

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-53-R-15

Study No.: 487

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

Period Covered: April 1, 1998 to September 30, 1999

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: The stocking of steelhead with coded-wire microtags for this study was completed. The numbers of fish stocked have remained within the range of the numbers proposed in the revised study design in 1996. Study fish are returning to the fishery and are being recovered through volunteer angler returns, Great Lake and river creel clerks, headhunters hired to look for study fish, and by DNR personnel conducting assessment work for other studies. After hiring short-term headhunters in 1998 to survey rivers, in 1999 we conducted full river creel surveys on the Muskegon, Manistee, and Au Sable rivers. These additional river creel surveys have been approved to continue into the year 2000. In 1996 and 1997 we collected 216 heads from fish marked for our study and in 1998 we recovered 895 fish; the number of fish returned in 1999 is even higher. Early results indicated that the upstream plants are returning better than downstream plants, and both strains are returning at similar rates in the Lake Michigan fishery.

Job 2. Title: Mark, stock and release steelhead smolts in selected lake tributaries.

Findings: A total of 306,049 steelhead were tagged and released in 1996; 400,546 in 1997; 392,172 in 1998; and 378,864 in 1999. This was the last year of stocking for the study. Table 1 summarizes the allocation of coded-wire-tagged steelhead at each stocking site for 1996-1999.

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

Findings: After the first three years of the study (1996, 1997, and 1998), it is still premature to fully quantify the differences between upstream and downstream plants. Adult fish of both strains are returning in the Great Lakes creel collections. Michigan strain steelhead have been returning in river systems for several years while Skamania have returned for the first time to the river systems to spawn in the fall/spring 1998/1999 season (Table 2).

On the Muskegon River, the mid-river plants are returning at a greater rate to the lake fishery than the mouth plants and the upstream plants are producing the greatest returns of all (Table 3). Michigan strain fish in the Manistee River also produced highest returns to the lake fishery when

stocked at the upstream site (Table 3). The mid-river site produced the lowest returns for Michigan strain fish. Skamania stocked in the Manistee River returned best to the lake fishery from the upstream stocking site (Tippy Dam). On the Sturgeon River, both strains returned best to the lake fishery when planted at the mouth site (Table 3). Initial results for the St. Joseph River are less clear. Returns of Michigan strain fish to the open lake fishery were similar for fish stocked at the four lower sites but the highest returns were for fish from the furthest upstream site (nearly 60 miles upstream). The State of Indiana did not implement a full stocking schedule for marked Skamania until 1997 on the St. Joseph River (Table 1).

Qualitative results on the Au Sable River showed that like Lake Michigan, the upstream plants of Michigan strain steelhead are returning to the Lake Huron fishery at a greater rate (Table 3).

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

Findings: As of 1998, Skamania strain steelhead had just begun to return to the river fisheries (Table 4). It is interesting to note that some stocked steelhead did not smolt and over-wintered in the Muskegon and St. Joseph Rivers. We were able to determine this through sampling efforts for other fish species. Returns of marked steelhead by river of origin to Great Lake fisheries are presented in Table 5. The results provided are preliminary and descriptive in nature. The Muskegon River seems to be providing the best input to the lake fishery, followed by the Manistee and St. Joseph rivers. In 1999, we initiated river creel surveys on the Muskegon, Manistee, and Au Sable rivers. Creel surveys have greatly enhanced our ability to obtain data from systems other than Lake Michigan and the St. Joseph River.

Returns in river fisheries as of January 1999 are preliminary and defined in Table 3. It is still early to define the implications behind the return rates and numbers have not been adjusted for stocking. So far in all rivers the Michigan strain steelhead are returning best, probably because the Skamania strain fish have not fully recruited to river fisheries at this early date in the study. A total of 14 study fish were recovered in the Au Sable River fishery, 158 fish were returned in the Manistee River fishery, 118 in the Muskegon River, and 286 from the St. Joseph River. Age and growth analyses have not been completed.

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

Findings: As of January 1999, we have evaluated over 1200 steelhead snouts at the Charlevoix station. Heads from a total of 563 fish were returned by Lake Michigan anglers from fish that were stocked in study river systems (Manistee, St. Joseph, and Sturgeon) with paired plantings of the two strains (Michigan and Skamania). Both strains returned at similar rates to the Lake Michigan Fishery when evaluated for only systems with paired plantings. The Michigan strain was represented by 202 (128 when adjusted per 100,000 stocked) fish while the Skamania strain was represented by 150 (117 when adjusted per 100,000 stocked; Tables 2 & 3). It is still too early to evaluate the implication of river returns.

Job 9. Title: Define condition of hatchery fish.

Findings: Spring-released Skamania from the Bodine Hatchery in Indiana were longer and heavier than Skamania released from Wolf Lake Hatchery. The water content of the Bodine and Wolf Lake groups of Skamania did not differ prior to release in the spring of 1997. Michigan and

Skamania strain fish sampled from Wolf Lake prior to stocking were similar in length, weight, and water content. At the same time, both Skamania and Michigan strain fish collected from Arden Pond were smaller, lighter, and had a slightly lower water content (higher fat) than any of the hatchery fish sampled prior to stocking. In the fall of 1997, the Skamania and Michigan strains of steelhead held at Wolf Lake Hatchery were similar in length, weight, and percent water. The Bodine Hatchery Skamania were longer and weighed more, and were significantly lower in water content (higher fat). We will continue to evaluate parameters relating to the health and condition of hatchery fish, and correlate this information with survival and return rates of fish to lake and river fisheries.

Prepared by: Jory Jonas.

Date: September 30, 1999

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

River	Stocking Location	1996			1997			1998			1999		
		Skamania	Michigan	Skamania	Michigan	Skamania	Michigan	Skamania	Michigan	Skamania	Michigan	Skamania	Michigan
St. Joseph	Pier 33	0	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	0	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 Mishawaka-Lincoln Park			15,535 31,755 (31,209)	19,819	16,135 32,013 (32,237)	20,317	15,989 31,726 (32,009)	20,054				
	Indiana-Merrifield Park S. Bend	0	20,931										
Manistee	Manistee				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				
Manistiquette	Manistiquette 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.—Number of marked steelhead returned in 1999 from newly initiated river creel surveys.

RIVER	LOCATION	NUMBER
AU SABLE RIVER	MOUTH	48
	UP	7
BIG MANISTEE RIVER	MOUTH	14
	MID	13
	UP	86
MUSKEGON RIVER	MOUTH	5
	MID1	3
	MID2	20
	UP	77
ST. JOSEPH RIVER	MOUTH	17
	MID 1	79
	MID 2	9
	MID 3	1
	MID 4	7
	DOWAGIAC RIVER	3
	MID 5	1
	UP	52

Table 3.-Steelhead coded-wire tag returns from lake-caught fish in 1996-1998 (all years combined). We adjusted the number recovered to a value equivalent to 100,000 stocked fish adjusted by the number planted from 1996-1998.

River	Stocking Location	Classification	Skamania Strain		Michigan Strain	
			Number	Number per 100,000 stocked	Number	Number per 100,000 stocked
St. Joseph River	Pier 33	Mouth	3	11	25	71
	Sportsmans Club-Arden Pond	Mid-17P	25	66	19	57
	Shamrock Park-Berrien Springs	Mid-23	5	19	21	60
	Buchanan City Launch-Smityys	Mid-32	30	81	19	55
	Mishawaka-Lincoln Park	Up-55	18	14	19	47
	Indiana-Merrifield Park S. Bend	Up-60	--	--	27	129
Manistee River	Manistee	Mouth	--	--	20	43
	High Bridge	Mid	16	33	14	31
	Tippy Dam	Up	45	83	31	67
Manistiquie River	City of Manistiquie	Mouth	--	--	10	40
Muskegon River	Muskegon Lake Outlet	Mouth	--	--	18	59
	Henning Park	Mid	--	--	43	70
	Pine Street	Up	--	--	60	96
Sturgeon River	Big Bay DeNoc-499 Bridge	Mouth	6	43	7	45
	Sturgeon River	Up	2	12	0	0
Au Sable River	Harbor	Mouth	--	--	29	40
	Rea Road	Up	--	--	39	52
TOTAL			151		401	

¹ No Skamania were stocked in 1996 by the State of Indiana

Table 4.—Steelhead coded-wire tag returns from river-caught fish from 1996-1998. Numbers have not been adjusted for number stocked.

River	Stocking Location	Classification	Number-SK	Number-MI
St. Joseph River	Pier 33	Mouth	0	44
	Sportsmans Club-Arden Pond	Mid-17P	8	19
	Shamrock Park-Berrien Springs	Mid-23	0	57
	Buchanan City Launch-Smittys	Mid-32	4	48
	Mishawaka-Lincoln Park	Up-55	0	38
	Indiana-Merrifield Park S. Bend	Up-60	0	68
Manistee River	Manistee	Mouth		6
	High Bridge	Mid	7	47
	Tippy Dam	Up	16	82
Manistique River	City of Manistique	Mouth		0
Muskegon River	Muskegon Lake Outlet	Mouth		5
	Henning Park	Mid		22
	Pine Street	Up		91
Sturgeon River	Big Bay DeNoc-499 Bridge	Mouth	0	0
	Sturgeon River	Up		0
Au Sable River	Harbor	Mouth		4
	Rea Road	Up		10
TOTAL			35	541

Table 5.—Description of the number of study fish caught in Great Lake fisheries (Michigan and Huron, both strains). The number caught indicates the actual number of heads returned in 1996-1998. The adjusted number indicates the number caught adjusted to a stocking rate of 100,000 fish per river.

River of origin	Number caught	Number per 100,000 stocked
Manistee River	126	52.2
St. Joseph River	211	46.5
Muskegon River	121	78.3
Au Sable River	68	44.6
Sturgeon River	15	24.9
Manistique River	10	40.3

Table 6.—Indicates the straying observed among river systems.

CAPTURE RIVER	PLANT RIVER	LOCATION	STRAIN	COUNT
BEAR RIVER	MANISTEE	UP	SK	1
BETSIE RIVER	AUSABLE	UP	MI	1
BETSIE RIVER	MUSKEGON	MID	MI	1
BLACK RIVER	AUSABLE	MOUTH	MI	1
BOARDMAN RIVER	MANISTEE	UP	SK	1
BOARDMAN RIVER	MANISTIQUE	MOUTH	MI	1
LITTLE MANISTEE RIVER	MANISTEE	UP	SK	2
MANISTEE RIVER	MUSKEGON	MID	MI	16
MANISTEE RIVER	MUSKEGON	MOUTH	MI	1
MANISTEE RIVER	MUSKEGON	UP	MI	19
MANISTEE RIVER	ST. JOSEPH	POND	SK	1
MANISTEE RIVER	ST. JOSEPH	UP55	MI	2
MANISTEE RIVER	ST. JOSEPH	MID23	MI	1
MANISTEE RIVER	ST. JOSEPH	MOUTH	MI	2
MANISTEE RIVER	AUSABLE	UP	MI	1
McCOY CREEK 387	ST. JOSEPH	MID32	MI	1
MUSKEGON RIVER	MANISTEE	MID	MI	1
MUSKEGON RIVER	MANISTEE	MOUTH	MI	1
MUSKEGON RIVER	ST. JOSEPH	POND	MI	1
PERE MARQUETTE RIVER	MANISTEE	MID	MI	1
PLATTE RIVER LOWER	MANISTEE	UP	MI	4
PLATTE RIVER LOWER	MUSKEGON	UP	MI	1
PLATTE RIVER LOWER	ST. JOSEPH	MID23	MI	2
PLATTE RIVER LOWER	ST. JOSEPH	UP55	MI	3
ST. JOSEPH RIVER	STURGEON	MOUTH	MI	1
ST. JOSEPH RIVER	MANISTEE	UP	SK	1
ST. JOSEPH RIVER	MUSKEGON	MID	MI	4
ST. JOSEPH RIVER	MUSKEGON	UP	MI	7
WHITE RIVER	MUSKEGON	UP	MI	1
WHITE RIVER LOWER	MANISTEE	UP	MI	1

Table 7.-Length, weight, condition factor (K_{TL}), and percent water for hatchery steelhead stocked in 1996-1998. Skamania strain steelhead are identified by the letters "SK" and Michigan strain fish are identified by the letters "MI".

HATCHERY	DATE	STRAIN	SAMPLE SIZE	MEAN		SE	MEAN WEIGHT (g)	SE	K_{TL}	SE	% WATER		SE
				LENGTH (mm)	LENGTH (mm)						WATER	WATER	
ARDEN POND	Mar-97	SK	80	163	2	41	1	9.25	0.06	25.5	0.1		
ARDEN POND	Mar-97	MI	26	144	3	30	2	9.74	0.14	25.7	0.2		
ARDEN POND	Jan-98	?? ³	14	137	3	22	1	8.23	0.06				
BODINE	Mar-97	SK	41	198	3	72	4	9.04	0.13	26.3	0.2		
BODINE	Mar-97	SK	47	174	4	50	3	8.80	0.11	22.6 ¹	0.4 ¹		
BODINE	Sep-97	SK	60	105	2	11	1	9.29	0.11	23.0 ²	0.3 ²		
WOLF LAKE	Jan-97	MI	60	147	2	33	2	9.82	0.08	27.0	0.2		
WOLF LAKE	Jan-97	SK	60	145	2	28	1	8.92	0.06	25.5	0.2		
WOLF LAKE	Apr-97	MI	180	189	2	71	2	9.86	0.06	26.7	0.2		
WOLF LAKE	Apr-97	SK	60	187	3	64	3	9.53	0.07	26.1	0.2		
WOLF LAKE	Oct-97	MI	60	96	1	9	0	9.76	0.13	25.4	0.2		
WOLF LAKE	Oct-97	SK	60	97	1	9	0	9.95	0.08	24.9	0.1		

¹ Sample Size=27 fish for percent water estimates.

² Sample Size=38 fish for percent water estimates.

³ Fish have not been dried. After drying CWT tags will be removed and their strain determined.