

Surveying Black Crappie in the Chowan River using Floating Trap Nets



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Abstract. Black Crappie *Pomoxis nigromaculatus* were sampled from tributaries of the Chowan River during October 2025 to update population characteristics in this coastal blackwater system. Total length (TL) ranged from 142 to 329 mm and exhibited a bimodal distribution, with stock, quality, and preferred length fish comprising the majority of the sample. Relative weight values (mean $W_r = 86$) were below the standard benchmark, consistent with seasonal energetic constraints commonly observed during fall sampling periods. Growth analysis using a von Bertalanffy model indicated moderate but relatively slow early growth ($K = 0.3$) compared to other coastal systems, with fish approaching an asymptotic length of 306.8 mm. Assigned ages ranged from 1 to 10 years, reflecting the presence of multiple cohorts and the persistence of older individuals in the population. Floating trap nets provided an adequate sample for evaluating size structure, condition, and growth despite typical site level constraints associated with coastal tributaries. Overall, this assessment provides an updated baseline for Black Crappie in the Chowan River tributaries and complements previous work conducted in the Roanoke River complex. Continued use of targeted sampling coupled with fall trap netting will ensure consistent, comparable monitoring of population trends and habitat conditions over time, supporting long-term management of this important coastal fishery.

Black Crappie *Pomoxis nigromaculatus* are highly sought after by anglers throughout the coastal rivers of North Carolina and can often be subject to high harvest rates (Dockendorf et al. 2004; Rundle et al. 2005; Homan et al. 2006; Homan 2013). Moreover, in a recent creel survey on the Chowan River, crappie had the second-highest harvest among the three focal species examined (Kerr et al. 2026). According to the 2022 North Carolina Wildlife Resources Commission (NCWRC) statewide survey on fishing, hunting, and wildlife associated recreation, crappie are a favorite target for North Carolina recreational anglers, falling only second to catfish (NCWRC 2022). Despite their popularity, NCWRC fisheries biologists have found it difficult to efficiently sample Black Crappie consistently in the coastal rivers and tributaries. Hodges (1997) conducted a comparison assessment between standard sinking trap nets and floating trap nets and observed better overall catch performance by floating trap nets. Moreover, Smith (2024) utilized multiple sampling techniques (electrofishing and floating trap nets) over the course of two sampling years (2021 and 2022) in the Chowan River. The majority (90%) of Black Crappie in that study were collected by floating trap nets compared to electrofishing. Despite showing recent success in the Roanoke River (Kerr and Smith 2025), the use of floating trap nets needs to be further evaluated. Gear limitations including high flow, stream width, and steep bathometric drop offs are common in coastal rivers and can impose challenges for this gear type. The objective of this study was to assess Black Crappie population characteristics using length frequency, age structure, growth, and sex ratios.

Methods

Study site. The Chowan River is a blackwater river that flows approximately 80 km (50 miles) from its origin at the confluence of the Blackwater and Nottoway rivers near the Virginia–North Carolina border into the Albemarle Sound near Edenton, NC (NCDEQ 2021). The river drains a basin of nearly 12,432 square kilometers across Virginia and North Carolina, with major tributaries including Potecasi and Ahoskie creeks, and the Wiccacon and Meherrin rivers (NCDEQ 2021). The Chowan River widens to nearly two miles at its mouth where it drains into the Albemarle Sound providing diverse, mildly brackish aquatic habitats that support both resident and migratory fish species.

Field staff collected Black Crappie from Chowan River tributaries during October 2025. Using a targeted approach, field staff selected sample sites within tributaries of the Chowan River that possessed suitable habitat (i.e., fallen timber and submerged complex structures) for Black Crappie (Table 1; Figure 1). When choosing sites, potential limitations to floating trap net efficiency were considered. Locations with fast moving currents and/or a narrow stream width were avoided.

Sampling gear. Trap nets had a 0.9-m deep and 1.8-m wide box with a lead line that was 0.9 m deep and 15-m long. Trap nets had six rings that stretched from the box to the cod end of the trap. The mesh size for each trap net was 25.4-mm (bar). Standard trap nets were modified to float 0.15–0.30-m below the surface by attaching a single crab pot buoy to each of the box corners and to each of the six rings. Two crab pot buoys were added to the lead line to aid in visibility. Trap nets were set perpendicular to shore with the cod end anchored by a window weight and fished overnight (Figure 2). On the following day, trap nets were pulled and captured fish were placed in a live-well until individuals could be processed.

All Black Crappie collected were weighed (g), measured (TL, mm), sexed (male, female, unknown) and sacrificed for aging via sagittal otolith removal. All otoliths were stored and dried in vials with a unique field ID number. Otoliths were submerged in immersion oil and aged in whole view using a dissecting microscope. Otoliths were aged by two independent readers, and agreement was estimated before a consensus read to determine the final ages for analysis.

Data analysis. To determine if data used for analyses needed to be stratified by sex, a Kolmogorov-Smirnov (KS) test was used to assess whether the distributions of lengths and weights differ significantly between males and females. Length frequency distributions (10-mm length groups) and proportional size distribution (PSD) categories were used to characterize the Black Crappie population by size. Length categories for Black Crappie PSD indices followed recommendations by Gabelhouse (1984) and Guy et al. (2007): stock (130–199 mm), quality (200–249 mm), preferred (250–299 mm), and memorable (300–379 mm). Relative weight (W_r) was calculated for all fish ≥ 100 -mm using the Neumann and Murphy (1991) standard weight (W_s) equation:

$$\log_{10} W_s = -5.618 + 3.345(\log_{10}(TL))$$

A von Bertalanffy growth model was used to determine growth parameters for Black Crappie (Ricker 1975; Ogle 2016). The model is represented by the following equation:

$$L_t = L_{inf} (1 - e^{-K(t-t_0)})$$

where L_t is the length of the fish at age, where t is time in years, L_{inf} is the asymptotic length, K is the growth coefficient, and t_0 is the hypothetical age at which the fish is size 0. Outliers were identified and eliminated from the dataset prior to quantifying mean length-at-age and growth. A linear model was applied to discern the expected length-at-age relationship and quantify residuals. Upper and lower boundaries were established by extending the 25th and 75th percentiles by 1.5 times the interquartile range. Residuals falling outside these boundaries were classified as outliers and subsequently excluded from the analysis.

The FSA package was used to generate a Chapman–Robson analysis to estimate total instantaneous mortality rate (Z ; Chapman and Robson 1960; Ogle 2016; R Core Team 2023). This estimator is less sensitive to irregular age frequencies and provides a minimum-variance unbiased estimate of mortality from catch-at-age data. Total annual mortality (A) was estimated from the equation:

$$A = 1 - e^{-Z}$$

(Ricker 1975; Miranda & Bettoli 2007).

Results

Black Crappie ($n = 101$) were collected at 23 of the 32 sites sampled throughout the Chowan River tributaries. Males made up the majority ($n = 47$), followed by females ($n = 41$), resulting in a sex ratio of 1.15:1. Sex for the remaining 13 individuals was not determined or was unidentifiable upon dissection and recorded as unknown. Unknown individuals varied by size throughout the length distribution. No significant differences in total length between male and female Black Crappie were detected ($D = 0.2$, $p = 0.3$). Therefore, all data were combined for the remaining analyses.

The length frequency distribution of Black Crappie ranged 142–329 mm TL, with a mean of 231 mm TL, and was bimodal with peaks at approximately 170 mm and 280 mm TL (Figure 3). Proportional size distribution length indices were quantified for all 101 individuals with stock-length comprising 32.6% of the sample. Quality-length fish represented 27.7%, followed by the preferred-length class at 29.7% composition. Memorable-length was the smallest composition of the sample at 9.9%. Body condition was indexed via relative weight analysis for all 101 individuals. Individual Wr ranged 71–103 with a mean of 86 ($SE = 0.54$). Mean Wr values for each PSD category were below the standard benchmark of 100 (Figure 4). Preferred-length fish had the highest mean Wr of all PSD categories ($Wr = 88$; $SE = 0.94$) while memorable-length fish had the lowest mean ($Wr = 79$; $SE = 1.7$).

The age of all age of 101 Black Crappie ranged 1–10 years (no age-8 fish were observed). Age estimates had 98% agreement within ± 1 year. Age-1 Black Crappie were the most abundant ($n = 24$) with a mean of 168 mm TL (Figures 5 & 6). Three age-length outliers were removed prior to model fitting. The estimated asymptotic length (L_{inf}) was 306.8 mm ($SE = 10.9$), with a growth coefficient (K) of 0.3 ($SE = 0.06$), and theoretical age (t_0) was -1.0 ($SE = 0.3$; Figures 6 & 7). The predicted growth curve indicated that Black Crappie in the Chowan River exhibit moderate growth through ages 1–3, followed by progressively slower growth at older ages as fish approach the asymptotic total length of 306.8 mm. Total instantaneous mortality was estimated at $Z = 0.32$ using the Chapman–Robson method and this corresponds to an annual mortality estimate of $A = 27\%$ (0.27).

Discussion

Black Crappie in the Chowan River tributaries exhibited a balanced size and age structure, with strong representation of age-1 fish suggesting moderate recent recruitment. The bimodal length distribution, characterized by peaks near 170 mm and 280 mm TL, suggests that at least two strong cohorts are contributing substantially to the population. Unlike the Roanoke River complex, where younger age classes were underrepresented in recent surveys (Kerr & Smith 2025), age-1 Black Crappie were the most abundant group in the Chowan River tributaries sample. Black Crappie recruitment can be highly variable, often following a “boom-or-bust” pattern across years (Allen & Miranda 1998; Aday et al. 2009; Baumhoer & Kelly 2016). While a single year of data cannot confirm long-term trends, the strong age-1 cohort and the generally continuous representation of year classes, with only a minor dip at age 5, suggest that recruitment has likely been stable in the Chowan River tributaries over the last 5 of 6 years. This interpretation is further supported by long-term monitoring data, which track the strong 2019

year-class from age 2 in 2021 to age 3 in 2022 and now age 6 in 2025, as well as the consistently low abundance of the 2020 cohort across those same years (Smith 2024).

Body condition (Wr) values were moderately below the standard benchmark of 100 across PSD categories, suggesting that Black Crappie may experience seasonal or habitat-related energetic constraints during the fall sampling period. Similar patterns have been documented in other aquatic systems, where fluctuating water temperatures and prey availability can influence condition during late summer and fall (Gabelhouse 1991; Pope and Willis 1996; Michaletz et al. 2012). Preferred-length individuals exhibited the highest mean Wr , which may reflect optimal foraging efficiency among mid-sized adults. Conversely, memorable-length fish had the lowest mean Wr , potentially indicating increased energetic demands or reduced prey availability for larger individuals.

Growth patterns derived from the von Bertalanffy model indicated moderate growth through ages 1–3, followed by diminishing increments at older ages as fish approached the estimated asymptotic length of 306.8 mm. These patterns are broadly consistent with the 2021–2022 Chowan River assessment, which also documented rapid early growth and fish reaching approximately 200–250 mm by ages 2–3. However, the previous survey estimated a higher growth coefficient ($K = 0.585$) and a slightly larger asymptotic length ($L_{inf} = 327.6$ mm), suggesting faster early growth and a marginally higher predicted maximum size during that period. Differences in VBGF parameters between survey periods likely reflect variation in year-class structure and sample composition, as the 2021–2022 assessment contained a higher proportion of younger, rapidly growing individuals, whereas the current dataset includes more older fish and a broader age range. Natural interannual variation in environmental conditions may also contribute to these shifts. Despite these differences, both assessments show similar size-at-age patterns, and the presence of individuals up to age 10 in the current sample extends the maximum age previously observed, indicating that the system continues to support long-term survival and the persistence of older cohorts. Although the growth coefficient in the current assessment is lower than that of the Roanoke River complex, it remains within the range reported for Black Crappie in other North Carolina coastal rivers (Jackson & Hurley 2005; Kerr & Smith 2025), and the relatively high asymptotic length indicated that the Chowan River can support fish capable of attaining large maximum sizes.

The mortality and age-structure patterns observed provide context for evaluating current harvest regulations for Black Crappie in the Chowan River. Although age-frequency distributions differed among tributaries, these differences reflected variation in the ages captured within individual creeks rather than evidence of distinct biological subpopulations. Black Crappie in the Chowan system are not managed as separate tributary stocks, and sample sizes within tributaries were small; therefore, age-based analyses were conducted at the population level. Total mortality was modest ($Z = 0.32$; $A = 27\%$), and the presence of multiple older age classes indicates that harvest pressure is not a dominant driver of population structure in this system. Although fishing mortality was not estimated directly, the low total mortality and persistence of older cohorts are consistent with findings from the 2024 creel survey, which documented relatively low harvest of Black Crappie in the Chowan River (Kerr et al. 2026). Angler behavior further supports this interpretation. Most crappie anglers (66%) reported that the current 8-inch minimum length limit is “just right,” and nearly half indicated that they do not typically retain fish smaller than 10 inches, effectively imposing a more conservative size threshold than

required. Additionally, 78% of anglers felt that the daily creel limit of 20 fish was appropriate. These patterns suggest that voluntary angler selectivity already exceeds regulatory requirements, reducing the likelihood that current harvest limits are constraining population structure or contributing substantially to mortality. Taken together, the biological indicators and angler-reported harvest practices suggest that existing regulations are functioning as intended, and there is no evidence that changes to the minimum length limit or daily creel limit would provide additional biological benefit at this time.

Floating trap nets proved effective for sampling Black Crappie in the Chowan River, yielding more than 100 individuals and providing a strong enough sample for evaluating size structure, body condition, and growth. Although total catch was lower than the 268 Black Crappie collected during the Roanoke River complex survey, both efforts demonstrated that floating trap nets consistently outperform electrofishing in North Carolina's coastal rivers (Smith 2024; Kerr & Smith 2025). The differences in total catch between systems likely reflect natural variation in habitat, population density, or spatial distribution rather than gear performance alone. Even with these advances, uncertainties remain in how best to sample coastal Black Crappie. Some habitats that appear structurally suitable for Black Crappie still produce few or no fish, likely reflecting environmental constraints such as low dissolved oxygen in backwater areas, periodic salinity intrusion during dry years, and algal blooms. These water-quality limitations can restrict habitat availability even when physical structure appears ideal, and they may help explain the patchy distribution of fish observed during sampling. Emerging technologies such as forward-facing sonar, side-scan, and 360-imaging may help identify fish distribution patterns under these variable conditions by revealing habitat use that traditional gear cannot detect. Future evaluations of alternative trap-net configurations, including smaller ½-inch mesh to better retain age-0 and age-1 fish, may further improve sampling efficiency and expand the size ranges represented in coastal surveys.

Overall, this assessment provides an updated baseline for Black Crappie in the Chowan River tributaries and complements previous work conducted in the Roanoke River complex. Continued use of targeted sampling coupled with fall trap-netting (Pope and Willis 1996) will ensure consistent, comparable monitoring of population trends and habitat conditions over time, supporting long-term management of this important coastal fishery. Notably, several (n = 9) "Blacknose" Black Crappie, which are individuals exhibiting a distinct midline stripe caused by a heritable melanistic pigmentation trait, were captured in the Meherrin River. This phenotype has been documented in scientific literature as a genetically inherited form of melanism within Black Crappie populations (Buchanan & Bryant 1973; Gomelsky et al. 2005), and its occurrence in the Chowan system may be of interest to anglers familiar with this variant.

Management Recommendations

1. Monitor the Black Crappie population in the Chowan River tributaries every 3 years to track changes in size structure, growth, and cohort strength.
2. Maintain the current 8-inch minimum size limit and 20-fish daily creel limit, as biological indicators and angler harvest patterns show no evidence that regulatory changes are warranted.

3. Continue using floating trap nets, paired with targeted site selection, as the primary approach for sampling Black Crappie in coastal rivers. Incorporating forward-facing sonar into pre-sampling assessments will improve the identification of suitable habitats and help refine site selection, particularly in areas where traditional visual cues have proven unreliable. Repeating this survey's methodology and evaluating alternative trap-net configurations (e.g., lead line lengths, frame dimensions, materials, and mesh sizes) will further refine gear performance and strengthen support for broader adoption and acquisition of floating trap nets for Black Crappie assessments in coastal systems.
4. Share key findings with local Black Crappie anglers and clubs to keep stakeholders informed and engaged in the management of the Chowan River fishery.

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TABLE 1. Sample Site information for Chowan River tributaries. The number of nets set is equal to the number of net-nights sampled. Water quality data were collected before trap nets were deployed at each site. Values for each site variable were averaged from the recorded set time and the recorded retrieval time. A hyphen (-) indicates water quality data were not collected due to technical difficulties.

Pick-up Date	Location	Number of Nets Set	Water Temperature (C°)	DO (mg/L)	Salinity (ppt)
10/7/2025	Pembroke Creek	4	-	-	-
10/9/2025	Wiccacon Creek	4	-	-	-
10/14/2025	Potecasi River	2	19.5	5.1	0.02
10/14/2025	Meherrin River	2	19.5	4.1	0.02
10/15/2025	Meherrin River	4	19.0	5.5	0.02
10/16/2025	Bennetts Creek	4	18.9	3.5	0.04
10/21/2025	Catherines Creek	4	18.2	5.0	0.05
10/22/2025	Sarem Creek	4	17.8	4.4	0.04
10/23/2025	Bennetts Creek	4	17.4	3.3	0.05

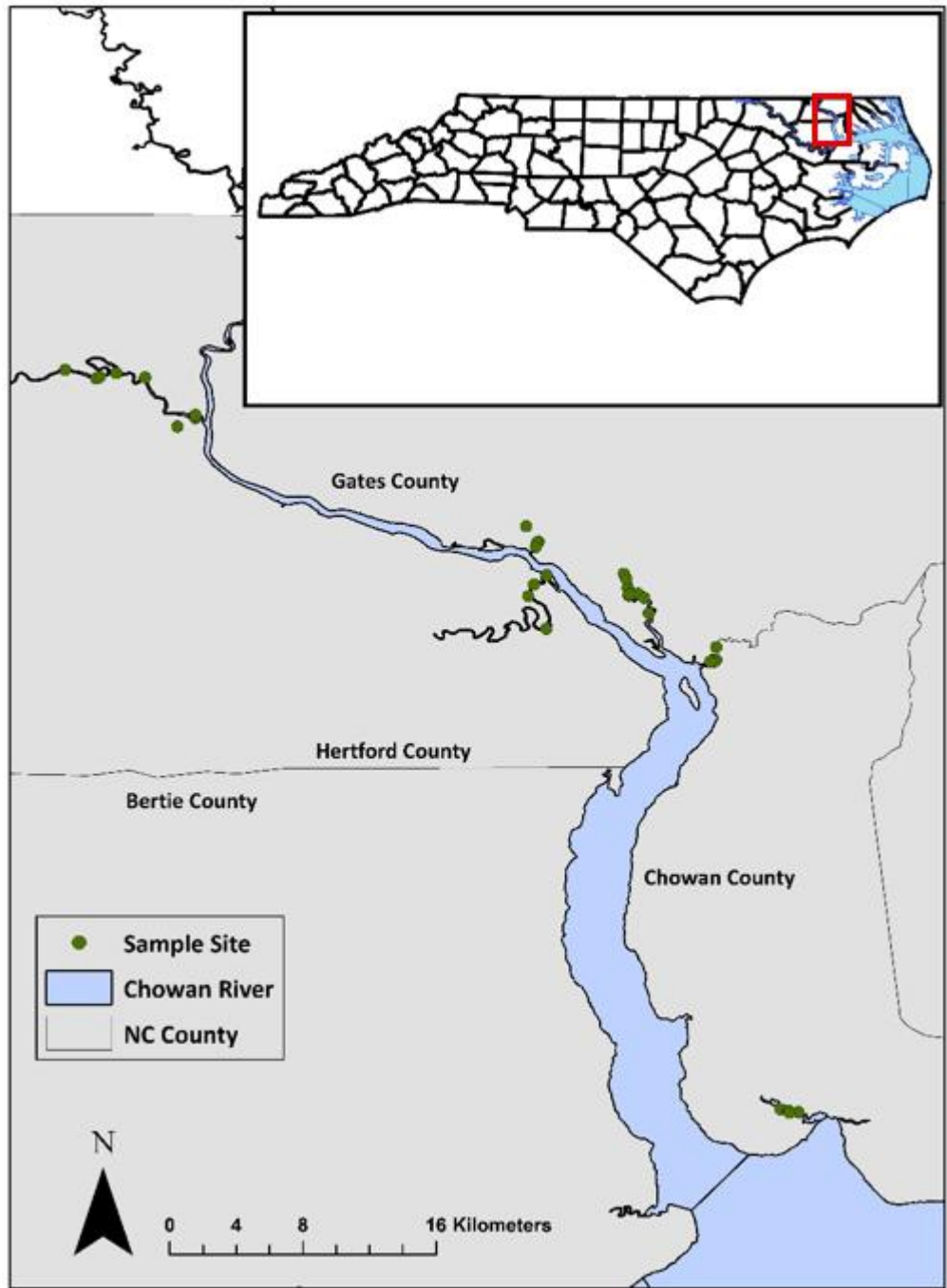


FIGURE 1. Trap net sites sampled in Chowan River tributaries, fall 2025.



FIGURE 2. Image of a floating trap net used to target Black Crappie in the Wiccacon River, a tributary of the Chowan River.

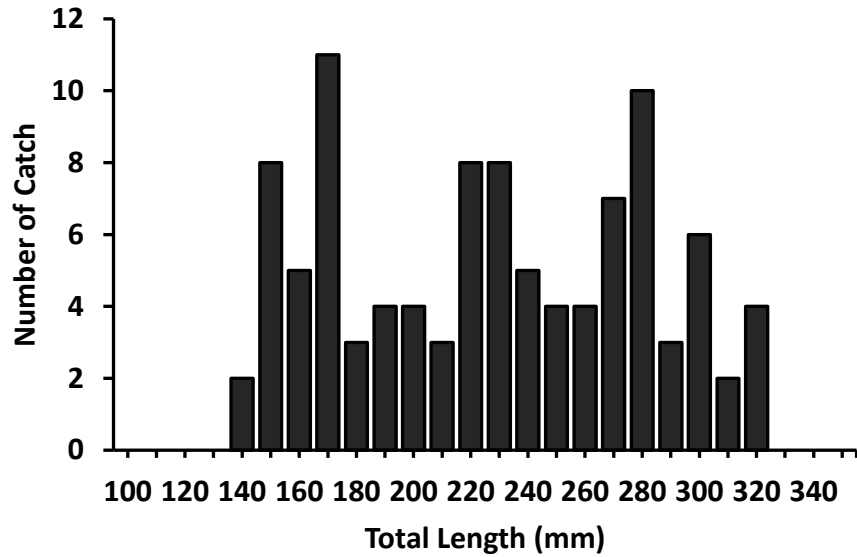


FIGURE 3. Length frequency distribution for all Black Crappie (n = 101) sampled from the Chowan River during fall 2025.

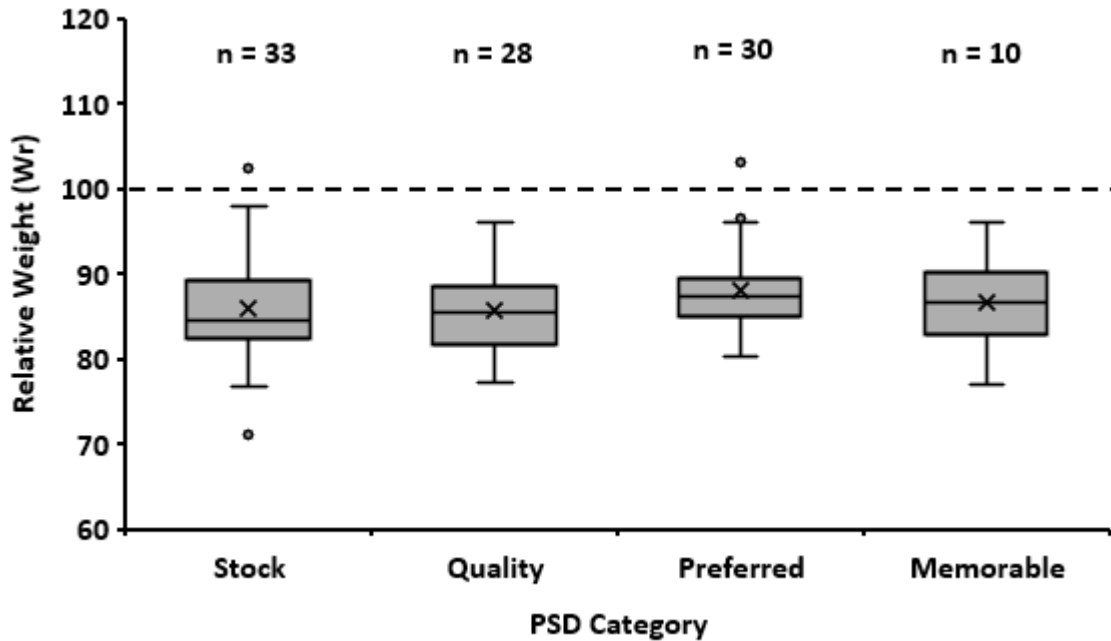


FIGURE 4. Incremental relative weight (Wr) for Black Crappie (n = 101) across PSD categories. The horizontal line inside the box represents the median, the “X” denotes the mean, and points plotted beyond the whiskers represent statistical outliers exceeding this threshold. The horizontal dashed line at $Wr = 100$ denotes the 75th percentile of weights at given lengths of Black Crappie across its entire range.

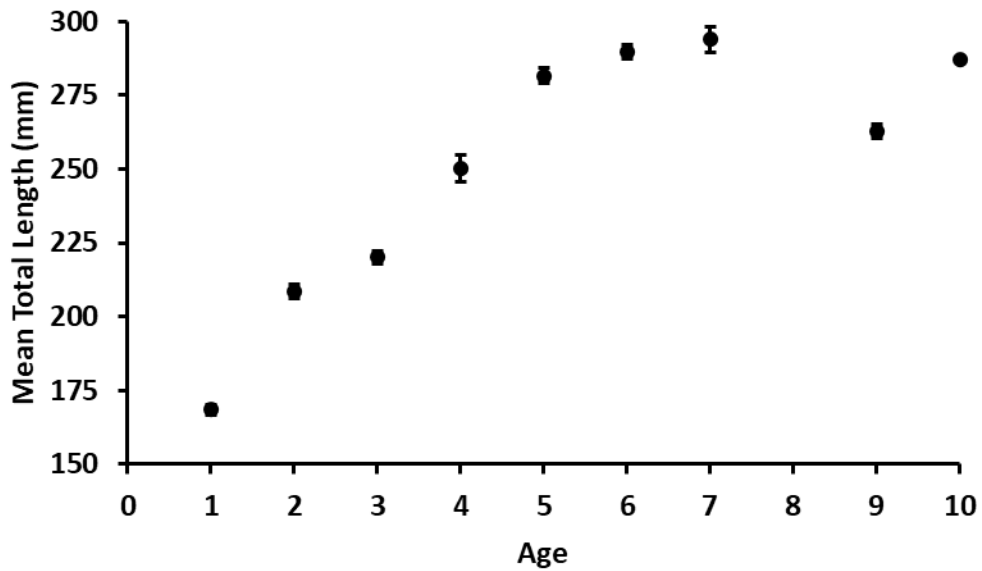


FIGURE 5. Mean length-at-age plot from all aged Black Crappie (n = 101) from the Chowan River during fall 2025. Error bars indicate the standard error for each mean length. Only a single individual was recorded for age 10.

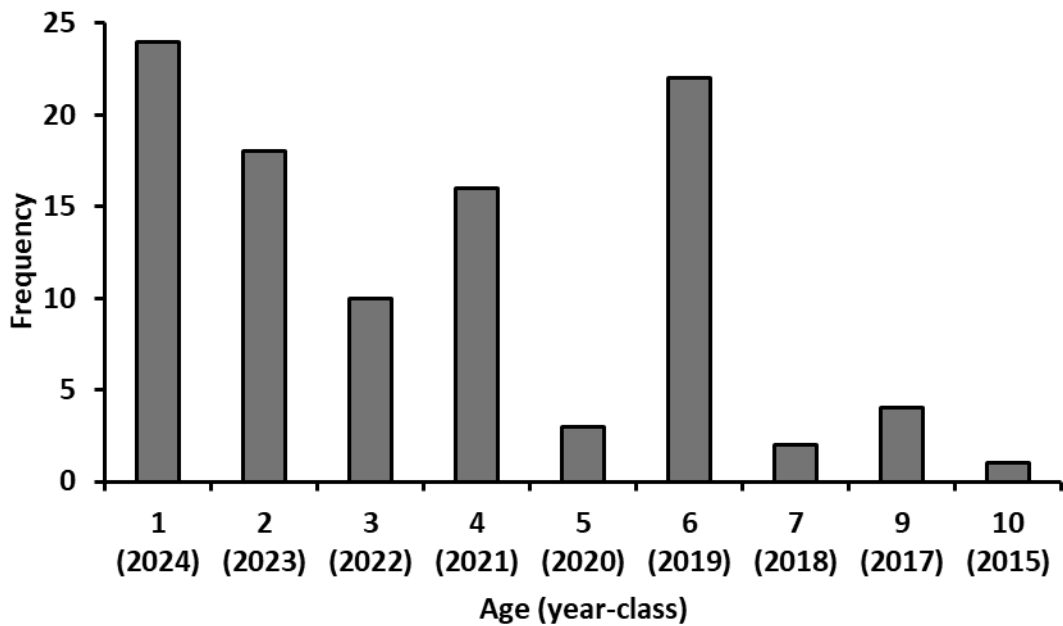


FIGURE 6. Age distribution for all Black Crappie (n = 101 collected from the Chowan River during fall 2025).

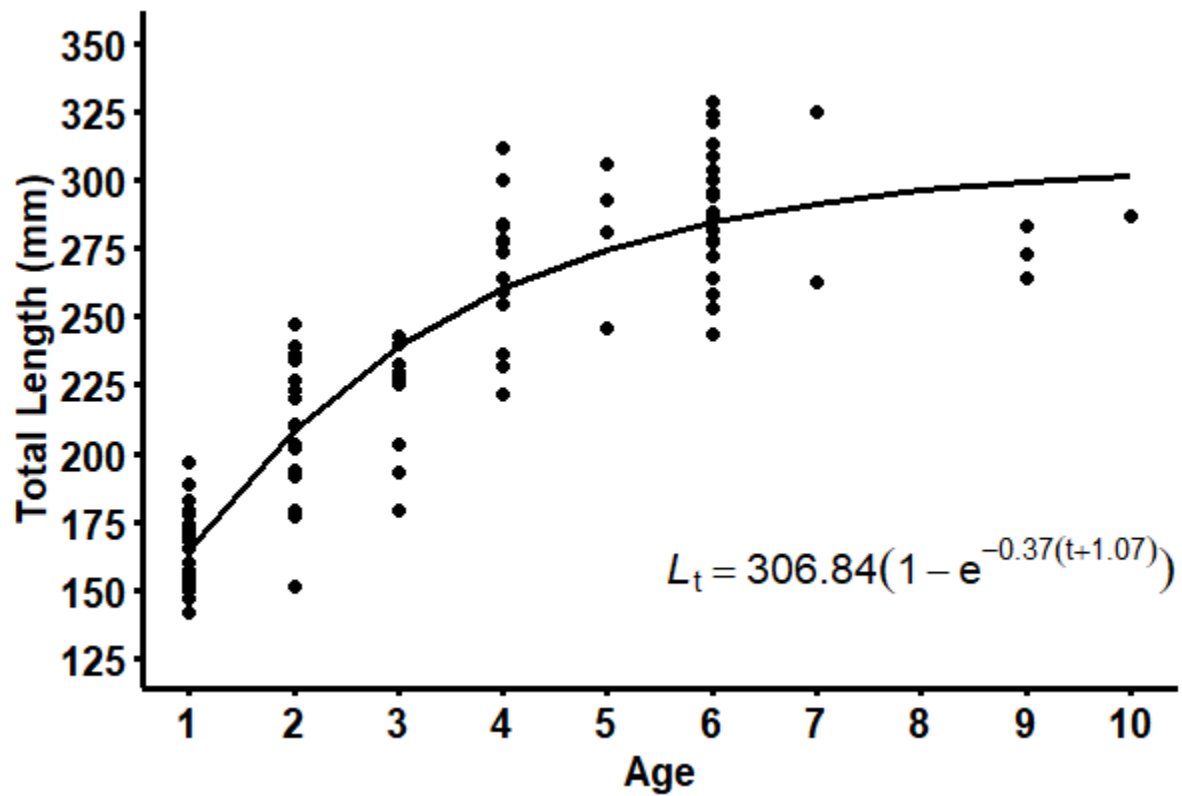


FIGURE 7. von Bertalanffy growth curve analysis for otolith-aged Black Crappie (n = 98) collected from the Chowan River during fall 2025.