STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-80-R-15

Study No.: 230746 **Title:** Evaluation of the relative growth and survival of Wild Rose and Sturgeon River brown trout stocked into Michigan lakes and reservoir tailwaters

Period Covered: October 1, 2013 to September 30, 2014

Study Objectives: The objectives of this study are to determine the relative growth and survival of Wild Rose (WR) and Sturgeon River (SR) brown trout stocked into Michigan lakes and two reservoir tailwaters.

Summary: I conducted fall brown trout surveys in 4 inland lakes and 2 reservoir tailwaters where equal numbers of marked yearling WR and SR brown trout were stocked every spring from 2010-2013. I also examined creel survey data from the Michigan waters of Lake Michigan, where paired stockings of fin-clipped yearling WR and SR brown trout were completed at 4 ports every spring since 2010. Size at plant-out was notably different between strains as WR brown trout were much larger than SR brown trout across all years of stocking. Electrofishing catch rates of all brown trout in inland lakes were low; however the average relative abundance of WR brown trout across all surveys completed to date is 8 times higher than that of SR brown trout. Depletion population estimates generated in 2012 from three nights of gillnetting effort in each of 2 experimental lakes stocked once with equal numbers of marked yearling brown trout in spring 2010 yielded different results: the abundance of SR brown trout was significantly higher than WR in Fuller Pond, while in East Fish Lake the abundance of SR brown trout was significantly lower than WR. Sturgeon River brown trout were more abundant than WR in reservoir tailwaters. Mark-recapture population estimates indicated the density of SR brown trout was over 2.5 times higher than WR in the Au Sable River; electrofishing catch rates showed relative abundance of SR was 5.5 times higher than WR in the Manistee River across all years of study. Only 10 brown trout (3 WR and 7 SR) from the paired stockings completed for this study were encountered during creel surveys at 4 Lake Michigan ports.

Findings: Jobs 2, 3, 4, and 5 were scheduled for 2013-14, and progress is reported below.

Job 2. Title: Conduct field surveys.–I conducted brown trout surveys in five inland lakes and two reservoir tailwaters during fall (14 October to 23 October) 2013 where equal numbers of marked yearling WR and SR fish were stocked (Table 1). Similar to 2010–2012, inland lake surveys in McCormick Lake, Bear Lake, Lake Fifteen, and Starvation Lake consisted of one nighttime electrofishing pass around the entire shoreline with a 2-probe, 240 V DC electrofishing boat. Surveys in experimental lakes (East Fish Lake and Fuller Pond) were completed during 2012 and consisted of three overnight gill-net sets using 8–10 250 foot nets with a mix of experimental and straight-run panels varying in length and ranging in size from 1.5–3 inches stretch monofilament mesh (the number and size of nets in each lake were not changed so that effort remained constant). Brown trout captured in inland lakes were examined for fin clips used to distinguish strain, measured, weighed (fin-clipped fish only) and released alive when possible after removing scales for age analysis. Fish captured in experimental lakes were sacrificed after each effort was

completed. Each captured brown trout was examined for fin clips, scanned for a PIT tag, measured, and weighed.

I used two, two-probe 240 V DC electrofishing boats to collect mark-recapture population data from the Au Sable and Manistee rivers. Mark-recapture population estimates for the Manistee River during 2011 and 2013 were not calculated due to low catch during the marking run, summaries for the Manistee River are presented using electrofishing catch per unit effort for comparison among years. Each electrofishing boat shocked a separate side of the river in a downstream direction, working back and forth between the center of the stream and the bank to cover the entire wetted width of the channel. Two dip netters at the bow of each boat collected all brown trout captured and transferred them to a livewell; once the livewell was full the fish were transferred to a holding tank in a chase boat for processing. Fish captured on the first pass were examined for fin clips used to distinguish strain, measured, weighed (fin-clipped fish only), and marked with a small caudal clip. Each fish captured was released after a sample of scales was removed for age analysis. All trout captured on the second pass (completed the day after the first pass) were measured, examined for marks, and released.

Job 3. Title: Conduct angler census.–Since paired stockings of fin-clipped yearling WR and SR brown trout were made at 4 Lake Michigan ports (Table 2), I requested data for the Michigan waters of Lake Michigan from Fisheries Division's Statewide Angler Survey Program, where creel clerks record biological data including marks, length, weight, and scales from fish examined during angler interviews. Each of the four ports included in this study were scheduled for creel surveys during 2013, as were several other Michigan ports along the Lake Michigan shoreline.

Job 4. Title: Analyze data.–Wild Rose brown trout were consistently larger than SR fish at the time of stocking (Figure 1). On average WR brown trout were 30% longer and 70% heavier than SR brown trout during fish quality assessments completed at Fisheries Division's Harrietta State Fish Hatchery immediately prior to plant-out. Lengths and weights of each individual brown trout strain varied little from 2010 to 2013.

While average electrofishing catch rates of fin-clipped brown trout continue to be low across all inland lakes and years of study, the average relative abundance of WR brown trout for all surveys completed from 2010 to 2013 is 8 times higher than that of SR brown trout (Figure 2). The highest catch rates in 2013 were in Starvation Lake, where 19 of 24 brown trout captured were marked WR-strain fish ranging from 11-19 inches TL. The remaining 5 fish (11-13 inches TL) were all unmarked brown trout, which were likely WR or SR-strain yearlings with indistinguishable marks as there is no known natural reproduction of brown trout in Starvation Lake. One WR brown trout (12 inches TL) and one SR brown trout (8 inches TL) were captured in McCormick Lake; no marked fish of either strain were captured during surveys of Lake Fifteen, Bridge Lake, or Bear Lake in 2013.

I used the MicroFish 3.0 software package (Van Deventer and Platts 1989) to calculate depletion population estimates from the 2012 gill-net catch in the experimental lakes. In Fuller Pond, the abundance of SR brown trout was significantly higher than WR, while in East Fish Lake the abundance of SR brown trout was significantly lower than WR as judged from overlap of 95% confidence intervals (Figure 3). During 2012 SR brown trout ranged from 20-23 inches TL in East Fish Lake and 14-19 inches TL in Fuller Pond; WR brown trout ranged from 19 to 22 inches TL in East Fish Lake and 16 to 20 inches TL in Fuller Pond. The average length of PIT-tagged SR brown trout was less than PIT-tagged WR brown trout in both experimental lakes across all years of study, with the exception of East Fish Lake in 2012 (Figure 4).

Sturgeon River brown trout continued to be more abundant than WR in reservoir tailwaters during 2013. The density of SR brown trout was nearly 10 times higher than WR brown trout in the Au Sable River and SR electrofishing catch rates were 19 times higher in the Manistee River when compared to WR fish. Similarly, mark-recapture population estimates completed from 2010 to 2013 indicate the average density of SR brown trout was over 2.5 times higher than WR in the Au Sable River; SR electrofishing catch rates were nearly 5.5 times higher than WR in the Manistee River during the same time period. Across all surveys the catch was comprised primarily of age-1 fish from the previous spring stocking, with fewer age-2 and age-3 fish of either strain from past year's plants (Figure 5). The average total density or relative abundance of all stocked brown trout (SR and WR combined) in the Au Sable and Manistee rivers is approximately half that of unclipped brown trout from natural reproduction or past stocking. In 2013, SR brown trout ranged from 5-18 inches TL in the Au Sable River and 7-15 inches TL in the Manistee River; WR brown trout ranged from 8-17 inches TL in the Au Sable River. A single 11 inch TL WR brown trout was captured in the Manistee River. The average length of age-1 SR brown trout in both the Au Sable and Manistee rivers was less than WR fish from 2010 to 2013, the average lengths of age-2 and age-3 stocked brown trout displayed no clear pattern between rivers (Figure 6).

Very few brown trout (3 WR and 7 SR) from the paired stockings completed for this study were encountered during creel surveys at the four Lake Michigan study ports during 2010–2013. Eighty-seven percent of all brown trout observed by creel clerks at the four study ports from 2010 to 2013 were unmarked fish (Table 3). Since no unmarked brown trout were stocked at any of the study ports during this time period, these fish are either strays from other plants, individuals that have migrated out of tributaries, or marked fish with regenerated fins. One age-1 and three age-2 WR brown trout strayed from their stocking location and were encountered by a creel clerk in Manistee (approximately halfway between the City of Ludington and Frankfort Harbor study ports); no other WR or SR fish were recorded at any other Lake Michigan ports in Michigan waters. All but one of the marked brown trout encountered by creel clerks were age-2 fish ranging in length from 16.4 inches to 21.5 inches; age-2 SR brown trout were on average 1 inch larger than WR brown trout (Table 4).

Job 5. Title: Write annual performance report.–This progress report was prepared.

Literature cited:

Van Deventer, J. S., and W. S. Platts. 1989. Microcomputer software system for generating population statistics from electrofishing data: user's guide for MicroFish 3.0. U.S. Forest Service, General Technical Report INT-254, Ogden, Utah.

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Date: September 30, 2014

Table 1.–Stocking locations for evaluating the relative performance of Wild Rose and Sturgeon River-strain brown trout stocked annually (2010–2013) into Michigan inland lakes and two reservoir tailwaters.

Fisheries Management Unit	Water body	Regulation type	Number stocked	
			Wild Rose	Sturgeon River
Central Lake Michigan	Bear Lake	B - 12" MSL open all year	7,900	7,900
	Starvation Lake	C - 8" MSL open all year	3,125	3,125
	Manistee River below Hodenpyl Pond	4–10” MSL open all year possession last Saturday in Apr–Sep 30	10,000	10,000
Northern Lake Huron	McCormick Lake	B - 12" MSL open all year	2,500	2,500
	Lake Fifteen	B - 12" MSL open all year	2,225	2,225
	Bridge Lake	B - 12" MSL open all year	1,675	1,675
	Au Sable River below Mio Pond	Gear restricted - 18" MSL, 1 fish open all year possession last Saturday in Apr–Sep 30 artificial lures only	24,000	24,000
Hunt Creek Fisheries Research Station [a]	East Fish Lake	Research water - closed to angling	800	800
	Fuller Pond	Research water - closed to angling	750	750

[a] Research waters were stocked in 2010 only.

Table 2.–Stocking locations for evaluating the relative performance of Wild Rose and Sturgeon River-strain brown trout stocked annually (2010–2013) into Michigan waters of Lake Michigan.

		Number stocked	
Fisheries Management Unit	Stocking site	Wild Rose	Sturgeon River
Northern Lake Michigan	Cedar River	14,250	14,250
	Menominee River	14,000	14,000
Central Lake Michigan	Frankfort Harbor	15,550	15,550
	City of Ludington	28,100	28,100

Table 3.–Number of brown trout, by strain, recorded by creel clerks at study ports in Michigan waters of Lake Michigan. Cedar River, Menominee River, Frankfort Harbor, and the City of Ludington are study ports where equal numbers of marked Wild Rose and Sturgeon River-strain brown trout were stocked from 2010 to 2013. Other = Lake Michigan ports along the Michigan coastline where paired plants did not occur (N=12) but creel clerks were instructed to look for marked brown trout. Other clip = marked fish with fin clips given as part of other studies unrelated to Michigan's Wild Rose and Sturgeon River brown trout evaluation.

Study port	Year	Wild Rose	Sturgeon River	Unmarked	Other clip
Cedar River[a]	2010	0	0	0	0
	2011	-	-	-	-
	2012	0	0	6	0
	2013	0	0	1	0
Menominee River	2010	0	0	0	0
	2011	0	0	4	0
	2012	0	0	14	0
	2013	0	0	2	0
Frankfort Harbor	2010	0	0	0	0
	2011	1	1	8	1
	2012	0	0	10	2
	2013	0	1	27	7
City of Ludington	2010	0	0	0	0
	2011	1	0	26	2
	2012	0	0	32	2
	2013	1	5	42	2
Other	2010	0	0	1	0
	2011	0	0	36	4
	2012	1	0	40	2
	2013	3	0	60	13
Total		7	7	309	35

[a] Not sampled in 2011.

Table 4.–Number at age, average length, and length range of brown trout, by strain, recorded by creel clerks at study ports in Michigan waters of Lake Michigan, 2010 to 2013. Other clip = marked fish with fin clips given as part of other studies unrelated to Michigan's Wild Rose and Sturgeon River brown trout evaluation.

Strain	Age	Number	Percent of total	Average length (in)	Length range (in)
Wild Rose	1	1	0.3	12.3	12.3
	2	6	1.7	18.2	16.8–20
	3	0	0.0	–	–
	4	0	0.0	–	–
Sturgeon River	1	0	0.0	–	–
	2	7	2.0	19.2	16.4–21.5
	3	0	0.0	–	–
	4	0	0.0	–	–
Unmarked	1	6	1.7	14.5	10.5–18.7
	2	210	58.7	19.6	14.4–26.5
	3	79	22.1	21.2	14.8–28.2
	4	14	3.9	22.9	20.5–27.1
Other clip	1	0	0.0	–	–
	2	23	6.4	19.2	16.0–23.1
	3	7	2.0	19.7	16.1–26.2
	4	5	1.4	21.2	18.8–24.0
Total		358	100.0	20.0	10.5–28.2

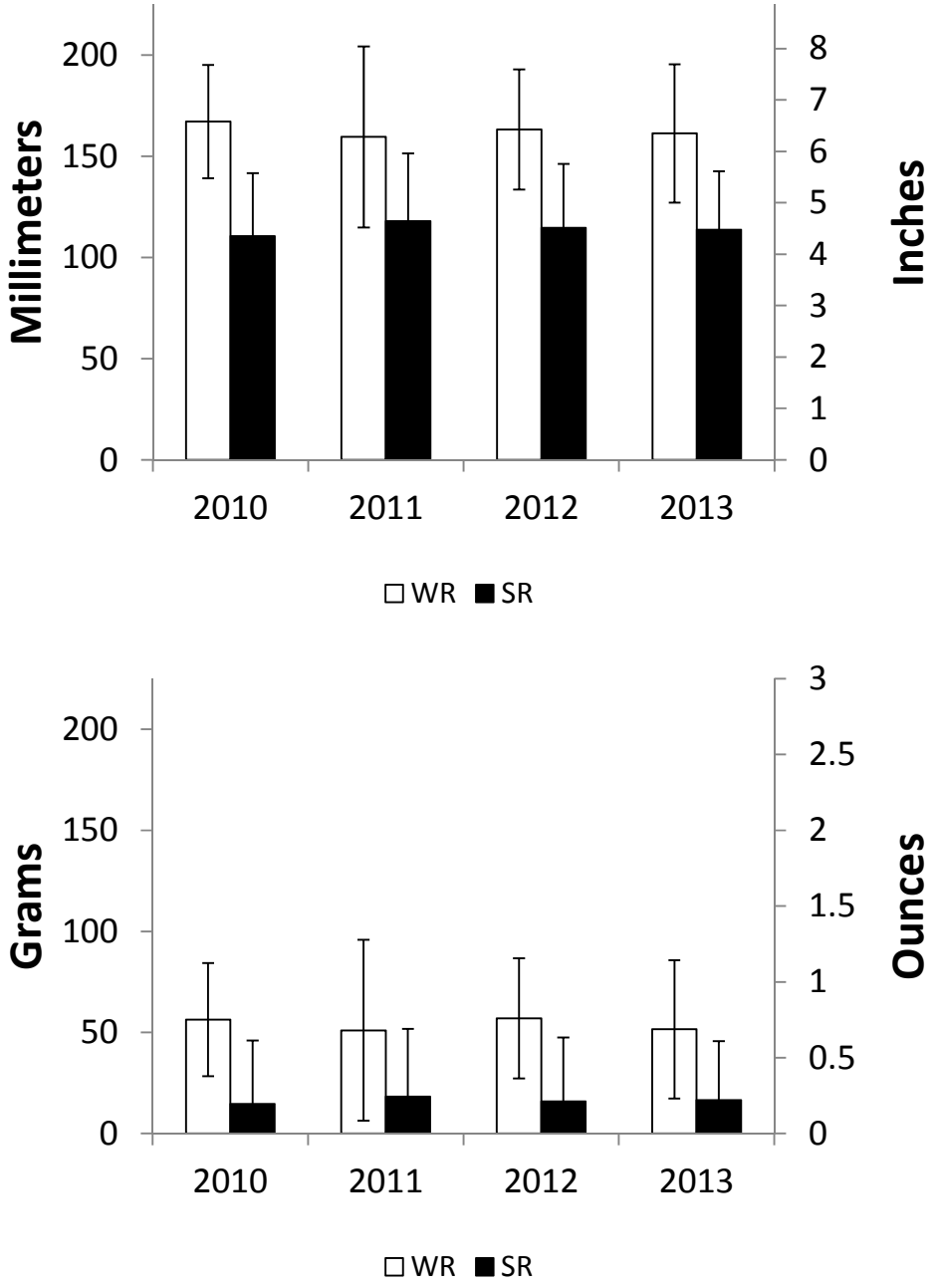

Figure 1.–Average length (top panel) and weight (bottom panel) of Wild Rose (WR) and Sturgeon River (SR) brown trout measured at Fisheries Division's Harrietta State Fish Hatchery during fish quality assessments conducted immediately prior to plant-out, 2010 to 2013.

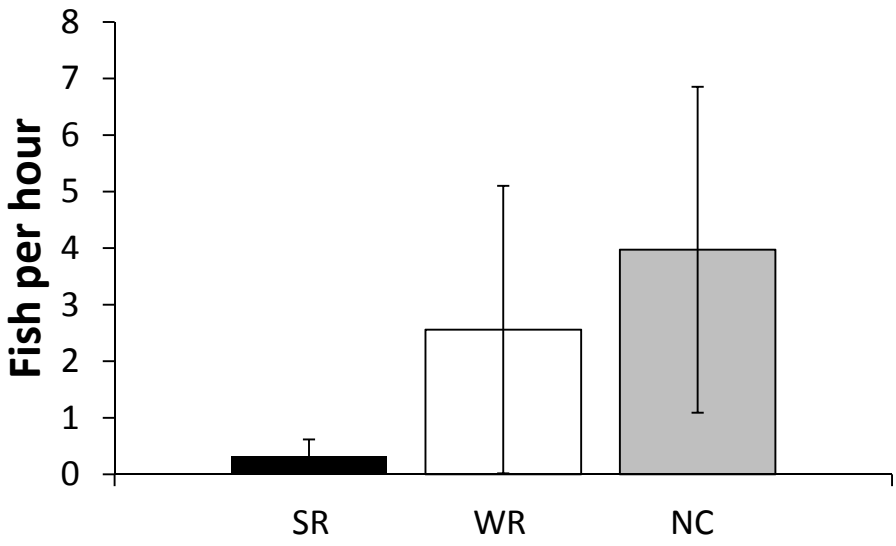

Figure 2.–Average electrofishing catch rates (±2 SE) of Sturgeon River (SR), Wild Rose (WR), and unclipped (NC) brown trout in five inland study lakes, 2010–2013.

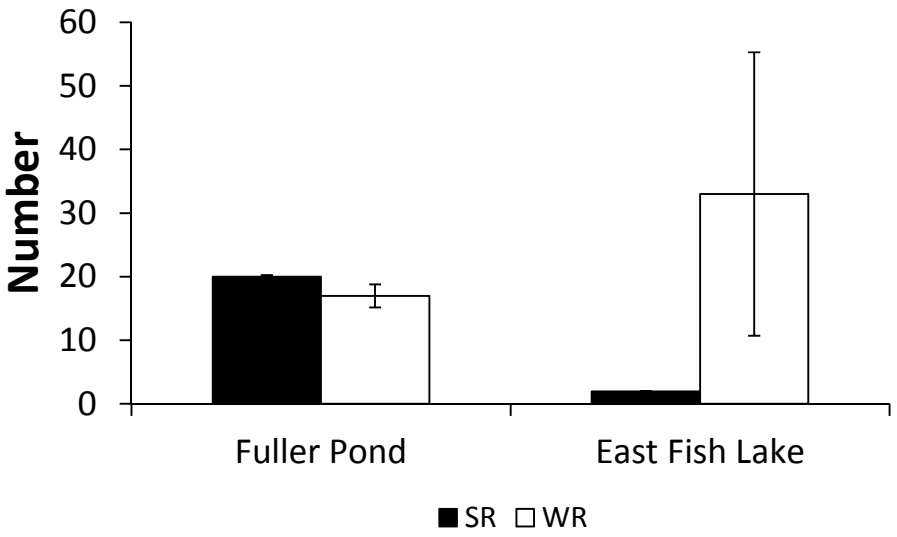

Figure 3.–Population estimates of Sturgeon River (SR) and Wild Rose (WR) brown trout in Fuller Pond and East Fish Lake, 2012. The thin vertical lines represent the 95% confidence intervals.

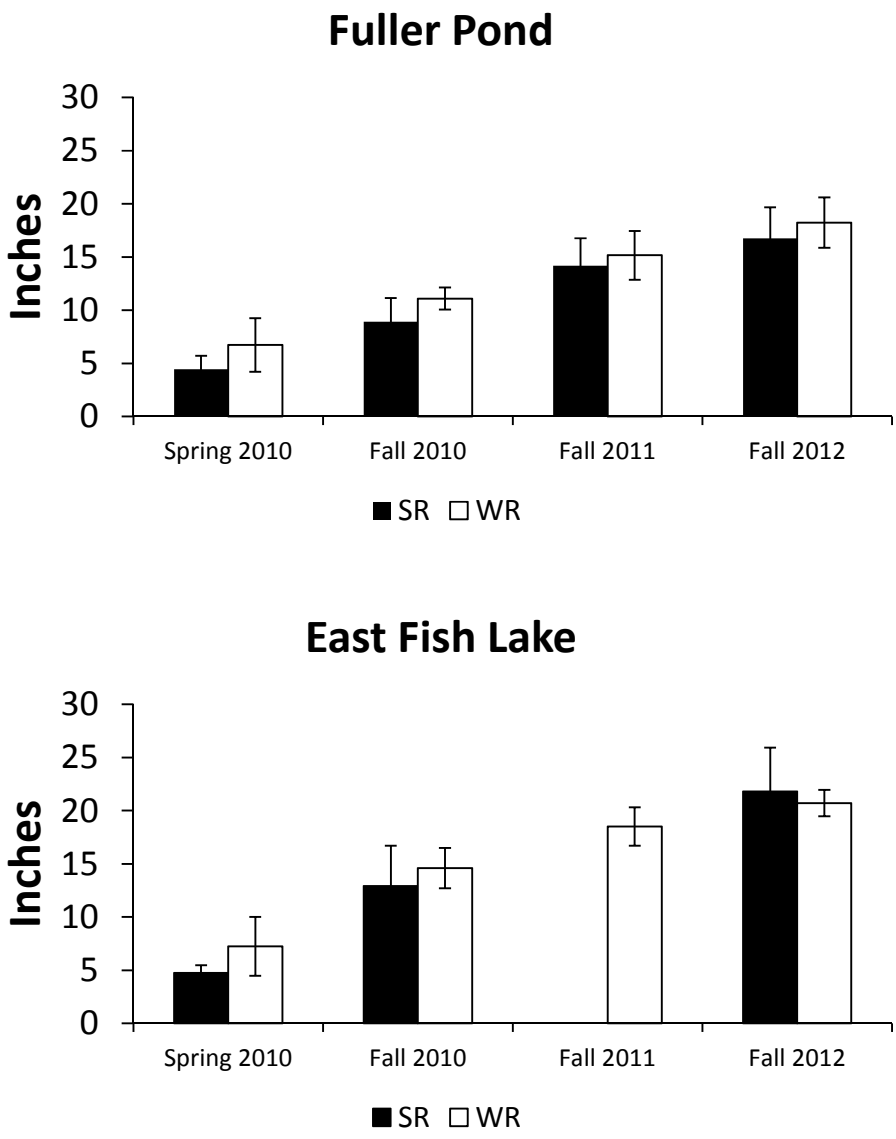

Figure 4.–Average length (±2 SD) at stocking (spring 2010) and sampling (fall 2010–fall 2012) for PIT-tagged Sturgeon River (SR) and Wild Rose (WR) brown trout in Fuller Pond and East Fish Lake.

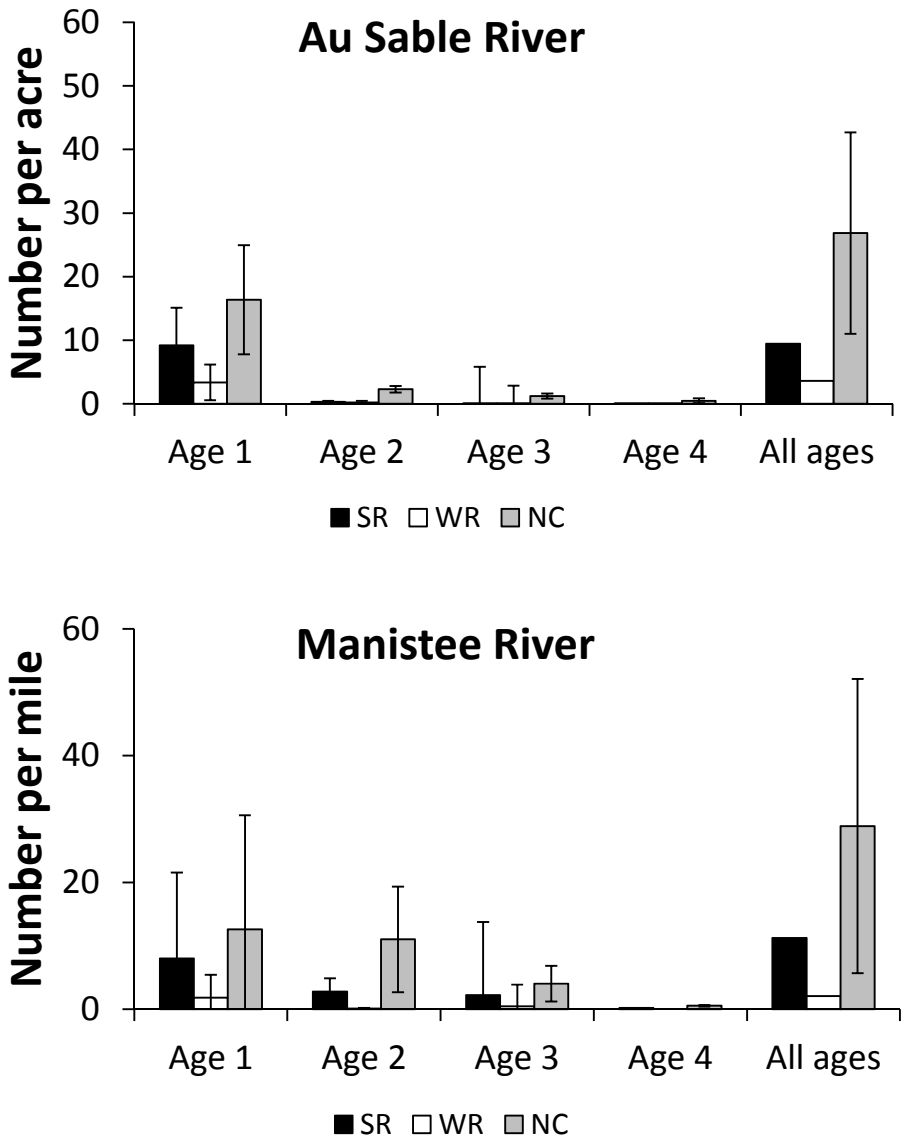

Figure 5.–Average density (Au Sable River) and relative abundance (Manistee River) of Sturgeon River (SR), Wild Rose (WR), and unclipped (NC) brown trout, by age, 2010–2013. Error bars represent ±2 SE and are omitted for age classes encountered in less than 3 years of sampling. Note the difference in Y-axes.

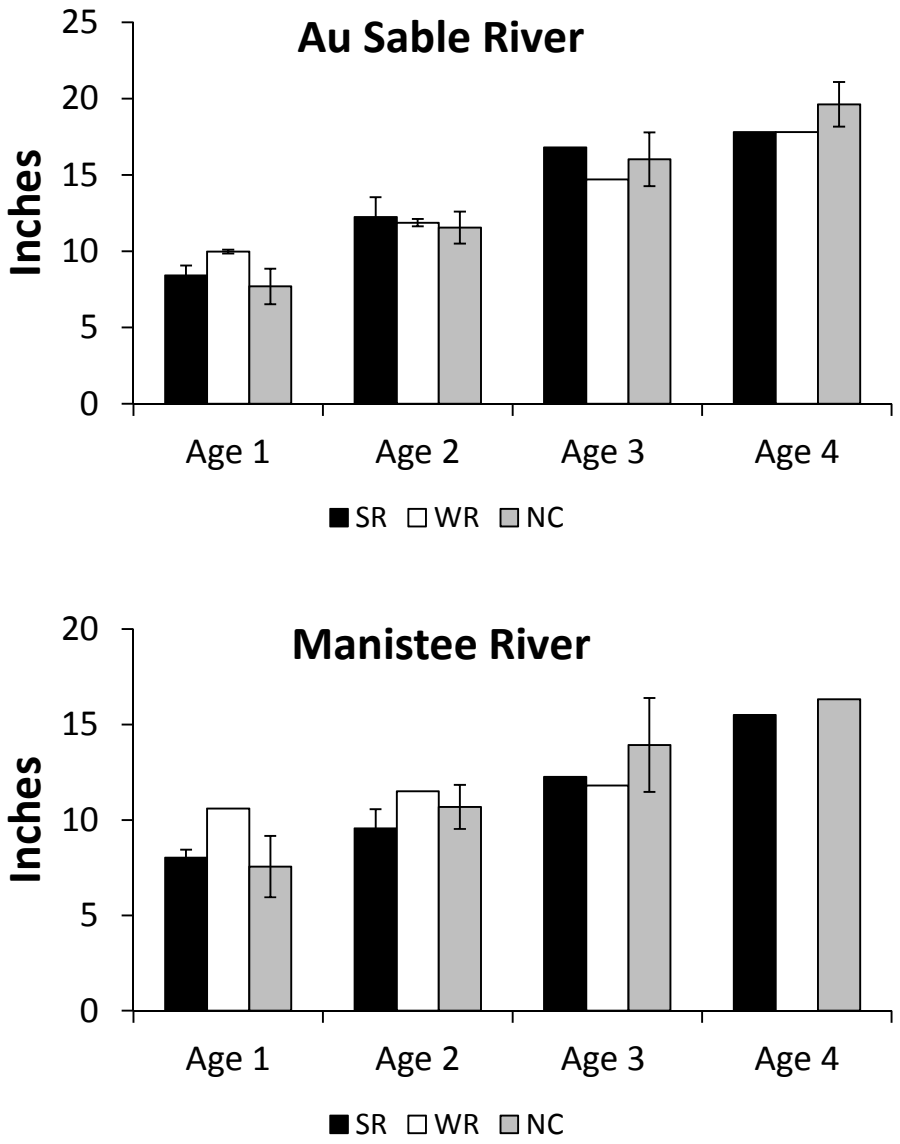

Figure 6.–Mean length of Sturgeon River (SR), Wild Rose (WR), and unclipped (NC) brown trout in the Au Sable and Manistee Rivers, 2010–2013. Error bars represent ±2SE and are omitted for age classes encountered in less than 3 years of sampling.