

STATE OF ALASKA
Bill Sheffield, Governor

Annual Performance Report for
STATUS OF SELECTED COHO SALMON STOCKS IN
SOUTHEASTERN ALASKA

by
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RESEARCH PROJECT SEGMENT

State: Alaska Name: Sport Fish
Investigations
of Alaska

Project: F-9-17

Study: G-II Study Title: A STUDY OF COHO SALMON
IN SOUTHEAST ALASKA

Job: G-II-D Job Title: Status of Selected
Coho Salmon Stocks in
Southeastern Alaska

Cooperator: Artwin E. Schmidt

Period Covered: July 1, 1984 to June 30, 1985

ABSTRACT

A coho salmon, *Oncorhynchus kisutch* (Walbaum), research project was continued to determine escapement goals, migration routes, run timing, harvest rates, and areas of harvest for selected index streams in southeast Alaska. Coded-wire tagging of pre-smolt and smolt populations was conducted at Salmon Lake. Population estimates of these groups were determined. The adult coho escapement to Salmon Lake was determined by weir and marked:unmarked expansion techniques. Escapement surveys were conducted on 27 streams in southeast Alaska.

The total coho escapement to Salmon Lake was estimated to be 1,514 adults and 689 jacks. The contribution of coho salmon to the commercial troll fishery was 856 fish or 36.1% of the total return. Survival of tagged smolt to adult return was 7.99 percent. All returns of coded-wire tagged fish were from the outer coastal area. Most returns were offshore of Kruzof and west Chichagof Islands.

KEY WORDS

Southeast, Alaska, coho salmon, *Oncorhynchus kisutch* (Walbaum), escapements, smolt, production, coded-wire tagging, weirs, fyke nets.

BACKGROUND

Coho salmon are one of the most important species in recreational, commercial, and subsistence fisheries in southeast Alaska. The sport harvest of coho salmon in 1983 was in excess of 55,000 fish. Although

coho are important, very little is known about their migration routes, run timing, exploitation rates, or the escapement of discrete populations.

A study to provide the information which will allow proper stock management was begun as a joint effort by the Divisions of Commercial Fisheries and Sport Fish. The Division of Sport Fish initiated this study at Salmon Lake near Sitka as a first phase of the joint study. The detailed work will be continued for three complete life cycles. Spawning-escapement counts will be continued indefinitely.

Table 1 lists the common name, scientific name, and abbreviations of each species of fish mentioned in this report. Figure 1 presents a map of the study area.

RECOMMENDATIONS

1. A larger recapture sample is needed for total-escapement estimation. A beach seine should be used to capture a larger sample of adults near the main inlet to the lake.
2. In addition to pre-smolt tagging in the fall, a larger number of smolts must be tagged in the spring before smolt emigration. This marking should differentiate those smolt tagged in the lake and those smolts tagged in the inlet so that their relative contributions to the total smolt production can be estimated.
3. Coded-wire tags should be collected from all jacks returning to the weir this fall. This will allow comparison of tag lots from fall and spring tagging as well as establish which portion of the smolt migration contributes the most to the jack population.
4. A sample of coded-wire tags must be collected from post-spawning adults to allow evaluation of survival from fish tagged as pre-smolts and those tagged as smolts.
5. Smolts tagged as juveniles in the fall and those tagged the following spring must have two separate tag codes to allow analysis of overwinter survival and contribution to the fishery.

OBJECTIVES

1. To enumerate the coho salmon escapement in the following streams.

Table 1. List of Common Names, Scientific Names, and Abbreviations.

Common name	Scientific name	Abbreviation
Coho salmon	<i>Oncorhynchus kisutch</i> (Walbaum)	SS
Sockeye salmon	<i>Oncorhynchus nerka</i> (Walbaum)	RS

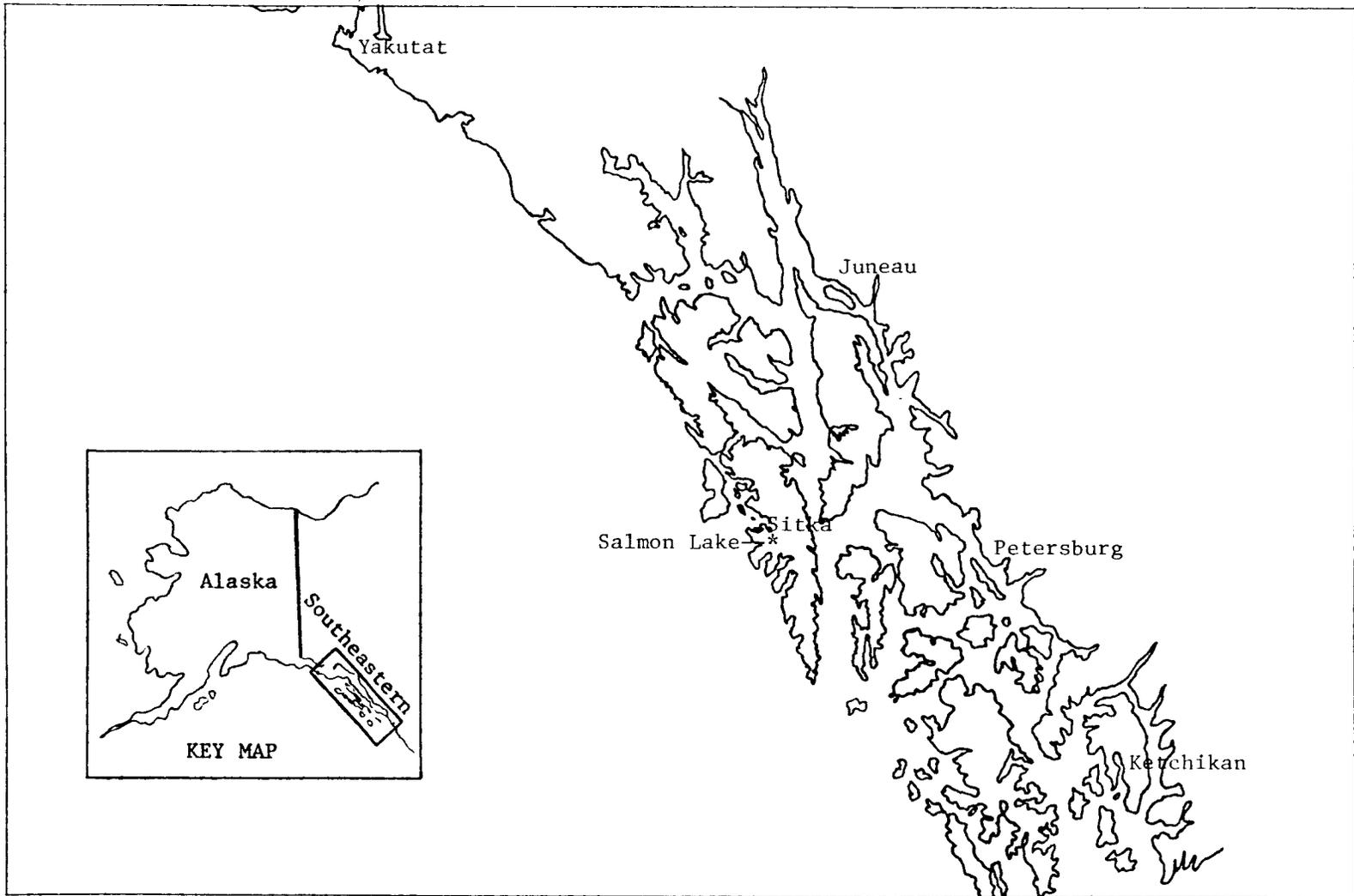


Figure 1. Location of Salmon Lake Research Site, Southeast Alaska, 1984.

Juneau Area	Sitka Area	Ketchikan Area	Petersburg Area
Steep Cr.	Starrigavan Cr.	Eulachon R.	Sumner Cr.
Montana Cr.	Sawmill Cr.	White R.	Ohmar Cr.
Switzer Cr.	Indian R.	Naha R.	Big Cr.
Jordon Cr.	Sinitsin Cr.	Ward Cr.	Falls Cr.
Duck Cr.	Salmon Lake Cr.	Ketchikan Cr.	Coho Cr.
Peterson Cr.		Indian R.	Petersburg Cr.
Auke Cr.			
Salmon Cr.			
Yehring Cr.			

2. To determine the migration route, run timing, harvest rates, and areas of harvest of coho salmon from selected index streams in southeast Alaska.
3. To establish escapement goals for coho salmon in the selected index streams contributing to urban area recreational fisheries in southeast Alaska.

TECHNIQUES USED

Adult Escapements

Coho salmon escapement surveys were conducted on selected streams near Juneau, Ketchikan, Petersburg and Sitka. Important coho-producing streams which were small enough to allow reliable foot surveys or weir installation were selected. The streams in each area were surveyed by the Area Management Biologist in that area. An attempt was made to survey each stream more than once to ensure enumeration during peak abundance.

Salmon Lake Research

The Salmon Lake watershed (113-41-32) was chosen as the first long-range study site. This year represents the first return of tagged fish released from Salmon Lake. Preliminary information on immigration route, run timing, harvest rates, and areas of harvest is now available from coded-wire tag recoveries and weir data.

Adult Population Analysis:

The weir was installed and operational on August 9 and operated until October 11. The physical construction of the weir is described in Schmidt (1984). Coho salmon were anesthetized with MS-222 and measured; scale samples were taken. All fish were marked with opercular punch marks that were changed weekly. The Floy tags used the previous year were discontinued because of tag-loss problems (Schmidt, 1984). Opercular punches were used because of their ease of application, permanence and limited effect on the fish. Fish which had been

processed were placed in a floating holding pen until they recovered enough to jump out of the pen without assistance.

Spawning ground surveys were conducted periodically on the inlet to Salmon Lake from September 25 through November 27. Adults in the inlet stream were examined to determine the ratio of tagged fish, which had been passed through the weir, to untagged fish, which had either gone over the weir or entered the system after the weir was removed. Spawning fish were collected with an underwater spear. The tagged to untagged ratio of recaptured fish was used to estimate the total escapement by the Chapman formula:

$$N = \frac{(M+1)(C+1)}{R+1}$$

where

N = population estimate,
M = number of fish marked,
C = number of fish captured, and
R = number of fish recaptured.

Smolt Population Investigations:

Smolts in Salmon Lake from April 25 to May 7 were coded-wire tagged and given adipose-fin and dorsal caudal-fin clips. These dorsal caudal-fin clipped fish were used to estimate total smolt emigration at the fyke net stations using Chapman's version of the Peterson estimate (Ricker, 1975).

Emigrant coho smolts were trapped with fyke nets beginning April 23 and continuing until May 25. Fyke nets had 1-m² opening, were 3 m long, and tapered to an 11.43-cm inside-diameter opening connected to a floating live box. Two fyke traps were located upstream from the cabin, using a natural lead formed by a log extending into the streambed. Additional leads were constructed from 0.25-inch Vexar netting lashed to 4-foot by 8-foot rebar frames.

The operation of the fyke nets and tagging procedures for smolts are described by Schmidt (1984).

Pre-Smolt Investigation:

Pre-smolt coho salmon with a minimum fork length of 85 mm were trapped, adipose-fin clipped, and coded-wire tagged in Salmon Lake intermittently from August 8 to September 26, 1984. Coho distribution was determined by setting traps throughout the lake. Once the distribution of coho salmon was determined, effort was concentrated in the most productive areas.

Coho salmon were collected with small-mesh fyke nets and 41 cm long, commercially available Gee's minnow traps. All traps and fyke nets were baited with salmon eggs. Captured fish were anesthetized in a dilute

solution of MS-222 before they were measured for length or weight, fin clipped, examined for marks and tagged.

FINDINGS

Adult Escapement Surveys

Adult coho escapement indexes were determined for 27 stream systems in southeast Alaska. Summary information is presented in Table 2. All records are included in the Department of Fish and Game computerized Salmon Escapement Stream Surveys.

Salmon Lake Research

Adult Population Analysis:

The weir was installed and operational on August 9 and began trapping coho salmon on August 14. Figure 2 presents the daily weir passage of adult and jack coho, along with the water level in the river. A total of 472 adults and 195 jacks passed through the weir from August 14 to October 11, 1984. Twenty-one of the adults and 12 of the jacks were adipose-fin clipped. All of these fish were marked with opercular punchmarks that varied weekly.

There were two periods of high water when fish were able to swim over and around the weir. One of these times, October 7 and 8, was during the peak of the coho migration. An estimated 225 coho salmon holding below the weir easily escaped over it. The escape was facilitated by several holes in the weir. These holes were created when 28 pickets sheared off above the highest channel. Extreme water pressure and vibration caused this damage.

Seven coho salmon died from wedging their heads through the weir pickets on October 1 and 2. The water level at that time was 69 cm, and fish were actively trying to move upstream.

Table 3 lists the 12 tagged, unspent, dead fish that washed up on the weir this season. Five of these had 20-75% scale loss, which probably contributed to their deaths.

Surveys of the inlets were conducted to get mark:unmark information for population-expansion calculations. The main inlet was surveyed September 25; October 16, 17, 30 and 31; and November 8, 14 and 27. No coho salmon were observed on September 25. A total of 37 fish was closely examined for marks on the other dates. The secondary inlet was surveyed October 15, and no coho were observed. One of six jacks and nine of 31 adults had been opercular punched. This marked:unmarked ratio was applied to expand weir data to a total escapement for Salmon Lake. The modified Peterson estimate yielded a population of 1,514 adults and 689 jacks for Salmon Lake.

A larger sample for estimating total escapement is needed.

Table 2. Summary of Adult Coho Escapement Surveys Conducted by Sport Fish Division in Southeast Alaska.

Area/System	Stream number	Escapement			
		1984		Previous counts	
		Number	Date	High	Year
Juneau					
Salmon Creek*	111-40-015	*	*	12	1981
Steep Creek	111-50-056	168	10/19	515	1981
Peterson Creek	111-50-075	50	10/17	95	1983
Montana and					
McGinnis Creeks	111-50-052	581	10/29	636	1983
Switzer Creek	111-40-007	123	11/01	168	1978
Jordan Creek	111-50-062	250	10/26	486	1981
Peterson Creek	111-50-010	189	10/11	320	1982
Taku					
Sockeye Creek	111-32-038	275	10/21	...	...
Johnson Creek	111-32-068	235	10/21	...	...
Yehring Creek	111-32-066	675	10/21	...	...
Fish Creek	111-32-056	415	10/21	...	...
Moose Creek	111-32-046	50	10/21	...	...
Ketchikan					
Ward Creek**	101-45-024	323	10/29	565	1983
Indian Creek	101-71-004	601	11/30	1,500	1979
Carroll River	101-45-078	411	10/30	524	1983
Hulakon River	101-75-015	1,211	10/28	380	1983
Petersburg					
Sumner Creek	108-40-040	83	10/02	48	1983
Ohmer Creek	108-40-050	129	10/02	160	1982
Bear Creek	108-50-003	91	10/04	216	1977
Falls Creek	106-44-006	171	10/03	1,950	1955
Petersburg Creek	106-44-060	414	10/19	7,000	1940
Sitka***					
Sinitzin Creek	113-62-008	160	10/10	85	1981
St. John's Creek	113-66-006	154	10/10	51	1981
Nakwasina River	113-43-002	715	10/17	780	1981
Indian River	113-41-019	175	10/30	161	1982
Starrigavan Creek	113-41-015	385	10/10	317	1982
Kizuchia Creek****	113-41-042	225	9/15	284	1981

* This system is influenced by hatchery production, so the escapement was not counted in 1984.

** Ward Creek has a natural early run in October and a later hatchery run in November. The peak of the hatchery run was 352 fish on November 29.

*** All surveys in the Sitka Management Area were a cooperative effort with the Commercial Fish staff.

**** This survey was conducted by the U.S. Forest Service.

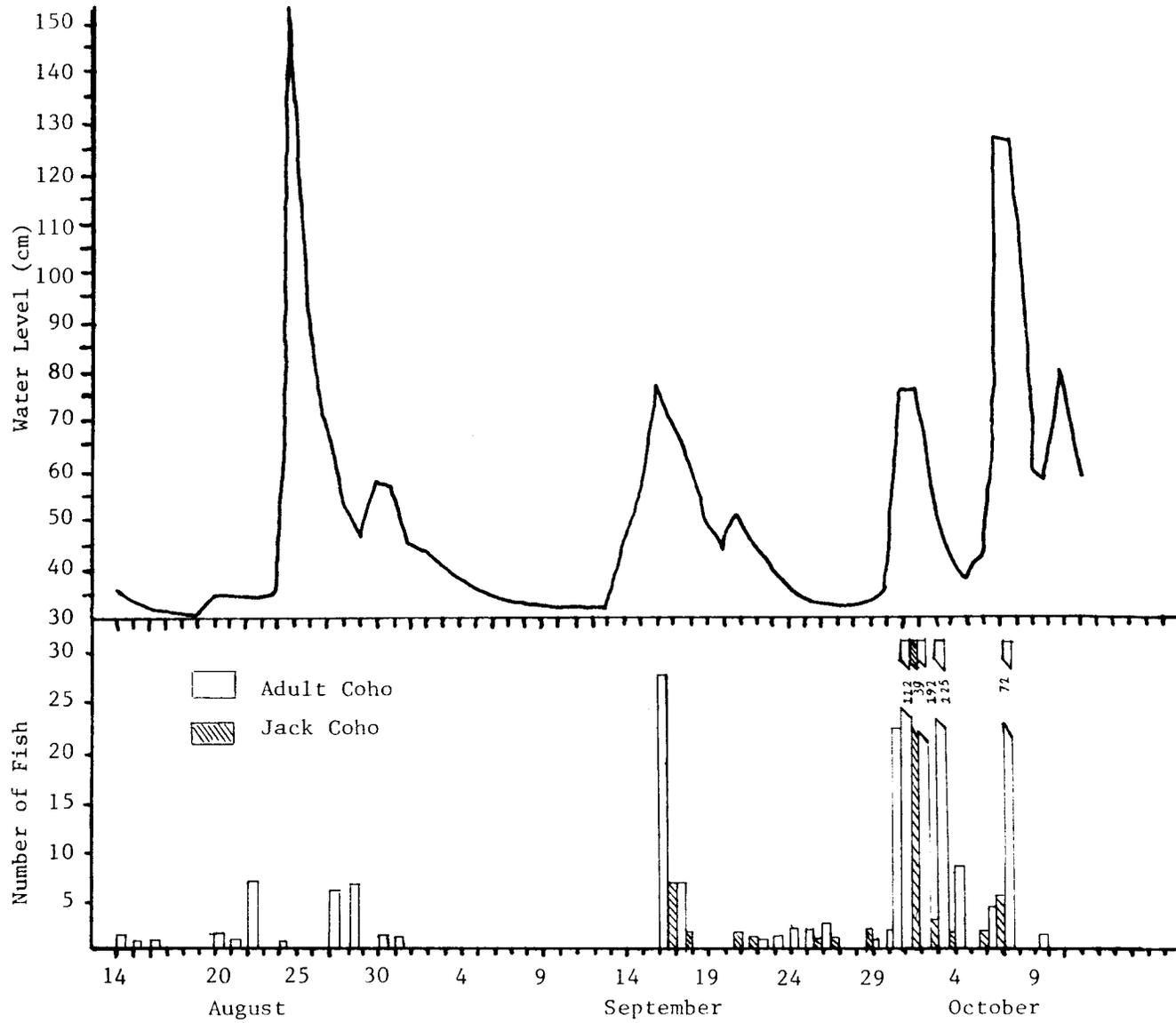


Figure 2. Coho Immigration as Correlated With Water Level, Salmon Lake Weir, 1984.

Table 3. Summary of Tagged Coho Salmon Which Died Before Spawning, Salmon Lake Weir, 1984.

Punch code	Sex	Date Tagged	Date received	Days free	Comments
R-2V	Female	8/21	8/21	0	Gill injury while tagging
L-2V	Male	8/28	8/29	1	...
L-2V	Female	8/28	8/29	1	40% scale loss
L-1S	Female	9/16	9/17	1	...
R-1D	Male	9/17	9/18	1	75% scale loss
R-1D	Jack	9/17	9/23	6	50% scale loss
R-1D	Male	9/17	9/25	8	Fungal infection
R-1L	Male*	10/01	10/02	1	Cleft mandible and emaciated
L-2H	Female	9/30	10/02	2	20% scale loss
L-2H	Male	9/25	10/04	9	25% scale loss and fungal infection
R-1L	Female	10/06	10/06	0	Internal bleeding
R-1L	Female	10/01-10/07	10/11	4-10	One aborted ovary

* adipose clipped

Unfortunately, there were never more than 30-65 fish in the inlet at one time, and it was only possible for a few of these to be closely examined for marks. A beach seine would aid in capturing a larger sample from the larger schools of coho that stayed in the lake near the main inlet. A seine should be purchased for next year.

Length-frequency analysis of the coho (Fig. 3) shows the size distribution of adults and jacks. Freshwater-age analysis from scales showed the majority of adults to be Age-2 (55%); fewer adults were Age-3 (34%), Age-4 (7.3%), Age-1 (3.3%) or Age-5 (0.3%). The age structures of the jack and adult populations were different. Most of the jacks were Age-3 freshwater fish (52.3%), and fewer jacks were Age-4 (25.5%), Age-2 (16.8%), Age-5 (3.3%), Age-1 (1.3%), or Age-6 (0.7%). Many of the jacks were fairly large fish. The separation point between jacks and adults was 460 mm mid-eye-fork length.

A length-weight regression for Salmon Lake coho adults (Figure 4) was calculated from the 1983 data. The formula for this log-transformed regression is $\text{Log } Y = -4.50455 + 2.86521(\text{Log } X)$. This regression has an r^2 of 0.9723.

Contribution to the Recreational Fishery:

Coho salmon returning to Salmon Lake contribute an unknown amount to the recreational fishery in the Sitka area (1977-1983 average harvest was 3,032 coho salmon). The fish are harvested in the marine fishery around Sitka and in the intertidal area off the mouth of Salmon Creek. Some recreational fishing for Salmon Lake coho probably occurs in the lower portion of the creek. The magnitude of the harvest from these fisheries has not been determined because of a lack of funding for creel surveys. However, upper Silver Bay (mouth of Salmon Creek) and Salmon Lake will be included in future printings of Mike Mills's Statewide Harvest Survey. This will provide an estimated recreational harvest of coho salmon in these areas.

Contribution to the Troll Fishery:

Two expansion factors were calculated to estimate the number of coho contributed to the fishery. The first expansion factor is determined by dividing the number of fish harvested in a fishery-area-time stratum by the number of fish sampled in that same stratum. The average expansion factor for Salmon Lake coho caught in the northern, outside troll fishery was 4.2357. The nine Salmon Lake coho sampled in the fishery then represent 38.12 tagged fish caught. This represents 2.89% of the 1,319 smolts originally tagged. The second expansion factor required to determine catch of Salmon Lake fish by the troll fishery is the ratio of tagged to untagged fish as adults. Weir data from Salmon Lake showed 21 of 472 adult coho were adipose-fin clipped. The total contribution of Salmon Lake coho to the troll fishery then is 856 coho ($472 \times 38.12 \div 21$).

Harvest Rate:

The harvest rate of Salmon Lake coho was obtained by dividing the total

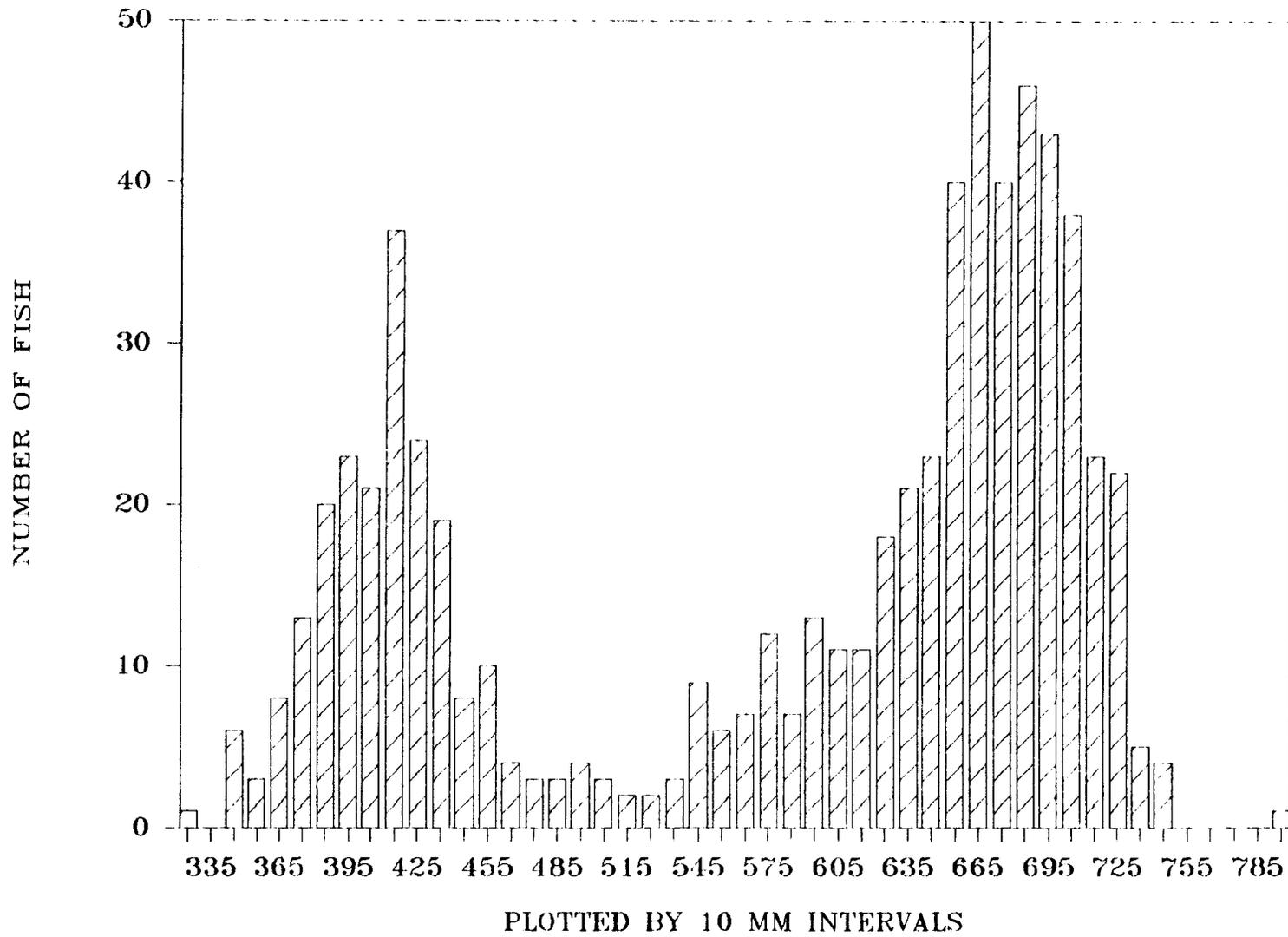


Figure 3. Number of Sexually Mature Coho by 10-mm (Mid-eye fork) Length Interval, Salmon Lake Weir, 1984.

harvest by the total adult production (commercial harvest + escapement). The escapement figures could be obtained by two methods. The weir count of 472 fish plus known escapement over the weir (estimate 225 fish) gives a minimal known escapement of 697 adult coho. The harvest rate based on this escapement would be 55% ($856 \div 1,553$).

The expanded estimate of escapement obtained by mark:recapture analysis was 1,514 ($473 \times 32 \div 10$). Harvest rate based on this escapement would be 36% ($856 \div 2,370$).

Timing and Location of Harvest:

Tagged coho were sampled from the troll catch beginning July 1 and continuing through September 14. The early fish had to be caught during the latter part of June because the troll fishery was closed from July 1 through July 10. The last fish sampled was sold on September 14, although the troll season did not close until September 21.

All returns of coded-wire tags were from the northern, outside area. Most returned fish were caught in the areas from offshore Cape Edgecombe and Pt. Amelia on outer Kruzof Island, on the south, to offshore of Hoktaheen, Elfin Cove and Deer Harbor, on the north. One coho was turned in from Statistical Area 181 (Yakutat) on September 14.

Smolt Population Investigations:

The number of smolts tagged this spring was 340 from the Lake and 3,653 from the outlet fyke nets, a total of 3,993 smolts. Tag retention from pre-smolt to smolt was 95.02%.

Smolts were trapped in Salmon Lake from April 25 to May 7 before their emigration. A total of 388 smolts were captured. Fifty-one of these smolts were recaptured fish from the 1,491 pre-smolts tagged the previous summer. Three of these 51 fish had to be retagged with coded-wire tags because of tag loss. The other 337 smolts were given an original coded-wire tag. A total of 353 smolts were dorsal caudal-fin clipped for population estimation at the fyke-net station.

Coded-wire tagging of smolts was conducted at the outlet fyke-net station from April 23 through May 25. During this period, 4,085 smolts were captured (Table 4). Of these smolts, 3,647 received new tags, 135 had adipose and dorsal caudal-fin clips, 267 had adipose-fin clips with tags, 14 had adipose-fin clips without tags, 8 had adipose-fin clips and ventral caudal-fin clips, and 14 were unmarked mortalities. There were 8 post-tagging mortalities. A total of 3,653 smolts were coded-wire tagged at the fyke-net station.

The smolt migration was minimal until May 3, and it peaked on May 9. The major migration was over by May 20. The length-frequency histogram (Fig. 5) shows the most frequent size to be 100-104 mm. Mean length of smolts sampled was 111 mm.

Table 4. Summary of Downstream Smolt Catch at the Fyke Net Capture Station, Salmon Lake, 1984.

Date	Water temp. (°C)	Stream Depth (cm)	Coho smolts (No.)	Sockeye smolts (No.)
April 19	6.0	26.0	...	3
20	4.0	35.0	1	2
21	4.0	54.0	...	...
22	5.0	51.0	Traps not set	...
23	4.2	43.0	8	...
24	5.8	40.0	...	...
25	5.0	36.0	4	...
26	5.0	33.0	1	...
27	...	...	2	...
28	5.5	33.0	Traps not set	...
29	5.5	34.0	4	...
30	5.0	34.5	6	5
May 1	5.0	35.0	6	1
2	5.2	34.5	2	...
3	6.0	32.0	26	4
4	5.0	31.0	33	1
5	5.8	30.0	45	...
6	6.0	30.0	34	...
7	5.2	34.5	156	9
8	5.0	43.5	77	11
9	5.0	42.0	730	33
10	5.0	39.5	413	55
11	5.8	36.5	356	47
12	6.2	35.5	387	67
13	6.0	36.0	362	61
14	6.2	36.5	437	141
15	6.5	38.0	282	135
16	6.2	39.5	198	124
17	6.2	37.0	171	144
18	5.5	39.0	54	111
19	6.0	38.5	91	72
20	6.0	39.5	38	75
21	6.0	37.5	40	151
22	6.0	36.5	70	188
23	6.8	37.0	15	72
24	6.2	40.5	16	56
25	7.0	45.0	24	114

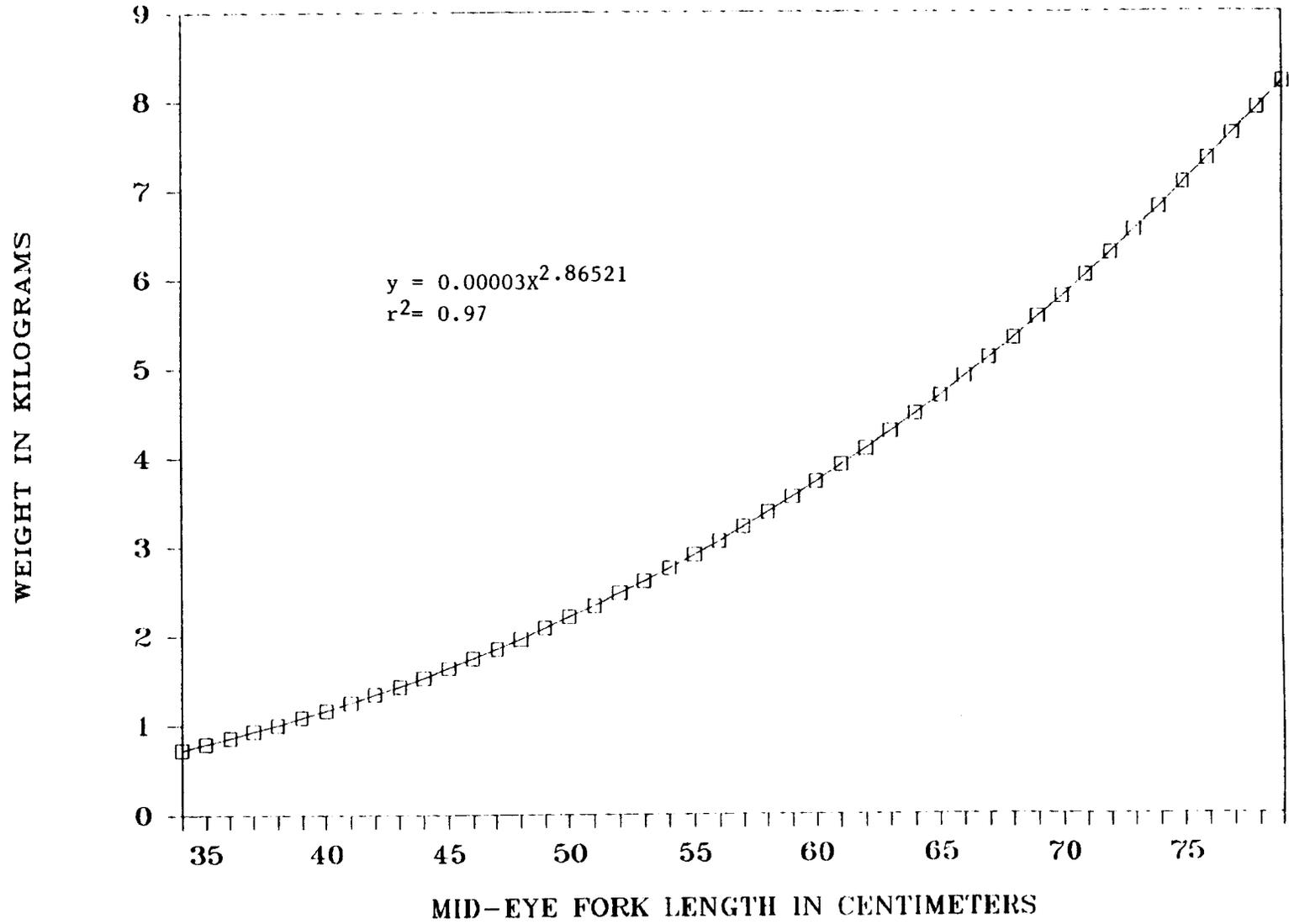


Figure 4. Relationship between Mid-eye Fork Length and Weight for Coho Salmon, Salmon Lake, Fall 1983.

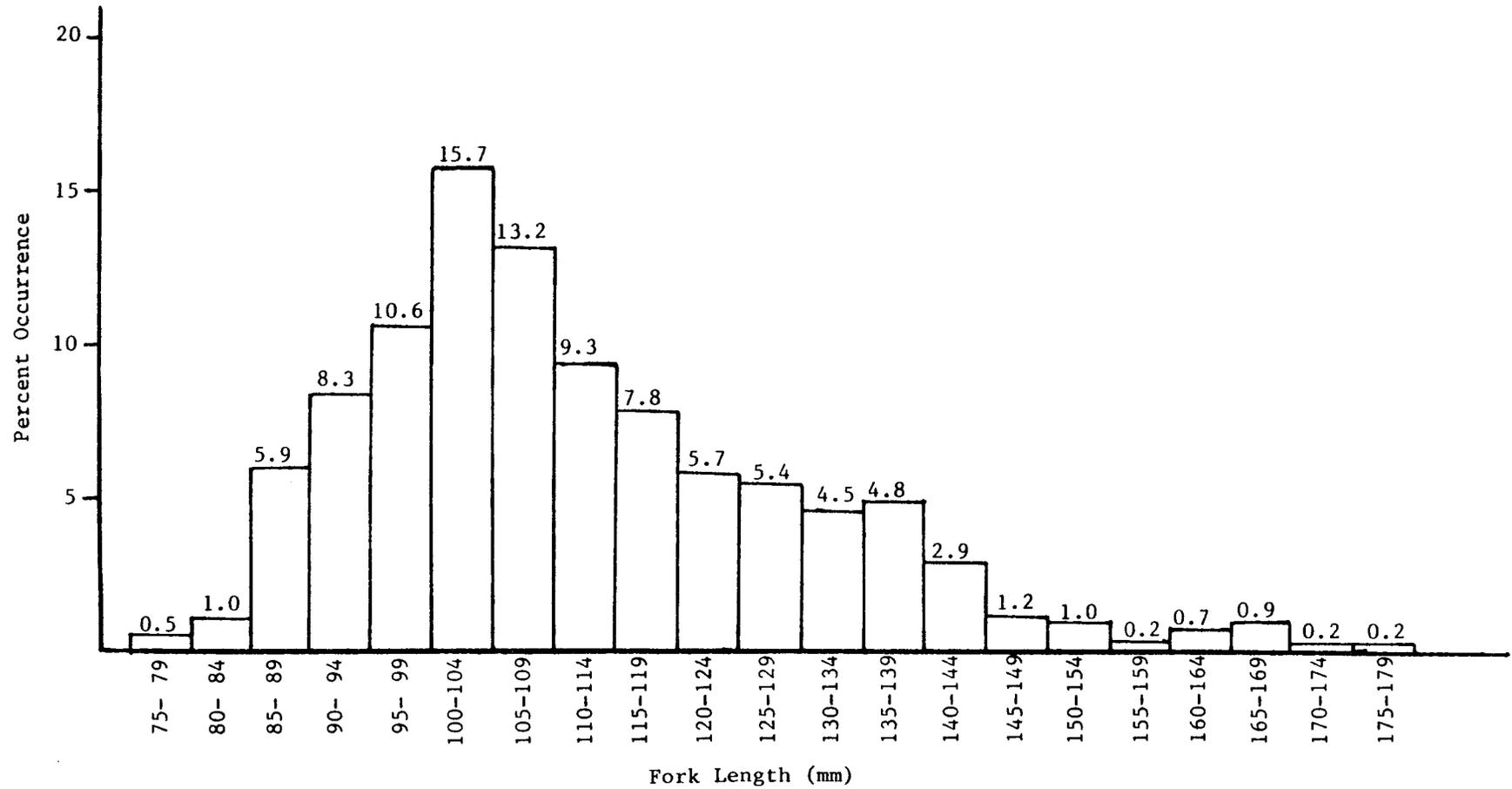


Figure 5. Relative Length-Frequency (Percent Occurrence) of 578 Coho Smolts, by 5-mm Size Class, Salmon Lake. May 9 and May 20-25, 1984.

The age-class structure of the coho smolt population was primarily Age 3 (46.1%), with fewer Age 2 (43.8%) or Age-4 (10.1%) smolts. The mean size and size range of smolt are summarized below by year class:

Smolt age	Length range (mm)	Mean length (mm)	Standard deviation (mm)
2.0	81-131	100.1	10.3
3.0	91-135	114.0	11.8
4.0	132-176	145.8	13.9

The length-weight relationship of coho smolts is presented in Figure 6.

Sockeye smolts were captured in good numbers by fyke nets from May 7 until the nets were pulled on May 25. A length-frequency histogram (Fig. 7) shows most sockeye smolts to be between 85 mm and 100 mm.

Smolt Population Estimates:

A total of 1,491 pre-smolts were tagged in 1983, as a base for the pre-smolt population estimation the following spring. An estimate of last year's pre-smolt population was done in the lake during spring 1984. From April 25 to May 7, 388 smolts were captured in the lake: 353 were given dorsal caudal-fin clips, and 35 were given ventral caudal-fin clips. Fifty-one of the 388 fish had been marked the year before. A modified Peterson estimate shows that the lake population of pre-smolts was 11,161 fish.

$$N = \frac{(M + 1)(C + 1)}{(R + 1)} = \frac{(1,492)(389)}{52} = 11,161 \text{ (95\% C.L. = 8,529-14,586),}$$

where

- N = population estimate,
- M = number of fish marked,
- C = number of fish captured, and
- R = number of fish recaptured.

An estimate of the spring coho smolt emigration was conducted during April and May 1984 at the fyke-net station. During this period, 4,085 coho smolts were captured. Included in this number were 143 of the 388 smolts marked in the lake just before emigration. These data, when used to calculate the smolt population, yield a modified Peterson estimate of 11,038 smolts, with 95% confidence interval of 9,437-13,093 smolts ($389 \times 4,086 \div 144 = 11,038$).

The pre-smolt population was estimated again during the fyke-net operations. Of the 1,491 pre-smolts marked in 1983, 289 were recaptured in the outlet fyke nets. A calculation of the pre-smolt population

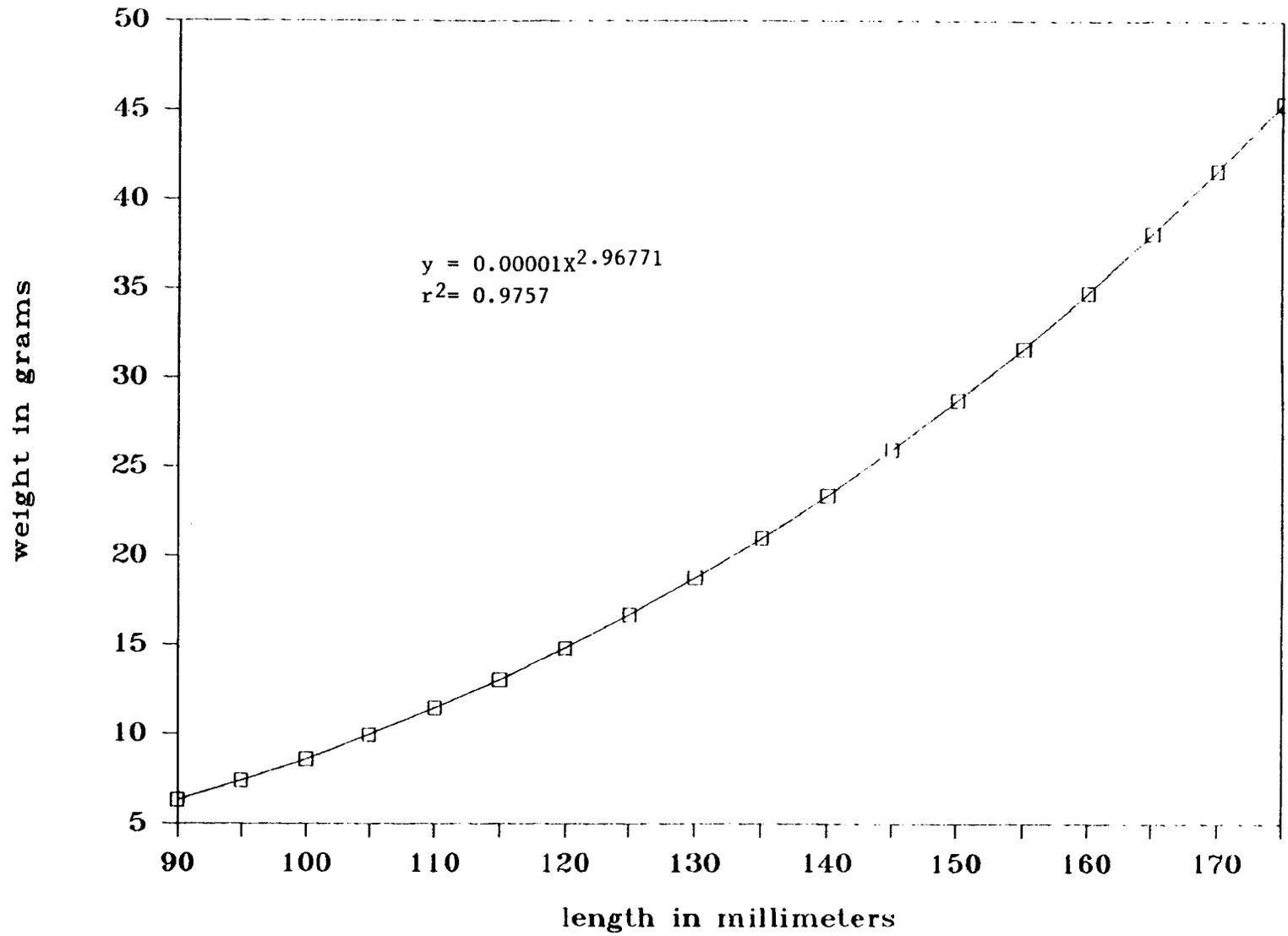


Figure 6. Relationship between Length and Weight of Coho Smolts, Salmon Lake, 1984.

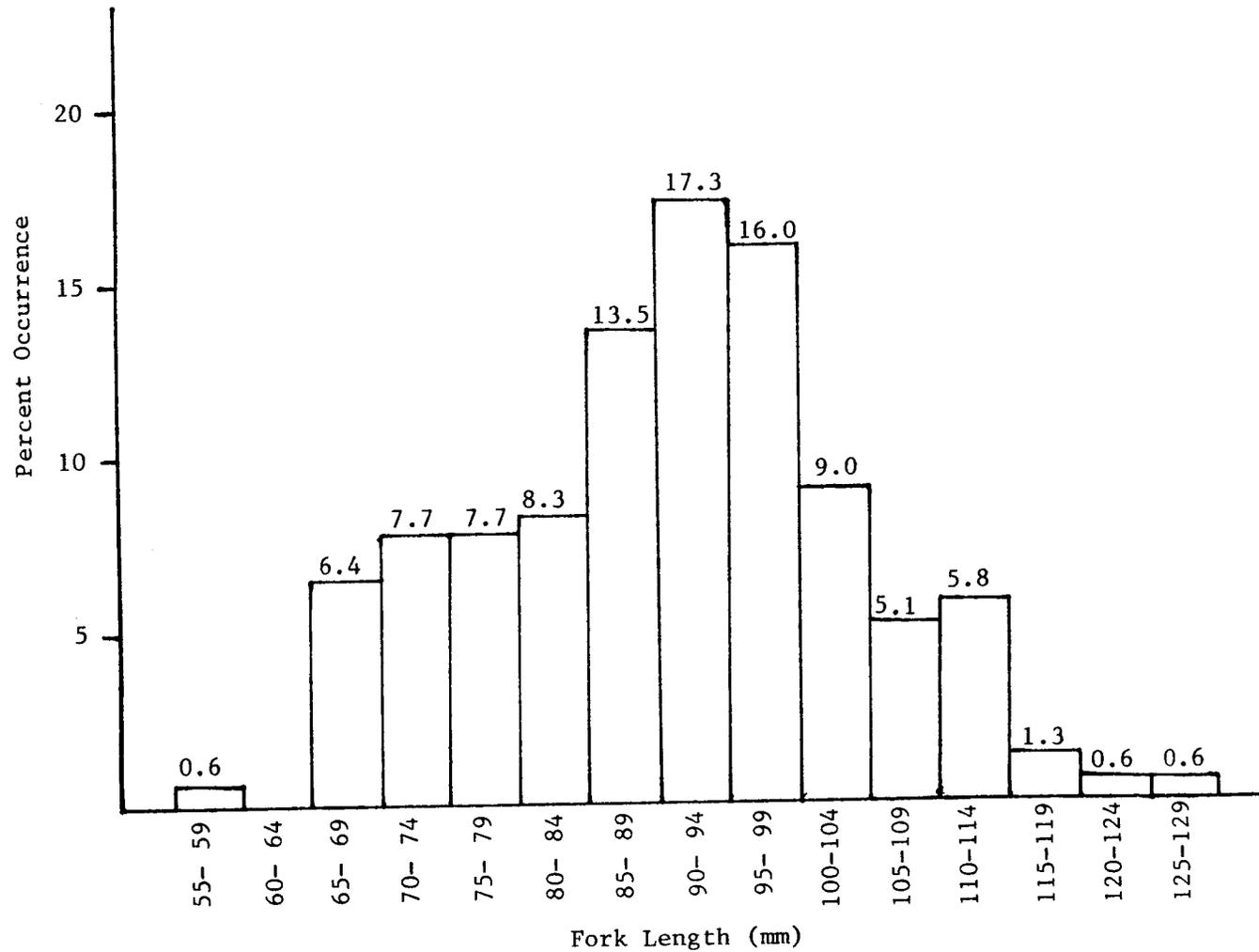


Figure 7. Relative Length-Frequency (Percent Occurrence) of 156 Sockeye Smolts, by 5-mm Size Class, Salmon Lake, May 10-12, 1984.

based on these data yields a modified Peterson estimate of 21,022 pre-smolts ($1,492 \times 4,086 + 290$) with 95% confidence intervals of 18,799 and 23,672 pre-smolts.

Pre-Smolt Investigations:

Coho pre-smolts in Salmon Lake were trapped on June 18-20 to see if any previously tagged fish remained in the lake. During this time, 152 pre-smolts were examined and one adipose-fin clipped fish was seen. This individual had an injury which likely contributed to its staying in the lake instead of smolting. If pre-smolts more than 85 mm fork length are tagged, we assume that we will have a negligible number which do not smolt in the spring.

A total of 1,530 pre-smolts were coded-wire tagged from August 8 to September 26. Tag retention was 95.84% on 433 pre-smolts recaptured during on going tagging operations. Based on this retention value, the total number of tagged pre-smolts in the lake should be 1,466.

A modified Peterson population estimate of pre-smolts was completed between October 30 and November 1, 1984. During this period, 253 coho salmon were captured. Fifty-three of the 1,530 tagged fish were captured. This yields a population estimate of 6,691 pre-smolts ($1,531 \times 236 + 54$).

Sampling the smolt out-migration in the spring of 1985 will provide the data necessary to again estimate the pre-smolt population and overwinter survival. Once a more accurate pre-smolt estimate is made, an evaluation of the original population estimates can be made to try to determine why the estimates were so varied.

SUMMARY

The 1984 total coho escapement to Salmon Lake was estimated to be 1,514 adults and 689 jacks. The contribution of coho to the commercial troll fishery was 856 fish, or 36.1% of the overall annual return. All returns of coded-wire tagged fish were from the outer coastal area. Most returns were from offshore of Kruzof and west Chichagof Islands.

The contribution of Salmon Lake coho to the recreational fishery is unknown. However, it is assumed that some are harvested in the Sitka area marine recreational fishery and at the mouth of Salmon Creek. A few are probably caught in Salmon Creek. The Sitka marine recreational fishery should be surveyed to refine the estimated exploitation rate and areas of harvest of Salmon Lake coho. These areas will be included in future editions of Mike Mills's Statewide Harvest Survey.

Survival of tagged smolts to returning adult in 1984 was 7.99%. If survival rates are the same for untagged smolts, a smolt population of 29,647 fish was required to produce this year's adult return.

The 1985 adult return will have coded-wire tagged adults and jacks from

1,491 pre-smolts tagged in the fall 1983 and 3,993 smolts tagged in spring 1984. Tag retention of fish tagged in fall 1983 was 96.65%, so 1,457 valid tags were released with code 4-22-62. Two tag codes were used during the spring 1984 tagging because we ran out of the first code. Tag code 4-24-29 was used for 3,675 smolts, and code 4-22-61 was used for 318 smolts.

The smolt population which emigrated from Salmon Lake in the spring of 1984 was estimated at 11,038 smolts. Two estimates of this cohort as pre-smolts varied widely. The first estimate was 11,161 pre-smolts based on tagging of 1,491 pre-smolts in fall 1983 and subsequent recapture in the lake in spring 1984. The second estimate of 21,022 pre-smolts was based on recapture of the same marked fish at the fyke-net stations. Obviously, some error exists in at least one of the pre-smolt estimates.

A total of 1,530 pre-smolts were tagged in fall 1984. These fish had a tag retention rate of 95.84%. The number of valid-tagged fish from this tagging was 1,484. These pre-smolts will emigrate in the spring of 1985.

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