STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-80-R-5

Study No.: 230735

Title: Evaluation of the field performance of wild and domestic brown trout strains in seven Michigan rivers

Period Covered: October 1, 2003 to September 30, 2004

Study Objectives: The objectives of this study are to 1) evaluate the performance of wild Gilchrist Creek strain brown trout in comparison to other domesticated hatchery strains (Wild Rose and Seeforellen) in Michigan rivers, 2) assess the contribution of hatchery-reared brown trout strains to brown trout populations and angler fisheries in Michigan rivers, and 3) provide information to guide management and policy decisions on the use of hatchery-reared brown trout in Michigan rivers.

Summary: In 1995-96, Michigan obtained a wild broodstock of brown trout from Gilchrist Creek (GC) in hopes that progeny of this stock would exhibit better survival and returns to anglers after stocking than the domesticated strains then available, Wild Rose (WR) and Seeforellen (SF). I evaluated the relative abundance, survival and growth of the three brown trout strains in seven Michigan rivers where paired plantings of yearling fish were made from 1997-2000. The wild GC strain brown trout grew and survived much better than the domesticated SF and WR strains in six of the seven rivers, despite being smaller at the time of stocking. The sole exception occurred in the Muskegon where abundance of WR was highest.

Findings: Jobs 1 through 5 were active this year, and progress is reported below.

Job 1. Title: <u>Assemble and format archived data.</u>–Fisheries management unit and research personnel archived brown trout abundance data from seven rivers and angler catch rate or harvest data from the two of the seven study rivers during the four years when paired plantings were made (Figure 1). Angler catch rate and harvest data for several years after the paired plantings ceased were also archived. I assembled these data and used them to summarize the performance of the three different brown trout strains, in comparison to each other and to unclipped (presumably naturally-reproduced) brown trout.

Job 2. Title: <u>Analyze data to compare performance of brown trout strains.</u>–I used mixed-effect analysis of variance (ANOVA) to determine if the abundance, survival, or growth of stocked brown trout varied predictably as a function of strain in river systems where population estimates were made. To determine differences among the three stocked strains of brown trout, I excluded unclipped fish from the initial analyses. For these analyses, I used total density, density of trout >8 in, survival, and annual growth increment (adjusted by using initial length as a covariate to account for differences in length among strains) as metrics of performance. I included unclipped fish in a subsequent analysis to compare the contribution of stocked fish to the total population. Since many of the unclipped fish were presumably young-of-year (<4 in TL), I used total density and total biomass as metrics of performance. I did not conduct statistical analyses on electrofishing CPE data from the Muskegon River due to the difference in format (CPE vs. population estimates) and relatively low brown trout catches compared to the other study rivers.

I used a paired t-test to determine if angler CPE of stocked brown trout varied as a function of strain in the Manistee River. I compared catch per 100 hours of all GC and SF brown trout, regardless of size, and of all GC and SF brown trout >8 in. I also compared the catch per 100 hours of all stocked and unclipped brown trout, regardless of size, and of all stocked and unclipped brown trout >8 in. Creel survey data were available for the Muskegon River; however, creel clerks recorded relatively few brown trout in the angler creel. Therefore, I did not conduct statistical analyses on these data.

The total density of GC strain brown trout was significantly higher than that of the other strains (Figure 2). GC brown trout survived to age 2 over 100 times better than the SF strain and over six times better than the WR strain (Figure 3). In addition, initial growth of the GC fish from stocking to the time of first sampling was nearly an inch higher than the SF brown trout and over ¾ of an inch higher than the WR brown trout (Figure 4). However, on average, the densities and biomass of all stocked brown trout were lower than the densities and biomass of unclipped brown trout. Relative angler returns of the wild and domestic brown trout strains varied in the two study systems in which creel data were available. In the Manistee River, the total number of GC and SF brown trout captured from 1997-2001 was very similar. In the Muskegon River, WR brown trout comprised the majority of the total recorded catch, followed by unclipped and GC fish.

Job 3. Title: Analyze data to compare habitat characteristics and brown trout strain performance.–For all mixed-effect ANOVA models, I treated river, year, and strain (or origin in the case of comparisons between stocked and unclipped brown trout) as fixed effects and site (nested within river) as a random effect. This ensured that variability due to river and year and their interactions with origin (hatchery vs. unclipped fish) could be accounted for in the statistical analysis. For example, significant river effects may account for the different characteristics of the study systems, such as stocking densities, available habitat, and thermal regimes, while significant year effects indicate yearly environmental variability or differences in hatchery production lots.

I found that variability due to river and year and their interactions with origin (hatchery vs. unclipped fish) was present in the six systems with population estimate data available. The presence of significant interactions, especially in comparisons between the densities and biomass of stocked and unclipped fish, complicated data interpretation. Such interactions probably indicate that the variety of environmental conditions present in the study rivers had variable effects on stocked fish, as well as the natural reproduction of wild fish.

Job 4. Title: Write research manuscript.–I prepared a 61-page research report detailing the findings of this study, which will be published in the next fiscal year. The results of this report suggest that the GC brown trout are better suited to stocking into streams with size limits >10 in because they survive better to older ages, grow faster, and consequently are more likely to reproduce, whereas WR fish may be better suited to streams with 8 in size limits where most of the angler harvest occurs during the year they are stocked. SF brown trout exhibited the lowest survival and immediate post-stocking growth of the three brown trout strains and should be stocked with caution. Fisheries managers must consider the performance of stocked brown trout strains, the performance of stocked brown trout in general, and returns to the angler when implementing or reviewing brown trout stocking programs.

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

Prepared by: Todd C. Wills
Date: September 30, 2004

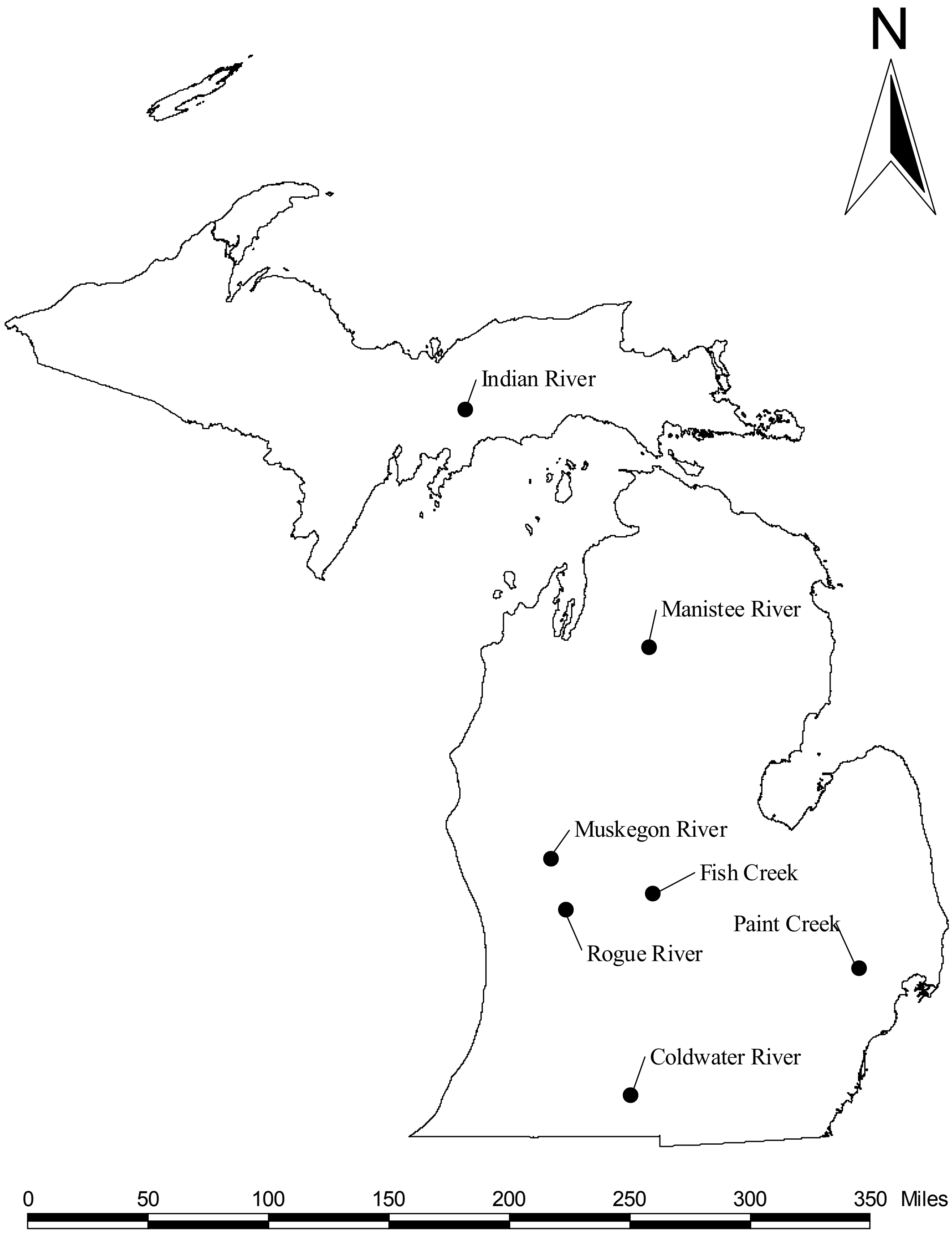

Figure 1.–Location of study rivers selected for brown trout strain evaluation.

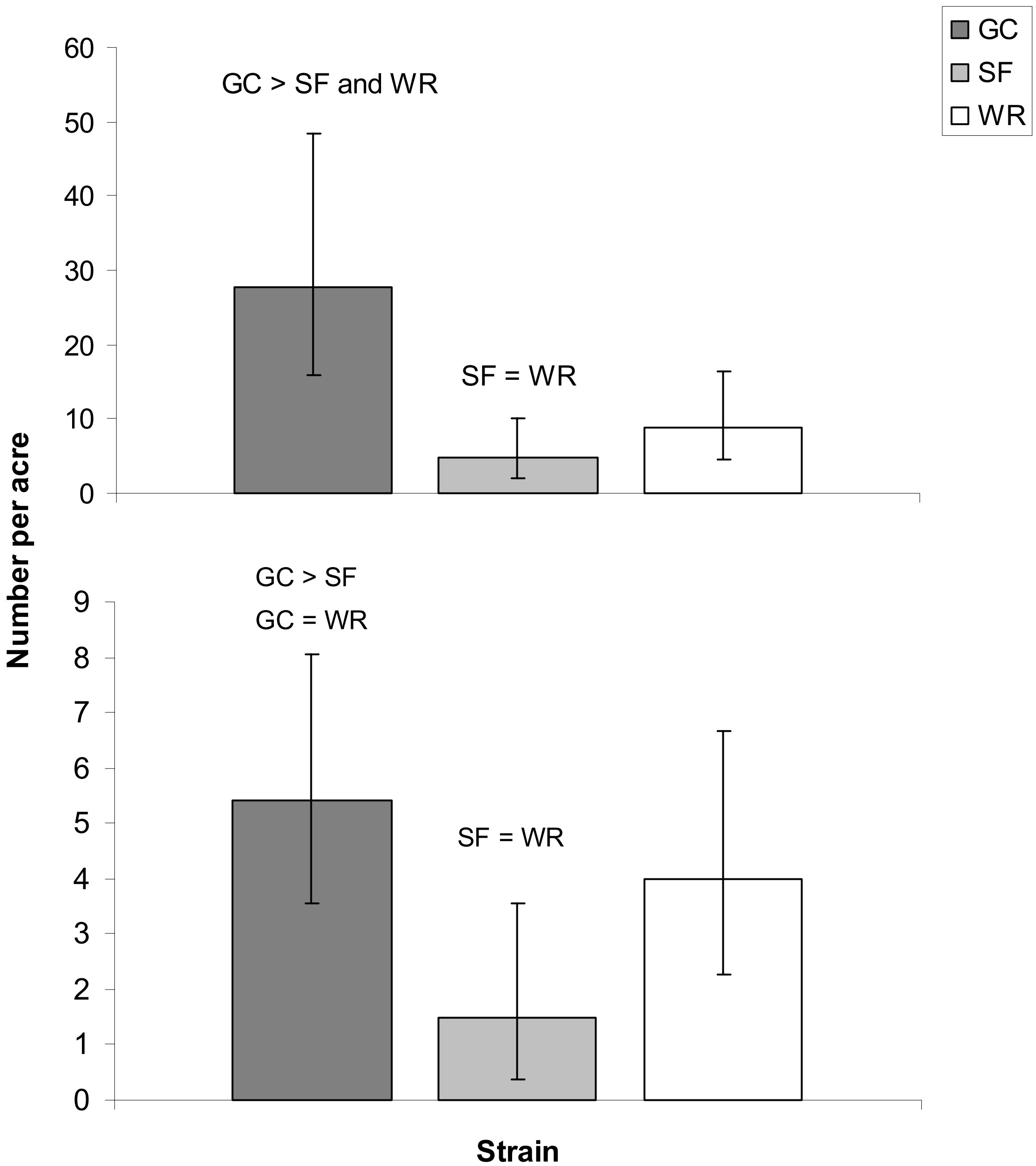

Figure 2.–Mean back-transformed total density (top) and density >8 in (bottom) of stocked brown trout, by strain, across all years and six rivers of study. Note the difference in y-axes scales. The thin vertical lines represent the 95% confidence intervals. GC = Gilchrist Creek, SF = Seeforellen, WR = Wild Rose. Significant differences shown above are for ANOVA $P \leq 0.05$.

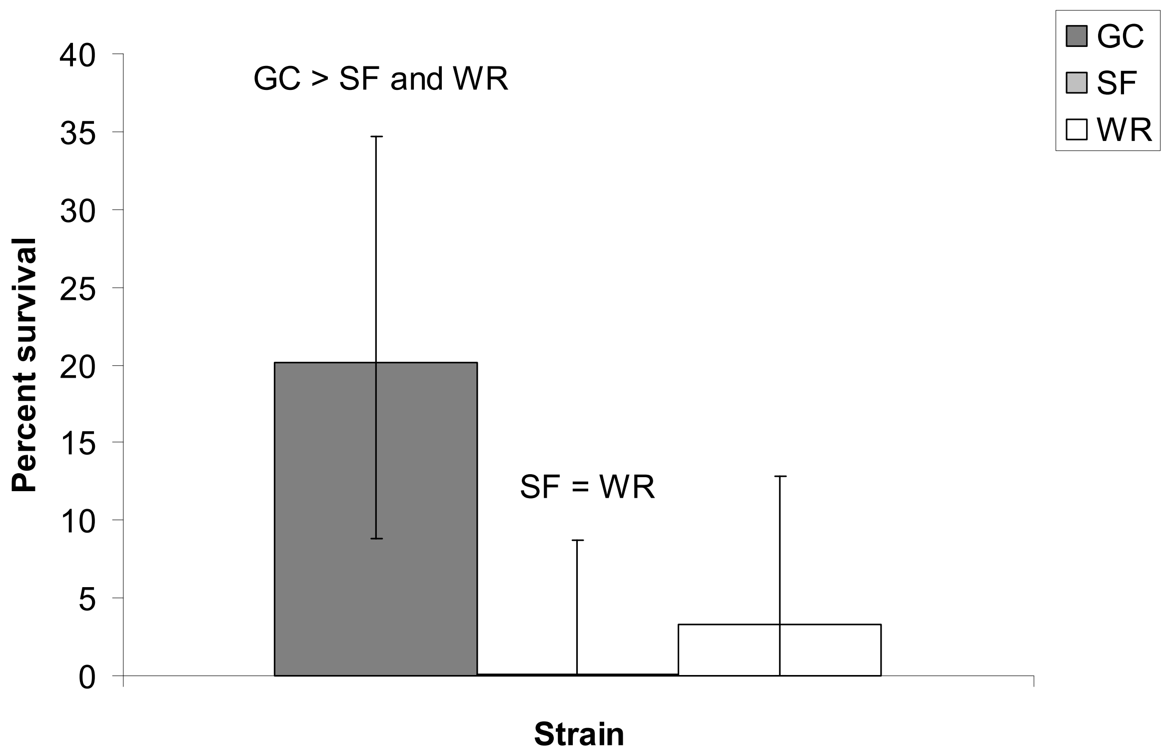

Figure 3.–Mean back-transformed survival to age 2 of stocked brown trout, by strain, across all years and six rivers. The thin vertical lines represent the 95% confidence intervals. GC = Gilchrist Creek, SF = Seeforellen, WR = Wild Rose. Significant differences shown above are for ANOVA $P \leq 0.05$.

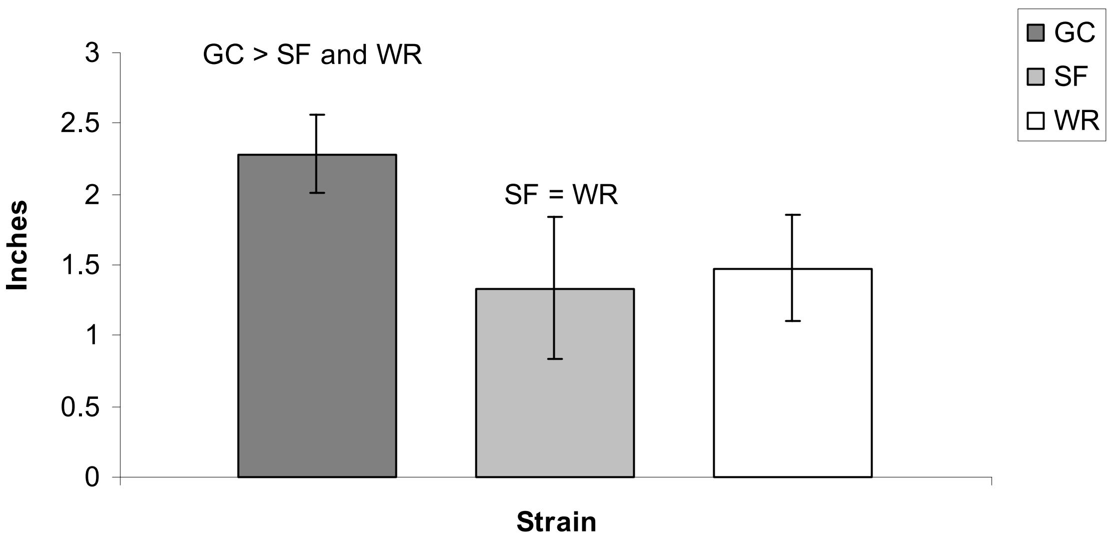

Figure 4.–Mean growth increment from stocking to time of sampling for three stocked brown trout strains across all years and six rivers. The thin vertical lines represent the 95% confidence intervals. GC = Gilchrist Creek, SF = Seeforellen, WR = Wild Rose. Significant differences shown above are for ANOVA $P \leq 0.05$.