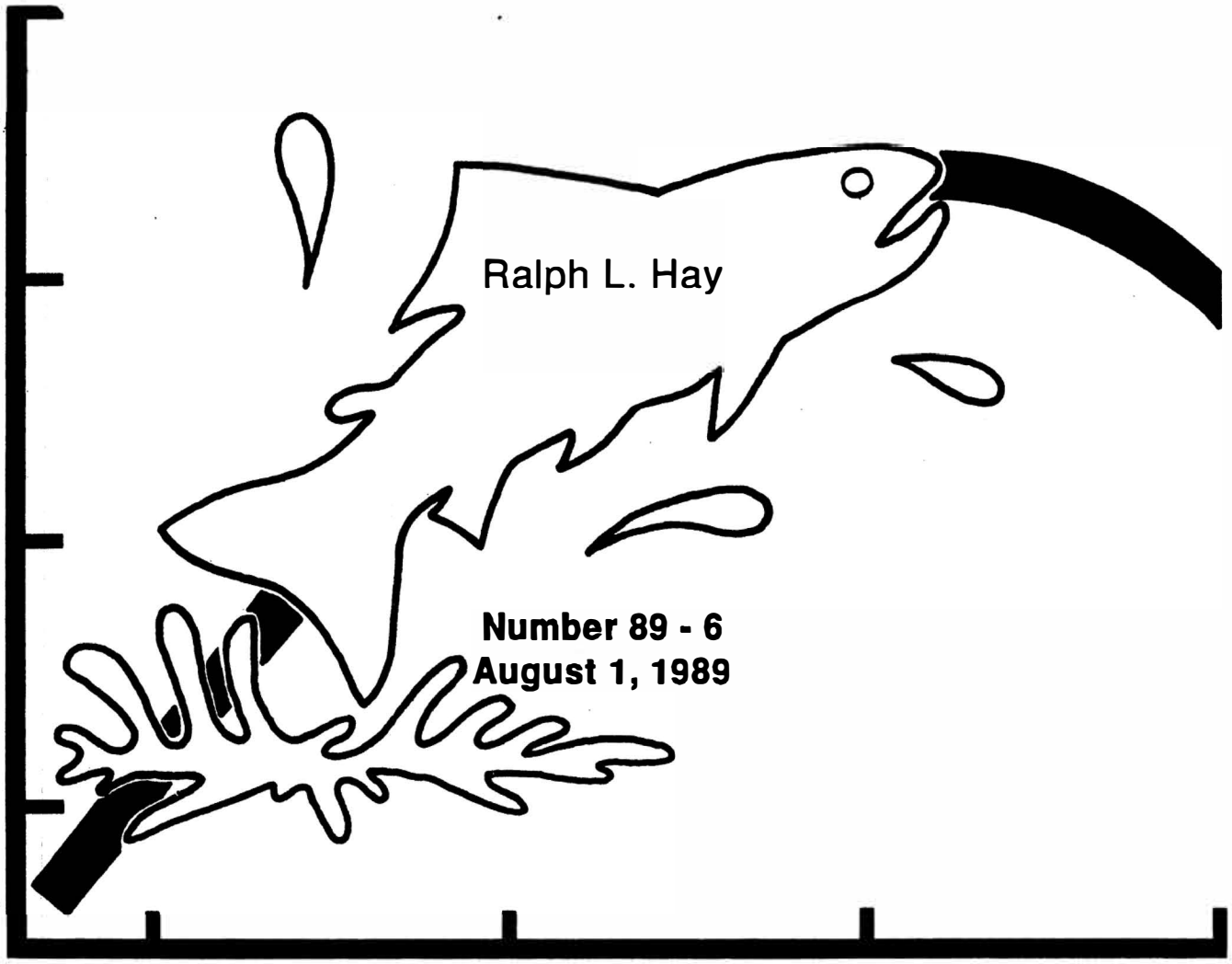
89-6

FISHERIES DIVISION

TECHNICAL REPORT

Boardman River Harvest Weir Report, 1987



Ralph L. Hay

Number 89 - 6
August 1, 1989

Michigan Department of
Natural Resources

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
FISHERIES DIVISION

Fisheries Technical Report No. 89-6
August 1, 1989

BOARDMAN RIVER HARVEST WEIR REPORT, 1987

Ralph L. Hay

INTRODUCTION

Coho and chinook salmon were stocked in Grand Traverse Bay early in the salmon program. However, because of the increased problems with large numbers of salmon returning to the Boardman River and nearby streams, it was decided to discontinue the salmon plants in the early 1980's.

In June 1984 the Traverse City Light and Power Department (TCLP), City of Traverse City (TC), and the Michigan Department of Natural Resources (MDNR) signed an agreement forming a partnership in fisheries management of the Boardman River. By the following year the MDNR began annual plantings of chinook salmon in the Boardman River to enhance the Grand Traverse Bay fishery, and issued all permits necessary to produce hydroelectric power at the Boardman and Sabin dams. The TCLP Department constructed a fish ladder at Union Street dam and a fish trap and transfer/harvest facility between the Union Street dam and the mouth of the Boardman River (Figure 1).

The fish trap and transfer/harvest facility is located 0.8 miles upstream from Grand Traverse Bay and is within the city of Traverse City. This facility is named in honor of James P. Price who was the first chairman of the Traverse City Light and Power Board and was instrumental in the agreement that was signed in 1984. Construction of the facility began early in 1987 and was completed by November. The fish ladder at the Union Street dam (1.2 miles upstream from Grand Traverse Bay) was completed about the same time as the harvest facility. Cost of both facilities including the land was about 1 million dollars.

Pacific salmon are to be harvested at the weir each fall (September and October). The trout and Atlantic salmon are permitted to migrate upstream (through the fish ladder at Union Street dam) to Sabin dam. The fish ladder at Union Street dam is operational year around. Each spring (April-July) metal plates with an overhanging lip are installed in the ladder to block the migration of adult sea lamprey.

The 1984 agreement also created the Grand Traverse Area Fisheries Advisory Council. The council consists of twelve (12) representatives from various interest groups and advises the MDNR on various fisheries issues in the area.

An average of 226,209 spring fingerling chinook have been planted annually in the Boardman River system since 1985 (Table 1). During this same time span, steelhead plants have averaged 17,182 yearlings per year.

In aging anadromous fish, the number preceding the decimal denotes age at smolting (0 for most chinook, 1 for most coho) and the number following the decimal represents the number of annuli formed in the Great Lakes (mostly 0, 1, 2, 3, 4, or 5 for chinook and 0 or 1 for coho).

Chinook return to the weir at either age 0.0 (mini-jacks), age-0.1 (jacks), age-0.2, age-0.3, age-0.4, or age-0.5—but most commonly at age-0.3.

HARVEST WEIR OPERATIONS, 1987

On August 31, 1987, the weir grates were installed to block anadromous fish. On September 21, the ponds were filled and the fish ladder was activated. Harvest began on September 22. The weir remained operational until October 23, at which time the grates were removed and the building was winterized. The weir was in operation for 54 days. All harvested chinook and coho salmon were sold on contract to Tempotech Industries, Hart, Michigan. Steelhead and brown trout were passed upstream of the weir.

Chinook salmon

Harvest of chinook salmon began September 22 and ended October 22, a period of 31 days. A few chinook began entering the river shortly after the weir grates were installed. However, the major run did not begin until late September and peaked in mid-October (Table 2). A total of 4,902 chinook were harvested in 1987 (Table 3). The calculated total weight of all chinook, in the round, was 49,996 pounds.

For several weeks during the run, biological data were obtained from a randomly selected sample of 500 chinook to provide information on age composition and growth. To overcome the problem of aging river fish with reabsorbed scales, chinook salmon length frequencies were converted to age frequencies by means of a length-age frequency table (Table 4). Data for this table were obtained from scale samples and length measurements collected from Lake Michigan fish during a creel census at several sites from August to November 1987. In applying the table to those length groups in which two or more age groups are represented, the lighter fish were assigned to the younger age group and the heavier fish to the older age group.

The estimated total harvest consisted of 1 (less than 0.1%) age-0.0 mini-jack weighing less than 1 pound; 1,210 (24.7%) age-0.1 jacks weighing 5,363 pounds; 677 (13.8%) age-0.2 adults weighing 4,528 pounds; 1,588 (32.4%) age-0.3 adults weighing 18,400 pounds; 1,335 (27.3%) age-0.4 adults weighing 19,951 pounds; and 91 (1.9%) age-0.5 adults weighing 1,754 pounds (Table 5). The 1987 run of jacks represented 0.5% of the fingerlings stocked in 1986, and the returning age-0.2 adults were 0.4% of the 1985 plant (Table 6). The rates of return for these year classes (1985 and 1986) were similar to those at the Medusa Creek weir (Fenske 1988). Return rates for age-0.3 adults and older could not be determined since the Boardman River system did not receive plants prior to 1985. These fish were either strays from other nearby plants and/or naturally produced fish in the river system.

Females constituted only about 26% of the total run—10.5% of age-0.2, 39.4% of age-0.3, 40.0% of age-0.4, and 25.3% of age-0.5 (Table 5). No age-0.0 or age-0.1 females were collected. The high percentage of males in the total run is in part due to returns of young fish (1985 and 1986 year classes) which are mostly males. Mean lengths and weights of males and

females combined were: age-0.0 (males only), 10.9 inches and 0.5 pounds; age-0.1 (males only), 22.8 inches and 4.4 pounds; age-0.2, 26.6 inches and 6.7 pounds; age-0.3, 33.0 inches and 11.6 pounds; age-0.4, 35.4 inches and 14.9 pounds; and age-0.5, 38.1 inches and 19.3 pounds (Tables 7 and 8). Growth was nearly linear on a weight basis (Figure 2). In general, females were slightly larger than males at each age.

A total of 500 chinook were examined for fin clips. Only one fin clip (adipose) was observed. Origin of this fish could not be determined since the fin clip, age (from scales), lack of coded-wire tag in snout of the fish, and planting records did not coincide. For the Great Lakes (beginning in 1985), the adipose clip is reserved for fish that are implanted with a very small coded-wire tag in the snout.

Only 1.8% of the chinook sampled had a lamprey wound (Table 9). This is considerably below the scarring rates in the 1960's and early 1970's (Hay 1988).

No chinook eggs were taken at the Boardman River weir in 1987.

In 1987 the estimated sport catch of chinook salmon from the West Arm of Grand Traverse Bay was 4,300 fish (G. Rakoczy, personal communication). It would appear that about one-half of the returning chinook are taken by anglers and the remaining fish escape upstream to the weir.

Coho salmon

In 1987 the coho harvest coincided with the chinook harvest (September 22 through October 22, a total of 31 days). The peak harvest occurred during the third week in October.

A total of 306 coho were harvested. The total weight calculated from biological samples was 1,713 pounds (Table 10).

The age composition of the harvested coho was 45 age-1.0 jacks weighing 62 pounds and 261 age-1.1 adults weighing 1,651 pounds (Table 11). Since coho have not been planted in the Boardman River, this small number represents fish that strayed from other planting locations and/or fish that were naturally reproduced in the river system. All age-1.0 and 48.3% of the age-1.1 coho were males. The total run consisted of 44.1% females. Mean lengths and weights were: age-1.0 males, 15.4 inches and 1.4 pounds; age-1.1 males, 26.4 inches and 6.3 pounds; age-1.1 females, 25.6 inches and 6.3 pounds; and age-1.1 sexes combined, 26.0 inches and 6.3 pounds (Tables 12 and 13). Adult males were slightly longer than females but their weights were equal.

Only 0.7% of the coho had lamprey wounds (Table 9). This rate was significantly less than the 1960's.

No coho eggs were taken at the Boardman River weir in 1987.

A total of 293 coho were randomly checked for fin clips. Of these fish, four (1.4%) had fin clips. Two different fin clips were observed, the left pectoral (LP) and right ventral (RV).

The LP fish (2) were either planted in 1986 by the MDNR into Lake Huron at Seymour Creek (50,000Y) or were planted by the Illinois Department of Conservation into Lake Michigan at Waukegan (77,000Y). The RV fish (2) were planted in 1986 by the MDNR into Lake Huron at Tawas River (98,735Y).

In 1987 the estimated sport catch of coho salmon in the West Arm of Grand Traverse Bay was less than 100 fish (G. Rakoczy, personal communication). This low coho catch is due to the fact that no coho are planted in Grand Traverse Bay and that these few fish taken are strays from other planting locations and/or naturally produced fish from the Boardman River system.

Steelhead trout

Only 17 steelhead (weighing 53 pounds) were collected during the weir operation (Table 14). This return is less than expected considering that the river has been stocked annually (Table 1). One possible explanation for the poor fall returns and excellent spring returns may be due to the fact that the planted fish are from spring spawners at the Little Manistee River. In an attempt to improve the fall runs, the summer strain of steelhead were planted beginning in 1986 with each plant receiving a different fin clip (Table 1).

Based upon the three weekly samples, nearly 65% of the returning steelhead were age-1.0 or age-1.1 (Table 15). Mean lengths and weights for the five different age groups are given in Table 16 and Figure 3. For all ages combined the mean length and weight were 18.4 inches and 3.1 pounds (Table 17). Size of returning adults is more dependent upon years spent in Lake Michigan that on age at smolting.

No fin clips or lamprey wounds were found on the 17 fish examined. Fifteen (15) of the steelhead were passed upstream (Table 17).

In 1987 the estimated sport catch of steelhead (rainbow) trout in the West Arm of Grand Traverse Bay was 400 fish (G. Rakoczy, personal communication).

Brown trout

Only 12 brown trout (weighing 53 pounds) were collected during the weir operation (Table 18). Despite large plants of brown trout into Grand Traverse Bay, the numbers returning to the river are very low. However, this is similar to data collected at the Little Manistee River weir (Hay 1988).

Based upon the three weekly samples, about 75% of the brown trout were age-1.0 or age-1.1 (Table 19). Mean lengths and weights for the four age groups are given in Table 20 and Figure 4. For all ages combined the mean length and weight were 20.4 inches and 4.4 pounds

(Table 21). Size of returning adults is more dependent upon years spent in Lake Michigan than on age at smolting.

No fin clips or lamprey wounds were found on the 12 fish examined. All of the brown trout were passed upstream (Table 21).

In 1987 the estimated sport catch of brown trout in the West Arm of Grand Traverse Bay was 500 fish (G. Rakoczy, personal communication).

Pink salmon

No pink salmon were harvested at the weir in 1987. However, during the harvest operation several pink salmon were observed spawning along the shoreline immediately below the weir.

In 1987 the estimated sport catch of pink salmon in the West Arm of Grand Traverse Bay was 700 fish (G. Rakoczy, personal communication).

Lake trout

No lake trout were collected at the weir in 1987. However, lake trout were in the river by late October. Immediately after the weir was opened (October 22) anglers observed them upstream at the Union Street dam.

In 1987 the estimated sport catch of lake trout from the West Arm of Grand Traverse Bay was 8,700 fish (G. Rakoczy, personal communication). This catch occurred during the period from May 1 through August 15.

SUMMARY

In 1987 the Boardman River harvest weir was in operation from August 31 through October 23 (54 days). Harvest of chinook and coho salmon and passage of other anadromous salmonids occurred from September 22 through October 22.

The entire salmon run of 4,902 chinook (49,996 pounds) and 306 coho (1,713 pounds) was harvested and sold to Tempotech Industries, Hart, Michigan.

The chinook run consisted of one age-0.0 mini-jack (less than 0.1% of the 1987 fingerling plant); 1,210 age-0.1 jacks (0.5% of the 1986 fingerling plant); 677 age-0.2 adults (0.4% of the 1985 fingerling plant); 1,588 age-0.3 adults; 1,335 age-0.4 adults; and 91 age-0.5 adults. Percent returns for the age-0.3 and older adults could not be determined since the Boardman River system did not receive chinook plants prior to 1985. These older fish were strays from other planting locations and/or naturally produced fish from the Boardman River system. Mean sizes were: age 0.0, 10.9 inches (0.5 pounds); age 0.1, 22.8 inches (4.4 pounds);

age 0.2, 26.6 inches (6.7 pounds); age 0.3, 33.0 inches (11.6 pounds); age 0.4, 35.4 inches (14.9 pounds); and age 0.5, 38.1 inches (19.3 pounds). No chinook eggs were taken at the weir in 1987.

The 1987 coho run was composed of 45 age-1.0 jacks and 261 age-1.1 adults. Percent returns could not be determined since coho have not been planted in the Boardman River. These were strays from other planting locations and/or naturally reproduced fish from the river system. No coho eggs were collected at the weir in 1987.

The 1987 fall steelhead run of 17 fish included five different age groups. Nearly 65% of these fish were age 1.0 or 1.1.

The 1987 run of 12 brown trout included four different age groups. About 75% of these fish were age 1.0 or 1.1.

Pink salmon and lake trout were observed in the river below the weir but none entered the holding ponds.

RECOMMENDATIONS FOR 1988

Biological samples should be collected on a weekly basis for all species.

Several modifications to the weir complex need to be done before the start of the 1988 season. These major changes are as follows:

1. Install lift beam in pump room and remove the two main pumps for inspection. One pump was shut down early because of a failure in the bushings.
2. Remove screened baskets from pump intakes and develop a barrier that will prevent leaves from entering the well pit.
3. Replace the existing weir panels. Spacing on the present panels are too narrow (15/16 inches clear space between bars) and are too long (8 feet). The new panels should be 1.75 inches of clear space between bars and only 5.5 feet long. Several times during the season the structure almost failed due to excessive headwater buildup caused by leaves plugging the grates.
4. Install padding in the lift baskets to reduce bruising of the fish.
5. Install additional supports to the overhead beam that the lift baskets travel along.
6. Install a bump rail along the outside edge of the loading dock to prevent the lift truck from falling off the dock.
7. Install a better handrail around the edge of the loading dock.

ACKNOWLEDGMENTS

Data collection, tabulation, and scale reading for age analyses were done by Alfred Allen, Steve Lazar, Janice Sapak, Simeon Syrewicze, Peter Makoweski, and Don Nelson. Various employees of Tempotech also assisted in the data collection. Technical advice was given by Charles Pecor and Kelley Smith. A computer program for age and data analyses was developed by Kelley Smith who also edited the report.

This partnership in fisheries management of the Boardman River would not have been possible if it were not for the cooperation of Traverse City Light and Power Department employees Thomas Miner, Donna Sivek, Robert Beagle, William Strom, Thomas Richards, Rod Simsa, and Charles Fricke (Executive Director). Employees in various other departments of the City of Traverse City have contributed to this successful program. Frank Ransley of Mead and Hunt, Inc., who worked on the design of the facility, was helpful in trouble-shooting problems during the initial year of operation. Finally, special thanks to William Strom who has been involved with the project from the beginning. His knowledge and willingness to help from the planning process through construction and operation were greatly appreciated.

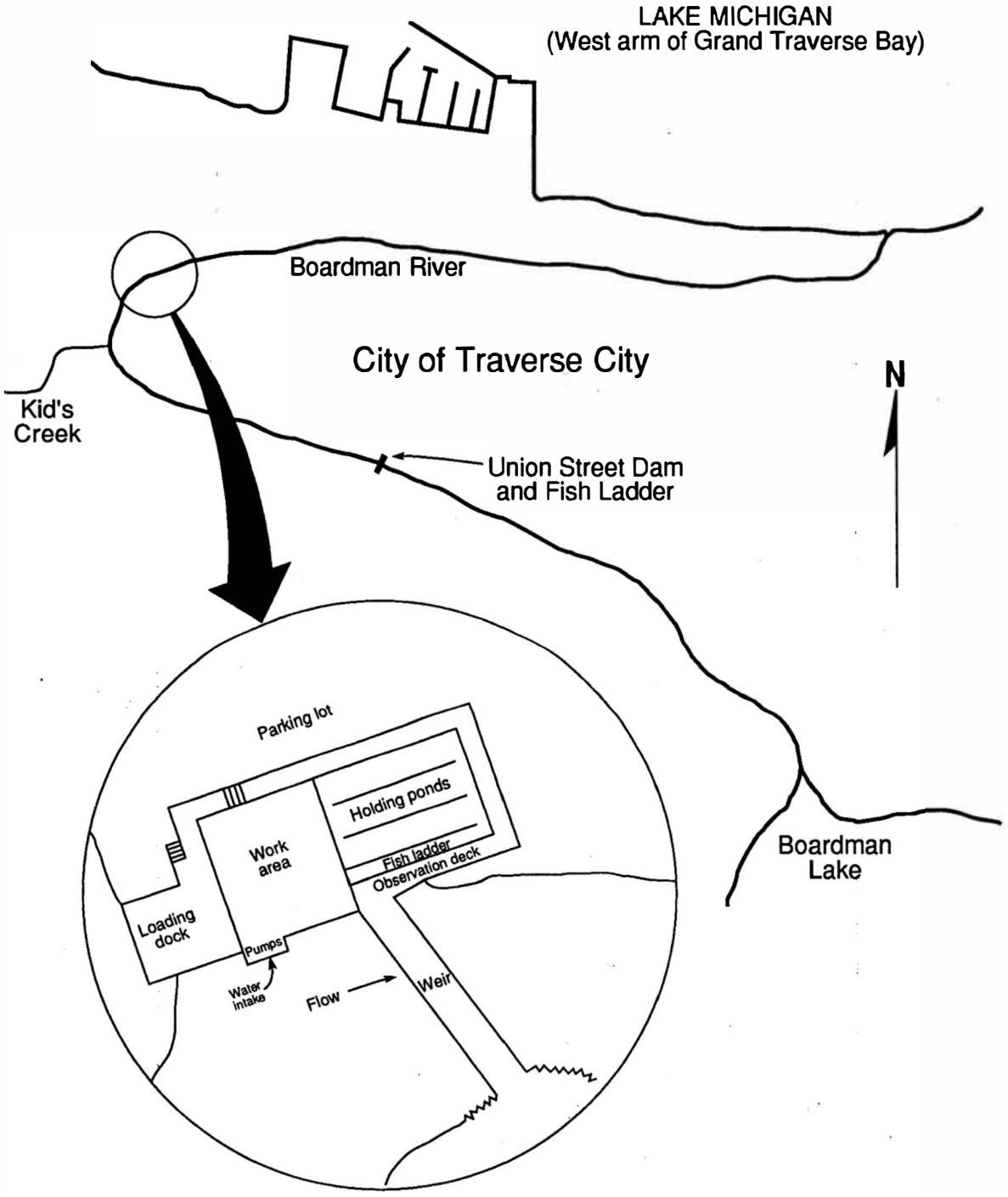


Figure 1. Location and schematic diagram of the Boardman River weir complex in Traverse City.

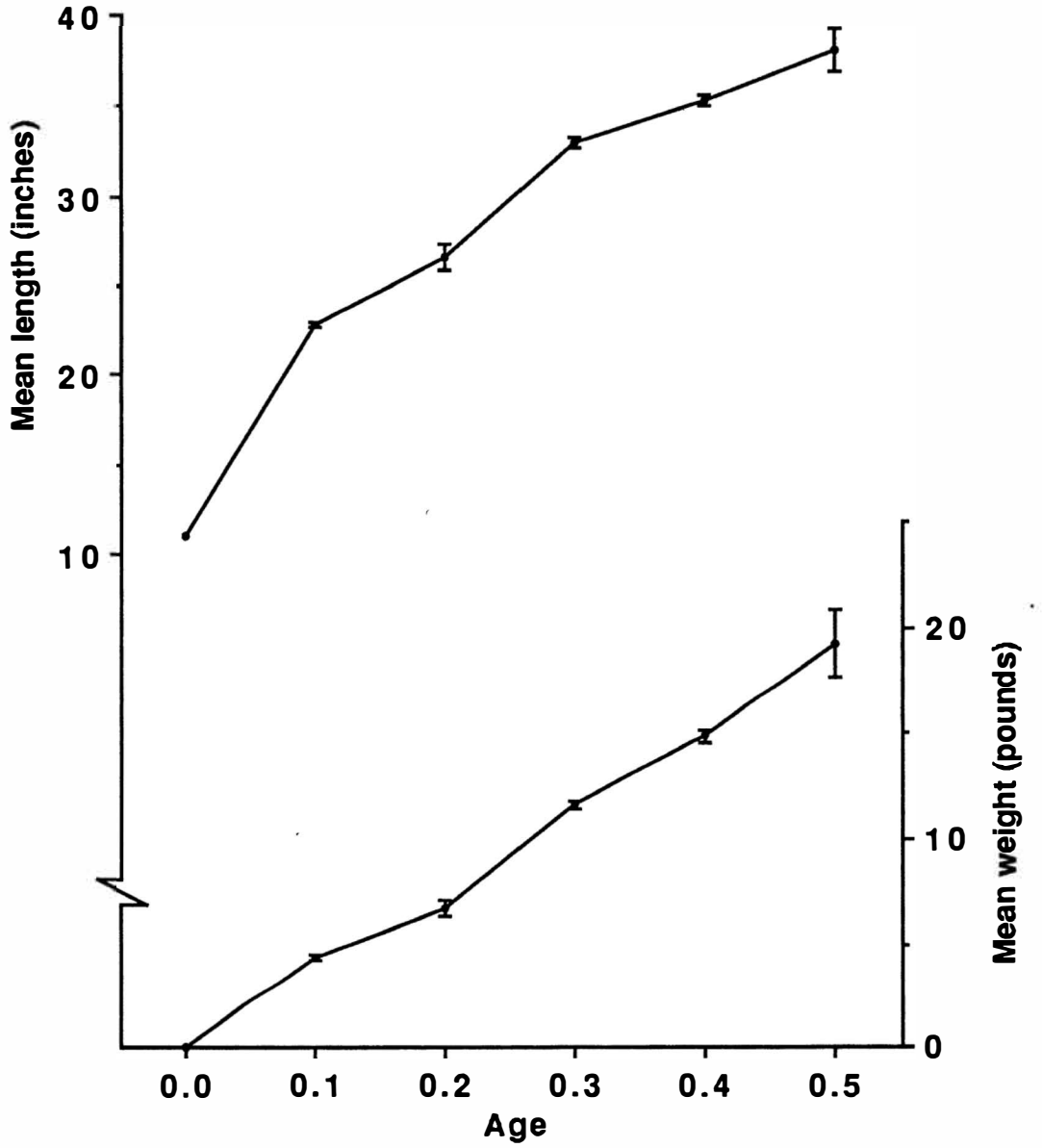


Figure 2. Mean total length (inches) and round weight (pounds), by age, of chinook salmon harvested at the Boardman River weir, fall 1987. Vertical bars represent two standard errors.

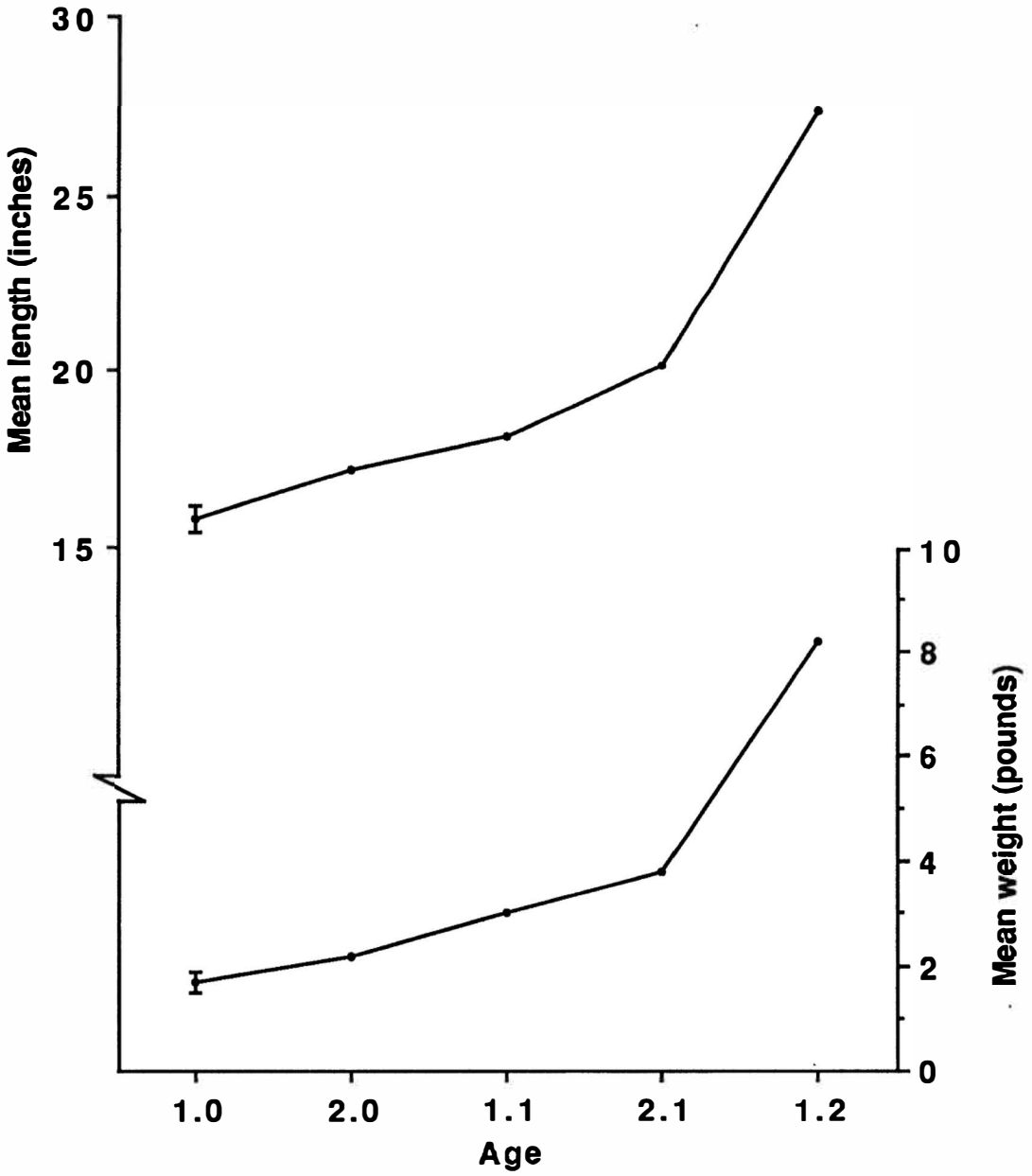


Figure 3. Mean total length (inches) and round weight (pounds), by age, of steelhead passed upstream at the Boardman River weir, fall 1987. Vertical bars indicate two standard errors.

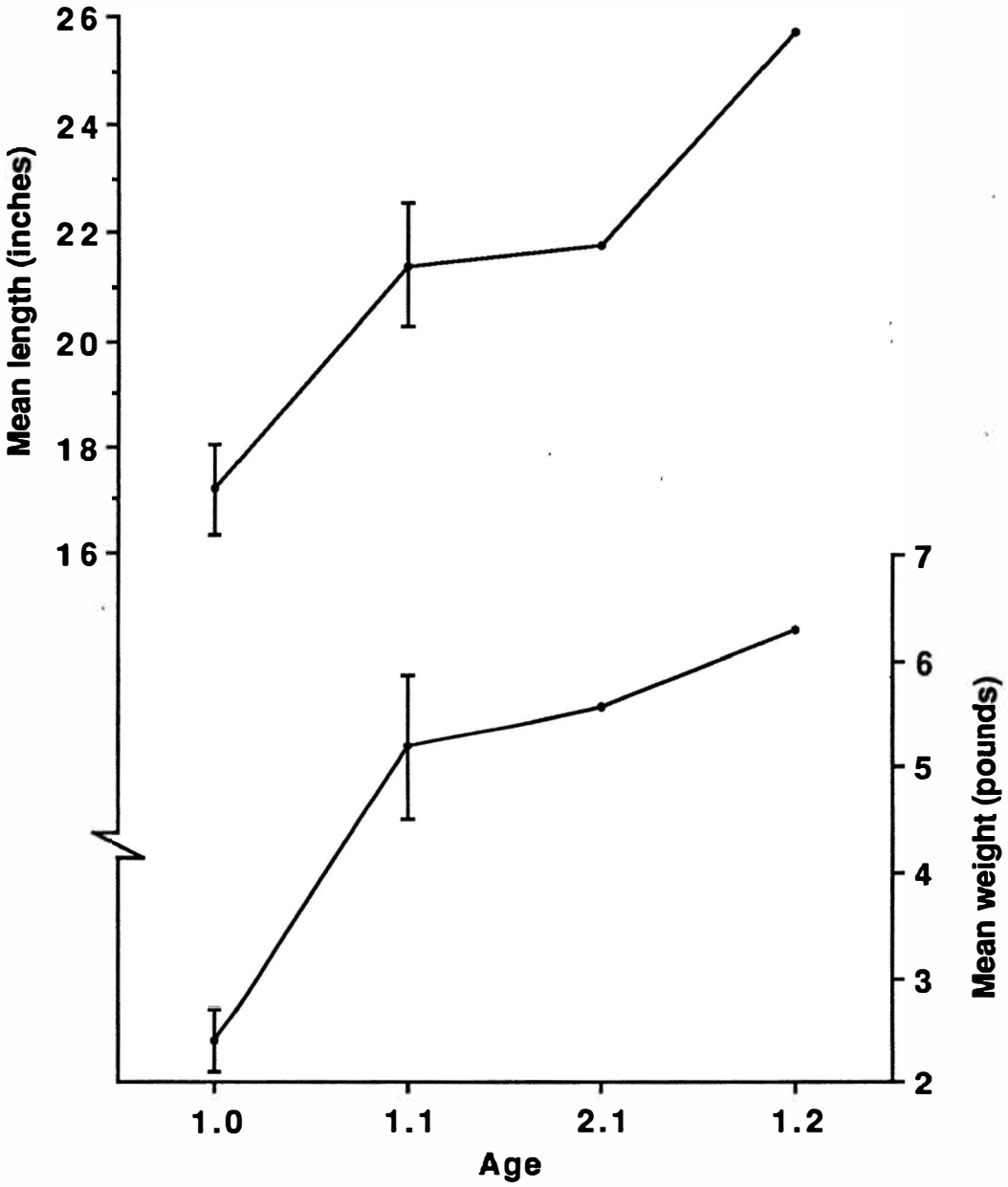


Figure 4. Mean total length (inches) and round weight (pounds), by age, of brown trout passed upstream at the Boardman River weir, fall 1987. Vertical bars indicate two standard errors.

Table 1. Planting history of chinook salmon (spring fingerlings) and steelhead trout (spring yearlings) in the Boardman River, Grand Traverse County, since 1985. The chinook plants beginning in 1987 were moved to Kid's Creek, a major tributary to the Boardman River. Fin clips in parentheses (Ad = adipose, Do-Ad = dorsal-adipose).

Planting year	Chinook salmon	Steelhead
1985	190,022	14,000
1986	250,105	20,000 (Ad)
1987	238,500	17,547 (Do-Ad)
Total	678,627	51,547
Average	226,209	17,182

Table 2. Number, by week, of salmon harvested and trout collected at the Boardman River weir, fall 1987.

Week beginning	Salmon		Trout	
	Chinook	Coho	Steelhead	Brown
9/20	249	23	6	0
9/27	1,100	75	6	3
10/04	980	68	4	7
10/11	1,269	17	0	0
10/18	1,304	123	1	2
Total	4,902	306	17	12

Table 3. Number, by age, of chinook salmon harvested at the Boardman River weir, fall 1987. Weight (pounds) is in parentheses and was estimated using seasonal means.

	Age						
Year	0.0	0.1	0.2	0.3	0.4	0.5	Total
1987	1 (<1.0)	1,210 (5,363)	677 (4,528)	1,588 (18,400)	1,335 (19,951)	91 (1,754)	4,902 (49,996)

Table 4. Length-age distribution (in percent of inch group) for chinook salmon scale sampled during creel census at Pentwater, Ludington, Manistee, Frankfort, Leland, Grand Traverse Bay, Manistee Lake, Big Manistee River, Betsie River, and Platte River, September-November 1987.[1]

Length (inches)	Age					
	0.0	0.1	0.2	0.3	0.4	0.5
<13	100	—	—	—	—	—
14	—	—	—	—	—	—
15	—	—	—	—	—	—
16	—	—	—	—	—	—
17	—	—	—	—	—	—
18	—	—	—	—	—	—
19	—	—	—	—	—	—
20	—	100	—	—	—	—
21	—	100	—	—	—	—
22	—	100	—	—	—	—
23	—	100	—	—	—	—
24	—	25	75	—	—	—
25	—	—	100	—	—	—
26	—	—	100	—	—	—
27	—	—	100	—	—	—
28	—	—	100	—	—	—
29	—	—	50	50	—	—
30	—	—	50	50	—	—
31	—	—	15	85	—	—
32	—	—	—	85	15	—
33	—	—	—	60	40	—
34	—	—	—	60	40	—
35	—	—	—	30	70	—
36	—	—	—	10	80	10
37	—	—	—	—	85	15
38	—	—	—	—	80	20
39	—	—	—	—	75	25
40+	—	—	—	—	—	100

[1]Table developed by District 6 personnel at the Harrietta warehouse.

Table 5. Number and weight, by age and sex, of chinook salmon harvested at the Boardman River weir, fall 1987.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 0.0						
9/20	—	—	—	—	—	—
9/27	—	—	—	—	—	—
10/04	1	—	—	—	1	—
10/11	—	—	—	—	—	—
10/18	—	—	—	—	—	—
Total	1	—	—	—	1	—
(Percent)	—	—	—	—	—	—
Age 0.1						
9/20	85	379	—	—	85	379
9/27	319	1,456	—	—	319	1,456
10/04	264	1,156	—	—	264	1,156
10/11	216	1,000	—	—	216	1,000
10/18	326	1,372	—	—	326	1,372
Total	1,210	5,363	—	—	1,210	5,363
(Percent)	(24.7)	(10.7)	—	—	(24.7)	(10.7)
Age 0.2						
9/20	35	220	—	—	35	220
9/27	154	1,069	22	217	176	1,286
10/04	186	1,160	10	101	196	1,261
10/11	127	875	—	—	127	875
10/18	104	664	39	222	143	886
Total	606	3,988	71	540	677	4,528
(Percent)	(12.4)	(8.0)	(1.4)	(1.1)	(13.8)	(9.1)
Age 0.3						
9/20	55	589	30	385	85	974
9/27	220	2,283	110	1,395	330	3,678
10/04	186	2,043	137	1,618	323	3,661
10/11	254	2,884	139	1,710	393	4,594
10/18	248	2,839	209	2,654	457	5,493
Total	963	10,638	625	7,762	1,588	18,400
(Percent)	(19.7)	(21.3)	(12.8)	(15.5)	(32.4)	(36.8)

Table 5. Continued:

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 0.4						
9/20	20	294	17	265	37	559
9/27	176	2,479	99	1,566	275	4,045
10/04	117	1,715	59	876	176	2,591
10/11	266	4,019	216	3,222	482	7,241
10/18	222	3,357	143	2,158	365	5,515
Total	801	11,864	534	8,087	1,335	19,951
(Percent)	(16.4)	(23.7)	(10.9)	(16.2)	(27.3)	(39.9)
Age 0.5						
9/20	7	127	—	—	7	127
9/27	—	—	—	—	—	—
10/04	10	220	10	175	20	395
10/11	38	722	13	267	51	989
10/18	13	243	—	—	13	243
Total	68	1,312	23	442	91	1,754
(Percent)	(1.4)	(2.6)	(0.5)	(0.9)	(1.9)	(3.5)

Table 6. Numbers, and in parentheses percent, by age, of chinook salmon in various year classes returning to the Boardman River weir 0 to 5 years after stocking.

Year class	Number stocked	Age						Total
		0.0	0.1	0.2	0.3	0.4	0.5	
1985	190,022	—	—	677	—	—	—	677
		—	—	(0.4)	—	—	—	(0.4)
1986	250,105	—	1,210	—	—	—	—	1,210
		—	(0.5)	—	—	—	—	(0.5)
1987	238,500	1	—	—	—	—	—	1
		(0.0)	—	—	—	—	—	(0.0)

Table 7. Mean total length (inches) and weight (pounds) by age and sex, of chinook salmon harvested at the Boardman River weir, fall 1987. Two standard errors in parentheses.

Week beginning	Measurement	Age 0.0		Age 0.1		Age 0.2	
		Male	Female	Male	Female	Male	Female
9/20	Length	—	—	22.7	—	26.1	—
		—	—	(0.278)	—	(1.285)	—
	Weight	—	—	4.5	—	6.3	—
		—	—	(0.173)	—	(0.741)	—
9/27	Length	—	—	22.8	—	27.0	30.4
		—	—	(0.302)	—	(1.519)	(0.300)
	Weight	—	—	4.6	—	6.9	9.9
		—	—	(0.235)	—	(0.769)	(0.100)
10/04	Length	10.9	—	22.7	—	25.8	31.2
		—	—	(0.321)	—	(1.007)	—
	Weight	0.5	—	4.4	—	6.2	10.1
		—	—	(0.182)	—	(0.605)	—
10/11	Length	—	—	23.2	—	27.0	—
		—	—	(0.292)	—	(1.851)	—
	Weight	—	—	4.6	—	6.9	—
		—	—	(0.218)	—	(0.925)	—
10/18	Length	—	—	22.8	—	26.2	25.6
		—	—	(0.460)	—	(1.978)	(3.069)
	Weight	—	—	4.2	—	6.4	5.7
		—	—	(0.258)	—	(1.142)	(0.872)
Weighted seasonal mean	Length	10.9	—	22.8	—	26.4	27.9
		—	—	(0.165)	—	(0.685)	(1.888)
	Weight	0.5	—	4.4	—	6.6	7.6
		—	—	(0.104)	—	(0.370)	(0.537)
Sexes combined	Length	10.9		22.8		26.6	
		—		(0.165)		(0.661)	
	Weight	0.5		4.4		6.7	
		—		(0.104)		(0.371)	

Table 7. Continued:

Week beginning	Measurement	Age 0.3		Age 0.4		Age 0.5	
		Male	Female	Male	Female	Male	Female
9/20	Length	32.3	33.0	35.3	35.5	38.0	—
		(0.740)	(1.078)	(1.364)	(1.141)	(2.030)	—
	Weight	10.7	12.8	14.7	15.6	18.1	—
		(0.495)	(0.990)	(1.608)	(0.806)	(2.458)	—
9/27	Length	31.9	33.8	34.7	35.3	—	—
		(0.664)	(0.690)	(0.815)	(0.899)	—	—
	Weight	10.4	12.7	14.1	15.8	—	—
		(0.522)	(0.805)	(0.570)	(1.088)	—	—
10/04	Length	32.3	33.1	35.7	34.6	39.8	36.8
		(0.529)	(0.602)	(0.855)	(1.047)	—	—
	Weight	11.0	11.8	14.7	14.9	22.0	17.5
		(0.437)	(0.763)	(1.002)	(1.106)	—	—
10/11	Length	32.8	33.4	36.1	34.6	38.2	37.4
		(0.847)	(0.645)	(0.683)	(0.717)	(1.920)	—
	Weight	11.4	12.3	15.1	14.9	19.0	20.5
		(0.602)	(0.810)	(0.728)	(1.121)	(2.485)	—
10/18	Length	33.5	33.7	36.2	35.1	37.9	—
		(0.762)	(0.560)	(0.789)	(0.655)	—	—
	Weight	11.4	12.7	15.1	15.1	18.7	—
		(0.558)	(0.643)	(0.878)	(0.412)	—	—
Weighted seasonal mean	Length	32.6	33.5	35.7	34.9	38.4	37.1
		(0.336)	(0.286)	(0.368)	(0.379)	(1.574)	—
	Weight	11.0	12.4	14.8	15.1	19.3	19.2
		(0.249)	(0.342)	(0.378)	(0.502)	(2.034)	—
Sexes combined	Length	33.0		35.4		38.1	
		(0.243)		(0.284)		(1.160)	
	Weight	11.6		14.9		19.3	
		(0.228)		(0.305)		(1.632)	

Table 8. Mean total length (L, in inches) and weight (W, in pounds), by age, of chinook salmon harvested at the Boardman weir, fall 1987.

	Age											
	0.0		0.1		0.2		0.3		0.4		0.5	
Year	L	W	L	W	L	W	L	W	L	W	L	W
1987	10.9	0.5	22.8	4.4	26.6	6.7	33.0	11.6	35.4	14.9	38.1	19.3

Table 9. Percent lamprey scarring of anadromous salmonids captured at the Boardman River weir, fall 1987.

	Salmon		Trout	
Year	Chinook	Coho	Steelhead	Brown
1987	1.8	0.7	0.0	0.0

Table 10. Number, by age, of coho salmon harvested at the Boardman River weir, fall 1987. Weight (pounds) is in parentheses and was estimated using seasonal means.

Year	Age 1.0	Age 1.1	Total
1987	45 (62)	261 (1,651)	306 (1,713)

Table 11. Summary of the number and weight, by age and sex, of coho salmon harvested at the Boardman River weir, fall 1987.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 1.0						
9/20	9	14	—	—	9	14
9/27	14	20	—	—	14	20
10/04	6	9	—	—	6	9
10/11	6	9	—	—	6	9
10/18	10	10	—	—	10	10
Total	45	62	—	—	45	62
(Percent)	(14.7)	(3.6)	—	—	(14.7)	(3.6)
Age 1.1						
9/20	7	42	7	41	14	83
9/27	28	175	33	206	61	381
10/04	29	188	33	209	62	397
10/11	7	46	4	24	11	70
10/18	55	345	58	375	113	720
Total	126	796	135	855	261	1,651
(Percent)	(41.2)	(46.5)	(44.1)	(49.9)	(85.3)	(96.4)

Table 12. Mean total length (inches) and weight (pounds), by age and sex, of coho salmon harvested at the Boardman River weir, fall 1987. Two standard errors in parentheses.

Week beginning	Measurement	Age 1.0		Age 1.1	
		Male	Female	Male	Female
9/20	Length	15.6	—	26.2	25.1
		(1.171)	—	(1.558)	(1.803)
	Weight	1.6	—	6.0	5.8
		(0.393)	—	(1.576)	(1.024)
9/27	Length	15.5	—	26.0	25.3
		(0.645)	—	(0.605)	(0.513)
	Weight	1.4	—	6.3	6.3
		(0.203)	—	(0.457)	(0.346)
10/04	Length	15.8	—	26.5	25.5
		(0.808)	—	(0.621)	(0.443)
	Weight	1.5	—	6.5	6.3
		(0.217)	—	(0.510)	(0.380)
10/11	Length	16.4	—	26.5	25.9
		(0.610)	—	(1.115)	(1.391)
	Weight	1.6	—	6.5	5.9
		(0.184)	—	(0.654)	(1.063)
10/18	Length	14.5	—	26.7	25.9
		(0.295)	—	(0.475)	(0.350)
	Weight	1.0	—	6.3	6.5
		(0.103)	—	(0.342)	(0.270)
Weighted seasonal mean	Length	15.4	—	26.4	25.6
		(0.165)	—	(0.062)	(0.065)
	Weight	1.4	—	6.3	6.3
		(0.055)	—	(0.060)	(0.038)
Sexes combined	Length	15.4		26.0	
		(0.165)		(0.045)	
	Weight	1.4		6.3	
		(0.055)		(0.033)	

Table 13. Mean total length (L, in inches) and weight (W, in pounds), by age, of coho salmon harvested at the Boardman River weir, fall 1987.

	Age 1.0		Age 1.1	
Year	L	W	L	W
1987	15.4	1.4	26.0	6.3

Table 14. Number, by age, of steelhead trout collected at the Boardman River weir, fall 1987. Weight (pounds) is in parentheses and was estimated using seasonal means.

	Age					
Year	1.0	2.0	1.1	2.1	1.2	Total
1987	6 (10)	2 (4)	4 (12)	3 (11)	2 (16)	17 (53)

Table 15. Summary of the number and weight, by age and sex, of steelhead passed upstream at the Boardman River weir, fall 1987.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 1.0						
9/27	3	5	—	—	3	5
10/04	1	2	—	—	1	2
10/18	—	—	—	—	—	—
Total	4	7	—	—	4	7
(Percent)	(33.3)	(20.6)	—	—	(33.3)	(20.6)
Age 2.0						
9/27	—	—	—	—	—	—
10/04	—	—	—	—	—	—
10/18	—	—	1	2	1	2
Total	—	—	1	2	1	2
(Percent)	—	—	(8.3)	(5.9)	(8.3)	(5.9)
Age 1.1						
9/27	—	—	—	—	—	—
10/04	—	—	3	9	3	9
10/18	—	—	—	—	—	—
Total	—	—	3	9	3	9
(Percent)	—	—	(25.0)	(26.5)	(25.0)	(26.5)
Age 2.1						
9/27	1	3	1	5	2	8
10/04	—	—	—	—	—	—
10/18	—	—	—	—	—	—
Total	1	3	1	5	2	8
(Percent)	(8.3)	(8.8)	(8.3)	(14.7)	(16.7)	(23.5)
Age 1.2						
9/27	—	—	1	8	1	8
10/04	—	—	—	—	—	—
10/18	—	—	—	—	—	—
Total	—	—	1	8	1	8
(Percent)	—	—	(8.3)	(23.5)	(8.3)	(23.5)

Table 16. Mean total length (inches) and weight (pounds) by age and sex, of steelhead passed upstream at the Boardman River weir, fall 1987. Two standard errors in parentheses.

Week beginning	Measurement	Age 1.0		Age 2.0		Age 1.1	
		Male	Female	Male	Female	Male	Female
9/27	Length	16.0	—	—	—	—	—
		(0.600)	—	—	—	—	—
	Weight	1.8	—	—	—	—	—
		(0.300)	—	—	—	—	—
10/04	Length	15.0	—	—	—	—	18.1
		—	—	—	—	—	(0.933)
	Weight	1.5	—	—	—	—	3.0
		—	—	—	—	—	(0.240)
10/18	Length	—	—	—	17.2	—	—
		—	—	—	—	—	—
	Weight	—	—	—	2.2	—	—
		—	—	—	—	—	—
Weighted seasonal mean	Length	15.8	—	—	17.2	—	18.1
		(0.346)	—	—	—	—	—
	Weight	1.7	—	—	2.2	—	3.0
		(0.173)	—	—	—	—	—
Sexes combined	Length	15.8		17.2		18.1	
		(0.346)		—		—	
	Weight	1.7		2.2		3.0	
		(0.173)		—		—	

Week beginning	Measurement	Age 2.1		Age 1.2	
		Male	Female	Male	Female
9/27	Length	17.8	22.6	—	27.4
		—	—	—	—
	Weight	2.5	5.2	—	8.2
		—	—	—	—
10/04	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
10/18	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
Weighted seasonal mean	Length	17.8	22.6	—	27.4
		—	—	—	—
	Weight	2.5	5.2	—	8.2
		—	—	—	—
Sexes combined	Length	20.2		27.4	
		—		—	
	Weight	3.8		8.2	
		—		—	

Table 17. Number and mean total length (L, in inches) and weight (W, in pounds) of steelhead (ages combined) collected at the Boardman River weir, fall 1987.

	Number			Mean	
Year	Passed	Mortalities	Total	L	W
1987	15	2	17	18.4	3.1

Table 18. Number, by age, of brown trout collected at the Boardman River weir, fall 1987. Weight (pounds) is in parentheses and was estimated using seasonal means.

	Age				
Year	1.0	1.1	2.1	1.2	Total
1987	4 (10)	5 (26)	2 (11)	1 (6)	12 (53)

Table 19. Summary of the number and weight, by age and sex, of brown trout passed upstream at the Boardman River weir, fall 1987.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 1.0						
9/27	—	—	—	—	—	—
10/04	1	2	3	8	4	10
10/18	—	—	—	—	—	—
Total	1	2	3	8	4	10
(Percent)	(7.7)	(3.8)	(23.1)	(15.1)	(30.8)	(18.9)
Age 1.1						
9/27	1	5	1	6	2	11
10/04	—	—	3	15	3	15
10/18	—	—	—	—	—	—
Total	1	5	4	21	5	26
(Percent)	(7.7)	(9.4)	(30.8)	(39.6)	(38.5)	(49.1)
Age 2.1						
9/27	—	—	—	—	—	—
10/04	—	—	—	—	—	—
10/18	—	—	2	11	2	11
Total	—	—	2	11	2	11
(Percent)	—	—	(15.4)	(20.8)	(15.4)	(20.8)
Age 1.2						
9/27	1	6	—	—	1	6
10/04	—	—	—	—	—	—
10/18	—	—	—	—	—	—
Total	1	6	—	—	1	6
(Percent)	(7.7)	(11.3)	—	—	(7.7)	(11.3)

Table 20. Mean total length (inches) and weight (pounds), by age and sex, of brown trout passed upstream at the Boardman River weir, fall 1987. Two standard errors in parentheses.

Week beginning	Measurement	Age 1.0		Age 1.1	
		Male	Female	Male	Female
9/27	Length	—	—	19.8	22.4
		—	—	—	—
	Weight	—	—	5.1	5.8
		—	—	—	—
10/04	Length	15.6	18.0	—	21.6
		—	(0.700)	—	(3.300)
	Weight	1.8	2.7	—	5.0
		—	(0.300)	—	(2.000)
10/18	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
Weighted seasonal mean	Length	15.6	18.0	19.8	21.8
		—	(0.404)	—	(1.905)
	Weight	1.8	2.7	5.1	5.2
		—	(0.173)	—	(1.155)
Sexes combined	Length	17.2		21.4	
		(0.841)		(1.143)	
	Weight	2.4		5.2	
		(0.296)		(0.693)	

Table 20. Continued:

Week beginning	Measure-ment	Age 2.1		Age 1.2	
		Male	Female	Male	Female
9/27	Length	—	—	25.7	—
		—	—	—	—
	Weight	—	—	6.3	—
		—	—	—	—
10/04	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
10/18	Length	—	21.8	—	—
		—	(0.600)	—	—
	Weight	—	5.6	—	—
		—	(0.900)	—	—
Weighted seasonal mean	Length	—	21.8	25.7	—
		—	—	—	—
	Weight	—	5.6	6.3	—
		—	—	—	—
Sexes combined	Length	21.8		25.7	
		—		—	
	Weight	5.6		6.3	
		—		—	

Table 21. Number and mean total length (L, in inches) and weight (W, in pounds) of brown trout (ages combined) collected at the Boardman River weir, fall 1987.

	Number			Mean	
Year	Passed	Mortalities	Total	Length	Weight
1987	12	0	12	20.4	4.4

LITERATURE CITED

Fenske, J. L. 1988. Medusa Creek harvest weir report, 1987. Michigan Department of Natural Resources, Fisheries Technical Report 88-8, Ann Arbor.

Hay, R. L. 1988. Little Manistee River harvest weir and chinook salmon egg-take report, 1986. Michigan Department of Natural Resources, Fisheries Technical Report 88-3, Ann Arbor.

Report approved by W. C. Latta

Word processing by G. M. Zurek