FISHERIES DIVISION

TECHNICAL REPORT

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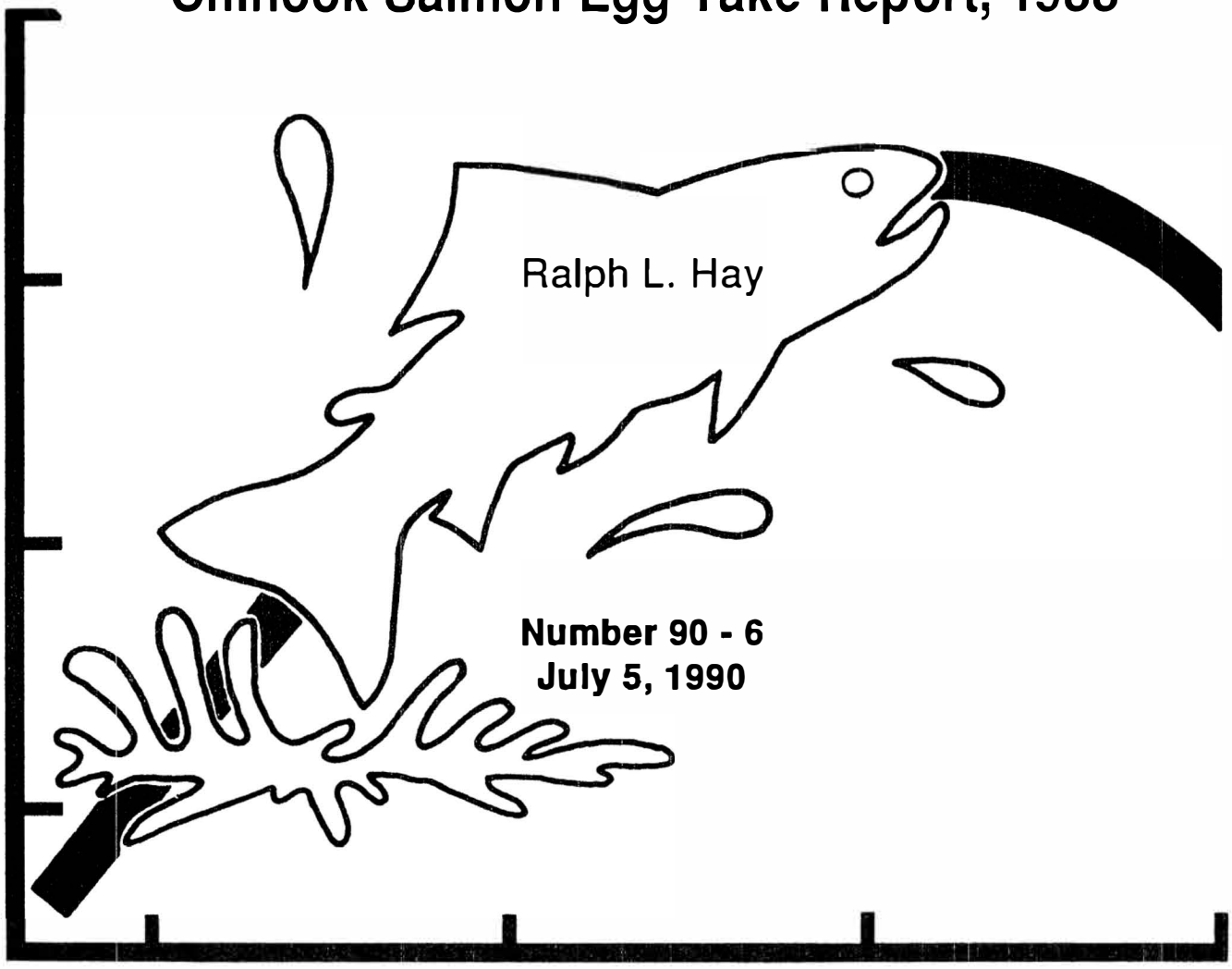

Ralph L. Hay

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Michigan Department of
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Since 1967, annual stockings of both coho and chinook salmon have been made by the Michigan Department of Natural Resources (MDNR) as part of the salmon management program for Lake Michigan (Table 1). Construction of a blocking weir, fish ladder, holding ponds, and harvest facility on the river, about 5 miles upstream from Manistee Lake, Manistee County, began in 1967 and was completed in 1968 (Figure 1). All chinook and coho salmon reaching the weir are harvested and sold to a commercial contractor. Normally, all other salmonids are passed upstream. The few salmon that enter the river when the weir is not in operation provide a limited stream fishery. Salmon processed at the Little Manistee weir are Michigan's primary source for chinook eggs for in-state and out-of-state hatchery rearing and serve as a back-up (to the Platte River upper weir) for coho eggs. Fall steelhead runs are monitored and the majority of steelhead eggs for in-state hatchery rearing are collected at the facility each spring. Biological data have been collected on chinook and other anadromous salmonids since 1968.

From 1967 through 1978, chinook fingerlings were stocked in the Little Manistee River at an average rate of about 345,000 per year (Table 1). Beginning in 1979, the planting rate was increased by 66% to an average of nearly 574,000 fingerlings. Substantial runs of returning adults have been produced, but run size has not been closely related to stocking rate. The number of chinook actually harvested at the weir has varied between 11,136 (in 1977) and 39,359 (in 1983) (Table 2).

Chinook return to the weir at either age-0.1 (jacks), age-0.2, age-0.3, age-0.4, or age-0.5--but most commonly at age-0.3.[1] For the 1967 and 1968 year classes and plants, return rates were 1.8% to 1.9% at age 0.1, 3.4% to 3.5% at age 0.2, and 2.0% to 3.1% at age 0.3 (Table 3). For the 1981 and 1982 year classes, return rates were 0.4% to 1.5% at age 0.1, 3.1% to 3.5% at age 0.2, 1.7% to 3.2% at age 0.3, 1.1% to 1.2% at age 0.4, and less than 0.2% at age 0.5. Comparable estimates cannot be made for the 1969-80 plants because the age composition of the run has not been monitored consistently; however, for jacks

[1]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 1, 2, 3, 4, or 5 for chinook and 0 or 1 for coho). Note: a very recent study of scale samples from the Lake Michigan fishery indicates some chinook live to age 0.4 and 0.5. This finding suggests that some spawning chinook absorb one or two annuli from their scales while in the rivers and that the aging data given in preceding reports may be underestimates.

returns have averaged 0.7%. The jack returns from the 1983-87 plants have averaged 0.5%.

The return rate of chinook salmon to the weir was high initially (1960s), declined (1970s), then increased (early 1980s). Return rates by chinook of all ages were approximately 8.5% for the 1967 plant, 7.2% for the 1968 plant, 6.8% for the 1981 plant, and 9.1% for the 1982 plant (Table 3). Returns from plants in the 1970s must have been lower because relatively low numbers came back to the weir in 1976-77 and 1980-82 (Table 2). Large runs, averaging 31,994 fish per year, occurred from 1983 through 1987. These originated from average plants of about 565,000 smolts in 1978-86—an average return rate of about 5.7% per plant. The 1984 plant had the lowest return rate (2.1%) on record. The return rates represent only the weir harvest and do not include the angler harvest, which has increased until recent years. For those Michigan waters of Lake Michigan which were surveyed by the MDNR in 1988, an estimated 213,000 chinook salmon were harvested by sport anglers (Rakoczy and Rogers 1990).

Growth rate of chinook has fluctuated considerably (Table 4, Figure 2). Average weight has varied from 3.0 to 9.5 pounds for age 0.1, from 7.2 to 20.9 pounds for age 0.2, and from 11.3 to 29.2 pounds for age 0.3. The fluctuations were especially large during the 1970s. Overall, age-0.1 chinook salmon decreased in size from 5.9 pounds (1960s) to an average of 4.3 pounds (1980s), a 27% reduction. A similar but less dramatic reduction in size can be seen for older fish.

Annual plants of yearling coho salmon in the Little Manistee River have varied widely from 92,000 in 1971 to 700,000 in 1969 (Table 1). Annual runs of coho to the weir have varied from 2,314 (in 1972) to 108,400 (in 1970) (Table 5). The return rate of jacks (age 1.0) has been relatively low, <0.1% to 0.7%, compared to adults (age-1.1), 1.5% to 15.0% (Table 3, Figure 3). The total return rate is usually between 11% and 15%, however, it declined to 8.5% for the 1983 plant and averaged only 3.4% for the 1984-87 plants. The return rate (1.5%) for the 1987 plant was the lowest on record (Table 3). As with chinook, these return rates represent only the weir harvest and do not include the angler harvest, which has also fluctuated annually. For those Michigan waters of Lake Michigan which were surveyed by the MDNR in 1988, an estimated 53,000 coho salmon were harvested by sport anglers (Rakoczy and Rogers 1990).

The average weight of coho jacks (age 1.0) increased slightly from 1974-83, gradually decreased through 1986, and then increased again in 1987-88 (Figure 4, Table 6). However, the size of adult coho decreased from 8.7 pounds in 1968 to less than 5.0 pounds in 1979, and has since stabilized at about 6.3 pounds. Like the chinook, there has been a decrease in average size of adult coho from the 1960s to the early 1980s, but in the last several years the average has been fairly constant. It is possible that the annual variations in size are related to a combination of predator density and forage density in Lake Michigan.

The Little Manistee River is one of the top quality steelhead streams in Michigan. The fishery is supported almost entirely by natural reproduction. However, a plant of 100,188 fall fingerlings was made in 1974, and from 1981 through 1983 annual plants were made in conjunction with a research project on steelhead production (Table 1). In 1984, a small planting of three strains of summer steelhead yearlings was made to extend the steelhead fishery. The strains (Siletz, Rogue, and Umpqua River) were imported from the State of Oregon. The number of steelhead returning to the weir each fall has not been consistent, ranging from 320 in 1978 to 7,622 in 1971 (Table 7). Mean weight of steelhead (all age groups) has varied from 6.5 pounds in 1973 to 9.3 pounds in 1972 (Table 7). For those Michigan waters of Lake Michigan which were surveyed by the MDNR in 1988, an estimated 58,000 steelhead were harvested by sport anglers (Rakoczy and Rogers 1990). Indications are that the open-water catch will increase significantly in future years.

Small runs of anadromous brown trout occur in the Little Manistee River. The largest run, 238, was in 1975 (Table 8). Average size has ranged from 3.4 pounds (1974) to 6.8 pounds (1979). Annual runs have steadily decreased since 1985. For those

Michigan waters of Lake Michigan which were surveyed by the MDNR in 1988, an estimated 23,000 brown trout were harvested by sport anglers (Rakoczy and Rogers 1990).

Atlantic salmon yearlings were first planted in the Little Manistee River in 1977 (Table 1). Subsequent plants have been made in an attempt to establish this new species. Until 1984, only an occasional fish had been captured. Of the several strains and hybrids planted, only the Sebago strain (from Maine) showed promise.

A few pink salmon have been harvested in the last few years. Numbers harvested are generally less than 25.

Harvest Weir Operations, 1988

On August 16, 1988, the weir grates were installed to block anadromous fish. On August 31, the ponds were filled and the fish ladder was activated. Harvest began on September 1. The weir remained operational until November 9, at which time the grates were removed and the building was winterized. The weir was in operation for 85 days. All harvested chinook and coho salmon were sold on contract to Tempotech Industries, Hart, Michigan.

Chinook salmon

Harvest of chinook salmon began September 1 and ended November 9, a period of 70 days. Fish that were not ripe were harvested because, in other years, holding early-run chinook in maturation ponds resulted in high mortality. Two peak harvests occurred, the first during late September and the second near mid-October (Table 9). Nearly 86% of the run occurred from late September through the third week in October. A total of 12,519 chinook were harvested in 1988 (Table 2). The calculated total weight of all chinook, in the round, was 145,099 pounds.

For several weeks during the run, biological data were obtained from a randomly selected sample of 695 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 10). 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 November, 1988. 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 2,114 (16.9%) age-0.1 jacks weighing 8,879 pounds, 1,973 (15.8%) age-0.2 adults weighing 16,968 pounds, 6,849 (54.7%) age-0.3 adults weighing 91,777 pounds, 1,556 (12.4%) age-0.4 adults weighing 26,919 pounds, and 27 (0.2%) age-0.5 adults weighing 556 pounds (Tables 2 and 9). The 1988 run of jacks represented 0.6% of the fingerlings stocked in 1987. The returning age-0.2 adults were 0.4% of the 1986 plant, age-0.3 adults were 1.4% of the 1985 plant, age-0.4 adults were 0.2% of the 1984 plant, and age-0.5 adults were less than 0.1% of the 1983 plant.

Females constituted about 36% of the total run--1.3% of age-0.1, 27.6% of age-0.2, 47.6% of age-0.3, and 42.7% of age-0.4 (Table 9). No age 0.5 females were collected. Mean lengths and weights of males and females combined were: age-0.1, 22.4 inches and 4.2 pounds; age-0.2, 29.3 inches and 8.6 pounds; age-0.3, 34.3 inches and 13.4 pounds; age-0.4, 36.6 inches and 17.3 pounds; and age-0.5 (males only) 40.3 inches and 20.6 pounds (Table 11). Growth was nearly linear on a weight basis (Figure 5). In general, females were slightly larger than males at each age.

The 1988 chinook egg-take operation began September 27 and ended November 9. During the 43-day period, 12.6 million eggs were collected, of which 10.8 million were for in-state rearing and 1.8 million were for out-of-state commitments (Table 12). A total of approximately 4,000 female chinook (ages 0.2, 0.3, and 0.4) were examined for egg quality. Of those, the eggs from 2,719 females were kept for hatchery rearing. Given that 4,000 females were handled to provide the 12.6 million eggs, a total run of 11,000 chinook (4,000/36% females) should provide sufficient

eggs for current in-state and out-of-state requirements.

Egg-take operations began when the proportion of ripe females approached 40%. The "dry" method of egg fertilization was used in 1988. 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 30 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 normal for chinook salmon with a range of 60.3% (October 19) to 77.9% (October 17) (Table 12).

During the egg-take operation, maximum recorded river water temperature was 56°F (September 27) and minimum water temperature was 37°F (October 29) (Figure 6).

A random sample of 60 spawning chinook were inspected by the state pathologist for disease and parasites. Nearly 83% of the fish examined had bacterial kidney disease (BKD) (J. Hnath, MDNR, personal communication).

No fin clips were found on 695 randomly examined chinook salmon.

Only 1.2% of the chinook sampled had a lamprey wound (Table 13). This was the second highest since 1971, but still considerably below scarring rates in the 1960s and early 1970s.

Coho salmon

In 1988, the coho harvest coincided with the chinook harvest (September 1 through November 9, a total of 70 days). The peak harvest occurred during the third week of September (Table 14). Since coho were held (beginning the end of September) for egg-take, the harvest does not coincide with migration into the river. Like the chinook, the coho runs had decreased significantly by late October.

A total of 4,467 coho were harvested. The total weight calculated from biological samples was 26,813 pounds (Table 5). This was the smallest harvest since 1972.

The age composition of the harvested coho was 463 (10.4%) age-1.0 jacks weighing 787 pounds and 4,004 (89.6%) age-1.1 adults weighing 26,026 pounds (Tables 5 and 14). The returning age-1.0 jacks were 0.1% of the 1988 plant and the age-1.1 adults were 1.5% of the 1987 plant.

Nearly all age-1.0 and 45.7% of the age-1.1 coho were males. The total run consisted of 48.8% females. Mean lengths and weights were: age-1.0 males, 15.3 inches and 1.7 pounds; age-1.0 females, 15.9 inches and 1.5 pounds; age-1.1 males, 25.7 inches and 6.4 pounds; age-1.1 females, 25.6 inches and 6.6 pounds; age-1.0 sexes combined, 15.3 inches and 1.7 pounds; and age-1.1 sexes combined, 25.6 inches and 6.5 pounds (Table 15). Adult females were slightly larger than males.

Only 0.6% of the 503 coho sampled had lamprey wounds (Table 13). This rate was significantly less than the 1960s.

Coho eggs were collected to supplement the egg-take operation at the Platte River Hatchery. Eggs were collected on October 19 and November 3 and 9. Approximately 0.9 million eggs were collected for in-state rearing (Table 16). A total of 308 female coho were stripped, excluding those which yielded low-quality eggs or were otherwise unsatisfactory.

The "dry" method of egg fertilization (as explained earlier) was employed. The percent eye-up ranged from 65.4% to 80.0% (Table 16). These percentages were below those recorded (76.2% to 85.2%) at the Platte River Hatchery in 1988 (Pecor 1989). However, the percent eye-up of coho eggs from the Little Manistee River has historically been lower than for those collected from the Platte River.

A total of 503 adult coho were randomly checked for fin clips. Of these fish, only one (0.2%) had a fin clip. Origin of the adipose (Ad) clipped fish could not be determined since no coded-wire tag was recovered from the snout.

Skin color was not examined on any of the coho.

Steelhead trout

Fall steelhead began entering the river in early September. Two peak runs occurred, the first in late September and the second in early November (Table 17). All but six steelhead were passed above the weir.

The 1988 run of 1,050 fish was the smallest since 1982 (Table 7). Fifty-five percent of the returning adults were age 1.2 or 2.2 (Table 17). These two age groups also represented 61% of the total estimated weight of 7,980 pounds. Mean lengths and weights for 12 different age groups are given in Table 18 and Figure 7. Size of returning adults is more dependent upon years spent in Lake Michigan than on age at smolting.

A total of 324 steelhead were randomly checked for fin clips. None had fin clips. However, eight (2.5%) had maxillary clips which were right maxillary (RM, two fish) and left maxillary (LM, six fish). One of the RM fish was planted in 1986 by the Wisconsin Department of Natural Resources (WDNR) in the Manitowac River and was the Skamania strain of summer steelhead. Origins of the remaining seven fish could not be decided because the marks, age (from scales), and planting records did not coincide.

Brown trout

The anadromous brown trout run peaked in late September and lingered into November (Table 19). All but five brown trout were passed above the weir.

The 1988 run of 27 fish was the smallest since 1972 (Table 8). About 73% of the returning adults were age 1.1 or 2.1 (Table 19). These two age groups represented 81% of the total estimated weight of 96 pounds. Mean lengths and weights of the four represented age groups are given in Table 20 and Figure 8. Size of returning adults is more dependent upon years spent in Lake Michigan than on age at smolting.

A total of 14 brown trout were randomly checked for fin clips and lamprey wounds. None of the fish had a fin clip or lamprey wound.

Brown trout are not planted in the Little Manistee River. Therefore, it is assumed that these anadromous fish are from wild stock or from hatchery stock planted in Lake Michigan at Manistee.

Atlantic salmon

No Atlantic salmon were collected at the weir in 1988.

Pink salmon

No pink salmon were collected at the weir in 1988.

Summary

In 1988, the Little Manistee harvest weir was in operation from August 16 through November 9 (85 days). Harvest of chinook and coho salmon and passage of other anadromous salmonids occurred from September 1 through November 9.

The entire salmon run of 12,519 chinook (145,099 pounds) and 4,467 coho (26,813 pounds) was harvested and sold to Tempotech Industries, Hart, Michigan.

The chinook run consisted of 2,114 age-0.1 jacks (0.6% of the 1987 fingerling plant), 1,973 age-0.2 adults (0.4% of the 1986 fingerling plant), 6,849 age-0.3 adults (1.4% of the 1985 fingerling plant), 1,556 age-0.4 adults (0.2% of the 1984 fingerling plant), and 27 age-0.5 adults (less than 0.1% of the 1983 fingerling plant). Mean sizes were: age 0.1, 22.4 inches (4.2 pounds); age 0.2, 29.3 inches (8.6 pounds); age 0.3, 34.3 inches (13.4 pounds); age 0.4, 36.6 inches (17.3 pounds); and age 0.5, 40.3 inches (20.6 pounds). During chinook egg-take operations (September 27 through November 9), 2,719 females (ages 0.2, 0.3, and 0.4) were stripped to obtain 12,566,538 eggs. The percent eye-up ranged from 60.3% (October 19) to 77.9% (October 17). During egg-take, the maximum recorded river water temperature was 56°F.

The 1988 coho run was composed of 463 age-1.0 jacks (0.1% of the 1988 yearling plant) and 4,004 age-1.1 adults (1.5% of the 1987 yearling plant). Mean sizes were: age 1.0, 15.3 inches (1.7 pounds); and age 1.1, 25.6 inches (6.5 pounds). The 1988 fall steelhead run of 1,050 fish included 12 different age groups.

Fifty-five percent of the fish were age-1.2 or age-2.2 (3 summers in Lake Michigan). Of the eight marked fish, one was identified as the Skamania strain of summer steelhead planted in Lake Michigan by Wisconsin and the origin of the remaining seven could not be determined.

The fall brown trout run of 27 fish was the smallest since 1972. About 73% of the returning adults were age-1.1 or age-2.1.

No Atlantic salmon returned to the weir in 1988.

No pink salmon were collected at the weir in 1988.

Recommendations for 1989

Use only data from biological samples to calculate weekly weights of chinook and coho salmon harvested. Do not scale sample river-run chinook salmon because their scales are severely eroded and are missing annuli; instead, collect scale samples from Lake Michigan chinook in the fall. Utilize the "dry" method for chinook egg-take. This method involves mixing eggs (from several females) with sperm in a 5-gallon plastic pail without water and letting the mixture stand for 30 minutes before water-hardening.

Acknowledgments

Data collection, tabulation, and scale reading were done by Alfred Allen, Janice Sapak, Pete Makoweski, Dann Manz, and Steve Lazar. Kelley Smith developed a computer program for data analyses and provided technical advice.

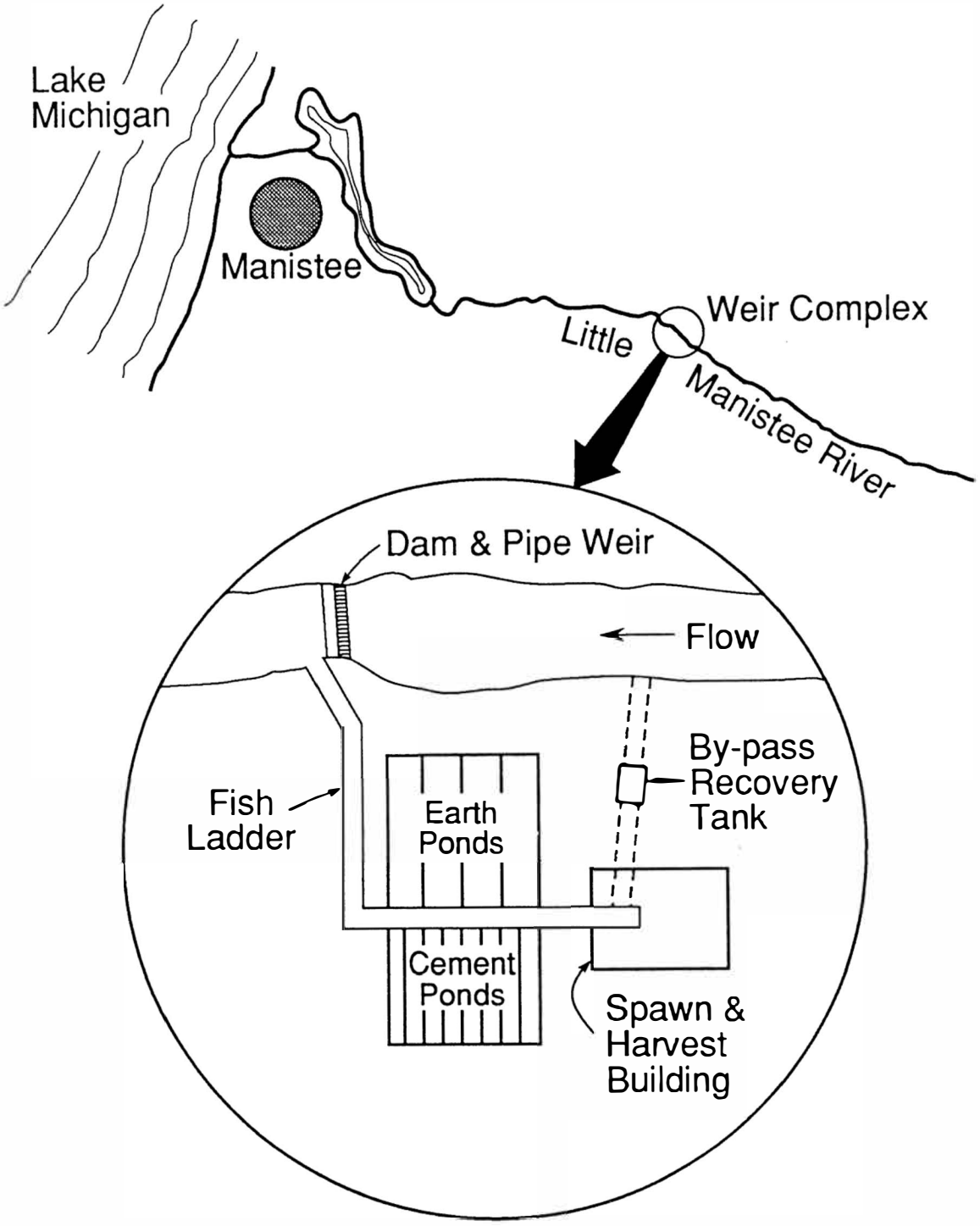

Figure 1.—Location and schematic diagram of the Little Manistee weir complex.

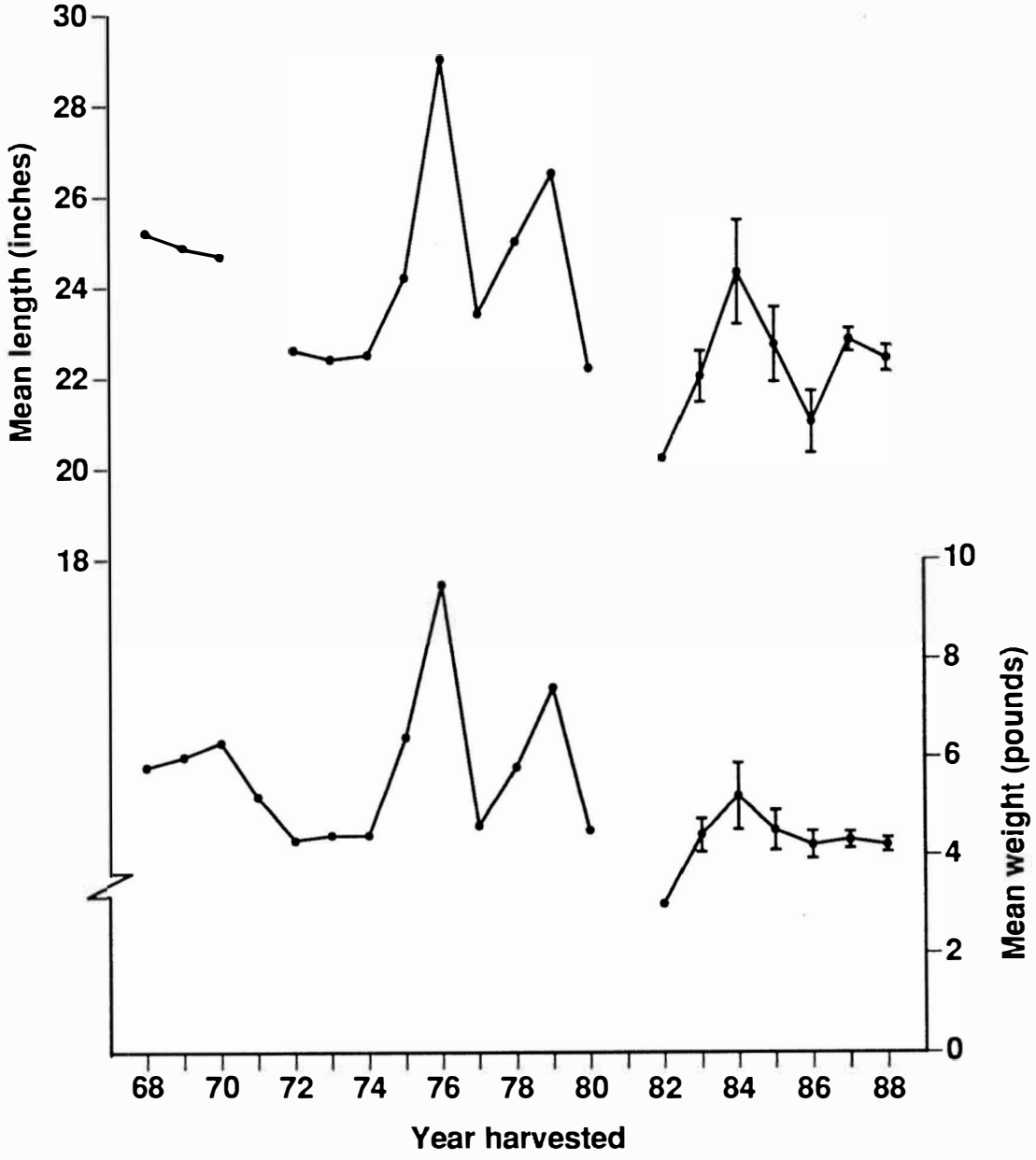

Figure 2.—Mean total length (inches) and round weight (pounds) of age-0.1 (jack) chinook salmon harvested at the Little Manistee River weir, fall 1988. Vertical bars indicate two standard errors.

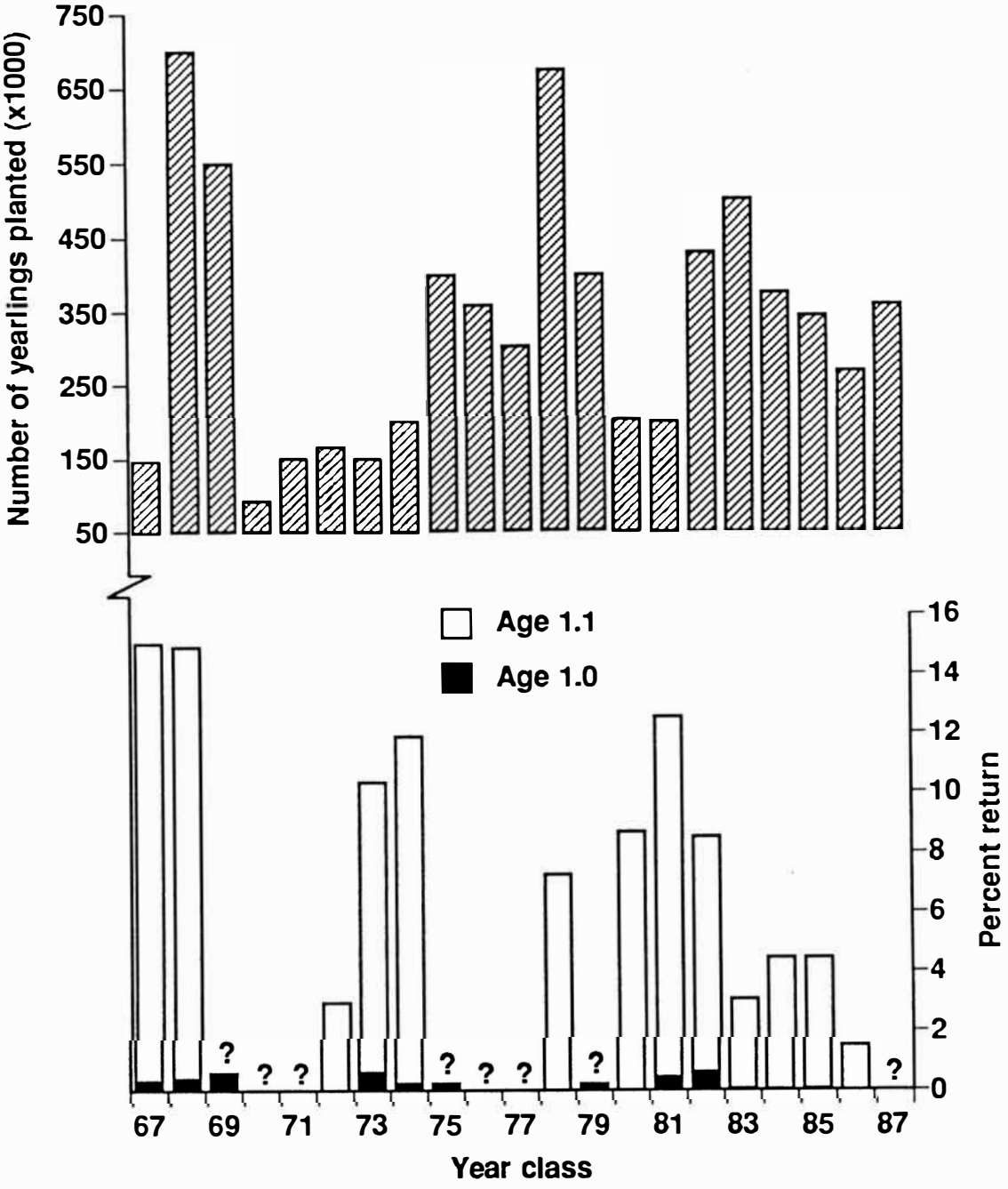

Figure 3.—Percent return, by age, of coho salmon year classes to the Little Manistee River weir compared with the number of yearlings planted. Question marks (?) indicate incomplete return data.

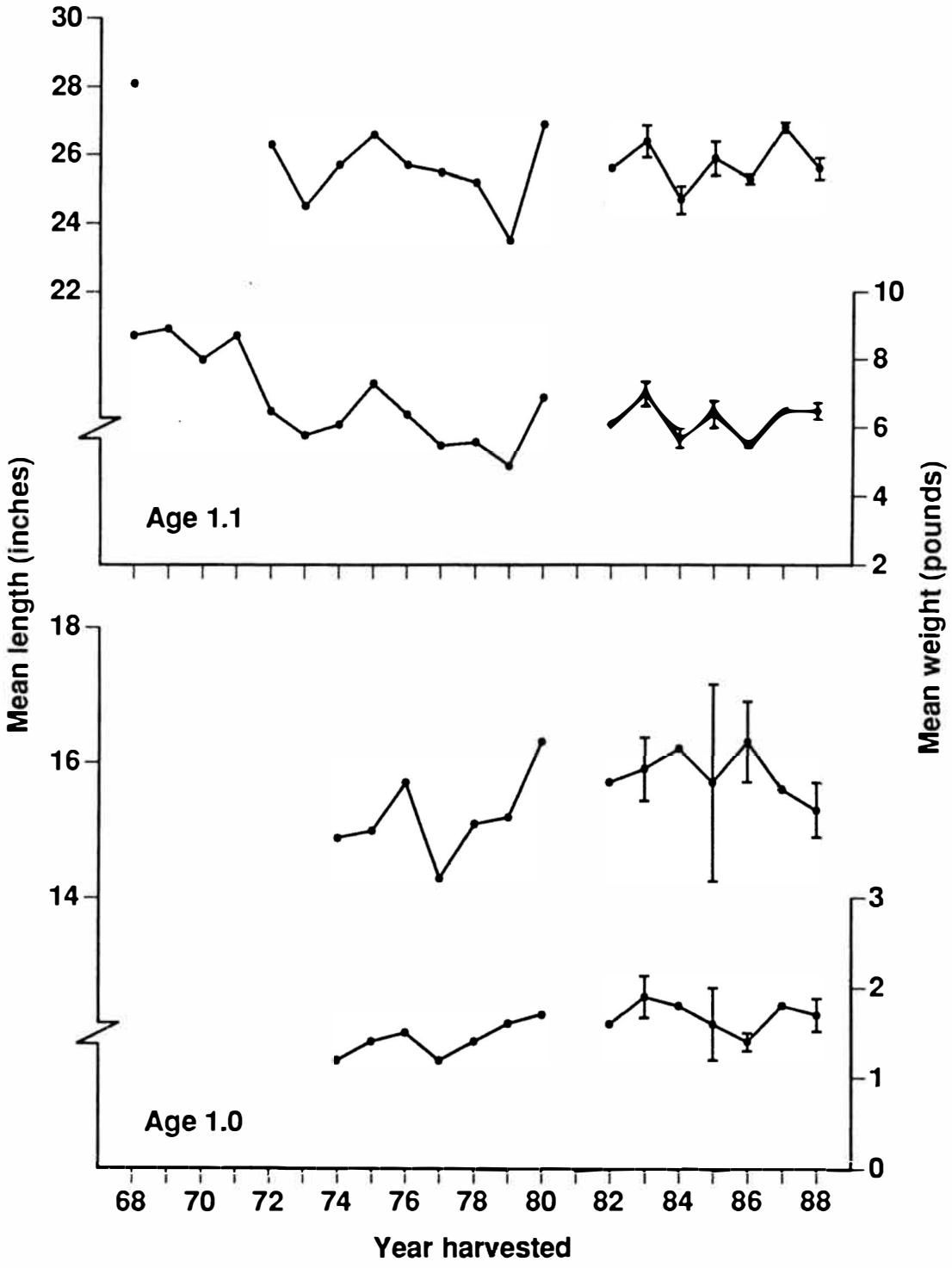

Figure 4.—Mean total length (inches) and round weight (pounds) of age-1.0 and age-1.1 coho salmon harvested at the Little Manistee River weir, fall 1988. Vertical bars indicate two standard errors.

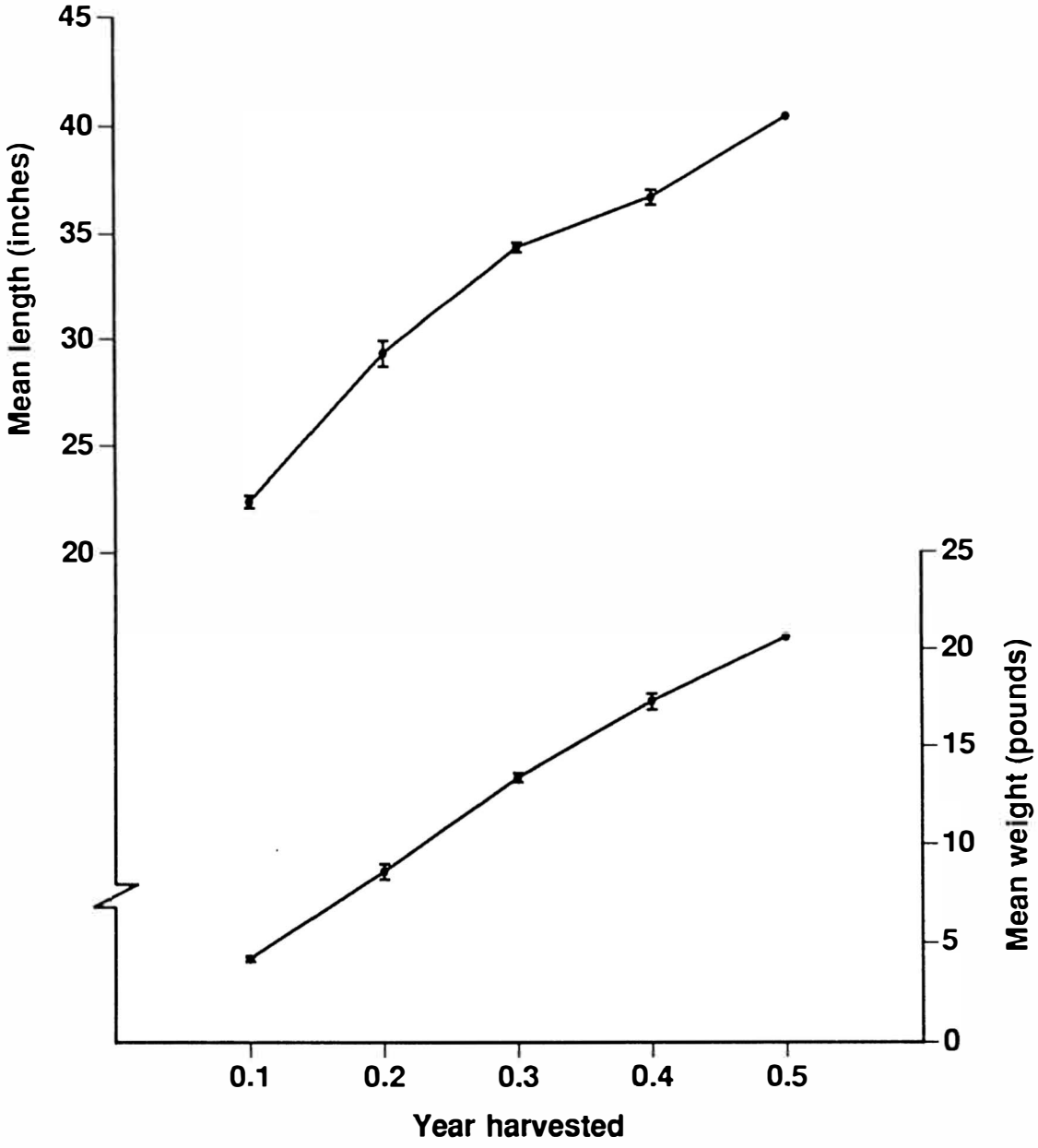

Figure 5.—Mean total length (inches) and round weight (pounds), by age, of chinook salmon harvested at the Little Manistee River weir, fall 1988. Vertical bars indicate two standard errors.

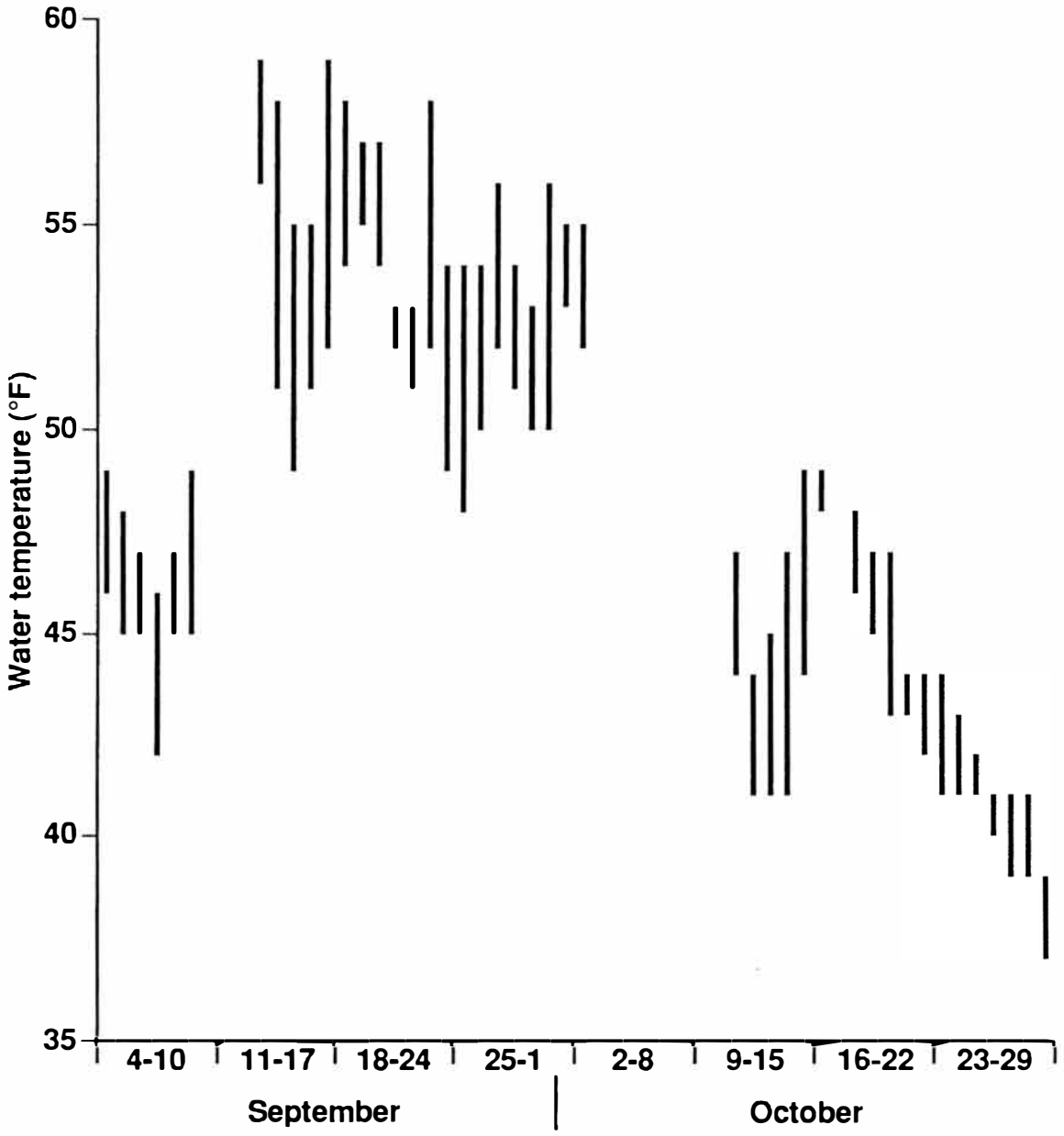

Figure 6.—Daily minimum and maximum water temperatures for the Little Manistee River, fall 1988.

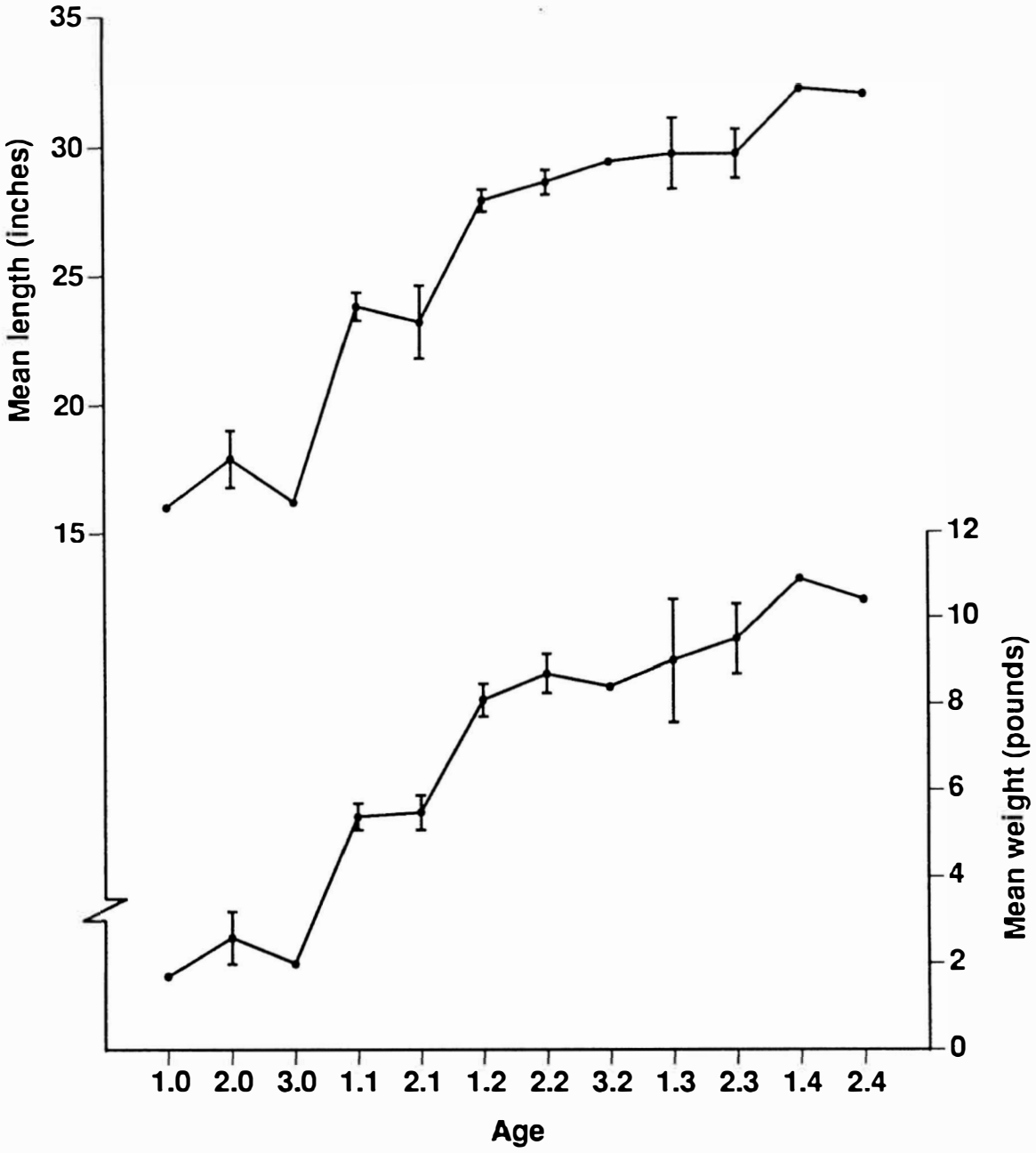

Figure 7.—Mean total length (inches) and round weight (pounds), by age, of steelhead passed upstream at the Little Manistee River weir, fall 1988. Vertical bars indicate two standard errors.

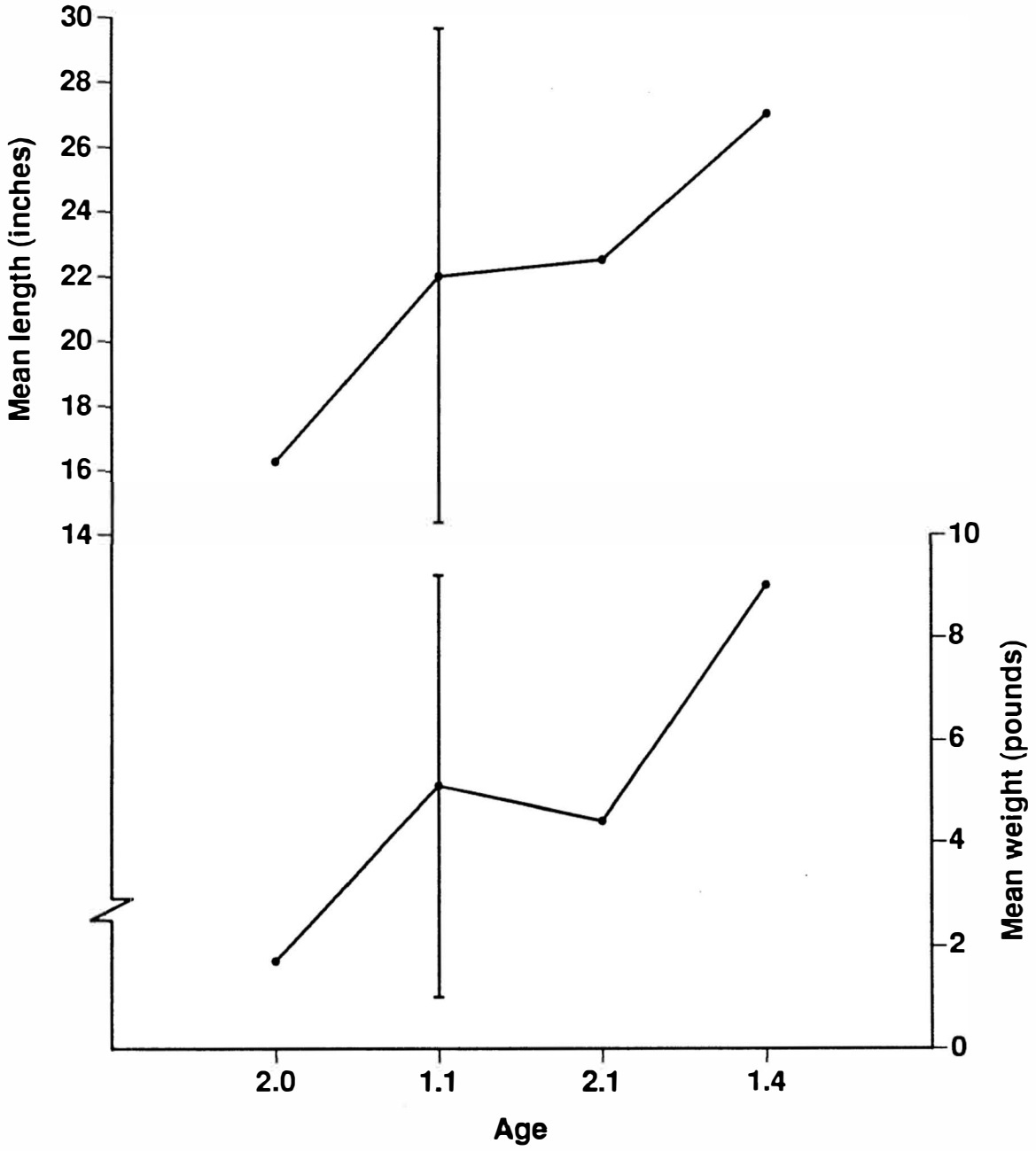

Figure 8.—Mean total length (inches) and round weight (pounds), by age, of brown trout passed upstream at the Little Manistee River weir, fall 1988. Vertical bars indicate two standard errors.

Table 1.—Planting history of anadromous salmonids in the Little Manistee River since 1967. Age of fish at planting are spring fingerling (SF), fall fingerling (FF), and yearling (Y).

Planting year	Salmon			Trout
	Chinook (All SF)	Coho (All Y)	Atlantic (All Y)	Steelhead
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	---	100,188 (FF)
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 (Y)[1]
	---	---	---	5,000 (Y)[2]
	---	---	---	4,817 (Y)[3]
1985	500,012	375,283	---	---
1986	450,273	343,121	---	---
	19,721[4]	---	---	---
1987	372,325	266,914	---	---
	63,321[4]	---	---	---
1988	523,400	358,250	---	---
	78,143[4]	---	---	---
Total	9,878,646	7,403,030	67,056	293,861 (FF)
	---	---	---	92,024 (Y)
Average	449,029	336,501	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.

Table 2.—Number, by age, of chinook salmon harvested at the Little Manistee River weir, fall 1968-88. Weight (pounds) is in parentheses.

Year	Age[1] 0.1	0.2	0.3	0.4	0.5	Adults[2]	Mortalities[3]	Total
1968	9,597	0	0	---	---	---	1,633	11,230
1969	5,175	18,693	0	---	---	---	2,420	26,288
1970	4,670	11,100	18,420	---	---	---	0	34,190
1971	2,885	11,913	6,415	---	---	---	---	21,213
1972	1,900	---	---	---	---	23,094	---	24,994
1973	1,153	---	---	---	---	15,323	---	16,476
1974	1,938	---	---	---	---	21,412	806	24,156
1975	762	---	---	---	---	27,106	1,360	29,228
1976	2,738	12,560	805	---	---	---	56	16,159
1977	---	---	---	---	---	---	---	11,136
1978	---	---	---	---	---	---	---	20,230
1979	---	---	---	---	---	---	---	22,925
1980	1,891	6,620	7,250	---	---	---	---	15,761
	---	---	---	---	---	---	---	(234,366)
1981	---	---	---	---	---	---	---	11,811
	---	---	---	---	---	---	---	(188,939)
1982	2,077	---	---	---	---	12,281	---	14,358
	---	---	---	---	---	---	---	(165,412)
1983	8,865	17,637	12,857	---	---	---	---	39,359
	---	---	---	---	---	---	---	(534,595)
1984	5,914	18,342	8,376	---	---	---	---	32,632
	---	---	---	---	---	---	---	(436,057)
1985	2,005	6,326	19,437	5,990	248	---	---	34,006
	---	---	---	---	---	---	---	(442,153)
1986	397	1,025	13,850	6,849	10	---	---	22,131
	---	---	---	---	---	---	---	(298,188)
1987	3,229	3,962	12,191	11,482	977	---	---	31,841
	---	---	---	---	---	---	---	(373,420)
1988	2,114	1,973	6,849	1,556	27	---	---	12,519
	(8,879)	(16,968)	(91,777)	(26,919)	(556)	---	---	(145,099)

[1]See footnote on Page 1 about aging.

[2]Ages 0.2 through 0.5 combined.

[3]Mortalities are included under age group headings in some years.

Table 3.—Numbers, and in parentheses percent, by age, of chinook and coho salmon in various year classes returning to the Little Manistee River weir 1 to 5 years after stocking.

Year class	Number stocked	Age[1] 0.1	0.2	0.3	0.4	0.5	Total
				Chinook			
1967	590,830	11,230	20,588	18,420	---	---	50,238
		(1.9)	(3.5)	(3.1)	---	---	(8.5)
1968	321,912	5,700	11,100	6,415	---	---	23,215
		(1.8)	(3.4)	(2.0)	---	---	(7.2)
1981	500,204	2,077	17,637	8,376	5,990	10	34,090
		(0.4)	(3.5)	(1.7)	(1.2)	(<0.1)	(6.8)
1982	600,294	8,865	18,342	19,437	6,849	977	54,470
		(1.5)	(3.1)	(3.2)	(1.1)	(0.2)	(9.1)
1983	677,250	5,914	6,326	13,850	11,482	27	37,599
		(0.9)	(0.9)	(2.0)	(1.7)	(<0.1)	(5.6)
1984	805,773	2,005	1,025	12,191	1,556	---	16,777
		(0.2)	(0.1)	(1.5)	(0.2)	---	(2.1)
1985	500,012	397	3,962	6,849	---	---	11,208
		(0.1)	(0.8)	(1.4)	---	---	(2.2)
1986	450,273	3,229	1,973	---	---	---	5,202
		(0.7)	(0.4)	---	---	---	(1.2)
1987	372,325	2,114	---	---	---	---	2,114
		(0.6)	---	---	---	---	(0.6)

Table 3.—Continued:

Year class	Number stocked	Age[1] 1.0	Age[1] 1.1	Total
		Coho		
1967	148,365	501 (0.3)	22,306 (15.0)	22,807 (15.4)
1968	700,002	2,880 (0.4)	105,006 (15.0)	107,886 (15.4)
1973	150,067	979 (0.7)	15,334 (10.2)	16,313 (10.9)
1974	200,601	492 (0.2)	23,525 (11.7)	24,017 (12.0)
1981	200,000	873 (0.4)	24,264 (12.1)	25,137 (12.6)
1982	429,612	2,704 (0.6)	33,764 (7.9)	36,468 (8.5)
1983	500,066	218 (<0.1)	15,177 (3.0)	15,395 (3.1)
1984	375,283	79 (<0.1)	16,599 (4.4)	16,678 (4.4)
1985	343,121	125 (<0.1)	15,016 (4.4)	15,141 (4.4)
1986	266,914	85 (<0.1)	4,004 (1.5)	4,089 (1.5)
1987	358,250	463 (0.1)	--- ---	463 (0.1)

[1]See footnote on Page 1 about aging.

Table 4.—Mean total length (L, in inches) and weight (W, in pounds), by age, of chinook salmon harvested at the Little Manistee weir, fall 1968-88. For chinook in 1972-75 and 1982, lengths and weights shown under age 0.2 are for ages 0.2 and older combined.

	Age[1]									
	0.1		0.2		0.3		0.4		0.5	
Year	L	W	L	W	L	W	L	W	L	W
1968	25.2	5.8	---	---	---	---	---	---	---	---
1969	24.9	6.0	34.2	15.9	---	---	---	---	---	---
1970	24.7	6.3	34.7	16.6	39.8	23.0	---	---	---	---
1971	---	5.2	---	15.0	---	22.7	---	---	---	---
1972	22.6	4.3	35.6	17.7	---	---	---	---	---	---
1973	22.4	4.4	36.0	17.8	---	---	---	---	---	---
1974	22.5	4.4	34.9	16.7	---	---	---	---	---	---
1975	24.2	6.4	37.1	20.2	---	---	---	---	---	---
1976	29.0	9.5	37.5	20.9	41.7	29.2	---	---	---	---
1977	23.4	4.6	34.6	15.0	38.1	20.1	---	---	---	---
1978	25.0	5.8	30.3	10.1	35.0	15.5	---	---	---	---
1979	26.5	7.4	34.6	15.1	35.7	16.9	---	---	---	---
1980	22.2	4.5	34.3	15.4	36.4	19.3	---	---	---	---
1981	---	---	---	---	---	---	---	---	---	---
1982	20.2	3.0	35.3	14.5	---	---	---	---	---	---
1983	22.0	4.4	33.6	14.0	37.0	19.3	---	---	---	---
1984	24.3	5.2	34.3	13.4	38.3	18.9	---	---	---	---
1985	22.7	4.5	30.8	9.5	34.4	13.4	37.3	17.7	41.1	22.0
1986	21.0	4.2	28.3	7.6	33.6	12.7	36.9	17.1	42.0	25.5
1987	22.8	4.3	27.7	7.2	33.1	11.3	35.9	15.1	38.5	19.8
1988	22.4	4.2	29.3	8.6	34.3	13.4	36.6	17.3	40.3	20.6

[1]Ages of chinook prior to 1977 were determined from length-frequency distributions: in 1977-80 and 1983-88, from scale samples and length-frequency distributions. See footnote on Page 1 about aging.

Table 5.—Number, by age, of coho salmon harvested at the Little Manistee River weir, fall 1968-88. Weight (pounds) is in parentheses.

Year	Age 1.0	Age 1.1	Mortalities[1]	Total
1968	490	58,422	1,336	60,248
1969	2,831	21,925	430	25,186
1970	3,300	102,100	3,000	108,400
1971	---	---	---	59,123
1972	---	---	---	2,314
1973	---	---	---	11,872
1974	939	4,928	262	6,129
1975	470	14,633	760	15,863
1976	978	23,480	47	24,505
1977	---	---	---	25,255
1978	---	---	---	23,696
1979	---	---	---	27,925
1980	900	49,104	---	50,004
	---	---	---	(353,043)
1981	---	---	---	(96,733)
1982	873	17,585	---	18,458
	---	---	---	(110,745)
1983	2,704	24,264	---	26,968
	---	---	---	(175,157)
1984	218	33,764	---	33,982
	---	---	---	(192,071)
1985	79	15,177	---	15,256
	---	---	---	(96,798)
1986	125	16,599	---	16,724
	---	---	---	(92,165)
1987	85	15,016	---	15,101
	---	---	---	(97,809)
1988	463	4,004	---	4,467
	(787)	(26,026)	---	(26,813)

[1]Mortalities are included under age group headings in some years.

Table 6.—Mean total length (L, in inches) and weight (W, in pounds), by age, of coho salmon harvested at the Little Manistee River weir, fall 1968-88.

Year	Age 1.0		Age 1.1	
	L	W	L	W
1968	---	---	28.1	8.7
1969	---	---	---	8.9
1970	---	---	---	8.0
1971	---	---	---	8.7
1972	---	---	26.3	6.5
1973	---	---	24.5	5.8
1974	14.9	1.2	25.7	6.1
1975	15.0	1.4	26.6	7.3
1976	15.7	1.5	25.7	6.4
1977	14.3	1.2	25.5	5.5
1978	15.1	1.4	25.2	5.6
1979	15.2	1.6	23.5	4.9
1980[1]	16.3	1.7	26.9	6.9
1981	---	---	---	---
1982	15.7	1.6	25.6	6.1
1983	15.9	1.9	26.4	7.0
1984	16.2	1.8	24.7	5.7
1985	15.7	1.6	25.9	6.4
1986	16.3	1.4	25.3	5.5
1987	15.6	1.8	26.8	6.5
1988	15.3	1.7	25.6	6.5

[1]Ages of coho in 1980 were determined from a length-frequency distribution.

Table 7.—Number and mean total length (L, in inches) and weight (W, in pounds) of steelhead (ages combined) collected at the Little Manistee River weir, fall 1968-88.

Year	Number				Total	
	Passed	Transferred	Mortalities	Total	L	W
1968	1,297	0	25	1,322	25.1	7.3
1969	2,987	0	56	3,043	25.6	7.8
1970	7,322	0	89	7,411	---	8.7
1971	7,523	0	99	7,622	---	8.8
1972	3,515	0	46	3,561	27.4	9.3
1973	421	1,478[1]	27	1,926	24.3	6.5
1974	2,270	1,200[1]	18	3,488	26.4	7.3
1975	4,722	1,300[1]	99	6,121	26.7	8.0
1976	503	45	30	578	26.8	7.6
1977	2,031	---	---	2,031	26.7	6.8
1978	320	---	---	320	---	---
1979	640	---	---	640	25.6	6.7
1980	1,111	---	---	1,111	25.6	7.0
1981	849	---	---	849	---	---
1982	347	---	---	347	25.2	6.9
1983	3,100	---	---	3,100	24.3	6.8
1984	1,830	---	79	1,909	26.0	7.1
1985	6,187	---	169	6,356	27.1	7.4
1986	4,646	16[2]	58	4,720	26.0	7.3
1987	1,421	---	29	1,450	27.6	7.8
1988	1,044	---	6	1,050	26.8	7.6

[1]Transferred to Big Manistee and Pine rivers.

[2]Summer strain steelhead transferred to Wolf Lake Hatchery.

Table 8.—Number and mean total length (L, in inches) and weight (W, in pounds) of brown trout (ages combined) collected at the Little Manistee River weir, all 1968-88.

Year	Number			Mean	
	Passed	Mortalities	Total	L	W
1968	28	---	28	---	---
1969	36	---	36	---	---
1970	123	---	123	---	5.6
1971	69	---	69	---	---
1972	5	---	5	---	---
1973	45	3	48	---	---
1974	159	2	161	19.4	3.4
1975	238	0	238	21.8	5.0
1976	104	2	106	22.9	5.8
1977	98	---	98	19.3	3.5
1978	51	---	51	---	---
1979	100	---	100	23.4	6.8
1980	28	---	28	18.6	3.4
1981	101	---	101	---	---
1982	62	---	62	21.4	4.9
1983	43	---	43	22.4	6.0
1984	134	7	141	22.4	5.3
1985	162	15	177	23.2	6.2
1986	89	10	99	22.4	5.6
1987	46	2	48	23.7	6.5
1988	22	5	27	21.0	4.3

Table 9.—Summary of the number and weight, by age and sex, of chinook salmon harvested at Little Manistee River weir, fall 1988.

Week beginning	Male		Female[1]		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 0.1						
08-28	9	36	---	---	9	36
09-18	310	1,389	---	---	310	1,389
09-25	247	1,097	---	---	247	1,097
10-02	439	1,771	26	107	465	1,878
10-09	361	1,503	---	---	361	1,503
10-16	541	2,269	---	---	541	2,269
11-06	22	89	---	---	22	89
---[2]	157	610	2	8	159	618
Total	2,086	8,764	28	115	2,114	8,879
(Percent)	(16.7)	(6.0)	(0.2)	(0.1)	(16.9)	(6.1)
Age 0.2						
08-28	6	51	1	11	7	62
09-18	165	1,281	206	1,996	371	3,277
09-25	229	2,017	53	479	282	2,496
10-02	414	3,118	26	242	440	3,360
10-09	136	1,009	75	705	211	1,714
10-16	313	2,902	114	1,166	427	4,068
11-06	58	466	29	297	87	763
---[2]	107	846	41	382	148	1,228
Total	1,428	11,690	545	5,278	1,973	16,968
(Percent)	(11.4)	(8.1)	(4.4)	(3.6)	(15.8)	(11.7)
Age 0.3						
08-28	33	415	33	469	66	884
09-18	702	8,736	392	5,240	1,094	13,976
09-25	669	8,755	282	4,011	951	12,766
10-02	465	6,427	1,034	14,189	1,499	20,616
10-09	467	5,988	331	4,592	798	10,580
10-16	768	9,947	740	10,343	1,508	20,290
11-06	216	2,946	202	3,000	418	5,946
---[2]	270	3,414	245	3,305	515	6,719
Total	3,590	46,628	3,259	45,149	6,849	91,777
(Percent)	(28.7)	(32.1)	(26.0)	(31.1)	(54.7)	(63.3)

Table 9.—Continued:

Week beginning	Male		Female[1]		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 0.4						
08-28	10	169	3	59	13	228
09-18	165	2,669	124	2,135	289	4,804
09-25	158	2,633	106	1,996	264	4,629
10-02	103	1,859	78	1,323	181	3,182
10-09	45	760	90	1,616	135	2,376
10-16	228	3,933	142	2,459	370	6,392
11-06	115	1,937	72	1,300	187	3,237
---[2]	67	1,164	50	907	117	2,071
Total	891	15,124	665	11,795	1,556	26,919
(Percent)	(7.1)	(10.4)	(5.3)	(8.1)	(12.4)	(18.5)
Age 0.5						
08-28	---	---	---	---	---	---
09-18	---	---	---	---	---	---
09-25	18	374	---	---	18	374
10-02	---	---	---	---	---	---
10-09	---	---	---	---	---	---
10-16	---	---	---	---	---	---
11-06	7	141	---	---	7	141
---[2]	2	41	---	---	2	41
Total	27	556	---	---	27	556
(Percent)	(0.2)	(0.4)	---	---	(0.2)	(0.4)

[1]Weight of stripped females was recalculated into round weight and, therefore, the total weight of chinook does not correspond with the weight shipped to Tempotech Industries.

[2]Combination of weeks when chinook salmon were harvested but no biological data were collected. Estimation of number and weight by age and sex for these weeks was done using the distributions calculated from the 7 weeks in which biological samples were obtained.

Table 10.—Length-age distribution (in percent of inch group) for chinook salmon scale sampled during creel census at Pentwater, Ludington, Manistee, Frankfort, Onekema, Leland, Grand Traverse Bay, Betsie River, Platte Bay and Platte River, August-November 1988.[1]

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	---	29	71	---	---	---
25	---	20	80	---	---	---
26	---	---	100	---	---	---
27	---	---	100	---	---	---
28	---	---	100	---	---	---
29	---	---	80	20	---	---
30	---	---	62	38	---	---
31	---	---	54	46	---	---
32	---	---	23	77	---	---
33	---	---	---	96	4	---
34	---	---	---	83	17	---
35	---	---	---	68	32	---
36	---	---	---	75	25	---
37	---	---	---	53	47	---
38	---	---	---	46	54	---
39	---	---	---	67	33	---
40+	---	---	---	---	75	25

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

Table 11.—Mean total length (inches) and weight (pounds), by age and sex, of chinook salmon harvested at the Little Manistee River weir, fall 1988. Two standard errors in parentheses.

Week beginning	Measure-ment	Age 0.1		Age 0.2		Age 0.3	
		Male	Female	Male	Female	Male	Female
08-28	Length	21.0	---	29.0	32.5	33.9	34.6
		(1.408)	---	(1.300)	---	(0.568)	(0.550)
	Weight	4.0	---	8.4	11.4	12.6	14.2
		(0.744)	---	(1.084)	---	(0.564)	(0.766)
09-18	Length	21.8	---	28.1	30.0	34.1	33.6
		(1.055)	---	(2.639)	(1.217)	(0.767)	(0.520)
	Weight	4.5	---	7.8	9.7	12.4	13.4
		(0.495)	---	(1.443)	(0.769)	(0.714)	(0.747)
09-25	Length	23.0	---	31.1	31.4	34.9	34.6
		(0.517)	---	(0.554)	(0.882)	(0.525)	(0.865)
	Weight	4.4	---	8.8	9.0	13.1	14.2
		(0.386)	---	(0.448)	(0.940)	(0.541)	(1.066)
10-02	Length	22.5	22.6	28.8	31.1	35.3	34.2
		(0.517)	---	(1.600)	---	(1.107)	(0.443)
	Weight	4.0	4.1	7.5	9.3	13.8	13.7
		(0.224)	---	(0.890)	---	(1.139)	(0.525)
10-09	Length	22.6	---	27.9	30.6	34.4	33.9
		(0.470)	---	(2.207)	(1.162)	(0.673)	(0.762)
	Weight	4.2	---	7.4	9.4	12.8	13.9
		(0.218)	---	(1.298)	(1.195)	(0.648)	(0.879)
10-16	Length	22.4	---	28.1	31.3	34.3	33.8
		(0.598)	---	(1.649)	(1.420)	(0.907)	(0.654)
	Weight	4.2	---	9.3	10.2	13.0	14.0
		(0.323)	---	(1.551)	(0.378)	(0.854)	(0.707)
11-06	Length	22.0	---	29.0	30.8	35.1	34.3
		(3.361)	---	(1.528)	(1.021)	(0.931)	(0.756)
	Weight	4.0	---	8.0	10.2	13.6	14.8
		(1.133)	---	(0.704)	(0.885)	(0.821)	(0.836)
Weighted seasonal mean	Length	22.4	22.6	28.9	30.6	34.6	34.0
		(0.284)	---	(0.744)	(0.646)	(0.336)	(0.258)
	Weight	4.2	4.1	8.2	9.7	13.0	13.9
		(0.143)	---	(0.509)	(0.398)	(0.324)	(0.300)
Sexes combined	Length	22.4		29.3		34.3	
		(0.280)		(0.598)		(0.216)	
	Weight	4.2		8.6		13.4	
		(0.141)		(0.400)		(0.225)	

Table 11.—Continued:

Week beginning	Measure-ment	Age 0.4		Age 0.5	
		Male	Female	Male	Female
08-28	Length	36.4	36.8	---	---
		(1.010)	(0.751)	---	---
	Weight	16.9	19.5	---	---
		(1.604)	(1.098)	---	---
09-18	Length	36.3	36.0	---	---
		(1.166)	(1.215)	---	---
	Weight	16.2	17.2	---	---
		(1.342)	(1.133)	---	---
09-25	Length	36.9	36.8	40.2	---
		(0.801)	(1.074)	---	---
	Weight	16.7	18.8	20.8	---
		(1.050)	(1.298)	---	---
10-02	Length	38.1	35.7	---	---
		(1.652)	(0.240)	---	---
	Weight	18.0	17.0	---	---
		(1.240)	(0.481)	---	---
10-09	Length	36.7	36.3	---	---
		(2.677)	(1.262)	---	---
	Weight	16.9	17.9	---	---
		(4.406)	(2.132)	---	---
10-16	Length	37.6	35.6	---	---
		(0.758)	(1.280)	---	---
	Weight	17.3	17.3	---	---
		(0.950)	(2.103)	---	---
11-06	Length	36.7	35.2	40.6	---
		(0.878)	(0.739)	---	---
	Weight	16.8	18.1	20.2	---
		(0.923)	(1.155)	---	---
Weighted seasonal mean	Length	37.0	36.0	40.3	---
		(0.436)	(0.461)	---	---
	Weight	16.9	17.7	20.6	---
		(0.515)	(0.659)	---	---
Sexes combined	Length	36.6		40.3	
		(0.356)		---	
	Weight	17.3		20.6	
		(0.409)		---	

Table 12.—Summary of the chinook egg-take operation at the Little Manistee River weir, fall 1988.

Date	Number of females stripped	Number of eggs collected	Percent eye-up	Destination
09-27	198	780,000	---	Illinois
09-29	203	1,000,000	---	Indiana
10-03	233	1,130,000	---	Thompson
10-04	240	1,242,780	---	Wolf Lake
10-05	216	1,016,000	---	Wolf Lake
10-10	444	1,979,840	73.0	Platte River
10-17	398	1,861,480	77.9	Platte River
10-19	249	1,183,600	60.3	Platte River
10-21	290	1,375,000	---	Wolf Lake
10-27	72	321,123	---	Wolf Lake
11-02	61	234,540	---	Wolf Lake (MSU)[1]
11-09	115	442,175	---	Wolf Lake (MSU)[1]
Total	2,719	12,566,538	---	
In-state	2,318	10,786,538	---	
Out-of-state	401	1,780,000	---	

[1]MSU = Michigan State University.

Table 13.—Percent lamprey scarring of anadromous salmonids captured at the Little Manistee River weir, fall 1968-88.

Year	Salmon		Trout	
	Chinook	Coho	Steelhead	Brown
1968	3.7	4.3	6.0	---
1969	4.7	2.5	0.9	---
1970	4.0	1.0	2.0	---
1971	2.8	1.5	0.0	---
1972	---	0.4	---	---
1973	0.7	0.0	0.0	---
1974	0.8	0.9	0.0	0.0
1975	1.0	0.4	0.3	0.0
1976	0.0	0.0	0.0	<0.1
1977	0.0	0.0	0.0	0.0
1978	---	---	---	---
1979	---	---	---	---
1980	0.3	0.2	0.0	0.0
1981	---	---	---	---
1982	0.0	0.0	0.0	0.0
1983	0.1	0.0	0.0	0.0
1984	0.1	0.1	0.0	0.0
1985	0.5	0.2	0.0	0.0
1986	1.4	0.1	0.2	0.0
1987	1.1	0.0	0.0	0.0
1988	1.2	0.6	0.0	0.0

Table 14.—Summary of the number and weight, by age and sex, of coho salmon harvested at Little Manistee River weir, fall 1988.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 1.0						
08-28	24	28	---	---	24	28
09-18	277	493	---	---	277	493
09-25	27	46	3	5	30	51
10-02	3	5	---	---	3	5
10-09	1	2	---	---	1	2
11-06	23	47	---	---	23	47
---[1]	104	160	1	1	105	161
Total	459	781	4	6	463	787
(Percent)	(10.3)	(2.9)	(0.1)	(<0.1)	(10.4)	(2.9)
Age 1.1						
08-28	12	54	2	13	14	67
09-18	1,106	7,109	1,383	9,153	2,489	16,262
09-25	120	777	150	937	270	1,714
10-02	36	250	34	211	70	461
10-09	7	47	7	40	14	87
11-06	133	796	104	739	237	1,535
---[1]	416	2,648	494	3,252	910	5,900
Total	1,830	11,681	2,174	14,345	4,004	26,026
(Percent)	(41.0)	(43.6)	(48.6)	(53.5)	(89.6)	(97.1)

[1]Combination of weeks when coho salmon were harvested but no biological data were collected. Estimation of number and weight by age and sex for these weeks was done using the distributions calculated from the 6 weeks in which biological samples were obtained.

Table 15.—Mean total length (inches) and weight (pounds), by age and sex, of coho salmon harvested at the Little Manistee River weir, fall 1988. Two standard errors in parentheses.

Week beginning	Measure-ment	Age 1.0		Age 1.1	
		Male	Female	Male	Female
08-28	Length	14.1	---	22.8	25.8
		(0.341)	---	(1.588)	(0.600)
	Weight	1.2	---	4.5	6.7
		(0.065)	---	(0.786)	(0.700)
09-18	Length	15.2	---	25.7	25.5
		(0.523)	---	(0.611)	(0.518)
	Weight	1.8	---	6.4	6.6
		(0.229)	---	(0.459)	(0.411)
09-25	Length	15.2	15.9	26.3	25.7
		(0.556)	---	(0.625)	(0.485)
	Weight	1.7	1.5	6.5	6.2
		(0.773)	---	(0.500)	(0.345)
10-02	Length	15.5	---	27.1	25.5
		(1.242)	---	(0.673)	(0.441)
	Weight	1.5	---	6.9	6.2
		(0.506)	---	(0.453)	(0.314)
10-09	Length	15.7	---	26.7	24.9
		(0.942)	---	(0.591)	(0.597)
	Weight	1.6	---	6.7	5.7
		(0.455)	---	(0.426)	(0.425)
11-06	Length	16.6	---	25.2	26.7
		(0.428)	---	(0.959)	(0.350)
	Weight	2.0	---	6.0	7.1
		(0.224)	---	(0.567)	(0.320)
Weighted seasonal mean	Length	15.3	15.9	25.7	25.6
		(0.403)	---	(0.476)	(0.420)
	Weight	1.7	1.5	6.4	6.6
		(0.182)	---	(0.357)	(0.333)
Sexes combined	Length	15.3		25.6	
		(0.400)		(0.314)	
	Weight	1.7		6.5	
		(0.180)		(0.243)	

Table 16.—Summary of the coho egg-take operation at the Little Manistee River weir, fall 1988.

Date	Number of females stripped	Number of eggs collected	Percent eye-up	Destination
10-19	164	445,684	65.4	Platte River
11-03	109	332,600	66.8	Platte River
11-09	35	106,432	80.0	Platte River
Total	308	884,716	---	
In-state	308	884,716	---	
Out-of-state	---	---	---	

Table 17.—Summary of the number and weight, by age and sex, of steelhead passed upstream at the Little Manistee River weir, fall 1988.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 1.0						
08-28	---	---	---	---	---	---
09-04	---	---	---	---	---	---
09-18	---	---	1	1	1	1
09-25	---	---	1	1	1	1
10-02	1	3	2	3	3	6
10-09	1	2	---	---	1	2
10-16	2	3	2	4	4	7
10-23	1	2	---	---	1	2
11-06	---	---	---	---	---	---
Total	5	10	6	9	11	19
(Percent)	(0.5)	(0.1)	(0.6)	(0.1)	(1.1)	(0.2)
Age 2.0						
08-28	---	---	---	---	---	---
09-04	---	---	---	---	---	---
09-18	2	3	1	2	3	5
09-25	1	2	1	3	2	5
10-02	1	2	---	---	1	2
10-09	---	---	1	2	1	2
10-16	4	8	---	---	4	8
10-23	---	---	---	---	---	---
11-06	25	73	---	---	25	73
Total	33	88	3	7	36	95
(Percent)	(3.2)	(1.1)	(0.3)	(0.1)	(3.5)	(1.2)
Age 3.0						
08-28	---	---	---	---	---	---
09-04	---	---	---	---	---	---
09-18	1	2	---	---	1	2
09-25	---	---	---	---	---	---
10-02	---	---	---	---	---	---
10-09	---	---	---	---	---	---
10-16	---	---	---	---	---	---
10-23	---	---	---	---	---	---
11-06	---	---	---	---	---	---
Total	1	2	---	---	1	2
(Percent)	(0.1)	(<0.1)	---	---	(0.1)	(<0.1)

Table 17.—Continued:

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 1.1						
08-28	---	---	---	---	---	---
09-04	1	1	---	---	1	1
09-18	2	9	2	6	4	15
09-25	3	14	5	26	8	40
10-02	1	4	---	---	1	4
10-09	1	5	2	8	3	13
10-16	11	52	4	24	15	76
10-23	1	4	2	4	3	8
11-06	33	177	49	301	82	478
Total	53	266	64	369	117	635
(Percent)	(5.1)	(3.4)	(6.1)	(4.7)	(11.2)	(8.1)
Age 2.1						
08-28	1	3	---	---	1	3
09-04	1	4	---	---	1	4
09-18	4	17	2	12	6	29
09-25	3	6	3	18	6	24
10-02	1	2	---	---	1	2
10-09	---	---	1	7	1	7
10-16	13	77	7	40	20	117
10-23	---	---	2	12	2	12
11-06	49	244	49	312	98	556
Total	72	353	64	401	136	754
(Percent)	(6.9)	(4.5)	(6.1)	(5.1)	(13.0)	(9.6)
Age 1.2						
08-28	---	---	---	---	---	---
09-04	1	8	---	---	1	8
09-18	1	9	3	23	4	32
09-25	2	18	3	23	5	41
10-02	4	31	3	24	7	55
10-09	---	---	1	9	1	9
10-16	7	57	2	13	9	70
10-23	1	9	---	---	1	9
11-06	74	630	165	1,310	239	1,940
---[1]	2	19	4	38	6	57
Total	92	781	181	1,440	273	2,221
(Percent)	(8.8)	(9.8)	(17.3)	(18.1)	(26.1)	(27.9)

Table 17.—Continued:

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 2.2						
08-28	1	7	---	---	1	7
09-04	---	---	2	12	2	12
09-18	11	90	8	67	19	157
09-25	3	25	1	9	4	34
10-02	3	26	5	37	8	63
10-09	1	12	---	---	1	12
10-16	20	162	9	75	29	237
10-23	1	7	---	---	1	7
11-06	115	1,055	115	982	230	2,037
---[1]	4	36	4	36	8	72
Total	159	1,420	144	1,218	303	2,638
(Percent)	(15.2)	(17.9)	(13.8)	(15.3)	(29.0)	(33.2)
Age 3.2						
08-28	---	---	---	---	---	---
09-04	---	---	---	---	---	---
09-18	---	---	1	8	1	8
09-25	---	---	---	---	---	---
10-02	---	---	---	---	---	---
10-09	---	---	---	---	---	---
10-16	---	---	---	---	---	---
10-23	---	---	---	---	---	---
11-06	---	---	---	---	---	---
Total	---	---	1	8	1	8
(Percent)	---	---	(0.1)	(0.1)	(0.1)	(0.1)
Age 1.3						
08-28	---	---	---	---	---	---
09-04	---	---	---	---	---	---
09-18	---	---	---	---	---	---
09-25	1	9	1	10	2	19
10-02	---	---	3	27	3	27
10-09	---	---	---	---	---	---
10-16	1	10	2	21	3	31
10-23	---	---	---	---	---	---
11-06	49	447	8	62	57	509
---[1]	1	9	2	18	3	27
Total	52	475	16	138	68	613
(Percent)	(5.0)	(6.0)	(1.5)	(1.7)	(6.5)	(7.7)

Table 17.—Continued:

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 2.3						
08-28	---	---	1	9	1	9
09-04	---	---	1	9	1	9
09-18	5	55	---	---	5	55
09-25	4	39	1	10	5	49
10-02	1	10	---	---	1	10
10-09	---	---	---	---	---	---
10-16	5	60	2	18	7	78
10-23	4	39	1	8	5	47
11-06	16	166	41	354	57	520
---[1]	2	22	1	9	3	31
Total	37	391	48	417	85	808
(Percent)	(3.5)	(4.9)	(4.6)	(5.3)	(8.1)	(10.2)
Age 1.4						
08-28	---	---	---	---	---	---
09-04	---	---	---	---	---	---
09-18	---	---	---	---	---	---
09-25	1	12	---	---	1	12
10-02	---	---	---	---	---	---
10-09	---	---	---	---	---	---
10-16	---	---	---	---	---	---
10-23	---	---	---	---	---	---
11-06	8	88	---	---	8	88
Total	9	100	---	---	9	100
(Percent)	(0.9)	(1.3)	---	---	(0.9)	(1.3)
Age 2.4						
08-28	---	---	---	---	---	---
09-04	---	---	---	---	---	---
09-18	3	33	1	9	4	42
09-25	---	---	---	---	---	---
10-02	---	---	---	---	---	---
10-09	---	---	---	---	---	---
10-16	---	---	---	---	---	---
10-23	---	---	---	---	---	---
11-06	---	---	---	---	---	---
Total	3	33	1	9	4	42
(Percent)	(0.3)	(0.4)	(0.1)	(0.1)	(0.4)	(0.5)

[1]Combination of weeks when steelhead were passed upstream but no biological data were collected. Estimation of number and weight by age and sex for these weeks was done using the distribution calculated from the 9 weeks in which biological samples were obtained.

Table 18.—Mean total length (inches) and weight (pounds), by age and sex, of steelhead passed upstream at the Little Manistee River weir, fall 1988. Two standard errors in parentheses.

Week beginning	Measure-ment	Age 1.0		Age 2.0		Age 3.0	
		Male	Female	Male	Female	Male	Female
08-28	Length	---	---	---	---	---	---
		---	---	---	---	---	---
	Weight	---	---	---	---	---	---
		---	---	---	---	---	---
09-04	Length	---	---	---	---	---	---
		---	---	---	---	---	---
	Weight	---	---	---	---	---	---
		---	---	---	---	---	---
09-18	Length	---	14.2	17.0	16.3	16.2	---
		---	---	(1.100)	---	---	---
	Weight	---	1.3	1.7	1.8	2.0	---
		---	---	(1.200)	---	---	---
09-25	Length	---	14.8	17.8	18.6	---	---
		---	---	---	---	---	---
	Weight	---	1.1	2.1	2.5	---	---
		---	---	---	---	---	---
10-02	Length	18.5	15.5	16.9	---	---	---
		---	(0.700)	---	---	---	---
	Weight	3.0	1.3	1.9	---	---	---
		---	(0.100)	---	---	---	---
10-09	Length	16.4	---	---	17.1	---	---
		---	---	---	---	---	---
	Weight	1.8	---	---	1.6	---	---
		---	---	---	---	---	---
10-16	Length	16.0	15.6	17.2	---	---	---
		(1.200)	(0.110)	(0.737)	---	---	---
	Weight	1.7	1.8	1.9	---	---	---
		(0.100)	(0.800)	(0.258)	---	---	---
10-23	Length	18.0	---	---	---	---	---
		---	---	---	---	---	---
	Weight	2.2	---	---	---	---	---
		---	---	---	---	---	---
11-06	Length	---	---	18.1	---	---	---
		---	---	(1.622)	---	---	---
	Weight	---	---	2.9	---	---	---
		---	---	(0.874)	---	---	---
Weighted seasonal mean	Length	17.0	15.2	17.9	17.3	16.2	---
		---	---	(1.227)	---	---	---
	Weight	2.1	1.4	2.7	2.0	2.0	---
		---	---	(0.661)	---	---	---
Sexes combined	Length		16.0		17.9		16.2
			---		(1.119)		---
	Weight		1.7		2.6		2.0
			---		(0.603)		---

Table 18.—Continued:

Week beginning	Measure-ment	Age 1.1		Age 2.1		Age 1.2	
		Male	Female	Male	Female	Male	Female
08-28	Length	—	—	19.5	—	—	—
		—	—	—	—	—	—
	Weight	—	—	3.3	—	—	—
		—	—	—	—	—	—
09-04	Length	14.2	—	23.3	—	28.6	—
		—	—	—	—	—	—
	Weight	1.1	—	4.3	—	8.1	—
		—	—	—	—	—	—
09-18	Length	22.1	18.4	21.4	24.4	28.6	26.9
		(1.800)	(6.400)	(3.599)	(0.400)	—	(0.481)
	Weight	4.0	3.0	4.2	5.7	9.0	7.6
		(0.700)	(2.400)	(0.822)	(0.700)	—	(0.346)
09-25	Length	23.3	23.9	17.6	24.5	29.0	26.9
		(2.099)	(2.433)	(4.468)	(3.311)	(2.300)	(1.377)
	Weight	4.5	5.2	2.1	5.9	8.9	7.7
		(1.405)	(1.480)	(1.768)	(2.575)	(3.200)	(1.617)
10-02	Length	20.6	—	17.8	—	28.4	28.8
		—	—	—	—	(0.829)	(1.400)
	Weight	3.9	—	1.7	—	7.6	8.1
		—	—	—	—	(0.915)	(1.622)
10-09	Length	25.5	22.3	—	25.1	—	28.2
		—	(1.000)	—	—	—	—
	Weight	5.2	3.8	—	6.5	—	8.8
		—	(1.900)	—	—	—	—
10-16	Length	23.0	25.3	23.5	24.8	28.2	25.9
		(1.796)	(0.666)	(2.075)	(0.928)	(0.997)	(0.300)
	Weight	4.6	5.9	5.9	5.5	8.2	6.3
		(0.833)	(0.915)	(1.015)	(0.663)	(0.816)	(0.300)
10-23	Length	22.0	19.4	—	25.0	30.4	—
		—	(4.400)	—	(1.200)	—	—
	Weight	4.4	2.2	—	5.8	9.2	—
		—	(0.400)	—	(1.100)	—	—
11-06	Length	23.7	24.8	23.0	23.5	28.6	27.5
		(1.115)	(1.005)	(2.042)	(3.726)	(1.142)	(0.468)
	Weight	5.3	6.1	4.9	6.3	8.5	7.9
		(0.837)	(0.391)	(0.825)	(0.235)	(0.942)	(0.464)
Weighted seasonal mean	Length	23.2	24.3	22.7	23.8	28.6	27.5
		(0.704)	(0.721)	(1.359)	(2.715)	(0.910)	(0.411)
	Weight	4.9	5.7	4.9	6.1	8.5	7.9
		(0.528)	(0.281)	(0.549)	(0.171)	(0.751)	(0.408)
Sexes combined	Length	23.8		23.2		27.9	
		(0.532)		(1.413)		(0.424)	
	Weight	5.4		5.5		8.1	
		(0.306)		(0.399)		(0.369)	

Table 18.—Continued:

Week beginning	Measure-ment	Age 2.2		Age 3.2		Age 1.3	
		Male	Female	Male	Female	Male	Female
08-28	Length	27.0	—	—	—	—	—
		—	—	—	—	—	—
	Weight	6.9	—	—	—	—	—
		—	—	—	—	—	—
09-04	Length	—	26.9	—	—	—	—
		—	(0.200)	—	—	—	—
	Weight	—	6.1	—	—	—	—
		—	(0.400)	—	—	—	—
09-18	Length	28.7	27.9	—	29.4	—	—
		(0.777)	(0.463)	—	—	—	—
	Weight	8.2	8.4	—	8.4	—	—
		(0.694)	(0.512)	—	—	—	—
09-25	Length	29.4	29.1	—	—	28.9	31.3
		(1.202)	—	—	—	—	—
	Weight	8.4	8.9	—	—	8.6	10.1
		(1.035)	—	—	—	—	—
10-02	Length	29.2	27.0	—	—	—	29.6
		(1.277)	(1.214)	—	—	—	(0.933)
	Weight	8.7	7.4	—	—	—	8.9
		(1.617)	(0.743)	—	—	—	(0.200)
10-09	Length	32.1	—	—	—	—	—
		—	—	—	—	—	—
	Weight	12.1	—	—	—	—	—
		—	—	—	—	—	—
10-16	Length	28.1	28.2	—	—	31.1	31.3
		(0.987)	(0.589)	—	—	—	(2.500)
	Weight	8.1	8.4	—	—	9.6	10.4
		(0.649)	(0.848)	—	—	—	(2.300)
10-23	Length	27.0	—	—	—	—	—
		—	—	—	—	—	—
	Weight	6.6	—	—	—	—	—
		—	—	—	—	—	—
11-06	Length	29.1	28.4	—	—	29.8	28.3
		(0.894)	(0.930)	—	—	(1.928)	—
	Weight	9.2	8.5	—	—	9.1	7.7
		(0.950)	(0.745)	—	—	(1.995)	—
Weighted seasonal mean	Length	28.9	28.3	—	29.4	29.9	29.2
		(0.634)	(0.721)	—	—	(1.806)	—
	Weight	8.9	8.5	—	8.4	9.1	8.5
		(0.674)	(0.577)	—	—	(1.869)	—
Sexes combined	Length	28.6		29.4		29.7	
		(0.478)		—		(1.387)	
	Weight	8.7		8.4		9.0	
		(0.446)		—		(1.424)	

Table 18.—Continued:

Week beginning	Measure-ment	Age 2.3		Age 1.4		Age 2.4	
		Male	Female	Male	Female	Male	Female
08-28	Length	—	29.1	—	—	—	—
		—	—	—	—	—	—
	Weight	—	9.0	—	—	—	—
		—	—	—	—	—	—
09-04	Length	—	29.5	—	—	—	—
		—	—	—	—	—	—
	Weight	—	9.3	—	—	—	—
		—	—	—	—	—	—
09-18	Length	31.0	—	—	—	32.8	30.4
		(1.685)	—	—	—	(1.100)	—
	Weight	10.9	—	—	—	11.1	8.9
		(1.463)	—	—	—	(1.100)	—
09-25	Length	30.4	29.7	32.2	—	—	—
		(1.170)	—	—	—	—	—
	Weight	9.8	10.0	11.8	—	—	—
		(1.810)	—	—	—	—	—
10-02	Length	30.8	—	—	—	—	—
		—	—	—	—	—	—
	Weight	10.3	—	—	—	—	—
		—	—	—	—	—	—
10-09	Length	—	—	—	—	—	—
		—	—	—	—	—	—
	Weight	—	—	—	—	—	—
		—	—	—	—	—	—
10-16	Length	32.2	30.3	—	—	—	—
		(0.933)	(2.100)	—	—	—	—
	Weight	11.9	9.0	—	—	—	—
		(1.291)	(1.300)	—	—	—	—
10-23	Length	31.0	29.1	—	—	—	—
		(1.500)	—	—	—	—	—
	Weight	9.8	7.6	—	—	—	—
		(0.902)	—	—	—	—	—
11-06	Length	30.3	28.8	32.2	—	—	—
		(3.500)	(1.533)	—	—	—	—
	Weight	10.4	8.6	10.8	—	—	—
		(4.100)	(0.689)	—	—	—	—
Weighted seasonal mean	Length	30.8	28.9	32.2	—	32.8	30.4
		(1.541)	(1.387)	—	—	—	—
	Weight	10.5	8.7	10.9	—	11.1	8.9
		(1.805)	(0.615)	—	—	—	—
Sexes combined	Length	29.7		32.2		32.0	
		(0.956)		—		—	
	Weight	9.5		10.9		10.4	
		(0.806)		—		—	

Table 19.—Summary of the number and weight, by age and sex, of brown trout passed upstream at the Little Manistee River weir, fall 1988.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 2.0						
09-04	1	1	---	1	1	1
09-18	---	---	---	---	---	---
09-25	---	---	---	---	---	---
10-02	---	---	2	4	2	4
10-09	---	---	1	2	1	2
10-16	---	---	---	---	---	---
10-23	1	2	---	---	1	2
11-06	---	---	---	---	---	---
Total	2	3	3	6	5	9
(Percent)	(9.1)	(3.1)	(13.6)	(6.3)	(22.7)	(9.4)
Age 1.1						
09-04	---	---	---	---	---	---
09-18	---	---	---	---	---	---
09-25	2	3	2	14	4	17
10-02	2	16	---	---	2	16
10-09	---	---	---	---	---	---
10-16	1	4	---	---	1	4
10-23	---	---	---	---	---	---
11-06	4	19	---	---	4	19
Total	9	42	2	14	11	56
(Percent)	(40.9)	(43.8)	(9.1)	(14.6)	(50.0)	(58.3)
Age 2.1						
09-04	---	---	---	---	---	---
09-18	2	13	---	---	2	13
09-25	2	5	---	---	2	5
10-02	---	---	---	---	---	---
10-09	---	---	---	---	---	---
10-16	---	---	---	---	---	---
10-23	1	4	---	---	1	4
11-06	---	---	---	---	---	---
Total	5	22	---	---	5	22
(Percent)	(22.7)	(22.9)	---	---	(22.7)	(22.9)
Age 1.4						
09-04	---	---	---	---	---	---
09-18	---	---	1	9	1	9
09-25	---	---	---	---	---	---
10-02	---	---	---	---	---	---
10-09	---	---	---	---	---	---
10-16	---	---	---	---	---	---
10-23	---	---	---	---	---	---
11-06	---	---	---	---	---	---
Total	---	---	1	9	1	9
(Percent)	---	---	(4.5)	(9.4)	(4.5)	(9.4)

Table 20.—Mean total length (inches) and weight (pounds), by age and sex, of brown trout passed upstream at the Little Manistee River weir, fall 1988. Two standard errors in parentheses.

Week beginning	Measure-ment	Age 2.0		Age 1.1	
		Male	Female	Male	Female
09-04	Length	15.5	---	---	---
		---	---	---	---
	Weight	1.1	---	---	---
		---	---	---	---
09-18	Length	---	---	---	---
		---	---	---	---
	Weight	---	---	---	---
		---	---	---	---
09-25	Length	---	---	14.7	25.5
		---	---	---	---
	Weight	---	---	1.4	7.2
		---	---	---	---
10-02	Length	---	16.8	24.8	---
		---	---	---	---
	Weight	---	2.1	8.0	---
		---	---	---	---
10-09	Length	---	15.3	---	---
		---	---	---	---
	Weight	---	1.5	---	---
		---	---	---	---
10-16	Length	---	---	20.7	---
		---	---	---	---
	Weight	---	---	3.9	---
		---	---	---	---
10-23	Length	17.1	---	---	---
		---	---	---	---
	Weight	1.7	---	---	---
		---	---	---	---
11-06	Length	---	---	22.8	---
		---	---	---	---
	Weight	---	---	4.7	---
		---	---	---	---
Weighted seasonal mean	Length	16.3	16.3	21.2	25.5
		---	---	---	---
	Weight	1.4	1.9	4.6	7.2
		---	---	---	---
Sexes combined	Length	16.3		22.0	
		---		(7.637)	
	Weight	1.7		5.1	
		---		(4.101)	

Table 20.—Continued:

Week beginning	Measure-ment	Age 2.1		Age 1.4	
		Male	Female	Male	Female
09-04	Length	---	---	---	---
		---	---	---	---
	Weight	---	---	---	---
		---	---	---	---
09-18	Length	24.9	---	---	27.0
		(0.500)	---	---	---
	Weight	6.3	---	---	9.0
		(0.900)	---	---	---
09-25	Length	19.5	---	---	---
		---	---	---	---
	Weight	2.7	---	---	---
		---	---	---	---
10-02	Length	---	---	---	---
		---	---	---	---
	Weight	---	---	---	---
		---	---	---	---
10-09	Length	---	---	---	---
		---	---	---	---
	Weight	---	---	---	---
		---	---	---	---
10-16	Length	---	---	---	---
		---	---	---	---
	Weight	---	---	---	---
		---	---	---	---
10-23	Length	23.6	---	---	---
		---	---	---	---
	Weight	4.1	---	---	---
		---	---	---	---
11-06	Length	---	---	---	---
		---	---	---	---
	Weight	---	---	---	---
		---	---	---	---
Weighted seasonal mean	Length	22.5	---	---	27.0
		---	---	---	---
	Weight	4.4	---	---	9.0
		---	---	---	---
Sexes combined	Length	22.5		27.0	
		---		---	
	Weight	4.4		9.0	
		---		---	

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