WARMWATER FISH POPULATION ASSESSMENTS
IN NEW HAMPSHIRE
BLACK BASS AGEING
F50R25 ERRATUM
(2008)

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ERRATUM

Black bass ((*Micropterus dolomieui,* smallmouth and *M. salmoides,* largemouth) scales collected in 2008 were miss-aged when reported in the original F-50-R-25 report. Scales were re-aged in 2011. In order to provide clarity, the original F-50-R-25 report is shown here and the correct ageing data have been inserted.

INTRODUCTION

Black bass 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 tournament pressure 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 2008 with all data analyses and summaries contained in this report. This report includes a summary of seven assessments conducted in Region 4, one conducted in Region 2 and one conducted in Region 3: Clement Pond (aka Joe Sylvia Pond; Hopkinton), Elm Brook Pool (Hopkinton), Grassy Pond (Rindge), Gregg Lake (Antrim), Island Pond (Stoddard), Powwow Pond

(Kingston), Spofford Lake (Chesterfield), Sunrise Lake (Middleton), and Warren Lake (Alstead) (Table 2).

The objectives of warmwater assessments were to determine: 1) fish condition; 2) size and population structure; 3) relative abundance (bass and community species); 4) young-of-year bass size; 5) age and growth; and 6) compare measured population parameters to statewide values and among populations.

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). Some community runs in 2008 were 250 seconds in duration in order to continue studies presented in Dexter (2008). Black bass or other target species 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).

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). PSD values that range from 40 to 60 indicate a structurally balanced population. Values < 40 indicate too many small fish and values > 60 indicate too many large 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 all 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.

RESULTS

Clement Pond (*Hopkinton*)

Clement Pond was surveyed on August 5. Three 1000-second target species runs and two 500-second community species runs were conducted (Table 2). A total of 79 largemouth bass and 10 smallmouth bass were sampled (Figure 1 and 2). The PSD for largemouth bass was 79 (lower and upper 80% CI's: 70, 86; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was 100 (lower and upper 80% CI's: 32, 100; 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, preferred and memorable size fish and lower for stock size fish when compared to statewide mean values (Racine, 2006b). Mean relative weight values for smallmouth bass were lower for preferred size fish when compared to statewide mean values (Racine, 2006b). The relationship between largemouth bass total length and relative weight was not significant (P = 0.17; Figure 1). The relationship between smallmouth bass total length and relative weight was not analyzed due to small sample size.

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 and smallmouth bass are presented in Table 5a and Figure 16. Largemouth bass growth was categorized as average when compared to New Hampshire water bodies sampled during 1997-2005. Average length at age was above statewide values (1997-2005) for largemouth bass aged 2-6. Largemouth bass took an average of 3.43 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2005) (Racine, 2006a). Smallmouth bass growth was not compared or categorized due to low sample size of fish greater than quality size (280 mm).

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 size fish when compared to statewide mean values (Racine, 2006b). Mean relative abundance estimates for smallmouth bass were lower for all bass lengths combined and for each length category except for preferred size fish when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch (*Perca flavescens*), bluegill (*Lepomis macrochirus*), pumpkinseed (*Lepomis gibbosus*), chain pickerel (*Esox niger*), black crappie (*Pomoxis nigromaculatus*), and yellow bullhead (*Ameiurus natalis*) (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Elm Brook Pool (*Hopkinton*)

Elm Brook Pool was surveyed on August 13. Three 1000-second target species runs and four 250-second community species runs were conducted (Table 2). A total of 53 largemouth bass were sampled (Figure 3). The PSD for largemouth bass was 54 (lower and upper 80% CI's: 40, 67; 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 lower for stock, 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 = 0.007; R^2 = 0.24; Figure 3).

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 5a and Figure 17. 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 aged 2-5.

Largemouth bass took an average of 3.26 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, pumpkinseed, yellow perch, golden shiner, black crappie, common white sucker (*Catostomus commersoni*), and yellow bullhead (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Grassy Pond (*Rindge*)

Grassy Pond was surveyed on August 14. Three 1000-second target species runs and four 250-second community species runs were conducted (Table 2). A total of 276 largemouth bass were sampled (Figure 4). The PSD for largemouth bass was 80 (lower and upper 80% CI's: 66, 90; 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, 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 ($P < 0.001$; $R^2 = 0.58$; 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 5a and Figure 18. 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 aged 2-6. Largemouth bass took an average of 3.13 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 and memorable size fish when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch, pumpkinseed, golden shiner, chain pickerel, and creek chubsucker (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Gregg Lake (*Antrim*)

Gregg Lake was surveyed on July 15. Two 1000-second target species runs and four 250-second community species runs were conducted (Table 2). A total of 53 largemouth bass and 11 smallmouth bass were sampled (Figure 5 and 6). The PSD for largemouth bass was 65 (lower and upper 80% CI's: 52, 76; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was 67 (lower and upper 80% CI's: 20, 97; 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, quality, and preferred size fish when compared to statewide mean values (Racine, 2006b). Mean relative weight values for smallmouth bass were higher for preferred size fish and lower for stock and quality 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 ($P = 0.06$; $R^2 = 0.08$; Figure 5). The relationship between smallmouth bass total length and relative weight was not analyzed due to small sample size.

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 5a and Figure 19. 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 aged 1-6. Largemouth bass took an average of 3.09 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2005) (Racine, 2006a). Smallmouth bass growth was not compared or categorized due to low sample size of fish greater than quality size (280 mm).

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 lower for all bass lengths combined and for each length category when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch, redbreast sunfish (*Lepomis auritus*), pumpkinseed, and golden shiner (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Island Pond (*Stoddard*)

Island Pond was surveyed on July 30. Three 1000-second target species runs and two 500 second community species runs were conducted (Table 2). A total of 94 largemouth bass and 9 smallmouth bass were sampled (Figure 7 and 8). The PSD for largemouth bass was 78 (lower and upper 80% CI's: 60, 90; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was 50 (lower and upper 80% CI's: 5, 95; 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 stock size fish and lower for quality, preferred, and memorable size fish when compared to statewide mean values (Racine, 2006b). Mean relative weight values for smallmouth bass were higher for quality size fish and lower for stock 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 ($P = 0.01$; $R^2 = 0.27$; Figure 7). The relationship between smallmouth bass total length and relative weight was not analyzed due to small sample size.

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 5a and Figure 20. Largemouth bass growth was categorized as average 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 3 and below statewide values for ages 1-2 and 4-6. Largemouth bass took an average of 3.75 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2005) (Racine, 2006a). Smallmouth bass growth was not compared or categorized due to low sample size of fish greater than quality size (280 mm).

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 quality size fish when compared to statewide mean values (Racine, 2006b). Mean relative abundance estimates for smallmouth bass were lower for all bass lengths combined and for each length category when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch, redbreast sunfish, pumpkinseed, golden shiner, white perch (*Morone americana*), rock bass (*Ambloplites rupestris*), chain pickerel, and brown bullhead (*Ameiurus nebulosus*) and black crappie (tied; Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Powwow Pond (*Kingston*)

Powwow Pond was surveyed on June 22. Four 500-second target species runs and two 500-second community species runs were conducted (Table 2). A total of 10 largemouth bass were sampled (Figure 9). The PSD for largemouth bass was 44 (lower and upper 80% CI's: 21, 70; 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 and preferred size fish and lower for quality 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 ($P = 0.10$; $R^2 = 0.34$; Figure 9).

Scales were not collected from bass sampled at Powwow Pond.

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 lower for all bass lengths combined and for each length category when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch, pumpkinseed, chain pickerel, bluegill, black crappie, and golden shiner (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Spofford Lake (*Chesterfield*)

Spofford Lake was surveyed on July 8 and July 10. Four 1000-second target species runs and eight 250-second community species runs were conducted (Table 2). A total of 16 largemouth bass and 78 smallmouth bass were sampled (Figure 10 and 11). The PSD for largemouth bass was 44 (lower and upper 80% CI's: 21, 70; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was 25 (lower and upper 80% CI's: 11, 44; 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, quality, and preferred size fish when compared to statewide mean values (Racine, 2006b). Mean relative weight values for smallmouth bass were higher for stock and quality size fish when compared to statewide mean values (Racine, 2006b). The relationship between largemouth bass total length and relative weight was not significant ($P = 0.97$; Figure 10). The relationship between smallmouth bass total length and relative weight was not significant ($P = 0.17$; Figure 11).

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

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 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 preferred size fish when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: bluegill, yellow perch, pumpkinseed, rock bass, yellow bullhead, and banded killifish (*Fundulus diaphanus*; Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Sunrise Lake (Middleton)

Sunrise Lake was surveyed on August 12. Three 1000-second target species runs and four 250-second community species runs were conducted (Table 2). A total of 66 largemouth bass and 122 smallmouth bass were sampled (Figure 12 and 13). The PSD for largemouth bass was 19 (lower and upper 80% CI's: 9, 32; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was 26 (lower and upper 80% CI's:19, 35; 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, quality, 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 (Racine, 2006b). The relationship between largemouth bass total length and relative weight was significant with a negative trend, but the variation was poorly explained ($P = 0.002$; $R^2 = 0.27$; Figure 12). The relationship between smallmouth bass total length and relative weight was significant with a negative trend, but the variation was poorly explained ($P < 0.001$; $R^2 = 0.25$; Figure 13).

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for smallmouth bass are presented in Table 5b and Figure 21. Largemouth bass growth was not compared or categorized due to low sample size of fish greater than quality size (300 mm). Smallmouth 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 smallmouth bass aged 1-6. Smallmouth bass took an average of 4.85 years to reach quality size (280 mm) compared to the statewide average of 4.47 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 less than stock and stock size fish, and were lower for quality, preferred, 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 when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch, pumpkinseed, golden shiner, common white sucker, and chain pickerel (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Warren Lake (*Alstead*)

Warren Lake was surveyed on July 28. Three 1000-second target species runs and two 250-second community species runs were conducted (Table 2). A total of 85 largemouth bass and 4 smallmouth bass were sampled (Figure 14 and 15). The PSD for largemouth bass was 95 (lower and upper 80% CI's: 90, 98; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was 100 (lower and upper 80% CI's: 10, 100; 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, quality, and preferred size fish when compared to statewide mean values (Racine, 2006b). Mean relative weight values for smallmouth bass were lower for 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 ($P = 0.006$; $R^2 = 0.11$; Figure 14). The relationship between smallmouth bass total length and relative weight was not analyzed due to small sample size.

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 5a and Figure 22. 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 aged 1-6. Largemouth bass took an average of 3.28 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2005) (Racine, 2006a). Smallmouth bass growth was not compared or categorized due to low sample size of fish greater than quality size (280 mm).

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 lower for all bass lengths combined and for each length category when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch, pumpkinseed, golden shiner, chain pickerel, and bluegill (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

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 vegetation 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 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 populations appear to have slightly more abundant and slightly better quality habitat types based upon habitat suitability information (Edwards and Gebhart, 1983).

PSD values that range from 40 to 60 indicate a structurally balanced population. Values < 40 indicate too many small fish and values > 60 indicate too many large fish. Of the nine largemouth bass populations for which PSD values were calculated, three (Elm Brook Pool, Powwow Pond, and Spofford Lake) had values indicating a balanced population. Five largemouth bass populations (Clement Pond, Grassy Pond, Gregg Lake, Island Pond, and Warren Lake) had PSD values indicating sizes were skewed towards larger fish. One population (Sunrise Lake) had PSD values indicating sizes were skewed towards smaller fish. Of the six smallmouth bass populations for which PSD values were calculated, only one (Island Pond) had a value indicating a balanced population. Three smallmouth bass populations (Clement Pond, Gregg Lake, and Warren Lake) had PSD values indicating sizes were skewed towards larger fish. Two populations (Sunrise Lake and Spofford Lake) had PSD values indicating sizes were skewed towards smaller fish.

Relative weight values > 90 may be considered good, with values > 100 considered excellent. Most size categories of largemouth bass sampled in 2008 had mean Wr values > 90 with few exceptions (Table 4a). Observed values are acceptable from a management standpoint, as no exceptional values were documented. Significant negative relationships between total length and relative weight values were observed in seven (Warren Lake, Elm Brook Pool, Grassy Pond, Gregg Lake, Island Pond, Powwow Pond, and Sunrise Lake) of the nine largemouth bass populations analyzed. Variation in the data was not well explained in any of the populations ($r^2 > 50$) which had a significant relationship, except for Grassy Pond.

Most size categories of smallmouth bass sampled in 2008 had mean Wr values > 90 with few exceptions (Table 4b). Observed values are acceptable from a management standpoint, as only one exceptional value (Wr = 69.7 for preferred size fish at Clement Pond) was documented, but values should be interpreted with caution due to small sample sizes (Table 4b). Significant negative relationships between total length and relative weight values were observed in one (Sunrise Lake) of the two smallmouth bass populations analyzed (four populations were not analyzed due to low sample size). Variation in the data was not well explained in any population ($r^2 > 50$) which had a significant relationship.

Mean relative abundance values (fish/hr) for largemouth and smallmouth bass populations sampled in 2008 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 memorable size (CV = 212) and lowest for stock and preferred size (CV = 66). The extreme variability of the memorable size for largemouth bass was driven by the fact that fish of this size were only captured in two water bodies (Table 6a). The CV of mean relative abundance values for smallmouth bass within size categories was greatest for stock size (CV = 173) and lowest for less stock size (CV = 114). 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 2008 revealed a shift in abundance between bass < stock size and those ≥ stock size (Figure 23). 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 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 2008 were variable (Table 7a and 7b). The limited number of runs utilized for community sampling, typically two per night, can produce tremendous variability in calculated mean relative abundance. Yellow perch and pumpkinseed were captured in all water bodies sampled, chain pickerel were captured in all but one, and golden shiner were captured in all but two (Table 7a, 7b, and 7c). Yellow perch had the highest overall mean relative abundance (495.6 fish/hr). The other most abundant species were bluegill (mean = 117.1 fish/hr), pumpkinseed (mean = 103.2 fish/hr), and golden shiner (mean = 35.1 fish/hr).

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.

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Table 1. Number of bass fishing tournament permits issued by the NHFGD (1992 - 2008).

Year	Number of Permits Issued
1992	303
1993	352
1994	404
1995	389
1996	475
1997	497
1998	466
1999	459
2000	472
2001	497
2002	510
2003	499
2004	492
2005	512
2006	498
2007	485
2008	464

Table 2. Summary of warmwater fish population assessments performed in 2008.

Sample Date	Water body	Region	Acreage	Town	County	Fishery	Sampling Method	Sample Type	Targeted Species[a]	Number of Runs	Run Times (seconds)
8/5/2008	Clement Pond	4	98	Hopkinton	Merrimack	Warmwater	electrofish	Community		2	500
								Target	BLB	3	1000
8/13/2008	Elm Brook Pool	4	412	Hopkinton	Merrimack	Warmwater	electrofish	Community		4	250
								Target	BLB	3	1000
8/14/2008	Grassy Pond	4	99	Rindge	Cheshire	Warmwater	electrofish	Community		4	250
								Target	BLB	3	1000
7/15/2008	Gregg Lake	4	195	Antrim	Hillsborough	Warmwater	electrofish	Community		4	250
								Target	BLB	2	1000
7/30/2008	Island Pond	4	212	Stoddard	Cheshire	Warmwater	electrofish	Community		2	500(x1),
								Target	BLB	3	1000
6/22/2008	Powwow Pond	3	247	Kingston	Rockingham	Warmwater	electrofish	Community		2	500
								Target	BLB	4	500
7/8/2008	Spofford Lake	4	707	Chesterfield	Cheshire	Coldwater,	electrofish	Community		4	250
7/10/2008								Community		4	250
7/8/2008								Target	BLB	2	1000
7/10/2008								Target	BLB	2	1000
8/12/2008	Sunrise Lake	2	257	Middleton	Strafford	Warmwater	electrofish	Community		4	250
								Target	BLB	3	1000
7/28/2008	Warren Lake	4	186	Alstead	Cheshire	Warmwater	electrofish	Community		2	250
								Target	BLB	3	1000

[a] BLB - black bass.

Table 3a. Proportional Stock Density (95% and 80% confidence intervals) of largemouth bass populations assessed in 2008 by electrofishing.

Water body	Sample Date	Lower CI 95%	Lower CI 80%	PSD	Upper CI 80%	Upper CI 95%	> Quality Size	> Stock Size
Clement Pond	8/5/2008	66	70	79	86	89	42	53
Elm Brook Pool	8/13/2008	34	40	54	67	72	15	28
Grassy Pond	8/14/2008	59	66	80	90	93	20	25
Gregg Lake	7/15/2008	46	52	65	76	80	22	34
Island Pond	7/30/2008	52	60	78	90	94	14	18
Powwow Pond	6/22/2008	14	21	44	70	79	4	9
Spofford Lake	7/8, 7/10/2008	14	21	44	70	79	4	9
Sunrise Lake	8/12/2008	6	9	19	32	38	5	27
Warren Lake	7/28/2008	87	90	95	98	99	61	64
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 2008 by electrofishing.

Water body	Sample Date	Lower CI 95%	Lower CI 80%	PSD	Upper CI 80%	Upper CI 95%	> Quality Size	> Stock Size
Clement Pond	8/5/2008	16	32	100	100	100	2	2
Gregg Lake	7/15/2008	9	20	67	97	99	2	3
Island Pond	7/30/2008	1	5	50	95	99	1	2
Spofford Lake	7/8, 7/10/2008	7	11	25	44	52	4	16
Sunrise Lake	8/12/2008	16	19	26	35	40	15	57
Warren Lake	7/28/2008	3	10	100	100	100	1	1
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 2008 by electrofishing.

		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
Clement Pond	8/5/2008	11	95.2	8.5	28	91.3	5.4	12	93.6	13.6	2	97.6	5.1
Elm Brook Pool	8/13/2008	13	99.0	9.6	6	86.2	6.6	9	88.9	11.5	-	-	-
Grassy Pond	8/14/2008	5	110.0	5.9	10	101.5	5.3	10	97.7	6.1	-	-	-
Gregg Lake	7/15/2008	12	92.8	4.7	14	92.9	5.5	8	89.6	9.0	-	-	-
Island Pond	7/30/2008	4	102.4	4.1	8	87.4	32.0	5	89.9	4.9	1	80.2	-
Powwow Pond	6/22/2008	5	103.0	12.0	3	84.3	9.9	1	99.3		-	-	-
Spofford Lake	7/8, 7/10/2008	5	91.1	2.2	2	88.4	2.0	2	85.8	17.3	-	-	-
Sunrise Lake	8/12/2008	22	92.5	7.0	3	92.1	2.6	2	92.1	0.7	-	-	-
Warren Lake	7/28/2008	3	91.0	2.7	50	86.0	5.9	11	84.4	6.8	-	-	-
Mean Wr			97.4			90.0			91.3			88.9	
Std Dev Wr			6.6			5.2			5.0			12.4	
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 2008 by electrofishing.

		Total Length Interval (mm)											
		Stock 180-279			Quality 280-349			Preferred 350-429			Memorable 430-509		
Water body	Sample Date	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD	*n*	Wr	SD
Clement Pond	8/5/2008	-	-	-	-	-	-	2	69.7	11.9	-	-	-
Gregg Lake	7/15/2008	1	94.1	-	1	88.1	-	1	88.6	-	-	-	-
Island Pond	7/30/2008	1	94.4	-	1	94.8	-	-	-	-	-	-	-
Spofford Lake	7/8, 710/2008	10	98.8	12.4	3	92.9	18.1	-	-	-	-	-	-
Sunrise Lake	8/12/2008	42	91.6	6.6	9	86.9	4.2	5	83.3	9.2	-	-	-
Warren Lake	7/28/2008	-	-	-	-	-	-	1	84.5	-	-	-	-
Mean Wr			94.7			90.7			81.5			-	
Std Dev Wr			3.0			3.8			8.2			-	
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 5a. 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 1	2	3	4	5	6	Number of fish aged >1	5-6	R^{2b}	Age at quality size 300 mm	Growth Categorization
Clement Pond	Hopkinton	2008	LMB	6	5	75	191	271	326	379		45	7	0.99	3.43	Average
Elm Brook Pool	Hopkinton	2008	LMB	5	5	78	198	283	345	382		25	2	0.99	3.26	Fast
Grassy Pond	Rindge	2008	LMB	6	6	82	218	313	352	379	408	23	6	0.99	3.13	Fast
Gregg Lake	Antrim	2008	LMB	5	5	89	201	297	351	397		32	2	0.99	3.09	Fast
Island Pond	Stoddard	2008	LMB	6	6	77	171	267	311	356	382	21	3	0.99	3.75	Average
Warren Lake	Alstead	2008	LMB	6	6	105	225	292	333	363	393	61	12	0.99	3.28	Fast
Statewide average[a]		1997-2005	LMB			83	185	265	320	357	387				3.74	

a. Reprinted from Racine (2006a).

b. Correlation coefficient for logarithmic trendline.

Table 5b. Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for smallmouth 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 1	2	3	4	5	6	Number of fish aged >1	5-6	R^{2b}	Age at quality size 280 mm	Growth Categorization
Sunrise Lake	Middleton	2008	SMB	6	6	78	137	202	246	286	328	26	6	0.97	4.85	Average
Statewide average[a]		1997-2005	SMB			85	148	217	277	322	364				4.47	

a. Reprinted from Racine (2006a).

b. 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 2008. n = number of electrofishing runs.

			Total Length Interval (mm)																
			All Lengths			< Stock (YOY & Juvenile)			Stock 200-299			Quality 300-379			Preferred 380-509			Memorabl 510-629	
Water body	Date sampled	n	# fish	f/h	SD	# fish	f/h	SD	# fish	f/h	SD	# fish	f/h	SD	# fish	f/h	SD	# fish	f/h
Clement Pond	8/5/2008	5	79	69.1	42.8	26	25.9	25.6	11	9.4	6.0	28	23.0	17.0	12	9.4	6.0	2	1.4
Elm Brook Pool	8/13/2008	7	53	58.1	32.6	25	34.5	24.4	13	8.2	11.9	6	6.2	6.1	9	9.3	11.4	0	0.0
Grassy Pond	8/14/2008	7	276	364.1	260.2	70	85.4	166.0	5	7.2	7.2	10	14.4	20.4	10	8.2	10.7	0	0.0
Gregg Lake	7/15/2008	6	53	71.4	69.5	19	22.2	15.5	12	18.0	20.6	14	19.2	22.2	8	12.0	23.1	0	0.0
Island Pond	7/30/2008	5	94	94.0	39.1	76	74.8	32.0	4	4.3	5.9	8	8.5	6.4	5	5.7	5.3	1	0.7
Powwow Pond	6/22/2008	6	10	12.0	26.0	1	1.2	2.9	5	6.0	14.7	3	3.6	6.0	1	1.2	2.9	0	0.0
Spofford Lake	7/8, 7/10/2008	12	16	10.2	14.0	7	4.8	6.6	5	3.3	5.6	2	1.5	4.2	2	0.6	2.1	0	0.0
Sunrise Lake	8/12/2008	7	66	75.6	34.1	39	49.4	36.8	22	19.0	12.2	3	4.6	6.8	2	2.6	5.4	0	0.0
Warren Lake	7/28/2008	5	85	106.6	52.9	21	32.4	30.8	3	4.3	6.4	50	57.6	28.8	11	12.2	3.2	0	0.0
Mean f/h				95.7			36.7			8.9			15.4			6.8			0.2
CV for f/h				111			78			66			113			66			212
Statewide average[a]	1997-2005		126[b]	49.6	50.1	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

a. Reprinted from Racine (2006b).

b. Represents 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 2008. n = number of electrofishing runs.

			Total Length Interval (mm)														
			All Lengths			< Stock (YOY & Juvenile)			Stock 200-299			Quality 300-379			Preferred 380-509		
Water body	Date sampled	n	# fish	f/h	SD	# fish	f/h	SD	# fish	f/h	SD	# fish	f/h	SD	# fish	f/h	SD
Clement Pond	8/5/2008	5	10	12.2	21.5	8	9.4	15.2	0	0.0	0.0	0	0.0	0.0	2	2.9	6.4
Gregg Lake	7/15/2008	6	11	10.2	12.1	8	6.6	7.3	1	2.4	5.9	1	0.6	1.5	1	0.6	1.5
Island Pond	7/30/2008	5	9	11.3	14.2	7	9.2	12.0	1	0.7	1.6	1	1.4	3.1	0	0.0	0.0
Spofford Lake	7/8, 7/10/2008	12	79	59.7	49.4	63	45.0	46.0	12	10.8	16.1	4	3.9	6.4	0	0.0	0.0
Sunrise Lake	8/12/2008	7	122	115.2	77.2	65	67.4	64.9	42	38.6	22.0	10	5.1	9.3	5	4.1	6.0
Warren Lake	7/28/2008	5	4	2.9	3.0	3	2.2	2.0	0	0.0	0.0	0	0.0	0.0	1	0.7	1.6
Mean f/h				35.2			23.3			8.7			1.8			1.4	
CV for f/h				125			114			173			118			123	
Statewide average[a]	1997-2005		61[b]	26.3	32.8	61[b]	19	27.2	61[b]	5.1	6.7	61[b]	1.5	2.4	61[b]	0.9	1.4

a. Reprinted from Racine (2006b).

b. Represents 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 2008. *n* = number of runs.

Water body	Sample Date	*n*	Banded Killifish	Black Crappie	Bluegill	Brown Bullhead	Common White Sucker	Creek Chubsucker	Chain Pickerel
Clement Pond	8/5/2008	2	-	7.2±10.2	122.4±10.2	-	-	-	14.4±20.4
Elm Brook Pool	8/13/2008	4	-	36.0±27.6	619.2±207.3	-	21.6±8.3	-	111.6±47.6
Grassy Pond	8/14/2008	4	-	-	-	-	-	3.6+7.2	18.0+13.8
Gregg Lake	7/15/2008	4	-	-	-	-	-	-	-
Island Pond	7/30/2008	2	-	3.5+4.9	-	3.5+4.9	-	-	3.6+5.1
Powwow Pond	6/22/2008	2	-	10.8±5.1	14.4±10.2	-	-	-	25.2±5.1
Spofford Lake	7/8, 7/10/2008	8	3.6+6.5	-	283.2±249.4	-	-	-	-
Sunrise Lake	8/12/2008	4	-	-	-	-	7.2±14.4	-	3.6±7.2
Warren Lake	7/28/2008	2	-	-	14.4±20.4	-	-	-	21.6±30.5
Mean f/hr			0.4	6.4	117.1	0.4	3.2	0.4	22.0
Stdev of f/hr			1.2	11.8	210.9	1.2	7.3	1.2	34.9

Table 7b. Mean relative abundance estimate (fish/hour) and one standard deviation for non-target species captured during community electrofishing runs in 2008 *n* = number of runs.

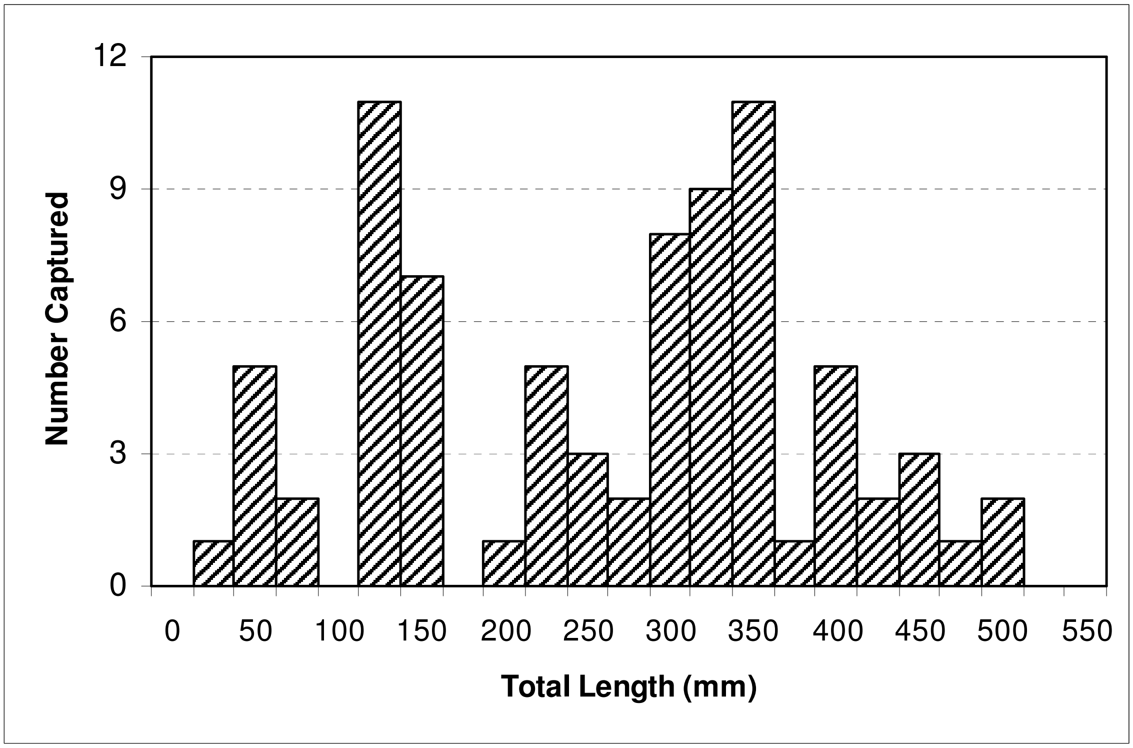
Water body	Sample Date	*n*	Golden Shiner	Pumpkinseed	Redbreast Sunfish	Rock Bass	White Perch	Yellow Bullhead
Clements Pond	8/5/2008	2	-	104.4±25.4	-	-	-	3.6±5.1
Elm Brook Pool	8/13/2008	4	68.4±46.1	75.6±56.8	-	-	-	18.0±18.1
Grassy Pond	8/14/2008	4	126.0+58.0	133.2+132.7	-	-	-	-
Gregg Lake	7/15/2008	4	25.2+41.4	28.8+23.5	46.8+51.8	-	-	-
Island Pond	7/30/2008	2	42.6+11.1	60.2+6.5	81.5+17.0	14.0+9.6	17.5+14.6	-
Powwow Pond	6/22/2008	2	3.6±5.1	43.2±10.2	-	-	-	-
Spofford Lake	7/8, 7/10/2008	8	-	51.6±51.9	-	31.2+49.8	-	6.0±14.3
Sunrise Lake	8/12/2008	4	21.6±14.9	129.6±154.2	-	-	-	-
Warren Lake	7/28/2008	2	28.8±0.0	302.4±0.0	-	-	-	-
Mean f/hr			35.1	103.2	14.3	5.0	1.9	3.1
Stdev of f/hr			40.6	83.4	29.6	10.9	5.8	6.0

Table 7c. Mean relative abundance estimate (fish/hour) and one standard deviation for non-target species captured during community electrofishing runs in 2008. *n* = number of runs.

Water body	Sample Date	*n*	Yellow Perch
Clements Pond	8/5/2008	2	871.2±437.8
Elm Brook Pool	8/13/2008	4	72.0±61.1
Grassy Pond	8/14/2008	4	338.4+383.2
Gregg Lake	7/15/2008	4	1627.2+287.5
Island Pond	7/30/2008	2	144.2+61.4
Powwow Pond	6/22/2008	2	136.8±20.4
Spofford Lake	7/8, 7/10/2008	8	64.8±112.0
Sunrise Lake	8/12/2008	4	882.0±644.8
Warren Lake	7/28/2008	2	324.0±71.3
Mean f/hr			495.6
Stdev of f/hr			529.4

Table 8. Sample size, mean total length and one standard deviation of YOY black bass captured by electrofishing during 2008.

		Largemouth			Smallmouth		
Water body	Date	*n*	Mean total length	SD	*n*	Mean total length	SD
Clement Pond	8/5/2008	8	64	14	4	67	2
Elm Brook Pool	8/13/2008	21	60	11	-	-	-
Grassy Pond	8/14/2008	67	56	7	-	-	-
Gregg Lake	7/15/2008	6	42	10	-	-	-
Island Pond	7/30/2008	60	53	8	2	54	3
Powwow Pond	6/22/2008	-	-	-	-	-	-
Spofford Lake	7/8, 7/10/2008	-	-	-	1	38	-
Sunrise Lake	8/12/2008	31	56	11	52	61	10
Warren Lake	7/28/2008	20	61	11	-	-	-
Mean			56			55	
Stdev			7			13	



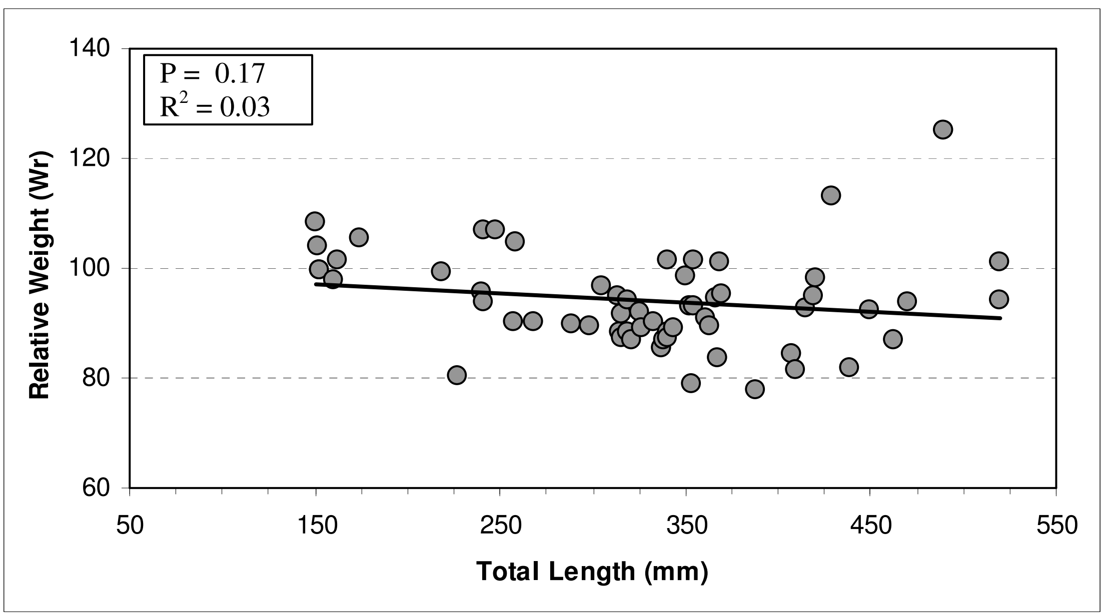


Figure 1. Length-frequency distribution (n = 79) and relationship of total length to relative weight (Wr; n = 60) for largemouth bass captured in Clement Pond (Hopkinton) during August 2008.

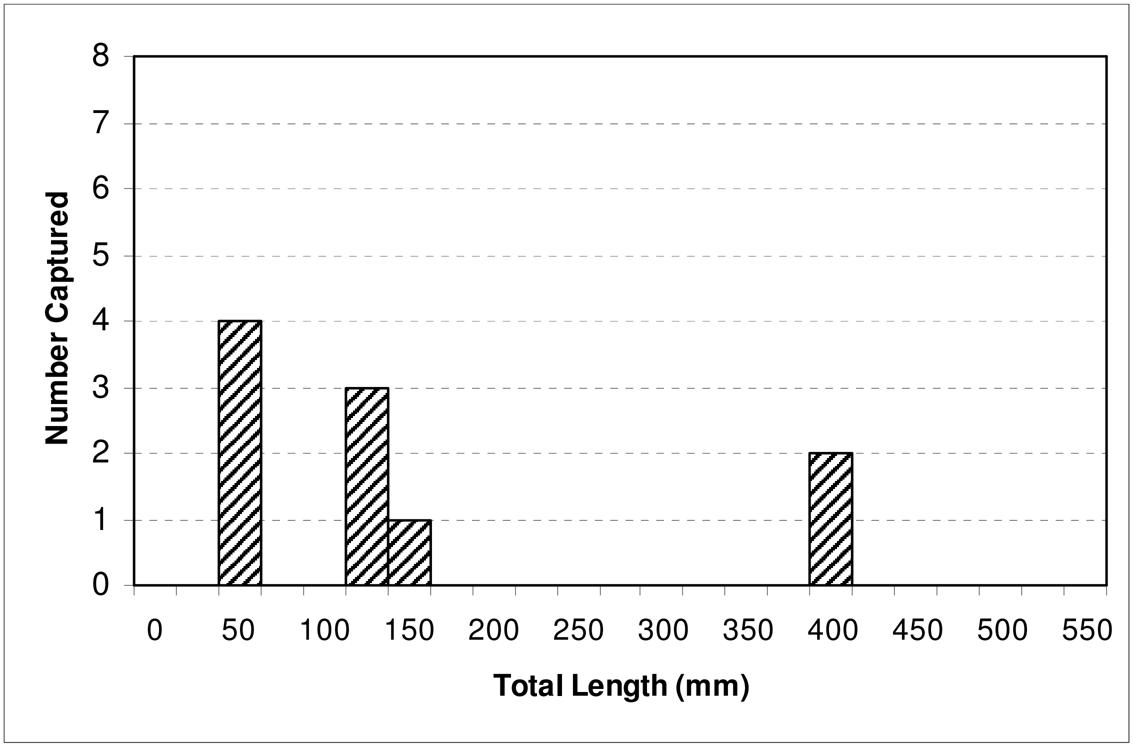
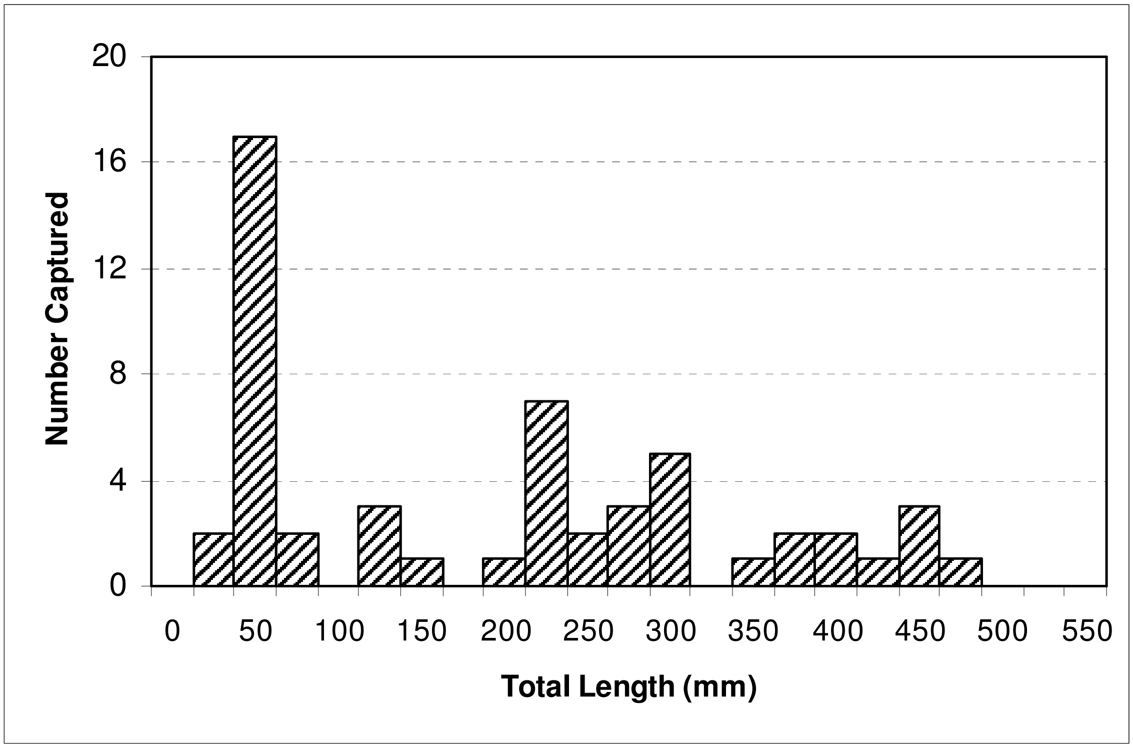


Figure 2. Length-frequency distribution (n = 10) for smallmouth bass captured in Clement Pond (Hopkinton) during August 2008.



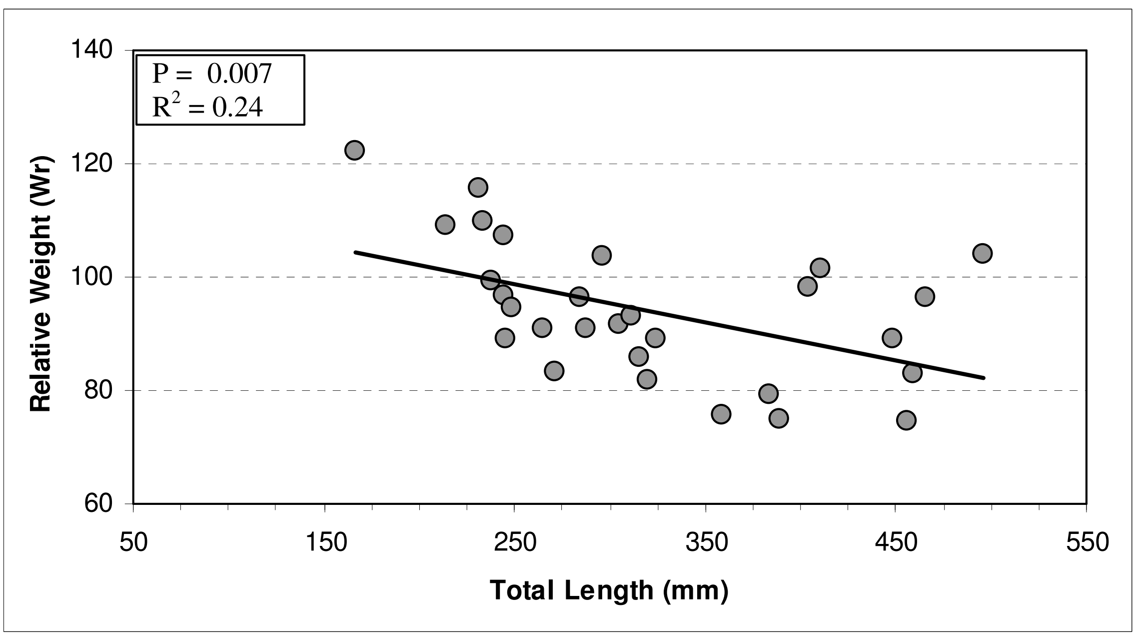
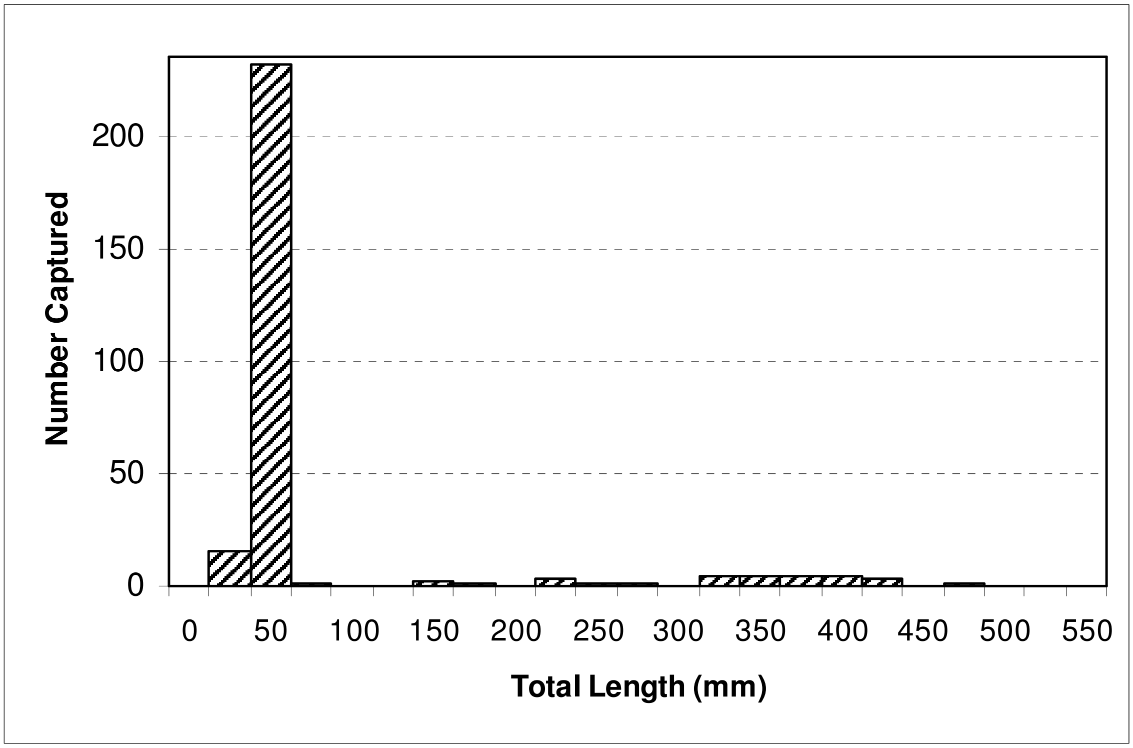


Figure 3. Length-frequency distribution (n = 53) and relationship of total length to relative weight (Wr; n = 29) for largemouth bass captured in Elm Brook Pool (Hopkinton) during August 2008.



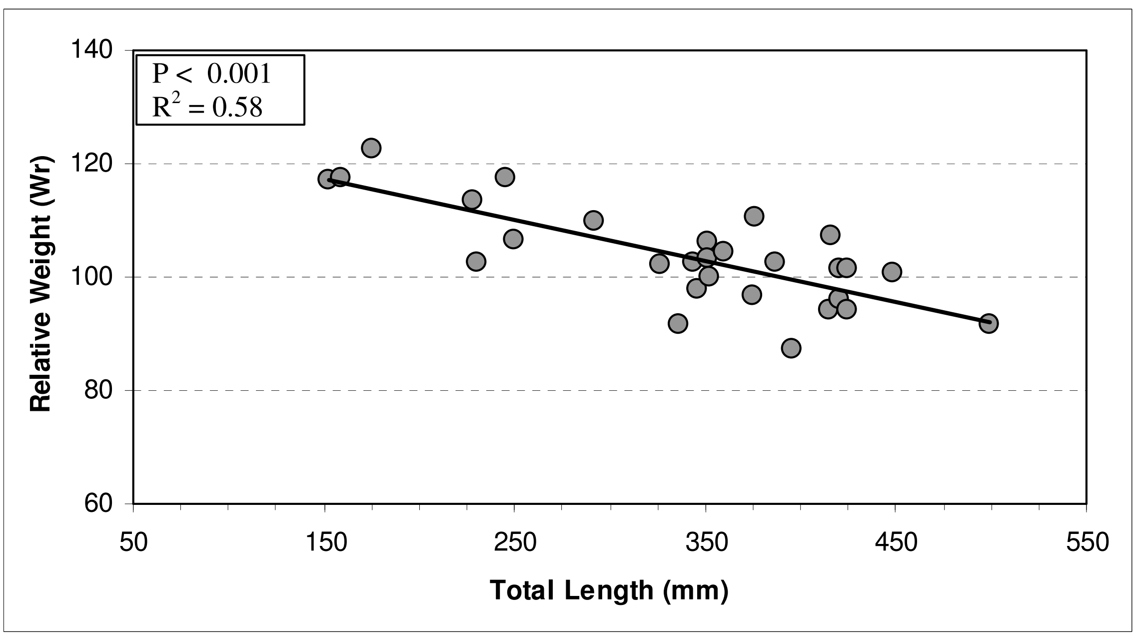
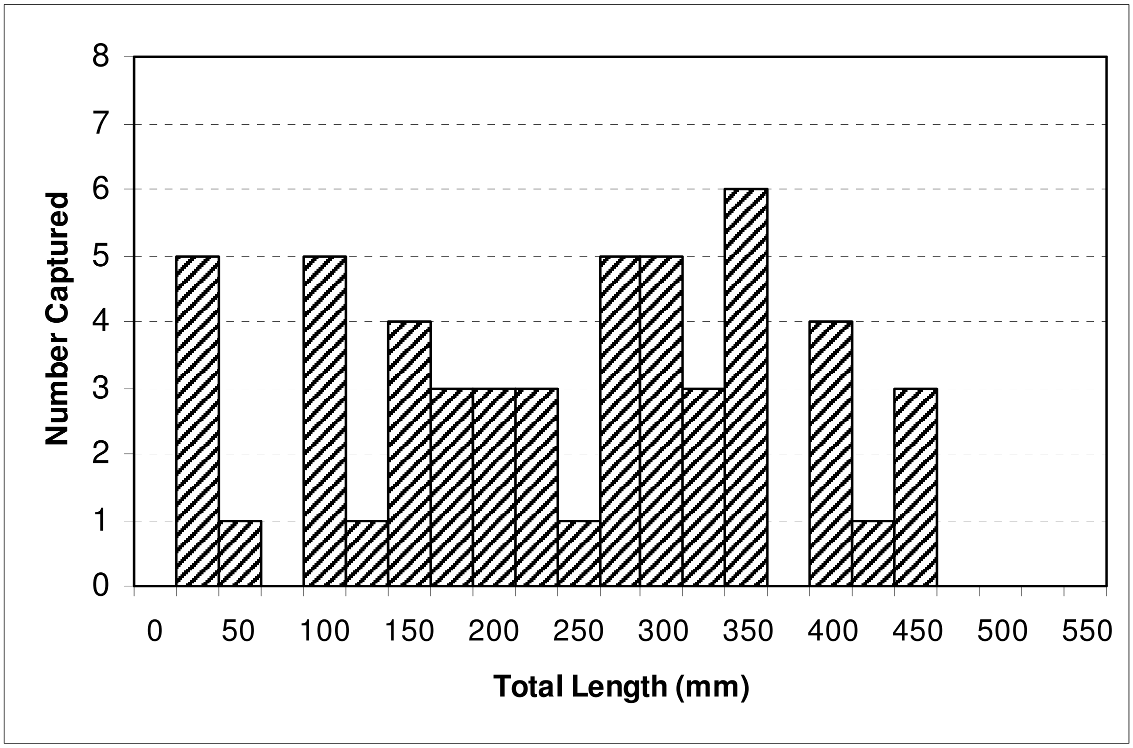


Figure 4. Length-frequency distribution (n = 276) and relationship of total length to relative weight (Wr; n = 28) for largemouth bass captured in Grassy Pond (Rindge) during August 2008.



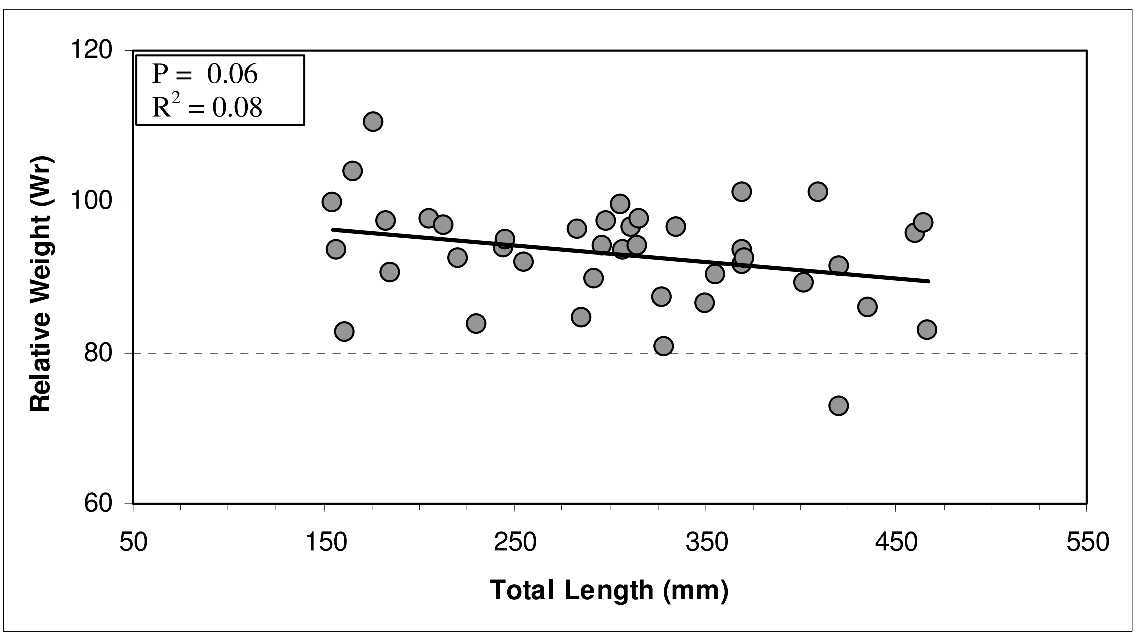


Figure 5. Length-frequency distribution (n = 53) and relationship of total length to relative weight (Wr; n = 41) for largemouth bass captured in Gregg Lake (Antrim) during July 2008.

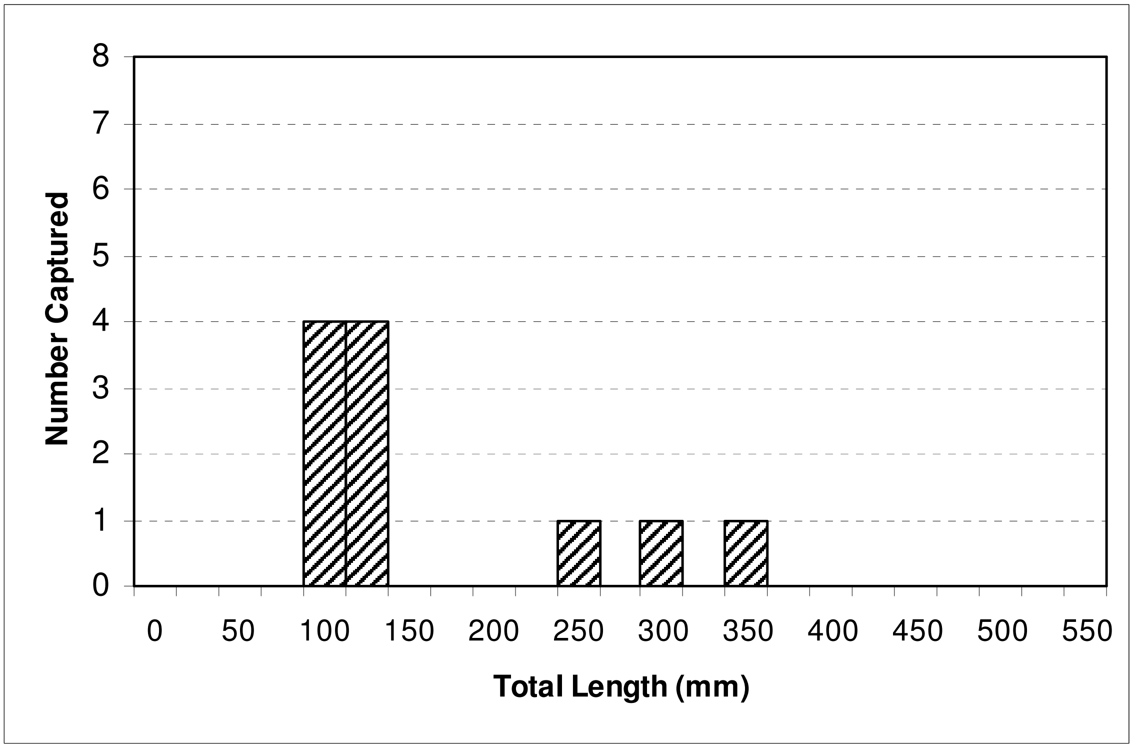
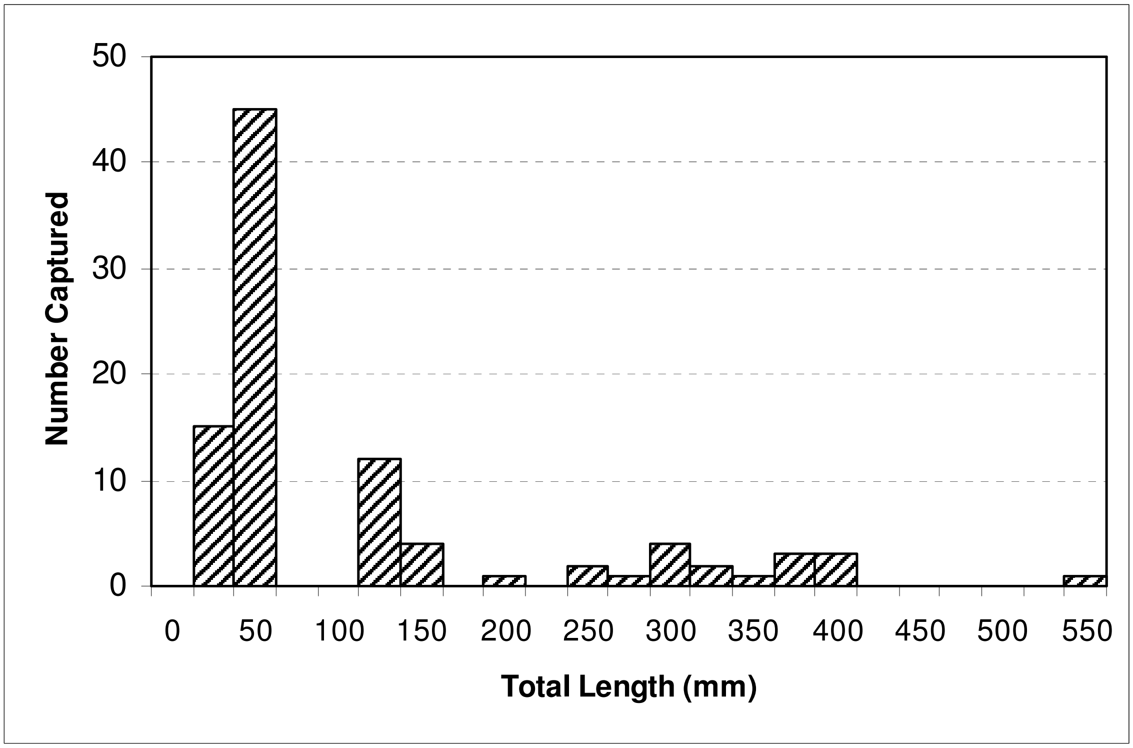


Figure 6. Length-frequency distribution (n = 11) for smallmouth bass captured in Gregg Lake (Antrim) during July 2008.



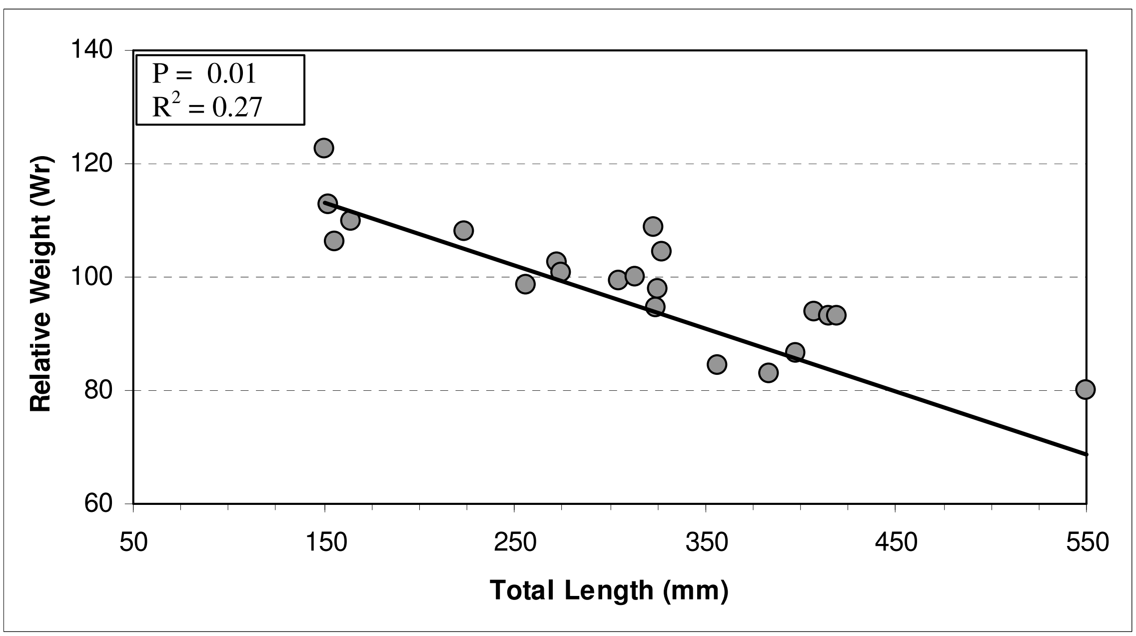


Figure 7. Length-frequency distribution (*n* = 94) and relationship of total length to relative weight (Wr; *n* = 22) for largemouth bass captured in Island Pond (Stoddard) during July 2008.

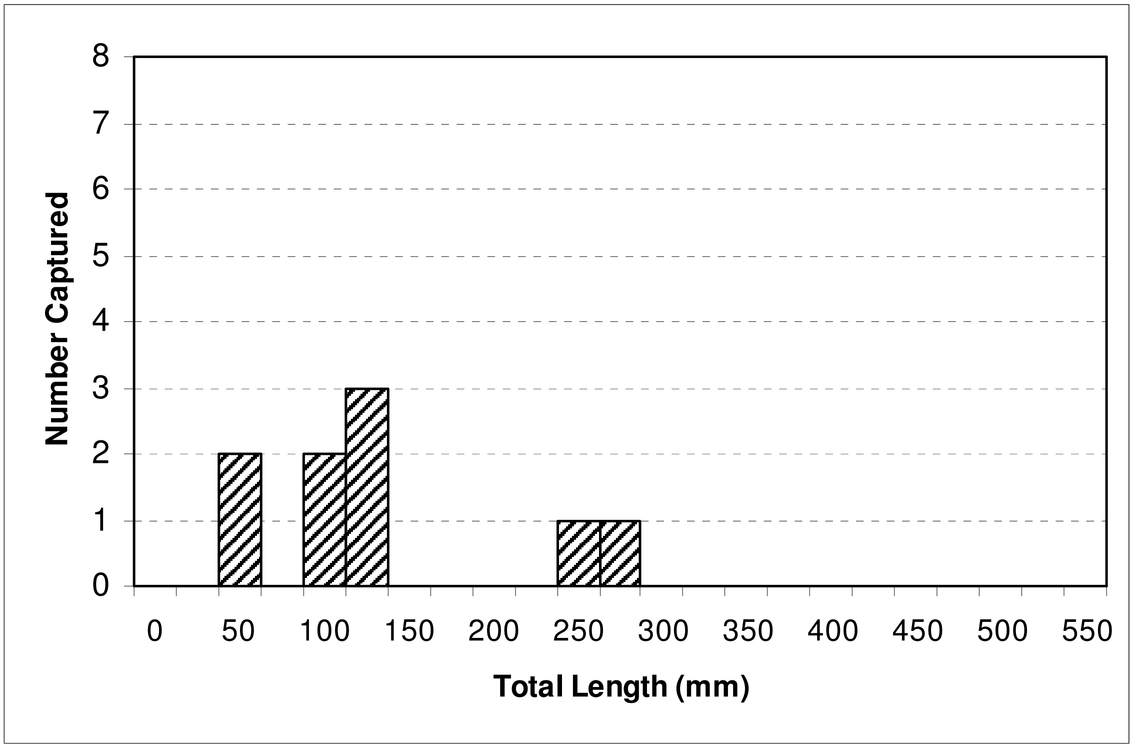
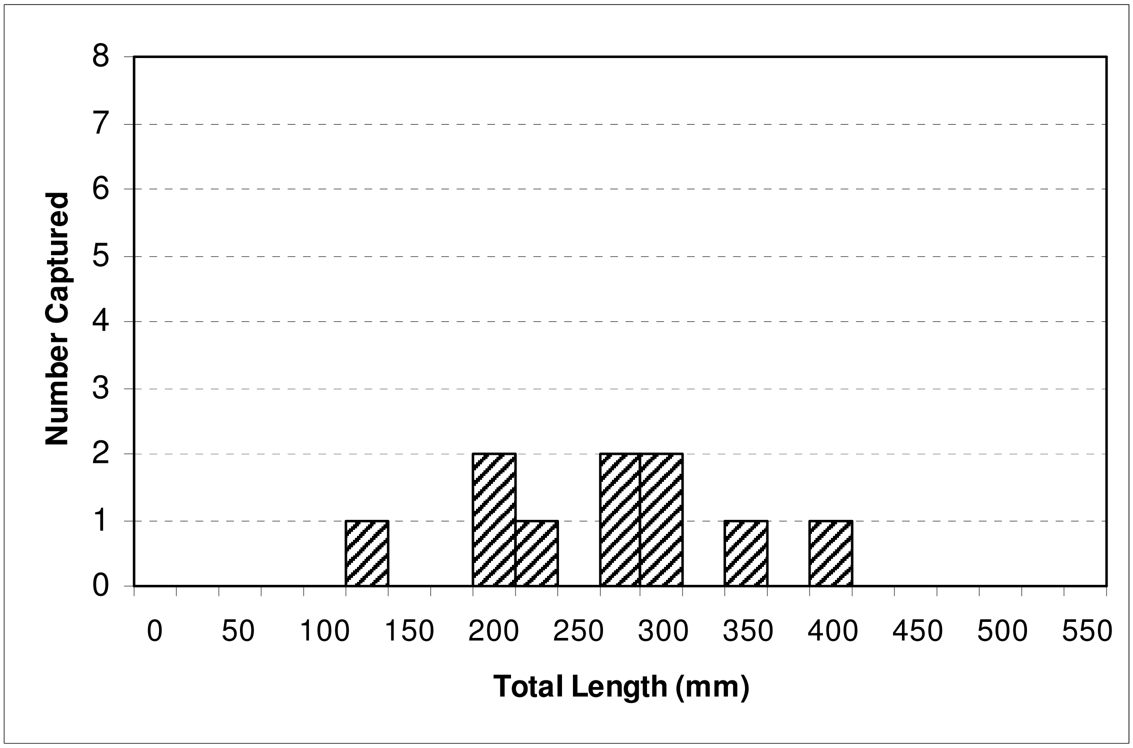


Figure 8. Length-frequency distribution (n = 9) for smallmouth bass captured in Island Pond (Stoddard) during July 2008.



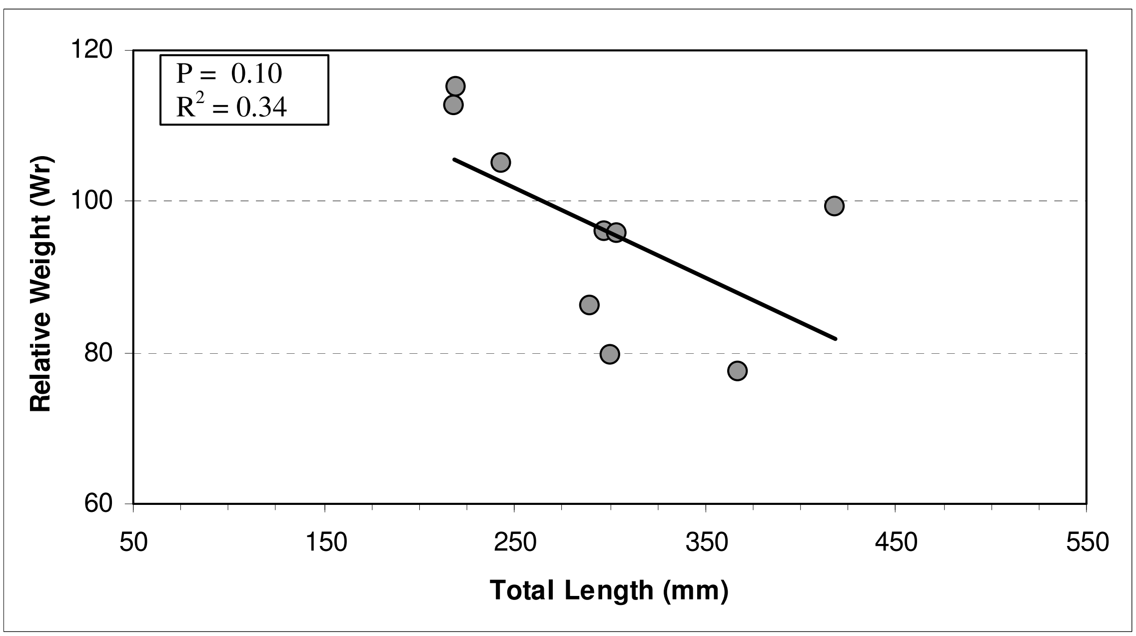
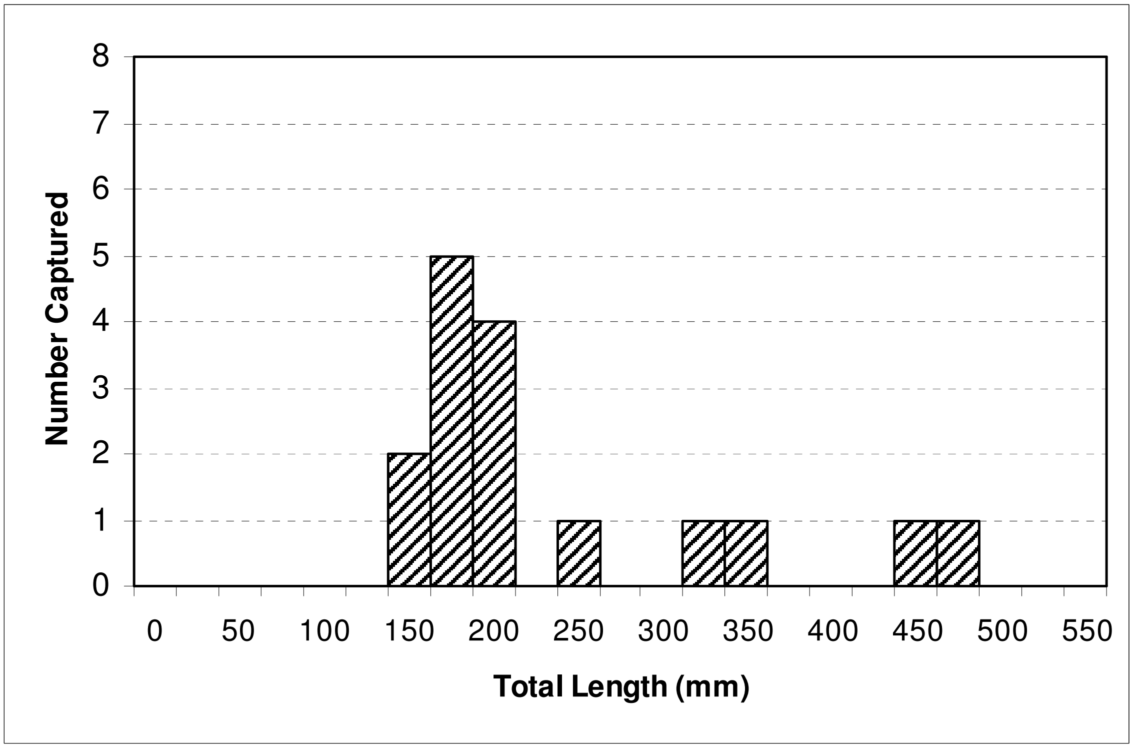


Figure 9. Length-frequency distribution (*n* = 10) and relationship of total length to relative weight (Wr; *n* = 9) for largemouth bass captured in Powwow Pond (Kingston) during June 2008.



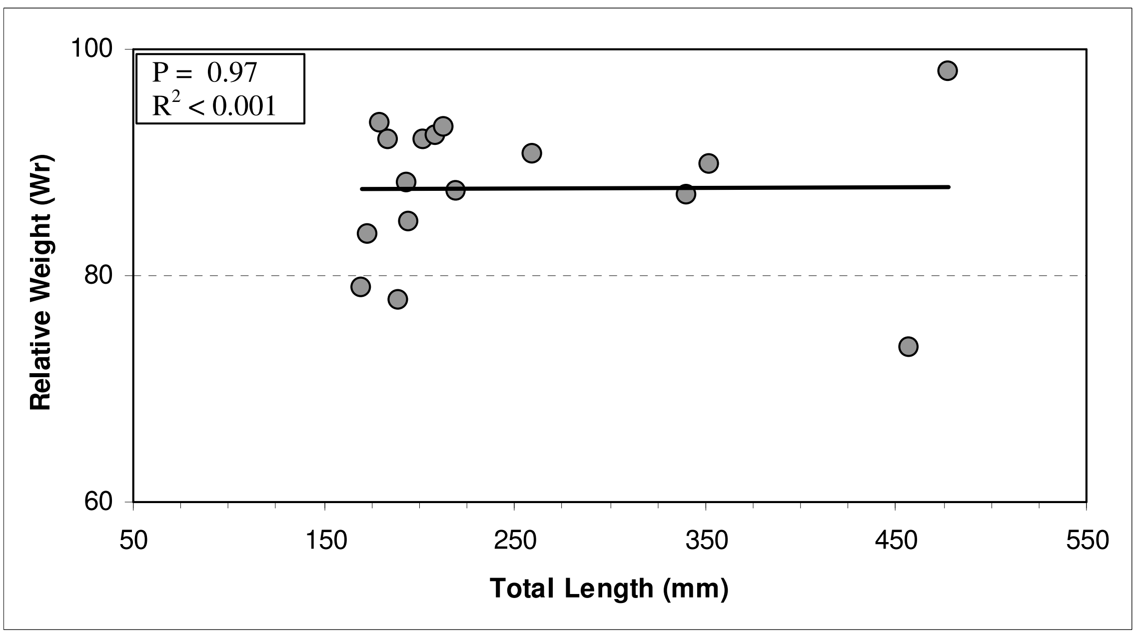
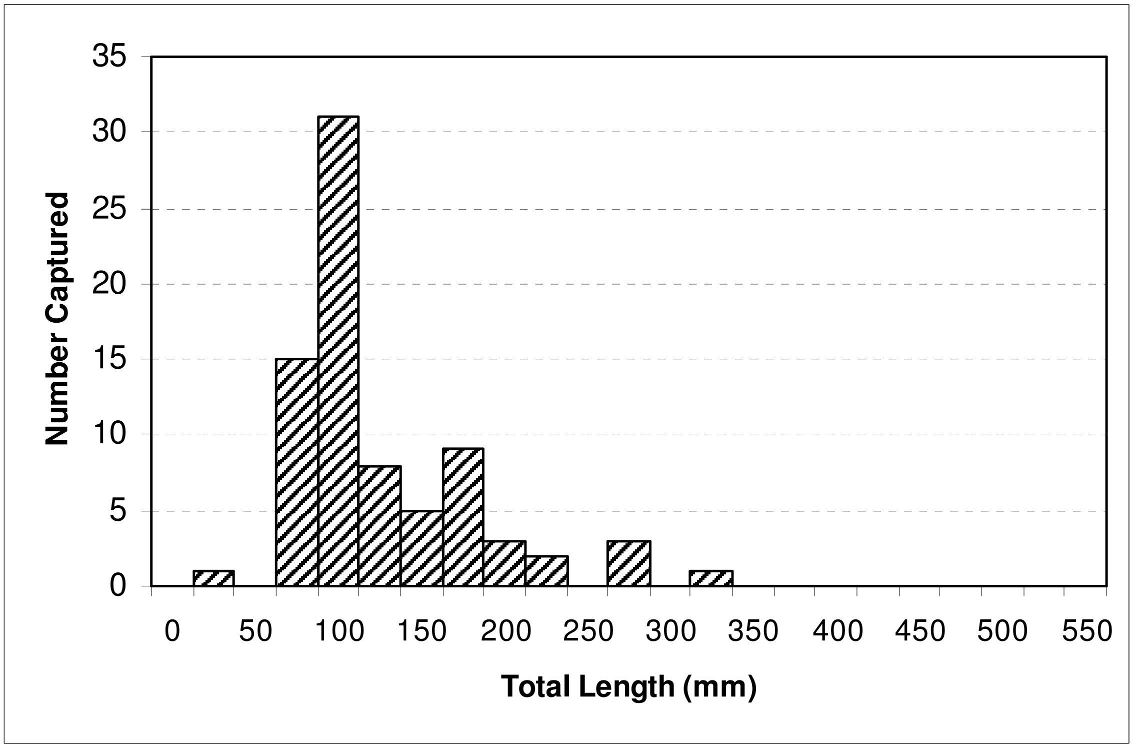


Figure 10. Length-frequency distribution (n = 16) and relationship of total length to relative weight (Wr; n = 16) for largemouth bass captured in Spofford Lake (Chesterfield) during July 2008.



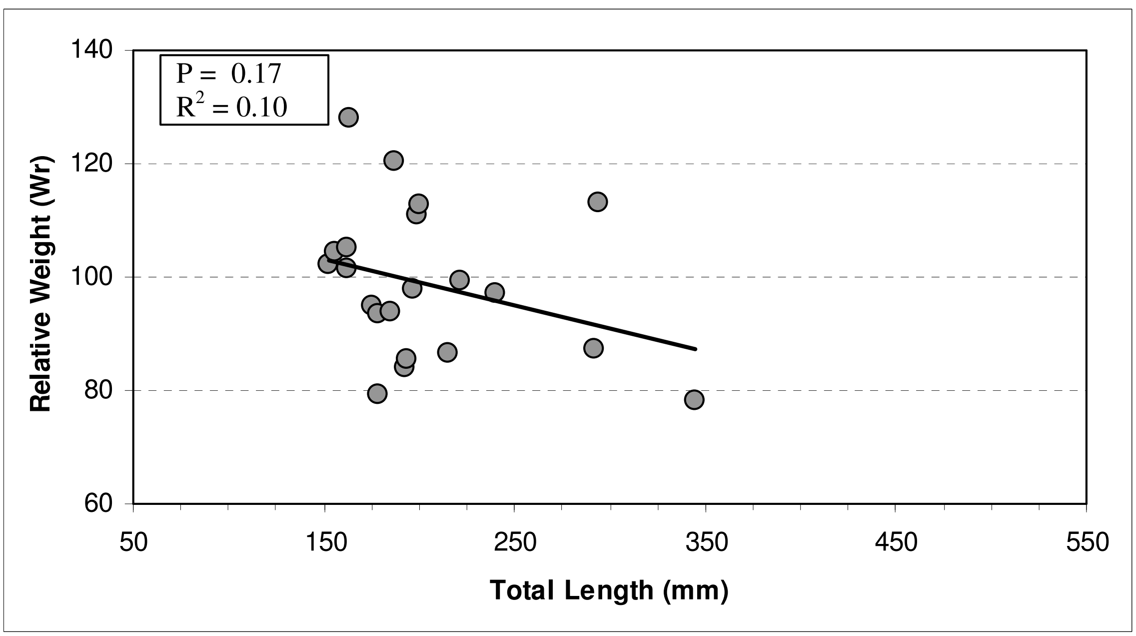


Figure 11. Length-frequency distribution (*n* = 78) and relationship of total length to relative weight (Wr; *n* = 21) for smallmouth bass captured in Spofford Lake (Chesterfield) during July 2008.

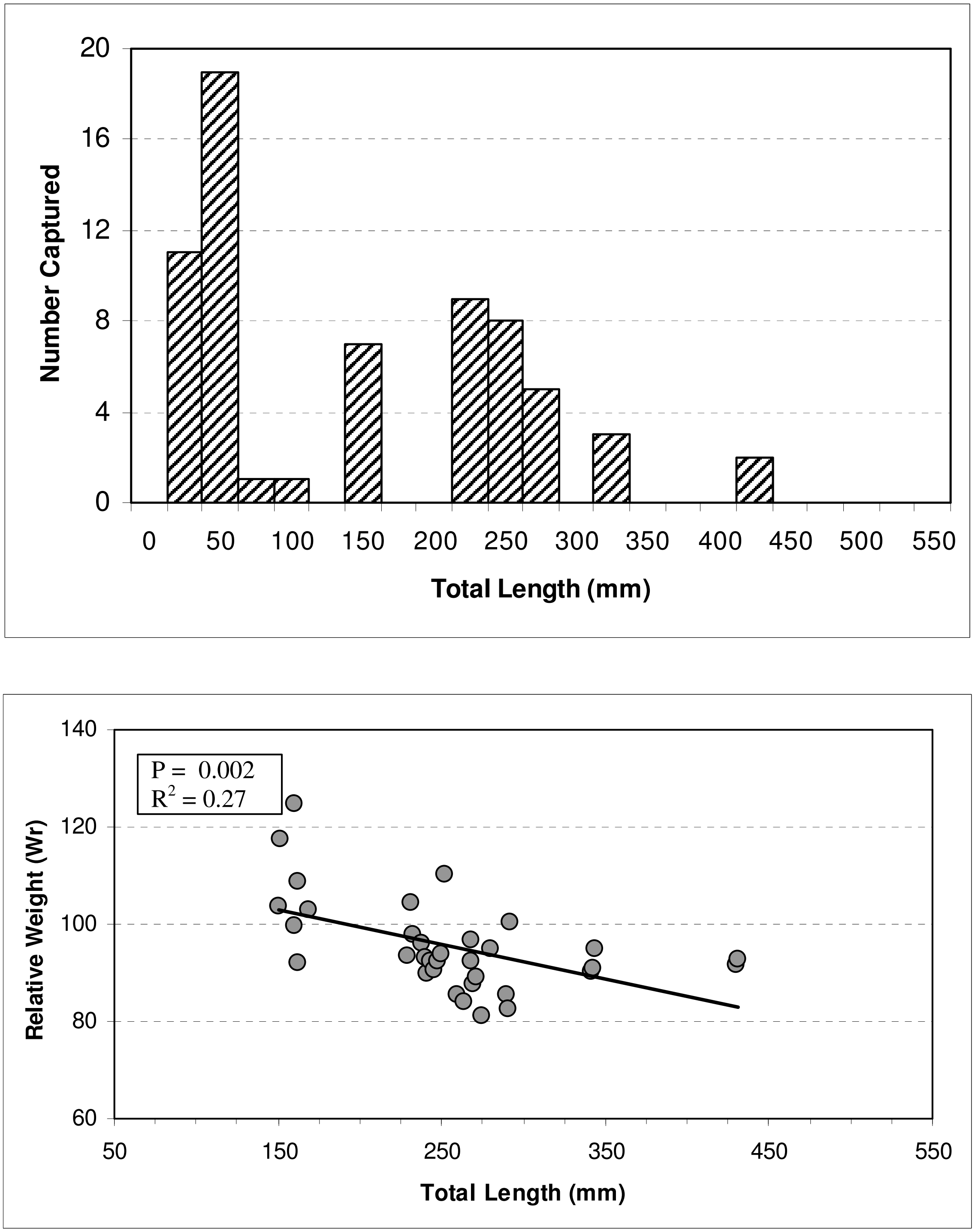


Figure 12. Length-frequency distribution (n = 66) and relationship of total length to relative weight (Wr; n = 34) for largemouth bass captured in Sunrise Lake (Middleton) during August 2008.

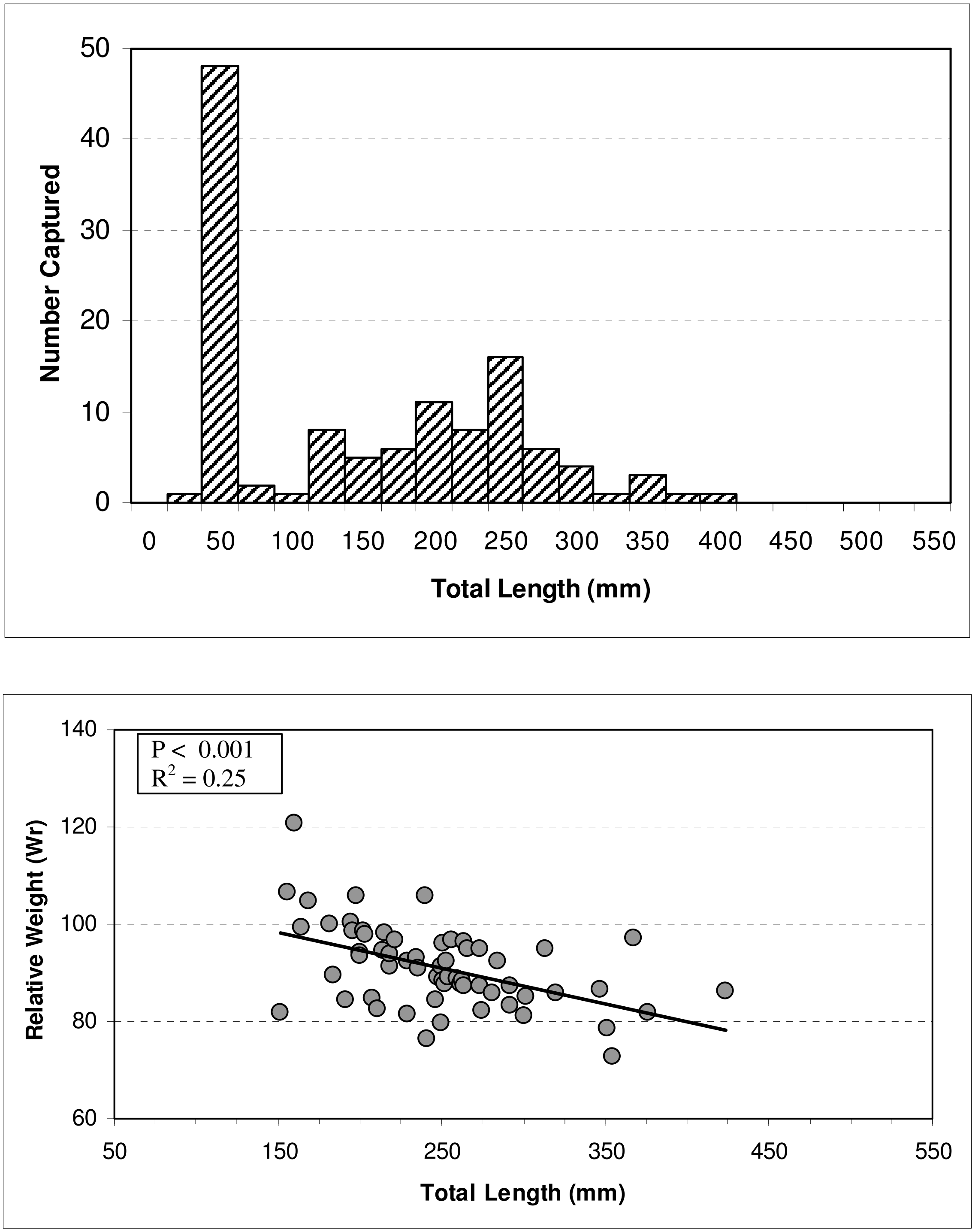
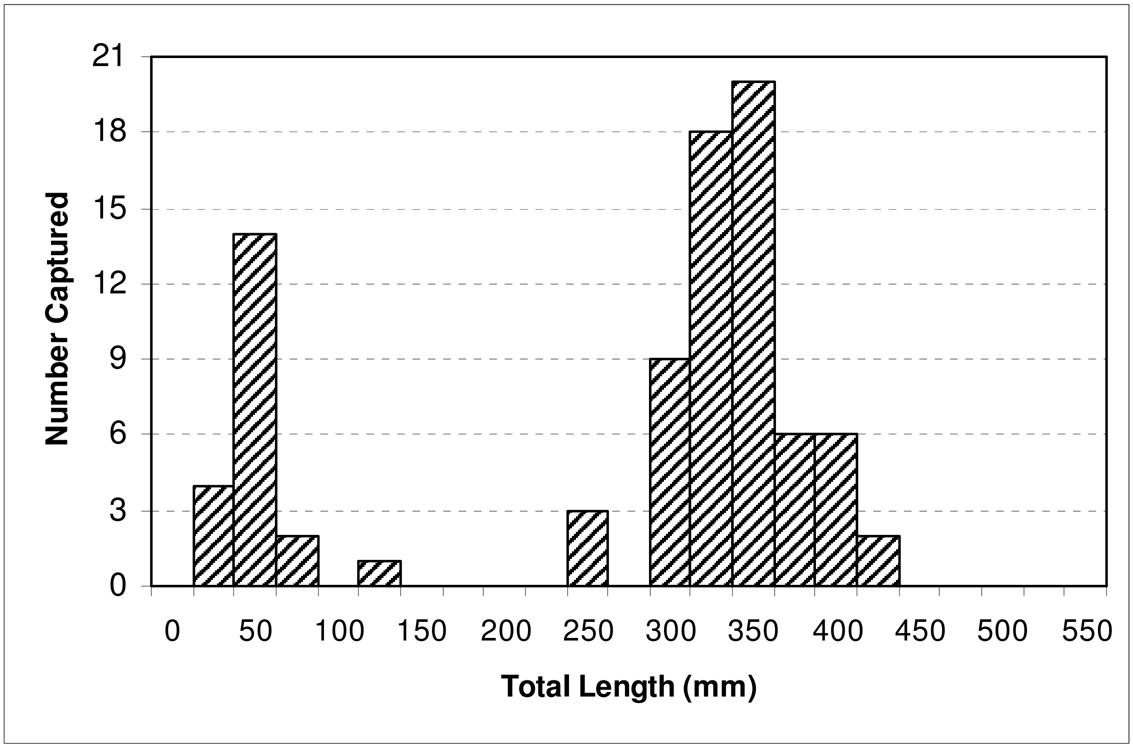


Figure 13. Length-frequency distribution (n = 122) and relationship of total length to relative weight (Wr; n = 61) for smallmouth bass captured in Sunrise Lake (Middleton) during August 2008.



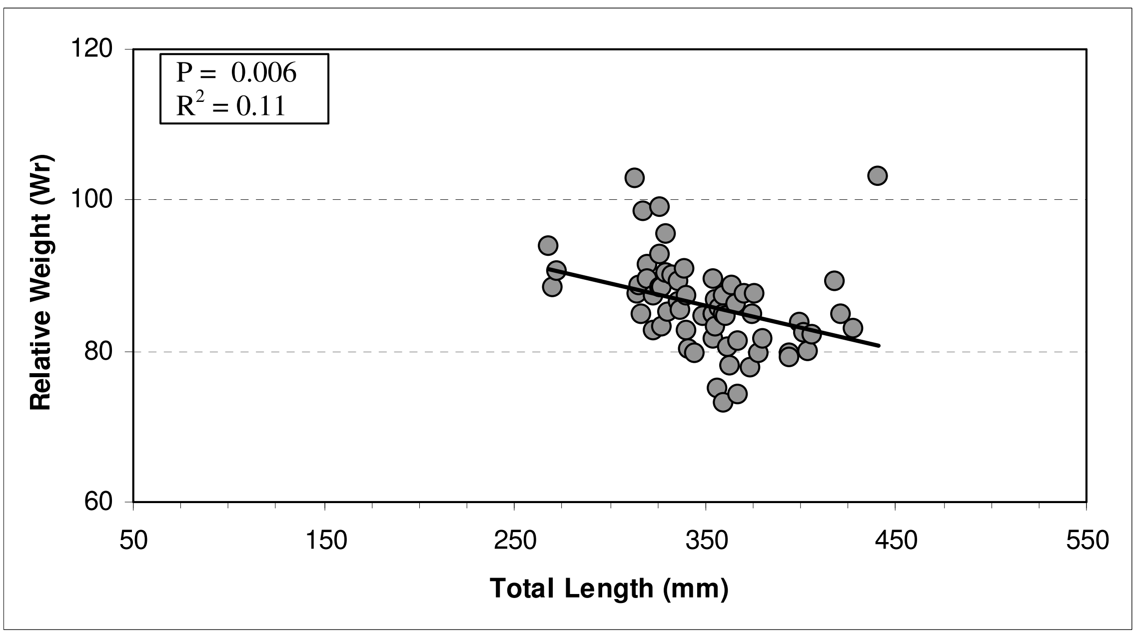


Figure 14. Length-frequency distribution (n = 85) and relationship of total length to relative weight (Wr; n = 64) for largemouth bass captured in Warren Lake (Alstead) during July 2008.

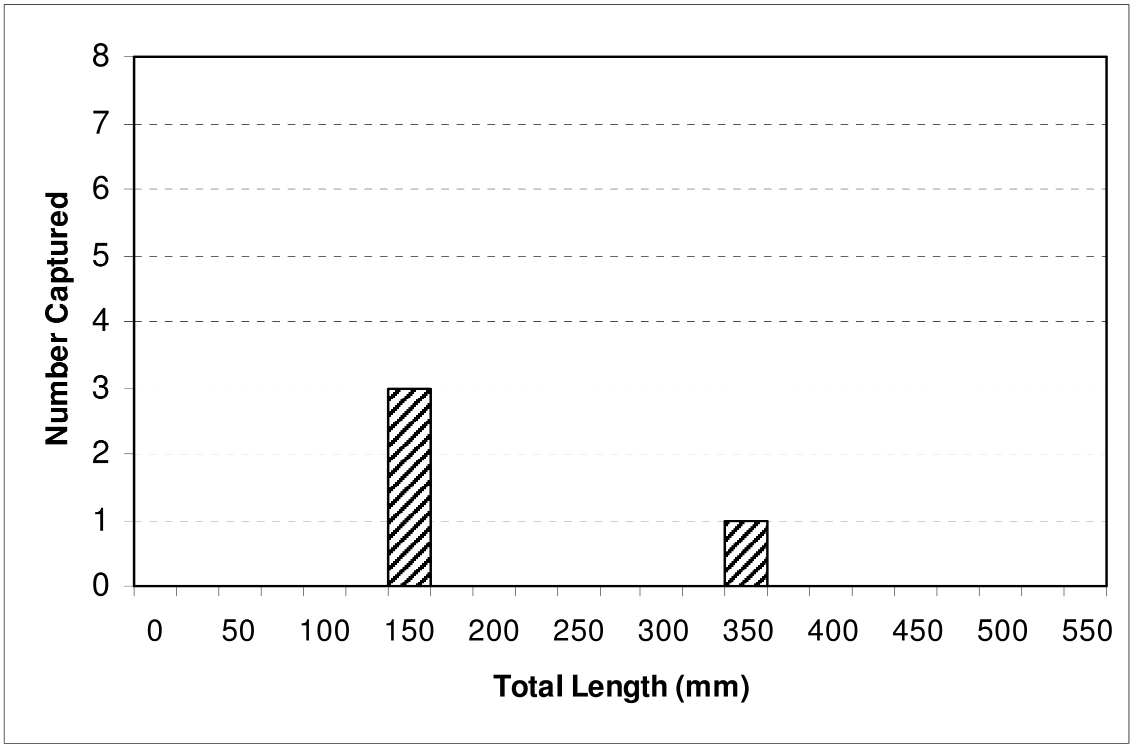


Figure 15. Length-frequency distribution (n = 4) for smallmouth bass captured in Warren Lake (Alstead) during July 2008.

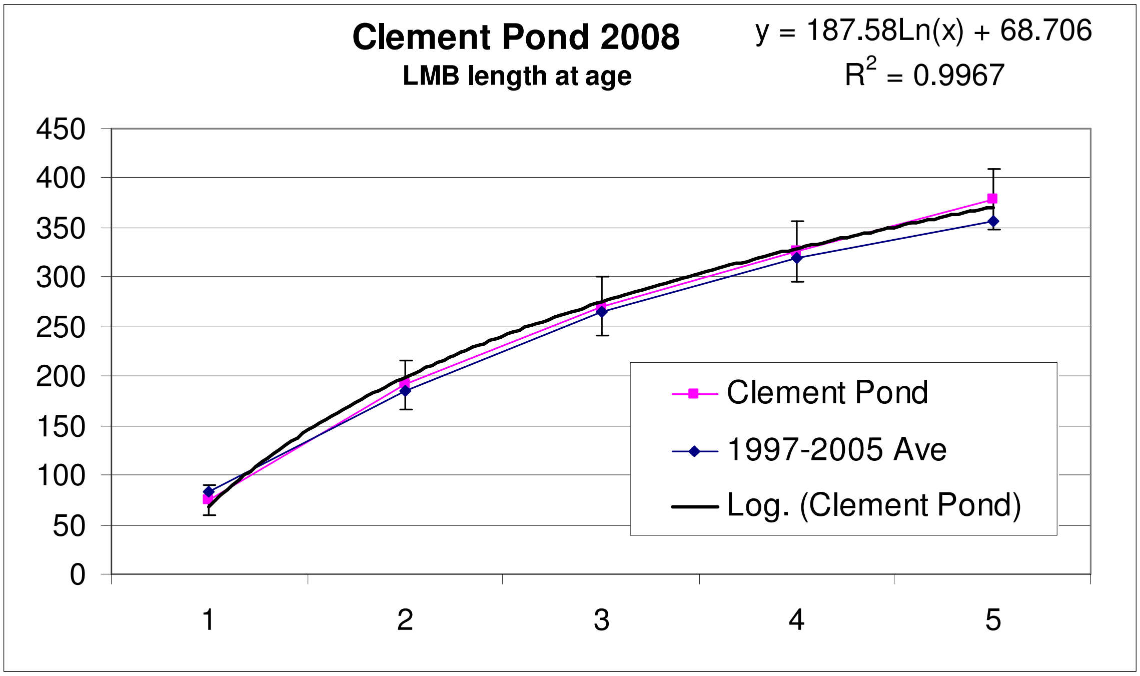


Figure 16. Average back-calculated length at age for largemouth bass from Clement Pond (Hopkinton) sampled in 2008 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for largemouth bass from 1997-2005 (from Racine 2006a).

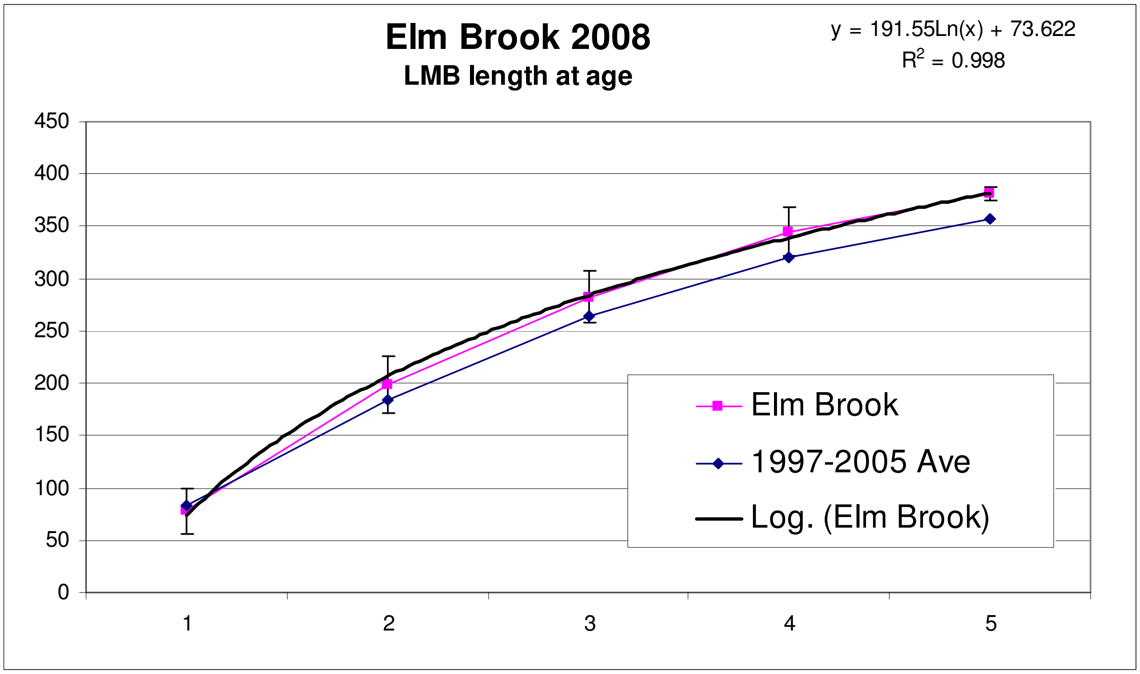


Figure 17. Average back-calculated length at age for largemouth bass from Elm Brook Pool (Hopkinton) sampled in 2008 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for largemouth bass from 1997-2005 (from Racine 2006a).

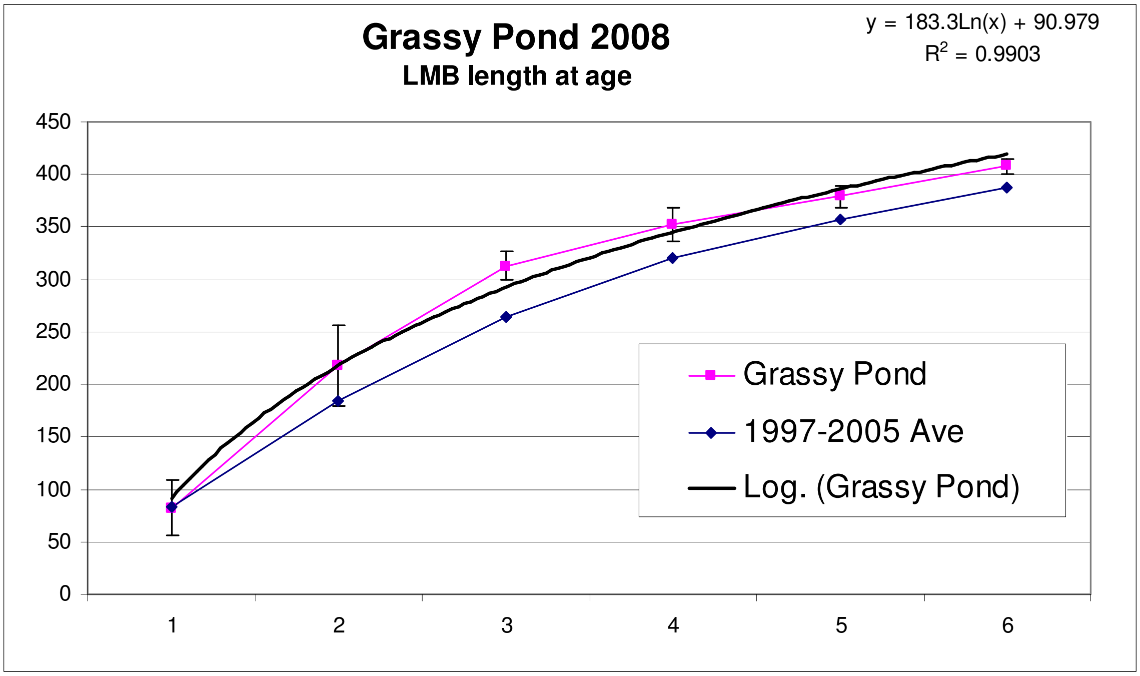


Figure 18. Average back-calculated length at age for largemouth bass from Grassy Pond (Rindge) sampled in 2008 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for largemouth bass from 1997-2005 (from Racine 2006a).

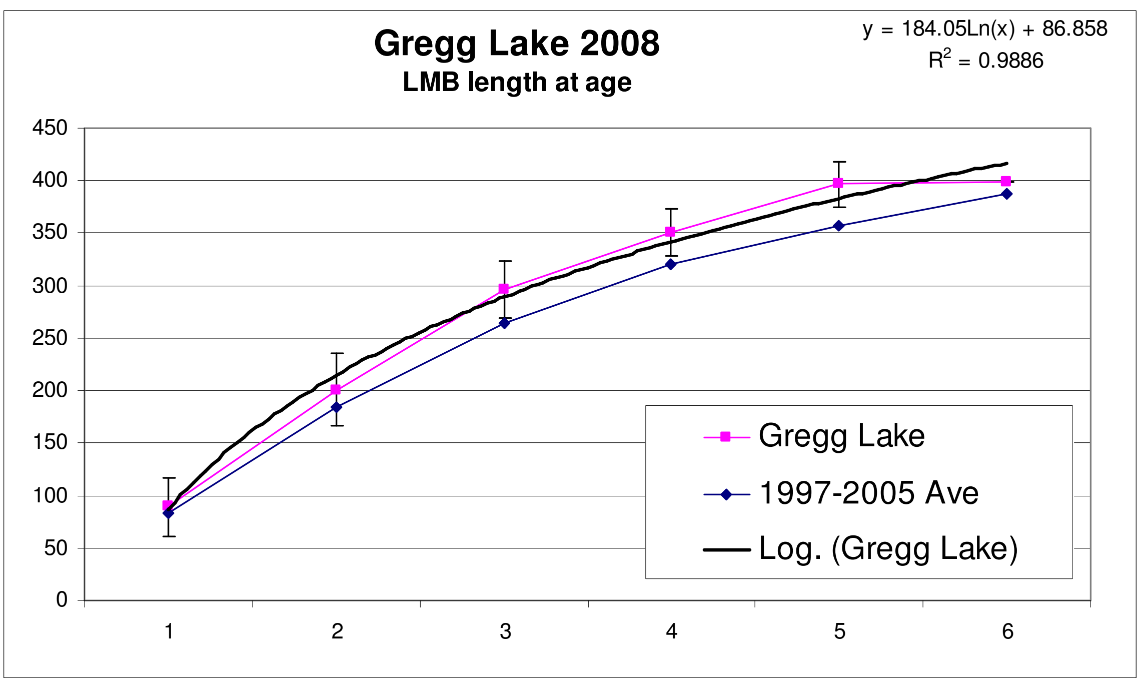


Figure 19. Average back-calculated length at age for largemouth bass from Gregg Lake (Antrim) sampled in 2008 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for largemouth bass from 1997-2005 (from Racine 2006a).

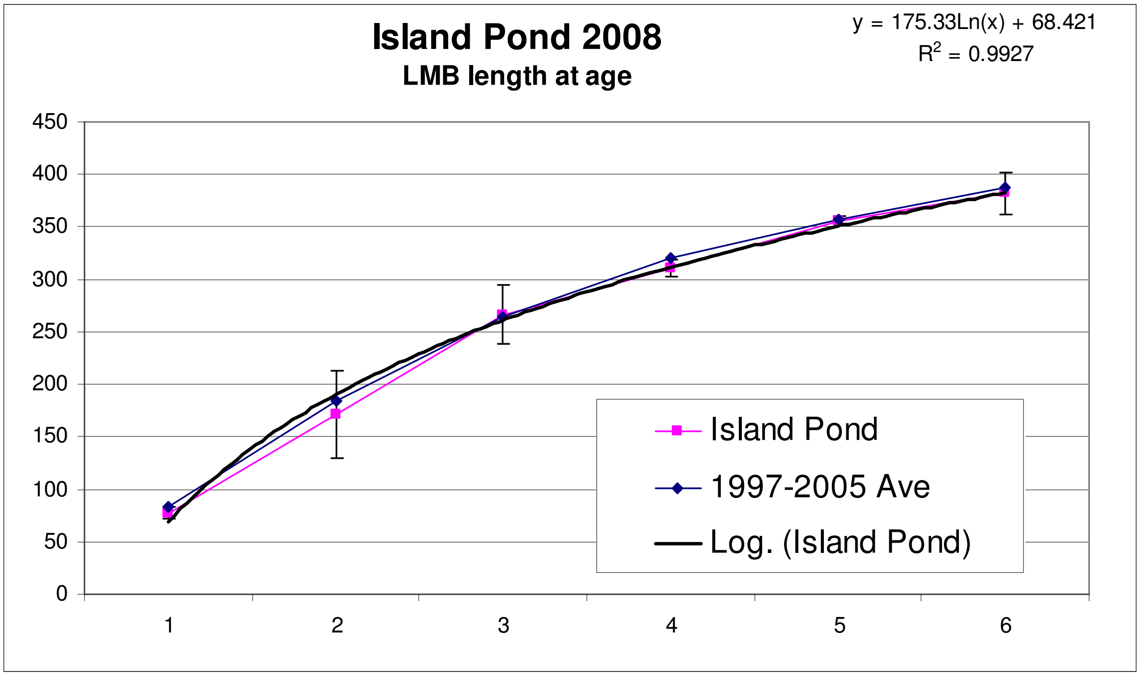


Figure 20. Average back-calculated length at age for largemouth bass from Island Pond (Stoddard) sampled in 2008 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for largemouth bass from 1997-2005 (from Racine 2006a).

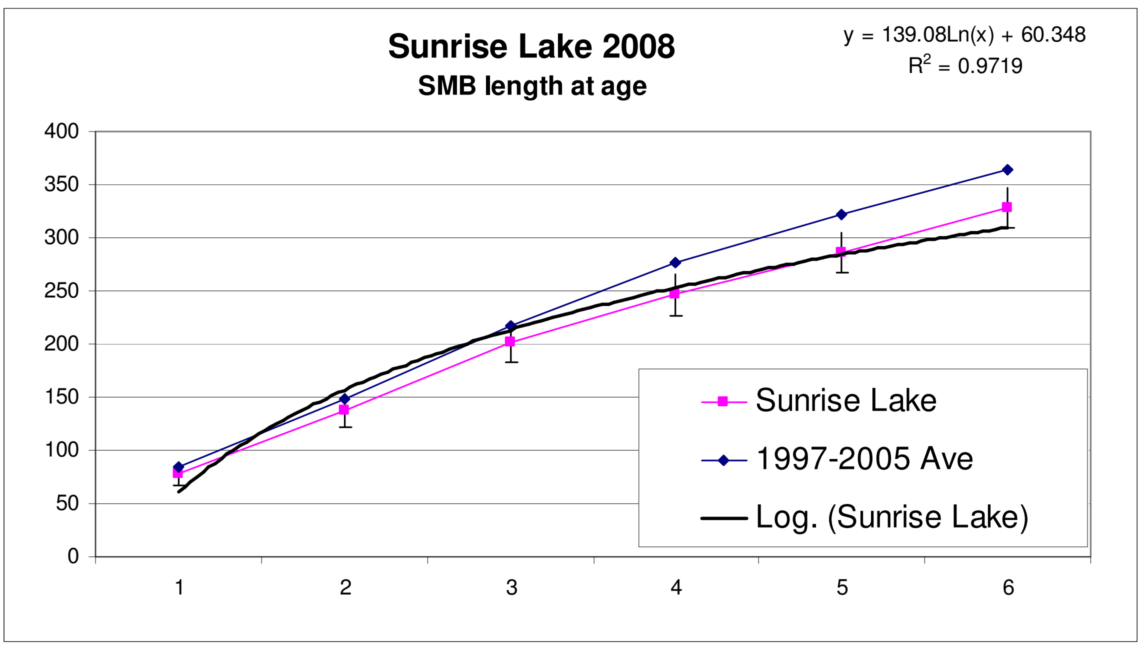


Figure 21. Average back-calculated length at age for smallmouth bass from Sunrise Lake (Middleton) sampled in 2008 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for smallmouth bass from 1997-2005 (from Racine 2006a).

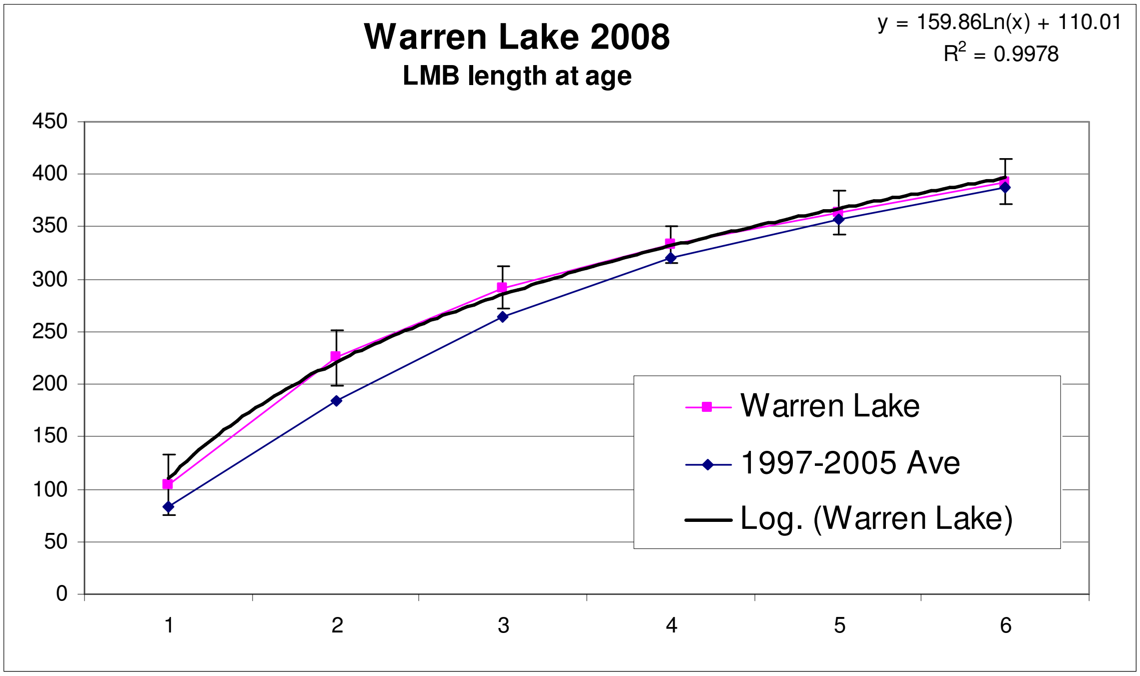
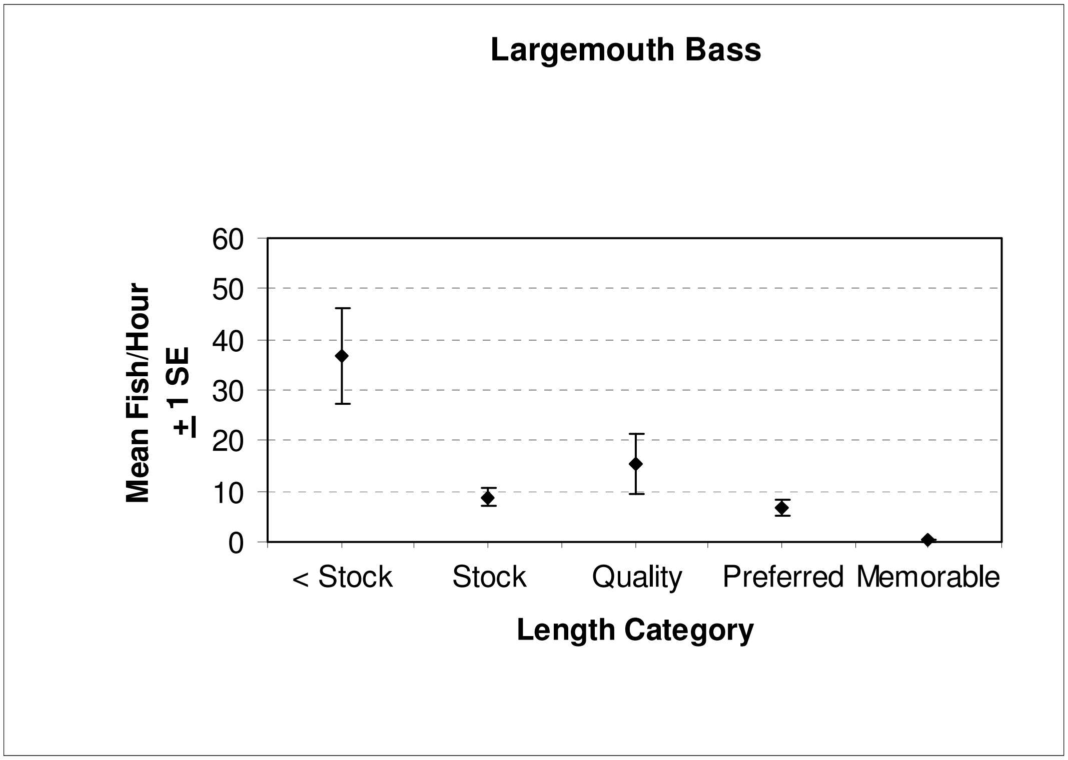


Figure 22. Average back-calculated length at age for largemouth bass from Warren Lake (Alstead) sampled in 2008 (± 1 SD), corresponding logarithmic trendline and equation, and statewide average back-calculated length at age for largemouth bass from 1997-2005 (from Racine 2006a).



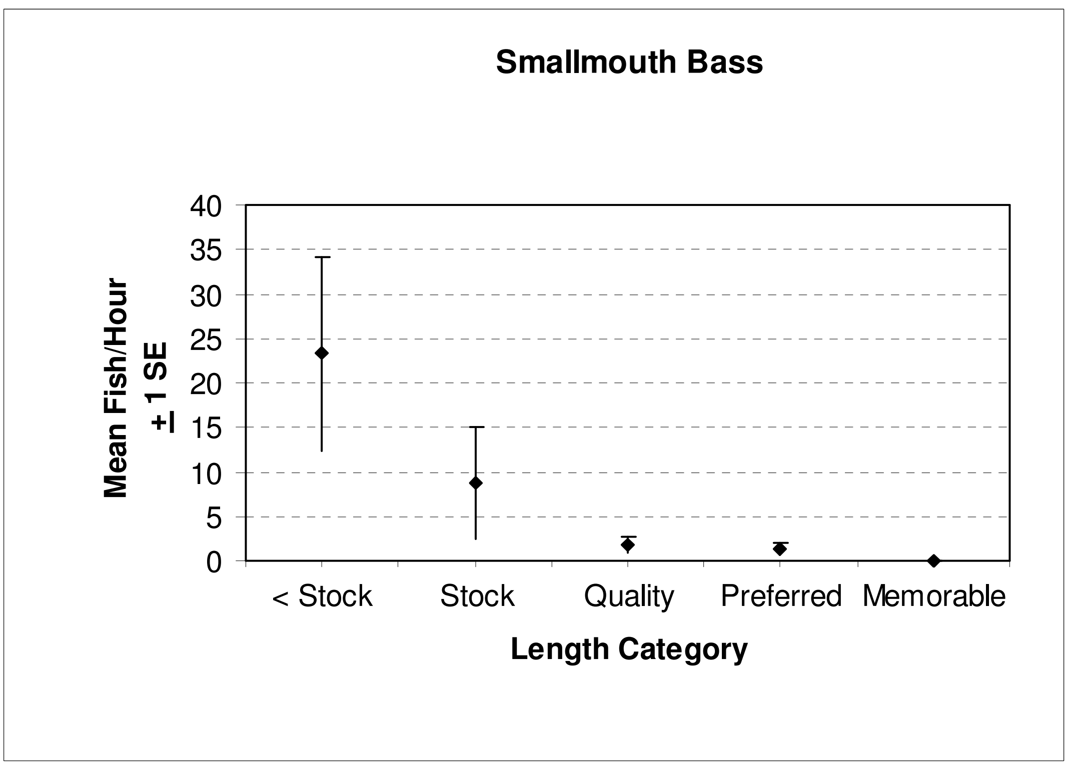


Figure 23. Mean relative abundance values (fish/hour) and one standard error for largemouth and smallmouth bass captured during electrofishing surveys in 2008 by length category (refer to Table 6a and 6b).