Admin # 177

AR-86 -
(Also AR-177) -

WARMWATER FISH POPULATION ASSESSMENTS IN NEW HAMPSHIRE (2007)

STATE:	New Hampshire
GRANT:	F-50-R-24
GRANT TITLE:	Anadromous and Inland Fisheries Operational Management Investigations
JOB 10:	Warmwater and Coolwater Fisheries Population Assessments
PERIOD COVERED:	July 1, 2007 – June 30, 2008

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This project was funded in part by the purchase of fishing equipment and motorboat fuels through the Federal Sport Fish Restoration Program.

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 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, 198,000 anglers fished 2.733 million days for warmwater species in New Hampshire (panfish: 30,000 anglers fished 339,000 days; black bass: 105,000 anglers fished 1.264 million 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 44% of New Hampshire's freshwater anglers and 38% of the total days of fishing. Since the average trip expenditure for anglers fishing in New Hampshire is $24 per day, the total estimated expenditures by anglers fishing for warmwater species equals approximately $33.6 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 2007 with all data analyses and summaries contained in this report. This report includes a summary of ten assessments conducted in Region 4 and two conducted in Region 3 during 2007: Connecticut River (Chesterfield and Walpole), Fullham Pond (Winchester), Gilmore Pond (Jaffrey), Gould Pond (Hillsboro), Grassy Pond (Rindge), Massasecum Lake (Bradford), May Pond (Washington), Merrimack River (Concord), Pisgah Reservoir (Winchester), Rocky Pond (Loudon), and Sunset Lake (Greenfield) (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 sampled by boat electrofishing or by New Hampshire design fyke nets. Fyke net sampling was conducted by setting nets around the shoreline of a water body. Nets were checked after 24 to 48 hours and all 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.

Fish collected by boat electrofishing (Smith-Root SR18) were sampled after sunset using three netters. Electrofishing equipment was adjusted according to water conductivity and observed fish behavior relative to their position in the electrode's field. The study design incorporated timed runs of 500 seconds and 1000 seconds using the equipment's "on" meter time when sampling for target species (black bass or other pre-determined species) and random or community runs, which were 250 seconds in duration, to assess the other fish species in the lake. Historically, community runs were typically 500 seconds in duration. Community sampling time in 2007 was changed to assess the relationship between sampling effort and community composition, relative abundance (fish/hr) and total length. Black bass or other target species were captured during both target and community runs. Historically, five runs were conducted during an evening, two of which were community collections. Because community run times in 2007 were cut in half, the number of community runs was doubled. 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 (total length). 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

Efficiency

Community sampling time in 2007 was changed to assess the relationship between sampling effort and community composition, relative abundance (fish/hr) and total length in the Connecticut River (North Walpole), Connecticut River (West Chesterfield), May Pond (Washington), and Merrimack River (Concord). At least 75% of all detected species were found within 1000 seconds in all waterbodies. Species with low relative abundance were sampled less frequently. Community runs lasting 500 seconds were adequate to ascertain relative abundance as "No significant difference was detected among sampling run CPUE for black crappie (n = 2, Kruskal Wallis Test, chi-square = 5.14, P = 0.642), bluegill (n = 3, Kruskal Wallis Test, chi-square = 2.74, P = 0.908), common sunfish (n = 3, F = 0.52, P = 0.81), common white sucker (n = 3, F = 0.28, P = 0.95), eastern chain pickerel (n = 3, F= 0.56, P = 0.78), fall fish (n=3, Kruskal Wallis

Test, chi-square = 3.05, P = 0.881), golden shiner (*n* = 3, Kruskal Wallis Test, chi-square = 2.01, P = 0.959), largemouth bass (*n* = 4, Kruskal Wallis Test, chi-square = 2.91, P = 0.893), rock bass (*n* = 3, F = 2.16, P = 0.096), redbreast sunfish (n = 3, F = 1.22, P = 0.348), spottail shiner (*n* = 3, F = 0.349, P = 0.919), tessellated darter (*n* = 2, Kruskal Wallis Test, chi-square = 10.74, P = 0.15), or yellow perch (*n* = 4, Kruskal Wallis Test, chi-square = 10.27, P = 0.174) (Dexter, 2008, p. 5)." Smallmouth bass and brown bullheads were sampled sporadically and with low abundances. Finally, 500 seconds of sampling time was adequate to obtain representative lengths and weights for all detectable species. Since current community runs total 1000 seconds, Dexter (2008) does not recommend increasing the community run sample times.

Connecticut River (North Walpole)

The Connecticut River was surveyed on August 9. One target species run and eight community species runs were conducted (Table 2). A total of 88 largemouth bass and 23 smallmouth bass were sampled (Figure 1 and 2). The PSD for largemouth bass was 93 (lower and upper 80% CI's: 61, 95; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was 63 (lower and upper 80% CI's: 34, 85; 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 all size fish when compared to statewide mean values (Racine, 2006b). Mean relative weight values for smallmouth bass were higher for all size categories of 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 significant with a negative trend, but the variation was poorly explained (P = 0.009; R^2 = 0.26; Figure 2).

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 Tables 5a and 5b and Figures 18 and 19. Largemouth bass growth was categorized as average when compared to fish sampled from New Hampshire water bodies during 1997-2005. Average length at age was above statewide values (1997-2005) for largemouth bass aged 3-4 and below statewide valued for ages 1-2 and 5-6. Largemouth bass took an average of 3.56 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2005) (Racine, 2006a). Smallmouth bass growth was categorized as fast when compared to fish sampled from New Hampshire water bodies during 1997-2005. Average length at age was above statewide values (1997-2005) for all ages of smallmouth bass. Smallmouth bass took an average of 3.12 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 each length category except for stock, quality, 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 except for stock size fish when compared when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch (*Perca flavescens*), spottail shiner (*Notropis hudsonius*), golden shiner (*Notemigonus crysoleucas*), pumpkinseed (*Lepomis gibbosus*), tessellated darter (*Etheostoma olmstedi*), common white sucker (*Catostomus commersoni*) and chain pickerel (*Esox niger*), bluegill (*Lepomis macrochirus*) and northern pike (*Esox lucius*), fallfish (*Semotilus corporalis*), redbreast sunfish (*Lepomis auritus*) and brown bullhead (*Ameiurus nebulosus*), and walleye (*Sander vitreus*) (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Connecticut River (West Chesterfield)

The Connecticut River was surveyed on September 4. Eight community species runs were conducted (Table 2). A total of 7 largemouth bass and 67 smallmouth bass were sampled (Figure 3 and 4). The PSD for largemouth bass was not calculated due to small sample size (Table 3a). The PSD for smallmouth bass was 50 (lower and upper 80% CI's: 20, 80; Table 3b) compared to the statewide mean of 43 (Racine, 2006b). Mean relative weight values for largemouth bass were not calculated due to small sample size. Mean relative weight values for smallmouth bass were calculated by length category (Table 4b). Mean relative weight values for smallmouth bass were higher for all size categories of fish when compared to statewide mean values (Racine, 2006b). The relationship between smallmouth bass total length and relative weight was significant with a negative trend, but the variation was poorly explained ($P = 0.07$; $R^2 = 0.26$; Figure 4).

Bass scales were not collected for ageing purposes.

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 preferred size fish when compared to statewide mean (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: spottail shiner, fallfish, yellow perch, bluegill, common white sucker, black crappie (*Pomoxis nigromaculatus*) and tessellated darter, and pumpkinseed (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Fullham Pond (Winchester)

Fullham Pond was surveyed in June. Three fyke nets were set on June 26 and retrieved 24 hours later (Table 2). No black bass were captured. Fyke nets captured the following species: golden shiners, pumpkinseed, yellow perch, brown bullhead and common white sucker, chain pickerel, and yellow bullhead (*Ameiurus natalis*) (Figure 29).

Gilmore Pond (Jaffrey)

Gilmore Pond was surveyed on July 12. Three target species runs and two community species runs were conducted (Table 2). A total of 25 largemouth bass and 1 smallmouth bass were sampled (Figure 5 and 6). The PSD for largemouth bass was 100 (lower and upper 80% CI's: 79, 100; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was not calculated due to small sample size (Table 3b). 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 memorable size fish and lower for preferred size fish when compared to statewide mean values (Racine, 2006b). Mean relative weight values for smallmouth bass were not calculated due to small sample size. The relationship between largemouth bass total length and relative weight was significant with a negative trend, but the variation was poorly explained ($P = 0.002$; $R^2 = 0.36$; Figure 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 and smallmouth bass are presented in Tables 5a and 5b and Figure 20. Largemouth bass growth was categorized as average when compared to fish from New Hampshire water bodies sampled during 1997-2005. Average length at age was above statewide values (1997-2005) for age 3 largemouth bass and below statewide valued for ages 1-2 and 4-5. Largemouth bass took an average of 3.82 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 analyzed due to small sample size.

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). Mean relative abundance estimates for smallmouth bass were not calculated due to low sample size. Community samples produced in decreasing order of relative abundance: pumpkinseed, bluegill, yellow perch, yellow bullhead, brown bullhead and chain pickerel (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Gould Pond (Hillsboro)

Gould Pond was surveyed on July 24. Two target species runs and two community species runs were conducted (Table 2). A total of 52 largemouth bass were sampled (Figure 7). The PSD for largemouth bass was 46 (lower and upper 80% CI's: 37, 60;

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 ($P = 0.004$; $R^2 = 0.38$; Figure 7).

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for largemouth bass are presented in Table 5a and Figure 21. Largemouth bass growth was categorized as fast when compared to fish from New Hampshire water bodies sampled during 1997-2005. Average length at age was above statewide values (1997-2005) for largemouth bass aged 2, 3, and 5 and below statewide valued for ages 1 and 4. Largemouth bass took an average of 3.27 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, bluegill, chain pickerel, golden shiner redbreast sunfish, and common shiner (*Luxilus cornutus*), and fallfish (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 July 5. One target species run (500 seconds) and one community species run (500 seconds) were conducted (Table 2). A total of 27 largemouth bass were sampled (Figure 8). The PSD for largemouth bass was 52 (lower and upper 80% CI's: 38, 66; 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 all size fish when compared to statewide mean values (Racine, 2006b). The relationship between largemouth bass total length and relative weight was significant ($P = 0.002$; $R^2 = 0.36$; 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 Tables 5a and Figure 22. Largemouth bass growth was categorized as fast when compared to fish from New Hampshire water bodies sampled during 1997-2005. Average length at age was below statewide values (1997-2005) for age 1 largemouth bass and above statewide valued for ages 2-6. Largemouth bass took an average of 3.16 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 size fish when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch, pumpkinseed, golden shiner, lake chub (*Couesius plumbeus*), and brown bullhead (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Massasecum Lake (Bradford)

Massasecum Lake was surveyed on July 26. Two target species runs and two community species runs were conducted (Table 2). A total of 54 largemouth bass and 1 smallmouth bass were sampled (Figure 9 and 10). The PSD for largemouth bass was 60 (lower and upper 80% CI's: 47, 72; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was not calculated due to small sample size (Table 3b). 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 quality size fish and higher for stock and preferred size fish when compared to statewide mean values (Racine, 2006b). Mean relative weight values for smallmouth bass were higher 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 ($P < 0.001$; $R^2 = 0.30$; Figure 9). The relationship between smallmouth bass total length and relative weight was not calculated due to small sample size (Figure 10).

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 Tables 5a and 5b and Figure 23. Largemouth bass growth was categorized as slow when compared to fish from New Hampshire water bodies sampled during 1997-2005. Average length at age was below statewide values (1997-2005) for all ages of largemouth bass. Largemouth bass took an average of 4.19 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 analyzed due to small sample size.

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). These values should be interpreted with caution as the boat timer batteries ran out and times were estimated by stopwatch. Mean relative abundance estimates for largemouth bass were higher for all bass lengths combined and for each length category except for preferred 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 when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch, pumpkinseed, chain pickerel, and common shiner and common white sucker and redbreast sunfish (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

May Pond (Washington)

May Pond was surveyed on July 31. One target species run and eight community species runs were conducted (Table 2). A total of 45 largemouth bass were sampled (Figure 11). The PSD for largemouth bass was 14 (lower and upper 80% CI's: 1, 45; 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 when compared to statewide mean values (Racine, 2006b). The relationship between largemouth bass total length and relative weight was not significant ($P = 0.66$; Figure 11).

Mean back-calculated length at age and total number of fish aged for largemouth bass are presented in Table 5a. Largemouth bass growth was not analyzed due to small sample size.

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

Merrimack River (Concord)

Merrimack River was surveyed on August 6. Three target species runs and eight community species runs were conducted (Table 2). A total of 81 largemouth bass and 11 smallmouth bass were sampled (Figure 12 and 13). The PSD for largemouth bass was 56 (lower and upper 80% CI's: 30, 79; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was not calculated due to small sample size (Table 3b). Mean relative weight values for largemouth bass were calculated by length category (Table 4a). Mean relative weight values for largemouth bass were higher for all 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 ($P = 0.002$; $R^2 = 0.59$; Figure 12).

Mean back-calculated length at age, total number of fish aged, logarithmic trendline correlation coefficient, age at quality size, and growth categorization for largemouth bass and smallmouth bass are presented in Table 5a and Figure 24. Largemouth bass growth was categorized as average when compared to fish from New Hampshire water bodies sampled during 1997-2005. Average length at age was above statewide values (1997-2005) for largemouth bass aged 1-3 and 6 and below statewide valued for ages 4-5. Largemouth bass took an average of 3.58 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2005) (Racine, 2006a). No smallmouth bass scales were collected as only young-of-year were captured.

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 each length category except for for all bass lengths combined and < 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 stock, quality, and preferred size fish when compared when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch, bluegill, pumpkinseed, chain pickerel, black crappie, redbreast sunfish, golden shiner, common white sucker, and brown bullhead (Table 7a, 7b, and 7c). Sample size and mean total length of YOY bass are shown in Table 8.

Pisgah Reservoir (Winchester)

Pisgah Reservoir was surveyed in July. Three fyke nets were set on July 2 and retrieved 24 hours later. The three fyke nets were set again on July 3 and retrieved 48 hours later. Fyke nets captured the following species: yellow perch, pumpkinseed, chain pickerel, and brown bullhead and black crappie (Figure 30).

Rocky Pond (Loudon)

Rocky Pond was surveyed on June 18. Five community species runs were conducted (Table 2). A total of 17 largemouth bass and 2 smallmouth bass were sampled (Figure 14 and 15). The PSD for largemouth bass was 57 (lower and upper 80% CI's: 37, 76; 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 lower for quality and preferred size fish and higher for stock and memorable size fish when compared to statewide mean values (Racine, 2006b). Mean relative weight values for smallmouth bass were higher for stock and preferred size fish when compared to statewide mean values (Racine, 2006b). The relationship between largemouth bass total length and relative weight was not significant ($P = 0.11$; Figure 14). The relationship between smallmouth bass total length and relative weight was not calculated due to small sample size (Figure 15).

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 Tables 5a and 5b and Figure 25. Largemouth bass growth was categorized as fast when compared to fish from New Hampshire water bodies sampled during 1997-2005. Average length at age was above statewide values (1997-2005) for largemouth bass aged 2-5 and below statewide valued for ages 1. Largemouth bass took an average of 3.24 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 analyzed due to small sample size.

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, were higher for memorable size fish, and were the same for preferred 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 memorable size fish when compared when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: yellow perch, common white sucker, pumpkinseed, golden shiner, American eel (*Anguilla rostrata*), chain pickerel, redbreast sunfish and yellow bullhead, and brown bullhead (Table 7a, 7b, an d7c).

Sunset Lake (Greenfield)

Sunset Lake was surveyed on August 2. Two target species runs and four community species runs were conducted (Table 2). A total of 79 largemouth bass and 19 smallmouth bass were sampled (Figure 16 and 17). The PSD for largemouth bass was 37 (lower and upper 80% CI's: 26, 49; Table 3a) compared to the statewide mean of 65 (Racine, 2006b). The PSD for smallmouth bass was 67 (lower and upper 80% CI's: 33, 91; 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, preferred, and memorable size fish and lower for quality size fish when compared to statewide mean values (Racine, 2006b). Mean relative weight values for smallmouth 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 ($P < 0.001$; $R^2 = 0.36$; Figure 16). The relationship between smallmouth bass total length and relative weight was significant with a negative trend ($P = 0.003$; $R^2 = 0.91$; Figure 17).

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 Tables 5a and 5b and Figures 26 and 27. Largemouth bass growth was categorized as average when compared to fish from New

Hampshire water bodies sampled during 1997-2005. Average length at age was above statewide values (1997-2005) for largemouth bass aged 3-4 and below statewide valued for ages 1-2 and 5-6. Largemouth bass took an average of 3.66 years to reach quality size (300 mm) compared to the statewide average of 3.74 years (1997-2005) (Racine, 2006a). Smallmouth bass growth was categorized as average when compared to fish from New Hampshire water bodies sampled during 1997-2005. Average length at age was above statewide values (1997-2005) for smallmouth bass aged 1-4 and below statewide values for ages 5 and 6. Smallmouth bass took an average of 4.07 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 each length category except for 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 except for stock and preferred size fish when compared when compared to statewide mean values (Racine, 2006b). Community samples produced in decreasing order of relative abundance: pumpkinseed, redbreast sunfish, yellow perch, chain pickerel, yellow bullhead, and golden shiner (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.

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 ten largemouth bass populations for which PSD values were calculated, five, Gould Pond Grassy Pond, Massasecum Lake, Merrimack River, and Rocky Pond, had values indicating a balanced population. Two largemouth bass populations, the Connecticut River (N. Walpole) and Gilmore Pond, had PSD values indicating sizes were skewed towards larger fish. Three populations, the Connecticut River (Chesterfield), May Pond, and Sunset Lake, had PSD values indicating sizes were skewed towards smaller fish. Of the seven smallmouth bass populations for which PSD values were calculated, only two, the Connecticut River (Chesterfield) and Rocky Pond, had a value indicating a balanced population. Two smallmouth bass populations, the Connecticut River (N. Walpole) and Sunset Lake, had PSD values indicating sizes were skewed towards larger fish. PSD values were not calculated for three smallmouth bass populations, Gilmore Pond, Massasecum Lake, and Merrimack River, because of small sample sizes.

Relative weight values > 90 may be considered good, with values > 100 considered excellent. All size categories of largemouth bass sampled in 2007 had mean Wr values > 90 with the exception of quality size fish from Gould Pond and Rocky Pond and preferred size fish from Gilmore Pond and Rocky Pond (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 six (the Connecticut River in N. Walpole, Gilmore Pond, Gould Pond, Grassy Pond, Lake Massasecum, and Sunset Lake) of the nine largemouth bass populations analyzed (two populations, the Connecticut River in Chesterfield and Gilmore Pond, were not analyzed due to low sample size). Variation in the data was not well explained in any of the populations ($r^2 > 50$) which had a significant relationship, except for the Merrimack River.

All size categories of smallmouth bass sampled in 2007 had mean Wr values > 90 with the exception of stock size fish from the Connecticut River (Chesterfield), quality size fish from the Connecticut River (Chesterfield) and Sunset Lake, and preferred size fish from the Connecticut River (Chesterfield) and Rocky Pond (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 (Table 4b). Significant negative relationships between total length and relative weight values were observed in all three of the smallmouth bass populations analyzed (two 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, except for Sunset Lake.

Mean relative abundance values (fish/hr) for largemouth and smallmouth bass populations sampled in 2007 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 = 225) and lowest for < stock size (CV = 84). 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 less stock size (CV = 159) and lowest for stock size (CV = 86). 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 2007 revealed a shift in abundance between bass < stock size and those ≥ stock size (Figure 28). 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 2007 were variable (Table 7a and 7b). The limited number of runs utilized for community sampling has been typically two per night. In 2007, an effort to analyze the correlation of community sample composition to number and frequency of runs was conducted with Timothy Dexter, an Antioch College student. Results will be forthcoming. Yellow perch were captured in all water bodies sampled, pumpkinseed were captured in all but one, and chain pickerel and redbreast sunfish were captured in all but two (Table 7a, 7b, and 7c). Yellow perch had the highest overall mean relative abundance (174.4 fish/hr). The other most abundant species were pumpkinseed (mean = 110.0 fish/hr), golden shiner (mean = 41.5 fish/hr), and spottail shiner (mean = 35.5 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 prespawn 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 the population 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.

Attempts should 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 (2006b) and Racine (2006a) should be performed for these species.

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.

ACKNOWLEDGMENTS

I would like to thank the following individuals for their assistance in collecting fish: NHFGD employees: Scott Decker, Gabe Gries, Joel Bader (and his son Brock), and Matt Carpenter; volunteers: Michael Haggan, Ed Massuco, Adam Dubriske, Gregg Spicher, Caroline Shannon, Brian Mulvey, Michelle Brown, Peter Spaulding, Josh Spaulding, Peter Kirchmann, Keene State College student Eric LaFontaine, Keith Kurowski, and Brad from Pillsbury State Park. Also thanks to Antioch College graduate student and biological aide Timothy Dexter and intern Nick Lewis.

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Table 1. Number of bass fishing tournament permits issued by the NHFGD (1992 - 2007).

Year	Number of Tournaments
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

Table 2. Summary of warmwater fish population assessments performed in 2007.

Sample Date	Water body	Region	Acreage	Town	County	Fishery	Sampling Method	Sample Type	Targeted Species[a]	Number of Runs	Run Times (seconds)
9/4/2007	Connecticut River	4		Chesterfield	Cheshire	Coldwater, Warmwater	electrofish	Community		8	250
8/9/2007	Connecticut River	4		North Walpole	Sullivan	Coldwater, Warmwater	electrofish	Community		8	250
								Target	BLB	1	518
6/27/2007	Fullham Pond	4	22	Winchester	Cheshire	Warmwater	fyke net	Community		3 nets	-
7/12/2007	Gilmore Pond	4	115	Jaffrey	Cheshire	Coldwater, Warmwater	electrofish	Community		2	500
								Target	BLB	3	500(x1), 1000(x2)
7/24/2007	Gould Pond	4	48	Hillsboro	Hillsborough	Coldwater, Warmwater	electrofish	Community		2	500
								Target	BLB	2	1000
7/5/2007	Grassy Pond	4	99	Rindge	Cheshire	Warmwater	electrofish	Community		1	500
								Target	BLB	1	500
7/26/2007	Massasecum, Lake	4	402	Bradford	Merrimack	Warmwater	electrofish	Community		2	500[b]
								Target	BLB	2	1000[b]
7/31/2007	May Pond	4	149	Washington	Hillsborough	Warmwater	electrofish	Community		8	250
								Target	BLB	1	500
8/6/2007	Merrimack River	3		Concord	Merrimack	Coldwater, Warmwater	electrofish	Community		8	250
								Target	BLB	3	500(x2), 1000(x1)
7/3/2007	Pisgah Reservoir	4	64	Winchester	Cheshire	Warmwater	fyke net	Community		3 nets	-
7/5/2007								Community		3 nets	-
6/18/2007	Rocky Pond	3	78	Loudon	Merrimack	Warmwater	electrofish	Community		5	400-500
8/2/2007	Sunset Lake	4	33	Greenfield	Hillsborough	Warmwater	electrofish	Community		4	250
								Target	BLB	2	500

[a] BLB - black bass.

[b] Run times were approximated with a stop watch as the batteries on the boat time ran out.

Table 3a. Proportional Stock Density (95% and 80% confidence intervals) of largemouth bass populations assessed in 2007 by electrofishing.

Water body	Sample Date	Lower CI		PSD	Upper CI		≥ Quality Size	≥ Stock Size
		95%	80%		80%	95%		
Connecticut River (North Walpole)	8/9/2007	52	61	83	95	98	10	12
Gilmore Pond	7/12/2007	69	79	100	100	100	10	10
Gould Pond	7/24/2007	27	32	46	60	67	12	26
Grassy Pond	7/5/2007	31	38	52	66	72	13	25
Massasecum, Lake	7/26/2007	41	47	60	72	77	18	30
May Pond	7/31/2007	0	1	14	45	58	1	7
Merrimack River	8/6/2007	21	30	56	79	86	5	9
Rocky Pond	6/18/2007	29	37	57	76	82	8	14
Sunset Lake	8/2/2007	21	26	37	49	55	13	35
Statewide average[a]	1997-2005	-	-	65	-	-	-	-

[a] Reprinted from Racine, 2006b.

PSD was not calculated for Connecticut River (Chesterfield) as no fish ≥ stock size were captured.

Table 3b. Proportional Stock Density (95% and 80% confidence intervals) of smallmouth bass populations assessed in 2007 by electrofishing.

Water body	Sample Date	Lower CI		PSD	Upper CI		≥ Quality Size	≥ Stock Size
		95%	80%		80%	95%		
Connecticut River (North Walpole)	8/9/2007	24	34	63	85	91	5	8
Connecticut River (Chesterfield)	9/4/2007	12	20	50	80	88	3	6
Rocky Pond	6/18/2007	1	5	50	95	99	1	2
Sunset Lake	8/2/2007	22	33	67	91	96	4	6
Statewide average[a]	1997-2005	-	-	43	-	-	-	-

[a] Reprinted from Racine, 2006b.

PSD was not calculated for Gilmore Pond and Merrimack River as no fish ≥ stock size were captured.
PSD was not calculated for Massasecum lake due to small sample size.

Table 4a. Sample size, mean relative weight value and one standard deviation by length category for largemouth bass populations assessed in 2007 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
Connecticut River (North Walpole)	8/9/2007	2	102.3	13.8	6	108.6	9.0	4	102.4	5.1		-	-
Gilmore Pond	7/12/2007	-	-	-	6	95.2	6.4	3	85.3	3.6	1	102.9	
Gould Pond	7/24/2007	14	93.5	6.2	6	87.7	9.3	6	92.6	12.5	-	-	-
Grassy Pond	7/5/2007	12	109.4	7.8	7	99.1	9.8	6	94.8	8.8	-	-	-
Massasecum, Lake	7/26/2007	12	101.7	12.7	15	91.8	7.6	3	100.2	6.8	-	-	-
May Pond	7/31/2007	6	103.5	17.4	-	-	-	1	120.0	-	-	-	-
Merrimack River	8/6/2007	4	104.5	8.0	3	102.6	4.1	2	99.8	1.0	-	-	-
Rocky Pond	6/18/2007	6	94.7	7.2	4	84.3	8.5	3	81.1	8.3	1	101.0	-
Sunset Lake	8/2/2007	20	98.7	6.3	11	90.6	9.7	1	94.4	-	-	-	-
Mean Wr			101.1			95.0			96.7			102.0	
Std Dev Wr			5.2			8.1			11.2			1.3	
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 2007 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
Connecticut River (North Walpole)	8/9/2007	3	107.0	6.5	3	101.1	8.0	2	91.4	0.3	-	-	-
Connecticut River (Chesterfield)	9/4/2007	3	86.4	0.7	1	85.6		2	84.7	2.8	-	-	-
Massasecum, Lake	7/26/2007	1	99.7	-	-	-	-	-	-	-	-	-	-
Rocky Pond	6/18/2007	1	99.4	-	-	-	-	1	85.6	-	-	-	-
Sunset Lake	8/2/2007	2	104.2	6.3	4	79.9	6.9	-	-	-	-	-	-
Mean Wr			99.3			88.9			87.2			-	
Std Dev Wr			7.9			10.9			3.7			-	
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
Connecticut River	North Walpole	2007	LMB	6	6	80	182	282	327	353	370	8	1	0.99	3.56	Average
Gilmore Pond	Jaffrey	2007	LMB	5	5	78	159	267	316	346		14	2	0.98	3.82	Average
Gould Pond	Hillsboro	2007	LMB	5	5	78	195	286	322	391		25	1	0.99	3.27	Fast
Grassy Pond	Rindge	2007	LMB	6	6	78	219	309	346	365	389	23	4	0.98	3.16	Fast
Massassecum, Lake	Bradford	2007	LMB	6	6	68	155	252	302	334	356	36	4	0.99	4.19	Slow
May Pond	Washington	2007	LMB	2	2	96	200					6	0	n.a.	n.a.	n.a.
Merrimack River	Concord	2007	LMB	5	5	94	191	270	303	375		11	1	0.98	3.58	Average
Rocky Pond	Loudon	2007	LMB	5	5	75	200	283	343	387		13	2	1.00	3.24	Fast
Sunset Lake	Greenfield	2007	LMB	6	6	72	174	276	326	354	381	45	2	0.99	3.66	Average
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
Connecticut River	North Walpole	2007	SMB	4	4	153	221	281	325			7	3	0.99	3.12	Fast
Gilmore Pond	Jaffrey	2007	SMB	1	1	90						1	0	n.a.	n.a.	n.a.
Massassecum, Lake	Bradford	2007	SMB	1	1	93	172					1	0	n.a.	n.a.	n.a.
Rocky Pond	Loudon	2007	SMB	4	4	86	193	268	317			2	0	n.a.	n.a.	n.a.
Sunset Lake	Greenfield	2007	SMB	6	6	91	154	228	285	316	335	13	3	0.98	4.07	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 2007. *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
Connecticut River (North Walpole)	8/9/2007	9	88	131.7	81.5	76	112.5	82.4	2	3.2	9.6	6	9.6	16.1	4	6.4	12.7	0	0.0	0.0
Connecticut River (Chesterfield)	9/4/2007	8	7	12.6	12.0	7	12.6	12.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Gilmore Pond	7/12/2007	5	25	23.8	17.7	15	15.1	11.8	0	0.0	0.0	6	5.8	3.2	3	2.2	4.8	1	0.7	1.6
Gould Pond	7/24/2007	4	52	55.6	20.7	26	28.7	16.8	14	15.2	8.5	6	5.4	4.6	6	6.3	6.1	0	0.0	0.0
Grassy Pond	7/5/2007	2	27	97.2	106.9	2	7.2	10.2	12	43.2	50.9	7	25.2	35.6	6	21.6	10.2	0	0.0	0.0
Massasecum, Lake	7/26/2007	3	48	98.4	55.0	21	44.4	24.0	10	21.6	31.4	15	28.8	12.5	2	3.6	3.6	0	0.0	0.0
May Pond	7/31/2007	9	45	72.0	88.5	38	60.8	93.3	6	9.6	12.5	0	0.0	0.0	1	1.6	4.8	0	0.0	0.0
Merrimack River	8/6/2007	11	81	94.6	74.1	72	82.8	70.3	4	5.2	9.7	3	3.9	6.7	2	2.6	5.8	0	0.0	0.0
Rocky Pond	6/18/2007	5	17	25.0	22.8	3	4.3	6.4	6	8.6	12.9	4	5.9	6.4	3	4.7	4.3	1	1.4	3.2
Sunset Lake	8/2/2007	6	79	148.7	47.1	44	85.6	44.6	22	38.0	21.3	12	22.7	13.3	1	2.4	5.9	0	0.0	0.0
Mean f/h				76.0			45.4			14.5			10.7			5.1			0.2	
CV for f/h				61			84			106			100			119			225	
Statewide average[a]	1997-2005		126	49.6	50.1	126	23.2	36.1	126	10.5	16.6	126	10.5	14.4	126	4.7	5.2	126	0.5	1.3

[a] Reprinted from Racine, 2006b.

[b] *n* 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 2007. *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	Sample Date	*n*	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD	#fish	f/h	SD
Connecticut River (N. Walpole)	8/9/2007	9	23	33.5	45.0	15	22.3	34.6	3	4.0	9.6	3	4.0	6.3	2	3.2	6.3
Connecticut River (Chesterfield)	9/4/2007	8	67	120.6	34.4	61	109.8	40.7	3	5.4	10.7	1	1.8	5.1	2	3.6	10.2
Gilmore Pond	7/12/2007	5	1	0.7	1.6	1	0.7	1.6	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Massasecum, Lake	7/26/2007	3	1	2.4	4.2	0	0.0	0.0	1	2.4	4.2	0	0.0	0.0	0	0.0	0.0
Merrimack River	8/6/2007	11	11	12.4	20.4	11	12.4	20.4	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
Rocky Pond	6/18/2007	5	2	2.9	6.4	0	0.0	0.0	1	1.4	3.2	0	0.0	0.0	1	1.4	3.2
Sunset Lake	8/2/2007	6	19	39.5	53.1	13	27.5	32.4	2	4.8	11.8	4	7.2	11.2	0	0.0	0.0
Mean f/h				30.3			24.7			2.6			1.9			1.2	
CV for f/h				141			159			86			151			137	
Statewide average[a]	1997-2005		61	26.3	32.8	61	19.0	27.2	61	5.1	6.7	61	1.5	2.4	61	0.9	1.4

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 2007. *n* = number of runs.

Water body	Sample Date	*n*	American Eel	Black Crappie	Bluegill	Brown Bullhead	Common Shiner	Common White Sucker	Chain Pickerel
Connecticut River (North Walpole)	8/9/2007	8	-	-	12.6+21.0	3.6+6.7	-	14.4+23.1	14.4+7.7
Connecticut River (Chesterfield)	9/4/2007	8	-	3.6+6.7	18.0+12.8	-	-	10.8+6.7	-
Gilmore Pond	7/12/2007	2	-	-	39.6+25.4	3.6+5.1	-	-	3.6+5.1
Gould Pond	7/24/2007	2	-	-	59.4+22.9	-	1.8+2.5	68.4+56.0	19.8+2.5
Grassy Pond	7/5/2007	1	-	-	-	7.2+0.0	-	-	-
Massasecum, Lake	7/26/2007	2	-	-	-	-	10.8+15.3	10.8+5.1	14.4+10.2
May Pond	7/31/2007	8	-	-	-	5.4+10.7	-	-	28.8+34.4
Merrimack River	8/6/2007	8	-	32.4+41.3	111.6+110.7	3.6+6.7	-	5.4+10.7	34.2+79.6
Rocky Pond	6/18/2007	5	9.2+9.9	-	-	1.4+3.2	-	25.1+20.5	8.9+11.8
Sunset Lake	8/2/2007	4	-	-	-	-	-	-	18.0+27.2
Mean f/hr			9.2	18.0	48.2	4.1	6.3	22.5	17.8
Stdev of f/hr			-	20.4	40.0	2.0	6.4	23.4	10.0

Table 7b. Mean relative abundance estimate (fish/hour) and one standard deviation for non-target species captured during community electrofishing runs in 2007. *n* = number of runs.

Water body	Sample Date	*n*	Fallfish	Golden Shiner	Lake Chub	Northern Pike	Pumpkinseed	Redbreast Sunfish
Connecticut River (North Walpole)	8/9/2007	8	5.4+10.7	61.2+59.5	-	12.6+30.2	41.4+43.2	3.6+10.2
Connecticut River (Chesterfield)	9/4/2007	8	235.8+161.3	-	-	-	1.8+5.1	-
Gilmore Pond	7/12/2007	2	-	-	-	-	46.8+35.6	-
Gould Pond	7/24/2007	2	1.8+2.5	14.4+15.3	-	-	90.0+40.7	5.4+2.5
Grassy Pond	7/5/2007	1	-	50.4+0.0	21.6+0.0	-	122.4+0.0	-
Massasecum, Lake	7/26/2007	2	-	-	-	-	54.0+35.6	10.8+15.3
May Pond	7/31/2007	8	-	261+140.6	-	-	-	1.8+5.1
Merrimack River	8/6/2007	8	-	12.6+30.2	-	-	102.6+94.4	25.2+25.2
Rocky Pond	6/18/2007	5	-	11.9+10.7	-	-	20.3+21.8	2.9+3.9
Sunset Lake	8/2/2007	4	-	3.5+6.9	-	-	620.3+268.8	32.4+24.6
Mean f/hr			81.0	59.3	21.6	12.6	122.2	11.7
Stdev of f/hr			134.1	91.6	-	-	190.8	12.2

Table 7c. Mean relative abundance estimate (fish/hour) and one standard deviation for non-target species captured during community electrofishing runs in 2007. *n* = number of runs.

Water body	Sample Date	*n*	Spottail Shiner	Tesselated Darter	Walleye	Yellow Bullhead	Yellow Perch
Connecticut River (North Walpole)	8/9/2007	8	86.4+114.7	18.0+20.0	1.8+5.1	-	313.2+240.2
Connecticut River (Chesterfield)	9/4/2007	8	268.2+309.1	3.6+6.7	-	-	28.8+23.1
Gilmore Pond	7/12/2007	2	-	-	-	7.2+10.2	25.2+35.6
Gould Pond	7/24/2007	2	-	-	-	-	124.2+119.6
Grassy Pond	7/5/2007	1	-	-	-	-	475.2+0.0
Massasecum, Lake	7/26/2007	2	-	-	-	-	266.4+132.4
May Pond	7/31/2007	8	-	-	-	-	198.0+83.5
Merrimack River	8/6/2007	8	-	-	-	-	214.2+120.8
Rocky Pond	6/18/2007	5	-	-	-	2.9+6.4	70.5+21.4
Sunset Lake	8/2/2007	4	-	-	-	3.6+7.2	28.4+26.0
Mean f/hr			177.3	10.8	1.8	4.6	174.4
Stdev of f/hr			128.6	10.2	-	2.3	148.5

Table 8. Sample size, mean total length and one standard deviation of YOY black bass captured by electrofishing during 2007.

		Largemouth			Smallmouth		
Water body	Date	*n*	Mean total length	SD	*n*	Mean total length	SD
Connecticut River (North Walpole)	8/9/2007	75	84	21	13	53	8
Connecticut River (Chesterfield)	9/4/2007	7	120	16	61	76	14
Gilmore Pond	7/12/2007	7	35	3	-	-	-
Gould Pond	7/24/2007	7	43	14	-	-	-
Grassy Pond	7/5/2007	1	58	-	-	-	-
Massasecum, Lake	7/26/2007	9	43	11	-	-	-
May Pond	7/31/2007	39	50	16	-	-	-
Merrimack River	8/6/2007	81	65	16	11	59	8
Sunset Lake	8/2/2007	6	46	14	6	67	5
Mean			60			64	
Stdev			27			10	