

## STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-80-R-4

Study No.: 487

Title: Performance, survival and production of steelhead strains in tributaries of Lake Michigan and Lake Huron.

Period Covered: October 1, 2002 to September 30, 2003

**Study Objectives:** To evaluate strain performance of winter (Michigan) and summer (Skamania) strains of steelhead. To evaluate the performance of steelhead in six rivers, Lake Michigan and Lake Huron. To evaluate returns of steelhead from upstream and downstream plants in rivers. To describe year-to-year variation in growth and survival of steelhead populations in Michigan. To define the quality, condition, and health of different strains and batches of hatchery-produced fish.

**Summary:** We completed the stocking of steelhead with coded-wire tags (CWTs) for this study in 1999 (Table 1). Study fish are recruiting to the fishery and are being recovered through volunteer angler returns, Great Lakes and river creel clerks, headhunters hired to look for study fish, and by Michigan Department of Natural Resources personnel conducting assessment work for other studies. CWTs were collected from the river fisheries by part-time personnel in 1998. Full river creel surveys have been conducted from 1999 until the present on the Muskegon, Manistee, and St. Joseph rivers. A full creel survey was also conducted on the Au Sable River in 1999 and 2000. From 1997 to 1998 the number of tags collected from marked fish increased from 57 to 1,600. The number of tags collected from fish in 1999 and 2000 increased dramatically to approximately 3,000 tags per year. In 2001, the return of tagged fish was slightly lower at 2,200. In 2002 returns had dropped significantly to approximately 1,000 tagged fish. We are still collecting and analyzing heads returned from the 2003 fishery, and have processed 67 at this time. In general, early results indicate that the furthest upstream plants are returning at equal or better rates when compared to downstream plants. Both strains are returning at similar rates to the Lake Michigan fishery and compare similarly when evaluated for potential to stray to non-stocked river systems. In river fisheries, Michigan-strain steelhead are returning at higher rates than Skamania-strain steelhead.

### **Job 4. Title: Evaluate performance of upstream and downstream plants.**

**Findings:** To date, tag-return data have been collected for 1- to 5-year old stocked fish in Great Lakes and river fisheries. However, evaluations of differences among upstream, midstream, and mouth plants will not be complete until data from 6- and 7-year old fish are fully included in the analysis (Table 2). With the exception of fish planted at the mouth, both strains of steelhead stocked in the St. Joseph River returned at similar rates to Lake Michigan fisheries (Tables 2 and 3). Fish stocked in Arden Pond (an extensive rearing facility intended to enhance survival by supplying a predator-free environment until fish are ready to passively smolt into the river system), provided Great Lakes return rates similar to other stocked sites (Tables 2 and 3), but provided the lowest return rates of Michigan-strain steelhead back to river fisheries (Table 4). In four other rivers evaluated, upstream plants returned to Great Lake fisheries at higher rates than downstream plants. For example, 33 to 100% higher return rates were observed for Michigan-

strain fish stocked upstream in the Manistee, Muskegon, Sturgeon, and Au Sable rivers compared to mouth and midstream plants (Tables 3 and 5). Upstream plants also returned at higher rates in river fisheries including the St. Joseph River, for both Michigan and Skamania strains of steelhead (Tables 4).

Comparisons indicated that steelhead stocked into the Au Sable, Muskegon, and Manistee rivers had a higher relative propensity for straying (Table 6). Results from the Muskegon, Manistee, and Sturgeon rivers further indicated that upstream-stocked fish were more likely to stray than downstream-stocked fish (Table 6). It is possible that upstream fish survived better to spawning and were thus more prevalent in all areas including non-study streams. Results from the St. Joseph River indicate that midstream-stocked fish were more likely to stray than mouth- or upstream-planted fish (Table 6). Michigan-strain fish were more likely to appear in non-study rivers than Skamania-strain fish (Table 6). The five most common sites for steelhead to stray to (not including streams tributary to study rivers) included the Thunder Bay, White, Platte, Pere Marquette, and Betsie rivers where return rates were 243, 144, 118, 112, and 61 fish per 100,000 fish stocked / site / river / year respectively.

We continue to collect and compile data from 2003 collection efforts.

**Job 5. Title: Estimate growth and survival of marked steelhead to lake and river fisheries.**

**Findings:** Marked Skamania-strain steelhead first returned to river fisheries in 1998, and only limited data were collected from river systems in that year. From 1999 through 2003, creel surveys were conducted, allowing for optimal collection of data to evaluate catch rates, effort allocations, and movements within river systems; these data were entered into standard database files. Examination of 804 heads returned from Lake Michigan river creel surveys in 1999 indicated that 698 (89%) had tags. In 2000, 1,942 heads were returned from river creel surveys and 1,712 (88%) had tags. In 2001, 470 heads were returned from river creel surveys and 376 (80%) had tags. Four years of data are currently available for analysis (1999, 2000, 2001, and 2002) and 2003 data are being collected and compiled. Data have been collected, but we have not yet evaluated the growth of steelhead in lake and river systems.

The relative return rates of marked steelhead in the open-lake fisheries of lakes Huron and Michigan are the primary measure of survival. The return rates of steelhead in river fisheries can be compared to open-lake estimates to help confirm relative survival estimates. For example, we observed that fish planted upstream returned better in both open-lake and river fisheries. The Manistee, Muskegon, and Au Sable rivers had significant returns of fish from upstream plants to river fisheries (Table 4). Returns of Michigan-strain fish to St. Joseph River fisheries were more similar across all stocking sites. However, the return rates from the upriver sites were higher for both Skamania and Michigan strains (Table 4). River returns have not yet been adjusted for differences in effort among sections within a river. River creel surveys on the Muskegon, Manistee, and Au Sable rivers initiated in 1999 have greatly increased the available data, enhancing our ability to evaluate systems other than Lake Michigan and the St. Joseph River. Only 2 years of data are available from the Au Sable River as creel surveys were discontinued in 2001.

To evaluate the contribution of steelhead planted in a given river system to the Lake Michigan sport fishery, we summarized the returns of marked steelhead by river of origin (Table 7). The Muskegon River seems to be providing the best input of winter-run Michigan-strain steelhead to the Lake Michigan fishery, followed by the St. Joseph and Manistee rivers. The largest returns to river fisheries occurred in the St. Joseph River, followed by the Muskegon and Manistee rivers (Table 7).

**Job 6. Title: Evaluate performance characteristics of steelhead strains.**

**Findings:** Michigan-strain steelhead stocked for study 487 have been returning to spawn in river systems since 1997, while Skamania-strain fish returned for the first time to study river systems in 1998. With the exception of the mouth plant on the St. Joseph River, the Michigan- and Skamania-strain steelhead appear to be contributing at similar rates to the Lake Michigan fishery when evaluated for systems with paired plantings (Table 2). The sixth year of river creel is being conducted and early results indicated that Michigan-strain fish contribute higher numbers to river fisheries than do Skamania when evaluating only systems and stocking sites that have received both strains (Table 4). The seasonal components of the fisheries remain to be evaluated and it is important to note that though stocked at the same age, Skamania return to river fisheries one year later than the Michigan-strain steelhead and may yet be underrepresented in the fisheries. Winter-run Michigan-strain steelhead appeared to be more likely to stray to other river systems than summer-run Skamania-strain fish (Table 6).

**Job 8. Title: Analyze data and write reports.**

**Findings:** Data collection for this project is closely coordinated with study 427. This progress report was prepared as scheduled. Presentations to angling groups and interested parties have been prepared as requested.

**Prepared by: Jory Jonas and John Clevenger**

**Date: September 30, 2003**

Table 1.—Stocking locations and number of marked (coded-wire tag and adipose fin clip) steelhead, by strain (Skamania, Michigan), stocked into study rivers during 1996-1999. Numbers in parentheses represent fish marked by the State of Indiana for additional study comparing size-at-stocking and rearing strategies.

River stocked	Stocking Location	1996		1997		1998		1999	
		Skamania	Michigan	Skamania	Michigan	Skamania	Michigan	Skamania	Michigan
St. Joseph	Pier 33		9,961	15,811	15,076	10,608	9,982	11,054	15,030
	Sportsman's Club-Arden	10,723	10,921	15,440	11,652	11,615	11,697	10,265	10,577
	Shamrock Park-Berrien		9,847	15,666	14,923	10,667	10,173	11,108	10,049
	Buchanan City Launch	10,697	9,801	15,672	14,780	10,556	10,107	10,823	9,987
	St. Patrick's Park			15,535		16,135		15,989	
	Mishawaka-Lincoln Park			31,755	19,819	32,013	20,317	31,726	20,054
	Mishawaka-Lincoln Park-additions Indiana-Merrifield Park S. Bend			(31,209)		(32,237)		(32,009)	
Manistee	Manistee		14,795		15,102		16,727		15,080
	High Bridge	15,357	15,787	16,494	14,787	17,071	15,044	12,555	15,444
	Tippy Dam	21,340	15,950	16,000	15,005	17,105	15,110	12,961	15,010
Manistique	Manistique Public Access Site		8,161		8,549		8,134		8,008
Muskegon	Muskegon Lake outlet		10,163		10,056		10,180		10,095
	Henning Park		21,489		19,965		20,218		20,022
	Pine Street		22,072		20,198		20,180		20,058
Sturgeon	Big Bay DeNoc-499 Bridge	5,397	5,430	5,021	5,116	3,682	5,128		5,216
	Sturgeon River	6,284	5,345	4,998	4,983	5,103	5,222		5,145
Au Sable	Harbor		28,426		21,095		22,134		25,050
	Rea Road		27,172		24,812		25,027		25,426
Total		69,798	236,251	183,601	235,918	166,792	225,380	148,490	230,451

Table 2.—Comparison of age-specific return rates averaged across stocking years (1996-99) for summer steelhead (Skamania strain) and winter steelhead (Michigan strain). Returns are from 1997 through 2003 collection efforts in Lake Michigan fisheries. The number of fish is adjusted to 100,000 fish stocked/site/river/year. Sites from left to right are ordered from down to upstream. The sites for the St. Joseph River begin at the mouth while Manistee River sites begin with the midstream site.

Strain	Ages	St. Joseph River					Manistee River	
		Pier 33	Arden Pond	Shamrock Park	Buchanan	Mishawaka	High Bridge	Tippy Dam
Michigan	1 <sup>a</sup>	24	7	12	4	10	4	5
	2 <sup>a</sup>	151	74	60	61	106	26	45
	3 <sup>a</sup>	700	168	109	112	147	87	144
	4 <sup>a</sup>	204	54	54	60	47	19	45
	5 <sup>a</sup>	68	28	2	8	20	2	3
	6	5	0	5	2	2	2	2
	7	3	0	0	0	0		
Total		1,154	334	242	246	332	140	245
Skamania	1 <sup>a</sup>	6	0	0	0	3	2	7
	2 <sup>a</sup>	48	33	49	25	39	28	31
	3 <sup>a</sup>	108	160	145	113	135	66	97
	4 <sup>a</sup>	107	141	148	89	126	77	101
	5 <sup>a</sup>	13	30	17	11	8	33	19
	6	0	2	0	0	0	2	4
	7	0	0	0	0	0		1
Total		283	366	360	238	296	208	261

<sup>a</sup> All stocked year classes have attained this age in the fishery. Ages 6 and 7 are not yet available for some stocked year classes.

Table 3.—Average annual coded-wire tag returns from Lake Michigan-caught steelhead stocked from 1996 through 1999. Summarized returns are for years 1997 through 2003. Numbers are adjusted to a stocking rate of 100,000 fish/site/river/year. The site classification defines whether the stocking site was at the mouth, a midstream location or an upstream location. The numbers following site classifications for the St. Joseph River indicate the distance, in miles, from the site to the mouth.

River stocked	Stocking location	Site classification	Returns	
			Michigan-strain	Skamania-strain
St. Joseph	Pier 33	Mouth	1,154	283
	Sportsmans Club-Arden Pond	Mid-17	334	336
	Shamrock Park-Berrien Springs	Mid-23	242	360
	Buchanan City Launch-Smittys	Mid-32	246	238
	Mishawaka-Lincoln Park	Up-55	332	312
	Indiana-Merrifield Park S. Bend	Up-60	227	— <sup>a</sup>
Big Manistee	Manistee	Mouth	139	—
	High Bridge	Mid	140	208
	Tippy Dam	Up	245	261
Manistique	City of Manistique	Mouth	92	—
Muskegon	Muskegon Lake outlet	Mouth	260	—
	Henning Park	Mid	304	—
	Pine Street	Up	348	—
Sturgeon	Big Bay DeNoc-499 Bridge	Mouth	20	34
	Sturgeon River	Up	59	29
Au Sable	Harbor	Mouth	14	—
	Rea Road	Up	19	—

<sup>a</sup> No Skamania were stocked in 1996 by the State of Indiana.

Table 4.—Average number of Michigan- and Skamania-strain steelhead returned to river fisheries for fish stocked from 1996 through 1999 and collected from 1997 to summer 2003 (numbers of fish adjusted to 100,000 fish stocked/site/river/year). Numbers are adjusted for stocking rate but not fishing effort. The site classification defines whether the stocking site was at the mouth, a mid-stream location or an upstream location. The numbers following site classifications for the St. Joseph River indicate the distance, in miles, from the site to the mouth.

River stocked	Stocking location	Site classification	Returns	
			Michigan-strain	Skamania-strain
St. Joseph	Pier 33	Mouth	906	110
	Sportsmans Club-Arden Pond	Mid-17	810	341
	Shamrock Park-Berrien Springs	Mid-23	1,036	221
	Buchanan City Launch-Smittys	Mid-32	1,156	242
	Mishawaka-Lincoln Park	Up-55	1,662	514
	Indiana-Merrifield Park S. Bend	Up-60	1,289	—
Big Manistee	Manistee	Mouth	300	—
	High Bridge	Mid	894	353
	Tippy Dam	Up	1,321	406
Manistique	Mouth	Mouth	77	—
Muskegon	Muskegon Lake Outlet	Mouth	342	—
	Henning Park	Mid	1,098	—
	Pine Street	Up	1,335	—
Sturgeon	499 Bridge	Mouth	37	0
	River	Up	110	34
Au Sable	Harbor	Mouth	167	—
	Rea Road	Up	250	—

Table 5.—Average annual coded-wire tag returns from Lake Huron-caught steelhead stocked from 1996 through 1999. Summarized returns are for years 1997 through 2003. Numbers are adjusted to a stocking rate of 100,000 fish/site/river/year. The site classification defines whether the stocking site was at the mouth, a midstream location or an upstream location. The numbers following site classifications for the St. Joseph River indicate the distance, in miles, from the site to the mouth.

River stocked	Stocking location	Site classification	Returns	
			Michigan-strain	Skamania-strain
St. Joseph	Pier 33	Mouth	0	0
	Sportsmans Club-Arden Pond	Mid-17	0	8
	Shamrock Park-Berrien Springs	Mid-23	0	7
	Buchanan City Launch-Smittys	Mid-32	0	4
	Mishawaka-Lincoln Park	Up-55	0	4
	Indiana-Merrifield Park S. Bend	Up-60	0	— <sup>a</sup>
Big Manistee	Manistee	Mouth	2	—
	High Bridge	Mid	0	0
	Tippy Dam	Up	0	0
Manistique	City of Manistique	Mouth	0	—
Muskegon	Muskegon Lake outlet	Mouth	3	—
	Henning Park	Mid	0	—
	Pine Street	Up	0	—
Sturgeon	Big Bay DeNoc-499 Bridge	Mouth	0	0
	Sturgeon River	Up	0	0
Au Sable	Harbor	Mouth	178	—
	Rea Road	Up	227	—

<sup>a</sup> No Skamania were stocked in 1996 by the State of Indiana.



Table 6.—Summary of fish straying from stocked rivers presented as total number of strays per river by stocking location and strain (fish straying to tributaries of study rivers have been eliminated from this analysis). Returns are from 1997 through 2003 collection efforts. Numbers of fish are adjusted to 100,000 fish stocked/site/river/year.

River stocked	Total	Stocking location			Strain	
		Mouth	Midstream	Upstream	Michigan	Skamania
Au Sable	499	160	—	339	—	—
Manistee	757	112	264	381	377	268
Manistique	295	295	—	—	—	—
Muskegon	1,666	159	706	801	—	—
St. Joseph	556	67	321	168	458	57
Sturgeon	330	81	—	249	229	101

Table 7.—Average number of marked Michigan- and Skamania-strain steelhead caught in the Great Lakes (Michigan and Huron) and in river fisheries, 1997-2003. Numbers are adjusted to a stocking rate of 100,000 fish/site/river/year.

River stocked	Lake Michigan returns		River returns	
	Michigan	Skamania	Michigan	Skamania
Au Sable River	16	—	208	—
Manistee River	174	235	839	379
Manistique River	92	—	77	—
Muskegon River	315	—	1,044	—
St. Joseph River	283	270	1,152	421
Sturgeon River	46	32	74	17