

STATE OF ALASKA  
Bill Sheffield, Governor

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

by  
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TABLE OF CONTENTS

Study: S-1	ANADROMOUS SALMON STUDIES	Page
Job: S-1-4	Status of Selected Coho Salmon Stocks in Southeastern Alaska by: Artwin E. Schmidt	
Abstract . . . . .		1
Key Words . . . . .		1
Background . . . . .		1
Recommendations . . . . .		2
Objectives . . . . .		2
Techniques Used . . . . .		5
Adult Escapements . . . . .		5
Salmon Lake Research . . . . .		5
Findings . . . . .		6
Adult Escapement Surveys . . . . .		6
Salmon Lake Research . . . . .		9
Smolt Catch at Fyke Stations . . . . .		18
Number of Smolt Tagged . . . . .		18
Population Estimate of Fall Lake Pre-Smolt Population . . . . .		18
Population Estimate of Spring Smolt Population . . . . .		18
Summary . . . . .		23
Literature Cited . . . . .		24

LIST OF TABLES AND FIGURES

Figure 1.	Location of Major Population Areas and Salmon Lake Research Site, Southeast Alaska, 1984 . . . . .	3
Table 1.	List of Common Names, Scientific Names, and Abbreviations . . . . .	4
Table 2.	Summary of Adult Coho Escapement Surveys Conducted by Sport Fish Division, Southeast Alaska, 1985 . . . . .	7
Table 3.	Summary of Coho Escapement at Salmon Lake Weir, 1985. . . . .	10
Table 4.	Summary of Coho Mortalities That Died Prior to Spawning, Salmon Lake Weir, 1985. . . . .	12
Table 5.	Percent of Salmon Lake Coho Troll Harvested by Time Period, 1985. . . . .	15
Figure 2.	Map of Southeast Alaska Showing Statistical Fishing Districts and Four Areas Used for Analysis of Coded-Wire-Tag Recoveries in the Troll Fishery. . . . .	16
Figure 3.	Number of Tag Returns from Salmon Lake Coho by Time and Geographic Area of Outer Coast, 1985, Troll Season. . . . .	17
Table 6.	Summary of Smolt Catch at Upstream Fyke-Net Station, Salmon Lake, 1985 . . . . .	19
Figure 4.	Relative Length Frequency (Percent Occurrence) of 2,140 Coho Smolts by 5-mm Size Classes, Salmon Lake, 1985. . . . .	21
Figure 5.	Relative Length Frequency (Percent Occurrence) of 398 Sockeye Smolts by 5-mm size Class, Salmon Lake, 1985. . . . .	22

## RESEARCH PROJECT SEGMENT

State: Alaska Name: Sport Fish  
Investigations  
of Alaska

Project: F-10-1

Study: S Study Title: ANADROMOUS SALMON  
STUDIES

Job: S-1-4 Job Title: Status of Selected  
Coho Salmon Stocks in  
Southeastern Alaska

Cooperator: Artwin E. Schmidt

Period Covered: 1 July 1985 to 30 June 1986

## ABSTRACT

A coho salmon, *Oncorhynchus kisutch* (Walbaum), research project was continued so that escapement goals, migration routes, run timing, harvest rates, and areas of harvest for selected index streams in southeast Alaska could be determined. 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 foot surveys. Escapement surveys were conducted on 34 additional streams in southeast Alaska.

The total coho escapement to Salmon Lake was 1,388 fish. This stock of coho contributed 753 fish to the commercial troll fishery, or 35.2% of the overall annual return. Survival of tagged smolts to the adult return was 13.5%. All returns of coded-wire-tagged fish were from the outer-coastal area; returns were from offshore of Kruzof, west Chichagof, and Yakobi Islands and as far north as Yakutat.

## KEY WORDS

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

## BACKGROUND

Coho salmon are important to commercial, recreational, and subsistence fisheries in southeast Alaska. Since 1980 coho salmon harvests have recovered from the lows experienced during the 1960s and 1970s. The annual commercial harvest during 1980-84 has averaged 1.7 million coho. The recreational anglers' harvest in recent years has ranged from 55,000 to 60,000 coho in southeast Alaska.

Relatively little is known about the migration routes, run timing, exploitation rates, or escapements of discrete coho salmon populations in southeast Alaska. This information is just now beginning to be collected and understood. Without such information, proper stock management cannot be accomplished.

Logging and mining annually affect over 24,000 acres in drainages producing coho salmon. Additionally, coho salmon are being impacted by expansion of the urban communities.

The Alaska Department of Fish and Game (ADF&G), Divisions of Sport Fish and Commercial Fisheries have developed a cooperative coho salmon research program. Under this plan, Sport Fish personnel concentrate their efforts in and near the major population centers (Figure 1), while Commercial Fisheries staff focus their activities on coho salmon in remote areas.

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

Table 1 lists the common name, scientific name, and abbreviation of each fish mentioned in this report.

#### RECOMMENDATIONS

1. About 500-1,000 smolts should be tagged in the lake in early spring prior to emigration. If the fyke nets fail because of high water, this group of marked fish will allow smolt population to be estimated.
2. Coded-wire tags should be collected from all jacks returning to the weir. By using two tag codes, one for smolts less than 150 mm and one for smolts greater than or equal to 150 mm, one can determine which segment of the smolt population contributes most heavily to the jacks in the adult return.
3. A sample of coded-wire tags should be collected from adults at the weir or on the spawning ground to allow evaluation of survival from fish tagged as pre-smolts and those tagged as smolts.

#### OBJECTIVES

1. To determine the coho salmon escapement in the following streams:

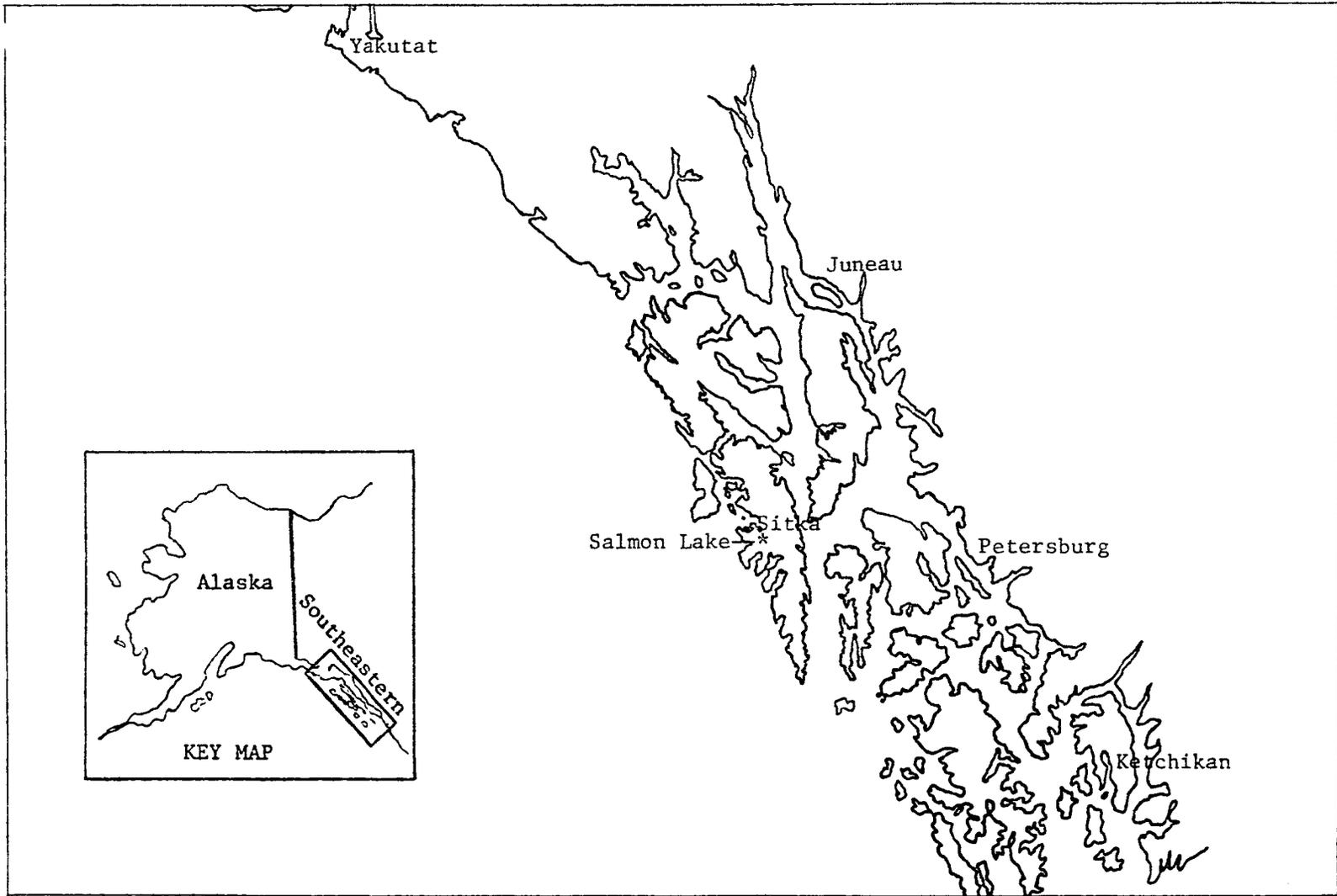


Figure 1. Location of Major Population Areas and Salmon Lake Research Site, Southeast Alaska, 1986.

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

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

<u>Juneau Area</u>	<u>Sitka Area</u>	<u>Ketchikan Area</u>	<u>Petersburg Area</u>
Steep Ck.	Starrigavan Ck.	Eulachon R.	Sumner Ck.
Montana Ck.	Indian R.	Ward Ck.	Ohmar Ck.
Switzer Ck.	Sinitsin Ck.	Indian R.	Falls Ck.
Jordan Ck.	Salmon Lake Ck.	Carroll R.	Bear Ck.
Peterson Ck.	St. Johns Ck.	White R.	Peterson Ck.
Outer Pt. Ck.	Nakwasina R.	Naha R.	
Yehring Ck.	Kizuchia Ck.		
Hilda Ck.			

2. To determine the migration route, run timing, harvest rates, and areas of harvest of coho salmon from Salmon Lake.

#### TECHNIQUES USED

##### Adult Escapements

Coho salmon escapement surveys were conducted on selected streams near Juneau, Ketchikan, Petersburg, and Sitka. Important coho-producing streams that were small enough to allow reliable foot surveys were selected. These streams were surveyed by Area Management Biologists in their respective areas. An attempt was made to survey each stream more than once to ensure enumeration during peak abundance.

##### Salmon Lake Research

###### Adult Population Analysis:

An aluminum picket weir was placed in Salmon Lake's outlet stream in order to enumerate the coho salmon escapement. The weir was installed on 13 August and operated until 15 October. The physical construction of the weir is described by Schmidt (1984). Coho were anesthetized with a 12-volt DC current, and prior to release, all fish were marked with opercular punches. The location of these marks were changed weekly. Opercular punch marks were used because of their ease of application, permanent nature, and limited effect on the fish.

All coho examined were electrically anesthetized with a 12-volt shocking basket (Gunstrom and Bethers 1985) that was placed into a specially constructed box, which held enough water to keep the electrodes submerged and the fish from escaping. One or two fish were dipnetted from the trap into the box and shocked for 2-5 seconds. They were then marked with an opercular punch and released immediately. Fish recovered immediately after processing, and a recovery box was not necessary.

This method of anesthetizing fish is an improvement over the use of Tricain Methane Sulfonate (MS-222) because fish recovered instantaneously and no deaths resulted from processing.

The weir was kept fish tight throughout the adult-return period, so no mark/unmarked ratios were obtained from the spawning ground. A foot

survey of coho below the weir was made just prior to removing the weir. The total escapement was determined by adding the survey count to the weir escapement.

#### Smolt Population Investigations:

Emigrant coho smolt were trapped with fyke nets, beginning on 24 April and continuing through 4 June. The fyke nets had 1- to 2-m openings, were 3-m long, and were tapered, having an 11.43-cm inside diameter at the end.

An upstream fyke-net station consisted of two fyke nets and several 8-foot by 4-foot panels of 1/4-inch Vexar used as leads. This arrangement fished about 94% of the stream width but allowed an escape route between the nets for migrating adult steelhead. This fyke station served as the major marking and recovery station for fish marked in the lake as pre-smolts. Smolts captured at this station were coded-wire tagged, allowed to recover, and held until the following evening. Tagged fish were released in the space between the two upstream fyke nets.

A second fyke-net station was fished about 20 yards downstream of the first fyke-net station. Two 8-foot Vexar panels were used on this fyke net so that about 40% of the stream width was fished. This station served as an index station for determining the mark/unmarked ratio of smolts moving downstream. Unmarked coho smolts captured were coded-wire tagged and subsequently released downstream of the fyke net.

#### Pre-Smolt Investigation:

In this study, pre-smolts are defined as coho that are at least 85-mm long (fork length) and expected to emigrate as smolts the following spring. In Salmon Lake from 16 August to 14 October 1985, pre-smolt coho salmon were intermittently trapped, their adipose fins clipped, and coded-wire tags implanted. Their distribution was determined by setting traps throughout the lake. Once that distribution had been determined, effort was concentrated in the most productive areas. Coho were collected with 4-in-long, 18-in-diameter funnel traps constructed from 3/16-in Vexar. All traps were baited with salmon eggs. Captured fish were anesthetized in a dilute solution of MS-222, before they were measured or weighed, fin clipped, examined for marks, and coded-wire 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 ADF&G's computerized "Salmon Escapement Stream Surveys."

Table 2. Summary of Adult Coho Escapement Surveys Conducted by Sport Fish Division, Southeast Alaska, 1985.

Area/System	Stream number	Survey type	Date	Number
Juneau				
Switzer Creek	111-40-007	Foot	10/29	122
Salmon Creek	111-40-015	Foot	10/25	1,300*
Steep Creek	111-40-056	Foot	10/28	186
Peterson Creek	111-40-010	Foot	10/15	276
Jordan Creek	111-50-062	Foot	10/15	70
Montana/				
McGinnis Creeks	111-50-052	Foot	10/08	810
Peterson Creek	111-50-075	Foot	10/07	144
Fish Creek	111-50-069	Foot	10/28	31
Johnson Creek	111-50-065	Foot	10/25	24
Taku				
Sockeye Creek	111-32-038	Heli	10/21	740
Johnson Creek	111-32-068	Heli	10/21	150
Yehring Creek	111-32-066	Heli	10/21	560
Fish Creek	111-32-056	Heli	10/21	180
Flannigan Slough	111-32-203	Heli	10/21	2,320
Sittakanay Creek	No number	Heli	10/21	500
Ketchikan				
Ward Creek	101-45-024	Foot	10/24	214
Indian Creek	101-71-004	Foot	10/23	812
Carroll River	101-45-078	Foot	10/22	1,550
Hulakon River	101-75-015	Foot	10/26	1,880
Petersburg				
Ohmer Creek	108-40-050	Foot	10/07	89
Bear Creek	108-50-003	Foot	10/08	65
Sumner Creek	108-40-040	Foot	10/11	46
Falls Creek	106-44-006	Foot	10/14	125
Petersburg Creek	106-44-060	Foot	10/15	275
Sitka**				
Sinitsin Creek	113-62-008	Foot	10/15	144
St. John Creek	113-66-006	Foot	10/08	109
Nakwasina River	113-43-002	Foot	10/07	408
Salmon Lake	113-41-032	Weir	10/11	1,388
Indian River	113-41-019	Dive	10/29	86
		Foot	11/15	450*
Starrigavan	113-41-015	Foot	10/11	193
Black River	113-81-011	Heli	10/07	1,628

Table 2. (cont'd) Summary of Adult Coho Escapement Surveys Conducted by Sport Fish Division, Southeast Alaska, 1985.

Area/System	Stream number	Survey type	Date	Number
Kizuchia Creek***	113-41-042	Foot	09/19	122
Sea Lion Cove****	113-61-006	Dive	11/01	188
Sashin Creek****	109-10-006	Dive	10/11	83

\* These counts are primarily hatchery production.

\*\* All surveys in the Sitka area are a cooperative effort with the Commercial Fish Division staff.

\*\*\* U.S. Forest Service survey.

\*\*\*\* Northern Southeast Regional Aquaculture Association survey.

## Salmon Lake Research

### Adult Population Analysis:

A wooden tripod and aluminum picket weir was operated at the outlet of Salmon Lake from 13 August to 15 October. The first coho salmon were counted on 27 August, and the last fish passed the weir on 15 October. A foot survey on October 15 indicated that 255 adult coho remained downstream when the weir was removed.

A total of 1,133 adult coho salmon were counted past the weir; 1,130 of these were examined and marked with an opercular punch. Three hundred and eighty-nine (34.42%) of the examined fish had missing adipose fins. In addition, 116 jacks were enumerated; 35 (30.17%) of these had missing adipose fins. Thirty-two of the marked jacks were killed to recover tags and to collect otoliths and scales for age analysis. Peak counts occurred on 1 and 2 October when 284 and 381 adults, respectively, passed the weir. Table 3 summarizes the daily coho escapement for Salmon Lake.

Because of the assiduous vigilance of the weir crew, water did not pass over the weir this year. The total adult coho escapement of 1,388 fish was counted.

Table 4 summarizes information from the unspent mortalities that died prior to spawning this year. Eleven of these fish had 15%-50% scale loss, and 23 fish suffered from fungal affliction. Water was incredibly fouled this year because of the huge mass of decaying pink salmon in the system. There were over 30,000 pinks above the weir.

### Contribution to the Troll Fishery:

Expansions for calculation of the number of coho contributed to the troll fishery are based on two factors. The first expansion factor is determined by dividing the number of fish harvested into a fishery/area/time stratum by number of fish sampled in that same stratum. The sum of expansion factors for the 56 Salmon Lake coho harvested in the troll fishery was 259.31; this sum represents 4.75% of the 5,450 smolt originally tagged.

The second expansion factor required to determine the harvest of Salmon Lake coho by the troll fishery is the ratio of tagged to untagged coho returning to Salmon Lake. Weir data from Salmon Lake showed that 389 of 1,130 adult coho were adipose clipped (indicating the presence of a coded-wire tag in the fish's snout). Therefore, the total contribution of Salmon Lake coho to the troll fishery was 753; i.e.,  $259.3 \times 1,130/389$ .

### Contribution to Other Fisheries:

The number of Salmon Lake coho contributed to the sport fishery was not possible to determine as no systematic sampling scheme was carried out. Sport fishermen returned two tagged heads to the ADF&G Sitka office. Only one tagged coho was sampled from the District 113 seine fishery.

Table 3. Summary of Coho Escapement at Salmon Lake Weir, 1985.

Date	Water temp. (°C)	Stream depth (m)	Adult coho (No.)	Jack coho (No.)
August 15	9.5	40.5	000	000
16	10.0	37.0	000	000
17	...	...	000	000
18	...	...	000	000
19	10.5	29.0	000	000
20	11.0	29.0	000	000
21	10.0	33.0	000	000
22	10.0	41.0	000	000
23	9.5	42.0	000	000
24	11.0	41.0	000	000
25	10.5	36.0	000	000
26	10.0	32.0	000	000
27	9.0	43.0	1	000
28	10.0	42.0	000	000
29	10.0	37.0	000	000
30	10.0	40.0	000	000
31	10.5	40.0	000	000
September 1	10.0	35.0	000	000
2	10.0	45.0	000	000
3	10.0	46.0	000	000
4	10.0	73.0	13	000
5	10.0	53.0	11	000
6	10.0	41.0	000	000
7	10.0	35.0	000	000
8	10.0	31.0	000	000
9	10.0	29.0	000	000
10	9.5	44.0	000	000
11	10.5	40.0	000	000
12	10.0	37.0	000	000
13	11.0	30.0	000	000
14	10.0	27.0	000	000
15	10.0	90.0	000	000
16	9.5	76.0	48	000
17	10.0	48.0	24	1
18	10.0	39.0	000	000
19	10.0	36.0	000	000
20	9.5	39.0	000	000
21	10.0	39.0	000	000
22	10.0	36.0	000	000
23	9.0	90.0	50	2
24	9.0	53.0	44	5
25	9.0	75.0	11	000
26	8.5	53.0	13	1

Table 3. (cont'd) Summary of Coho Escapement at Salmon Lake Weir, 1985.

Date	Water temp. (°C)	Stream depth (m)	Adult coho (No.)	Jack coho (No.)
September 27	9.0	42.0	000	000
28	9.0	35.0	000	000
29	9.0	32.0	000	000
30	9.0	80.0	24	2
October 1	8.0	105.0	284	20
2	8.0	98.0	381	53
3	7.5	59.0	42	7
4	7.5	105.0	54	1
5	7.5	56.0	40	3
6	7.5	43.0	5	2
7	7.5	38.0	2	1
8	7.0	36.0	000	000
9	7.0	56.0	Weir closed	
10	7.0	77.0	31	2
11	7.0	54.0	5	1
12	7.0	51.0	9	2
13	6.5	71.0	20	5
14	7.0	67.0	18	3
15	7.0	44.0	<u>000</u>	<u>2</u>
		1,130	113	

Table 4. Summary of Coho Mortalities That Died Prior to Spawning, Salmon Lake Weir, 1985.

Opercular Punch code*	Sex	Week coded	Date recovered	Approx. days free	Comments
Not coded	Male**	...	8/23	...	
Not coded	Jack male**	...	9/02	...	
Not coded	Jack male**	...	9/06	...	
Not coded	Jack male**	...	9/13	...	
Not coded	Male**	...	9/16	...	Gilled in weir
Not coded	Female	...	9/16	...	Gilled in weir
R-2H	Female**	9/16- 9/22	9/17	1	50% scale loss
R-2H	Female**	9/16- 9/22	9/19	1-3	Fungal affliction
R-2H	Female**	9/16- 9/22	9/19	1-3	Fungal affliction
R-2H	Male	9/16- 9/22	9/19	1-3	Fungal affliction
R-2H	Female	9/16- 9/22	9/21	1-5	Fungal affliction
R-1L	Jack Male	9/23- 9/29	9/25	1-2	50% scale loss
R-1L	Female	9/23- 9/29	9/28	1-5	Fungal affliction, 25% scale loss
R-1L	Female**	9/23- 9/29	9/29	1-6	Fungal affliction, lower jaw injury
R-1L	Female	9/23- 9/29	9/30	1-7	Fungal affliction
R-1L	Female	9/23- 9/29	9/30	1-7	Fungal affliction
R-1L	Female	9/23- 9/29	9/30	1-7	Fungal affliction
R-1L	Female	9/23- 9/29	9/30	1-7	Fungal affliction
L-1L	Female	9/30-10/06	10/01	1	Fungal affliction, 30% scale loss
L-1L	Female	9/30-10/06	10/01	1	Fungal affliction, 50% scale loss
L-1L	Jack female	9/30-10/06	10/01	1	70% scale loss
L-1L	Male	9/30-10/06	10/01	1	Fungal affliction
L-1L	Female**	9/30-10/06	10/02	1-2	Fungal affliction, 20% scale loss
L-1L	Jack female	9/30-10/06	10/02	1-2	
L-1L	Female	9/30-10/06	10/03	1-3	Fungal affliction, 25% scale loss
Not coded	Male		10/03	1-3	Found dead in trap, pinned between pickets
Not coded	Female	...	10/04	...	Gilled in weir

Table 4. (cont'd) Summary of Coho Mortalities That Died Prior to Spawning, Salmon Lake Weir, 1985.

Opercular Punch code*	Sex	Week coded	Date recovered	Approx. days free	Comments
R-1L	Male	9/23- 9/29	10/06	7-13	Fungal affliction
R-1L	Female**	9/23- 9/29	10/09	10-16	Fungal affliction
Not coded	Female		10/10	...	Gilled in weir
L-1L	Female**	9/30-10/06	10/10	4-10	Fungal affliction, 25% scale loss
L-1L	Female	9/30-10/06	10/10	4-10	Fungal affliction, 30% scale loss
L-1L	Female	9/30-10/06	10/10	4-10	Fungal affliction, 15% scale loss
L-1L	Female	9/30-10/06	10/11	5-11	Fungal affliction
Not coded	Male**	...	10/12	...	Gilled in weir
L-1L	Female	9/30-10/06	10/12	6-12	Fungal affliction
L-1L	Female	9/30-10/06	10/12	6-12	Fungal affliction
Not coded	<u>Male**</u>				
Totals	32 Adults 6 Jacks				

\* Designates location and number of opercular punches, e.g., R-2H = right side, two holes punched high (dorsally) and L-1L = left side, one hole punched low (ventrally).

\*\* Adipose-clipped fish.

#### Harvest Rate:

The harvest rate of Salmon Lake coho was obtained by dividing the total harvest by the total adult production (harvest + escapement). The weir count of 1,133 fish plus the survey count of coho below the weir (255) gives a minimal known escapement of 1,388 adult coho. Based on this escapement, the harvest rate was 35.2% (753/2,141).

#### Timing and Location of Harvest:

Tagged coho were sampled from the troll catch as soon as the fishery opened (1 July), and sampling continued throughout the season (mid-September). The mid-season, 10-day closure (15 August through 24 August) resulted in no tag recoveries for statistical week 34 (18 August-24 August). Table 5 shows the percent of Salmon Lake coho troll harvested by time period during the 1985 troll season.

Tag-recovery information from port sampling shows that 97% of the Salmon Lake coho caught in the troll fishery came from the northern outside area, and only 1.5% came from each of the northern inside and southern outside areas (Figure 2).

The specific location of the troll harvest by time period is more difficult to evaluate, since many fishermen fish several statistical areas during a given trip. Tags recovered by port samplers were analyzed, and only recoveries that could be definitely assigned to a given area were used for the time and area evaluation. Although this method omits consideration of variable expansion-factor rates, it does approximate harvest rates. This time and area analysis will be better defined when more tag returns are available in the future.

Tag-return information (Figure 3) shows that Salmon Lake coho are caught primarily in the Sitka Sound-Kruzof area during July. The primary catch area moves away from Sitka Sound to the north in early August. For the remainder of the season, the Yakobi-Cross Sound and Yakutat areas produce the majority of the harvest. The harvest in these northern areas continues through mid-September; however, the harvest in Sitka Sound is minimal.

The coho salmon return to Salmon Lake was nearly complete by 5 October, indicating a rapid migration southward.

During the 1985 season, approximately 51% of the harvest occurred in the Yakobi-Cross Sound area; a lesser harvest occurred near Sitka (31%) and Yakutat (12%). Only 4% of the tag returns came from the Whale Bay (southern Baranof) area.

#### Smolt Population Investigations:

The spring smolt migration from Salmon Lake was monitored with two fyke-net stations from 25 April through 4 June 1985. The upper, or south, station consisted of two fyke nets with leads and was the primary capture and marking station. The lower, or north, station was the recapture station and consisted of a single fyke net with two 8-foot leads.

Table 5. Percent of Salmon Lake Coho Troll Harvested by Time Period, 1985.\*

Statistical Week	Dates	Percent of Harvest
27	30 June-6 July	7.9
28	7-13 July	4.0
29	14-20 July	9.9
30	21-27 July	7.9**
31	28 July-3 August	16.2
32	4-10 August	21.7
33	11-17 August	13.4***
34	18-24 August	0.0***
35	25-31 August	8.7
36	1-7 September	8.7
37	8-14 September	0.0
38	15-21 September	1.6

\* The coho season opened 1 July and closed 20 September with a 10-day midseason closure from 15-24 August.

\*\* Reduced catch resulted from chinook closure on 22 July, which resulted in most vessels landing fish and less coho fishing effort during this period.

\*\*\* Ten-day coho closure from 15-24 August resulted in no catch during this 10-day period.

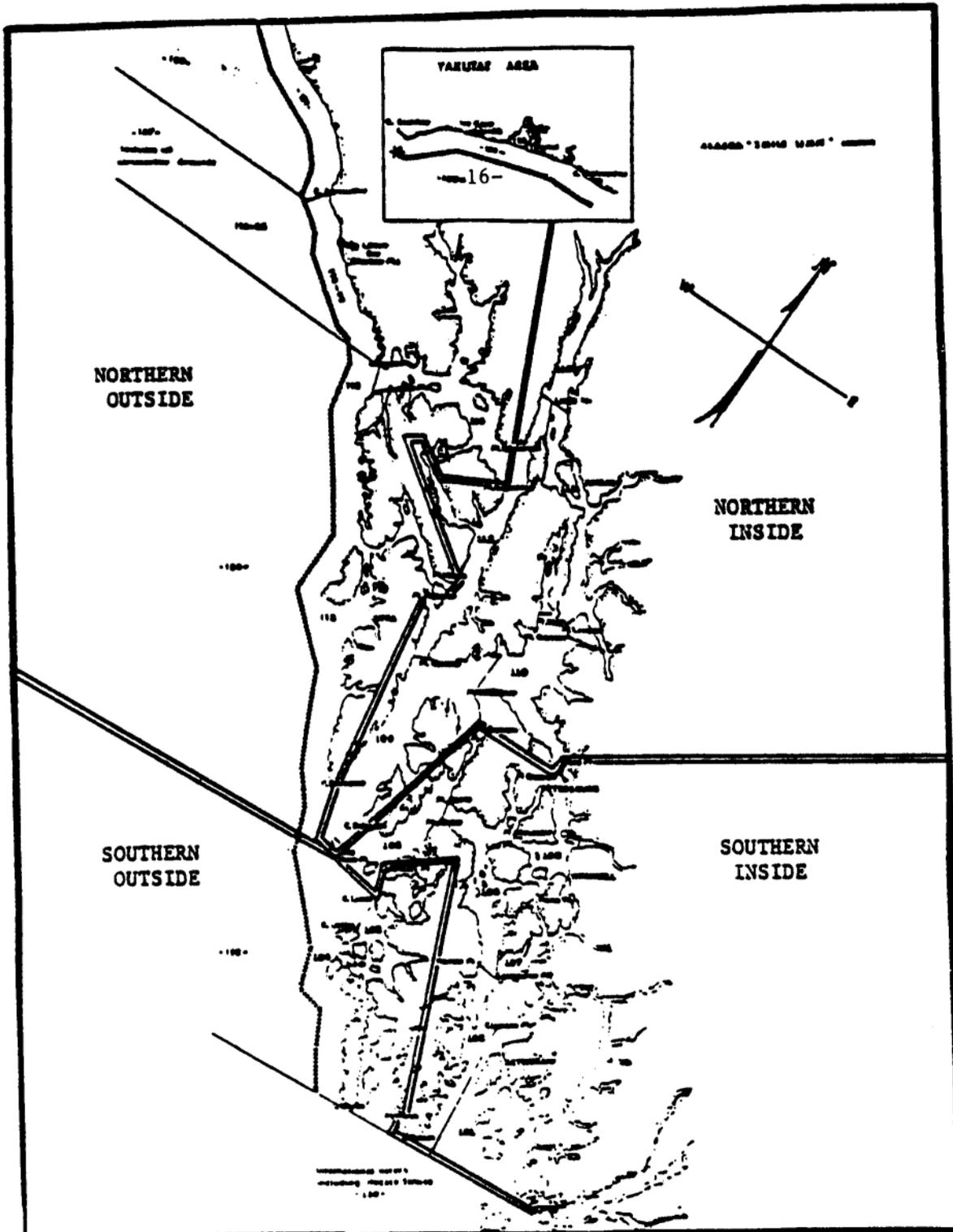


Figure 2. Map of Southeast Alaska Showing Statistical Fishing Districts and Four Areas Used for Analysis of Coded-Wire-Tag Recoveries in the Troll Fishery.

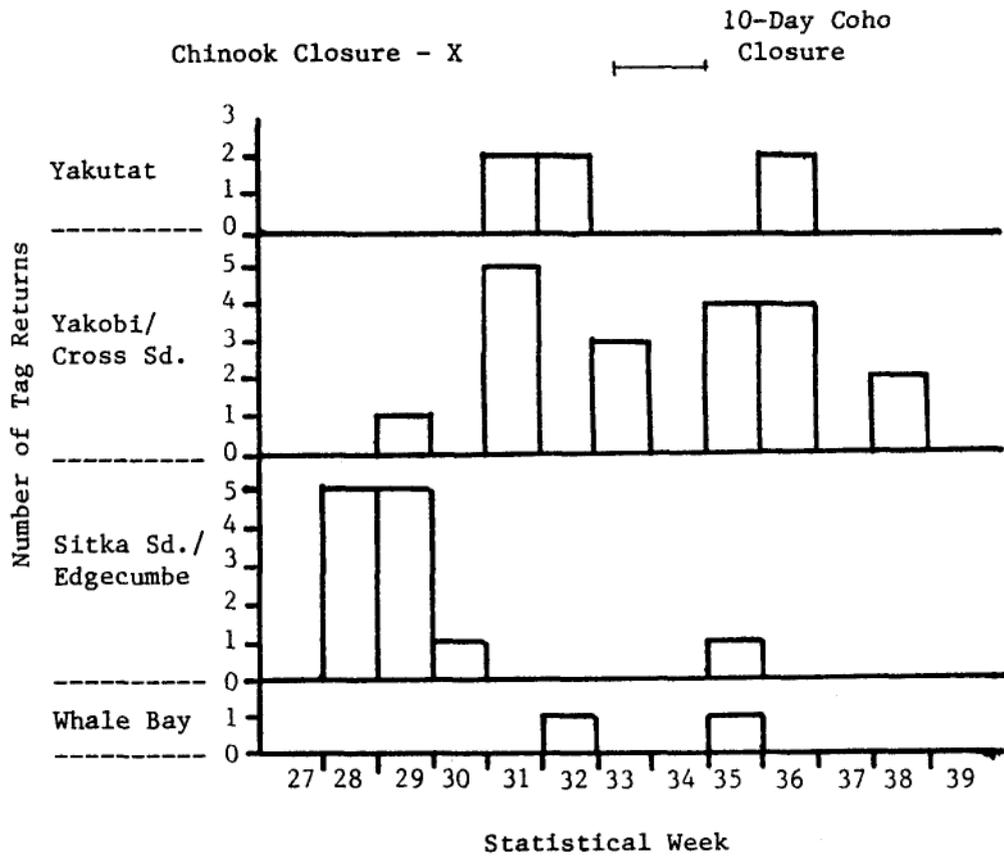


Figure 3. Number of Tag Returns from Salmon Lake Coho by Time and Geographic Area of Outer Coast, 1985, Troll Season.

The first coho smolt were captured on 25 April. A steady migration began during the third week of May and peaked on 27 May, when 1,241 coho smolt were captured. Table 6 presents a summary of the daily smolt catch at the upstream fyke net station. Figures 4 and 5 show length-frequency histograms of 2,140 coho and 398 sockeye, respectively. Most of the coho smolts were between 95 and 120 mm long (fork length) and most of the sockeye were between 70 and 100 mm long.

#### Smolt Catch at Fyke Stations

The total catch of coho smolts at the upper site was 6,837 fish. This included 6,201 coho smolts that had not been untagged and 636 tagged coho. Of the 6,201 unmarked fish, 85 died prior to tagging and 6,116 received coded-wire tags. There were 78 post-tagging mortalities caused by a mink getting in one of the holding pens; 6,038 newly tagged smolts were released at the upper fyke stations. Most of the tagged coho smolts (634) captured at the upper station had been tagged the previous fall during lake-tagging operations. The remainder (2) had been tagged in the lake just prior to emigration. Five of these tagged fish were killed during capture operations. Tag retention of marked fish from fall to spring emigration was 94% (596 tags out of 634 adipose finclipped coho smolt).

At the lower fyke station, 2,624 coho smolts were captured during the 1 May through 4 June period. Of this total, 982 were unmarked fish (768 of these were subsequently tagged and released), 1,388 had been tagged at the upper fyke station, 250 had been tagged in the lake the previous fall, and 4 had been finclipped in the lake in the spring.

#### Number of Smolt Tagged

The total number of tagged coho smolts released from the spring marking was 6,824; most of these (6,038) were tagged at the upper fyke-net station, while 768 smolts were tagged at the lower fyke-net station, and 18 smolts were tagged in the lake.

#### Population Estimate of Fall Lake Pre-Smolt Population

The fall pre-smolt population was estimated from the recapture of 634 of 1,530 fall-tagged fish recaptured at the upper fyke station. At the time of tagging last fall, the pre-smolt population (N) was estimated using the (Ricker 1975 Chapman formula):  $N = (M + 1)(C + 1)/(R + 1)$ . The pre-smolt population estimate was 16,487 ( $1,531 \times 6,837/635$ ) with a 95% confidence interval of 15,274 to 17,847.

#### Population Estimate of Spring Smolt Population

The spring smolt population was estimated from mark/recapture information at the two fyke-net stations. Of the 6,038 tagged smolts released at the upper fyke-net station, 1,388 (23%) were recaptured at the lower fyke-net station. The total number of coho smolts captured at the lower fyke-net station was 2,624. Therefore, again using Chapman's formula, the estimated smolt emigration during the sampling period was 11,413 ( $6,039 \times 2,625/1,389$ ) fish. The total coho smolt emigration was

Table 6. Summary of Smolt Catch at Upstream Fyke-Net Station, Salmon Lake, 1985.

Date	Rainfall (inches)	Average water Temp. °C	Highest stream depth (cm)	Total coho smolt	Sockeye smolt	Steel-head smolt
April 8	0.0	0.5	Missing	...	...	...
9	0.4	0.5	Missing	...	...	...
10	Trace	0.5	37.0	...	...	...
11	Trace	0.8	31.0	...	...	...
15	0.0	1.0	35.0	...	...	...
16	0.2 Snow	1.0	32.0	...	...	...
17	1.2	1.0	41.0	...	...	...
18	1.4 Snow	1.0	43.0	...	...	...
24	0.	Missing	38.0	Fyke nets installed		
25	Trace	1.5	37.0	*	0	0
26	1.2	1.5	37.0	*	0	0
27	0.6	1.5+	37.0	16	0	0
28	Trace	1.3	34.0	*	0	0
29	0.1	1.2	31.0	*	0	0
30	0.4	1.5	30.5	*	0	0
May 1	0.2	1.5	32.5	18	0	0
2	Trace	1.5+	45.0	20	0	0
3	Trace	1.5+	47.0	*	0	0
4	Trace	1.5+	43.5	*	0	0
5	0.2	1.7	42.0	*	0	0
6	0.2	1.8	42.0	104	0	0
7	0.0	1.7	39.5	*	0	0
8	0.1	2.0	37.0	*	0	0
9	0.4	2.0	48.5	79	0	0
10	0.9	2.0	45.5	*	0	0
11	1.2	2.0+	41.5	*	0	0
12	0.4	2.0	43.0	*	0	0
13	1.0	1.8	69.0	56	0	0
14	1.0	2.0	55.0	Fyke nets out due to to high water		
15	2.9	2.0	97.0	Fyke nets out due to to high water		
16	0.6	2.3	70.0	Fyke nets out due to to high water		
17	0.0	2.7	57.0	73	0	0
18	0.0	2.8	55.0	*	0	0
19	0.0	3.0	49.0	216	1	0
20	0.2	3.0	46.0	72	3	0
21	0.3	3.3	44.0	133	0	0
22	0.0	3.2	47.0	146	11	0
23	0.0	3.2	64.0	261	11	0
24	0.2	3.5	73.0	173	7	0

Table 6. (cont'd) Summary of Smolt Catch at Upstream Fyke-Net Station, Salmon Lake, 1985.

Date	Rainfall (inches)	Average water Temp. °C	Highest stream depth (cm)	Total coho smolt	Sockeye smolt	Steel- head smolt
May 25	0.2	3.8	67.0	284	7	1
26	Trace	3.8	62.0	590	6	0
27	Trace	4.3	58.0	1,241	64	3
28	Trace	4.5	57.0	822	81	9
29	0.0	4.9	57.0	462	125	0
30	0.0	4.7	54.0	806	257	2
31	Trace	4.4	54.0	456	186	3
June 1	Trace	4.9	54.0	304	195	0
2	0.0	5.2	61.0	294	404	0
3	0.0	4.7	72.0	137	110	0
4	0.3	4.0	74.0	71	3	0

\* Information for coho included in next recorded catch figure.

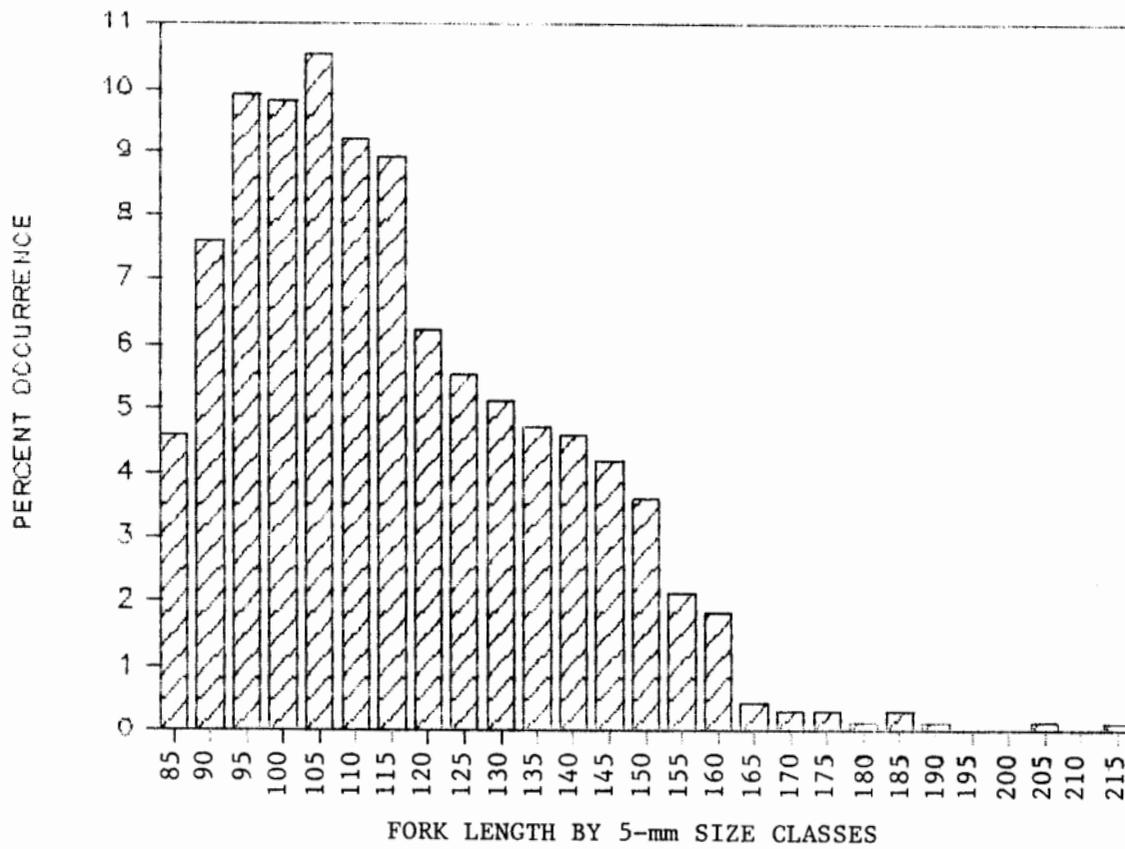


Figure 4. Relative Length Frequency (Percent Occurrence) of 2,140 Coho Smolts 5-mm size Classes, Salmon Lake, 1985.

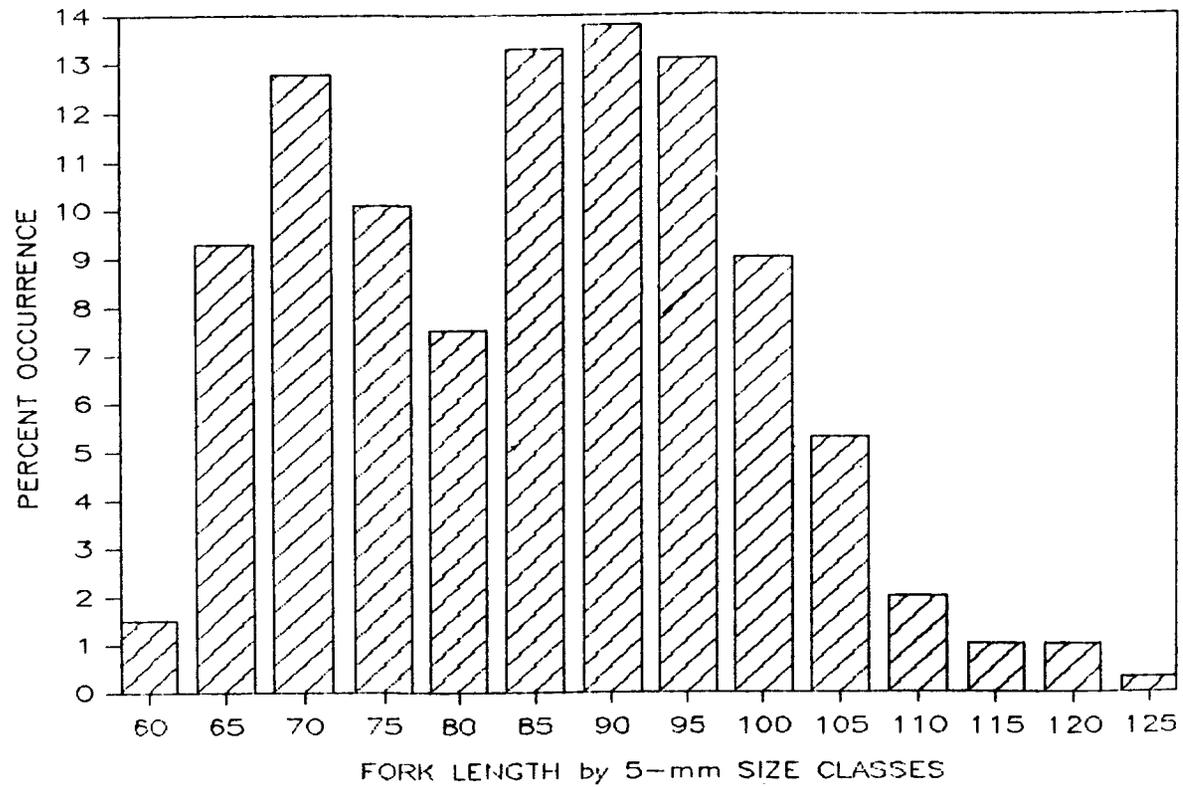


Figure 5. Relative Length Frequency (Percent Occurrence) of 398 Sockeye Smolts by 5-mm Size Class, Salmon Lake, 1985.

greater than this, because coho smolts were caught the first day that the fyke nets were fished and the fishing was discontinued prior to the end of the smolt migration. In addition, the fyke nets were not fished for 3 days during May, when about 100 smolts per day were being captured.

A second estimate of the spring smolt emigration was made from fish marked in the lake just prior to emigration. Of 91 smolt finclipped in the lake, 32 were captured at the upper fyke-net station. This estimate (using Chapman's formula) of 19,061 smolts ( $92 \times 6,837/33$ ) may be biased by poor distribution of the marked fish. The larger smolts are never captured in the lake during marking operations; this leads to a biasing of the estimates. This estimate of the spring smolt population includes (1) fish that were in the lake during the fall pre-smolt tagging and (2) smolts that moved into the lake from the inlet and outlet areas in late fall (September-October).

The growth patterns of some smolts leaving the system in the spring suggest that rearing takes place in highly productive estuarine water. Elliott (pers. comm., 1985) found this upstream movement from estuarine areas in an unnamed creek of Big John Bay, Kupreanof Island.

An intensive trapping effort in the inlet and outlet areas of Salmon Lake during early April produced no smolts, although rearing smolt-size fish have been observed in the inlet during fall diving surveys. A further attempt to quantify smolt production from the inlet and outlet should occur. This evaluation should be conducted with an electroshocker in early April and again in late August.

#### Pre-Smolt Investigations:

Coho pre-smolts over 85 mm were tagged in the lake during 16 August-14 October. A total of 2,125 coho were finclipped (adipose) and coded-wire tagged during this period. The immediate tag-retention rate was 97% (500/514). This tagging resulted in the release of 2,061 fish with valid tags.

During 16-20 August 1985, 18 previously tagged fish were recaptured. These fish were sampled for tag identification to determine when they had been tagged. The tag-retention rate among this small group was 93% (13/14).

#### SUMMARY

The 1985 coho escapement to Salmon Lake was 1,388 adult and 116 jack coho (weir count). The jack escapement was probably much higher, as many jacks go around the weir. The contribution to the commercial troll fishery was 753 coho, 35.2% of the total production (2,138 coho). Nearly all returns of coded-wire tags (97%) were from the northern outer-coastal area.

Tag-return information shows that during July Salmon Lake coho are caught primarily in the Sitka Sound-Kruzof area. The catch area moves northward from Sitka Sound in early August. For the remainder of the season, the Yakobi-Cross Sound and Yakutat areas produce the majority of the harvest. The catch in these northern areas continues through mid-September, but the catch in Sitka Sound appears minimal.

The adult return to Salmon Lake was nearly completed by 5 October, indicating a rapid migration southward.

The survival rate of tagged smolts to returning adults was 13.5%. If the survival rate was the same for untagged smolts, a smolt population of 15,837 would be required to produce this year's return. The 1986 adult return will have coded-wire-tagged adults from the 1,530 pre-smolts tagged in the fall of 1984 and 6,824 smolts tagged in the spring of 1985. The fall-tagged pre-smolts (1,530 coho) had a tag-retention rate of 95.84%, resulting in 1,484 valid tags coded 4/24/39. An assumed 95% tag-retention ratio of code 4/24/40 would yield 6,482 valid tags.

The smolt population that emigrated during the spring fyke-sampling period of 1985 was estimated at a minimum of 11,413 fish. This estimate does not account for a 3-day period of fyke-net absence or the smolt migration prior to and following the sample period.

An estimate of the total spring smolt migration from Salmon Lake was made by marking smolts in the lake just prior to smolt emigration. This estimate was 19,061 fish.

A total of 2,125 pre-smolts were tagged with code 4/3/51 in the fall of 1985. These fish had a tag retention rate of 97%, for a valid release of 2,061 tags.

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