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FISHERIES DIVISION

TECHNICAL REPORT

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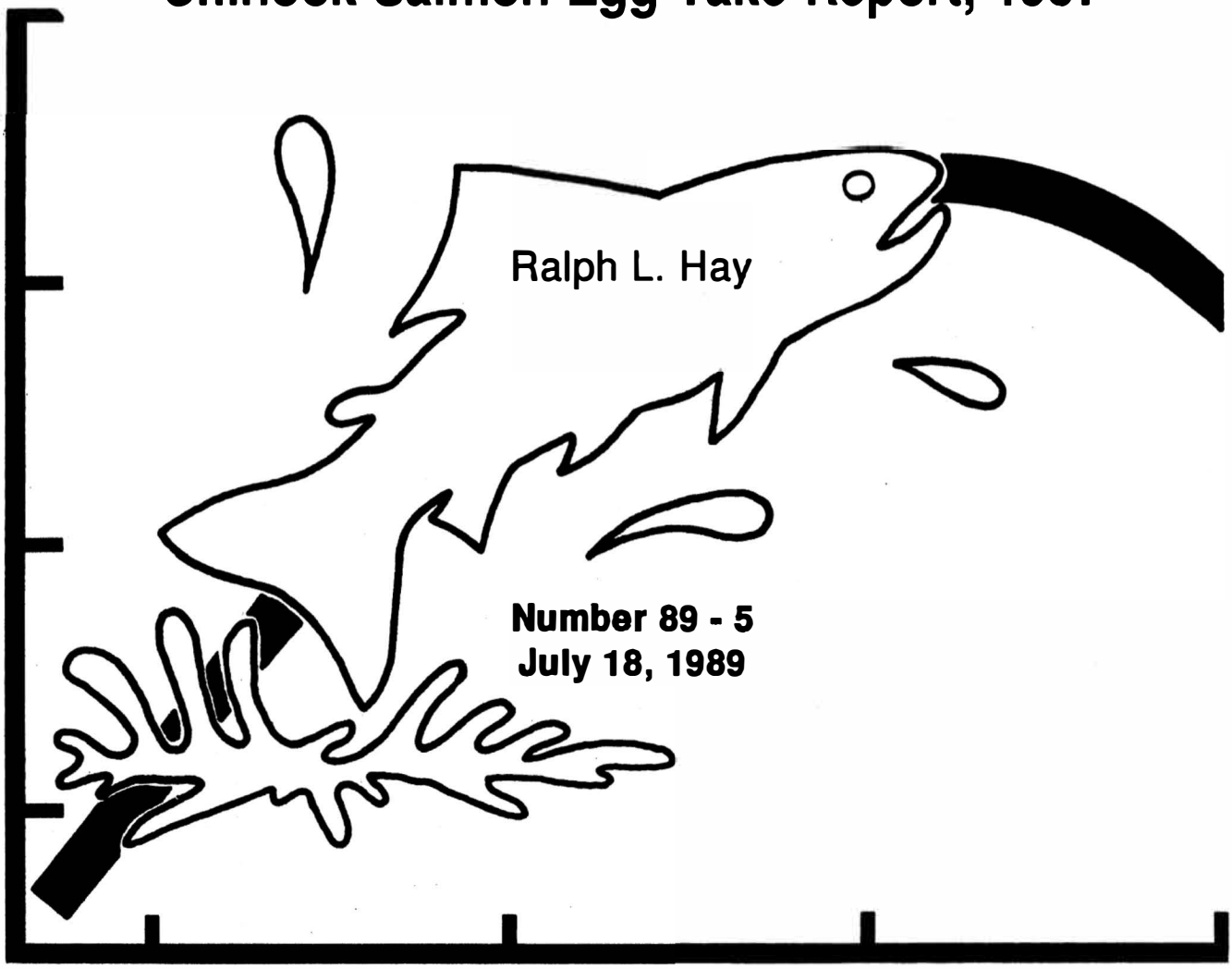

Ralph L. Hay

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Michigan Department of
Natural Resources

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LITTLE MANISTEE RIVER HARVEST WEIR AND CHINOOK SALMON EGG-TAKE REPORT, 1987

Ralph L. Hay

INTRODUCTION

As part of the Michigan Department of Natural Resources salmon management program for Lake Michigan, the Little Manistee River has been planted annually since 1967 with both coho and chinook salmon (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. The Little Manistee weir is Michigan's primary source for chinook eggs for in-state and out-of-state hatchery rearing and serves as a back-up (to the Platte River upper weir) for coho eggs. The facility is also used to monitor fall steelhead runs and each spring provides the majority of steelhead eggs for in-state hatchery rearing. Biological data have been collected on chinook and other anadromous salmonids since 1968.

From 1968 through 1978 chinook fingerlings were stocked in the Little Manistee River at an average rate of about 322,000 per year (Table 1). Beginning in 1979, the planting rate was increased by 78% to an average of nearly 572,000 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 and 1.5% at 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 alone returns have averaged 0.7%. The jack returns from the 1983–86 plants have averaged 0.5%.

The return rate of chinook salmon to the weir was high initially (1960's), declined (1970's), then increased (1980's). 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

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[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.

plant (Table 3). Returns from plants in the 1970's must have been lower because relatively low numbers came back to the weir in 1976–77 and 1980–82 (Table 2). Large runs, averaging 31,993 fish per year, occurred from 1983 through 1987. These originated from average plants of about 570,000 smolts in 1978–86—an average return rate of about 5.6% per plant. The return rates represent only the weir harvest and do not include the angler harvest, which has increased since the 1960's. In 1987, the estimated sport harvest from all stocks of chinook salmon in Michigan waters of Lake Michigan which were surveyed was 347,000 fish (G. Rakoczy, personal communication).

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 1970's. Overall, age-0.1 chinook salmon decreased in size from 5.9 pounds (1960's) to an average of 4.3 pounds (1980's), a 27% reduction. A similar but less dramatic reduction in size can be seen for older fish. Average size declined further in 1987 but this is due, in part, to better aging techniques.

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), 3.0% 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 4.0% for the 1984–86 plants. The return of the 1985 plant to the Platte River was low also (Pecor 1987). Possible reasons for the poor returns were discussed by Pecor (1987). As with chinook, these return rates represent only the weir harvest and do not include the angler harvest, which has also fluctuated annually. In 1987, anglers harvested an estimated 139,000 coho salmon from all stocks in Michigan waters of Lake Michigan which were surveyed (G. Rakoczy, personal communication).

The average weight of coho jacks (age 1.0) increased slightly from 1974–83, then gradually decreased through 1986 but then increased again in 1987 (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, then stabilized at about 6.3 pounds. Like the chinook, there has been a decrease in average size of adult coho from the 1960's to the early 1980's, but in the last several years the average has been fairly constant. It is assumed that the annual variations in size are primarily 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). The estimated sport harvest of steelhead from all Michigan waters of Lake Michigan which were surveyed was 46,000 in 1987 (G. Rakoczy, personal communication). 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 1984. In 1987, the estimated sport harvest from Michigan waters of Lake Michigan which were surveyed was 28,000 brown trout (G. Rakoczy, personal communication).

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, 1987

On September 1, 1987, the weir grates were installed to block anadromous fish. On September 8, the ponds were filled and the fish ladder was activated. Harvest began on September 10. The weir remained operational until November 12, at which time the grates were removed and the building was winterized. The weir was in operation for 73 days. All harvested chinook and coho salmon were sold on contract to Tempotech Industries, Hart, Michigan.

Chinook salmon

Harvest of chinook salmon began September 10 and ended November 12, a period of 64 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 80% of the run occurred from late September through the third week in October. A total of 31,841 chinook were harvested in 1987 (Table 2). The calculated total weight of all chinook, in the round, was 373,420 pounds.

For several weeks during the run, biological data were obtained from a randomly selected sample of 900 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 was obtained from scale samples and length measurements collected from Lake Michigan fish during a creel census at several sites from August to November 1987. In applying the table to those length groups in which two or more age groups are represented, the lighter fish were assigned to the younger age group and the heavier fish to the older age group. The estimated total harvest consisted of 3,229 (10.1%) age-0.1 jacks weighing 14,010 pounds, 3,962 (12.4%) age-0.2 adults weighing 28,424 pounds, 12,191 (38.3%) age-0.3 adults weighing 138,346 pounds, 11,482 (36.1%) age-0.4 adults weighing 173,281 pounds, and 977 (3.1%) age-0.5 adults weighing 19,359 pounds (Table 9). The 1987 run of jacks represented 0.7% of the fingerlings stocked in 1986. The returning age-0.2 adults were 0.8% of the 1985 plant, age-0.3 adults were 1.5% of the 1984 plant, age-0.4 adults were 1.7% of the 1983 plant, and age-0.5 adults were 0.2% of the 1982 plant.

Females constituted about 38% of the total run — 2.5% of age 0.1, 11.8% of age 0.2, 47.7% of age 0.3, and 49.2% of age 0.4, and 23.5% of age 0.5 (Table 9). Mean lengths and weights of males and females combined were: age 0.1, 22.8 inches and 4.3 pounds; age 0.2, 27.7 inches and 7.2 pounds; age 0.3, 33.1 inches and 11.3 pounds; age 0.4, 35.9 inches and 15.1 pounds; and age 0.5, 38.5 inches and 19.8 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 1987 chinook egg-take operation began September 25 and ended October 20. During the 26-day period 19 million eggs were collected of which 14 million were for in-state rearing and 5 million were for out-of-state commitments (Table 12). A total of 4,111 female chinook (ages 0.2, 0.3, 0.4, and 0.5) were stripped, excluding those which yielded low-quality eggs or were otherwise unsatisfactory. Assuming that about 7,000 females were handled to provide the 19 million eggs, a total run of 18,000 chinook (7,000/38% 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 "wet" method of egg fertilization was again used in 1987. Eggs were collected in a plastic pan and several milliliters of sperm were added. River water was quickly added, the mixture was stirred for several seconds and then allowed to stand for several minutes. The fertilized eggs were rinsed and allowed to water harden in milk cans (with flowing water) prior to transportation. The percent eye-up was normal for chinook salmon with a range of 68.5% (October 12) to 73.4% (October 3) (Table 12).

During the egg-take operation, maximum river water temperature was 58 °F (September 28) and minimum water temperature was 44 °F (October 11) (Figure 6). Only 18% of the eggs were collected when the river water temperature exceeded 50 °F.

Fecundity data were collected from 75 chinook salmon in 1987. The mean egg mass was 3.2 pounds. This represents 23% of the body weight (13.9 pounds).

No fin clips were found on 900 randomly examined chinook salmon.

Only 1.1% 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 1960's and early 1970's.

Coho salmon

In 1987 the coho harvest coincided with the chinook harvest (September 10 through November 12, a total of 64 days). Peak harvests occurred during the first and third weeks of September and since coho were not held for egg-take, the harvest dates roughly coincide with migration of coho into the river (Table 14). Like the chinook, the coho runs had decreased significantly by late October.

A total of 15,101 coho were harvested. The total weight calculated from biological samples was 97,809 pounds (Table 5). This was the smallest harvest since 1975.

The age composition of the harvested coho was 85 (0.6%) age-1.0 jacks weighing 149 pounds and 15,016 (99.4%) age-1.1 adults weighing 97,660 pounds (Table 14). The returning age-1.0 jacks were 0.03% of the 1987 plant and the age-1.1 adults were 4.4% of the 1986 plant.

Nearly all age-1.0 and 48.0% of the age-1.1 coho were males. The total run consisted of 51.7% females. Mean lengths and weights were: age-1.0 males, 15.7 inches and 1.8 pounds; age-1.0 females, 13.9 inches and 1.7 pounds; age-1.1 males, 27.5 inches and 6.7 pounds; age-1.1 females, 26.2 inches and 6.3 pounds; age-1.0 sexes combined, 15.6 inches and 1.8 pounds; and age-1.1 sexes combined, 26.8 inches and 6.5 pounds (Table 15). Adult males were slightly larger than females.

None of the 900 coho sampled had lamprey wounds (Table 13). This rate was significantly less than the 1960's.

No coho eggs were taken at the Little Manistee weir in 1987.

A total of 900 adult coho were randomly checked for fin clips. Of these fish, 3 (0.3%) had fin clips. The three fin clips observed were: right pectoral (RP, 1 fish), left pectoral (LP, 1 fish), and adipose (Ad, 1 fish). The RP and Ad fish were planted in 1986 by the Michigan Department of Natural Resources (MDNR) into Lake Huron at Port Hope (101,000Y) and Seymour Creek (187,000Y), respectively. The LP fish was planted in 1986 by the MDNR into Lake Huron at Seymour Creek (50,000Y), or planted in 1986 by the Illinois Department of Conservation into Lake Michigan at Waukegan (77,000Y).

Skin color was examined on 900 coho salmon sampled at approximately weekly intervals (Table 16). Most early run coho had silver skin, however, as the season progressed, fish lost their silver sheen and by mid-October most coho were dark colored. Females retained their silver color longer than males.

Steelhead trout

Fall steelhead began entering the river in early September. Two peak runs occurred, the first occurred in late September and the second in early November (Table 17). All but 29 steelhead were passed above the weir.

The 1987 run of 1,450 fish was the smallest since 1982 (Table 7). Sixty-four percent (64%) of the returning adults were age 1.2 or 2.2 (Table 17). These two age groups also represented 69% of the total estimated weight of 11,381 pounds. Mean lengths and weights for 11 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 413 steelhead were randomly checked for fin clips. Seven (1.7%) had fin clips. The three different fin clips observed were: right pectoral-adipose (RP Ad, 3 fish), adipose (Ad, 3 fish), and left maxillary (LM, 1 fish). The RP-Ad fish were planted in 1984 by the MDNR into several streams tributary to Lake Michigan and were the Skamania strain of summer steelhead. One of the Ad fish (Skamania) was planted in 1986 by the MDNR into several streams tributary to Lake Michigan. Origins of the other two Ad and LM fish could not be decided because fin clips, 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 two brown trout were passed above the weir.

The 1987 run of 48 fish was down from the previous 3 years (Table 8). About 77% of the returning adults were age 1.1 or 1.2 (Table 19). These two age groups represented 77% of the total estimated weight of 311 pounds. Mean lengths and weights for the six 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 44 brown trout were randomly checked for fin clips. Only 1 (2.3%) had a fin clip. The origin of this fish could not be determined because the fin clip, age (from scales), and planting records did not coincide.

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 1987.

Pink salmon

Five (5) pink salmon were collected at the weir in 1987.

SUMMARY

In 1987 the Little Manistee harvest weir was in operation from September 1 through November 12 (73 days). Harvest of chinook and coho salmon and passage of other anadromous salmonids occurred from September 10 through November 12.

The entire salmon run of 31,841 chinook (373,420 pounds) and 15,101 coho (97,809 pounds) was harvested and sold to Tempotech Industries, Hart, Michigan.

The chinook run consisted of 3,229 age-0.1 jacks (0.7% of the 1986 fingerling plant), 3,962 age-0.2 adults (0.8% of the 1985 fingerling plant), 12,191 age-0.3 adults (1.5% of the 1984 fingerling plant), 11,482 age-0.4 adults (1.7% of the 1983 fingerling plant), and 977 age-0.5 adults (0.2% of the 1982 fingerling plant). Mean sizes were: age 0.1, 22.8 inches (4.3 pounds); age 0.2, 27.7 inches (7.2 pounds); age 0.3, 33.1 inches (11.3 pounds); age 0.4, 35.9 inches (15.1 pounds); and age 0.5, 38.5 inches (19.8 pounds). During chinook egg-take operations (September 25 through October 20) 4,111 females (ages 0.2, 0.3, 0.4, and 0.5) were stripped to obtain 19,347,655 eggs. The percent eye-up ranged from 68.5% (October 12) to 73.4% (October 3) During the first 3 days of egg-take, the river water temperature exceeded 50 °F.

The 1987 coho run was composed of 85 age-1.0 jacks (0.03% of the 1987 yearling plant) and 15,016 age-1.1 adults (4.4% of the 1986 yearling plant). Mean sizes were: age 1.0, 15.6 inches (1.8 pounds); and age 1.1, 26.8 inches (6.5 pounds).

The 1987 fall steelhead run of 1,450 fish included 11 different age groups. Sixty-four percent (64%) of the fish were age 1.2 or 2.2 (three summers in Lake Michigan). Of the seven fin-clipped fish, four were the Skamania strain of summer steelhead planted in Lake Michigan by Michigan.

The fall brown trout run of 48 fish was less than the previous 3 years. About 77% of the returning adults were age 1.1 or 1.2.

No Atlantic salmon returned to the weir in 1987.

Five (5) pink salmon were collected at the weir in 1987.

RECOMMENDATIONS FOR 1988

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, Simeon Syrewicze, and Steve Lazar. Kelley Smith developed a computer program for data analyses and provided technical advice.

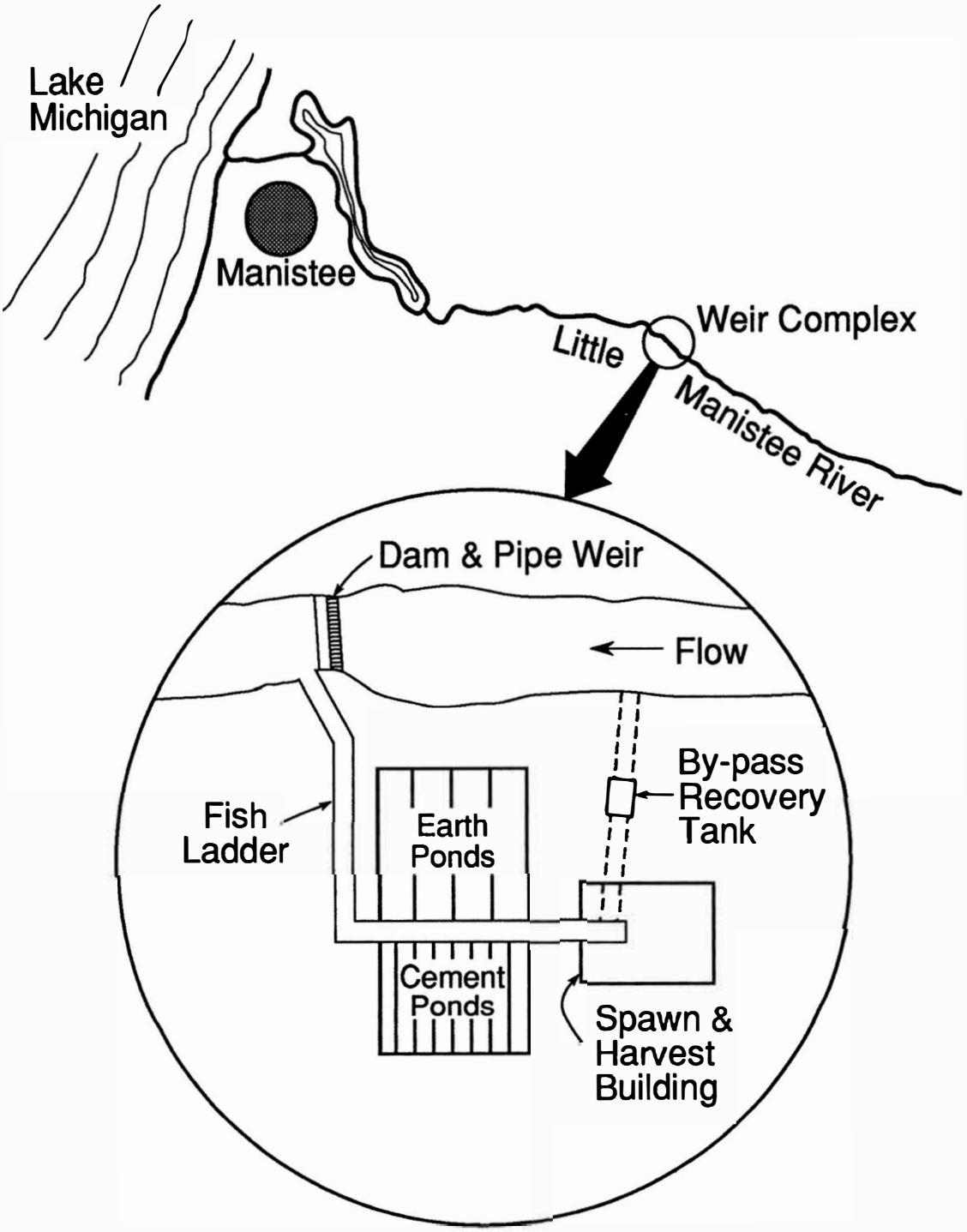

Figure 1. Location and schematic diagram of the Little Manistee River weir complex.

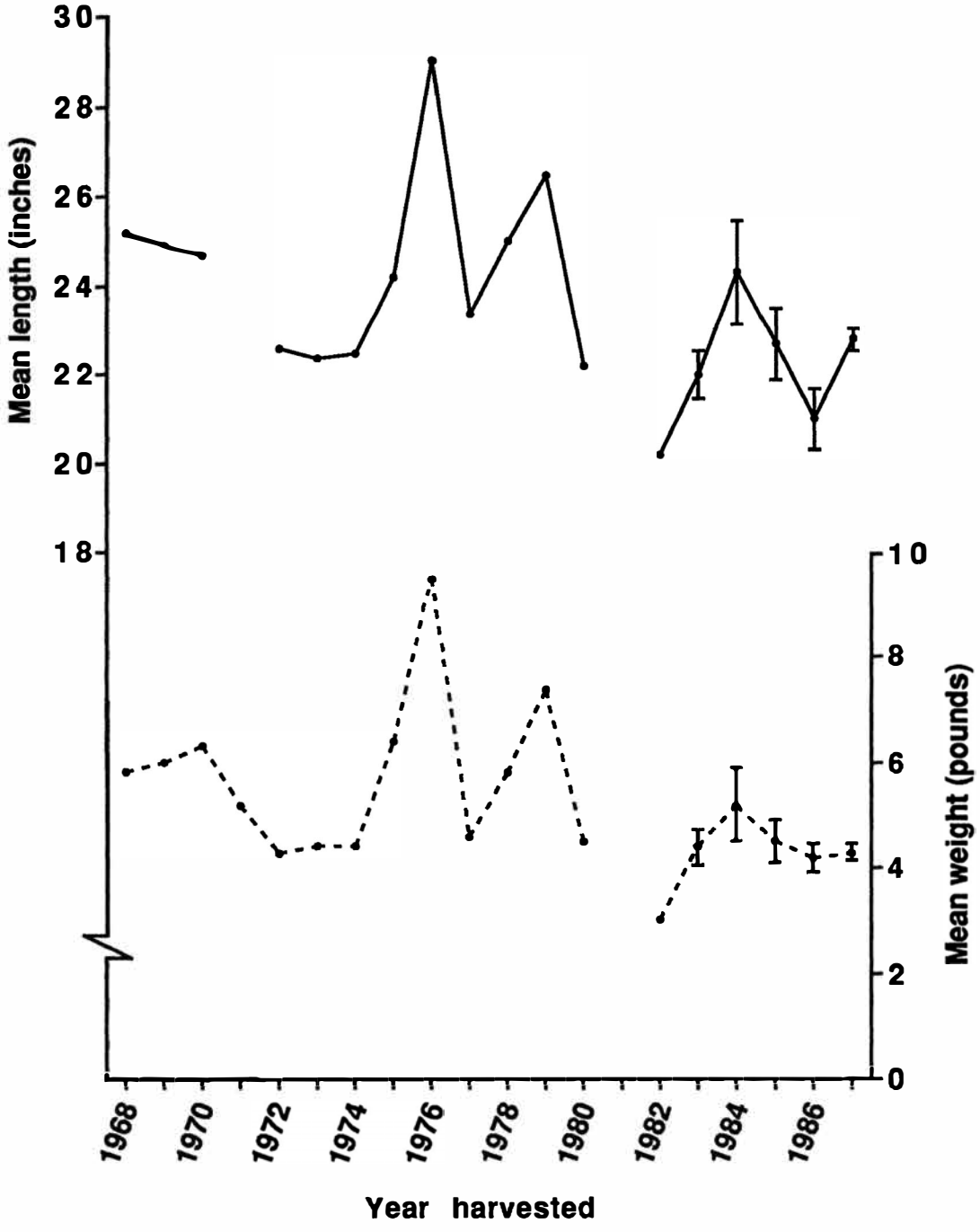

Figure 2. Mean total length (inches) and round weight (pounds) of age-0.1 (jack) chinook salmon harvested at the Little Manistee River weir. Vertical bars indicate two standard errors.

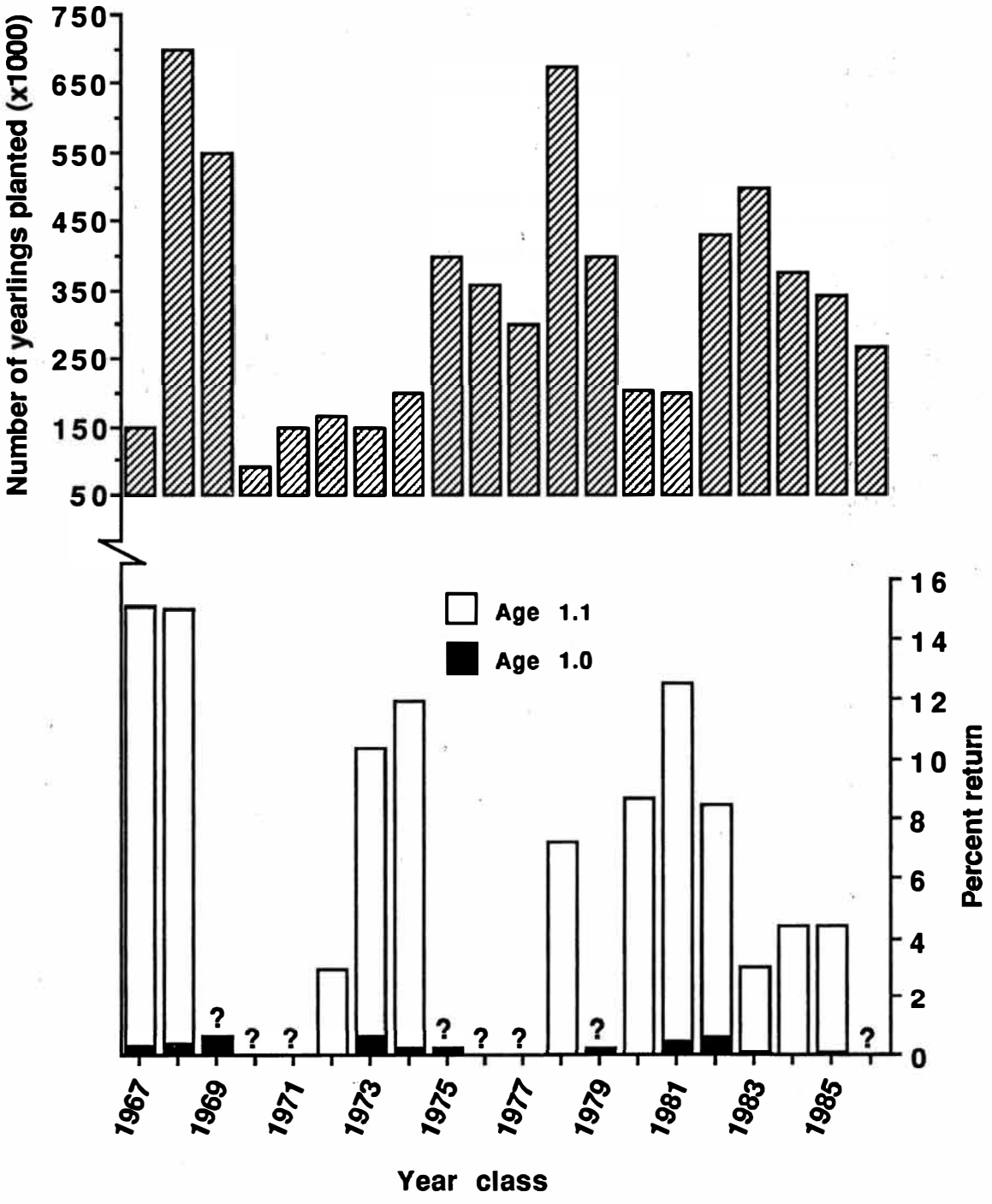

Figure 3. Percent return, by age, of coho salmon year classes to the Little Manistee River weir compared with the number of yearlings planted. Question marks (?) indicate incomplete return data.

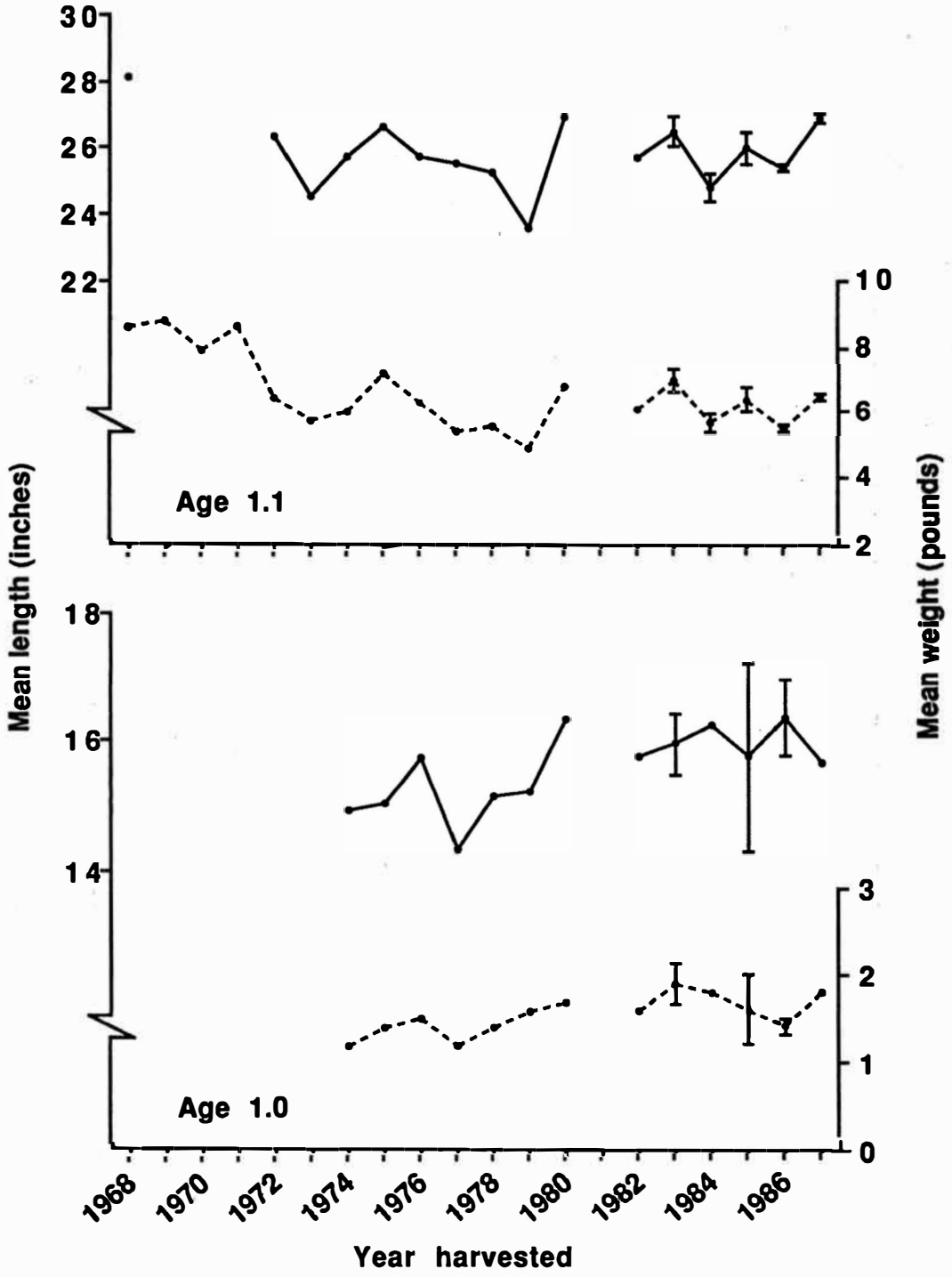

Figure 4. Mean total length (inches) and round weight (pounds) of age-1.0 and age-1.1 coho salmon harvested at the Little Manistee River weir. Vertical bars indicate two standard errors.

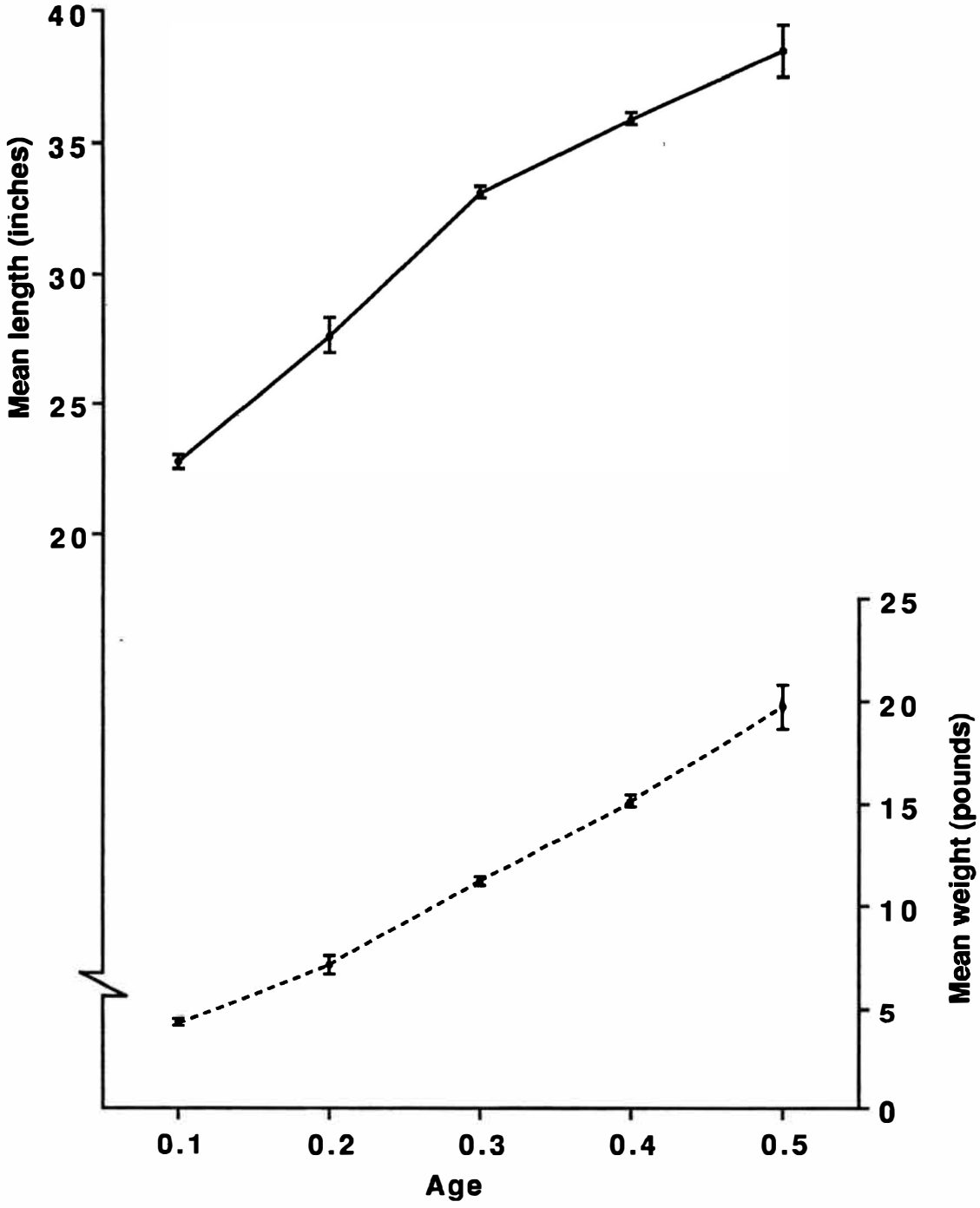

Figure 5. Mean total length (inches) and round weight (pounds), by age, of chinook salmon harvested at the Little Manistee River weir, fall 1987. Vertical bars indicate two standard errors.

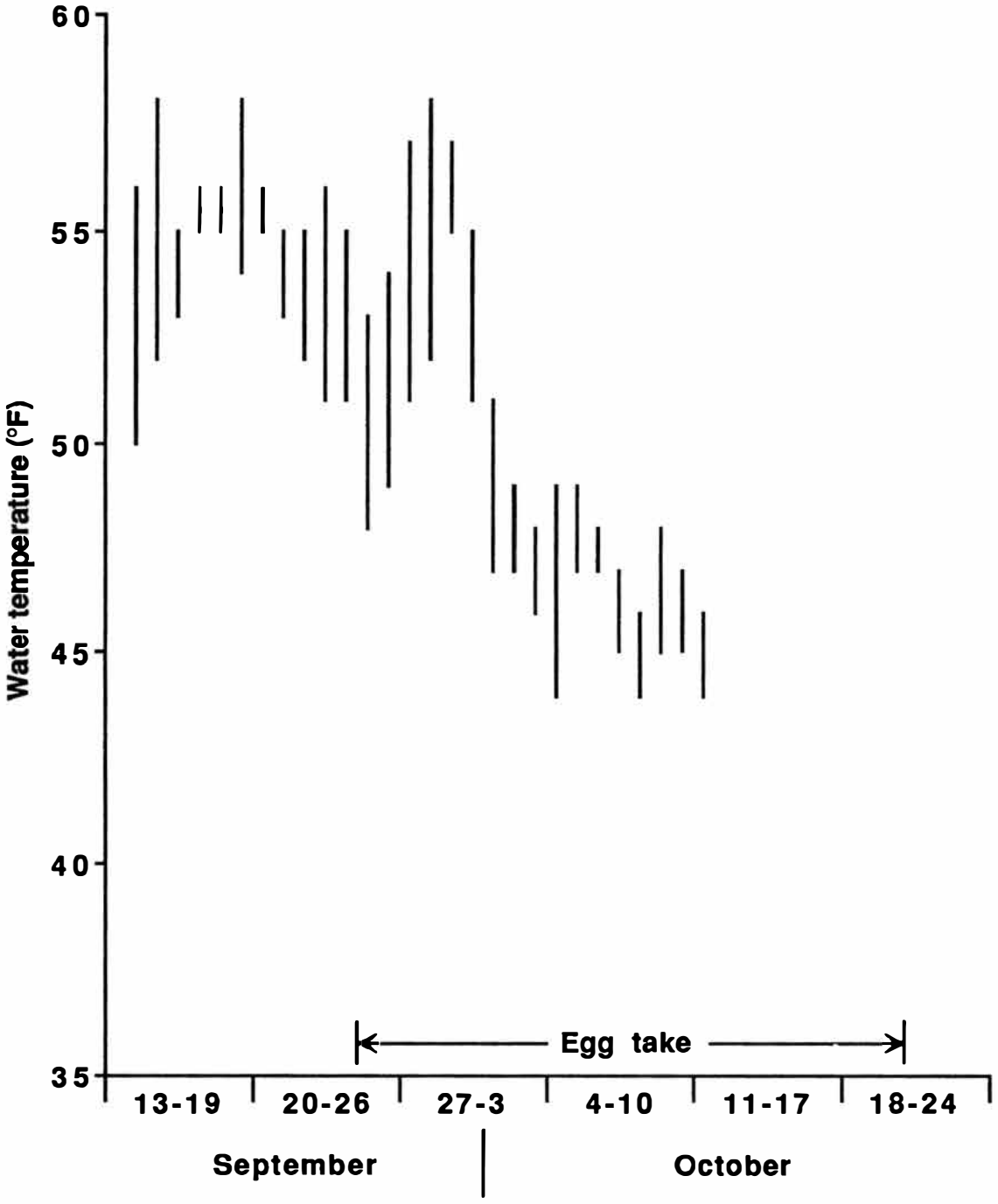

Figure 6. Daily minimum and maximum water temperatures for the Little Manistee River, fall 1987. No winter temperatures after October 11, due to equipment failure.

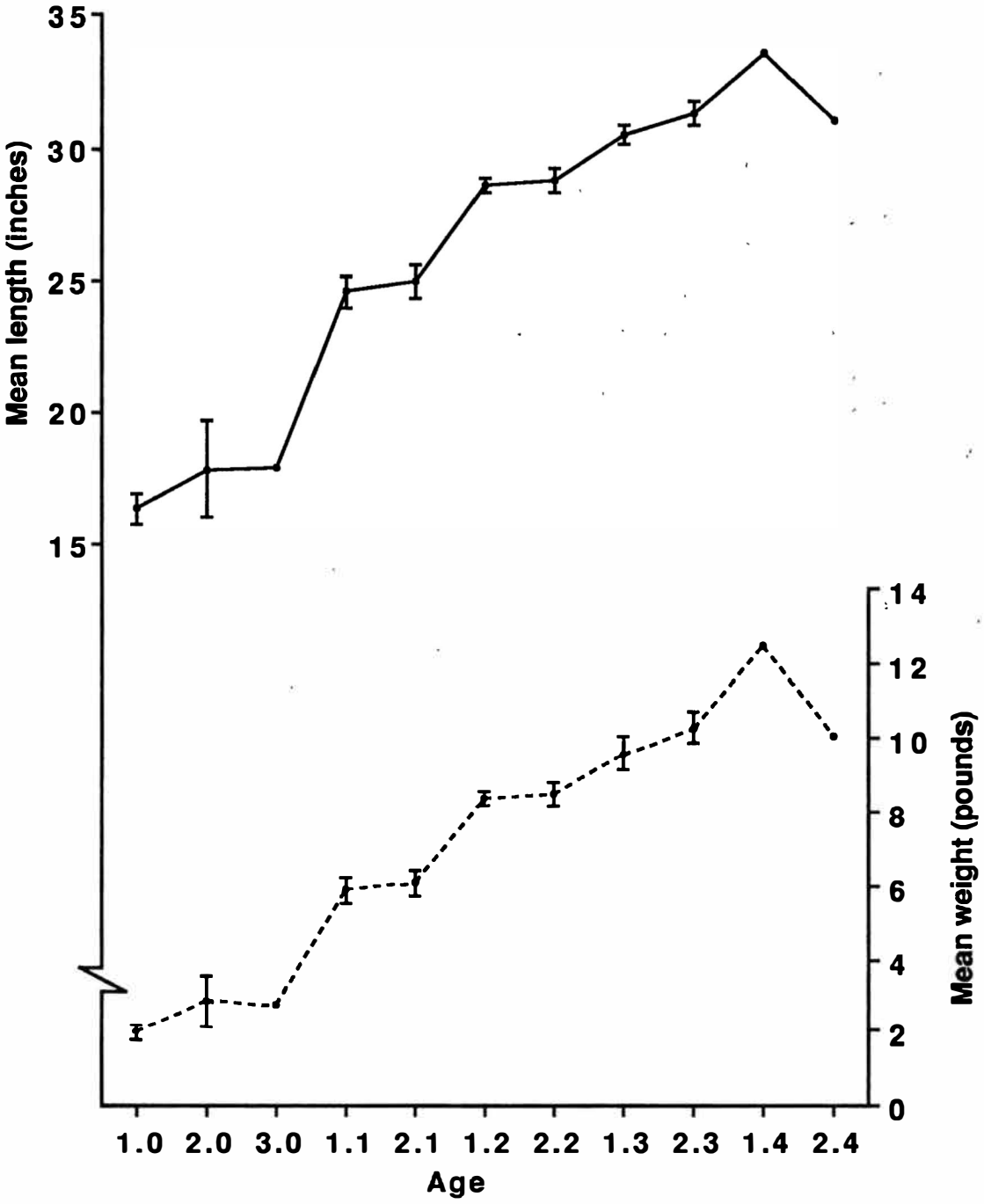

Figure 7. Mean total length (inches) and round weight (pounds), by age, of steelhead passed upstream at the Little Manistee River weir, fall 1987. Vertical bars indicate two standard errors.

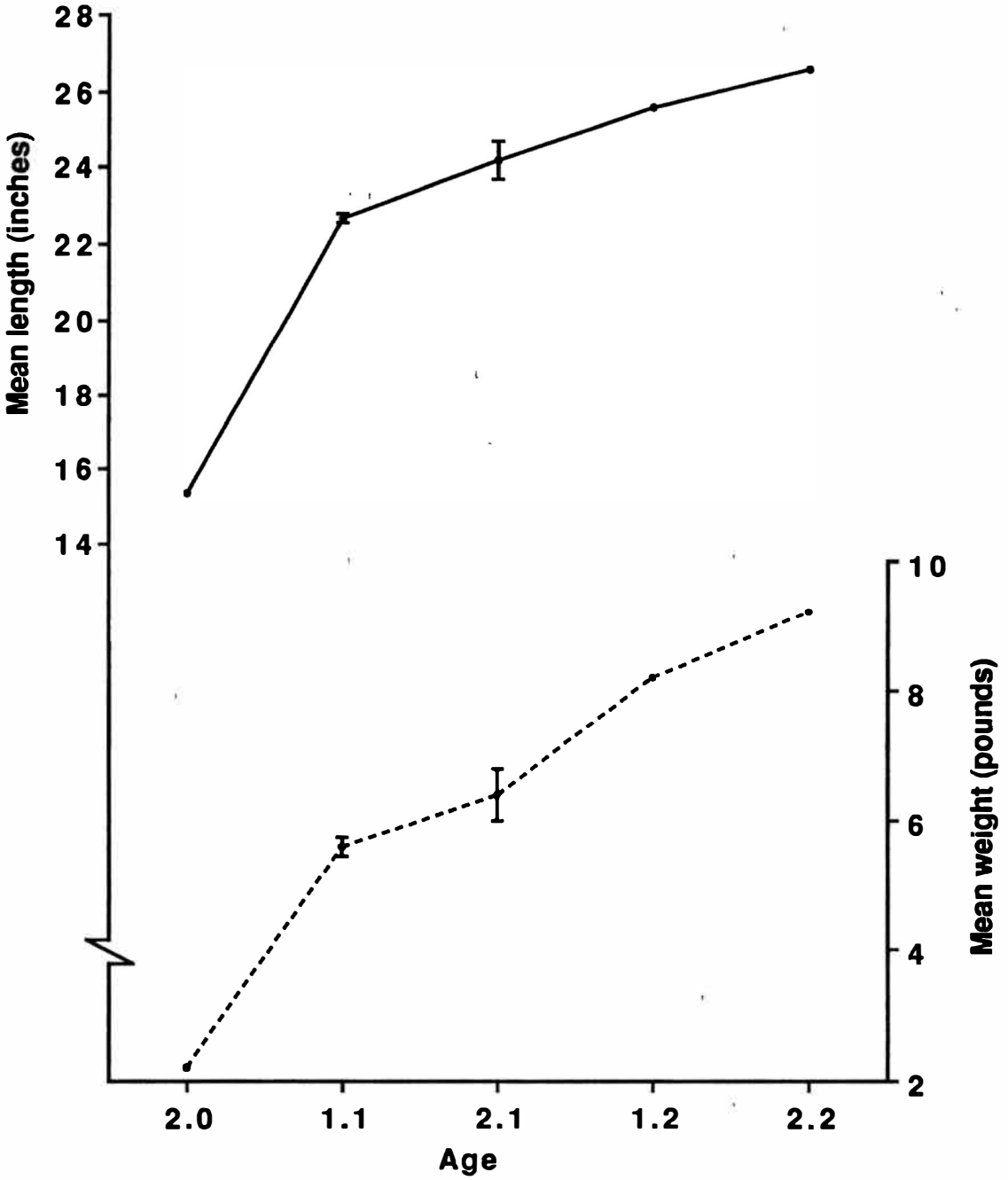

Figure 8. Mean total length (inches) and round weight (pounds), by age, of brown trout passed upstream at the Little Manistee River weir, fall 1987. Vertical bars indicate two standard errors.

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]	—	—	—
Total	9,277,103	7,044,780	67,056	293,861(FF)
	—	—	—	92,024(Y)
Average	441,767	335,466	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 1968–87. Weight (pounds) is in parentheses.

	Age[1]							
Year	0.1	0.2	0.3	0.4	0.5	Adult[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)

[1]See footnote in Introduction 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.

Chinook

Year class	Number stocked	Age 0.1	0.2	0.3	0.4	0.5	Total
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)	(<0.0)	(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	—	37,572
		(0.9)	(0.9)	(2.0)	(1.7)	—	(5.5)
1984	805,773	2,005	1,025	12,191	—	—	15,221
		(0.2)	(0.1)	(1.5)	—	—	(1.8)
1985	500,012	397	3,962	—	—	—	4,359
		(0.1)	(0.8)	—	—	—	(0.9)
1986	469,994	3,229	—	—	—	—	3,229
		(0.7)	—	—	—	—	(0.7)

Table 3. Continued:

Coho

Year class	Number stocked	Age 1.0	Age 1.1	Total
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 (<0.0)	15,177 (3.0)	15,395 (3.1)
1984	375,283	79 (<0.0)	16,599 (4.4)	16,678 (4.4)
1985	343,121	125 (<0.0)	15,016 (4.4)	15,141 (4.4)
1986	266,914	85 (<0.0)	— —	85 (<0.0)

[1]See footnote in Introduction 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 1968–87. 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

[1]Ages of chinook prior to 1977 were determined from length-frequency distributions; in 1977–80 and 1983–87, from scale samples and length-frequency distributions. See footnote in Introduction regarding uncertainties of aging age-0.2 and older chinook.

Table 5. Number, by age, of coho salmon harvested at the Little Manistee River weir, fall 1968–87. Weight (pounds) is in parentheses.

Year	Age		Mortalities[1]	Total
	1.0	1.1		
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)

[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 1968–87.

	Age 1.0		Age 1.1	
Year	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

[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 1978–87.

	Number				Mean	
Year	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

[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, fall 1968–87.

	Number			Mean	
Year	Passed	Mortalities	Total	Length	Weight
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

Table 9. Summary of the number and weight, by age and sex, of chinook salmon harvested at Little Manistee River weir, fall 1987. 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.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 0.1						
9/06	27	128	—	—	27	128
9/13	71	274	—	—	71	274
9/20	825	3,599	—	—	825	3,599
9/27	1,201	5,139	—	—	1,201	5,139
10/04	437	1,868	—	—	437	1,868
10/11	323	1,389	81	389	404	1,778
10/18	244	1,147	—	—	244	1,147
10/25	20	77	—	—	20	77
11/01	—	—	—	—	—	—
Total	3,148	13,621	81	389	3,229	14,010
(Percent)	(9.9)	(3.6)	(0.3)	(0.1)	(10.1)	(3.8)
Age 0.2						
9/06	32	193	5	40	37	233
9/13	66	426	6	54	72	480
9/20	859	5,803	—	—	859	5,803
9/27	1,029	7,306	86	516	1,115	7,822
10/04	492	3,608	—	—	492	3,608
10/11	728	4,861	243	2,074	971	6,935
10/18	244	1,659	122	1,529	366	3,188
10/25	33	248	7	55	40	303
11/01	10	52	—	—	10	52
Total	3,493	24,156	469	4,268	3,962	28,424
(Percent)	(11.0)	(6.5)	(1.5)	(1.1)	(12.4)	(7.6)
Age 0.3						
9/06	30	295	71	866	101	1,161
9/13	40	409	54	638	94	1,047
9/20	584	5,953	378	4,460	962	10,413
9/27	1,973	20,296	1,458	17,685	3,431	37,981
10/04	1,202	12,654	929	11,110	2,131	23,764
10/11	1,617	17,682	2,022	24,757	3,639	42,439
10/18	692	7,649	692	8,617	1,384	16,266
10/25	100	1,107	114	1,385	214	2,492
11/01	143	1,689	92	1,094	235	2,783
Total	6,381	67,734	5,810	70,612	12,191	138,346
(Percent)	(20.0)	(18.1)	(18.2)	(18.9)	(38.3)	(37.0)

Table 9. Continued:

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 0.4						
9/06	25	355	39	606	64	961
9/13	31	464	14	247	45	711
9/20	344	4,658	344	5,322	688	9,980
9/27	1,287	17,735	1,287	19,974	2,574	37,709
10/04	1,257	18,860	984	15,427	2,241	34,287
10/11	1,294	19,127	1,617	25,282	2,911	44,409
10/18	1,018	15,250	896	14,022	1,914	29,272
10/25	194	2,890	167	2,593	361	5,483
11/01	378	5,607	306	4,862	684	10,469
Total	5,828	84,946	5,654	88,335	11,482	173,281
(Percent)	(18.3)	(22.7)	(17.8)	(23.7)	(36.1)	(46.4)
Age 0.5						
9/06	—	—	—	—	—	—
9/13	3	59	—	—	3	59
9/20	103	2,015	—	—	103	2,015
9/27	257	5,183	—	—	257	5,183
10/04	164	3,056	—	—	164	3,056
10/11	81	1,701	81	1,580	162	3,281
10/18	81	1,458	81	1,782	162	3,240
10/25	27	511	7	156	34	667
11/01	31	616	61	1,242	92	1,858
Total	747	14,599	230	4,760	977	19,359
(Percent)	(2.3)	(3.9)	(0.7)	(1.3)	(3.1)	(5.2)

Table 10. Length-age distribution (in percent of inch group) for chinook salmon scale sampled during creel census at Pentwater, Ludington, Manistee, Frankfort, Leland, Grand Traverse Bay, Manistee Lake, Big Manistee River, Betsie River, and Platte River, September-November 1987.[1]

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

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

Table 11. Mean total length (inches) and weight (pounds), by age and sex, of chinook salmon harvested at the Little Manistee River weir, fall 1987. Two standard errors in parentheses.

Week beginning	Measurement	Age 0.1		Age 0.2		Age 0.3	
		Male	Female	Male	Female	Male	Female
9/06	Length	23.6	—	26.0	30.6	31.7	33.8
		(0.370)	—	(1.196)	(0.199)	(0.907)	(0.515)
	Weight	4.8	—	6.0	7.9	9.8	12.2
		(0.237)	—	(0.673)	(1.400)	(0.676)	(0.526)
9/13	Length	23.1	—	27.8	31.6	32.5	34.1
		(0.319)	—	(0.950)	(0.300)	(1.177)	(0.538)
	Weight	3.9	—	6.5	9.0	10.2	11.8
		(0.227)	—	(0.539)	(0.300)	(0.757)	(0.680)
9/20	Length	22.4	—	27.1	—	32.1	32.9
		(0.359)	—	(0.918)	—	(0.838)	(0.823)
	Weight	4.4	—	6.8	—	10.2	11.8
		(0.237)	—	(0.513)	—	(0.613)	(1.005)
9/27	Length	22.6	—	27.7	26.5	32.3	33.2
		(0.489)	—	(1.499)	—	(0.778)	(0.584)
	Weight	4.3	—	7.1	6.0	10.3	12.1
		(0.326)	—	(0.852)	—	(0.578)	(0.629)
10/04	Length	23.3	—	29.0	—	33.1	33.4
		(0.725)	—	(1.806)	—	(0.606)	(0.734)
	Weight	4.3	—	7.3	—	10.5	12.0
		(0.320)	—	(0.963)	—	(0.441)	(0.642)
10/11	Length	23.3	23.2	27.2	30.2	33.1	33.7
		(1.021)	—	(2.227)	(1.348)	(0.706)	(0.460)
	Weight	4.3	4.8	6.7	8.5	10.9	12.2
		(0.606)	—	(1.268)	(0.742)	(0.590)	(0.728)
10/18	Length	22.7	—	26.6	28.8	32.8	33.2
		(0.714)	—	(2.439)	(1.798)	(0.917)	(0.523)
	Weight	4.7	—	6.8	12.5	11.1	12.5
		(0.556)	—	(0.969)	(6.567)	(0.530)	(0.519)
10/25	Length	22.0	—	28.6	29.4	33.9	33.0
		(2.887)	—	(2.234)	—	(1.047)	(0.638)
	Weight	3.8	—	7.5	7.9	11.1	12.1
		(1.139)	—	(1.241)	—	(0.744)	(0.579)
11/01	Length	—	—	24.0	—	33.3	33.1
		—	—	—	—	(0.873)	(1.143)
	Weight	—	—	5.2	—	11.8	11.9
		—	—	—	—	(0.642)	(0.839)
Weighted seasonal mean	Length	22.7	23.2	27.5	29.1	32.7	33.4
		(0.259)	—	(0.742)	(1.040)	(0.343)	(0.259)
	Weight	4.3	4.8	6.9	9.1	10.6	12.2
		(0.163)	—	(0.413)	(2.158)	(0.259)	(0.327)
Sexes combined	Length	22.8		27.7		33.1	
		(0.251)		(0.686)		(0.221)	
	Weight	4.3		7.2		11.3	
		(0.160)		(0.457)		(0.233)	

Table 11. Continued:

Week beginning	Measurement	Age 0.4		Age 0.5	
		Male	Female	Male	Female
9/06	Length	35.7	36.1	—	—
		(1.178)	(0.721)	—	—
	Weight	14.2	15.5	—	—
		(1.037)	(0.613)	—	—
9/13	Length	37.2	37.7	38.6	—
		(0.853)	(0.831)	—	—
	Weight	15.0	17.7	19.6	—
		(0.806)	(0.941)	—	—
9/20	Length	34.5	35.7	38.2	—
		(0.817)	(1.022)	(3.267)	—
	Weight	13.5	15.5	19.6	—
		(1.070)	(1.503)	(5.135)	—
9/27	Length	35.6	35.6	40.0	—
		(0.694)	(0.781)	(2.403)	—
	Weight	13.8	15.5	20.2	—
		(0.585)	(0.798)	(1.764)	—
10/04	Length	36.9	35.5	38.5	—
		(0.612)	(0.454)	(3.500)	—
	Weight	15.0	15.7	18.6	—
		(0.623)	(0.546)	(2.924)	—
10/11	Length	36.4	35.8	39.1	37.2
		(0.675)	(0.747)	—	—
	Weight	14.8	15.6	21.0	19.5
		(0.644)	(1.302)	—	—
10/18	Length	36.8	35.4	37.2	36.9
		(0.652)	(0.495)	(0.500)	(1.600)
	Weight	15.0	15.6	18.0	22.0
		(1.042)	(0.454)	(2.800)	(6.000)
10/25	Length	36.5	35.0	38.2	38.1
		(0.494)	(0.531)	(0.981)	—
	Weight	14.9	15.5	18.9	22.3
		(0.584)	(0.599)	(0.936)	—
11/01	Length	35.5	34.8	39.0	37.4
		(0.497)	(0.636)	(3.208)	(0.826)
	Weight	14.8	15.9	19.9	20.4
		(0.533)	(0.566)	(3.535)	(1.058)
Weighted seasonal mean	Length	36.2	35.6	38.9	37.2
		(0.280)	(0.306)	(1.367)	(0.962)
	Weight	14.6	15.6	19.5	20.7
		(0.303)	(0.439)	(1.317)	(3.407)
Sexes combined	Length		35.9		38.5
			(0.214)		(0.989)
	Weight		15.1		19.8
			(0.277)		(1.075)

Table 12. Summary of the chinook egg-take operation at the Little Manistee River weir, fall 1987.

Date	Number of females stripped	Number of eggs collected	Percent eye-up	Destination
9/25	216	1,080,000	—	Indiana
9/30	252	1,110,000	—	Wolf Lake
10/01	296	1,389,000	—	Wolf Lake
10/02	240	1,200,000	—	Wolf Lake
10/03	219	1,076,196	73.4	Platte River
10/05	222	1,099,340	72.7	Platte River
10/06	262	1,200,000	—	Wolf Lake (MSU)*
10/07	264	1,200,000	—	Wolf Lake (MSU)*
10/08	496	2,161,071	71.9	Platte River
10/09	516	2,314,400	70.3	Platte River
10/12	300	1,550,648	68.5	Platte River
10/14	192	900,000	—	Illinois
10/15	276	1,400,000	—	South Dakota
10/16	168	787,000	—	South Dakota
10/20	192	880,000	—	Minnesota
Total	4,111	19,347,655	—	
In-state	3,067	14,300,655	—	
Out-of-state	1,044	5,047,000	—	

*MSU = Michigan State University.

Table 13. Percent lamprey scarring of anadromous salmonids captured at the Little Manistee River weir, fall 1968–87.

	Salmon		Trout	
Year	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

Table 14. Summary of the number and weight, by age and sex, of coho salmon harvested at the Little Manistee River weir, fall 1987.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 1.0						
9/06	—	—	—	—	—	—
9/13	—	—	—	—	—	—
9/20	43	69	—	—	43	69
9/27	26	52	—	—	26	52
10/04	—	—	7	12	7	12
10/11	—	—	—	—	—	—
10/18	9	16	—	—	9	16
10/25	—	—	—	—	—	—
11/01	—	—	—	—	—	—
Total	78	137	7	12	85	149
(Percent)	(0.5)	(0.1)	(0.0)	(0.0)	(0.6)	(0.2)
Age 1.1						
9/06	1,198	7,639	1,588	10,110	2,786	17,749
9/13	845	5,833	1,167	7,404	2,012	13,237
9/20	2,017	13,424	2,231	14,446	4,248	27,870
9/27	1,345	9,306	1,215	7,285	2,560	16,591
10/04	361	2,639	314	2,116	675	4,755
10/11	532	3,467	492	3,181	1,024	6,648
10/18	442	2,861	433	2,592	875	5,453
10/25	89	582	108	718	197	1,300
11/01	383	2,391	256	1,666	639	4,057
Total	7,212	48,142	7,804	49,518	15,016	97,660
(Percent)	(47.8)	(49.2)	(51.7)	(50.6)	(99.4)	(99.8)

Table 15. Mean total length (inches) and weight (pounds), by age and sex, of coho salmon harvested at the Little Manistee River weir, fall 1987. Two standard errors in parentheses.

Week beginning	Measurement	Age 1.0		Age 1.1	
		Male	Female	Male	Female
9/06	Length	—	—	27.0	26.5
		—	—	(0.644)	(0.396)
	Weight	—	—	6.4	6.4
		—	—	(0.423)	(0.299)
9/13	Length	—	—	27.7	26.2
		—	—	(0.520)	(0.493)
	Weight	—	—	6.9	6.3
		—	—	(0.383)	(0.326)
9/20	Length	15.0	—	27.6	26.4
		—	—	(0.541)	(0.456)
	Weight	1.6	—	6.7	6.5
		—	—	(0.425)	(0.394)
9/27	Length	16.6	—	27.8	25.9
		—	—	(0.443)	(0.470)
	Weight	2.0	—	6.9	6.0
		—	—	(0.386)	(0.309)
10/04	Length	—	13.9	27.8	25.9
		—	—	(0.326)	(0.406)
	Weight	—	1.7	7.3	6.7
		—	—	(0.266)	(0.320)
10/11	Length	—	—	27.1	26.1
		—	—	(0.687)	(0.364)
	Weight	—	—	6.5	6.5
		—	—	(0.424)	(0.275)
10/18	Length	16.5	—	27.0	25.4
		—	—	(0.502)	(0.545)
	Weight	1.8	—	6.5	6.0
		—	—	(0.354)	(0.358)
10/25	Length	—	—	27.2	26.3
		—	—	(0.712)	(0.279)
	Weight	—	—	6.5	6.6
		—	—	(0.434)	(0.239)
11/01	Length	—	—	27.2	26.6
		—	—	(0.456)	(0.373)
	Weight	—	—	6.2	6.5
		—	—	(0.398)	(0.367)
Weighted seasonal mean	Length	15.7	13.9	27.5	26.2
		—	—	(0.218)	(0.187)
	Weight	1.8	1.7	6.7	6.3
		—	—	(0.165)	(0.146)
Sexes combined	Length	15.6		26.8	
		—		(0.151)	
	Weight	1.8		6.5	
		—		(0.111)	

Table 16. Relationship between skin color and sex for coho salmon harvested at the Little Manistee River weir, fall 1987.

Week beginning	Percent			
	Silver		Dark	
	Male	Female	Male	Female
9/06	9	53	34	4
9/13	9	29	33	29
9/20	1	13	48	38
9/27	1	7	54	38
10/04	2	15	51	32
10/11	0	0	52	48
10/18	0	2	52	46
10/25	0	0	45	55
11/01	1	1	57	41

Table 17. Summary of the number and weight, by age and sex, of steelhead passed upstream at the Little Manistee River weir, fall 1987.

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 1.0						
9/06	1	1	2	2	3	3
9/13	—	—	7	15	7	15
9/20	—	—	11	20	11	20
9/27	10	17	—	—	10	17
10/04	—	—	—	—	—	—
10/11	11	21	7	15	18	36
10/18	—	—	—	—	—	—
10/25	—	—	—	—	—	—
11/01	—	—	9	25	9	25
11/08	2	5	—	—	2	5
Total	24	44	36	77	60	121
(Percent)	(1.7)	(0.4)	(2.5)	(0.7)	(4.1)	(1.1)
Age 2.0						
9/06	—	—	—	—	—	—
9/13	—	—	2	5	2	5
9/20	—	—	—	—	—	—
9/27	5	18	—	—	5	18
10/04	—	—	—	—	—	—
10/11	2	5	—	—	2	5
10/18	—	—	11	32	11	32
10/25	3	6	1	3	4	9
11/01	—	—	—	—	—	—
11/08	—	—	—	—	—	—
Total	10	29	14	40	24	69
(Percent)	(0.7)	(0.3)	(1.0)	(0.4)	(1.7)	(0.6)
Age 3.0						
9/06	—	—	—	—	—	—
9/13	—	—	—	—	—	—
9/20	—	—	—	—	—	—
9/27	—	—	—	—	—	—
10/04	—	—	—	—	—	—
10/11	—	—	—	—	—	—
10/18	—	—	4	11	4	11
10/25	—	—	—	—	—	—
11/01	—	—	—	—	—	—
11/08	—	—	—	—	—	—
Total	—	—	4	11	4	11
(Percent)	—	—	(0.3)	(0.1)	(0.3)	(0.1)

Table 17. Continued:

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 1.1						
9/06	—	—	—	—	—	—
9/13	—	—	—	—	—	—
9/20	14	56	3	13	17	69
9/27	10	71	14	103	24	174
10/04	—	—	7	40	7	40
10/11	2	13	7	42	9	55
10/18	8	35	11	65	19	100
10/25	4	23	1	4	5	27
11/01	—	—	47	292	47	292
11/08	6	36	—	—	6	36
Total	44	234	90	559	134	793
(Percent)	(3.0)	(2.1)	(6.2)	(4.9)	(9.3)	(7.0)
Age 2.1						
9/06	1	4	—	—	1	4
9/13	2	9	2	11	4	20
9/20	3	22	3	18	6	40
9/27	5	20	10	72	15	92
10/04	—	—	5	29	5	29
10/11	5	32	5	34	10	66
10/18	8	46	8	44	16	90
10/25	7	46	—	—	7	46
11/01	9	58	28	178	37	236
11/08	—	—	2	10	2	10
Total	40	237	63	396	103	633
(Percent)	(2.8)	(2.1)	(4.4)	(3.5)	(7.1)	(5.6)
Age 1.2						
9/06	2	15	1	8	3	23
9/13	—	—	—	—	—	—
9/20	31	259	26	194	57	453
9/27	58	464	48	384	106	848
10/04	18	151	32	258	50	409
10/11	14	110	27	210	41	320
10/18	34	309	26	230	60	539
10/25	13	108	12	99	25	207
11/01	132	1,118	85	737	217	1,855
11/08	21	183	23	199	44	382
Total	323	2,717	280	2,319	603	5,036
(Percent)	(22.3)	(23.9)	(19.4)	(20.4)	(41.7)	(44.2)

Table 17. Continued:

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 2.2						
9/06	1	7	1	7	2	14
9/13	—	—	—	—	—	—
9/20	20	162	—	—	20	162
9/27	19	158	14	108	33	266
10/04	16	148	11	97	27	245
10/11	7	67	16	135	23	202
10/18	30	259	15	138	45	397
10/25	15	131	9	73	24	204
11/01	66	603	56	426	122	1,029
11/08	8	68	23	194	31	262
Total	182	1,603	145	1,178	327	2,781
(Percent)	(12.6)	(14.1)	(10.0)	(10.4)	(22.6)	(24.4)
Age 1.3						
9/06	—	—	2	17	2	17
9/13	—	—	—	—	—	—
9/20	11	113	14	135	25	248
9/27	19	198	5	35	24	233
10/04	—	—	7	64	7	64
10/11	—	—	5	30	5	30
10/18	23	227	11	109	34	336
10/25	4	42	3	28	7	70
11/01	19	185	—	—	19	185
11/08	6	59	4	34	10	93
Total	82	824	51	452	133	1,276
(Percent)	(5.7)	(7.2)	(3.5)	(4.0)	(9.2)	(11.2)
Age 2.3						
9/06	—	—	—	—	—	—
9/13	—	—	—	—	—	—
9/20	3	27	—	—	3	27
9/27	14	148	5	60	19	208
10/04	5	53	—	—	5	53
10/11	5	47	5	50	10	97
10/18	—	—	—	—	—	—
10/25	—	—	—	—	—	—
11/01	—	—	9	88	9	88
11/08	2	24	—	—	2	24
Total	29	299	19	198	48	497
(Percent)	(2.0)	(2.6)	(1.3)	(1.7)	(3.3)	(4.4)

Table 17. Continued:

Week beginning	Male Number	Male Pounds	Female Number	Female Pounds	Total Number	Total Pounds
Age 1.4						
9/06	—	—	—	—	—	—
9/13	—	—	—	—	—	—
9/20	—	—	—	—	—	—
9/27	—	—	—	—	—	—
10/04	—	—	—	—	—	—
10/11	—	—	—	—	—	—
10/18	—	—	—	—	—	—
10/25	—	—	—	—	—	—
11/01	9	113	—	—	9	113
11/08	—	—	—	—	—	—
Total	9	113	—	—	9	113
(Percent)	(0.6)	(1.0)	—	—	(0.6)	(1.0)
Age 2.4						
9/06	—	—	—	—	—	—
9/13	—	—	—	—	—	—
9/20	—	—	3	28	3	28
9/27	—	—	—	—	—	—
10/04	—	—	—	—	—	—
10/11	—	—	2	23	2	23
10/18	—	—	—	—	—	—
10/25	—	—	—	—	—	—
11/01	—	—	—	—	—	—
11/08	—	—	—	—	—	—
Total	—	—	5	51	5	51
(Percent)	—	—	(0.3)	(0.4)	(0.3)	(0.4)

Table 18. Mean total length (inches) and weight (pounds), by age and sex, of steelhead passed upstream at the Little Manistee River weir, fall 1987. Two standard errors in parentheses.

Week beginning	Measurement	Age 1.0		Age 2.0		Age 3.0	
		Male	Female	Male	Female	Male	Female
9/06	Length	16.4	15.0	—	—	—	—
		—	(0.600)	—	—	—	—
	Weight	1.4	1.0	—	—	—	—
		—	(0.100)	—	—	—	—
9/13	Length	—	17.4	—	17.5	—	—
		—	(2.618)	—	—	—	—
	Weight	—	2.1	—	2.4	—	—
		—	(0.648)	—	—	—	—
9/20	Length	—	16.0	—	—	—	—
		—	(0.386)	—	—	—	—
	Weight	—	1.8	—	—	—	—
		—	(0.245)	—	—	—	—
9/27	Length	16.0	—	20.0	—	—	—
		(2.700)	—	—	—	—	—
	Weight	1.6	—	3.5	—	—	—
		(0.900)	—	—	—	—	—
10/04	Length	—	—	—	—	—	—
		—	—	—	—	—	—
	Weight	—	—	—	—	—	—
		—	—	—	—	—	—
10/11	Length	16.0	16.2	17.7	—	—	—
		(0.438)	(0.353)	—	—	—	—
	Weight	1.9	2.1	2.7	—	—	—
		(0.469)	(0.643)	—	—	—	—
10/18	Length	—	—	—	17.2	—	18.0
		—	—	—	(2.946)	—	—
	Weight	—	—	—	2.9	—	2.8
		—	—	—	(1.157)	—	—
10/25	Length	—	—	16.6	18.8	—	—
		—	—	(0.400)	—	—	—
	Weight	—	—	2.2	2.7	—	—
		—	—	(0.100)	—	—	—
11/01	Length	—	17.4	—	—	—	—
		—	—	—	—	—	—
	Weight	—	2.8	—	—	—	—
		—	—	—	—	—	—
11/08	Length	18.1	—	—	—	—	—
		—	—	—	—	—	—
	Weight	2.7	—	—	—	—	—
		—	—	—	—	—	—
Weighted seasonal mean	Length	16.2	16.6	18.5	17.4	—	18.0
		(1.162)	(0.467)	(0.231)	(2.513)	—	—
	Weight	1.8	2.1	2.9	2.8	—	2.8
		(0.424)	(0.185)	(0.058)	(0.986)	—	—
Sexes combined	Length	16.4		17.9		18.0	
		(0.560)		(1.853)		—	
	Weight	2.0		2.9		2.8	
		(0.205)		(0.725)		—	

Table 18. Continued:

Week beginning	Measurement	Age 1.1 Male	Age 1.1 Female	Age 2.1 Male	Age 2.1 Female	Age 1.2 Male	Age 1.2 Female
9/06	Length	—	—	22.2	—	28.9	28.2
		—	—	—	—	(0.700)	—
	Weight	—	—	3.7	—	7.3	7.9
		—	—	—	—	(0.500)	—
9/13	Length	—	—	22.3	23.5	—	—
		—	—	—	—	—	—
	Weight	—	—	4.6	5.5	—	—
		—	—	—	—	—	—
9/20	Length	22.1	21.2	26.0	25.3	29.5	27.8
		(3.638)	—	—	—	(0.658)	(0.743)
	Weight	4.0	4.2	7.3	6.1	8.4	7.4
		(1.877)	—	—	—	(0.273)	(0.603)
9/27	Length	26.3	26.2	21.9	26.8	28.5	28.0
		(0.400)	(0.769)	—	(3.400)	(0.973)	(0.544)
	Weight	7.1	7.4	4.0	7.2	8.0	8.0
		(0.400)	(0.982)	—	(1.400)	(0.901)	(0.607)
10/04	Length	—	24.6	—	25.0	28.9	28.3
		—	(1.929)	—	(1.200)	(0.873)	(0.559)
	Weight	—	5.7	—	5.8	8.4	8.1
		—	(1.400)	—	(0.500)	(0.757)	(0.441)
10/11	Length	26.3	25.2	25.8	25.5	28.9	27.5
		—	(1.933)	(0.600)	(0.300)	(1.014)	(0.841)
	Weight	6.3	6.0	6.3	6.7	7.8	7.8
		—	(0.874)	(1.400)	(0.400)	(0.839)	(0.710)
10/18	Length	20.6	24.2	23.7	22.8	29.5	28.4
		(0.800)	(2.515)	(2.900)	(0.400)	(0.554)	(0.782)
	Weight	4.4	5.9	5.8	5.4	9.1	8.9
		(0.900)	(0.867)	(1.600)	(0.100)	(0.611)	(0.662)
10/25	Length	24.2	22.2	25.9	—	29.0	28.2
		(2.034)	—	(3.153)	—	(0.471)	(1.192)
	Weight	5.8	4.2	6.6	—	8.3	8.2
		(0.872)	—	(1.864)	—	(0.284)	(1.015)
11/01	Length	—	25.3	26.2	25.6	29.1	28.0
		—	(1.026)	—	(0.968)	(0.762)	(0.969)
	Weight	—	6.2	6.4	6.4	8.5	8.7
		—	(0.863)	—	(0.533)	(0.457)	(1.118)
11/08	Length	25.3	—	—	23.5	29.2	28.7
		(1.849)	—	—	—	(0.874)	(0.717)
	Weight	6.0	—	—	5.0	8.7	8.7
		(1.288)	—	—	—	(0.566)	(0.577)
Weighted seasonal mean	Length	23.6	25.1	24.7	25.2	29.0	28.1
		(1.007)	(0.630)	(1.171)	(0.717)	(0.347)	(0.317)
	Weight	5.3	6.2	5.9	6.3	8.4	8.3
		(0.547)	(0.488)	(0.709)	(0.340)	(0.240)	(0.351)
Sexes combined	Length	24.6		25.0		28.6	
		(0.552)		(0.618)		(0.248)	
	Weight	(5.9)		(6.1)		8.4	
		(0.365)		(0.363)		(0.202)	

Table 18. Continued:

Week beginning	Measurement	Age 2.2 Male	Age 2.2 Female	Age 1.3 Male	Age 1.3 Female	Age 2.3 Male	Age 2.3 Female
9/06	Length	29.2	28.7	—	30.2	—	—
		—	—	—	(0.099)	—	—
	Weight	7.0	7.2	—	8.4	—	—
		—	—	—	(0.800)	—	—
9/13	Length	—	—	—	—	—	—
		—	—	—	—	—	—
	Weight	—	—	—	—	—	—
		—	—	—	—	—	—
9/20	Length	28.9	—	31.6	30.4	31.0	—
		(0.586)	—	(1.320)	(0.947)	—	—
	Weight	8.1	—	10.3	9.7	9.0	—
		(0.637)	—	(0.889)	(1.172)	—	—
9/27	Length	29.5	26.8	31.5	27.6	32.1	32.4
		(1.605)	(3.692)	(0.574)	—	(1.039)	—
	Weight	8.3	7.7	10.4	7.0	10.6	11.9
		(1.370)	(1.701)	(0.150)	—	(0.406)	—
10/04	Length	30.1	29.1	—	29.2	31.4	—
		(0.626)	(0.958)	—	(1.348)	(1.800)	—
	Weight	9.2	8.8	—	9.2	10.5	—
		(0.717)	(0.879)	—	(1.102)	(0.200)	—
10/11	Length	29.5	28.1	—	28.6	30.8	30.0
		(0.467)	(0.666)	—	(1.200)	(0.500)	(1.100)
	Weight	9.6	8.5	—	6.1	9.4	10.1
		(1.392)	(0.669)	—	(5.300)	(1.400)	(0.100)
10/18	Length	28.7	28.3	30.4	30.9	—	—
		(0.979)	(0.975)	(0.812)	(0.769)	—	—
	Weight	8.6	9.2	9.9	9.9	—	—
		(0.777)	(2.130)	(0.512)	(0.882)	—	—
10/25	Length	29.7	27.9	31.6	29.3	—	—
		(1.046)	(0.661)	(2.163)	(0.100)	—	—
	Weight	8.7	8.1	10.6	9.3	—	—
		(0.741)	(1.019)	(1.576)	(0.100)	—	—
11/01	Length	29.9	27.5	30.5	—	—	30.2
		(0.879)	(1.855)	(1.100)	—	—	—
	Weight	9.1	7.6	9.8	—	—	9.8
		(0.612)	(1.238)	(2.700)	—	—	—
11/08	Length	28.6	28.7	31.2	29.4	32.9	—
		(1.103)	(0.563)	(0.982)	(2.000)	—	—
	Weight	8.4	8.4	9.8	8.6	12.0	—
		(1.179)	(0.484)	(1.467)	(1.400)	—	—
Weighted seasonal mean	Length	29.5	27.9	30.9	29.8	31.7	30.7
		(0.377)	(0.764)	(0.368)	(0.357)	(0.616)	(0.852)
	Weight	8.8	8.1	10.1	8.9	10.3	10.4
		(0.288)	(0.524)	(0.619)	(0.580)	(0.310)	(0.077)

Sexes combined		Age 2.2	Age 1.3	Age 2.3
	Length	28.8	30.5	31.3
		(0.461)	(0.364)	(0.452)
	Weight	8.5	9.6	10.3
		(0.311)	(0.483)	(0.393)

Table 18. Continued:

Week beginning	Measurement	Age 1.4		Age 2.4	
		Male	Female	Male	Female
9/06	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
9/13	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
9/20	Length	—	—	—	30.8
		—	—	—	—
	Weight	—	—	—	9.3
		—	—	—	—
9/27	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
10/04	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
10/11	Length	—	—	—	31.4
		—	—	—	—
	Weight	—	—	—	11.4
		—	—	—	—
10/18	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
10/25	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
11/01	Length	33.6	—	—	—
		—	—	—	—
	Weight	12.5	—	—	—
		—	—	—	—
11/08	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
Weighted seasonal mean	Length	33.6	—	—	31.0
		—	—	—	—
	Weight	12.5	—	—	10.1
		—	—	—	—
Sexes combined	Length	33.6		31.0	
		—		—	
	Weight	12.5		10.1	
		—		—	

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

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 2.0						
9/20	—	—	—	—	—	—
9/27	—	—	—	—	—	—
10/04	—	—	—	—	—	—
10/11	—	—	1	2	1	2
10/18	—	—	—	—	—	—
11/01	—	—	—	—	—	—
11/08	—	—	—	—	—	—
Total	—	—	1	2	1	2
(Percent)	—	—	(2.0)	(0.6)	(2.0)	(0.6)
Age 1.1						
9/20	2	12	3	15	5	27
9/27	9	52	3	15	12	67
10/04	—	—	2	12	2	12
10/11	—	—	2	11	2	11
10/18	—	—	—	—	—	—
11/01	1	5	1	5	2	10
11/08	—	—	2	14	2	14
Total	12	69	13	72	25	141
(Percent)	(24.5)	(22.2)	(26.5)	(23.2)	(51.0)	(45.3)
Age 2.1						
9/20	1	9	—	—	1	9
9/27	4	22	1	5	5	27
10/04	—	—	—	—	—	—
10/11	—	—	—	—	—	—
10/18	—	—	1	8	1	8
11/01	—	—	1	7	1	7
11/08	—	—	—	—	—	—
Total	5	31	3	20	8	51
(Percent)	(10.2)	(10.0)	(6.1)	(6.4)	(16.3)	(16.4)

Table 19. Continued:

Week beginning	Male		Female		Total	
	Number	Pounds	Number	Pounds	Number	Pounds
Age 1.2						
9/20	6	50	1	7	7	57
9/27	1	9	—	—	1	9
10/04	—	—	—	—	—	—
10/11	—	—	1	7	1	7
10/18	—	—	1	10	1	10
11/01	—	—	2	16	2	16
11/08	—	—	—	—	—	—
Total	7	59	5	40	12	99
(Percent)	(14.3)	(19.0)	(10.2)	(12.9)	(24.5)	(31.8)
Age 2.2						
9/20	—	—	—	—	—	—
9/27	1	6	—	—	1	6
10/04	—	—	—	—	—	—
10/11	1	12	—	—	1	12
10/18	—	—	—	—	—	—
11/01	—	—	—	—	—	—
11/08	—	—	—	—	—	—
Total	2	18	—	—	2	18
(Percent)	(4.1)	(5.8)	—	—	(4.1)	(5.8)

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 1987. Two standard errors in parentheses.

Week beginning	Measurement	Age 2.0		Age 1.1		Age 2.1	
		Male	Female	Male	Female	Male	Female
9/20	Length	—	—	23.0	22.1	27.5	—
		—	—	(2.700)	(1.435)	—	—
	Weight	—	—	5.8	5.1	8.6	—
		—	—	(2.400)	(1.471)	—	—
9/27	Length	—	—	22.7	21.6	23.4	22.0
		—	—	(0.598)	(0.200)	(1.249)	—
	Weight	—	—	5.8	4.9	5.5	5.4
		—	—	(0.614)	(0.900)	(1.249)	—
10/04	Length	—	—	—	22.6	—	—
		—	—	—	(2.200)	—	—
	Weight	—	—	—	5.8	—	—
		—	—	—	(0.700)	—	—
10/11	Length	—	15.4	—	22.2	—	—
		—	—	—	(2.800)	—	—
	Weight	—	2.2	—	5.5	—	—
		—	—	—	(1.000)	—	—
10/18	Length	—	—	—	—	—	25.9
		—	—	—	—	—	—
	Weight	—	—	—	—	—	8.3
		—	—	—	—	—	—
11/01	Length	—	—	23.1	22.9	—	25.3
		—	—	—	—	—	—
	Weight	—	—	5.2	4.6	—	7.3
		—	—	—	—	—	—
11/08	Length	—	—	—	24.9	—	—
		—	—	—	(1.700)	—	—
	Weight	—	—	—	7.0	—	—
		—	—	—	—	—	—
Weighted seasonal mean	Length	—	15.4	22.8	22.6	24.2	24.4
		—	—	(0.231)	(0.029)	(0.625)	—
	Weight	—	2.2	5.7	5.5	6.1	7.0
		—	—	(0.237)	(0.130)	(0.625)	—
Sexes combined	Length	15.4		22.7		24.2	
		—		(0.136)		(0.504)	
	Weight	2.2		5.6		6.4	
		—		(0.132)		(0.396)	

Table 20. Continued:

Week beginning	Measurement	Age 1.2		Age 2.2	
		Male	Female	Male	Female
9/20	Length	26.3	24.5	—	—
		(1.307)	—	—	—
	Weight	8.3	6.7	—	—
		(0.966)	—	—	—
9/27	Length	25.4	—	24.4	—
		—	—	—	—
	Weight	8.6	—	6.0	—
		—	—	—	—
10/04	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
10/11	Length	—	23.2	28.9	—
		—	—	—	—
	Weight	—	7.1	12.4	—
		—	—	—	—
10/18	Length	—	25.2	—	—
		—	—	—	—
	Weight	—	9.6	—	—
		—	—	—	—
11/01	Length	—	25.6	—	—
		—	(0.199)	—	—
	Weight	—	8.0	—	—
		—	(0.400)	—	—
11/08	Length	—	—	—	—
		—	—	—	—
	Weight	—	—	—	—
		—	—	—	—
Weighted seasonal mean	Length	26.2	24.8	26.6	—
		—	—	—	—
	Weight	8.4	7.9	9.2	—
		—	—	—	—
Sexes combined	Length	25.6		26.6	
		—		—	
	Weight	8.2		9.2	
		—		—	

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