

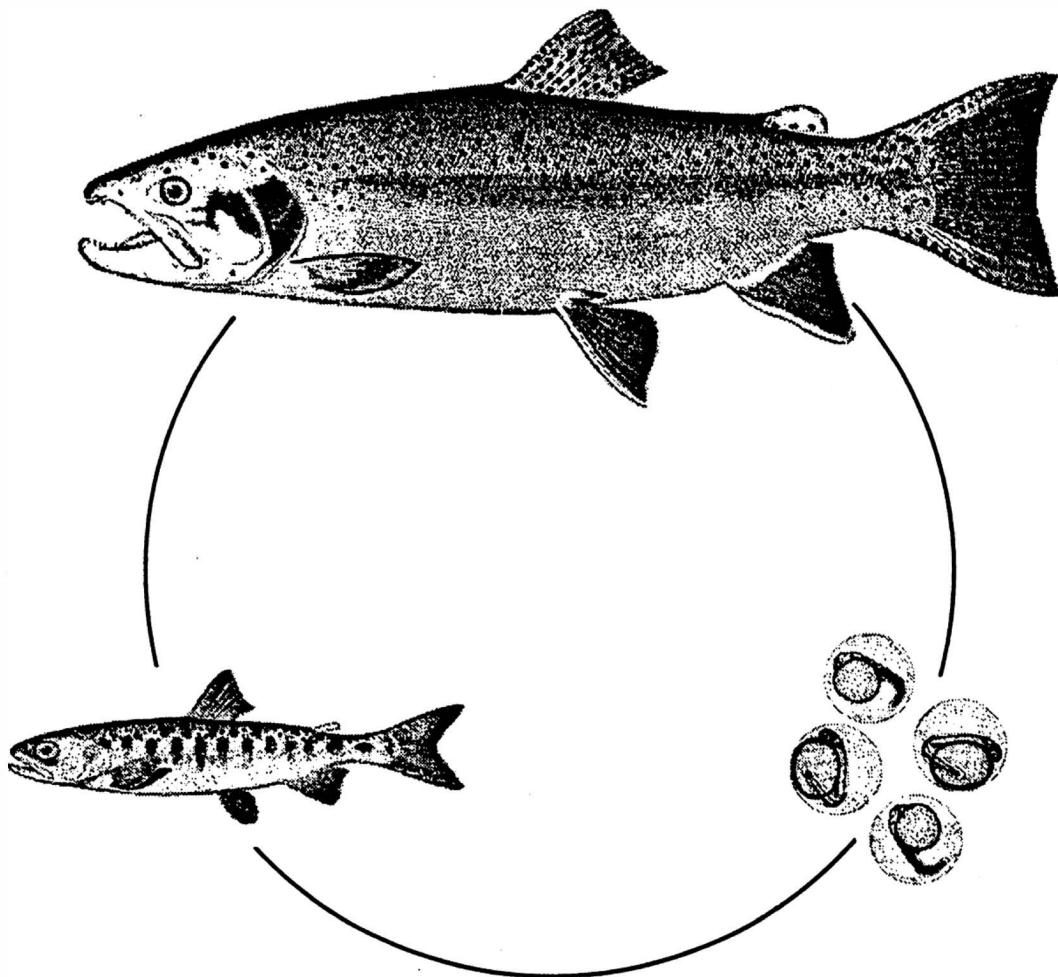
# FISHERIES DIVISION TECHNICAL REPORT

Number 92-1

January 9, 1992

## Boardman River Harvest Weir Report, 1989

Ralph L. Hay




**MICHIGAN DEPARTMENT OF NATURAL RESOURCES  
FISHERIES DIVISION**

**COMPLETED**

**Fisheries Technical Report No. 92-1  
January 9, 1992**

**BOARDMAN RIVER HARVEST WEIR REPORT, 1989**

**Ralph L. Hay**

PRINTED BY AUTHORITY OF Michigan Department of Natural Resources  
TOTAL NUMBER OF COPIES: 300 TOTAL COST: \$347.90 COST PER COPY: \$1.15  
Michigan Department of Natural Resources 

## Boardman River Harvest Weir Report, 1989

Ralph L. Hay

Michigan Department of Natural Resources  
District Office #6  
8015 Mackinaw Trail  
Cadillac, Michigan 49601

Coho salmon *Oncorhynchus kisutch* and chinook salmon *O. tshawytscha* 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 1980s.

In June 1984, the Traverse City Light and Power Department (TCLP), City of Traverse City, 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 mile 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 (*Oncorhynchus* sp.) are to be harvested at the weir each fall (September and October). The trout and Atlantic salmon *Salmo salar* 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-round. Each spring (April-July), metal plates with an overhanging lip are installed in the ladder to block the migration of adult sea lamprey *Petromyzon marinus*.

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

An average of 251,144 spring fingerling chinook have been planted annually in the Boardman River system since 1985 (Table 1). During this same time span, steelhead

*O. mykiss* plants have averaged 16,309 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, 1989

On August 31, 1989, the weir gates were installed to block anadromous fish. On September 23, the ponds were filled and the fish ladder was activated. Harvest began on September 27. The weir remained operational until October 30, at which time the gates were removed and the building was winterized. The weir was in operation for 61 days. All harvested chinook and coho salmon were sold on contract to Tempotech Industries, Hart, Michigan. Steelhead and brown trout *Salmo trutta* were passed upstream of the weir.

### Chinook Salmon

Harvest of chinook salmon began September 27 and ended October 30, a period of 34 days. A few chinook began entering the river shortly after the weir gates were installed. Migrations increased during September and peaked in early October (Table 2). A total of 5,809 chinook were harvested in 1989 (Table 3). The calculated total weight of all chinook, in the round, was 61,485 pounds.

For several weeks during the run, biological data were obtained from a randomly selected sample of 600 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 survey at several sites from August to October 1989. 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 1,810 (31.2%) age-0.1 jacks weighing 8,192 pounds; 886 (15.3%) age-0.2 adults weighing 6,061 pounds; 1,878 (32.3%) age-0.3 adults weighing 24,991 pounds; 1,202 (20.7%) age-0.4 adults weighing 21,532 pounds; and 33 (0.6%) age-0.5 adults weighing 709 pounds (Table 5). The absence of age-0.0 mini-jacks could be due to their ability to swim through the new, wider-spaced weir gates. The 1989 run of jacks represented 0.7% of the fingerlings stocked in 1988, age-0.2 adults were 0.4% of the 1987 plant, age-0.3 adults were 0.8% of the fingerlings stocked in 1986, and age-0.4 adults were 0.6% of the fingerlings stocked in 1985 (Table 6). Return rate for age-0.5 adults could not be determined since the Boardman River system did not receive plants prior to 1985. These fish were either strays from other nearby rivers or fish which were produced naturally in the Boardman River.

Females constituted only about 26% of the total run—6.4% of age-0.2, 45.6% of age-0.3, 48.5% of age-0.4 fish, and 18.2% of age-0.5 fish (Table 5). No age-0.1 females were collected. The high percentage of males in the total run is in part due to returns of young fish (1987 and 1988 year classes) which are mostly males. Mean lengths and weights of males and females combined were: age 0.1 (males only), 23.0 inches and 4.5 pounds; age 0.2, 26.2 inches and 6.8 pounds; age 0.3, 33.6 inches and 13.3 pounds; age 0.4, 36.1 inches and 17.9 pounds; and age 0.5, 41.0 inches and 21.5 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.

Six hundred randomly selected chinook were examined for fin clips. Nine (1.5%) had fin clips. The four clips observed were adipose (Ad, 6 fish), right ventral (RV, 1 fish),

left ventral (LV, 1 fish), and both ventrals (BV, 1 fish). Only three of the Ad fish had a very small coded-wire tag in the snout. One was planted in 1987 by the MDNR into Lake Huron at Seymour Creek (130,000 SF), one was planted in 1987 by the MDNR into Lake Huron at Swan Creek (150,000 SF), and one was planted in 1986 by the Wisconsin Department of Natural Resources (WDNR) into Lake Michigan at Strawberry Creek. Origin of the RV fish could not be decided because the fin clip, and planting records did not coincide. The LV-clipped fish was planted in 1987 by the MDNR into Lake Huron at Lexington (130,000 SF) and the BV-clipped fish was planted in 1988 by the MDNR into Lake Huron at Nunn's Creek (200,000 SF). In addition to the random sample, one other Ad-clipped fish was observed. This fish was planted in 1987 by the MDNR into Lake Huron at Seymour Creek (130,000 SF).

Only 1.2% of the chinook sampled had a lamprey wound (Table 9). This is considerably below the scarring rates in the 1960s and early 1970s (Hay 1989).

Chinook eggs were collected to supplement the egg-take operation at the Little Manistee River weir. From October 3 through October 17 (14 days), 1.1 million eggs were collected for in-state rearing, and 1.2 million for Illinois (Table 10). A total of 499 female chinook (ages 0.2, 0.3, and 0.4) were stripped, excluding those which yielded low-quality eggs or were otherwise unsatisfactory.

In an attempt to reduce the level of bacterial kidney disease (BKD) infection in chinook, each fish spawned was examined for gross clinical signs of BKD. Eggs and sperm from fish exhibiting any of the clinical signs (cloudy ovarian fluid; "cheesy" membranes on the spleen, liver or heart; bleeding from the vent; or swollen kidneys, sometimes with "pustules") were discarded and all utensils discarded or disinfected. The prevalence rate was 13.4% in males and 23.0% in females.

When the egg-take operation began, 90% of the females were ripe. The "dry" method of egg fertilization was employed. The "dry" method involved mixing eggs (from several females) with sperm in a 5-gallon plastic pail without water and letting the mixture stand for

10 minutes before water-hardening. The fertilized eggs were water-hardened in flowing river water for 1 hour prior to transportation. The percent eye-up was slightly below normal for chinook, with a range of 37.2% to 61.0% (Table 10).

A random sample of 60 spawning chinook were inspected by the state pathologist for diseases and parasites. Analysis of the ovarian fluids for BKD showed that nearly 95% of the chinook sampled were infected (J. Hnath, MDNR, personal communication).

In 1989, the estimated sport catch of chinook salmon from the West Arm of Grand Traverse Bay was 1,900 fish (G. Rakoczy, MDNR, personal communication). It would appear that about one-third of the returning chinook are taken by anglers and the remaining fish escape upstream to the weir.

#### *Coho Salmon*

In 1989, the coho harvest coincided with the chinook harvest (September 27 through October 30, a total of 34 days). The peak harvest occurred during the first week in October.

A total of 288 coho were harvested. The total weight calculated from biological samples was 1,785 pounds (Table 11).

The age composition of the harvested coho was 288 age-1.1 adults weighing 1,785 pounds (Table 12). The absence of age-1.0 jacks could be due to their ability to swim through the new, wider-spaced weir grates. Because coho have not been planted in the Boardman River, this small number represents fish that strayed from other planting locations or fish that were naturally reproduced in the river system. The total run consisted of 50.7% females. Mean lengths and weights were: age-1.1 males, 26.5 inches and 6.3 pounds; age-1.1 females, 25.5 inches and 6.1 pounds; and age-1.1 sexes combined, 26.0 inches and 6.2 pounds (Tables 13 and 14). Adult males were slightly longer and heavier than females.

A total of 286 coho were checked for fin clips. Of these fish, fourteen (4.9%) had a fin clip. Thirteen fish had an adipose (Ad) fin clip, and one had a left pectoral (LP) fin clip.

Ten of the Ad fish had a very small coded-wire tag in the snout. All were planted in 1988 by the MDNR into Lake Michigan at the Platte River (155,000 Y). Origin of the other three Ad fish could not be decided since no wire tags were found in the snout. Origin of the LP fish could not be determined.

Only 0.3% of the coho had lamprey wounds (Table 9). This rate was significantly less than in the 1960s.

No coho eggs were taken at the Boardman River weir in 1989.

In 1989, no coho salmon were reported caught in the West Arm of Grand Traverse Bay (G. Rakoczy, MDNR, personal communication). This is due to the fact that no coho are planted in Grand Traverse Bay and that the few fish taken at the weir are strays from other planting locations or naturally produced fish from the Boardman River system.

#### *Steelhead Trout*

Only 36 steelhead (weighing 327 pounds) were collected during the weir operation (Table 15). This return is less than expected considering that the river has been stocked annually (Table 1). Skamania (summer strain) were planted in the Boardman River beginning in 1986. One possible explanation for the poor fall return is that the Skamania tend to migrate up the rivers prior to the installation of the weir in September and that the fall operation captures only the late migrants.

Based upon the six weekly samples, nearly 78% of the returning steelhead were age 1.3 (Table 16). Mean lengths and weights for the five different age groups are given in Table 17 and Figure 3. For all ages combined, the mean length and weight were 29.3 inches and 9.0 pounds (Table 15). Size of returning adults is more dependent upon years spent in Lake Michigan than on age at smolting.

A total of 23 randomly selected steelhead were examined for fin clips. Of these fish, 16 (70%) had a fin clip. All 16 fish had an adipose (Ad) clip. Because none of these fish

were sacrificed in an attempt to recover the small coded-wire tag in the snout, the planting location could not be determined. However, aging (from scale samples) revealed that all were age 1.3, and were planted in 1986 by the MDNR at several locations in Lake Michigan, including the Boardman River. They were the Skamania strain of summer steelhead.

Only 1 (4.3%) of 23 fish examined had a lamprey wound. This wounding rate isn't significant considering the small sample size. Thirty-five steelhead were passed upstream (Table 15).

In 1989, the estimated sport catch of steelhead (rainbow) trout in the West Arm of Grand Traverse Bay was 750 fish (G. Rakoczy, MDNR, personal communication).

#### *Brown Trout*

Only 21 brown trout (weighing 151 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 1989).

Based upon the five weekly samples, 57% of the brown trout were age 1.2 (Table 19). Mean length and weight of age-1.1, age-2.1, and age-1.2 fish are found in Table 20. 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 eight fish examined. Nineteen of the brown trout were passed upstream (Table 18).

In 1989, the estimated sport catch of brown trout in the West Arm of Grand Traverse Bay was 500 fish (G. Rakoczy, MDNR, personal communication).

#### *Pink Salmon*

No pink salmon *O. gorbuscha* were harvested at the weir in 1989. Also, none were reported caught by anglers in the West Arm of Grand Traverse Bay (G. Rakoczy, MDNR, personal communication).

## Lake trout

No lake trout *Salvelinus namaycush* were collected at the weir in 1989. However, several hundred lake trout were in the river by late October. Immediately after the weir was opened (October 30), anglers observed them upstream at the Union Street dam.

In 1989, the estimated sport catch of lake trout from the West Arm of Grand Traverse Bay was 10,300 fish (G. Rakoczy, MDNR, personal communication). This catch occurred during the period from May 1 through August 15.

### Summary

In 1989, the Boardman River harvest weir was in operation from August 31 through October 30 (61 days). Harvest of chinook and coho salmon and passage of other anadromous salmonids occurred from September 27 through October 30.

The entire salmon run of 5,809 chinook (61,485 pounds) and 288 coho (1,785 pounds) was harvested and sold to Tempotech Industries, Hart, Michigan.

The chinook run consisted of 1,810 age-0.1 jacks (0.7% of the 1988 fingerling plant); 886 age-0.2 adults (0.4% of the 1987 fingerling plant); 1,878 age-0.3 adults (0.8% of the 1986 fingerling plant); 1,202 age-0.4 adults (0.6% of the 1985 fingerling plant) and 33 age-0.5 adults. Percent returns for the age-0.5 adults could not be determined because the Boardman River system did not receive chinook plants prior to 1985. These older fish were strays from other planting locations or naturally produced fish from the Boardman River system. Mean sizes were: age 0.1, 23.0 inches (4.5 pounds); age 0.2, 26.2 inches (6.8 pounds); age 0.3, 33.6 inches (13.3 pounds); age 0.4, 36.1 inches (17.9 pounds); and age 0.5, 41.0 inches (21.5 pounds). Chinook eggs were taken again in 1989. During the egg-take operations (October 3 through October 17), 499 females (ages 0.2, 0.3, and 0.4) were stripped to obtain 2.3 million eggs. The percent eye-up ranged from 37.2% (October 3) to 61.0% (October 11).

The 1989 coho run was composed of 288 age-1.1 adults. Percent returns could not be determined because coho have not been planted in the Boardman River. These were strays from other planting locations or naturally reproduced fish from the river system. No coho eggs were collected at the weir in 1989.

The 1989 steelhead run of 36 fish included five different age groups. Nearly 78% of these fish were age 1.3.

The 1989 run of 21 brown trout was comprised of age 1.1 (33.3%), age 2.1 (9.5%), and age 1.2 (57.1%) fish.

No pink salmon were observed in the river below the weir. However, several hundred lake trout appeared at the weir just prior to removal of the grates (October 30).

### Recommendations for 1990

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 1990 season.

These major changes are as follows:

- 1) Install additional supports to the overhead beam that the lift baskets travel along.
- 2) Modify the loading dock area to permit the fork-lift to drive off the dock into the parking lot.
- 3) Eliminate the rough concrete from the walls of the holding panels. Scales are missing from fish that are held for several days.
- 4) Install a continuously recording thermometer for river water temperatures.
- 5) Install a river staff gauge and correlate to mean sea level.
- 6) Use an electronic weight scale. It is more precise and easier to read.

### **Acknowledgments**

Data collection, tabulation, and scale reading for age analyses were done by Alfred Allen, Steve Lazar, Janice Sapak, Dann Manz, Peter Makowski, and Tom Rozich. 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.

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. 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.



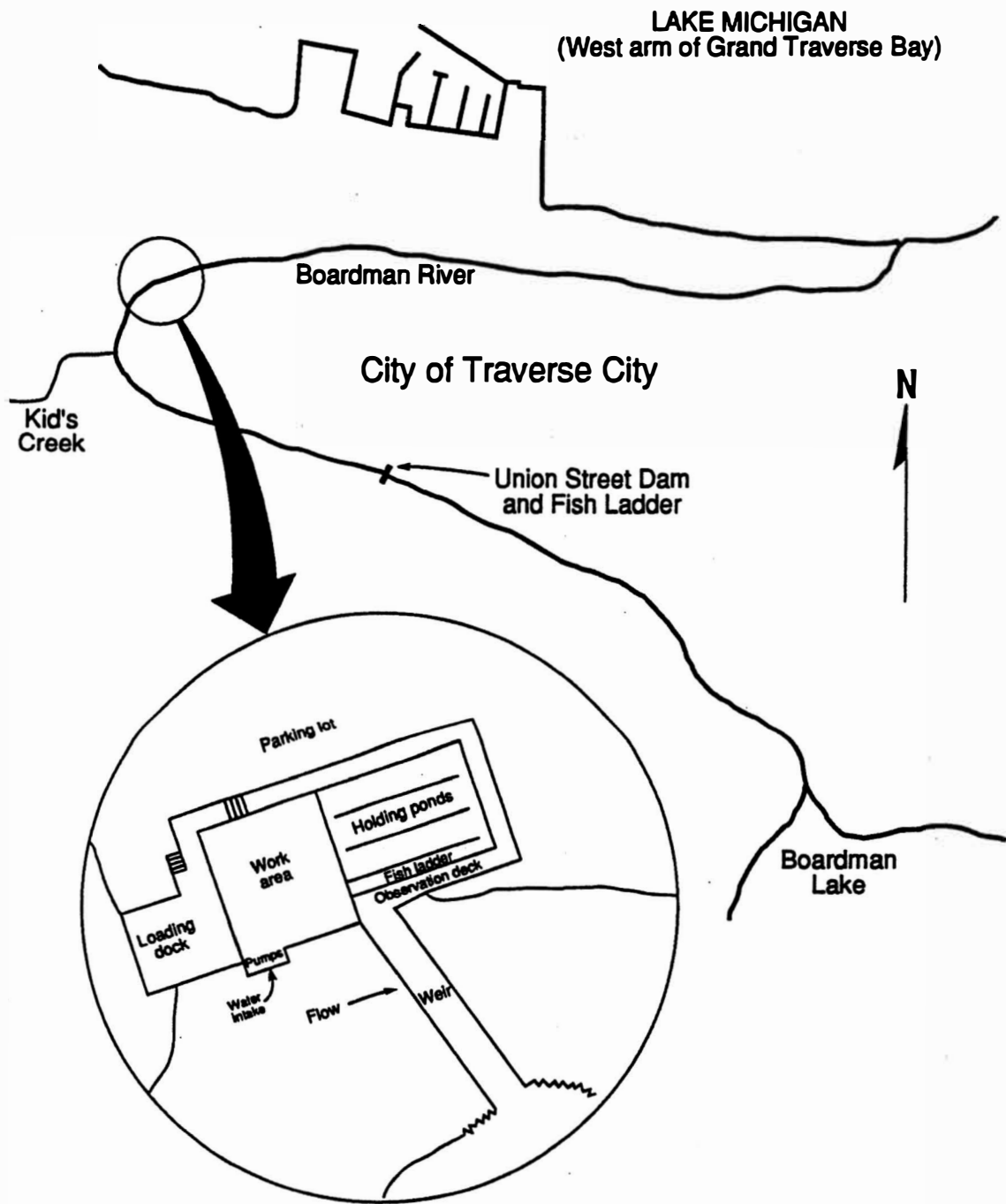


Figure 1.—Location and schematic diagram of the Boardman River weir complex in Traverse City.

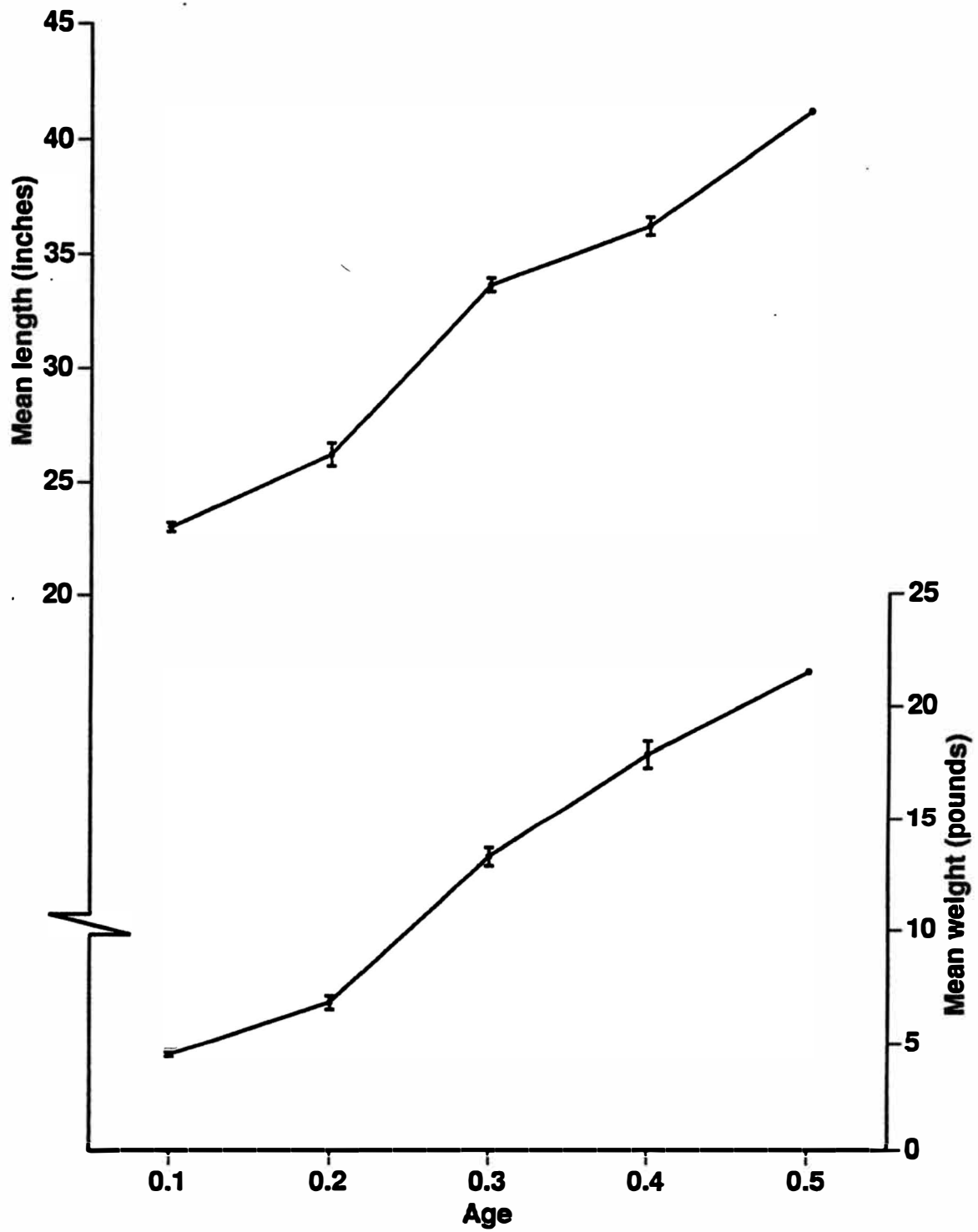


Figure 2.—Mean total length (inches) and round weight (pounds), by age, of chinook salmon harvested at the Boardman River weir, fall 1989. Vertical bars represent two standard errors.

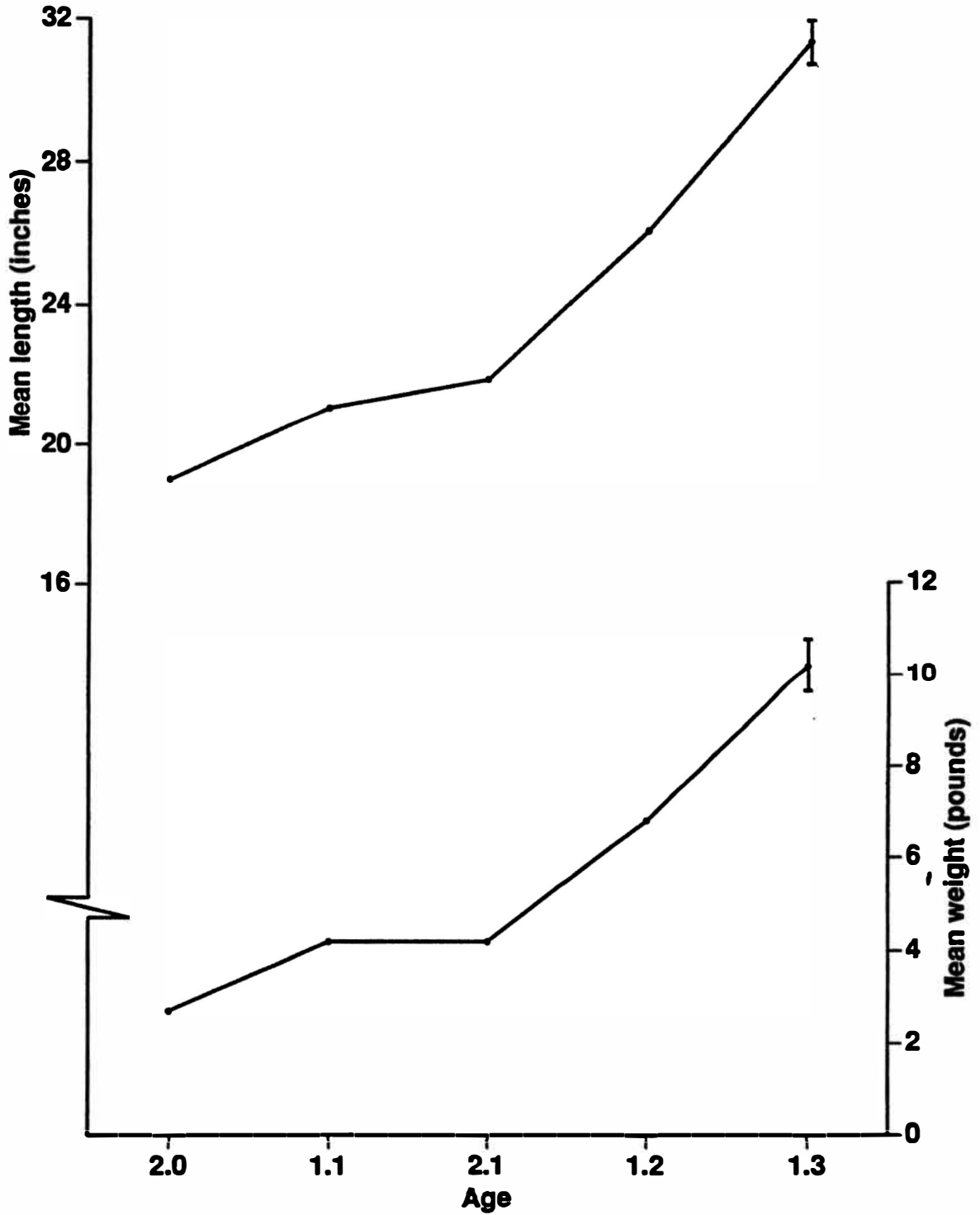


Figure 3.—Mean total length (inches) and round weight (pounds), by age, of steelhead passed upstream at the Boardman River weir, fall 1989. Vertical bars represent two standard errors.

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, Mt-Ad = microtag-adipose).

Planting year	Chinook salmon	Steelhead
1985	190,022	14,000
1986	250,105	20,000 (Ad)
1987	238,500	17,547 (Do-Ad)
1988	277,000	15,000 (Mt-Ad)
1989	300,093	15,000 (Mt-Ad)
Total	1,255,720	81,547
Average	251,144	16,309

Table 2.—Number, by week, of salmon harvested and trout collected at the Boardman River weir, fall 1989.

Week beginning	Salmon		Trout	
	Chinook	Coho	Steelhead	Brown
09/24	843	63	15	4
10/01	611	38	4	2
10/08	1,892	72	2	4
10/15	1,775	42	8	0
10/22	407	27	1	1
10/29	281	46	6	10
Total	5,809	288	36	21

**Table 3.—Number, by age, of chinook salmon harvested at the Boardman River weir, fall 1987-89. Weight (pounds) is in parentheses and was estimated using seasonal means.**

Year	Age						Total
	0.0	0.1	0.2	0.3	0.4	0.5	
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)
1988	47 (28)	1,195 (5,484)	1,247 (10,315)	2,936 (39,533)	694 (12,394)	10 (224)	6,129 (67,978)
1989	0 (0)	1,810 (8,192)	886 (6,061)	1,878 (24,991)	1,202 (21,532)	33 (709)	5,809 (61,485)

Table 4.—Length-age distribution (in percent of inch group) for chinook salmon scale-sampled during creel survey at Ludington, Manistee, Frankfort, and Grand Traverse Bay, August-October 1989.<sup>1</sup>

Length (inches)	Age					
	0.0	0.1	0.2	0.3	0.4	0.5
<13	100	—	—	—	—	—
14	—	—	—	—	—	—
15	—	—	—	—	—	—
16	—	—	—	—	—	—
17	—	—	—	—	—	—
18	—	100	—	—	—	—
19	—	100	—	—	—	—
20	—	100	—	—	—	—
21	—	100	—	—	—	—
22	—	100	—	—	—	—
23	—	100	—	—	—	—
24	—	57	43	—	—	—
25	—	—	100	—	—	—
26	—	—	100	—	—	—
27	—	—	100	—	—	—
28	—	—	100	—	—	—
29	—	—	78	22	—	—
30	—	—	17	83	—	—
31	—	—	15	85	—	—
32	—	—	5	81	14	—
33	—	—	—	67	33	—
34	—	—	—	53	47	—
35	—	—	—	50	50	—
36	—	—	—	44	56	—
37	—	—	—	33	67	—
38	—	—	—	33	67	—
39	—	—	—	33	67	—
40+	—	—	—	—	75	25

<sup>1</sup>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 1989.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
<b>Age 0.0</b>						
09/24	—	—	—	—	—	—
10/01	—	—	—	—	—	—
10/08	—	—	—	—	—	—
10/15	—	—	—	—	—	—
10/22	—	—	—	—	—	—
10/29	—	—	—	—	—	—
Total	—	—	—	—	—	—
(Percent)	—	—	—	—	—	—
<b>Age 0.1</b>						
09/24	194	925	—	—	194	925
10/01	128	582	—	—	128	582
10/08	568	2,681	—	—	568	2,681
10/15	674	2,974	—	—	674	2,974
10/22	159	656	—	—	159	656
10/29	87	374	—	—	87	374
Total	1,810	8,192	—	—	1,810	8,192
(Percent)	(31.2)	(13.3)	—	—	(31.2)	(13.3)
<b>Age 0.2</b>						
09/24	118	755	—	—	118	755
10/01	73	511	6	63	79	574
10/08	284	1,912	19	205	303	2,117
10/15	249	1,588	18	187	267	1,775
10/22	57	388	8	80	65	468
10/29	48	313	6	59	54	372
Total	829	5,467	57	594	886	6,061
(Percent)	(14.3)	(8.9)	(1.0)	(1.0)	(15.3)	(9.9)

Table 5.—Continued:

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
<b>Age 0.3</b>						
09/24	228	2,956	59	816	287	3,772
10/01	104	1,302	98	1,460	202	2,762
10/08	378	4,651	208	2,821	586	7,472
10/15	213	2,481	355	5,346	568	7,827
10/22	65	815	69	1,020	134	1,835
10/29	34	417	67	906	101	1,323
<b>Total</b>	<b>1,022</b>	<b>12,622</b>	<b>856</b>	<b>12,369</b>	<b>1,878</b>	<b>24,991</b>
<b>(Percent)</b>	<b>(17.6)</b>	<b>(20.5)</b>	<b>(14.7)</b>	<b>(20.1)</b>	<b>(32.3)</b>	<b>(40.6)</b>
<b>Age 0.4</b>						
09/24	185	3,119	51	1,054	236	4,173
10/01	86	1,413	110	2,098	196	3,511
10/08	265	4,490	151	2,831	416	7,321
10/15	71	1,369	195	3,583	266	4,952
10/22	12	187	37	661	49	848
10/29	—	—	39	727	39	727
<b>Total</b>	<b>619</b>	<b>10,578</b>	<b>583</b>	<b>10,954</b>	<b>1,202</b>	<b>21,532</b>
<b>(Percent)</b>	<b>(10.7)</b>	<b>(17.2)</b>	<b>(10.0)</b>	<b>(17.8)</b>	<b>(20.7)</b>	<b>(35.0)</b>
<b>Age 0.5</b>						
09/24	8	177	—	—	8	77
10/01	—	—	6	85	6	85
10/08	19	447	—	—	19	447
10/15	—	—	—	—	—	—
10/22	—	—	—	—	—	—
10/29	—	—	—	—	—	—
<b>Total</b>	<b>27</b>	<b>624</b>	<b>6</b>	<b>85</b>	<b>33</b>	<b>709</b>
<b>(Percent)</b>	<b>(0.5)</b>	<b>(1.0)</b>	<b>(0.1)</b>	<b>(0.1)</b>	<b>(0.6)</b>	<b>(1.2)</b>



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 (0.4)	2,936 (1.5)	1,202 (0.6)	— —	4,815 (2.5)
1986	250,105	— —	1,210 (0.5)	1,247 (0.5)	1,878 (0.8)	— —	— —	4,335 (1.7)
1987	238,500	1 (<0.1)	1,195 (0.5)	886 (0.4)	— —	— —	— —	2,082 (0.9)
1988	277,000	47 (<0.1)	1,810 (0.7)	— —	— —	— —	— —	1,857 (0.7)
1989	300,093	— —	— —	— —	— —	— —	— —	0 (<0.1)

Table 7.—Mean total length (inches) and weight (pounds), by age and sex, of chinook salmon harvested at the Boardman River weir, fall 1989. Two standard errors in parentheses.

Week beginning	Measurement	Age 0.0		Age 0.1		Age 0.2	
		Male	Female	Male	Female	Male	Female
09/24	Length	—	—	23.0	—	25.4	—
	Weight	—	—	(0.308)	—	(0.792)	—
10/01	Length	—	—	22.4	—	26.9	29.6
	Weight	—	—	(0.534)	—	(1.534)	—
10/08	Length	—	—	23.2	—	25.7	29.0
	Weight	—	—	(0.396)	—	(0.517)	—
10/15	Length	—	—	23.0	—	25.8	32.0
	Weight	—	—	(0.322)	—	(1.070)	—
10/22	Length	—	—	22.9	—	26.8	30.4
	Weight	—	—	(0.447)	—	(1.384)	(2.000)
10/29	Length	—	—	22.3	—	26.6	30.5
	Weight	—	—	(0.444)	—	(1.180)	(0.299)
Weighted seasonal mean	Length	—	—	23.0	—	25.9	30.4
	Weight	—	—	(0.178)	—	(0.404)	(0.995)
Sexes combined	Length	—	—	23.0	—	26.2	—
	Weight	—	—	(0.178)	—	(0.473)	—
		—	—	4.5	—	6.8	—
		—	—	(0.122)	—	(0.328)	—

Table 7.—Continued:

Week beginning	Measurement	Age 0.3		Age 0.4		Age 0.5	
		Male	Female	Male	Female	Male	Female
09/24	Length	33.9 (1.073)	32.5 (2.229)	36.3 (0.954)	36.6 (1.026)	40.0 —	— —
	Weight	13.0 (1.156)	13.8 (2.236)	16.9 (1.217)	20.7 (1.976)	22.1 —	— —
10/01	Length	33.0 (1.021)	33.7 (1.021)	35.8 (1.199)	35.5 (0.858)	— —	42.5 —
	Weight	12.5 (1.112)	14.9 (0.993)	16.4 (1.325)	19.1 (1.659)	— —	14.1 —
10/08	Length	33.8 (0.992)	33.1 (1.099)	36.1 (1.347)	35.9 (1.129)	41.0 —	— —
	Weight	12.3 (0.823)	13.6 (1.282)	16.9 (1.682)	18.8 (1.472)	23.5 —	— —
10/15	Length	32.3 (0.848)	34.6 (0.678)	38.5 (1.374)	35.7 (0.801)	— —	— —
	Weight	11.7 (0.791)	15.1 (0.921)	19.3 (2.530)	18.4 (1.166)	— —	— —
10/22	Length	33.8 (1.219)	34.1 (0.907)	36.1 (1.368)	35.5 (0.905)	— —	— —
	Weight	12.5 (1.227)	14.8 (0.973)	15.6 (0.416)	17.9 (1.127)	— —	— —
10/29	Length	33.3 (1.086)	33.4 (0.810)	— —	35.8 (0.645)	— —	— —
	Weight	12.3 (1.273)	13.5 (0.782)	— —	18.6 (1.159)	— —	— —
Weighted seasonal mean	Length	33.4 (0.471)	33.8 (0.425)	36.4 (0.658)	35.8 (0.426)	40.7 —	42.5 —
	Weight	12.3 (0.434)	14.5 (0.518)	17.1 (0.846)	18.8 (0.630)	23.1 —	14.1 —
Sexes combined	Length	33.6 (0.340)		36.1 (0.414)		41.0 —	
	Weight	13.3 (0.382)		17.9 (0.553)		21.5 —	

Table 8.—Mean total length (L, in inches) and weight (W, in pounds), by age, of chinook salmon harvested at the Boardman River weir, fall 1987-89.

Year	Age											
	0.0		0.1		0.2		0.3		0.4		0.5	
	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
1988	10.9	0.6	22.7	4.6	28.8	8.3	34.2	13.5	36.8	17.9	40.0	22.4
1989	—	—	23.0	4.5	26.2	6.8	33.6	13.3	36.1	17.9	41.0	21.5

Table 9.—Percent lamprey scarring of anadromous salmonids captured at the Boardman River weir, fall 1987-89.

Year	Salmon		Trout	
	Chinook	Coho	Steelhead	Brown
1987	1.8	0.7	0.0	0.0
1988	1.7	0.0	0.0	0.0
1989	1.2	0.3	4.8	0.0

Table 10.—Summary of the chinook egg-take operation at the Boardman River weir, fall 1989.

Date	Number of females stripped	Number of eggs collected	Percent eye-up	Destination
10/03	123	603,560	37.2	Platte River
10/11	101	505,720	59.6	Platte River
10/11	160	807,000	61.0	Illinois
10/17	115	425,020	58.0	Illinois
<b>Total</b>	<b>499</b>	<b>2,341,300</b>	—	
<b>In-state</b>	<b>224</b>	<b>1,109,280</b>	—	
<b>Out-of-state</b>	<b>275</b>	<b>1,232,020</b>	—	

Table 11.—Number, by age, of coho salmon harvested at the Boardman River weir, fall 1987-89. 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)
1988	29 (50)	448 (2,745)	477 (2,795)
1989	0 0	288 (1,785)	288 (1,785)

Table 12.—Summary of the number and weight, by age and sex, of coho salmon harvested at the Boardman River weir, fall 1989.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
<b>Age 1.0</b>						
09/24	—	—	—	—	—	—
10/01	—	—	—	—	—	—
10/08	—	—	—	—	—	—
10/15	—	—	—	—	—	—
10/22	—	—	—	—	—	—
10/29	—	—	—	—	—	—
Total	—	—	—	—	—	—
(Percent)	—	—	—	—	—	—
<b>Age 1.1</b>						
09/24	32	198	31	197	63	395
10/01	18	119	20	119	38	238
10/08	35	223	37	229	72	452
10/15	26	164	16	92	42	256
10/22	15	96	12	74	27	170
10/29	16	100	30	174	46	274
Total	142	900	146	885	288	1,785
(Percent)	(49.3)	(50.4)	(50.7)	(49.6)	(100.0)	(100.0)

Table 13.—Mean total length (inches) and weight (pounds), by age and sex, of coho salmon harvested at the Boardman River weir, fall 1989. Two standard errors in parentheses.

Week beginning	Measurement	Age 1.0		Age 1.1	
		Male	Female	Male	Female
09/24	Length	—	—	25.5 (0.736)	25.3 (0.516)
	Weight	—	—	6.2 (0.537)	6.4 (0.387)
10/01	Length	—	—	26.2 (0.812)	24.8 (0.611)
	Weight	—	—	6.6 (0.714)	6.0 (0.431)
10/08	Length	—	—	26.8 (0.709)	25.9 (0.515)
	Weight	—	—	6.4 (0.571)	6.2 (0.423)
10/15	Length	—	—	26.9 (0.625)	25.3 (0.726)
	Weight	—	—	6.3 (0.534)	5.8 (0.516)
10/22	Length	—	—	27.5 (0.730)	26.2 (1.015)
	Weight	—	—	6.4 (0.678)	6.2 (0.590)
10/29	Length	—	—	26.6 (0.927)	25.4 (0.663)
	Weight	—	—	6.3 (0.693)	5.8 (0.451)
Weighted seasonal mean	Length	—	—	26.5 (0.020)	25.5 (0.019)
	Weight	—	—	6.3 (0.018)	6.1 (0.013)
Sexes combined	Length	—	—	26.0 (0.017)	
	Weight	—	—	6.2 (0.012)	

Table 14.—Mean total length (L, in inches) and weight (W, in pounds), by age, of coho salmon harvested at the Boardman River weir, fall 1987-89.

Year	Age 1.0		Age 1.1	
	L	W	L	W
1987	15.4	1.4	26.0	6.3
1988	15.4	1.7	25.3	6.1
1989	—	—	26.0	6.2

Table 15.—Number and mean total length (L, in inches) and weight (W, in pounds) of steelhead (ages combined) collected at the Boardman River weir, fall 1987-89.

Year	Number			Mean	
	Passed	Mortalities	Total	L	W
1987	15	2	17	18.4	3.1
1988	57	9	66	21.0	4.6
1989	35	1	36	29.3	9.0



Table 16.—Summary of the number and weight, by age and sex, of steelhead passed upstream at the Boardman River weir, fall 1989.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
<b>Age 2.0</b>						
09/24	—	—	—	—	—	—
10/01	—	—	—	—	—	—
10/08	—	—	—	—	—	—
10/15	—	—	1	3	1	3
10/22	—	—	—	—	—	—
10/29	—	—	—	—	—	—
Total	—	—	1	3	1	3
(Percent)	—	—	(2.8)	(0.9)	(2.8)	(0.9)
<b>Age 1.1</b>						
09/24	—	—	—	—	—	—
10/01	—	—	—	—	—	—
10/08	—	—	—	—	—	—
10/15	1	5	1	3	2	8
10/22	—	—	—	—	—	—
10/29	—	—	—	—	—	—
Total	1	5	1	3	2	8
(Percent)	(2.8)	(1.5)	(2.8)	(0.9)	(5.6)	(2.4)
<b>Age 2.1</b>						
09/24	—	—	—	—	—	—
10/01	—	—	—	—	—	—
10/08	—	—	—	—	—	—
10/15	—	—	—	—	—	—
10/22	—	—	—	—	—	—
10/29	—	—	2	8	2	8
Total	—	—	2	8	2	8
(Percent)	—	—	(5.6)	(2.4)	(5.6)	(2.4)
<b>Age 1.2</b>						
09/24	—	—	—	—	—	—
10/01	—	—	—	—	—	—
10/08	—	—	—	—	—	—
10/15	—	—	1	8	1	8
10/22	—	—	—	—	—	—
10/29	—	—	2	13	2	13
Total	—	—	3	21	3	21
(Percent)	—	—	(8.3)	(6.4)	(8.3)	(6.4)

Table 16.—Continued:

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
<b>Age 1.3</b>						
09/24	9	96	6	55	15	151
10/01	2	15	2	22	4	37
10/08	—	—	2	21	2	21
10/15	1	10	3	34	4	44
10/22	1	9	—	—	1	9
10/29	—	—	2	25	2	25
<b>Total</b>	<b>13</b>	<b>130</b>	<b>15</b>	<b>157</b>	<b>28</b>	<b>287</b>
<b>(Percent)</b>	<b>(36.1)</b>	<b>(39.8)</b>	<b>(41.7)</b>	<b>(48.0)</b>	<b>(77.8)</b>	<b>(87.8)</b>

Table 17.—Mean total length (inches) and weight (pounds), by age and sex, of steelhead passed upstream at the Boardman River weir, fall 1989. Two standard errors in parentheses.

Week beginning	Measurement	Age 2.0		Age 1.1		Age 2.1	
		Male	Female	Male	Female	Male	Female
09/24	Length	—	—	—	—	—	—
	Weight	—	—	—	—	—	—
10/01	Length	—	—	—	—	—	—
	Weight	—	—	—	—	—	—
10/08	Length	—	—	—	—	—	—
	Weight	—	—	—	—	—	—
10/15	Length	—	19.0	23.3	19.0	—	—
	Weight	—	2.7	5.3	3.0	—	—
10/22	Length	—	—	—	—	—	—
	Weight	—	—	—	—	—	—
10/29	Length	—	—	—	—	—	21.9
	Weight	—	—	—	—	—	4.2
Weighted seasonal	Length	—	19.0	23.3	19.0	—	21.9
	Weight	—	2.7	5.3	3.0	—	4.2
Sexes combined	Length	—	19.0	—	21.1	—	21.9
	Weight	—	2.7	—	4.2	—	4.2

Table 17.—Continued:

Week beginning	Measurement	Age 12		Age 13	
		Male	Female	Male	Female
09/24	Length	—	—	30.8 (0.942)	30.8 (1.179)
	Weight	—	—	10.7 (1.117)	9.2 (0.416)
10/01	Length	—	—	28.5	33.2
	Weight	—	—	7.4	11.0
10/08	Length	—	—	—	32.0 (3.600)
	Weight	—	—	—	10.3 (1.200)
10/15	Length	—	27.5	31.4	31.6 (0.462)
	Weight	—	7.5	9.6	11.4 (1.890)
10/22	Length	—	—	32.3	—
	Weight	—	—	9.2	—
10/29	Length	—	25.2	—	33.1
	Weight	—	6.5	—	12.5
Weighted seasonal mean	Length	—	26.0	30.6 (0.702)	31.8 (0.455)
	Weight	—	6.8	10.0 (0.832)	10.5 (0.161)
Sexes combined	Length	—	26.0	—	31.2 (0.608)
	Weight	—	6.8	—	10.2 (0.556)

Table 18.—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 1987-89.

Year	Number			Mean	
	Passed	Mortalities	Total	L	W
1987	12	0	12	20.4	4.4
1988	7	1	8	23.0	5.6
1989	19	2	21	24.7	7.2

Table 19.—Summary of the number and weight, by age and sex, of brown trout passed upstream at the Boardman River weir, fall 1989.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
<b>Age 1.1</b>						
09/24	—	—	2	10	2	10
10/01	—	—	2	8	2	8
10/08	—	—	2	11	2	11
10/22	—	—	1	6	1	6
10/29	—	—	—	—	—	—
Total	—	—	7	35	7	35
(Percent)	—	—	(33.3)	(23.2)	(33.3)	(23.2)
<b>Age 2.1</b>						
09/24	—	—	2	9	2	9
10/01	—	—	—	—	—	—
10/08	—	—	—	—	—	—
10/22	—	—	—	—	—	—
10/29	—	—	—	—	—	—
Total	—	—	2	9	2	9
(Percent)	—	—	(9.5)	(6.0)	(9.5)	(6.0)
<b>Age 1.2</b>						
09/24	—	—	—	—	—	—
10/01	—	—	—	—	—	—
10/08	2	13	—	—	2	13
10/22	—	—	—	—	—	—
10/29	5	55	5	39	10	94
Total	7	68	5	39	12	107
(Percent)	(33.3)	(45.0)	(23.8)	(25.8)	(57.1)	(70.9)

Table 20.—Mean total length (inches) and weight (pounds), by age and sex, of brown trout passed upstream at the Boardman River weir, fall 1989. Two standard errors in parentheses.

Week beginning	Measurement	Age 1.1		Age 2.1		Age 1.2	
		Male	Female	Male	Female	Male	Female
09/24	Length	—	21.5	—	22.5	—	—
	Weight	—	5.2	—	4.5	—	—
10/01	Length	—	20.0	—	—	—	—
	Weight	—	4.0	—	—	—	—
10/08	Length	—	23.0	—	—	24.8	—
	Weight	—	5.6	—	—	6.6	—
10/22	Length	—	22.0	—	—	—	—
	Weight	—	6.0	—	—	—	—
10/29	Length	—	—	—	—	28.4	26.1
	Weight	—	—	—	—	11.0	7.8
Weighted seasonal mean	Length	—	21.6	—	22.5	27.4	26.1
	Weight	—	5.1	—	4.5	9.7	7.8
Sexes combined	Length	21.6		22.5		26.8 (2.057)	
	Weight	5.1		4.5		8.9 (2.862)	

## **References**

- Hay, R. L. 1989. Little Manistee River harvest weir and chinook salmon egg-take report, 1987. Michigan Department of Natural Resources, Fisheries Technical Report 89-5, Ann Arbor.**

**Report approved by J. C. Schneider  
Richard D. Clark, Jr. Editor  
Kelley D. Smith, Editorial Board Reviewer  
Alan D. Sutton, Graphics  
Grace M. Zurek, Work Processor**