STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-53-R-14

Study No.: 469 **Title:** Investigations into causes of, and solutions for, recent declines in survival of trout stocked in Lake Huron

Period Covered: April 1, 1997 to March 31, 1998

Study Objective: (1) to explore methods of documenting the lacustrine early life history of stocked salmonids, with emphasis upon an understanding of factors influencing mortality during their first year at large; (2) to determine whether there are genetically based differences in early life history characteristics that affect return to the creel, by comparing performance of a lacustrine strain of brown trout with that of one of the standard domesticated strains; and (3) to define methods that can be employed to improve survival and extend average longevity of brown trout used for stocking, such that return to the creel in lakes can be improved to 10% of the number stocked.

Summary: Two strains of brown trout were selected for study, Wild Rose and Seeforellen. The stocking phase of this evaluation was completed in 1995. Returns of the two strains continued to be monitored in 1997. In 1996, a two-year comparison of stocking methods began: two study lots were stocked each year, one lot was stocked offshore in Thunder Bay, and a second lot stocked using conventional techniques from the beach. In 1996 Wild Rose strain was used for both groups; in 1997, Seeforellen strain was used. Relative survival is being measured using creel census. The stocking phase of this study was completed in 1997. Since 1991, brown trout stocking dates were delayed until the June peak in alewife spawning density was reached to reduce losses to predation. Also, beginning in 1991, the selected study strains were introduced. The 1991-95 year classes of brown trout were much more successful than those of previous years. Estimated sport harvest of brown trout increased from 500 in 1991 to 2,284 in 1992 and 3,908 in 1993. Harvest steadily declined thereafter, however, and was only 1,198 in 1997. In Thunder Bay to date, Seeforellen and Wild Rose strains produced similar return to creel. Both strains produced significantly better harvests than Plymouth Rock strain. Seeforellen strain grew significantly faster than the other strains. During the July 1997 Alpena Brown Trout Festival, the proportion of Seeforellen strain was not significantly different than that of Wild Rose ($P>0.05$), but by July, age-3 Seeforellen strain were significantly larger ($P<0.05$). A similar study was conducted on Lake Charlevoix. Creel census was conducted there from 1993-96 to assess the performance of three strains: Seeforellen, Wild Rose, Plymouth Rock. The catch rates (fish per 100 angler hours) were similar for Seeforellen and Wild Rose strains of the same age. However, in 1993 and 1994 catch rates of both Seeforellen and Wild Rose strains were at least 5 times those for Plymouth Rock strain of the same age. Paired Seeforellen and Wild Rose stocked in 1994 and 1995 survived poorly and fishing success for brown trout in Lake Charlevoix sharply declined in 1995 and 1996. Causes of the recent declines in brown trout catches at Thunder Bay and Lake Charlevoix have not been identified, but declining numbers of alewives in the spawning run may have contributed to the relapse.

Job 5. Title: <u>Determine return to creel of stocked trout.</u>

Findings: *Thunder Bay*.–From 1985 through 1990, an average of 100,000 yearling brown trout was stocked annually in Thunder Bay. But in 1991, the estimated harvest was only 500 brown trout (Study 427). This was the lowest estimated harvest since the creel census began. Clearly, the brown trout fishery had collapsed in Thunder Bay.

After the stocking date was changed to Mid-June, and with introduction of the test strains, harvest increased in 1992 to 2,284 and rose again in 1993 to 3,908 fish. A reversal occurred from 1994 to present, however, and only 1,198 brown trout were harvested from Thunder Bay in 1997 (Table 1). Causes for the recent declines are unclear. In 1997, MDNR personnel measured a total of 186 creeled brown trout, including 71 Seeforellen, 63 Wild Rose strain, 6 stocked on shore in 1996, and 7 stocked offshore in 1996. These data will be used to produce monthly harvest estimates, by experimental lot, for the final report.

Beginning in 1993, a concerted effort was made to collect a significant amount of biological data during a discrete time period for the purpose of comparing biological parameters of the test strains. The Alpena Brown Trout Festival, held annually during mid-July, was chosen as the best opportunity to collect these data because of the large number of fish available for measurement. Until 1997, the brown trout harvest during this period produced adequate sample sizes for comparisons of performance, including growth, maturation rates, and harvest. In 1997, however, too few brown trout (one "offshore" and 2 "onshore") from the 1996 stocking method comparison were observed to evaluate that test. There were no significant differences in catch of age-3 and age-4 Seeforellen and Wild Rose strains (Table 2). Reviewing earlier Festival catch data, the ratio of age-3 Seeforellen strain was significantly higher than the expected 50% when compared with Plymouth Rock strain in 1993 and with Wild Rose strain in 1994 ($P<0.01$), but was not significantly different from Wild Rose in 1995 or 1996 ($P>0.05$). The incidence of age-2 Seeforellen strain in Festival catches was also significantly ($P<0.01$) higher than that of Wild Rose in 1994 (Table 2), but not in 1995. These results from the biological data were reflected in the ratio of strains officially entered in the tournament. The ratio of Seeforellen (right ventral clip) to Wild Rose and Plymouth Rock (left ventral clip) was significantly higher ($P<0.01$) than the expected 50% in 1993, 1994, and 1996 but not ($P>0.05$) in 1995 (Table 3). In 1997, a total of 202 brown trout was entered in the Tournament, the lowest since 1991 (Table 3). These fish included 64 left ventral clips and 76 right ventral clips. Most were probably from the strain evaluation phase of the study, but scales were not taken from all tournament entries; thus age and study phase could not be completely ascertained. Based on Festival biological data, age-3 Seeforellen strain trout were significantly larger in both length and weight (Table 4) than Wild Rose in all years ($P<0.05$). Only two age-3 Plymouth Rock fish were observed and very few fish of any strain were as old as age 4. Thus, Seeforellen strain grew faster but all strains displayed low survival past age 3.

Sampling during 1997 completed the strain evaluation phase of this study.

Lake Charlevoix: Three genetic strains (Seeforellen, Plymouth Rock and Wild Rose) of marked (fin clipped) brown trout were stocked in Lake Charlevoix from 1991-95. Evaluations were completed at Lake Charlevoix in 1996 (Study 469, 1996 Annual Report).

Job 6. Title: Assess age at maturity.

Findings: Requirements of this study element were completed in 1996. There was no activity on this job in 1997.

Job 7. Title: Analyze data, prepare performance and final reports and technical publications.

Findings: Completed as scheduled. The progress report was prepared. Graphics were prepared and presentations were made to various public interest groups and the Lake Huron Committee.

Literature Cited:

Weber, J. R. 1988. Return to the creel of brown trout stocked in the Great Lakes as yearlings and fall fingerlings. Pages 244-268 *in* Michigan Dingell-Johnson Annual Reports, Projects F-35-R-13 and F-53-R-4, Lansing.

Prepared by : James E. Johnson
Date: March 31, 1998

Table 1.–Brown trout harvest, 1991-97, Thunder Bay, Lake Huron.

Year	Brown trout harvest
1991	500
1992	2,284
1993	3,908
1994	3,322
1995	3,167
1996	1,899
1997	1,198

Table 2. –Number of brown trout by age group from biological data collected during the 1993-97 Alpena Brown Trout Festivals, by strain.

	Strain			
Age	Seeforellen	Wild rose	Plymouth Rock	Unclipped
		1993		
Age 2	26	27	---	3
Age 3	12[1]	---	2[1]	1
Age 4	---	---	---	---
Year total	38	27	2	4
		1994		
Age 2	61[1]	38[1]	---	108
Age 3	47[1]	9[1]	---	47
Age 4	---	---	---	0
Year total	108	47	0	26
		1995		
Age 2	36	50	---	45
Age 3	25	26	---	6
Age 4	7	1	---	1
Age 5	1	0	---	0
Year total	69	77	0	52
		1996		
Age 2	29	18	---	5
Age 3	7	5	---	0
Age 4	0	0	---	0
Age 5	0	0	---	0
Year total	36	23	---	5
		1997		
Age 3	24	30	---	10
Age 4	13	15	---	5
Age 5	1	3	---	0
Year total.	38	48	---	15

[1] Ratio of test strains (binomial test) significantly different from 0.50 ($P<0.01$): numbers stocked were essentially the same for each paired comparison.

Table 3.–Number of each strain weighed-in during Alpena Brown Trout Festival 1993-97.

Strain	1993	1994	1995	1996	1997
Seeforellen	203	89	59	93	---
Wild Rose or Plymouth Rock	113	56	70	50	---
Unknown	218	146	235	69	202
Total	534	291	364	212	202

Table 4.–Comparison of lengths and weights of brown trout by year, strain, and age from Alpena Brown Trout festival, mid-July, 1993-97.

	1993		1994		1995			1996		1997	
Strain	Age 2	Age 3	Age 2	Age 3	Age 2	Age 3	Age 4	Age 2	Age 3	Age 3	Age 4
Seeforellen											
Length (mm)	518	670	528	690[1]	519[1]	701[1]	721	532[1]	711[1]	680	738
Standard deviation	42	49	46	59	46	51	41	35	47	75	64
Weight (kg)	2.01	4.93	2.11	5.07[1]	2.06	5.42[1]	5.50	2.33	5.85[1]	4.85	5.74
Standard deviation	0.6	1.23	0.71	1.21	0.60	1.00	0.81	0.49	1.57	1.22	1.37
Number	26	12	61	46	37	25	7	29	7	24	13
Wild Rose											
Length (mm)	521	---	513	628[1]	500[1]	615[1]	665	504[1]	586[1]	611	659
Standard deviation	36	---	47	36	26	52	---	22	39	67	70
Weight (kg)	2.22	---	2.15	3.79[1]	2.04	3.78[1]	4.31	2.16	3.51[1]	3.54	4.46
Standard deviation	1.04	---	0.79	0.67	0.39	0.97	---	0.31	0.85	1.23	1.40
Number	27	---	37	9	50	26	1	18	5	30	15
Plymouth Rock											
Length (mm)	---	605	---	---	---	---	---	---	---	---	---
Standard deviation	---	17.7	---	---	---	---	---	---	---	---	---
Weight (kg)	---	3.76	---	---	---	---	---	---	---	---	---
Standard deviation	---	0.23	---	---	---	---	---	---	---	---	---
Number	0	2	0	0	0	0	0	0	0	0	0

[1] Significant difference (t test: $P<0.05$) between Wild Rose and Seeforellen.