STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-80-R-16

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, 2014 to September 30, 2015

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 (*Salmo trutta*) 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 to 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 as 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 4, 5, and 6 were scheduled for 2014-15, and progress is reported below.

Job 4. 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 the Harrietta State Fish Hatchery immediately prior to plant-out. Lengths and weights of each individual Brown Trout strain varied little from 2010 to 2013.

Although the average electrofishing catch rates of fin-clipped Brown Trout were 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 was 8 times higher than that of SR Brown Trout (Figure 2). Sturgeon River Brown Trout captured from inland lakes during 2010 to 2013 ranged from 6.1 to 13.7 inches while WR Brown Trout ranged from 8.8 to 19.0 inches. Nearly two-thirds (64%) of the 121 Brown Trout captured from inland lakes during the entire study came from McCormick Lake, followed by Starvation Lake (25%). Relatively few (11%) Brown Trout were captured in Bear Lake, Lake Fifteen, and Bridge Lake.

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 20.3–23.2 inches TL in East Fish Lake and 14.8–19.1 inches TL in Fuller Pond; WR Brown Trout ranged from 19.4 to 22.0 inches TL in East Fish Lake and 16.7 to 20.6 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 were more abundant than WR in reservoir tailwaters during the entire study. 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. 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. Write annual performance report.–This progress report was prepared. In addition, a project summary was completed (Attachment 1).

Job 6. Write manuscript for publication.–A research manuscript describing the final results of this study is in progress and will be completed by December 31, 2015.

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.

Prepared by: Todd C. Wills
Date: September 30, 2015

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.

			Number stocked	
Fisheries Management Unit	Water body	Regulation type	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 where Brown Trout 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	16.8–20.0
	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

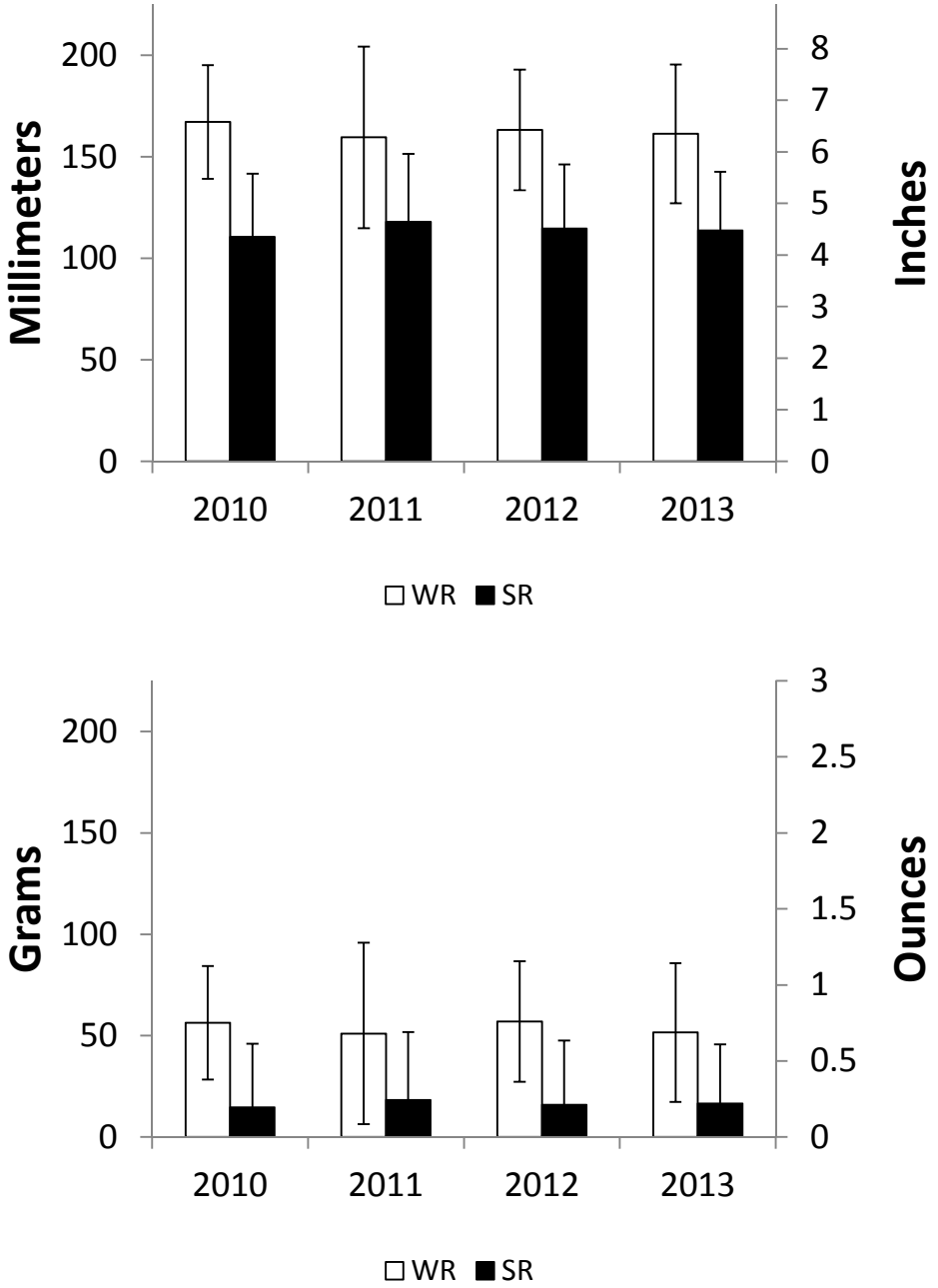

Figure 1.–Average length (top panel) and weight (bottom panel) of Wild Rose (WR) and Sturgeon River (SR) Brown Trout measured at Harrietta State Fish Hatchery during fish quality assessments conducted immediately prior to plant-out, 2010 to 2013.

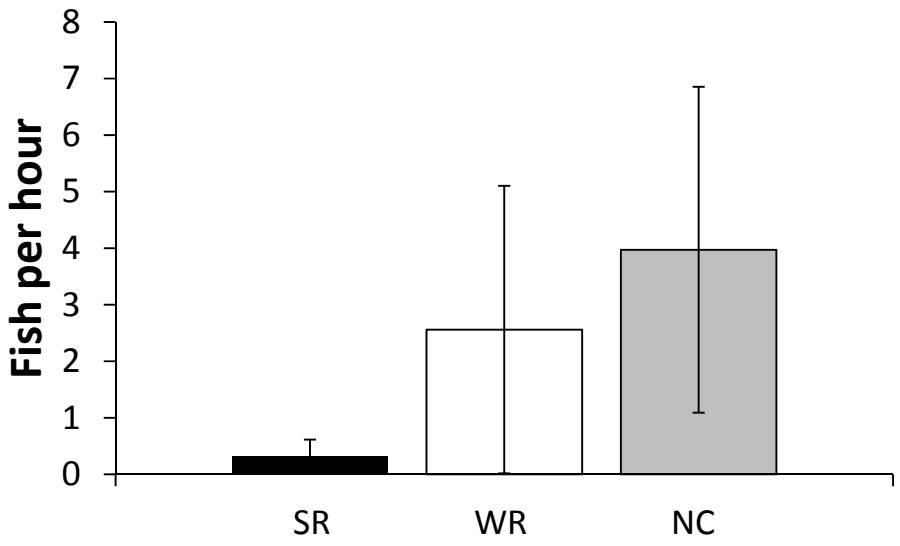

Figure 2.–Average electrofishing catch rates (±2 SE) of Sturgeon River (SR), Wild Rose (WR), and unclipped (NC) Brown Trout in five inland study lakes, 2010–2013.

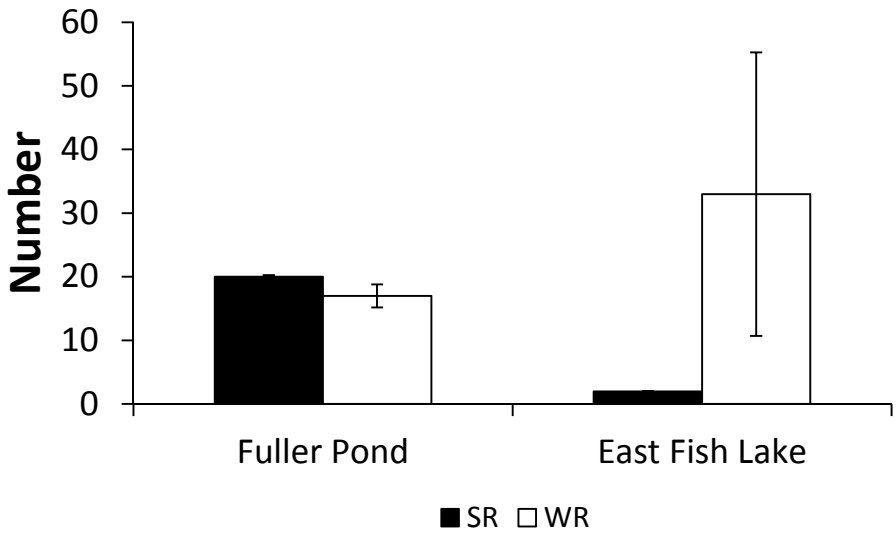

Figure 3.–Population estimates of Sturgeon River (SR) and Wild Rose (WR) Brown Trout in Fuller Pond and East Fish Lake, 2012. The thin vertical lines represent the 95% confidence intervals.

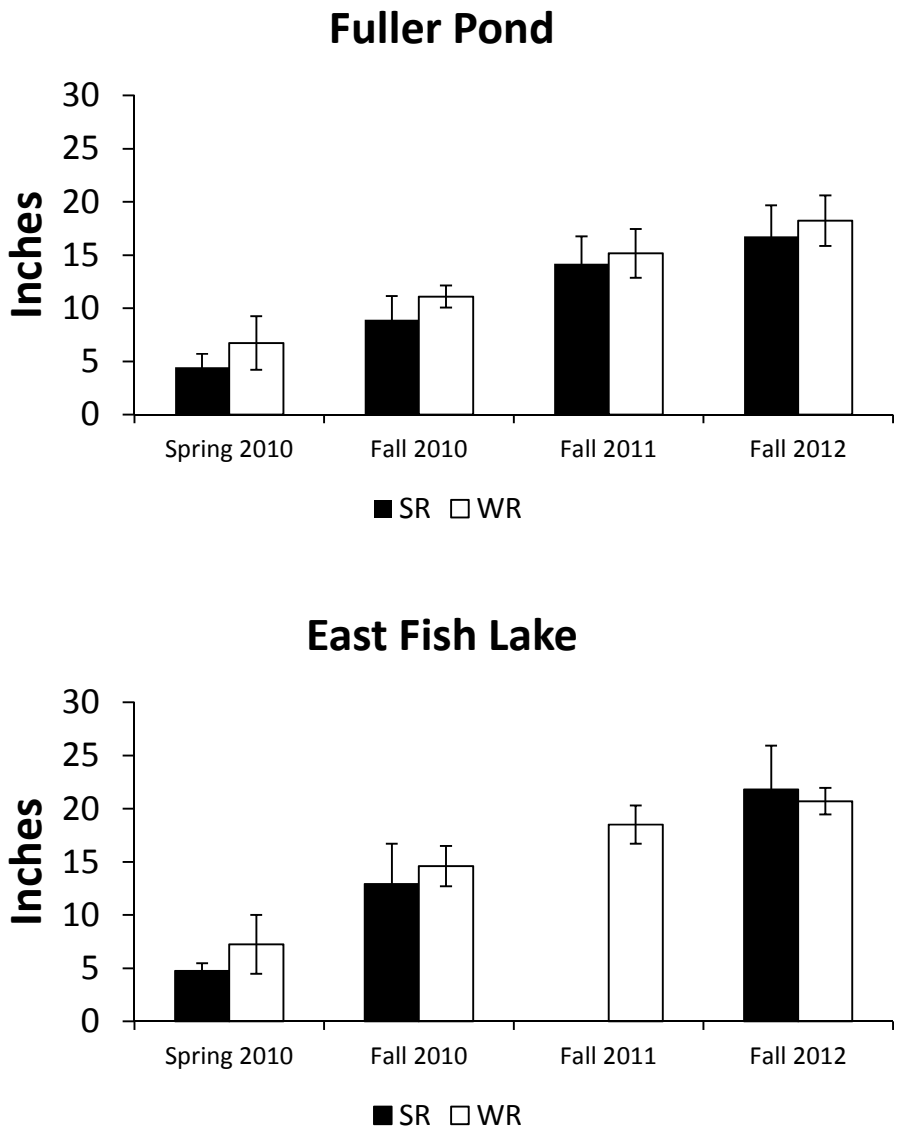

Figure 4.–Average length (±2 SD) at stocking (spring 2010) and sampling (fall 2010–fall 2012) for PIT-tagged Sturgeon River (SR) and Wild Rose (WR) Brown Trout in Fuller Pond and East Fish Lake.

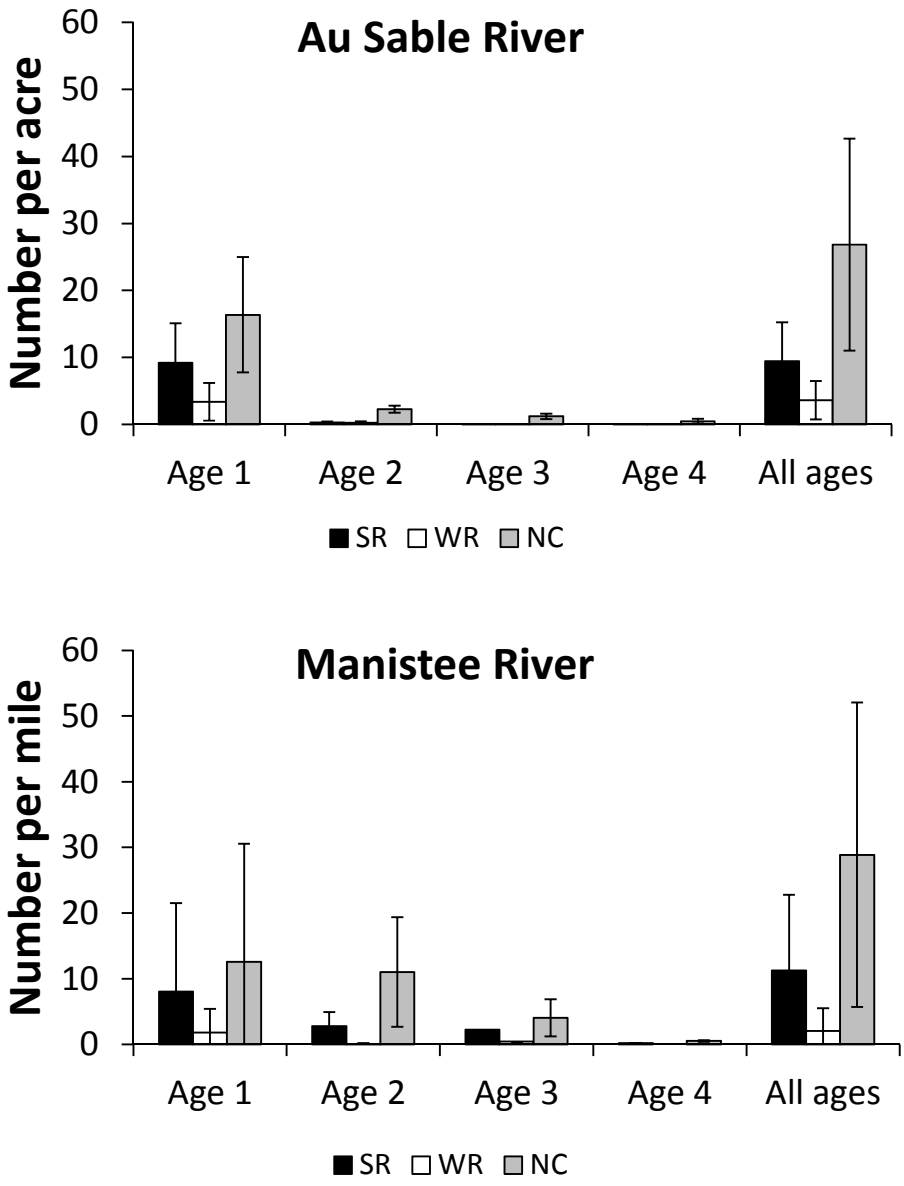

Figure 5.–Average density (Au Sable River) and relative abundance (Manistee River) of Sturgeon River (SR), Wild Rose (WR), and unclipped (NC) Brown Trout, by age, 2010–2013. Error bars represent ±2 SE and are omitted for age classes encountered in less than 3 years of sampling. Note the difference in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

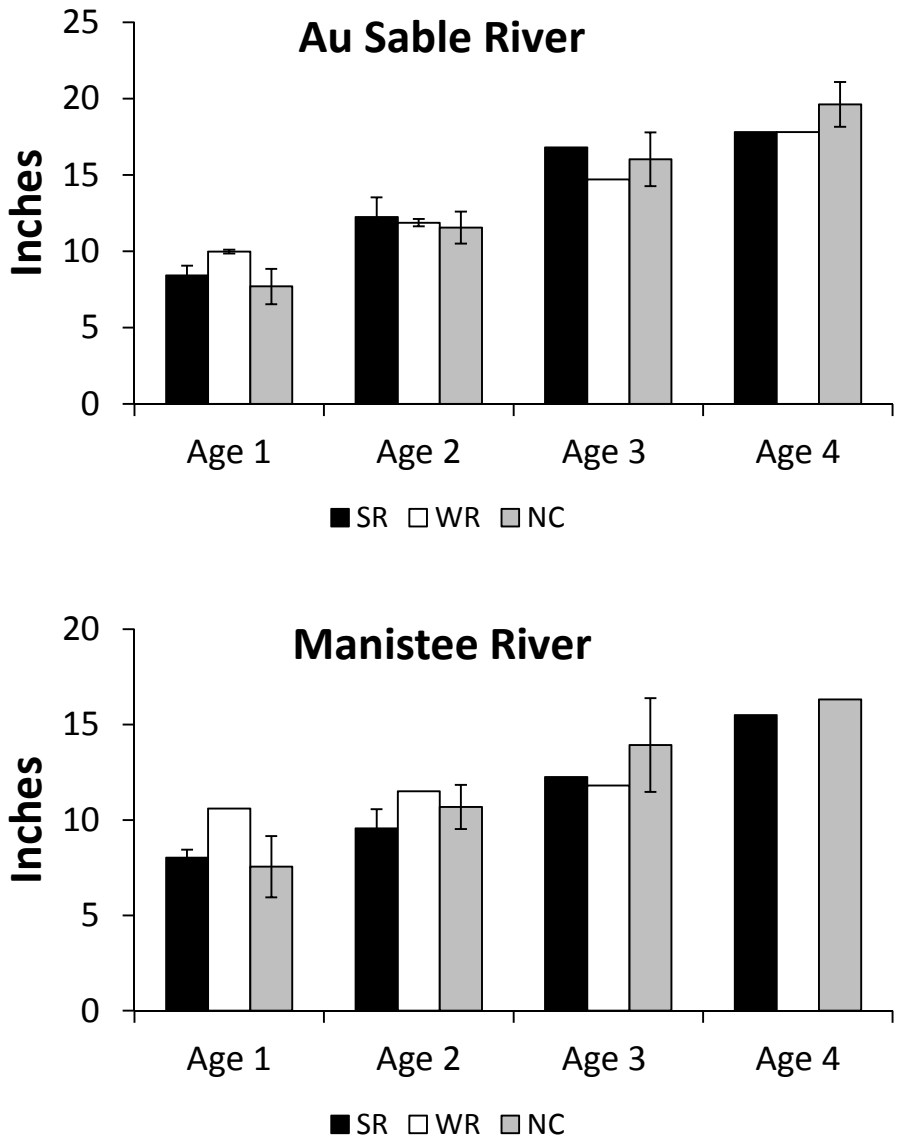

Figure 6.–Mean length of Sturgeon River (SR), Wild Rose (WR), and unclipped (NC) Brown Trout in the Au Sable and Manistee Rivers, 2010–2013. Error bars represent ±2SE and are omitted for age classes encountered in less than 3 years of sampling.

Evaluation of the Relative Growth and Survival of Wild Rose and Sturgeon River Brown Trout Stocked into Michigan Lakes and Reservoir Tailwaters

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Background

Michigan has a long history of stocking trout into waters where spawning is limited and doesn't produce enough fish naturally to support sustainable fishing opportunities. Recently, some of these efforts have been less successful than hoped, leading Fisheries Division to believe that the overall fitness of hatchery-raised or domesticated brown trout was poor. As a potential solution to this problem we began to look for a wild source of brown trout from Michigan's own waters that could replace the domestic type of brown trout used to produce eggs for the state hatchery system. After successfully introducing a wild brown trout used for stocking streams (Gilchrist Creek strain) into Fisheries Division's hatchery system, we began an effort to find wild browns that would survive and grow well in Michigan's lakes and reservoir tailwaters. Fisheries managers selected wild brown trout from the Sturgeon River, a tributary to the northern Lower Peninsula's Burt Lake, as a candidate strain. The purpose of this project is to determine how well the wild Sturgeon River brown trout perform compared to domestic "Wild Rose" brown trout, which are named after the Wisconsin hatchery where they were first raised and have been used to produce eggs in Michigan's hatcheries for over two decades.

What do the results show?

The results differ depending on the types of water bodies that were stocked (lakes or reservoir tailwaters) in northern Lower Michigan. Across five small inland lakes, the abundance of Wild Rose brown trout was higher than Sturgeon River fish, while in two reservoir tailwaters the abundance of Sturgeon River brown trout was higher than Wild Rose fish. Unexpectedly in both tailwaters, we found that brown trout produced from natural spawning outnumbered either type of stocked brown trout. Wild Rose brown trout grew to larger sizes in inland lakes; the opposite was true in reservoir tailwaters where Sturgeon River brown trout survived better and grew larger. In Lake Michigan, where the most fish were stocked, very few brown trout of either type were reported to creel clerks.

What do the results mean for fisheries managers and anglers?

Fisheries managers can successfully and economically use stocking as a tool to meet management objectives (and increase angler success!) by first determining existing levels of natural spawning before choosing what type of brown trout to stock. Although neither type of brown trout did well in the Great Lakes, Wild Rose fish appear to be the best strain for stocking inland lakes with limited or no natural reproduction. Sturgeon River browns are better suited for reservoir tailwaters, especially those where higher size limits require fish to survive for at least a year so that they can grow to reach the minimum size necessary for legal harvest.

Additional detailed information on this study can be found at
http://www.michigan.gov/dnr/0,4570,7-153-10364_52259_19056-333302--,00.html.