2020 SPORT FISH SURVEY OF THE NEUSE RIVER, NORTH CAROLINA

Federal Aid in Sport Fish Restoration
Project F-108

Benjamin R. Ricks
T.D. VanMiddlesworth

North Carolina Wildlife Resources Commission
Inland Fisheries Division
Raleigh

2021

Keywords: Largemouth Bass, Bluegill, Redear Sunfish, Neuse River

Recommended Citation

Ricks, B. R., and T.D. VanMiddlesworth. 2021. 2020 sport fish survey of the Neuse River, North Carolina. North Carolina Wildlife Resources Commission, Federal Aid in Sport Fish Restoration, Project F-108, Final Report, Raleigh.

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. Monitoring of the Neuse River is necessary to ensure regulations are appropriate and beneficial to our angling constituency. Sport fish were collected from the Neuse River with boat-mounted electrofishing gear October through November 2020. Largemouth Bass *Micropterus salmoides*, Bluegill *Lepomis macrochirus*, and Redear Sunfish *L. microlophus* size structure, relative abundance, and condition were assessed. Other sport fish species were collected but not in sufficient abundance to warrant analysis. Largemouth Bass abundance was near average when compared to previous Neuse River samples, with much of the sample consisting of ages 0 and 1. Bluegill abundance in the Neuse River appeared to indicate that fish are reproducing in a manner expected for a healthy population. Memorable- and trophy-length Bluegill were not observed; however, this seems to be typical for the Neuse River. Redear Sunfish in the Neuse River were observed up to memorable-length, although the low sample size merits caution when analyzing this data set. Condition factors suggest adequate forage availability for all three species. The declining abundance of Redbreast Sunfish and Pumpkinseed is a notable trend. Declines could be attributed to Flathead Catfish predation as the abundance of these two sunfish species has decreased since the establishment of Flathead Catfish in the Neuse River. Lastly, the decrease in abundance of Largemouth Bass between age 2 and 3 was evidence of fish kills associated with Hurricane Florence in 2018.

The Neuse River begins near Raleigh, NC, 376 km from the mouth where it joins the Pamlico Sound. The source of the Neuse River in the coastal plain originates from a hypolimnetic discharge from Falls Lake Dam. At its origin, the Neuse River can be clear to turbid depending on rainfall and sediment loading. The Neuse River gradually converts to a blackwater system typical of coastal North Carolina rivers. Anglers fishing this river target freshwater, anadromous, and marine fish species. The lower 64 km of the Neuse River experiences salinity influences from the Pamlico Sound, and marine species are commonly observed. The rest of the Neuse River basin supports a warmwater fish assemblage that provides a recreational fishery valued around $4,000,000 annually (Rundle et al. 2004). The majority of the freshwater fishing activity targets Largemouth Bass *Micropterus salmoides,* sunfish *Lepomis* spp., Black Crappie *Pomoxis nigromaculatus*, and catfish *Ictalurus spp.*

Hurricane-related fish kills have been well documented throughout the southeastern United States (Tabb and Jones 1962, Alford et al. 2009, Vrancken and O'Connell 2010) and in North Carolina (McCargo et al. 2008, Thomas and Dockendorf 2009, Ricks and Rachels 2015). These widespread kills are often a result of increased biological oxygen demand that causes a decrease in dissolved oxygen. The increase in biological oxygen demand is usually caused by decomposition of high inputs of natural material, re-suspension of bottom sediments, or wastewater system overflows (Bales and Childress 1996, Bales and Waters 2004). The most significant hurricanes to impact the Neuse River basin in recent years were Hurricane Irene (2011), Hurricane Matthew (2016), and Hurricane Florence (2018). While Hurricane Irene caused extensive fish kills in the Neuse River basin, hurricanes Matthew and Florence were responsible for isolated fish kill events.

In addition to hurricane-related fish kills, non-native fish introductions have become a conservation concern for the Neuse River. The primary non-native introduction that has impacted the Neuse River is the establishment of Flathead Catfish *Pylodictis olivaris*. Flathead Catfish compete with and predate directly on native fish species (Pine et al. 2005; Baumann and Kwak 2011).

Any significant changes to the fish assemblage in the Neuse River could have impacts on recreational angling success. Therefore, it is important for fishery managers to monitor changes and shift management actions accordingly. Survey objectives are to document recovered populations and establish a baseline to allow for comparison with future surveys. In addition, impacts to Neuse River sport fish populations from invasive Flathead Catfish will also be documented.

Methods

Sport fish were collected with boat-mounted electrofishing gear (Smith Root 7.5 GPP; 5000–8000 W pulsed DC; 4−6 amps) during daylight hours between October 10, 2020 and November 10, 2020. Sites targeted either Largemouth Bass only or sport fish, which consisted of all sport fish species observed excluding catfishes. Twenty-five (12 tributary and 13 mainstem) sport fish sites and 26 (17 tributary and 9 mainstem) Largemouth Bass-only sites were surveyed (Figure 1). Sampling sites were along shoreline transects and were 15 minutes in duration for sport fish sites and 30 minutes in duration for Largemouth Bass-only sites. For each site, target species were netted as they were encountered and held in a livewell. Upon completion of the site, all fish collected were enumerated, measured for total length (TL, mm), and weighed (g). Up to 10 Largemouth Bass per 25-mm length increment were sacrificed for sagittal otolith extraction and age determination. Otolith annular rings were first enumerated in whole view under a dissecting microscope. Otoliths determined to be age 3 or older were divided in half, sanded, and polished. Otolith annular rings were then enumerated using fiberoptic light directed across the polished section of the otolith (Hoyer et al. 1985; Buckmeier and Howells 2011). Each otolith was read by two readers. Any discrepancies between the two readers were resolved with a third read in concert.

Relative abundance of Largemouth Bass, Bluegill *L. macrochirus,* and Redear Sunfish *L. microlophus* was expressed as the number of fish collected per electrofishing hour and was indexed as catch-per-unit-effort (CPUE; fish/h). Largemouth Bass CPUE was reported for combined Largemouth Bass-only sites and sport fish sites. Relative abundance was reported for multiple length categories. Length categories were defined for Largemouth Bass as stock-length (200−299 mm), quality-length (300−379 mm), preferred-length (380−509 mm) and memorable-length (510−629 mm). Bluegill length categories were defined as stock-length (80−149 mm), quality-length (150−199 mm), preferred-length (200−249 mm) and memorable-length (250−300 mm). Redear Sunfish length categories were defined as stock-length (100−179 mm), quality-length (180−299 mm), preferred-length (230−279 mm) and memorable-length (280−329 mm). Size structures of the Largemouth Bass, Bluegill, and Redear Sunfish populations were evaluated with length frequency histograms as well as proportional size distribution (PSD; Anderson and Newman 1996; Guy et al. 2007). Largemouth Bass, Bluegill, and Redear Sunfish condition factors were assessed with the relative weight index (W_r) developed by Wege and Anderson (1978). For Largemouth Bass, mean length-at-age was calculated after applying a length-at-age key to the entire sample. The Poisson GLM mortality estimator was used to calculate total instantaneous mortality using the peak plus 1 observed year class abundance (Z; Nelson 2019).

Results

A total of 403 Largemouth Bass was collected from the Neuse River; 276 Largemouth Bass were stock-length or greater (Table 1). Relative abundance was highly variable between transects (range 0–56 fish/h), and mean CPUE was 18.42 fish/h (SE = 2.22). Substock-length and stock-length Largemouth Bass were most abundant (overall CPUE 11.9 fish/h) and constituted 60% of the sample (Figure 2). Largemouth Bass lengths ranged from 66 mm to 597 mm, and 23% were at or above the minimum length limit (356 mm; Figure 3). Mean length for Largemouth Bass was 266 mm (SE = 6.1). PSD for Largemouth Bass was 57%. $PSD_{Q\text{-}P}$ and $PSD_{P\text{-}M}$ were similar at 28% and 24% while $PSD_{S\text{-}Q}$ was higher (43%; Figure 4). Mean relative weight for Largemouth Bass was 98 (SE = 0.6) and was similar across all length categories (Stock-length W_r = 94, SE = 0.7; Quality-length W_r = 98, SE = 1.0; Preferred-Length W_r = 100, SE = 1.0; Memorable-length *W_r = 98, SE = 1.8*; Figure 5). Largemouth Bass ages ranged from 0 to 10 (Table 2). The most abundant ages were ages 0–2, which constituted 78% of the sample (Figure 6). The Poisson GLM mortality estimator yielded an instantaneous mortality rate (*Z)* of 0.47 (SE = 0.07), which corresponds to a 37% annual discrete mortality rate (A).

A total of 423 Bluegill was collected from the Neuse River (Table 3). Relative abundance of Bluegill was highly variable between transects (ranged 0–302 fish/h). Mean CPUE was 61.7 fish/h (SE = 13.4) with quality-length being the highest in abundance (30.3 fish/h). Bluegill lengths ranged from 52 mm to 234 mm, and the majority of the sample (72%) was between 125 mm and 200 mm. Mean length for Bluegill was 152 mm (SE = 1.6). Bluegill PSD was 56%. $PSD_{S\text{-}Q}$, $PSD_{Q\text{-}P}$, and $PSD_{P\text{-}M}$ were 44%, 49%, and 7%, respectively. Mean relative weight for Bluegill was 86.1 (SE = 0.6) and was similar from stock- to preferred-length (Stock W_r = 84, SE = 1.1; Quality W_r = 88, SE = 0.6; Preferred W_r = 88, SE = 1.4).

In the 2020 Neuse River sport fish sample, 159 Redear Sunfish were collected. Relative abundance of Redear Sunfish was variable between transects (range 0–75 fish/h) and mean CPUE was 23.5 fish/h (SE = 5.0). Redear Sunfish lengths ranged from 46 mm to 274 mm and displayed a peak at 175 mm. Mean length for Redear Sunfish was 187 mm (SE = 3.1). Redear Sunfish PSD was 61%. $PSD_{S\text{-}Q}$, $PSD_{Q\text{-}P}$, and $PSD_{P\text{-}M}$ were 39%, 47%, and 13%, respectively. Mean relative weight for Redear Sunfish was 89.6 (SE = 0.8).

Black Crappie (N = 16), Warmouth *L. gulosus* (N = 9), Redbreast Sunfish *L. auritus* (N = 8), Pumpkinseed *L. gibbosus* (N = 7), Chain Pickerel *Esox niger* (N = 4), and White Perch *Morone americana* (N = 1) were also collected in insufficient numbers to warrant further analysis.

Discussion

The high abundance of age-0, age-1, and age-2 Largemouth Bass in the Neuse River showed evidence of recent successful spawns. The abundance of Largemouth Bass age 3–10 showed little variation, ranging from 5.7 % to 0.5 %, which explains the low mortality rate reported. Condition factors suggested adequate forage availability. As the stock- and substock-length fish recruit into the fishery, the population will likely provide improved angling opportunities for harvestable Largemouth Bass. The decrease in abundance of Largemouth Bass from age 2 to age 3, was evidence of isolated fish kills associated with Hurricane Florence in 2018. Because fish kills were isolated, however, the low but persistent age-classes from age 3 to age 10 suggests Largemouth Bass were able to survive in unaffected areas.

Bluegill in the Neuse River appeared to be in abundances that indicated fish were reproducing in a manner expected for a healthy population. There were no signs of low recruitment in the length frequency, and fish reached preferred length. The lack of memorable- and trophy-length Bluegill suggested growth rates were less than what is expected for healthy populations or that food availability was affecting growth rates. However, relative weights indicated that overall body condition was acceptable; therefore, food availability was likely not limited. Furthermore, surveys conducted since 2002 did not contain memorable- or trophy-length fish in the Neuse River, so these results seem to be typical for Neuse River Bluegill. Collecting age data during future surveys should be considered to evaluate mortality for Bluegill in the Neuse River.

Redear Sunfish in the Neuse River were observed up to memorable length, although the low sample size merits caution when analyzing this data set. Future surveys should attempt to collect more Redear Sunfish to better describe the population.

Results from this survey indicate abundances of Redbreast Sunfish and Pumpkinseed have decreased in recent years. In 1994, Redbreast Sunfish were almost equal to Bluegill (Kornegay et al. 1994), yet Redbreast Sunfish were much less abundant than Bluegill in 2020. In 2003, Pumpkinseed CPUE (68.4 fish/h; unpublished data) was 66 times higher than Pumpkinseed CPUE observed in 2020 (1.0 fish/h). These declines in abundance could likely be attributed to Flathead Catfish predation, as abundances of these two sunfish species have decreased since the establishment of Flathead Catfish in the Neuse River and introduced Flathead Catfish have been shown to impact native fish communities (Pine et al. 2005, Baumann and Kwak. 2011).

Management Recommendations

1. Maintain current harvest limits. Largemouth Bass harvest in these rivers is regulated by a minimum size limit of 356 mm (14 in) with a creel limit of five fish per day, with 2 fish allowed under the minimum size limit. Sunfish harvest is regulated by a creel limit of 30 sunfish per day in combination with no more than 12 Redbreast Sunfish *L. auritus*.
2. Assess sportfish abundance and growth rates by surveying the Neuse River sportfish populations by 2025.
3. Promote these fisheries when opportunities are available via biological presentations at fishing club meetings, public forums, and website updates.
4. Consider collecting age data from sunfish during the next Neuse River sport fish survey.
5. Continue to employ the NCWRC Hurricane Response Plan.
6. Conduct a Neuse River Creel Survey. Creel data are more than 10 years old; current creel information would inform management decisions.

Acknowledgments

We thank Kevin Dockendorf, Jeremy McCargo, and Chad Thomas for their review of previous drafts which were valued and significantly improved the quality of this report.

References

Alford, J. B., D. M. O'Keefe, and D. C. Jackson. 2009. Effects of stocking adult Largemouth Bass to enhance fisheries recovery in Pascagoula River floodplain lakes impacted by Hurricane Katrina. Proceedings of the Annual Conference of the Southeast Association of Fish and Wildlife Agencies 63:104–110.

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447–481 *in* B. R. Murphy and D. W. Willis, editors. Fisheries Techniques. 2nd Edition. American Fisheries Society, Bethesda, Maryland.

Bales, J. D., and C. J. O. Childress. 1996. Aftermath of Hurricane Fran in North Carolina-Preliminary data on flooding and water quality. U.S. Geological Survey. Open File Report 96-499.

Bales, J. D., and D. A. Walters. 2004. Relations among floodplain water levels, instream dissolved-oxygen conditions, and streamflow in the lower Roanoke River, North Carolina, 1997–2001. U.S. Geological Survey. Water-Resources Investigations Report 03-4295.

Baumann, J. R., and T. J. Kwak. 2011. Trophic relations of introduced Flathead Catfish in an Atlantic river. Transactions of the American Fisheries Society 140:1120–1134.

Buckmeier, D. L., and R. G. Howells. 2011. Validation of otoliths for estimating ages of Largemouth Bass to 16 years. North American Journal of Fisheries Management 23:590–593.

Guy, C. S., R. M. Neuman, D. W. Willis, and R. O. Anderson. 2007. Proportional size distribution (PSD): A further refinement of population size structure index terminology. Fisheries 32:348.

Hoyer, M. V., J. V. Shireman, M. J. Maceina. 1985. Use of otoliths to determine age and growth of Largemouth Bass in Florida. Transactions of the American Fisheries Society 114:307–309.

Kornegay, J. W., K. W. Ashley, and M. B. Wynne. 1994. A survey of sunfish populations in the coastal region of North Carolina. North Carolina Wildlife Resources Commission, Federal Aid in Sport Fish Restoration, Project F-22, Final Report, Raleigh.

McCargo, J. W., K. J. Dockendorf, and C. D. Thomas. 2008. Fish assemblage response following a hurricane-induced fish kill in the lower Roanoke River, North Carolina. North Carolina Wildlife Resources Commission, Federal Aid in Sport Fish Restoration, Project F-22, Final Report, Raleigh.

Nelson, G. A. 2019. Bias in common catch-curve methods applied to age frequency data from fish surveys. ICES Journal of Marine Science 76:2090–2101.

Pine, W. E., III, T. J. Kwak, D. S. Waters, and J. A. Rice. 2005. Diet selectivity of introduced Flathead Catfish in coastal rivers. Transactions of the American Fisheries Society 134:901–909.

Ricks, B. R., and K. T. Rachels. 2015. Sportfish survey of coastal rivers in the Pamlico Sound Drainage, North Carolina. North Carolina Wildlife Resources Commission, Federal Aid in Sport Fish Restoration, Project F-108, Final Report, Raleigh.

Rundle, K. R., C. T. Waters, and R. D. Barwick. 2004. Neuse River basin sport fishery creel survey, 2002-2003. North Carolina Wildlife Resources Commission, Federal Aid in Sport Fish Restoration, Project F-22, Final Report, Raleigh.

Tabb, D. C., and A. C. Jones. 1962. Effect of Hurricane Donna on aquatic fauna of North Florida Bay. Transactions of the American Fisheries Society 91:375–378.

Thomas, C. D., and K. J. Dockendorf. 2009. Contribution of stocked Largemouth Bass following hurricane-induced fish kills in two North Carolina coastal rivers. North Carolina Wildlife Resources Commission, Federal Aid in Sport Fish Restoration, Project F-22, Final Report, Raleigh.

Vrancken, J. V., and M. O'Connell. 2010. Effects of Hurricane Katrina on freshwater fish assemblages in a small coastal tributary of Lake Pontchartrain, Louisiana. Transactions of the American Fisheries Society 139:1723–1732.

Wege, G. J., and R. O. Anderson. 1978. Relative weight (W_r): a new index of condition for Largemouth Bass. Pages 79–91 *in* G. Novinger and J. Dillard, editors. New approaches to the management of small impoundments. American Fisheries Society, North Central Division, Special Publication 5, Bethesda, Maryland.

TABLE 1. Neuse River Largemouth Bass sampling summary 1997–2020.

		#	Total	Substock			Stock ≤		PSD-Stock				PSD-Quality				PSD-Preferred				PSD-Memorable				Total		
Year	Species	Samples	Effort	#	CPUE	%	#	CPUE	#	CPUE	%	Wr	#	CPUE	%	Wr	#	CPUE	%	Wr	#	CPUE	%	Wr	#	CPUE	Wr
1997 Spring	LMB	5	10.5	42	4.0	42.0	58	5.5	21	2.0	36.2	108	26	2.5	44.8	88	11	1.0	19.0	89					100	9.5	97
2002 Spring	LMB	3	4.5	75	16.7	58.1	54	12.0	24	5.3	44.4	101	18	4.0	33.3	93	12	2.7	22.2	94					129	28.7	97
2003 Spring	LMB	4	6	46	7.7	38.7	73	12.2	44	7.3	60.3	108	24	4.0	32.9	98	5	0.8	6.8	91					119	19.8	103
2003 Fall	LMB	13	4.5	53	11.8	55.2	43	9.6	18	4.0	41.9	93	16	3.6	37.2	98	9	2.0	20.9	93					96	21.3	95
2004 Spring	LMB	15	5.1	38	7.5	45.2	46	9.0	28	5.5	60.9	98	10	2.0	21.7	95	7	1.4	15.2	93	1	0.2	2.2	94	84	16.5	97
2004 Fall	LMB	13	3.1	38	12.3	41.8	53	17.1	25	8.1	47.2	93	21	6.8	39.6	94	7	2.3	13.2	97					91	29.4	94
2005 Spring	LMB	10	7.9	19	2.4	27.5	50	6.3	27	3.4	54.0	97	13	1.6	26.0	93	9	1.1	18.0	89	1	0.1	2.0	115	69	8.7	95
2006 Spring	LMB	10	9.4	54	5.7	22.3	188	20.0	91	9.7	48.4	97	62	6.6	33.0	95	32	3.4	17.0	94	3	0.3	1.6	92	242	25.7	96
2007 Spring	LMB	10	9	108	12.0	43.0	143	15.9	49	5.4	34.3	103	70	7.8	49.0	103	22	2.4	15.4	96	2	0.2	1.4	97	251	27.9	102
2008 Fall	LMB	14	13.5	186	13.8	46.7	212	15.7	100	7.4	47.2	92.1	70	5.2	33.0	97.2	41	3.0	19.3	93	1	0.1	0.5	83.6	398	29.5	93.8
2009 Fall	LMB	12	11.3	141	12.5	46.5	162	14.3	77	6.8	47.5	91	58	5.1	35.8	93	24	2.1	14.8	96	3	0.3	1.9	95	303	26.8	93
2010 Fall	LMB	12	11.2	225	20.1	49.6	229	20.4	108	9.6	47.2	95	74	6.6	32.3	101	46	4.1	20.1	101	1	0.1	0.4	96	454	40.5	98
2011 Fall	LMB	7	4.1	1	0.2	9.1	10	2.4	3	0.7	30.0	88	4	1.0	40.0	101	3	0.7	30.0	106					11	2.7	99
2012 Spring	LMB	8	5.7	15	2.6	30.6	34	6.0	6	1.1	17.6	102	17	3.0	50.0	104	10	1.8	29.4	101	1	0.2	2.9	100	49	8.6	103
2012 Fall	LMB	8	6.4	189	29.5	79.1	50	7.8	28	4.4	56.0	96	14	2.2	28.0	97	8	1.3	16.0	104					239	37.3	98
2014 Fall**	LMB	34	8.7	44	5.1	18.2	198	22.8	80	9.2	40.4	96	98	11.3	49.5	99	20	2.3	10.1	103					242	27.8	98
2016 Fall	LMB	6	1.8	3	1.7	9.0	32	17.0	7	3.9	21.9		16	8.9	50.0		9	5.0	28.1						35	19.4	
2020 Fall	LMB	51	19.4*	127	5.9*	33.9	276	14.0*	120	6.0*	43.5	94	78	3.9*	28.3	98	66	3.4*	4.3	100	12	0.6*	4.3	98	403	19.1*	97
Average					**9.7**	**38.7**		**12.6**		**5.5**	**43.3**	**97**		**4.8**	**36.9**	**97**		**2.2**	**17.8**	**96**		**0.2**	**1.9**	**97**		**22.4**	**97**

* Effort was not recorded for one sample site due to a malfunction. Fish collected in this site were omitted from CPUE calculations.

** Prior to 2014 if sites on the Trent River were included in Neuse River reporting. After 2014 Trent River sites were summarized independently when sampled.

TABLE 2. Largemouth Bass age, year class, number observed, percent composition, mean length at age, and standard error for mean length at age for the 2020 Neuse River sport fish survey.

Age	Year Class	Number	Percent	Mean TL	SE
0	2020	116	28.8	120	3.0
1	2019	110	27.3	241	3.1
2	2018	87	21.6	315	3.5
3	2017	17	4.2	376	7.1
4	2016	23	5.7	414	6.5
5	2015	17	4.2	427	10.4
6	2014	4	1.0	482	7.6
7	2013	11	2.7	479	13.7
8	2012	13	3.2	491	16.4
9	2011	2	0.5	525	48.5
10	2010	3	0.7	524	43.7

TABLE 3. Neuse River Bluegill sampling survey summary 2002–2020.

Year	Species	# Samples	Total Effort	Substock #	Substock CPUE	Substock %	Stock ≤ #	Stock ≤ CPUE	PSD-Stock #	PSD-Stock CPUE	PSD-Stock %	PSD-Stock Wr	PSD-Quality #	PSD-Quality CPUE	PSD-Quality %	PSD-Quality Wr	PSD-Preferred #	PSD-Preferred CPUE	PSD-Preferred %	PSD-Preferred Wr	Total #	Total CPUE	Total Wr
2002 Spring	BG	3	4.5	43	9.6	24.2	135	30.0	81	18	60	92	45	10	33.3	89	9	2	6.4	93	178	39.6	91
2003 Fall	BG	13	4.3	73	17	20	288	67.0	203	47.2	70.5	91	63	14.7	21.9	91	22	5.1	7.6	89	362	84.0	91
2004 Spring	BG	14	4.2	33	7.9	14	196	46.7	157	37.4	80.1	95	32	7.6	16.3	95	7	1.7	3.6	99	229	54.5	95
2005 Spring	BG	4	3.3	17	5.2	20.5	66	19.9	16	4.8	24.2	92	45	13.6	98.2	93	5	1.5	7.6	88	83	25.2	92
2006 Spring	BG	3	2.99	28	9.4	16.1	146	48.8	103	34.4	70.5	86	37	12.4	25.3	86	6	2	4.1	94	174	58.2	87
2007 Spring	BG	3	3.7	197	53.2	44.7	244	65.9	168	45.4	68.9	100	57	15.4	23.4	98	19	5.1	7.8	96	441	119	99
2008 Fall	BG	3	3.7	64	17.3	19	273	73.9	257	69.5	94.1	90	15	4.1	5.5	74	1	0.3	0.4	103	337	91.9	89
2009 Fall	BG	3	3.4	300	88.2	57.3	224	65.9	211	62.1	94.2	88	13	3.8	5.8	84					524	154	88
2010 Fall	BG	3	3.3	75	22.7	33.6	148	44.9	128	38.8	86.5	95	18	5.5	12.2	93	2	0.6	1.4	91	223	67.6	94
2011 Fall	BG	3	1.9	3	1.6	8.1	34	17.9	27	14.2	79.4	101	5	2.6	14.7	88	2	1.1	5.9	80	37	19.5	98
2012 Spring	BG	2	1.7	59	34.7	32.4	123	72.3	91	53.5	74	98	25	14.7	20.3	105	7	4.1	5.7	109	182	107	100
2012 Fall	BG	3	2.7	23	8.5	7.4	286	105.9	240	88.9	83.9	89	46	17.0	16.1	89					309	114	89
2014 Fall**	BG	19	4.9				163	33.2	69	14.1	42.3	84	85	17.3	52.1	91	9	1.8	5.5	95	163	33.3	88
2016 Fall	BG	6	1.8				29	16.1	12	6.7	41.4		11	6.1	37.9		6	3.3	20.7		29	16.1	
2020 Fall	BG	25	6.7	8	1.2	1.9	415	61.9	181	27.0	43.6	84	203	30.3	48.9	88	31	4.6	7.5	88	423	63.1	86
Average					**21.3**	**23**		**51.4**		**37.5**	**67.6**	**92**		**11.7**	**28.8**	**90**		**2.6**	**6.5**	**94**		**69.9**	**92**

** Prior to 2014 if sites on the Trent River were included in Neuse River reporting. After 2014 Trent River sites were summarized independently when sampled.

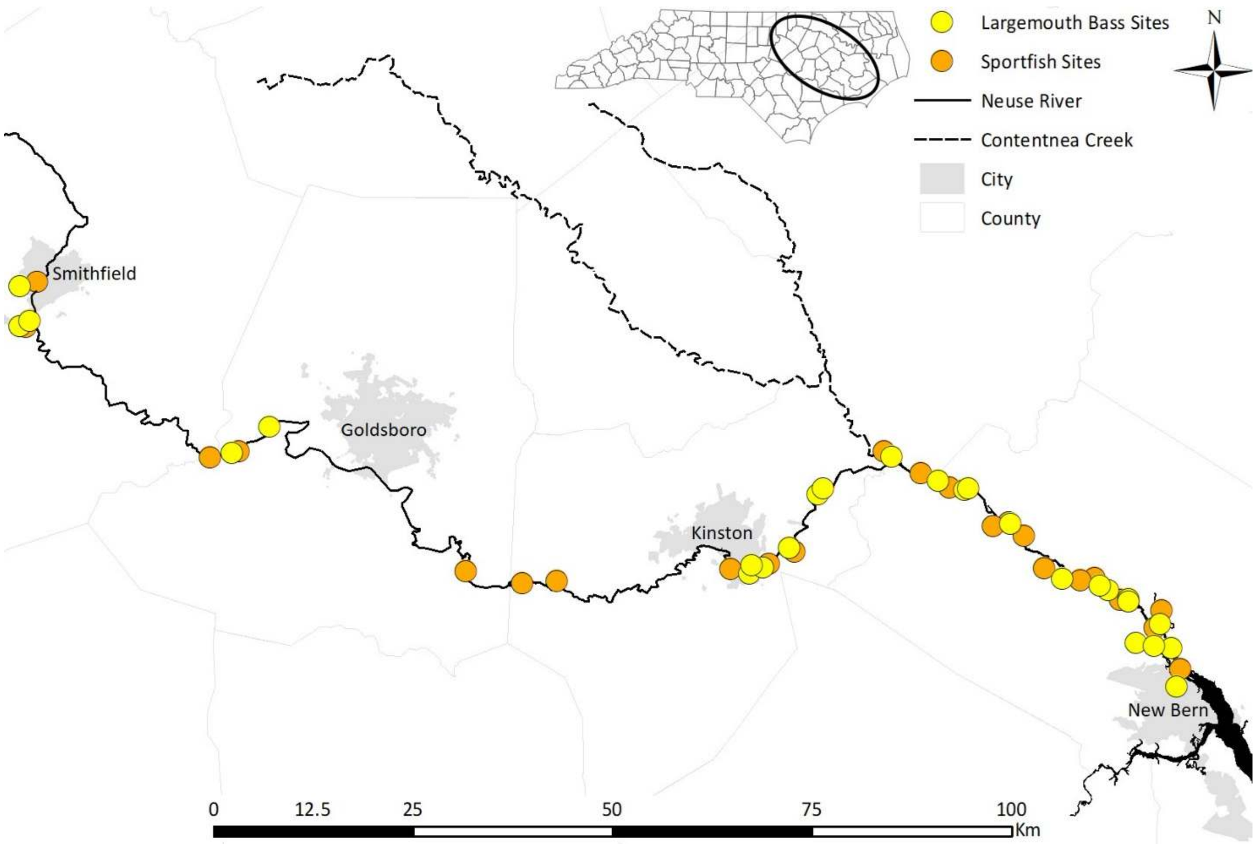

FIGURE 1. Boat electrofishing sites for the 2020 Neuse River sport fish survey.

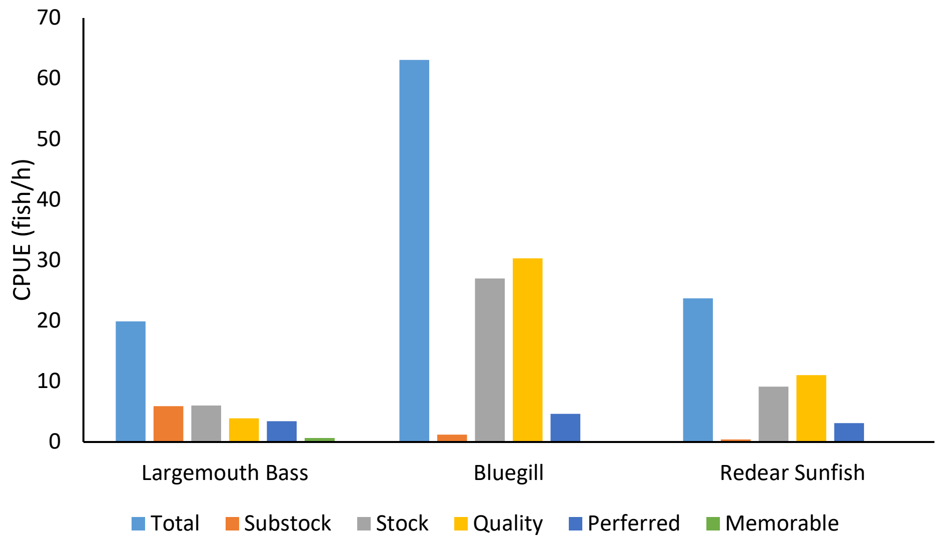

FIGURE 2. Total catch per unit effort (CPUE) for Largemouth Bass, Bluegill, and Redear Sunfish by PSD increments collected during the 2020 central coastal rivers sport fish survey.

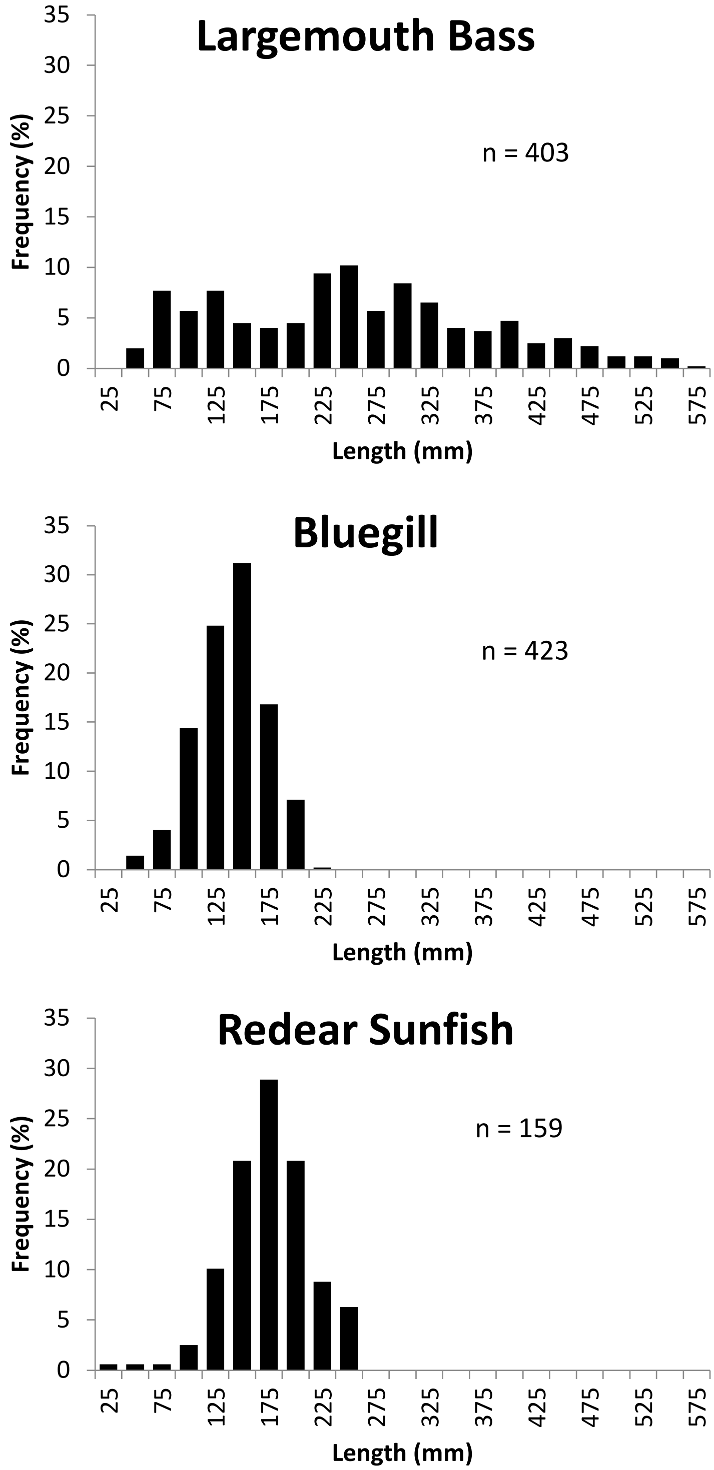

FIGURE 3. Length distribution for Largemouth Bass, Bluegill, and Redear Sunfish collected via electrofishing in the Neuse River, 2020.

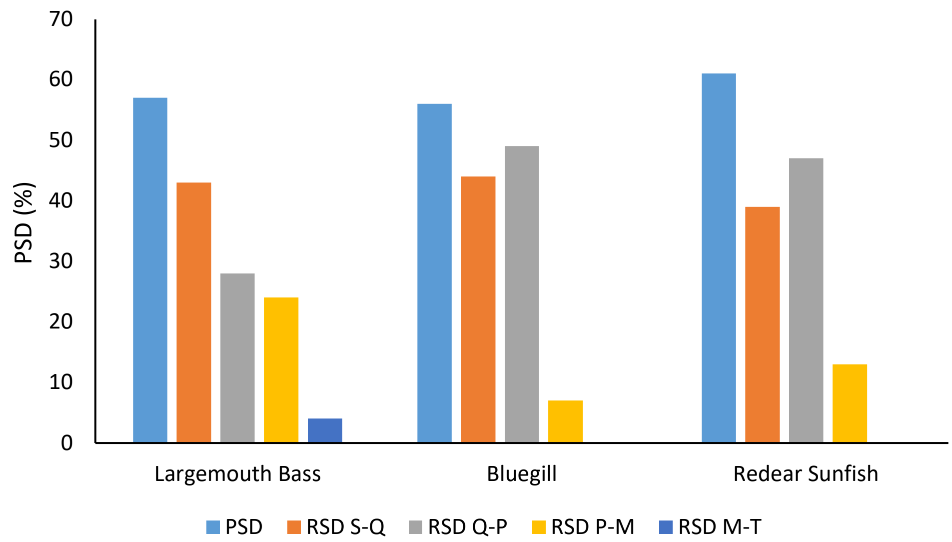

FIGURE 4. PSD values for Largemouth Bass, Bluegill, and Redear Sunfish collected via electrofishing in the Neuse River, 2020.

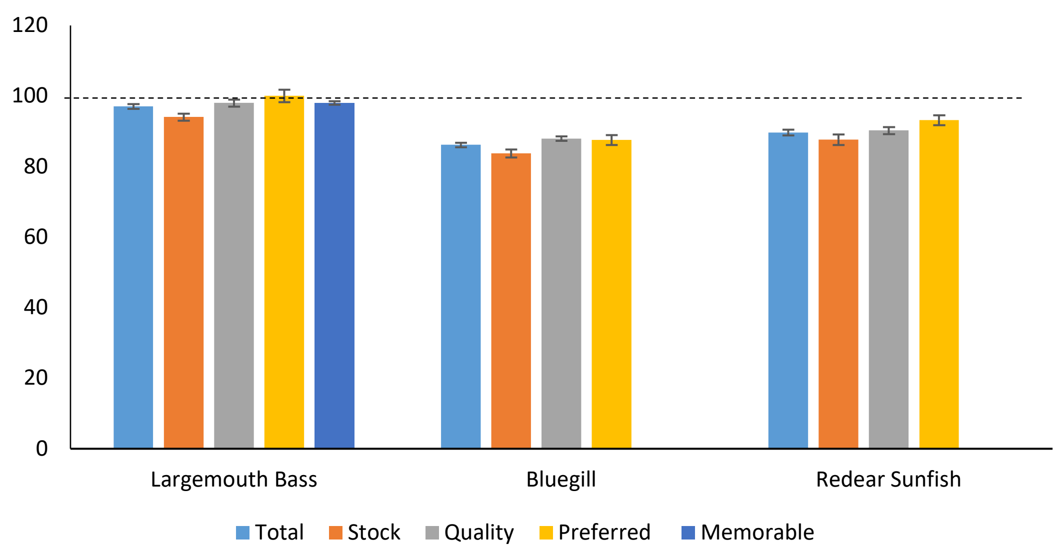

FIGURE 5. Mean relative weight by PSD length category for Largemouth Bass, Bluegill, and Redear Sunfish. Error bars represent one standard error. The dotted line at W_r = 100 denotes the 75th percentile of weights at given length categories for each species across its entire range.

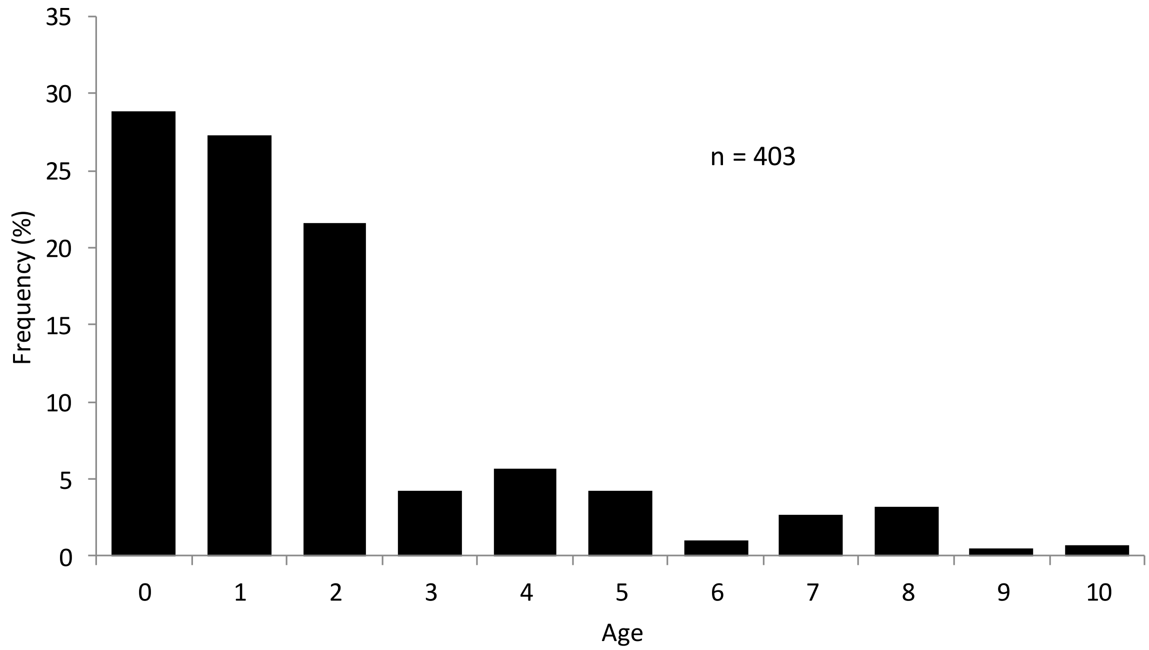

FIGURE 6. Age distribution for Largemouth Bass collected via electrofishing in the Neuse River, 2020.