Lake Moraine Fisheries Survey 2014

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Introduction

Lake Moraine is a 101 hectare (261 acre) mesotrophic lake located in the Town of Madison, Madison County. The lake is comprised of two basins which are separated by a causeway and interconnected by a culvert. The northern basin is 32 hectares (79 acres) and is relatively shallow with a maximum depth of 3.7 meters (12.0 feet) and mean depth of 1.1 m (3.7 ft). The larger southern basin is 67 hectares (172 acre) and has a maximum depth of 13.7 m (45 ft) and a mean depth of 5.5 m (17.7 ft; Harman et al. 2011). It is one of numerous area reservoirs that were built to supply water to the Erie Canal.

Lake Moraine has been under an intensive plant management program for the invasive Eurasian water-milfoil (*Myriophyllum spicatum*, EWM) since the mid-1990s and, in recent years, curly leaf pond weed (*Potamogeton crispus*). Numerous control methods have been tried including herbicide treatments (1996, 2001, 2004, 2006 and 2014), mechanical harvesting, draw downs, and biological control such as stocking weevils (*Euhrychiopis lecontei,* 1998, 2000) and walleye (*Sander vitreus,* 2009, 2010*).* In theory, weevils were stocked to graze on the EWM, while walleye were stocked to prey on the panfish species that are potential predators of the weevils.

The reservoir supports a warm water fishery and is stocked yearly by the New York State Department of Environmental Conservation (DEC) with 1,200 fall fingerling tiger muskellunge *(Esox masquinongy x lucius).* The Lake Moraine Association also stocks walleye fry occasionally, with the last stocking permits being obtained from the DEC in 2009 and 2010. There is a DEC boat launch on the reservoir that provides public access for both open water and ice fishing (Figure 1).

The purpose of this survey was to evaluate age, growth, abundance, and predator/prey balance of the reservoir's sportfish community, and to determine if stocked tiger musky are surviving and recruiting to the fishery.

Methods

Water Chemistry

Surface water temperatures were recorded on June 2nd and 3rd, 2014, prior to electrofishing. A temperature and dissolved oxygen (DO) profile was done on July 15th in 12.5 m (41 ft) of water in the southern (main lake) basin, and on July 16th in 4 m (13 ft) of water in the smaller, shallower northern basin. A YSI meter was used for both.

Electrofishing

Lake Moraine was electrofished over the two nights of June 2nd and 3rd, 2014. Five sites covering almost the entire shoreline of the main lake, and two sites covering the entire northern basin (Figure 1) were sampled for a total of 4.05 hours of “on-time”. A Smith-Root model SR-18 electrofishing boat was operated with the boat hull as negative and two six-dropper umbrella arrays, extended six feet in front of the boat, as anodes. Direct current half-wave (120 pulses per second) with 6.0 amps and 500 volts was used. Shocking started half an hour before sunset and sampling was conducted along the shoreline in 0.6 m (2 ft) to 1.5 m (5 ft) of water. The crew consisted of a driver and two netters. Four 15 minute “all fish” runs and three “gamefish only” runs were conducted. Gamefish only runs had on-times ranging from 50 to 69 minutes. During all-fish runs attempts (within reason) were made to collect every fish that was shocked, while largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*) walleye, chain pickerel (*Esox niger*) and tiger musky were the target species during gamefish runs.

Collected fish were identified to species, and lengths and weights were recorded. For largemouth bass, smallmouth bass, walleye, chain pickerel, bluegill (*Lepomis machrochirus*), pumpkinseed sunfish (*Lepomis gibbosus*), black crappie (*Pomoxis nigromaculatus*), yellow perch (*Perca flavescens*), and rock bass (*Ambloplotes rupestris*), scale samples were collected from five individual fish per 10 mm size increment. 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

Five DEC standard inland gill nets were set over two nights, July 15th and 16th (Figure 1). The standard gill net is 1.8 m (6 ft) deep with 7.6 m (25 ft) panels of 3.8, 5.1, 6.4, 7.6, 8.9, 10.2 cm (1.5, 2.0, 2.5, 3.0, 3.5 and 4 in) stretch mesh monofilament netting. Nets were set on the bottom perpendicular to shore, with the exception of site 1, where the net was set obliquely to shore due to a sharp drop-off. Nets were set from 3 m (10 ft) out, with outside depths of 4 m (13 ft), 4.9 m (16 ft), 5.5 m (18 ft), 7.6 m (25 ft) and 12.2 m (40 ft). Gill nets were fished for 19.4 to 22.1 hours. Unfortunately, on the first night one gill net (site 3) was stolen and never recovered. Initial plans called for six net sets but because of the theft only 5 were fished.

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Fyke Net

A fyke net was fished in the main lake on July 15th and in the northern basin on July 16th (Figure 1). The net used was a modified fyke net with a sinking trap and a single lead. Specifications for the net are: netting - 13 mm (1/2 in) bar knot-less nylon, with black asphalt-type coating; lead - 30 m (100 ft) long and 0.91 m (3 ft) high; frames – the opening consists of two 0.9 x 1.8 m (3 x 6 ft) rectangular frames each with a center brace; frames are spaced 0.6 m (24 in) apart with inwards mesh trap that tapers from the first frame to the second ending in a 102 mm (4 in) diameter opening; these are followed behind by four 0.77 m (30 in) diameter hoop frames spaced 0.6 m (24 in) apart, with mesh funnel between first and third hoops; cod end - with purse string closure. Nets were fished perpendicular to shore in 0.31 m (1 ft) to 1.5 m (5 ft) of water, for 19.6 and 22.1 hours.

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Results and Discussion

Water Chemistry

During the June 2nd and 3rd electrofishing survey, the surface water temperature was within the range of 59 to 77 ° F suggested in the Centrarchid Sampling Manual (Green 1989), and was 73.6° F and 72.7° F, respectively (Table 1). The main lake was stratified during the July 15th and 16th gill and fyke netting survey, with the thermocline established at a depth of 6.1 to 7.6 m (20-25 ft). Temperatures ranged from 75.7° F at the surface down to 47.5° F at 10.6 m (35 ft). DO levels from the surface to 7.6 m (25 ft) ranged from 7.5 to 3.2 parts per million (ppm) but

was ≤1 ppm from 9.1 m (30 ft) to the bottom. The northern basin was not stratified and temperatures ranged from 75.3° F at the surface to 72.1° F at 3 m (10 ft). DO levels from the surface to 3 m ranged from 7.2 to 2.5 ppm (Figure 2).

Species Collected

Overall, 1,093 fish were caught, representing 15 species (Table 2). Pumpkinseed sunfish were the most numerous with 224 caught (20% of catch). The next most numerous species was bluegill (n = 171, 15% of catch), followed by yellow perch (n = 137, 13 % of catch), golden shiner (*Notemigonus crysoleucas*) (n = 134, 12% of catch), chain pickerel (n = 132, 12% of catch), and largemouth bass (n = 110, 10% of catch). Thirty-two walleye were also caught (3% of catch). No tiger musky were captured or observed during the survey.

With three different gears used during the survey it is noteworthy to mention that all of the 15 species represented were captured with electrofishing gear (100%), 11 species with gill nets (73%) and 7 species with fyke nets (47%; Table 2). Nonetheless the other gears were clearly more effective than electrofishing for sampling several different species, including crappie.

Pumpkinseed sunfish

Pumpkinseed sunfish mean electrofishing, fyke and gill netting catch per unit effort (CPUE) was 157 fish per hour (fish/h) (8.2 standard deviation, SD), 29.0 fish per net night (fish/net night) (SD 58.7) and 1.8/net night (SD 1.8), respectively. The combined proportional stock density (PSD)(Anderson 1980), the percentage of the sample that are ≥ stock size (3 inches) and also ≥ quality size (6 inches), was 38. It should be noted that size selectivity of gears was different, the electrofishing PSD was 50 (n=157), fyke net PSD was 13 (n=48) and gill net PSD was 33 (n=9). Data was combined to get an overall PSD of the population. A PSD of 20 to 60 represents a balanced pumpkinseed population. Though the PSD fell within the balanced population range, there were few pumpkinseeds of the "preferred" size (≥ 8 inches). The Relative Stock Density (RSD) of pumpkinseed ≥8 inches (RSD_8) was just 4. No pumpkinseed of "memorable" or "trophy" size were captured (Table 3). Lengths ranged from 2 to 9 inches, with fish in the 3 inch size range being most numerous (Figure 3). Pumpkinseeds were in good condition with a mean relative weight (Wr) of 97.9 (SD 12.7). Growth rates appear to be good with mean length being very near the NYS mean for most ages (Figure 4).

Bluegill

The bluegill mean electrofishing, fyke and gill netting CPUE was 115/h (SD 84.6), 22.0/net night (SD 25.5) and 2.4/net night (SD 2.3), respectively. Bluegill PSD was 23 and RSD_8 was zero. As with pumpkinseeds, a PSD of 20 to 60 represents a balanced bluegill population. Although the PSD is fair, the RSD_8 reflects the fact than no 8 inch or larger bluegill were collected. This situation is indicative of either an overabundant bluegill population or a high harvest rate of preferred, memorable or trophy sized bluegills. Given that bluegills were in fair condition, with a mean Wr of 90.1 (SD 16.4), and their mean length at all ages is consistent with the NYS mean (Figure 5), it's safe to assume stunting is not the issue. Lengths ranged from 1 to 7 inches, with fish in the 3 inch range being most numerous (Figure 6). The data suggest that the lack of larger sized bluegill in Lake Moraine is most likely related to angler harvest.

Yellow perch

The yellow perch mean electrofishing, fyke and gill netting CPUE was 72.0/h (SD 18.8), 6.0/net night (SD 4.2) and 10.6/net night (SD 5.6), respectively. Electrofishing catch rates of >50 yellow perch/h and/or a gill net catch rates of >5 yellow perch/net are generally considered to be indicators of a highly abundant population (Forney et al. 1994). Likewise, Lake Moraine's yellow perch age-4 mean length of 7 inches (180 mm) also suggests high perch abundance because of slow growth rate (Forney et al. 1994). Yellow perch were on the thin side with a mean Wr of 84.4 (SD 11.3). The Wr index uses a range of 95 to 105 as the benchmark for fish in good condition (Pope and Kruse 2007). Perch PSD was 11 and RSD_{10} was 7 indicating the current population has a very small proportion of "keeper" size fish. Only two of the perch collected were of memorable size (Table 3). Length frequency ranged from 3 to 12 inches, with fish in the 5 inch range being most numerous (Figure 7). As stated above, yellow perch were slow growing with the mean yellow perch length at age, for most ages, falling below the NYS mean (Figure 8). Many definitions of "stunting" exist, but Heath and Roff (1987) define stunting as a population with drastically reduced growth rates. So, though slow growing, Lake Moraine yellow perch do not appear to be "stunted" at this time. Age-3 perch were the most abundant year class, comprising more than 62% of the sample (Figure 9).

Chain pickerel

Chain pickerel electrofishing mean CPUE was 30.6/h (SD 12.4), and gill net was 1.6/net night (SD 1.5); no pickerel were collected with the fyke net. The mean electrofishing CPUE for pickerel >15 inches was 10.6/h (SD 6.4). Pickerel lengths ranged from 4.9 to 23.8 inches, with the majority (61%) being below the 15 inch legal size (Figure 10). Based on the abundance of pickerel in the smaller length ranges, recruitment appears to have been very good in recent years. Sixteen pickerel were of preferred size, 20 inches, and no pickerel were collected of memorable or trophy size (Table 3). Pickerel were on the thin side with a mean Wr of 87.1 (SD 9.8). No age frequency was done as scale analysis for chain pickerel is generally unreliable. Chain pickerel appear to comprise a major component of the Lake Moraine predator fish community and the population has a reasonable proportion of preferred size pickerel (PSD of 22).

Largemouth bass

Largemouth bass electrofishing CPUE ranged from 8.0 to 36.4/h with an average of 24.2/h (SD 9.8) for all size largemouth bass. This CPUE is above the statewide average of 17/h (SD 19) (Perry et al. 2014). For largemouth bass ≥10 inches, the average catch was 18.5/h. According to Green (1989), this catch rate yields a first order density estimate of 8.2 largemouth bass ≥10 in per acre, which indicates a moderate bass population density. The mean largemouth bass CPUE per fyke and gill net was 0.5/net night (SD 0.71) and 2.2/net night (SD 2.3), respectively.

Largemouth bass were in good condition with a mean Wr of 98.7 (SD 8.1). This is equal to the spring statewide average of 99 (SD 7) (Perry et al. 2014). Mean length at age was similar to the NYS mean, with the mean age to reach legal size (12 inches) being age 4 (Figure 11; Green 1989). Age-2 bass (2012 year class) were the most frequently collected followed by age five and six (2009 and 2008 year classes; Figure 12).

Largemouth bass in the 12 to 14 inch size range accounted for 43% of the total catch (Figure 13). The resulting PSD was 86, which falls outside of the PSD range of 40 to 70 that would represent a balanced population. Twenty-seven of the bass were of preferred length, 15

inches, or larger (Table 3). This Relative Stock Density of bass ≥15 inches (RSD_{15}) was 31. A RSD_{15} of 10 to 40 would represent a balanced population. So, there is some discrepancy between the PSD and RSD on the balance of the largemouth population. Given decent growth rates, the RSD_{15} and the fact that age 4, 5, and 6 year classes, which are in the 12 to 14 inch size range, all appear to be fairly strong, the high PSD is probably not a concern at this time and the population is most likely fairly balanced.

Black crappie

Black crappie electrofishing, fyke and gill netting CPUE was 5.0/h (SD 7.6), 8.5/net night (SD 2.1) and 8.2/net night (SD 9.3), respectively. PSD was 78 and RSD_{10} was 3. This falls out of the range of 30 to 60 and >10 for a balanced crappie population. The high PSD resulted from few crappies in the 5 to 6 inch range being caught. Only two of the crappie were of the preferred length of 10 inches, a majority of the crappie were in the 8 inch range (58%; Figure 14). These crappie should be reaching the legal size of 9 inches (229 mm) in the next year. However, crappie appear to have slow growth rates in Lake Moraine so it may take longer as mean length at age was well below the NYS mean for all ages. On average, crappie are not reaching legal size until they are 7 years old; the state mean is 9 inches between ages 4 and 5 (Figure 15; Green 1989). Age-7 crappie comprised the largest portion of the sample (Figure 16). Crappie were in fair condition with a mean Wr of 92.9 (SD 7.8). It's possible that high angler harvest may be skewing the observed growth rates for crappie, and other panfish. If anglers harvest the fastest growing fish from each year class as they reach legal or desired size, it leaves the slower growing fish in the population.

Walleye

Walleye electrofishing and gill netting CPUE was 2.2/h (SD 1.9) and 4.6/net night (SD 5.5), no walleye were collected with the fyke net. An electrofishing catch of 8 walleye/h or less, in the fall, would suggest low abundance, but a gillnet catch of 5/net or greater generally suggests high abundance (Forney et al. 1994). If we also look at growth rates of walleye, the mean length at age-4 for Lake Moraine fish is 15.3 inches (389 mm, Figure 17). For NY State populations, a mean length at age-4 of 18 inches (457 mm) would suggest low abundance while a mean length of 15 inches (380 mm) would suggest high abundance (Forney et al. 1994). Although the electrofishing CPUE is conflicting, the other two indices (gill net fish/net night and mean length at age four) suggest a moderate to abundant walleye population is present in Lake Moraine. It should be noted that fall electrofishing catch rates for walleye are generally higher than those in the spring (Forney et al. 1994) so the observed catch rates likely underestimates walleye density. Walleye were on the thin side with a mean Wr of 85.1 (SD 5.5). PSD was 81 and RSD_{20} was 4. However, this may be misleading due to the low sample size (n=32), and gill nets often select for larger individuals. No young-of-year (YOY) were captured, which is not surprising considering the timing of the electrofishing runs and the size of the mesh used with the other gears, and walleye ages ranged from one to seven. This was interesting as the two most recent stocking permits given by the department to stock the lake with walleyes was in 2009 and 2010. Walleye stocked in those years would be four and five year olds in 2014; five year olds were the most numerous walleye collected (Figure 18). Walleye ranged in size from 7 to 20 inches with 17 inch fish being the most numerous (Figure 19). The presence of multiple year classes would suggest that there has been either some natural reproduction taking place or some unauthorized (illegal) stockings.

Smallmouth bass

Smallmouth bass electrofishing mean CPUE was 1.5/h (SD 7.5), no smallmouths were collected with either the fyke or gill net. For smallmouth bass ≥10 inches, the average catch was 1.3/h. A spring night time electrofishing catch of <1.5 fish/h, for ten inch or larger smallmouth bass suggests a low bass population density (Green 1989). As only six smallmouths were collected it wasn't a large enough data set to calculate an accurate PSD and RSD_{14}. The few smallmouth collected were in fair condition with a mean Wr of 92.4 (SD 5.9). One of the smallmouth was of memorable size (≥17 inches) but none were trophy size (20 inches; Table 3). The few smallmouth bass collected had good growth rates with mean length at age above or slightly below the NYS mean for the three ages (Figure 20). It would appear the smallmouth bass comprise a very minor component of the fishery.

Prey Fish Community

Golden shiner (*Notemingonus crysoleucas*) were the only member of the minnow family collected during our survey and they were the most abundant species collected in the gill nets with a mean CPUE of 26.8/net night (SD 26.8). The majority of these shiners were large with fish in the 7 to 8 inch range being most frequent (Figure 21). Though large sized, these fish are still within the size range for larger predators like largemouth bass, walleye, tiger musky and chain pickerel to prey on. Along with the shiners, yellow perch, bluegill and pumpkinseed are also an abundant prey item for the predators.

Recommendations

One of the objectives for doing the survey was to determine if recent year classes of tiger musky were recruiting. No tiger musky were captured or observed during the survey, indicating little or no recruitment in recent years. Because of the lack of (or limited) tiger musky recruitment we considered terminating the tiger musky stocking for Lake Moraine. However, after some discussion it was decided to not "throw in the towel" on the tiger stocking. Boat stocking the tiger musky will be tried for several years to see if survival of stocked fish improves. Shore stocking has been used on the lake during most of the past decade plus. With the current survey rotation for Madison County waters, Lake Moraine was scheduled to be re-surveyed in 2020, however, this date may be moved up to evaluate the boat stocking of tiger musky. If boat stocking does not improve the tiger musky recruitment, stocking pure strain muskellunge (*Esox masquinongy*) may be another alternative in the future. Muskellunge are already found in the Susquehanna watershed and pond-raised muskies may perform better than tank-reared tiger musky.

It does appear, from the number of walleye collected, that the walleye stocking conducted by the Lake Moraine Association is seeing some success. This is interesting as the number of potential walleye predators in the lake is extremely high. 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* >381 mm (15 inches; Jackson et al. 2003). The average combined electrofishing catch rate for largemouth bass and chain pickerel >381 mm was 16.8 fish/h, indicating that we would expect survival of stocked fingerling walleye to be low. With the apparent walleye survival the department will consider the feasibility of a walleye stocking program on the lake in the future.

Based on the abundance and population characteristic of the other species sampled, there appears to be no need to change any sportfish regulations at this time on Lake Moraine. While it

appears that panfish populations may be subject to high angler harvest, we are not prepared to institute more restrictive regulations at this time. If the trend continues to be observed during future surveys than higher size and lower creel limits should be considered.

Acknowledgement

I would like to thank Scott Prindle (Aquatic Biologist), Ian Blackburn (Fish and Wildlife Technician II), Heather Bull (Fish and Wildlife Technician), Greg Cocquyt (Fish and Wildlife Technician) and Katherine England (Student Intern) for their hard work during fish sampling efforts on Lake Moraine in 2014. I would also like to thank David Lemon (Region 7 Fisheries Manager) and Jeff Loukmas (Warmwater Unit leader) for their careful review and comments on early drafts of this report.

References

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.

Green, David M., 1989. Centrarchid Sampling Manual. New York State Department of Environmental Conservation, Albany, NY.

Green, D.M., T.E. Brooking, J.L. Forney, and T. Greig. 1993. Evaluation of the effects of exploitation on the structure of panfish populations, N.Y. federal aid study VII, NYSDEC Report.

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.

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.

Jackson, J.R., T.E. Brooking, A.J.VanDeValk, and L.G. Rudstam. 2003. Factors Affecting Survival of Stocked Walleye in New York Lakes. Cornell Warmwater Fisheries Unit. Cornell University Biological Field Station. Bridgeport, NY.

Harman, W.N., M.F. Albright, and O. Zaengle. 2011. BFS Technical Report #31, Aquatic Macrophyte Management Plan Facilitation Lake Moraine. SUNY Oneonta Biological Field Station. Cooperstown, NY.

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.

Table 1. 2014 Water Chemistry for Lake Moraine (Madison County).

Date	Air Temp. (Farhreneit)	Depth (Feet)	Water Temp. (Farhreneit)	DO (ppm)	pH	Conductivity (umho/cm3)	Location
6/2/2014	80	0	73.6	9.6	8.5	759	Northern Basin
6/3/2014	75	0	72.7	9.9	8.6	755	Northern Basin
7/15/2014	75	0	75.7	7.5	8.2		Southern Basin
		5	75.7	7.5			
		10	75.6	7.6			
		15	73.9	5.3			
		20	67.9	3			
		25	58.0	3.2			
		30	54.0	1			
		35	47.5	0.3			
7/16/2014	75	0	75.3	7.2	8.7		Northern Basin
		5	75.2	7.5			
		10	72.1	2.5			

Table 2. Number of fish collected in 2014 Lake Moraine (Madison County).

Species	Scientific name	Electrofishing	Fyke Net	Gill Net	Sum	Sum percent
Chain Pickerel	*Esox niger*	124	0	8	132	12%
Golden shiner	*Notemigonus crysoleucas*	8	0	126	134	12%
White Sucker	*Catostomus commersoni*	4	0	2	6	1%
Creek Chubsucker	*Erimyzon oblongus*	2	0	1	3	0%
Yellow Bullhead	*Ameirus natalis*	4	4	0	8	1%
Brown Bullhead	*Ameirus nebulosis*	29	4	0	33	3%
Rock Bass	*Ambloplities rupestris*	23	0	4	27	2%
Redbreast Sunfish	*Lepomis auritus*	2	0	0	2	0%
Pumpkinseed	*Lepomis gibbosus*	157	58	9	224	20%
Bluegill	*Lepomis macrochirus*	115	44	12	171	16%
Smallmouth Bass	*Micropterus dolomieu*	6	0	0	6	1%
Largemouth Bass	*Micropterus salmoides*	98	1	11	110	10%
Black Crappie	*Pomoxis nigromaculatus*	7	20	41	68	6%
Yellow Perch	*Perco flavescens*	72	12	53	137	13%
Walleye	*Sander vitreus*	9	0	23	32	3%
	Total	**660**	**143**	**290**	**1,093**	
	Species	**15**	**7**	**11**		

Table 3. Number of fish collected of stock, quality, preferred, memorable and trophy lengths in 2014 fisheries surveys on Lake Moraine(Madison County).

	FREQ	Stock		Quality		Preferred		Memorable		Trophy	
Chain pickerel	132	60	(10)	52	(15)	16	(20)	0	(25)	0	(30)
Rock bass	27	26	(4)	11	(7)	1	(9)	0	(11)	0	(13)
Pumpkinseed	224	223	(3)	84	(6)	9	(8)	0	(10)	0	(12)
Bluegill	171	163	(3)	39	(6)	0	(8)	0	(10)	0	(12)
Smallmouth bass	6	5	(7)	5	(11)	5	(14)	1	(17)	0	(20)
Largemouth bass	110	86	(8)	74	(12)	27	(15)	0	(20)	0	(25)
Black crappie	68	68	(5)	53	(8)	2	(10)	0	(12)	0	(15)
Yellow perch	137	118	(5)	13	(8)	8	(10)	2	(12)	0	(15)
Walleye	32	26	(10)	21	(15)	1	(20)	0	(25)	0	(30)

*Number in ( ) is length in inches for stock, quality, preferred, memorable and trophy for species.

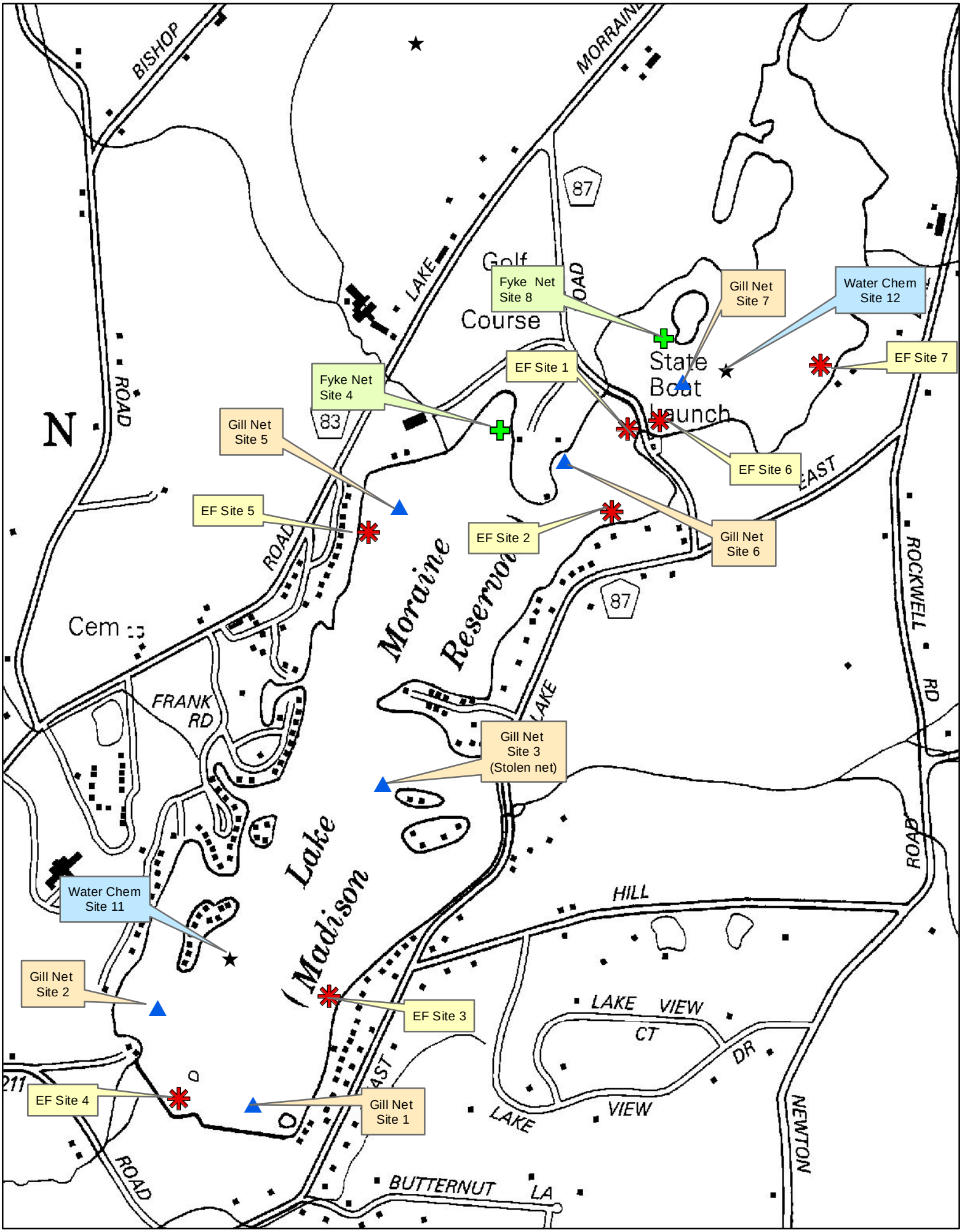

Figure 1. Site locations for electrofishing (EF), gill net(GN) and fyke net Lake Moraine 2014.

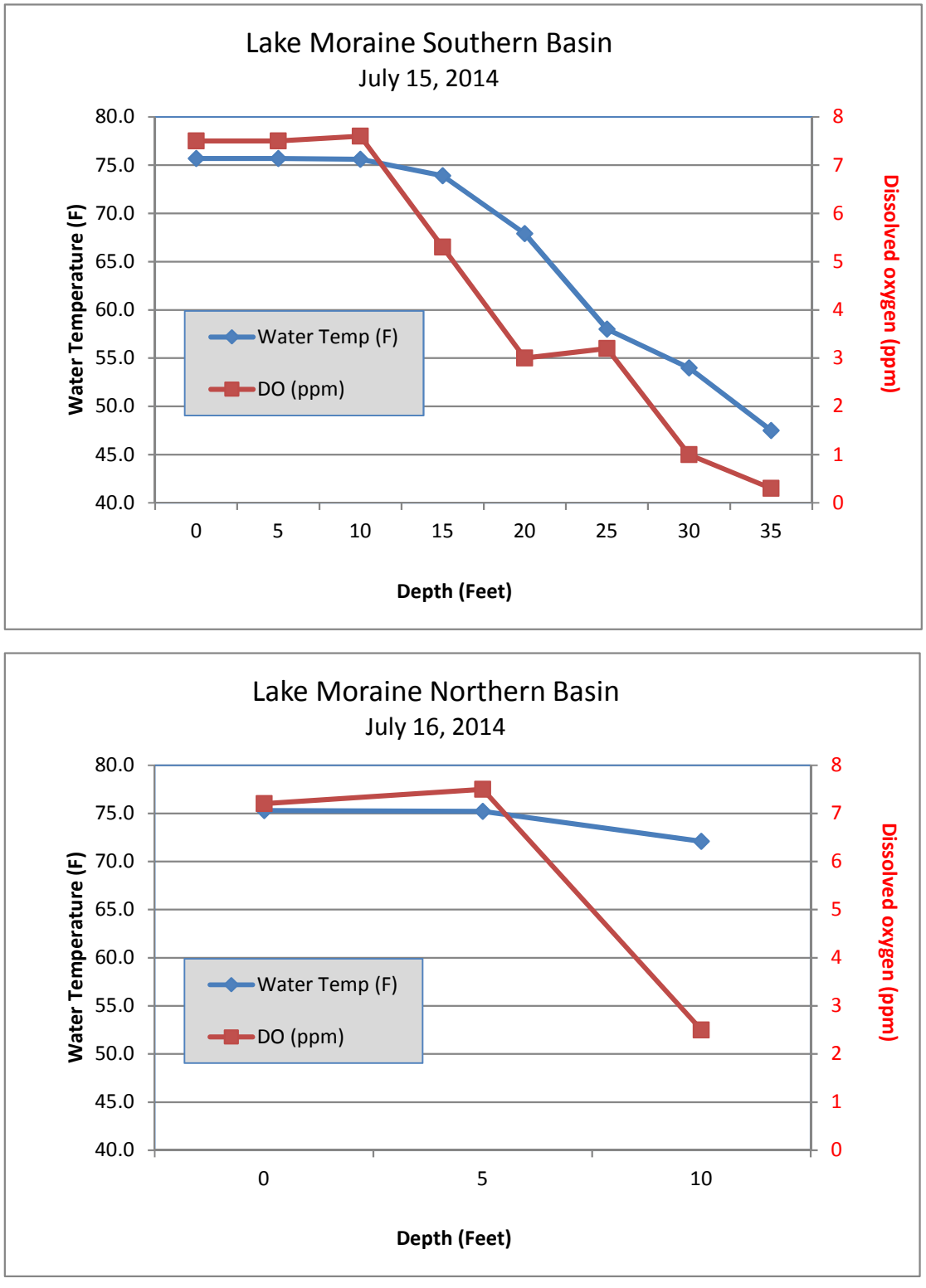

Figure 2. Temperature and Dissolved Oxygen Profile for Lake Moraine, Madison County.

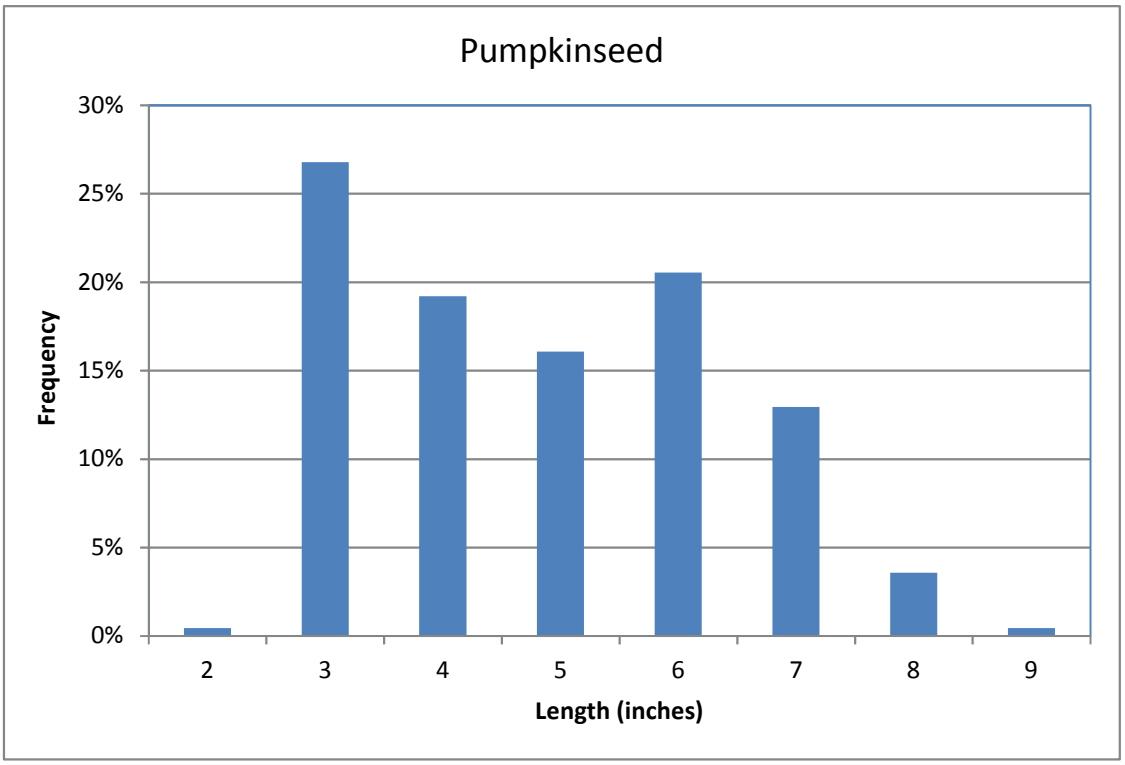

Figure 3. Length frequency distributions of pumpkinseed sampled in Lake Moraine 2014.

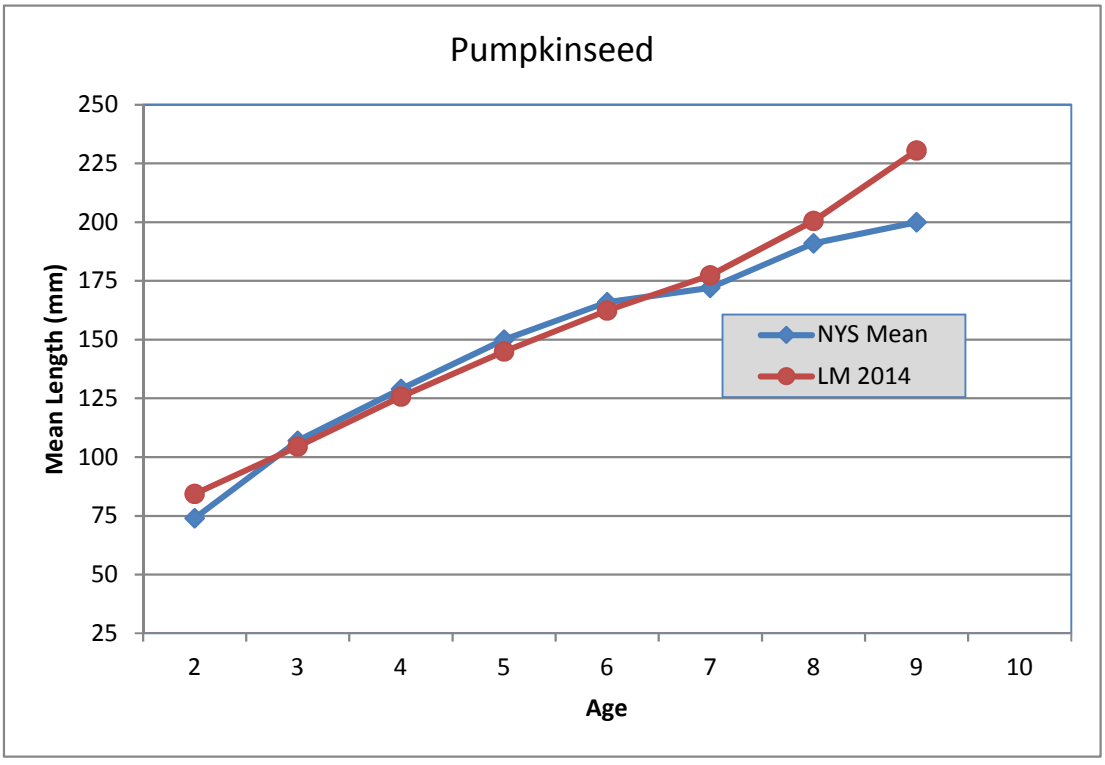

Figure 4. Lake Moraine pumpkinseed mean lengths (mm) at age and the New York State mean growth rate (Green 1989).

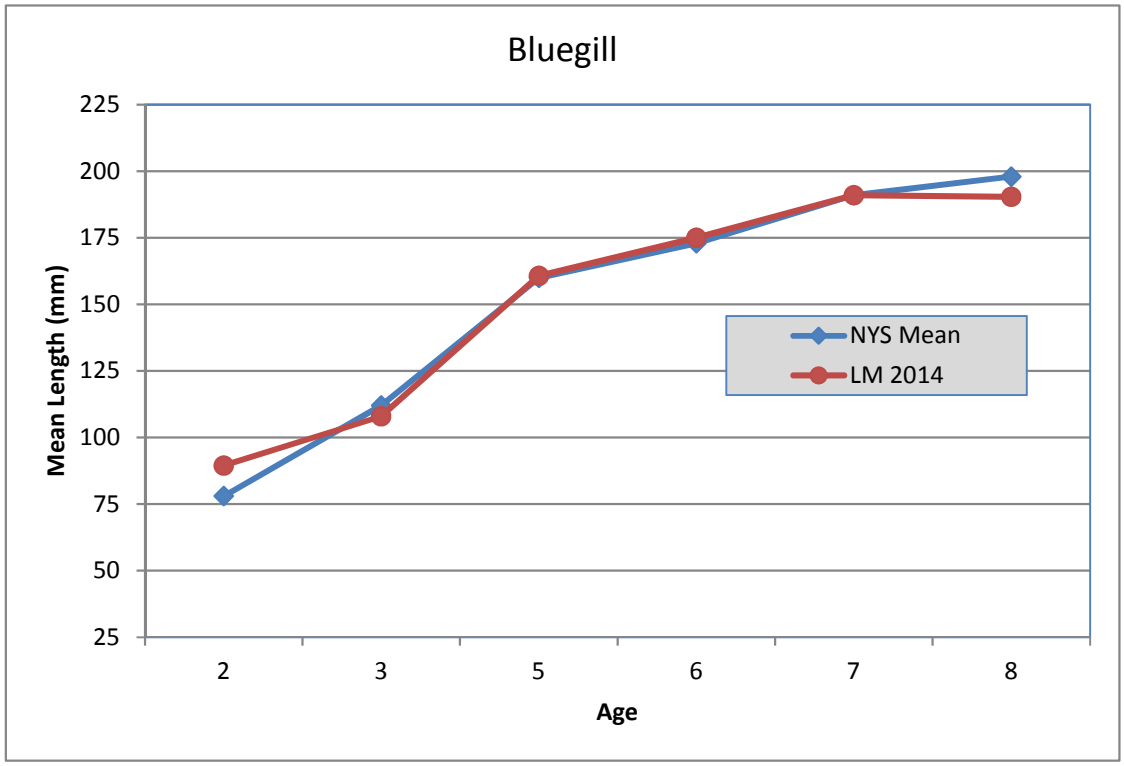

Figure 5. Lake Moraine bluegill mean lengths (mm) at age and the New York State mean growth rate (Green 1989).

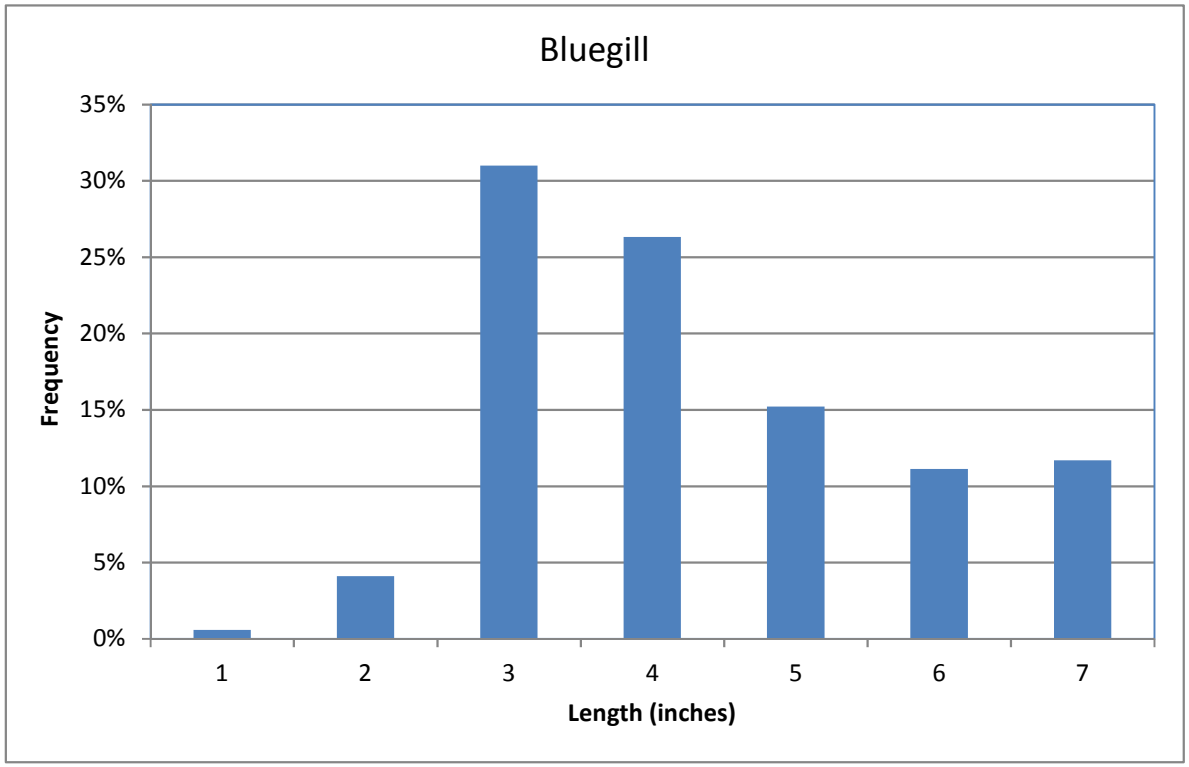

Figure 6. Length frequency distributions of bluegill sampled in Lake Moraine 2014.

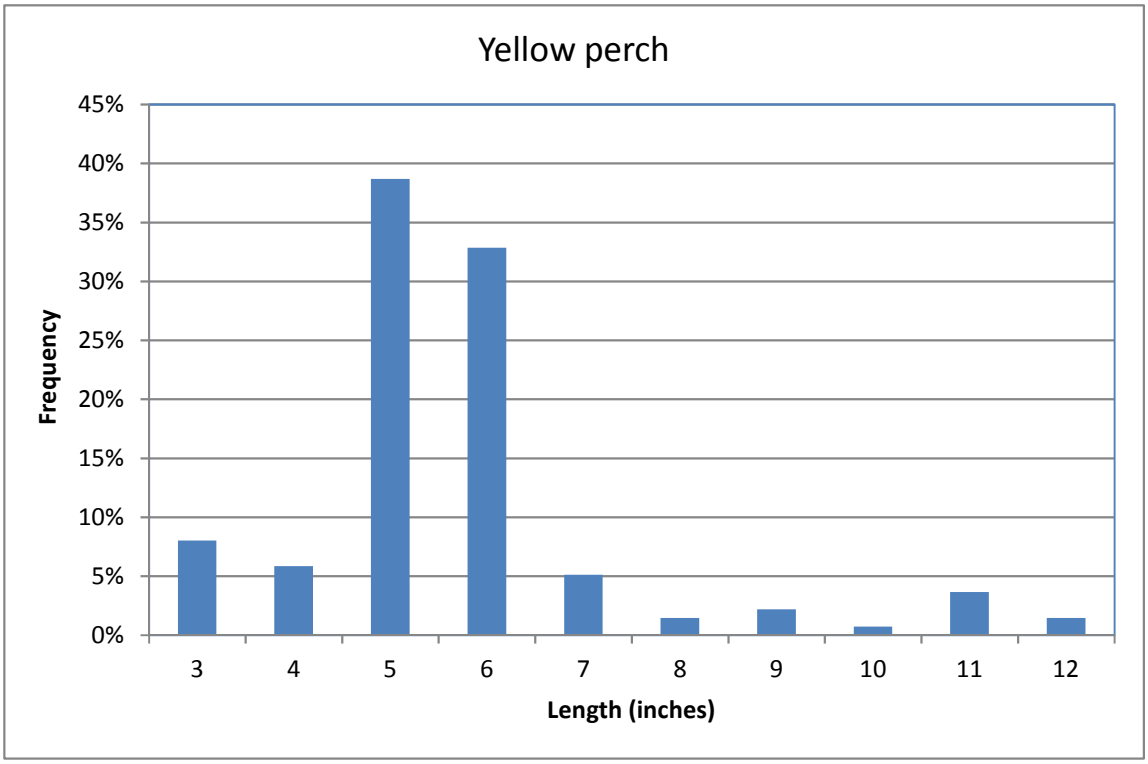

Figure 7. Length frequency distributions of yellow perch sampled in Lake Moraine 2014.

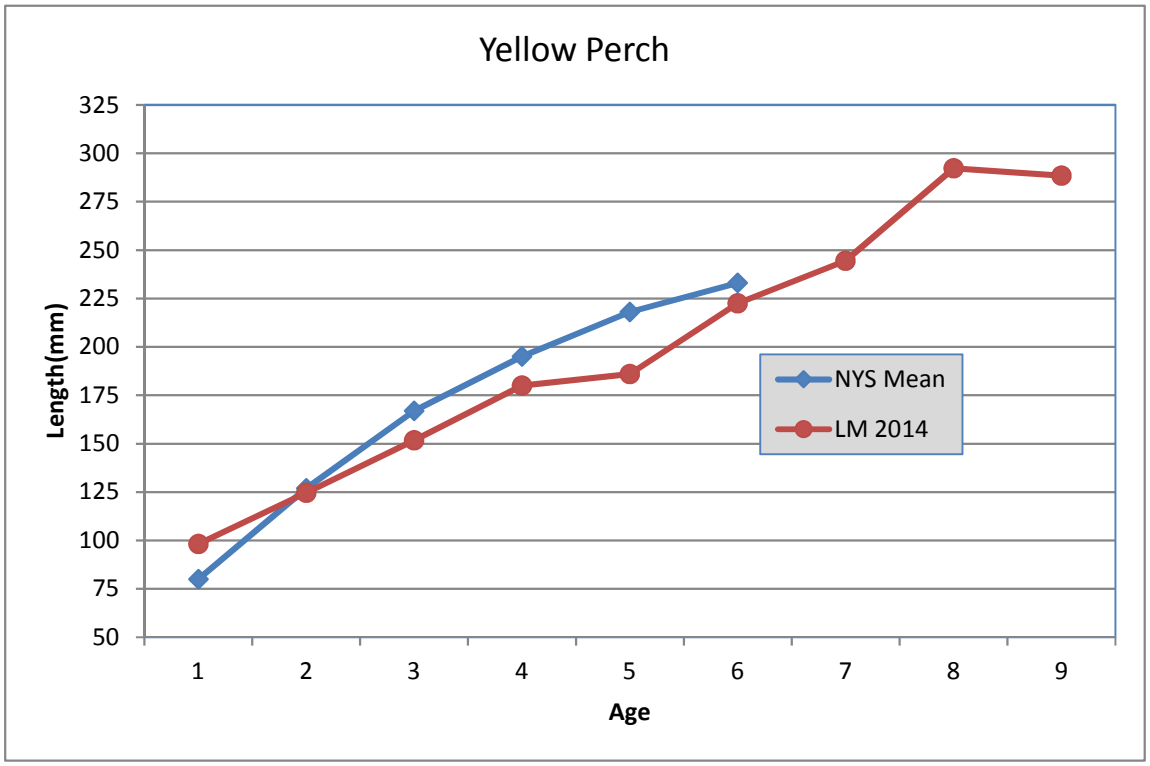

Figure 8. Lake Moraine yellow perch mean lengths (mm) at age and the New York State mean growth rate (Green et al. 1993).

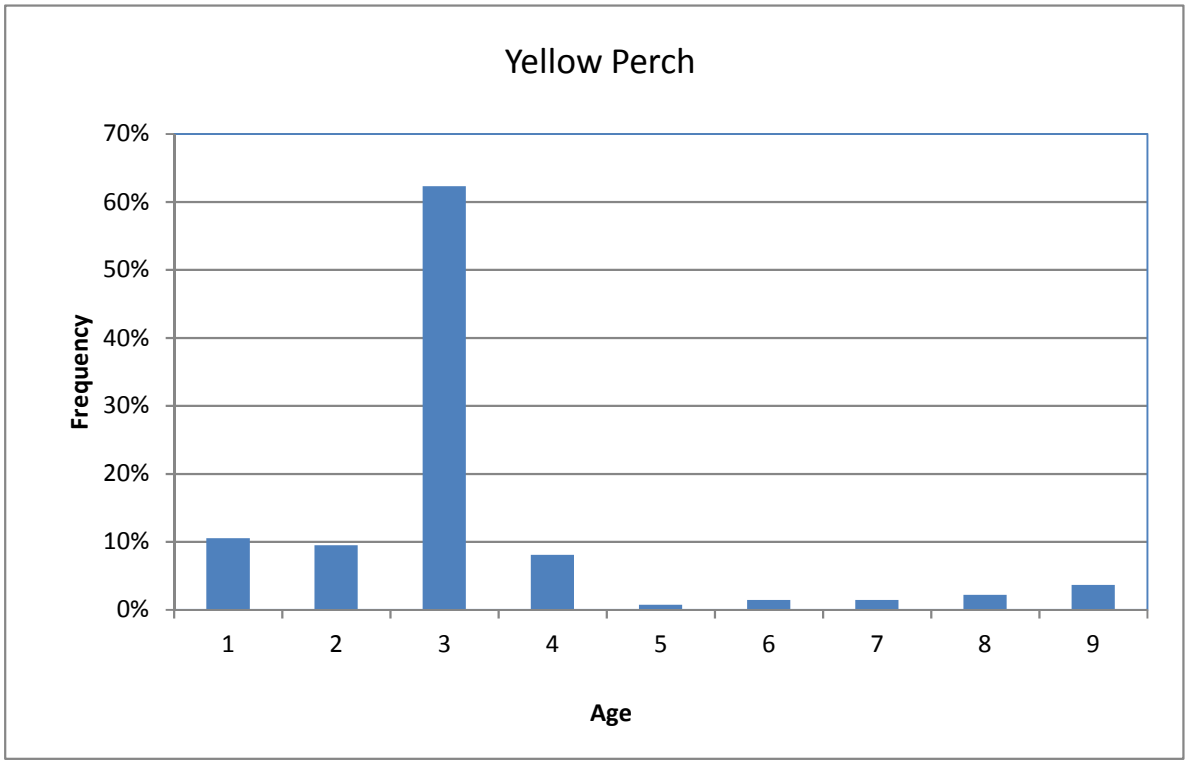

Figure 9. Age frequency distributions of yellow perch sampled in Lake Moraine 2014.

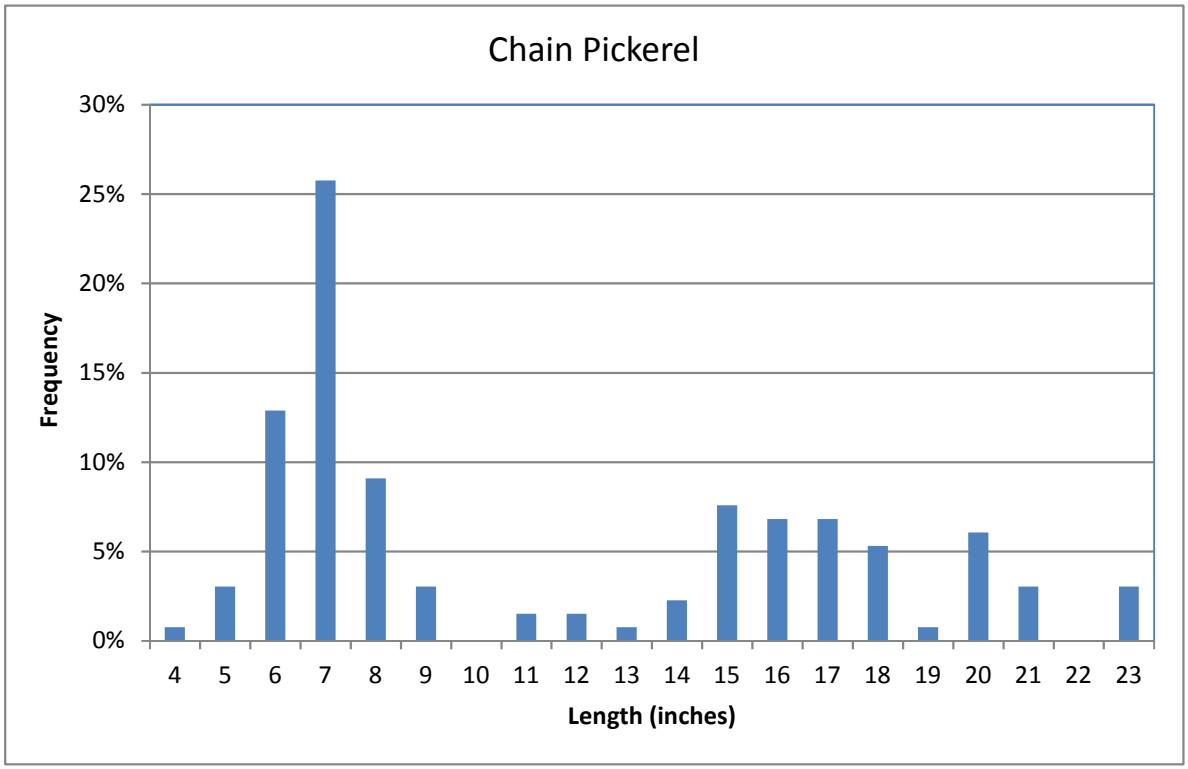

Figure 10. Length frequency distributions of Chain Pickerel sampled in Lake Moraine 2014.

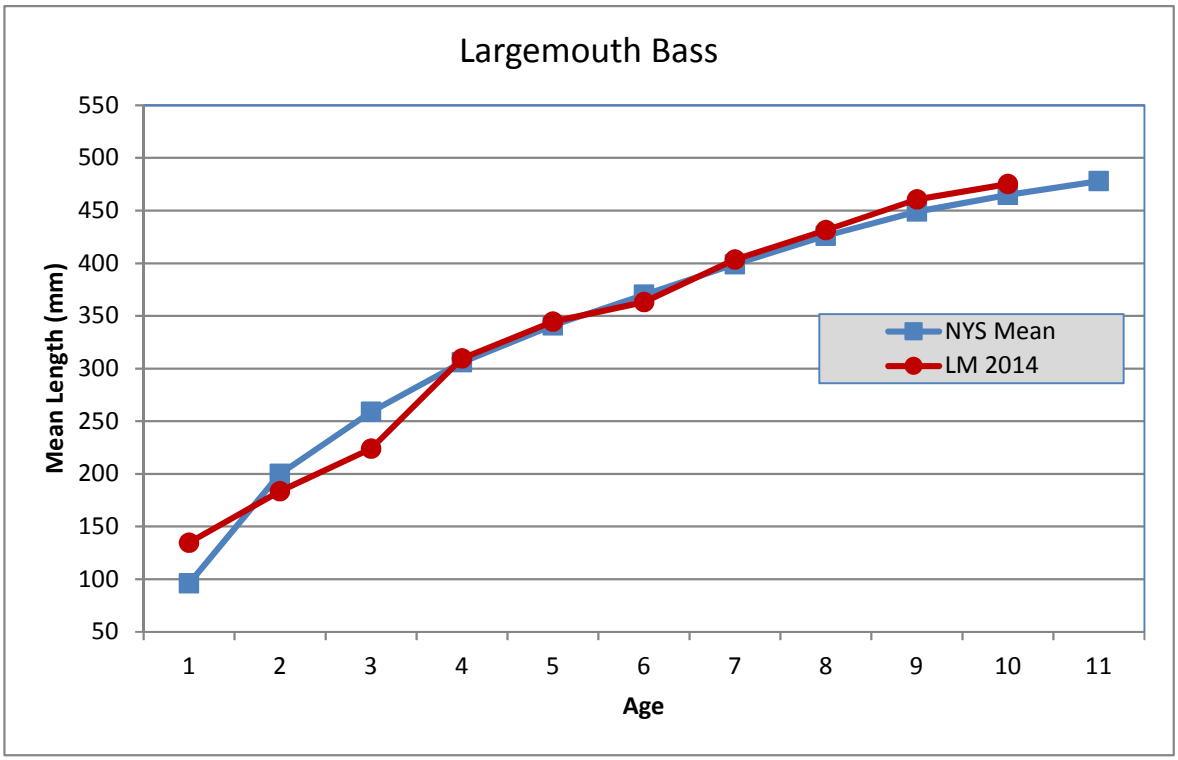

Figure 11. Lake Moraine largemouth bass mean lengths (mm) at age and the New York State mean growth rate (Green 1989).

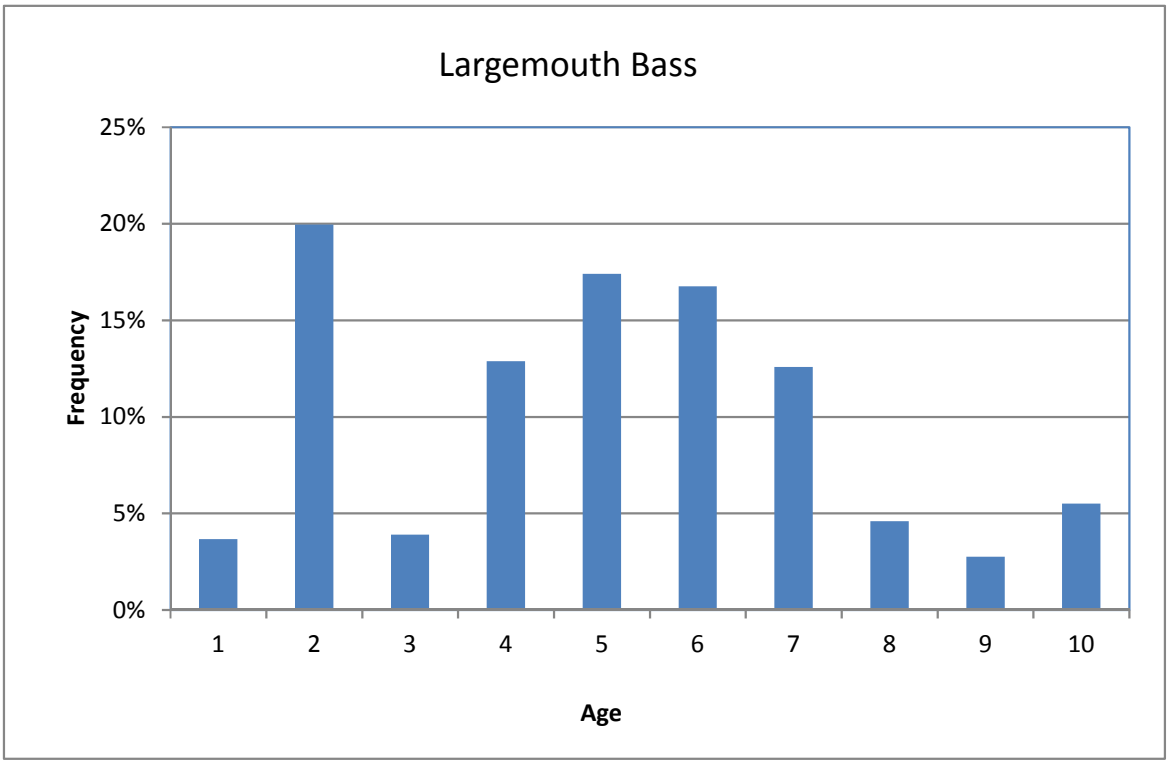

Figure 12. Age frequency distributions of largemouth bass sampled in Lake Moraine 2014.

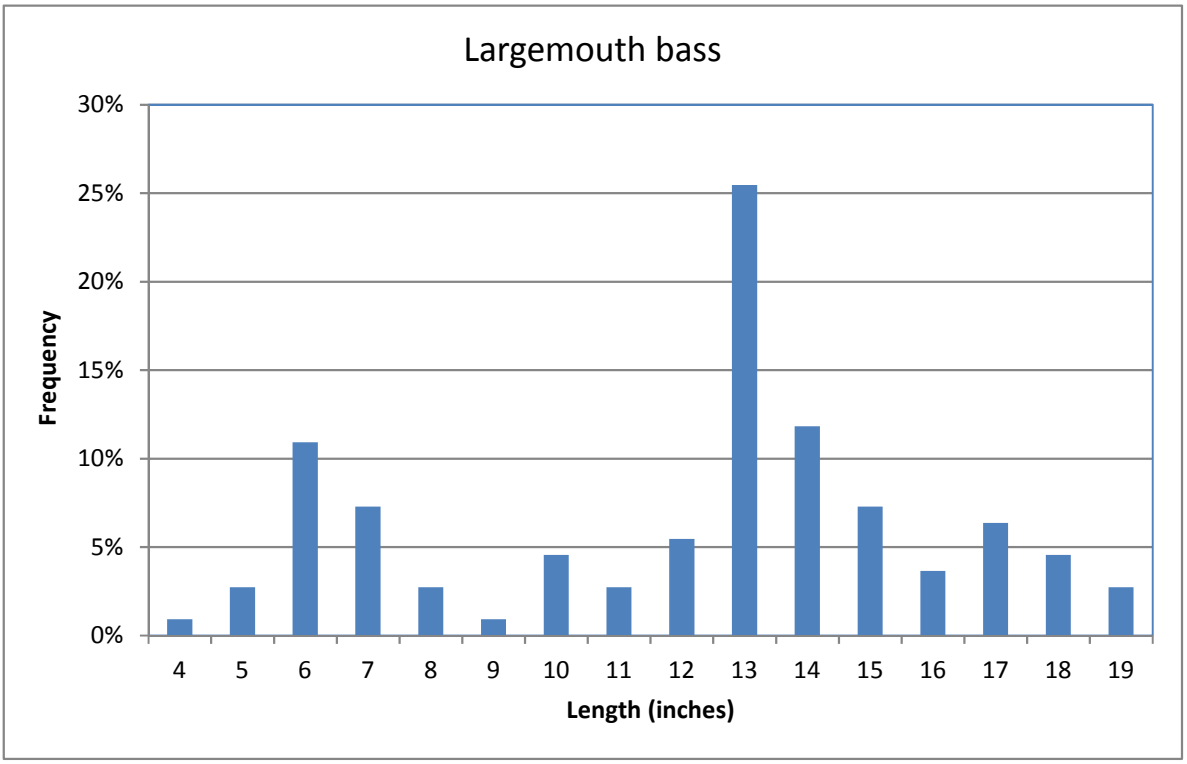

Figure 13. Length frequency distributions of largemouth bass sampled in Lake Moraine 2014.

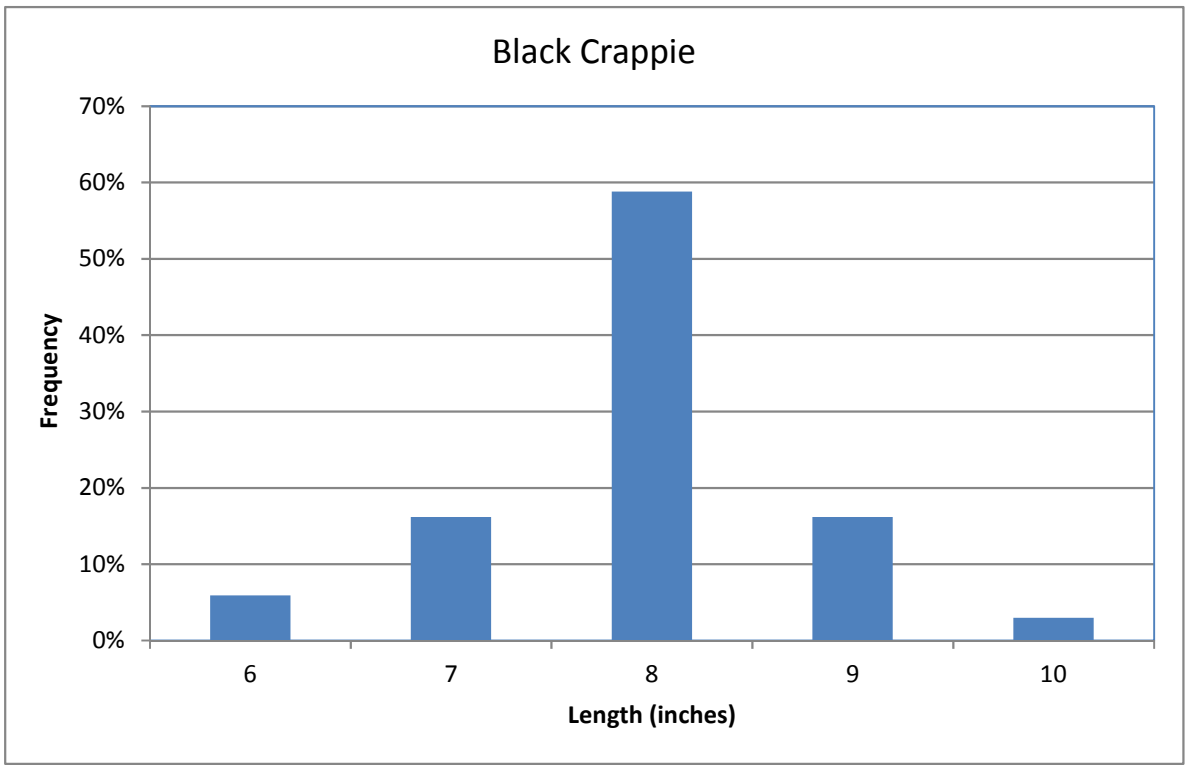

Figure 14. Length frequency distributions of black crappie sampled in Lake Moraine 2014.

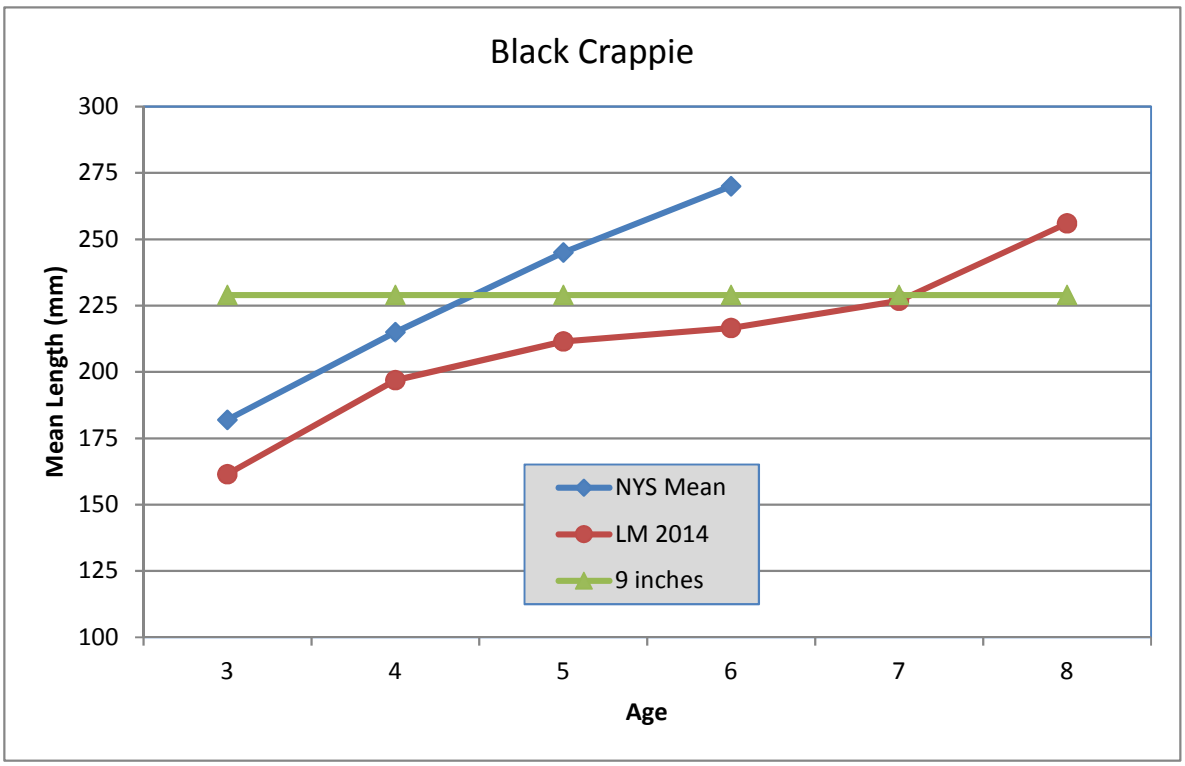

Figure 15. Lake Moraine black crappie mean lengths (mm) at age, 9 inch legal length and the New York State mean growth rate (Green 1989).

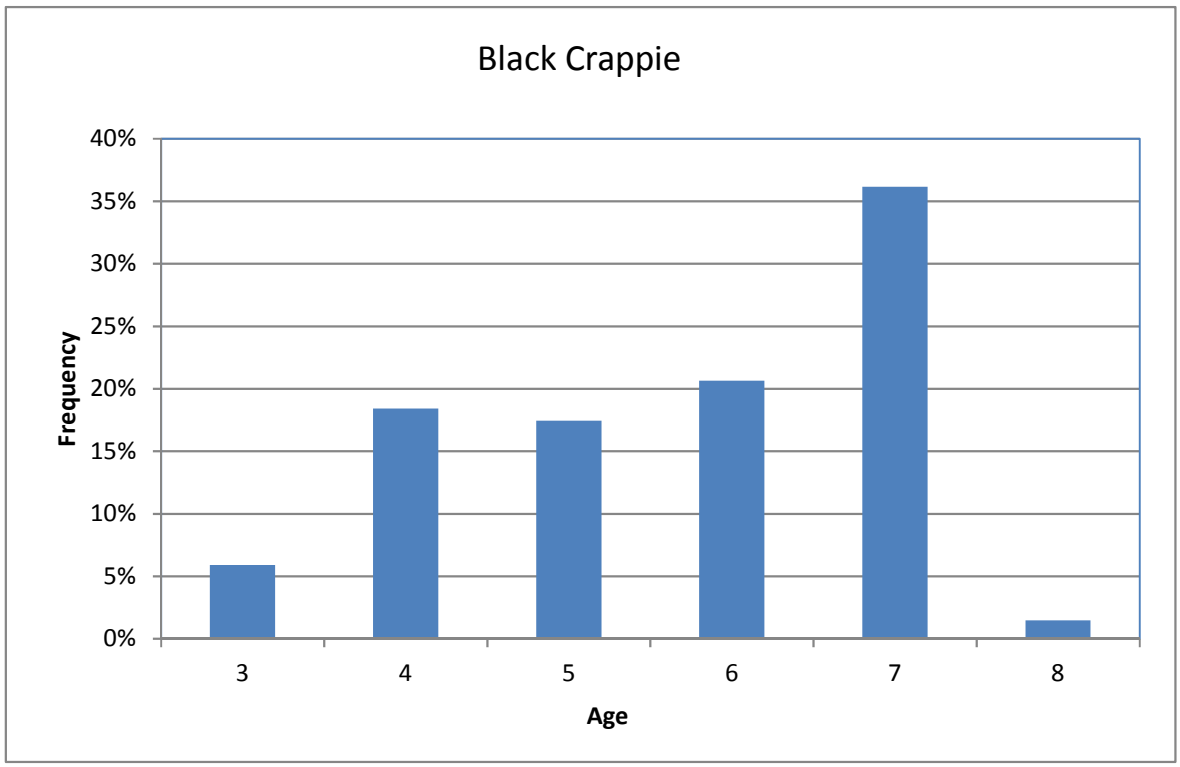

Figure 16. Age frequency distributions of black crappie sampled in Lake Moraine 2014.

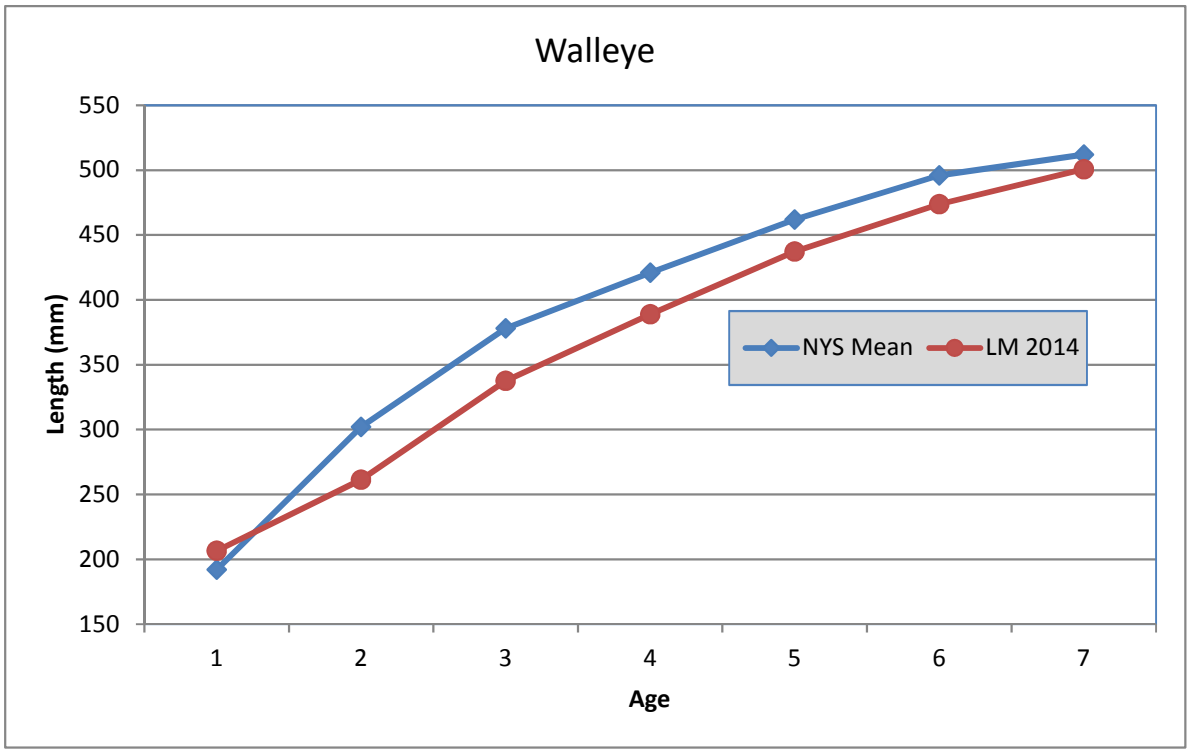

Figure 17. Lake Moraine walleye mean lengths (mm) at age and the New York State mean growth rate (Green et al. 1993).

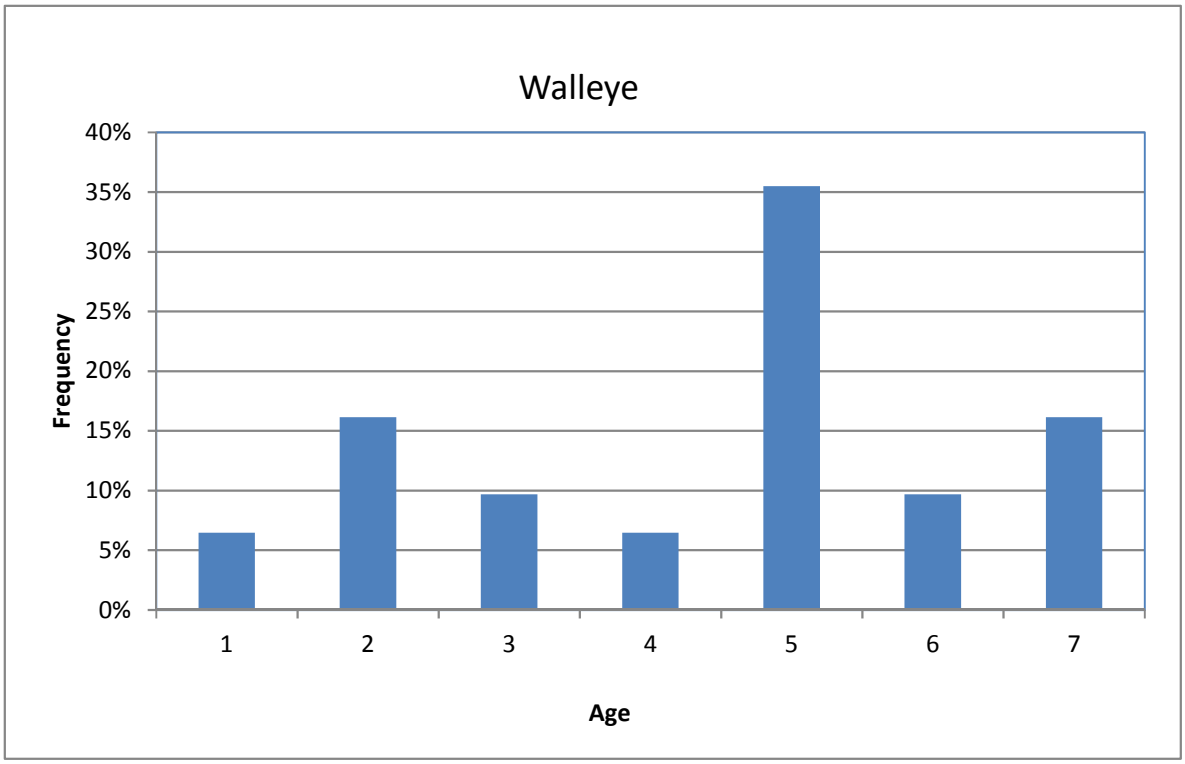

Figure 18. Age frequency distributions of walleye sampled in Lake Moraine 2014.

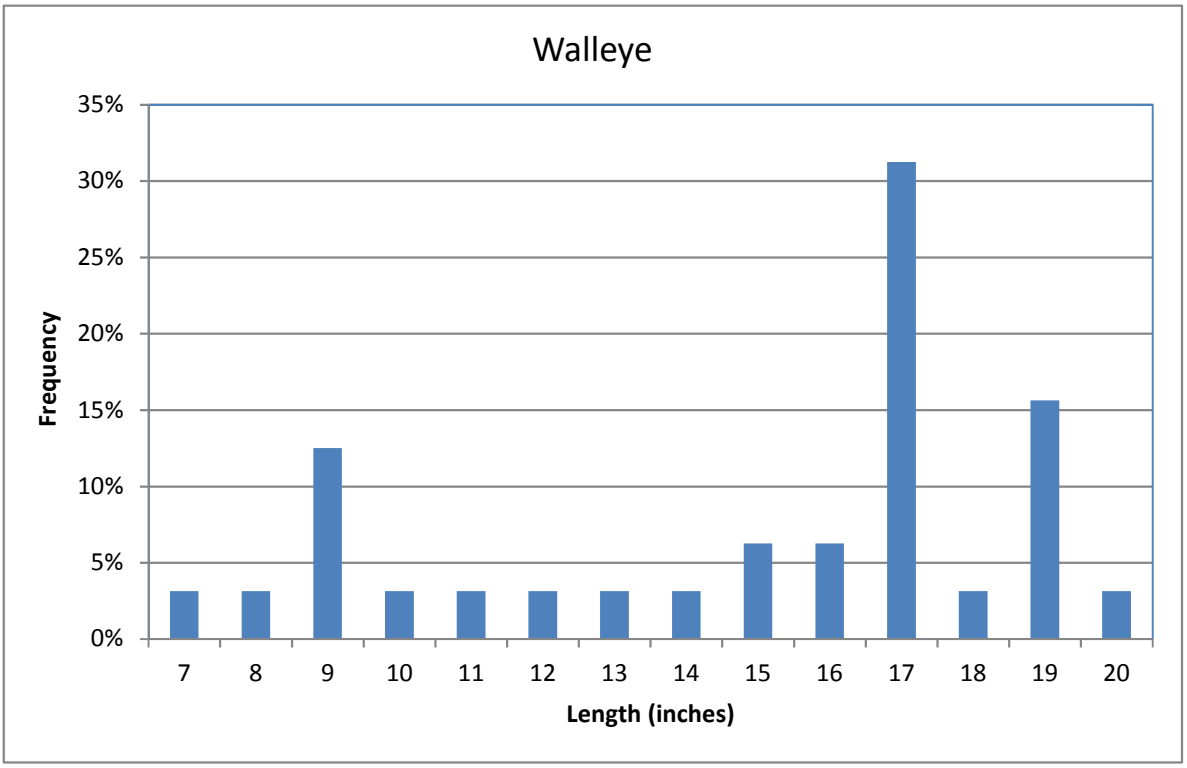

Figure 19. Length frequency distributions of walleye sampled in Lake Moraine 2014.

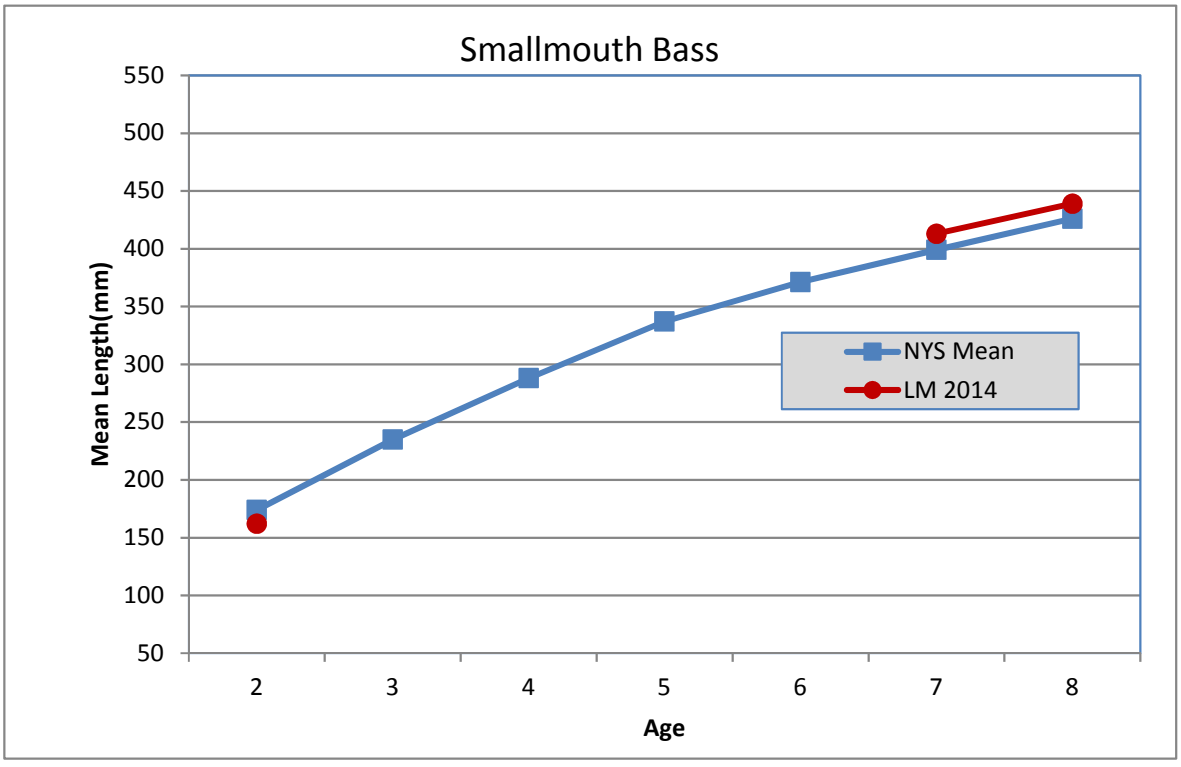

Figure 20 Lake Moraine smallmouth bass mean lengths (mm) at age and the New York State mean growth rate (Green 1989).

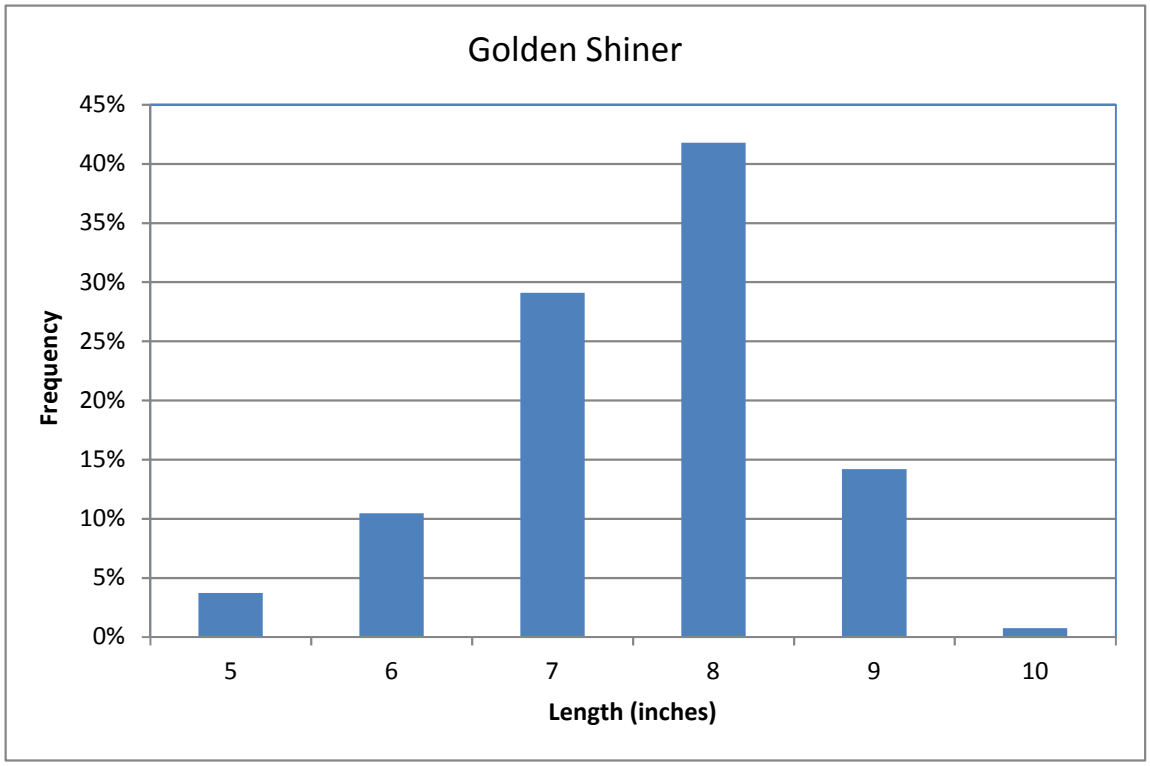

Figure 21. Length frequency distributions of golden shiner sampled in Lake Moraine 2014.