

CONTRIBUTION OF STOCKED WALLEYE IN LAKE GLENVILLE



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Abstract.—The Walleye *Sander vitreus* population in Lake Glenville, North Carolina has experienced recruitment failures since 2006. In 2012, we began stocking oxytetracycline-marked fingerling Walleye to determine if they could recruit to adulthood (age ≥ 1) and augment the declining population. We assessed the Walleye population with annual fall gill net surveys from 2013 to 2016. The first four annual stockings (2012–2015) were all represented in our gill net collections. The stocked Walleye recruited to adulthood and by age-4 reached total lengths similar to the oldest year-classes still present in the reservoir. The percentage of stocked Walleye in our samples increased every year and by 2016 comprised 64.6% of the adult Walleye population. Fingerling stocking is a promising approach for maintaining the Lake Glenville Walleye population and fishery. We recommend continued annual fingerling stockings and a re-evaluation of this management strategy in 2022.

Lake Glenville is a small (592 ha), high elevation (1,064 m above mean sea level), oligotrophic, hydropower reservoir in Jackson County, North Carolina (TVA 1954, NCDENR 2005). It was impounded in 1941 and Walleye were first introduced in 1954 (Messer 1966). This initial introduction established a self-sustaining Walleye population and, until this study, there have been no additional stockings. The Walleye fishery is popular and a creel survey conducted between 2000 and 2001 estimated that Walleye attracted 46.0% of the directed angling effort and that anglers harvested 1,617 Walleye annually (Yow and Shaver 2012).

Gill-net surveys of Lake Glenville in 2009 and 2010 revealed that the Walleye population had experienced complete recruitment failures since 2006 and that the population was almost entirely comprised of year-classes from 2003 and earlier (NCWRC unpublished data). The cause of the recruitment failure is unknown. Blueback Herring are present in the reservoir and are commonly associated with Walleye recruitment problems (Wheeler et al. 2004); however, they were present in the lake since at least 1999 (NCWRC unpublished data) without causing the sudden and immediate recruitment problems observed in nearby Lake Hiwassee (Wheeler et al. 2004).

In other North Carolina reservoirs, annual stockings of fingerling Walleye have successfully compensated for poor and failed recruitment (NCWRC unpublished data, Bushon et al. 2009). Our goal is to restore the recruitment of adult (\geq age-1) Walleye in Lake Glenville and our objective is to determine if stocked fingerling Walleye can recruit to adulthood.

Methods

In 2012, we began an experimental annual stocking of 8,000 fingerling Walleye in Lake Glenville. This stocking rate (13.5/ha) is similar to rates in other North Carolina reservoirs (NCWRC 2018). Each March, Walleye brood stock were collected with electrofishing from Lake James and transported to Table Rock State Fish Hatchery in Morganton, North Carolina. Walleye were strip-spawned at the hatchery and the fertilized eggs were transferred to hatching jars. After hatching, the fry were transferred to outdoor ponds and reared to 25–38 mm TL. Walleye fingerlings were then transferred into indoor tanks where they were marked by 6 hours of immersion in a solution of 500 mg/L of oxytetracycline hydrochloride (OTC) and 1,000 mg/L of sodium chloride and the pH was buffered to 6.5–6.9 with tris. Besler (2004) and Bushon et al. (2009) found 30 d OTC mark retention using these methods was \geq 99%. Within three days of harvesting, the marked Walleye were released at one of two locations. In 2012 and 2013, they were stocked in the reservoir from Pine Creek Boating Access Area, and in 2014–2016 they were stocked in Pine Creek upstream of the reservoir. All the stockings occurred between April 26 and May 14.

We used gill net surveys in October of 2013, 2014, 2015, and 2016 to sample the Walleye population. The gill net dimensions were 2.4 x 76.3 m and consisted of consecutive, equal-length panels of 25-, 32-, 38-, 44-, and 51-mm bar mesh. The nearshore end (small or large mesh) of the nets was randomly selected before we set the nets perpendicular to the shore at eight sites (Figure 1) for one 24-h period. The sites were spread throughout the reservoir and chosen to avoid gill net hazards such as submerged trees and boat docks. All captured Walleye were bagged by site, placed on ice, transported to the lab where they were measured for TL (mm), weighed (g), and sexed within 24h. Sagittal otoliths were removed, placed in individually coded plastic vials, and stored in the dark.

Walleye ages were estimated by counting otolith annuli with a compound microscope. Two readers evaluated each otolith independently and then assigned ages after disagreements were discussed and resolved. If the otoliths were \leq age-1, they were aged intact (without breaking or sectioning); whereas, older otoliths were aged after removing two 0.5-mm sections of the focus using a Buehler Isomet low-speed diamond wheel saw.

After aging, the otoliths were checked for OTC marks under a compound microscope with transmitted epifluorescent light. Sectioned otoliths were placed on a glass microscope slide and examined on both sides of the two, 0.5-mm sections. Intact otoliths were attached to microscope slides with cyanoacrylate glue and ground with 800-grit sandpaper, before exposing them to epifluorescent light.

We calculated Walleye relative weight according to Murphy et al. (1990). The percentage of stocked Walleye in our samples was used as an estimate of the percentage of stocked Walleye in the entire reservoir and the Clopper and Pearson (1934) exact binomial method (R version 3.4.3) estimated 95% confidence intervals. Finally, we qualitatively compared the growth of the stocked Walleye to the older Walleye cohorts with traditional Tukey-style boxplots.

Results and Discussion

We collected 185 Walleye during this investigation from 32 net-nights of effort (Table 1) and assigned ages and year-classes to 179. Although year-classes in our samples ranged from 1997 to 2015, no Walleye were caught from the 2006–2011 year-classes, indicating six consecutive years of complete recruitment failure before this study began. In addition, Walleye recruited to our gill nets at age-1 and we did not collect any age-0.

We collected 70 Walleye from the stocked year-classes. Overall, 95.7% of these were verified as stocked by the presence of OTC marks. Considering the history of failed recruitment, the small percentage of unmarked fish were most likely stocked fish with undetected OTC marks rather than products of renewed natural recruitment. All year-classes of stocked Walleye were represented in our collections and thus, Walleye were recruiting from both stocking locations. Each year the stocked Walleye formed a larger percentage of the total catch (Figure 2). As of the 2016 sample, we estimated 64.6% of the adult Walleye in Lake Glenville were stocked and we are 95% confident that the actual percentage is between 49.5 and 77.8 (Table 1). Overall, the Walleye in Lake Glenville were robust with relatively high relative weight values (Table 1) and reached similar total lengths to the much older (\geq age-8) cohorts by age-4 (Figure 3).

We accomplished the objective of this research; the stocked fingerling Walleye are recruiting to the adult population. Although we did not survey angler creels, these Walleye are likely contributing to angler catch and harvest rates. As the older year-classes continue to experience mortality and natural reproduction continues to fail, we anticipate that the percentage of stocked Walleye will continue to increase and the Lake Glenville Walleye fishery will soon be entirely supported by hatchery-raised fingerlings.

Management Recommendations

- 1.) Continue annual fingerling Walleye stocking in Lake Glenville. Also, stocking should occur from the Pine Creek Boating Access Area, because Walleye stocked there successfully recruit to adulthood and it's more convenient to the hatchery staff than Pine Creek.
- 2.) Re-sample Lake Glenville in 2022 to verify that the stocking is still effective.

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TABLE 1.—Catch per unit effort (CPUE; individuals/net night), TL range (mm), relative weight (W_r), and percent stocked for Walleye collected during this study. Standard deviations are reported for CPUE and W_r and a 95% confidence interval is reported for percent stocked.

Year	N	CPUE	TL range	W_r	Percent stocked
2013	43	5.4 (4.6)	357–616	88.0 (10.9)	4.7 (0.1–15.8)
2014	42	5.3 (4.7)	351–614	93.9 (7.2)	28.6 (15.7–44.6)
2015	52	6.5 (3.3)	375–574	95.4 (9.7)	48.1 (34.0–62.4)
2016	48	6.0 (4.9)	335–592	94.0 (9.4)	64.6 (49.5–77.8)

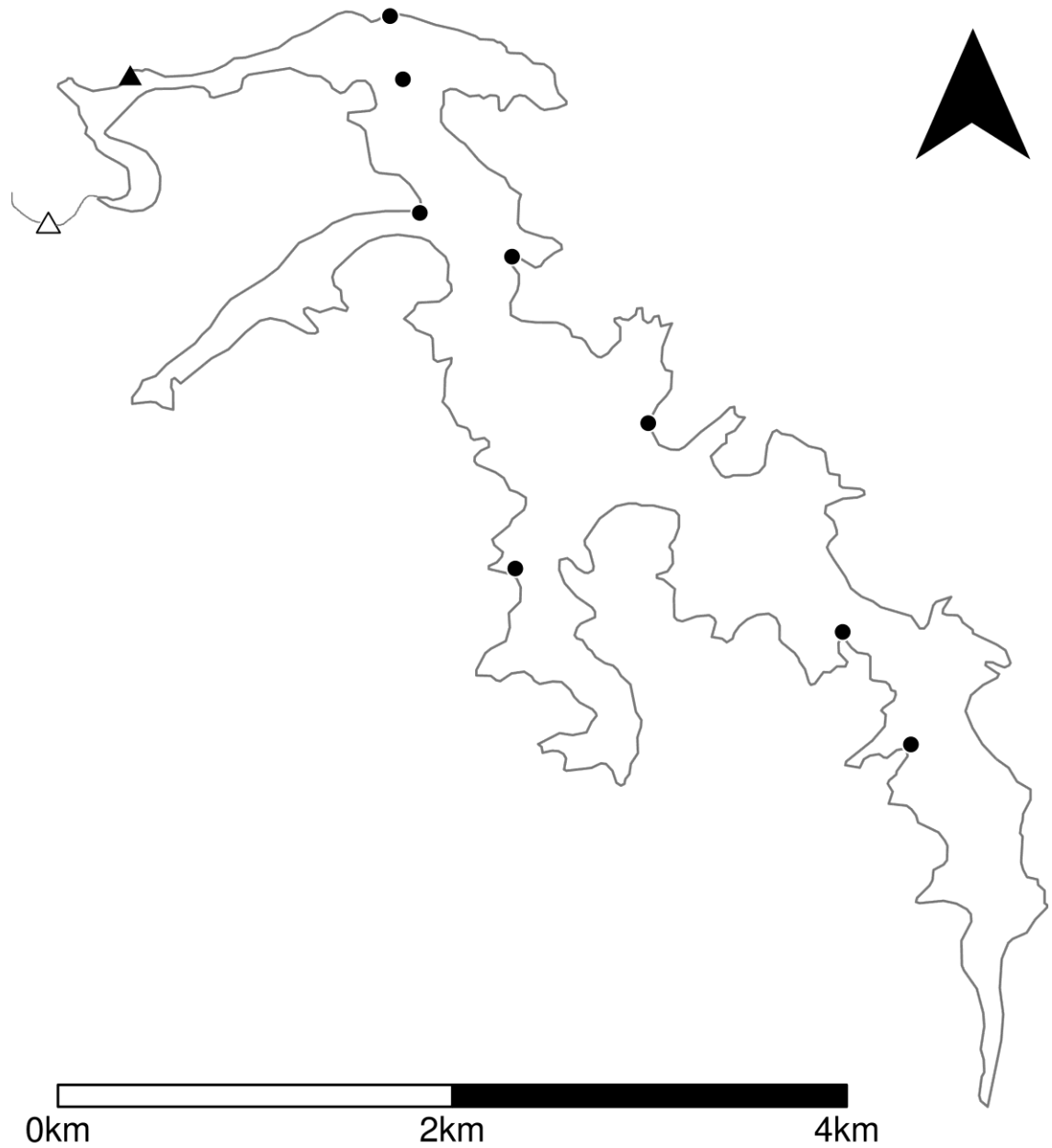


FIGURE 1.—Map of Lake Glenville, Jackson County, North Carolina. The dots show the eight gill net locations used for Walleye collections in this study (2012–2016). The filled triangle represents the stocking point at Pine Creek Boating Access Area and the open triangle represents the stocking point on Pine Creek.

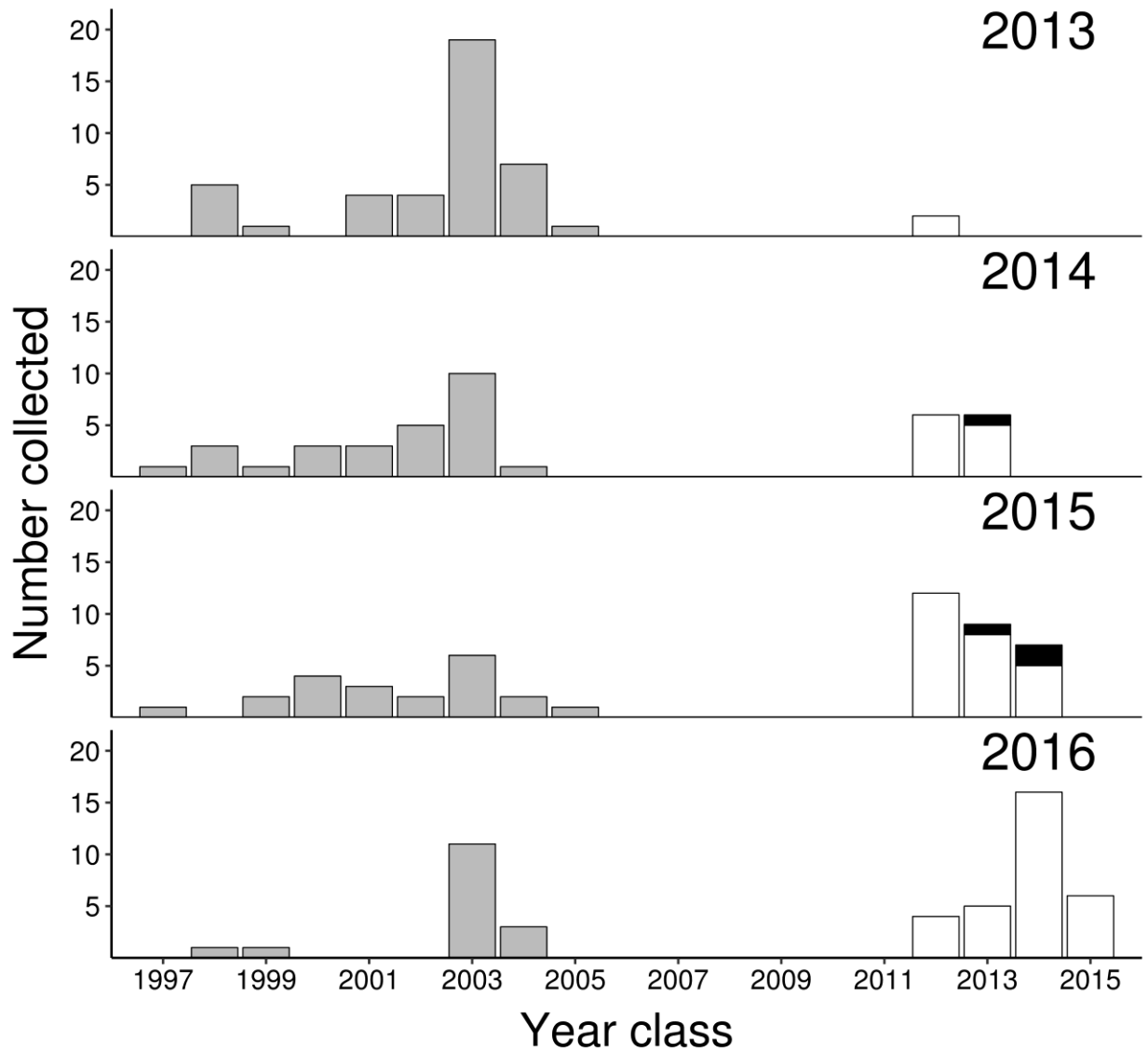


FIGURE 2.—The frequency distributions of Walleye year-classes collected from 2013–2016 during this study. Walleye from stocked year-classes (2012–2015) were checked for OTC marks. White shading represents OTC-marked Walleye and black shading represents unmarked Walleye. Year-classes that were older than our stocking efforts were not checked for OTC marks and are shown in gray.

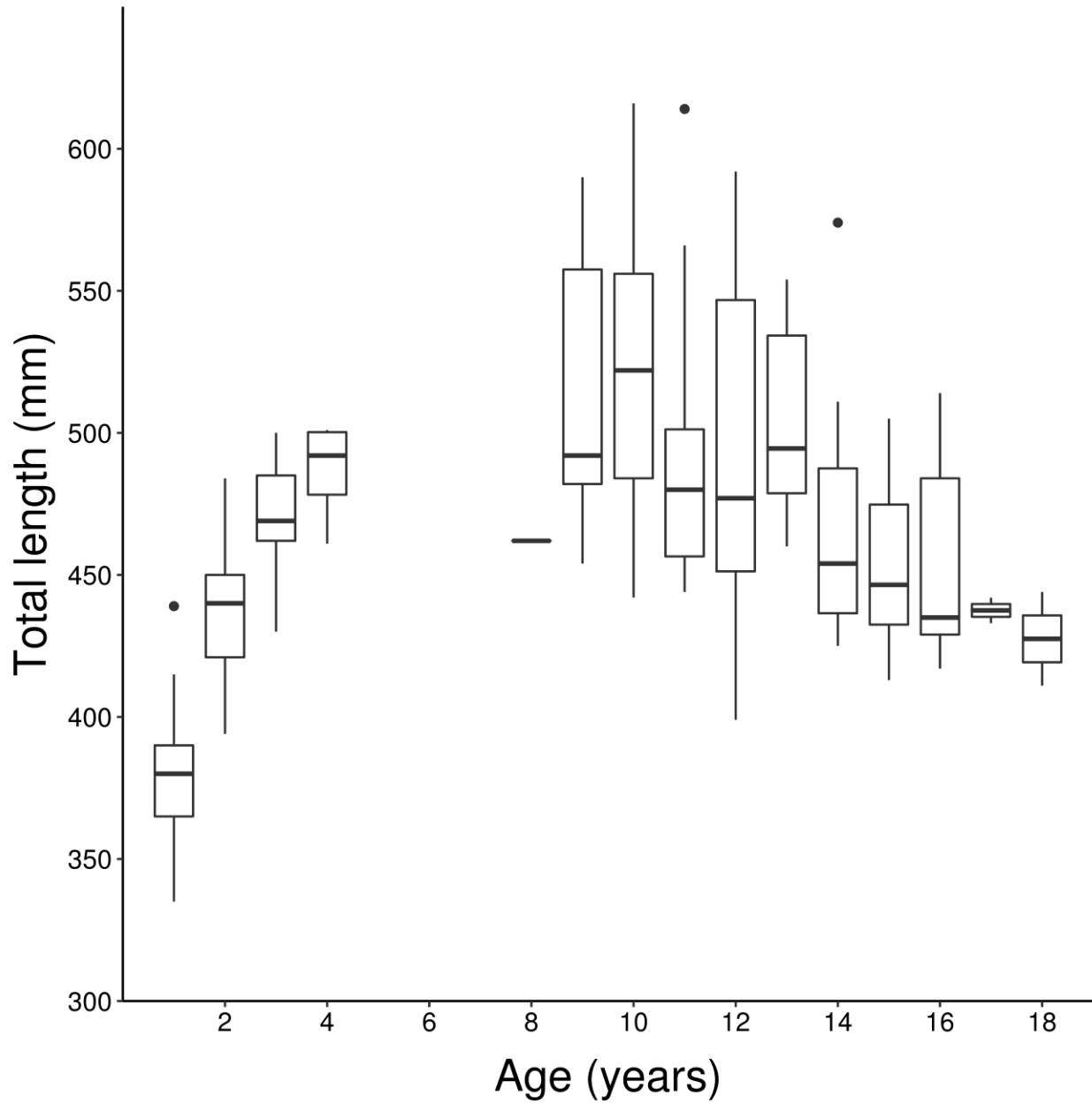


FIGURE 3.—Distribution of total length (mm) by age of all Walleye collected during this study. These are traditional Tukey boxplots: the dark line represents the median, the box represents the distance between the first and third quartiles, the whiskers show the range of observations within 1.5 quartiles of the box, and the dots are outlying values.