EVALUATION OF "QUALITY" BASS FISHING REGULATIONS IN FOUR NEW HAMPSHIRE LAKES (2018)

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INTRODUCTION

Black bass fishery resources in the State of New Hampshire are highly utilized by anglers, with Smallmouth Bass (*Micropterus dolomieui*) and Largemouth Bass (*M. salmoides*) ranking as the top two species fished for by anglers. Based on the most recent data available, anglers are the most satisfied with bass fishing than any other species in New Hampshire; 78% and 75% overall satisfaction for Largemouth Bass and Smallmouth Bass, respectively (Responsive Management 2016).

According to the 2011 National Survey of Fishing, Hunting, and Wildlife Associated Recreation, 140,000 anglers fished 1.705 million days for warmwater and coolwater species in New Hampshire (panfish: 23,000 anglers fished 226,000 days; black bass: 110,000 anglers fished 1.434 million days; Northern Pike (*Esox lucius*) and Chain Pickerel (*Esox niger*): 7,000 anglers fished 45,000 days) (U.S. Department of Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2013). Since the average trip expenditure for anglers fishing in New Hampshire is $35 per day, the total estimated expenditures by anglers fishing for warmwater and coolwater species equals approximately $59.68 million per year.

As black bass populations in the state are managed solely by natural reproduction, it is necessary to conduct population assessments to monitor their status in response to existing or proposed management strategies and to ensure their continued health. Assessments also provide opportunities to examine the need for new angling regulations in order to improve existing fisheries.

While some harvest of black bass occurs during the open-water season, bass harvest rates through the ice are much higher. Racine and Gries (2007) examined ice angler data from four New Hampshire warmwater lakes (two in the Lakes Region and two in the Southwest Region) and found anglers harvested 49% of the largemouth bass they caught and 28% of the smallmouth bass they caught. When anglers were asked, "Do you practice catch and release for bass caught while ice fishing?" 48.0% said they practice catch and release sometimes, and 3.1% said they never practice catch and release.

In addition to higher bass harvest rates during winter, harvest tends to focus on larger fish. Racine and Gries (2007) found 69% of largemouth bass harvested by ice anglers were $\geq$ 15". Sample size of smallmouth bass was too low to provide accurate length data.

In 2011 a new administrative rule was put into place designed to improve the quality of bass fisheries in Clement Pond (Hopkinton), Grassy Pond (Rindge), Warren Lake (Alstead), and Gregg Lake (Antrim). The rule stipulated that from January 1 to March 31, the taking of black bass from 15 to 20 inches in length is prohibited and the daily limit of black bass is 3 fish, of which only one may be longer than 20 inches. The goal of this proposed rule was to increase the number of black bass $\geq$ 381 mm ($\geq$ 15") in these water bodies. This goal was to be met through protection of bass within the slot-length limit and increased growth rates brought about as a result of an increased harvest of bass < 381 mm (< 15"). Because Largemouth Bass is either the only bass species present or the most prevalent bass species in each of these four water bodies,

regulations were conceived with a focus on Largemouth Bass. However, Smallmouth Bass populations, where present, should have also benefitted from these regulations.

The objective of the 2018 surveys was to evaluate the potential effects of the 2011 winter angling regulation change on the bass populations in the four lakes.

METHODS

Each water body was sampled three times by boat electrofishing and three times by angling (Table 1). Sampling was conducted using these two techniques to minimize any sampling technique associated size bias.

Bass collected by boat electrofishing (Smith-Root SR18) were sampled after sunset using three netters. Electrofishing equipment was adjusted according to water conductivity and observed fish behavior relative to their position in the electrode's field. Each night's sampling was broken up into timed runs of 1000 seconds (using the equipment's "on" meter time) and black bass were the only species collected. With the exception of Gregg and Warren Lakes, each water body's entire shoreline was surveyed during each night's sample; only a small portion of Gregg and Warren Lakes' shorelines was not surveyed. All bass were placed in a live well upon capture. Bass were identified to species, checked for fin clips (see below), and measured to the nearest millimeter (TL) using the lower lobe of the caudal fin. Bass captured for the first time were marked via a slight upper caudal clip (excised fin). For age and growth purposes, scale samples were taken from black bass in the region below the lateral line and slightly posterior to the pectoral fin on the left side of the fish. Fish were processed shortly after capture and then released. Bass < 152 mm (< 6") were released without being processed. Detailed black bass growth methodology and analyses are presented in Racine (2006a). In this report, only fish aged as $\leq$ 6 years of age and having scales with ageing confidence $\leq$ 3 (i.e. $\pm$ 1 year) were analyzed.

Bass collected by anglers were caught during the day using artificial lures. Two to three boats (three to seven anglers) participated in each day's survey. Catch and effort for each boat was recorded separately (boat effort = # anglers x hours angled). Bass were either processed immediately or held in live-wells until staff was available to process them (see above). Bass < 152 mm (< 6") were released without being processed.

Schnabel population estimators (multiple mark and multiple recapture) were used to estimate bass population size (Ricker 1975) and associated 95% confidence intervals. Population estimates were calculated by species for all bass $\geq$ 152 mm ($\geq$ 6") in each water body and by length categories related to rule.

A Mann-Whitney Rank Sum test was used to compare catch rates between angling and electrofishing for each year and between years on each water body by species. Prior to analysis, a square root transformation was applied to catch rate (# bass captured/hour) data (Zar 1984). Catch rate data were calculated for each sample date either by electrofishing run or by boat for

angling samples. A two-way ANOVA was used to compare TL of bass captured between angling and electrofishing sampling methods by species, using water body and sampling method as treatments.

The electrofishing and angling data collected in 2018 is being compared to the 2009 data that was collected prior to the rule change. However, scale samples for age and growth were not collected during the 2009 surveys but were collected in 2010 for future age and growth comparisons. Due to the small sample size of Smallmouth Bass sampled during these surveys the focus of data comparison will be on Largemouth Bass.

All reported mean values include estimated standard deviations, unless otherwise noted. The level of significance for all statistical analyses was 0.10.

RESULTS AND DISCUSSION

Clement Pond (*Hopkinton*)

Clement Pond is natural water body, raised by damming, and is 119 acres. Mean depth is 6.6 m and maximum depth is 15.5 m. Fish species present include Largemouth Bass, Smallmouth Bass, Yellow Perch (*Perca flavescens*), Bluegill (*Lepomis macrochirus*), Pumpkinseed (*Lepomis gibbosus*), Chain Pickerel, Black Crappie (*Pomoxis nigromaculatus*), and Yellow Bullhead (*Ameiurus natalis*). Clement Pond was surveyed three times by electrofishing and three times by angling during July and August 2018 (Tables 1 and 2). A total of 243 Largemouth Bass and 22 Smallmouth Bass were sampled. Population estimates were greater for Largemouth Bass and varied by length category (Tables 3 and 4; Figures 1 and 2). Catch rates for Largemouth and Smallmouth Bass were significantly greater during electrofishing samples than during angling samples ($P < 0.001$; Tables 1 and 2; Figures 3 and 4).

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for Largemouth Bass are presented in Table 5 and Figure 5. Largemouth Bass growth was categorized as fast when compared to New Hampshire water bodies sampled during 1997-2017. Average length at age was the same as statewide values for age 1 and above statewide values for Largemouth Bass ages 2-6. Largemouth Bass took an average of 3.12 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2017). Smallmouth Bass growth was not categorized due to low sample size.

Grassy Pond (Rindge)

Grassy Pond is natural water body, and is 99 acres. Mean depth is 1.1 m and maximum depth is 2.3 m. Fish species present include Largemouth Bass, Yellow Perch, Pumpkinseed, Golden Shiner (*Notemigonus crysoleucas*), Chain Pickerel, and Creek Chubsucker (*Erimyzon oblongus*). Grassy Pond was surveyed three times by electrofishing and three times by angling during July and August 2018 (Table 1). A total of 320 Largemouth Bass were sampled. Population estimates varied by length category (Table 3; Figure 6). Catch rates for largemouth bass were

significantly greater during electrofishing samples than during angling samples ($P < 0.001$; Table 1; Figure 7)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for Largemouth Bass are presented in Table 5 and Figure 8. Largemouth Bass growth was categorized as fast when compared to New Hampshire water bodies sampled during 1997-2017. Average length at age was lower than statewide values for age 1 and above statewide values for Largemouth Bass ages 2-6. Largemouth Bass took an average of 3.08 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2017).

Gregg Lake (Antrim)

Gregg Lake is natural water body, raised by damming, and is 195 acres. Mean depth is 5.3 m and maximum depth is 11.0 m. Fish species present include Largemouth Bass, Smallmouth Bass, Yellow Perch, Chain Pickerel, Redbreast sunfish (*Lepomis auritus*), Pumpkinseed, and Golden Shiner. Gregg Lake was surveyed three times by electrofishing and three times by angling during July and August 2018 (Tables 1 and 2). A total of 229 Largemouth Bass and 150 Smallmouth Bass were sampled. Population estimates were greater for Largemouth Bass and varied by length category (Tables 3 and 4; Figures 9 and 10). Catch rates for Largemouth and Smallmouth Bass were significantly greater during electrofishing samples than during angling samples ($P < 0.001$; Tables 1 and 2; Figures 11 and 12)

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for Largemouth Bass are presented in Table 5 and Figure 13. Largemouth Bass growth was categorized as average when compared to New Hampshire water bodies sampled during 1997-2017. Average length at age was below statewide values for age 1 and above statewide values for Largemouth Bass ages 2-6. Largemouth Bass took an average of 3.57 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2017). Smallmouth Bass growth was not categorized due to low sample size on the night scale samples were taken.

Warren Lake (Alstead)

Warren Lake is natural water body, raised by damming, and is 186 acres. Mean depth is 2.0 m and maximum depth is 4.2 m. Fish species present include Largemouth Bass, Smallmouth Bass, Yellow Perch, Pumpkinseed, Golden Shiner, Chain Pickerel, Bluegill, Rainbow Trout (*Oncorhynchus mykiss*), and Brown Trout (*Salmo trutta*). Warren Lake was surveyed three times by electrofishing and three times by angling during July and August 2018 (Tables 1 and 2). A total of 669 Largemouth Bass and 19 Smallmouth Bass were sampled. Population estimates for Largemouth Bass varied by length category (Table 3; Figure 14). Population estimates for Smallmouth Bass were not calculated due to small sample size (N=19). Catch rates for Largemouth and Smallmouth Bass were significantly greater during electrofishing samples than during angling samples ($P < 0.001$; Tables 1 and 2; Figures 15 and 16).

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for Largemouth Bass are presented in

Table 5 and Figure 17. Largemouth Bass growth was categorized as average when compared to New Hampshire water bodies sampled during 1997-2017. Average length at age was the below statewide values for age 1 and above statewide values for Largemouth Bass ages 2-6. Largemouth Bass took an average of 3.4 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2017). Smallmouth Bass growth was not categorized due to low sample size.

Lake Comparisons Between Years

Clement Pond (Hopkinton)

Clement Pond was surveyed three times by electrofishing and three times by angling during July and August 2009. A total of 340 Largemouth Bass and 9 Smallmouth Bass were sampled (Tables 1 and 2). Population estimates were greater for Largemouth Bass and varied by length category (Tables 3 and 4; Figures 1 and 2). Population estimates for Largemouth Bass $\geq$ 381 ($\geq$15") showed no significant difference between 2009 and 2018 with a high degree of overlap in confidence intervals (Table 3). Smallmouth Bass were not compared due to low sample sizes. Catch rates for Largemouth Bass were higher in 2018 by electrofishing than in 2009 and angling catch rates were higher in 2009 than in 2018 (Table 1).

In August 2010 Clement Pond was surveyed by electrofishing on a single night to collect scale samples for aging (Gries 2011). Five bass only 1000-second runs were conducted in 2010. A total of 71 Largemouth Bass and 4 Smallmouth Bass were sampled.

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for Largemouth Bass are presented for 2010 (Table 5 and Figure 18) and 2018 (Table 5 and Figure 5). Largemouth Bass growth was categorized as fast in both 2010 and 2018 when compared to New Hampshire water bodies sampled during 1997-2017. Average length at age was higher in 2018 than in 2010 for Largemouth Bass age 1-5 and slightly lower for age 6. Largemouth Bass took an average of 3.12 years to reach quality size (300 mm) in 2018 compared to 3.27 years in 2010.

Grassy Pond (Rindge)

Grassy Pond was surveyed three times by electrofishing and three times by angling during July and August 2009. A total of 157 largemouth bass were sampled (Table 1). Population estimates varied by length category (Table 3, Figure 6). Population estimates for Largemouth Bass $\geq$ 381 ($\geq$15") showed no significant difference between 2009 and 2018 with a high degree of overlap in confidence intervals (Table 3). Catch rates for Largemouth Bass were higher in 2018 by electrofishing and angling than in 2009 (Table 1).

In July 2010 Grassy Pond was surveyed by electrofishing on a single night to collect scale samples for aging (Gries 2011). Six bass only 1000-second runs were conducted in 2010. A total of 72 Largemouth Bass were sampled.

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for Largemouth Bass are presented for 2010 (Table 5 and Figure 19) and 2018 (Table 5 and Figure 8). Largemouth Bass growth was categorized as fast in both 2010 and 2018 when compared to New Hampshire water bodies sampled during 1997-2017. Average length at age was higher in 2010 than in 2018 for Largemouth Bass age 1-3 and lower for ages 4-6. Largemouth Bass took an average of 3.08 years to reach quality size (300 mm) in 2018 compared to 2.96 years in 2010.

Gregg Lake (Antrim)

Gregg Lake was surveyed three times by electrofishing and three times by angling during July and August 2009. A total of 261 Largemouth Bass and 9 Smallmouth Bass were sampled (Tables 1 and 2). Population estimates were greater for Largemouth Bass and varied by length category (Tables 3 and 4, Figure 9 and 10). Population estimates for Largemouth Bass $\geq$ 381 ($\geq$15") showed no significant difference between 2009 and 2018 with a high degree of overlap in confidence intervals (Table 3). Smallmouth Bass were not compared due to low sample sizes. Catch rates for Largemouth Bass were higher in 2018 by electrofishing than in 2009 and angling catch rates were the same between years (Table 1).

In August 2010 Gregg Lake was surveyed by electrofishing on a single night to collect scale samples for aging (Gries 2011). Four bass only 1000-second runs were conducted in 2010. A total of 70 Largemouth Bass and 7 Smallmouth Bass were sampled.

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for Largemouth Bass are presented for 2010 (Table 5 and Figure 20) and 2018 (Table 5 and Figure 13). Largemouth Bass growth was categorized as fast in 2010 and average in 2018 when compared to New Hampshire water bodies sampled during 1997-2017. Average length at age was higher in 2018 than in 2010 for Largemouth Bass age 1 and lower for ages 2-6. Largemouth Bass took an average of 3.57 years to reach quality size (300 mm) in 2018 compared to 3.21 years in 2010.

Warren Lake (Alstead)

Warren Lake was surveyed three times by electrofishing and three times by angling during July and August 2009. A total of 453 Largemouth Bass and 9 Smallmouth Bass were sampled (Tables 1 and 2). Population estimates were greater for Largemouth Bass and varied by length category (Tables 3 and 4; Figure 14). Population estimates for Largemouth Bass $\geq$ 381 ($\geq$15") showed no significant difference between 2009 and 2018 with a high degree of overlap in confidence intervals (Table 3). Smallmouth Bass were not compared due to low sample sizes. Catch rates for Largemouth Bass were higher in 2018 by electrofishing than in 2009 and angling catch rates were the same between years (Table 1).

In July 2010 Warren Lake was surveyed by electrofishing on a single night to collect scale samples for aging (Gries 2011). Five bass only 1000-second runs were conducted in 2010. A total of 93 Largemouth Bass and 0 Smallmouth Bass were sampled.

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for Largemouth Bass are presented for 2010 (Table 5 and Figure 21) and 2018 (Table 5 and Figure 17). Largemouth Bass growth was categorized as fast in 2010 and average in 2018 when compared to New Hampshire water bodies sampled during 1997-2017. Average length at age was higher in 2010 than in 2018 for Largemouth Bass age 1-6. Largemouth Bass took an average of 3.4 years to reach quality size (300 mm) in 2018 compared to 3.03 years in 2010.

RECOMMENDATIONS

Clement Pond, Grassy Pond, Gregg Lake, and Warren Lake were recommended to be managed with "quality" regulations in 2009. On January 1, 2011 the new rule went into effect: From January 1 to March 31, the taking of black bass from 15 to 20 inches in length is prohibited. The daily limit of black bass is 3 fish, of which only one may be longer than 20 inches. The goal of this proposed rule was to increase the number of black bass $\geq$ 381 mm ($\geq$ 15") in these water bodies and to increase the growth rates brought about as a result of an increased harvest of bass < 381 mm (< 15").

The 2018 survey results showed that population estimates of fish $\geq$381 mm increased slightly in all waters. However, there is a high degree of overlap in the upper and lower 95% confidence intervals (CI) between years and the 2009 population estimates fall within the CI for 2018 and the 2018 population estimates fall within the 2009 CI. This indicates that there is not a statistically significant change in the population of bass $\geq$381 mm in any of the four waters when compared to 2009 ($P <= 0.05$).

Largemouth Bass growth rates decreased slightly from 2010 to 2018 in Grassy Pond, Gregg Lake, and Warren Lake while they increased slightly in Clement Pond when comparing age at quality size (300 mm) (Table 5).

The 2018 survey results proved that the goals of the "quality" regulations were not achieved. There was no significant increase in the number of black bass $\geq$ 381 mm ($\geq$15") and growth rates did not increase. It is recommended that Clement Pond, Grassy Pond, Gregg Lake, and Warren Lake revert back to the statewide black bass general rules. This would only change the January 1 to March 31 rule to be 2 fish daily limit; only 1 fish > 16 inches.

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Table 1. Effort, number of bass captured, sample size, and mean bass catch rate (# bass captured/hour) by water body and sampling method for Largemouth Bass by year.

Water body	Sampling Method	2018 Effort (hours)	Number largemouth bass captured 2018 (# recaptures; inclusive)	*n* (# boats angling or # electrofishing runs) 2018	2009 Effort (hours)	Number largemouth bass captured 2009 (# recaptures; inclusive)	*n* (# boats angling or # electrofishing runs) 2009	Mean largemouth bass catch rate (± 1 SD) 2018	Mean largemouth bass catch rate (± 1 SD) 2009
Clement Pond	Angling	77.25	67 (8)	8	96.5	117 (14)	7	0.9 (± 0.7)	1.1 (± 1.0)
Clement Pond	Electrofishing	4.25	176 (14)	15	6.06	223 (25)	21	40.8 (± 19.8)	36.4 (± 22.4)
Grassy Pond	Angling	92.03	95 (9)	9	100.05	43 (5)	10	1.2 (± 0.6)	0.5 (± 0.3)
Grassy Pond	Electrofishing	4.74	225 (13)	17	7.43	114 (10)	27	46.7 (± 29.3)	15.3 (± 17.7)
Gregg Lake	Angling	84.50	67 (3)	9	117	89 (9)	10	0.8 (± 0.5)	0.8 (± 0.3)
Gregg Lake	Electrofishing	4.28	162 (15)	15	6.81	172 (7)	25	37.8 (± 16.3)	25.2 (± 12.0)
Warren Lake	Angling	82.25	98 (10)	9	92.08	110 (23)	12	1.2 (± 0.4)	1.2 (± 0.5)
Warren Lake	Electrofishing	4.93	571 (35)	18	6.31	343 (39)	23	115.7 (± 44.8)	54.0 (± 22.3)
Total	Angling	336.03	327 (30)	35	405.63	359 (51)	39	1.1 (± 0.6)	0.9 (± 0.6)
Total	Electrofishing	18.20	1134 (77)	65	26.61	852 (81)	96	62.4 (± 44.8)	31.7 (± 23.6)

Table 2. Effort, number of bass captured, sample size, and mean bass catch rate (# bass captured/hour) by water body and sampling method for Smallmouth Bass by year.

Water body	Sampling Method	2018 Effort (hours)	Number smallmouth bass captured 2018 (# recaptures; inclusive)	*n* (# boats angling or # electrofishing runs) 2018	2009 Effort (hours)	Number smallmouth bass captured 2009 (# recaptures; inclusive)	*n* (# boats angling or # electrofishing runs) 2009	Mean smallmouth bass catch rate (± 1 SD) 2018	Mean smallmouth bass catch rate (± 1 SD) 2009
Clement Pond	Angling	77.25	7 (0)	8	96.5	2 (0)	7	0.1 (± 3.2)	0.02 (± 0.03)
Clement Pond	Electrofishing	4.25	15 (1)	15	6.06	7 (1)	21	3.5 (± 4.6)	1.1 (± 2.3)
Grassy Pond	Angling	92.03	-	9	100.05	-	10	-	-
Grassy Pond	Electrofishing	4.74	-	17	7.43	-	27	-	-
Gregg Lake	Angling	84.50	23 (3)	9	117	38 (4)	10	0.3 (± 0.2)	0.3 (± 0.3)
Gregg Lake	Electrofishing	4.28	127 (6)	15	6.81	57 (8)	25	28.8 (± 22.6)	8.3 (± 5.9)
Warren Lake	Angling	82.25	2 (0)	9	92.08	3 (1)	12	-	0.1 (± 0.1)
Warren Lake	Electrofishing	4.93	17 (0)	18	6.31	6 (1)	23	3.4 (± 5.3)	0.9 (± 1.6)
Total	Angling	336.03	32 (3)	35	405.63	43(5)	39	0.1 (± 0.2)	0.1 (± 0.2)
Total	Electrofishing	18.20	159 (7)	65	26.61	70(10)	96	11.3 (± 17.6)	3.7 (± 5.2)

Table 3. Largemouth Bass population estimates (Schnabel estimator), 95% confidence intervals, and number of bass per acre by year, water body, and total length category.

Water body	Total length category (inches)	Total length category (mm)	2018 population estimate	2018 95% Confidence Interval	2018 Largemouth bass per acre	2009 population estimate	2009 95% Confidence Interval	2009 Largemouth bass per acre
Clement Pond	≥ 6 "	≥ 152 mm	1019	719, 1750	9	1107	843, 1614	9
Clement Pond	6 - <15"	152 - 380 mm	548	355, 1201	5	747	548, 1175	6
Clement Pond	15-20"	381 - 508 mm	432	261, 1246	4	359	222, 944	3
Clement Pond	> 20"	> 508 mm	2	-	0.02	1	-	0.01
Grassy Pond	≥ 6 "	≥ 152 mm	1737	1225, 2983	18	604	401, 1224	6
Grassy Pond	6 - <15"	152 - 380 mm	1386	939, 2641	14	390	208, 3156	4
Grassy Pond	15-20"	381 - 508 mm	340	181, 2751	3	255	157, 670	3
Grassy Pond	> 20"	> 508 mm	0	-	0	0	-	0.00
Gregg Lake	≥ 6 "	≥ 152 mm	1110	259, 2063	6	1645	1104, 3225	8
Gregg Lake	6 - <15"	152 - 380 mm	445	274, 1169	2	1209	783, 2648	6
Gregg Lake	15-20"	381 - 508 mm	674	398, 2194	4	400	188, -	2
Gregg Lake	> 20"	> 508 mm	0	-	0	1	-	0.01
Warren Lake	≥ 6 "	≥ 152 mm	3484	2696, 4922	19	1170	937, 1558	6
Warren Lake	6 - <15"	152 - 380 mm	3275	2339, 5459	18	623	470, 925	3
Warren Lake	15-20"	381 - 508 mm	611	425, 1087	3	537	385, 883	3
Warren Lake	> 20"	> 508 mm	1	0.3, -	0.01	4	1, -	0.02

Table 4. Smallmouth Bass population estimates (Schnabel estimator), 95% confidence intervals, and number of bass per acre by year, water body, and total length category.

Water body	Total length category (inches)	Total length category (mm)	2018 population estimate	2018 95% Confidence Interval	2018 Smallmouth Bass per acre	2009 population estimate	2009 95% Confidence Interval	2009 Smallmouth Bass per acre
Clement Pond	≥ 6 "	≥ 152 mm	98	33, -	1	29	10, -	0.24
Clement Pond	6 - <15"	152 - 380 mm	85	29, -	1	15	5, -	0.13
Clement Pond	15-20"	381 - 508 mm	6	-	1	2	-	0.02
Clement Pond	> 20"	> 508 mm	0	-	0	-	-	-
Gregg Lake	≥ 6 "	≥ 152 mm	808	489, 2331	4	290	185, 669	1
Gregg Lake	6 - <15"	152 - 380 mm	290	185, 669	2	290	185, 669	1
Gregg Lake	15-20"	381 - 508 mm	26	9, -	0.13	0	-	0.00
Gregg Lake	> 20"	> 508 mm	0	-	0	0	-	0.00
Warren Lake	≥ 6 "	≥ 152 mm	0	-	0	12	5, -	0.06
Warren Lake	6 - <15"	152 - 380 mm	0	-	0	4	-	0.02
Warren Lake	15-20"	381 - 508 mm	0	-	0	3	1, -	0.02
Warren Lake	> 20"	> 508 mm	0	-	0	0	-	0.00

Table 5. Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for Largemouth Bass by water body.

Water body	Town	Sample Year(s)	Species	Maximum Age ≤ 6 with CR < 4[a]	Maximum age used for back-calculations	Mean back-calculated length (mm) at age						Number of fish aged		R^{2b}	Age at quality size 300 mm	Growth Categorization
						1	2	3	4	5	6	≥1	5-6			
Clement Pond	Hopkinton	2010	LMB	6	6	75	192	289	342	379	422	57	8	1.00	3.27	Fast
Clement Pond	Hopkinton	2018	LMB	6	6	82	208	312	356	395	402	44	8	0.99	3.12	Fast
Grassy Pond	Rindge	2010	LMB	6	6	87	226	317	367	399	416	52	7	0.99	2.96	Fast
Grassy Pond	Rindge	2018	LMB	6	6	69	198	289	371	405	432	33	7	1.00	3.08	Fast
Gregg Lake	Antrim	2010	LMB	5	5	72	190	297	352	380		64	3	0.99	3.21	Fast
Gregg Lake	Antrim	2018	LMB	6	6	78	186	276	331	361	382	36	12	0.99	3.57	Average
Warren Lake	Alstead	2010	LMB	6	6	97	227	306	350	385	411	82	20	1.00	3.03	Fast
Warren Lake	Alstead	2018	LMB	6	6	80	195	283	332	373	398	76	21	1.00	3.40	Average
Statewide average		1997-2017	LMB			82	188	270	322	359	391				3.74	

a. Oldest fish aged with a confidence rating of 1 to 3.

b. Correlation coefficient for logarithmic trendline.

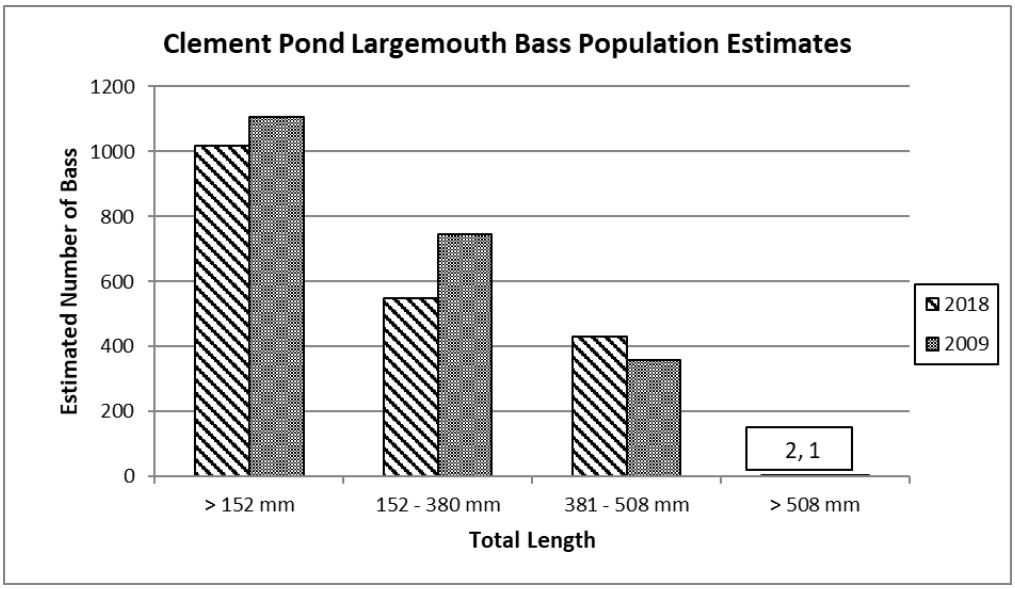

Figure 1. Largemouth Bass population estimates by year and length category (mm).

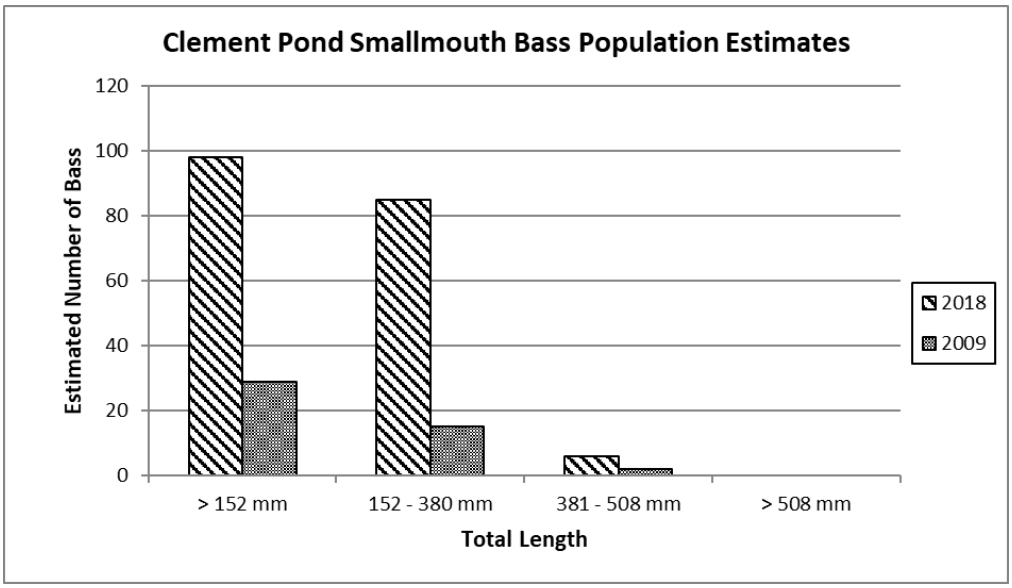

Figure 2. Smallmouth Bass population estimates by year and length category (mm).

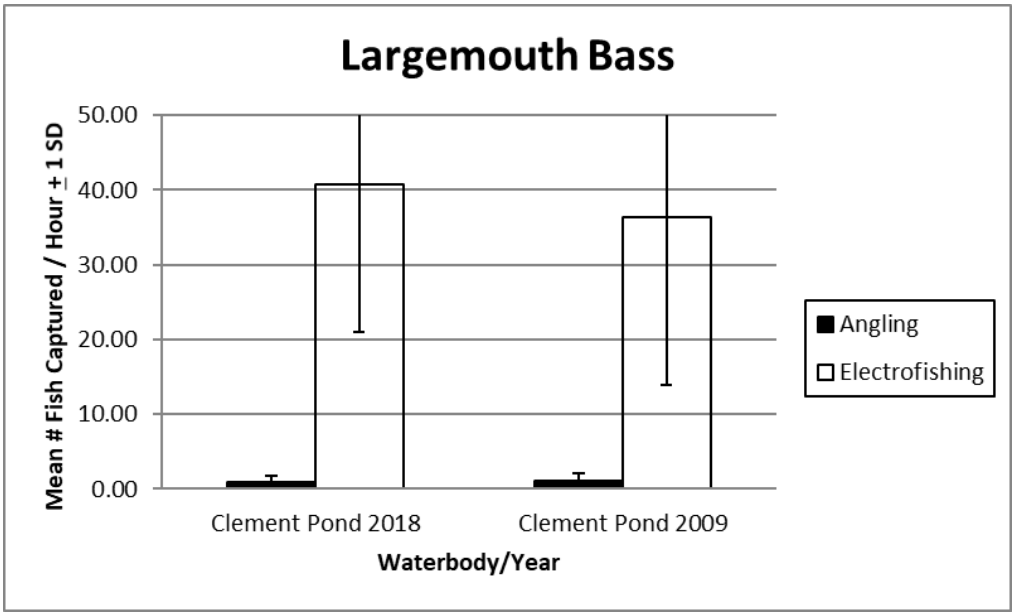

Figure 3. Mean catch rates (fish captured per hour) by year for Largemouth Bass sampled by angling and electrofishing.

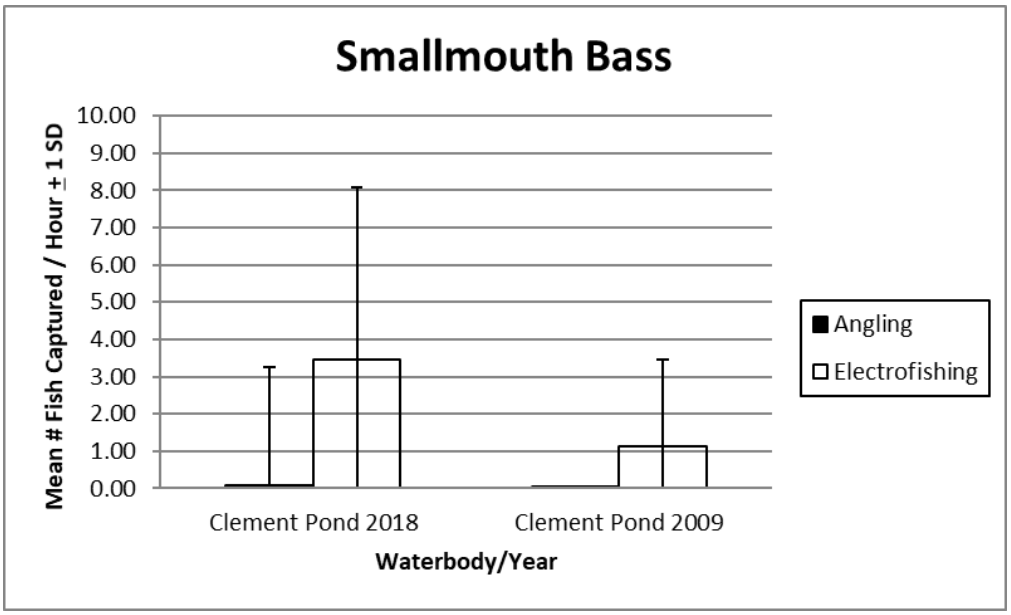

Figure 4. Mean catch rates (fish captured per hour) by year for Smallmouth Bass sampled by angling and electrofishing.

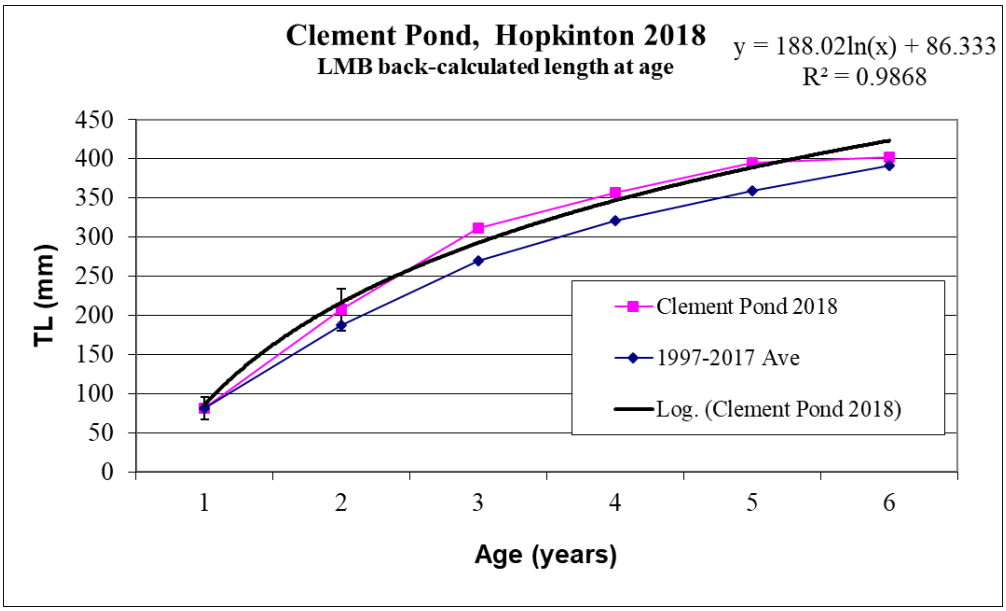

Figure 5. Average back-calculated length at age for Largemouth Bass from Clement Pond sampled in 2018 (± 1 SD), corresponding logarithmic trend line and equation, and statewide back-calculated length at age for Largemouth Bass from 1997-2017.

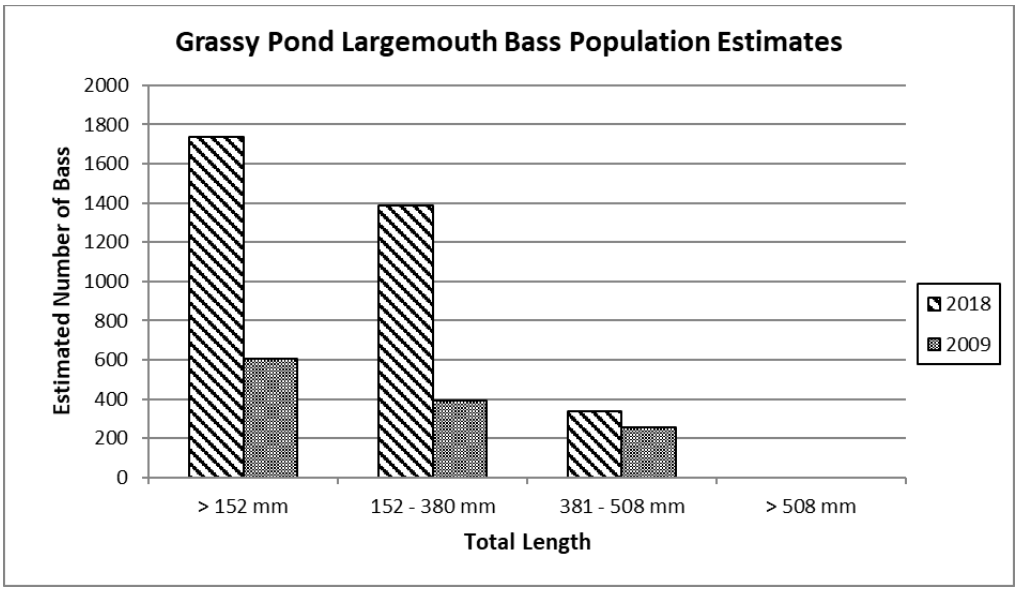

Figure 6. Largemouth Bass population estimates by year and length category (mm).

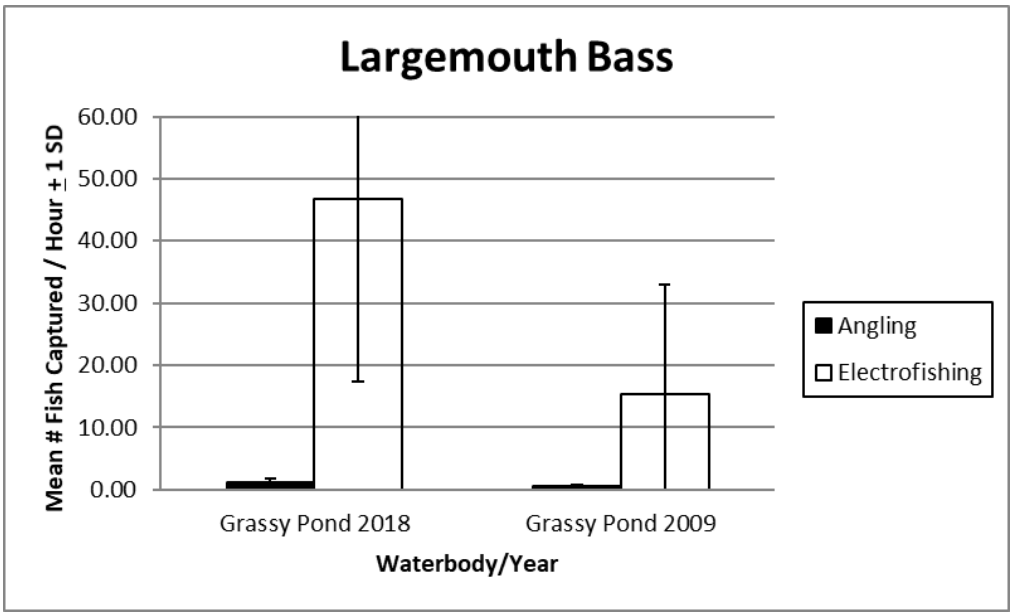

Figure 7. Mean catch rates (fish captured per hour) by year for Largemouth Bass sampled by angling and electrofishing.

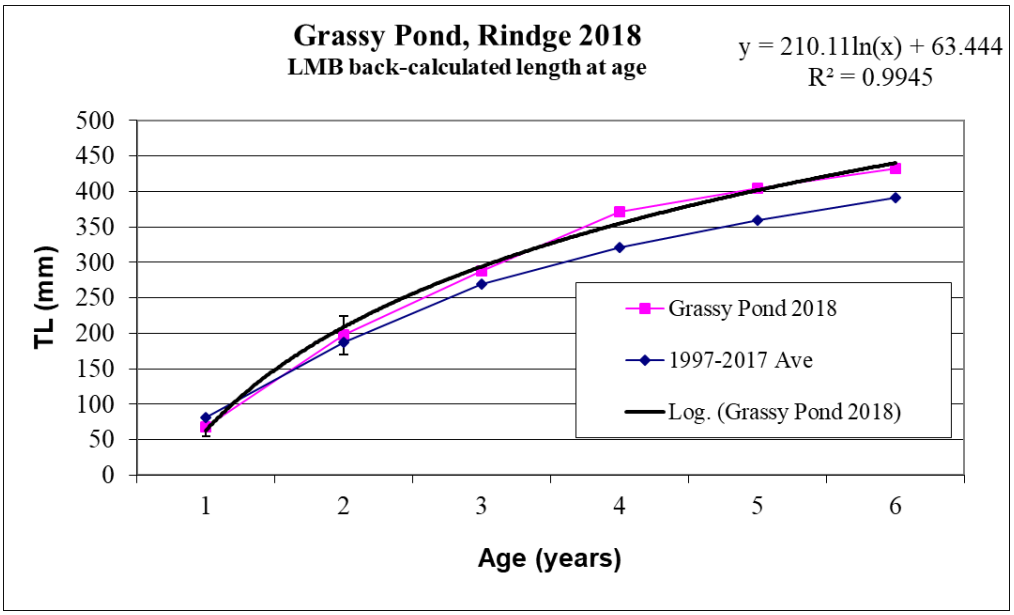

Figure 8. Average back-calculated length at age for Largemouth Bass from Grassy Pond sampled in 2018 (+ 1 SD), corresponding logarithmic trend line and equation, and statewide back-calculated length at age for Largemouth Bass from 1997-2017.

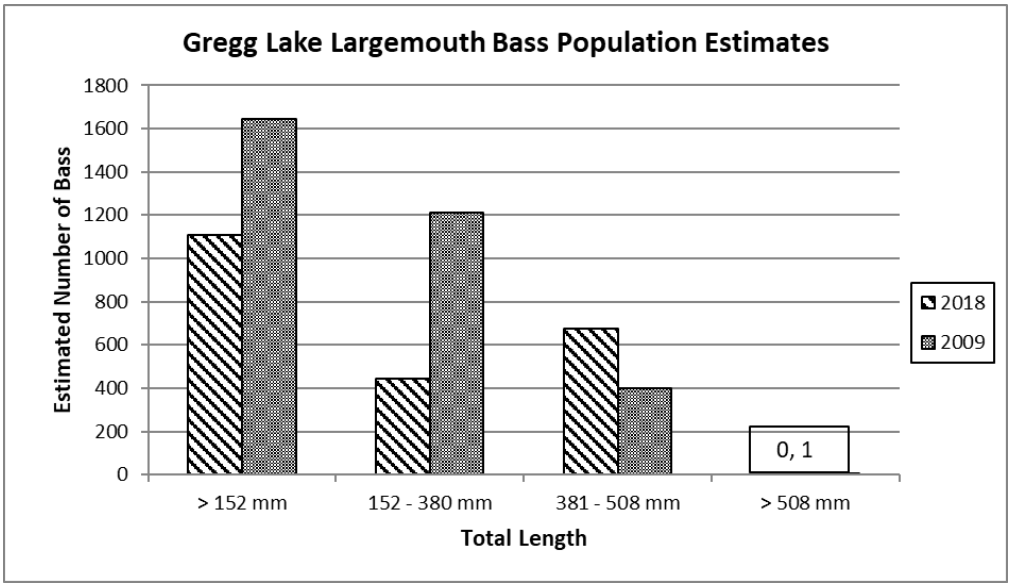

Figure 9. Largemouth Bass population estimates by year and length category (mm).

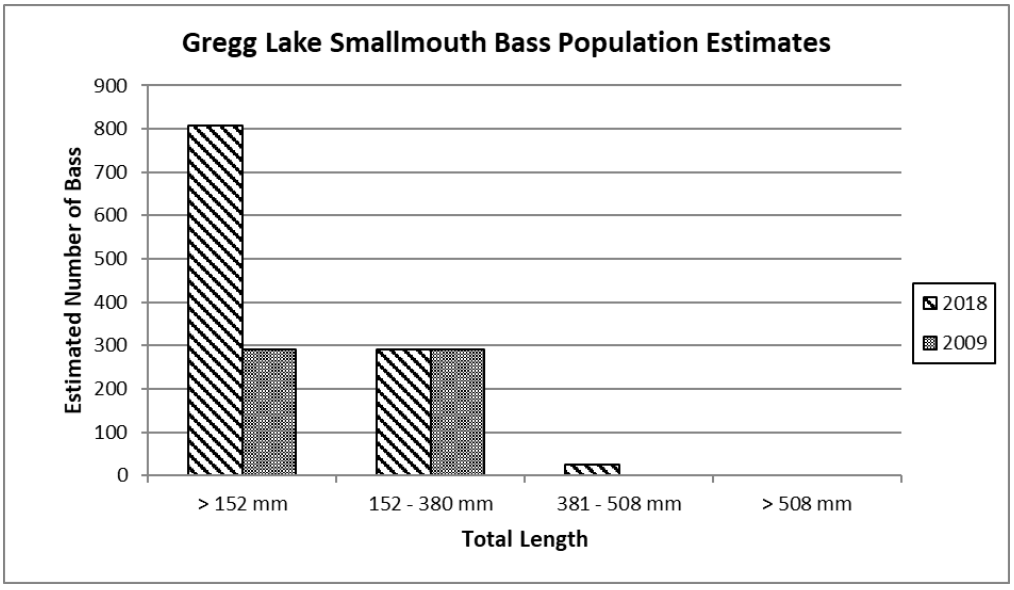

Figure 10. Smallmouth Bass population estimates by year and length category (mm).

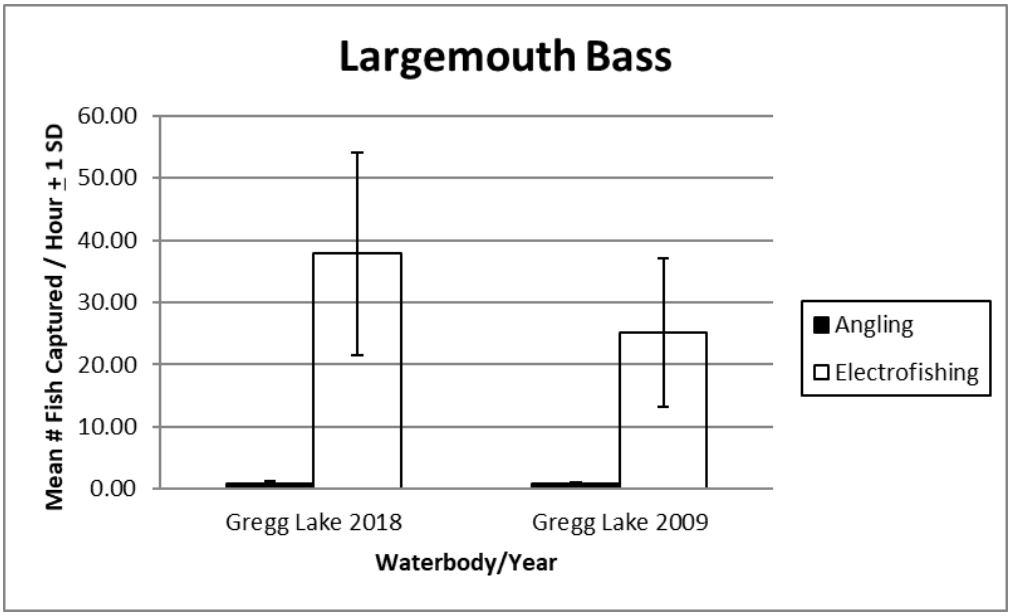

Figure 11. Mean catch rates (fish captured per hour) by year for Largemouth Bass sampled by angling and electrofishing.

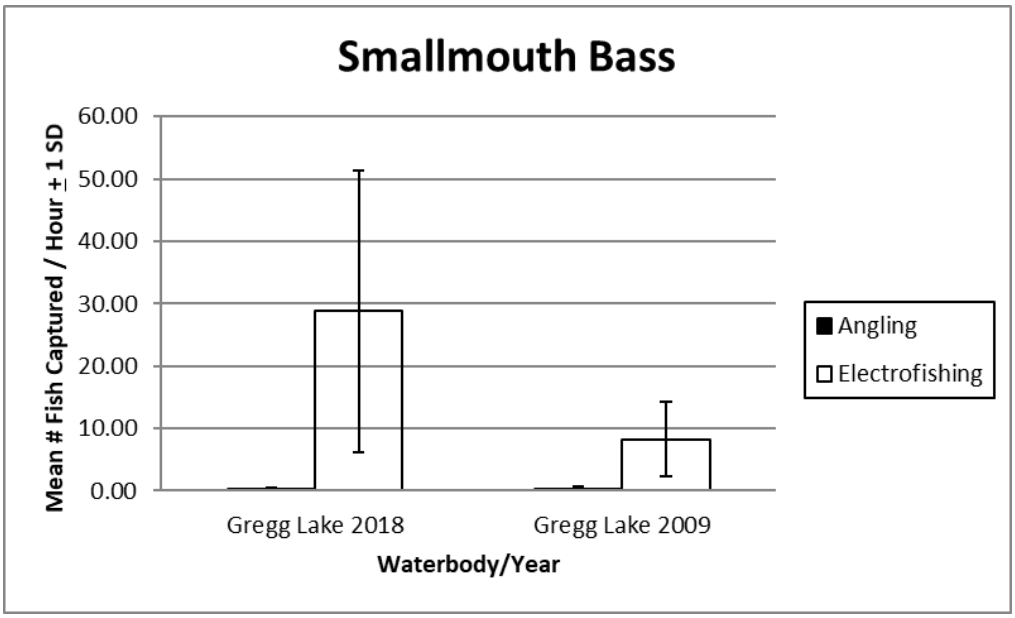

Figure 12. Mean catch rates (fish captured per hour) by year for Smallmouth Bass sampled by angling and electrofishing.

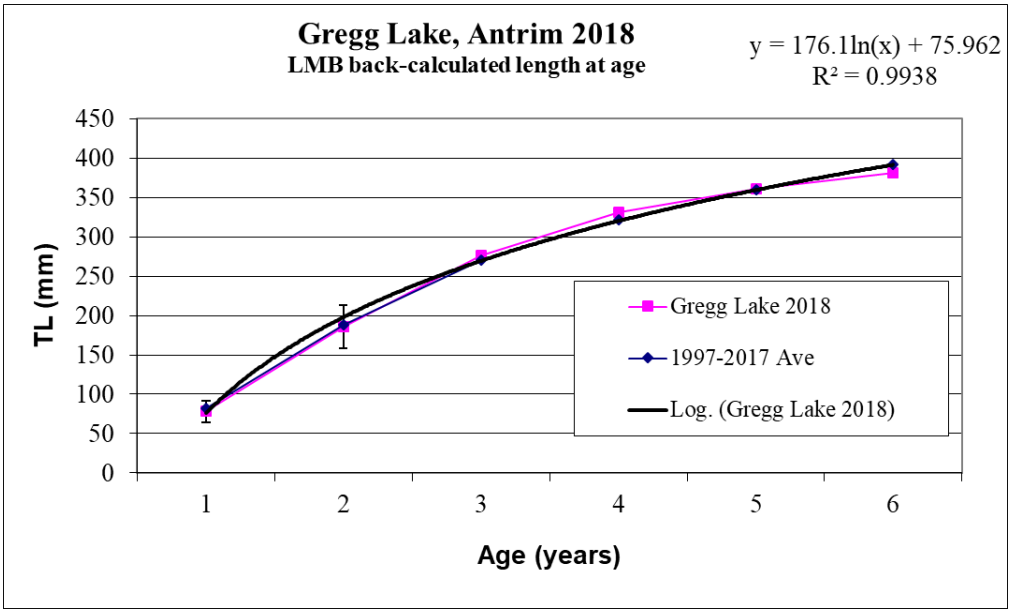

Figure 13. Average back-calculated length at age for Largemouth Bass from Gregg Lake sampled in 2018 (+ 1 SD), corresponding logarithmic trend line and equation, and statewide back-calculated length at age for Largemouth Bass from 1997-2017.

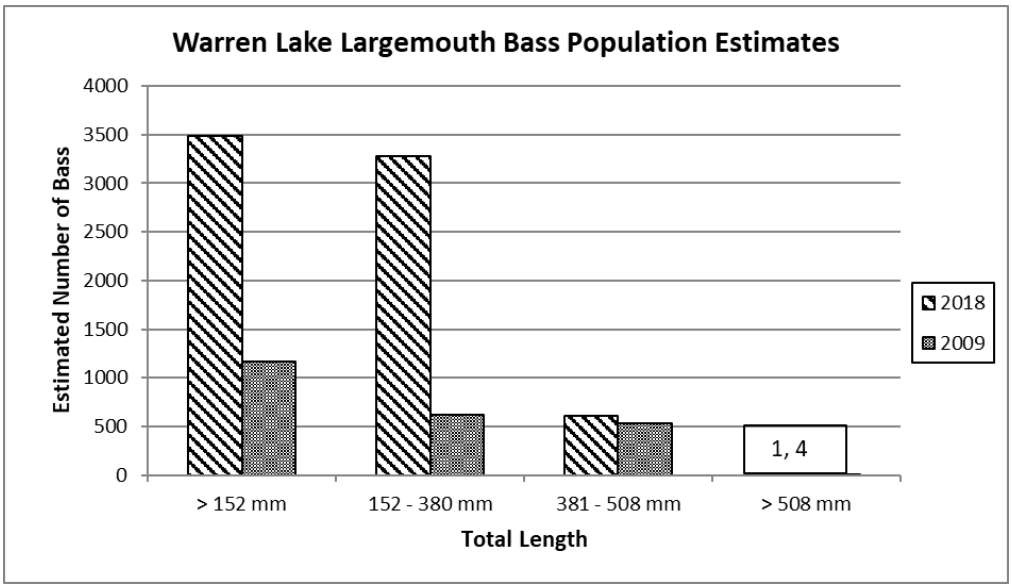

Figure 14. Largemouth Bass population estimates by year and length category (mm).

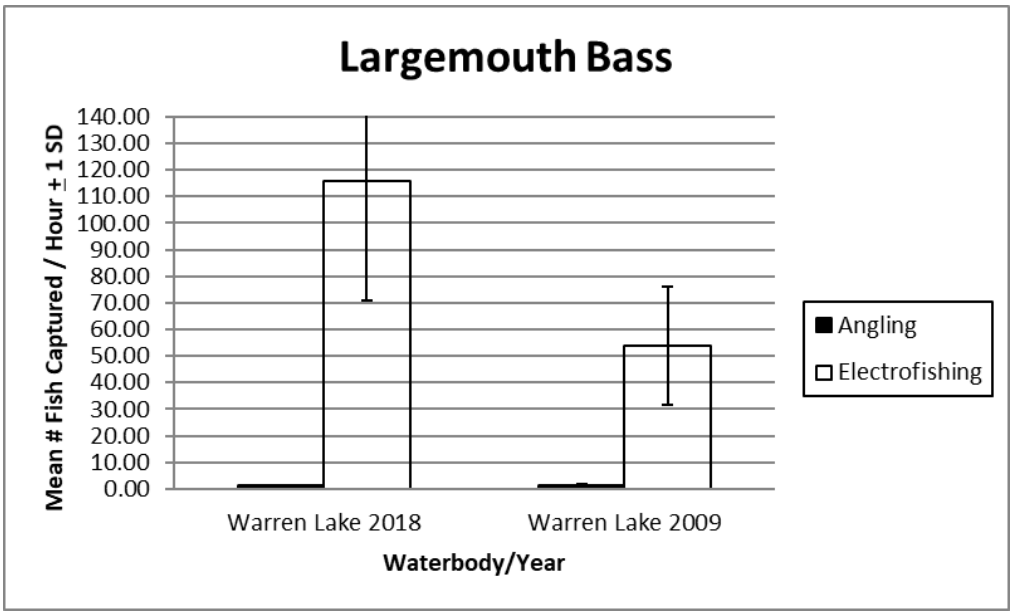

Figure 15. Mean catch rates (fish captured per hour) by year for Largemouth Bass sampled by angling and electrofishing.

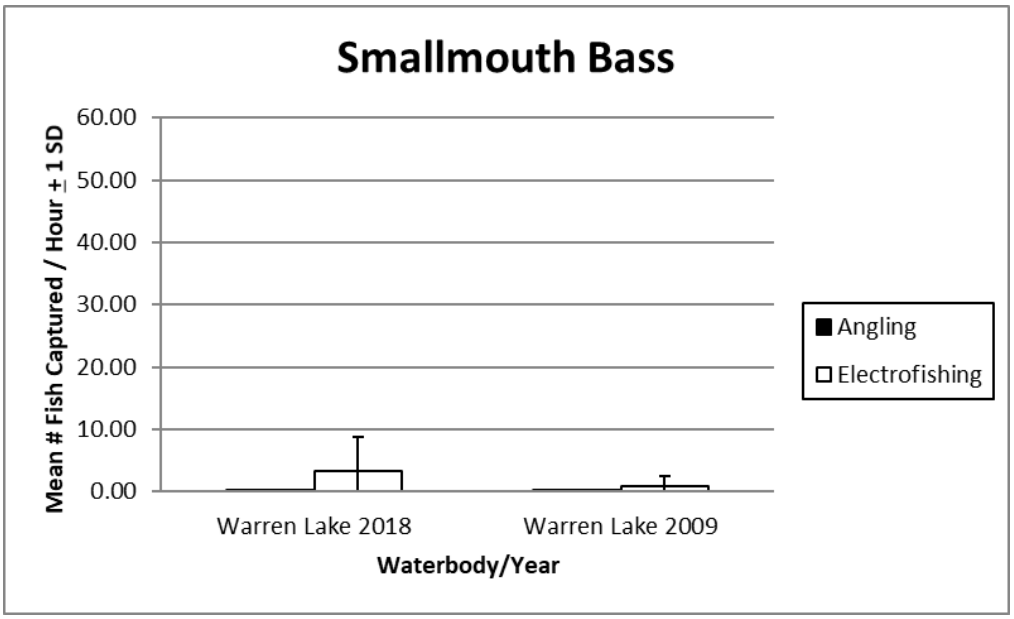

Figure 16. Mean catch rates (fish captured per hour) by year for Smallmouth Bass sampled by angling and electrofishing.

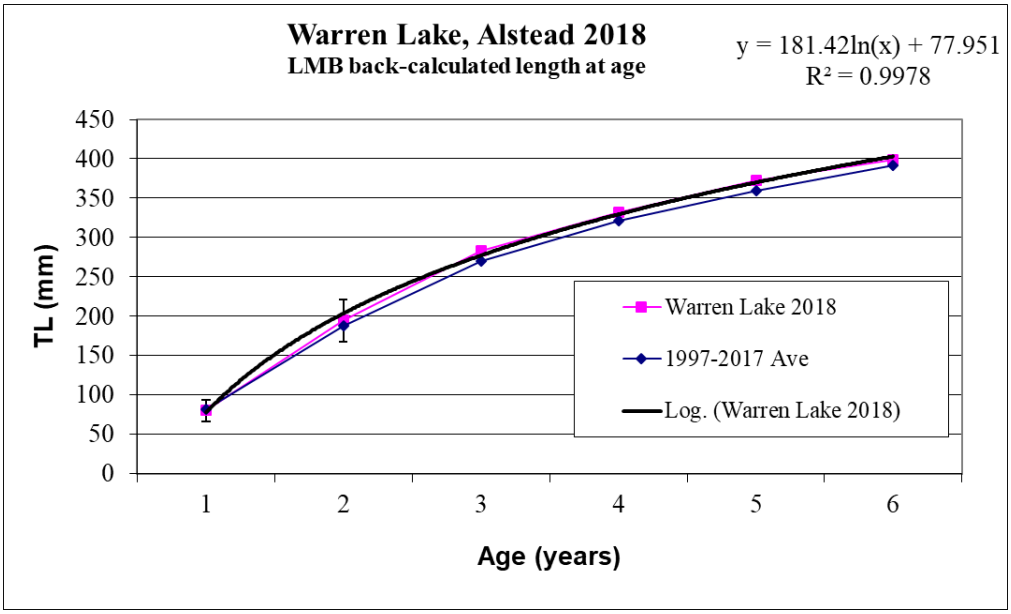

Figure 17. Average back-calculated length at age for Largemouth Bass from Warren Lake sampled in 2018 (+ 1 SD), corresponding logarithmic trend line and equation, and statewide back-calculated length at age for Largemouth Bass from 1997-2017.

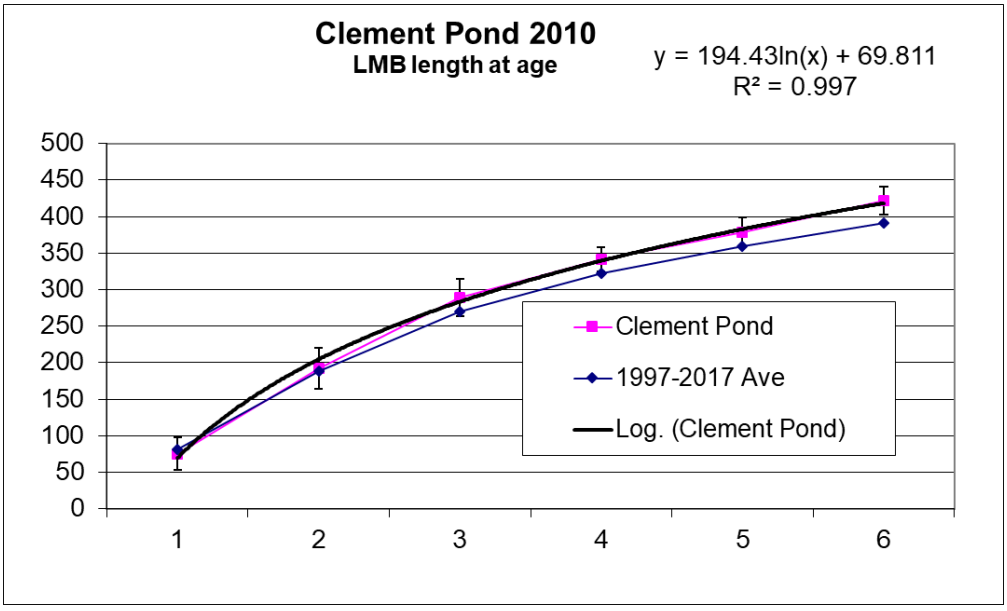

Figure 18. Average back-calculated length at age for Largemouth Bass from Clement Pond sampled in 2010 (+ 1 SD), corresponding logarithmic trend line and equation, and statewide back-calculated length at age for Largemouth Bass from 1997-2017.

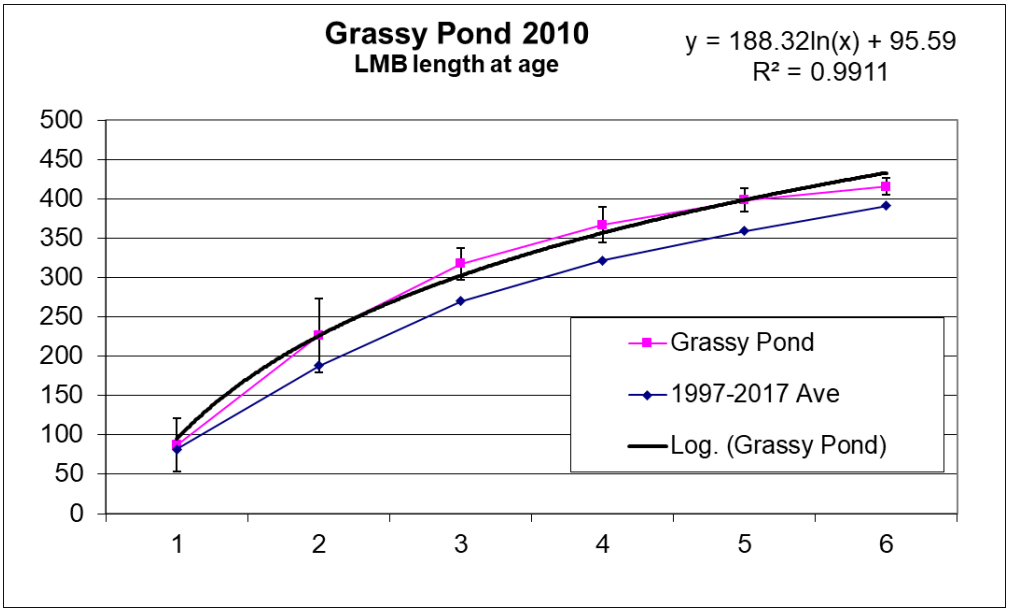

Figure 19. Average back-calculated length at age for Largemouth Bass from Grassy Pond sampled in 2010 (+ 1 SD), corresponding logarithmic trend line and equation, and statewide back-calculated length at age for Largemouth Bass from 1997-2017.

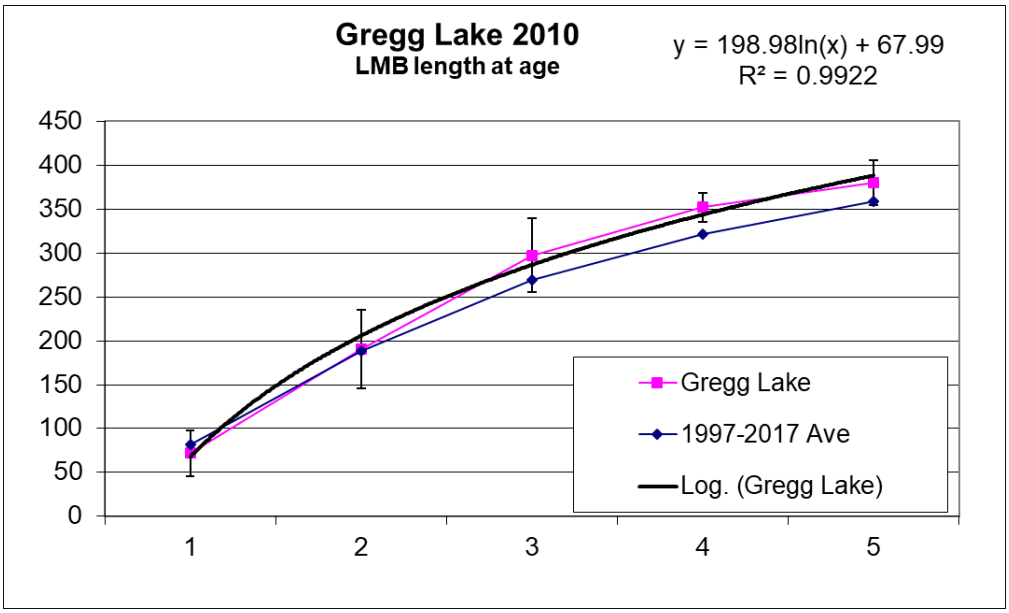

Figure 20. Average back-calculated length at age for Largemouth Bass from Gregg Lake sampled in 2010 (+ 1 SD), corresponding logarithmic trend line and equation, and statewide back-calculated length at age for Largemouth Bass from 1997-2017.

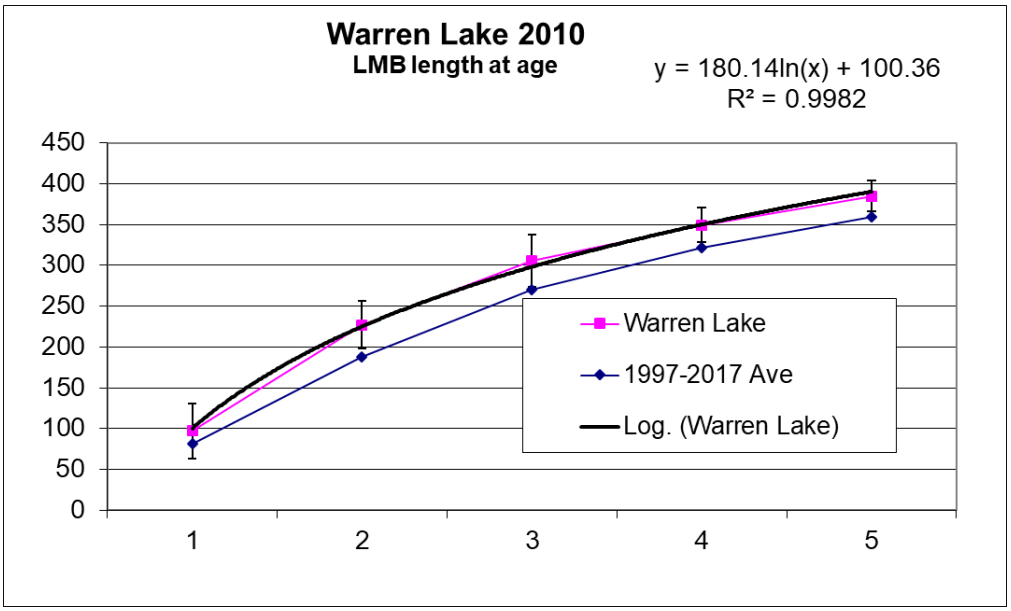

Figure 21. Average back-calculated length at age for Largemouth Bass from Warren Lake sampled in 2010 (+ 1 SD), corresponding logarithmic trend line and equation, and statewide back-calculated length at age for Largemouth Bass from 1997-2017.