CHARACTERISTICS OF RECREATIONALLY IMPORTANT FISH POPULATIONS OF THE WHITE OAK RIVER

Federal Aid in Sport Fish Restoration
Project F-108
Report Type: Survey

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Raleigh

2016

Keywords: Largemouth Bass, Bluegill, catfish, White Oak River, Coastal Region

This project was funded under the Federal Aid in Sport Fish Restoration Program utilizing state fishing license money and federal grant funds derived from federal excise taxes on fishing tackle and other fishing related expenditures. Funds from the Sport Fish Restoration Program are used for fisheries management and research, aquatic education, and boating access facilities. The program is administered cooperatively by the N.C. Wildlife Resources Commission and the U.S. Fish and Wildlife Service.

Abstract.—Surveys were conducted August–September 2015 in the White Oak River to assess the status of the ictalurid community and to monitor changes in sport fish population characteristics following the impacts of Hurricane Irene in 2011. Low (15 Hz) and high (120 Hz) frequency electrofishing and hoop netting in August collected 120 White Catfish *Ameiurus catus*; no other ictalurids were observed. Electrofishing for sport fish in September resulted in a mean (SE) Largemouth Bass *Micropterus salmoides* CPUE of 11.6 (2.4) fish/h. Largemouth Bass catch rates and size-structure were similar to surveys conducted in 2012. Mean Bluegill *Lepomis macrochirus* CPUE was 15.5 (2.8) fish/h, a 67% reduction from fall 2012. Few other fish of recreational angling importance were collected. Overall, the White Oak River ictalurid community may be unique among coastal NC rivers due to the lack of an established nonnative catfish population. However, the Largemouth Bass and sunfish populations have not demonstrated improvement since surveys conducted in 2012. Future surveys should analyze age-structure and habitat availability for centrarchid populations, while a recreational angler creel survey should be conducted to analyze angling effort and harvest characteristics.

The White Oak River is a blackwater stream that originates in Hoffman State Forest and flows approximately 78 km to its confluence with the Atlantic Ocean through Bogue Inlet near Swansboro, NC (Sholar 1975). The river is tidal from the flood-tidal delta at Bogue Inlet upstream approximately 45 km to a series of lakes (Belgrade Quarry Lakes) constructed between 1940 and 1960 for the Martin Marietta Belgrade Quarry (Sholar 1975; Hosier and Cleary 1982). Fisheries resources are managed by the NC Division of Marine Fisheries in designated coastal waters downstream of Grants Creek (rkm 23 as measured from the NC HWY 24 bridge in Swansboro, NC), and the NC Wildlife Resources Commission (Commission) manages adjacent inland waters.

Angler use and preferences remain unquantified for the White Oak River as no creel survey has been conducted. Commission regulations for Largemouth Bass *Micropterus salmoides* include a 356-mm minimum length limit (14 in; MLL) and 5 fish daily creel limit, except that 2 fish less than 356 mm may be kept as part of the 5 fish creel limit. Crappie (*Pomoxis* spp.) are subject to a 203-mm MLL (8 in) and 20 fish daily creel limit, while sunfish (*Lepomis* spp.) are managed by a 30 fish daily creel limit with no more than 12 Redbreast Sunfish *L. auritus*. All catfish are considered nongame species and up to 200 may be taken daily in combination with other nongame fish, crayfish, and mollusks. Regulations for inland game fish in coastal waters mirror Commission regulations. Nongame fish may be harvested by the commercial fishery in coastal waters.

Two Flathead Catfish *Pylodictis olivaris* were collected in the Belgrade Quarry Lakes in spring 2009, representing the first confirmed occurrence of the species in the White Oak River and prompting concerns that a population had become established. Additionally, the landfall of Hurricane Irene in 2011 caused hypoxic conditions throughout the watershed that resulted in widespread fish kills. Commission surveys in fall 2011 and 2012 did not detect Flathead Catfish, yet found significant impacts to sport fish populations as a result of hurricane-induced fish kills (Dycus and Homan 2013). The objective of this survey was to monitor changes in recreationally important fish populations several years after the impacts of Hurricane Irene, as well as to document the current species composition of the catfish community.

Methods

Catfish survey.—Catfish were collected during targeted sampling August 3–5, 2015. Boat-mounted electrofishing (Smith-Root 7.5 GPP) was conducted at 7 sites using high frequency (120 Hz; 5000–7500 W; one dip netter) for approximately 900 s, followed 100-m downstream by a low frequency (15 Hz; 1000–2500 W) site sampled for approximately 900 s in conjunction with a chase boat (Figure 1). Additionally, baited hoop nets (3.7-m long x 1.1-m diameter hoops x 0.4-m diameter throat with 2.5-cm bar mesh) were deployed overnight at six sites (Figure 1). Hoop nets were baited with pelleted catfish feed (Sportsman's Choice) and set parallel to shore with the opening oriented downstream.

Sport fish survey.—Boat-mounted electrofishing (Smith-Root 7.5 GPP; 120 Hz; 5000-7500 W) was utilized at 13 sites from September 3–16, 2015 to collect sport fish (Figure 1). Fish were netted as they were encountered by one dip netter while moving downstream (regardless of tide) for approximately 900 s at each site. Fish were enumerated by species, measured for total length (TL; mm), weighed to the nearest gram, and released.

Data analyses.—For each species with more than 40 collected individuals, relative abundance was indexed as catch per unit effort (CPUE; fish/h) by gear type. Size-structure was evaluated using length-frequency distributions. Relative weight (W_r) was used to assess condition based on standard weight equations reported by Bister et al. (2000) and Willis et al. (2010).

Results and Discussion

Catfish survey—White Catfish *Ameiurus catus* were the only ictalurid observed during this survey. All 120 White Catfish were collected using low frequency electrofishing. Mean (SE) CPUE was 63.1 (13.5) fish/h, with the highest CPUE coming from rkm 25 (130 fish/h; Table 1). Catch effort for fish greater than 200 mm was 33.5 fish/h, while CPUE was 3.1 fish/h for fish greater than 400 mm. Most White Catfish were collected just upstream of the transition zone from freshwater to brackish water (rkm 15–23). All of the White Catfish collected in the most downstream site (rkm 15) were congregated around the SR 1442 bridge pylons. It is likely that the electrofishing effective range and gear efficiency was decreased in this site, as the subsurface salinity indicated the presence of a salt wedge. Analysis of White Catfish size-structure indicated gear bias using low frequency electrofishing with a chase boat was minimal (Figure 2) as catch declined with increasing size for fish greater than 100-mm TL. Mean length was 218 (8.7) mm, while the largest fish captured was 534 mm. This largest individual also represents the largest White Catfish ever collected in the White Oak River (Commission unpublished data). Mean relative weight was 94 (2.4), indicating most individuals displayed good condition (Figure 3). Mean relative weight of individuals greater than 300 mm was 79 (1.7). Varying salinity conditions may influence White Catfish condition and growth due to fluid loss and the increased energy demand of osmotic regulation in a hypertonic environment (Lagler et al. 1962; Kendall and Schwartz 1968). This impact may be less pronounced in juvenile fish as a higher gill-to-body surface ratio improves osmotic regulation and anabolism (Lagler et al. 1962; Pauly 1979). Alternatively, temporary laboratory diuresis (Lagler et al. 1962) could confound comparisons of condition between fish collected in fresh and brackish environments.

Nelson and Little (1986) found that hoop nets were the most effective gear for sampling White Catfish in the Neuse River. Hoop nets have also been reported to be effective for the collection of Channel Catfish *Ictalurus punctatus* and Blue Catfish *I. furcatus* (Flammang and Schultz 2007; Buckmeier and Schlechte 2009; Bodine et al. 2013). The ineffectiveness of hoop nets in this survey may be due to bait selection. Future hoop net deployments should use soybean cake as a standardized bait (Flammang and Schultz 2007; Wallace et al. 2011). Additionally, deployment duration greater than one net night may be required (Bodine et al. 2013).

Sport fish survey.—A total of 40 Largemouth Bass ≥200 mm were collected in 13 electrofishing sites for a mean CPUE of 11.6 (2.4) fish/h. Largemouth Bass ranged 84–505 mm, with a unimodal size distribution (Figure 4) and a mean length of 264 (12.7) mm. Only 12% (*N* = 6) of the Largemouth Bass catch was larger than 356 mm. Mean relative weight was 92 (1.1), indicating most individuals displayed good condition (Figure 5). Dycus and Homan (2013) reported similar Largemouth Bass catch effort (15.3 fish/h) and size-structure (mode = 250-mm size-group) one year after Hurricane Irene as found in this survey. It is possible that Largemouth Bass population dynamics reached equilibrium after a quick recovery period in 2012, the year following Hurricane Irene. However, fall 2007 CPUE (21.0 fish/h) and size-structure (mode = 350-mm size-group) have not been attained (Commission unpublished data).

A total of 45 Bluegill *L. macrochirus* were captured in 11 electrofishing sites for a mean CPUE of 15.5 (2.8) fish/h. Bluegill ranged 88–231 mm and exhibited an approximate uniform distribution (Figure 6) with a mean of 149 (6.0) mm. Bluegill relative weights (Figure 7) were widely varying with a mean of 84 (2.5). Dycus and Homan (2013) reported a fall 2012 CPUE (47.3 fish/h) that approached the level seen before Hurricane Irene. Bluegill catch effort in fall 2015 was much lower, possibly due to different environmental conditions during sampling events (higher water temperatures and salinities in fall 2015), although Dycus and Homan (2013) reported that few juvenile sunfish catches in fall 2012 surveys were a cause for concern.

In addition to Largemouth Bass and Bluegill, 19 Redear Sunfish *L. microlophus*, 7 Chain Pickerel *Esox niger*, 6 Redbreast Sunfish, 4 Pumpkinseed *L. gibbosus*, 2 Warmouth *L. gulosus*, and 2 Black Crappie *P. nigromaculatus* were collected. Davis and McCoy (1965) found the dominant game fish populations during summer rotenone and seine samples were Redbreast Sunfish, Bluegill, and Redfin Pickerel *E. americanus*. The Redbreast Sunfish population has likely experienced a decline since the 1964 surveys (Davis and McCoy 1965), as they have not constituted more than 8% of the electrofishing catch in 9 surveys since 1995 (Commission unpublished data). Redear Sunfish were introduced into the White Oak River in 1954 (Davis and McCoy 1965), and demonstrated a high catch rate during surveys in the 2000s (Commission unpublished data). It is likely that Redear Sunfish were significantly impacted by Hurricane Irene and will require additional recruitment and growth before attaining pre-Hurricane Irene levels.

Conclusions

Previous surveys of coastal streams suggest varying salinities can lead to habitat compression and reduced growth rates for Largemouth Bass in the White Oak River (Keup and Bayless 1964; Tebo and McCoy 1964; Rundle and Barwick 2005). White Oak River Largemouth Bass demonstrated the least growth potential in an analysis of surveys conducted 1997–2009 in 5 coastal NC rivers (Barwick and Homan 2011). Although significant improvement in Largemouth Bass growth is unlikely, additional time may be needed for improvements to abundance and size-structure.

Sunfish catch rates were poor compared to previous surveys. Given the prolific reproductive potential of many sunfish (Davis 1971; Carlander 1977), future surveys are warranted to evaluate abundance and age-structure, and to identify factors potentially limiting Bluegill, Redear Sunfish, and Redbreast Sunfish.

The lack of Flathead Catfish collected during this survey suggests a population has not been established in the six years since their first confirmed observation in the river. Although this survey did not sample the Belgrade Quarry Lakes where Flathead Catfish were collected in 2009, Commission surveys in 2013 conducted upstream of the Belgrade Quarry Lakes failed to collect any Flathead Catfish (Commission unpublished data). If a Flathead Catfish population has become established in the White Oak River, it is currently confined to the Belgrade Quarry Lakes. It is possible that the White Oak River, along with the New and Newport rivers (Davis and McCoy 1965; Commission unpublished data), are the only coastal streams remaining in North Carolina with an exclusively native catfish community.

Management Recommendations

1. Maintain current minimum length limits and daily creel limits for inland game fish.
2. Conduct a recreational angler creel survey to assess angler utilization and harvest information. No creel survey information is available for the White Oak, New, or Newport rivers. Their close proximity and limited access points may enable a single survey to adequately characterize all three systems.
3. By 2017, conduct surveys to assess abundance, age-structure, and population dynamics for inland game fish and White Catfish. Continue catfish community surveys to monitor any expansion in the geographical distribution of nonnative catfish.
4. Evaluate the effectiveness of hoop nets for surveying catfish in tidal streams. Hoop nets are successfully used in lentic systems for Channel Catfish and Blue Catfish surveys, and have been effective in previous Commission surveys of White Catfish. Size (diameter and length), mesh size, deployment (single or tandem; opening orientation; duration), and bait should be standardized to minimize size selectivity and abundance biases.

Acknowledgments

We extend appreciation to NCWRC staff from the Enforcement and Land and Water Access divisions for considerable assistance during field sampling. Suggestions and comments from Kevin Dockendorf and Chad Thomas to previous drafts were valued and improved the quality of this report.

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TABLE 1.—White Catfish catch using low frequency (15 Hz) electrofishing. Electrofishing sites were conducted within the river kilometer indicated (RKM; measured from the NC HWY 24 bridge in Swansboro, NC). No White Catfish were collected using high frequency electrofishing (120 Hz) or baited hoop nets. Numbers in parentheses denote standard error.

		Catch						
RKM	**Effort (s)**	**<100mm**	**100–199mm**	**200–299mm**	**300–399mm**	**400+ mm**	**Total**	**CPUE (fish/h)**
31	926	0	3	6	2	0	11	42.8
29	1026	0	3	2	0	0	5	17.5
27	1013	0	17	6	1	0	24	85.3
25	969	2	12	12	7	2	35	130.0
23	889	0	6	3	4	2	15	60.7
19	924	1	10	2	0	1	14	54.5
15	1138	0	2	11	2	1	16	50.6
Total	6885	3	53	42	16	6	120	63.1 (13.5)

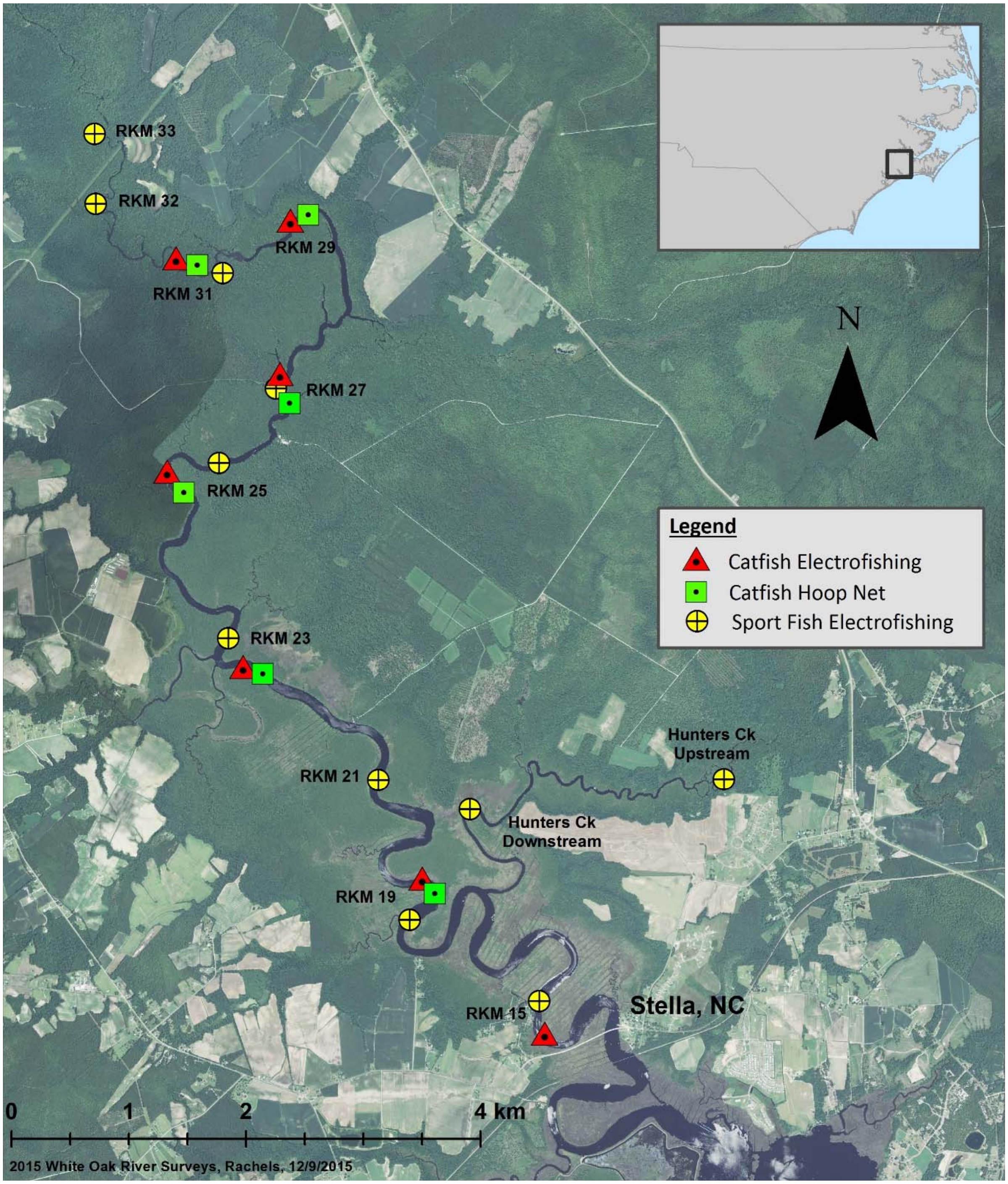

FIGURE 1.—Sites surveyed for catfish and sport fish in the White Oak River in 2015. Each catfish electrofishing site consisted of a high frequency (120 Hz) site followed by a low frequency (15 Hz) site.

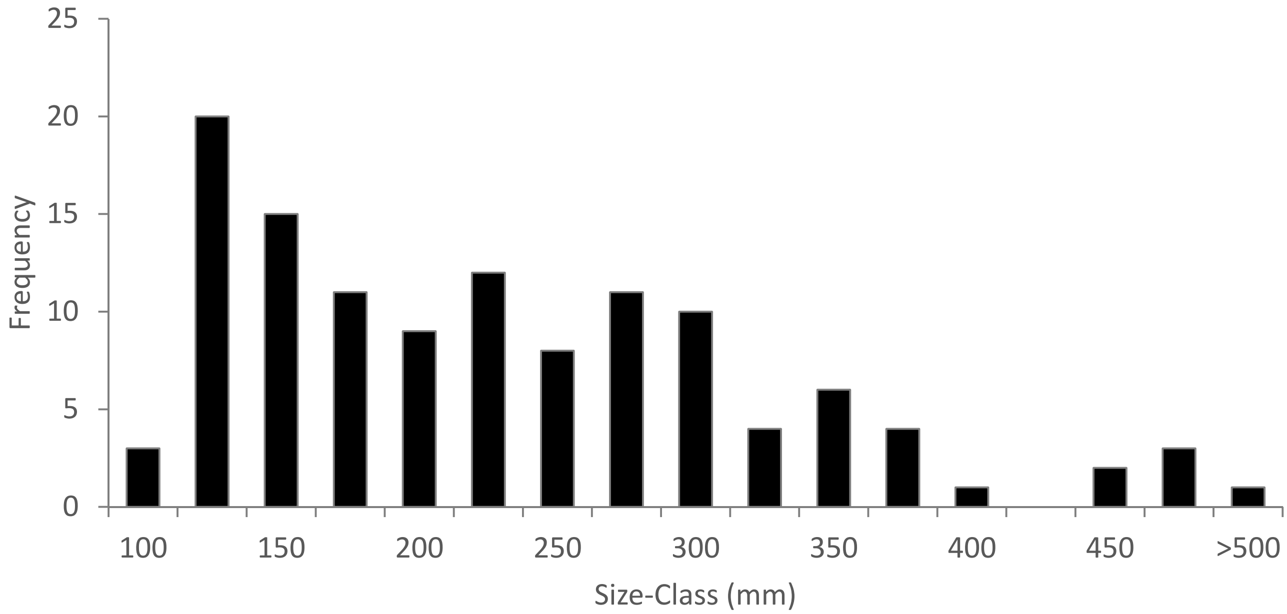

FIGURE 2.—White Catfish length frequency (N = 120) collected using low frequency (15 Hz) electrofishing in the White Oak River, 2015.

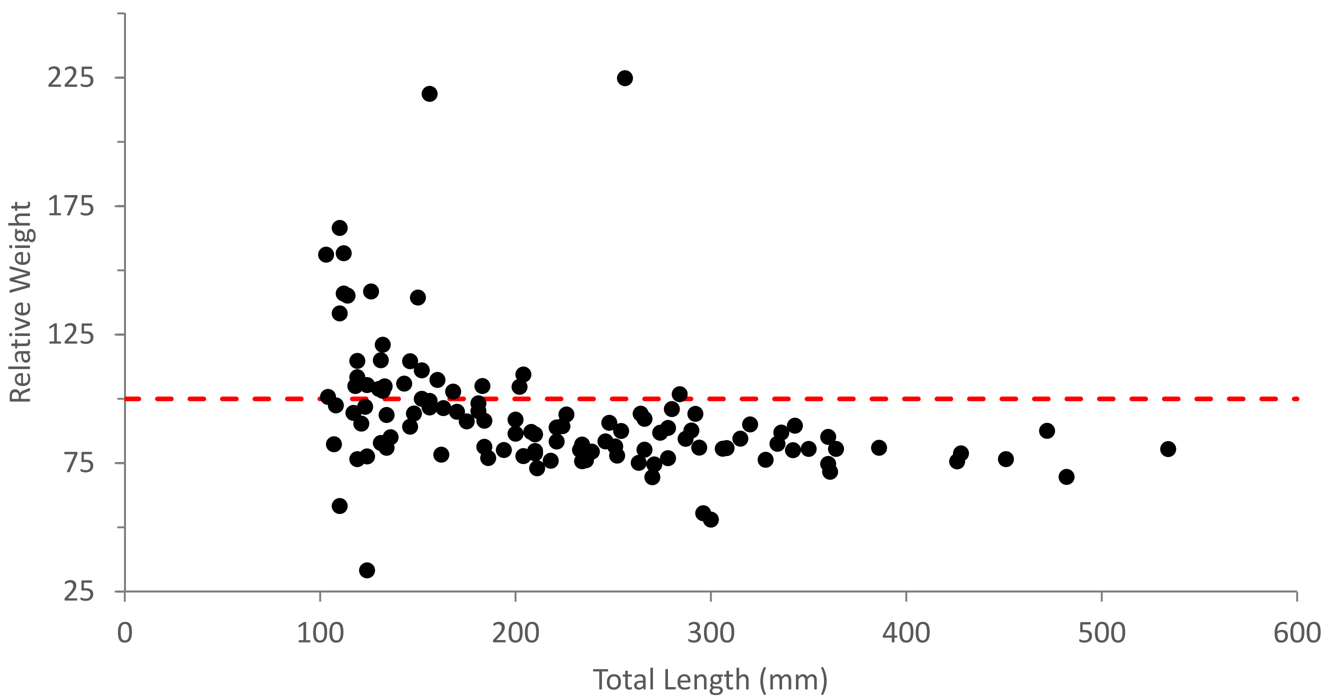

FIGURE 3.—White Catfish relative weight for fish greater than 100 mm (N = 117) collected using low frequency (15 Hz) electrofishing in the White Oak River, 2015. The red line represents the 75th percentile of relative weight for White Catfish across their geographical distribution.

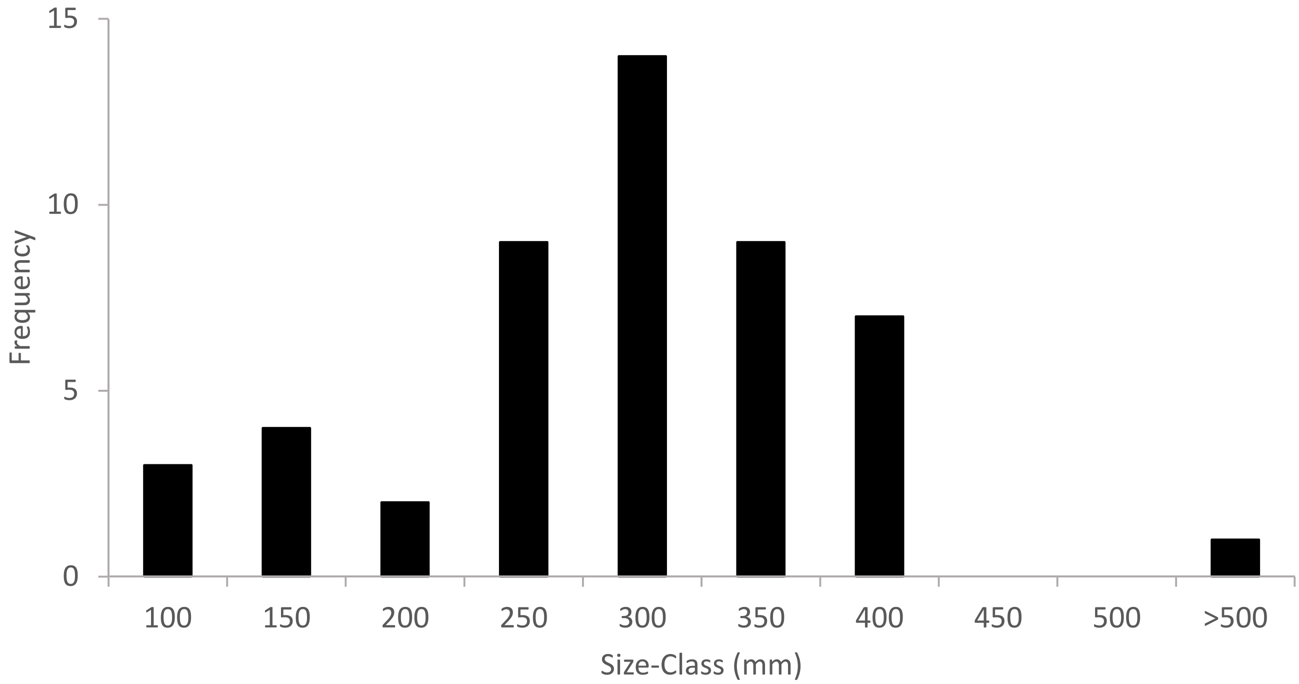

FIGURE 4.—Largemouth Bass length frequency (*N* = 49) collected using high frequency (120 Hz) electrofishing in the White Oak River, 2015.

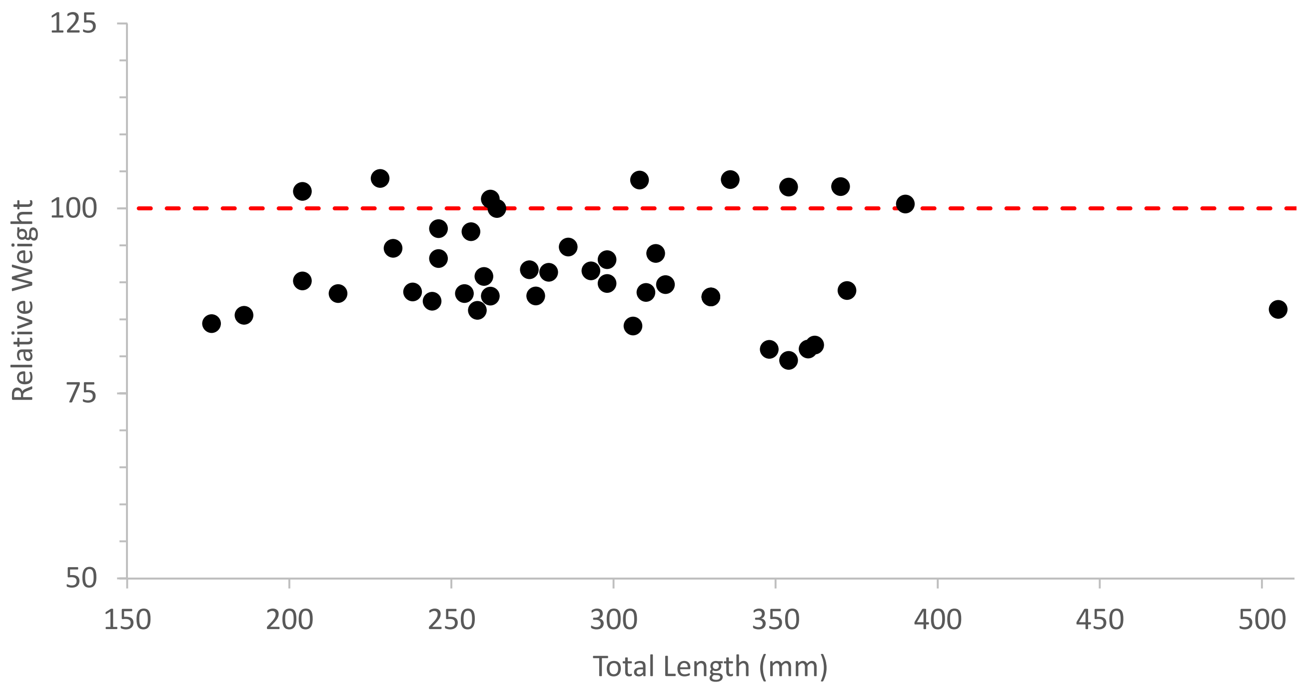

FIGURE 5.—Largemouth Bass relative weight for fish greater than 150 mm (*N* = 42) collected using high frequency (120 Hz) electrofishing in the White Oak River, 2015. The red line represents the 75th percentile of relative weight for Largemouth Bass across their geographical distribution.

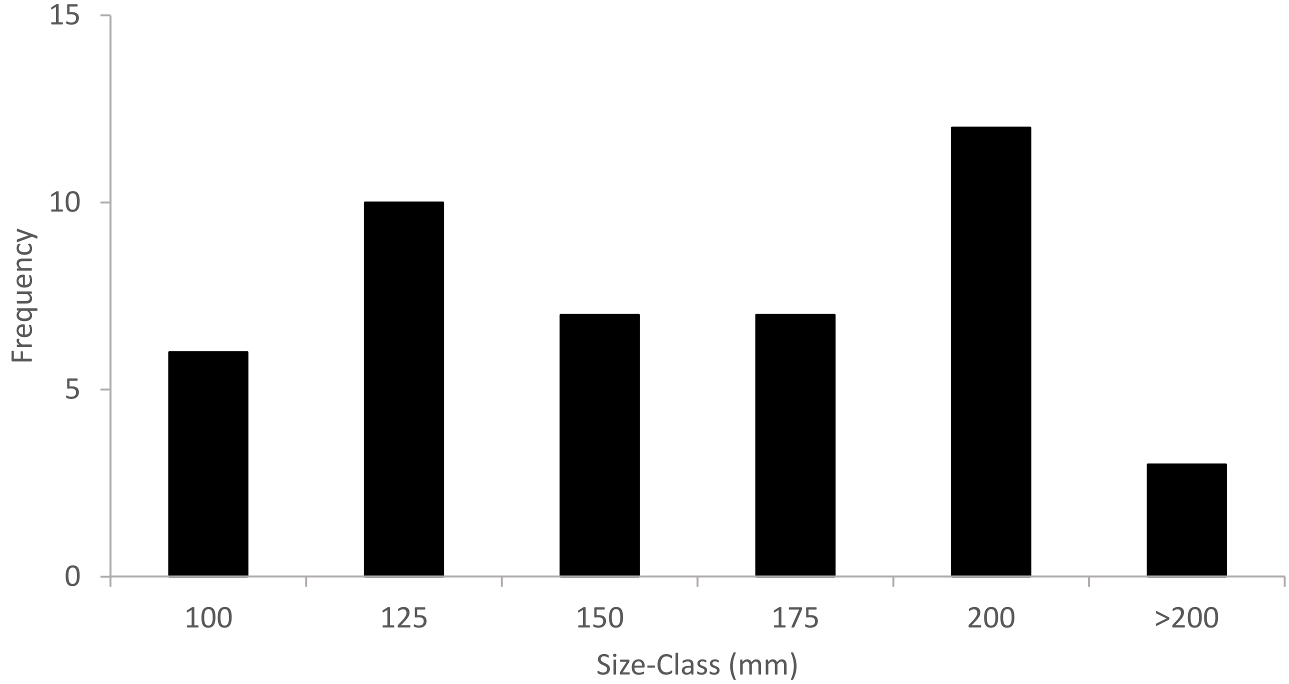

FIGURE 6.—Bluegill length frequency (*N* = 45) collected using high frequency (120 Hz) electrofishing in the White Oak River, 2015.

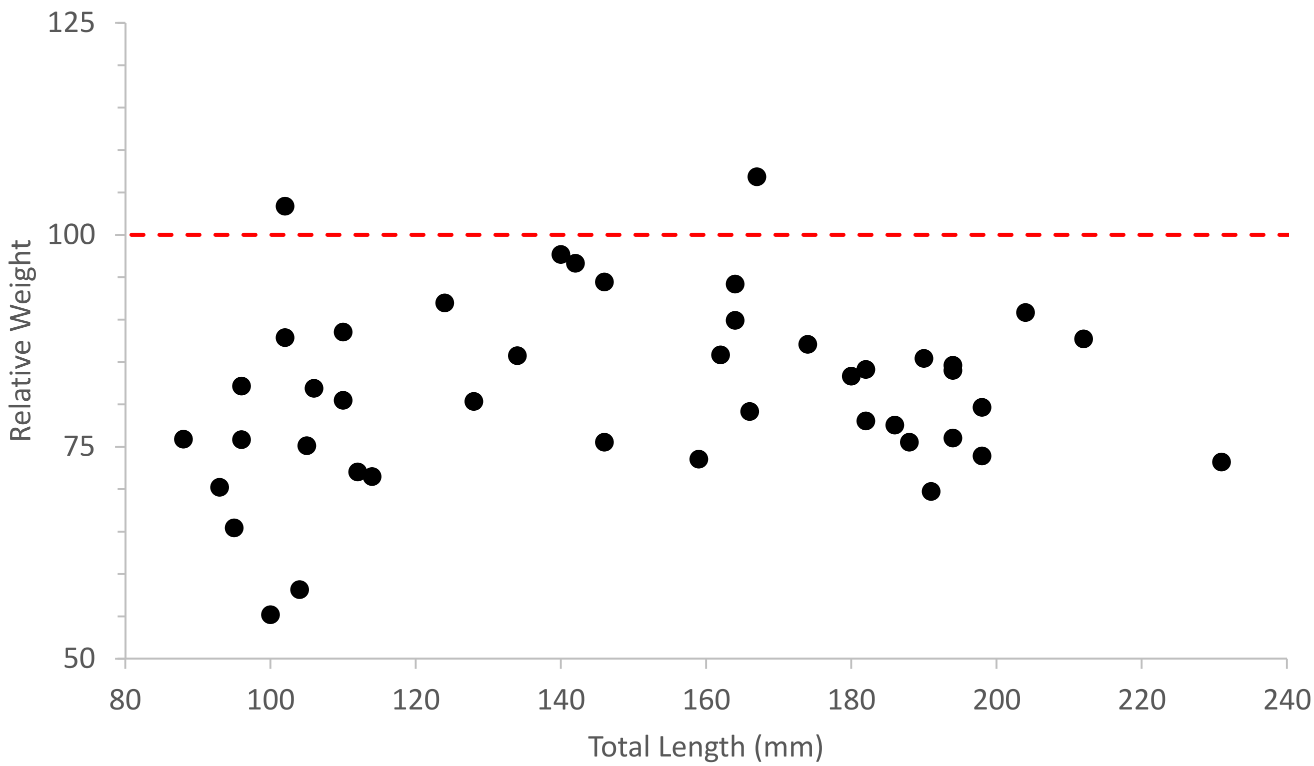

FIGURE 7.—Bluegill relative weight for fish greater than 80 mm (*N* = 45) collected using high frequency (120 Hz) electrofishing in the White Oak River, 2015. The red line represents the 75th percentile of relative weight for Bluegill across their geographical distribution.