Characterizing the Status of Black Bass Populations in New York

-Report Summary-

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Preface

This report summarizes the full project report "Characterizing the status of black bass populations in New York"[1] which was finalized in September 2014. The intent of this document is to provide a succinct reference of the key results, with an emphasis on general, statewide values and relationships. For more detailed information please refer to the full project report.

A note about tables, figures, and literature citations in this report:

All references to tables, figures, and literature citations in the text are hyper-linked so that clicking on a reference will take the reader directly to the associated table or figure at the end of the report. One can return to the text where they left off by clicking Alt + LEFT ARROW.

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[1] 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, New York.

Introduction

Black bass [largemouth bass (*Micropterus salmoides*) and smallmouth bass (*M. dolomieu*)] are distributed throughout New York and are the most sought after freshwater sportfish in the state (Connelly and Brown 2009). Black bass are also ecologically important as top trophic level predators that can strongly influence the abundance and size quality of panfish (Gabelhouse 1984, Guy and Willis 1991) and other sportfish species (Jackson 2002). The New York State Department of Environmental Conservation Bureau of Fisheries (NYSDEC BOF) Regional and Great Lakes Units often conduct surveys of black bass populations to assess their current status and, in some instances, document trends. The focus of these surveys is typically on individual waters, but to more completely understand survey results they should be assessed in the context of other black bass populations across the state. Comparative data are available from a statewide black bass population assessment conducted by Green et al. (1984 and 1986), but this investigation occurred about 30 years ago and was limited by a primary focus on small- to medium-sized inland lakes.

Since this last statewide assessment, black bass fisheries and many associated aquatic ecosystems have undergone significant changes. Bass angling has largely become a catch and release activity (Connelly and Knuth 2013) and tournament fishing has become much more prevalent (Wilde 2003). In 2006, a major change in the statewide fishing regulations for black bass allowed for catch and release angling through the winter and spring. The introduction of zebra mussels (*Dreissena polymorpha*) and quagga mussels (*D. rostriformis*) in many waters throughout the state has resulted in clearer water and expanded littoral zones, likely benefitting black bass. Also, the invasive round goby (*Neogobius melanostomus*) has had a dramatic effect on bass populations in the Great Lakes (Einhouse 2014, Lantry 2014) and is quickly spreading to other waters in the state (Jackson et al. 2014). On a broader scale, a warming climate may positively impact black bass populations, as warmer summer water temperatures have been correlated with production of larger smallmouth bass year classes (Casselman et al. 2002, Einhouse 2002). Effective evaluation of these changes, and future management decisions and direction, require that a baseline of new information be developed for New York's black bass populations.

Since 1988, NYSDEC BOF has maintained a comprehensive statewide database for surveys conducted in inland waters. In addition, decades of long-term monitoring data for the prominent and highly utilized bass populations on eastern Lake Ontario, Lake Erie and Oneida Lake are maintained. These data repositories provided an opportunity to conduct a current, more comprehensive, statewide investigation of black bass population characteristics that spans the recent time period of important angling, ecological, and regulatory changes. The objectives of this study were to 1) consolidate black bass data from multiple long-term datasets across the state, 2) summarize standard population metrics including relative abundance, size structure, condition, and growth, 3) determine relationships among population metrics and environmental variables, 4) summarize population trends through time, and 5) describe limitations of current databases and provide suggestions to address them.

Methods

Black bass populations were assessed by summarizing population metrics recommended in the NYSDEC BOF Centrarchid Sampling Manual (Green 1989), including relative abundance, size structure, condition, and growth. Data were acquired from four long-standing, annually maintained, databases: the Statewide (1988-March 2012, release #42), Lake Erie (1981 – October 2010), Eastern Basin of Lake Ontario (1976 – August 2010), and Oneida Lake (1984 – October 2012) fisheries databases. Relative abundance was measured via catch rates (catch per unit effort (CPUE[2])), size structure was measured via length frequency distributions and proportional and relative stock densities (PSDs and RSDs)[3], condition was measured via relative weights (Wr)[4], and growth was measured via estimates of lengths at age.

Only lakes were assessed and standardized data were selected to compare metrics among lakes. For CPUE, only data from nighttime boat electrofishing surveys within a temperature range of 59 - 77ºF were used, including both spring and fall surveys. CPUEs were only assessed for black bass ≥254 mm (10 in). Similarly, size structure assessments were based on nighttime boat electrofishing surveys within the same temperature range. The minimum sample size for PSD/RSD assessments was 100 stock-sized fish [≥203 mm (8 in) for largemouth bass and ≥178 mm (7 in) for smallmouth bass]. These surveys were also used for length frequency determinations. Because the Oneida and Great Lakes data were exclusively based on gill net surveys, only data from the Statewide database were used for relative abundance and size structure assessments.

Survey data from all four databases were used to assess Wr. Only boat electrofishing surveys were used from the Statewide database and data were separated into spring and fall. Gill net surveys were used for the Oneida and Great Lakes databases. The Great Lakes databases were limited to fall smallmouth bass surveys, whereas the Oneida Lake database provided spring and fall data for both species. A minimum of 20 black bass per survey were required for Wr assessments.

Survey data from all four databases were also used to assess growth. Data selected from the statewide database were not restricted to specific gears. Only surveys with at least 10 aged bass were included in growth assessments for the Statewide database lakes. A minimum of 10 black bass per year were required from the Great Lakes databases, and all aged bass from the Oneida Lake database were assessed. Length at age was assessed for all age groups, and age 2 and age 5 bass were separately assessed to compare "juvenile" and "adult" age classes among data sources. Growth assessments were made for both species for spring and fall for the statewide and Oneida databases, and only for fall smallmouth bass for the Great Lakes databases. To compare growth

[2] Number of black bass caught per hour of boat electrofishing.

[3] PSD is an index of size structure generated by dividing the number of bass quality-length and larger by the number of bass stock-length and larger to derive a proportion. Similarly, relative stock density, RSD metrics are computed as the proportion of stock-length and larger bass that are of preferred, memorable, or trophy lengths. Black bass PSD values ranging from 40-70 are generally considered to represent balanced populations, however, use of other metrics are critical for proper assessments.

[4] Relative weight is a measure of condition which compares the weight of an individual fish of a certain length to a standard weight for that length predicted from a length-weight regression developed from data throughout the species' geographic range. Generally, relative weight scores from 95 – 105 are indicative of fish in good condition.

of all ages across datasets, von Bertalanffy[5] growth curves were fit to plotted age at length data for both species, and curves were compared among data sources for each species and season using the growth parameter estimates. Likelihood ratio tests (Kimura 1980) were used to determine if growth curves were different among data sources.

Seven different regionalization schemes were evaluated using mixed effect models to determine which one best explained variance in black bass population metrics across the state. The schemes included Omernik's ecoregion version 3 (Omernik 1987), Omernik's ecoregion version 4 (Omernik 1995), Ecological drainage units (Higgins et al. 2005), US Geological Survey GAP hexagons (Scott et al. 1993, 1996), and 4-digit, 8-digit, and 10-digit USGS hydrologic unit code (HUC) watershed boundaries (Seaber et al. 1987).

The influence of environmental variables on bass relative abundance, condition, and growth metrics was determined using mixed effect models. Up to 12 variables were tested for each metric, including: most influential regionalization scheme, year of survey, lake surface area, shoreline diversity index (SDI – a metric of shoreline complexity using surface area and shoreline length), mean depth, maximum depth, tributary catchment area, % deciduous forest in the tributary catchment area, % cultivated land in the tributary catchment area, % impervious surface in the tributary catchment area, total phosphorus, and pH. Restricted Maximum Likelihood was used for this analysis, but Maximum Likelihood may be preferred for exploring alternative fixed effects in a mixed effects model and the influence of the choice of the optimization approach will be explored in future work (Perry, PhD dissertation in prep).

Trends in population metrics through time were determined by incorporating survey year into the mixed effect model assessment. Changes in black bass catch rates in lakes assessed by Green et al. (1986), and population metric time trends for inland lakes with at least three years of survey data where the first and last surveys were at least five years apart were also determined.

Results

Data selection

From the statewide database, 744 surveys from 282 lakes met the standardized selection criteria for at least one population metric (Appendix A). Relative abundance was the most commonly summarized metric, followed in order by Wr, length at age 2, length at age 5, and PSD (Figure 1). There were 17 different survey purpose categories, with General Biological Survey (37%) and Centrarchid Sampling Plan (24%) the primary ones (Figure 2). The number of surveys used to calculate population metrics ranged from 10 – 44/yr (mean ± SD = 34 ± 9/yr); whereas the number of surveys categorized as Centrarchid Sampling Plan ranged from 1 – 14/yr (mean ± SD = 7 ± 4/yr; Figure 3).

[5] The von Bertalanffy equation, $L_t = Linf*[1 - exp(-K*(t-t_0))]$, is used to model growth in length as a function of age. Lt is length at time t, Linf is a measure of the asymptotic length of the growth curve at which growth is zero (i.e., the top end of the curve), K is the growth rate (i.e., the curve), and t_0 is the age at which the bass would have zero size (i.e., the starting point on the curve).

Relative abundance
Boat electrofishing catch rates were calculated for 222 lakes for both largemouth and smallmouth bass (Table 1). Largemouth bass CPUEs (mean ± SD = 17 ± 19/h, range: 0 – 114/h) were generally higher than smallmouth bass CPUEs (mean ± SD = 4 ± 8/h, range: 0 – 45/h; t-value = 9.18, p-value ≤ 0.001). These results included all lakes that had surveys which met standardized CPUE data selection criteria and included a number of lakes where either largemouth bass or smallmouth bass were not collected. If lakes with zero collects of either species were excluded from the assessment, the mean CPUEs were 18/h for largemouth bass (206 lakes) and 7/h for smallmouth bass (130 lakes). Largemouth bass were relatively more abundant, and prevalent, than smallmouth bass in lakes from the southeastern part of the state; whereas smallmouth bass were relatively more abundant, and prevalent, in lakes surveyed in the northeastern part of the state (Figure 4, Appendices B and C). No other broad spatial patterns in catch rates were evident.

Size structure
Proportional stock densities (PSDs) were determined for 42 lakes for largemouth bass (mean ± SD = 55 ± 24, range: 2 – 93) and 15 lakes for smallmouth bass (mean ± SD = 56 ± 24, range: 16 – 86; Table 1, Figure 5 and Figure 6). The mean (±SD) relative stock densities (RSDs) for largemouth bass were: 19 ± 14 ($RSD_{381\ (15\ in)}$), 1 ± 1 ($RSD_{508\ (20\ in)}$), and 0 ± 0 ($RSD_{635\ (25\ in)}$). The mean (±SD) RSDs for smallmouth bass were: 36 ± 24 ($RSD_{330\ (13\ in)}$), 13 ± 14 ($RSD_{406\ (16\ in)}$), and 0 ± 1 ($RSD_{508\ (20\ in)}$). Length frequency graphs were developed for all of these lakes and the resulting distributions reflect a high degree of variability in size structure among lakes (see full report).

Condition
The grand mean (±SD) relative weight (Wr) for largemouth bass from lakes in the statewide database was 99 ± 7 for spring captures and 103 ± 8 for fall captures (Table 1, Figure 7). The mean Wr (±SD) for largemouth bass captured in the fall from Oneida Lake was 107 ± 11.

The grand mean Wr (±SD) for smallmouth bass from lakes in the statewide database was 90 ± 8 for spring captures and 93 ± 7 for fall captures (Figure 8). The mean (±SD) Wr for smallmouth bass from Oneida Lake was 99 ± 16 for spring captures and 100 ± 10 for fall captures (Figure 8). The mean (±SD) Wr for smallmouth bass captured in the fall from Lake Erie and Lake Ontario was 103 ± 3 and 98 ± 5, respectively (Figure 8). Wr for both Lake Erie and Lake Ontario have increased since the introduction of round gobies in the mid- to late 1990's, and Wr values have been above the long-term mean in both waters over the last several years, dramatically so for Lake Ontario (Figure 8).

Growth
From spring collections in the Statewide database, the grand mean (±SD) lengths at age 2 for largemouth and smallmouth bass were 187 ± 27 mm (7.4 ± 1.1 in) and 172 ± 31 mm (6.8 ± 1.2 in), respectively, and the grand mean (±SD) lengths at age 5 for largemouth and smallmouth bass were 331 ± 35 mm (13.0 ± 1.4 in) and 316 ± 35 mm (12.4 ± 1.4 in), respectively (Table 1, Figure 9). From fall collections, the grand mean lengths at age 2 for largemouth and smallmouth bass were the same [228 mm (9.0 in)] and the grand mean (±SD) lengths at age-5 for largemouth and

smallmouth bass were very similar [351 ± 21 mm (13.8 ± 0.8 in) and 346 ± 14 mm (13.6 ± 0.6 in), respectively, Table 1, Figure 10]. Length at age 2 and 5 determinations for Oneida Lake bass were only available for 18 – 104 bass for the entire times series of the database; however, despite the limited data, spring and fall length at both ages for both species were higher than those from the statewide database. The fall mean lengths at ages 2 and 5 for Lake Erie smallmouth bass were the highest of any database, while those from Lake Ontario were the lowest (Table 1, Figure 11).

Table 1. Means, standard deviations, ranges, and numbers of bass, lakes or years assessed for largemouth and smallmouth bass population metrics, by database and season.

	Population metrics							
	Relative abundance (CPUE)[1]	Size structure (PSD)	Condition (Wr)		Growth (length at age (mm))			
					Spring		Fall	
Databases	Spring/Fall combined	Spring/Fall combined	Spring	Fall	Age 2	Age 5	Age 2	Age 5
Largemouth bass								
Statewide	17±19/h (0-114/h) 222 lakes	55±24 (2-93) 42 lakes	99±7 (83-122) 147 lakes	103±8 (84-123) 75 lakes	187±27 (122-262) 52 lakes	331±35 (225-405) 47 lakes	228±39 (164-297) 23 lakes	351±21 (317-389) 13 lakes
Oneida Lake			na	107±9 (na) 1 year	220±53 (137-317) 40 bass[2]	351±19 (311-394) 19 bass	267±23 (241-317) 18 bass	389±28 (334-448) 34 bass
Smallmouth bass								
Statewide	4±8/h (0-45/h) 222 lakes	56±24 (16-86) 15 lakes	90±8 (75-120) 76 lakes	93±7 (78-110) 35 lakes	172±31 (121-265) 32 lakes	316±35 (225-382) 24 lakes	228±32 (148-268) 11 lakes	346±14 (332-367) 5 lakes
Oneida Lake			123±34 (98-162) 3 years	100±3 (91-105) 24 years	224±37 (136-343) 80 bass	373±25 (304-439) 104 bass	255±30 (164-339) 95 bass	379±29 (324-488) 84 bass
Lake Erie				103±3 (95-110) 30 years			270±19 (242-303) 27 years	386±17 (359-418) 26 years
Lake Ontario				98±5 (92-111) 35 years			209±13 (189-236) 17 years	313±37 (267-396) 29 years

1Mean CPUEs included all lakes with surveys that met standardized selection criteria, even those where catch rates for either species were zero. Mean CPUEs for lakes where the presence of bass of either species was confirmed from either surveys included in this study or from other surveys were 18/h for largemouth bass (206 lakes) and 7/h for smallmouth bass (130 lakes).
[2]The number of bass in each age class from throughout the entire time series of the Oneida Lake database.

Growth curves for all age classes indicated that there were significant differences among all database comparisons. Fall collected Oneida Lake largemouth bass grew faster than those from lakes in the Statewide database (Figure 12); whereas growth rates for fall collected smallmouth bass were highest in Lake Erie, followed by Oneida Lake, the Statewide database lakes, and Lake Ontario, respectively (Figure 13). Growth rates have increased for Lake Erie and Lake Ontario smallmouth bass over the time series of the respective databases (Figure 14). There was a wide divergence in growth rates between these waters in the 1980's, but that gap was eliminated by the 2000's. The most current growth curves are nearly identical for these lakes.

Environmental variables

The 8-digit hydrologic unit code (HUC08[6]) watershed boundary was determined to be the best regionalization scheme for grouping lakes based on bass population metrics. Therefore, population metrics for both species were summarized within HUC08 watersheds (Figure 15 – Figure 22), and indices for a combination of these metrics were also determined for each HUC08 (see full report).

The modeling assessment revealed some significant relationships among population metrics and environmental variables (Table 2). Lake surface area, % of the tributary catchment area in cultivation, and total phosphorus were all positively related to largemouth bass growth, either at age 2, age 5, or both. Maximum lake depth and the % of the tributary catchment area that was forested were positively related to smallmouth bass CPUE, and SDI was positively related to smallmouth bass Wr. None of the environmental variables tested were related to smallmouth bass length at age 2.

Table 2. Relationships among bass population metrics and environmental variables[1].

	Environmental variables						
Population metric	Year of survey	Lake surface area	Shoreline diverity index	Maximum lake depth	% forest in TCA	% culti-vated in TCA	Total phosphorus
Largemouth bass							
CPUE	+						
Wr	-						
Length at age 2		+					+
Length at age 5	+	+				+	
Smallmouth bass							
CPUE	+			+	+		
Wr			+				
Length at age 2							
Length at age 5	+						

[1]Significantly positive relationships are indicated with (+) and significantly negative relationships are indicated with (-). Mean lake depth, tributary catchment area (TCA), % impervious surface in TCA, and pH were not related to any metric.

Temporal trends

The temporal trend assessments produced variable results among the three methods. The modeling assessment revealed trends through time for several population metrics. Year of survey was positively related to both largemouth and smallmouth bass CPUE and length at age 5, and negatively related to largemouth bass Wr (Table 2).

For lakes included in the NYS Bass Study (Green et al. 1986), largemouth bass CPUE increased over time for seven of ten lakes (Figure 23), and smallmouth bass CPUE increased for four of

[6] HUC08s typically represent subbasins of major river systems (e.g., East Branch Delaware River).

seven lakes (Figure 24). All seven of the lakes assessed for smallmouth bass CPUE trends were also assessed for largemouth bass. CPUE increased for both species in 3 lakes and decreased for both species in 1 lake. CPUE trends were in opposite directions for each species in the other 3 lakes.

For lakes with at least three years of data over the course of at least five years, CPUE trends were assessed for 47 lakes for both largemouth and smallmouth bass (Table 3). The majority of these lakes exhibited no trend for either species, however, this wasn't consistent across the State. Largemouth bass CPUE increased in most NYSDEC Region 9 lakes, while CPUE from 50% of the waters in Region 3 decreased.

Table 3. Number of lakes per NYSDEC Region with increasing (↑), decreasing (↓) or no (↔) trends through time for CPUE for largemouth and smallmouth bass.

	Largemouth bass CPUE			Smallmouth bass CPUE		
Region	↑	↓	↔	↑	↓	↔
1	3	1	8			2
2						
3		4	4			5
4			5	2	1	2
5						
6	1		5		2	4
7			2		1	1
8	1	2	2	2	1	2
9	5	1	3	1		8
Total	10	8	29	5	5	24[1]

[1]An additional 10 lakes in Region 1 and 3 lakes in Region 3 were determined to have no trend for smallmouth bass, but were removed from the table because smallmouth bass were never caught from these lakes.

The number of lakes that met these criteria for other metrics were much lower (e.g., length at age trends for both species were only available for 0 – 2 waters). Therefore, time trend assessments were limited and no clear large scale trends were evident.

Discussion

Building a foundation of current black bass population information is an important step in understanding the status of these important sportfish species and can provide insight into the impacts of changing aquatic environments via introduction of invasive species and warming temperatures, which are current or potential issues for many of New York's warm- and coolwater lakes. The availability of standardized lake-specific population data from four long-term databases was a critical component of this project and allowed for a comprehensive status assessment of black bass populations throughout the state and a determination of population trends over the last three decades. These data also provided an opportunity to examine population survey methods to determine their utility in assessing populations.

The Statewide database is the primary repository of inland fisheries data in New York and provided at least some standardized bass population data for 282 lakes. The most prevalent metric obtained in the database was relative abundance, as most surveys assessed included effort and species counts. Metrics that relied on other measurements, including weights and ages (i.e., condition and growth), or were dependent on high sample sizes (i.e., PSD), were much less prevalent, which impacted the overall quality and completeness of population assessments. Only 25 lakes in the database had enough standardized data to measure all four population metrics for largemouth bass, and only eight had enough to measure all metrics for smallmouth bass. Also, comparisons between data from the Statewide database and the Oneida and Great Lakes databases were limited to non-gear-specific metrics (i.e., condition and growth) because of the differences in survey techniques.

There were clear differences between largemouth bass and smallmouth bass metric values, especially catch rates (mean = 17/h for largemouth, 4/h for smallmouth) from the Statewide database. Even if lakes with zero bass collected are excluded from catch rate calculations, the inter-species difference is still large (mean = 18/h for largemouth, 7/hr for smallmouth). Population density categories provided by Green (1989) indicate that the catch rates for both species represent high population densities, with largemouth bass catch rates well above the base value for high density[7]. Mean Wr was also higher in largemouth bass than smallmouth bass, and suggests that largemouth bass populations are generally in good condition, whereas smallmouth bass populations tend to fall below the standard weights for the species. This is a consistent pattern throughout the State (Appendices B and C). Further, largemouth bass growth was somewhat faster than smallmouth bass growth; however, growth rates for both species were average based on New York standards (Green 1989).

Comparisons among all four databases were limited to fall smallmouth bass condition and growth, but consistently indicated that the Lake Erie smallmouth population was in better condition and grew faster than populations from other waters in the state. Mean growth rates in Eastern Basin Lake Ontario smallmouth bass were lower than other waters, and mean Wr was lower than those from Lake Erie and Oneida Lake. However, smallmouth bass growth rates began to improve in Lake Ontario in the mid-1990s, probably as a compensatory response to decreased abundance due to double crested cormorant (*Phalacrocorax auritus*) predation, and perhaps also linked to ecosystem changes following the introduction of Dreissenid mussels (Lantry 2014). Smallmouth bass condition dramatically improved in Lake Ontario in the mid-2000s after their diets shifted from predominantly crayfish to primarily round gobies (Lantry 2014). Recent data indicate that Lake Ontario smallmouth bass condition and growth rivals those from Lake Erie, where condition and growth have also improved since the introduction of round gobies there (Einhouse 2014). The comprehensive assessments of the changes in these populations would not be possible without annual long-term monitoring.

Despite relatively low mean smallmouth bass Wrs from lakes in the Statewide database, both species appear to be doing well across the state and there are indications that populations have improved over the time series of the databases. Along with improvements in smallmouth bass condition and growth in the Great Lakes, catch rates and adult growth are trending upward for

[7] Boat electrofishing cate rates >13/h and >3/h represent high population densities of ≥10 inch largemouth bass and smallmouth bass, respectively (Green 1989).

both black bass species from lakes in the Statewide database. In addition, Oneida Lake smallmouth bass have been increasing in abundance in Oneida Lake since the 1990s (Jackson et al. 2014). These trends are likely reflective of improving environmental conditions in New York State for black bass, due to a warming climate, increasing water clarity caused by the invasion and spread of Dreissinid mussels, and the addition of round gobies as an important component of the forage base in some waters.

This project provided evidence that bass populations have adapted positively over the last three decades to changing environmental conditions in New York lakes. The assessment was dependent on the availability of adequate long-term standardized survey data, and could be improved if data collection for some metrics (e.g., aging) is expanded. In the Statewide database, surveys specifically focused on assessing bass populations (i.e., those labeled "Centrarchid Sampling Plan") tended to provide the most usable data and, thus, the most complete assessments. Useful data on bass populations were also available from surveys where bass assessments were not the primary objective, but the assessment of metrics was often compromised by small sample sizes. For inland lake surveys or monitoring programs where full black bass population assessments are needed, close adherence to the methods detailed in the NYSDEC Centrarchid Sampling Manual (Green 1989) is necessary. In cases where bass are secondary targets in surveys directed at other species, it is important to recognize that a full assessment of the bass population requires collection of approximately 100 stock sized individuals to reliably calculate size structure metrics, and age data are of particular value as assessment of growth is critical to understanding bass population status, as well as ecosystem processes, fish community dynamics, and resource utilization.

Despite the assessment benefits, the thorough and rigorous nature of the Centrarchid Sampling Manual (Green 1989) places heavy demands on NYSDEC Fisheries staff effort and time, particularly for larger waters. Expanding the full use of these methods is likely to increase the amount of effort required to survey many waters. To balance this with the already full slate of responsibilities of NYSDEC Fisheries Biologists, the development of efficient black bass management and monitoring strategies is necessary. Follow-up actions will include revising the Centrarchid Manual to create a more efficient sampling protocol, and developing a cohesive statewide sampling strategy based on priority black bass information needs. In addition, a similar assessment of the status of riverine black bass populations throughout the state will be conducted. This will complete the overall statewide status assessment of black bass populations and provide information necessary to compare stream and lake populations and assess special stream bass fishing regulations. Compilation of baseline information, development of standardized, efficient management and monitoring strategies, and the maintenance of long-term monitoring programs and databases are essential to track the influence of changing environmental conditions on New York's black bass resources and to accurately evaluate future management actions.

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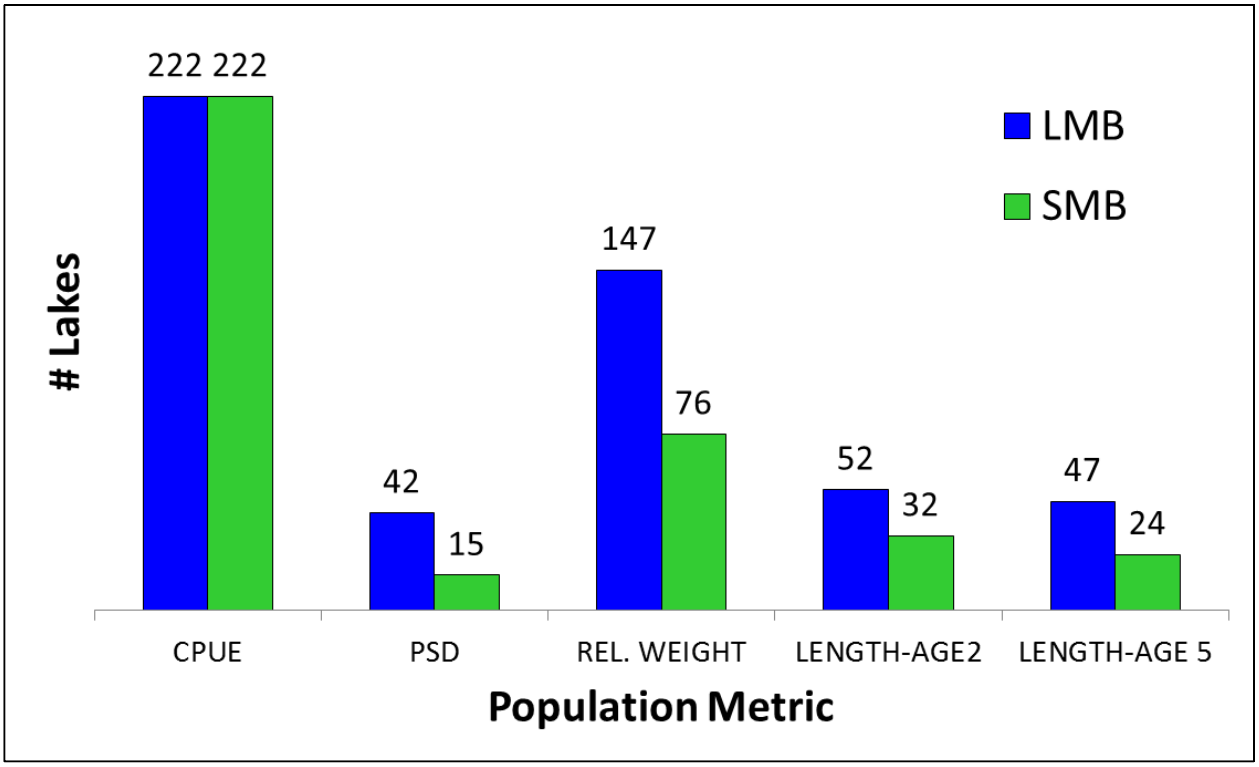


Figure 1. Number of lakes from the Statewide database that were assessed for population metrics.

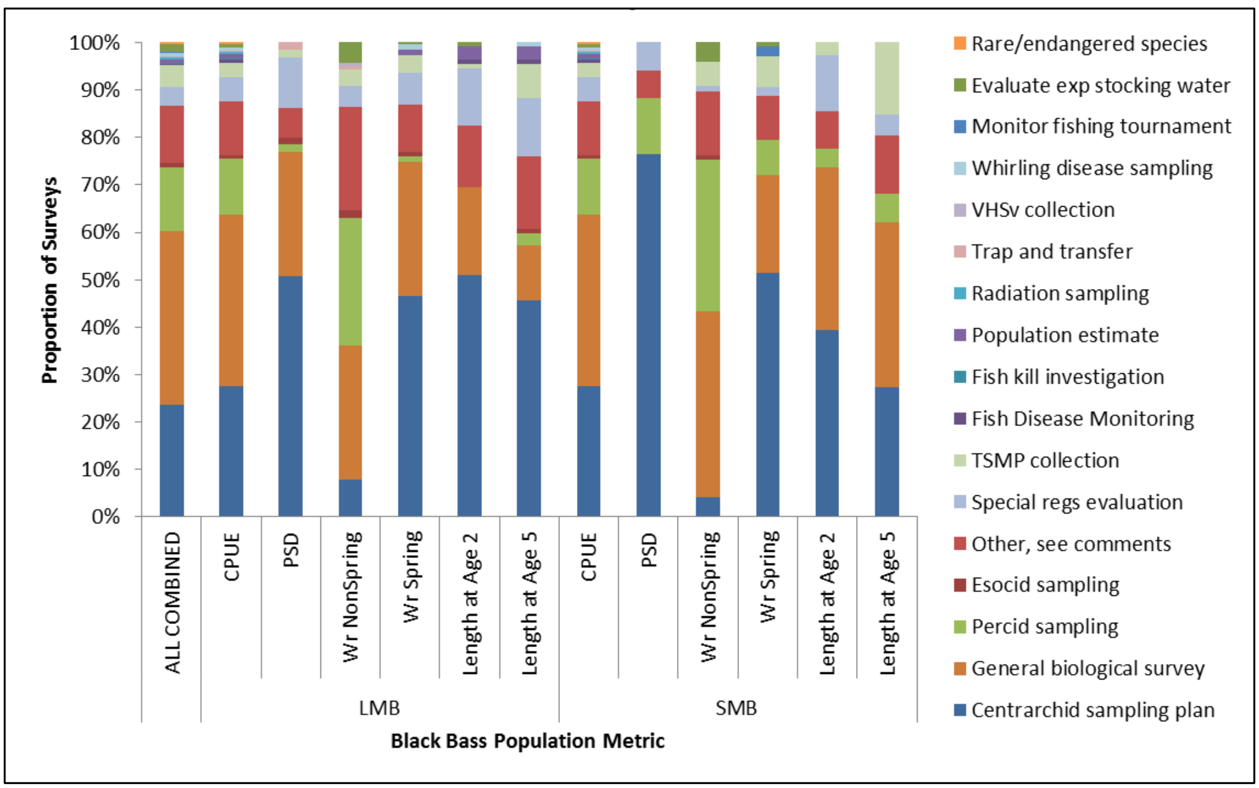


Figure 2. Proportion of surveys from the Statewide database, by category type, that were used for computing bass population metrics.

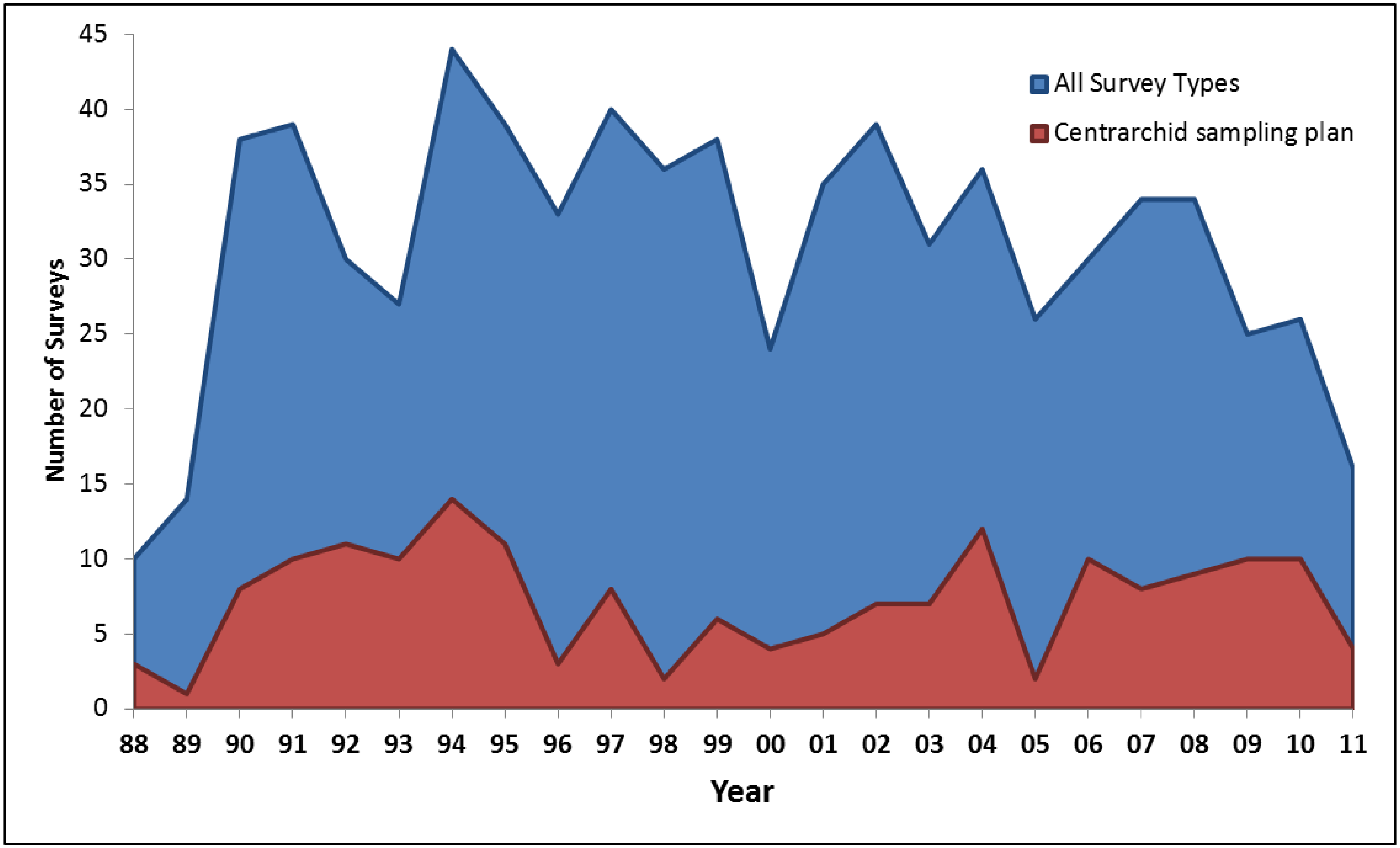
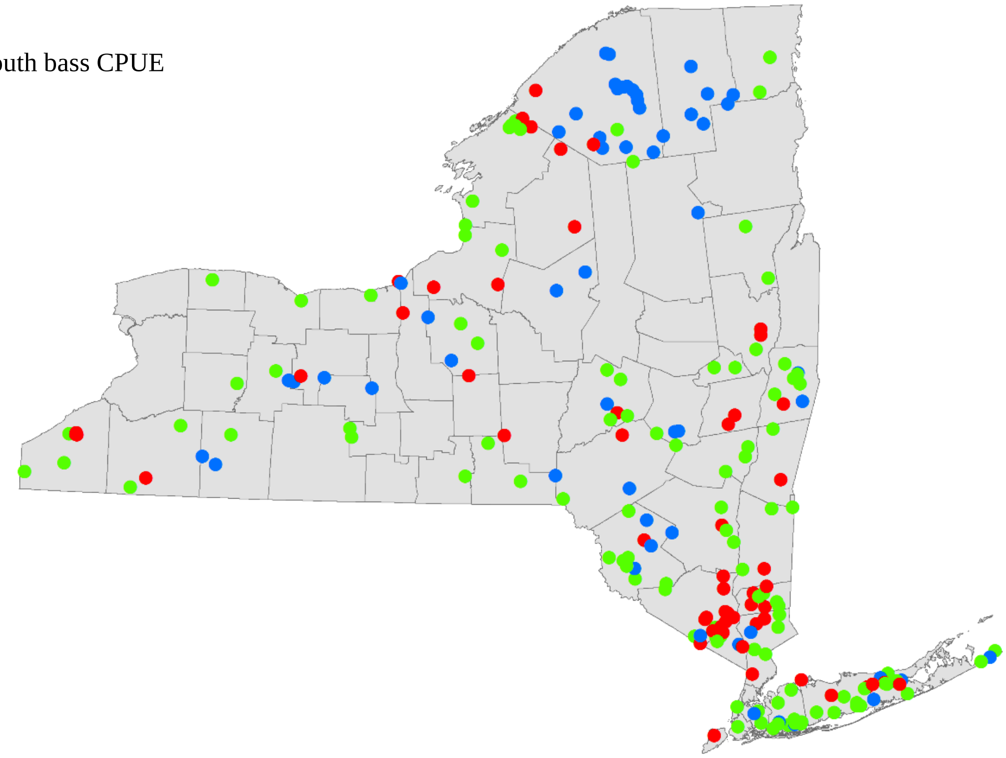


Figure 3. Number of surveys from the Statewide database used to calculate population metrics by year.

Largemouth bass CPUE



Smallmouth bass CPUE

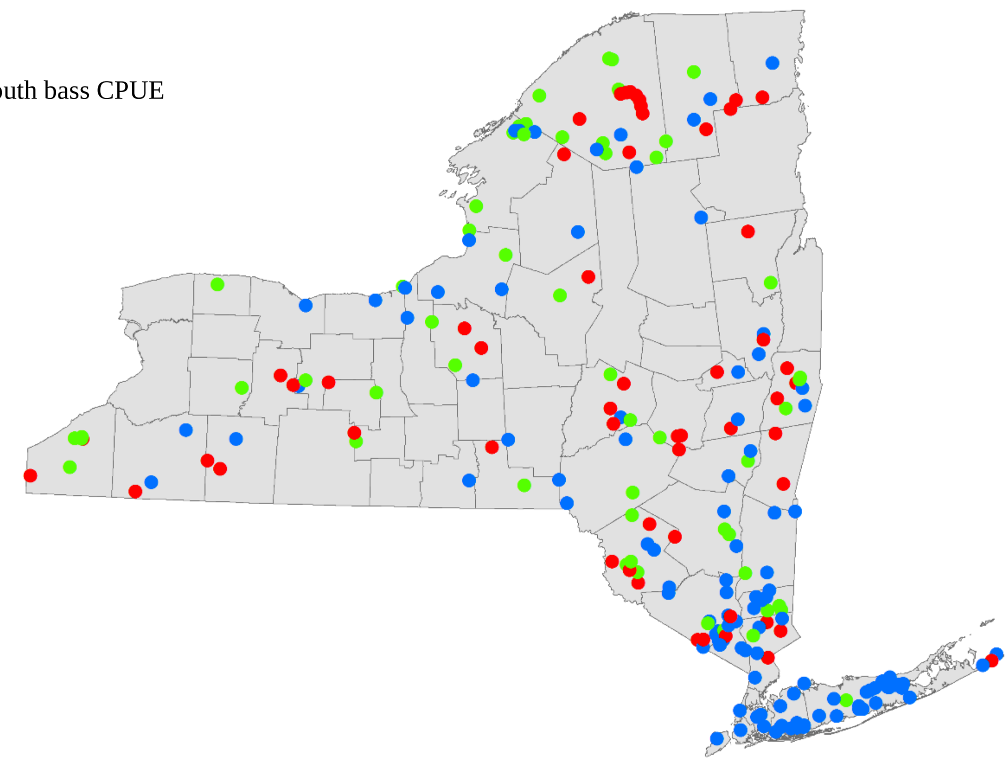


Figure 4. Distribution of largemouth (top) and smallmouth bass (bottom) catch rates (number caught/hour of boat electrofishing), 1988-2011. Blue dots represent CPUEs in the lower 25th percentile, green dots represent CPUEs between the 25th and 75th percentiles, and red dots represent CPUEs in the upper 75th percentile for each species.

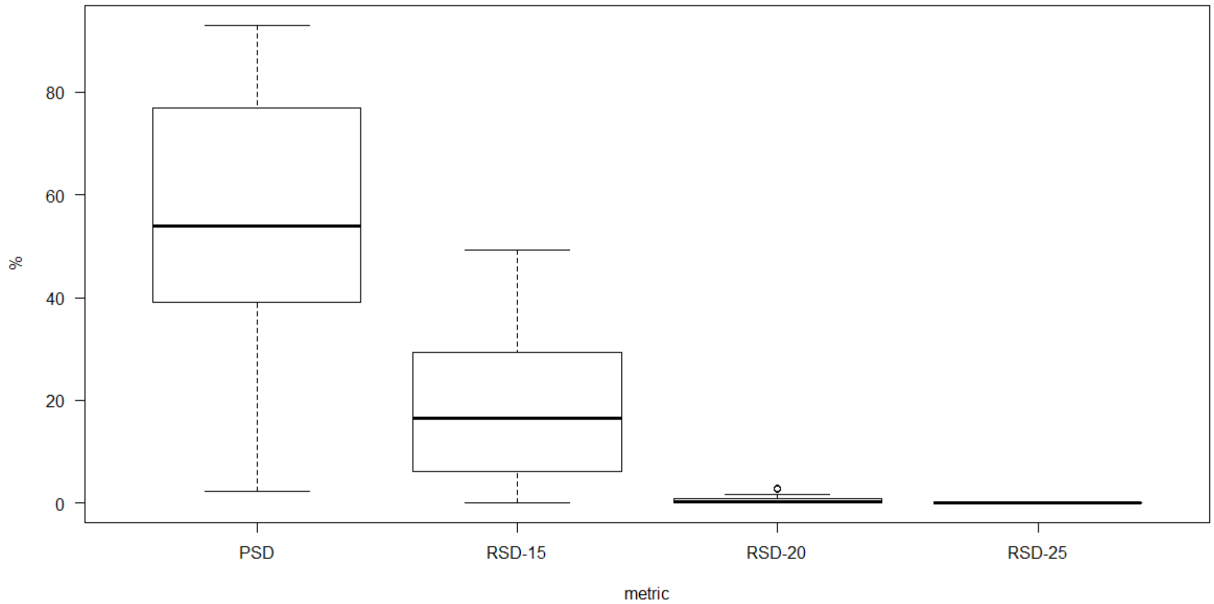


Figure 5. PSD and RSD values for largemouth bass. The center line in the box is the median value and the bottom and top ends of the box are the 1st and 3rd quartile values. Whiskers indicate the minimum and maximum values.

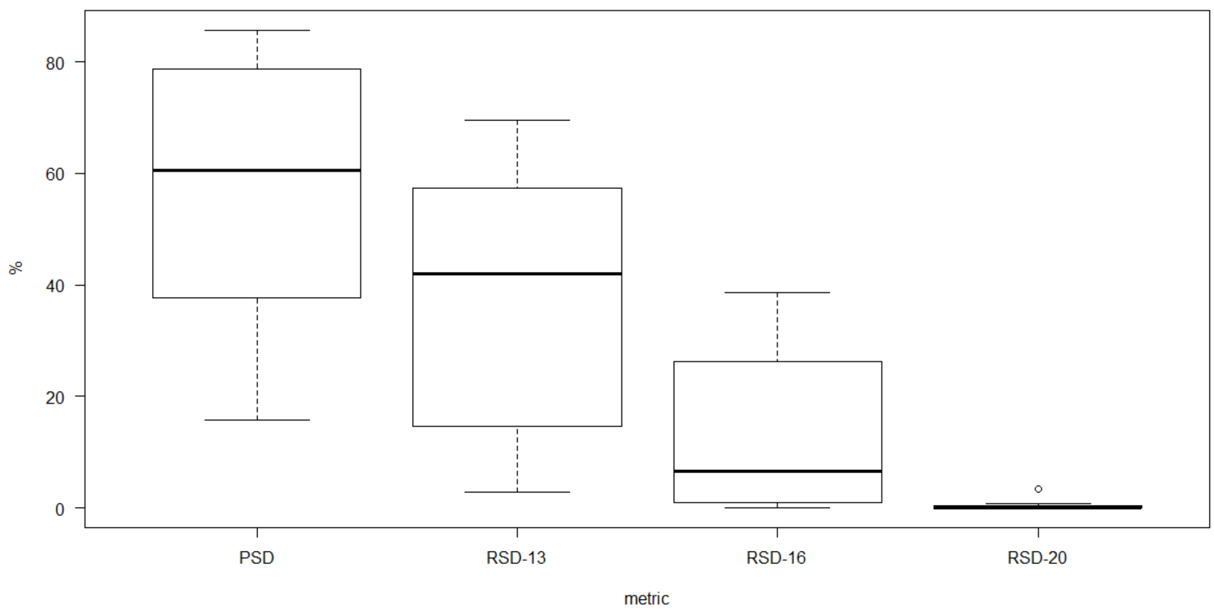


Figure 6. PSD and RSD values for smallmouth bass. The center line in the box is the median value and the bottom and top ends of the box are the 1st and 3rd quartile values. Whiskers indicate the minimum and maximum values.

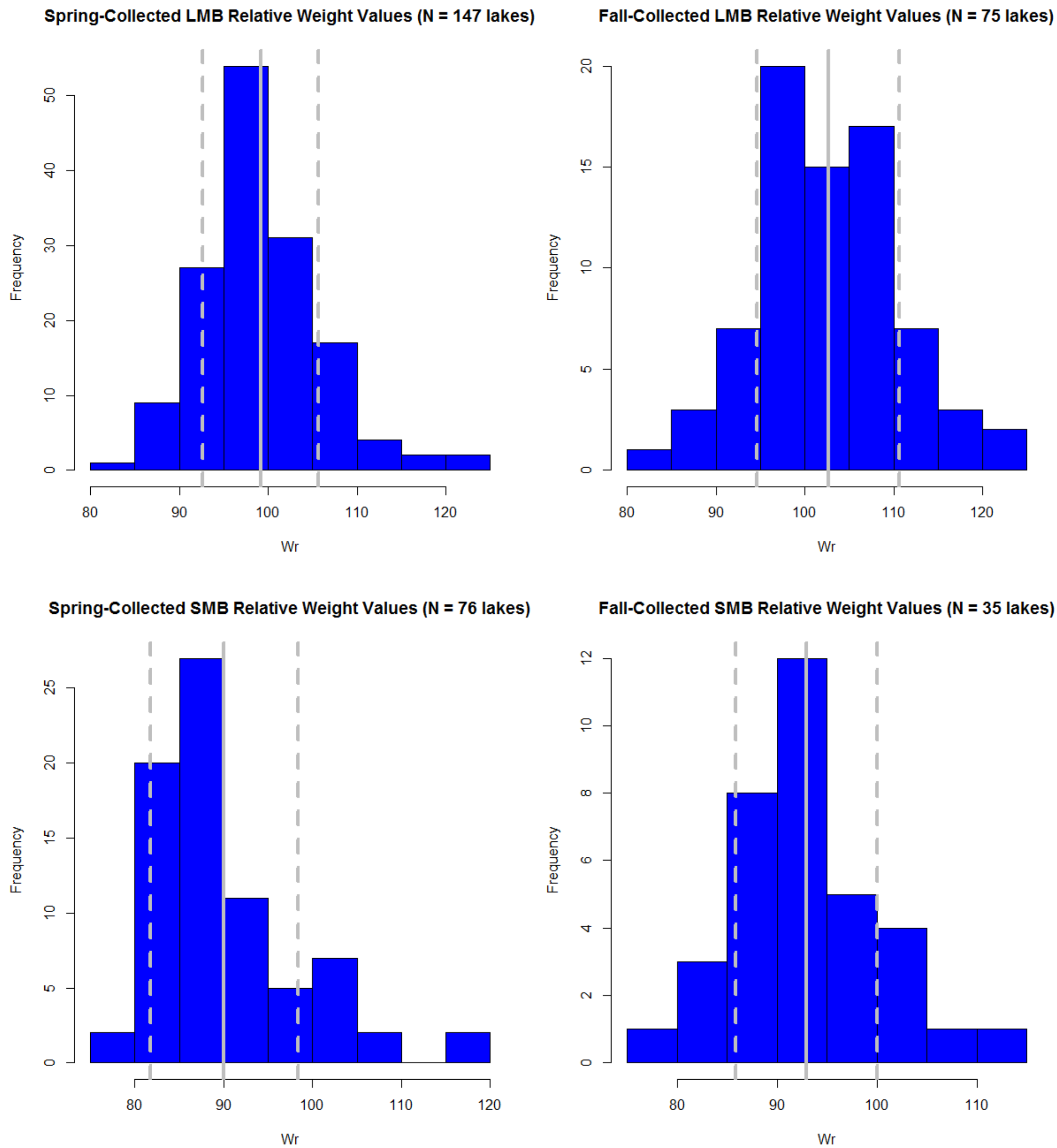


Figure 7. Spring and fall frequency distributions of largemouth and smallmouth bass Wrs from the Statewide database. Gray vertical lines represent grand means (solid) and standard deviations (dotted) of lake-mean lengths at age.

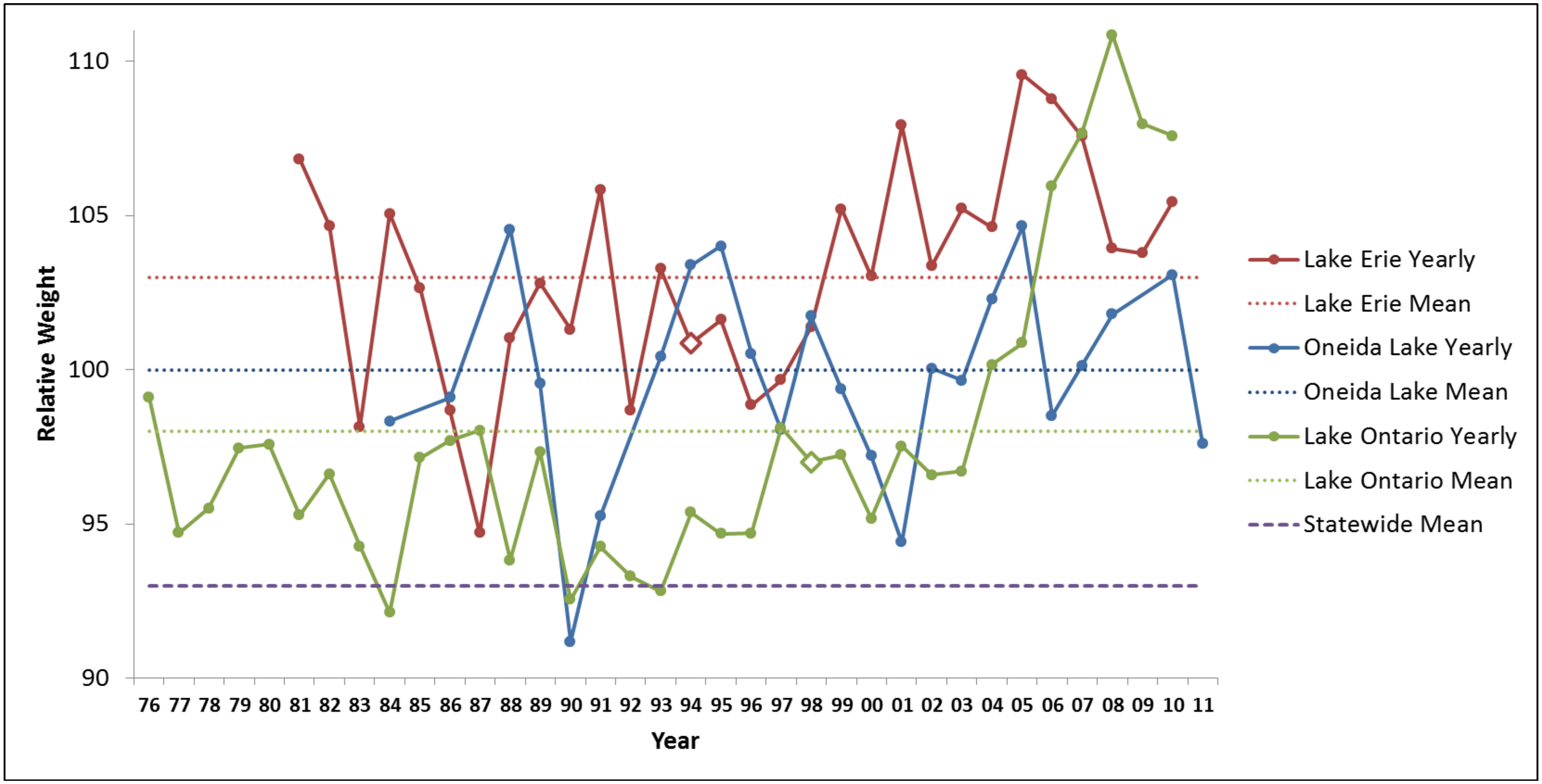


Figure 8. Time series of mean relative weights for Lake Erie, Oneida Lake, and Lake Ontario fall caught smallmouth bass. Open diamond points represent the year in which round gobies were first reported in Lake Erie and Lake Ontario. Round gobies were first reported in Oneida Lake in 2013.

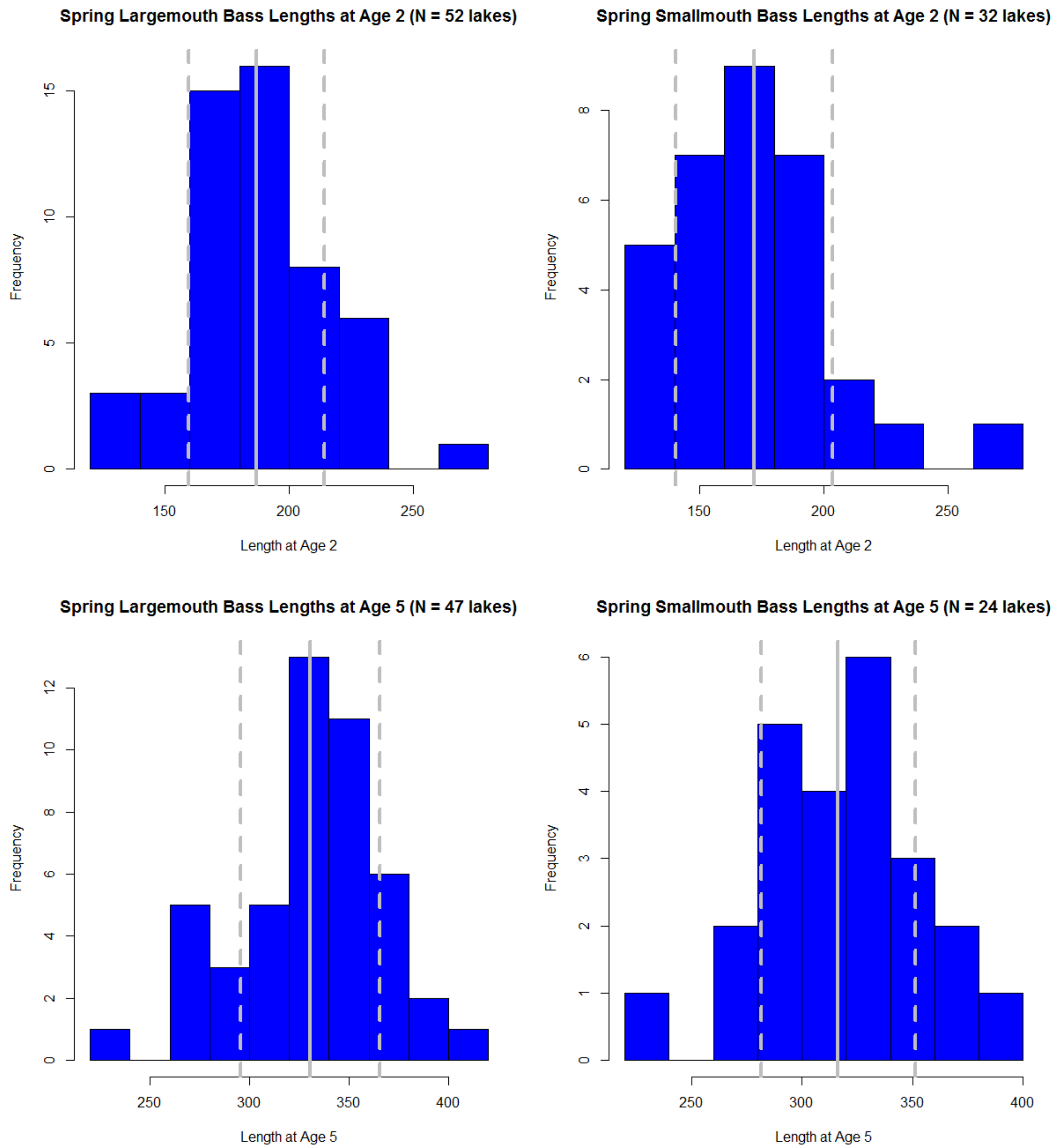


Figure 9. Length frequency distributions of spring collected age 2 and age 5 largemouth and smallmouth bass from the Statewide database. Gray vertical lines represent grand means (solid) and standard deviations (dotted) of lake-mean lengths at age.

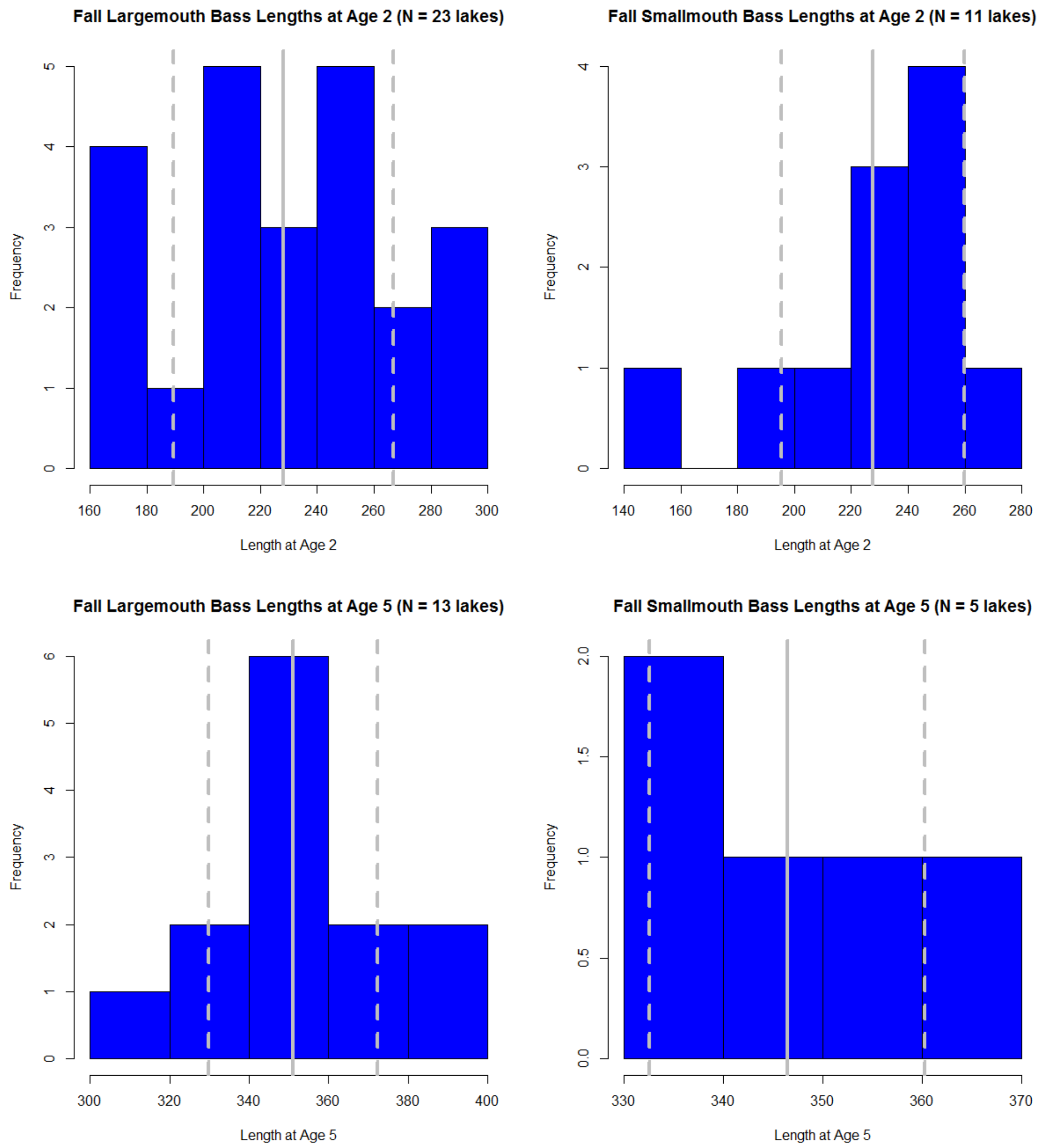


Figure 10. Length frequency distributions of fall collected age 2 and age 5 largemouth and smallmouth bass from the Statewide database. Gray vertical lines represent grand means (solid) and standard deviations (dotted) of lake-mean lengths at age.

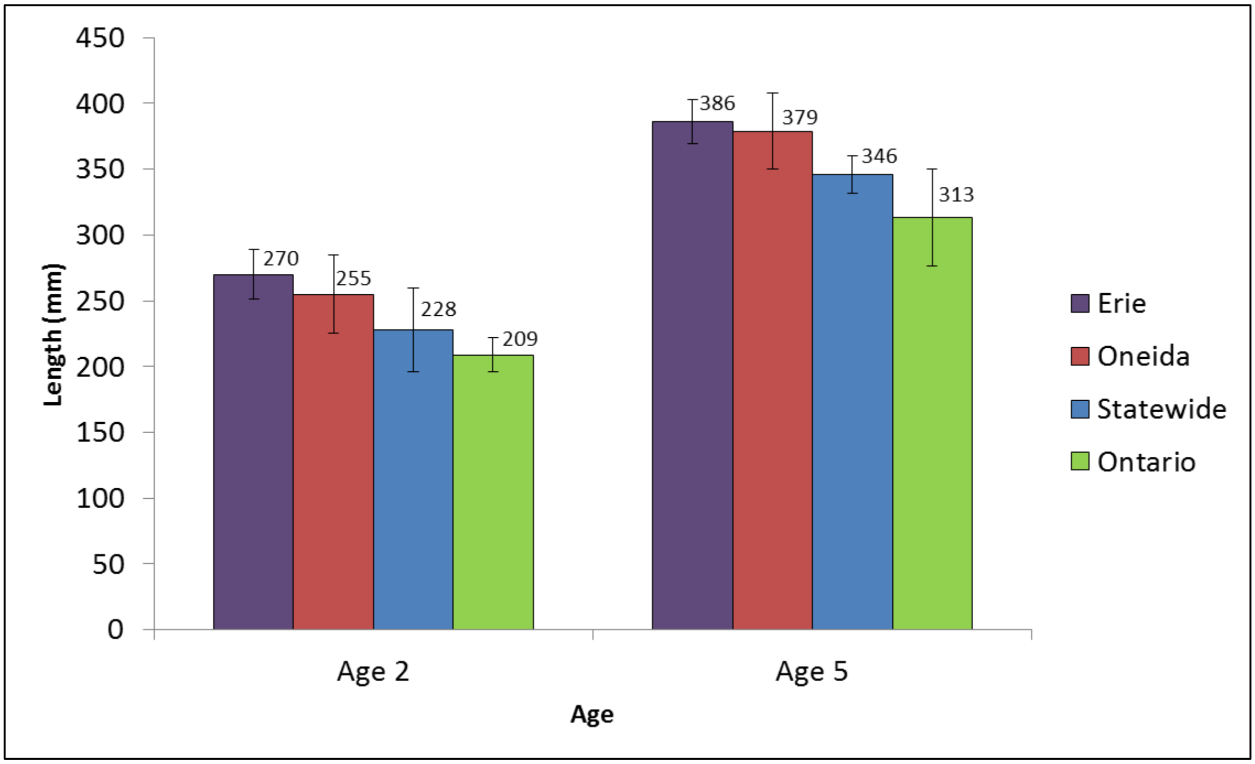


Figure 11. Mean lengths at ages 2 and 5 for fall collected smallmouth bass from all four databases. Error bars are SD.

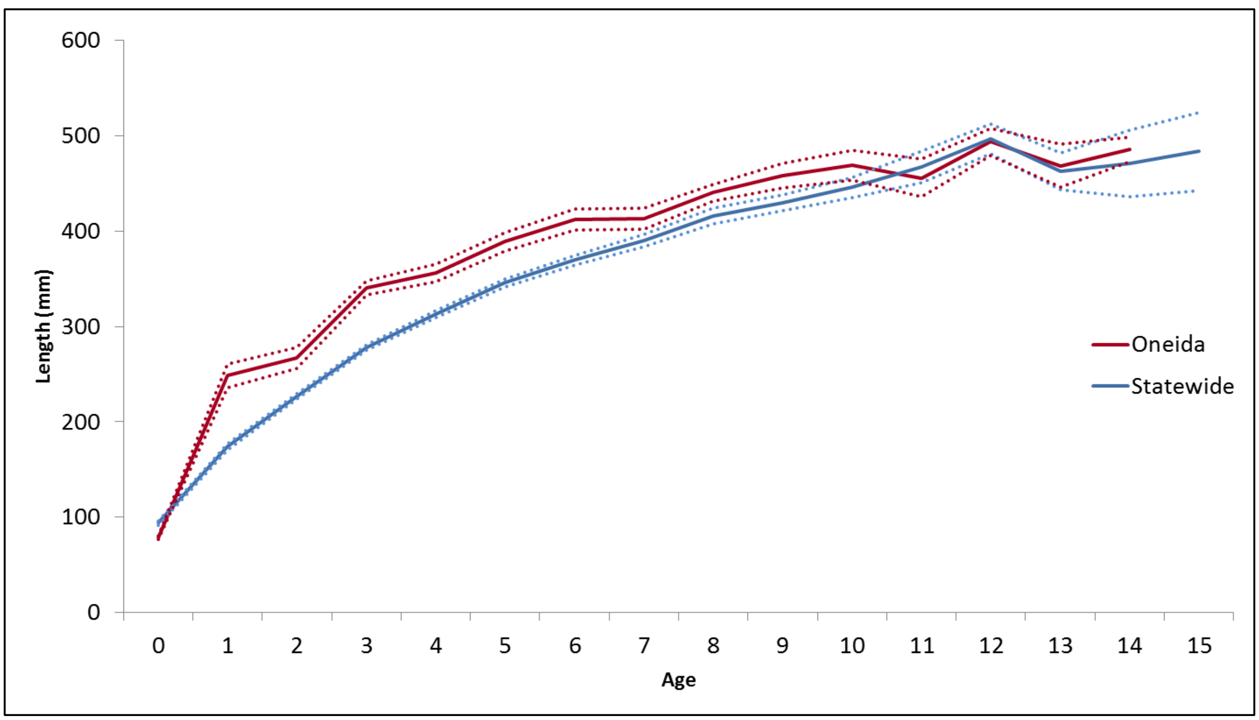


Figure 12. Length at age for fall collected largemouth bass from the Statewide and Oneida Lake databases. Dotted lines are 95% CI.

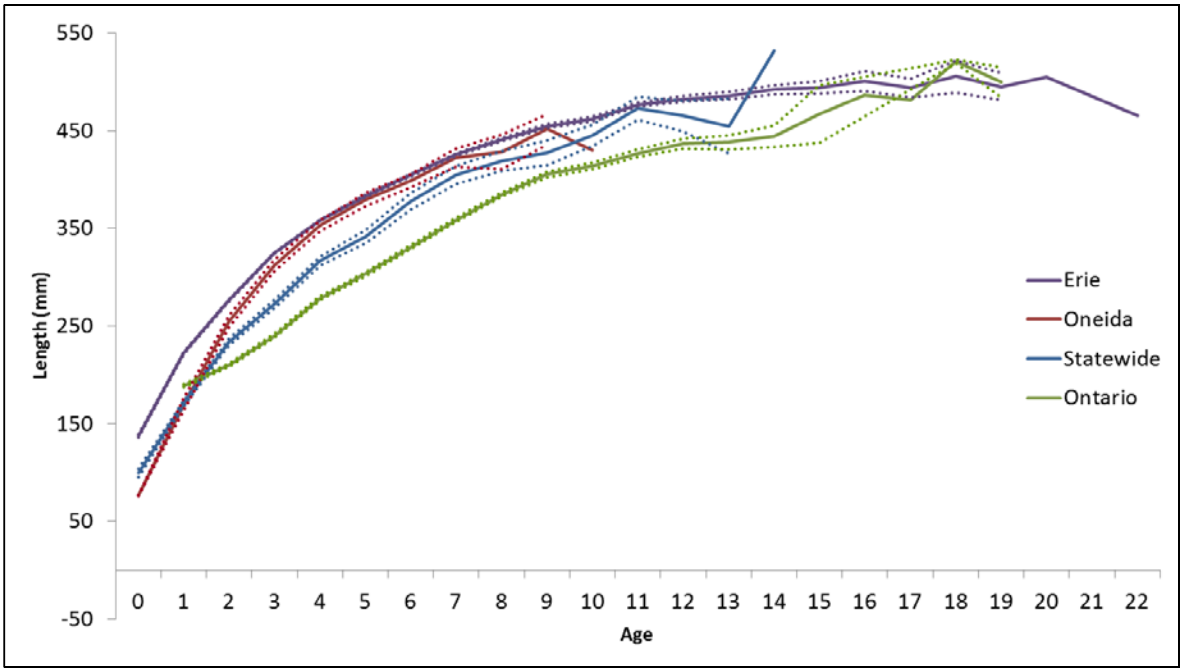


Figure 13. Fall collected smallmouth bass length at age across all four databases. Dotted lines are 95% CI.

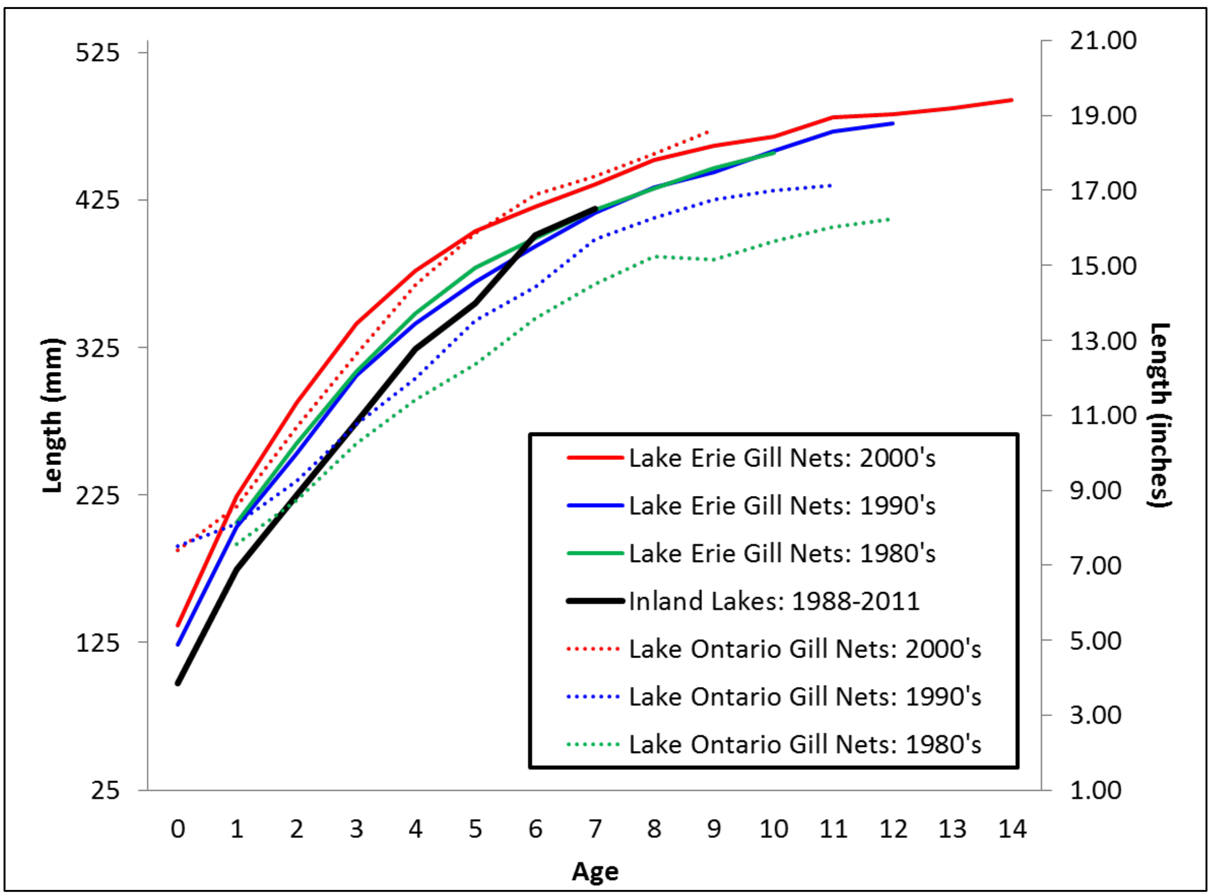


Figure 14. Fall collected smallmouth bass length at age from the Great Lakes through three decades (1980's, 1990's, and 2000's), and from the Statewide database.

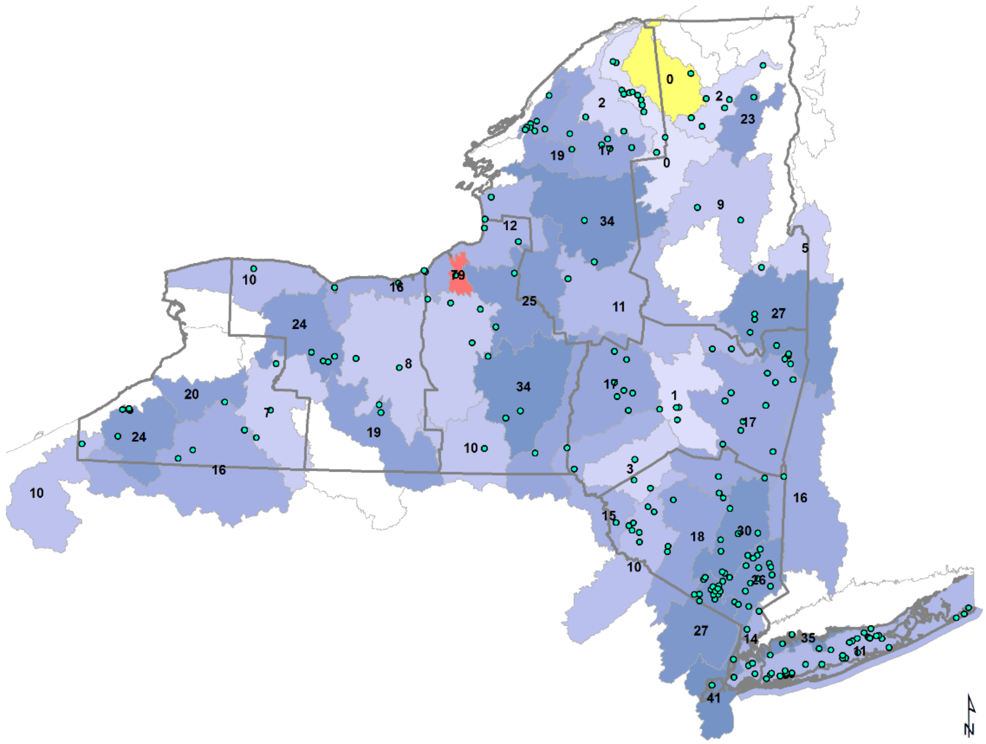


Figure 15. Largemouth bass CPUE summarized by HUC 08 Subbasin. Grand mean CPUE = 16.8 ± 2.5 (n=221 lakes). Darker blue indicates subbasins with higher mean CPUE. The subbasin with the lowest (yellow) and highest (red) mean CPUEs are noted. Surveyed lakes are represented by dots.

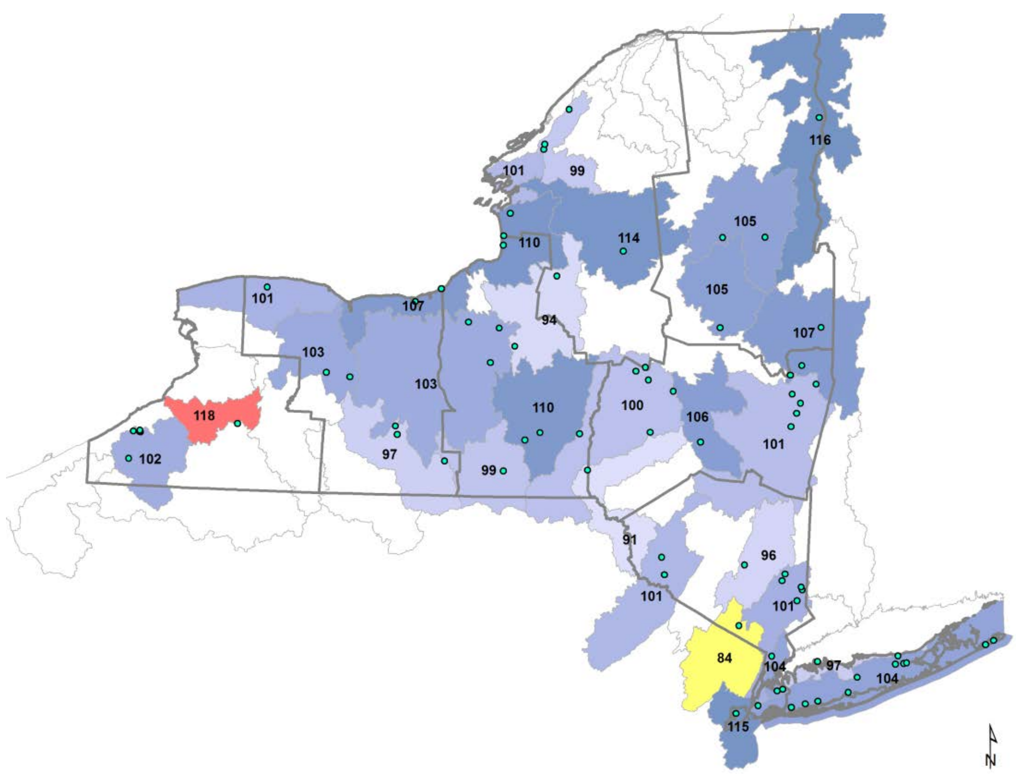


Figure 16. Largemouth bass relative weight summarized by HUC 08 Subbasin. Grand mean Wr = 102.7 ±1.9 (n=75 lakes). The subbasin with the lowest (yellow) and highest (red) mean Wrs are noted. Surveyed lakes are represented by dots.

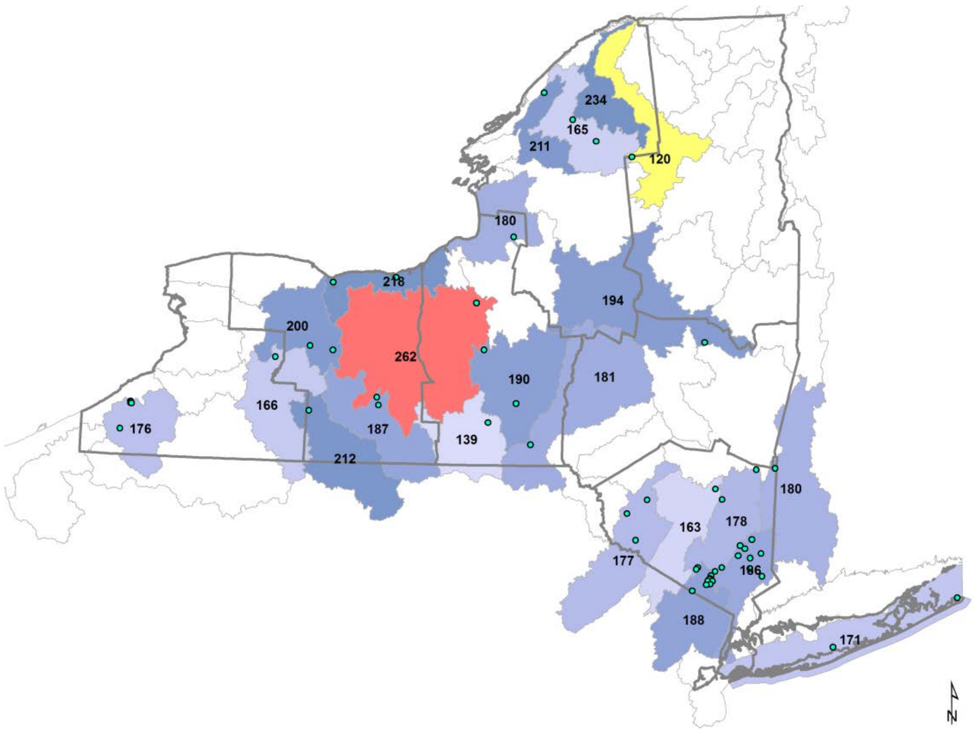


Figure 17. Largemouth bass length at age 2 summarized by HUC 08 Subbasin. Grand mean length at age 2 = 185.5 ± 7.9 (n=52 lakes). Darker blue indicates subbasins with higher mean length. The subbasins with the lowest (yellow) and highest (red) mean lengths are noted. Surveyed lakes are represented by dots.

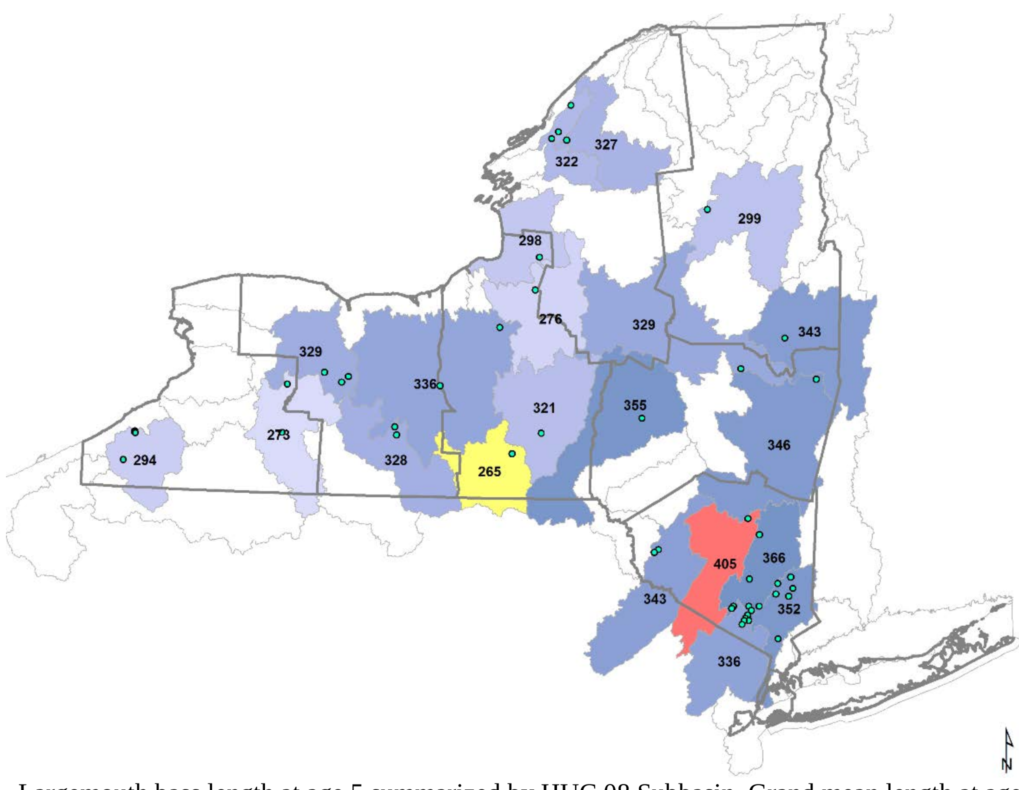


Figure 18. Largemouth bass length at age 5 summarized by HUC 08 Subbasin. Grand mean length at age 5 = 331.8 ± 10.2 (n=47 lakes). Darker blue indicates subbasins with higher mean length. The subbasins with the lowest (yellow) and highest (red) mean lengths are noted. Surveyed lakes are represented by dots.

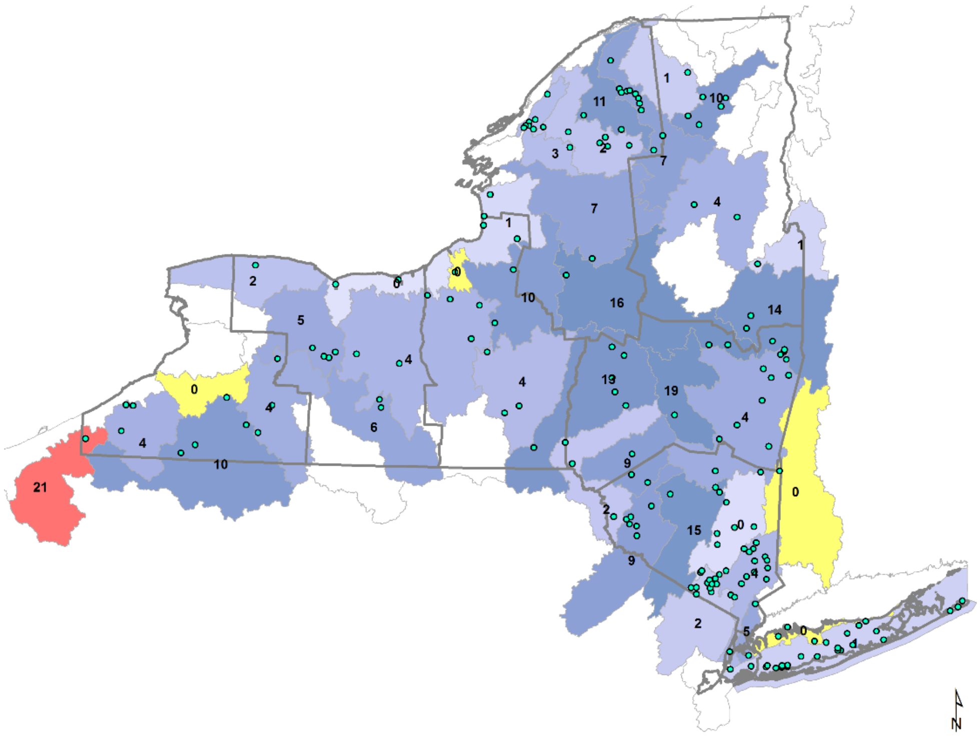


Figure 19. Smallmouth bass CPUE summarized by HUC 08 Subbasin. Grand mean CPUE = 4.2 ± 1.2 (n=180 lakes). Darker blue indicates subbasins with higher mean CPUE. The subbasins with the lowest (yellow) and highest (red) mean CPUEs are noted. Surveyed lakes are represented by dots.

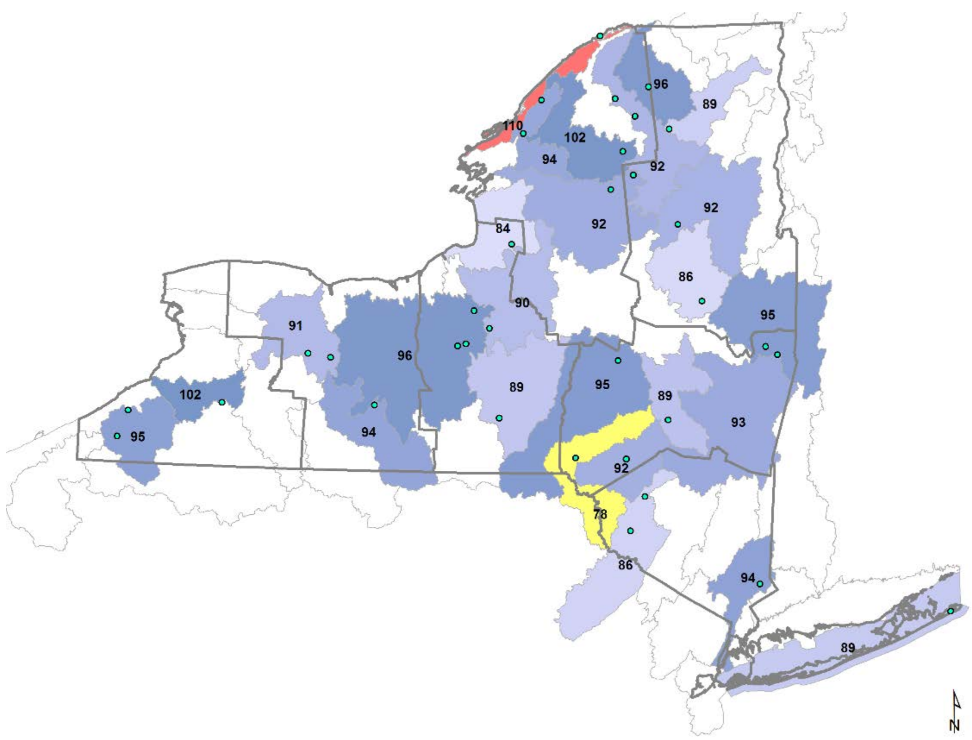


Figure 20. Smallmouth bass relative weight summarized by HUC 08 Subbasin. Grand mean Wr = 92.6 ± 2.4 (n=34 lakes). Darker blue indicates subbasins with higher mean Wr. The subbasins with the lowest (yellow) and highest (red) mean Wrs are noted. Surveyed lakes are represented by dots.

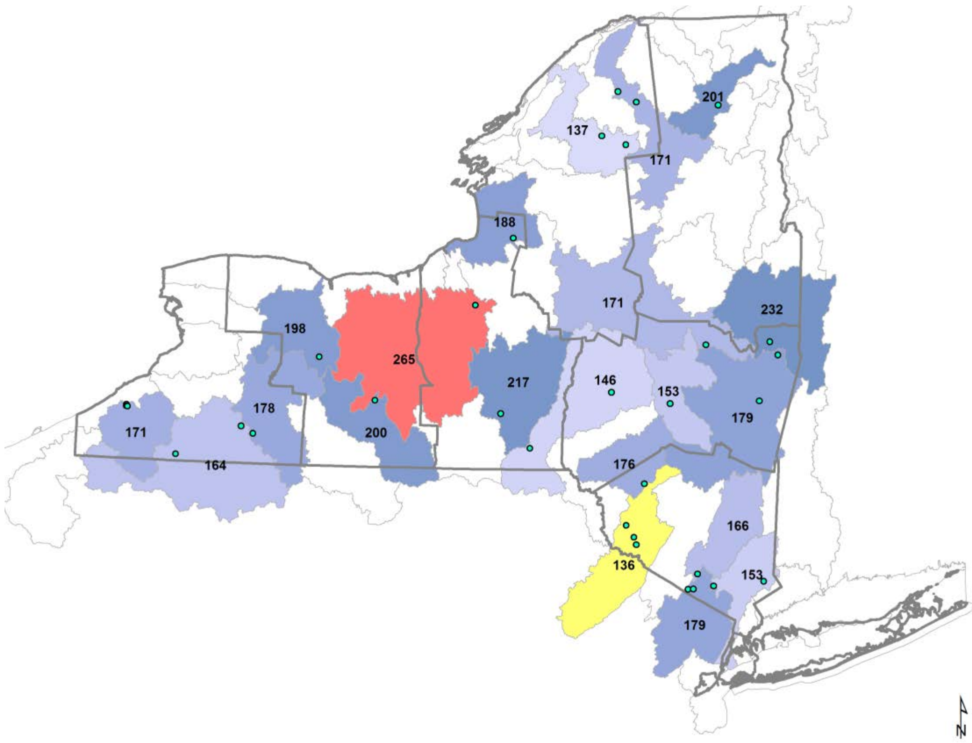


Figure 21. Smallmouth bass length at age 2 summarized by HUC 08 Subbasin. Grand mean length at age 2 = 172.6 ± 11.2 (n=32 lakes). Darker blue indicates subbasins with higher mean length. The subbasins with the lowest (yellow) and highest (red) mean lengths are noted. Surveyed lakes are represented by dots.

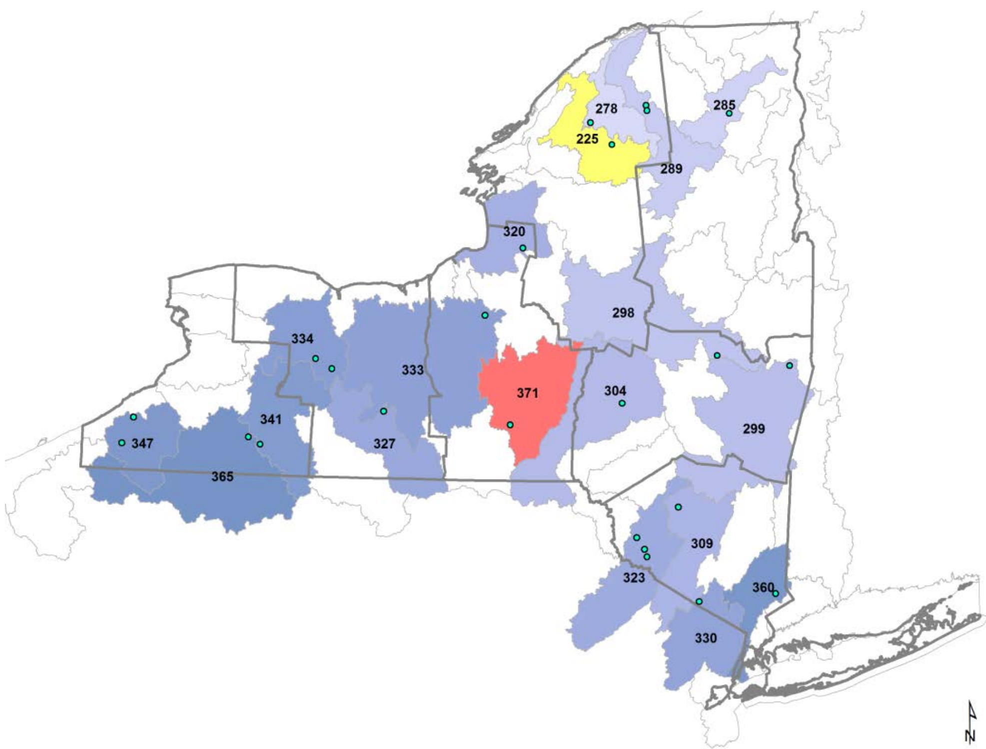


Figure 22. Smallmouth bass length at age 5 summarized by HUC 08 Subbasin. Grand mean length at age 5 = 319.0 ± 14.4 (n=24 lakes). Darker blue indicates subbasins with higher mean length. The subbasins with the lowest (yellow) and highest (red) mean lengths are noted. Surveyed lakes are represented by dots.

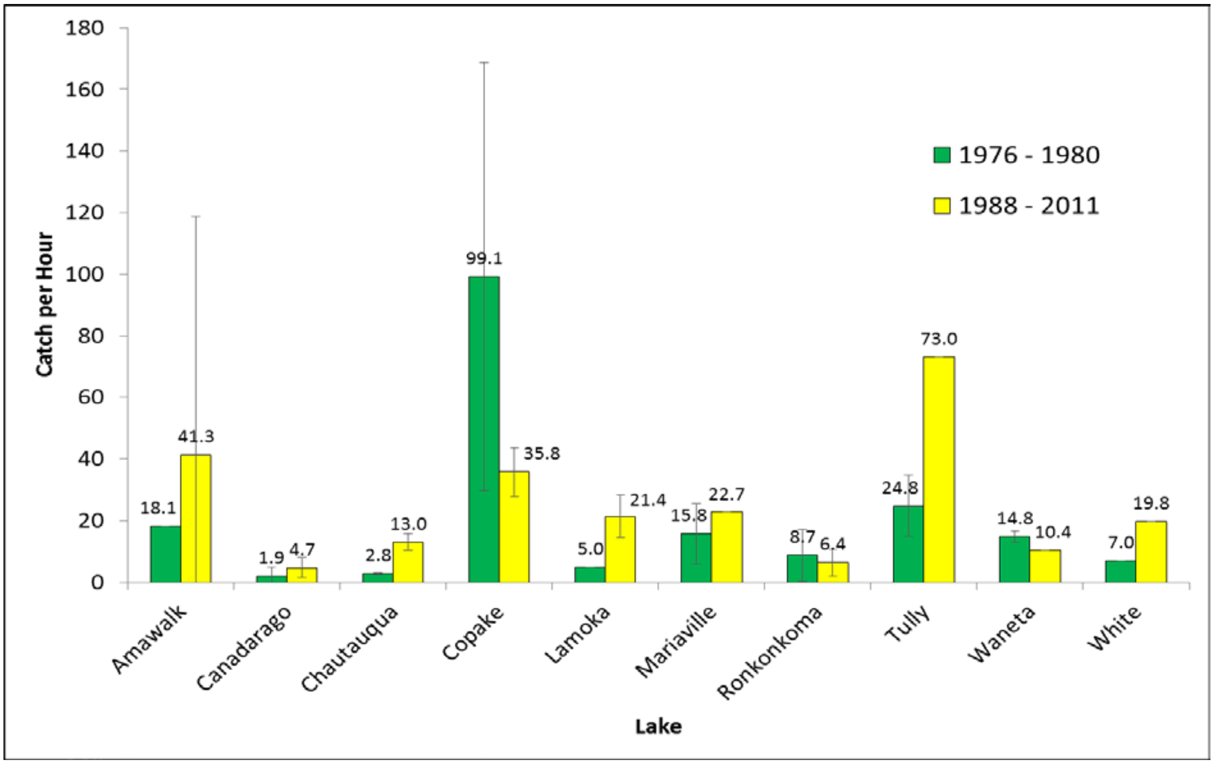


Figure 23. Comparison of largemouth bass CPUE on lakes that were assessed by Green et al. (1986). Error bars are 2SE.

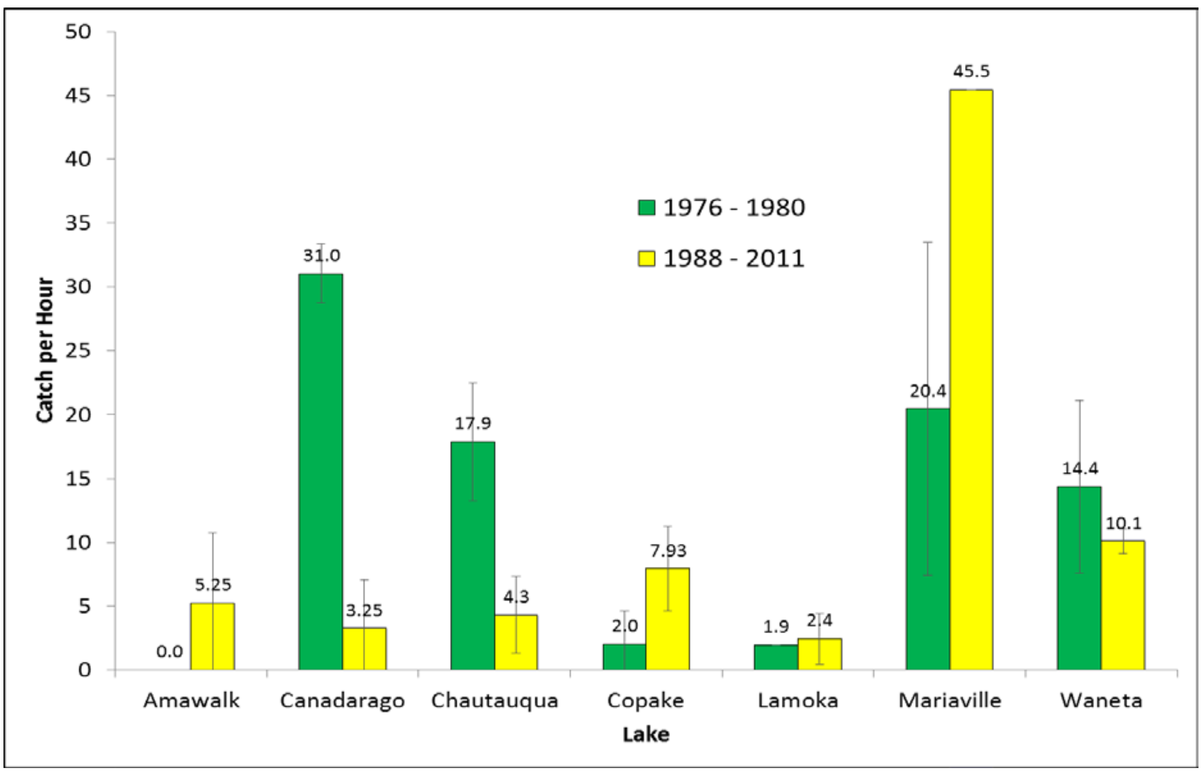


Figure 24. Comparison of smallmouth bass CPUE on lakes that were assessed by Green et al. (1986). Error bars are 2SE.

Appendices

Appendix A-1. Mean values of largemouth and smallmouth bass population metrics for lakes in the Statewide database, by NYSDEC Region.

			Largemouth Bass								Smallmouth Bass							
Region	Lake Name	County	CPUE[1]	PSD	Wr Spring	Wr Fall	LA2 Spring[2]	LA2 Fall	LA5 Spring	LA5 Fall	CPUE	PSD	Wr Spring	Wr Fall	LA2 Spring	LA2 Fall	LA5 Spring	LA5 Fall
1	Arrow Head Pond	Suffolk	9.5			113					0.0							
	Artist Lake	Suffolk	24.1	39	92						0.0							
	Belmont Lake	Suffolk	5.8		106						0.0							
	Big Reed Pond	Suffolk	10.9		100		159				0.0							
	Canaan Lake	Suffolk	6.5		94						0.0							
	Deep Pond	Suffolk	0.0								0.0							
	Donahues Pond	Suffolk	9.9		89						0.0							
	East Meadow Pon	Nassau	10.8		99	118					0.0							
	Forest City Par	Nassau	7.1		93						0.0							
	Fort Pond	Suffolk	2.3		110	110					15.4		87	89				
	Fresh Pond	Suffolk	10.9			96					0.1							
	Fresh Pond	Suffolk	111.2	77	99	91					0.0							
	Grangebel Park	Suffolk	2.0								0.0							
	Grant Pond	Nassau	17.1		97	95					0.0							
	Great Patchogue	Suffolk	8.4		98		183				0.0							
	Great Pond	Suffolk			97													
	Hards Lake	Suffolk	3.0								0.0							
	Hempstead Lake	Nassau	2.9		101						0.0							
	Ice Pond	Suffolk	5.2								0.0							
	Jones Pond	Nassau	2.2								0.0							
	Knapps Lake	Suffolk	5.3			108					0.0							
	Lake Ronkonkoma	Suffolk	6.4		102	101					1.8		83					
	Lower Silver La	Nassau	16.0		92						0.0							
	Lower Twin Pond	Nassau	3.3								0.0							

			Largemouth Bass								Smallmouth Bass							
Region	Lake Name	County	CPUE[1]	PSD	Wr Spring	Wr Fall	LA2 Spring[2]	LA2 Fall	LA5 Spring	LA5 Fall	CPUE	PSD	Wr Spring	Wr Fall	LA2 Spring	LA2 Fall	LA5 Spring	LA5 Fall
1	Massapequa Lake	Nassau	10.1		99						0.0							
	Massapequa Rese	Nassau	17.6		107	98					0.0							
	Mckay Pond	Suffolk	48.9	83		102					0.0							
	Mill Pond	Nassau	10.3		109						0.0							
	New Mill Pond	Suffolk	28.3	93	89						0.0							
	Peconic Lake	Suffolk	15.3		98	107					0.0							
	Smith Pond	Nassau			102													
	South Pond	Nassau	3.3		101						0.0							
	Spring Lake	Suffolk	21.0		91						0.0							
	Swan Lake	Suffolk	8.0								0.0							
	Swan Pond	Suffolk	21.7		95						0.0							
	Unnamed Water	Suffolk	30.0		95						0.0							
	Upper Mills Pon	Suffolk	4.7			103					0.0							
	Upper Twin Pond	Nassau	7.6		94						0.0							
	Wildwood Lake	Suffolk	26.2		98						0.0							
	Region 1 grand means		**14.4**	**73**	**98**	**104**					**5.8**		**85**	**89**				
2	Baisley Pond	Queens	15.2		108						0.0							
	Harlem Meer	New York			99													
	Kissena Lake	Queens	14.6			103					0.0							
	Meadow Lake	Queens	0.0								0.0							
	Oakland Lake	Queens				87												
	Prospect Park L	Kings	8.7			106					0.0							
	The Lake	New York	17.1		104						0.0							
	Willowbrook Pon	Richmond	41.4			115					0.0							
	Region 2 grand means		**19.4**		**104**	**103**												
3	Amawalk Reservo	Westchest.	41.3	88	103		196				5.3							
	Bog Brook Reser	Putnam				109												

			Largemouth Bass								Smallmouth Bass							
Region	Lake Name	County	CPUE[1]	PSD	Wr Spring	Wr Fall	LA2 Spring[2]	LA2 Fall	LA5 Spring	LA5 Fall	CPUE	PSD	Wr Spring	Wr Fall	LA2 Spring	LA2 Fall	LA5 Spring	LA5 Fall
3	Boyd Corners Re	Putnam	20.3			95		262			0.0							
	Breakneck Pond	Rockland	12.6		96		174				0.0							
	Canopus Lake	Putnam	24.4	27	91		173		327		0.0							
	Chadwick Lake	Orange	28.8			96					0.0							
	Chodikee Lake	Ulster	23.1		99		207		367		0.0							
	Cliff Lake	Sullivan											88					
	Cross River Res	Westchest.	18.3		96		193				25.6		83	94	152		360	
	DeForest Lake	Rockland	2.0								0.0							
	Diverting Reser	Putnam	4.9								4.9							
	Dixie Lake	Sullivan	26.0		104						0.0							
	East Branch Res	Putnam				98												
	Fourth Lake	Ulster	44.1	88	104				405		0.9							
	Grassy Sprain R	Westchest.	30.8			104		283			0.0							
	Greenwood Lake	Orange	13.3	79	98						7.6		89		187		327	
	Hessian Lake	Rockland	40.2	93	107		122		366		0.0							
	Island Pond	Orange	6.7								0.0							
	Kensico Reservo	Westchest.	9.0		99						9.9		89					
	Lake Askoti	Orange	11.8	23	90		161				0.0							
	Lake Huntington	Sullivan	21.1		97						5.3							
	Lake Kanawauke	Rockland	45.1	50	97		157		326		0.0							
	Lake Mahopac	Putnam	71.0	83	102		181		349		5.0		89					
	Lake Sebago	Rockland	22.2	38	101		187		335		0.0							
	Lake Skanatati	Orange			89		173		332									
	Lake Stahahe	Orange	38.4		101						0.0							
	Lake Superior	Sullivan	17.9		101				372		0.7							
	Lake Tiorati	Orange	28.1	47	104		210		348		1.6							
	Lake Washington	Orange	38.2		104				382		0.0							

			Largemouth Bass								Smallmouth Bass							
Region	Lake Name	County	CPUE[1]	PSD	Wr Spring	Wr Fall	LA2 Spring[2]	LA2 Fall	LA5 Spring	LA5 Fall	CPUE	PSD	Wr Spring	Wr Fall	LA2 Spring	LA2 Fall	LA5 Spring	LA5 Fall
3	Lake Welch	Rockland	23.9	56	90		178		344		8.6	54	86		154			
	Loch Sheldrake	Sullivan			113		207											
	Lower Twin Lake	Orange			83				323									
	Middle Branch R	Putnam	17.2		95		213				3.1							
	Mohansic Lake	Westchest.	68.1	49	88						0.0							
	Mongaup Falls R	Sullivan	7.2								20.5		90		121		280	
	Mongaup Pond	Sullivan	0.0								20.3		88		176			
	Morningside Lak	Sullivan	1.1								0.0							
	Neversink Reser	Sullivan												82				
	New Croton Rese	Westchest.	2.5		100						2.5		85					
	Onteora Lake	Ulster	4.8								0.0							
	Oscawana Lake	Putnam	48.0		100		182		352		0.0							
	Pine Meadow Lak	Rockland	8.9			84		171			0.0							
	Pocantico Lake	Westchest.	10.8		102						0.0							
	Popolopen Lake	Orange	43.2	42							0.0							
	Pudding Street	Putnam	16.3	2	88		179				0.0							
	Rio Reservoir	Sullivan			99	97	140						86		125		300	
	Rockland Lake	Rockland	26.6	72	99						0.4							
	Rondout Reservo	Ulster	0.0								40.3		88				309	
	Round Lake	Orange	114.1	60	94		225		349		0.0							
	Rudd Pond	Dutchess	16.4		96		180				0.0							
	Silver Mine Lak	Orange	55.0	73	99		169		369		0.0							
	Sterling Forest	Orange	29.0		102		234				0.0							
	Sterling Lake	Orange	2.7								10.2		83		174			
	Stillwell Lake	Orange	25.4								7.0							
	Stissing Pond	Dutchess	15.2		94		160				0.0							
	Sturgeon Pool	Ulster	10.2		98		163				4.1		89					

			Largemouth Bass								Smallmouth Bass							
Region	**Lake Name**	**County**	**CPUE[1]**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring[2]**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**	**CPUE**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**
3	Swan Lake	Westchest.			106				389									
	Swinging Bridge	Sullivan	2.9			106				380	5.2		91	91		241		346
	Sylvan Lake	Dutchess	27.3		99						0.0							
	Titicus Reservo	Westchest.	3.8			103					0.4							
	Toronto Reservo	Sullivan	5.1		109						22.8		86		142		373	
	Unnamed Water	Sullivan	3.7								0.0							
	Unnamed Water	Orange	4.3								0.0							
	Walton Lake	Orange	36.4	62	100		186		363		1.2		85		172			
	Waneta Lake	Sullivan	10.5		121						3.0							
	Wappinger Lake	Dutchess	8.6								2.6							
	West Branch Res	Putnam			101				364									
	White Lake	Sullivan	19.8		99		185		311		4.0		85					
	White Pond	Putnam	23.9	40	95	103	204	257	328		0.1							
	Region 3 grand means		**23.4**	**56**	**99**	**100**	**183**	**243**	**352**	**380**	**8.0**	**54**	**87**	**89**	**156**	**241**	**325**	**346**
4	Arnold Lake	Otsego	0.0								45.0		80					
	Basic Creek Res	Albany	50.8		101						18.2		108					
	Bear Swamp Pond	Otsego				88												
	Black River Pon	Rensselaer	0								0.0							
	Blazer Pond	Schoharie	13.0		102						2.0		107					
	Blenheim Gilboa	Schoharie	0								5.2		92		153			
	Burden Lake	Rensselaer	24.0			98		263			0.8							
	Canadarago Lake	Otsego	4.7		104	110					3.3		93					
	Cannonsville Re	Delaware												78				
	Collins Lake	Schenect.	10.0		89						0.0							
	Copake Lake	Columbia	35.8	38	93						7.9	33	83					
	Crumhorn Lake	Otsego	67.1		95						0.0							
	Dunham Reservoi	Rensselaer	16.6		95				346		24.7		87		140		299	

			Largemouth Bass								Smallmouth Bass							
Region	Lake Name	County	CPUE[1]	PSD	Wr Spring	Wr Fall	LA2 Spring[2]	LA2 Fall	LA5 Spring	LA5 Fall	CPUE	PSD	Wr Spring	Wr Fall	LA2 Spring	LA2 Fall	LA5 Spring	LA5 Fall
4	Dyking Pond	Rensselaer	4.7			107					0.0							
	Gilbert Lake	Otsego			107													
	Goodyear Lake	Otsego	15.9		93				355		16.4	42	81		145		304	
	Green Lake	Greene	20.1		95						0.6							
	Johnsonville Re	Rensselaer			119													
	Kinderhook Lake	Columbia	9.6		98	97					9.4		83		219			
	Lansingburgh Re	Rensselaer			103	95												
	Lawson Lake	Albany	35.3		100						0.0							
	Long Pond	Rensselaer	0.88								1.5		84	93				
	Looking Glass P	Schoharie			122													
	Mariaville Lake	Schenect.	22.7	23	101		194		329		45.5	45	89		171		298	
	Mill Pond	Rensselaer	11.2								2.0							
	Nassau Lake	Rensselaer				103												
	North-South Lak	Greene	10.4		98						0.0							
	Otsego Lake	Otsego	6.7	88	102	104					12.4	85	91	95				
	Pepacton Reserv	Delaware	0.0								5.2		84	92				
	Pine Lake	Delaware	28.0			97					0.0							
	Queechy Lake	Columbia			94													
	Reservoir	Greene	16.0		105						0.0							
	Schenevus Lake	Otsego	7.5								0.6							
	Schoharie Reser	Schoharie	3.2			106					18.7	30	85	89		254		
	Second Pond	Rensselaer	13.6		97						2.6							
	Silver Lake	Delaware	22.0		94						0.0							
	Snyders Lake	Rensselaer	15.6		99	98					8.0		102					
	Tomhannock Rese	Rensselaer	12.5		109	106		297			33.3	78	90	95	232			
	Tubbs Pond	Albany			96													
	Upper Blenheim	Schoharie	0.0								30.0	17	75					

			Largemouth Bass								Smallmouth Bass							
Region	**Lake Name**	**County**	**CPUE[1]**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring[2]**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**	**CPUE**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**
4	Vlaie Pond	Schoharie			94													
	Region 4 grand means		**18.4**	**50**	**100**	**101**	**194**	**280**	**343**		**13.3**	**47**	**89**	**90**	**177**	**254**	**300**	
5	Bartlett Pond	Essex			96													
	Cadyville Reser	Clinton	9.7								0.0							
	Cossayuna Lake	Washington			90													
	Deer River Flow	Franklin	0.0								0.7							
	Fern Lake	Clinton	22.6								8.3		101					
	Franklin Falls	Franklin	0.0								11.7				201		287	
	Glen Lake	Warren	4.67								0.7							
	Great Sacandaga	Fulton												86				
	Indian Lake	Hamilton												92				
	Kings Flow	Hamilton				108												
	Lake Abanakee	Hamilton	1.1								0.0							
	Lake Champlain	Essex	6.9			116					13.1	61	98					
	Lake Durant	Hamilton			101				299									
	Lake Lauderdale	Washington				120												
	Lake Lila	Hamilton												91				
	Lake Lonely	Saratoga	29.0		107						0.0							
	Lake Pleasant	Hamilton											84					
	Little Green Po	Franklin	0.0								0.0							
	Long Lake	Hamilton											84					
	Loon Lake	Warren	16.0			102					8.0							
	Lower Saranac L	Franklin	1.5								5.9		91					
	Mayfield Lake	Fulton				105												
	Middle Saranac	Franklin											86					
	Northville Pond	Fulton											82					
	Oxbow Lake	Hamilton			99								81					

			Largemouth Bass								Smallmouth Bass							
Region	Lake Name	County	CPUE[1]	PSD	Wr Spring	Wr Fall	LA2 Spring[2]	LA2 Fall	LA5 Spring	LA5 Fall	CPUE	PSD	Wr Spring	Wr Fall	LA2 Spring	LA2 Fall	LA5 Spring	LA5 Fall
5	Rainbow Lake	Franklin	0.0								0.0							
	Rollins Pond	Franklin												89				
	Round Lake	Saratoga	18.8		101						0.0							
	Saratoga Lake	Saratoga	45.8	83	97				343		8.8		97					
	Schroon Lake	Warren											94					
	Union Falls Pon	Clinton	0.0								34.0							
	Region 5 grand means		**15.6**	**83**	**99**	**110**			**321**		**10.1**	**61**	**90**	**90**	**201**		**287**	
6	Black Lake	St. Lawrence	28.5	58	107	98	223		348	389	5.0		120	105				
	Blake Falls Res	St. Lawrence	0.0								11.1		88				282	
	Butterfield Lak	Jefferson	12.8		106						0.7							
	Carry Falls Res	St. Lawrence	0.0								7.5		104	89				
	Clear Lake	Jefferson	21.2			99					2.8							
	Colton Flow	St. Lawrence	0.6								2.6							
	Cranberry Lake	St. Lawrence	1.1								5.9		93	102	139			
	Delta Lake	Oneida	0.8								1.4							
	First Lake	Herkimer											87					
	Five Falls Rese	St. Lawrence	0.0								6.8							
	Flat Rock Reser	St. Lawrence	0.0								3.6				135		225	
	Fourth Lake	Herkimer											85					
	Grass Lake	St. Lawrence	31.3		100				328		3.3							
	Hickory Lake	St. Lawrence			98													
	Higley Falls Re	St. Lawrence	0.5								10.3			94	176			
	Horseshoe Lake	St. Lawrence	2.6								2.6					148		
	Huckleberry Lak	St. Lawr.					234											

			Largemouth Bass								Smallmouth Bass							
Region	**Lake Name**	**County**	**CPUE[1]**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring[2]**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**	**CPUE**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**
6	Hyde Lake	Jefferson				101												
	Kayuta Lake	Oneida	0.3								6.7							
	Lake Bonaparte	Lewis	24.6	36	95						11.3		82					
	Lake Of Pines	Lewis	66.7		96						0.0							
	Lake Ozonia	St. Lawrence											89	96				
	Lake St Lawrenc	St. Lawrence												110		234		
	Lows Lake	St. Lawrence	14.4				147				0.0							
	Millsite Lake	Jefferson	11.5		87				299		0.0							
	Mud Lake	Jefferson	6.3								0.0							
	North Pond	Oswego	12.2			107		248		369	0.6							
	Norwood Reservo	St. Lawrence	0.0								4.7		104					
	Otter Lake	Oneida				114												
	Payne Lake	Jefferson	59.7		91				330		0.0							
	Piercefield Flo	St. Lawrence	0.0								5.2							
	Rainbow Falls R	St. Lawrence	0.0								8.3							
	Red Lake	Jefferson	15.5								3.6							
	Sixberry Lake	Jefferson												82				336
	Sixtown Pond	Jefferson	13.5	66		113					0.7							
	South Colton Re	St. Lawrence	0.0								12.3							
	South Pond	Oswego	7.2			110		211		317	0.0							
	Star Lake	St. Lawrence	2.5								0.8		87					
	Stark Falls Res	St. Lawrence	0.2								8.5		86		166		295	
	Stillwater Rese	Herkimer												93				
	Sucker Lake	St. Lawrence	32.2		94		170				0.0							

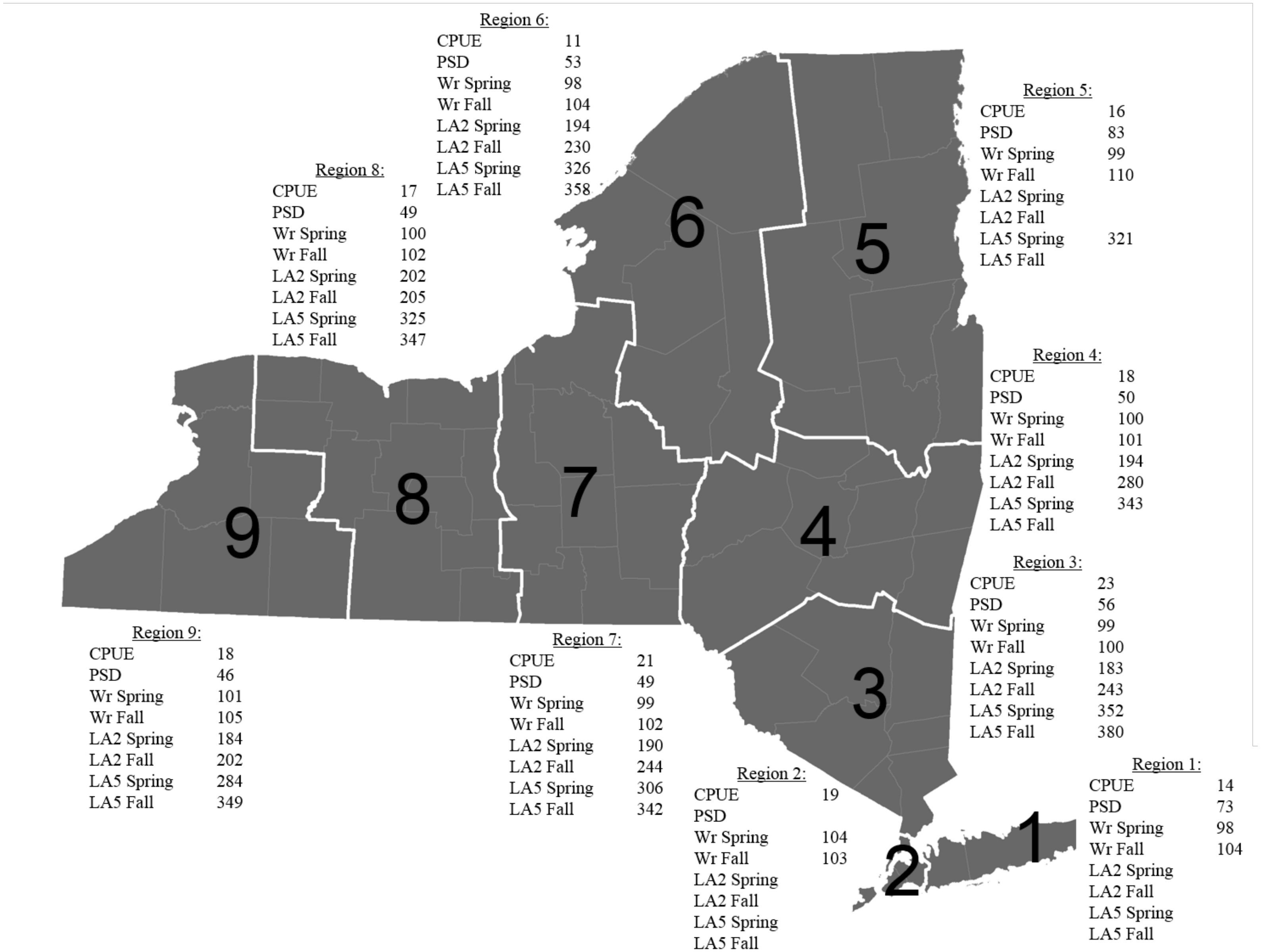
			Largemouth Bass								Smallmouth Bass							
Region	**Lake Name**	**County**	**CPUE[1]**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring[2]**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**	**CPUE**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**
6	Sylvia Lake	St. Lawrence	1.8								3.6		83					
	Tooley Pond	St. Lawrence	21.2								0.0							
	Trout Lake	St. Lawrence	2.0								10.7		91				278	
	Unnamed Water	St. Lawrence	0.0								0.6							
	Unnamed Water	Oneida				90												
	Youngs Lake	Herkimer				101												
	Region 6 grand means		**11.2**	**53**	**98**	**104**	**194**	**230**	**326**	**358**	**5.2**		**90**	**97**	**160**	**191**	**287**	**336**
7	Arctic Lake	Broome	2.3			91		209		321	0.0							
	Cayuga Lake	Cayuga			97				319				94					
	Cross Lake	Onondaga	2.0			98					3.6		79					
	Duck Lake	Cayuga	37.3		99						0.0							
	Greenwood Lake	Broome			95		139		265									
	Guilford Lake	Chenango				103		285										
	Jamesville Rese	Onondaga	22.2			99		252			20.1	16		90		199		
	Lake Neatahwant	Oswego	79.3	91	111						0.0							
	Little Sodus Ba	Cayuga	0.0		101						0.0							
	Long Pond	Chenango	25.1		100	106	192		325		0.0							
	Nathaniel Cole	Broome	7.5		90		181				1.5				147			
	Oakley Corners	Tioga	9.6			99					0.0							
	Onondaga Lake	Onondaga	7.6		107	113	262		355		7.5		88	86	265		323	
	Otisco Lake	Onondaga	1.2			98		232		336	0.9			98		218		332
	Panther Lake	Oswego	27.9	2	94				275		0.0							
	Salmon River Re	Oswego	13.2		101		180		298		1.1		99	84	188		324	
	Skaneateles Lak	Onondaga												105				
	Tully Lake	Cortland	73.0	54	99		188				0.0							
	Whitney Point R	Broome	3.5			113		241		369	10.5		91	89	199	245		351

			Largemouth Bass								Smallmouth Bass							
Region	**Lake Name**	**County**	**CPUE[1]**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring[2]**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**	**CPUE**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**
7	**Region 7 grand means**		**20.8**	**49**	**99**	**102**	**190**	**244**	**306**	**342**	**6.5**	**16**	**90**	**92**	**200**	**221**	**324**	**342**
8	Almond Reservoi	Steuben			95		212											
	Blind Sodus Bay	Wayne	36.9			106		226		342	1.0							
	Canadice Lake	Ontario	0.0		96				313		0.0		95				335	
	Canandaigua Lak	Ontario	1.1								9.7							
	Conesus Lake	Livingston	11.9	55	107	110	166	208	302	346	5.6	71	117	93			319	
	Hemlock Lake	Livingston	1.0		98						11.8	80	83		198			
	Honeoye Lake	Ontario	81.9	54	99	96	234		356		1.1			90				
	Irondequoit Bay	Monroe	5.9		105		235				0.0							
	Lamoka Lake	Schuyler	21.4		94	97	181	210	322	340	2.5							
	Seneca Lake	Yates	0.0								1.2							
	Sodus Bay	Wayne	22.1	37	108	109	201			356	0.3							
	Unnamed Water	Chemung				95		164										
	Waneta Lake	Schuyler	16.6		94	98	186	217	319	353	10.1		90	94	198	222	323	
	Waterport Reser	Orleans	10.5			101					2.1					244		
	Region 8 grand means		**17.4**	**49**	**100**	**102**	**202**	**205**	**325**	**347**	**4.5**	**76**	**97**	**92**	**198**	**233**	**321**	
9	Allen Lake	Allegany	12.0					170	225		0.0							
	Bear Lake	Chautauqua	7.2		100	123					2.2		96					
	Chautauqua Lake	Chautauqua	13.0	51	106	107	209	237	331	349	4.3		101	99		268	343	367
	Cuba Lake	Allegany	0.4								9.1	79	84		188		382	
	Findley Lake	Chautauqua	9.6		96						21.1	86	86					
	Lime Lake	Cattaraugus	20.0		113	118					0.0			102				
	Lower Cassadaga	Chautauqua	27.0	30	99	95	166		275		5.9		105		181		326	
	Middle Cassadag	Chautauqua	35.0		95	93	172	169	272		4.3			91	166	231		
	Quaker Lake	Cattaraugus	10.7	39	94						20.8	67	87		144			
	Red House Lake	Cattaraugus	36.0	40	91						0.2							
	Rushford Lake	Allegany	0.0								12.0		87		176		342	

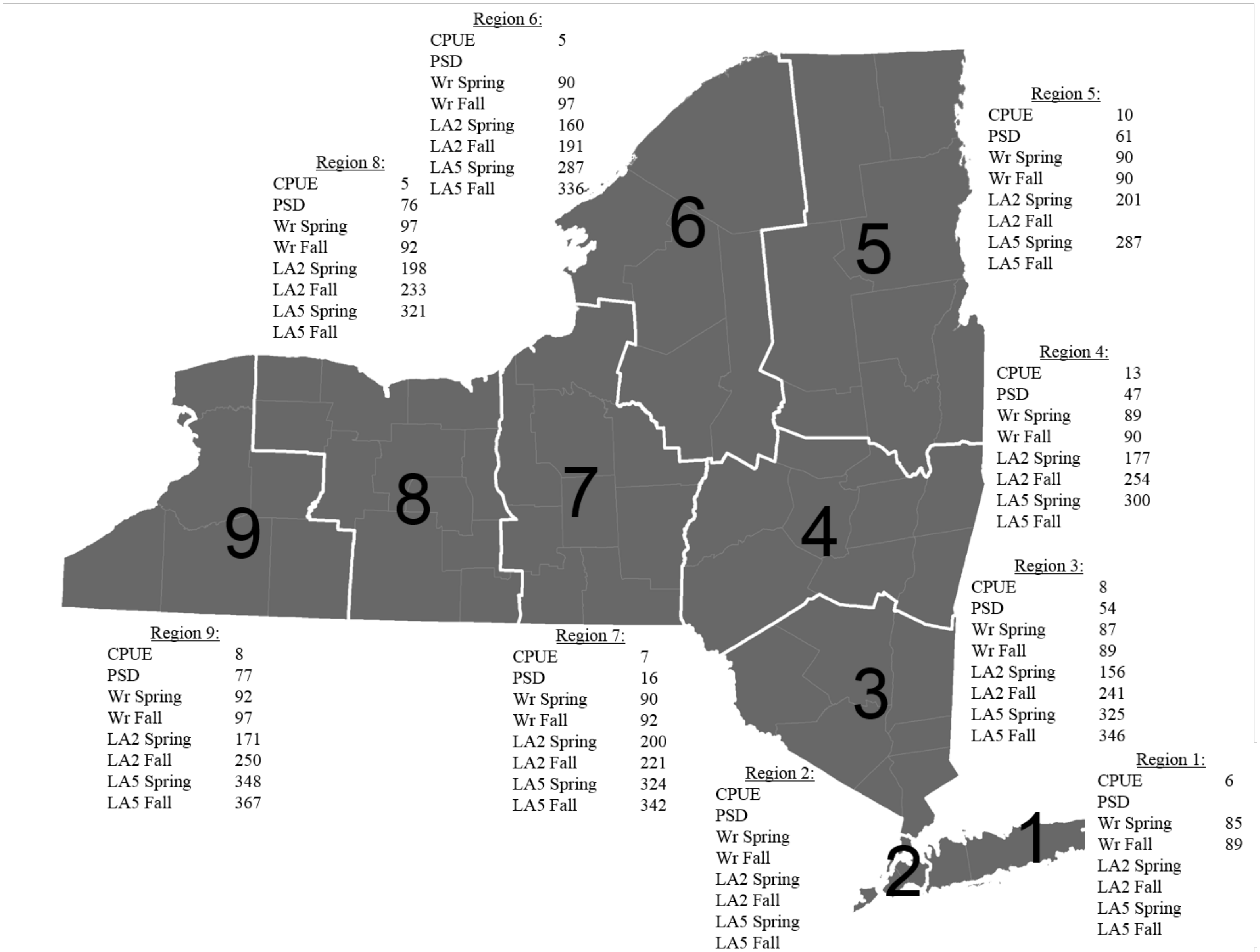
			Largemouth Bass								Smallmouth Bass							
Region	**Lake Name**	**County**	**CPUE[1]**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring[2]**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**	**CPUE**	**PSD**	**Wr Spring**	**Wr Fall**	**LA2 Spring**	**LA2 Fall**	**LA5 Spring**	**LA5 Fall**
9	Silver Lake	Wyoming	8.5	74	115		194	246	326		0.6							
	Upper Cassadaga	Chautauqua	37.2	44	101	93	181	190	277		3.0				172			
	Region 9 grand means		**18.1**	**46**	**101**	**105**	**184**	**202**	**284**	**349**	**7.6**	**77**	**92**	**97**	**171**	**250**	**348**	**367**
Mult.	Oneida Lake	Mult.				107	217	270	347	389			123	100	209	255	379	361
Mult.	Lake Ontario	Mult.											98			209		313
Mult.	Lake Erie	Mult.											103			270		386

[1] Boat electrofishing catch per hour. Regional grand mean CPUE calculations for both largemouth bass and smallmouth bass do not include metric values of zero.

[2] Length at age units = mm



Appendix A-2: Grand mean largemouth bass population metrics by NYSDEC Region.



Appendix A-3: Grand mean smallmouth bass population metrics by NYSDEC Region.

Appendix B. Number of lakes in each NYSDEC Region within largemouth bass relative abundance, condition, and growth categories[1].

Region	Relative abundance[2]			Condition[3]						Growth (Age 2)[4]			Growth (Age 5)[5]		
				Spring			Fall			Spring			Spring		
	Low	Mod.	High	Sub-standard	Good	Excel.	Sub-standard	Good	Excel.	Slow	Mod.	Fast	Slow	Mod.	Fast
1	10	14	12	8	15	4	1	6	5	2					
2	0	1	4		2	1	1	1	2						
3	11	11	36	9	31	5	1	7	2	19	8			17	4
4	4	8	14	6	16	4	1	7	4	1				3	
5	3	2	5	1	5	1		2	3				1	1	
6	10	5	11	3	4	2	1	4	4	2	2		1	3	
7	4	3	7	2	7	2	1	5	3	5		1	3	3	
8	2	3	5	2	5	3		5	3	3	4		1	4	
9	1	6	5	2	5	3	2	1	3	4	1		4	2	
Total	45	53	99	33	90	25	8	38	29	36	15	1	10	33	4

[1]Excludes lakes where largemouth bass of were not captured.

[2]For largemouth bass ≥ 10 inches: CPUE < 5.5/h = low abundance, 5.5-13.0/h = moderate abundance, >13.0/h = high abundance (Green 1989).

[3]Condition is considered sub-standard, good, or excellent when Wrs are <95, 95 – 105, and >105, respectively (Pope and Kruse 2007).

[4]For age 2 largemouth bass, ≤195mm = slow growth, 196 – 235 = moderate growth, and ≥236 = fast growth (Green 1989).

[5]For age 5 largemouth bass, <310mm = slow growth, 311 – 370 = moderate growth, and >371 = fast growth (Green 1989).

Appendix C. Number of lakes in each NYSDEC Region within smallmouth bass relative abundance, condition, and growth categories[1].

Region	Relative abundance[2]			Condition[3]						Growth (Age 2)[4]			Growth (Age 5)[5]		
				Spring			Fall			Spring			Spring		
	Low	Mod.	High	Sub-standard	Good	Excel.	Sub-standard	Good	Excel.	Slow	Mod.	Fast	Slow	Mod.	Fast
1	1	1	1	2			1								
2															
3	5	5	5	17			3			5	3	1	1	3	2
4	3	4	8	14	1	2	4	2		3	1	2	2	1	
5	2		7	7	3		4					1	1		
6	5	4	18	10	2	1	4	3	1	2	2		4		
7	1	2	4	4	1		4	2		1		3		2	
8	2	4	4	2	1	1	3					2		3	
9	2	2	7	4	3		1	2		1	3	2		3	1
Total	21	22	54	60	11	4	24	9	1	12	9	11	8	12	3

[1]Excludes lakes where smallmouth bass were not captured.
[2]For smallmouth bass ≥ 10 inches: CPUE < 1.0/h = low abundance, 1.0-3.0/h = mod abundance, >3.0/h = high abundance (Green 1989).
[3]Condition is considered sub-standard, good, or excellent when Wrs are <95, 95 – 105, and >105, respectively (Pope and Kruse 2007).
[4]For age 2 smallmouth bass, ≤164mm = slow growth, 165 – 176 = moderate growth, and ≥177 = fast growth (Green 1989).
[5]For age 5 smallmouth bass, ≤300mm = slow growth, 301 – 352 = moderate growth, and ≥353 = fast growth (Green 1989).