SPORT FISH SURVEY OF COASTAL RIVERS IN THE PAMLICO SOUND DRAINAGE, NORTH CAROLINA

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Abstract.—The Neuse River, Trent River, and Pungo River are popular angler destinations and a representative subset of North Carolina's central coastal rivers in the Pamlico Sound drainage. On 28 August 2011, Hurricane Irene made landfall at Cape Lookout, NC and flooded many swamps and back waters, flushing hypoxic water into creeks and rivers which contributed to widespread fish kills. The objective of this survey was to assess sport fish community recovery after Hurricane Irene. Sport fish were collected with boat-mounted electrofishing gear September through November 2014 from the Neuse, Trent, and Pungo rivers. Largemouth Bass *Micropterus salmoides*, Bluegill *Lepomis macrochirus*, Pumpkinseed *L. gibbosus*, and Redear Sunfish *L. microlophus* size structure, relative abundance and condition were assessed. Largemouth Bass populations in the Neuse, Trent, and Pungo rivers exhibited abundances that would indicate that recovery is occurring since Hurricane Irene fish kills. Abundance of quality- and memorable-length Largemouth Bass is likely to increase over the next few years as recovery continues. Similar to the Largemouth Bass populations, sunfish population parameters indicated continued Hurricane Irene impacts on each fishery with the exception of Trent River Redear Sunfish. While not at pre- hurricane levels, the sunfish populations in all rivers appeared to be adequate to provide forage for Largemouth Bass as indicated by their condition. Three years after Hurricane Irene related fish kills, impacts still persisted in the Neuse River, whereas the Pungo River population metrics suggested a return to near pre-hurricane conditions, and is likely a function of the extent and duration of the hypoxia in each system. With the exception of Trent River where many larger Redear Sunfish were observed, truncated size structures suggested sport fish populations were dominated by young fish. Full recovery from any Hurricane Irene related impacts is expected to occur as these fish age and spawn in the future.

Many of the rivers of central coastal North Carolina are characterized as blackwater systems with heavy salinity influences from the Pamlico Sound. The Neuse River, Trent River, and Pungo River are three popular angler destinations and a representative subset of central coastal North Carolina rivers (Figure 1). Anglers fishing these rivers target anadromous and marine fish species in downstream areas of these rivers, as well as resident freshwater sport fish species such as Largemouth Bass *Micropterus salmoides* and sunfish *Lepomis* spp. in areas of low salinity. Largemouth Bass harvest is regulated by a minimum size limit of 356 mm (14 in) with a creel limit of five fish per day, while sunfish harvest is regulated by a creel limit of 30 sunfish per day in combination with no more than 12 Redbreast Sunfish *L. auritus*.

On 27 August 2011, Hurricane Irene made landfall at Cape Lookout, NC as a Category 1 hurricane, took a northerly path through coastal North Carolina, and impacted the Pamlico Sound and Albemarle Sound drainages. Hurricane Irene flooded many of the swamps and back waters with storm surge and heavy precipitation which is typical of such a cyclonic event (Bales and Walters 2004). Flushing of hypoxic water and organic solids from backwater habitats into creeks and rivers resulted in a marked decrease in dissolved oxygen in many waterbodies in eastern NC. These events typically have negative effects on fish communities including stress, displacement, or fish kills. After Hurricane Irene, hypoxic waters and associated fish kills were reported in nearly all rivers draining into the Pamlico Sound. The objective of this survey was to assess sport fish recovery after Hurricane Irene by examining a suite of population metrics.

Methods

Largemouth Bass and sunfish were collected with boat-mounted electrofishing gear (Smith Root 7.5 GPP; 5000–8000 W pulsed DC; 4−6 A) during daylight hours between 10 September and 4 November 2014. Sites targeted Largemouth Bass only or sportfish which consisted of Largemouth Bass and sunfish. Twenty-one sport fish and 14 Largemouth Bass only sites were selected for the Neuse River, 20 sport fish and 8 Largemouth Bass only sites were selected for the Trent River, and 12 sport fish and 7 Largemouth Bass only sites were selected for the Pungo River (Figure 1). Sampling sites were shoreline transects with 15 minutes in duration (pedal time). For each site, target species were netted as they were encountered, held in a live well, measured for total length (TL, mm), and weighed (g) upon transect completion.

Relative abundance of Largemouth Bass and sunfish was expressed as the number of fish collected per electrofishing hour and was indexed as catch-per-unit-effort (CPUE; fish/h). CPUE was reported for Largemouth Bass from combining Largemouth Bass only sites and sportfish sites. Relative abundance was reported for multiple length categories. Length categories are 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). For Bluegill *L. macrochirus* and Pumpkinseed *L. gibbosus* length categories are defined as stock-length (80−149 mm), quality-length (150−199 mm), preferred-length (200−249 mm), and memorable-length (250−300 mm) and for Redear Sunfish *L. microlophus* length categories are 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 and 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 and sunfish condition factors were assessed with the relative weight index (W_r) developed by Wege and Anderson (1978).

Results

Neuse River.—A total of 242 Largemouth Bass were collected from the Neuse River. Largemouth Bass relative abundance was highly variable between transects (range 0–88 fish/h) and mean CPUE was 27.9 fish/h (SE = 4.0). Quality-length Largemouth Bass were most abundant (CPUE = 11.3 fish/h; SE = 1.8; Figure 2). Largemouth Bass lengths ranged from 70 mm to 470 mm and the majority of the sample (85%) was smaller than the minimum length limit (356 mm; Figure 3). The most abundant size group was quality-length fish, which constituted 49% of the sample (Figure 4). Mean length for Largemouth Bass was 279 mm (SE = 5.3). PSD for Largemouth Bass was 60%. PSD_{S-Q} and PSD_{Q-P} were similar at 40% and 49% while PSD_{P-M} was lower (10%; Figure 4). Mean relative weight for Largemouth Bass was 98 (SE = 0.6) and was similar across all length categories (Stock W_r = 96, SE = 0.8; Quality W_r = 99, SE = 0.9; Preferred W_r 103, SE = 2.1; Figure 5).

A total of 163 Bluegill were collected from the Neuse River. Relative abundance of stock-length and longer Bluegill was highly variable between transects (range 0–168 fish/h). Mean CPUE was 33.7 fish/h (SE = 9.9) with quality-length being the highest in abundance (6.6 fish/hour; Figure 6). Bluegill lengths ranged from 82 mm to 218 mm and the majority of the sample (77%) was between 110 mm and 180 mm (Figure 7). Mean length for Bluegill was 153 mm (SE = 2.5). Bluegill PSD was 58%. $PSD_{S-Q,}$ $PSD_{Q-P,}$ and PSD_{P-M} were 42%, 52% and 6% (Figure 8). Mean relative weight for Bluegill was 88 (SE = 0.9) and increased slightly with length from stock- to preferred-length (Stock W_r = 84, SE = 1.9; Quality W_r = 91, SE = 0.8; Preferred W_r = 95, SE = 1.5; Figure 9).

A total of 31 Pumpkinseed were collected from the Neuse River. Relative abundance of stock-length and longer Pumpkinseed was variable between transects (range 0–52 fish/h), and mean CPUE was 6.5 fish/h (SE = 3.2; Figure 10). Pumpkinseed lengths ranged from 90 mm to 162 mm with the majority (58%) of fish between 130 mm and 150 mm (Figure 11). Mean length for Pumpkinseed was 133 mm (SE = 3.6). Pumpkinseed PSD was 23%. PSD_{S-Q} (77%) was higher than PSD_{Q-P} (23%; Figure 12). Mean relative weight for Pumpkinseed was 85.8 (SE = 5.8). However, quality length fish displayed higher condition (W_r = 93; SE = 4.9) than stock-length fish (W_r = 83; SE = 2.9; Figure 13).

In the 2014 Neuse River sport fish sample, 70 Redear Sunfish were collected. Relative abundance of stock-length and longer Redear Sunfish was variable between transects (range 0–71 fish/h), and mean CPUE was 14.4 fish/h (SE = 4.7; Figure 14). Redear Sunfish lengths ranged from 100 mm to 286 mm and displayed a bimodal distribution with peaks at 120 mm and 200 mm (Figure 15). Mean length for Redear Sunfish was 173 mm (SE = 4.9). Redear Sunfish PSD was 47%. $PSD_{S-Q,}$ PSD_{Q-P}, PSD_{P-M}, and PSD_{M-T} were 53%, 40%, 6% and 1% (Figure 15). Mean relative weight for Redear Sunfish was 84.2 (SE = 1.0; Figure 16).

In the Neuse River sport fish survey, Flier *Centrarchus macropterus* (N = 2), Black Crappie *Pomoxis nigromaculatus* (N = 18), Chain Pickerel *Esox niger* (N = 2), Green Sunfish *L. cyanellus* (N = 6), Redbreast Sunfish *L. auritus* (N = 6), Redfin Pickerel E. americanus (N = 1),

Yellow Perch *Perca flavescens* (N = 24), and Warmouth *L. gulosus* (N = 9) were also collected but not in sufficient number to warrant analysis.

Trent River.—A total of 119 Largemouth Bass were collected from the Trent River. Relative abundance of Largemouth Bass was highly variable between transects (range 0–48 fish/h) and mean CPUE was 17.8 fish/h (SE = 2.3). Stock-length Largemouth Bass were most abundant (CPUE = 6.7 fish/h; SE = 1.3 Figure 2). Largemouth Bass lengths ranged from 80 mm to 526 mm and the majority of the sample (88%) was smaller than the 356 mm minimum length limit (Figure 3). Mean length for Largemouth Bass was 267 mm (SE = 8.3). PSD for Largemouth Bass was 51%. PSD_{S-Q} and PSD_{Q-P} were similar at 49% and 41% while PSD_{P-M} was lower at 9% (Figure 4). Mean relative weight for Largemouth Bass was 90 (SE = 1.1) and was highest for stock-length fish (W_r = 93, SE = 1.9; Figure 5).

A total of 64 Bluegill were collected from the Trent River. Relative abundance of stock-length and longer Bluegill was variable between transects (range 4–36 fish/h), and mean CPUE was 14 fish/h (SE = 2.5; Figure 6). Bluegill lengths ranged from 91 mm to 254 mm with a unimodal distribution peaking at 200 mm (Figure 7). Mean length for Bluegill was 175 mm (SE = 4.8). Bluegill PSD was 75%; $PSD_{S-Q,}$ $PSD_{Q-P,}$ PSD_{P-M}, and PSD_{M-T} were 25%, 39%, 34%, and 2% (Figure 8). Mean relative weight for Bluegill was 81 (SE = 1.4) and was similar across length groups (Stock W_r = 84, SE = 5.0; Quality W_r = 80, SE = 1.4; Preferred W_r = 82, SE = 1.6; Memorable W_r = 81; Figure 9).

A total of 82 Pumpkinseed were collected from the Trent River. Relative abundance of stock-length and longer Pumpkinseed was variable between transects (range 0–94 fish/h), and mean CPUE was 18 fish/h (SE = 5.8; Figure 10). Pumpkinseed lengths ranged from 82 mm to 214 mm with a unimodal distribution between 100 mm and 129 mm (Figure 11). Mean length for Pumpkinseed was 128 mm (SE = 2.9). Pumpkinseed PSD was 17%. PSD_{S-Q} (83%) was higher than PSD_{Q-P} (16%) or PSD_{P-M} (1%; Figure 12). Mean relative weight for Pumpkinseed was 82 (SE = 1.5; Figure 13).

Trent River sport fish sampling yielded 92 Redear Sunfish. Relative abundance of stock-length and longer Redear Sunfish was variable between transects (range 0–76 fish/h), and mean CPUE was 20 fish/h (SE = 4.8; Figure 14). Redear Sunfish lengths ranged from 92 mm to 315 mm and a majority of the sample (69%) was over 200 mm (Figure 15). Mean length for Redear Sunfish was 221 mm (SE = 4.5). Redear Sunfish PSD was 82%. $PSD_{S-Q,}$ PSD_{Q-P}, PSD_{P-M}, and PSD_{M-T} were 18%, 38%, 37%, and 7%, respectively (Figure 15). Mean relative weight for Redear Sunfish was 83 (SE = 1.2). Condition improved with size from stock to memorable-length fish (Stock W_r = 77, SE = 3.2; Quality W_r = 82, SE = 1.1; Preferred W_r = 86, SE = 2.1; Memorable W_r = 92, SE = 4.7; Figure 16).

In the Trent River sport fish survey, Black Crappie (N = 5), Chain Pickerel (N = 12), Redbreast Sunfish (N = 5), Yellow Perch (N = 21), and Warmouth (N = 2) were also collected but not in sufficient numbers to warrant analysis.

Pungo River.—A total of 115 Largemouth Bass were collected from the Pungo River. Relative abundance of Largemouth Bass was variable between transects (range 0–19 fish/h) and mean CPUE was 23.4 fish/h (SE = 4.2; Figure 2). Largemouth Bass lengths ranged from 87 mm to 500 mm, exhibiting a bimodal distribution with peaks at 125 mm and 275 mm. The majority of the sample (81%) was smaller than the 356 mm minimum length limit (Figure 3). Mean length for Largemouth Bass was 275 mm (SE = 9.0). The most abundant size group was

quality-length fish, which constituted 48% of the sample (Figure 4). PSD for Largemouth Bass was 60%. PSD_{S-Q}, PSD_{Q-P}, and PSD_{P-M} were 38% 48% and 14%, respectively (Figure 4). Mean relative weight for Largemouth Bass was 93 (SE = 0.9) and was similar across all length categories (Stock W_r = 90, SE = 1.7; Quality W_r = 95, SE = 1.2; Preferred W_r = 91, SE = 1.7; Figure 5).

A total of 105 Bluegill were collected from the Pungo River. Relative abundance of stock-length and longer Bluegill was variable between transects (range 7–72 fish/h), and mean CPUE was 34 fish/h (SE = 6.5) with stock- and quality-length being similar in abundance (Stock = 11.3 fish/h, SE = 3.4; Quality = 11.2 fish/h, SE = 4.6; Figure 6). Bluegill lengths ranged from 93 mm to 234 mm and the majority of the sample (57%) was between 160 mm and 210 mm (Figure 7). Mean length for Bluegill was 168 mm (SE = 3.4). Bluegill PSD was 67%; $PSD_{S-Q,}$ $PSD_{Q-P,}$ and PSD_{P-M} were 33%, 49% and 18% (Figure 8). Mean relative weight for Bluegill was 93 (SE = 1.3) and increased slightly with length from stock- to preferred-length (Stock W_r = 87, SE = 2.7; Quality W_r = 94, SE = 1.6; Preferred W_r = 96, SE = 2.1; Figure 9).

A total of 139 Pumpkinseed were collected from the Pungo River. Relative abundance of stock-length and longer Pumpkinseed was variable between transects (range 0–180 fish/h), and mean CPUE was 44 fish/h (SE = 16.7; Figure 10). Pumpkinseed lengths ranged from 82 mm to 206 mm and displayed a unimodal distribution with a peak at 160 mm (Figure 11). Mean length for Pumpkinseed was 144 mm (SE = 2.2). Pumpkinseed PSD was 52%. PSD_{S-Q} (47%) was slightly lower than PSD_{Q-P} (52%; Figure 12). Mean relative weight for Pumpkinseed was 89 (SE = 1.1); however, quality-length fish displayed higher condition (W_r = 94; SE = 0.9) than stock-length fish (W_r = 83; SE = 1.8; Figure 13).

A total of 31 Redear Sunfish were collected from the Pungo River. Relative abundance of stock-length and longer Redear Sunfish was variable between transects (range 0–72 fish/h), and mean CPUE was 10 fish/h (SE = 5.8; Figure 14). Redear Sunfish lengths ranged from 101 mm to 270 mm and displayed a unimodal distribution with a peak at 160 mm (Figure 15). Mean length for Redear Sunfish was 174 mm (SE = 7.2). Redear Sunfish PSD was 35%; $PSD_{S-Q,}$ PSD_{Q-P}, and PSD_{P-M} were 65%, 19%, and 10% (Figure 15). Mean relative weight for Redear Sunfish was 86 (SE = 7.5; Figure 16).

In the Pungo River sport fish survey, Black Crappie (N = 1), Yellow Perch (N = 3), and Warmouth (N = 1) were also collected but not in sufficient abundance to warrant analysis.

Discussion

The Largemouth Bass population in the Neuse, Trent and Pungo rivers appeared recovered in regards to abundance and size structure since Hurricane Irene related fish kills. Neuse River relative abundance of stock-length and longer Largemouth Bass was 9.5 times larger in Fall 2014 (22.8 fish/h) than it was immediately after Hurricane Irene in Fall 2011 (2.4 fish/h), and 1.8 times larger than the long-term average (12.8 fish/h; Table 1). Trent River relative abundance was 10.4 fish/h in Fall 2014 which is slightly below the long term average of 12.0 f/h and a 2.9 fold increase since the sample taken in Fall 2011 (3.6 fish/h; Table 2). The Pungo River was not sampled immediately after Hurricane Irene; however, fish kills were reported in that area. Relative abundance in the Pungo River of stock-length and longer Largemouth Bass was higher in Fall 2014 (17.9 fish/h) than what was previously observed in that area (NCWRC unpublished

data 2007; 14.2 fish/h) indicating that either fish kills were minimal or recovery had also occurred in the Pungo River. No Largemouth Bass of memorable-length or larger were collected, which likely is an indication that most of the population was comprised of fish younger than age-3 produced the spawning seasons following Hurricane Irene. Largemouth Bass in all three rivers can be described as predominantly stock- and quality-length fish. Increases in quality- and memorable-length Largemouth Bass abundance is expected to increase as recovery continues in these systems. The condition of Largemouth Bass in all three rivers was adequate and suggested healthy growth rates. As these younger fish grow in the coming years, the Largemouth Bass size structure is expected to expand.

Similar to Largemouth Bass populations, sunfish population parameters also indicated Hurricane Irene impacts on each fishery. Preferred-length Bluegill abundance was lowest for the Neuse River suggesting that Hurricane Irene related fish kills were more extensive on the Neuse River than the Trent or Pungo rivers. In all three systems, Bluegill in the quality-length category were the most abundant. Hurricane related impacts should diminish as these fish grow and reproduce. Similarly, the Pumpkinseed population in the Neuse River showed possible Hurricane Irene impacts as no fish were collected over quality-length. Conversely, the Trent and Pungo Rivers had higher abundances of Pumpkinseed as well as memorable-length individuals. Therefore, while impacts of Hurricane Irene were more evident in the Neuse River Pumpkinseed population, they were not entirely absent from the Trent or Pungo rivers. Trent River Redear Sunfish appeared to show no Hurricane Irene related impacts. Memorable-length and larger Redear Sunfish in the Trent River had greater abundance than the Neuse and Pungo rivers, which may indicate that Redear Sunfish survived episodic hypoxia in the Trent River. Conversely, the Neuse and Pungo Rivers had relatively few large Redear Sunfish. Despite the absence of larger fish, the bimodal length distribution of Neuse River Redear Sunfish indicates that a successful year-class had recruited to the population. Despite depressed size structure, sunfish populations in the Neuse, Trent, and Pungo rivers displayed healthy condition, and provide fishing opportunities for anglers and adequate forage for Largemouth Bass.

Management Recommendations

1. Maintain the current 356-mm minimum length limit and five fish daily creel limit for Largemouth Bass, and 30 fish daily creel limit for sunfish with no more than 12 Redbreast Sunfish.
2. Reassess sport fish abundance and growth rates by surveying the Neuse, Trent, and Pungo river sport fish populations in 2018. Collect age structures to assess growth rates and mortality.
3. Promote these fisheries when opportunities are available via biological presentations at fishing club meetings, public forums, and website updates.

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TABLE 1.—Summary table for Neuse River Largemouth Bass samples from 1997–2014.

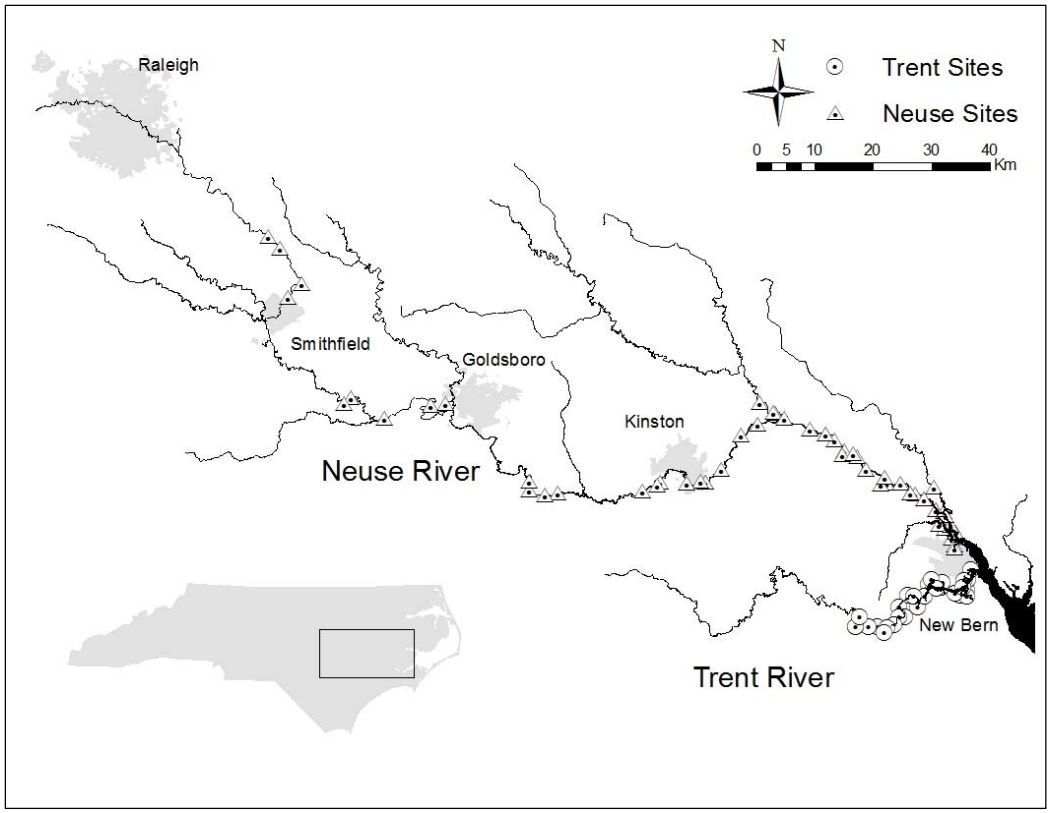
		Number	Total	Substock			Stock ≤		PSD-Stock				PSD-Quality				PSD-Preferred				PSD-Memorable				Total		
Year	Species	of Samples	Effort	Number	CPUE	Percent	Number	CPUE	Number	CPUE	Percent	Wr	Number	CPUE	Percent	Wr	Number	CPUE	Percent	Wr	Number	CPUE	Percent	Wr	Number	CPUE	Wr
1997 Spring	LMB	5	10.5	42	4.0	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
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
Average					**10.0**	**40.5**		**12.1**		**5.5**	**44.4**	**97.7**		**4.5**	**36.9**	**96.8**		**2.0**	**17.9**	**96.5**		**0.2**	**1.8**	**98.4**		**22.1**	**97.7**

TABLE 2.—Summary table for Trent River Largemouth Bass samples from 1997–2014.

	Total	Substock			Stock ≤		PSD-Stock				PSD-Quality				PSD-Preferred				PSD-Memorable				Total		
Year	Effort	Number	CPUE	Percent	Number	CPUE	Number	CPUE	Percent	Wr	Number	CPUE	Percent	Wr	Number	CPUE	Percent	Wr	Number	CPUE	Percent	Wr	Number	CPUE	Wr
1997 Spring	5.8	8	1.4	7.4	95	16.4	11	1.9	11.0	91	63	10.9	63.0	90	16	2.8	16.0	80	5	0.9	5.0	91	108	18.6	87
2002 Spring	4.1	24	5.9	42.1	33	8.0	16	3.9	48.5	100	15	3.7	45.5	89	1	0.2	3.0	69	1	0.2	3.0	89	57	13.9	94
2003 Spring	2.2	9	4.1	20.0	36	16.4	16	7.3	44.4	99	12	5.5	33.3	86	8	3.6	22.2	88					45	20.5	92
2003 Fall	2.4	3	1.3	17.6	14	5.8	4	1.7	28.6	97	4	1.7	28.6	81	6	2.5	42.9	91					17	7.1	90
2004 Spring	2.6	13	5.0	41.9	18	6.9	9	3.5	50.0	94	4	1.5	22.2	90	5	1.9	27.8	80					31	11.9	89
2004 Fall	1.8	9	5.0	36.0	16	8.9	7	3.9	43.8	90	5	2.8	31.3	89	4	2.2	25.0	85					25	13.9	89
2005 Spring	1.3	3	2.3	75.0	1	0.8					1	0.8	100.0	90									4	3.1	90
2006 Spring	1.6	6	3.8	23.1	20	12.5	6	3.8	30.0	92	9	5.6	45.0	90	5	3.1	25.0	87					26	16.3	90
2007 Spring	1.4	12	8.6	57.1	9	6.4	5	3.6	55.6	93	4	2.9	44.4	103									21	15.0	97
2009 Fall	1.8	2	1.1	12.5	14	7.8	8	4.4	57.1	89	3	1.7	21.4	94					3	1.7	21.4	93	16	8.9	91
2010 Spring	4.6	21	4.6	26.6	58	12.6	25	5.4	43.1	96	20	4.3	34.5	89	13	2.8	22.4	92					79	17.2	94
2011 Fall	1.1	0	0.0	0.0	4	3.6	1	0.9	25.0	98	2	1.8	50.0	90	1	0.9	25.0	94					4	3.6	93
2012 Spring	2.1	3	1.4	33.3	6	2.9	2	1.0	33.3	100	4	1.9	66.7	85									9	4.3	91
2013 Spring	5.7	38	6.7	42.2	52	9.1	17	3.0	32.7	98	17	3.0	32.7	89	18	3.2	34.6	88					90	15.8	92
2014 Fall	6.7	22	3.3	31.4	97	14.5	48	7.2	100.0	93	40	6.0	83.3	88	9	1.3	18.8	87					70	10.4	90
Average			**3.6**	**31.1**		**8.8**		**3.7**	**43.1**	**95.0**		**3.6**	**46.8**	**89.5**		**2.2**	**23.9**	**85.5**		**0.9**	**9.8**	**91.0**		**12.0**	**91.3**

TABLE 2.—Summary table for Pungo River Largemouth Bass samples from 2007 and 2014.

		Total	Substock			Stock ≤		PSD-Stock				PSD-Quality				PSD-Preferred				Total		
Year	Species	Effort	Number	CPUE	Percent	Number	CPUE	Number	CPUE	Percent	Wr	Number	CPUE	Percent	Wr	Number	CPUE	Percent	Wr	Number	CPUE	Wr
2007 Spring	LMB	2.6	1	0.4	2.6	37	14.2	17	6.5	45.9	96	18	6.9	48.6	82	2	0.8	5.4	90	38	14.6	89
2014 Fall	LMB	4.8	19	4.0	16.5	86	17.9	33	6.9	34.4	90	41	8.5	42.7	95	12	2.5	12.5	91	115	24.0	93
Average				**2.2**			**16.1**		**6.7**		**93.0**		**7.7**		**88.5**		**1.6**		**90.5**		**19.3**	**91.0**



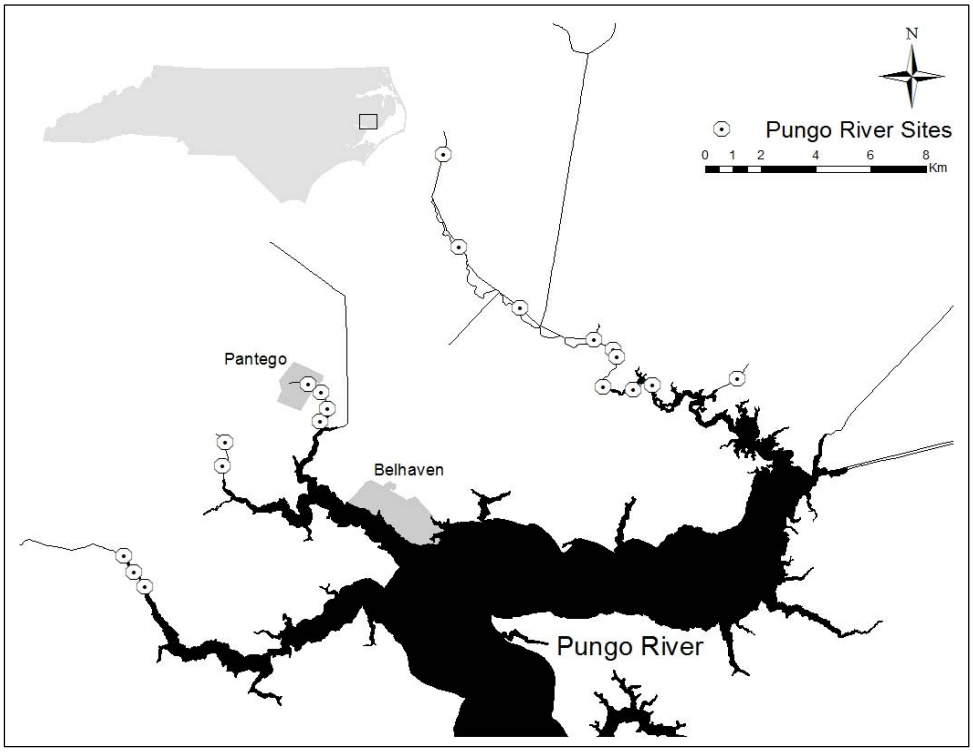


FIGURE 1.—Electrofishing site locations for the 2014 central coastal rivers sport fish survey.

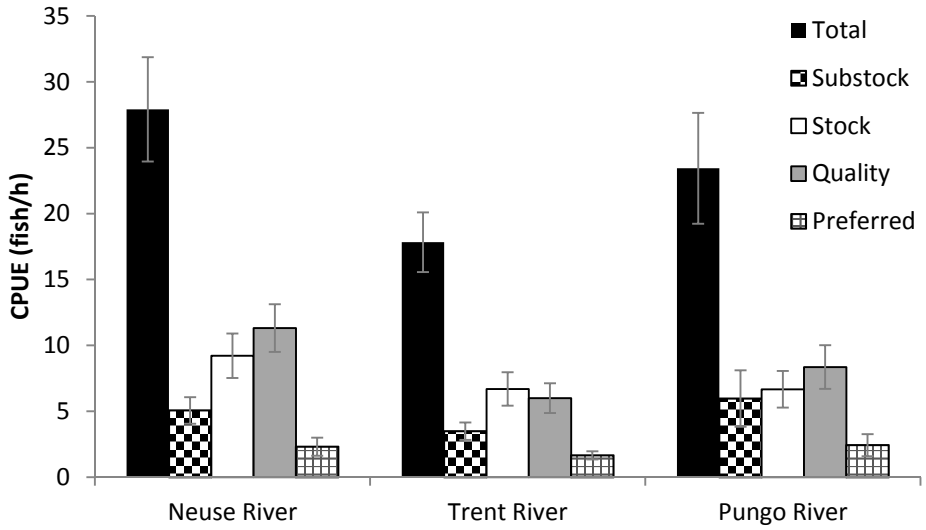


FIGURE 2.—Mean catch per unit effort (CPUE) for Largemouth Bass by river and PSD increments collected during the 2014 central coastal rivers sport fish survey. Error bars represent one standard error.

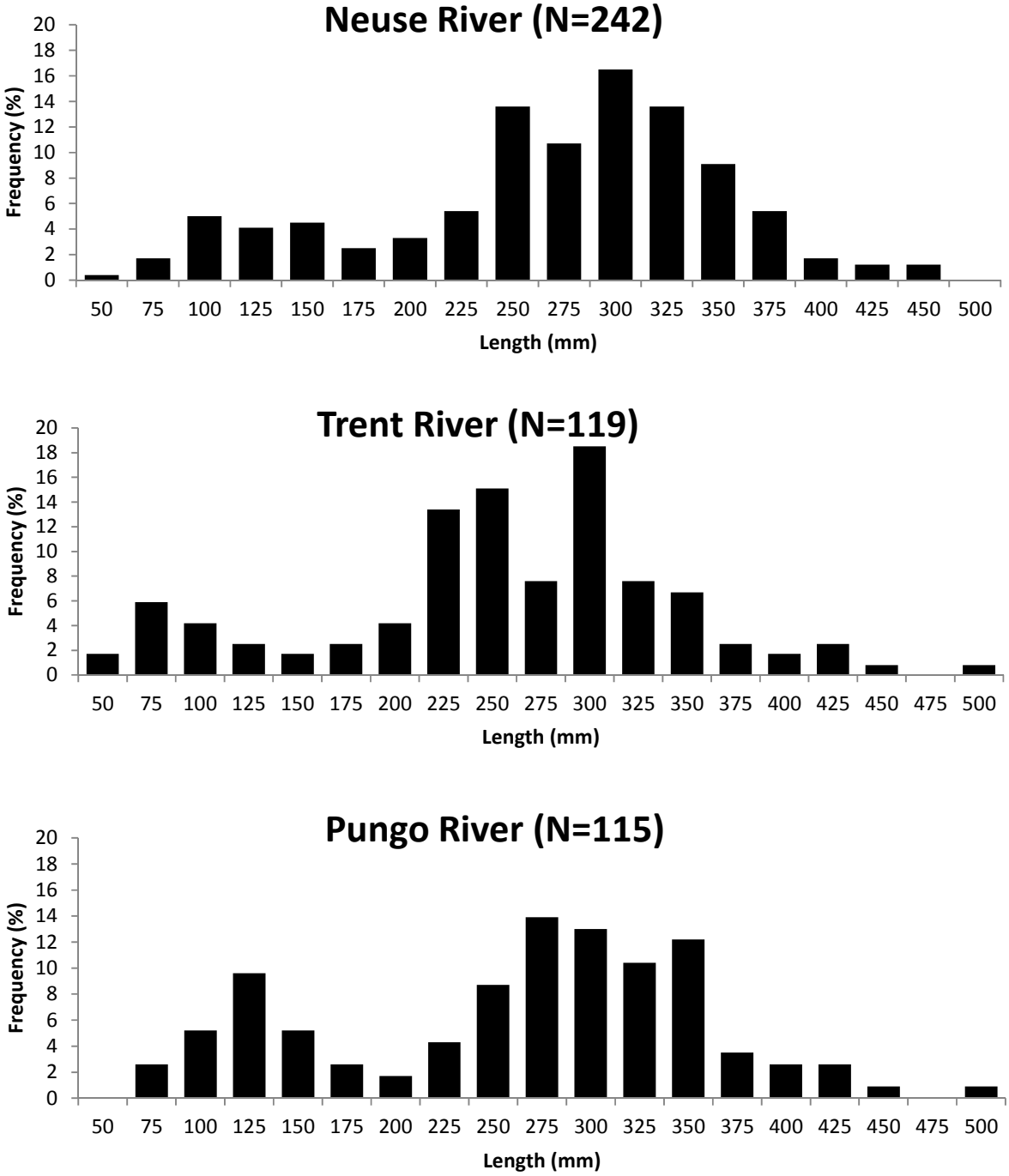


FIGURE 3.—Length distribution by river for Largemouth Bass collected during the 2014 central coastal rivers sport fish survey.

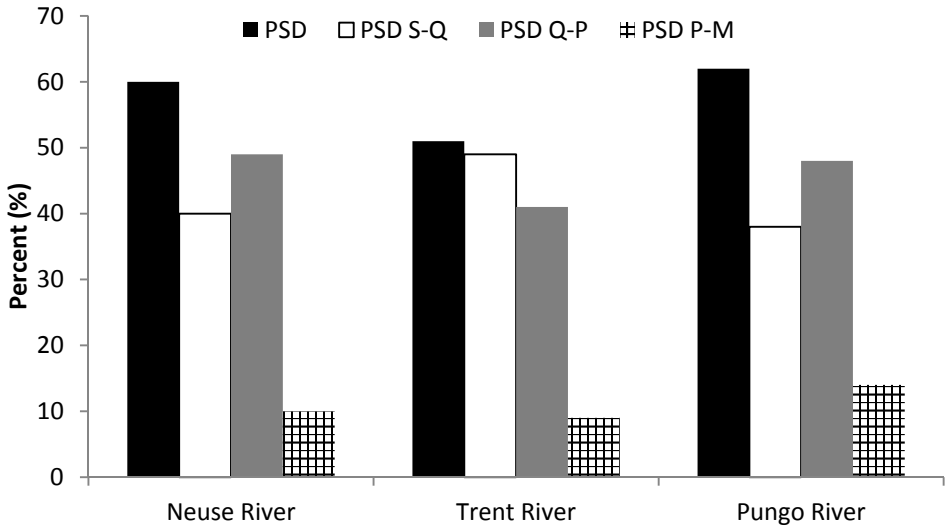


FIGURE 4.—PSD values for Largemouth Bass by river collected during the 2014 central coastal rivers sport fish survey.

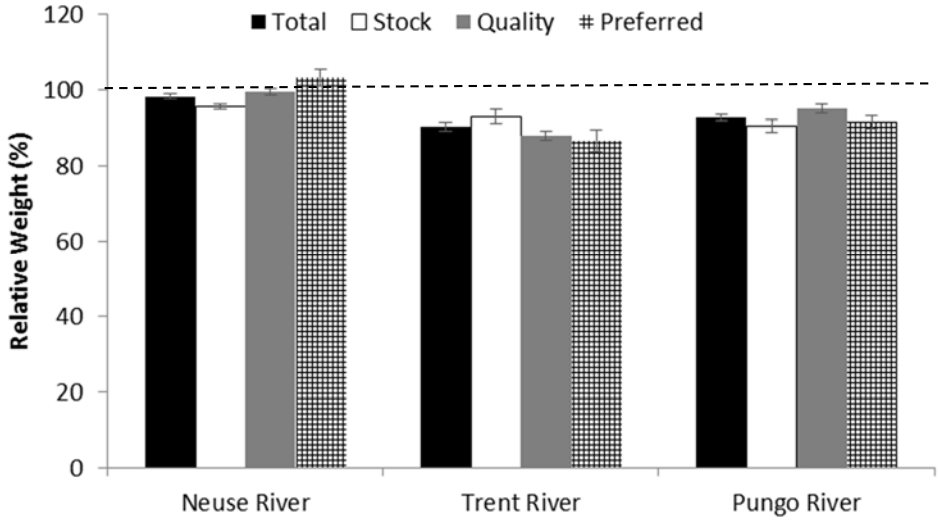


FIGURE 5.—Mean relative weight by PSD length category and river for Largemouth Bass collected during the 2014 central coastal rivers sport fish survey. Error bars represent one standard error. The dotted line at W_r = 100 denotes the 75th percentile of weights at given length categories of Largemouth Bass across its entire range.

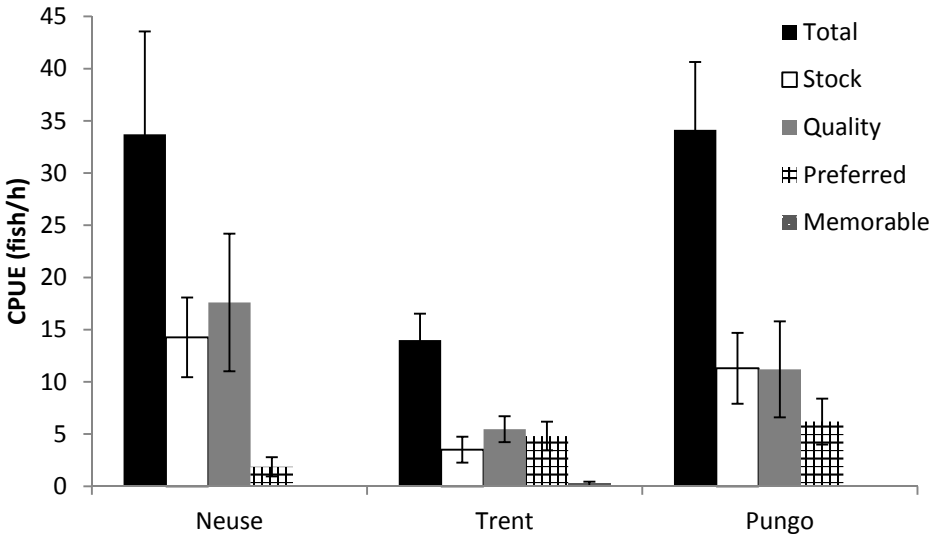


FIGURE 6.—Mean catch per unit effort (CPUE) for Bluegill by river and PSD increments collected during the 2014 central coastal rivers sport fish survey. Error bars represent one standard error.

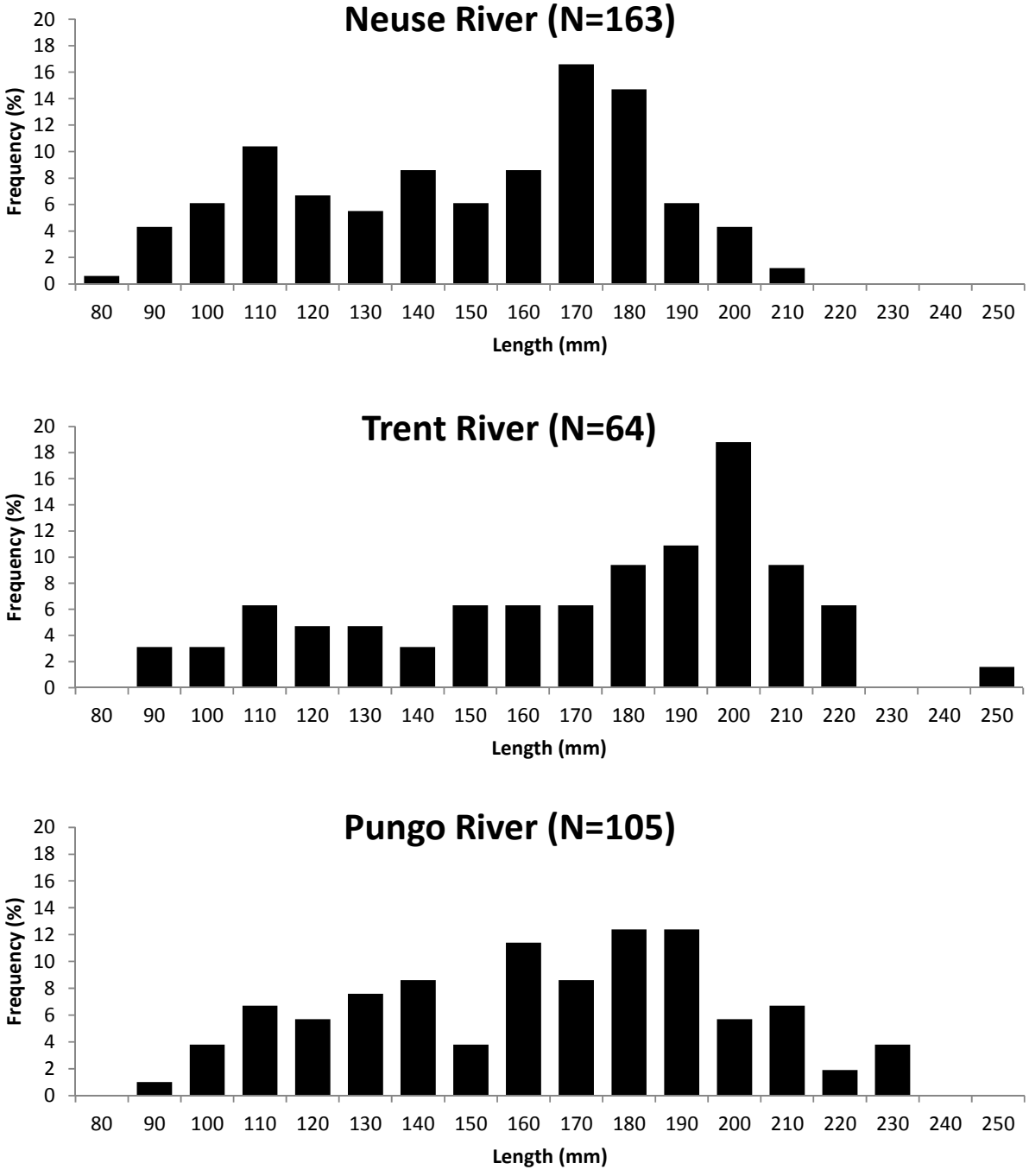


FIGURE 7.—Length distribution by river for Bluegill collected during the 2014 central coastal rivers sport fish survey.

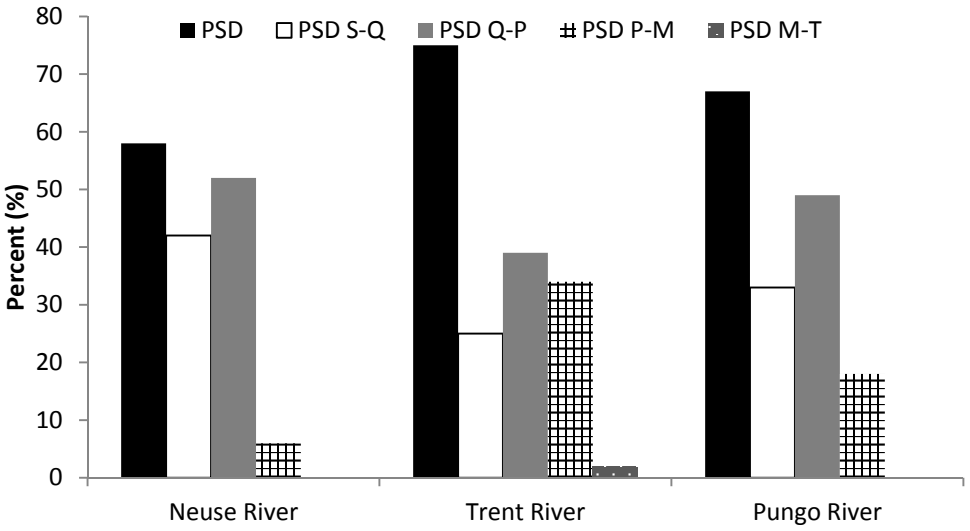


FIGURE 8.—PSD values for Bluegill by river collected during the 2014 central coastal rivers sport fish survey.

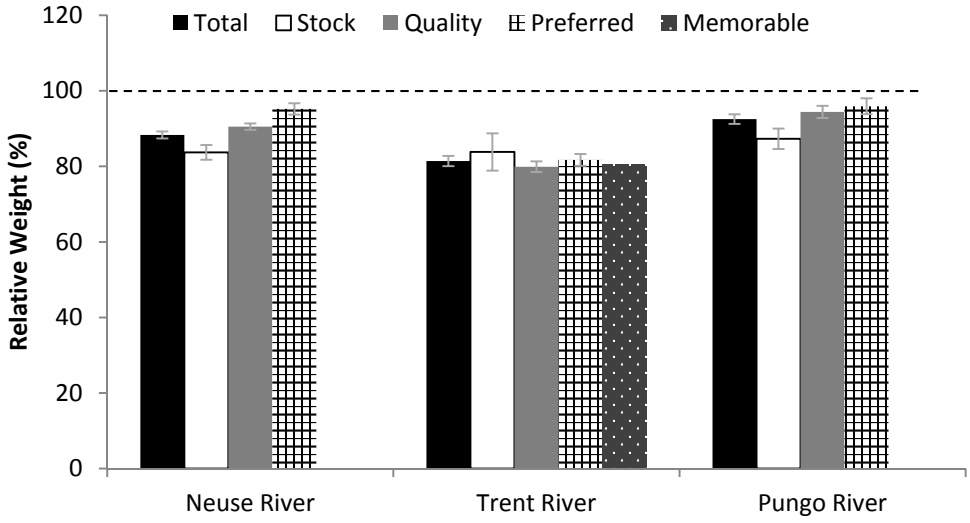


FIGURE 9.—Mean relative weight by PSD length category and river for Bluegill collected during the 2014 central coastal rivers sport fish survey. The dotted line at W_r = 100 denotes the 75th percentile of weights at given length categories of Bluegill across its entire range.

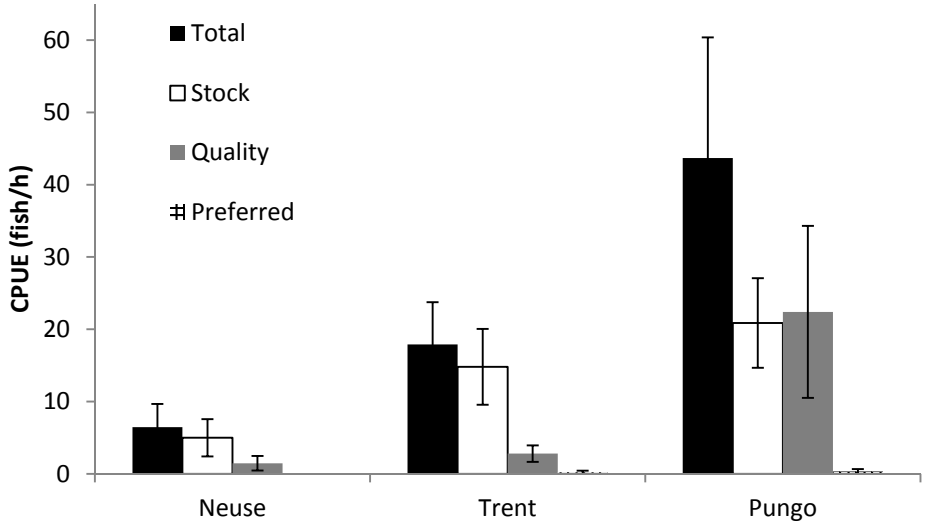


FIGURE 10.—Mean catch per unit effort (CPUE) for Pumpkinseed by river and PSD increments collected during the 2014 central coastal rivers sport fish survey. Error bars represent one standard error.

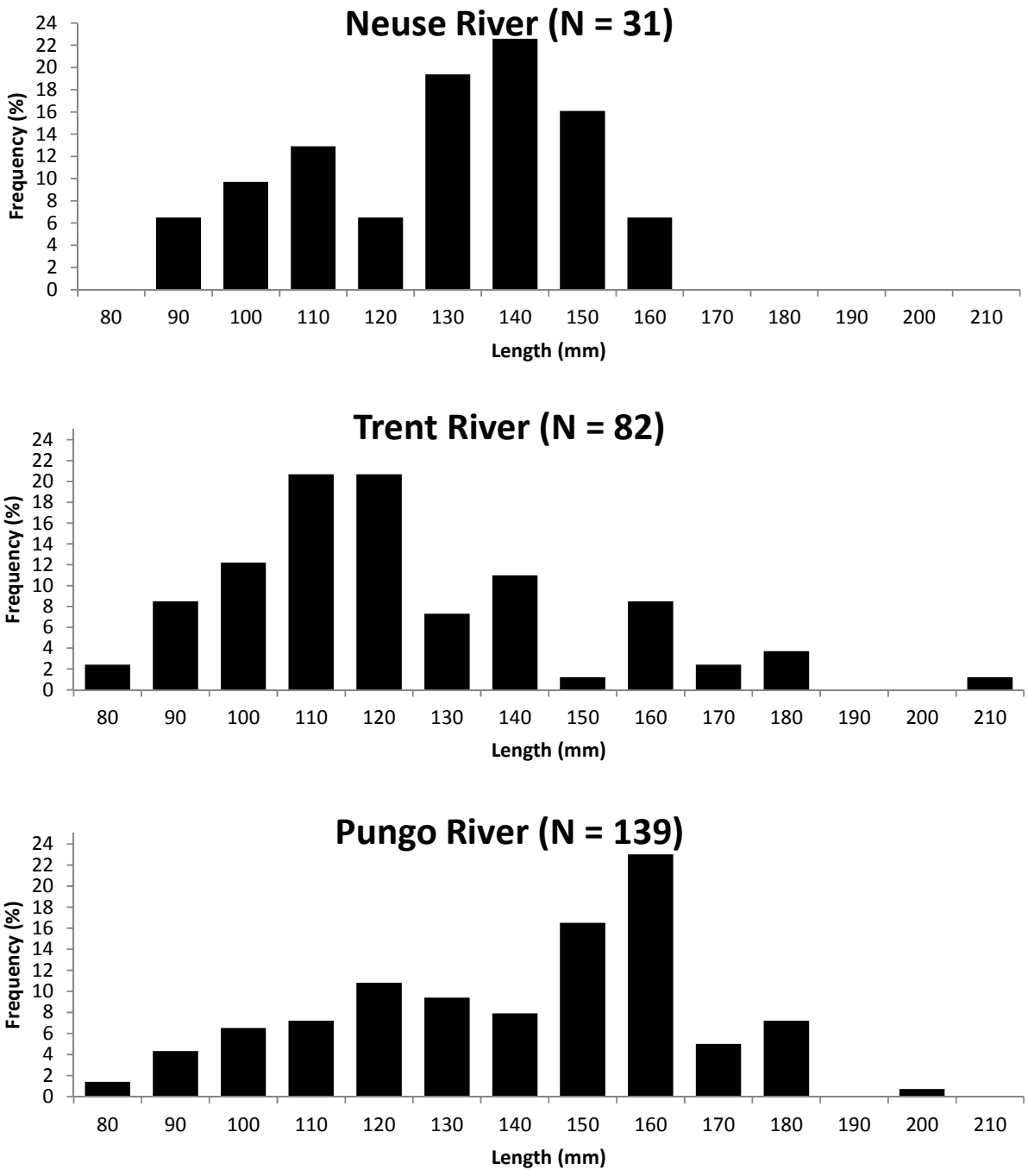


FIGURE 11.—Length distribution by river for Pumpkinseed collected during the 2014 central coastal rivers sport fish survey.

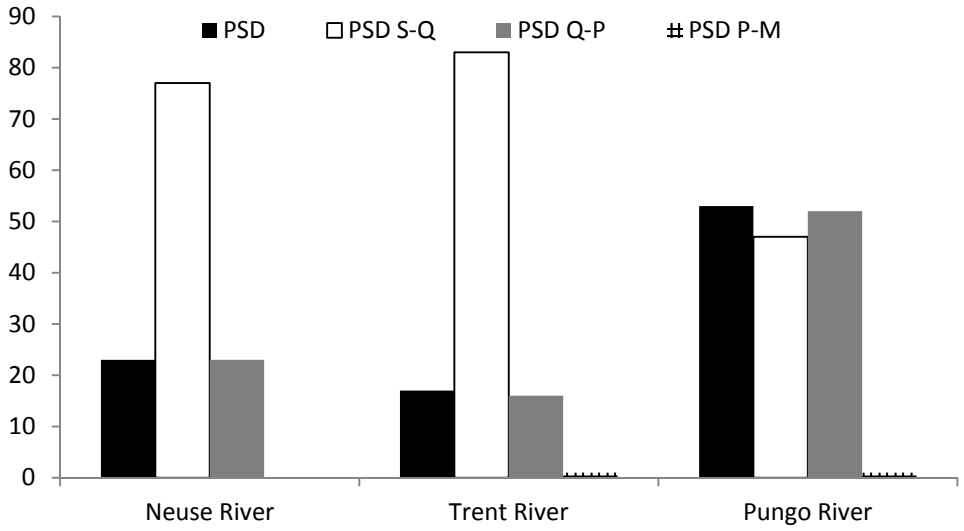


FIGURE 12.—PSD values for Pumpkinseed by river collected during the 2014 central coastal rivers sport fish survey.

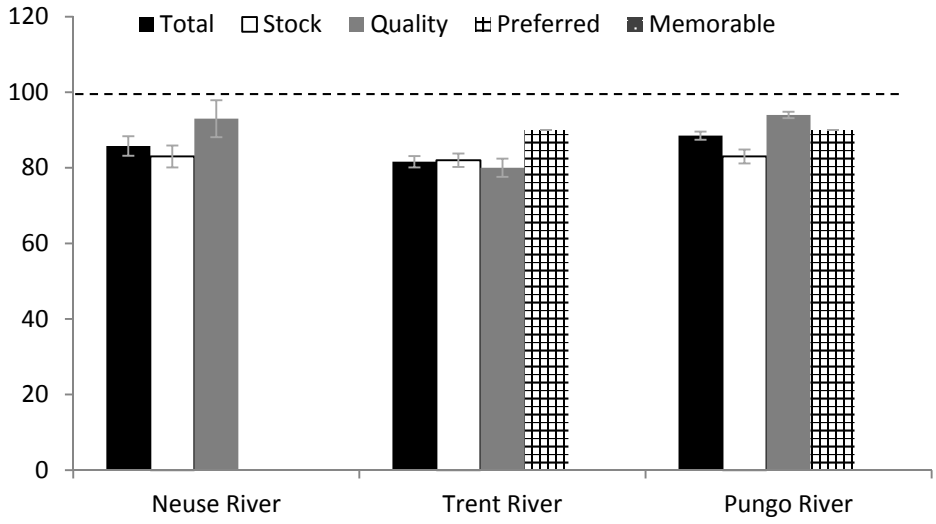


FIGURE 13.—Mean relative weight by PSD length category and river for Pumpkinseed collected during the 2014 central coastal rivers sport fish survey. The dotted line at W_r = 100 denotes the 75th percentile of weights at given length categories of Pumpkinseed across its entire range. Error bars represent one standard error.

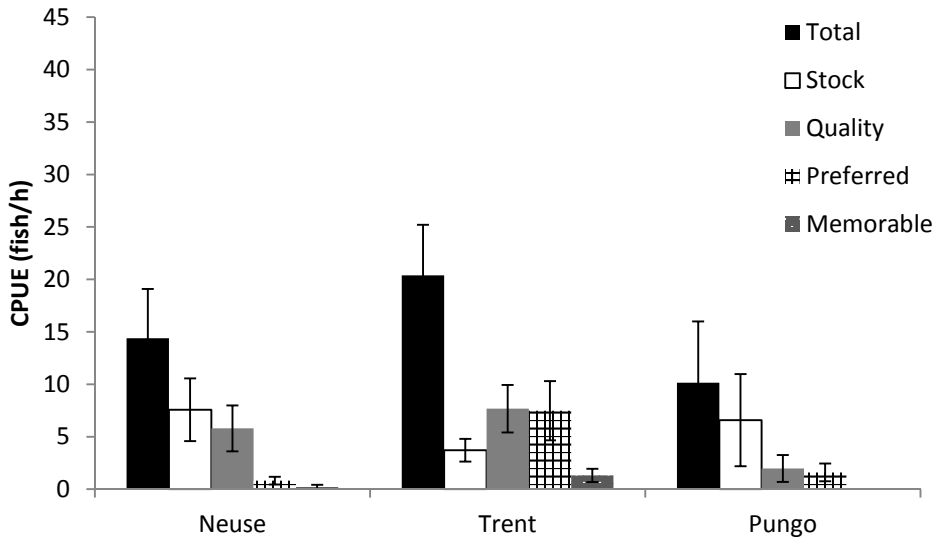


FIGURE 14.—Mean catch per unit effort (CPUE) for Redear Sunfish by river and PSD increments collected during the 2014 central coastal rivers sport fish survey. Error bars represent one standard error.

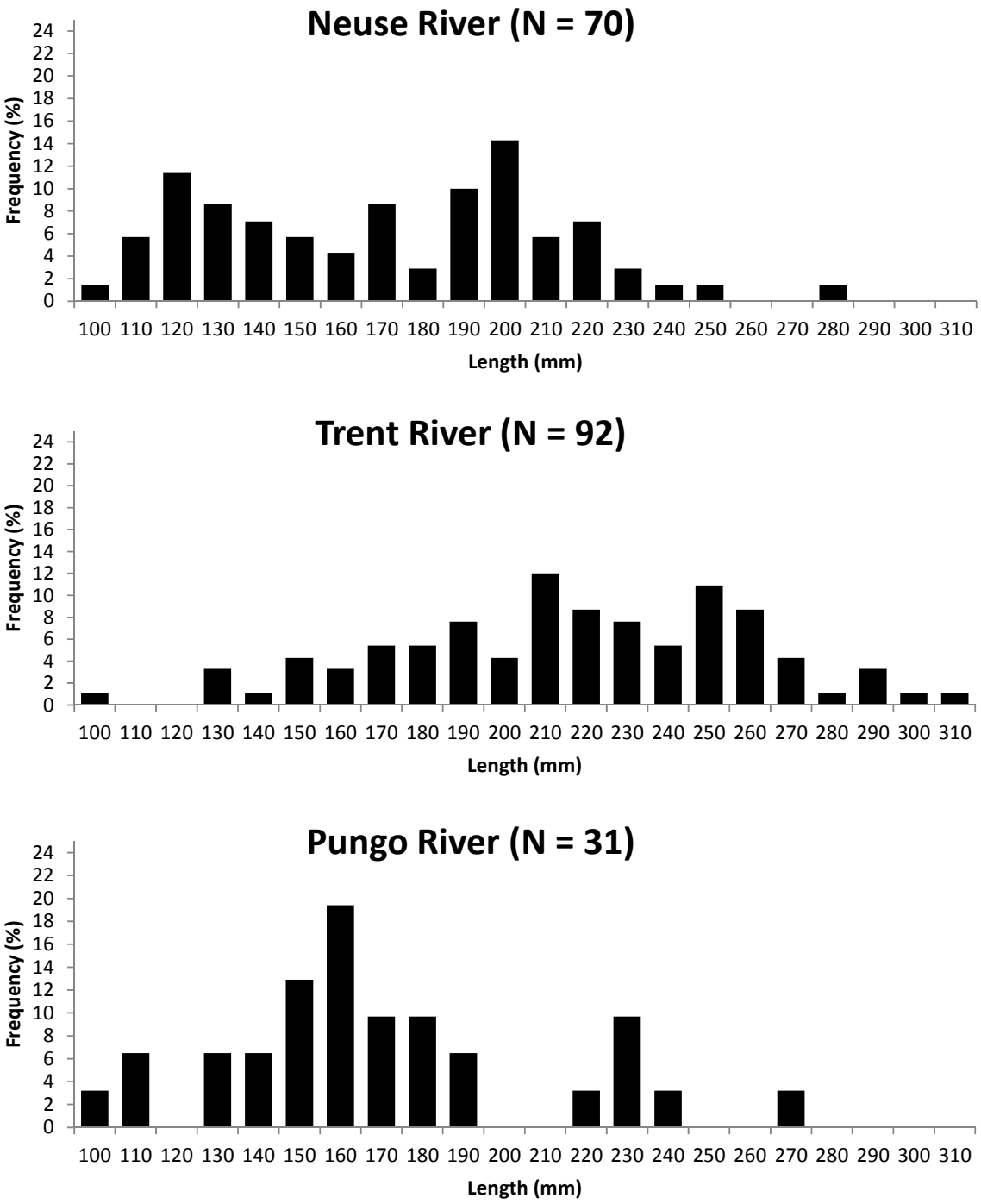


FIGURE 17.—Length distribution by river for Redear Sunfish collected during the 2014 central coastal rivers sport fish survey.

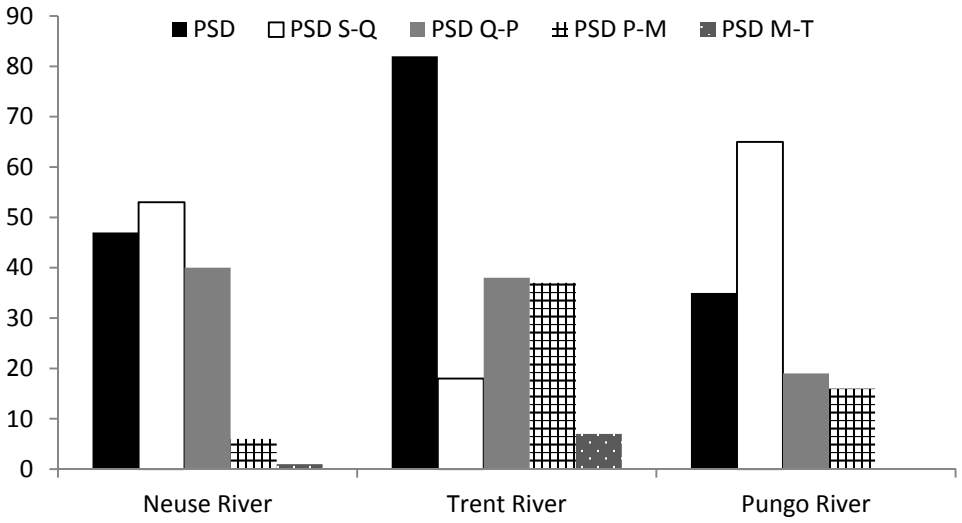


FIGURE 18.—PSD values for Redear Sunfish by river collected during the 2014 central coastal rivers sport fish survey.

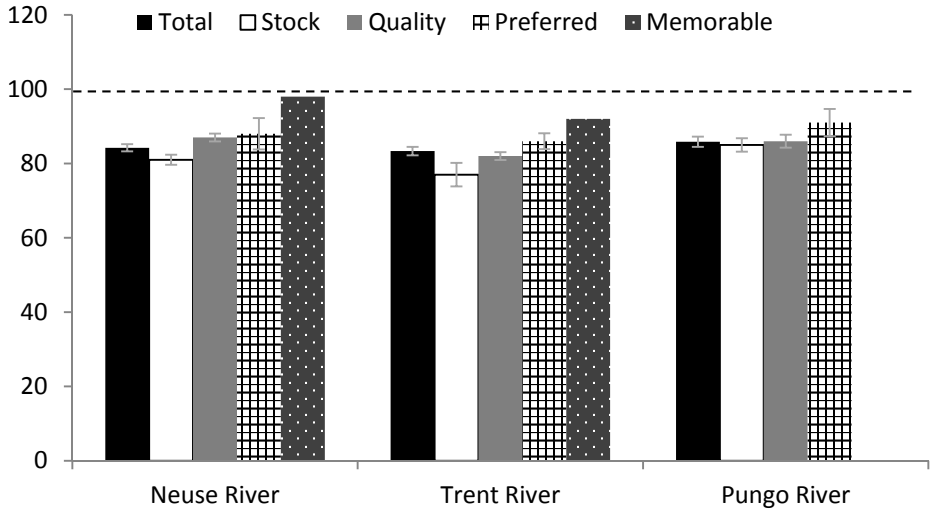


FIGURE 19.—Mean relative weight by PSD length category and river for Redear Sunfish collected during the 2014 central coastal rivers sport fish survey. The dotted line at $W_r = 100$ denotes the 75th percentile of weights at given length categories of Pumpkinseed across its entire range. Error bars represent one standard error.