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Little Manistee River Weir
Steelhead Egg-Take Report, 1967-92

Ralph Hay*

Platte River Hatchery
15210 U.S. 31
Beulah, Michigan 49617

Abstract.–Winter steelhead have been collected each spring at the Little Manistee River weir facility since 1968. These wild fish are the only source of Michigan-strain steelhead eggs reared in Michigan hatcheries. The earliest weir installation was 2 March and the latest removal was 28 April. The weir was operated for an average of 37 days a year during this period. Egg collection began when approximately 50% of females are ripe. The number of adults returning to the weir each spring has ranged from 996 to 10, 480. The annual catch per weir-day ranged from 41 to 283. Steelhead eggs collected since 1968 have been sent to various Michigan hatcheries, several states, and two foreign countries. The number of eggs collected annually has ranged from 1.2 million to 8.8 million. Average percent eye-up of fertilized eggs has ranged from 63 to 96%, with most years exceeding 80%. Since 1979, an average of 77% of the steelhead had smolted after two summers in the stream. Size of returning adults is more dependent upon years spent in Lake Michigan than on age at smolting. Length at age for steelhead has fluctuated since 1979, and few fish live to lake age 5 or 6. Sex ratio (percent females) has not changed dramatically since 1979, with an average of 68%. Steelhead may spawn more than once. Percent lamprey marks (wounds/scars) was highest in the late 1960s and early 1970s, then decreased to less than three percent in recent years. The State Fish Pathologist has examined samples of fish each year since 1972. Bacterial kidney disease (BKD) was not detected in the 1970s, but has been detected since 1988.

Steelhead *Oncorhynchus mykiss* (the anadromous form of rainbow trout) were first introduced from the Pacific Coast into the Great Lakes in the late 1800s (MacCrimmon 1972). This species established itself in many rivers, one of the first being the Little Manistee River. Adult collection for hatchery operations has been conducted at different locations on the river, such as Fox Bridge in Lake County (1926-1929) and Link's ponds in Manistee County near Six Mile Bridge (1967), since the start of the program. Annual recorded runs, during March to May from 1926 through 1929, ranged between 1,123 and 2,274 fish at Fox Bridge. Construction of a permanent facility for adult and gamete collection was begun in 1967 and completed in 1968. This facility is located about 5 miles upstream from Manistee Lake, Manistee County, and consists of a blocking weir, fish ladder, holding ponds and a fish harvest and egg collection building (Figure 1). Since 1968, this facility has been used to collect salmon and steelhead gametes, and to monitor population trends.

From 1967 to present, Little Manistee River has been planted annually with spring fingerling chinook salmon *Oncorhynchus tshawytscha* and yearling coho salmon *Oncorhynchus kisutch* (Table 1). All returning adult chinook and coho salmon reaching the weir are harvested and sold

*Retired, 2002

to a commercial contractor, while other salmonids are passed upstream. Chinook salmon harvested at the Little Manistee weir each fall are Michigan's primary source of eggs for in-state and out-of-state hatchery rearing, and coho salmon harvested serve as a back-up to the Platte River's upper weir for eggs. Biological data have been collected on returning salmon since 1968. Results of the fall operation since 1983 are discussed in detail in a series of technical reports prepared annually (Hay 1992), but this is the first of such reports focusing specifically on steelhead.

Atlantic salmon *Salmo salar* yearlings were planted on four occasions in the Little Manistee River between 1977 and 1982 (Table 1). Returns from these plants were very low and the plants have been discontinued.

Little Manistee River is one of the highest quality steelhead streams in Michigan. The river's population of steelhead is supported almost entirely by natural reproduction (Seelbach 1993). However, experimental plants of hatchery fish reared from Little Manistee eggs were made in 1981, 1982, 1983, and 1984 (Table 1). The 1981-1983 plants were part of a research project on steelhead production. In 1984, three strains of summer steelhead (Siletz, Rogue, and Umpqua River) were imported from the State of Oregon (Table 1). Yearlings of all three strains were planted in Little Manistee River to extend the steelhead fishery, but this extended fishery never developed.

History of Weir Operations

Winter steelhead have been collected each spring at the Little Manistee River weir facility since 1968. These wild fish are the only source of Michigan-strain steelhead eggs reared in Michigan hatcheries.

Weir operations have varied over the past 25 years. The earliest weir installation was 2 March and the latest removal was 28 April (Table 2). The weir was operated for an average of 37 days a year during this period.

In general, weir grates are installed in early March (depending on weather and runoff) to block migrating adult steelhead. When adequate numbers of fish are observed below the weir (approximately the last week of March), river pumps are turned on to fill earthen holding ponds with water and the fish ladder is opened to allow steelhead to enter the facility. Fish are directed into holding ponds where they ripen.

Each week, fifty randomly selected fish are sampled for ripeness. Biological data collected from the sample include sex, length, weight, and scale samples for age determination. Fish are also examined for tags, fin clips, and lamprey marks. Egg collection begins when approximately 50% of females are ripe. All fish handled during biological sampling and egg-take are placed in a recovery tank for a short period and then released to the river upstream from the weir.

Duration of egg-take depends on number of fish in the run, their ripeness, and number of eggs required. When the egg quota is reached the fish ladder is closed and all fish remaining in the ponds are counted and transferred upstream from the weir. Pumps are then turned off, ponds drained, and weir grates removed. All subsequent fish in the run are allowed to ascend the river uninhibited.

Number of adults returning to the weir during spring has ranged from 996 to 10,480 (Table 2). However, a more meaningful measure is catch per unit of effort (CPUE) or catch per weir-day, assuming catch is representative of number of fish migrating. Annual CPUE has ranged from 41 to 283 (Table 2).

Spawn taking procedures have changed over the years. Initially, eggs were removed by hand stripping and later by injection of oxygen (via a needle) into the body cavity. Eggs have been collected in netting (allowing ovarian fluids to drain) or in plastic pans. In early years, sperm was collected from several males and then added to eggs of each female. In recent years, sperm from one or two males was added directly to eggs of each female and the egg/sperm mixture from 20 females was combined in a 5 gallon pail prior to addition of river water.

Eggs collected since 1968 have been sent to various Michigan hatcheries, several states, and two foreign countries (Table 3). Number of eggs collected annually ranged from 1.2 million to 8.8 million (Table 3).

Only once since 1968 did the egg-take operation end before 1 April (Table 4). That early egg-take (1983) corresponded to a very mild winter. The earliest and latest dates for

egg-take operations were 19 March and 26 April, respectively. Length of egg-take operations is determined by the quota and ripeness of females and in recent years has generally lasted about one week.

Average percent eye-up of fertilized eggs has ranged from 63 to 96%, with most years exceeding 80% (Table 4).

Steelhead have historically been aged using scales. In aging anadromous fish, the number preceding the decimal denotes age at smolting (termed stream age) and the number following the decimal represents the number of summers or annuli formed in the Great Lakes (termed lake age). Most spring steelhead return to the stream at ages 1.1, 2.1, 1.2, 2.2, 1.3, 2.3, 1.4, 2.4, 1.5, or 2.5. Most steelhead in the Little Manistee River smolt after two summers in the stream. Since 1979, the percentage smolting at stream age-2 has ranged from 56 to 88% with an average of 77% (Table 5).

Size of returning adults is more dependent upon years spent in Lake Michigan than on age at smolting. Length and weight at lake age for steelhead have fluctuated since 1979 (Tables 6 and 7), and few fish live to lake age 5 or 6.

In recent years the percentage of older fish in the run has increased. From 1979 through 1982 there were no lake age-5 fish collected, but since 1982 the percentage has steadily increased (Table 8). The percentage of lake age-6 fish has also increased since 1987.

Sex ratio (percent females) has not changed dramatically since 1979 (Table 4). The ratio ranged from 60 to 77% with an average of 68%.

Steelhead may spawn more than once. Age at which a fish spawns can be determined by close examination of scales. The percentage of repeat spawners for lake age-4 fish has declined since 1982 (Table 9). Increased mortality may be a reason for the decrease. For lake age-3 fish the trend was not as clear.

Percent lamprey marks (wounds/scars) was highest in the late 1960s and early 1970s (Table 2). In the last several years, wounding rates have been less than three percent.

Samples of fish have been examined each year since 1972 by the State Fish Pathologist. Bacterial kidney disease (BKD) was not detected in the 1970s but has been detected since 1988 (Table 10). This is similar to the trend observed in chinook salmon, although it has occurred a few years later.

Weir Operations, 1992

On 2 March 1992, weir grates were installed to block anadromous fish. On 30 March ponds were filled and the fish ladder was activated. Steelhead were passed upstream of the weir beginning on 31 March. The weir remained operational until 16 April, which time grates were removed. The weir was in operation for 45 days.

Steelhead Trout

The spring run of 4,595 fish in 1992 (CPUE of 102) was second lowest since 1982 (Table 2). Biological data were obtained during the run from a random sample of 302 steelhead to provide information on age composition and growth. Seventy-five percent of the steelhead had smolted after two summers in the stream, and 23% had smolted after 1 summer (Table 5). Steelhead which had spent three or four summers in Lake Michigan accounted for 71% of the run (Table 8). Number and weight, by lake age and sex of steelhead taken in spring 1992, are listed in Table 11.

Females constituted about 63% of the total run: 59% of lake age-2, 64% of lake age-3, 63% of lake age-4, 75% of lake age-5, and 80% of lake age-6 (Table 11). No lake age-1 females were collected. Mean length and weight, by lake age, of males and females combined are listed in Tables 6 and 7.

Percentage of repeat spawners for lake age-3 and 4 fish were 18% and 69%, respectively. Although higher than the previous two years, the downward trend since 1982 continued and was most noticeable for lake age-4 fish.

The 1992 steelhead egg-take operation began 2 April and ended 13 April. During this 11-day period, 2.2 million eggs were collected from 421 females, of which 1.9 million were for Michigan hatcheries and 0.3 million were for out-of-state commitments (Table 12).

Egg-take operations began when the proportion of ripe females approached 50%. Eggs from each female were collected in a

plastic pan and sperm from one or two males was added. Eggs from about 20 females were placed in a 5 gallon plastic pail and allowed to stand 15 minutes before water hardening. Fertilized eggs were water-hardened in flowing river water for 1 h prior to transportation. Percent eye-up was normal (89%) for steelhead (personal communication with hatchery biologists). Fecundity was approximately 5,300 eggs per female, which is better than the 23-yr average of 5,100 eggs per female (Table 4).

For the last two days of egg-take, when water temperatures are usually highest, maximum recorded river water temperature was 49^0F (9 April) and minimum was 38^0F (12-14 April) (Table 13).

Only 0.3% of the steelhead sampled had lamprey wounds or scars (Table 2). This was the lowest wounding/scarring rate since 1977.

A total of 302 steelhead were examined for fin clips. Three distinct clips were recorded; adipose (Ad, 1 fish), left maxillary (LM, 3 fish), and right maxillary (RM, 2 fish). Origin of the Ad-clipped steelhead could not be determined since it was not sacrificed to recover the coded wire tag implanted in its head. One of the LM fish was planted in 1989 and another in 1990 by Wisconsin Department of Natural Resources (WDNR) in the Root and/or Kewaunee River. Both fish were Chambers Creek strain. Origin of the third LM fish could not be determined since fin clip, aging (from scale samples), and planting records did not coincide. The two RM fish were planted in 1988 by WDNR in the Root River and were Skamania strain.

Brown Trout

No brown trout were collected at the weir in 1992.

Coho Salmon

Five adult coho salmon were collected at the weir in 1992. Numbers collected in previous springs have ranged from 0 to 99 (Table 2).

Chinook Salmon

Three adult chinook salmon were collected at the weir in 1992. One of these fish was a 20 pound, ripe female. Numbers collected in previous springs have ranged from 0 to 7 (Table 2).

Summary for 1992

In 1992, the Little Manistee weir was in operation from 2 March through 16 April (45 days). Steelhead passage and egg-take operations occurred from 31 March through 16 April.

During steelhead egg-take operations (2 April through 13 April), 421 females were stripped to obtain 2.2 million eggs. Percent eye-up ranged from 85 to 95 percent.

The 1992 steelhead run of 4,595 fish included 6 different lake-age groups. Forty-one percent of the fish were lake age-3. Of six marked fish, two were identified as Skamania strain of summer steelhead planted in Lake Michigan, two were Chambers Creek strain, and the origin of the remaining two could not be determined.

Recommendations for 1993

Biological data from 50 randomly selected steelhead each week should continue to be collected during the weir operation in 1993. The "dry" method for steelhead egg-take should be continued. This method involves mixing eggs (from several females) with sperm in a 5-gallon plastic pail without water and letting the mixture stand for 15 minutes before water hardening.

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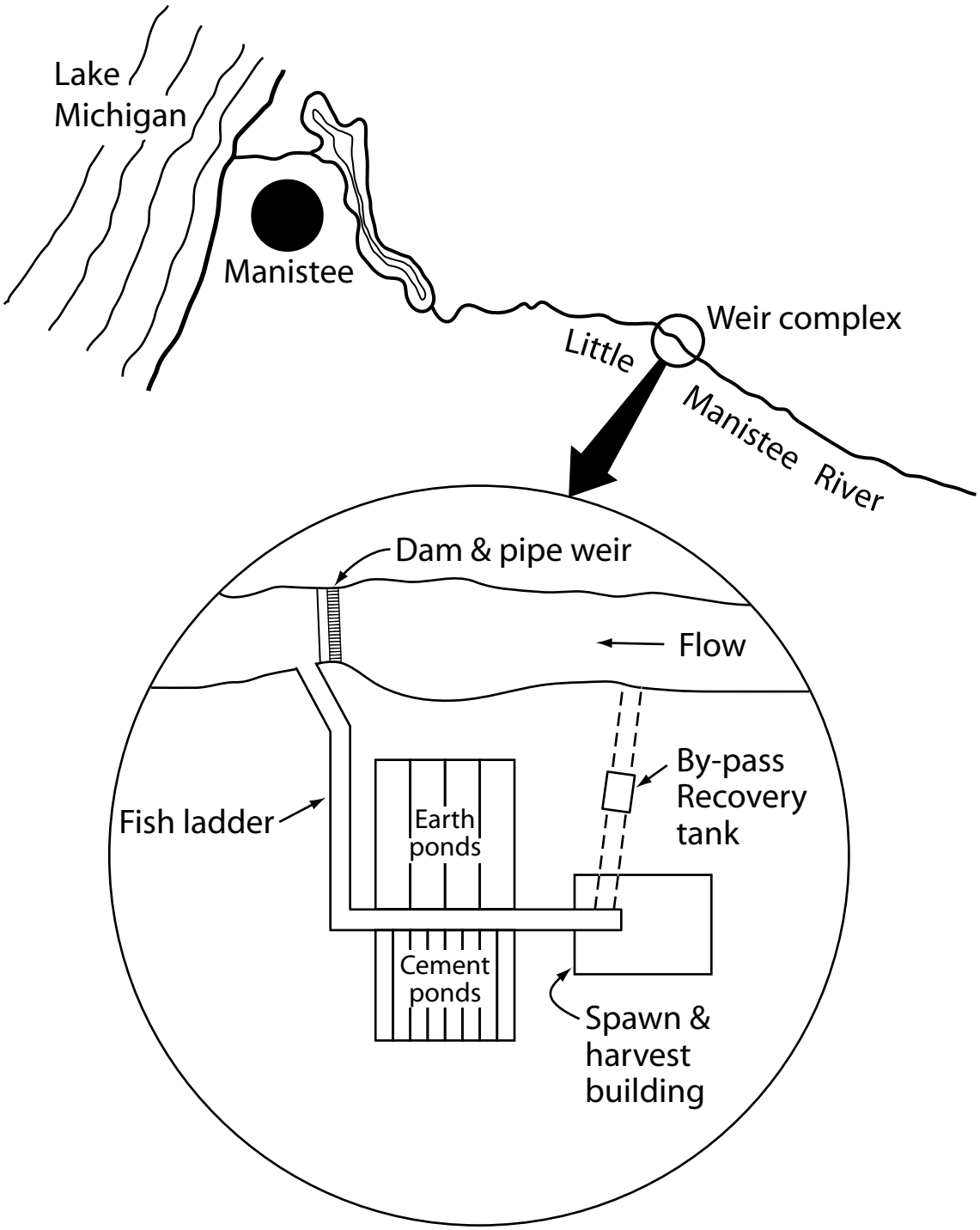

Figure 1.–Location and schematic diagram of the Little Manistee River weir complex.

Table 1.–Planting history of anadromous salmonines in the Little Manistee River since 1967. Age of fish at planting are spring fingerling (SF), fall fingerling (FF), and yearling (Y). Fin clipped fish are indicated with Ad (adipose) and RV (right ventral). All fish planted with an adipose clip after 1985 were tagged with a small coded wire in the snout. All chinook planted in Lake Michigan since 1990 were marked with oxytetracycline.

Year	Salmon			Steelhead
	Chinook (SF)	Coho (Y)	Atlantic (Y)	
1967	590,830	433,215	---	---
1968	321,912	148,365	---	---
1969	300,000	700,002	---	---
1970	308,900	550,012	---	---
1971	301,868	91,674	---	---
1972	300,908	150,067	---	---
1973	356,140	165,714	---	---
1974	402,330	150,067	---	---
1975	300,144	200,601	---	---
1976	301,300	400,282	---	---
1977	250,200	358,832	7,497	---
1978	400,028	302,980	15,000	---
1979	603,098	675,000	---	---
1980	550,272	400,158	---	---
1981	500,204	202,815	19,529	93,673 (FF)
	---	---	---	30,700 (Y)
1982	600,294	200,000	25,030	100,000 (FF)
	---	---	---	30,000 (Y)
1983	677,250	429,612	---	16,428 (Y)
1984	805,773	500,066	---	5,079[1] (Y)
	---	---	---	5,000[2] (Y)
	---	---	---	4,817[3] (Y)
1985	500,012	375,283	---	---
1986	450,273	343,121	---	---
	19,721[4] (Ad)	---	---	---
1987	372,325	266,914	---	---
	63,321[4] (Ad)	---	---	---
1988	523,400	358,250	---	---
	78,143[4] (Ad)	---	---	---
1989	659,858	400,883	---	---
	60,494[4] (Ad)	---	---	---

Table 1.–Continued.

Year	Salmon			Steelhead	
	Chinook (SF)	Coho (Y)	Atlantic (Y)		
1990	77,444[4] (Ad)	225,007	---	---	
	107,031[5] (Ad)	---	---	---	
	297,845[5] (RV)	---	---	---	
	205,109 (Ad)	---	---	---	
	100,000	---	---	---	
1991	106,958[5] (Ad)	355,403	---	---	
	296,394[5] (RV)	---	---	---	
	211,979 (Ad)	---	---	---	
	65,000	---	---	---	
1992	302,298[5] (Ad)	300,440	---	---	
	5,760,505	---	---	---	
Total	12,945,106	8,684,763	67,056	293,861	(FF)
	---	---	---	92,024	(Y)
Average	497,889	334,029	16,764	97,954	(FF)
	---	---	---	23,006	(Y)

[1]Siletz River strain of summer steelhead
[2]Rogue River strain of summer steelhead
[3]Umpqua River strain of summer steelhead
[4]Triploid chinook salmon (Michigan strain)
[5]New York strain

Table 2.–Operational days, numbers and catch per unit of effort (CPUE), percent of steelhead with lamprey marks, and number of salmon collected at the Little Manistee River weir, spring 1968-92.

	Weir Grates		Weir	Steelhead		Lamprey	Salmon	
Year	In	Out	days	Numbers	CPUE	marks	Coho	Chinook
1968	03/18	04/01	14	1,640	117.1	10.2	--	--
1969 [1]	03/17	04/18	24	996	41.5	5.3	--	--
1970	03/16	04/01	16	1,405	87.8	1.8	--	--
1971	03/15	04/26	42	5,031	119.8	5.5	--	--
1972	03/15	04/27	43	7,403	172.2	2.4	--	--
1973	03/05	04/12	38	6,588	173.4	2.3	1	0
1974	03/15	04/22	38	3,684	96.9	3.6	--	--
1975	03/06	04/25	50	7,183	143.7	2.5	--	--
1976	03/09	04/09	31	1,874	60.5	0.9	--	--
1977	03/09	04/15	37	10,480	283.2	0.2	--	--
1978	03/09	04/21	43	7,240	168.4	0.9	14	3
1979	03/08	04/27	50	3,540	70.8	--	2	1
1980	03/10	04/28	49	4,505	91.9	0	2	4
1981	03/05	04/17	43	6,307	146.7	1.4	--	--
1982	03/09	04/27	49	4,100	83.7	--	--	--
1983	03/02	03/29	27	5,091	188.6	3.9	--	--
1984	03/02	04/10	39	7,950	203.8	1.4	16	5
1985	03/06	04/12	37	6,517	176.1	--	--	--
1986	03/11	04/11	31	7,036	227	1.5	2	5
1987	03/04	04/09	36	6,315	175.4	2.5	99	4
1988	03/07	04/07	31	8,432	272	0.5	0	7
1989	03/22	04/21	30	5,102	170.1	2	1	7
1990	03/12	04/26	45	4,411	98	3.2	2	0
1991	03/05	04/08	34	6,109	179.7	0.3	0	0
1992	03/02	04/16	45	4,595	102.1	0.3	5	3
Total			922	133,534			14	39
Average			36.9	5,341	143.7			

[1] For 8 days during this period (3/17-4/18) the weir grates were removed to allow passage of adults upstream. Unknown numbers moved upstream.

Table 3.–Numbers and destination of steelhead eggs collected at the Little Manistee weir, spring 1968-92.

Year	Total egg-take (Millions)	Michigan destination (Millions)	Out-of-State Destination (Millions)	
1968	1.2	1.2	0	
1969	---	---	---	
1970	2.9	2.8	0.1	MS
1971	5.8	5.6	0.2	MO, FRANCE
1972	7.9	7.3	0.6	MN, NY, VT
1973	6.9	5.6	1.3	MN, NY, OH, PA, VA, CANADA
1974	4.9	3.6	1.3	NY, NC, OH, PA, VA, CANADA
1975	5.2	4.4	0.8	NC, OH, PA, VT
1976	2.5	2.4	0.1	NC
1977	1.6	1.2	0.4	NC, OH, PA
1978	5.9	5.1	0.8	NC, PA
1979	4	3.2	0.8	NY, PA
1980	3.9	3.1	0.8	MN, NY, PA
1981	5.4	4.3	1.1	MN, IN
1982	6.6	5.4	1.2	MN, IN
1983	6	4.5	1.5	MN, IN
1984	8.8	6.5	2.3	MN
1985	7	4	3	MN
1986	5.5	2.4	3.1	MN
1987	5	1.9	3.1	MN, IN
1988	6.3	1.9	4.4	MN, IN
1989	4.6	2.2	2.4	MN, IN
1990	3.7	1.5	2.2	MN, IN, OH
1991	8.1	2	6.1	MN, IN
1992	2.2	1.9	0.3	IN
Total	121.9	84	37.9	

Table 4.–Dates, fecundity, percent eye-up, and sex ratio for steelhead egg-take operations at the Little Manistee weir, spring 1968-92.

Year	Spawning dates		Eggs per female	Percent eye-up			Percent females
	Begin	End		Minimum	Maximum	Mean	
1968	03/22	04/03	---	57	77	63	77
1969	---	---	---	---	---	---	--
1970	03/30	04/13	4,665	73	90	83	--
1971	04/06	04/20	5,256	66	90	74	--
1972	04/03	04/19	5,683	85	90	88	--
1973	03/19	04/03	5,529	65	91	76	--
1974	03/28	04/22	4,737	72	91	84	--
1975	03/21	04/08	4,367	70	93	79	--
1976	04/02	04/08	4,694	81	90	85	--
1977	03/30	04/07	4,888	91	95	94	--
1978	03/31	04/18	4,457	87	94	92	--
1979	04/10	04/17	4,122	74	93	88	71
1980	04/03	04/11	4,372	85	94	90	72
1981	04/03	04/10	5,111	74	94	84	70
1982	04/02	04/26	4,583	70	92	79	65
1983	03/22	03/28	6,253	92	96	95	62
1984	03/27	04/09	6,008	---	---	---	68
1985	04/04	04/12	6,061	---	---	---	67
1986	04/04	04/11	5,211	---	---	---	67
1987	04/03	04/10	5,345	50	77	68	63
1988	04/01	04/07	4,756	94	98	96	60
1989	04/17	04/21	4,717	82	90	86	77
1990	04/09	04/26	4,832	77	90	85	69
1991	04/01	04/08	5,609	89	90	90	69
1992	04/02	04/13	5,270	85	95	89	63
Average			5,066				68

Table 5.–Percentage of adult steelhead smolting at stream age 1 and 2 that were collected as returning adults at the Little Manistee weir, spring 1979-92.

Year	Percent at Stream Age	
	1	2
1979	24.7	75.3
1980	29.5	70.5
1981	15	85
1982	14.4	85.6
1983	11.7	88.3
1984	18.9	81.1
1985	24.2	75.8
1986	19	81
1987	43.9	56.1
1988	25	75
1989	30.3	69.7
1990	21.5	78.5
1991	24.7	75.3
1992	23.2	74.8
Average	23.4	76.6

Table 6.–Mean length (in) by lake age of steelhead collected at the Little Manistee weir, spring 1979-92. Two standard errors in parentheses.

	Length at lake age					
Year	1	2	3	4	5	6
1979	17.2	24.1	26.9	29.1	---	---
	(0.54)	(2.94)	(2.80)	(3.16)	---	---
1980	19.9	24.6	27.8	28.9	---	---
	(0)	(2.32)	(2.96)	(2.86)	---	---
1981	---	25.5	28.4	29.4	---	---
	---	(3.26)	(2.56)	(3.84)	---	---
1982	18.1	25.5	28.7	30.4	---	---
	(2.16)	(2.84)	(3.54)	(3.80)	---	---
1983	18.6	25.6	29.1	30.3	30.5	---
	(4.72)	(2.76)	(2.64)	(2.94)	(0)	---
1984	18.9	25.6	29	30.9	31.8	---
	(2.10)	(2.68)	(2.40)	(3.02)	(4.36)	---
1985	19.8	25.6	28.7	31	32.5	---
	(3.24)	(2.08)	(3.00)	(3.16)	(3.06)	---
1986	19.8	25.5	29	30.5	32.2	---
	(0)	(3.04)	(3.00)	(3.60)	(4.24)	---
1987	21.3	26.4	29	30.5	31.9	---
	(1.14)	(2.54)	(2.74)	(3.20)	(0.84)	---
1988	18.1	25.5	28.7	30	31.8	28.5
	(0)	(2.76)	(2.60)	(2.92)	(5.10)	(0)
1989	19.1	25.3	28.3	30.4	31.9	---
	(0)	(2.76)	(2.66)	(3.34)	(3.16)	---
1990	20.8	25.4	28.7	30.4	30.9	29.8
	(3.96)	(3.02)	(3.44)	(4.10)	(3.88)	(1.84)
1991	18.1	24.8	28.5	29.7	30.3	31.5
	(2.28)	(1.84)	(3.08)	(2.64)	(2.86)	(0.42)
1992	18.3	24.9	27.5	29.3	31	31.9
	(1.90)	(2.60)	(3.00)	(3.78)	(2.80)	(3.68)

Table 7.–Mean weight (lbs) by lake age of steelhead collected at the Little Manistee weir, spring 1979-92. Two standard errors in parentheses.

	Weight at lake age					
Year	1	2	3	4	5	6
1979	1.8	5.1	6.7	8.3	---	---
	(0.22)	(2.42)	(2.22)	(3.32)	---	---
1980	2.7	5.4	7.7	8.5	---	---
	(0)	(1.56)	(2.16)	(2.38)	---	---
1981	---	6.1	8.3	9.4	---	---
	---	(1.86)	(2.50)	(4.04)	---	---
1982	2.2	6.1	8.3	9.7	---	---
	(0.68)	(1.98)	(3.02)	(4.44)	---	---
1983	2.8	6.4	9	10.2	9.5	---
	(1.68)	(2.16)	(2.38)	(2.56)	(0)	---
1984	2.5	6.5	9.3	11	12.7	---
	(1.04)	(1.88)	(2.40)	(3.04)	(3.80)	---
1985	3	6.2	8.5	10.3	11.5	---
	(2.38)	(1.82)	(2.52)	(3.24)	(3.82)	---
1986	2.8	5.9	8.3	9.6	11	---
	(0)	(2.12)	(2.70)	(3.80)	(2.84)	---
1987	3.7	6.8	8.7	9.8	10.8	---
	(0.98)	(1.86)	(2.20)	(3.08)	(1.10)	---
1988	2.1	6	8.1	9.1	10.6	8.3
	(0)	(1.92)	(2.48)	(2.72)	(3.22)	(0)
1989	2.4	5.8	7.9	9.4	10.1	---
	(0.84)	(2.06)	(2.44)	(3.66)	(4.26)	---
1990	3.5	6.1	8.4	10	11.1	9
	(1.92)	(1.94)	(3.00)	(3.62)	(4.86)	(5.52)
1991	2.3	5.4	8.1	9	9.5	10.2
	(0.88)	(1.32)	(2.52)	(2.66)	(2.90)	(0)
1992	2.3	5.4	7.5	8.8	10.6	11.1
	(1.06)	(1.86)	(2.62)	(3.22)	(3.78)	(3.56)

Table 8.–Percentage of all steelhead collected at the Little Manistee weir by lake age, spring 1979-92.

Year	Percent at lake age					
	1	2	3	4	5	6
1979	1	11.5	71.5	15.9	0	0
1980	1	22.9	55.2	20.8	0	0
1981	0	12.6	73.8	13.6	0	0
1982	5.9	38.1	48.5	7.4	0	0
1983	2.2	26.8	55.4	15.2	0.4	0
1984	3.1	10.6	48.1	35.5	2.7	0
1985	2.5	36	39.9	19.8	1.8	0
1986	0.6	19.5	59.8	18.9	1.2	0
1987	0.5	23.1	52.9	22.8	0.8	0
1988	0.5	11	58	22.5	7.5	0.5
1989	1.7	34	45.3	17.3	1.7	0
1990	1.2	20.5	58.8	16.3	2.7	0.5
1991	3.3	16.7	46.7	28	4.7	0.7
1992	1.6	18.5	40.7	30.9	6.6	1.7

Table 9.–Percent of repeat spawners by lake age of steelhead collected at the Little Manistee River weir, spring 1979-92.

Year	Percent repeat spawners at lake age	
	3	4
1979	22	77
1980	13	85
1981	10	93
1982	22	100
1983	11	80
1984	22	75
1985	22	91
1986	21	97
1987	15	64
1988	8	47
1989	22	65
1990	15	48
1991	12	50
1992	18	69

Table 10.–Percentage of individual ovarian fluid samples that tested positive for bacterial kidney disease from steelhead collected at the Little Manistee weir, spring 1987-92. The "Direct Florescent Antibody Test" (DFAT) was used each year. Sample size in parentheses.

1987	1988	1989	1990	1991	1992
0	79.3	33.3	21.7	41.7	66.7
(94)	(58)	(24)	(23)	(24)	(24)

Table 11.–Number and weight, by lake age and sex, of steelhead collected at the Little Manistee River weir, spring 1992. Percent in parentheses.

	Male		Female		Total	
Lake age	Number	Pounds	Number	Pounds	Number	Pounds
1	75	174	---	---	75	174
	(1.60)	(0.50)	---	---	(1.60)	(0.50)
2	349	1,884	503	2,677	852	4,561
	(7.60)	(5.30)	(10.90)	(7.60)	(18.50)	(12.90)
3	671	4,931	1,202	9,162	1,873	14,093
	(14.60)	(14.00)	(26.20)	(25.90)	(40.80)	(39.90)
4	519	4,890	897	7,558	1,416	12,448
	(11.30)	(13.80)	(19.50)	(21.40)	(30.80)	(35.20)
5	76	758	228	2,461	304	3,219
	(1.70)	(2.20)	(5.00)	(7.00)	(6.70)	(9.20)
6	15	182	60	655	75	837
	(0.30)	(0.50)	(1.30)	(1.80)	(1.60)	(2.30)
Total	1,705	12,819	2,890	22,513	4,595	35,332
	(37.10)	(36.30)	(62.90)	(63.70)	(100.00)	(100.00)

Table 12.–Summary of the steelhead egg-take operation at the Little Manistee River weir, spring 1992.

Date	Number of females stripped	Number of eggs collected	Percent eye-up	Destination
04/02	181	1,027,000	85	Wolf Lake
04/06	21	100,000	---	Lake Superior State University University
04/09	167	800,000	95	Wolf Lake
04/13	52	292,000	---	Indiana
Total	421	2,219,000	---	
Michigan	369	1,927,000	---	
Other	52	292,000	---	

Table 13.–Daily minimum and maximum water temperatures (degrees Fahrenheit) for the Little Manistee River weir, April 1992.

Date	Minimum Temperature	Maximum Temperature
6	---	46
7	44	48
8	43	48
9	43	49
10	39	47
11	39	40
12	38	43
13	38	41
14	38	39
15	39	42
16	41	42

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