WARMWATER FISH POPULATION ASSESSMENTS IN NEW HAMPSHIRE (2012)

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INTRODUCTION

Black bass (*Micropterus dolomieui*, smallmouth and *M. salmoides*, largemouth) fishery resources in the State of New Hampshire are highly utilized by anglers, with smallmouth and Largemouth Bass ranking among the top four species fished for by anglers (Responsive Management 2004). The New Hampshire Fish and Game Department (NHFGD) requires clubs and organizations to apply for permits to hold bass tournaments and a database which tracks these permits has shown a general increase in the annual number of tournaments held over time (Table 1).

Bass anglers are the most satisfied of any angler group in New Hampshire; 87% of Smallmouth Bass anglers and 81% of Largemouth Bass anglers were either very or somewhat satisfied with their fishing experiences for these species. Strong support for special black bass management regulations was also shown in the survey: 70% supported catch and release; 68% supported special length limits; 50% supported reduced bag limits; and 47% supported artificial lures and flies only (Responsive Management 1996).

According to the 2006 National Survey of Fishing, Hunting, and Wildlife Associated Recreation, 168,000 anglers fished 1.871 million days for warmwater and coolwater species in New Hampshire (panfish: 30,000 anglers fished 339,000 days; black bass: 105,000 anglers fished 1.264 million days; northern pike and pickerel: 33,000 anglers fish 268,000 days) (U.S. Department of Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau 2008). The level of angler participation in black bass fishing represented 53% of New Hampshire's freshwater anglers and 46% of the total days of fishing. Since the average trip expenditure for anglers fishing in New Hampshire is $30 per day, the total estimated expenditures by anglers fishing for warmwater species equals approximately $56.13 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. Standardized assessment protocols developed and utilized in surveys conducted in 1997 (Sprankle 1998) were modified in 1998 (Sprankle 1999) to improve indices of relative abundance.

Statewide warmwater surveys were conducted in 2012 with all data analyses and summaries contained in this report. This report includes a summary of three assessments conducted in Region 2 and two assessments conducted in Region 4: Crystal Lake (Enfield), Lees Pond (Moultonborough), Mountain Brook Reservoir (Jaffrey), Rockwood Pond (Fitzwilliam), and Spectacle Pond (Enfield) (Table 2).

Objectives of warmwater assessments in all water bodies were to determine: 1) black bass condition; 2) fish size and population structure; 3) relative abundance (black bass and community species); 4) young-of-year black bass size; 5) black bass age and growth; and 6) compare measured population parameters to statewide values and among populations. Lees Pond and Rockwood Pond were sampled at the request of the water

bodies' respective Lake Association. Mountain Brook Reservoir was sampled due to an unintended drawdown in 2012 due to dam repairs.

METHODS

Fish were collected by boat electrofishing (Smith-Root SR18) 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. The study design incorporated timed runs of 500 or 1000 seconds (using the equipment's "on" meter time) when sampling for target species (black bass or other pre-determined species), and community runs of 500 seconds when sampling for non-target species. Past studies showed 500 second community runs were adequate to ascertain species relative abundance in New Hampshire waters (Dexter 2008; Racine and Gries 2008). Black bass were captured during both target and community runs. Typically, five runs were conducted during an evening, two of which were community runs. Timed runs permitted a measure of statistical precision (standard deviation) to be estimated for relative abundance indices, expressed in mean fish per hour (fish/hr) that were further partitioned into discrete length categories for black bass (see below).

All fish were placed in a live well upon capture. Fish were measured to the nearest millimeter, total length (TL), and weighed to the nearest gram. For aging 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. 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 ratings of less than 3 (i.e. $\pm$ 1 year) were analyzed.

Proportional Stock Density (PSD) measures for bass were determined according to the length categories (based on total length) described in Gablehouse (1984) for smallmouth: stock 180-279 mm; quality 280-349 mm; preferred 350-429 mm; memorable 430-509 mm; and trophy > 510 mm. Largemouth Bass were similarly grouped: stock 200-299 mm; quality 300-379 mm; preferred 380-509 mm; memorable 510-629 mm; and trophy > 630 mm. Relative abundance (fish/hr) measures incorporated a < stock category, which was any bass less than stock size (juveniles and young-of-the-year (YOY)).

$$PSD = \frac{number\ \ of\ \ fish \geq quality}{number\ \ of\ \ fish \geq stock} \bullet 100$$

Confidence intervals were calculated for PSD estimates at the 80% and 95% confidence level using formulas based on Gustafson (1988). A PSD value ranging from 40 to 60 indicates a balanced fish population; a balanced fish population is defined as one that is intermediate between the extremes of a large number of small fish and a small number of large fish and indicates that rates of recruitment, growth and mortality rates may be satisfactory (Anderson and Weithman 1978). Values < 40 indicate an extreme number of

small fish when compared to the number of large fish. Values > 60 indicate an extreme number of large fish when compared to the number of small fish.

Relative weight (W_r) values were derived as a measure of condition of individual fish. Relative weight values were calculated for black bass > 150 mm (TL). This index compares the actual weight of an individual (W) with a standard weight (W_s) for a fish of the same length:

$$W_r = W/W_s \cdot 100$$

The standard weight equation used for smallmouth was $\log_{10} W_s$ (g) = - 5.329 + 3.20 x $\log_{10}$ TL (mm), proposed by Kolander et al. (1993). The equation used for largemouth was $\log_{10} W_s$ (g) = -5.316 + 3.191 x $\log_{10}$ TL (mm), proposed by Wege and Anderson (1978). Relative weight values > 90 may be considered good, with values > 100 considered excellent.

Although black bass YOY data are presented, there are inherent biases associated with using this data due to the small size (generally < 70 mm, TL) of these fish during the summer sampling period. Although, the sampling crew attempts to capture YOY black bass, they can be difficult to capture and differentiate from other YOY fish. Therefore, it must be assumed that black bass YOY relative abundance data are conservative and not an accurate representation of the YOY population.

All reported mean values include estimated standard deviations, unless otherwise noted. Linear regression was used to examine the relationship of fish total length to relative weight. The level of significance for all statistical analyses was 0.10.

Data collected in Mountain Brook Reservoir and Rockwood Pond were compared to data collected in previous years (2004 and 1999, respectively; ageing data were not collected during the 1999 Rockwood Pond sample). A t-test or Mann-Whitney Rank Sum test was used to compare relative abundance (fish captured/hour) and TL of Largemouth Bass between years for each water body. Relative weight by size category, the relationship between relative weight and TL, PSD, and age and growth of Largemouth Bass were also examined. A square root transformation was applied to relative abundance data prior to analysis (Zar 1984). Relative abundance of non-bass species was examined between years for each water body.

RESULTS

Crystal Lake (Enfield)

Crystal Lake was surveyed on August 22. Three 1000-second target species runs and two 500-second community species runs were conducted (Table 2). A total of 40 Largemouth Bass and 31 Smallmouth Bass were sampled (Figure 1 and 2). The PSD for Largemouth Bass was 25 (lower and upper 80% CI's: 3, 68; Table 3a) compared to the statewide

mean of 65 (Racine 2006b). The PSD for Smallmouth Bass was 7 (lower and upper 80% CI's: 1, 25; Table 3b) compared to the statewide mean of 43 (Racine 2006b).

Mean relative weight values for Largemouth Bass and Smallmouth Bass were calculated by length category (Table 4a and 4b). Mean relative weight values for Largemouth Bass were lower for stock and preferred size fish when compared to statewide mean values (Racine 2006b). Mean relative weight values for Smallmouth Bass were slightly lower for stock size fish when compared to statewide mean values (Racine 2006b). The relationship between Largemouth Bass total length and relative weight was not significant, but the sample size was low (n = 9; P = 0.71; R^2 = 0.02; Figure 1). The relationship between Smallmouth Bass total length and relative weight was not significant, but the sample size was low for fish larger than 247 mm TL (n = 1; P = 0.29; R^2 = 0.08; Figure 2).

Largemouth and Smallmouth Bass growth was not compared or categorized due to a low sample size of fish greater than quality size (300 mm TL for largemouth and 280 mm TL for smallmouth).

Mean relative abundance estimates (fish/hr) for Largemouth Bass and Smallmouth Bass were calculated for all fish and by length category (Table 6a and 6b). Mean relative abundance estimates for Largemouth Bass were lower for all bass lengths combined and for each length category except for < stock size fish when compared to statewide mean values (Racine 2006b). Mean relative abundance estimates for Smallmouth Bass were higher for all bass lengths combined and for each length category except for < stock, quality, and preferred size fish when compared to statewide mean values (Racine 2006b). Community samples produced in decreasing order of relative abundance: Yellow Perch (*Perca flavescens*), Pumpkinseed (*Lepomis gibbosus*), Rock Bass (*Ambloplites rupestris*), Chain Pickerel (*Esox niger)*, Brown Bullhead (*Ameiurus nebulosus*), and Black Crappie (*Pomoxis nigromaculatus*) (Table 7). Sample size and mean total length of YOY bass are shown in Table 8.

Lees Pond (Moultonborough)

Lees Pond was surveyed on August 8. Two 1000-second target species runs and two 500-second community species runs were conducted (Table 2). A total of 137 Largemouth Bass and 32 Smallmouth Bass were sampled (Figure 3 and 4). The PSD for Largemouth Bass was 77 (lower and upper 80% CI's: 63, 87; Table 3a) compared to the statewide mean of 65 (Racine 2006b). The PSD for Smallmouth Bass was 28 (lower and upper 80% CI's: 14, 46; Table 3b) compared to the statewide mean of 43 (Racine 2006b). Mean relative weight values for Largemouth Bass and Smallmouth Bass were calculated by length category (Table 4a and 4b).

Mean relative weight values for Largemouth Bass were higher for quality size fish and lower for stock and preferred size fish when compared to statewide mean values (Racine 2006b). Mean relative weight values for Smallmouth Bass were lower for stock, quality,

and preferred size fish when compared to statewide mean values, but sample sizes were low (Racine 2006b). The relationship between Largemouth Bass total length and relative weight was significant with a negative trend, but the variation was poorly explained ($P = 0.001$; $R^2 = 0.27$; Figure 3). The relationship between Smallmouth Bass total length and relative weight was significant with a negative trend ($P = 0.002$; $R^2 = 0.47$; Figure 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. Smallmouth Bass growth was not compared or categorized due to a low sample size of fish greater than quality size (280 mm TL). Largemouth Bass growth was categorized as average when compared to New Hampshire water bodies sampled during 1997-2005. Average length at age was below statewide values (1997-2005) for Largemouth Bass age 1 and above statewide values for bass age 2-5. Largemouth Bass took an average of 3.44 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2005) (Racine 2006a).

Mean relative abundance estimates (fish/hr) for Largemouth Bass and Smallmouth Bass were calculated for all fish and by length category (Table 6a and 6b). Mean relative abundance estimates for Largemouth Bass were higher for all bass lengths combined and for each length category except for stock and memorable size fish when compared to statewide mean values (Racine 2006b). Mean relative abundance estimates for Smallmouth Bass were higher for all bass lengths combined and for each length category except for < stock and memorable size fish when compared to statewide mean values (Racine 2006b). Community samples produced in decreasing order of relative abundance: Bluegill (*Lepomis macrochirus*), Redbreast Sunfish (*Lepomis auritus*), Pumpkinseed, Yellow Perch, Golden Shiner (*Notemigonus crysoleucas*) and Chain Pickerel (tied), and Common White Sucker (*Catostomus commersoni*) and Black Crappie (tied) (Table 7). Sample size and mean total length of YOY bass are shown in Table 8.

Mountain Brook Reservoir (Jaffrey)

Mountain Brook Reservoir was surveyed on August 23. Three target species runs (1000, 1000, and 900 seconds, respectively) and two 500-second community species runs were conducted (Table 2). A total of 50 Largemouth Bass were sampled (Figure 6). The PSD for Largemouth Bass was 100 (lower and upper 80% CI's: 100, 100; Table 3a) compared to the statewide mean of 65 (Racine 2006b).

Mean relative weight values for Largemouth Bass were calculated by length category (Table 4a and 4b). Mean relative weight values for Largemouth Bass were lower for preferred size fish and higher for quality size fish when compared to statewide mean values (Racine 2006b). The relationship between Largemouth Bass total length and relative weight was not significant, but the sample size was low ($n = 9$; $P = 0.60$; $R^2 = 0.04$; Figure 6).

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 7. Largemouth Bass growth was categorized as fast when compared to New Hampshire water bodies sampled during 1997-2005, but sample size was low. Average length at age was above statewide values (1997-2005) for Largemouth Bass age 1-6. Largemouth Bass took an average of 2.91 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2005) (Racine 2006a).

Mean relative abundance estimates (fish/hr) for Largemouth Bass were calculated for all fish and by length category (Table 6a). Mean relative abundance estimates for Largemouth Bass were higher for all bass lengths combined and for each length category, except for stock, quality, and memorable size fish, when compared to statewide mean values (Racine 2006b). Community samples produced in decreasing order of relative abundance: Bluegill, Chain Pickerel, Golden Shiner, Pumpkinseed, Black Crappie, and Yellow Perch (Table 7). Sample size and mean total length of YOY bass are shown in Table 8.

Rockwood Pond (Fitzwilliam)

Rockwood Pond was surveyed on August 1. Three 500-second target species runs and two 500-second community species runs were conducted (Table 2). A total of 44 Largemouth Bass were sampled (Figure 8). The PSD for Largemouth Bass was 54 (lower and upper 80% CI's: 39, 69; Table 3a) compared to the statewide mean of 65 (Racine 2006b).

Mean relative weight values for Largemouth Bass were calculated by length category (Table 4a). Mean relative weight values for Largemouth Bass were higher for stock size fish and lower for quality and preferred size fish when compared to statewide mean values (Racine 2006b). The relationship between Largemouth Bass total length and relative weight was significant with a negative trend, but the variation was poorly explained ($P = 0.0005$; $R^2 = 0.39$; Figure 8).

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 9. Largemouth Bass growth was categorized as fast when compared to New Hampshire water bodies sampled during 1997-2005. Average length at age was above statewide values (1997-2005) for Largemouth Bass age 1-6. Largemouth Bass took an average of 3.23 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2005) (Racine 2006a).

Mean relative abundance estimates (fish/hr) for Largemouth Bass were calculated for all fish and by length category (Table 6a). Mean relative abundance estimates for Largemouth Bass were higher for all bass lengths combined and for each length category except for quality and memorable size fish when compared to statewide mean values (Racine 2006b). Community samples produced in decreasing order of relative abundance: Yellow Perch, Pumpkinseed, Common White Sucker, and Black Crappie (Table 7). Sample size and mean total length of YOY bass are shown in Table 8.

Spectacle Pond (Enfield)

Spectacle Pond was surveyed on August 6. Two 500-second target species runs and two 500-second community species runs were conducted (Table 2). A total of 33 Smallmouth Bass were sampled (Figure 10). The PSD for Smallmouth Bass was 0 (lower and upper 80% CI's: 0, 0; Table 3b) compared to the statewide mean of 43 (Racine 2006b).

Mean relative weight values for Smallmouth Bass were not calculated as no fish greater than or equal to stock size ($\geq$ 180 mm TL) were sampled. The relationship between Smallmouth Bass total length and relative weight was not examined as no fish greater than 150 mm TL were sampled.

Smallmouth Bass growth was not compared or categorized as no fish greater than quality size (280 mm TL) were sampled.

Mean relative abundance estimates (fish/hr) for Smallmouth Bass were calculated for all fish and by length category (Table 6b). Mean relative abundance estimates for Smallmouth Bass were higher for all bass lengths combined and for < stock size fish, and lower for stock, quality, preferred, and memorable size fish when compared to statewide mean values (Racine 2006b). Community samples produced in decreasing order of relative abundance: Yellow Perch, Redbreast Sunfish, Golden Shiner, Chain Pickerel, and Brown Bullhead (Table 7). Sample size and mean total length of YOY bass are shown in Table 8.

Lake Comparisons Between Years:

Mountain Brook Reservoir (Jaffrey)

Mountain Brook Reservoir was surveyed in 2012 (see above) and on June 29, 2004. Three target species runs (1000, 1000, and 811 seconds, respectively) and two community species runs (1035 and 1000 seconds, respectively) were conducted in 2004. A total of 43 Largemouth Bass were sampled in 2004. The PSD for Largemouth Bass was 50 (lower and upper 80% CI's: 36, 64) in 2004 compared to 100 (lower and upper 80% CI's: 100, 100) in 2012 (Table 9).

Mean relative weight values for Largemouth Bass were calculated by length category for 2012 and 2004 (Table 10). When compared to 2004, mean relative weight values for Largemouth Bass were lower in 2012 for preferred size fish and higher for quality size fish, but only one fish of quality size was captured in 2012 (Table 10). The relationship between Largemouth Bass total length and relative weight was not significant in 2012 (small sample size; $n = 9$; $P = 0.60$; $R^2 = 0.04$; Figure 6) and was also not significant in 2004 ($P = 0.87$; $R^2 = 0.001$; Figure 11).

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 2012 (Table 11 and Figure 7) and 2004 (Table 11 and Figure 12). Largemouth Bass growth was categorized as fast in both 2012 and 2004 when compared to New Hampshire water bodies sampled during 1997-2005. Average length at age was higher in 2012 than in 2004 for Largemouth Bass age 1-4 and slightly lower for age 5. Sample size of Largemouth Bass aged in 2012 was small (n = 6). Largemouth Bass took an average of 2.91 years to reach quality size (300 mm) in 2012 compared to 3.24 years in 2004.

Mean relative abundance estimates (fish/hr) for Largemouth Bass were calculated for all fish and by length category (Table 12). Mean relative abundance estimates for Largemouth Bass in 2012 were higher than 2004 for all bass lengths combined, < stock, and preferred size fish and lower than 2004 for stock, quality, and memorable size fish. Relative abundance estimates for preferred size Largemouth Bass were significantly higher in 2012 than in 2004 (P = 0.03). Relative abundance estimates for stock size Largemouth Bass were signifcanlty lower in 2012 than in 2004 (P = 0.01).

Largemouth Bass TL was significantly greater in 2004 than in 2012 (P = 0.06).

Community samples from 2004 and 2012 were examined relative to fish presence/absence and relative abundance (Table 13). Black Crappie was captured in 2012, but not 2004. Brown Bullhead and Common White Sucker were captured in 2004, but not in 2012. Relative abundance of Bluegill was similar between years. Chain Pickerel, Golden Shiner and Pumpkinseed were more abundant in 2012 than in 2004. Yellow Perch were more abundant in 2004 than in 2012.

Rockwood Pond (Fitzwilliam)

Rockwood Pond was surveyed in 2012 (see above) and on June 30, 1999. Four target species runs (1100, 1027, 1020, and 1000 seconds, respectively) and two 500-second community species runs were conducted in 1999. A total of 81 Largemouth Bass were sampled in 1999. The PSD for Largemouth Bass was 16 (lower and upper 80% CI's: 9, 25) in 1999 compared to 54 (lower and upper 80% CI's: 39, 69) in 2012 (Table 9).

Mean relative weight values for Largemouth Bass were calculated by length category for 2012 and 1999 (Table 10). Mean relative weight values for Largemouth Bass were higher in 2012 for stock size fish and lower for preferred size fish, when compared to 1999 (Table 10). The relationship between Largemouth Bass total length and relative weight was significant with a negative trend in 2012 (P = 0.0005; R^2 = 0.39; Figure 8) and was not significant in 1999 (P = 0.45; R^2 = 0.01; Figure 13).

Mean relative abundance estimates (fish/hr) for Largemouth Bass were calculated for all fish and by length category (Table 12). Mean relative abundance estimates for Largemouth Bass in 2012 were higher than 1999 for all bass lengths combined, < stock,

quality, and preferred size fish, and lower than 1999 for stock size fish. Relative abundance estimates for all bass lengths combined, quality, and preferred size Largemouth Bass were significantly higher in 2012 than in 1999 ($P = 0.049$, $P= 0.0004$), and $P < 0.001$, respectively).

Largemouth Bass TL was not significantly different between 1999 and 2012 ($P = 0.20$).

Community samples from 1999 and 2012 were examined relative to fish presence/absence and relative abundance (Table 13). Black Crappie and Common White Sucker were captured in 2012, but not 1999. Pumpkinseed was twice as abundant in 2012 when compared to 1999 and Yellow Perch was five times more abundant in 2012 than in 1999.

DISCUSSION

A number of the water bodies sampled to date appear to lack cover preferred by Largemouth Bass in water 1 – 3 meters deep. Reports on cover preferences for Largemouth Bass typically cite 40 – 60% as an ideal range (Stuber and Gebhart, 1982). This range of cover has been observed occasionally at water bodies sampled to date, but the use of existing cover by largemouth when present is clear during sampling events. Future analyses of the quantity and quality of cover in relation to the population measures currently utilized should be conducted. This relationship has implications for herbicide treated waters where exotic and native vegetation removal efforts are increasing.

Lentic waters that have habitat features preferred by Smallmouth Bass are typically oligotrophic, have good water clarity, and poor conductivity. In addition to these issues, larger bass may be more heavily concentrated in deep-water habitats not possible to sample by electrofishing from the early summer through fall. This creates a difficult situation for representatively sampling and characterizing a Smallmouth Bass population by electrofishing. In these waters, the size of the field around the electrodes is often limited and bass are able to evade the field or leave the area ahead of the boat. However, YOY Smallmouth Bass appear to be effectively sampled in preferred shallow habitats in water bodies sampled to date. In contrast to the apparent habitat limitations Largemouth Bass may be faced with in waters sampled to date, Smallmouth Bass populations appear to have slightly more abundant and slightly better quality habitat types based upon habitat suitability information (Edwards and Gebhart, 1983).

A PSD value ranging from 40 to 60 indicates a structurally balanced population. Values < 40 indicate an extreme number of small fish when compared to the number of large fish. Values > 60 indicate an extreme number of large fish when compared to the number of small fish. Of the four Largemouth Bass populations for which PSD values were calculated, only Rockwood Pond had a value indicating a balanced population (Table 3a). Of the three Smallmouth Bass populations for which PSD values were calculated, none had a value indicating a balanced population (Table 3b).

Relative weight values > 90 may be considered good, with values > 100 considered excellent. Approximately 70% of size categories of Largemouth Bass sampled in 2012 had mean Wr values > 90 (Table 4a). Observed values are acceptable from a management standpoint, as no exceptional values were documented. A significant negative relationship between total length and relative weight values was observed in two of the four Largemouth Bass populations analyzed.

Approximately 50% of size categories of Smallmouth Bass sampled in 2012 had mean Wr values > 90 (Table 4b). Observed values are acceptable from a management standpoint, as no exceptional values were documented, but values should be interpreted with caution due to small sample sizes in some cases (Table 4b). A significant negative relationship between total length and relative weight values was observed in one of the two Smallmouth Bass populations analyzed.

Mean relative abundance values (fish/hr) for Largemouth Bass and Smallmouth Bass populations sampled in 2012 by length category were variable (Table 6a and 6b). This variability, as measured by coefficient of variation (CV) for Largemouth Bass within size categories, was greatest for quality size (CV = 124) and lowest for < stock size (CV = 60). The CV of mean relative abundance values for Smallmouth Bass within size categories was greatest for quality, preferred, and memorable size (CV = 173) and lowest for < stock size (CV = 90). The extreme variability of the quality, preferred, and memorable size for Smallmouth Bass was driven by the fact that fish of this size were only captured in one water body (Table 6b). Mean values (fish/hr) by length category may provide a means of categorizing populations by relative abundance. It is important to note again that sampled water bodies vary in the quantity and quality of bass habitat and these values should be interpreted cautiously. However, comparisons over time for a single population will provide important information on the inter-annual variability of this measure. The single greatest obstacle to the interpretation of these values within a population over time is unknown rates of harvest mortality, which is likely high in some cases and low in others.

A plot of mean relative abundance (fish/hr) by length category for all Largemouth Bass and Smallmouth Bass populations assessed in 2012 revealed a shift in abundance between bass < stock size and those $\underline{\geq}$ stock size (Figure 14). These shifts in abundance should hypothetically correspond with the smallest size Largemouth Bass considered harvestable by anglers and can act in essence as a surrogate catch curve. However, this assumption is likely not valid for smallmouth given the difficulties in characterizing a Smallmouth Bass population based on electrofishing (see above).

Relative abundance measures for community species in assessments conducted in 2012 were variable (Table 7). Yellow Perch had the highest overall mean relative abundance (665.3 fish/hr) and were captured in all water bodies sampled. The other most abundant species was Bluegill (mean = 110.9 fish/hr). Black Crappie, Pumpkinseed, and Chain Pickerel were captured in all water bodies sampled but one.

RECOMMENDATIONS

Required sampling effort needed to produce adequate sample sizes is essential to conduct a meaningful and valid assessment (Miranda, 1993). Analysis of data and its interpretation is dependent on a level of statistical confidence and precision. Statistical precision of the measures generated by the assessment and the ability to use standard analytical methods are driven by sample size. The use of timed runs permits an estimate of precision for some estimated parameters (i.e. relative abundance), but this approach produces highly variable measures, which precludes some statistical testing.

Due to obstacles (conductivity/water clarity/deepwater habitat use) faced when trying to assess a lentic smallmouth population, it is recommended that sampling efforts target the spawning stock of Smallmouth Bass in the spring, during pre-spawn movements. Due to concerns of inadequate sample sizes from electrofishing samples, fyke nets should be used as the primary sampling gear. A program targeting selected spawning areas (fixed stations) as an index should be developed and employed in important smallmouth fisheries such as Lake Winnipesaukee. This program should be used as a tool to monitor the size/age structure and condition (Wr) of populations over time.

Significant negative relationships between total length and relative weight values may indicate a lack of forage for larger fish. Relationship between relative weight values by size category and relative abundance values of forage fish should be examined in future years. Additionally, efforts should be made to transfer appropriate forage species to specific waters where black bass populations might benefit from increased prey resources.

The NHFGD should continue to assess warmwater bass populations throughout the state and annually update the statewide black bass database. This database will allow biologists to target specific water bodies for more detailed assessments and to make well-informed management recommendations that will preserve and improve the quality of bass populations state-wide. Additionally, a survey of habitat features of assessed water bodies should be conducted to evaluate potential habitat improvements for warmwater species. Attempts should also be made to more closely examine population parameters of non-black bass species of warmwater fish. Accordingly, data analyses similar to those found in Racine (2006a and 2006b) should be performed for these species.

Lees Pond (Moultonborough)

Lees Pond was sampled in part, due to a request from the local lake association. Prior data were not available to compare to data collected in 2012. In general, the warm water fish populations in Lees Pond appear to be abundant and diverse when compared to other waters in the state and are indicative of a system with adequate cover/habitat (i.e. aquatic vegetation, depth, wood, rocks) and food resources. It should be noted that this assessment is based on only one year of data and that environmental conditions (for

example, a cold spring which results in poor spawning success) and/or changes in fish habitat (quality and quantity) could lead to changes in the current fish populations.

Mountain Brook Reservoir (Jaffrey):

Mountain Brook Reservoir was sampled due to an unintended drawdown in 2012 because of dam repairs. Data from 2012 was compared to data collected in 2004. In general, factors examined for Largemouth Bass sampled in both years were similar. However, bass from 115 to 310 mm TL were notably absent in the 2012 sample (Figure 6). It is unclear if the absence of these size bass was a result of the drawdown. Accordingly, mean relative abundance estimates were lower in 2012 than in 2004 for stock and quality size fish, but differences were not significant. Relative abundance of YOY fish was much higher in 2012 than 2004. This is likely due to fact that YOY bass were larger in 2012 and thus easier for netters to see and capture; the 2012 sample was conducted on August 23 and the 2004 sample was conducted on June 29. In general, community samples indicated no significant change, although Chain Pickerel, Golden Shiner, and Pumpkinseed were more abundance in 2012 than in 2004 and Yellow Perch were more abundant in 2004. It is likely that any changes in the fish community as a result of the drawdown were minimal with the potential exception of the lack of Largemouth Bass from 115 to 310 mm TL in the 2012 sample.

Rockwood Pond (Fitzwilliam):

Rockwood Pond (Fitzwilliam) was sampled due to a request from the water bodies' Lake Association. Data from 2012 were compared to data collected in 1999. In general, the warmwater fish populations in 2012 appeared robust, more abundant, and in better condition than in 1999. Additionally, the PSD value for 2012 (54) indicates a balanced Largemouth Bass population and is an improvement over the PSD value from 1999 (16).

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Table 1. Number of bass fishing tournament permits issued by the NHFGD (1992 - 2012).

Year	Number of Permits Issued
1992	303
1993	352
1994	404
1995	389
1996	475
1997	459
1998	426
1999	421
2000	476
2001	487
2002	468
2003	496
2004	493
2005	508
2006	502
2007	490
2008	465
2009	481
2010	518
2011	557
2012	513

Table 2. Summary of warmwater fish population assessments performed in 2012.

Sample Date	Water body	Region	Acreage	Town	County	Fishery	Sampling Method	Sample Type	Targeted Species[a]	Number of Runs	Run Times (seconds)
8/22/2012	Crystal Lake	2	401	Enfield	Grafton	Warmwater, Coldwater	Electrofish	Community		2	500
								Target	BLB	3	1000
8/8/2012	Lees Pond	2	154	Moultonborough	Carroll	Warmwater	Electrofish	Community		2	500
								Target	BLB	2	1000
8/23/2012	Mountain Brook Reservoir	4	234	Jaffrey	Hillsborough	Warmwater	Electrofish	Community		2	500
								Target	BLB	3	1000, 1000, 900
8/1/2012	Rockwood Pond	4	90	Fitzwilliam	Cheshire	Warmwater	Electrofish	Community		2	500
								Target	BLB	3	500
8/6/2012	Spectacle Pond	2	95	Enfield, Grafton	Grafton	Warmwater	Electrofish	Community		2	500
								Target	BLB	2	500

[a] BLB - black bass.

Table 3a. Proportional Stock Density (95% and 80% confidence intervals) of largemouth bass populations assessed in 2012 by electrofishing.

Water body	Sample Date	Lower CI		PSD	Upper CI		≥ Quality Size	≥ Stock Size
		95%	80%		80%	95%		
Crystal Lake	8/22/2012	1	3	25	68	81	1	4
Lees Pond	8/8/2012	56	63	77	87	91	20	26
Mountain Brook Reservoir	8/23/2012	100	100	100	100	100	10	10
Rockwood Pond	8/1/2012	33	39	54	69	74	13	24
Statewide average[a]	1997-2005	-	-	65	-	-	-	-

[a.] Reprinted from Racine (2006b).

Table 3b. Proportional Stock Density (95% and 80% confidence intervals) of smallmouth bass populations assessed in 2012 by electrofishing.

Water body	Sample Date	Lower CI		PSD	Upper CI		≥ Quality Size	≥ Stock Size
		95%	80%		80%	95%		
Crystal Lake	8/22/2012	0	1	7	25	34	1	14
Lees Pond	8/8/2012	10	14	28	46	53	5	18
Spectacle Pond	8/6/2012	0	0	0	0	0	0	0
Statewide average[a]	1997-2005	-	-	43	-	-	-	-

[a.] Reprinted from Racine (2006b).

Table 4a. Sample size, mean relative weight value and one standard deviation by length category for largemouth bass populations assessed in 2012 by electrofishing.

		Total Length Interval (mm)											
		Stock			Quality			Preferred			Memorable		
	Sample	200-299			300-379			380-509			510-629		
Water body	Date	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD
Crystal Lake	8/22/2012	3	96.9	16.2	-	-	-	1	86.0	-	-	-	-
Lees Pond	8/8/2012	6	95.8	5.3	15	94.3	8.2	5	86.2	7.2	-	-	-
Mountain Brook Reservoir	8/23/2012	-	-	-	1	98.2	-	8	93.2	8.4	-	-	-
Rockwood Pond	8/1/2012	11	100.0	6.1	5	92.0	7.6	8	84.6	8.9	-	-	-
Mean Wr			97.6			94.8			87.5			-	
Std Dev Wr			2.2			3.2			3.9			-	
Statewide average[a]	1997-2005	115[b]	99.1	12.4	118[b]	93.2	8.2	112[b]	93.4	8.5	40[b]	97.3	12.4

a. Reprinted from Racine (2006b).

b. *n* represents the number of waterbodies.

Table 4b. Sample size, mean relative weight value and one standard deviation by length category for smallmouth bass populations assessed in 2012 by electrofishing.

		Total Length Interval (mm)											
		Stock			Quality			Preferred			Memorable		
	Sample	180-279			280-349			350-429			430-509		
Water body	Date	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD
Crystal Lake	8/22/2012	13	96.1	5.4	-	-	-	-	-	-	1	93.2	-
Lees Pond	8/8/2012	12	92.9	2.7	3	88.7	2.0	2	81.3	12.0	-	-	-
Spectacle Pond	8/6/2012	-	-	-	-	-	-	-	-	-	-	-	-
Mean Wr			94.5			88.7			81.3			93.2	
Std Dev Wr			2.2			-			-			-	
Statewide average[a]	1997-2005	48[b]	96.2	8.6	41[b]	90.1	9.2	34[b]	86.9	7.7	14[b]	86.9	8.6

a. Reprinted from Racine (2006b).

b. *n* represents the number of waterbodies.

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^{2c}	Age at quality size 300 mm	Growth Categorization
						1	2	3	4	5	6	≥1	5-6			
Lees Pond	Moultonborough	2012	LMB	5	5	74	188	284	330	366		38	3	0.99	3.44	Average
Mt Brook Res	Jaffrey	2012	LMB	6	6	102	238	308	366	391	426	6	2	0.99	2.91	Fast
Rockwood Pond	Fitzwilliam	2012	LMB	6	6	84	200	275	340	390	425	25	4	0.99	3.23	Fast
Statewide average[b]		1997-2005	LMB			83	185	265	320	357	387				3.74	

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

b. Reprinted from Racine (2006a).

c. Correlation coefficient for logarithmic trendline.

Table 6a. Sample size, mean relative abundance estimate (fish/hour) and one standard deviation by length category for largemouth bass captured by electrofishing in 2012. *n* = number of electrofishing runs.

		Total Length Interval (mm)																		
			All Lengths			< Stock (YOY & Juvenile)			Stock 200-299			Quality 300-379			Preferred 380-509			Memorable 510-629		
Waterbody	Sample Date	*n*	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD
Crystal Lake	8/22/2012	5	40	38.16	29.86	28	28.08	27.227	3	3.6	6.2354	0	0	0	1	0.72	1.61	0	0	0
Lees Pond	8/8/2012	4	137	157.5	114.31	81	90.9	86.967	6	6.3	4.5299	15	20.7	11.895	5	7.2	5.8788	0	0	0
Reservoir	8/23/2012	5	50	58.16	57.838	40	48.64	58.773	0	0	0	2	2.16	3.2199	8	7.36	2.5706	0	0	0
Rockwood Pond	8/1/2012	5	44	63.36	23.552	20	28.8	26.454	11	15.84	7.8872	5	7.2	5.0912	8	11.52	3.9436	0	0	0
Mean f/h				79.3			49.1			6.4			7.5			6.7			0.0	
CV for f/h				67			60			105			124			67			-	
Statewide average[a]	1997-2005		126[b]	49.6	50.8	126[b]	23.2	36.1	126[b]	10.5	16.6	126[b]	10.5	14.4	126[b]	4.7	5.2	126[b]	0.5	1.3

[a] Reprinted from Racine (2006b).

[b] Represents the number of waterbodies.

Table 6b. Sample size, mean relative abundance estimate (fish/hour) and one standard deviation by length category for smallmouth bass captured by electrofishing in 2012. *n* = number of electrofishing runs.

		Total Length Interval (mm)																		
			All Lengths			< Stock (YOY & Juvenile)			Stock 180-279			Quality 280-349			Preferred 350-429			Memorable 430-509		
Water body	Sample Date	*n*	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD
Crystal Lake	8/22/2012	5	31	28.1	12.8	11	13.0	13.8	13	10.1	6.9	0	0.0	0.0	0	0.0	0.0	1	0.7	1.6
Lees Pond	8/8/2012	4	32	41.4	28.4	13	15.3	13.3	13	17.1	12.9	3	4.5	6.8	2	2.7	3.4	0	0.0	0.0
Spectacle Pond	8/6/2012	4	33	59.4	54.6	33	59.4	54.6	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Mean f/h				43.0			29.2			9.1			1.5			0.9			0.2	
CV for f/h				37			90			95			173			173			173	
Statewide average[a]	1997-2005		61[b]	26.3	32.8	61[b]	19.0	27.1	61[b]	5.1	6.7	61[b]	1.5	2.4	61[b]	0.9	1.4	61[b]	0.2	0.5

[a] Reprinted from Racine (2006b).

[b] *n* represents the number of waterbodies.

Table 7a. Mean relative abundance estimate (fish/hour) and one standard deviation for non-target species captured during community electrofishing runs in 2012. *n* = number of runs.

Water body	Sample Date	*n*	Black Crappie	Bluegill	Brown Bullhead	Pumpkinseed	Common White Sucker
Crystal Lake	8/22/2012	2	3.6 ± 5.1	-	10.8 ± 15.3	50.4 ± 10.2	-
Lees Pond	8/8/2012	2	3.6 ± 5.1	381.6 ± 112.0	-	61.2 ± 56.0	3.6 ± 5.1
Mountain Brook Reservoir	8/23/2012	2	43.2 ± 30.5	172.8 ± 91.6	-	61.2 ± 45.8	-
Rockwood Pond	8/1/2012	2	7.2 ± 0.0	-	-	122.4 ± 10.2	14.4 ± 10.2
Spectacle Pond	8/6/2012	2	-	-	7.2 ± 0.0	-	-
Mean f/hr			11.5	110.9	3.6	59.0	3.6
Stdev of f/hr			17.9	168.8	5.1	43.5	6.2

Table 7b. Mean relative abundance estimate (fish/hour) and one standard deviation for non-target species captured during community electrofishing runs in 2012. *n* = number of runs.

Water body	Sample Date	*n*	Chain Pickerel	Golden Shiner	Redbreast Sunfish	Rock Bass	Yellow Perch
Crystal Lake	8/22/2012	2	14.4 ± 0.0	-	-	28.8 ± 30.5	504.0 ± 20.4
Lees Pond	8/8/2012	2	14.4 ± 10.2	14.4 ± 0.0	68.4 ± 25.5	-	36.0 ± 30.5
Mountain Brook Reservoir	8/23/2012	2	86.4 ± 30.5	68.4 ± 5.1	-	-	14.4 ± 10.2
Rockwood Pond	8/1/2012	2	-	-	-	-	1818.0 ± 96.7
Spectacle Pond	8/6/2012	2	14.4 ± 0.0	54.0 ± 35.6	104.4 ± 96.7	-	954.0 ± 351.3
Mean f/hr			25.9	27.4	34.6	5.8	665.3
Stdev of f/hr			34.4	31.9	49.0	12.9	751.3

Table 8. Sample size, mean total length and one standard deviation of YOY black bass captured by electrofishing during 2012.

		Largemouth			Smallmouth		
Water body	Date	*n*	Mean total length	SD	*n*	Mean total length	SD
Crystal Lake*	8/22/2012	20	65	9	8	73	7
Lees Pond**	8/8/2012	59	68	15	2	61	4
Mountain Brook Reservoir	8/23/2012	40	77	14	-	-	-
Rockwood Pond	8/1/2012	15	55	14	-	-	-
Spectacle Pond	8/6/2012	-	-	-	17	57	6
Mean			66			64	
Stdev			9			8	

* Total of 28 largemouth and 14 smallmouth sampled
** Total of 89 largemouth and 3 smallmouth sampled

Table 9. Proportional Stock Density (95% and 80% confidence intervals) of largemouth bass populations in Mountain Brook Reservoir and Rockwood Pond by year.

Water body	Sample Date	Lower CI 95%	Lower CI 80%	PSD	Upper CI 80%	Upper CI 95%	≥ Quality Size	≥ Stock Size
Mountain Brook Reservoir	6/29/2004	30	36	50	64	70	13	26
Mountain Brook Reservoir	8/23/2012	100	100	100	100	100	10	10
Rockwood Pond	6/30/1999	7	9	16	25	30	7	44
Rockwood Pond	8/1/2012	33	39	54	69	74	13	24

Table 10. Sample size, mean relative weight value and one standard deviation by length category for largemouth bass populations captured by electrofishing in Mountain Brook Reservoir and Rockwood Pond by year.

		Total Length Interval (mm)											
		Stock 200-299			Quality 300-379			Preferred 380-509			Memorable 510-629		
Water body	Sample Date	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD
Mountain Brook Reservoir	6/29/2004	13	98.1	6.8	7	90.6	5.8	5	97.1	9.8	1	102.4	-
Mountain Brook Reservoir	8/23/2012	-	-	-	1	98.2	-	8	93.2	8.4	-	-	-
Rockwood Pond	6/30/1999	37	96.5	7.1	-	-	-	7	97.6	7.3	-	-	-
Rockwood Pond	8/1/2012	11	100.0	6.1	5	92.0	7.6	8	84.6	8.9	-	-	-

Table 11. 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 in Mountain Brook Reservoir by year.

						Mean back-calculated length (mm) at age						Number of fish aged				
Water body	Town	Sample Year(s)	Species	Maximum Age < 6 with CR < 4[a]	Maximum age used for back-calculations	1	2	3	4	5	6	>1	5-6	R^{2b}	Age at quality size 300 mm	Growth Categorization
Mountain Brook Reservoir	Fitzwilliam	2004	LMB	5	5	79	195	269	348	393		27	1	0.99	3.24	Fast
Mountain Brook Reservoir	Fitzwilliam	2012	LMB	6	6	102	238	308	366	391	426	6	2	0.99	2.91	Fast

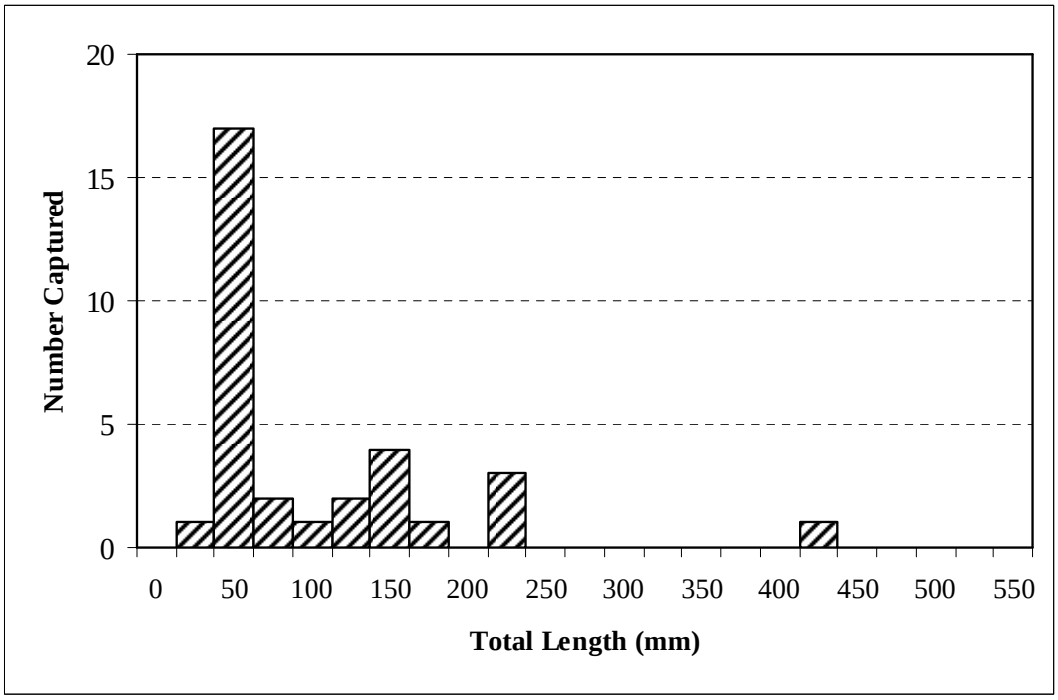
a. Oldest fish aged with a confidence rating of 1 to 3.
b. Correlation coefficient for logarithmic trendline.

Table 12. Sample size, mean relative abundance estimate (fish/hour) and one standard deviation by length category for largemouth bass captured by electrofishing in Mountain Brook Reservoir and Rockwood Pond by year. *n* = number of electrofishing runs.

		Total Length Interval (mm)																		
		All Lengths				< Stock (YOY & Juvenile)			Stock 200-299			Quality 300-379			Preferred 380-509			Memorable 510-629		
Waterbody	Sample Date	*n*	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD
Mountain Brook Reservoir	6/29/2004	5	43	31.6	24.2	17	12.3	23.2	13	9.5	6.6	7	5.4	3.6	5	3.6	3.5	1	0.7	1.6
Mountain Brook Reservoir	8/23/2012	5	50	58.2	57.8	40	48.6	58.8	0	0.0	0.0	2	2.2	3.2	8	7.4	2.6	0	0.0	0.0
Rockwood Pond	6/30/1999	6	81	54.6	26.7	37	28.6	18.5	37	22.1	22.0	1	0.6	1.4	6	3.4	4.2	0	0.0	0.0
Rockwood Pond	8/1/2012	5	44	63.4	23.6	20	28.8	26.5	11	15.8	7.9	5	7.2	5.1	8	11.5	3.9	0	0.0	0.0

Table 13. Mean relative abundance estimates (fish/hour) for non-target species captured during community electrofishing runs in Mountain Brook Reservoir and Rockwood Pond. *n* = number of electrofishing runs.

Waterbody	Sample Date	*n*	Black Crappie	Bluegill	Brown Bullhead	Common White Sucker	Chain Pickerel	Golden Shiner	Pumpkinseed	Yellow Perch
Mountain Brook Reservoir	6/29/2004	2	-	188.9±109.7	3.5±4.9	1.7±2.5	39.2±26.0	5.4±7.6	31.7±14.2	73.2±54.3
Mountain Brook Reservoir	8/23/2012	2	43.2 ± 30.5	172.8 ± 91.6	-	-	86.4 ± 30.5	68.4 ± 5.1	61.2 ± 45.8	14.4 ± 10.2
Rockwood Pond	6/30/1999	2	-	-	-	-	-	-	61±4	511±151
Rockwood Pond	8/1/2012	2	7.2 ± 0.0	-	-	14.4 ± 10.2	-	-	122.4 ± 10.2	1818.0 ± 96.7



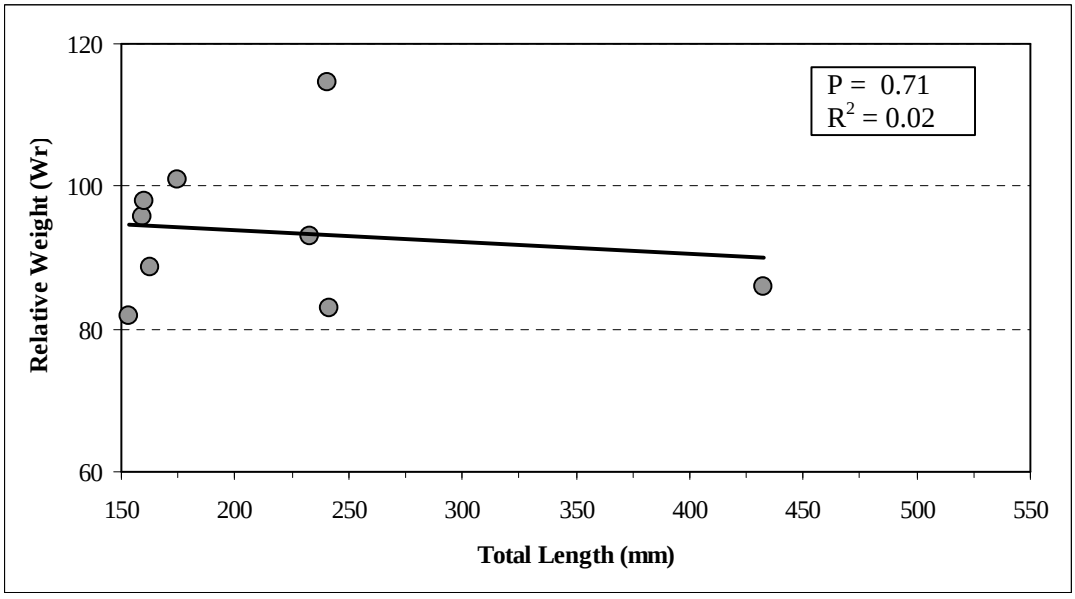
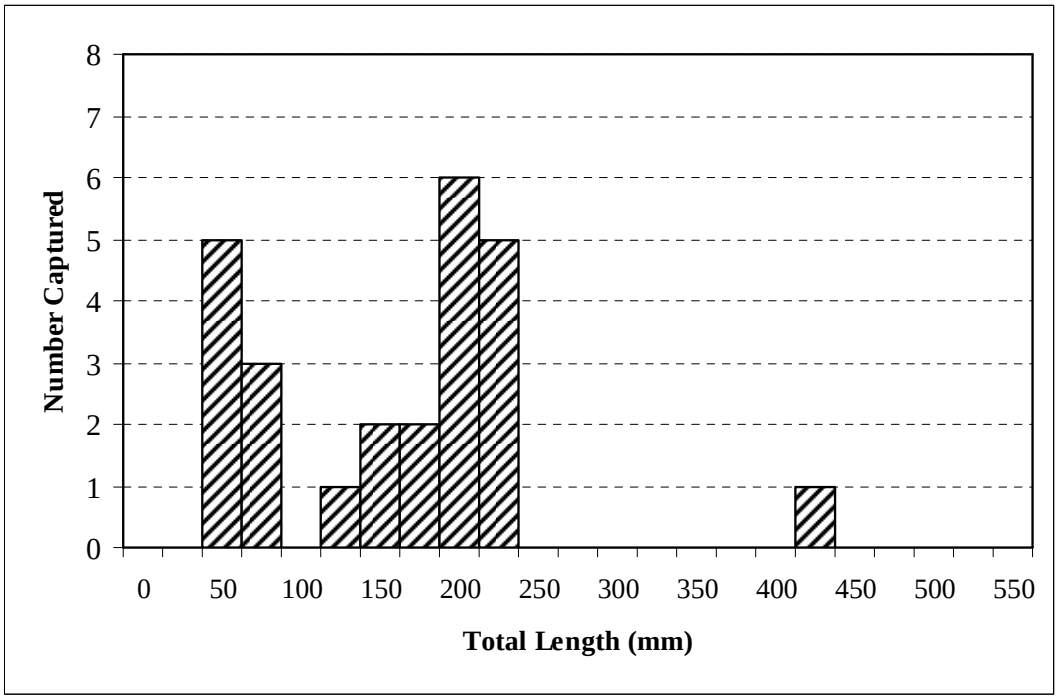


Figure 1. Length-frequency distribution (n = 32) and relationship of total length to relative weight (Wr; n = 9) for Largemouth Bass captured in Crystal Lake (Enfield) during 2012.



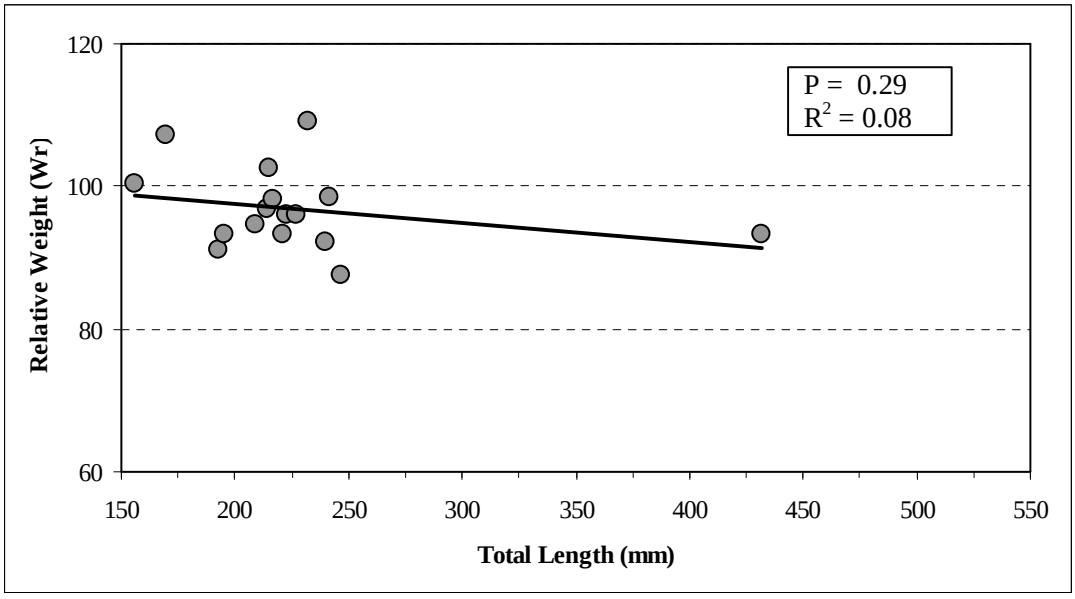
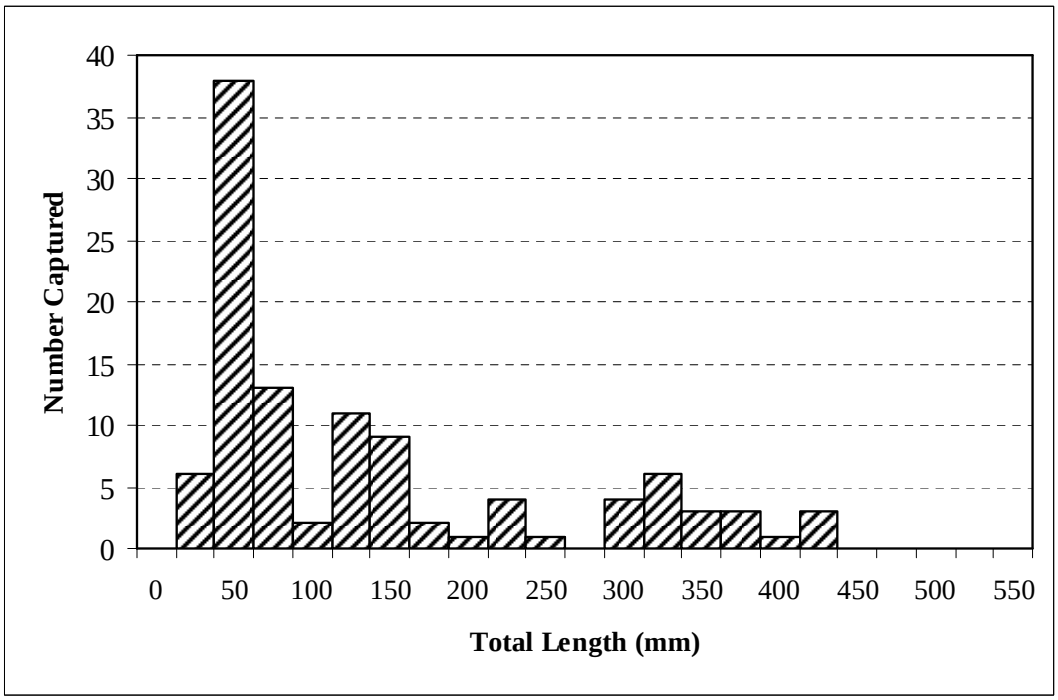


Figure 2. Length-frequency distribution (n = 25) and relationship of total length to relative weight (Wr; n = 16) for Smallmouth Bass captured in Crystal Lake (Enfield) during 2012.



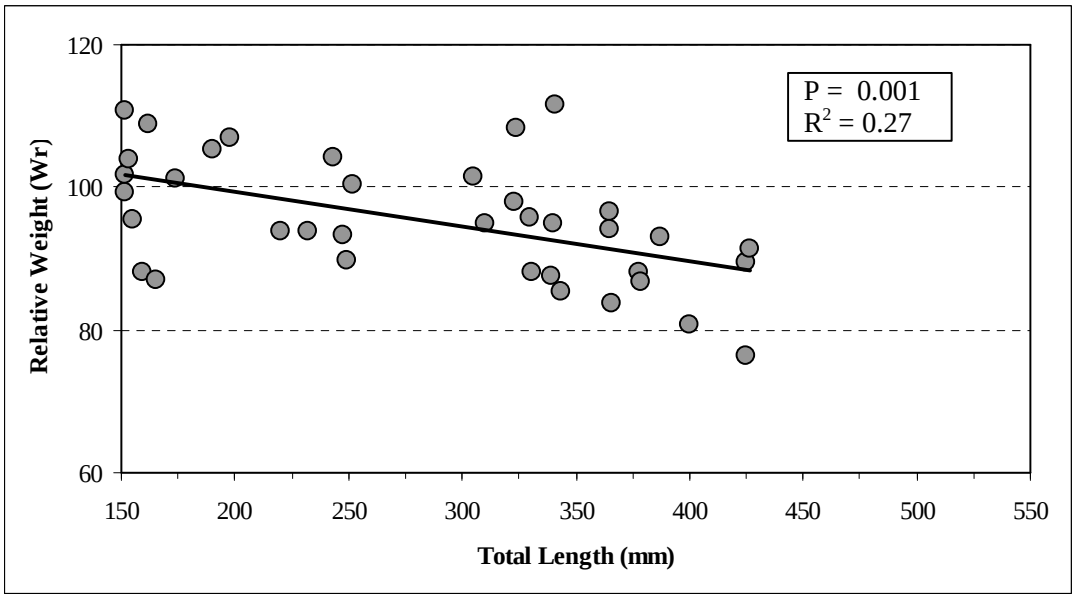
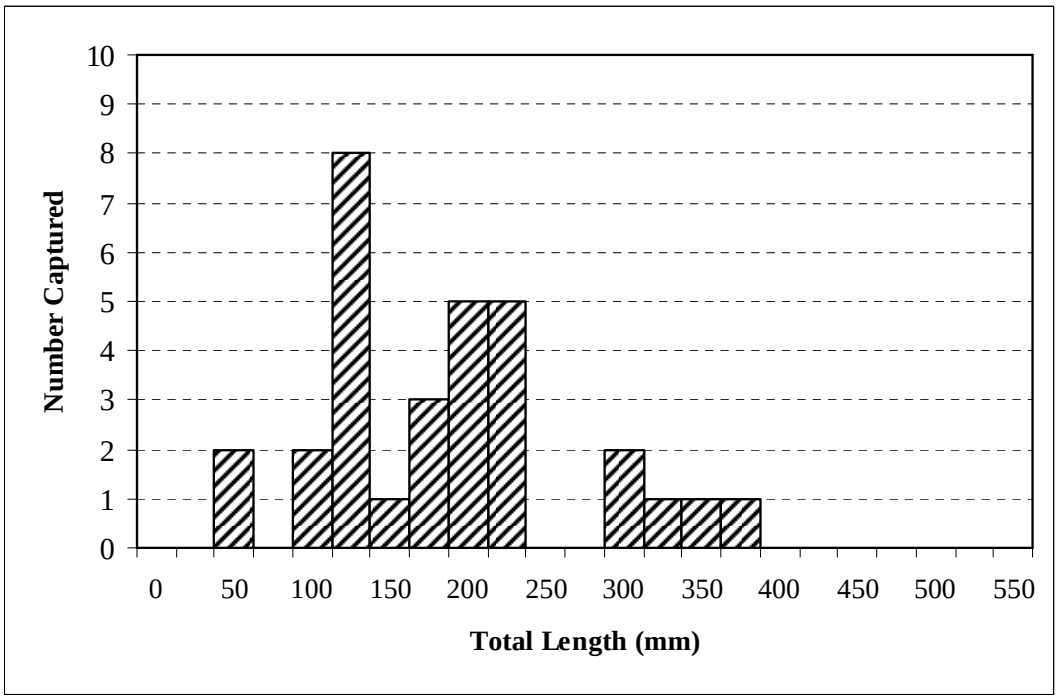


Figure 3. Length-frequency distribution (n = 107) and relationship of total length to relative weight (Wr; n = 37) for Largemouth Bass captured in Lees Pond (Moultonborough) during 2012.



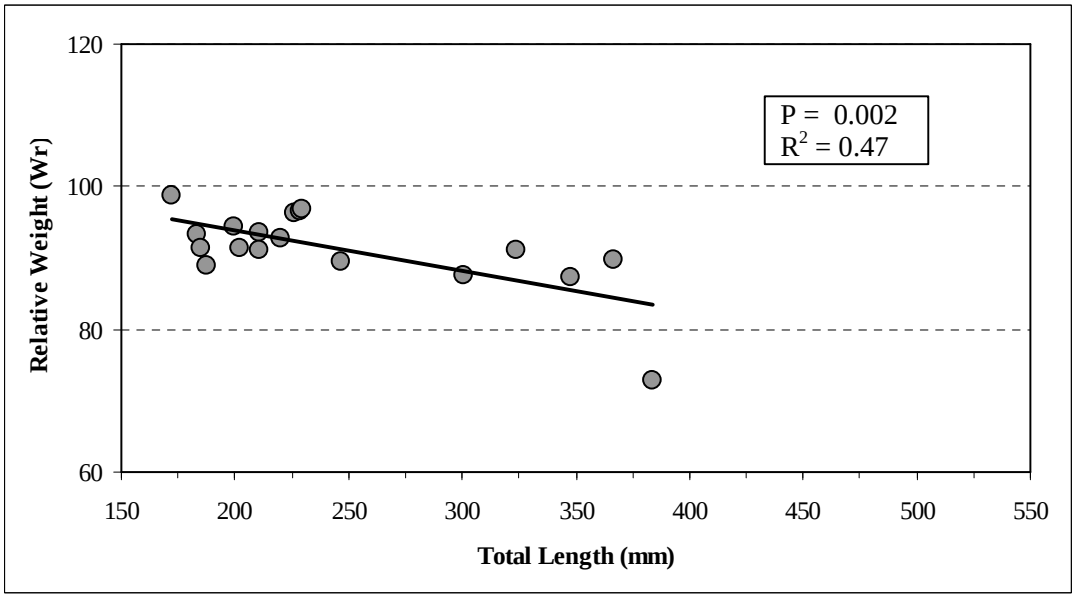


Figure 4. Length-frequency distribution (n = 31) and relationship of total length to relative weight (Wr; n = 18) for Smallmouth Bass captured in Lees Pond (Moultonborough) during 2012.

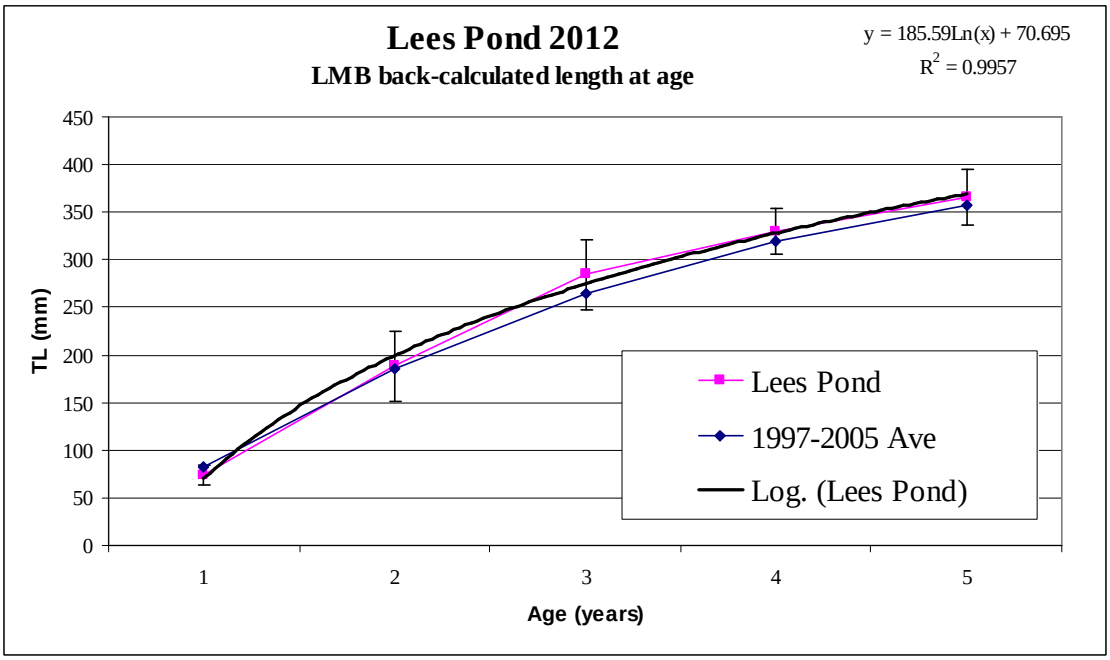
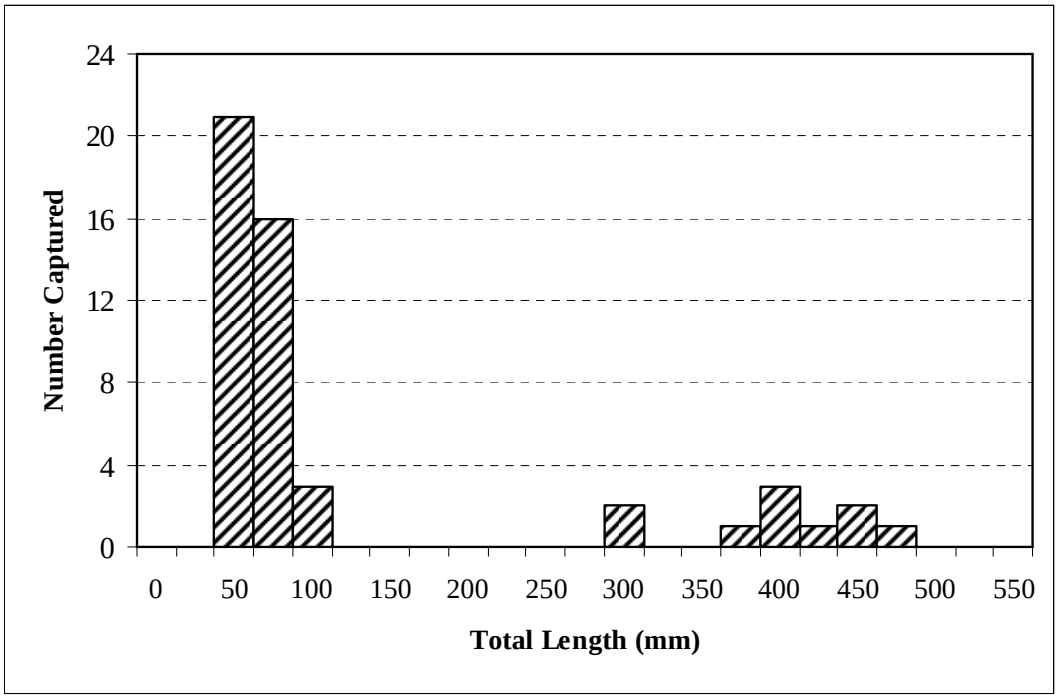


Figure 5. Average back-calculated length at age for Largemouth Bass from Lees Pond (Moultonborough) sampled in 2012 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for Largemouth Bass from 1997-2005 (from Racine 2006a).



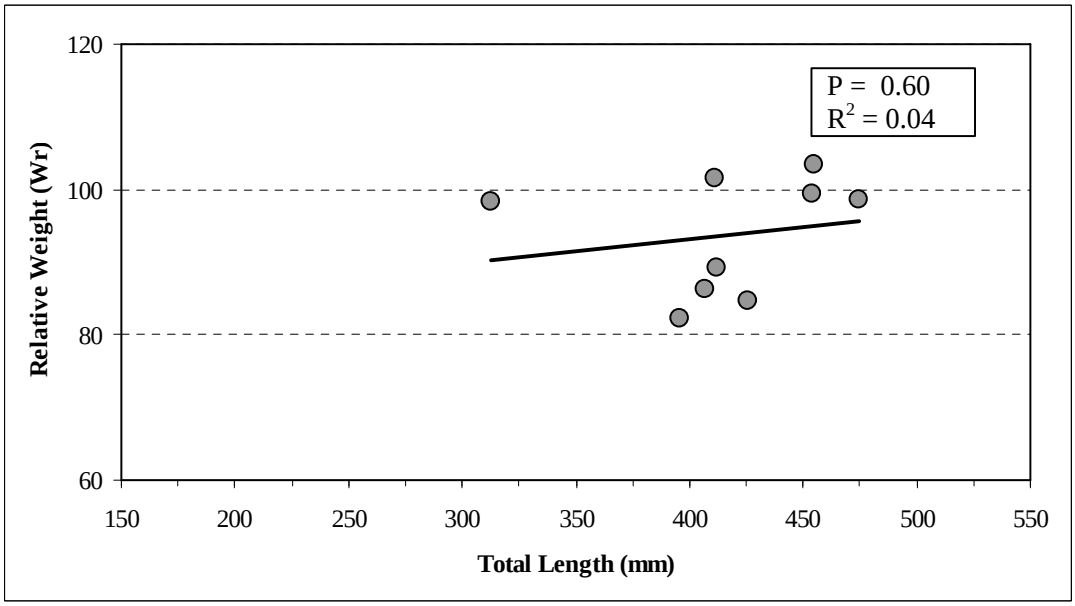


Figure 6. Length-frequency distribution (n = 50) and relationship of total length to relative weight (Wr; n = 9) for Largemouth Bass captured in Mountain Brook Reservoir (Jaffrey) during 2012.

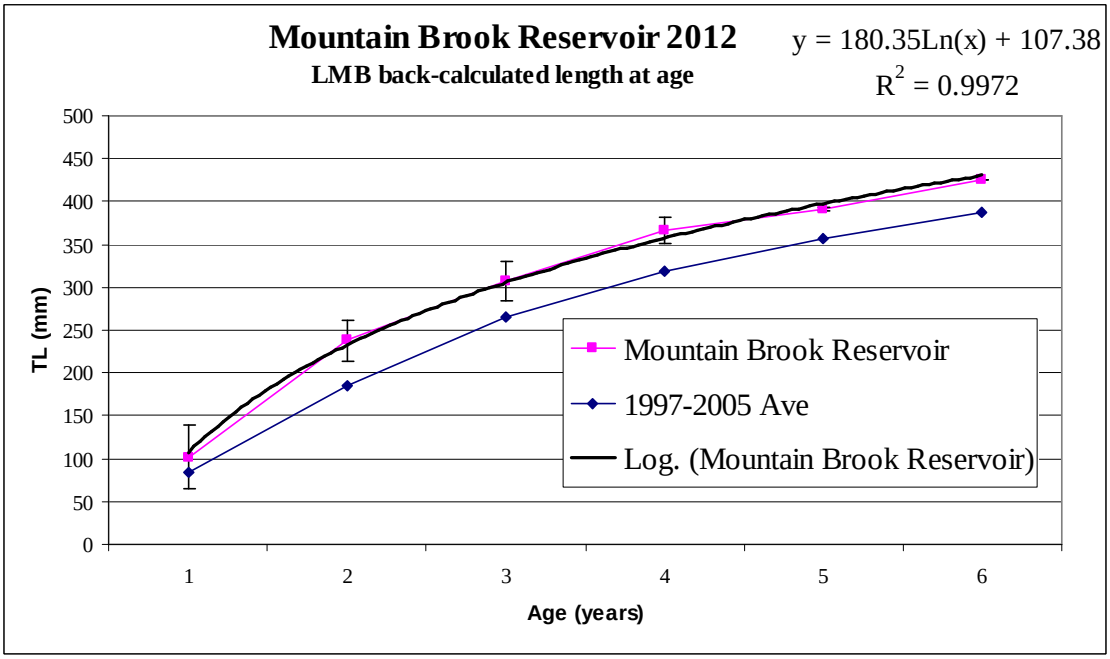
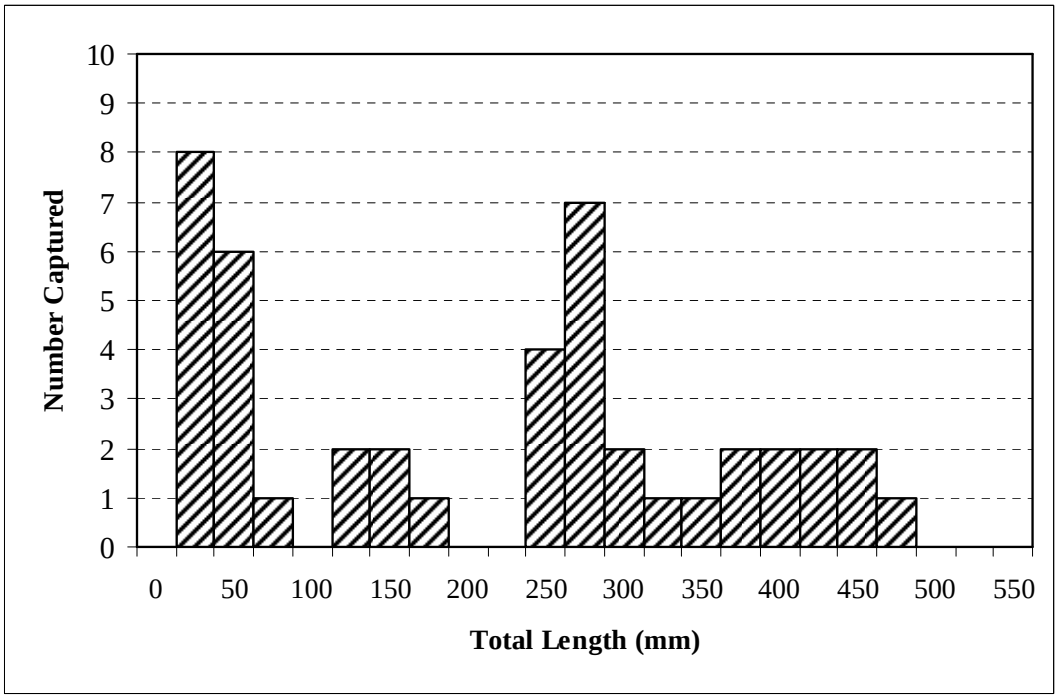


Figure 7. Average back-calculated length at age for Largemouth Bass from Mountain Brook Reservoir (Jaffrey) sampled in 2012 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for Largemouth Bass from 1997-2005 (from Racine 2006a).



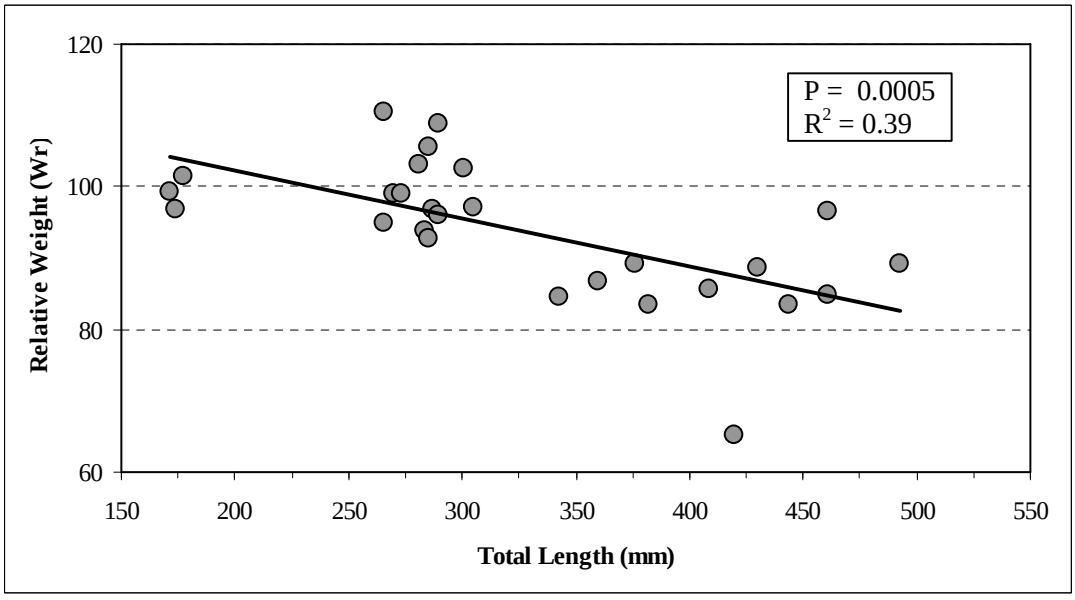


Figure 8. Length-frequency distribution (n = 44) and relationship of total length to relative weight (Wr; n = 27) for Largemouth Bass captured in Rockwood Pond (Fitzwilliam) during 2012.

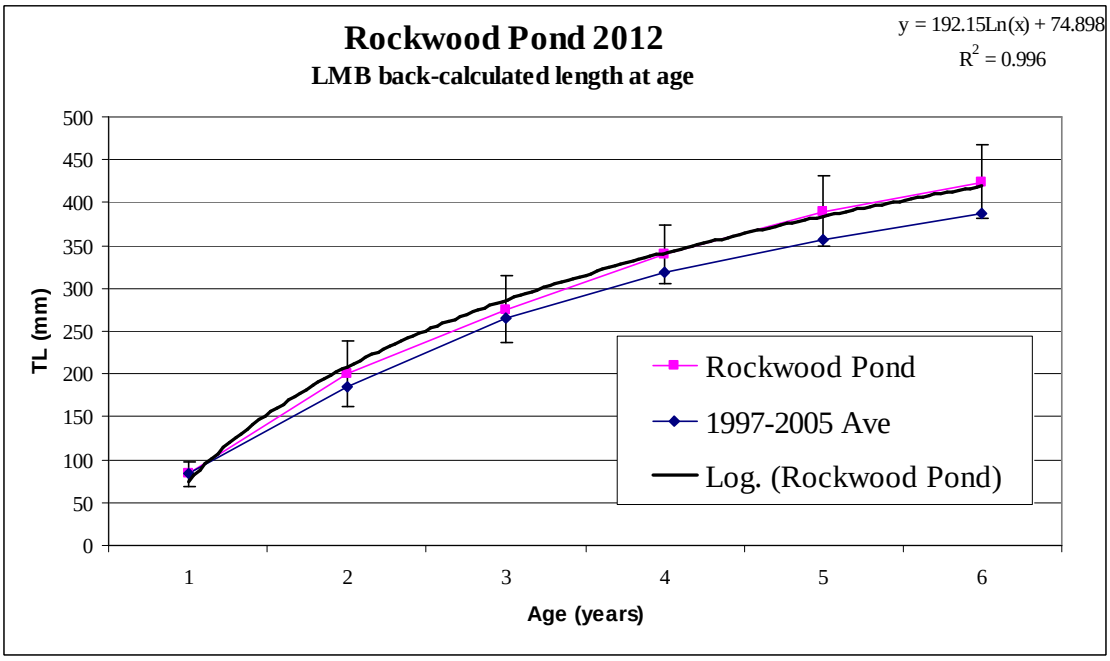


Figure 9. Average back-calculated length at age for Largemouth Bass from Rockwood Pond (Fitzwilliam) sampled in 2012 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for Largemouth Bass from 1997-2005 (from Racine 2006a).

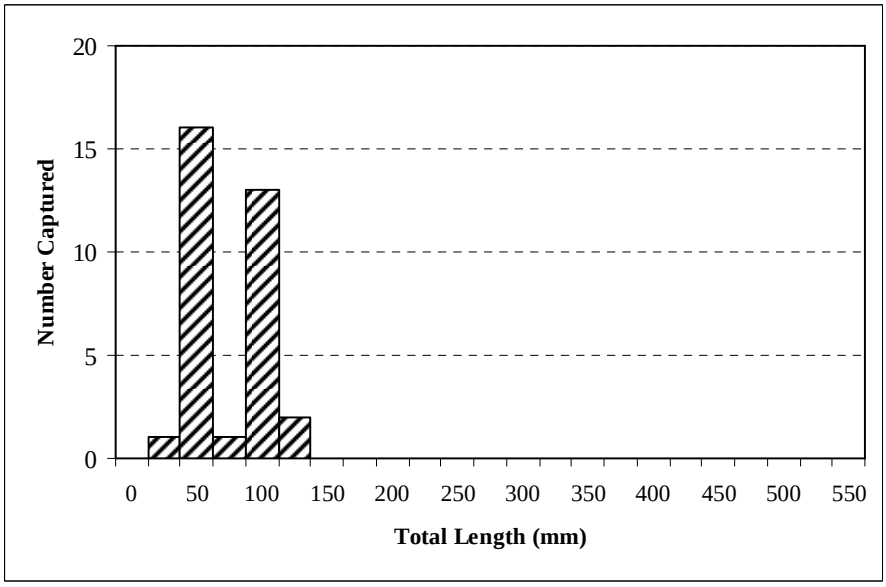


Figure 10. Length-frequency distribution (*n* = 33) for Smallmouth Bass captured in Spectacle Pond (Enfield) during 2012.

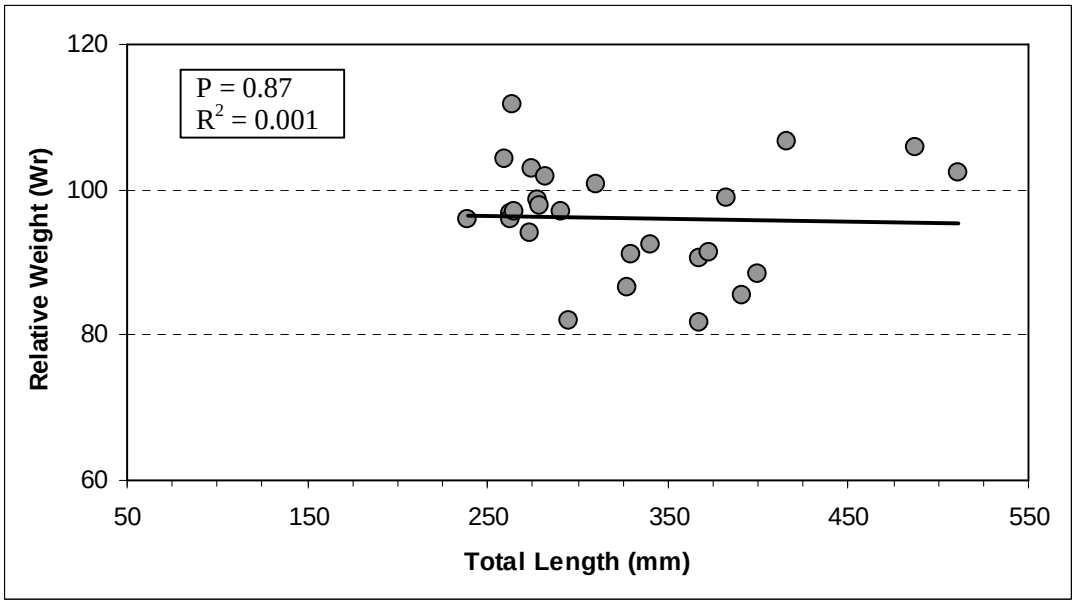


Figure 11. Relationship of total length to relative weight (Wr; *n* = 26) for Largemouth Bass captured in Mountain Brook Reservoir (Jaffrey) during 2004.

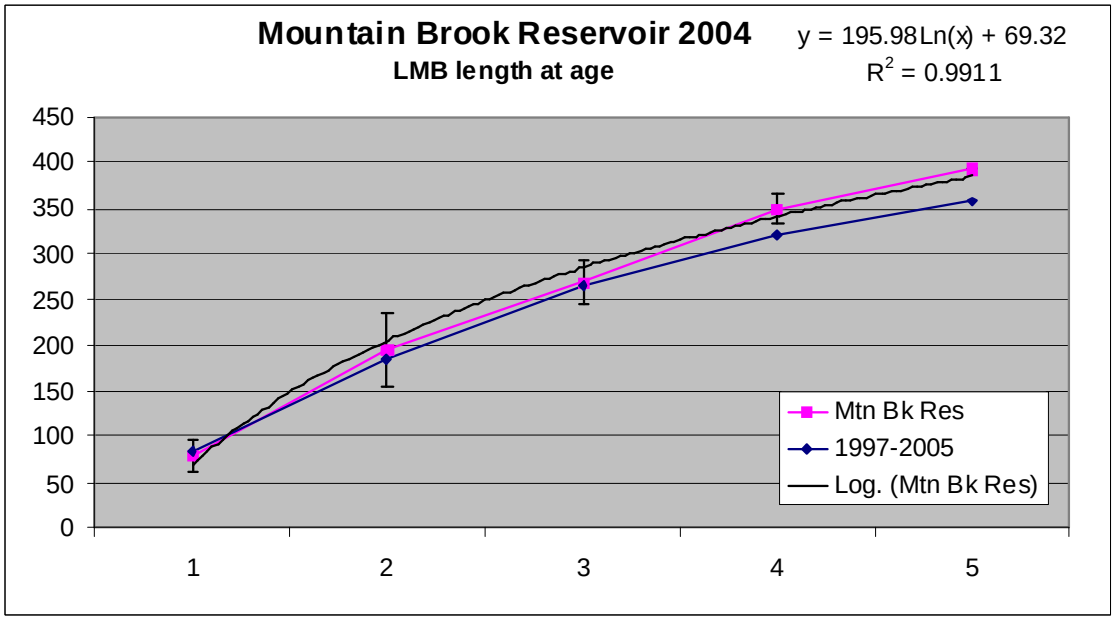


Figure 12. Average back-calculated length at age for Largemouth Bass from Mountain Brook Reservoir (Jaffrey) sampled in 2004 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for Largemouth Bass from 1997-2005 (from Racine 2006a).

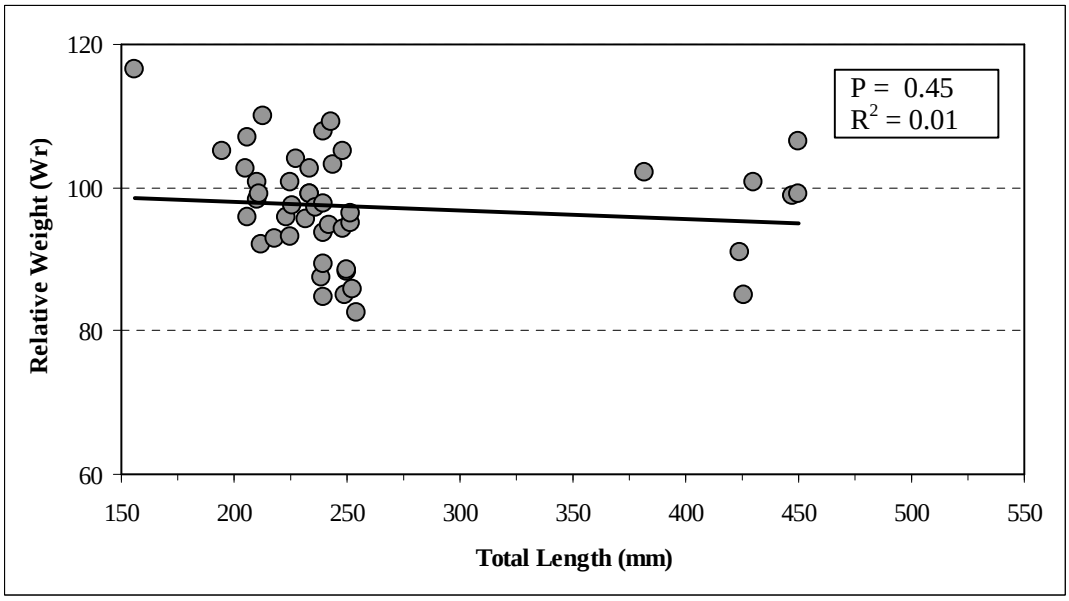
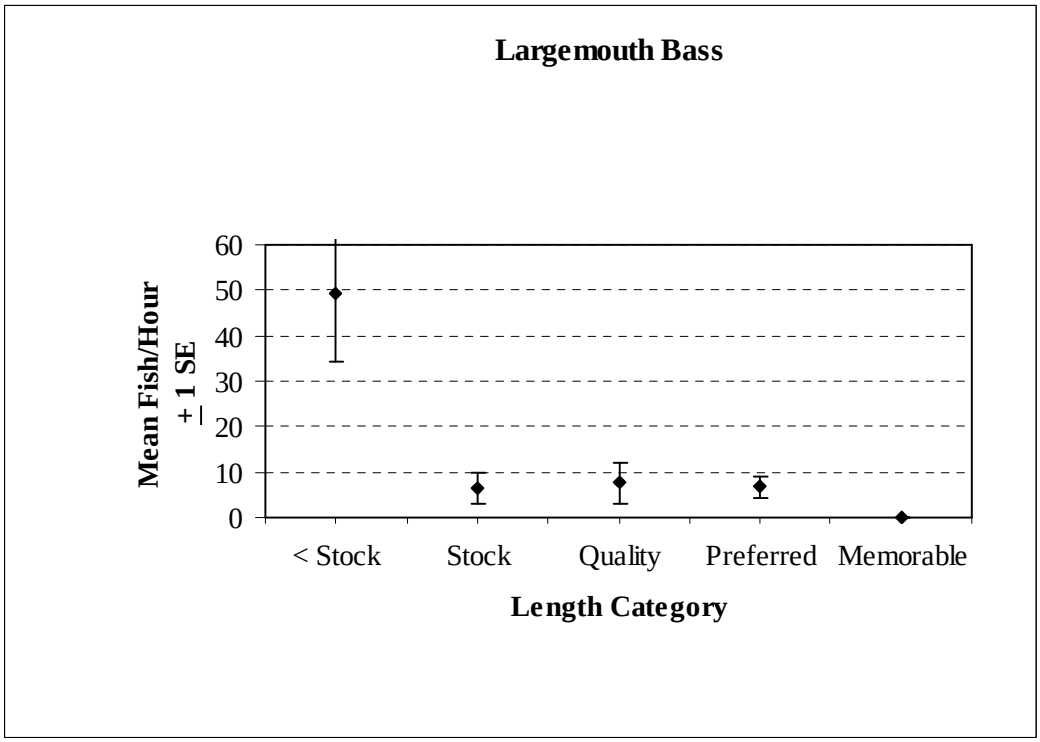


Figure 13. Relationship of total length to relative weight (Wr; *n* = 29) for Largemouth Bass captured in Rockwood Pond (Fitzwilliam) during 1999.



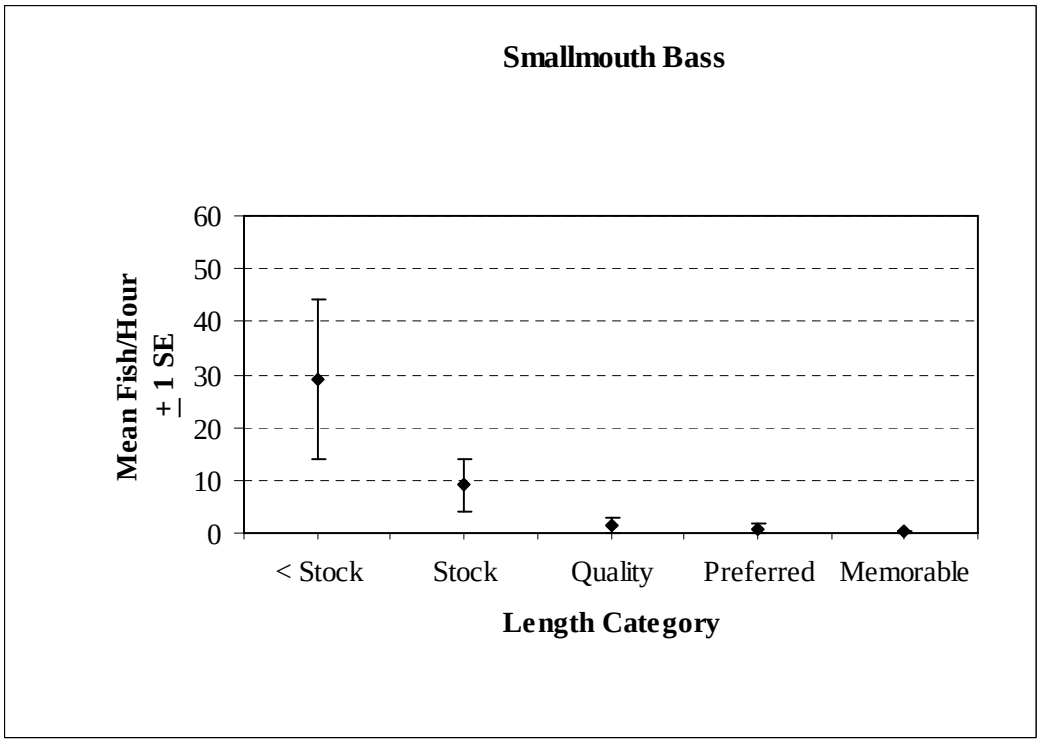


Figure 14. Mean relative abundance values (fish/hour) and one standard error for largemouth and Smallmouth Bass captured during electrofishing surveys in 2012 by length category (refer to Table 6a and 6b).