YADKIN RIVER GAME FISH AND CATFISH SURVEY, 2012

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Abstract.— Boat mounted electrofishing gear was used to sample the catfish and game fish community of the upper Yadkin River during the summer of 2012. Based largely on the observed declines in the native fish assemblage, the Flathead Catfish *Pylodictis olivaris* population appears to be expanding throughout the upper Yadkin River. While Flathead Catfish were only collected at two of the four sites sampled and overall CPUE was only four fish/hour, the reduced numbers of bullhead catfishes *Ameiurus spp*. and Redbreast Sunfish *Lepomis auritus* collected at certain sites suggest that Flathead Catfish may be more abundant than our electrofishing surveys indicate. We collected 53 Largemouth Bass *Micropterus salmoides*, 48 Smallmouth Bass *M. dolomieu*, and 99 Spotted Bass *M. punctulatus* for an overall CPUE of 40 fish/hour. Although black bass were collected at all sites during the survey, anecdotal observations along with a cursory comparison of electrofishing and angling catch rates suggest that our electrofishing gear may not collect them in proportion to their true abundance.

The Yadkin-Pee Dee River basin is the second largest in North Carolina, covering 7,213 square miles (NCDENR 2013). Originating in the mountains of Watauga and Caldwell counties, the Yadkin River flows through Wilkes, Surry, Yadkin, Forsyth, Davie, and Davidson counties before it joins the South Yadkin River and enters High Rock Lake. Between W. Kerr Scott Reservoir in Wilkesboro, the uppermost impoundment on the Yadkin River, and High Rock Lake, the river is free of major impoundments for 120 miles. The only dams within this stretch are Idols Dam, a small, defunct hydroelectric dam on the Davie-Forsyth County border, and the

intake dam for the City of Winston-Salem's Northwest Water Treatment Plant on the Yadkin-Forsyth County border.

Previous North Carolina Wildlife Resources Commission (Commission) survey efforts on the Yadkin River have described the populations of game fish and non-game fish in the river from W. Kerr Scott Reservoir Dam to High Rock Lake (Figure 1). In 1987 surveys were conducted using a hand-cranked telephone generator and catfish basket traps to document the populations of catfishes in the Yadkin River. Non-native Flathead Catfish *Pylodictis olivaris* were documented downstream of Idols Dam near the Concord Church community, with no native bullhead catfish species being collected below the dam. Conversely, no Flathead Catfish were collected upstream of Idols Dam during the study and the ictalurid community was comprised primarily of Flat Bullheads *Ameiurus platycephalus* and Snail Bullheads *A. brunneus* (Mickey and Simpson 1988). While no Flathead Catfish were collected upstream of Idols Dam during the 1987 surveys, one large adult specimen was collected in Elkin prior to the beginning of the survey period while testing the electrofishing gear (Mickey and Simpson 1988). However, no evidence of a reproducing population was found in that section of river during the official surveys.

No further major survey work was conducted on the upper Yadkin River until a pair of electrofishing surveys was conducted in 2001 and 2005 to provide a more comprehensive assessment of both the game fish and non-game fish communities. The game fish community during these surveys consisted primarily of Largemouth Bass *Micropterus salmoides,* Spotted Bass *M. Punctulatus,* Smallmouth Bass *M. dolomieu,* Redbreast Sunfish *Lepomis auritus,* and several other centrarchid species (Hining 2006). While black bass were collected at all locations during both surveys, their numbers seemed lower than expected based on the angling experiences of Commission staff and secondhand reports of black bass catches from other anglers. As was the case during the 1987 catfish surveys, the 2001 and 2005 surveys also documented the presence of Flathead Catfish and the absence of bullhead catfishes downstream of Idols Dam. While bullhead catfishes were still abundant upstream of Idols Dam, Flathead Catfish were also collected at two locations in Surry and Yadkin counties (Hining 2006).

Historically, the fishery for bullhead catfishes has been the most popular fishery in the upper Yadkin River given that they are excellent table fare and can be caught in high numbers without requiring a high degree of specialization by anglers. In the late 2000's Commission staff began receiving complaints from anglers regarding a decline in the catch rates of bullhead catfish in the river throughout Surry and Yadkin counties. Electrofishing surveys conducted near Siloam and in Elkin to investigate these reports in 2010 suggested that the angler reports were valid and that bullhead catfishes were becoming less abundant (NCWRC unpublished data).

Given the ongoing concerns over the status of the bullhead catfish community and the possibility that black bass were being underrepresented in our electrofishing surveys, additional electrofishing surveys of the upper Yadkin River were conducted in 2012. The primary objectives of these surveys were to 1) obtain updated information on the distribution, relative abundance, and size structure of game fish populations, 2) assess the distribution of Flathead Catfish, 3) assess the distribution, relative abundance and size structure of bullhead catfishes, and 4) conduct a comparison of the relative effectiveness of electrofishing and angling as collection tools for black bass. This report summarizes the results of the 2012 surveys.

Methods

Boat-mounted electrofishing gear was used to collect game fishes and catfishes from four stretches of the Yadkin River between Wilkesboro and East Bend during daylight hours between June 5 and September 13, 2012, with the Wilkesboro reach being sampled on three occasions. Equipment failure during the initial Wilkesboro survey in June necessitated a return visit in August. After we realized that we were putting out less power at electrofishing settings used to collect bullhead catfishes in June and August than we had during the 2001 and 2005 surveys when different electrofishing equipment was used, a third survey was conducted in September after bow cathode droppers were added to the boat in an effort to increase power output. Since catfishes are generally more susceptible to lower electrofishing pulse frequencies than game fishes, both 15 and 120 pps electrofishing settings were used at all sites to maximize the catchability of all species, with a minimum of 1200 seconds of effort with each electrofishing setting being expended at each site. Electrofishing settings of 120 pps were used to survey shoreline habitat and mid-channel areas with suitable habitat while working downstream, and 15 pps settings were employed in mid-channel areas while working back upstream, with both game fishes and catfishes being collected regardless of the pulse frequency. During most surveys, we attempted to collect all game fishes and catfishes, although collections focused exclusively on black bass and catfish during the final survey in Wilkesboro on September 13. All fish collected were measured for total length (mm) and weight (g) before being released. Catch per unit effort (CPUE) was indexed as the number of fish collected per hour of electrofishing time. Length distribution histograms were constructed and size structure indices and relative weights were calculated for Flathead Catfish and all game fish that were collected in sufficient numbers ($n \geq 20$) to allow for additional analyses. The lengths for stock, quality, and preferred-sized fish were those proposed by Gabelhouse (1984) and refined by Guy et al. (2007). Relative weights were calculated using equations provided in Anderson and Neumann (1996).

Angling gear was used to collect black bass from within the Wilkesboro sample site on August 29, 2012 in an effort to validate the results of electrofishing surveys, which have historically seemed to underrepresent black bass abundance in the Yadkin River. Additional angling collections planned at East Bend and Ronda could not be carried out due to the river being too turbid for angling during most of the summer. Fish collected by angling were measured for total length (mm) before being released.

Results

Catfish

We collected 20 Flathead Catfish for a CPUE of 4 fish/hour. Flathead Catfish were collected in East Bend and Elkin, with all but one specimen coming from the East Bend location where they were the primary species collected (Table 1). All specimens were collected using the 120 pps settings. Flathead Catfish catch rates at Elkin, Ronda, and Wilkesboro in this survey were similar to those from the 2001 and 2005 surveys utilizing the same sample reaches, with one specimen being collected at the Elkin site and zero being collected at Ronda and Wilkesboro (Hining 2006). Although no Flathead Catfish were collected at the Ronda site during any of our official surveys, one specimen was collected there during fish collections for a 2011 toxicology

survey (NCWRC unpublished data). No previous quantitative surveys had been conducted at the East Bend site, although similar numbers of Flathead Catfish were observed during fish collections for the aforementioned toxicology study in 2011. During previous surveys conducted by Commission staff, Flathead Catfish have only been collected from the Yadkin River in considerable numbers (n ≥ 5) at four sites, with all other sites only yielding zero–one specimens per survey (Table 2).

Flathead Catfish ranged in length from 212 to 890 mm, indicating that multiple age classes were present (Figure 2). PSD was 75 and PSD-P was 25. Relative weights could not be calculated after a scale malfunction during the East Bend survey prevented weight data from being collected.

Snail and Flat Bullheads were the primary catfishes collected during the survey, with Snail Bullheads (n = 126) being much more common than Flat Bullheads (n = 22). Bullhead catch rates were higher in Wilkesboro than in sites further downstream, and all but 18 bullheads were captured using 15 pps electrofishing settings (Table 1). Bullhead catch rates at Wilkesboro did not improve noticeably in September when a bow cathode dropper array was used. However, site selection varied somewhat between surveys, making it difficult to compare catch rates between surveys directly.

Bullhead catch rates at Elkin, Ronda, and Wilkesboro were lower than during the 2005 survey (Hining 2006) when the 15 pps settings were first used, with the declines at Elkin and Ronda being particularly pronounced. While bullhead catch rates were higher in Wilkesboro during the 2005 survey than in 2012, it should be noted that only 179 seconds of effort were expended using the 15 pps settings in 2005 due to an equipment malfunction. As such, the 2005 catch rate might not have been representative of overall bullhead densities throughout that entire stretch of river. In addition to the 2001, 2005 and 2012 surveys, an additional survey was conducted at Elkin in 2010 (NCWRC unpublished data), and catch rates there were intermediate between the 2005 and 2012 surveys (Figure 3).

Total lengths of Flat and Snail Bullheads combined ranged from 47 to 394 mm, with size distributions varying considerably between locations. While a broad range of sizes of bullheads were collected from Wilkesboro, all but one bullhead collected from downstream sites was ≥ 280 mm long (Figure 4). Among the four sites surveyed in 2012, there is a negative relationship between electrofishing catch rate and mean fish length (Figure 5), suggesting that density-dependent factors are influencing the size structure of the populations.

White Catfish (n = 18) ranging in length from 107 to 273 mm were collected within a short stretch of river immediately adjacent to the dam of W. Kerr Scott Reservoir during the June survey, but none were collected during the subsequent two Wilkesboro samples when this river reach was not surveyed. The only White Catfish collected from the upper Yadkin River during the 2005 survey also came from this same location (Hining 2006). Other catfish species collected were Channel Catfish (n = 5) and Margined Madtom (n = 4) (Table 1).

Game Fish

We collected 53 Largemouth Bass, 48 Smallmouth Bass, and 99 Spotted Bass for an overall black bass CPUE of 40 fish/hour. All black bass were collected using the 120 pps electrofishing settings. Black bass catch rates were the highest in Wilkesboro and the lowest in East Bend,

with the relative abundance of each species varying considerably between sites as well as between sample dates during the multiple surveys conducted in Wilkesboro (Table 1). Spotted Bass made up a lower proportion of the black bass collected than in previous surveys, comprising only 49% of the sample in 2012 versus 82% in 2001 and 75% in 2005.

Overall black bass catch rates were similar to those observed during previous surveys in 2001 (mean = 39.8) and 2005 (mean = 30), although it is difficult to compare overall catch rates over time since sample locations have varied between surveys. Comparing catch rates between sites that were also sampled in 2001 and 2005, catch rates of all three black bass species at Elkin and Ronda in 2012 were generally within the range of those seen during previous surveys. Overall catch rates for black bass in Wilkesboro during the three samples in 2012 (range = 48.5–71.6 bass/hr) were somewhat lower than those observed in 2001 (62.4 bass/hr) and 2005 (77.9 bass/hr), with catch rates of individual species varying considerably between survey periods. Part of the decline in black bass catch rates in Wilkesboro during the 2012 sample is attributable to reduced catch rates of Spotted Bass. While Spotted Bass catch rates in 2001 and 2005 ranged from 53 to 57 fish/hour (Hining 2006), only 19–36 Spotted Bass per hour were collected in 2012.

Black bass captured during this survey ranged in length from 70 to 469 mm, suggesting that multiple age classes were present (Figure 6). Overall, 69% of the black bass collected were <300 mm in length and only 11% were large enough to be harvested under the statewide minimum length limit of 356 mm. PSD values for Largemouth, Smallmouth, and Spotted Bass, respectively, were 47, 55, and 52, with PSD-P values of 17, 29, and 17. While PSD values for Spotted Bass in the current survey were comparable to those obtained in 2001 and 2005, values for Largemouth and Smallmouth Bass were lower. However, sample sizes of Largemouth and Smallmouth Bass were considerably lower during the previous surveys, which may have resulted in the stock index values being artificially elevated (Hining 2006).

Relative weights for Largemouth, Smallmouth, and Spotted Bass averaged 97, 95, and 100 (Figure 7). Relative weights decreased slightly in a linear fashion as total length increased for all three species, suggesting that forage availability declines as fish size increases. These values are generally similar to those from the 2001 and 2005 surveys, although Smallmouth Bass relative weights in the current survey had improved from earlier levels (Hining 2006).

Redbreast Sunfish (n=119) and Bluegill (n=29) were the primary sunfish species collected during the survey. Similar to black bass, catch rates of both species were highest in Wilkesboro and lowest in East Bend (Table 1), with all individuals being collected using 120 pps electrofisher settings. Relative to previous surveys, Redbreast Sunfish catch rates at Elkin were significantly lower, catch rates at Ronda were marginally lower, and catch rates in Wilkesboro were significantly higher (Figure 8).

Total lengths of Redbreast Sunfish and Bluegill collected ranged from 62 to 209 mm and 60 to 192 mm, respectively (Figures 9 and 10). PSD and PSD-P values for Bluegill were 36 and 0, in that order. Although stock index length categories do not exist for Redbreast Sunfish, the population contained a high proportion of larger individuals, with 46% of the fish collected being ≥ 150 mm in length. Bluegill relative weights were high, averaging 117 and increasing in relation to fish length (Figure 11). Relative weight equations do not exist for Redbreast Sunfish.

Other game fish collected included Rock Bass *Ambloplites Rupestris*, Warmouth *Lepomis gulosus*, Pumpkinseed *Lepomis gibbosus*, Redear Sunfish *Lepomis microlophus*, Chain Pickerel

Esox niger, and Walleye *Sander vitreus*, with all individuals of these species being collected in Wilkesboro (Table 1). All other game fish collected were collected using 120 pps electrofisher settings, with the exception of one Chain Pickerel that was collected using 15 pps electrofisher settings.

Angling

We collected two Largemouth Bass, nine Smallmouth Bass, and three Spotted Bass in Wilkesboro between US 421 and Curtis Bridge Road by angling. Total lengths of these fish ranged from 210 to 385 mm, with all fish ≥ 280 mm being Smallmouth Bass (Figure 12).

To facilitate direct comparisons of electrofishing and angling catch rates of black bass, catch rates were standardized by distance instead of sample time. The stretch of river from which fish were collected by angling (US 421 to Curtis Bridge Road) was also sampled during the August and September electrofishing surveys. During the August survey, a substantial river reach above and below the area surveyed by angling were also sampled, while the September sample reach more closely mimicked the exact reach sampled by angling. When comparing fish collected by angling against fish collected by electrofishing, 28 black bass/1000 m were collected by angling while electrofishing catch rates ranged from 10.8 black bass/1000 m in August to 41.9 black bass/1000 m in September. When only bass ≥ 210 mm long (the minimum size collected by angling) were included to compare catch rates of bass that were susceptible to both gears, electrofishing catch rates dropped to 6 black bass/1000 m in August and 15.2 black bass/1000 m in September. While relatively little effort was expended collecting fish by angling, the relative number of fish collected by the two gears suggests that black bass were more effectively collected by angling than by electrofishing. More extensive comparisons are needed to determine the relative effectiveness of each collection method.

Discussion

Flathead Catfish Impacts

Flathead Catfish are known to severely impact populations of Redbreast Sunfish and bullhead catfishes when introduced into rivers outside of their native range (Guier et al. 1981; Thomas 1993). Within the Yadkin River, we have documented similar impacts to populations of Redbreast Sunfish and bullhead catfishes at locations where we have been able to collect Flathead Catfish in considerable numbers either historically or during the current survey (Table 2). Previous samples between Idols Dam and High Rock Lake have yielded zero bullhead catfishes and reduced numbers of Redbreast Sunfish in comparison to other sites on the river (Mickey and Simpson 1988; Hining 2006). While bullhead catfishes have not yet been eliminated from any sites upstream of Idols Dam, we have observed similar inverse relationships between Flathead Catfish densities and the densities of Redbreast Sunfish and bullhead catfishes at the East Bend site during the current survey and during previous collection efforts near Enon and Donnaha (NCWRC unpublished data).

Aside from the aforementioned sites where we have collected considerable numbers of Flathead Catfish, they would not appear to be very abundant throughout most of the upper Yadkin River based solely on the numbers we collect during our electrofishing surveys.

However, the declining densities of bullhead catfishes and Redbreast Sunfish along with anecdotal reports of Flathead Catfish being caught by anglers suggest that our electrofishing surveys may be underrepresenting the abundance of Flathead Catfish in certain sections of the river.

During recent surveys near Siloam, Elkin, and Ronda, single specimens of Flathead Catfish have been collected, thereby confirming their presence in those river sections (Tables 1 and 2). Yet despite the low numbers of Flathead Catfish collected, densities of bullhead catfishes were substantially lower in these areas than what has historically been collected from the Yadkin River (Table 1; NCWRC unpublished data; Hining 2006). Additionally, the few bullhead catfishes that were collected at these sites were substantially larger than the historical norm (Mickey and Simpson 1988; Hining 2006), with smaller individuals (<250 mm TL) being almost completely absent from the populations. These shifts in densities and sizes suggest that Flathead Catfish predation may be eliminating younger, smaller bullheads from the population, thereby allowing older, larger fish to reach greater sizes as a result of reduced density-dependent competition for food. If this is the case, it is possible that bullhead catfishes will eventually be eliminated from river reaches inhabited by Flathead Catfish once the larger bullheads age out of the population and there are no younger fish to take their place.

Similarly, Redbreast Sunfish densities appear to be low or declining at these sites, with the lowest densities occurring at Elkin and Siloam (NCWRC unpublished data). While Redbreast Sunfish catch rates have declined at Ronda during each successive survey between 2001 and 2012, the change in catch rates has been relatively small. Future surveys are needed to determine if these results reflect an actual decline in Redbreast Sunfish numbers in the section of river around Ronda or if they are simply the result of natural fluctuations in population density or variations in electrofishing capture efficiency.

While no Flathead Catfish have been collected in the vicinity of Wilkesboro during electrofishing surveys, their presence was confirmed in the stretch of river below W. Kerr Scott Reservoir by Commission staff in 1997 (NCWRC unpublished data) and by various angler reports. However, there is little evidence to suggest that they are impacting populations of bullhead catfishes and Redbreast Sunfish in this section of river. While electrofishing catch rates of bullhead catfishes in the Wilkesboro area declined substantially between 2005 and 2012, they were still very abundant during the latter survey. Additionally, unlike downstream sites where only larger bullhead specimens were found, most bullhead catfishes collected from the Wilkesboro area during the 2012 survey were 100–300 mm in length, suggesting that smaller individuals are not experiencing high levels of predation. Finally, the catch rates of Redbreast Sunfish at the Wilkesboro site in 2012 were the highest on record, further suggesting that the native fish community in this stretch of river is not being subjected to an increasing amount of predation.

The degree to which the native fish community of the Yadkin River appears to have been impacted by Flathead Catfish varies longitudinally, with impacts being more pronounced at downstream locations and less pronounced at upstream locations. The impacts of Flathead Catfish are probably worse below Idols Dam because they were introduced into this stretch of river before they were introduced into areas further upstream. Flathead Catfish were introduced by the Commission into High Rock Lake in the 1950's (Mickey and Simpson 1988), after which they expanded into the stretch of river between High Rock Lake and Idols Dam.

While it is not possible to determine exactly when Flathead Catfish were introduced upstream of Idols Dam, anecdotal reports from local anglers suggest that anglers may have begun introducing them above the dam by the mid 1980's, if not sooner. Despite Flathead Catfish possibly being present in the Yadkin River above Idols Dam for several decades, it would appear as if their population only reached levels detectable by our sampling efforts in more recent years.

It is not clear why Flathead Catfish are more abundant in certain stretches of river than others. While much of the upper Yadkin River is relatively narrow and shallow with sandy or silty substrate and considerable current, the sections of river where Flathead Catfish are currently collected in substantial numbers are generally either wider with abundant shoals, exposed bedrock, and reduced current velocities owing to the greater width of the river, or they contain deeper runs and pools. In other North Carolina rivers where Flathead Catfish introductions have occurred, they have been shown to prefer deeper habitats and lower current velocities, which may explain why greater numbers were collected in habitats within the Yadkin River that were deeper or wider than average (Kwak et al. 2004; Malindzak 2006). Given that current velocities seem higher in the stretch of river around Wilkesboro owing to the discharges from W. Kerr Scott Dam, conditions in this stretch of river may be preventing Flathead Catfish densities from becoming high enough to adversely affect the densities of native species. Additional efforts to quantify current velocities and habitat characteristics preferred by Flathead Catfish are needed to gain a better understanding of why they are more abundant in certain stretches of the Yadkin River than others.

Black Bass

The variation in species-specific catch rates of black bass in Wilkesboro during the 2012 survey relative to the 2001 and 2005 surveys could be due to shifts in black bass community species composition or to differences in catchability between surveys. Slight variations in the river reaches that were surveyed on each date could contribute to the variations in catches as well. In particular, over half (n=28) of the Largemouth Bass collected during the entire 2012 survey came from one short stretch of habitat in the W. Kerr Scott Dam tailrace that could only be accessed during the June sample. This same stretch also produced almost half the Largemouth Bass collected during the 2005 sample. It should also be noted that habitat within the Wilkesboro sample reach was substantially different in 2012 relative to previous surveys due to the establishment of Bur-reed *Sparganium spp*. throughout much of the sample reach. The presence of significant amounts of aquatic vegetation could change the relative abundance and habitat selection of each black bass species or possibly change their electrofishing capture efficiency (Bayley and Austen 2002).

Within the 2012 surveys at Wilkesboro, catch rates for black bass overall were highest during the September survey after bow cathode dropper arrays had been added to the boat to increase power output. However, variations in the exact sections of river sampled during these surveys make it difficult to determine the exact effect of the bow cathode droppers on catch rates. Additional surveys need to be conducted to better determine how catch rates of black bass may be affected by gear modifications.

It is not clear what factors might be related to the apparent inability of our electrofishing gear to collect black bass effectively given that black bass are usually relatively susceptible to electrofishing. In general, larger-bodied fish species with greater body volumes such as black bass are collected more effectively than smaller species (Reynolds 1996; Dolan and Miranda 2003). Additionally, in a study involving electrofishing capture efficiency in impounded waters, Largemouth Bass were found to have the highest catchability among the species groups inhabiting the study waters, with capture efficiency being highest for Largemouth Bass in the 230-380 mm size range (Bayley and Austen 2002). Interestingly, this size range is very similar to the size range of black bass caught by angling during this study, suggesting that the ineffectiveness with which our electrofishing gear collects black bass may be even more pronounced than it initially appeared to be given that the sizes of fish collected by angling were the sizes that should have been collected most effectively by electrofishing.

One possible explanation for the apparent inefficiency of electrofishing gear in collecting black bass could involve the exceptionally high densities of catostomids found throughout the Yadkin River. While centrarchids usually respond passively when they come in contact with the electrofishing field, catostomids tend to respond by thrashing and jumping vigorously (personal observation). Additionally, most catostomids are larger and have greater body volumes than the black bass found in the Yadkin River. As such, they are susceptible to the electrofishing field at lower thresholds than black bass and may begin to respond to the field before the bass have been immobilized. Between the high numbers of catostomids encountered while electrofishing, their susceptibility to the field, and the manner in which they respond to the electrical field, it is possible that they may startle other species of fish and cause them to evacuate the sampling area prior to being immobilized (Dolan and Miranda 2003). Conversely, in systems like the New River where catostomids are much less common (NCWRC unpublished data), Smallmouth Bass electrofishing capture efficiency seems to be much higher. While this hypothesis is highly speculative in nature, this possibility needs to be evaluated in the future.

Additional comparisons between angling and electrofishing, as well as efforts to calibrate the effectiveness of electrofishing gear at capturing specific fish taxon, need to be undertaken to increase our understanding of the effectiveness of electrofishing as a black bass collection tool in the Yadkin River.

Recommendations

1. Conduct additional surveys to better describe the extent of Flathead Catfish distribution in the Yadkin River upstream of Idols Dam. Consider incorporating additional gear types into the survey to maximize the effectiveness of collection efforts and including additional sample reaches not included in previous surveys.
2. Determine habitat and current velocity preferences of Flathead Catfish in the upper Yadkin River.
3. Survey the East Bend sample sites across multiple seasons to determine if Flathead Catfish densities vary temporally.
4. Continue to monitor the status of the Redbreast Sunfish and bullhead catfish communities.

5. Conduct additional assessments of electrofishing gear configurations on our ability to effectively collect black bass and bullhead catfishes.
6. Conduct additional comparisons of the effectiveness of angling and electrofishing as collection methods for black bass.

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TABLE 1.— Catch rates (fish/hour) of fish collected during electrofishing surveys of the Yadkin River using both 15 and 120 pps electrofisher settings, 2012.

	East Bend		Elkin		Ronda		Wilkesboro – June		Wilkesboro – August		Wilkesboro – September *	
Species	15	120	15	120	15	120	15	120	15	120	15	120
Largemouth Bass	0	0	0	1.6	0	0	0	34.6	0	13.6	0	12.3
Smallmouth Bass	0	5.1	0	9.8	0	5.1	0	3.7	0	10.7	0	23.5
Spotted Bass	0	4.0	0	21.3	0	16.5	0	18.5	0	24.3	0	35.8
Bluegill	0	0	0	3.3	0	2.5	0	21.0	0	7.8	0	-
Redbreast Sunfish	0	0	0	14.8	0	17.7	0	50.6	0	53.4	0	-
Rock Bass	0	0	0	0	0	0	0	3.7	0	3.9	0	-
Warmouth	0	0	0	0	0	0	0	1.2	0	1.0	0	-
Redear Sunfish	0	0	0	0	0	0	0	1.2	0	0	0	-
Pumpkinseed	0	0	0	0	0	0	0	1.2	0	0	0	-
Chain Pickerel	0	0	0	0	0	0	0	1.2	0	1.9	0	-
Walleye	0	0	0	0	0	0	0	0	0	1.0	0	-
Snail Bullhead	7.5	0	0	0	0	0	126.5	6.2	32.4	1.9	100.0	4.9
Flat Bullhead	0	0	2.5	1.6	15.4	3.8	0	3.7	17.6	0	5.1	0
Flathead Catfish	0	19.2	0	1.6	0	0	0	0	0	0	0	-
Channel Catfish	0	1.0	0	1.6	0	0	0	2.5	0	0	0	-
White Catfish	0	0	0	0	0	0	0	22.2	0	0	0	-
Margined Madtom	0	0	0	0	0	0	2.0	1.2	0	0	7.7	-
Time Sampled (s)	1456	3579	1429	2187	1387	2836	1748	2905	1232	3695	1410	2923

*Only black bass and bullhead catfishes collected during the September survey.

TABLE 2.— Number of Flathead Catfish collected per sampling location during previous (2001-2011) Yadkin River electrofishing surveys.

Site (Year)	Number of Flathead Catfish
Concord Church (2001)	11
Concord Church (2005)	33
Donnaha (2005)	5
East Bend (2011)*	10-20
Elkin (2001)	0
Elkin (2005)	1
Elkin (2010)	1
Elkin (2011)	0
Enon (2007)*	10-15
Huntsville (2001)	0
Ronda (2001)	0
Ronda (2005)	0
Ronda (2011)	1
Siloam (2010)	1

*Numbers estimated since Flathead Catfish were not collected during these surveys

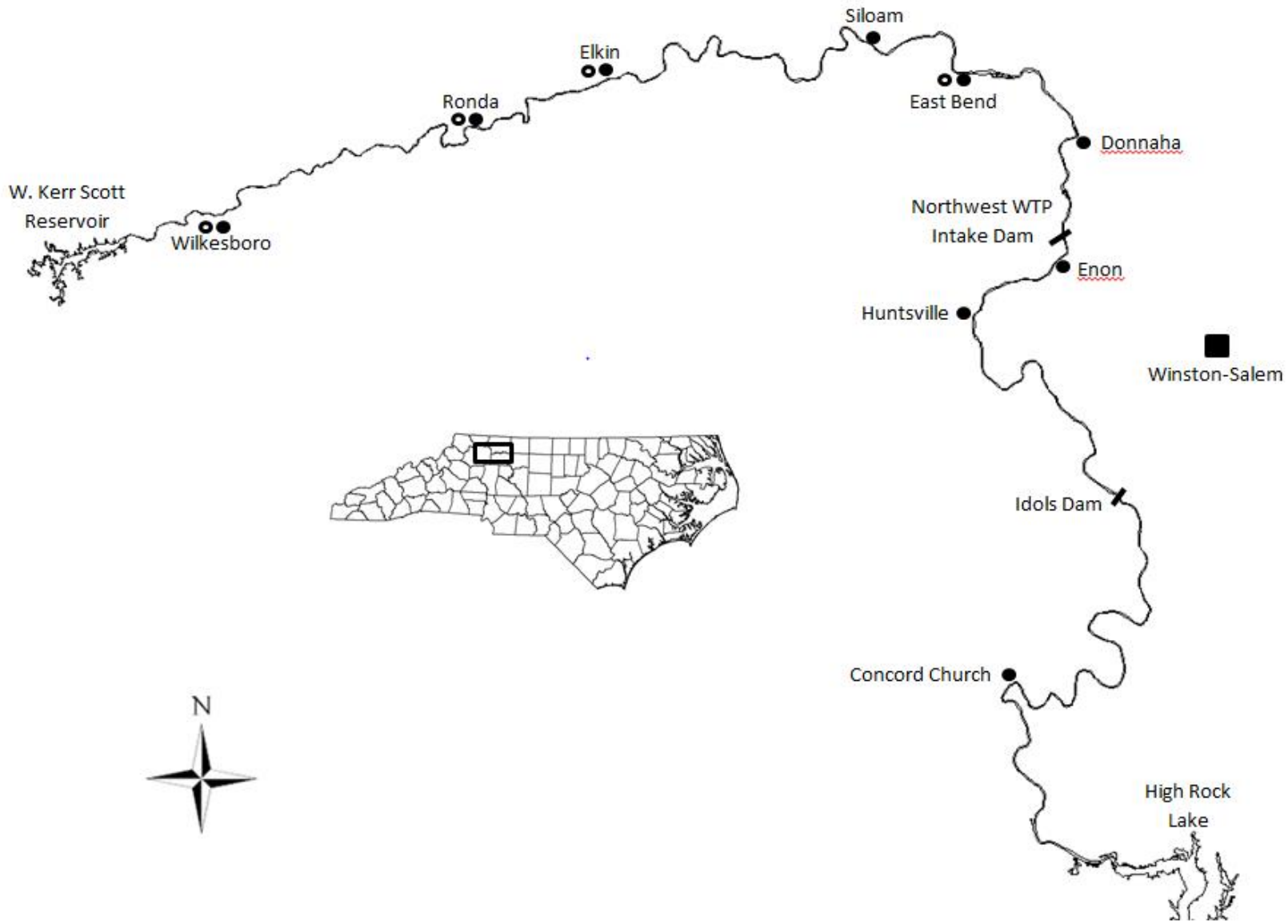

FIGURE 1.— Map of Yadkin River sites electrofished during the 2012 survey (⊙) and previous surveys (●).

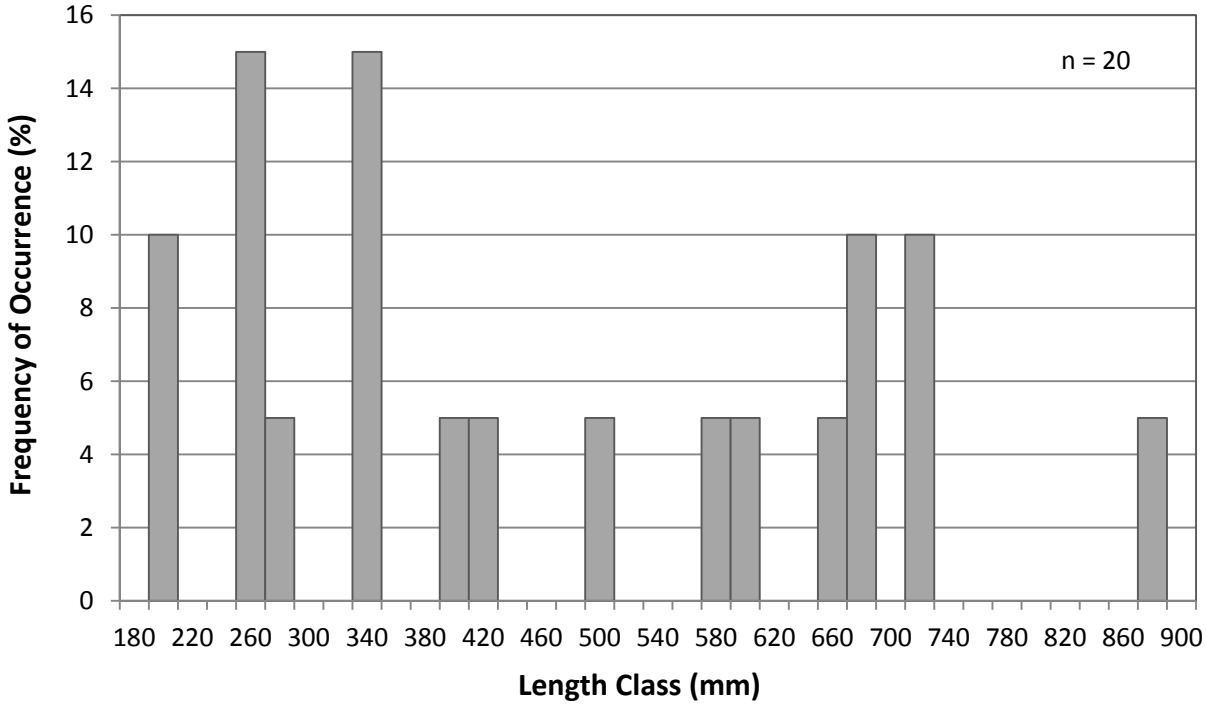

FIGURE 2.— Length-frequency distribution of Yadkin River Flathead Catfish, 2012.

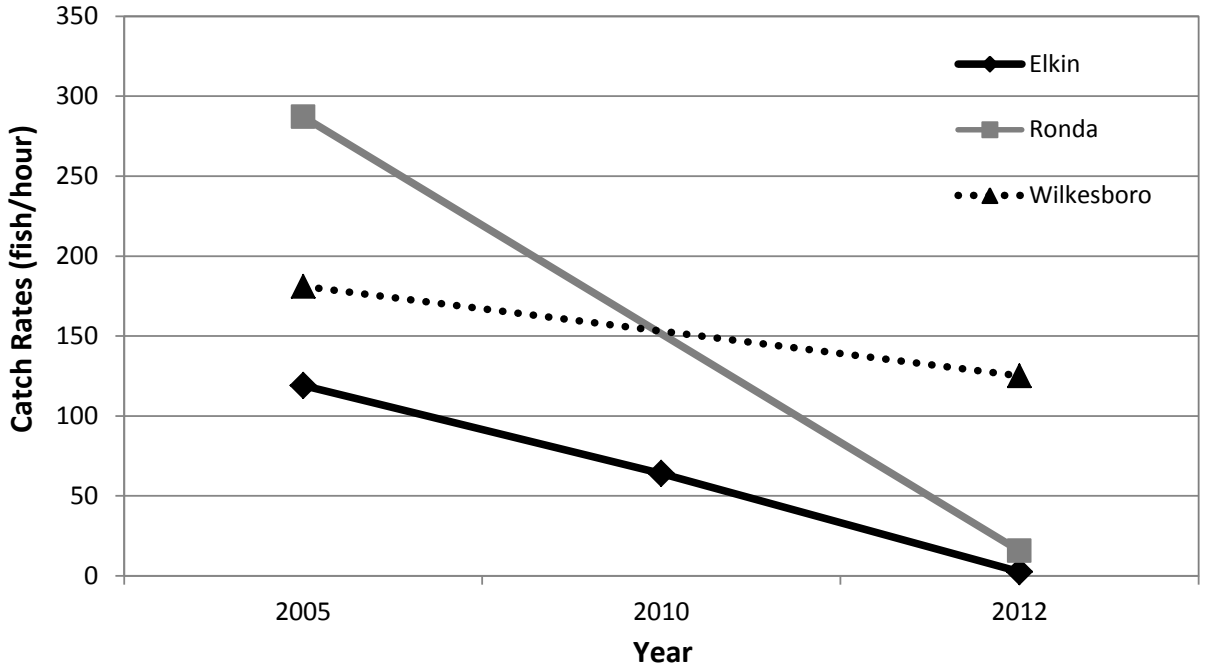

FIGURE 3.— Electrofishing catch rates of Yadkin River bullhead catfishes, 2005–2012.

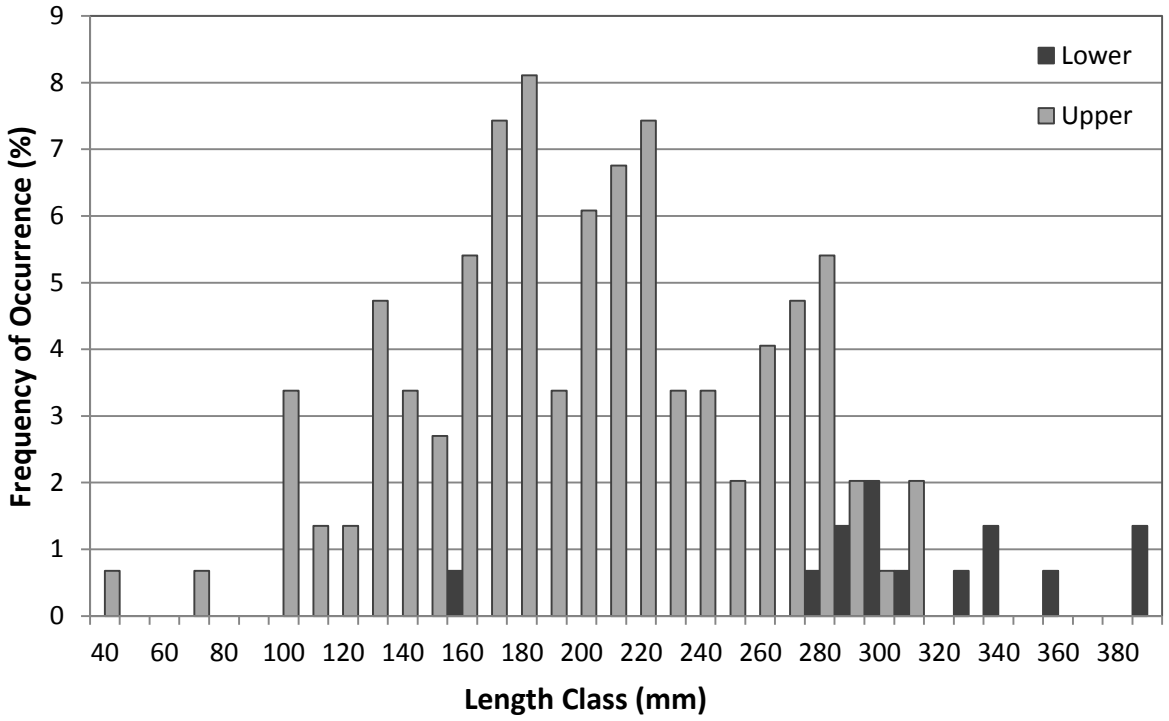

FIGURE 4.— Length-frequency distribution of Yadkin River bullhead catfishes collected from upper sites (Wilkesboro) and lower sites (East Bend, Elkin, Ronda), 2012.

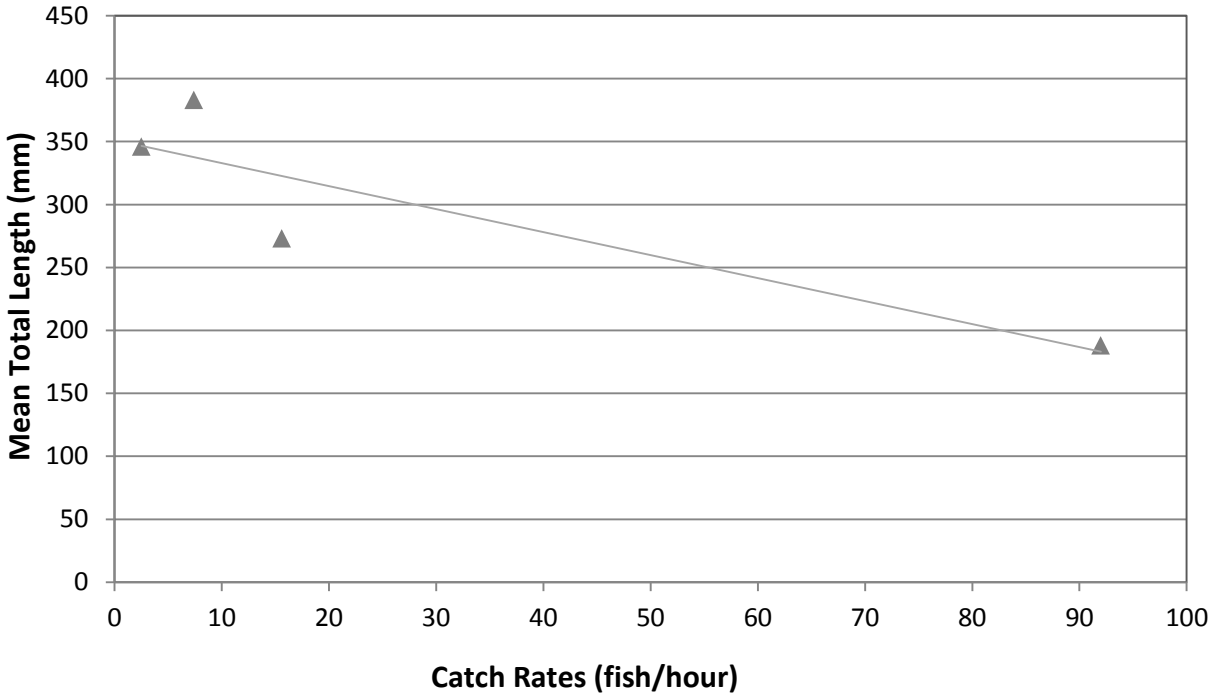

FIGURE 5.— Relationship between electrofishing catch rates and mean total length of Yadkin River bullhead catfishes, 2012.

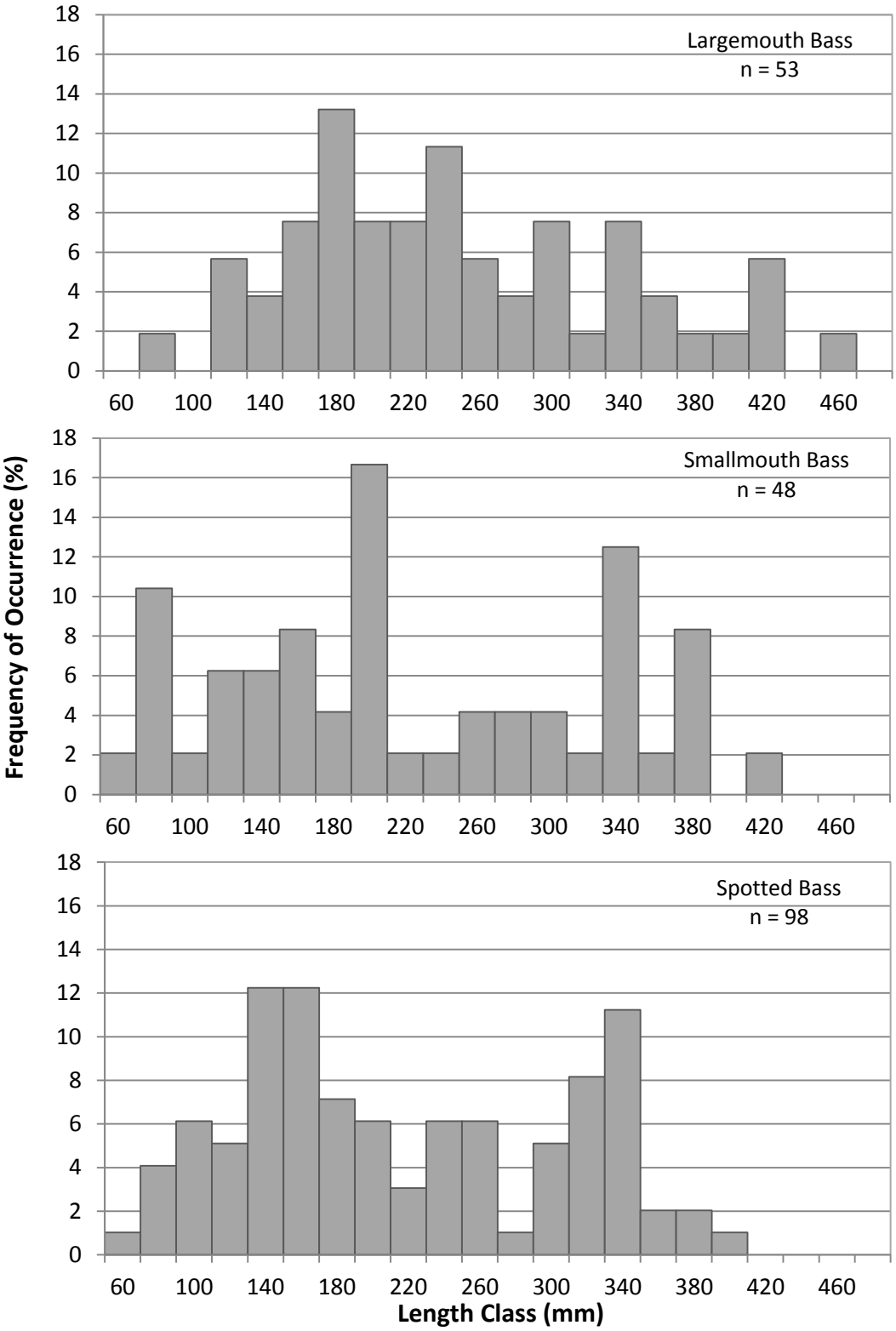

FIGURE 6.— Length-frequency distribution of Yadkin River Largemouth, Smallmouth, and Spotted Bass, 2012.

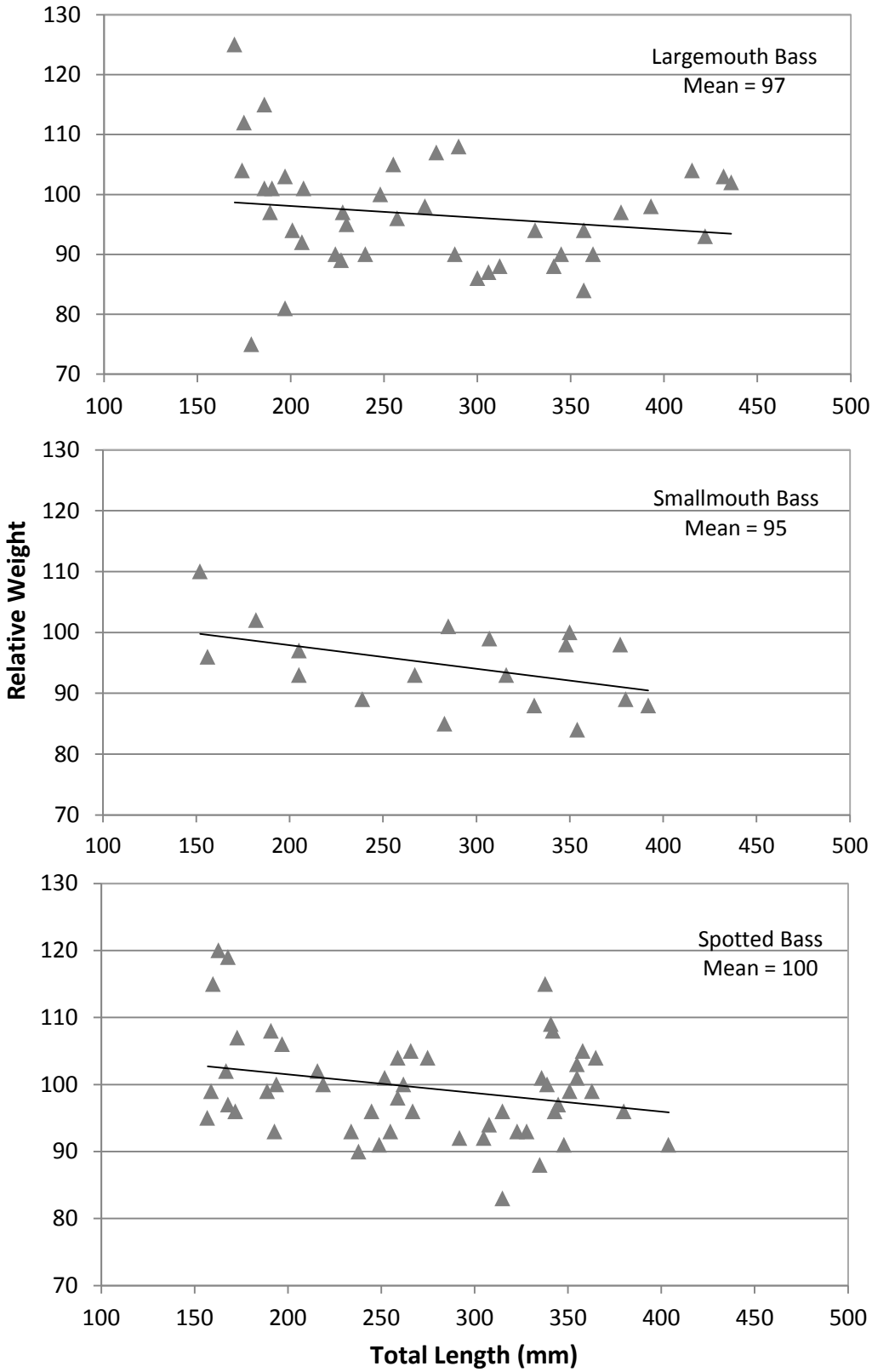

FIGURE 7.— Relative weights of Yadkin River Largemouth, Smallmouth, and Spotted Bass, 2012.

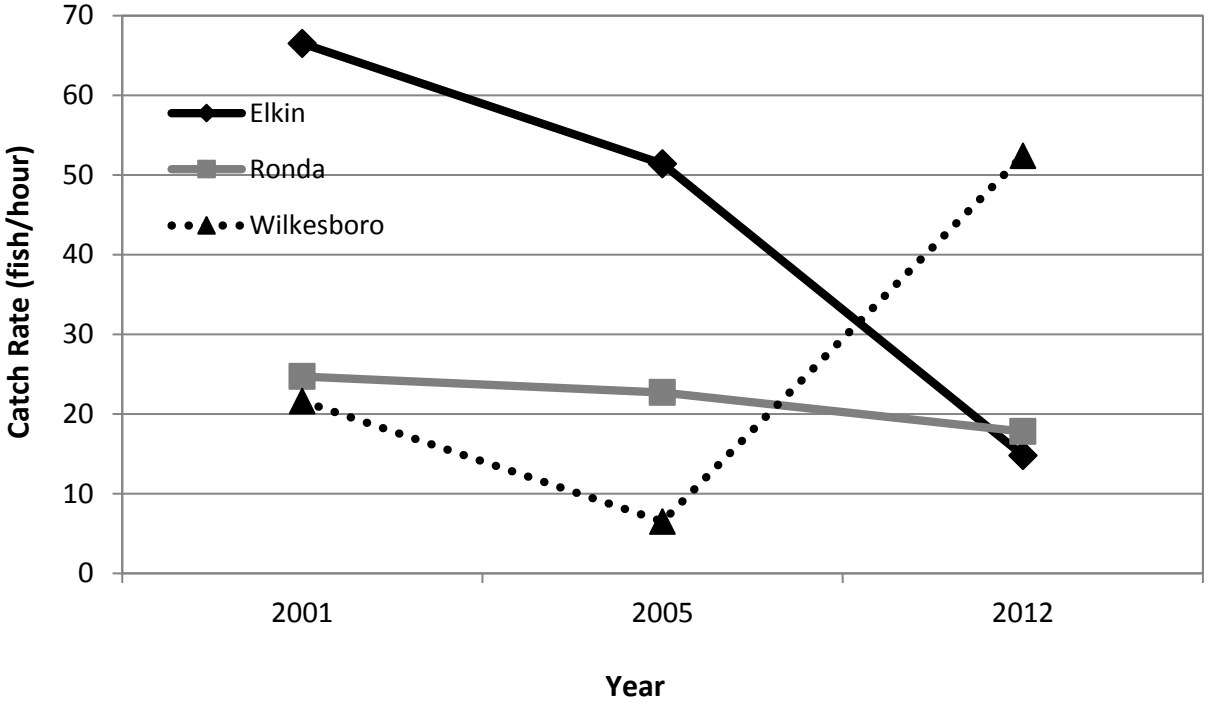

FIGURE 8.— Electrofishing catch rates of Yadkin River Redbreast Sunfish, 2001–2012.

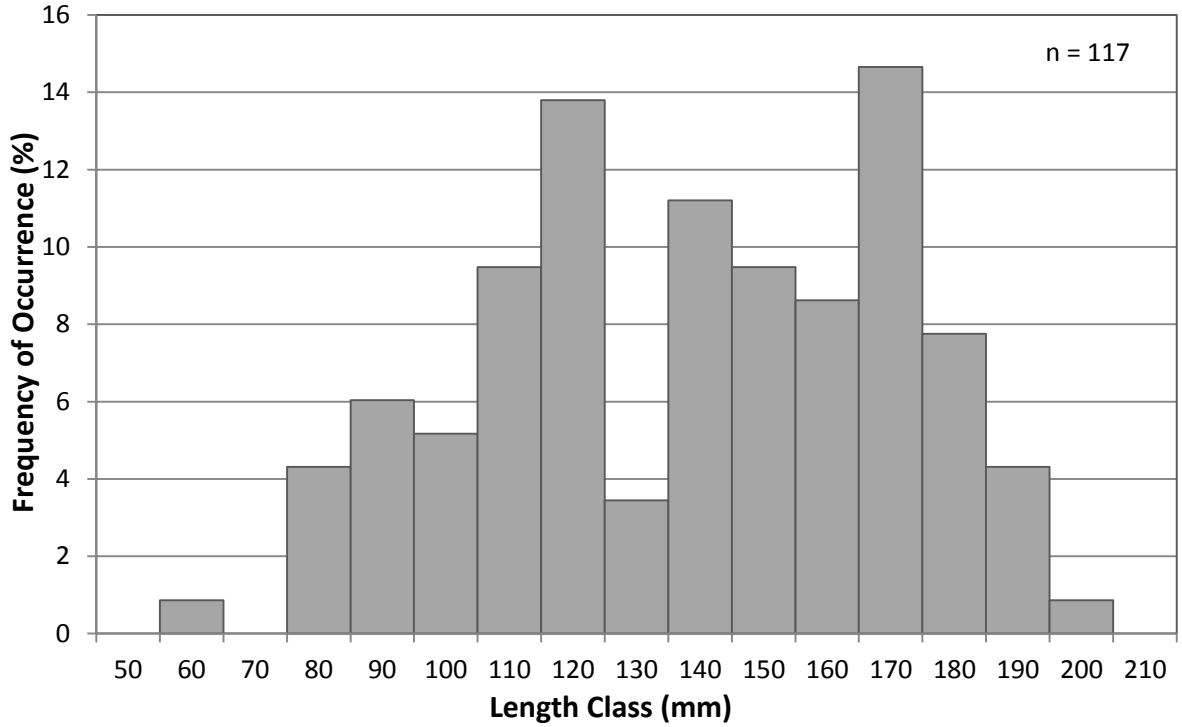

FIGURE 9.— Length-frequency distribution of Yadkin River Redbreast Sunfish, 2012.

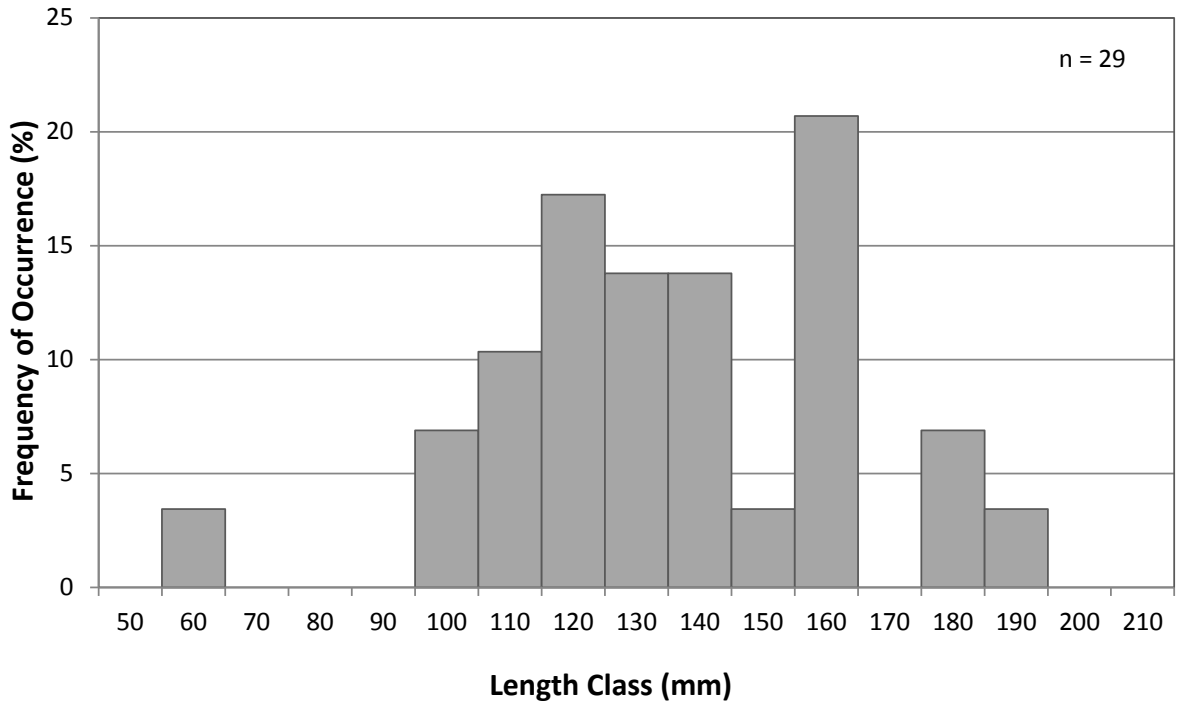

FIGURE 10.— Length-frequency distribution of Yadkin River Bluegill, 2012.

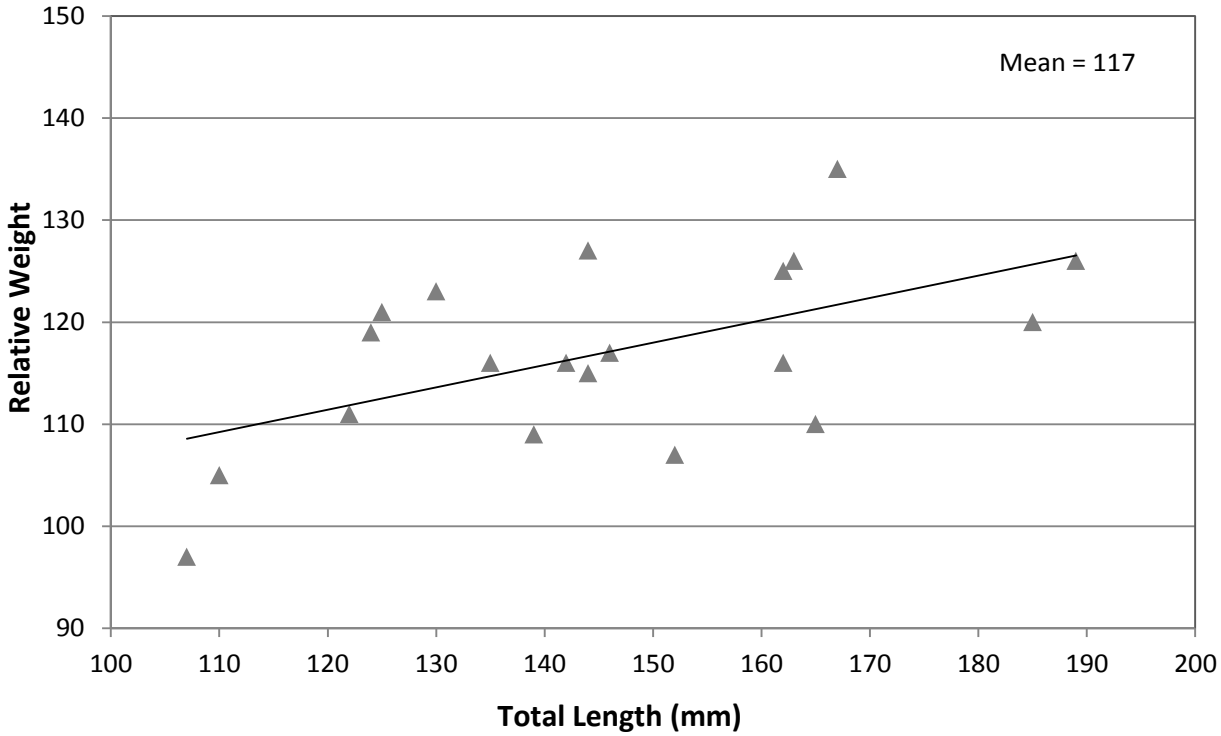

FIGURE 11.— Relative weights of Yadkin River Bluegill, 2012.

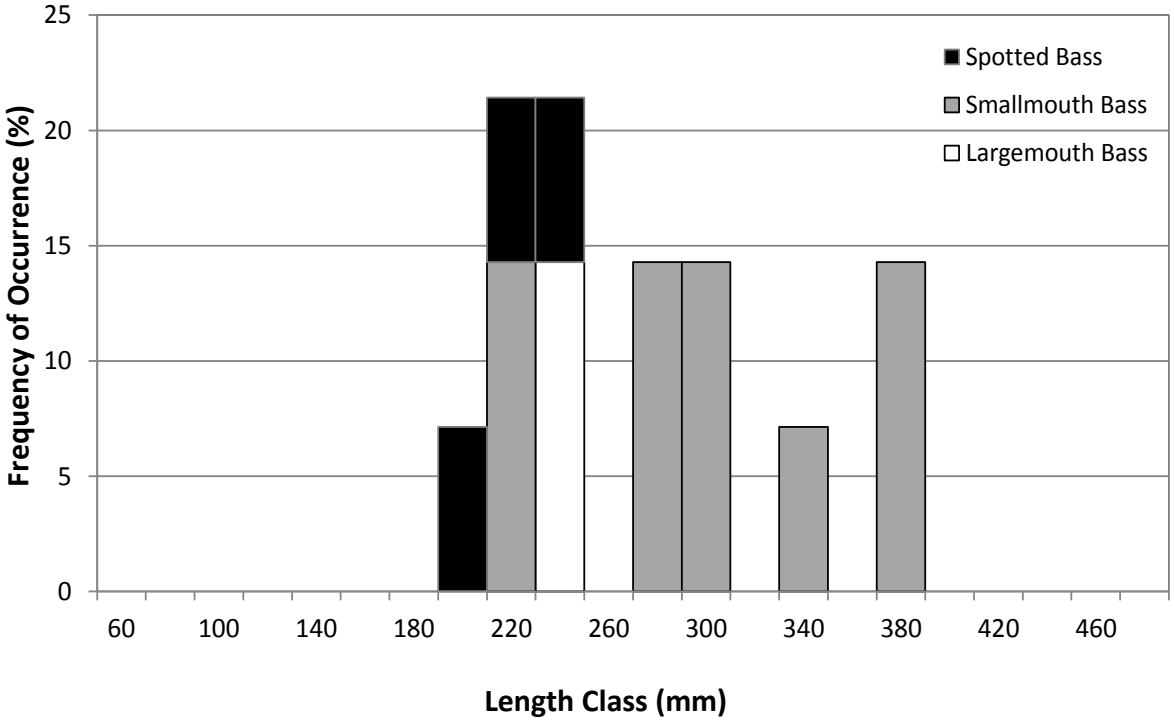

FIGURE 12.— Length-frequency distribution of Yadkin River Largemouth, Smallmouth, and Spotted Bass collected by angling, 2012.