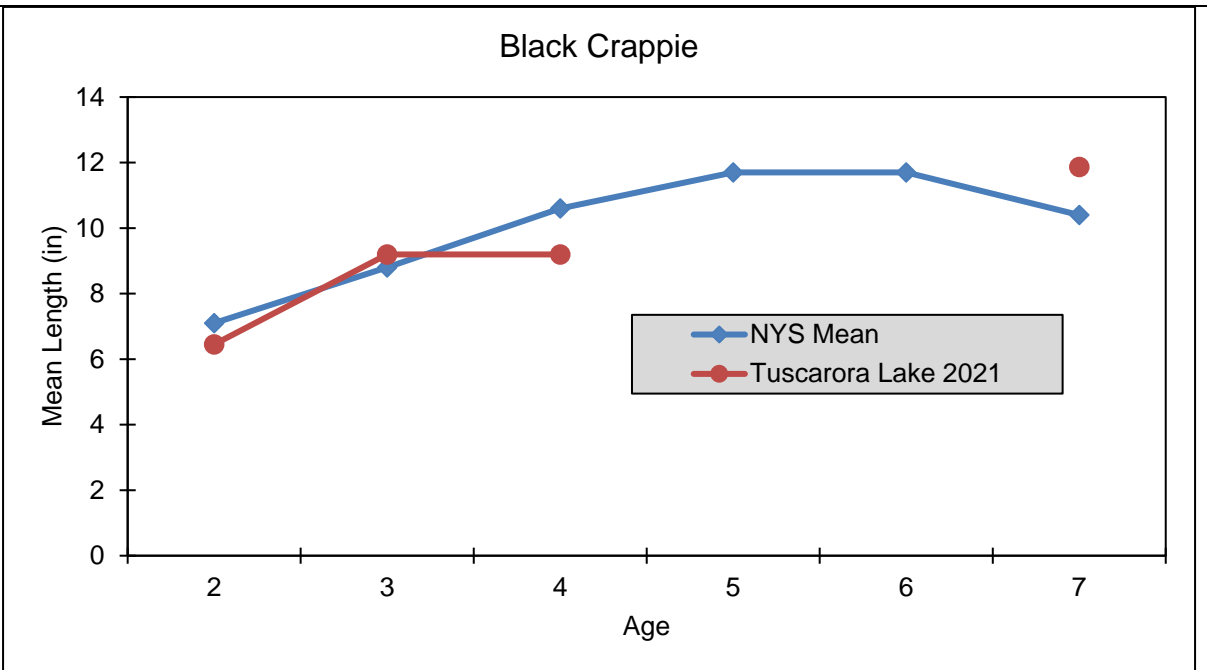
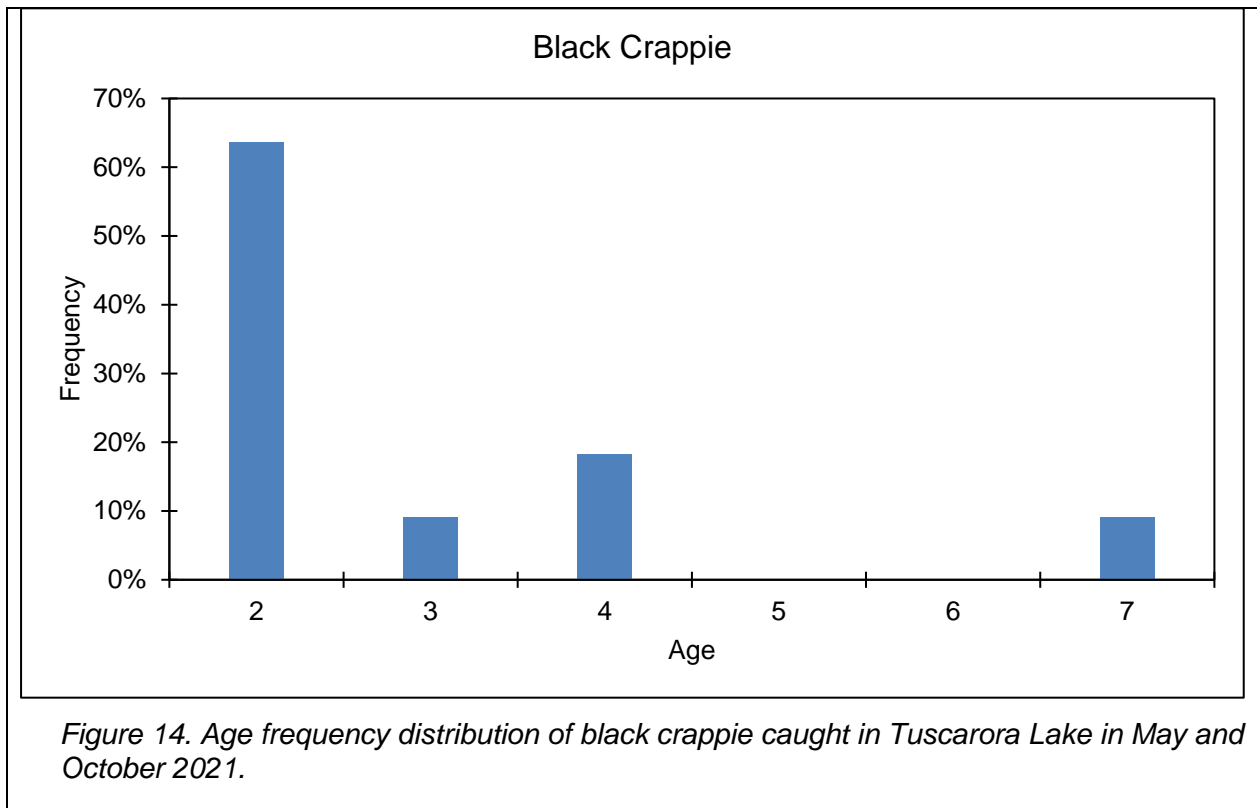


Figure 13. Observed mean length at age of black crappie caught in Tuscarora Lake in May and October 2021 and the NYS mean (Brooking et al. 2018).



Panfish

Yellow Perch

A total of 67 yellow perch were caught with 23 by electrofishing, and 44 with gill nets. The electrofishing CPUE ranged by run from 6 to 71 fish/h with an average of 27/h (SE=12; Table 3). The average gill net CPUE was 11/net night (SE=6). Yellow perch lengths ranged from 3.1 to 12.4 in. with fish in the 9.5 in. size range being most frequent (Figure 15). Yellow perch PSD was 83 and RSD₁₀ was 54 (Table 4). Three yellow perch were of memorable size (≥ 12 in., Table 4). Yellow perch had an average W_r of 90 (SE=3; Table 5). Yellow perch had average growth rates by NYS standards for most ages (Figure 16). Age-8 yellow perch were most frequent age class collected (Figure 17).

Bluegill

A total of 62 bluegill were caught, 60 by electrofishing and 2 with gill net. The electrofishing CPUE for all size bluegill ranged from 0 to 171 fish/h with an average of 71/h (SE=28; Table 3). The average gill net CPUE was 0.5/net night (SE=0). Bluegill lengths ranged from 1.6 to 8.9 in. with fish in the 5.5 in. size range being most frequent (Figure 18). Bluegill PSD was 27 and RSD₈ was 5 (Table 4). Bluegill had an average W_r of 109 (SE=2; Table 5). Bluegill mean length at age was below the NYS mean for ages 3 to 5, and above for age-7 and 8 (Figure 19). Age-4 bluegill were the most frequent age class collected (Figure 20).

Pumpkinseed

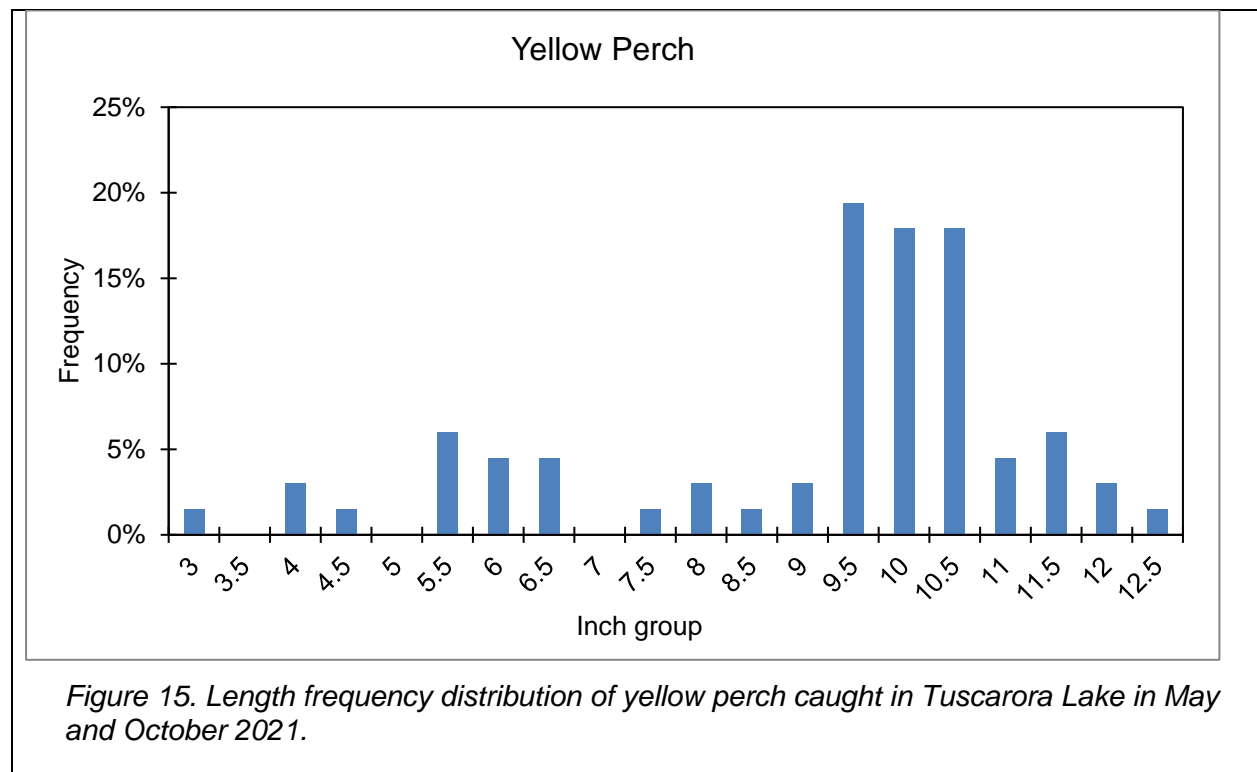
A total of 61 pumpkinseed were caught with 55 by electrofishing and six by gill nets. The electrofishing CPUE for all sized pumpkinseed ranged by run from 35 to 106/h with an average of 65/h (SE=15; Table 3). The gill net average CPUE was 1.5/net night (SE=0). Pumpkinseed lengths ranged from 2.8 to 8.8 in. with fish in the 6 in. size range being most frequent (Figure 21). Pumpkinseed PSD was 65 and RSD₈ was 20 (Table 4). Pumpkinseed had an average Wr of 103 (SE=9; Table 5). Pumpkinseed mean length at age was average for NYS (Figure 22). Age-5 pumpkinseed were most frequent age class collected (Figure 23).

Rock Bass

A total of 28 rock bass were caught, all by electrofishing for a CPUE range by run of 12 to 53/h with an average of 33/h (SE=7; Table 3). Rock bass lengths ranged from 2.0 to 9.4 in. with fish in the 5.0, 6.5, and 8.0 in. range most common (Figure 24). PSD was 46 and RSD₉ was 8 (Table 4). Rock bass had an average Wr of 98 (SE=2; Table 5).

Other Fishes

Sixteen brown bullhead (*Ameiurus nebulosus*) were collected with an average length of 12.5 in. (SE=0). Four yellow bullhead (*Ameiurus natalis*) were also collected with an average length of 10.0 in. (SE=1). Non-sport fish consisted of six golden shiners (*Notemigonus crysoleucas*), two emerald shiner (*Notropis atherinoides*), three white sucker (*Catostomus commersonii*) and one rudd (*Scardinius erythrophthalmus*).



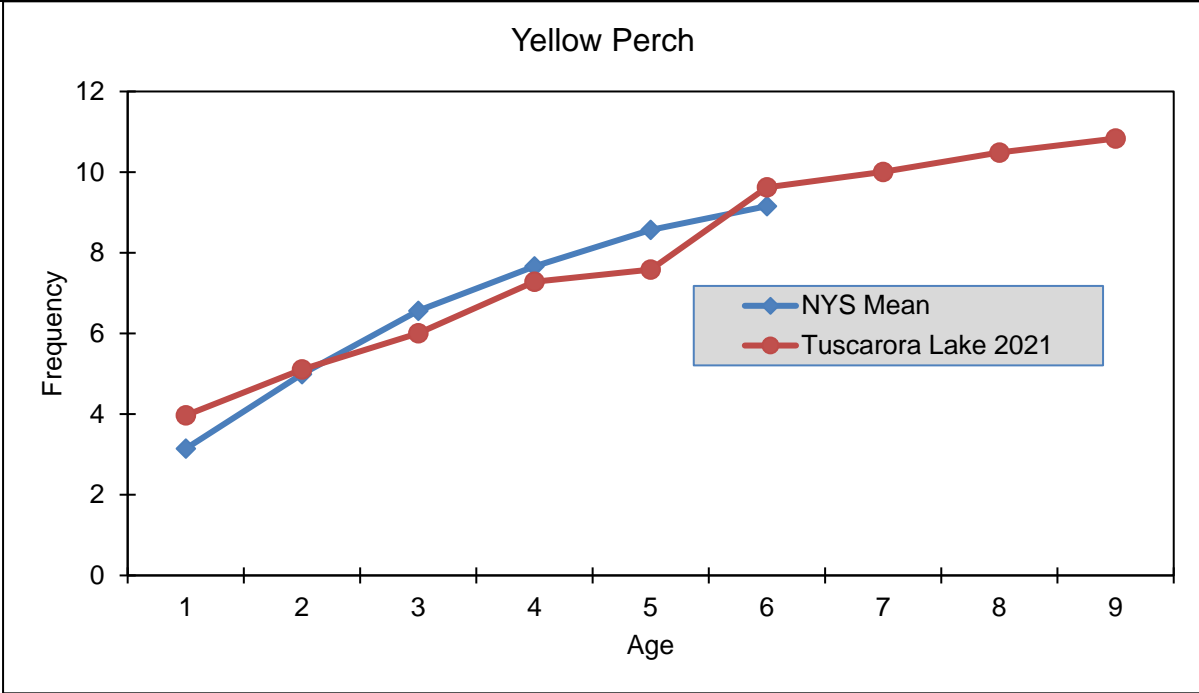


Figure 16. Observed mean length at age of yellow perch caught in Tuscarora Lake in May and October 2021 and the NYS mean (Forney et al. 1994).

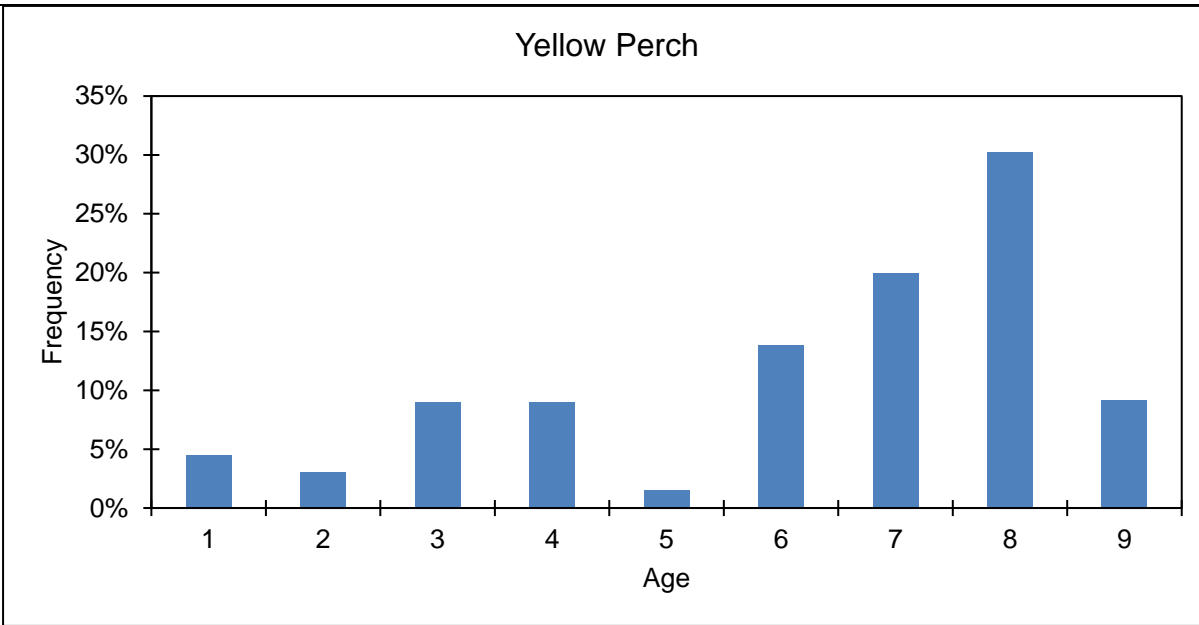


Figure 17. Age frequency distribution of yellow perch caught in Tuscarora Lake in May and October 2021.

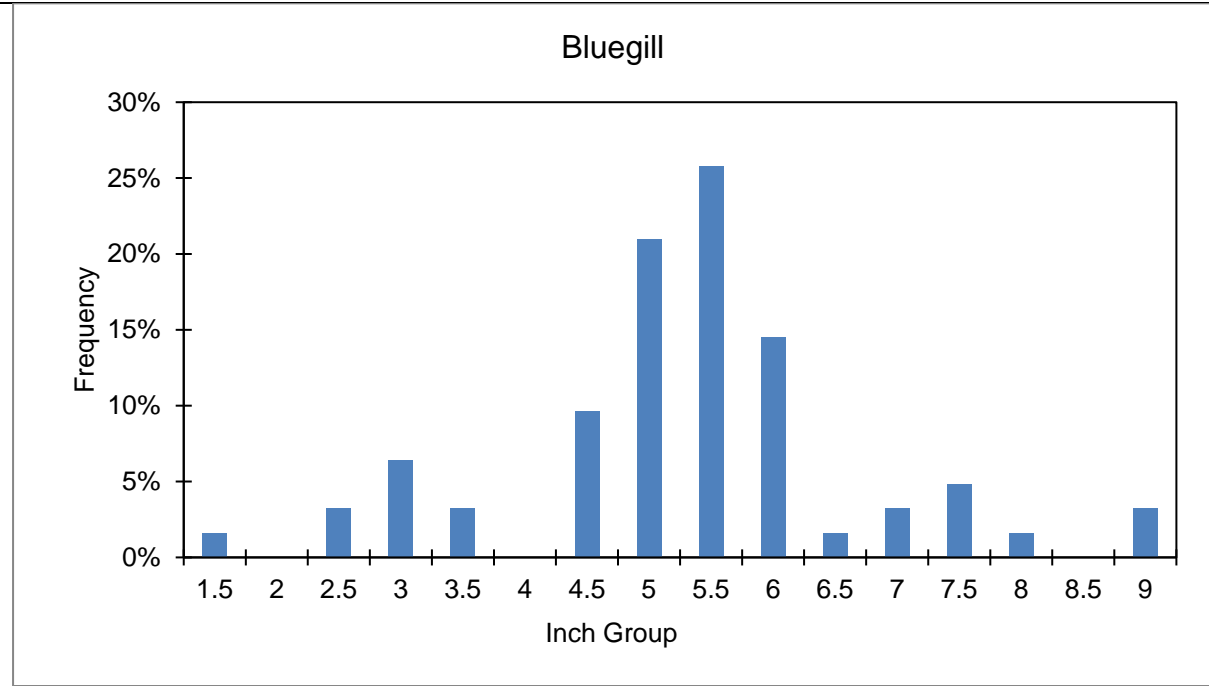


Figure 18. Length frequency distribution of bluegill caught in Tuscarora Lake in May and October 2021.

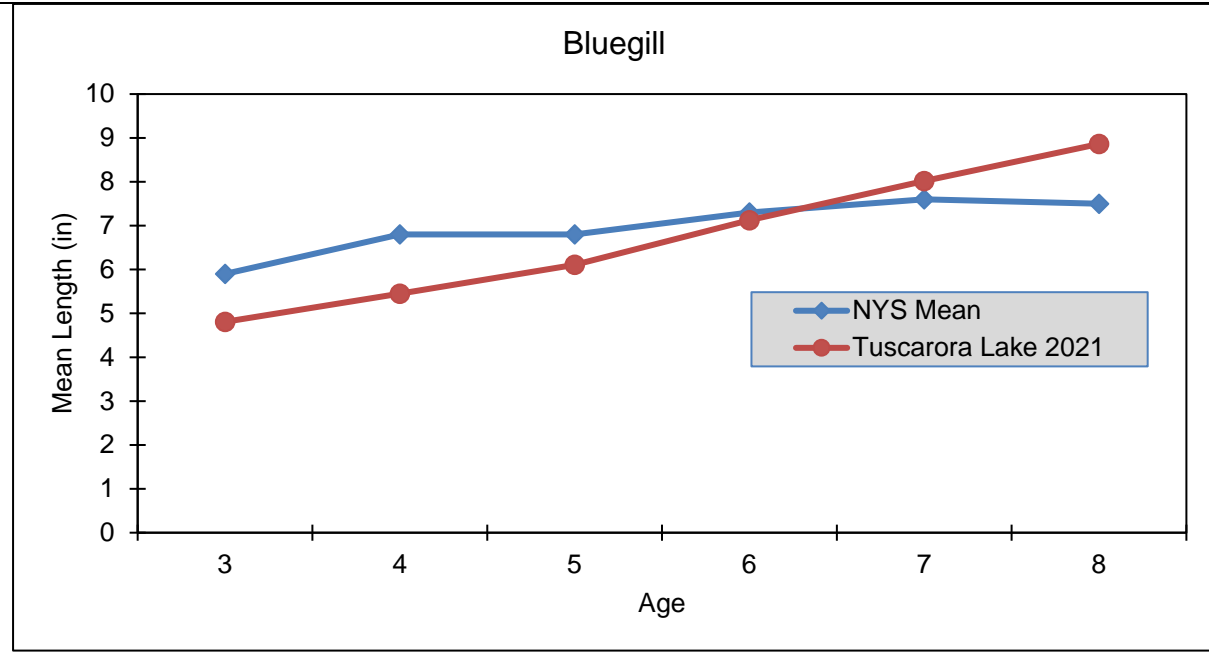


Figure 19, Observed mean length at age of bluegill caught in Tuscarora Lake in May and October 2021 and the NYS mean (Brooking et al. 2018).

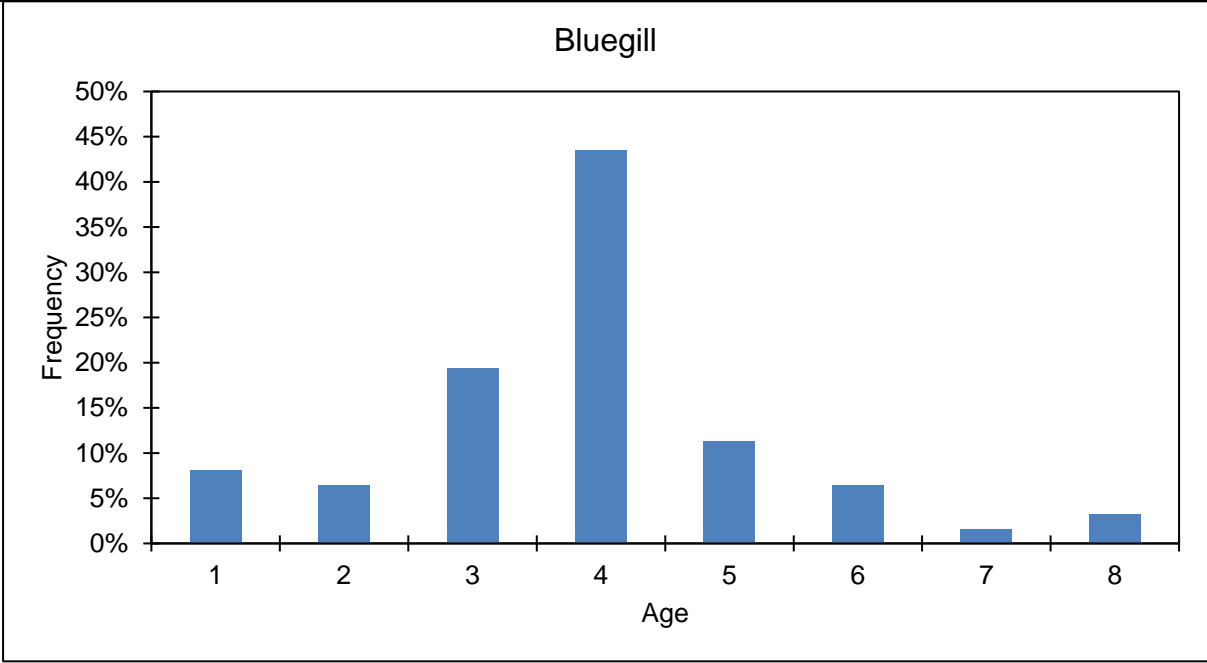


Figure 20. Age frequency distribution of bluegill caught in Tuscarora Lake in May and October 2021.

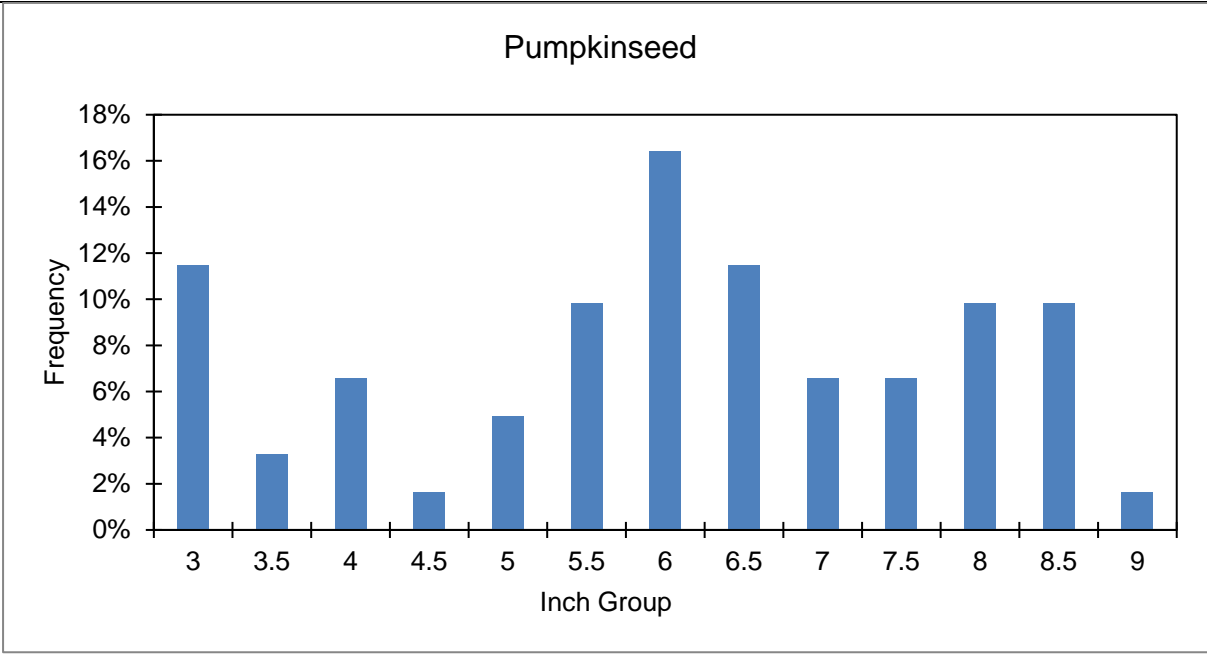


Figure 21. Length frequency distribution of pumpkinseed caught in Tuscarora Lake in May and October 2021.

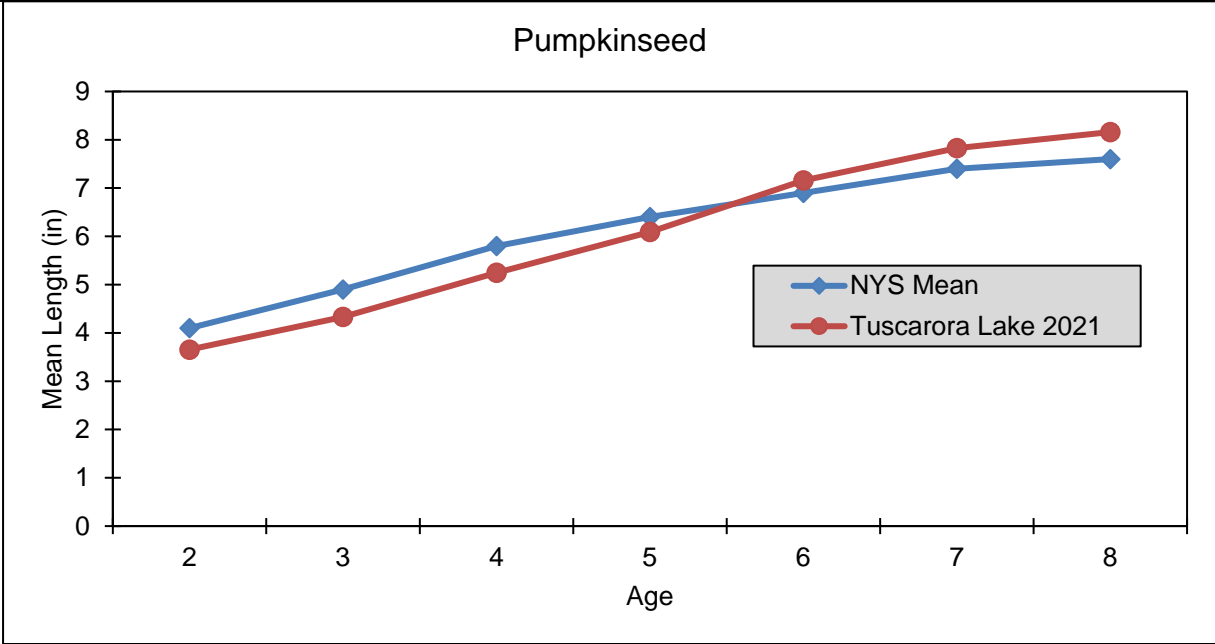


Figure 22. Observed mean length at age of pumpkinseed caught in Tuscarora Lake in May and October 2021 and the NYS mean (Brooking et al. 2018).

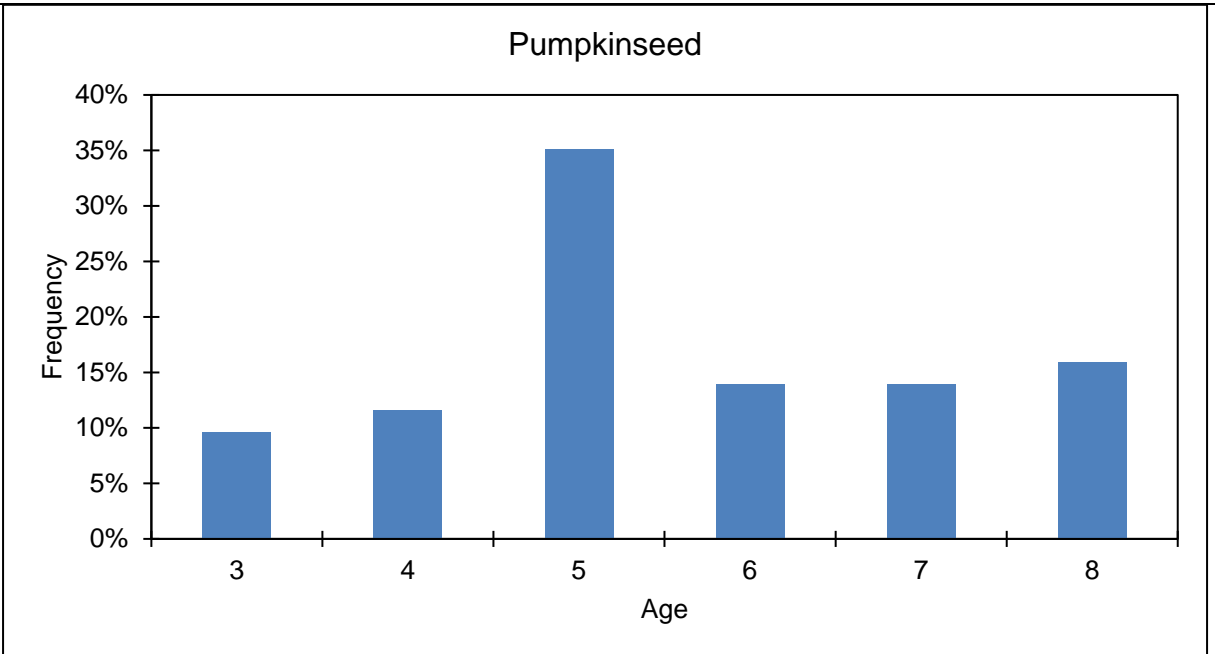
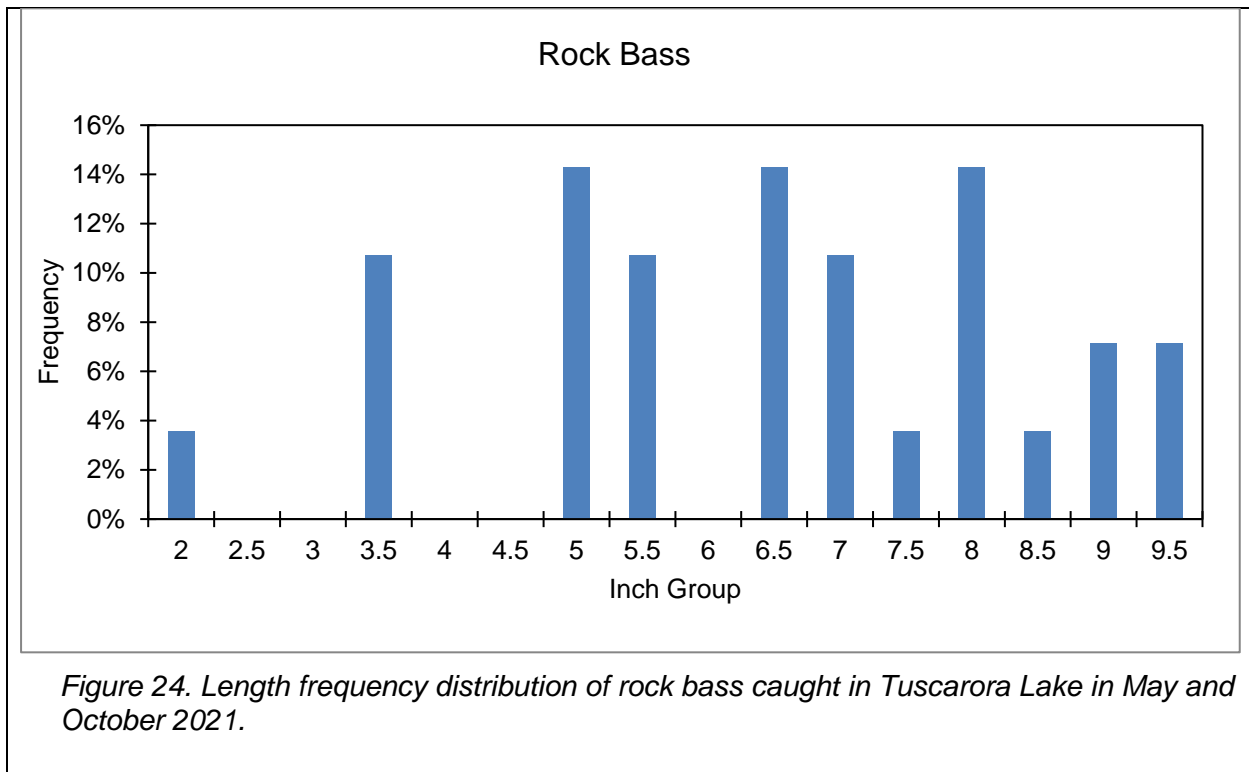


Figure 23. Age frequency distribution of pumpkinseed caught in Tuscarora Lake in May and October 2021.



Discussion

Water Chemistry

During the May electrofishing survey, the surface water temperature was well within the 59 to 73° F range suggested in the Bass and Sunfish Manual (Brooking et al. 2018). During the October survey the water temperature was “fairly” uniform from top to bottom and no thermocline was evident suggesting the lake had turned over for the fall. DO levels were sufficient to support fish at all depths at that time.

Species Collected

The 15 species collected in Tuscarora Lake is comparable to the number of species collected for other Madison County waters surveyed by the NYSDEC in recent years (Table 7). Seventeen species were collected in Cazenovia Lake (Everard 2013), 16 in Eaton Brook Reservoir (Everard 2016), 15 in Lake Moraine (Everard 2015), 18 in Upper and Lower Leland Ponds (Everard 2017), 11 in Lebanon Reservoir (Everard 2020), 9 in Stoney Pond (Everard 2020a), and 15 in DeRuyter Reservoir (Everard 2021). It should be noted that different gears were used at times between surveys, see Table 6 for the gear used on each water. It’s also comparable to the 16 species caught by SUNY Cobleskill during their 2003 electrofishing survey on Tuscarora Lake (unpublished data, Table 8).

Though it will be discussed further under the individual species sections the overall number of fish collected was lower than expected. The electrofishing survey did have some complications as the newly reconditioned boat did have problems with one of the pads on the front deck which had a faulty switch (netters need to stand on these

pads to activate the electrofishing unit). When going to net a fish, if the netter moved off the “sweet spot” on the pad the unit quit shocking sometimes resulting in the fish escaping. Though some fish were obviously lost, I do not think it led to a significant reduction of the overall catch but it should be mentioned.

Table 7. Fish species collected by the NYSDEC in recent sampling efforts on Madison County waters and year sampled. Cazenovia Lake (CL), Eaton Brook Reservoir (EB), Lake Moraine (LM), Upper and Lower Leland Ponds (LP), Lebanon Reservoir (LR), Stoney Pond (SP), DeRuyter Reservoir (DR) and Tuscarora Lake (TL). ¹= Boat electrofishing and gill net. ²= Boat electrofishing, gill net, and fyke net. ³= Boat electrofishing

Species	CL 2012¹	EB 2013¹	LM 2014²	LP 2015²	LR 2016²	SP 2017³	DR 2018²	TL 2021¹
Alewife				X				
Brown Trout				X				
Rainbow Trout		X			X			
Chain Pickerel	X	X	X	X		X	X	X
Common Carp				X				
Golden Shiner	X	X	X	X	X	X	X	X
Emerald Shiner		X						X
Spottail Shiner	X	X		X			X	
Spotfin Shiner	X							
Rudd								X
White Sucker	X	X	X	X	X		X	X
Creek Chubsucker			X	X				
Yellow Bullhead	X		X	X			X	X
Brown Bullhead	X	X	X	X	X	X	X	X
Banded Killifish	X						X	
Rock Bass	X	X	X	X	X	X	X	X
Redbreast Sunfish			X	X				
Pumpkinseed	X	X	X	X	X	X	X	X
Bluegill	X	X	X	X	X	X	X	X
Smallmouth Bass	X	X	X	X			X	X
Largemouth Bass	X	X	X	X	X	X	X	X
Black Crappie	X	X	X	X	X	X	X	X
Tessellated Darter	X	X						
Yellow Perch	X	X	X	X	X	X	X	X
Walleye	X	X	X		X		X	X
Species	17	16	15	18	11	9	15	15

Table 8. Fish species caught, and electrofishing catch per unit effort (CPUE) for Fisheries surveys on Tuscarora Lake by the DEC and SUNY Cobleskill (SUNY).

Species	CPUE (fish/h)	
	SUNY 2003	DEC 2021
Chain Pickerel	5.9	5.1
Golden Shiner	10.1	3.5
Emerald Shiner	1.7	2.4
Spottail Shiner	2.5	-
White Sucker	21.8	-
Yellow Bullhead	-	1.2
Brown Bullhead	17.6	19.0
Banded Killifish	1.7	-
Rock Bass	200.6	32.9
Pumpkinseed	111.6	64.7
Bluegill	79.7	70.6
Smallmouth Bass	35.2	25.4
Largemouth Bass	61.3	22.4
Black Crappie	0.8	0.3
Tessellated Darter	11.7	-
Yellow Perch	14.3	27.1
Walleye	10.1	0.9

Gamefish

Smallmouth Bass

The average electrofishing CPUE of 25/h (SE=4) for all size smallmouth bass was just below the spring statewide average of 27/h (SE=2) while the average CPUE for quality bass (≥ 11 in.) of 20/h (SE=3) was well above the statewide average of 10/h (SE=1; Brooking et al. 2018). When using the electrofishing CPUE for bass ≥ 10 in. of 21/h (SE=3) compared to Greens (1989) formula it suggests Tuscarora Lake has a high smallmouth bass population density. There is not a good explanation for why none were caught in the gillnets. A gill-netting survey on a nearby water the week before also had a very low overall catch. Possible fall turnover had fish spread out, or shallower than nets were set for this October gill-net survey.

Both the smallmouth bass PSD and RSD_{14} were above the spring statewide average of 50 and 24, respectively (Brooking et al. 2018). These high PSD and RSD_{14} values would suggest that a large portion of the adult stock is comprised of quality (≥ 11 in.) sized fish. Smallmouth bass were in fair condition with an average spring electrofishing Wr of 94 (SE=2) for \geq stock<quality sized, which was above the statewide spring average Wr for that size class of 91 (SE=1; Brooking et al. 2018). The Wr index uses a range of 95 to 105 as the benchmark for fish in good condition (Pope and Kruse 2007) but as noted above the statewide average falls below that range so the lower Wr of Tuscarora Lake smallmouth is not a concern at this time. Smallmouth bass had average growth rates by NYS standards and were, on average, reaching legal size between age-4 and age-5.

Tuscarora Lake should, and does, provide anglers with good opportunities to catch numbers of smallmouth bass in quality (≥ 11 in.) and preferred (≥ 14 in.) sizes but with a limited chance at memorable (≥ 17 in.) sized smallmouth bass.

Largemouth Bass

The average electrofishing CPUE of 22/h (SE=5) for all size largemouth bass was well below the spring statewide average of 36/h (SE=2; Brooking et al. 2018). While the average electrofishing CPUE of 13/h (SE=3) for quality sized (≥ 12 in.) bass was just short of the spring statewide average of 14/h (SE=1; Brooking et al. 2018). Using Green's (1989) formula and the average electrofishing CPUE for bass ≥ 10 in. suggests Tuscarora Lake has a moderate largemouth bass population density. Anderson (1980) suggests a balanced bass population has a PSD range of 40 to 70, and RSD₁₅ of 10 to 40. So, the Tuscarora Lake largemouth bass PSD of 75 and RSD₁₅ of 7 falls just out of the balanced population range. The largemouth bass mean Wr of 106 (SE=1), was well above the spring statewide Wr average of 98 (SD = 7; Perry et al. 2014) for all size largemouth bass. As was the average spring electrofishing Wr of 113 (SE=2) for \geq stock<quality size, statewide average is 99 (SE=1; Brooking et al. 2018).

Though largemouth bass had slightly slow growth rates, by NYS standards, it's not likely caused by "stunting". Many definitions of stunting exist, but Heath and Roff (1987) define it as a population with "drastically" reduced growth rates. Given that the mean length at most ages for Tuscarora Lake fish was just a year behind the NYS mean, mean Wr was above the NYS mean, and the population had a near balanced PSD and RSD₁₅, there is no concern at this time for the slow growth rate.

Though almost as many largemouth were collected as smallmouth, anglers typically catch more smallmouth than largemouth in a typical fishing trip (personal experience). Tuscarora Lake should, and does, provide good opportunities for anglers to catch numbers of quality (≥ 12 in) sized bass with a limited chance at preferred (≥ 15 in) size.

Chain Pickerel

Overall, the number of chain pickerel caught during this survey was surprisingly low. Pickerel are frequently caught while angling on the lake, almost to the point of being perceived as a "nuisance" by some anglers when targeting other species (personal angling experience). It should be mentioned here that this survey was not designed to monitor pickerel. However, one explanation for this low catch of chain pickerel in the 2021 electrofishing survey is they may not have been in the near shore area during the spring sampling. Some evidence for this is that the gill net CPUE of 1.5/net night was similar to the 1.6/net night for chain pickerel caught on Lake Moraine in 2014 (Everard 2015). Lake Moraine is considered an excellent chain pickerel fishery, and the electrofishing CPUE for that survey was 31/h. The chain pickerel average Wr was just below the 95 to 105 suggesting a fish in good condition. This is a typical result for chain pickerel in the six recently surveyed Madison County waters, with average Wr ranging from 82 to 87 (Everard 2013, Everard 2015, Everard 2016, Everard 2017, Everard 2020a, Everard 2021). Tuscarora Lake chain pickerel had the highest Wr, compared to those waters. Though our sampling doesn't show it, Tuscarora Lake should provide excellent chain pickerel fishing with good catch rates for legal length fish.

Walleye

The electrofishing CPUE for walleye on Tuscarora Lake was well below the 8/h threshold that would suggest low abundance, while the gill-net CPUE was equal to the 1/net-night suggesting low abundance (Forney et al. 1984). We can also compare growth rates of walleye when trying to determine abundance, specifically, the mean length at age-4. As no age-4 were caught, back calculations were done on the three walleye that were age-6 and the average back calculated length at age-4 was 15.8 in. (401 mm) which is just below the mean length of 15 in. that would suggest high abundance (Forney et al. 1994). So, between the three estimates we have two lows, and a high.

Though the walleye average W_r of 87 (SE=2) fell below the 95 to 105 benchmark for fish in good condition (Pope and Kruse 2007), this hasn't been unusual for walleye in Madison County waters surveyed in recent years. For the five other waters where walleye were caught the average W_r ranged from 85 to 91 (Everard 2013, Everard 2015, Everard 2016, Everard 2020a, Everard 2021) with an average of 88. The low W_r for Tuscarora lake walleye is likely of little concern at this time.

Scales were taken from all walleye and to more accurately determine ages, otoliths were also collected from the four walleye that were caught with gill nets. As expected, there was a difference in age estimates between scale and otolith aging methods. However, it was greater than expected considering all fish were age-6 or younger. Scales are generally reliable for determining walleye ages up to age-7 (Forney et al. 1994). That pattern was also observed when otoliths and scales were compared for Otisco Lake (Everard 2017a) and DeRuyter Reservoir (Everard 2021) with most of the disparity in walleye that were age-7 or greater.

One of the objectives of the survey was to determine if recent year classes of fingerling walleye stocked by the TLA were recruiting to the fisheries. It should be noted that walleye stocked into Tuscarora Lake have not been marked for identification so there is no way to determine if a walleye was stocked or naturally produced (wild). Only three year classes of walleye were collected with fish from the 2015 and 2019 stocking represented along with one fish from 2018, a non-stocking year (Appendix 1).

Overall, the number of walleye caught was lower than expected on this survey, as it was for some other species. Tuscarora Lake does have significant walleye fry and fingerling predators. Research conducted by Cornell University indicated that low survival of stocked walleye was observed in lakes with electrofishing catch rates of >5 fish/h of largemouth bass and *Esocids* >15 in. (Jackson et al. 2003). The Tuscarora Lake average electrofishing catch rate for largemouth bass and chain pickerel >15 in. was 3.8 fish/h, which does fall below the 5 fish/h. As was discussed above, the electrofishing catch of chain pickerel in this survey was lower than expected so that predator catch rate of 3.8/h is likely underestimated. Also, if we include smallmouth bass >15 in. it goes to 6.9/h, This would indicate that the expected survival of stocked walleye should be low. However, even though our catch data doesn't show it, it does appear that the walleye stocking is seeing some success indicated by the two year classes collected along with anecdotal reports of angler catches. I personally catch more "accidental" walleye here while I'm targeting bass than I do on the other Madison County waters. Recommend the TLA to continue stocking walleye if they desire.

Black Crappie

It was interesting to see the difference in catch rates of black crappie between the two gears, with gill netting accounting for most of the fish. Black crappie can often be difficult to collect by electrofishing, as this survey shows, and are likely underrepresented when that is the only gear used. The electrofishing catch rate of 0.03/h falls well below the statewide average of 11/h (SE=1; Brooking et al. 2018). Three of the black crappie collected were legal length of ≥ 9 -inches. The average Wr of 102 (SE=2) suggest the black crappie in Tuscarora Lake are in good condition.

Panfish

Yellow Perch

The average electrofishing catch rate for yellow perch would suggest moderate abundance as it fell between the 15/h that would suggest low abundance and 50/h that would suggest high abundance (Forney et al. 1994). Similarly, the gill net catch rate would also suggest moderate abundance as it came in between the 5/net night that would suggest low abundance and below the 25/net-night that would suggest high abundance (Forney et al. 1994). Yellow perch mean length at age-4 can also be used to estimate abundance with a mean length of 8.5 in. (215 mm) suggesting low abundance, while a mean length of 7 in. (180 mm) suggests high abundance (Forney et al. 1994). The Tuscarora Lake yellow perch mean length at age-4 of 7.3 in. (185 mm) suggests high abundance which contradicts the electrofishing and gill net CPUEs, so it's likely the yellow perch population would fall in the moderate range. The yellow perch PSD of 83 falls above the accepted range of 30 to 60 (Anderson and Weithman 1978) for a balanced population. Currently the population seems to be largely made up of larger fish of quality (≥ 8 in.) and preferred size (≥ 10 in.). Three memorable (≥ 12 in.) yellow perch were also collected. It's also possible that smaller fish were just underrepresented due to gear used in this survey and recruitment may be highly variable for yellow perch on Tuscarora Lake with good and bad years. With a moderate population and a good proportion of "keeper" size yellow perch Tuscarora Lake should provide good yellow perch fishing for quality and preferred size with a realistic chance at an occasional memorable sized yellow perch.

Bluegill

The average electrofishing CPUE of 62/h (SE=29) for \geq stock (3 in.) size bluegill was well below the spring statewide average of 91 (SE=9; Brooking et al. 2018). As was the average CPUE for \geq preferred size (8 in.) bluegills of 2/h (SE=1) compared to the statewide average of 6/h (SE=2; Brooking et al. 2018). Anderson (1985) suggests a balanced bluegill population should have a PSD range of 20 to 60, and a RSD₈ of 5 to 20. Both the Tuscarora Lake bluegill PSD and RSD₈ fall within those suggested ranges and would indicate a balanced population. Bluegill were also in very good condition with the mean Wr for \geq stock < quality size bluegills of 109 (SE=5) which is above the statewide average of 102 (SE=0; Brooking et al. 2018). So, Tuscarora Lake should provide fair angling for bluegills both in numbers and size.

Pumpkinseed

The average electrofishing CPUE of 57.6/h (SE=12) for stock size (≥ 3 in.) pumpkinseed was below the statewide spring average of 70 (SE=9; Brooking et al. 2018). However, the CPUE of 10.6/h (SE=5) for preferred size (≥ 8 in.), was well above the spring statewide average of 3/h (SE=0; Brooking et al 2018). If we assume pumpkinseed stock density ranges are similar to bluegill, the Tuscarora Lake PSD of 65 would just fall out of the suggested range of 20 to 60, and RSD_8 of 20 would fall on the upper edge of the 5 to 20 suggested range. The pumpkinseed average W_r of 101 for \geq stock<quality size fish is above the statewide average of 98 (SE=2; Brooking et al. 2018).

Though no memorable (≥ 10 in.) or trophy (≥ 12 in.) sized pumpkinseeds were caught, when looking at CPUE's for preferred size, along with the RSD_8 and W_r , Tuscarora Lake should provide good pumpkinseed angling for both numbers and size.

Rock Bass

The average electrofishing CPUE of 28.2/h (SE=6) for stock size (≥ 4 in.) rock bass was just below the statewide average of 32/h (SE=2; Brooking et al. 2018). While the average CPUE for preferred size (≥ 9 in.) rock bass was equal to the statewide average of 2/h (SE=2; Brooking et al. 2018). Rock bass were also in good condition with the mean W_r for \geq stock<quality size rock bass of 97 (SE=3), which is equal to the spring statewide average of 97 (SE=2; Brooking et al. 2018).

The number of rock bass collected was very low compared to what I was expecting. I fish this lake quite often, and as mentioned with the pickerel, catching rock bass almost becomes an annoyance at times. Just a few days prior to the electrofishing survey I caught over 30 rock bass in just a few hours fishing out of a kayak targeting black bass. So, to only catch 28 rock bass between electrofishing and gill netting was dumbfounding. I have no explanation or theory as to why the catch was so low. Though the data does not suggest it, Tuscarora Lake does provide excellent rock bass fishing both in size and numbers.

Recommendations

Management recommendations based on the results of this survey are:

- Continue with statewide angling regulations for all species.
- Recommend TLA continue with the walleye stocking if desired.

Acknowledgement

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Literature Cited

- Anderson, R. O. 1980. Proportional stock density (PSD) and relative weight (Wr): Interpretive indices of fish populations and communities. pp. 27-35. In: S. Gloss and B. Shupp (eds.) Practical fisheries management: More with less in the 1980's. Proceedings 1st annual workshop of New York chapter American Fisheries Society.
- Anderson, R. O. 1985. Managing ponds for good fishing. Columbia: University of Missouri Extension Division.
- Anderson, R. O. and A.S. Weithman. 1978. Concept of balance for coolwater fish populations. American Fisheries Society special publication. 11:371-381.
- Brooking, T.E., J.J. Loukmas, J.R. Jackson, and A. J. VanDeValk. 2018. Black bass and sunfish sampling manual for lakes and ponds. New York State Department of Environmental Conservation, Albany, NY.
- Everard, J. F. 2013. Cazenovia Lake Fisheries Survey 2012. New York State Department of Environmental Conservation, Cortland, NY.
- Everard, J. F. 2015. Lake Moraine Fisheries Survey 2014. New York State Department of Environmental Conservation, Cortland, NY.
- Everard, J. F. 2016. Eaton Brook Reservoir Fisheries Survey 2013. New York State Department of Environmental Conservation, Cortland, NY.
- Everard, J. F. 2017. Upper and Lower Lelands Ponds Fisheries Survey 2015. New York State Department of Environmental Conservation, Cortland, NY.
- Everard, J. F. 2017a. 2014 Otisco Lake Fish Community Report. New York State Department of Environmental Conservation, Cortland, NY.
- Everard, J. F. 2020. Lebanon Reservoir Fisheries Survey 2016. New York State Department of Environmental Conservation, Cortland, NY.
- Everard, J. F. 2020a. Stoney Pond Fisheries Survey 2017. New York State Department of Environmental Conservation, Cortland, NY.
- Everard, J. F. 2021. DeRuyter Reservoir Fisheries Survey 2018. New York State Department of Environmental Conservation, Cortland, NY.
- Forney, J.L., L.G. Rudstam, D.M. Green, and D.L. Stang. 1994. Percid sampling manual. New York State Department of Environmental Conservation, Albany, NY.

- Gabelhouse, D. W. 1984. A length-categorization system to assess fish stocks. *North American Journal of Fish Management*. 4:273-285.
- Green, D. M. 1989. *Centrarchid Sampling Manual*. New York State Department of Environmental Conservation, Albany, NY.
- Heath, D.D. and Roff, D.A. 1987. Test of Genetic Differentiation in Growth of Stunted and Nonstunted Populations of Yellow Perch and Pumpkinseed. *Transactions of the American Fisheries Society* 116:1, 98-102.
- Perry, P.C., J.J. Loukmas, W.L. Fisher, P.J. Sullivan, and J.R. Jackson. 2014. Characterizing the status of black bass populations in New York. Final Report. New York State Department of Environmental Conservation, Albany, NY.
- Pope, K.L. and C.G. Kruse. 2007. Condition. Pages 423-471 in C.S. Guy and M.L. Brown, editors. *Analysis and Interpretation of Freshwater Fisheries Data*. American Fisheries Society, Bethesda, Maryland.

Appendix 1. Number of walleye stocked into Tuscarora Lake by the Tuscarora Lake Association.

Year	Number	Size	Age in 2021
2005	2,000	5-7"	16
2006	2,000	5-7"	15
2007	2,000	5-7"	14
2008	2,000	5-7"	13
2009	2,000	5-7"	12
2010	2,000	5-7"	11
2011	2,000	5-7"	10
2012	2,000	5-7"	9
2013	2,000	5-7"	8
2014	2,000	5-7"	7
2015	2,000	5-7"	6
2016	2,000	5-7"	5
2017	3,000	4-7"	4
2018	-	-	3
2019	8,000	4-7"	2
2020	4,700	5-7"	1

Appendix 2. Lengths used for stock, quality, preferred, memorable, and trophy sizes for species collected from DeRuyter Reservoir, Madison County, NY in June and July 2018.

Species	Stock		Quality		Preferred		Memorable		Trophy	
	mm	in	mm	in	mm	in	mm	in	mm	in
Chain Pickerel	250	10	380	15	510	20	630	25	760	30
White Sucker	150	6	250	10	330	13	410	16	510	20
Brown Bullhead	130	5	200	8	280	11	360	14	430	17
Rock Bass	100	4	180	7	230	9	280	11	330	13
Pumpkinseed	80	3	150	6	200	8	250	10	300	12
Bluegill	80	3	150	6	200	8	250	10	300	12
Largemouth Bass	200	8	300	12	380	15	510	20	630	25
Smallmouth Bass	180	7	280	11	350	14	430	17	510	20
Black Crappie	130	5	200	8	250	10	300	12	380	15
Yellow Perch	130	5	200	8	250	10	300	12	380	15
Walleye	250	10	380	15	510	20	630	25	760	30