

## STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-53-R-15

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, 1998 to September 30, 1999

**Study Objective:** (1) to explore methods of documenting the lacustrine early life history of stocked salmonids, with emphasis on understanding 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 1996-1999. In 1996 and 1997, a two-year comparison of stocking methods was conducted: two study lots were stocked each year, one lot was stocked offshore in Thunder Bay, and a second lot stocked off the beach using conventional techniques. 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 to reduce losses to predation. Also, beginning in 1991, the selected study strains were introduced. The 1991-1995 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 589 in 1998. 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 Alpena's Brown Trout Festivals, the proportion of Seeforellen strain was not significantly different than that of Wild Rose ( $P>0.05$ ), but age-3 Seeforellen strain were significantly larger ( $P<0.05$ ). A similar study was conducted on Lake Charlevoix. Creel census was conducted there from 1993-1996 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. Thus far, returns from offshore (vessel) stocking and shore stocking in Thunder Bay have been equally dismal.

**Job 5. Title: Determine return to creel of stocked trout.**

**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 589 brown trout were harvested from Thunder Bay in 1998 (Table 1). Causes for the recent declines are unclear.

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 sport-harvested fish available for measurement. Through 1997, brown trout harvest produced adequate sample sizes for comparisons of performance: including growth, maturation rates, and harvest (Tables 2 and 4). In 1998, however, too few brown trout from the 1996 and 1997 stocking method comparisons were collected to evaluate that test (Table 4). Similarly, in 1999 few brown trout were observed during the festival. The 1999 data will be entered and analyzed this winter. It has become clear that neither shore stocking nor boat stocking strategies have improved post-stocking survival and that brown trout stocking since 1995 has failed to produce a significant sportfishery.

Reviewing earlier Festival biological data collected by DNR personnel, age-3 Seeforellen strain trout were significantly larger in both length and weight (Table 3) 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.

The proportion of age-3 Seeforellen strain in the angler catch was significantly higher than the expected 50% when compared with Plymouth Rock strain in 1993 and 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 5). In 1998, a total of 155 brown trout was entered in the Tournament, the lowest since 1991 (Table 5). These fish included 54 right-ventral clips and 38 left-ventral clips. Brown trout from both study phases were probably represented in the 1998 sample. The Brown Trout Festival personnel did not take scales from tournament entries; thus age and study phase could not be ascertained from Festival files.

Sampling during 1998 completed the strain evaluation phase of this study. Evaluation of the stocking methods phase will be completed at the end of the 1999 field season.

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

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

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**Date:** September 30, 1999

Table 1.—Brown trout harvest, 1991-1998, 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
1998	589

Table 2.—Number of brown trout by age group and strain collected during the 1993-1998 Alpena Brown Trout Festivals.

Age	Strain			
	Seeforellen	Wild rose	Plymouth Rock	Unclipped
		<u>1993</u>		
Age 2	26	27	---	3
Age 3	12 <sup>1</sup>	---	2 <sup>1</sup>	1
Age 4	---	---	---	---
Year total	38	27	2	4
		<u>1994</u>		
Age 2	61 <sup>1</sup>	38 <sup>1</sup>	---	108
Age 3	47 <sup>1</sup>	9 <sup>1</sup>	---	47
Age 4	---	---	---	0
Year total	108	47	0	26
		<u>1995</u>		
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
		<u>1996</u>		
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
		<u>1997</u>		
Age 3	24	30	---	10
Age 4	13	15	---	5
Age 5	1	3	---	0
Year total	38	48	---	15

<sup>1</sup> 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 1.)

Table 3.-Comparison of lengths and weights of brown trout by year, strain, and age from Alpena Brown Trout festival, mid-July, 1993-97.

Strain	1993		1994		1995		1996		1997		
	Age 2	Age 3	Age 2	Age 3	Age 2	Age 3	Age 2	Age 3	Age 3	Age 4	
<b>Seeforellen</b>											
Length (mm)	518	670	528	690 <sup>1</sup>	519 <sup>1</sup>	701 <sup>1</sup>	721	532 <sup>1</sup>	711 <sup>1</sup>	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 <sup>1</sup>	2.06	5.42 <sup>1</sup>	5.50	2.33	5.85 <sup>1</sup>	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
<b>Wild Rose</b>											
Length (mm)	521	---	513	628 <sup>1</sup>	500 <sup>1</sup>	615 <sup>1</sup>	665	504 <sup>1</sup>	586 <sup>1</sup>	611	659
Standard deviation	36	---	47	36	26	52	---	22	39	67	70
Weight (kg)	2.22	---	2.15	3.79 <sup>1</sup>	2.04	3.78 <sup>1</sup>	4.31	2.16	3.51 <sup>1</sup>	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
<b>Plymouth Rock</b>											
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

<sup>1</sup> Significant difference (t test: P<0.05) between Wild Rose and Seeforellen.

Table 4.—Lengths, weights, and sample sizes of brown trout, by age and study group, in Thunder Bay Creel Census biological data, 1998.

Age	Clip	Year stocked	Study group	Sample size	Length (mm)	Std. Dev.	Weight (gm)	Std. Dev.
2	LV	1997	Shore stocking	10	564	86	2,732	1,525
	RV		Boat stocking	10	645	106	4,137	2,324
	None			7	517	91	1,886	1,259
3	LV	1996	Shore stocking	8	610	151	4,031	2,603
	RV		Boat stocking	5	699	75	5,225	1,592
	None			2	641	242	3,470	2,149
4	LV	1995	Wild Rose	9	548	76	2,394	1,015
	RV		Seeforellen	4	715	95	5,613	2,188
	None			3	634	60	3,568	367
5	LV	1994	Wild Rose	4	605	73	3,357	1,100
	RV		Seeforellen	2	747	14	5,511	96

Table 5.—Number of each strain weighed-in during Alpena Brown Trout Festival 1993-1998.

Strain	1993	1994	1995	1996	1997	1998
Seeforellen	203 <sup>1</sup>	89 <sup>1</sup>	59	93 <sup>1</sup>	---	---
Wild Rose or Plymouth Rock	113 <sup>1</sup>	56 <sup>1</sup>	70	50 <sup>1</sup>	---	---
Unknown	<u>218</u>	<u>146</u>	<u>235</u>	<u>69</u>	<u>202</u>	<u>155</u>
Total	534	291	364	212	202	155