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CODED-WIRE TAGGING OF WILD COHO (Oncorhynchus kisutch) STOCKS IN SOUTHEASTERN ALASKA, 1982-1983

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March 1985

ALASKA DEPARTMENT OF FISH AND GAME
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Don W. Collinsworth
Commissioner

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CODED-WIRE TAGGING OF WILD COHO *(Oncorhynchus kisutch)* STOCKS IN SOUTHEASTERN ALASKA, 1982-1983[1]

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March 1985

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF FIGURES (Continued)

LIST OF APPENDICES

LIST OF APPENDICES (Continued)

ABSTRACT

Wild coho salmon *(Oncorhynchus kisutch)* that were tagged as juveniles and smolts at eight locations in Southeastern Alaska returned from the ocean as adults in 1982. Tags were recovered from commercial and sport catches and escapements. Resulting data was analyzed to estimate escapement, fishery contribution by area and gear type, harvest rates, migratory timing, survival rates, and juvenile abundance. Harvest rate estimates for the eight study systems were as follows: Auke Lake 44.4%, Speel Lake 71.4%, Berners River 71.5%, Ford Arm Lake 39.0%, Politofski Lake 33.4%, Warm Chuck Lake 63.0%, Klakas Lake 76.7%, and Hugh Smith Lake 62.1% (excluding harvest by Canadian fisheries). Despite reduced troll harvest rates due primarily to restrictions implemented since 1978, escapements to Auke and Speel Lakes in Stephens Passage were substantially lower than average. This was primarily a result of increased purse seine effort in northern straits and passages that was directed at an exceptionally large pink salmon *(O. gorbuscha)* return. The Juneau area marine sport fishery was relatively ineffective at harvesting local coho salmon stocks compared with commercial fisheries with estimates of the sport harvest percentage of total returns to Auke Lake, Speel Lake, and the Berners River ranging from 0.0% to 5.7%, and averaging 2.0% for 11 studies. Results from 4 years of tag recoveries indicated that the Lynn Canal drift gillnet fishery harvested an average of half (50.4%) of Berners River coho salmon that escaped other fisheries (range = 35.2%-57.2%). Relatively low harvest rate estimates for Ford Arm and Politofski Lakes indicated that, despite intensive troll effort along the nearby coast, District 113 stocks were probably harvested less intensively than stocks in southern and inside areas that were subjected to pressure by sequential fisheries. Southern stocks were subjected to higher harvest rates in outside waters than northern stocks. Stocks in District 103 were subjected to the greatest pressure by outside fisheries with estimated harvest rates in outer coastal and offshore waters of approximately 60%. Returns to Auke, Speel, Ford Arm, Warm Chuck, Klakas, and Hugh Smith Lakes were relatively central in migratory timing in outside waters. The Politofski Lake stock appeared to be slightly earlier in timing while the return to the Berners River migrated through outside waters later than the majority of available stocks. Survival rate estimates for juvenile coho salmon tagged in six study systems ranged from 2.2% to 5.7%, and averaged 4.4%, while the survival rate of tagged Auke Creek smolts were estimated at 11.8%. Density estimates for predominantly age 1+ juvenile coho salmon rearing in lake systems ranged from 139-203/hectare to 1,380/hectare, and averaged approximately 650/hectare. Southeastern Alaska hatcheries contributed an estimated 60,963 coho salmon which was 2.9% of the total 1982 regional commercial harvest.

KEY WORDS: Coho salmon, *Oncorhynchus kisutch*, coded-wire tagging, migration patterns, migratory timing, harvest rates, Southeastern Alaska.

The Preface on page ix, which is listed in the
Table of Contents, is missing from the original.

INTRODUCTION

The coho salmon *(Oncorhynchus kisutch)* is an important contributing species to commercial, sport, and subsistence fisheries in Southeastern Alaska. The total annual harvest of coho salmon during 1955-1983 has averaged 1.2 million compared with an average of 1.8 million during the previous 30-year period from 1925 through 1954. In recent years, commercial fisheries have accounted for the vast majority of the total harvest while sport and subsistence fisheries have taken only 2-3%. An average of 60-70% of the commercial harvest is taken by troll gear while the remainder is divided in approximately equal proportions between gillnet and purse seine gear. The annual Southeastern Alaska commercial coho salmon harvest and 10-year averages since 1893 are shown in Figure 1. The 1982 catch of 2,137,646 was the highest since 1951.

The majority of coho salmon harvested in Southeastern Alaska are produced in approximately 2,000 local streams. Important contributions are also made by the Canadian portions of three major transboundary rivers (Stikine, Taku, and Alsek) and by streams along the British Columbia coast.

In order to better understand the migratory nature of coho salmon stocks and the effects of the fishery, a pigment marking study was initiated in 1972 on the Chilkat, Berners, and Taku Rivers in northern Southeastern (Gray et al. 1978) (Figure 2). Juvenile coho salmon were captured in minnow traps and marked with fluorescent pigment. Fishery and escapement sampling was conducted to recover marked fish. The study showed that these important stocks were subjected to heavy fishing pressure with harvest rates exceeding 75%. It was also found that fish returning to Lynn Canal and Stephens Passage were harvested primarily in northern Southeastern as they migrated from outer coastal waters through Icy Strait toward their respective systems of origin. An analysis of migratory timing data showed that Chilkat and Berners River stocks returned relatively late in the season and were highly available to fisheries for a shorter period of time than Taku River stocks.

In 1976, pigment marking was replaced by coded-wire tagging as a method of marking wild coho salmon smolts and juveniles. Tagging experiments were repeated on the three previously studied systems and were expanded to several lake systems in northern Southeastern. During 1976-1979, tagging was conducted at Auke, Speel, and Crescent Lakes near Juneau, Chilkoot Lake near Haines, Porcupine Creek near Wrangell, and at several sites along the lower Stikine River (Figure 2).

During 1980, the scope of coded-wire tagging efforts was expanded to include four stocks from the outer coast and a mainland stock near Ketchikan. During 1981, tagging was repeated on these stocks which included: Ford Arm and Politofski Lakes in District 113, Warm Chuck and Klakas Lakes in District 103, and Hugh Smith Lake in District 101. In addition, juveniles were tagged during 1981 at Reflection Lake in District 101, Kegan Lake in District 102, Speel Lake in District 111, and Chilkoot Lake, Chilkat Lake, and the Berners River in District 115. In 1982, smolts were tagged at the outlets of Auke, Hugh Smith, and McDonald Lakes. During March-June 1983 smolts were tagged at Auke Lake, Hugh Smith Lake, and the Chickamin River while juveniles were tagged on the Berners River. (ADF&G statistical areas in Southeastern Alaska are shown in detail in Appendix Figures 1-4).

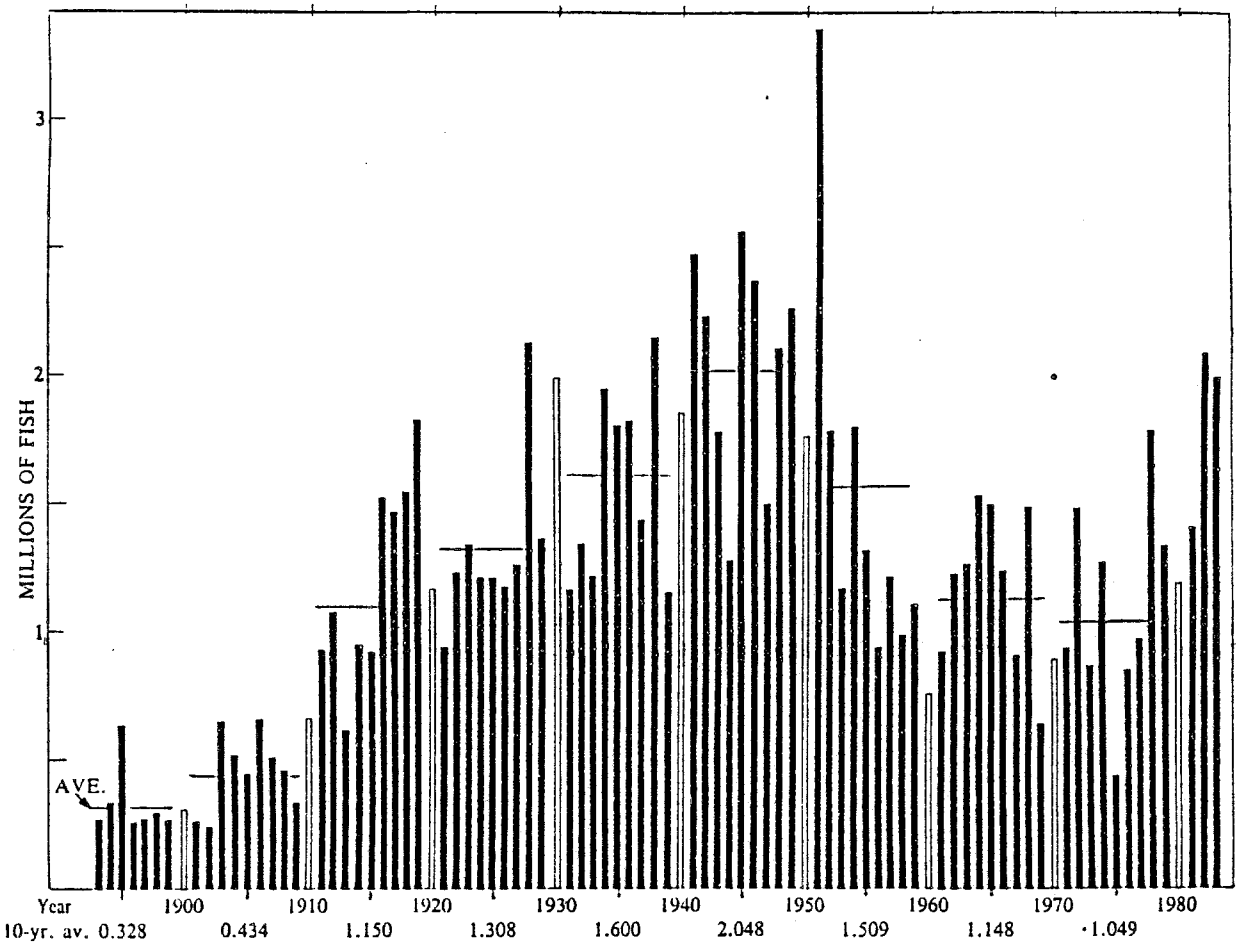

Figure 1. Annual commercial catch of coho salmon in Southeastern Alaska and 10-year averages, in millions of fish, 1893-1983.

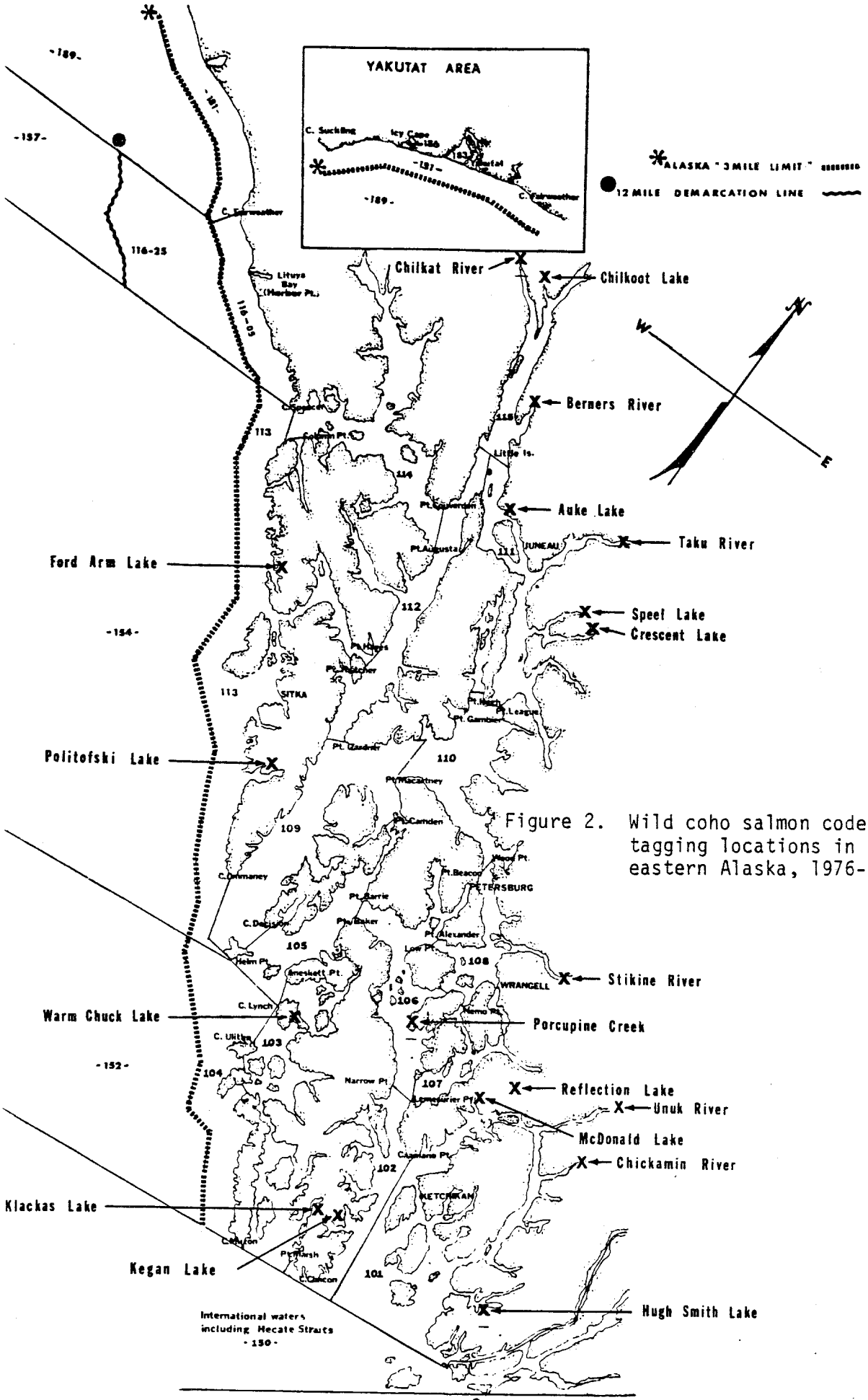

Figure 2. Wild coho salmon coded-wire tagging locations in Southeastern Alaska, 1976-1983.

The majority of Southeastern Alaska coho salmon that are tagged as age 1+ rearing juveniles return as adults 2 years later (Gray et al. 1981). Most fish tagged as outmigrating smolts return the following year. Stratified sampling is conducted to recover tags from commercial and sport catches, while tagged fish returning to their streams of origin are sampled and enumerated whenever possible at weir sites and during stream surveys. The result is a broad spectrum of information on the biological characteristics and harvest patterns of specific stocks.

Information from coded-wire tagging studies through June 1982 was reported in Shaul et. al. (1983). The results showed that fishing pressure on Lynn Canal and Stephens Passage stocks was reduced substantially by troll fishery restrictions implemented in northern inside waters in 1979. The estimated harvest rate on those stocks by the troll and purse seine fisheries decreased from 53% in 1978 to 33% in 1979. It was hypothesized that pressure on outer coastal and southern Southeastern stocks was increased significantly by shifts in troll effort from inside waters to the outer coast. During 1981, an estimated 46.3% of the total Southeastern Alaska harvest and escapement of coho salmon returning to hatcheries in Clarence Strait (District 101) was taken by the troll fishery while the estimated average troll harvest rate for Stephens Passage stocks was only 28.0%.

This report summarizes the results of investigations conducted during 1 July 1982 - 30 June 1983. Of primary importance is newly acquired information on the biological characteristics and harvest patterns of wild coho salmon stocks along the outer coast and in Clarence Strait.

SMOLT AND JUVENILE TAGGING

A total of 17,074 coho salmon smolts and 11,348 rearing juveniles was coded-wire tagged in four systems in Southeastern Alaska during March - June 1983. All four are mainland systems and include: Auke Bay in Stephens Passage, the Berners River in Lynn Canal, the Chickamin River in Behm Canal, and Hugh Smith Lake in Boca de Quadra (Figure 2). The number of fish tagged and the code used at each location are listed in Table 1. Most surviving smolt tagged during 1983 will return as adults in 1984, while the majority of age 1+ juveniles tagged during 1983 will return in 1985.

Methods

Outmigrating smolts were captured for tagging at Auke and Hugh Smith Lakes with smolt weirs that were operated on the outlets of both systems. Wire-mesh minnow traps were used to capture age 1+ juveniles and smolts from the Chickamin and Berners Rivers. Fifty traps baited with salmon roe were checked and set four to six times daily at 2 hour intervals. Traps were moved frequently to maintain the highest possible catch rates. Gray et al. (1984) describe the minnow trapping method in detail. Juveniles were held in pens before tagging until a total of 1,000-4,000 was captured, but not for a period longer than 5 days. Outmigrating smolts captured at smolt weirs were tagged and released daily. A description of the coded-wire tagging technique is found in Koerner (1977).

Table 1. Summary of coded-wire tagging of wild coho salmon in Southeastern Alaska, 1 July 1982 - 30 June 1983[1].

Date	Location	Number Tagged	Code	Adult Return Year
22 March - 11 June	Auke Lake	6,115 smolts	3-17-57	1984
28 April - 16 May	Hugh Smith Lake	9,647 smolts	4-20-28 (2,489) 4-20-29 (1,289) 4-22-06 (5,869)	1984
1 March - 12 April	Chickamin River	1,312 smolts 900 juveniles	4-20-27 4-21-44	1984 1985
19 - 30 June	Berners River	10,348 juveniles	4-22-08 (1,278) 4-22-43 (9,070)	1985 1985
TOTAL	28,322 (17,074 smolts and 11,248 juveniles)			

[1] Includes only fish tagged by the ADF&G, Commercial Fisheries Division.

Summary of Tagging

The following is a brief summary of coded-wire tagging of wild coho salmon stocks by location in Southeastern Alaska during March - June 1983.

Auke Lake Smolts:

The downstream migrant traps at the Auke Creek weir were placed in operation on 11 March. The first outmigrating coho salmon smolts were captured on 22 March, although a steady migration did not begin until the last week of April. The outmigration peaked on 18 May and ended on 11 June. A total of 6,634 wild coho salmon smolts migrated from the Auke Lake system of which 6,115 were tagged and released. Of the smolts which were tagged and released, 385 were 100 mm or less, 5,060 were 101-130 mm, and 670 were greater than 130 mm snout-fork length.

The timing of the coho salmon smolt outmigration is shown with respect to water temperature in Figure 3. The period of peak smolt outmigration occurred during 13-24 May, during and shortly after an increase in water temperature from approximately 8°C to 13°C.

Hugh Smith Lake Smolts:

The smolt weir at the outlet of Hugh Smith Lake was placed in operation on 28 April. The coho salmon smolt outmigration was already in progress when the weir was installed. A total of 9,647 smolts was tagged before the project was terminated on 16 May.

Chickamin River Smolts and Juveniles:

A total of 1,312 coho salmon smolts and 900 age 1+ and older juveniles was minnow trapped and tagged on the Chickamin River during 1 March - 12 April. Traps were set in log jams and near tree roots along the main river and in side sloughs. A total of 670 smolts and 370 juveniles was tagged during the first trip (1-12 March), while 642 smolts and 530 juveniles were tagged during the second trip (5-12 April). Smolts were differentiated from rearing juveniles by their silver coloration, dark-tipped fins, and lack of distinctive parr marks. Most surviving smolts are expected to return as adults in 1984, while the majority of tagged juveniles are expected to rear in the system for an additional year and return as adults in 1985.

Berners River Juveniles:

A total of 10,348 juvenile coho salmon was trapped and tagged on the east fork of the Berners River during 19-30 June. Catches were fair and averaged 6.1 juveniles per trap compared with 9.7 in 1976, 7.5 in 1977, 6.9 in 1980, and 5.3 in 1981 (Shaul, et al. 1983). Juveniles tagged during 1983 ranged in size from 62 mm to 112 mm snout-fork length. Of the total number tagged, 8,308 were 62-79 mm, 2,027 were 80-100 mm, and 13 were 101-112 mm.

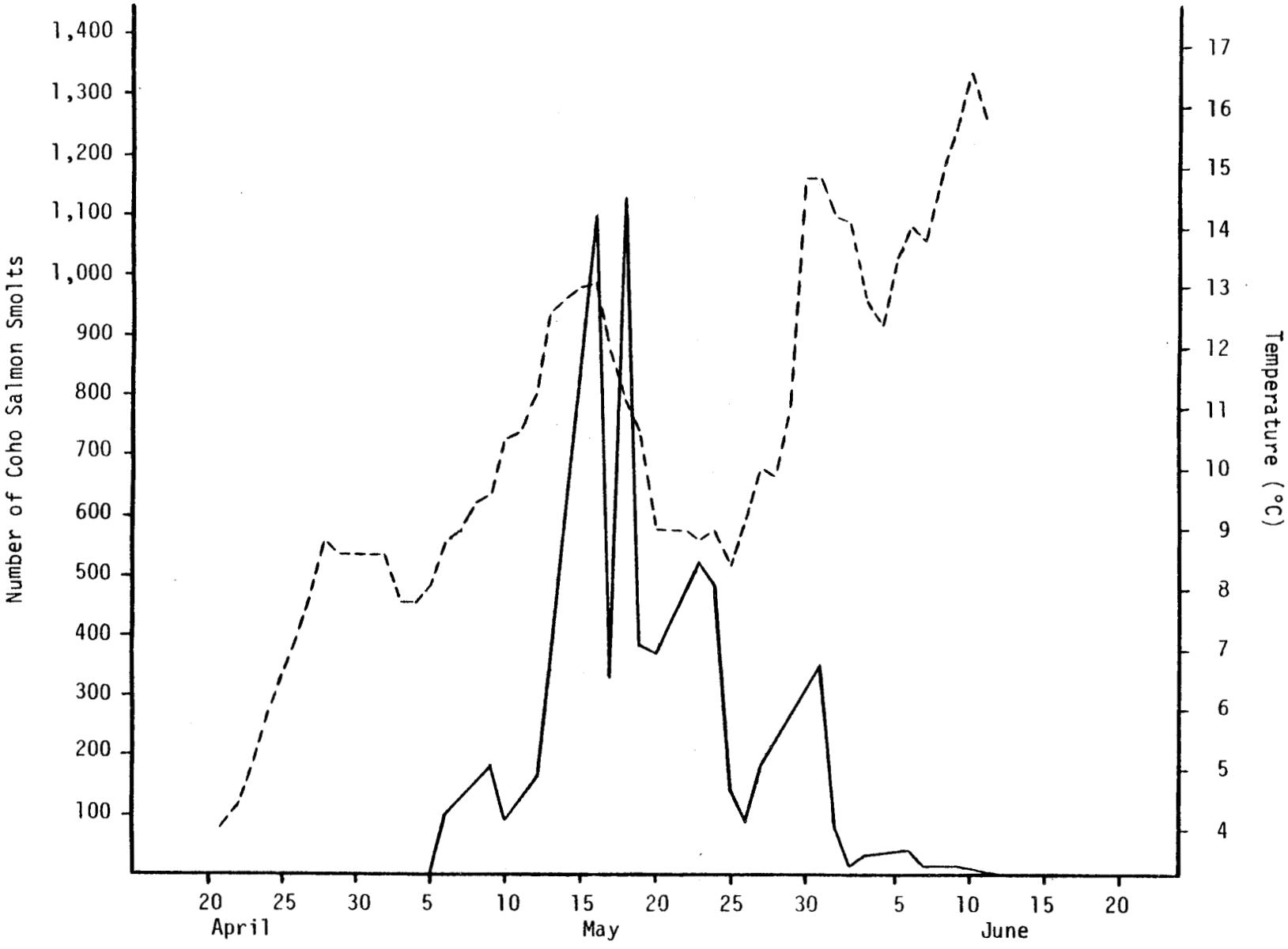

Figure 3. Coho salmon smolt outmigration (solid line) and water temperature (dashed line) at Auke Creek during 21 April-12 June, 1983.

TAG RECOVERY FROM FISHERIES

Commercial catch sampling for coded-wire tagged coho salmon was conducted by the ADF&G Statewide Stock Biology Group which had samplers stationed at fish processors and buying stations located throughout Southeastern Alaska. The samplers watched for adipose clipped coho salmon during offloading and sorting operations. Skippers of fishing vessels and tenders were interviewed to determine fishing areas. The heads of all adipose clipped fish were sent to the ADF&G Code Wire Tag Lab in Juneau for removal and decoding of tags. Areas used in expanding random recoveries were the nine Pacific Marine Fisheries Commission (PMFC) area groupings of regulatory districts shown in Appendix Table 1. Time strata used were statistical weeks (Appendix Table 2).

A total of 1,988,652 commercially caught coho salmon was landed in Southeastern Alaska (excluding Yakutat net fisheries) during 1982. Of this total, 496,915, or 25.0%, were examined for missing adipose fins by port samplers. Randomly recovered tags were expanded by the inverse of the proportion of the catch that was sampled within area, gear type, and weekly strata.

The ADF&G Sport Fish Division conducted a creel census and survey of the Juneau area marine recreational fishery (Neimark and Schwan 1983). Interviewers examined 4,073 coho salmon for missing adipose fins out of a total estimated catch of 20,747. Because weekly catch estimates were not available, tags recovered from random samples were expanded to the total season catch.

A total of 378 coded-wire tagged wild Southeastern Alaska coho salmon was recovered from area-specific commercial and sport catches in Southeastern Alaska in 1982. Information from these recoveries is presented in Appendix Tables 3-10. British Columbia recoveries were not included as 1982 Canadian data was not available.

ESCAPEMENT ENUMERATION AND SAMPLING

Coho salmon escapements were enumerated, or estimated, and sampled on eight systems in Southeastern Alaska during 1982. All or a portion of the escapement to each system was examined for missing adipose fins and the presence of coded-wire tags. Escapement figures and tagged-untagged ratios for each system are shown in Table 2.

Auke Creek Weir

The first adult coho salmon of the season was counted through the Auke Creek weir on 27 August. No additional coho salmon were counted until 11 September. The peak daily count of 95 adults occurred on 2 October. The last fish was counted on 16 October and the weir was removed on 30 October. The total season count of wild coho salmon was 447 adults and 338 jacks. Of those, a total of 417 adults and 335 jacks were found to have clipped adipose fins. In addition to the wild coho salmon return, 11 adults and 141 jacks from Auke Creek hatchery releases returned to the weir. These were identified by ventral fin marks. The 1982 wild

Table 2. Total adult escapement and estimated number of coded-wire tagged wild coho salmon escaping to eight systems in Southeastern Alaska, 1982.

System	Adult Escapement	95% Confidence Limits	No. Examined For Marks	No. Marked	Estimated No. of Tagged Adults In Escapement[1]
Auke Lake	447	complete count	447	417 (93.3%)	417
Speel Lake	1,164	complete count	1,164	118 (10.1%)	105
Berners River	7,505	survey count	885	9 (1.0%)	68
Ford Arm Lake	2,662[2]	2,381 - 2,880	1,753	141 (8.0%)	203
Politofski Lake	1,731[2]	1,269 - 2,285	388	42 (10.8%)	186
Warm Chuck Lake	1,017	complete count	1,017	90 (8.8%)	90
Klakas Lake	627[2]	517 - 776	562	16 (2.8%)	18
Hugh Smith Lake	2,144[3]	-	998	136 (13.6%)	219

[1] Adjusted for tag loss.
[2] Peterson estimate of the population upstream of the weir plus weir mortalities, coded-wire tag retention samples, and fish remaining downstream when the weir was removed.
[3] Mark-recapture estimate based on the method presented by Schaefer (1951) plus weir mortalities, coded-wire tag retention samples, and fish remaining downstream when the weir was removed.

coho salmon escapement to Auke Lake and escapements during other years are shown in Appendix Table 11.

Speel Lake Weir

A wooden tripod and aluminum picket weir was installed at the outlet of Speel Lake on 7 September. The first adult coho salmon was counted on 8 September but no more fish passed the weir until 18 September. The peak daily counts of 95 adults occurred on 30 September. The run appeared to be finished by the second week of November and the weir was removed on 11 November. The total wild adult coho salmon escapement was 1,164 of which 118 had missing adipose fins. Thirty-five jacks were counted of which two had missing adipose fins. Of a total of 115 marked adults that were examined, 102 had coded-wire tags for a tag retention rate of 86.7%.

Ford Arm Lake Weir

A wooden tripod and aluminum picket weir was operated at the outlet of Ford Arm Lake on the west coast of Chichagof Island during 14 August - 17 November. The first coho salmon were counted on 23 August and the last fish passed the weir on 14 November. A foot survey of the outlet stream before the weir was removed indicated that 351 adults remained downstream. The total count of adult coho salmon past the weir was 1,754. Of a total of 1,753 adults that were examined for marks, 141 had missing adipose fins. In addition, 34 jack coho salmon were enumerated of which only one was marked. Peak counts occurred on 9 October and 30 October when 161 and 163 adults respectively, passed the weir. However, a number of fish were believed to have passed the weir uncounted during extreme flooding conditions on 12 October.

A total of 1,018 adults was marked at the weir with numbered Floy anchor tags through 25 October. Recapture efforts were conducted on four tributaries of the lake during 26 October - 16 November. As many spawning fish as possible were captured in dipnets, examined for tags, clipped on the posterior end of the dorsal fin, and released. A total of 101 fish was captured and examined, not including fish that were tagged and released at the weir after recovery efforts began on 26 October. Of the total, 48 had Floy tags while 10 showed signs of tag loss. It was necessary to assume that tag loss was the same for fish tagged before 26 October, when recapture sampling began, and for fish tagged after that date. There was some difficulty in determining whether an untagged fish had lost a tag. Often the hole was obvious, but sometime could not be easily located without probing with a toothpick or other object. We recommend that a secondary fin clip be used in future Floy tagging experiments with spawning coho salmon where tag loss is an important factor.

The relationship between the timing of entry of tagged fish into the lake and the timing of their recapture in the inlet streams is shown in Figure 4. The residence time in the lake ranged from 1 to 78 days and averaged 26.4 days. The correlation between the timing of entry into the lake and recapture in the inlet streams during the study period was insignificant ($r = 0.18$). This suggested that bias in a single stratum Peterson estimate caused by differential tagging and recapture rates would be minimal. An estimate of the total adult coho salmon escapement into the lake through 25 October can be calculated using the modified Peterson population estimator where:

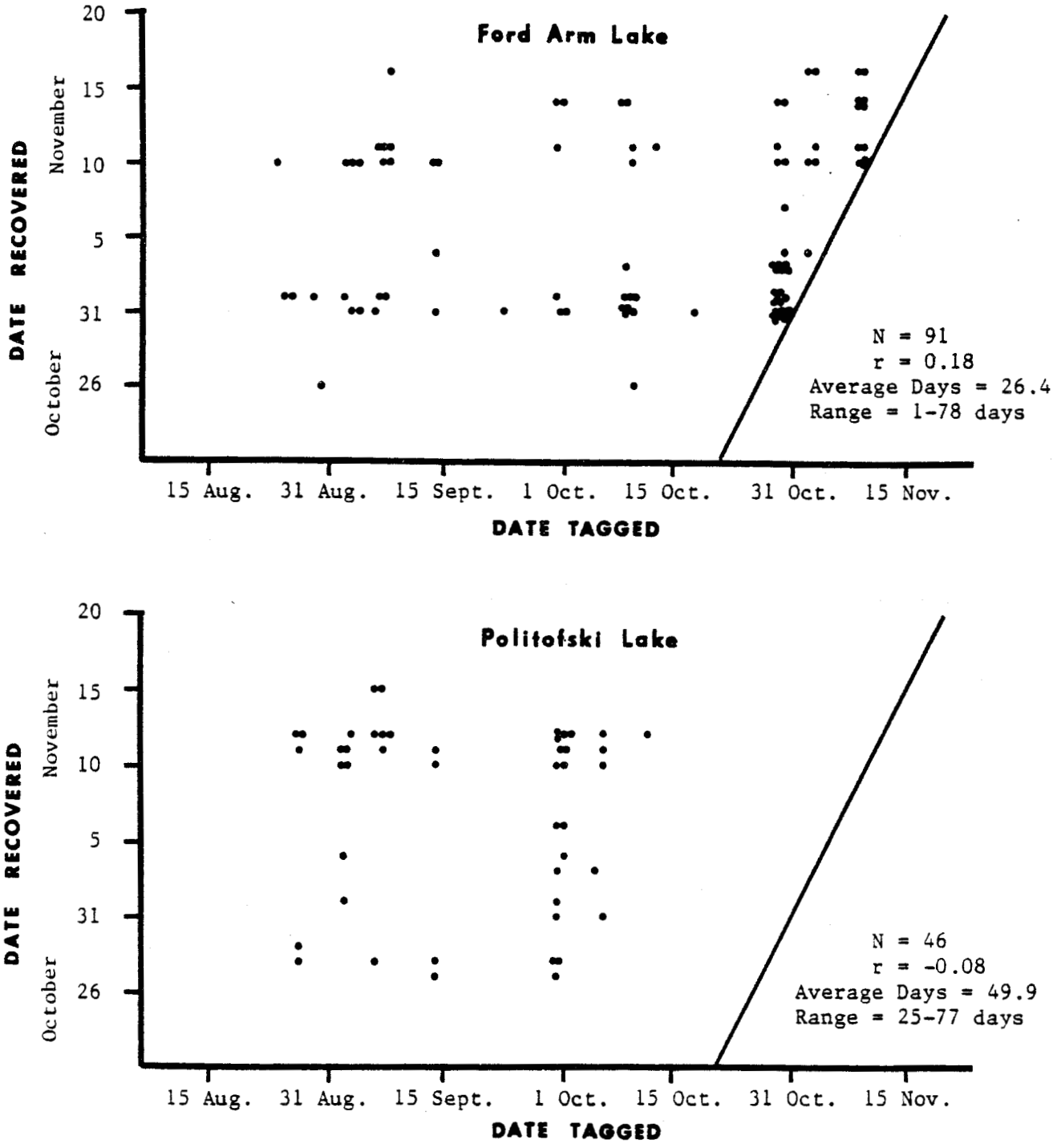

Figure 4. Recoveries by dates of tagging and recovery of adult coho salmon tagged at the outlets of Ford Arm and Politofski Lakes and recaptured in inlet streams, 1982.

Number tagged (M) = 1,018; Number examined for tags (C) = 101;

Number with tags (R) = 58

$$\text{Population Estimate } (\hat{N}) = \frac{(1{,}018 + 1)\ (101 + 1)}{(58 + 1)} = 1{,}762$$

After adding 510 adults that were Floy tagged and passed through the weir after 25 October, 19 weir mortalities, 20 coded-wire tag retention samples, and 351 fish remaining below the weir when it was removed, the total adult coho salmon escapement to the system was estimated at 2,662 fish. A binomial approximation of the 95% confidence interval for the estimate is 2,381 to 2,880.

Of a total of 20 adipose marked coho salmon checked for tag retention, 19 contained coded-wire tags implanted at Ford Arm Lake in 1980, while one had no tag.

Politofski Lake Weir

A wooden tripod and aluminum picket weir was operated at the outlet of Politofski Lake on southern Baranof Island during 15 August - 14 November. The first coho salmon were counted on 26 August and the last fish passed the weir on 10 November. A foot survey of the outlet stream on 14 November indicated that 63 adults remained downstream when the weir was removed. A total of 391 adult coho salmon were counted past the weir of which 388 were examined. Forty two of the examined fish had missing adipose fins. No jack coho salmon were observed. The level of the lake increased dramatically on 12 October, after a period of heavy rains, and water passed over the weir structure during 12 and 13 October. Because several hundred coho salmon were known to be holding downstream when the flood occurred, it was suspicioned that a significant number of fish passed the weir uncounted.

A total of 362 fish that passed the weir during 26 August - 25 October was marked with numbered Floy anchor tags. Recapture efforts were conducted using dipnets and a seine in the main tributary to the upper lake during 27 October - 11 November. A total of 198 fish were captured, examined, marked, and released during that period. Of the total, 37 had Floy tags and 6 showed definite signs of tag loss. The modified Peterson population estimator was used to estimate the total adult coho salmon escapement to the lake where:

$$M = 362;\ C = 198;\ R = 43$$

$$\hat{N} = \frac{(362 + 1)\ (198 + 1)}{(43 + 1)} = 1{,}642$$

After adding four fish that were Floy tagged and passed through the weir after 25 October, 22 coded-wire tag retention samples and weir mortalities, and 63 fish remaining below the weir when it was removed, the total adult coho salmon escapement to the system was estimated at 1,731 fish. A binomial approximation of the 95% confidence interval for the estimate ranged from 1,269 to 2,285.

The residence time of tagged fish in the lake ranged from 25 to 77 days and averaged 49.9 days (Figure 4). The correlation between the timing of entry into the

lake and recapture in the inlet stream during the study period and was not signficant ($r = -0.08$).

Of a total of 19 adipose marked coho salmon checked for tag retention, all had coded-wire tags implanted in age 1+ and older juvenile coho salmon at Politofski Lake in 1980.

Warm Chuck Lake Weir

A wooden tripod and aluminum picket weir was installed at the outlet of Warm Chuck Lake on Hecata Island during 24 August - 13 November. During that period, 1,017 adult coho salmon and 16 jacks were counted at the weir which remained fish-tight for adult salmon. Ninety adults and one jack had missing adipose fins. The adult immigration began on 2 September and was completed by 5 November. The peak daily count of 115 adults occurred on 1 October.

Klakas Lake Weir

A wooden tripod and aluminum picket weir was operated on the outlet stream of Klakas Lake during 30 July - 20 November. The first adult coho salmon was counted at the weir on 3 August and the run was completed on 15 November. The peak daily count of 70 adults occurred on 5 September. A total of 562 adults was sampled, of which 16 had missing adipose fins. A total of 550 adults was marked with Floy anchor tags and released upstream from the weir.

A storm on 10 October brought the water level over the top of the weir for approximately 48 hours, allowing an unknown number of fish to pass. In order to estimate the number of fish that passed over the weir during the flood, spawning ground surveys were conducted above the weir to estimate the Floy tagged:untagged ratio of the spawning population. A total of 106 adult coho salmon was captured on the spawning grounds of which 93 were Floy tagged or showed signs of tag loss. Using the modified Peterson population estimator, the escapement to the system was estimated as follows:

$$M = 500$$

$$C = 106$$

$$R = 93$$

$$\hat{N} = \frac{(550 + 1)\ (106 + 1)}{(93 + 1)} = 627$$

A binomial approximation of the 95% confidence interval for the estimate ranged from 517 to 776.

The number of adipose clipped adult coho salmon in the escapement was estimated at 18. A total of 31 coho salmon jacks was counted at the weir, none of which were marked.

Hugh Smith Lake Weir

A wooden tripod and aluminum picket weir was operated on the outlet stream of Hugh Smith Lake in Boca de Quadra from the beginning of the sockeye salmon migration

in June until 26 November. The adult coho salmon migration began on 1 August and the last coho salmon were counted past the weir on 24 November. The peak daily count of 86 adults occurred on 4 October. The season count of adult coho salmon at the weir totaled 1,118. However, an unknown number of fish passed the weir when the pickets had to be pulled to save the structure during a storm on 10 October. The weir was inoperative for a total of 63 hours.

A total of 821 adult coho salmon that passed the weir during the season was marked with Floy anchor tags and released upstream. Surveys to recapture Floy tagged fish were conducted on Buschman and Cobb Creeks, inlet streams to Hugh Smith Lake, during November - February. Of a recapture sample of 237 adult coho salmon examined on the spawning grounds, 84 were Floy tagged or showed signs of tag loss. The residence time of tagged fish in the lake ranged from 15 to 140 days and averaged 76.7 days. There was a greater observed correlation between the timing of entry into Hugh Smith Lake and recapture in the inlet streams (Figure 5) than at Ford Arm or Politofski Lakes. Although the correlation was only marginally significant, it was judged to be strong enough to justify applying a stratified method of estimating total escapement. An appropriate estimator for this problem was given by Schaefer (1951) who developed formulas for estimating sockeye salmon *(O. nerka)* abundance in a tributary of the lower Fraser River from mark-recapture experiments.

The number of fish passing the weir site during period i which entered the inlet streams during period j is estimated by:

$$\hat{n}ij = m_{ij} \frac{T_i}{m_{i.}} \frac{C_j}{m_{.j}}$$

where

m_{ij} = the number of fish tagged during period i and recovered during period j.

T_i = the total number of fish tagged during period i.

C_j = the number of fish recovered that were tagged during period j.

$m_{i.}$ = the number of fish recovered that were tagged during period i.

$m_{.j}$ = the number of tagged fish recovered during period j.

The estimate of the total escapement is obtained by summing $\hat{n}ij$ values:

$$\hat{N} = \sum_i \sum_j m_{ij} \frac{T_i}{m_{i.}} \frac{C_i}{m_{.j}}$$

The Hugh Smith Lake data was divided into two tagging periods and two recovery periods. It was necessary to assume that tag loss was unrelated to residence time in the lake. The time when the flood occurred and apparent midpoint of the run (10-11 October) was used to divide the tagging periods while the recovery

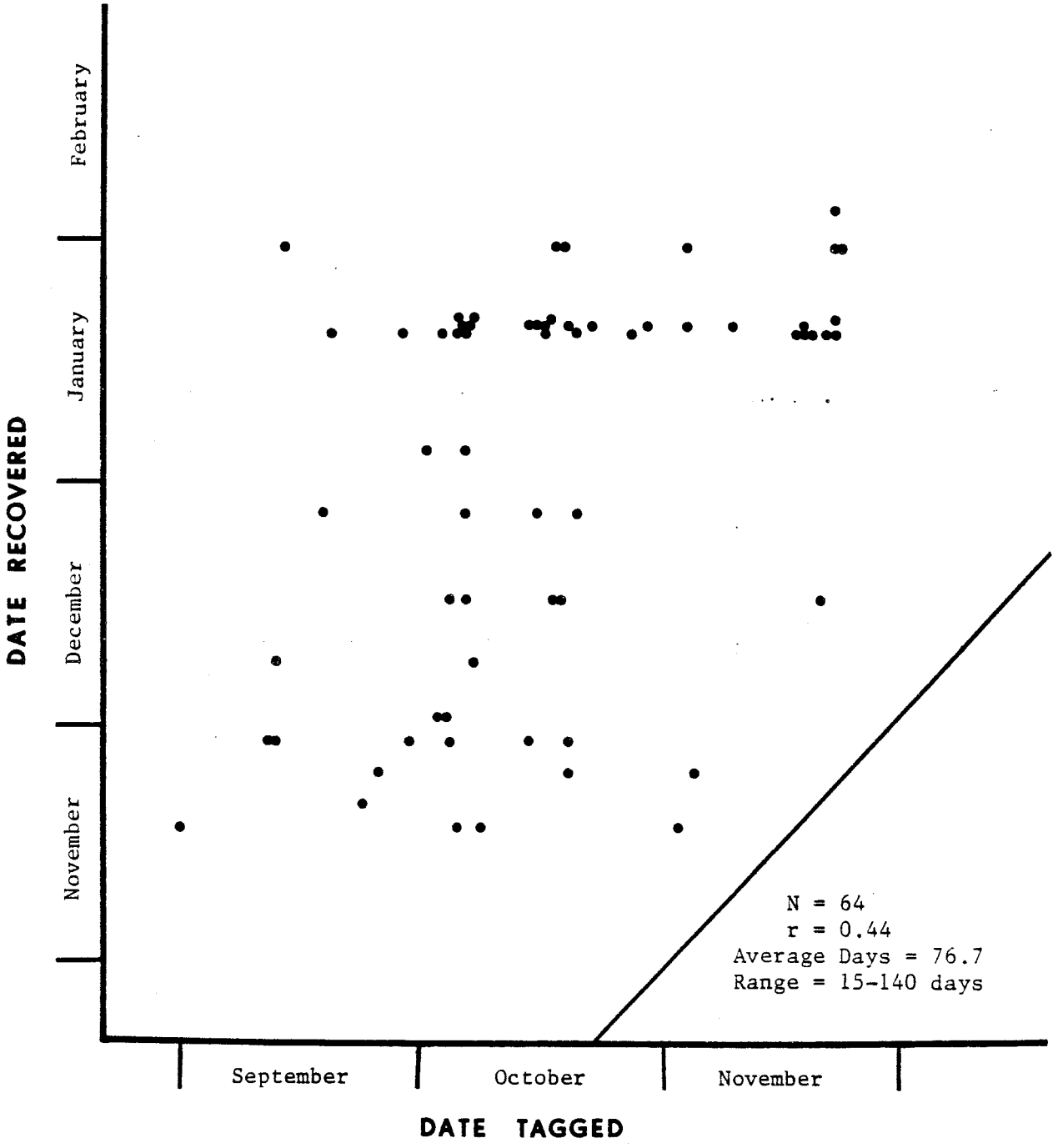

Figure 5. Recoveries by dates of tagging and recovery of adult coho salmon tagged at the outlet of Hugh Smith Lake and recaptured in inlet streams, 1982.

periods were divided into 2-month intervals (November - December and January - February). The basic tagging and recovery data and computation of the escapement estimate for Hugh Smith Lake is shown in Table 3. Schaefer's method yields an adult escapement estimate for Hugh Smith Lake of 2,144 compared with the pooled Peterson estimate of 2,302. By subtracting the weir count of 1,118 plus 7 fish remaining behind the weir from the stratified estimate of 2,144, the number of adults that escaped past the weir during the flood period (63 hours) was estimated at 1,019.

Of a total of 998 adult coho salmon that were examined for marks at the weir and in the inlet streams, 136 (13.6%) had missing adipose fins. Of a sample of 20 adipose clipped fish that were examined for tags, 15 were found to contain tags implanted at Hugh Smith Lake, while 5 did not have tags.

Berners River Surveys

A total of 7,505 adult coho salmon was counted during a float and foot survey of the west fork of the Berners River during 1-10 November. Although many fish had begun actively spawning in riffle areas, the majority were found in aggregations of up to 1,300 in deep pools. The 1982 peak counts were the highest ever recorded to date (Appendix Table 12).

A total of 885 fish was captured in seines and dipnets, of which only 9 (1.02%) were missing adipose fins. Of those, eight were found to contain coded-wire tags implanted in juvenile coho salmon on the Berners River in 1980.

HARVEST BY GEAR TYPE

The estimated total return, harvest by gear type, and escapement of coho salmon returns to the eight study systems in Southeastern Alaska in 1982 are shown in Table 4.

Contribution to the troll fishery ranged from an estimated 231 fish for Auke Lake to 9,127 fish for the Berners River. The estimated percentage of the total return harvested by troll gear ranged from 23.0% for Klakas Lake to 51.7% for Warm Chuck Lake. However, the precision of the estimates for these two systems was lower than for other systems because of small fishery sample sizes (Table 4). Overall, the estimated troll harvest percentage of the total return to each of the three southern systems (Warm Chuck, Klakas, Hugh Smith) averaged 41.0% excluding the Canadian harvest. This is similar to the estimate of 41.9% for the Southeastern Alaska troll harvest percentage of the total return to District 101 hatcheries in 1981 (see Figure 32, pg. 73). The estimated troll harvest percentages for Ford Arm and Politofski Lakes were 37.2% and 33.4%, respectively (average = 35.3%). The estimated troll harvest percentages for the three Lynn Canal and Stephens Passage stocks were 28.8% for Auke Lake, 42.5% for Speel Lake, and 34.7% for the Berners River (average = 35.3%). Therefore, it appears that the troll fishery exploited Lynn Canal - Stephens Passage stocks and District 113 stocks at somewhat similar rates. A comparison with previous estimates (1978-1981) for Auke Lake, Speel Lake, and the Berners River shows that a significant decrease in troll fishing pressure on Lynn Canal and Stephens Passage stocks took place after 1978 (Table 5-7). The average percentage of the three stocks that was harvested by

Table 3. Data from tagging and recovery at Hugh Smith Lake, 1982, and computation of the escapement estimate using Schaefer's (1951) formulas.

Tagging and Recovery Data	Period of Tagging (i) 12 Aug.- 10 Oct.	11 Oct.- 26 Nov.	Total Tagged Fish Recovered $m_{.j}$	Total Fish Recovered c_j
Period of Recovery (j)				
November - December	18	18	36	58
January - February	11	37	48	179
Total Tagged Fish Recovered ($m_{i.}$)	29	55	84	
TOTAL FISH TAGGED (T_i)	561	260		

Population Estimate	Period of Tagging (i) 12 Aug.- 10 Oct.	11 Oct.- 26 Nov.	Total
Period of Recovery (j)			
November - December	561	137	698
January - February	794	652	1,446
TOTAL	1,355	789	2,144

Table 4. Estimated total return, harvest by gear type, and escapement of coho salmon returns to eight systems in Southeasten Alaska, 1982.

Location	Fishery Sample Size [1]	Troll	Purse Seine	Drift Gillnet	Sport	Total Catch [2]	Escapement	Total Return
Auke Lake	28	231 (28.8%)	97 (12.0%)	23 (2.9%)	6 (0.7%)	357 (44.4%)	447 (55.6%)	804 (100%)
Speel Lake	30	1,733 (42.5%)	1,011 (24.8%)	168 (4.1%)	-	2,912 (71.4%)	1,164 (28.6%)	4,076 (100%)
Berners River	40	9,127 (34.7%)	-	9,679 (36.8%)	-	18,806 (71.5%)	7,505 (28.5%)	26,311 (100%)
Ford Arm Lake	31	1,622 (37.2%)	79 (1.8%)	-	-	1,701 (39.0%)	2,662 (61.0%)	4,363 (100%)
Politofski Lake	24	867 (33.4%)	-	-	-	867 (33.4%)	1,731 (66.6%)	2,598 (100%)
Warm Chuck Lake	20	1,421 (51.7%)	311 (11.3%)	-	-	1,732 (63.0%)	1,017 (37.0%)	2,749 (100%)
Klakas Lake	14	617 (23.0%)	1,442 (53.7%)	-	-	2,059 (76.7%)	627 (23.3%)	2,686 (100%)
Hugh Smith Lake	72	2,732 (48.2%)	556 (9.8%)	232 (4.1%)	-	3,520 (62.1%)	2,144 (37.9%)	5,664 (100%)

[1] Includes only expandable random recoveries.
[2] Does not include Canadian catch.

Table 5. Estimated total return, harvest by gear type, and escapement of coho salmon returns to Auke Lake, 1978, 1980, 1981, and 1982.

Year	Fishery Sample Size[1]	Troll	Purse Seine	Drift Gillnet	Sport	Total Catch	Escapement	Total Return
1978	32	778 (49.2%)	-	30 (1.9%)	90 (5.7%)	898 (56.8%)	683 (43.2%)	1,581 (100%)
1980	8	60 (7.6%)	-	17 (2.1%)	17 (2.1%)	94 (11.8%)	698 (88.2%)	792 (100%)
1981	35	215 (24.4%)	4 (0.5%)	2 (0.2%)	17 (1.9%)	238 (27.0%)	644 (73.0%)	882 (100%)
1982	28	231 (28.8%)	97 (12.0%)	23 (2.9%)	6 (0.7%)	357 (44.4%)	447 (55.6%)	804 (100%)

[1] Includes only expandable random recoveries.

Table 6. Estimated total return, harvest by gear type, and escapement of coho salmon returns to Speel Lake, 1978, 1979, 1981, and 1982.

Year	Fishery Sample Size[1]	Troll	Purse Seine	Drift Gillnet	Sport	Total Catch	Escapement	Total Return
1978	47	2,255 (60.9%)	-	219 (2.2%)	146 (3.7%)	2,620 (66.8%)	1,300 (33.2%)	3,920 (100%)
1979	40	1,268 (36.0%)	73 (2.1%)	234 (6.7%)	132 (3.7%)	1,707 (48.5%)	1,811 (51.5%)	3,518 (100%)
1981	20	1,045 (32.2%)	129 (4.0%)	78 (2.4%)	51 (1.6%)	1,303 (40.2%)	1,935 (59.8%)	3,238 (100%)
1982	30	1,733 (42.5%)	1,011 (24.8%)	168 (4.1%)	-	2,912 (71.4%)	1,164 (28.6%)	4,076 (100%)

[1] Includes only expandable random recoveries.

Table 7. Estimated total return, harvest by gear type, and escapement of coho salmon returns to the Berners River, 1978, 1979, and 1982.

Year	Fishery Sample Size[1]	Troll	Purse Seine	Drift Gillnet	Sport	Total Catch	Escapement	Total Return
1978	105	6,190 (45.4%)	-	4,240 (31.1%)	83 (0.6%)	10,513 (77.1%)	3,119 (22.9%)	13,632 (100%)
1979	58	2,708 (33.0%)	-	1,883 (23.0%)	137 (1.7%)	4,728 (57.7%)	3,460 (42.3%)	8,188 (100%)
1982	40	9,127 (34.7%)	-	9,679 (36.8%)	-	18,806 (71.5%)	7,505 (28.5%)	26,311 (100%)

[1] Includes only expandable random recoveries.

the troll fishery was estimated at only 35.3% for 1982 compared with 51.8% for 1978.

The estimated percentage of the total return to the study systems that was harvested by purse seine gear ranged from 0.0% for the Berners River and Politofski Lake to 53.7% for Klakas Lake (Table 4). The average was 14.3%. The Berners River stock appears to have been relatively unaffected by the seine fishery (Table 7), probably because it migrates toward inside waters after purse seine effort along its major migratory pathway has been curtailed. The estimated harvest of the Auke Lake and Speel Lake stocks by purse seine gear was considerably greater in 1982 compared with previous years (Tables 5 and 6). This increase was probably largely the result of increased purse seine effort in the open straits and passages to harvest an exceptionally large pink salmon return. Purse seine fisheries harvested an estimated 12.0% of the total return to Auke Lake and 24.8% of the total return to Speel Lake in 1982 compared with estimates of 4.0% and less for previous years.

As expected, only inside area stocks were harvested to a significant extent by drift gillnet fisheries. Those fisheries harvested an estimated 2.9% of the Auke Lake stock and 4.1% of the Speel Lake stock. Both of these estimates are comparable with previous figures since 1978 (Tables 5 and 6). The Lynn Canal (District 115) drift gillnet fishery harvested an estimated 36.8% of the return to the Berners River in 1982, compared with 31.1% for 1978 and 23.0% for 1979 (Table 7). An estimated 4.1% of the 1982 return to Hugh Smith Lake was harvested by drift gillnet fisheries in southern and central Southeastern.

Only one coded-wire tagged wild coho salmon (originating in Auke Lake) was recovered from random samples of the Juneau area marine sport catch in 1982. Estimates of the percentage of the total return harvested by the Juneau area marine sport fishery have ranged 0.7%-5.7% for Auke Lake, 0.0%-3.7% for Speel Lake, and 0.0%-1.7% for the Berners River (Table 5-7). Average estimates for all years were 2.6% for Auke Lake, 2.2% for Speel Lake, and 0.8% for the Berners River. These figures demonstrate the relatively low harvesting capability of the Juneau area marine sport fishery compared with commercial fisheries.

HARVEST BY AREA

The estimated area distribution of the harvest for the eight study systems is shown in Table 8. The most important harvest area for the Auke Lake stock in 1982 was in the central intermediate area of Cross Sound, Icy Strait, and upper Chatham Strait (Districts 112 and 114) where an estimated 32.6% of the total return was harvested. During the four study years (1978, 1980, 1981, and 1982) the estimated harvest in those areas ranged from 2.0% to 36.5% and averaged 21.4% (Table 9). The harvest of Auke Lake coho salmon in outside areas accounted for a relatively small proportion of the estimated total return during those years ranging from 1.9% to 9.7% (average 5.4%). The majority of returning Auke Lake coho salmon apparently entered inside waters through Icy Strait while a small percentage entered through lower Chatham Strait where tagged fish were recovered in 1980 and 1982.

Table 8. Estimated total return, harvest by area, and escapement of coho salmon returns to eight systems in Southeastern Alaska, 1982.

Area (Districts)	Auke Lake	Speel Lake	Berners River	Ford Arm Lake	Politofski Lake	Warm Chuck Lake	Klakas Lake	Hugh Smith Lake
Northern Outside 116, 157, 181, 183, 186, 189	19 (2.4%)	141 (3.5%)	2,737 (10.4%)	136 (3.1%)	61 (2.4%)	199 (7.2%)	77 (2.9%)	-
Central Outside 113, 154	24 (3.0%)	650 (15.9%)	927 (3.5%)	1,040 (23.8%)	675 (26.0%)	158 (5.8%)	209 (7.8%)	1,152 (20.3%)
Southern Outside 103, 104, 152	-	391 (9.6%)	-	218 (5.0%)	-	1,331 (48.4%)	1,258 (46.8%)	768 (13.6%)
Central Intermediate 112, 114	262 (32.6%)	1,122 (27.5%)	5,463 (20.8%)	274 (6.3%)	131 (5.0%)	-	-	65 (1.2%)
Southern Intermediate 105, 109, 110	23 (2.8%)	440 (10.8%)	-	-	-	-	132 (4.9%)	376 (6.6%)
Stephens Passage 111	22 (2.7%)	127 (3.2%)	-	-	-	-	-	-
Lynn Canal 115	7 (0.9%)	37 (0.9%)	9,679 (36.8%)	-	-	-	-	-
Central Inside 106, 107, 108	-	-	-	33 (0.8%)	-	-	-	52 (0.9%)
Southern Inside	-	-	-	-	-	44 (1.6%)	383 (14.3%)	1,107 (19.5%)
Total Catch	357 (44.4%)	2,912 (71.4%)	18,806 (71.5%)	1,701 (39.0%)	867 (33.4%)	1,732 (63.0%)	2,059 (76.7%)	3,520 (62.1%)
Escapement	447 (55.6%)	1,164 (28.6%)	7,505 (28.5%)	2,662 (61.0%)	1,731 (66.6%)	1,017 (37.0%)	627 (23.3%)	2,144 (37.9%)
Total Return	804 (100%)	4,076 (100%)	26,311 (100%)	4,363 (100%)	2,598 (100%)	2,749 (100%)	2,686 (100%)	5,664 (100%)

Table 9. Estimated total return, harvest by area, and escapement of coho salmon returns to Auke Lake, 1978, 1980, 1981, and 1982.

Year	Northern Outside 116, 157, 181 183, 186, 189	Central Outside 113, 154	Central Intermediate 112, 114	Southern Intermediate 105, 109, 110	Lynn Canal 115	Stephens Passage 111	British Columbia Area 1	Escapement	Total Return
1978	-	30 (1.9%)	577 (36.5%)	-	30 (1.9%)	261 (16.5%)	-	683 (43.2%)	1,581 (100%)
1980	7 (0.9%)	30 (3.8%)	16 (2.0%)	7 (0.9%)	-	34 (4.2%)	-	698 (88.2%)	792 (100%)
1981	48 (5.4%)	38 (4.3%)	128 (14.6%)	-	2 (0.2%)	17 (1.9%)	5 (0.6%)	644 (73.0%)	882 (100%)
1982	19 (2.4%)	24 (3.0%)	262 (32.6%)	23 (2.8%)	7 (0.9%)	22 (2.7%)	-	447 (55.6%)	804 (100%)

The Speel Lake stock was more heavily harvested in outside waters and in southern intermediate Districts (105, 109, and 110) compared with the Auke Lake stock during 4 years when tagged fish returned to both systems (Tables 9 and 10). It is apparent that substantial proportions of the return to Speel Lake entered inside waters through both Icy and lower Chathan Straits (central and southern intermediate areas). The estimated proportion of the Speel Lake stock that was harvested in outside waters ranged from 9.8% to 29.0% (average age = 18.6%). The estimated percentage harvested in central intermediate, and southern intermediate waters ranged 5.5%-27.5% (average 16.0%) and 6.2%-25.4% (average 13.0%), respectively.

The estimated area distribution of the harvest of Berners River coho salmon in 1978, 1979, and 1982 indicated that virtually the entire return migrated through Icy Strait (central intermediate area) (Table 11). The locations of area specific tag recoveries in outside waters for 1982 (Appendix Table 5) and previous years indicated that nearly all returning Berners River fish approached the coast north of Sitka. The estimated percentages harvested in outside waters and central intermediate Districts (112 and 114) ranged 13.9%-27.4% (average 18.7%) and 5.6%-28.5% (average 18.3%), respectively.

The majority of the harvest of Ford Arm Lake and Politofski Lake coho salmon occurred in central outside Districts (113 and 154). An estimated 23.8% of the return to Ford Arm Lake and 26.0% of the return to Politofski Lake was harvested along the central outside coast (Table 8). With the exception of one tagged Ford Arm Lake fish that was harvested by troll gear in District 106-41, all of the recoveries for both stocks were reported from outside waters, predominantly north of Cape Ommaney, and from District 114 (Appendix Tables 6 and 7).

The majority of the harvest of Warm Chuck and Klakas Lake coho salmon occurred in southern outside Districts (103, 104, and 152) where an estimated 48.4% and 46.8%, respecitvely, of the return to those systems occurred (Table 8). Also important were northern and central outside waters where an estimated 13.0% of the return to Warm Chuck Lake and 10.7% of the return to Klakas Lake was harvested. Tags from both systems were recovered in southern inside waters (Districts 101 and 102) (Appendix Tables 8 and 9).

An estimated 33.9% of the total return to Hugh Smith Lake was harvested in outside waters. The second most important harvest area was in southern inside waters where an estimated 19.5% of the return was taken (Table 8). Lesser percentages of the Hugh Smith Lake stock were harvested in central intermediate, southern intermediate, and central inside areas.

HARVEST RATES

In sequential "gauntlet" type fisheries such as occur for coho salmon in Southeastern Alaska, information on the area distribution of the harvest provides a biased indication of the relative fishing pressure exerted on stocks by different fisheries. For example, if equal numbers of returning fish from a single stock are harvested by two sequential fisheries, the harvest rate of the second fishery must be higher than that of the first since fewer fish are available to the second fishery. A reduction in fishing effort by the second fishery will

Table 10. Estimated total return, harvest by area, and escapement of coho salmon returns to Speel Lake, 1978, 1979, 1981, and 1982.

Year	Northern Outside 116, 157, 181 183, 186, 189	Central Outside 113, 154	Southern Outside 103, 104, 152	Central Intermediate 112, 114	Southern Intermediate 105, 109, 110	Lynn Canal 115	Stephens Passage 111	Escapement	Total Return
1978	91 (2.3%)	302 (7.7%)	-	567 (14.5%)	997 (25.4%)	-	663 (16.9%)	1,300 (33.2%)	3,920 (100%)
1979	289 (8.2%)	611 (17.4%)	-	195 (5.5%)	217 (6.2%)	-	395 (11.2%)	1,811 (51.5%)	3,518 (100%)
1981	43 (1.3%)	276 (8.5%)	-	541 (16.7%)	314 (9.7%)	-	129 (4.0%)	1,935 (59.8%)	3,238 (100%)
1982	141 (3.5%)	650 (15.9%)	391 (9.6%)	1,122 (27.5%)	440 (10.8%)	37 (0.9%)	131 (3.2%)	1,164 (28.6%)	4,076 (100%)

Table 11. Estimated total return, harvest by area, and escapement of coho salmon returns to the Berners River, 1978, 1979, and 1982.

Year	Northern Outside 116, 157, 181 183, 186, 189	Central Outside 113, 154	Central Intermediate 112, 114	Stephens Passage 111	Lynn Canal 115	Escapement	Total Return
1978	1,775 (13.0%)	247 (1.8%)	3,890 (28.5%)	307 (2.3%)	4,294 (31.5%)	3,119 (22.9%)	13,632 (100%)
1979	900 (11.0%)	1,347 (16.4%)	461 (5.6%)	137 (1.7%)	1,883 (23.0%)	3,460 (42.3%)	8,188 (100%)
1982	2,737 (10.4%)	927 (3.5%)	5,463 (20.8%)	-	9,679 (36.8%)	7,505 (28.5%)	26,311 (100%)

effectively allow more fish to pass to the spawning grounds than a proportional effort reduction in the first fishery. In evaluating management options that affect conservation and allocation of stocks, an examination of harvest rate information provides a clearer picture of the probably results of various regulatory measures.

For this analysis, the term "harvest rate" refers to the proportion of the total number of fish that pass through a defined area that are harvested by fisheries in that area. The number of fish that pass through the area is the estimated total return minus fish previously harvested in other areas. Therefore, it is necessary to assume a direction of migration. In this analysis, it was assumed that returning coho salmon migrated by the most direct route(s) from the open ocean toward their systems of origin.

The total harvest rate for a stock was estimated as follows:

$$\text{Harvest Rate } (\hat{H}) = \frac{F}{F + E}$$

where F = estimated number of tagged fish harvested (expanded sum of random fishery recoveries).

E = estimated number of tagged fish in the escapement.

Estimated total harvest rates and harvest rates by area (outside, intermediate, and inside waters) for adult coho salmon returning to the eight study systems are shown in Table 12. The data indicated that the highest harvest rates in outside waters were experienced by the returns to Warm Chuck and Klakas Lakes which are located along the southern outside coast (District 103). The estimated harvest rates in outside waters for those stocks were 61.4%. For Warm Chuck Lake and 57.5% for Klakas Lake. Returns to Ford Arm and Politofski Lakes in District 113 were apparently subjected to less fishing pressure in outside waters with estimated harvest rates of 32.0% and 28.3%, respectively.

The estimated harvest rates in outside waters for Lynn Canal and Stephens Passage stocks were 5.3% for Auke Lake, 29.0% for Speel Lake, and 13.9% for the Berners River (Table 12). Interestingly, the estimated harvest rate in outside waters for the Auke Lake stock (Table 13) has averaged only 5.6% (range 1.9%-10.3%) while estimates for Speel Lake (Table 14) and the Berners River (Table 15) have usually been higher. Estimated 1982 harvest rates in intermediate waters for those three stocks were 37.4% for Auke Lake, 54.0% for Speel Lake, and 24.1% for the Berners River (Table 12). These estimates are the highest since 1978 (Tables 13-15) after which time restrictions were placed on the troll fishery in Icy Strait and northern District 112. Estimated harvest rates by troll and sport fisheries in Stephens Passage and Lynn Canal have been lower in more recent years compared with 1978. This is probably due, in large part, to closure of northern Stephens Passage to commercial trolling. The estimated harvest rate on the Berners River stock by the Lynn Canal drift gillnet fishery in 1982 was 56.3% which compared closely with estimates of 52.9% for 1974 (data from Gray et al. 1978) and 57.2% in 1978, but is higher than the estimate of 35.2% for 1979 (Table 15).

Table 12. Estimated harvest rate[1] by area for coho salmon returns to eight systems in Southeastern Alaska, 1982.

Stock	Outside Waters[2]	Intermediate Waters[3]	Inside Waters[4]	Total
Auke Lake	5.3%	37.4%	6.1%	44.4%
Speel Lake	29.0%	54.0%	12.6%	71.4%
Berners River	13.9%	24.1%	56.3%	71.5%
Ford Arm Lake	32.0%	6.3%	0.8%	39.0%
Politofski Lake	28.3%	5.0%	-	33.4%
Warm Chuck Lake	61.4%	-	1.6%	63.0%
Klakas Lake	57.5%	4.9%	14.3%	76.7%
Hugh Smith Lake	33.9%	7.8%	35.1%	62.1%[5]

[1] Harvest rate is defined as the proportion of a stock available in an area that is harvested by fisheries in that area.

[2] Districts 103, 104, 113, 116, 152, 154, 157, 181, 183, 186, 189.

[3] Districts 105, 109, 110, 112, 114.

[4] Districts 101, 102, 106, 107, 108, 111, 115.

[5] Does not include Canadian harvest.

Table 13. Estimated harvest rate[1] by area for coho salmon returns to Auke Lake, 1978, 1980, 1981, and 1982.

Year	Outside 113, 116, 154, 157 181, 183, 186, 189	Intermediate 105, 109, 110, 112, 114	Inside (Drift Gillnet)	Inside (Troll and Sport)	Total
1978	1.9%	37.2%	3.1%	26.8%	56.8%
1980	4.7%	3.0%	2.3%	2.3%	11.8%
1981	10.3%	16.2%	0.3%	2.6%	27.0%
1982	5.3%	37.4%	4.8%	1.3%	44.4%

[1] Harvest rate is defined as the proportion of a stock available in an area that is harvested by fisheries in that area.

Table 14. Estimated harvest rate[1] by area for coho salmon returns to Speel Lake, 1978, 1979, 1981, and 1982.

Year	Outside 103, 104, 113, 152, 154 157, 181, 183, 186, 189	Intermediate 105, 109, 110, 112, 114	Inside (Troll and Sport)	Inside (Drift Gillnet)	Total
1978	10.0%	44.3%	22.6%	14.4%	66.8%
1979	25.6%	15.7%	7.3%	11.4%	48.5%
1981	9.9%	29.3%	2.5%	3.9%	40.2%
1982	29.0%	54.0%	-	12.6%	71.4%

[1] Harvest rate is defined as the proportion of a stock available in an area that is harvested by fisheries in that area.

Table 15. Estimated harvest rate[1] by area for coho salmon returns to the Berners River, 1978, 1979, and 1982.

Year	Outside 113, 116, 154, 157 181, 183, 186, 189	Intermediate 105, 109, 110, 112, 114	Inside (Troll and Sport)	Inside (Drift Gillnet)	Total
1978	14.8%	33.5%	4.7%	57.2%	77.1%
1979	27.4%	7.8%	2.5%	35.2%	57.7%
1982	13.9%	24.1%	-	56.3%	71.5%

[1] Harvest rate is defined as the proportion of a stock available in an area that is harvested by fisheries in that area.

The estimated 1982 harvest rate in outside waters for the Hugh Smith Lake stock was 33.9% (Table 12). This is similar to the combined estimate of 30.6% for the 1981 return to three hatcheries in District 101 (Shaul et al. 1983). Both of these estimates exclude the Canadian harvest. The estmated harvest rate of the Hugh Smith Lake stock in inside waters (predominantly Districts 101 and 102) was 35.1%.

Total 1982 harvest rate estimates ranged from 33.4% for Politofski Lake to 76.7% for Klakas Lake (Table 12), and averaged 57.7%. Total harvest rates for Stephens Passage and Lynn Canal systems were estimated at 44.4% for Auke Lake, 71.4% for Speel Lake, and 71.5% for the Berners River. The estimate for Speel Lake was the highest recorded (Table 14), while the estimate for Auke Lake fell between the 1978 figure of 56.8% and 1980-1981 figures of 11.8% and 27.0%, respectively (Table 13). The 1982 total harvest rate estimate for the Berners River was within the range of previous estimates for 1974 at 77.4% (Gray et al. 1978), 77.1% in 1978, and 57.7% in 1979 (Table 15). Harvest rates for central outside stocks were estimated at 39.0% for Ford Arm Lake and 33.4% for Politofski Lake. Stocks in District 103 (southern outside coast) apparently received more fishing pressure than central outside area stocks with estimates of 63.0% for Warm Chuck Lake and 76.7% for Klakas Lake. The total harvest rate for Hugh Smith Lake was estimated at 62.1% excluding the Canadian harvest. In 1981, British Columbia fisheries harvested an estimated 9.4% of the total return to three hatcheries near Hugh Smith Lake in District 101 (see Table 21). Assuming that a similar Canadian interception rate for the Hugh Smith Lake stock occurred in 1982, the total harvest rate would have been approximately 70%.

MIGRATORY TIMING

An understanding of migratory timing features of individual component stocks in the highly mixed stock fisheries for coho salmon is necessary improvement of management techniques. Coded-wire tagging and recovery provides such information albeit often with marginal sample sizes. Repetition of tagging experiments over a period of years is needed to develop confidence in our understanding of the timing features of individual stocks and their position in the overall temporal composite of stocks reflected in the seasonal catch curve.

In the following figures (6-29), biweekly estimates of commercial catch and CPUE of tagged adult coho salmon from individual stocks in different areas are shown as a proportion of the season total by bar graphs. For comparison, time density distributions of total coho salmon catch or CPUE of all available stocks in the same areas are displayed as line graphs.

In this analysis, the time strata used were 2 week periods corresponding to the statistical weeks shown in Appendix Table 2. For CPUE determinations, the estimated catch of tagged fish was multiplied by the proportion of the total commercial catch harvested by power troll gear for each area - time stratum. Effort was expressed in power troll units. The total number of landings per week was available from fish ticket data while the average number of days fished per trip was available from interviews with skippers by the port sampling staff. Catch per unit of effort (c/f) is the ratio of the estimated power troll harvest (c) of coded-wire tagged fish from a certain stock to the total number of landings made

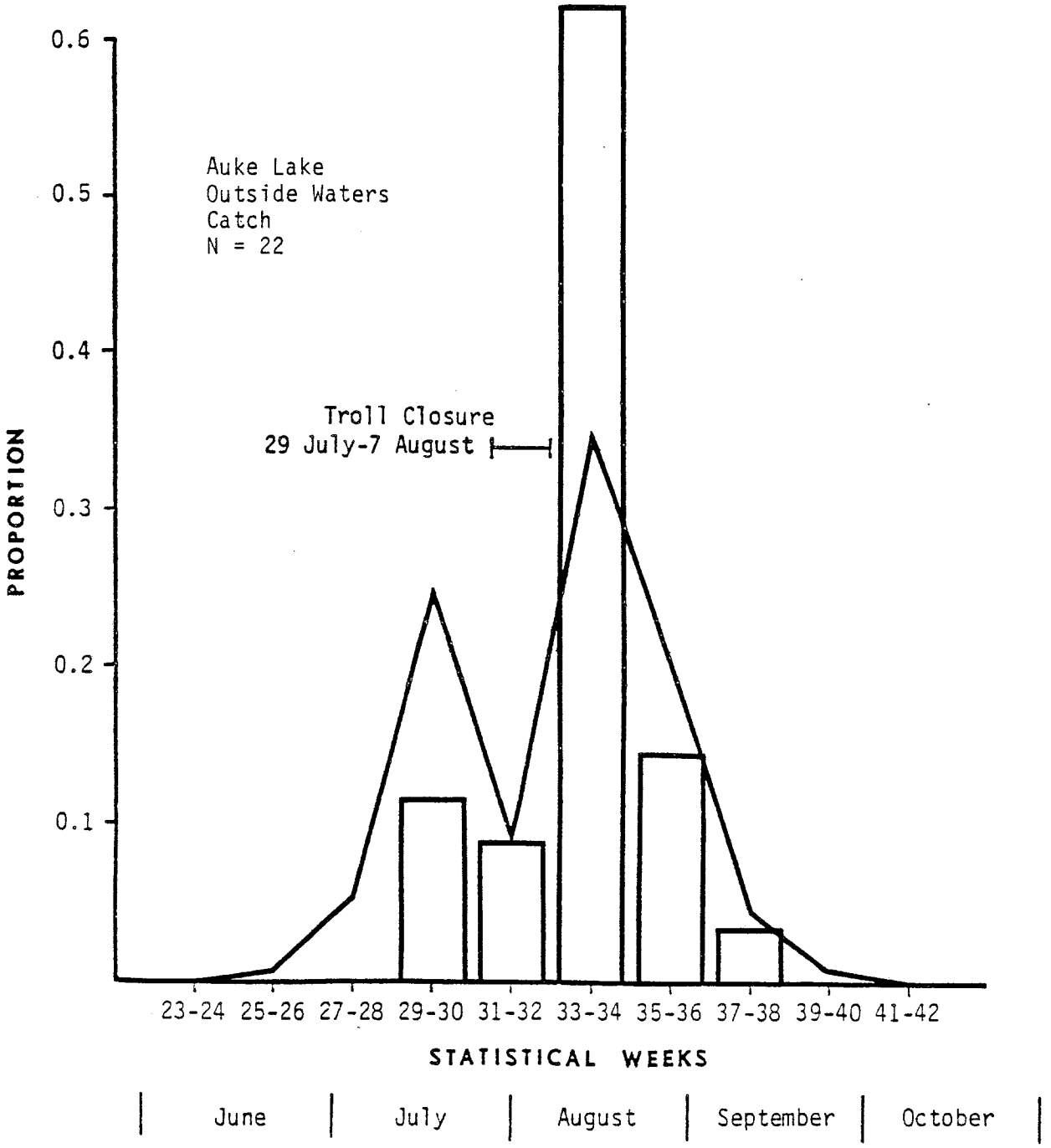

Figure 6. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Auke Lake coho salmon (bar graph) in outside waters, 1982.

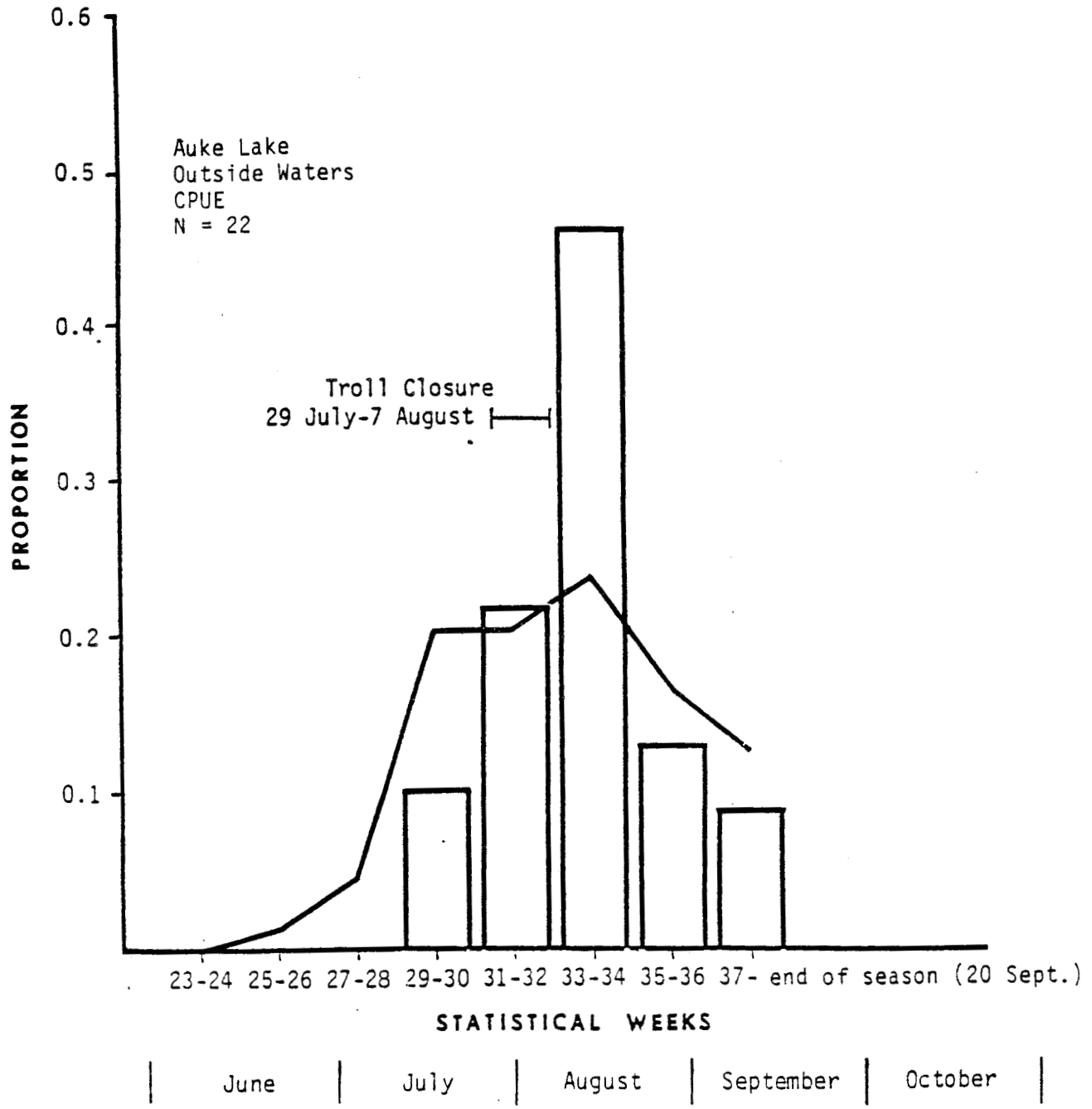

Figure 7. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Auke Lake coho salmon (bar graph) in outside waters, 1982.

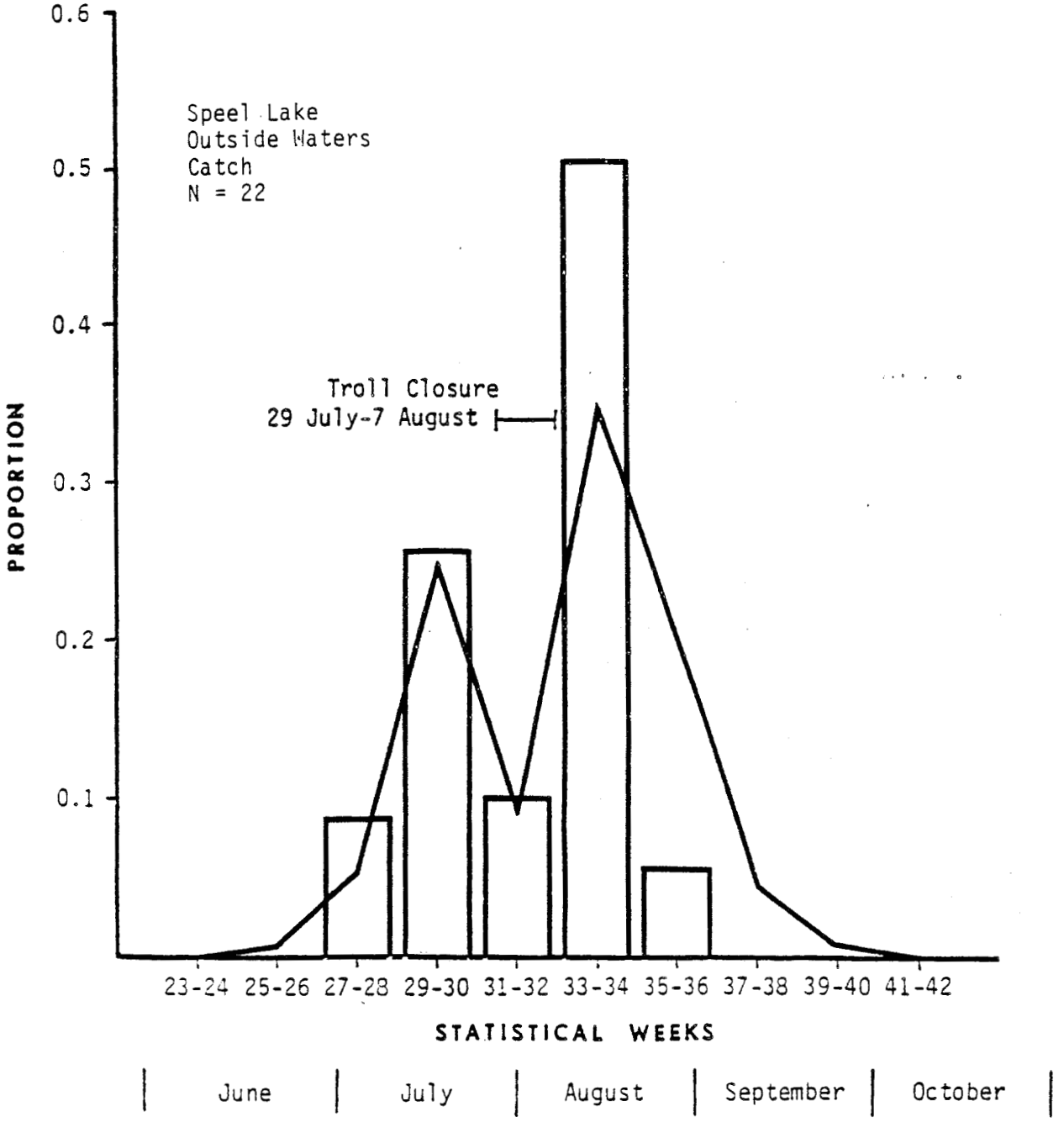

Figure 8. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Speel Lake coho salmon (bar graph) in outside waters, 1982.

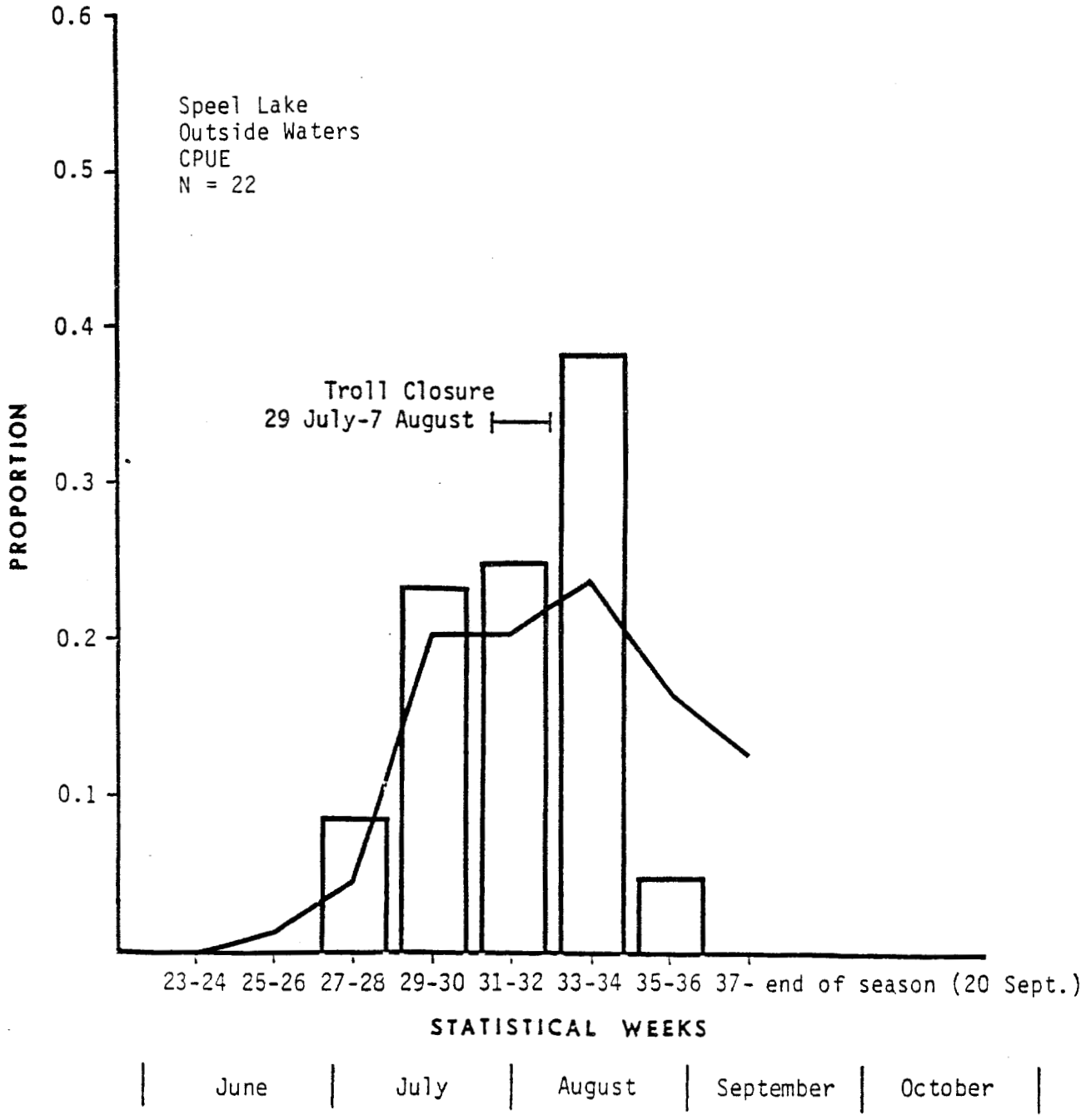

Figure 9. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Speel Lake coho salmon (bar graph) in outside waters, 1982.

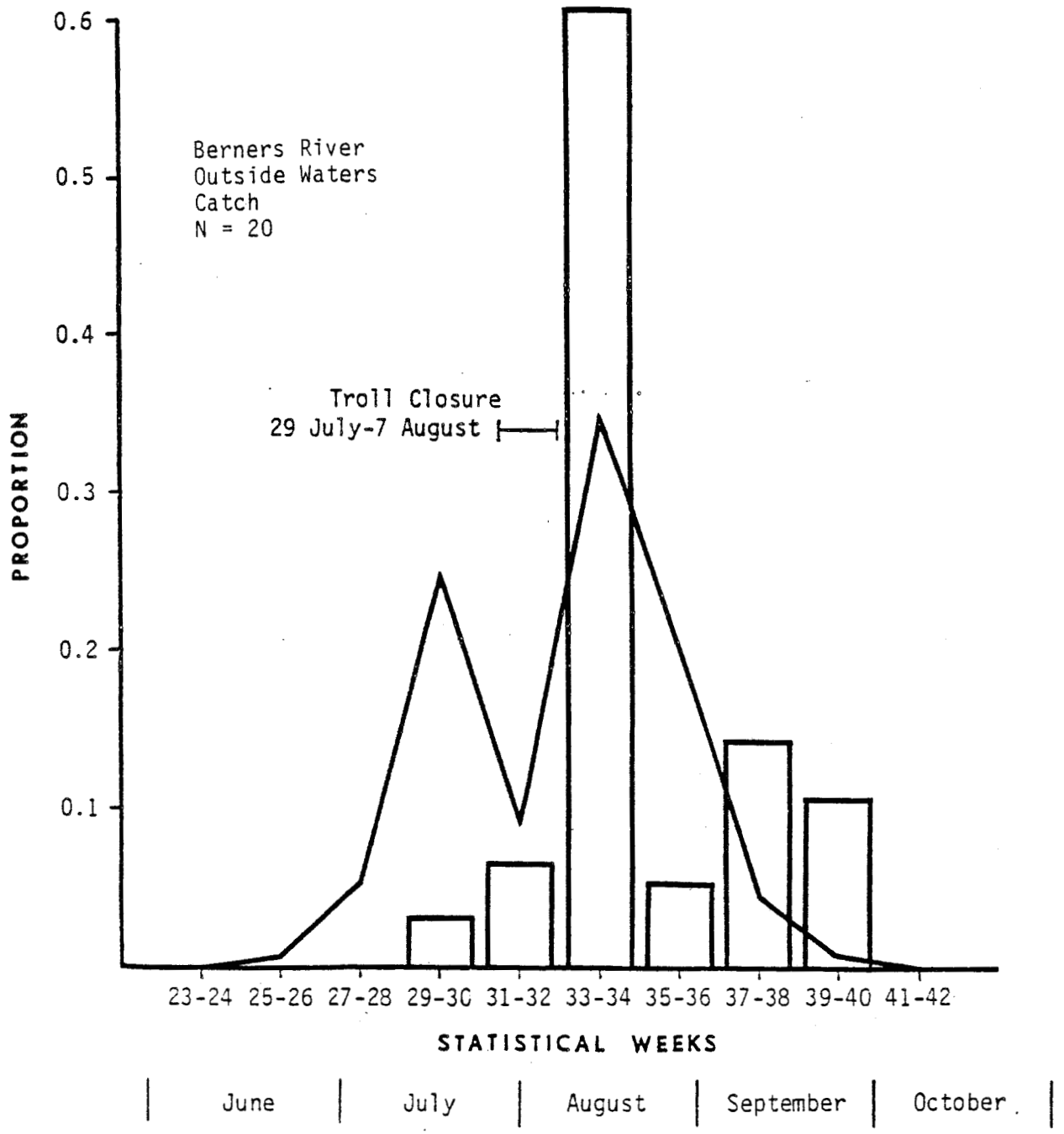

Figure 10. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Berners River coho salmon (bar graph) in outside waters, 1982.

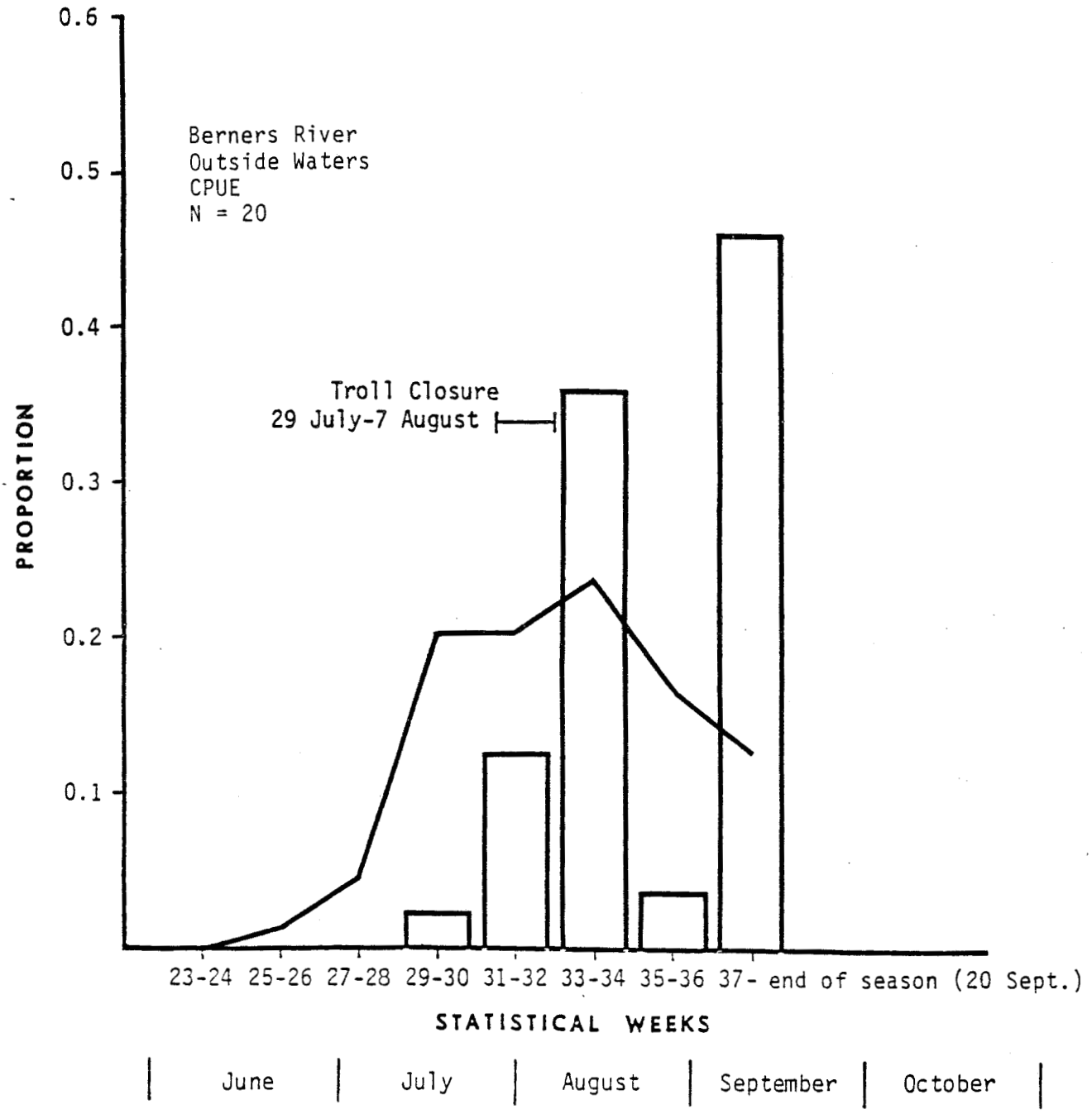

Figure 11. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Berners River coho salmon (bar graph) in outside waters, 1982.

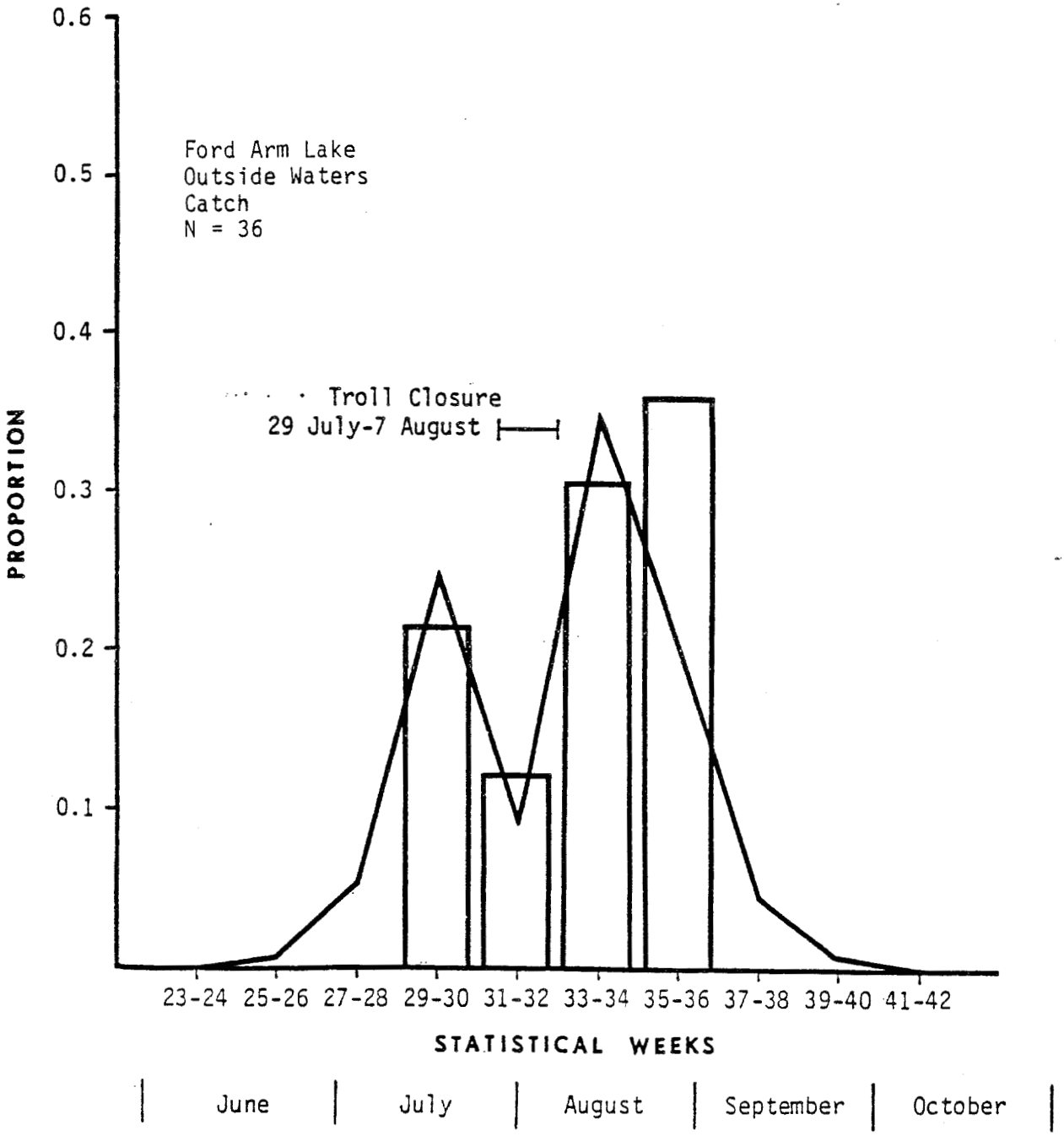

Figure 12. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Ford Arm Lake coho salmon (bar graph) in outside waters, 1982.

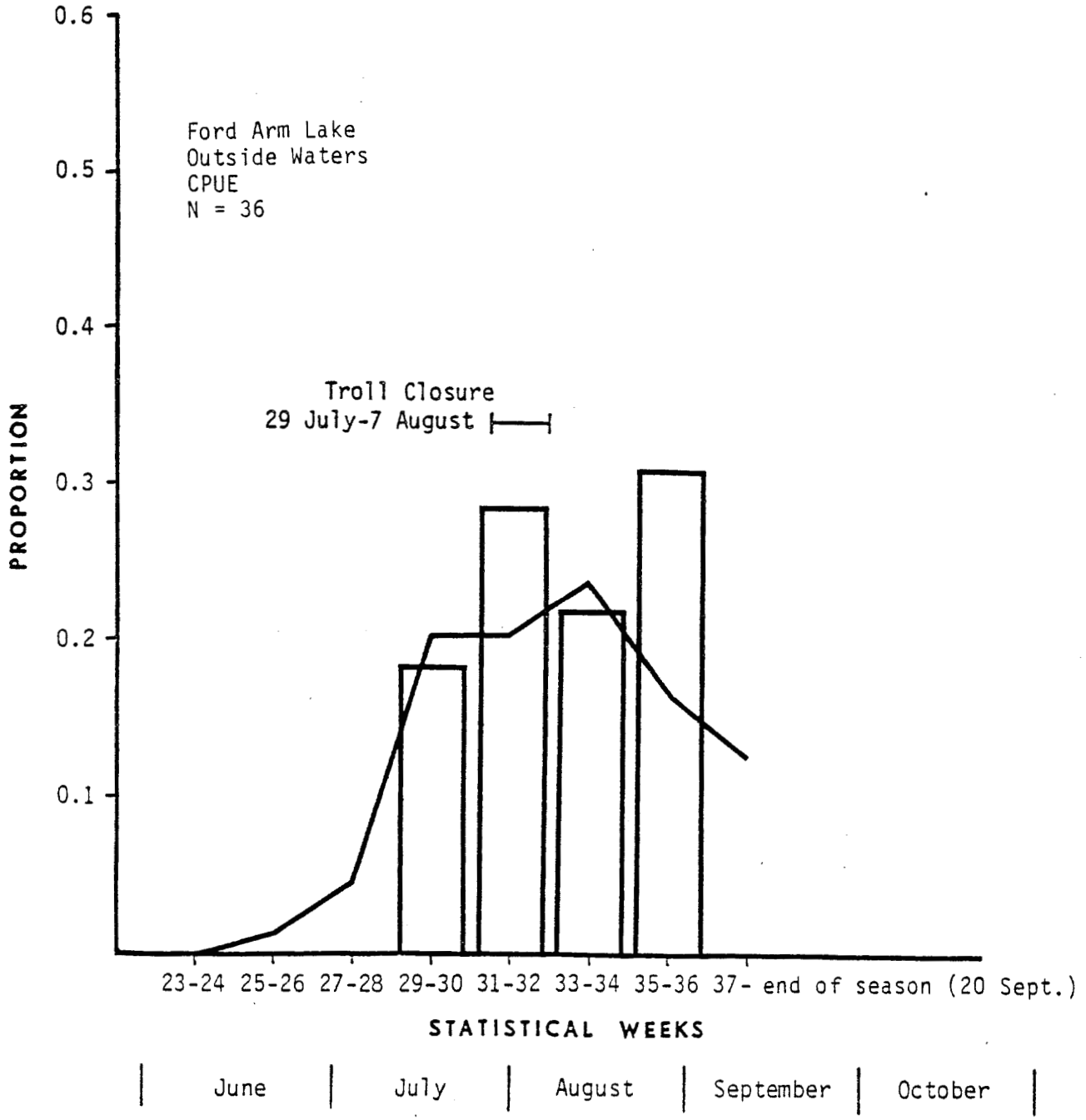

Figure 13. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Form Arm Lake coho salmon (bar graph) in outside waters, 1982.

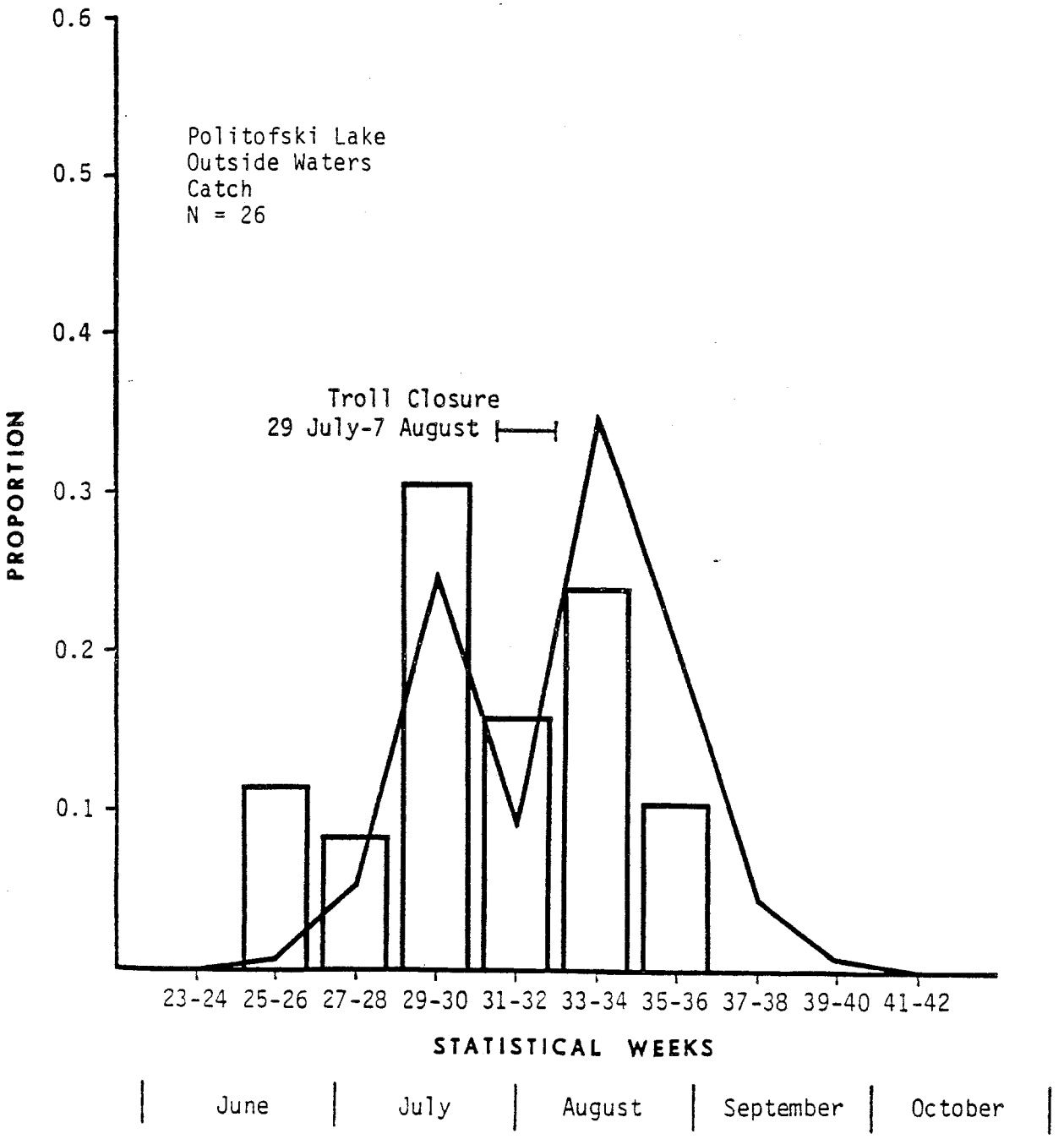

Figure 14. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Politofski Lake coho salmon (bar graph) in outside waters, 1982.

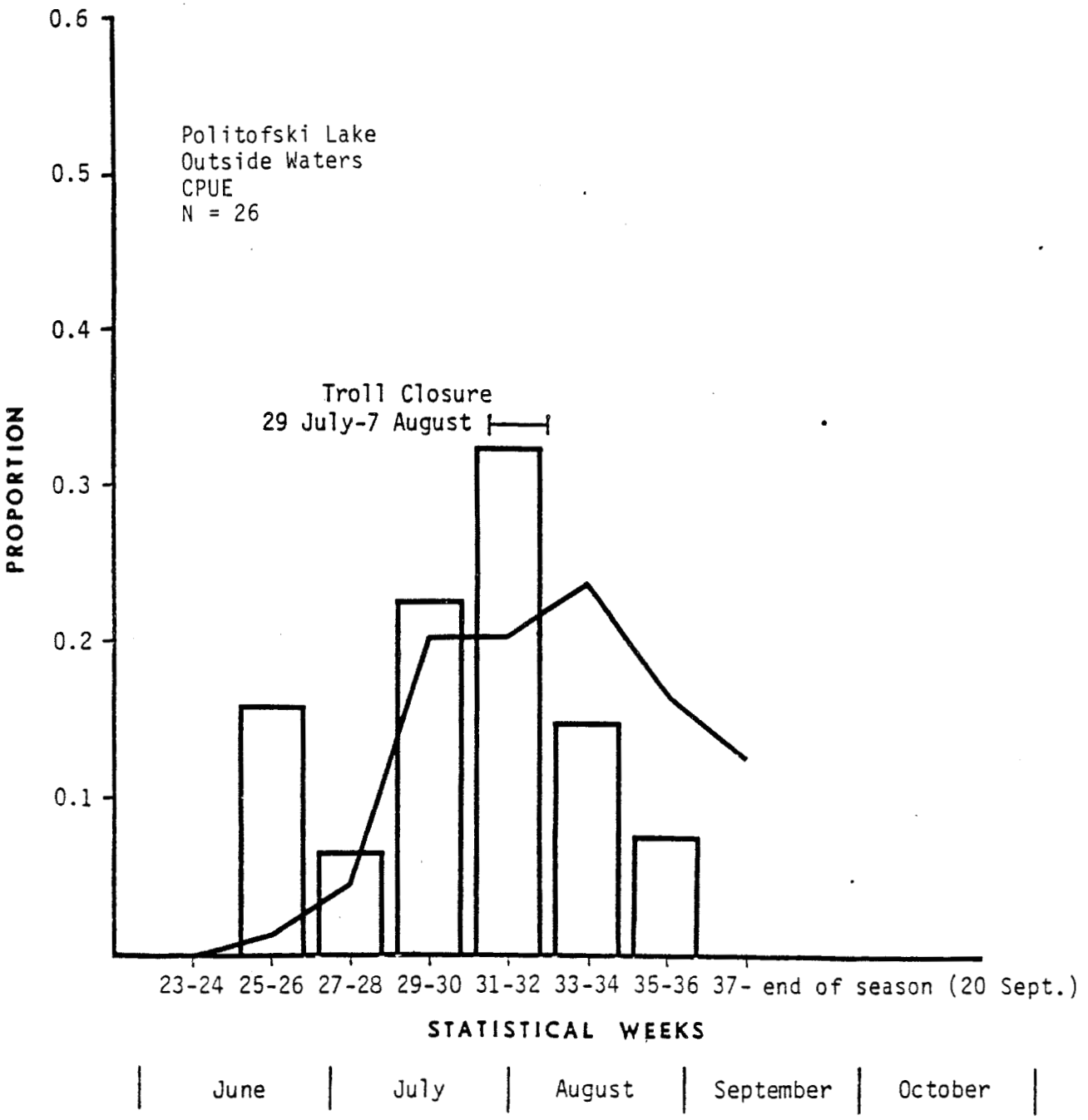

Figure 15. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Politofski Lake coho salmon (bar graph) in outside waters, 1982.

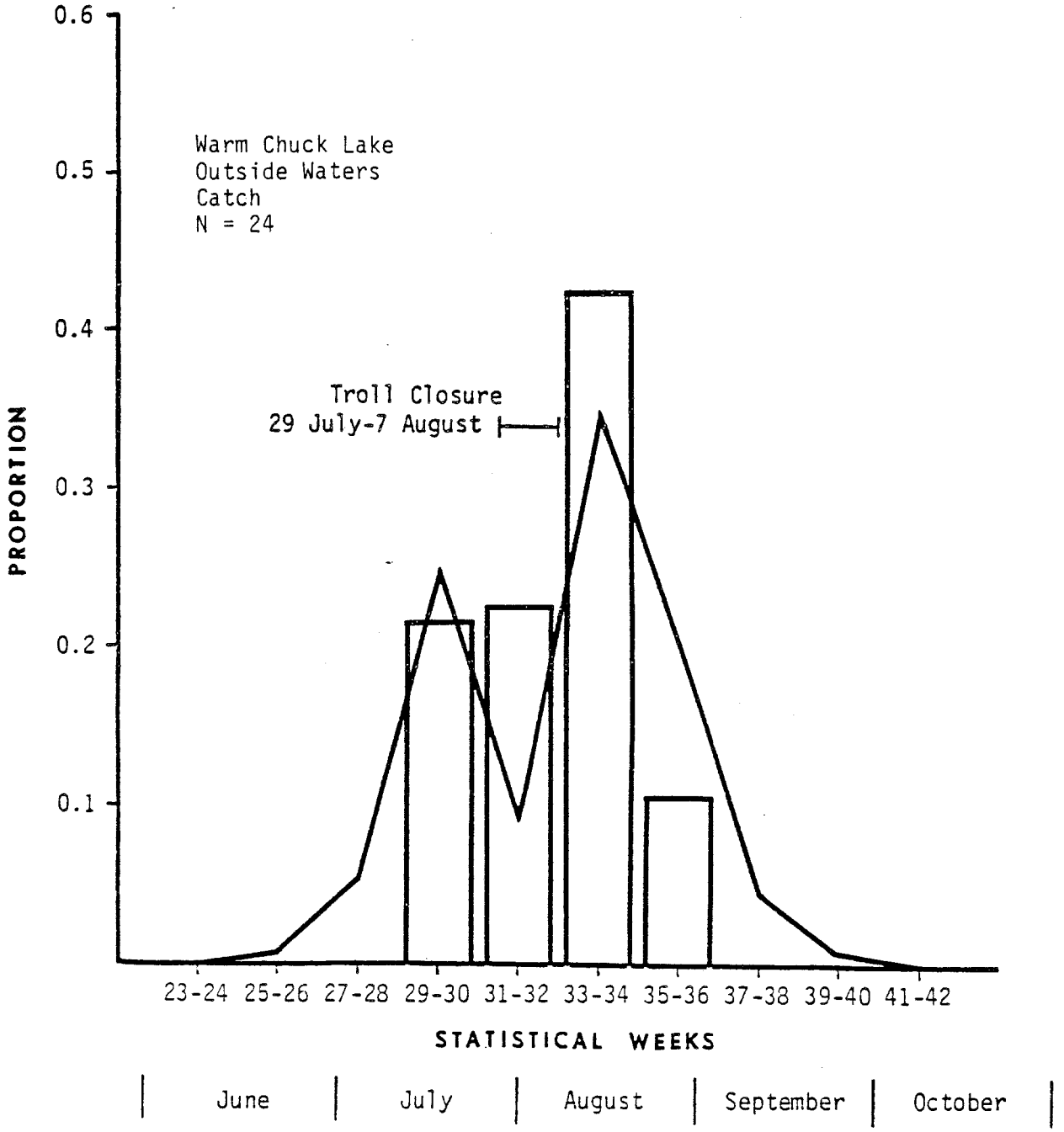

Figure 16. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Warm Chuck Lake coho salmon (bar graph) in outside waters, 1982.

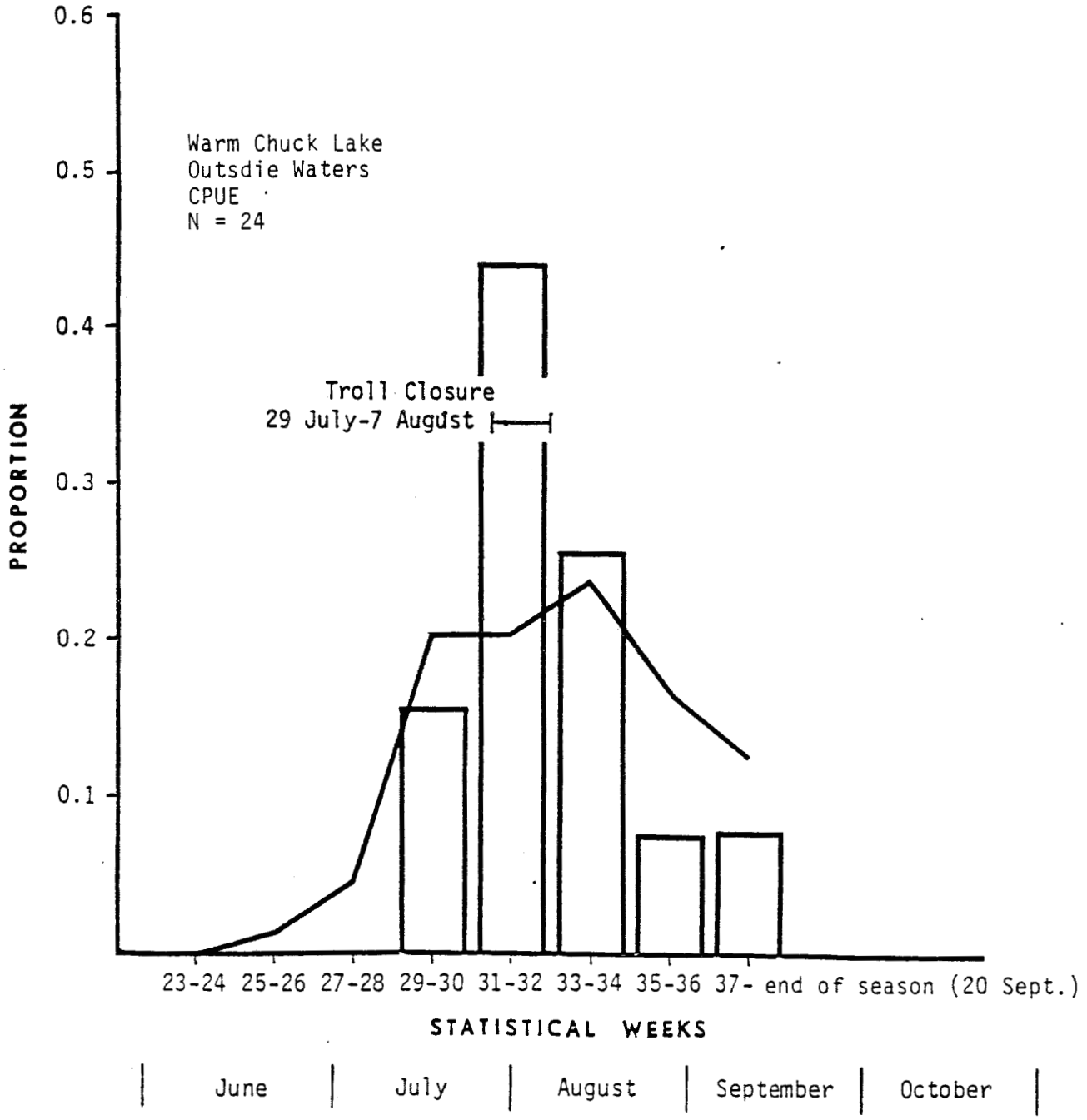

Figure 17. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Warm Chuck Lake coho salmon (bar graph) in outside waters, 1982.

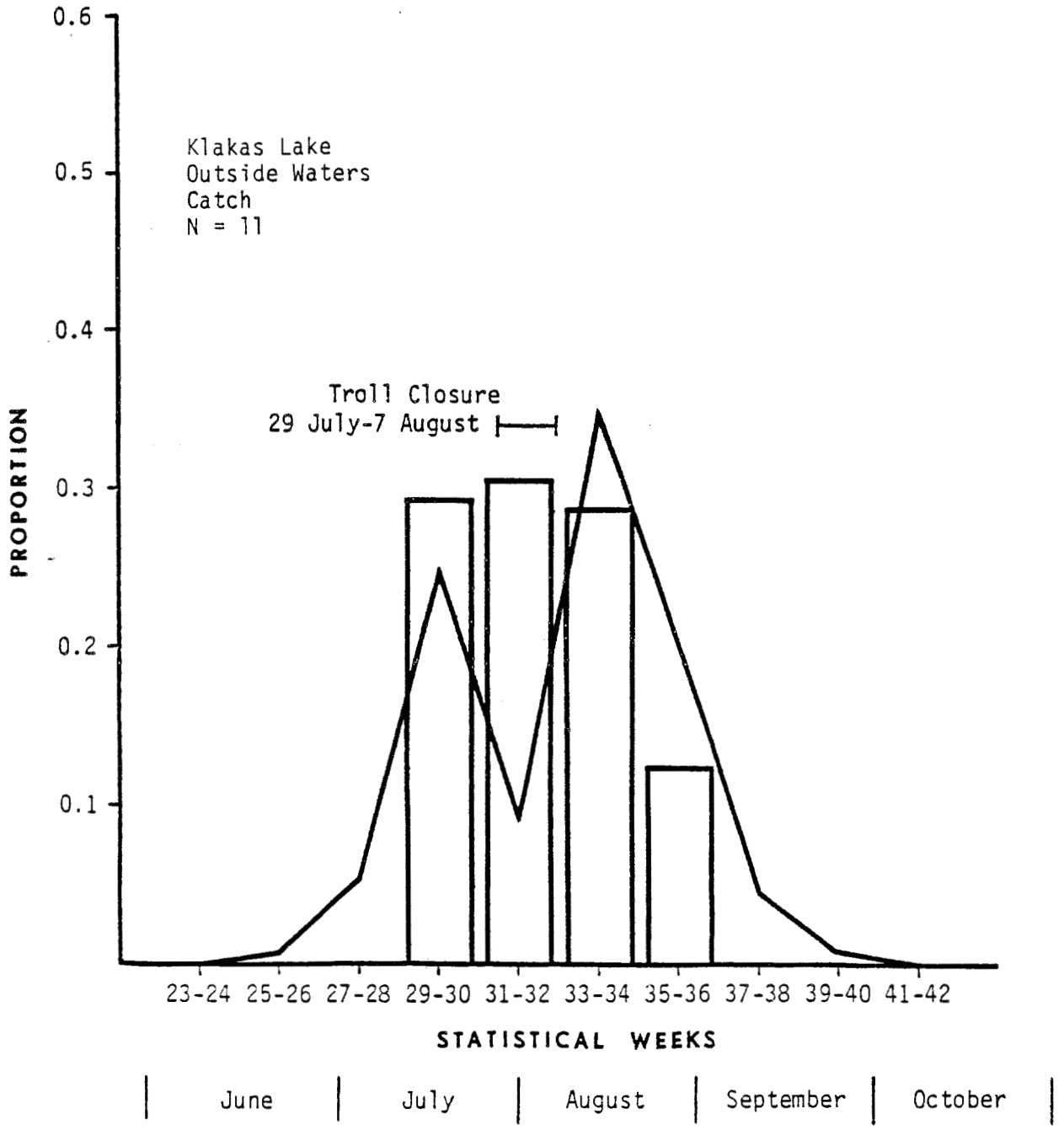

Figure 18. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Klakas Lake coho salmon (bar graph) in outside waters, 1982.

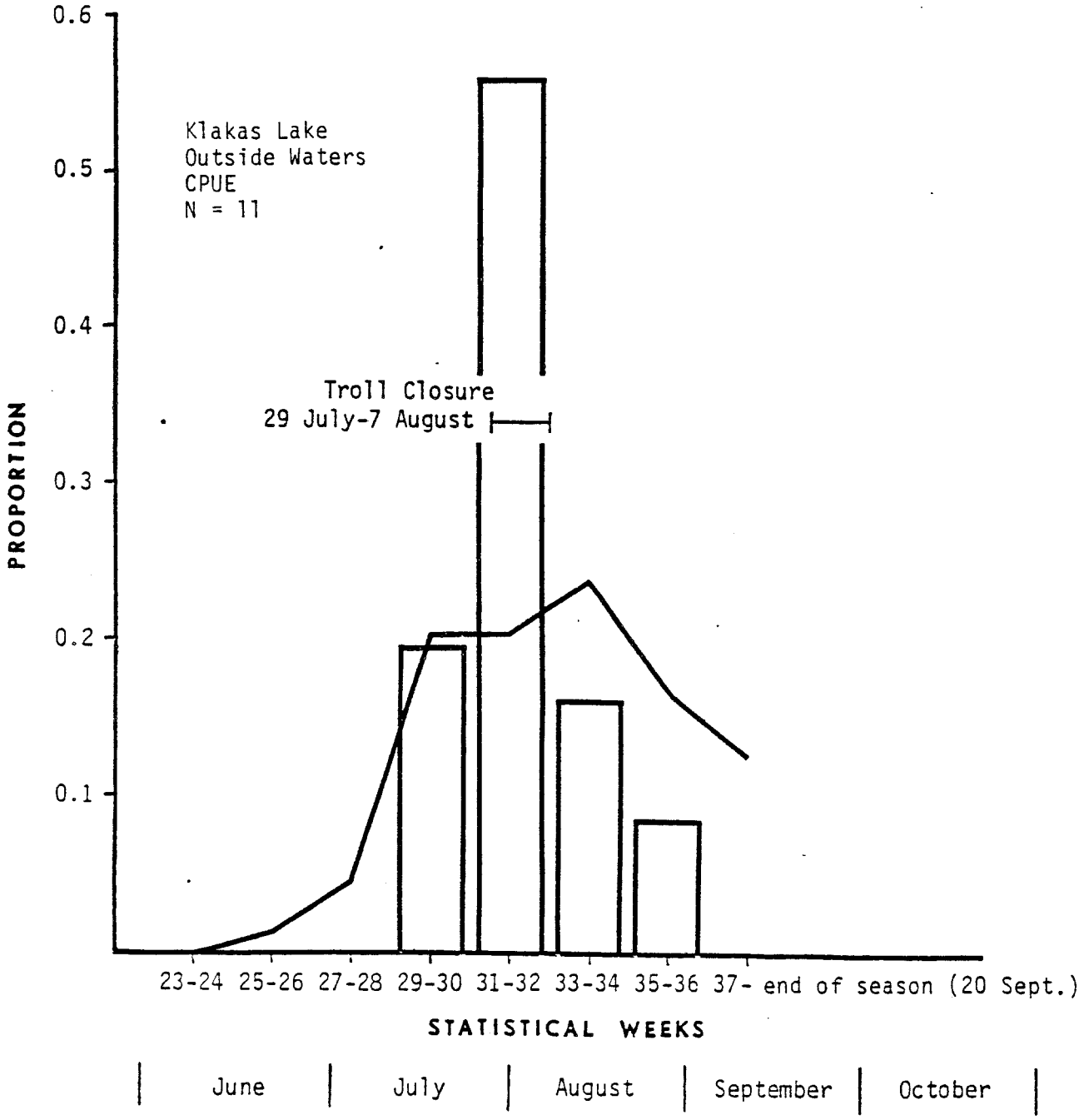

Figure 19. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Klakas Lake coho salmon (bar graph) in outside waters, 1982.

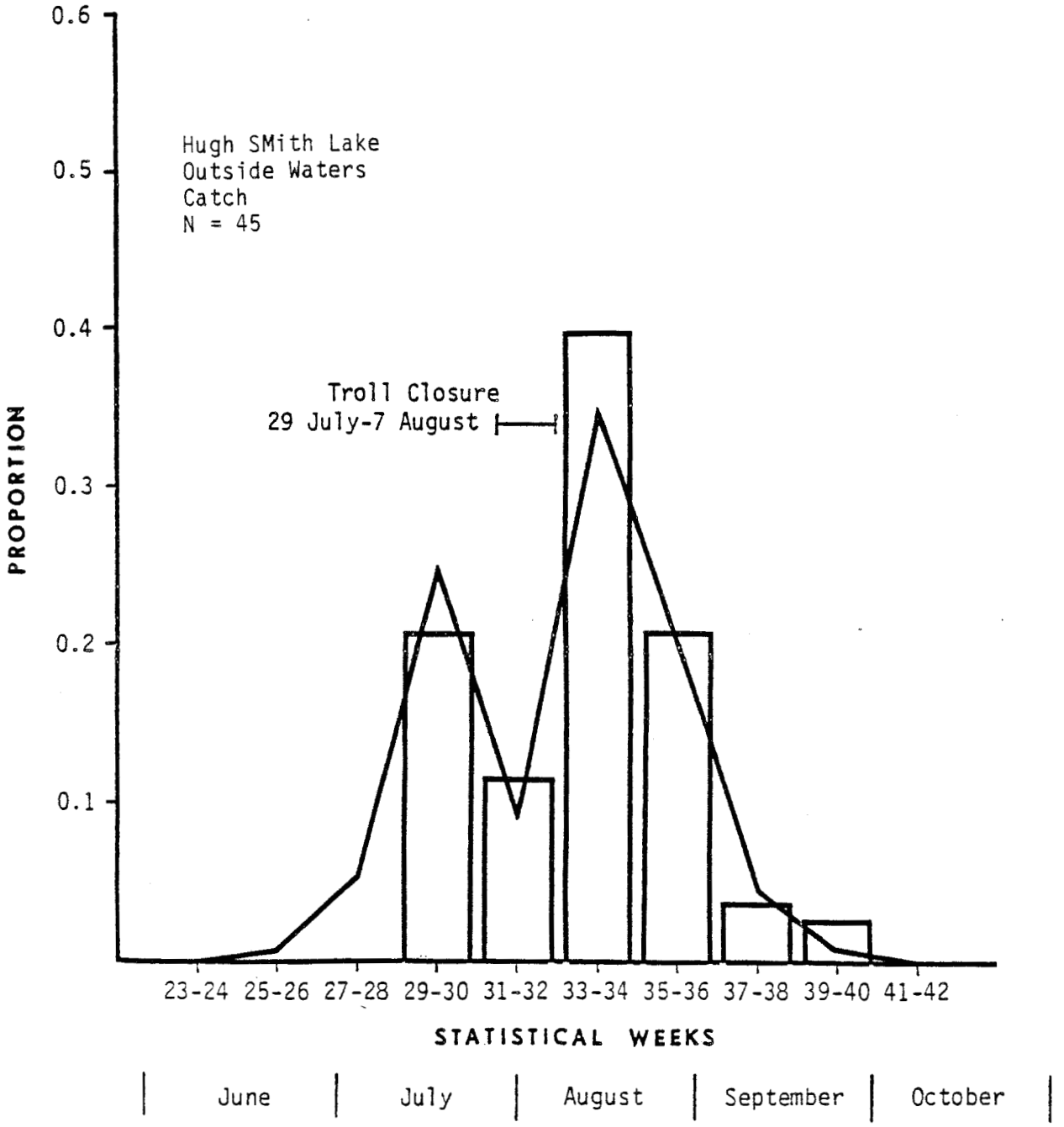

Figure 20. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Hugh Smith Lake coho salmon (bar graph) in outside waters, 1982.

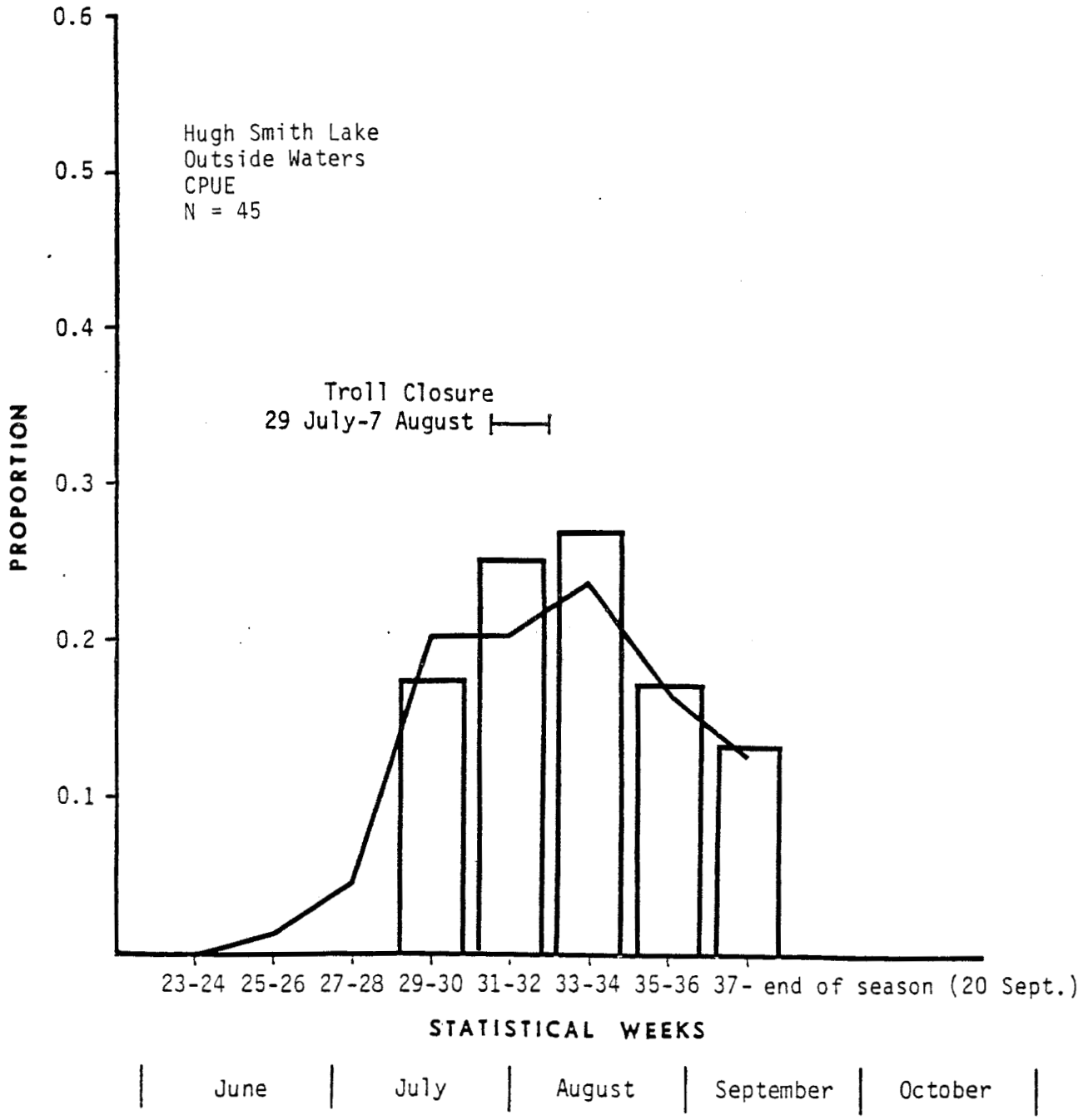

Figure 21. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Hugh Smith Lake coho salmon (bar graph) in outside waters, 1982.

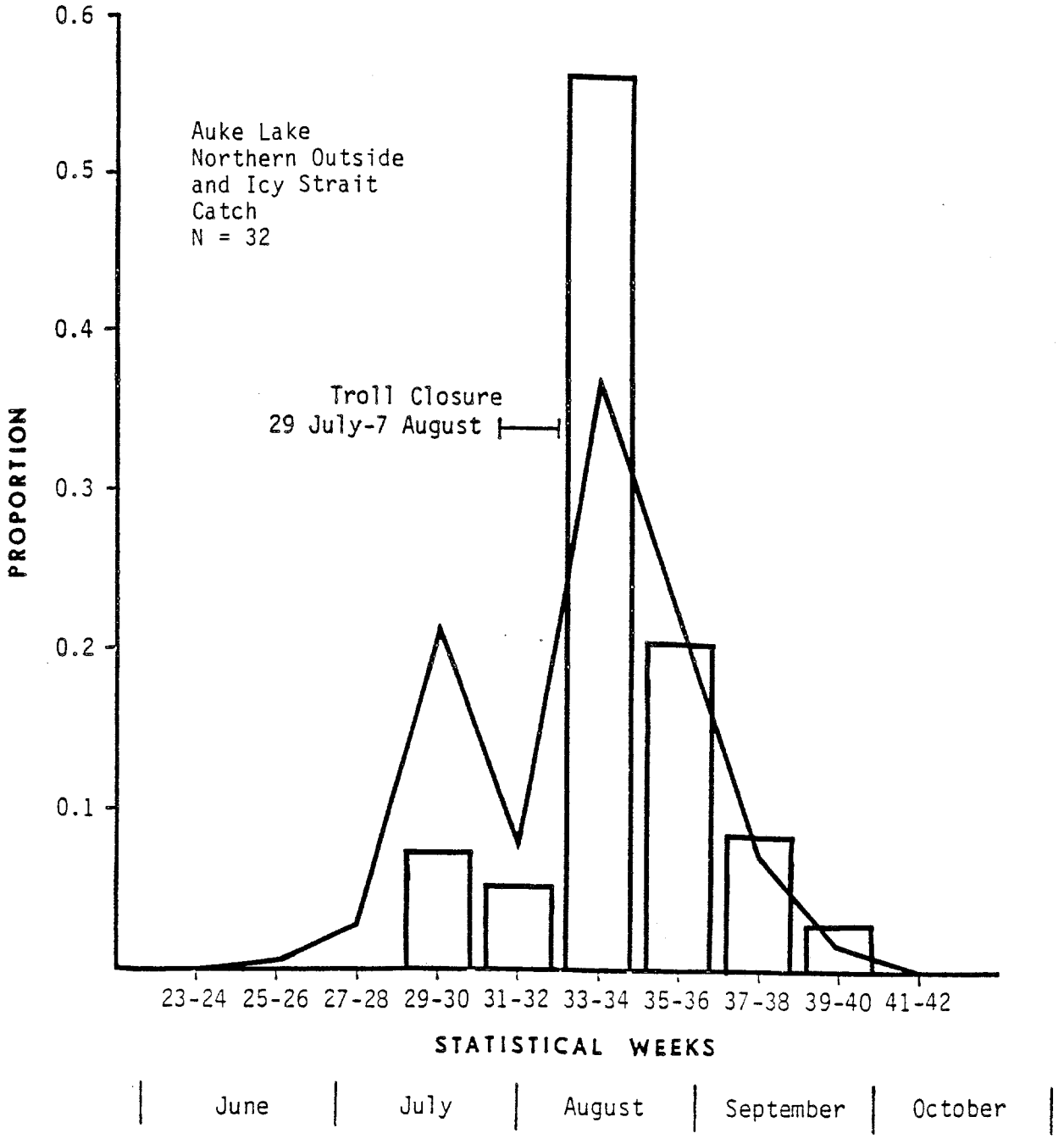

Figure 22. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Auke Lake coho salmon (bar graph) in Icy Strait and outside waters north of Helm Point, 1982.

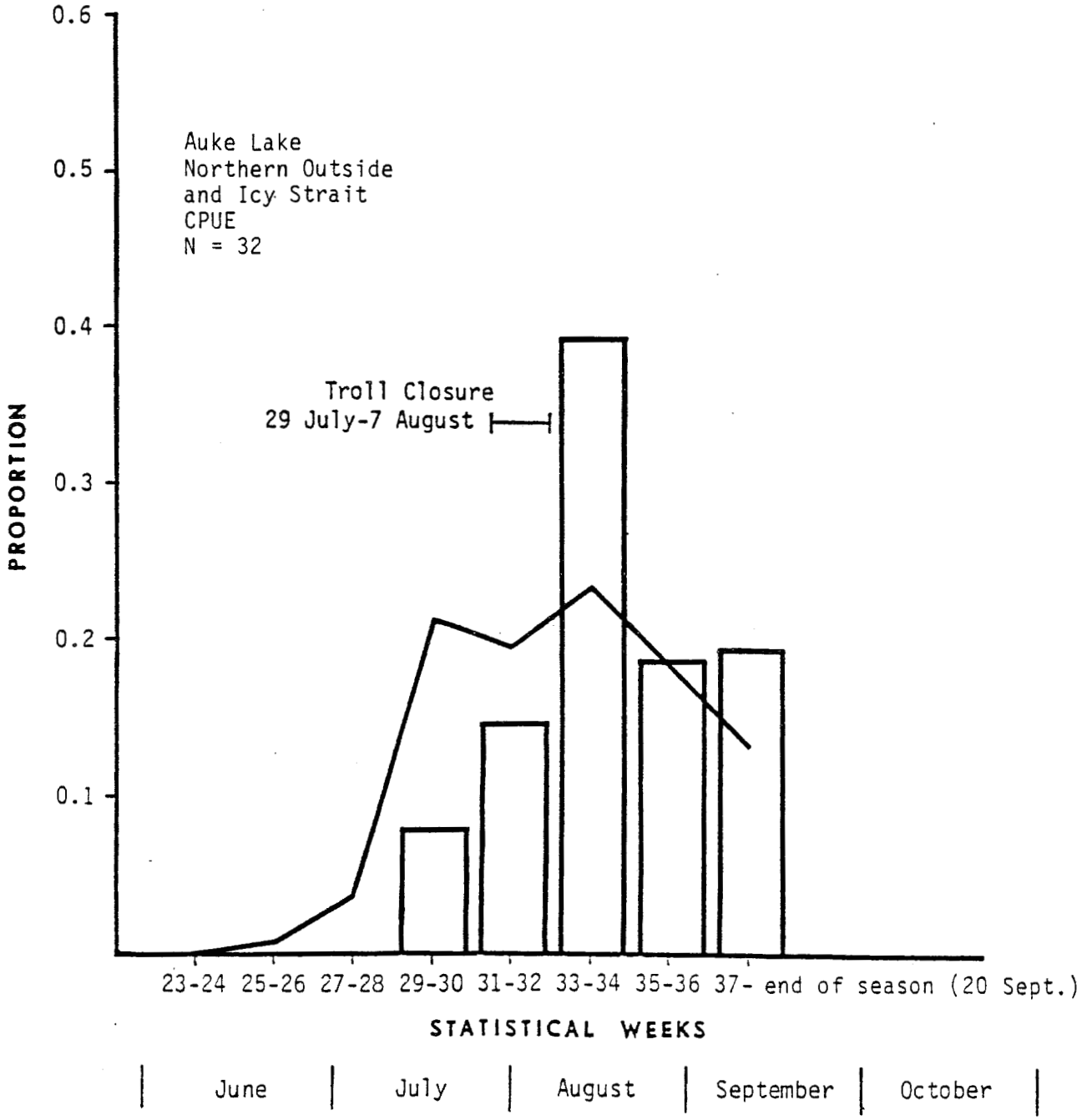

Figure 23. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Auke Lake coho salmon (bar graph) in Icy Strait and outside waters north of Helm Point, 1982.

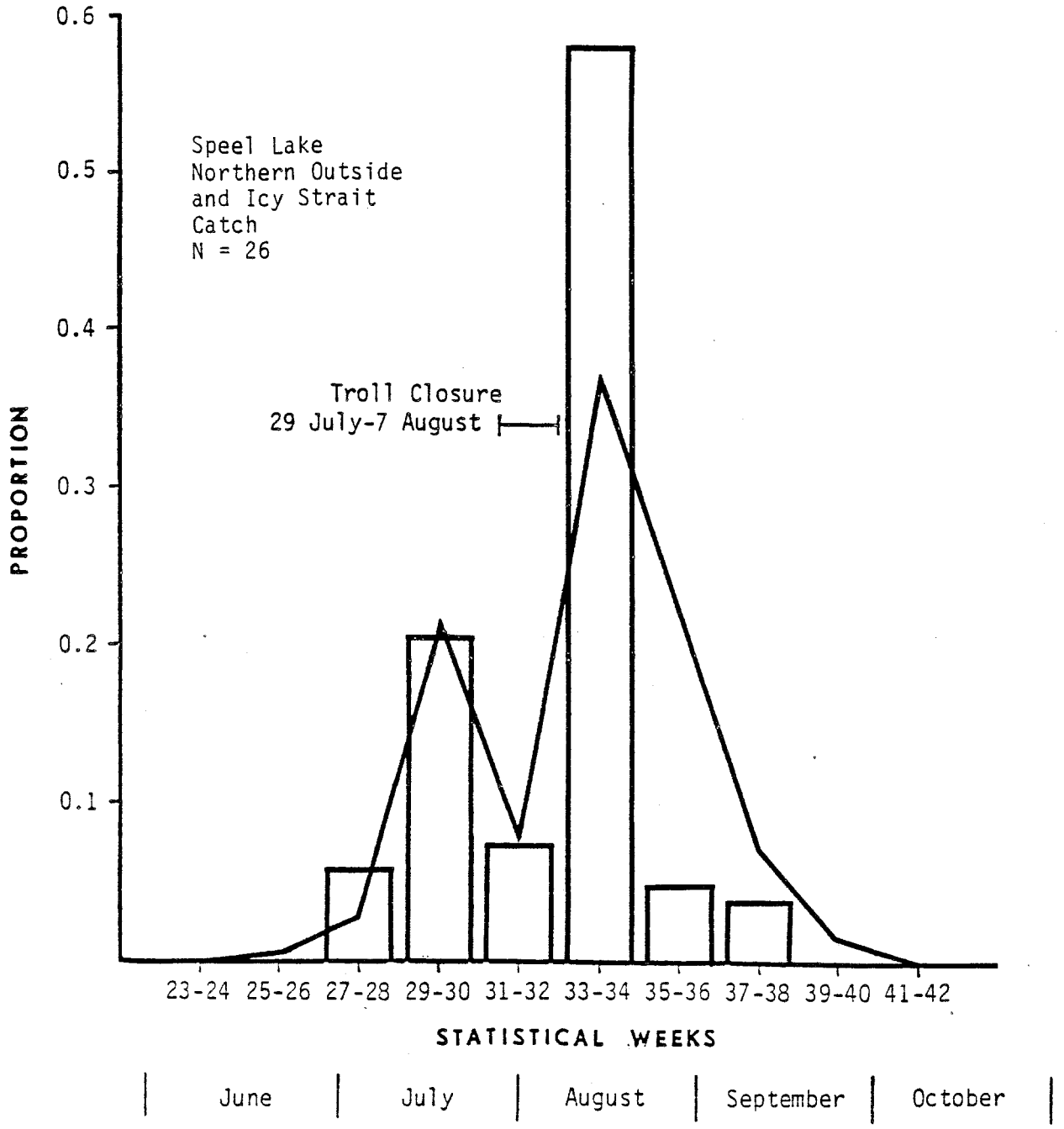

Figure 24. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Speel Lake coho salmon (bar graph) in Icy Strait and outside waters north of Helm Point, 1982.

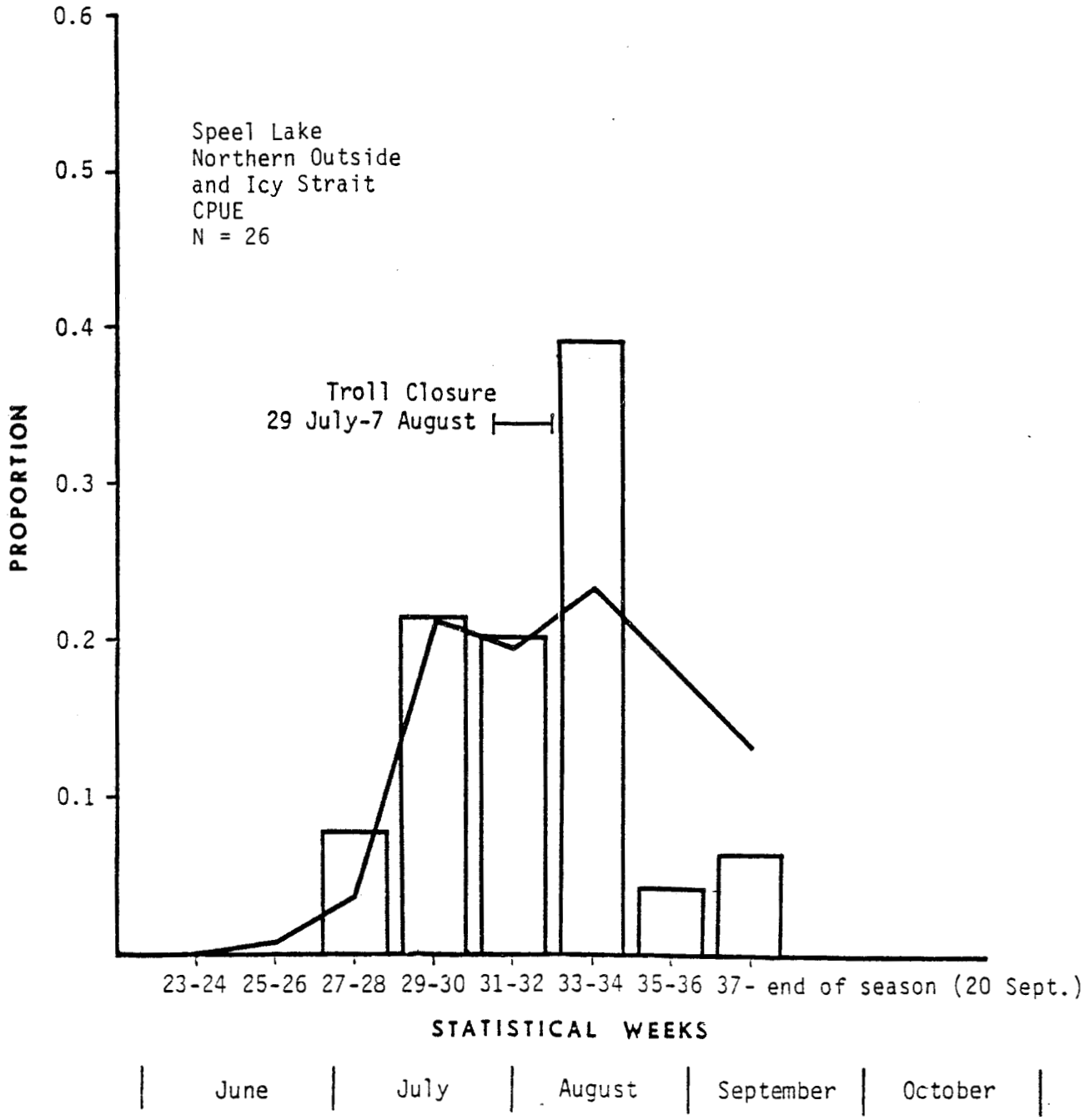

Figure 25. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Speel Lake coho salmon (bar graph) in Icy Strait and outside waters north of Helm Point, 1982.

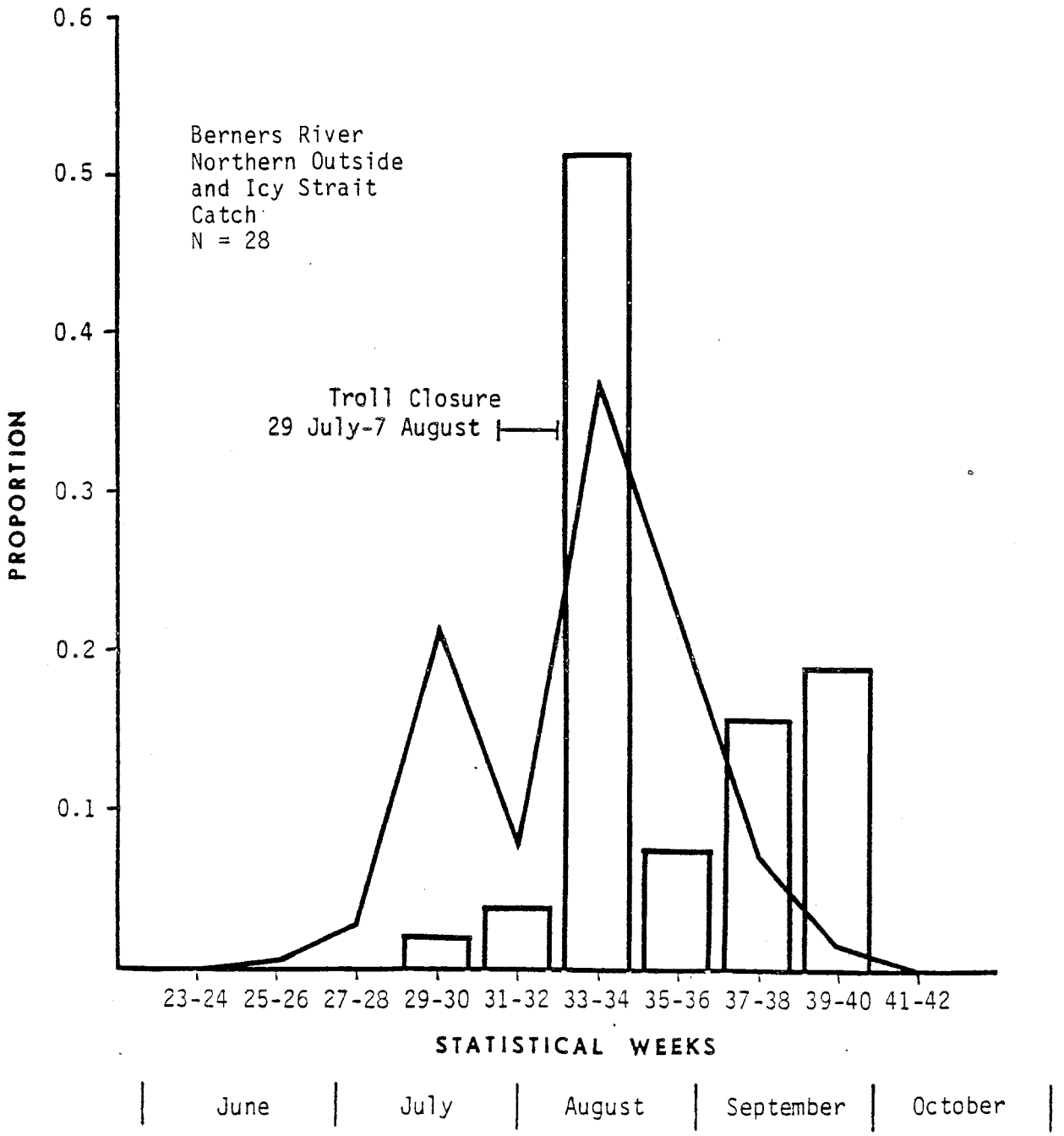

Figure 26. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Berners River coho salmon (bar graph) in Icy Strait and outside waters north of Helm Point, 1982.

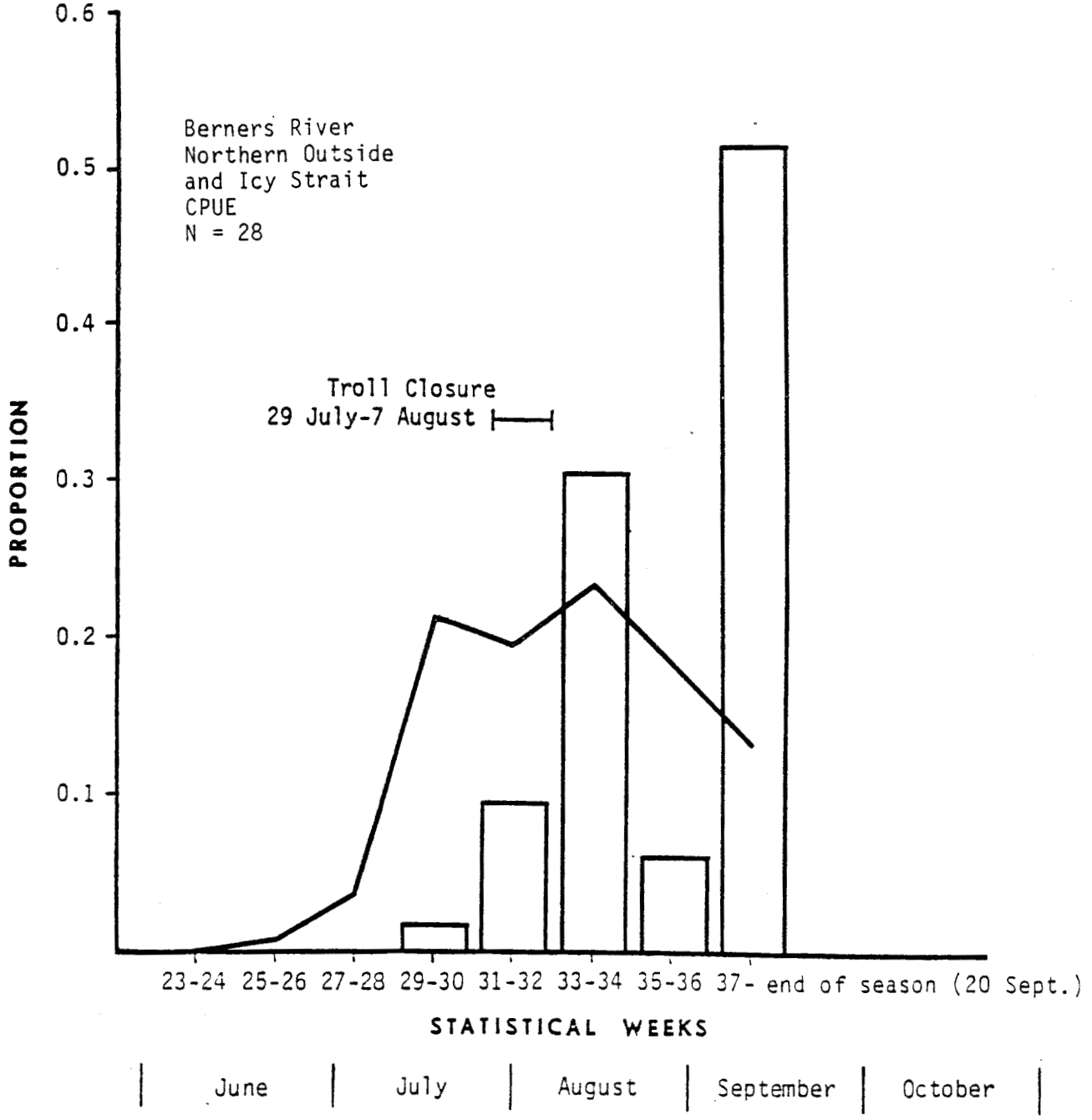

Figure 27. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Berners River coho salmon (bar graph) in Icy Strait and outside waters north of Helm Point, 1982.

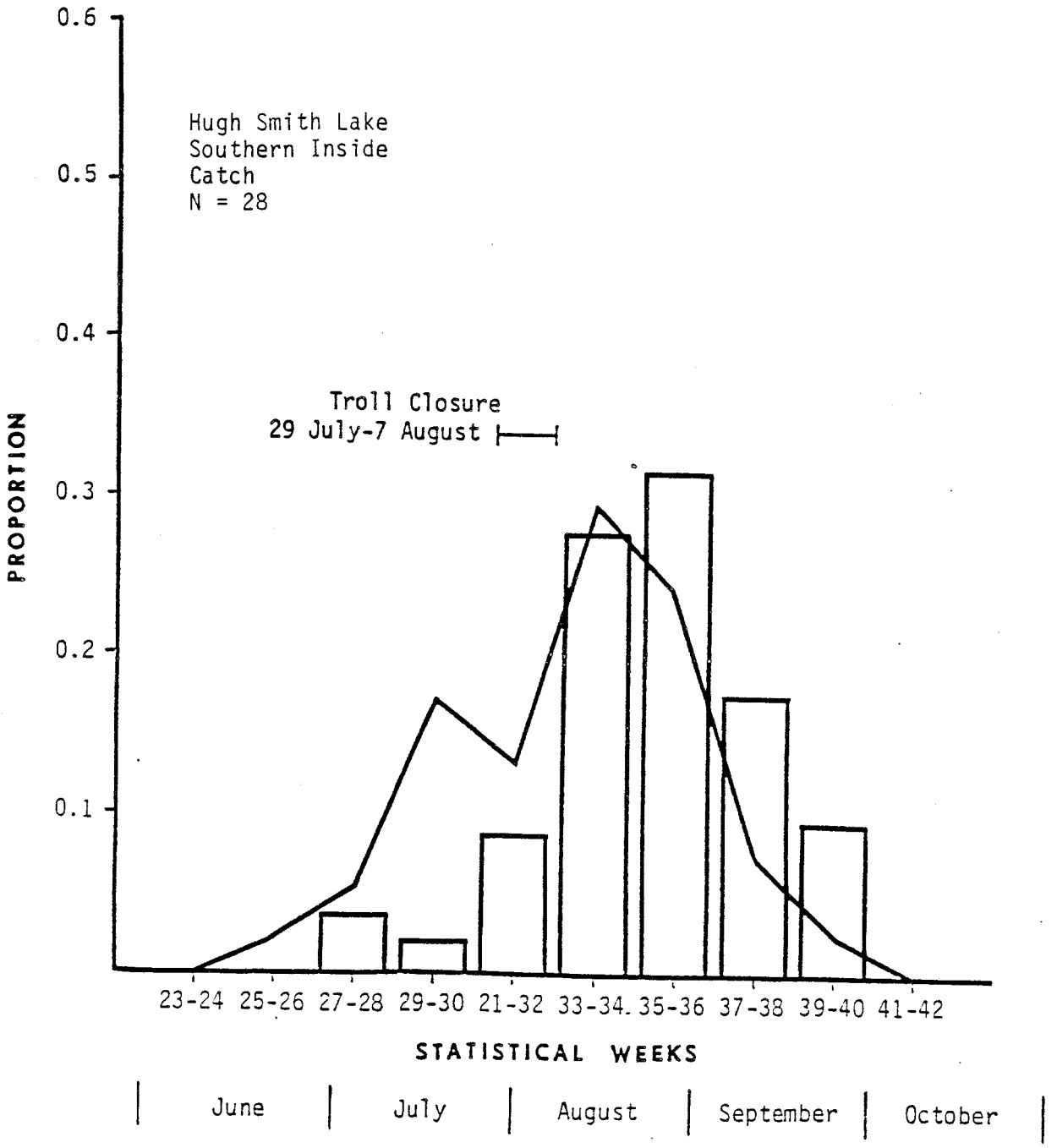

Figure 28. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged Hugh Smith Lake coho salmon (bar graph) in Districts 101 and 102, 1982.

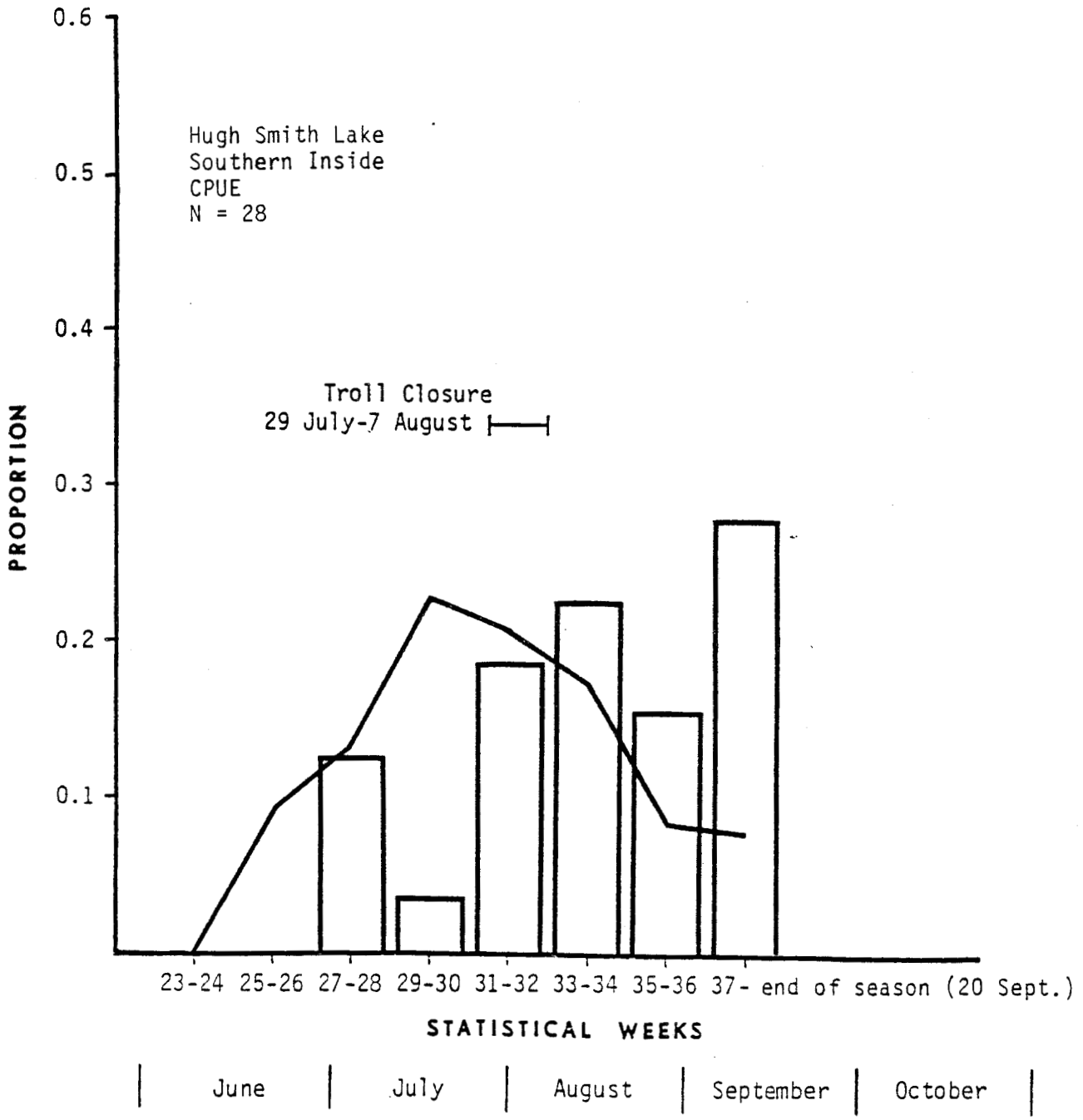

Figure 29. Biweekly proportion of coho salmon CPUE (line graph) and estimated CPUE of coded-wire tagged Hugh Smith Lake coho salmon (bar graph) in Districts 101 and 102, 1982.

times the average number of days fished per trip by power troll vessels (f). No attempt was made to account for the effect of targeting on different species as was done by Funk (1981).

The resulting time density distributions were based on the date when the fish were landed instead of when they were caught. Since the average trip length for troll vessels was approximately 4-6 days, the time when fish were caught preceded the time when they were landed by an average of 2-3 days. The lag time between catch and landing probably averaged less for purse seine and drift gillnet vessels than for troll vessels.

For CPUE determinations, the first 2 days of week 39 (19-20 September) were included in the same stratum with weeks 37-38, as the troll season ended on 20 September.

Outside Waters

Figures 6-21 show the estimated time density distributions of catch and catch per unit of effort (CPUE) for eight coho salmon stocks in outside waters (Districts 103, 104, 113, 116, 152, 154, 157, 181, and 189). The total coho salmon catch increased dramatically in outside waters during mid-July but then decreased during weeks 31-32 as a 10-day closure during 29 July - 7 August permitted troll vessels to fish during only 4 days of the 2-week period. The peak catch of 401,631 fish occurred during 8-21 August (weeks 33-34) immediately following the closure. Catches then declined and approximately 95% of the catch had been taken by the end of the first week of September. The total season coho salmon catch in outside waters was 1,165,368. The midpoint (median date) of the catch occurred during the second week of August (week 33). CPUE in outside waters apparently also peaked during 8-21 August (weeks 33 and 34) while the midpoint of the time density distribution of CPUE occurred during the second week of August (week 33).

Stocks originating in Auke and Speel Lakes (Figure 2) in Stephens Passage apparently are somewhat central in migratory timing compared with overall coho salmon catch and abundance distributions in outside waters. Figures 6-9 and 1981 data (Shaul et al. 1983) show that the peaks and midpoints of both stocks in outside waters occurred near the middle of August. These stocks were available from early July through early or mid-September.

The Berners River stock exhibits the latest migration on all Southeastern Alaska coho salmon stocks that have been studied thus far. During 1982, the peak catch of tagged Berners River coho salmon in outside waters was estimated to have occurred during 8-21 August while the midpoint occurred during the third week of August (week 34) (Figure 10). However, CPUE data (Figure 11) indicated that peak availability occurred during early September while the midpoint occurred on approximately 21 August. Findings by Gray et al. (1978) indicated that fluorescent pigment marked coho salmon returning to the Berners and Chilkat Rivers were most abundant in outside waters during late August and early September which is 2-3 weeks later than the peak of overall coho salmon abundance in early to mid-August.

Time-density distributions of catch and CPUE in outside waters for tagged coho salmon returning to Ford Arm and Politofski Lakes located along the north - central outside coast (Figure 2) are shown in Figures 12-15. The Ford Arm Lake

stock exhibited central migratory timing with the apparent midpoints of catch and abundance occurring in early to mid-August. Tagged Ford Arm Lake coho salmon were available during at least early to mid-July through the first week of September (weeks 29-36. The Politofski Lake stock was available during at least the third week of June until early September (weeks 29-36) with the approximate midpoints of catch and CPUE occurring during the last week of July. This suggests that the Politofski Lake stock migrated through outside waters earlier than the Ford Arm Lake stock. The difference in timing may be attributed somewhat to changes in the distribution of troll effort, with decreasing effort occurring in southern District 113 later in the season while the troll fishery in northern Southeastern targets more on stocks that migrate through Icy Strait (Appendix Figure 1). The timing of migration through the Ford Arm Lake and Politofski Lake weirs did not indicate that the Politofski Lake stock was significantly earlier. The midpoints (50% dates) of the migration through the weirs occurred on 11 October and 12 October, respectively, for Ford Arm and Politofski Lakes (Mesiar 1982). The outlet of Politofski Lake is longer with more deep pools and, therefore, returning adults may have remained in the stream for a longer period of time before entering the lake compared with Ford Arm Lake. Additional information about the migratory timing of these stocks will be available following analysis of the 1983 tag recovery and weir data.

Time-density distributions of catch and CPUE in outside waters for Warm Chuck and Klakas Lakes located along the southern outside coast (District 103) are shown in Figures 16-19. Both stocks appear to have exhibited central timing distributions as they were available during at least early to mid-July through early September. The midpoints of the migration of both stocks in outside waters were estimated to have occurred during the first week of August.

The Hugh Smith Lake stock (District 101) was also characterized by a central migratory timing pattern in outside waters (Figures 20 and 21). Tagged Hugh Smith Lake fish were available during at least early to mid-July through the end of the troll season on 20 September while the midpoint of the migration occurred during the second week of August (week 33).

Northern Outside Waters and Icy Strait

Figures 22-27 show the estimated time-density distributions of catch and CPUE for three northern Southeastern Alaska stocks (Auke and Speel Lakes and the Berners River) in northern outside waters and Icy Strait (Districts 113, 114, 116, 154, 157, 181, 183, 186, and 189). The overall catch and CPUE temporal distributions for all available stocks were slightly later than timing patterns in outside waters including southern Southeastern. However, the midpoints and peaks of catch and CPUE occurred during 8-21 August (weeks 33-34) for both the outside area and the northern outside - Icy Strait area.

The Auke Lake and Speel Lake stocks were somewhat central in timing with the estimated midpoints and peaks of both stocks occurring during 8-21 August (weeks 33-34) (Figures 22-25). The Auke Lake stock was apparently slightly later than the Speel Lake stock. The Berners River stock showed a later timing distribution compared with other stocks that were studied. While the peak and midpoint of the catch was estimated to have occurred around the third week of August (Figure 26), the estimated peak and midpoint of CPUE occurred during the first or second week of September (Figure 27).

Southern Inside Waters

Figures 28 and 29 show the coho salmon catch and CPUE time-density distributions for southern inside waters, principally Clarence Strait (Districts 101 and 102), compared with the estimated migratory timing of the Hugh Smith Lake stock. The peak and midpoint of catch in the area occurred during weeks 33-34 (mid-August) while the peak and midpoint of power troll CPUE occurred during weeks 29-30 and 31-32, respectively (mid-July to early August). The later distribution of the catch compared with troll CPUE was due largely to an increased purse catch of coho salmon in mid to late August incidental to the pink salmon *(O. gorbuscha)* harvest.

The estimated catch and CPUE time density distributions for tagged Hugh Smith Lake coho salmon show that they were more available and contributed a higher percentage of the total catch in Districts 101 and 102 later in the season. The midpoints of catch and abundance for that stock apparently occurred during the second half of August. Shaul et al. (1983) found that the timing of local District 101 hatchery stocks in southern inside area fisheries were also substantially later than the overall catch distribution. Evidence so far suggests that predominant local stock groups in lower Clarence Strait migrate through Districts 101 and 102 relatively late in the season (August-September) while certain northern British Columbia stocks are more available in July.

SURVIVAL

Survival from the time of tagging (smolt or age 1+ juvenile) to the adult stage was estimated as follows:

$$\text{Survival Rate } (\hat{S}) = \frac{F + E}{T}$$

Where: F = estimated number of marked fish harvested

E = number of marked fish in the escapement

T = number of smolts or juveniles tagged

Estimated survival rates for the eight study systems are shown in Table 16. Juvenile survival figures should be considered as minimum estimates because a small percentage of tagged juveniles usually outmigrate as smolts 2 years after being tagged instead of the following spring.

The estimated survival rate of 11.8% (excluding jacks) for Auke Creek smolts that outmigrated in 1981 compared favorably with previous survival estimates of 10.5%, 9.0%, and 8.2%, respectively, for smolts that outmigrated in 1977, 1979, and 1980.

Survival rate estimates of 2.2% and 2.5% for juvenile coho salmon tagged at Klakas Lake and the Berners River were lower than estimates resulting from eight previous studies in Southeastern Alaska that ranged from 3.2% to 5.4% (Shaul et al. 1983). Survival of juveniles tagged in 1980 at Ford Arm and Warm Chuck Lakes was estimated

Table 16. Estimated survival rates of predominantly age 1+ and older juvenile coho salmon and smolts from the time of tagging (1980-1981) until entry into the fisheries (1982) for eight systems in Southeastern Alaska.

Location	Number Marked	Dates	Estimated Marked Return	Survival Rate[1]
Auke Lake	6,372 smolts	30 April - 12 June	750	11.8% (15.0%)
Speel Lake	7,235 juveniles	25 August - 3 September	413	5.7%
Berners River	10,929 juveniles	16-28 June	268	2.5%
Ford Arm Lake	6,369 juveniles	30 June - 11 July	350	5.5%
Politofski Lake	5,814 juveniles	14-26 July	279	4.8%
Warm Chuck Lake	4,391 juveniles	25 August - 5 September	243	5.5%
Klakas Lake	3,517 juveniles	11-22 August	77	2.2%
Hugh Smith Lake	5,345 juveniles	28 July - 8 August	409[2]	7.7%[2]
			546	10.2%
			600	11.2%
	2,777 smolts	8 April - 31 May	369[2]	13.3%[2]
			226	8.1%
			169	6.1%

[1] The higher survival rate estimate for Auke Lake smolts (in parentheses) includes the return of jacks (age .0) in 1981; the other estimates include only adult returns.

[2] Range of estimates depending on whether tag loss was attributed entirely to the juvenile release group, the smolt release group, or was equal for both groups.

at 5.5% while survival of Politofski Lake juveniles was estimated at 4.8%. The survival rate estimate for Speel Lake juveniles was the highest at 5.7%.

Estimation of survival rates from juvenile and smolt stages for the return to Hugh Smith Lake was complicated by significant tag loss that could not be accurately attributed to either release group. Table 16 shows three estimates depending on whether tag loss was attributed entirely to the juvenile release group, the smolt release group, or equally for both groups. Minimum and maximum survival rates for the juveniles were 7.7% and 11.2% while the range of estimates of smolt survival ranged from 6.1% to 13.3%. Since smolt survival should have been higher, it is likely that most of the tag loss can be attributed to fish that were tagged as smolts. If all of the tag loss was attributed to fish that were tagged as smolts, survival estimates for juveniles tagged in 1980 and smolts tagged in 1981 were 7.7% and 13.3%, respectively.

The overall average estimated survival rate from the juvenile to returning adult stages for Speel, Ford Arm, Politofski, Warm Chuck, and Klakas Lakes and the Berners River was 4.4% which compares closely with the average of 4.5% for eight previous studies (Shaul et al. 1983).

JUVENILE AND ADULT PRODUCTION

Lake stocking of coho salmon fry and juveniles has become an increasingly popular fisheries enhancement strategy in recent years. Potential rearing capacity and adult production of lakes that are inaccessible to anadromous fish has been estimated by evaluating characteristics such as surface area, other physical characteristics, and food availability (Van Alen 1981). However, little work has been done to evaluate production from lakes that are presently utilized by coho salmon.

It was possible to estimate the abundance of predominantly age 1+ and older juvenile coho salmon during 1980 for seven Southeastern Alaska systems by employing a Peterson mark-recapture estimator. Juvenile coho salmon that were marked and released were 65 mm and greater in length which approximated the division between age 0+ and age 1+ rearing fish in most systems during the summer months. The vast majority of surviving tagged fish were expected to outmigrate the following spring and return as adults after 2 years. (Gray et al. 1981 estimated that adult coho salmon commercially harvested in Southeastern Alaska during 1969-1970 were of the following age composition: 26.7% age 1.1, 63.9% age 2.1, 8.9% age 3.1, and 0.5% age 4.1.) Adults were enumerated at weirs on the lake systems and during a ground survey of the Berners River.

All or a portion of the adult escapement was examined for marks. Therefore, it was possible to obtain mark-recapture estimates of the number of rearing juvenile coho salmon in each system. The estimates may be slightly conservative since the portion of each population that outmigrated as age 1+ smolts may have been underrepresented in the groups that were tagged. These younger fish may have suffered greater mortality, assuming that they outmigrated at a smaller size than age 2+ and older smolts. This bias would have been offset somewhat by any tagging mortality that occurred. A point estimate was not possible for Hugh Smith Lake since the same age classes were tagged as rearing juveniles and smolts. It was impossible to completely apportion returning tagged adults because of signicant tag loss.

Therefore, a range of values was established by attributing all or none of the tag loss to each release group.

Table 17 shows estimates of the number of juvenile coho salmon in each, including the Berners River, and density estimates (number of fish/hectare) for the six lake systems. Estimated rearing populations ranged from 52,605 for Politofski Lake to 968,398 for the Berners River. Among the lakes, juvenile density ranged from 139-203/hectare for Hugh Smith Lake to 1,380/hectare for Ford Arm Lake. It should be noted that these density estimates are high as they don't account for adjacent stream rearing habitat which, although not extensive in area, was important on all six systems. Figure 30 shows estimated juvenile densities and associated 95% confidence limits for the six lake systems in comparison with lake surface area. The smallest lakes (Ford Arm and Warm Chuck) had the highest densities while the largest lake (Hugh Smith) had the lowest density of rearing juveniles. The other three lakes (Politofski, Speel, and Klakas) were somewhat intermediate in rearing densities. The average density for all six lakes was approximately 650 rearing juveniles per hectare. The wide range of estimated rearing densities points out the importance of heavily weighting factors other than surface area in determining the number of fish to be stocked in inaccessible lakes. Minnow trapping results for the study systems indicated that shoreline type, the location of shallow areas less than 3 m in depth, and the presence of aquatic vegetation were most important in determining the distribution and abundance of rearing coho salmon.

The Ford Arm Lake system is relatively shallow with extensive weedy areas in the main lake and in an attached pond. Conversely, Politofski and Hugh Smith Lakes are steep-sided and deep. Both of the latter systems provide very limited habitat for juvenile coho salmon. While aquatic vegetation is almost non-existent in the upper and lower lakes of the Politofski Lake system, there is a relatively long shoreline for the amount of surface area. Rearing coho salmon in Politofski Lake appeared to seek out cover around windfalls and in the interstices of rock slides along the shoreline. Warm Chuck, Klakas, and Speel Lakes have varying amounts of aquatic vegetation and other important habitat features. Although Speel Lake contains extensive weed beds in the southwest end, the overall density of rearing coho salmon was not high, possibly because of its more circular shape and low shoreline-to-surface-area ratio.

Estimates of adult production are available for the eight study systems. Estimates of total return (catch and escapement) ranged from 804 for Auke Lake to 26,311 for the Berners River (Table 17). The highest estimated total adult return to a lake system was 5,664 for Hugh Smith Lake (excluding the Canadian catch). Estimated production from the other lakes ranged from 2,598 for Politofski Lake to 4,363 for Ford Arm Lake. Ford Arm Lake was most productive at 76.5 adults/hectare while Auke Lake was the least productive system at 12.4 adults/hectare. One factor that probably decreased the adult production for Auke Lake was the relatively high percentage (23.1%) of surviving smolts that returned as precocious jacks after a single summer in saltwater. The estimated contribution to the fisheries ranged from 357 for Auke Lake to 3,520 (excluding the Canadian harvest) for Hugh Smith Lake (Table 17) while the average contribution for the seven lake systems was 1,878 fish.

These estimates provide some insight about naturally occurring juvenile densities and the widely scattered nature of the coho salmon resource. Although most of

Table 17. Estimated population size and density of predominantly age 1+ and older juvenile coho salmon, 1980, and adult return (catch and escapement), 1982, for eight systems in Southeastern Alaska.

Location	Approximate Surface Area (hectares)	Number of Juveniles Marked	Dates	Estimated Rearing Population	95% C.I.	Number of Juveniles Per Hectare	Estimated Adult Return	Adult Return Per Hectare
Auke Lake	65	-	-	-	-	-	804	12.4
Berners River	-	10,929	16-28 June	968,398	398,648 - 1,538,148	-	26,311	-
Speel Lake	170	7,235	25 August - 3 September	70,840	58,929 - 82,751	417	4,076	24.0
Ford Arm Lake	57	6,369	30 June - 11 July	78,683	72,446 - 84,920	1,380	4,363	76.5
Politofski Lake	101	5,814	14-26 July	52,605	44,714 - 60,496	521	2,598	25.7
Warm Chuck Lake	61	4,391	25 August - 5 September	49,132	44,295 - 53,969	805	2,749	45.1
Klakas Lake	178	3,517	11-22 August	116,508	89,530 - 143,486	655	2,686	15.1
Hugh Smith Lake	352	5,345	28 July - 8 August	48,956 - 71,449	44,575 - 79,638	139 - 203	5,664[1] 1/	16.1

[1] Does not include Canadian catch.

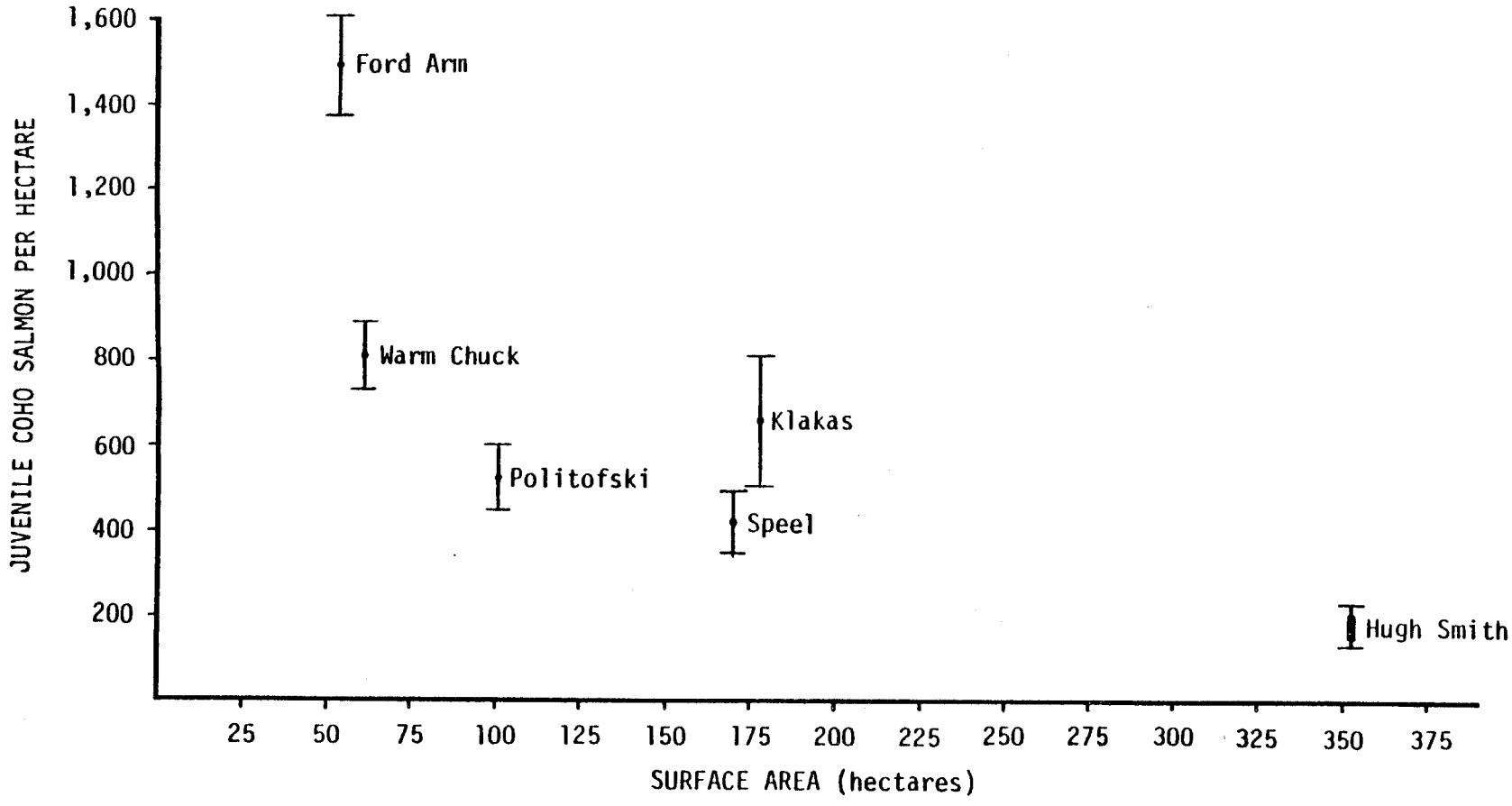

Figure 30. Estimated density (number per surface hectare) of predominantly age 1+ and older juvenile coho salmon with 95% confidence limits for six lake systems in Southeastern Alaska, 1980.

the eight study systems were probably representative of the more productive streams in their respective areas, they contributed only an estimated 32,074 or 1.5% of the total Southeastern Alaska-Yakutat coho salmon catch of 2,137,646 fish.

HATCHERY CONTRIBUTION

As hatchery programs in Southeastern Alaska mature, their contribution will become an increasingly important consideration in fisheries management. Evaluation of hatchery contribution is needed in order to facilitate the harvest of hatchery stocks while protecting wild stocks, and for assessment of enhancement programs.

Based on smolt and fry releases, significant coho salmon returns were expected at eight Southeastern Alaska hatchery facilities in 1982. These included the Snettisham, Crystal Lake, Klawock, and Deer Mountain hatcheries operated by the ADF&G (F.R.E.D. Division); the Sheldon Jackson College hatchery at Sitka; the Little Port Walter hatchery (National Marine Fisheries Service); the Whitman Lake hatchery (Southern Southeast Regional Aquaculture Association); and the Tamgas Creek hatchery (Metlakatla Indian Community). Numbers of fish released, estimated contribution by gear type, and percentage harvested of the number of smolts or fry released for each hatchery are shown in Table 18. Hatchery contribution was estimated by dividing expanded fishery tag recoveries by the percentage of each release group that was tagged. This method was used because significant returns of wild fish to some streams with hatcheries rendered it impossible to accurately determine the tagged-untagged ratio of the hatchery escapement.

Hatchery facilities in Southeastern Alaska contributed an estimated 60,963 adult coho salmon to commercial fisheries in Southeastern Alaska and Yakutat during 1982. Hatchery contribution accounted for an estimated 2.9% of the total commercial harvest of 2,137,646 coho salmon. The estimated hatchery contribution by gear type was as follows: 35,715 (2.7%) of the troll harvest of 1,329,693; 10,202 (2.3%) of the purse seine harvest of 452,120; 15,011 (7.4%) of the drift gillnet harvest of 201,682; and 35 (6.7%) of the trap harvest of 520 coho salmon. The hatchery contribution to the Yakutat setnet fishery was negligible because that fishery targets on local wild stocks in the Yakutat area. The greater relative hatchery contribution to the drift gillnet catch, compared with other gear types, was due largely to the special terminal area harvest in Blind Slough that accounted for approximately 8,000 coho salmon returning to the Crystal Lake hatchery.

Hatchery contribution by area (Table 19) was greatest for central inside districts (106-108) where hatchery stocks contributed an estimated 19.2% of the catch. Hatchery contribution in other areas ranged from 0.9% to 4.2% of the catch. The area distribution of the contribution for individual hatcheries is shown in Table 20. The Crystal Lake and Whitman Lake hatcheries accounted for an estimated 92.8% of the total harvest of hatchery stocks. The most important harvest area for the return to the Crystal Lake hatchery was in central inside districts (106-108) where an estimated 61.7% of the catch occurred. An estimated 45.8% of the catch of fish reared at the Whitman Lake hatchery and released at Herring Cove was taken in southern inside districts (101-102). However, only 25.2% of the estimated contribution of the Neets Bay release was harvested in those districts. A greater pro-

Table 18. Estimated 1982 fishery contribution by gear type and total fishery contribution as a percentage of the number of coho salmon smolts and fry released by Southeastern Alaska hatcheries.

Harvested	Troll	Purse Seine	Drift Gillnet	Trap	Total Contribution[1]	No. Released	% Harvested of the Number Released
Snettisham	-	-	-	-	-	86,112 (smolts)	0.0
Snettisham (First Lake)	25	-	-	-	25	9,042 (fry)	0.3
Sheldon Jackson	32	-	-	-	32	2,520 (smolts)	1.3
Little Port Walter	909	1,234	-	-	2,143	19,223 (smolts)	11.1
Crystal Lake	11,573	1,192	13,452[2]	-	26,217	546,806 (smolts)	4.8
Klawock	217	149	-	-	366	36,537 (smolts)	1.0
Deer Mountain	834	206	76	-	1,116	67,548 (smolts)	1.7
Whitman Lake (Herring Cove)	2,344	975	320	8	3,647	224,300 (smolts)	1.6
Whitman Lake (Neets Bay)	19,528	6,011	1,121	27	26,687	562,520 (smolts	4.7
Tamgas Creek (Nadzaheen Cr. stock)	237	188	42	-	467	21,500 (smolts)	2.2
Tamgas Creek (Columbia R. stock)	16	247	-	-	263	214,900 (smolts)	0.1
Tamgas Creek (Total)	253	435	42	-	730	236,400 (smolts)	0.3
Total	35,715	10,202	15,011	35	60,963	2,018,366 smolts 9,042 fry	3.0 0.3

[1] Does not include Canadian harvest.

[2] Approximately 8,000 fish returning to Crystal Lake hatchery were harvested by a terminal fishery in Blind Slough.

Table 19. Commercial fisheries contribution by area of coho salmon returning to Southeastern Alaska hatcheries, 1982.

Area	Catch	Hatchery Contribution	Percentage Contributed
Yakutat (set net)	148,994	-	-
Northern Outside 116, 157, 181, 183, 186, 189	197,967	2,250	1.1
Central Outside 113, 154	480,638	14,879	3.1
Southern Outside 103, 104, 152	348,956	5,922	1.7
Central Intermediate 112, 114	221,014	2,062	0.9
Southern Intermediate 105, 109, 110	190,658	8,073	4.2
Stephens Passage 111	33,607	-	-
Lynn Canal 115	73,894	-	-
Central Inside 106-108	94,693	18,163	19.2
Southern Inside 101, 102	347,225	9,614	2.8
TOTAL	2,137,646	60,963	2.9

Table 20. Area distribution of the harvest of coho salmon returning to Southeastern Alaska hatcheries based on coded-wire tag recoveries, 1982.

Hatchery	Northern Outside 116, 157, 181, 189	Central Outside 113, 154	Southern Outside 103, 104, 152	Central Intermediate 112, 114	Southern Intermediate 105, 109, 110	Central Inside 106-108	Southern Inside 101, 102	Total Contribution
Snettisham (smolts)	-	-	-	-	-	-	-	-
Snettisham (fry) (First Lake)	14 (56.0%)	3 (12.0%)	-	-	8 (32.0%)	-	-	25 (100%)
Sheldon Jackson	-	18 (56.2%)	-	14 (43.8%)	-	-	-	32 (100%)
Little Port Walter	41 (1.9%)	429 (29.0%)	10 (0.5%)	43 (2.0%)	1,619 (75.5%)	-	1 (0.1%)	2,143 (100%)
Crystal Lake	842 (3.2%)	4,006 (15.3%)	1,316 (5.0%)	815 (3.1%)	2,754 (10.5%)	16,172[1] (61.7%)	312 (1.2%)	26,217 (100%)
Klawock	2 (0.6%)	56 (15.3%)	254 (69.4%)	15 (4.1%)	18 (4.9%)	-	21 (5.7%)	366 (100%)
Deer Mountain	-	229 (20.5%)	39 (3.5%)	151 (13.5%)	224 (20.1%)	-	473 (42.4%)	1,116 (100%)
Whitman Lake (Herring Cove)	49 (1.4%)	1,113 (30.5%)	380 (10.4%)	152 (4.2%)	194 (5.3%)	88 (2.4%)	1,671 (45.8%)	3,647 (100%)
Whitman Lake (Neets Bay)	1,302 (4.9%)	8,943 (33.5%)	3,838 (14.4%)	872 (3.3%)	3,137 (11.7%)	1,868 (7.0%)	6,727 (25.2%)	26,687 (100%)
Tamgas Creek	-	82 (11.2%)	85 (11.7%)	-	119 (16.3%)	35 (4.8%)	409 (56.0%)	730 (100%)
TOTAL	2,250 (3.7%)	14,879 (24.4%)	5,922 (9.7%)	2,062 (3.4%)	8,073 (13.2%)	18,163 (29.8%)	9,614 (15.8%)	60,963 (100%)

[1] Approximately 8,000 fish returning to Crystal Lake hatchery were harvested in a terminal fishery in Blind Slough.

portion of the return to Neets Bay was harvested in Sumner and upper Clarence Straits compared with the Herring Cove release. The majority (75.5%) of the estimated harvest of fish reared at the Little Port Walter hatchery on southern Baranof Island was taken in the southern intermediate area (Districts 105, 109, and 110). In general, the harvest of hatchery produced fish returning to individual facilities was broadly distributed among areas and gear types.

Estimated percentages harvested of smolts and fry released from Southeastern Alaska hatcheries are shown in Table 18. These figures are a function of both survival and harvest rates. The average percentage harvested for the eight facilities was estimated at 3.0% for smolts. This figure ranged considerably from 0.0% for Snettisham to 11.1% for Little Port Walter. Contribution rates for the Crystal Lake and Neets Bay release groups were estimated at 4.8% and 4.7%, respectively. Contribution rates for Sheldon Jackson, Klawock, Herring Cove, and Deer Mountain ranged from 1.0% to 1.7%. Of particular interest is the difference in contribution rates of the two release groups from Tamgas Creek. Only 0.1% of Columbia River stock smolts released from the hatchery contributed to Southeastern Alaska fisheries compared with 2.2% smolts from the local Nadzaheen Creek stock. This partially demonstrates why it is inadvisable to introduce brood stock over long distances.

CANADIAN HARVEST OF RETURNS TO SOUTHERN SOUTHEASTERN ALASKA, 1981

The harvest rate of the 1981 returns to three hatcheries in District 101 by fisheries in Southeastern Alaska was discussed by Shaul et al. (1983). The availability of Canadian coded-wire tag recovery data (Bailey et al. 1983) has made it possible to estimate the harvest of those returns by fisheries along the British Columbia coast. British Columbia statistical areas are shown in Figure 31. Table 21 shows total return and harvest by area estimates for the Deer Mountain, Herring Cove, and Tamgas Creek facilities near Ketchikan. Harvest percentages by area and gear type are shown in Figure 32. An estimated 13,634 adult coho salmon were produced by the three hatcheries of which 9,419 (69.1%) were harvested by commercial fisheries.

Total harvest rate estimates by facility were 68.5%, 70.8%, and 64.5% for Deer Mountain, Herring Cove, and Tamgas Creek, respectively. The estimated proportion of the total return that was harvested by Canadian fisheries ranged from 7.8% to 15.2% for each facility and amounted to 9.4% of the total combined return. The estimated proportion of the total harvest accounted for by Canadian fisheries ranged from 12.1% to 22.1% for each facility and amounted to 13.6% of the total harvest of the combined return. A similar harvest division between Alaskan and Canadian fisheries was evident for the 1981 coho salmon return to the Klawock hatchery (District 103) of which Canadian fisheries accounted for an estimated 12.6% of the total catch (Table 22). Shaul (et al. 1983) estimated that during 1979 British Columbia caostal fisheries accounted for 3.9% of the total harvest of coded-wire tagged coho salmon returning to Southeastern Alaska Districts 106-108 but intercepted 0% of returns to Stephens Passage and Lynn Canal systems.

Nearly all of the Canadian harvest of returns to southern Southeastern occurred in northern British Columbia areas 1-5 (Figure 31). An estimated 1,231 (96.3%)

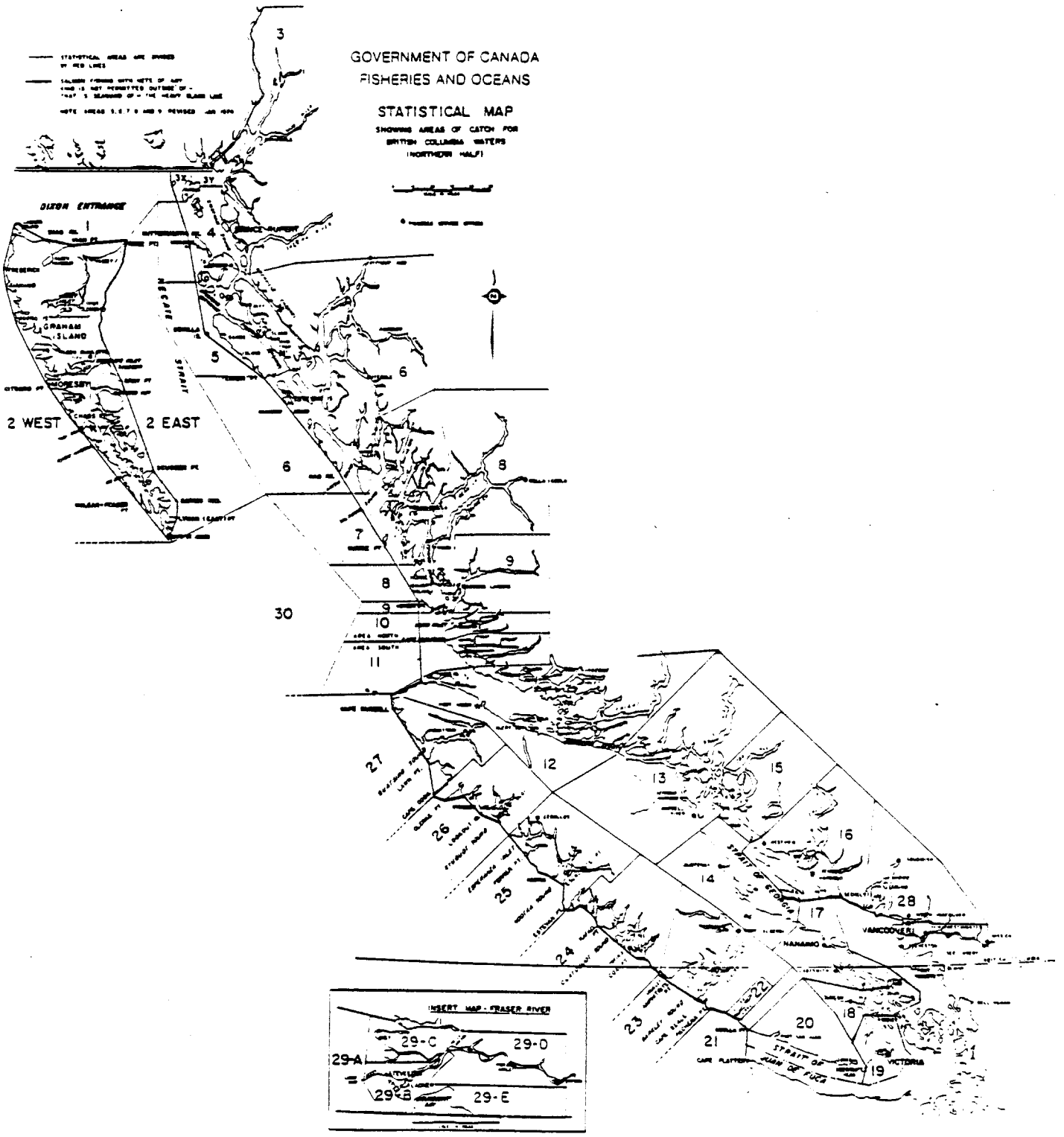

Figure 31. British Columbia statistical areas (from Bailey et al. 1983).

Table 21. Estimated total return, harvest by area, and escapement of coho salmon returns to three hatcheries in Southern Southeastern Alaska.

Area	Hatchery			
	Deer Mountain	Herring Cove	Tamgas Creek	Total
Southeastern Alaska				
Northern Outside 116, 157, 181, 183, 186, 189	13 (1.2%)	156 (1.7%)	-	169 (1.2%)
Central Outside 113, 154	37 (3.5%)	912 (9.9%)	136 (4.0%)	1,085 (8.0%)
Southern Outside 103, 104, 152	227 (21.5%)	1,659 (18.1%)	642 (18.7%)	2,528 (18.5%)
Central Intermediate 112, 114	19 (1.8%)	-	-	19 (0.2%)
Southern Intermediate 105, 109, 110	32 (3.0%)	569 (6.2%)	113 (3.3%)	714 (5.2%)
Central Inside 106, 107, 108	23 (2.2%)	191 (2.1%)	-	214 (1.6%)
Southern Inside 101, 102	212 (20.1%)	2,149 (23.5%)	1,050 (30.7%)	3,411 (25.0%)
Southeastern Alaska (TOTAL)	563 (53.3%)	5,636 (61.5%)	1,941 (56.7%)	8,140 (59.7%)
British Columbia				
Northern (1-5)	129 (12.2%)	853 (9.3%)	249 (7.3%)	1,231 (9.0%)
Central (6-12)	-	-	17 (0.5%)	17 (0.1%)
Southwest (21, 23, 24)	31 (3.0%)	-	-	31 (0.3%)
British Columbia (TOTAL)	160 (15.2%)	853 (9.3%)	266 (7.8%)	1,279 (9.4%)
Escapement	332 (31.5%)	2,669 (29.2%)	1,214 (35.5%)	4,215 (30.9%)
TOTAL	1,055 (100%)	9,158 (100%)	3,421 (100%)	13,634 (100%)

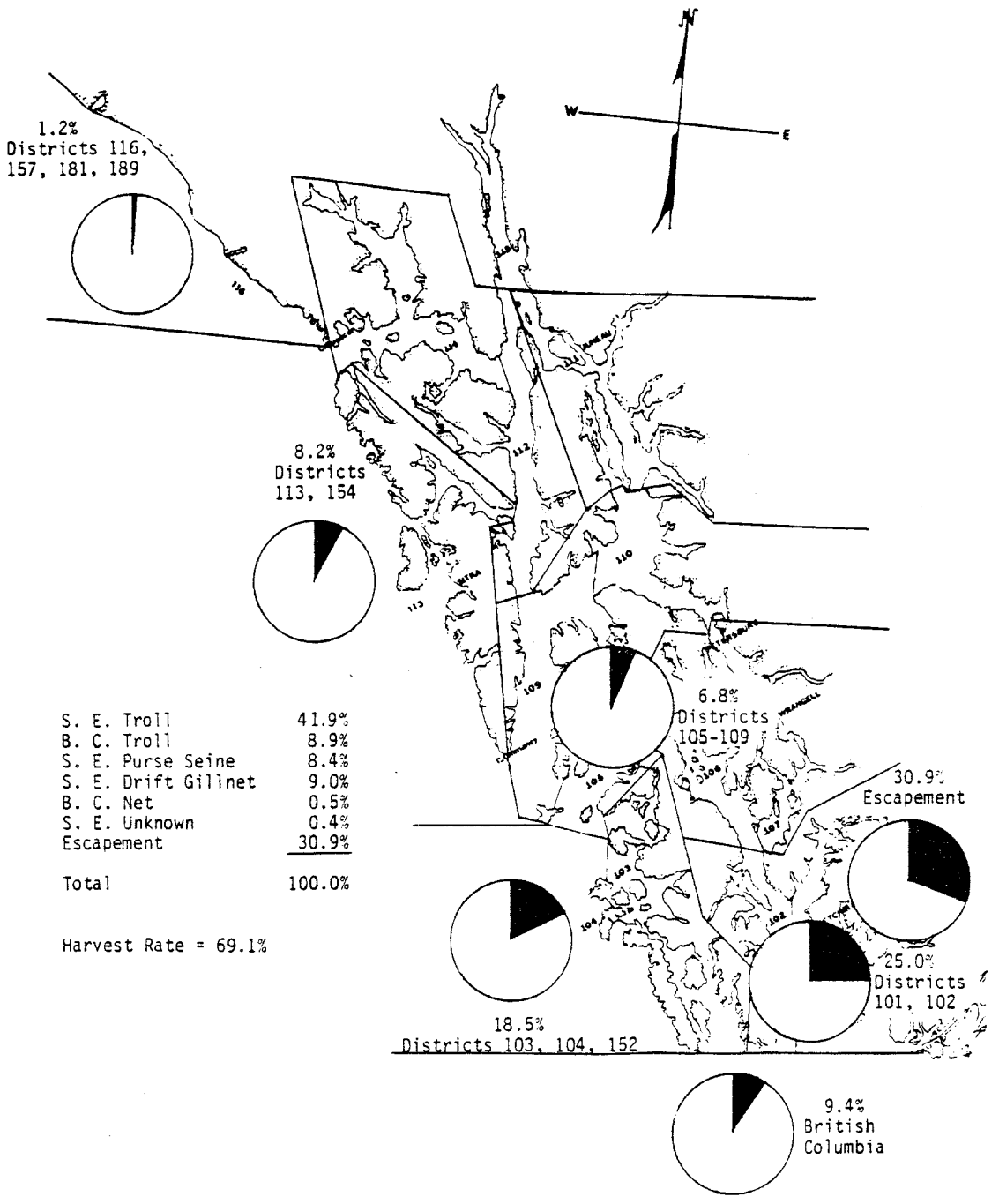

Figure 32. Harvest by area and escapement as a percentage of the total return of District 101 hatchery coho salmon stocks based on coded-wire tag recoveries, 1981.

Table 22. Estimated harvest by area of coded-wire tagged coho salmon returning to the Klawock Hatchery, 1981.

Area	No. of Recoveries From Random Fishery Samples	Expanded Recoveries	Percentage of Total
Southestern Alaska			
Northern Outside (116, 157, 181, 186, 189)	1	4.2	1.0
Central Outside (113, 154)	1	4.8	1.1
Southern Outside (103, 104, 152)	62	322.6	74.0
Southern Intermediate (105, 109, 110)	6	31.0	7.1
Southern Inside (101, 102)	8	18.2	4.2
Southeastern Alaska (Total)	78	380.8	87.4
British Columbia			
Northern (1-5)	12	50	11.5
Central (6-12)	2	5	1.1
British Columbia (Total)	14	55	12.6
TOTAL	92	435.8	100.0

of the intercepted fish from District 101 hatcheries were harvested in northern areas compared with only 17 (1.3%) caught in central area (6-12) and 31 (2.4%) in southwest areas (21, 23, 24). An estimated 90.9% of the British Columbia catch of returns to the Klawock hatchery were harvested in northern areas while 9.1% were harvested in central areas.

An estimated 50.8% of the total return to District 101 hatcheries was harvested by troll gear while 17.9% was taken by net fisheries. The estimated area distribution of the troll harvest is shown in Figure 33. An estimated 17.4% of the troll harvest was attributed to British Columbia fisheries. Outer coastal fisheries in Southeastern Alaska accounted for an estimated 43.1% of the troll catch while 39.5% was taken in intermediate and inside waters. The distribution of the troll harvest indicated that a portion of the return entered inside water through Sumner and upper Clarence Straits (Appendix Figure 2) as well as from the south through Dixon Entrance (Appendix Figure 3). Overall, the greatest estimated percentage (29.2%) of the troll harvest of District 101 hatchery stocks occurred in southern inside waters (Districts 101 and 102).

The time-density distributions for the total harvest of coho salmon and the estimated harvest of tagged coho salmon returning to southern Southeastern Alaska hatcheries by the northern British Columbia troll fishery (statistical areas 1-5) are shown in Figure 34. The distribution of the total catch peaked near the end of July while the estimated catch of tagged fish returning to southern Southeastern Alaska hatcheries peaked during the first half of August. The midpoint of the total catch occurred during the first week of August while the midpoint of the catch of tagged fish returning to southern Southeastern hatcheries occurred during the third week of August.

This indicates that tagged southern Southeastern Alaska hatchery stocks contributed a greater percentage to later segments of the northern B.C. troll harvest compared with earlier harvests. Limited data reported by Shaul et al. (1983) indicated that tagged Canadian coho salmon stocks, primarily from the Skeena, Kitimat, and Atnarko Rivers, showed an earlier timing distribution in outer coastal waters of Southeastern Alaska than the total coho salmon harvest. Therefore, there appears to exist a significant difference in marine waters between the migratory timing of the predominant stock compositions originating in Southeastern Alaska and northern British Columbia. The majority of Southeastern Alaska stocks that have been studied are most available to troll fisheries during the first 3 weeks of August while predominant northern B.C. stock groups probably peak during the latter half of July.

SUMMARY AND DISCUSSION

Harvest Rates

Estimated total 1982 harvest rates by Southeastern Alaska fisheries for coho salmon returns to eight study systems were as follows: Auke Lake 44.4%, Speel Lake 71.4%, Berners River 71.5%, Ford Arm Lake 39.0%, Politofski Lake 33.4%, Warm Chuck Lake 63.0%, Klakas Lake 76.7%, and Hugh Smith Lake 62.1% (excluding harvest by Canadian fisheries).

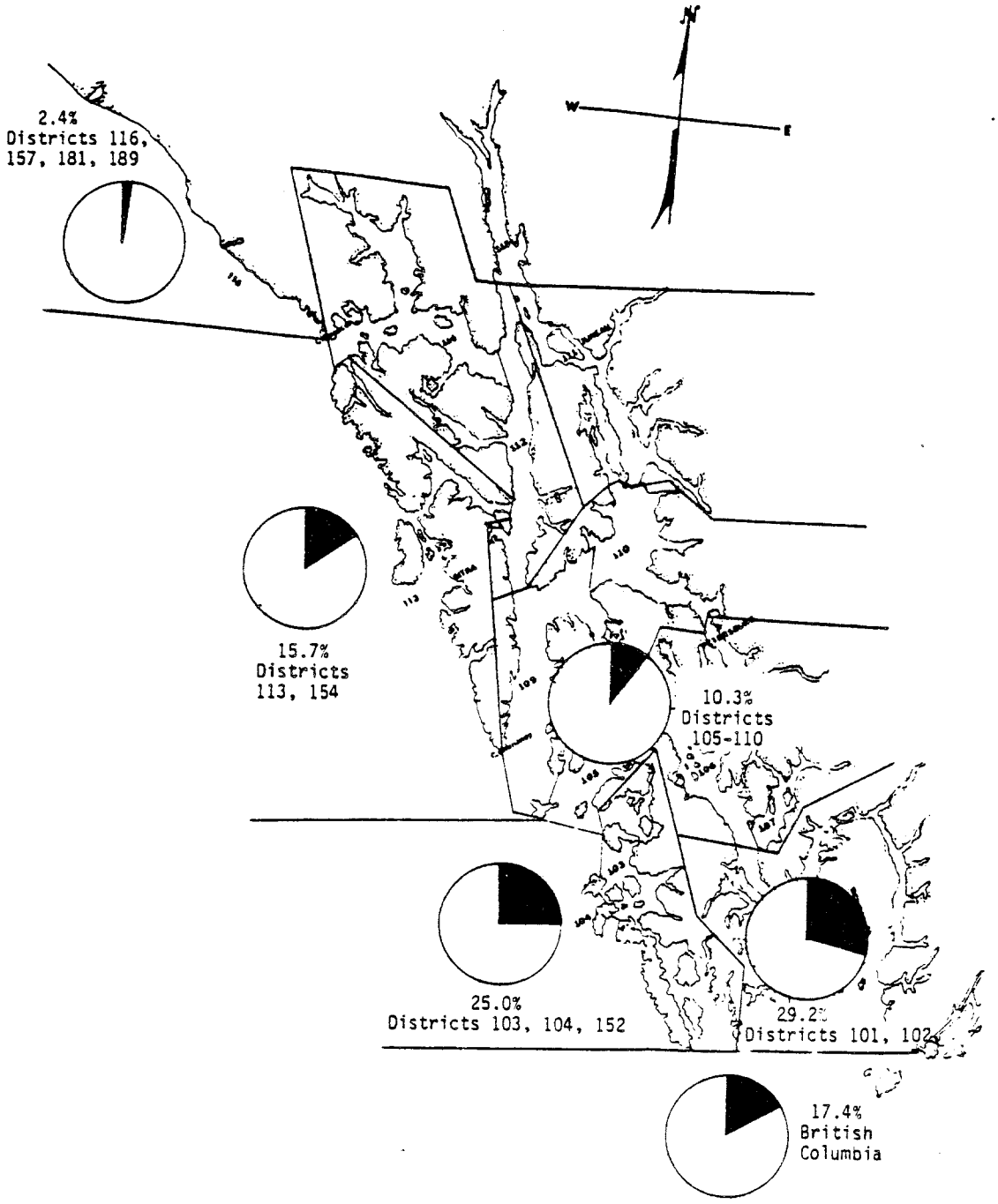

Figure 33. Estimated percentage by area of the total troll catch of coho salmon returns to District 101 hatcheries based on coded-wire tag recoveries, 1981.

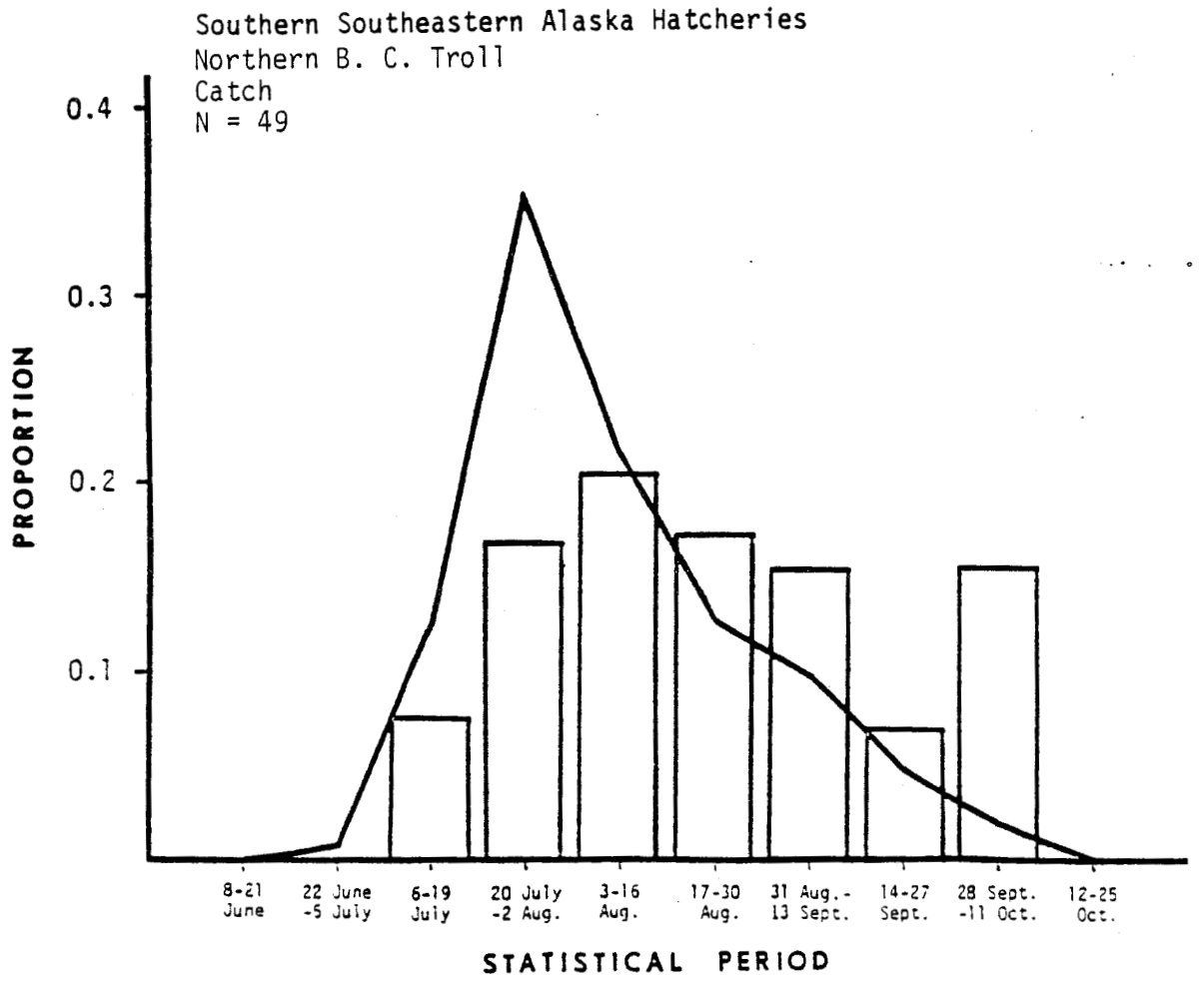

Figure 34. Biweekly proportion of the total coho salmon catch (line graph) and the estimated catch of coded-wire tagged coho salmon returning to southern Southeastern Alaska hatcheries (bar graph) by the troll fishery in Northern British Columbia (Areas 1-5), 1981.

Stephens Passage-Lynn Canal Stocks:

Estimated 1982 harvest rates on Stephens Passage and Lynn Canal stocks were the highest since 1978 for returns to Auke Lake and the Berners River, and the highest ever for Speel Lake. The percentage of the total return to these systems that was harvested by the troll fishery, however, apparently decreased appreciably following troll restrictions implemented since 1978. Increased overall harvest rates in 1982 resulted largely from an increase in the percentage taken by net fisheries. In spite of a near record coho salmon catch in the region, escapements to Auke and Speel Lakes were substantially lower than average. This decrease appears to have been due, in large part, to an increased harvest by the purse seine fishery. The estimated percentage of the total return that was harvested by purse seine gear increased from 4% or less for both stocks during previous years to 12.0% for Auke Lake and 24.8% for Speel Lake in 1982. It appears that the effect of increased purse seine effort on coho salmon in straits and passages in northern Southeastern is an important management consideration during years of strong pink salmon returns. The purse seine fishery has a more significant impact on stocks with early or central timing, while late run stocks (i.e., Berners River and Chilkat River are relatively unaffected.

Estimated harvest rates for the Berners River stock in Lynn Canal demonstrated the effectiveness of the drift gillnet fishery in harvesting that stock. Harvest rates on Berners River coho salmon in Lynn Canal were estimated at 52.9%, 57.2%, 35.2%, and 56.3% for 1974, 1978, 1979, and 1982, respectively. The average was 50.4%. Despite a relatively high estimated overall harvest rate of 71.5%, the 1982 escapement to the Berners River of 7,505 fish was the highest recorded. This was due to a large estimated total return of 26,311 compared with estimates of 18,282, 13,632, and 8,188 for 1974, 1978, and 1979, respectively.

The Juneau area marine sport fishery is relatively ineffective at harvesting local coho salmon stocks compared with commercial fisheries. Estimates of the percentage harvested by that fishery of returns to Auke Lake, Speel Lake, and the Berners River during 1978-1982 have ranged from 0.0% to 5.7% and average 2.0%.

District 113 Stocks:

Despite very intensive troll effort in District 113, harvest rate estimates for local stocks were relatively low at 39.0% for Ford Arm Lake and 33.4% for Politofski Lake. Approximately one-fourth of the total return to both systems was harvested along the central outside coast (Districts 113 and 154). Fishery managers have been concerned that these stocks may be overharvested because their streams of origin terminate in the most intensive troll fishing area in Southeastern Alaska. However, the results indicated that they received less fishing pressure than southern and inside area stocks that must return through a number of sequential fisheries. Additional tag recovery data is needed to substantiate any general conclusion about harvest rates on these stocks.

Southern Stocks:

District 103 stocks were harvested more intensively than District 113 stocks with harvest rate estimates of 63.0% for Warm Chuck Lake and 76.7% for Klakas Lake. Nearly half of the estimated total return to both systems was harvested in southern outside districts (103, 104, 152). These stocks were the most heavily affected

by outer coastal and offshore fisheries with estimated harvest rates in outside waters of approximately 60%. As expected, the Hugh Smith Lake stock was harvested less intensively in outside waters but more intensively in inside waters compared with southern outside stocks.

Estimated harvest rates by outer coastal and offshore fisheries were higher for the three southern stocks (average = 50.9%; range = 33.9% - 61.4%) compared with the five northern stocks (average = 21.7%; range = 5.3% - 32.0%). This appears to have been largely a result of an overall southward coastal migration tendency for returning coho salmon whereby southern stocks are exposed to more outer coastal and offshore fishing effort.

Migratory Timing

Data collected so far indicate that returns to Auke, Speel, Ford Arm, Warm Chuck, Klakas, and Hugh Smith Lakes have relatively central migratory timing distributions in outside waters. These stocks were available from early to mid-July through early to mid-September, with mid-points occurring in early to mid-August. A similar time density distribution was reported for Stikine River stocks by Shaul et al. (1984). Based on only 1 year of data, the Politofski Lake stock appeared to have arrived along the outer coast earlier than the majority of stocks and was available from the third week of June through early September, with midpoints of catch and CPUE occurring during the last week of July. The Berners River stock has consistently migrated through the troll fishery later in the season and has been available from mid to late July through the end of the troll season on 20 September, with peak availability occurring during late August or early September.

The Hugh Smith Lake stock was representative of the later migrating stocks that were available in southern inside districts (101 and 102). Its timing was similar to that of 1981 hatchery returns to facilities in District 101 (Shaul et al. 1983). In 1981, southern Southeastern hatchery stocks were most available relatively late in the season compared with the overall mixtures of stocks that migrated through southern inside districts and the northern British Columbia troll fishery.

Survival

Estimated survival rates in the returning adult stage (age .1) for predominantly age 1+ juvenile coho salmon tagged at Speel, Ford Arm, Politofski, Warm Chuck, and Klakas Lakes and the Berners River ranged from 2.2% to 5.7% (average 4.4%). These figures are relatively close to estimates ranging from 3.2% to 5.4% (average 4.5%) for eight previous studies (Shaul et al. 1983). The estimated survival rate of juveniles tagged at Hugh Smith Lake was between 7.7% and 11.2%, depending on the tag loss rate.

An estimated 11.8% of smolts tagged at Auke Creek in 1981 survived to the returning adult stage. Survival rate estimates for tagged Auke Creek smolts during 4 years (1977, 1979, 1980, 1981) has ranged from 8.2% to 11.8%, and averaged 9.9%.

Juvenile and Adult Production

Estimated total adult returns for the eight study systems in 1982 ranged from 804

for Auke Lake to 26,311 for the Berners River. Estimated contribution to the fisheries ranged from 357 for Auke Lake to 18,806 for the Berners River. The estimated contribution of the seven lake systems averaged 1,878 fish while the Berners River contributed an estimated 18,806 adult coho salmon to the fisheries.

The average rearing density of predominantly age 1+ juvenile coho salmon for six lakes (Speel, Ford Arm, Politofski, Warm Chuck, Klakas, Hugh Smith) was approximately 650/hectare. Estimated densities ranged from 139-203/hectare for Hugh Smith Lake to 1,380/hectare for Ford Arm Lake. The estimated adult return (catch and escapement per hectare ranged from 12.4 for Auke Lake to 76.5 for Ford Arm Lake (average = 30.7). While these figures provide an indication of the productivity of selected wild stocks related to surface area in lake systems, minnow trapping results have shown that other habitat features are of greater importance in determining potential coho salmon production.

Hatchery Contribution

Hatcheries in Southeastern Alaska contributed an estimated 60,963 coho salmon, or 2.9%, of the total commercial harvest of 2,137,646 in the region in 1982. The percentage of the catch contributed by hatcheries was highest (19.2%) in central inside districts (106-108) and lowest (0%) for the Yakutat setnet fisheries. The estimated percentage hatchery contribution by gear type was 2.7% for troll gear, 2.3% for purse seine gear, 7.4% for drift gillnet gear, and 6.7% for traps. Two hatcheries (Crystal Lake and Whitman Lake) accounted for an estimated 92.8% of the total contribution by hatcheries in the region. The most effective release groups, as measured by fishery contribution per smolt released, originated at the Little Port Walter facility while the least effective release groups originated at the Snettisham and Tamgas Creek facilities.

Canadian Harvest

British Columbia fisheries harvested an estimated 9.4% of the total 1981 coho salmon return to three hatcheries in District 101 (Clarence Strait). An estimated 96.3% of the intercepted fish were taken in northern statistical areas (1-5), primarily by troll gear. Canadian fisheries accounted for an estimated 13.6% of the troll harvest of fish returning to District 101 hatcheries and 12.6% of the harvest of returns to Klawock hatchery.

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APPENDICES

Appendix Table 1. Pacific Marine Fisheries Commission (PMFC) area groupings of Southeastern Alaska regulatory districts.

PMFC Area		Regulatory Districts
NOUT	Northern Outside	116, 157, 181, 183, 186, 189
COUT	Central Outside	113, 154
SOUT	Southern Outside	103, 104, 152
SIN	Southern Inside	101, 102, 150
SNTR	Southern Intermediate	105, 109, 110
CIN	Central Inside	106, 107, 108
STEP	Stephens Passage	111
CNTR	Central Intermediate	112, 114
LYNN	Lynn Canal	115

Appendix Table 2. Statistical weeks used in recording and compiling Southeastern Alaska commercial fisheries catch data.

STAT WEEK	YEAR/DATE 1978	YEAR/DATE 1979	YEAR/DATE 1980	YEAR/DATE 1981	YEAR/DATE 1982	YEAR/DATE 1983	YEAR/DATE 1984	YEAR/DATE 1985
1	0101 - 0107	0101 - 0106	0101 - 0105	0101 - 0103	0101 - 0102	0101 - 0101	0101 - 0107	0101 - 0105
2	0108 - 0114	0107 - 0113	0106 - 0112	0104 - 0110	0103 - 0109	0102 - 0108	0108 - 0114	0106 - 0112
3	0115 - 0121	0114 - 0120	0113 - 0119	0111 - 0117	0110 - 0116	0109 - 0115	0115 - 0121	0113 - 0119
4	0122 - 0128	0121 - 0127	0120 - 0126	0118 - 0124	0117 - 0123	0116 - 0122	0122 - 0128	0120 - 0126
5	0129 - 0204	0128 - 0203	0127 - 0202	0125 - 0131	0124 - 0130	0123 - 0129	0129 - 0204	0127 - 0202
6	0205 - 0211	0204 - 0210	0203 - 0209	0201 - 0207	0131 - 0206	0130 - 0205	0205 - 0211	0203 - 0209
7	0212 - 0218	0211 - 0217	0210 - 0216	0208 - 0214	0207 - 0213	0206 - 0212	0212 - 0218	0210 - 0216
8	0219 - 0225	0218 - 0224	0217 - 0223	0215 - 0221	0214 - 0220	0213 - 0219	0219 - 0225	0217 - 0223
9	0226 - 0304	0225 - 0303	0224 - 0301	0222 - 0228	0221 - 0227	0220 - 0226	0226 - 0303	0224 - 0302
10	0305 - 0311	0304 - 0310	0302 - 0308	0301 - 0307	0228 - 0306	0227 - 0305	0304 - 0310	0303 - 0309
11	0312 - 0318	0311 - 0317	0309 - 0315	0308 - 0314	0307 - 0313	0306 - 0312	0311 - 0317	0310 - 0316
12	0319 - 0325	0318 - 0324	0316 - 0322	0315 - 0321	0314 - 0320	0313 - 0319	0318 - 0324	0317 - 0323
13	0326 - 0401	0325 - 0331	0323 - 0329	0322 - 0328	0321 - 0327	0320 - 0326	0325 - 0331	0324 - 0330
14	0402 - 0408	0401 - 0407	0330 - 0405	0329 - 0404	0328 - 0403	0327 - 0402	0401 - 0407	0331 - 0406
15	0409 - 0415	0408 - 0414	0406 - 0412	0405 - 0411	0404 - 0410	0403 - 0409	0408 - 0414	0407 - 0413
16	0416 - 0422	0415 - 0421	0413 - 0419	0412 - 0418	0411 - 0417	0410 - 0416	0415 - 0421	0414 - 0420
17	0423 - 0429	0422 - 0428	0420 - 0426	0419 - 0425	0418 - 0424	0417 - 0423	0422 - 0428	0421 - 0427
18	0430 - 0506	0429 - 0505	0427 - 0503	0426 - 0502	0425 - 0501	0424 - 0430	0429 - 0505	0428 - 0504
19	0507 - 0513	0506 - 0512	0504 - 0510	0503 - 0509	0502 - 0508	0501 - 0507	0506 - 0512	0505 - 0511
20	0514 - 0520	0513 - 0519	0511 - 0517	0510 - 0516	0509 - 0515	0508 - 0514	0513 - 0519	0512 - 0518
21	0521 - 0527	0520 - 0526	0518 - 0524	0517 - 0523	0516 - 0522	0515 - 0521	0520 - 0526	0519 - 0525
22	0528 - 0603	0527 - 0602	0525 - 0531	0524 - 0530	0523 - 0529	0522 - 0528	0527 - 0602	0526 - 0601
23	0604 - 0610	0603 - 0609	0601 - 0607	0531 - 0606	0530 - 0605	0529 - 0604	0603 - 0609	0602 - 0608
24	0611 - 0617	0610 - 0616	0608 - 0614	0607 - 0613	0606 - 0612	0605 - 0611	0610 - 0616	0609 - 0615
25	0618 - 0624	0617 - 0623	0615 - 0621	0614 - 0620	0613 - 0619	0612 - 0618	0617 - 0623	0616 - 0622
26	0625 - 0701	0624 - 0630	0622 - 0628	0621 - 0627	0620 - 0626	0619 - 0625	0624 - 0630	0623 - 0629
27	0702 - 0708	0701 - 0707	0629 - 0705	0628 - 0704	0627 - 0703	0626 - 0702	0701 - 0707	0630 - 0706
28	0709 - 0715	0708 - 0714	0706 - 0712	0705 - 0711	0704 - 0710	0703 - 0709	0708 - 0714	0707 - 0713
29	0716 - 0722	0715 - 0721	0713 - 0719	0712 - 0718	0711 - 0717	0710 - 0716	0715 - 0721	0714 - 0720
30	0723 - 0729	0722 - 0728	0720 - 0726	0719 - 0725	0718 - 0724	0717 - 0723	0722 - 0728	0721 - 0727
31	0730 - 0805	0729 - 0804	0727 - 0802	0726 - 0801	0725 - 0731	0724 - 0730	0729 - 0804	0728 - 0803
32	0806 - 0812	0805 - 0811	0803 - 0809	0802 - 0808	0801 - 0807	0731 - 0806	0805 - 0811	0804 - 0810
33	0813 - 0819	0812 - 0818	0810 - 0816	0809 - 0815	0808 - 0814	0807 - 0813	0812 - 0818	0811 - 0817
34	0820 - 0826	0819 - 0825	0817 - 0823	0816 - 0822	0815 - 0821	0814 - 0820	0819 - 0825	0818 - 0824
35	0827 - 0902	0826 - 0901	0824 - 0830	0823 - 0829	0822 - 0828	0821 - 0827	0826 - 0901	0825 - 0831
36	0903 - 0909	0902 - 0908	0831 - 0906	0830 - 0905	0829 - 0904	0828 - 0903	0902 - 0908	0901 - 0907
37	0910 - 0916	0909 - 0915	0907 - 0913	0906 - 0912	0905 - 0911	0904 - 0910	0909 - 0915	0908 - 0914
38	0917 - 0923	0916 - 0922	0914 - 0920	0913 - 0919	0912 - 0918	0911 - 0917	0916 - 0922	0915 - 0921
39	0924 - 0930	0923 - 0929	0921 - 0927	0920 - 0926	0919 - 0925	0918 - 0924	0923 - 0929	0922 - 0928
40	1001 - 1007	0930 - 1006	0928 - 1004	0927 - 1003	0926 - 1002	0925 - 1001	0930 - 1006	0929 - 1005
41	1008 - 1014	1007 - 1013	1005 - 1011	1004 - 1010	1003 - 1009	1002 - 1008	1007 - 1013	1006 - 1012
42	1015 - 1021	1014 - 1020	1012 - 1018	1011 - 1017	1010 - 1016	1009 - 1015	1014 - 1020	1013 - 1019

Appendix Table 3. Recoveries of coded-wire tagged wild Auke Lake coho salmon from area specific fishery samples, 1982.

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
181-05	troll	34	3-17-29	random	6.9
116	troll	29	3-17-29	random	2.9
116-05	troll	30	3-17-29	random	1.7
116-05	troll	35	3-17-29	random	6.6
113	troll	31	3-17-29	random	3.3
113-P	troll	31	3-17-29	random	3.3
113-91	troll	34	3-17-29	random	5.1
113	troll	34	3-17-29	random	5.1
113-91	troll	35	3-17-29	random	5.1
NOUT, COUT	troll	29	3-17-29	random	-
NOUT, COUT	troll	29	3-17-29	random	-
NOUT, COUT	troll	31	3-17-29	random	-
NOUT, COUT	troll	34	3-17-29	random	-
NOUT, COUT	troll	34	3-17-29	random	-
NOUT, COUT	troll	34	3-17-29	random	-
NOUT, COUT	troll	34	3-17-29	random	-
NOUT, COUT	troll	34	3-17-29	random	-
NOUT, COUT	troll	34	3-17-29	random	-
NOUT, COUT	troll	34	3-17-29	random	-
NOUT, COUT	troll	34	3-17-29	random	-
NOUT, COUT	troll	36	3-17-29	random	-
NOUT, COUT	troll	37	3-17-29	random	-
114	troll	33	3-17-29	random	14.8
114	troll	34	3-17-29	random	6.1
114	troll	34	3-17-29	random	6.1
114-23	troll	34	3-17-29	random	6.1
114	troll	35	3-17-29	random	14.1
114	troll	35	3-17-29	random	14.1
114-25	troll	36	3-17-29	random	88.6
114	troll	37	3-17-29	random	11.2
114	troll	37	3-17-29	random	11.2
114-23	troll	39	3-17-29	random	3.0
112	seine	32	3-17-29	random	7.6
112	seine	32	3-17-29	random	7.6
112	seine	32	3-17-29	random	7.6
112-13	seine	32	3-17-29	random	7.6
112	seine	34	3-17-29	random	26.3
112	seine	35	3-17-29	random	12.6
109	seine	33	3-17-29	random	21.8
111-31	gillnet	34	3-17-29	random	11.8
111	gillnet	38	3-17-29	random	3.5
115-10	gillnet	40	3-17-29	random	3.4
115	gillnet	40	3-17-29	random	3.4
111	sport	34	3-17-29	random	5.1
116	troll	37	3-17-29	select	-

-Continued-

Appendix Table 3. (continued).

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
116	troll	37	3-17-29	select	-
116	troll	38	3-17-29	select	-
114-25	troll	33	3-17-29	select	-
114-25	troll	33	3-17-29	select	-
114	troll	33	3-17-29	select	-
114	troll	34	3-17-29	select	-
114-23	troll	37	3-17-29	select	-
109-45	troll	35	3-17-29	select	-
111	sport	33	3-17-29	select	-
111	sport	33	3-17-29	select	-
111	sport	34	3-17-29	select	-
111	sport	36	3-17-29	select	-
111	sport	38	3-17-29	select	-
111	sport	39	3-17-29	select	-
113	unknown	33	3-17-29	select	-

[1] P - landed in Pelican; S - landed in Sitka; NOUT - Districts 116, 157, 181, 183, 186, 189; COUT - Districts 113, 154.

Appendix Table 4. Recoveries of coded-wire tagged Speel Lake coho salmon from area specific fishery samples, 1982.

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
116	troll	29	4-19-10	random	2.2
116	troll	29	4-19-11	random	2.2
116	troll	29	4-19-11	random	2.2
116	troll	29	4-19-11	random	2.2
116	troll	30	4-19-10	random	1.7
116	troll	31	4-19-11	random	2.2
113-11	troll	27	4-19-10	random	2.5
113-S	troll	30	4-19-10	random	2.7
113-S	troll	31	4-19-10	random	3.3
113	troll	31	4-19-10	random	3.3
113-P	troll	33	4-19-10	random	13.2
113-P	troll	33	4-19-10	random	13.2
113-S	troll	34	4-19-10	random	5.1
113-P	troll	34	4-19-11	random	5.1
113-S	troll	34	4-19-11	random	5.1
113-S	troll	35	4-19-11	random	5.1
NOUT, COUT	troll	28	4-19-11	random	-
NOUT, COUT	troll	29	4-19-10	random	-
NOUT, COUT	troll	30	4-19-11	random	-
NOUT, COUT	troll	33	4-19-10	random	-
NOUT, COUT	troll	34	4-19-11	random	-
114-30	troll	34	4-19-10	random	6.1
114-30	troll	34	4-19-11	random	6.1
114	troll	34	4-19-10	random	6.1
114	troll	34	4-19-10	random	6.1
114	troll	37	4-19-10	random	11.2
112	troll	35	4-19-10	random	14.1
103	troll	33	4-19-10	random	35.3
112-16	seine	34	4-19-10	random	26.3
112	seine	35	4-19-10	random	12.6
112	seine	35	4-19-10	random	12.6
110	seine	35	4-19-10	random	17.9
109	seine	33	4-19-10	random	21.8
111-31	gillnet	34	4-19-10	random	11.8
115-10	gillnet	40	4-19-10	random	3.4
116	troll	38	4-19-10	select	-
113	unknown	33	4-19-10	select	-

[1] P - landed in Pelican; S - landed in Sitka; NOUT - Districts 116, 157, 181, 183, 186, 189; COUT - Districts 113, 154.

Appendix Table 5. Recoveries of coded-wire tagged Berners River coho salmon from area specific fishery samples, 1982.

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
181	troll	37	4-20-15	random	2.4
181-05	troll	37	4-20-15	random	2.4
116-05	troll	30	4-20-15	random	1.7
116-05	troll	34	4-20-15	random	6.9
116	troll	35	4-20-15	random	6.6
116-05	troll	37	4-20-15	random	2.4
NOUT	troll	37	4-20-15	random	2.4
113-91	troll	31	4-20-15	random	3.3
113-S	troll	34	4-20-15	random	5.1
NOUT, COUT	troll	31	4-20-15	random	-
NOUT, COUT	troll	33	4-20-15	random	-
NOUT, COUT	troll	33	4-20-15	random	-
NOUT, COUT	troll	34	4-20-15	random	-
NOUT, COUT	troll	34	4-20-15	random	-
NOUT, COUT	troll	34	4-20-15	random	-
NOUT, COUT	troll	34	4-20-15	random	-
NOUT, COUT	troll	34	4-20-15	random	-
NOUT, COUT	troll	34	4-20-15	random	-
NOUT, COUT	troll	40	4-20-15	random	-
NOUT, COUT	troll	40	4-20-15	random	-
114	troll	34	4-20-15	random	6.1
114	troll	34	4-20-15	random	6.1
114-23	troll	35	4-20-30	random	14.1
114	troll	37	4-20-15	random	11.2
114-23	troll	39	4-20-15	random	3.0
114	troll	39	4-20-30	random	3.0
114	troll	39	4-20-15	random	3.0
114-25	troll	39	4-20-15	random	3.0
115	gillnet	38	4-20-15	random	4.8
115	gillnet	38	4-20-15	random	4.8
115-10	gillnet	39	4-20-15	random	4.1
115-10	gillnet	39	4-20-15	random	4.1
115-10	gillnet	39	4-20-15	random	4.1
115-10	gillnet	39	4-20-15	random	4.1
115-10	gillnet	39	4-20-15	random	4.1
115-10	gillnet	39	4-20-15	random	4.1
115-10	gillnet	39	4-20-30	random	4.1
115-10	gillnet	40	4-20-15	random	3.4
115-10	gillnet	40	4-20-15	random	3.4
115-10	gillnet	40	4-20-15	random	3.4
115-10	gillnet	40	4-20-15	random	3.4
115-10	gillnet	40	4-20-15	random	3.4
115-10	gillnet	40	4-20-15	random	3.4
115-10	gillnet	40	4-20-15	random	3.4

-Continued-

Appendix Table 5. (continued.)

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
115-10	gillnet	40	4-20-15	random	3.4
115-10	gillnet	40	4-20-15	random	3.4
115-10	gillnet	40	4-20-15	random	3.4
115-10	gillnet	40	4-20-15	random	3.4
115-10	gillnet	40	4-20-30	random	3.4
115-10	gillnet	40	4-20-30	random	3.4
115-31	gillnet	41	4-20-15	random	5.2
181	troll	35	4-20-15	select	-
116	troll	37	4-20-15	select	-
116	troll	37	4-20-15	select	-
116	troll	38	4-20-15	select	-
116	troll	38	4-20-15	select	-
116	troll	38	4-20-15	select	-
114	seine	34	4-20-15	select	-
115	gillnet	39	4-20-15	select	-
111	sport	38	4-20-15	select	-

[1] P - landed in Pelican; S - landed in Sitka; NOUT - Districts 116, 157, 181, 183, 186, 189; COUT - Districts 113, 154.

Appendix Table 6. Recoveries of coded-wire tagged Ford Arm Lake coho salmon from area specific fishery samples, 1982.

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
116	troll	36	4-20-21	random	5.2
116	troll	36	4-20-21	random	5.2
113-P	troll	29	4-20-21	random	3.1
113-P	troll	29	4-20-21	random	3.1
113-S	troll	29	4-20-21	random	3.1
113-S	troll	29	4-20-21	random	3.1
113-P	troll	30	4-20-21	random	2.7
113	troll	30	4-20-21	random	2.7
113	troll	30	4-20-21	random	2.7
113	troll	30	4-20-21	random	2.7
113, 154	troll	30	4-20-21	random	2.7
113	troll	31	4-20-21	random	3.3
113-71	troll	31	4-20-21	random	3.3
113-71	troll	31	4-20-21	random	3.3
113-71	troll	31	4-20-21	random	3.3
113-P	troll	31	4-20-21	random	3.3
113-21	troll	33	4-20-21	random	13.2
113-91	troll	34	4-20-21	random	5.1
113-P	troll	34	4-20-21	random	5.1
113-P	troll	34	4-20-21	random	5.1
113-S	troll	36	4-20-21	random	1.4
113-S	troll	36	4-20-21	random	1.4
113-S	troll	36	4-20-21	random	1.4
113-71	troll	36	4-20-21	random	1.4
113-S	troll	36	4-20-21	random	1.4
113-S	troll	36	4-20-21	random	1.4
NOUT, COUT	troll	29	4-20-21	random	-
NOUT, COUT	troll	31	4-20-21	random	-
NOUT, COUT	troll	33	4-20-21	random	-
NOUT, COUT	troll	33	4-20-21	random	-
NOUT, COUT	troll	34	4-20-21	random	-
NOUT, COUT	troll	35	4-20-21	random	-
NOUT, COUT	troll	35	4-20-21	random	-
NOUT, COUT	troll	35	4-20-21	random	-
114-21	troll	33	4-20-21	random	14.8
114	troll	34	4-20-21	random	6.1
106-41	troll	33	4-20-21	random	2.5
104-40	troll	29	4-20-21	random	10.6
104-40	seine	33	4-20-21	random	6.0
113-S	troll	28	4-20-21	select	-
113	troll	28	4-20-21	select	-
113	troll	29	4-20-21	select	-

[1] "Foot notes from following page P - landed in Pelican; S - landed in Sitka; NOUT - Districts 116, 157, 181, 183, 186, 189; COUT - Districts 113, 154.

Appendix Table 7. Recoveries of coded-wire tagged Politofski Lake coho 1982 salmon from area specific fishery samples.

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
116	troll	29	4-20-22	random	2.2
116	troll	31	4-20-22	random	2.2
116	troll	31	4-20-22	random	2.2
113-22	troll	26	4-20-22	random	2.4
113-22	troll	26	4-20-22	random	2.4
113-S	troll	26	4-20-22	random	2.4
113-S	troll	28	4-20-22	random	2.8
113-S	troll	28	4-20-22	random	2.8
113-S	troll	29	4-20-22	random	3.1
113-S	troll	29	4-20-22	random	3.1
113-S	troll	29	4-20-22	random	3.1
113-22	troll	29	4-20-22	random	3.1
113-P	troll	30	4-20-22	random	2.7
113	troll	30	4-20-22	random	2.7
113	troll	30	4-20-22	random	2.7
113-44	troll	30	4-20-22	random	2.7
113-41	troll	31	4-20-22	random	3.3
113-S	troll	31	4-20-22	random	3.3
113-S	troll	33	4-20-22	random	13.2
113-S	troll	34	4-20-22	random	5.1
113-21	troll	34	4-20-22	random	5.1
113-S	troll	35	4-20-22	random	5.1
113-22	troll	36	4-20-22	random	1.4
NOUT, COUT	troll	29	4-20-22	random	-
NOUT, COUT	troll	31	4-20-22	random	-
NOUT, COUT	troll	34	4-20-22	random	-
114	troll	35	4-20-22	random	14.1
113-22	troll	34	4-20-22	select	-
113-S	unknown	33	4-20-22	select	-
113-S	unknown	34	4-20-22	select	-
113-S	unknown	34	4-20-22	select	-

[1] P - landed in Pelican; S - landed in Sitka; NOUT - Districts 116, 157, 181, 183, 186, 189; COUT - Districts 113, 154.

Appendix Table 8. Recoveries of coded-wire tagged Warm Chuck Lake coho salmon from area specific fishery samples, 1982.

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
116	troll	29	4-20-17	random	2.2
116	troll	29	4-20-17	random	2.2
116-05	troll	35	4-20-17	random	6.6
NOUT	troll	35	4-20-17	random	6.6
113-S	troll	29	4-20-17	random	3.1
113-S	troll	29	4-20-17	random	3.1
113-S	troll	30	4-20-17	random	2.7
113-91	troll	32	4-20-17	random	-
113-S	troll	32	4-20-17	random	-
113-11	troll	34	4-20-17	random	5.1
NOUT, COUT	troll	29	4-20-17	random	-
NOUT, COUT	troll	31	4-20-17	random	-
NOUT, COUT	troll	31	4-20-17	random	-
NOUT, COUT	troll	33	4-20-17	random	-
104-40	troll	29	4-20-17	random	10.6
104-40	troll	31	4-20-17	random	5.7
104-50	troll	31	4-20-17	random	5.7
103	troll	33	4-20-17	random	35.3
103	troll	33	4-20-17	random	35.3
SIN, CIN	troll	35	4-20-17	random	-
SIN, CIN	troll	35	4-20-17	random	-
SIN, CIN	troll	35	4-20-17	random	-
102-10	troll	30	4-20-17	random	1.6
104	seine	31	4-20-17	random	4.4
104-40	seine	33	4-20-17	random	6.0
104-40	seine	33	4-20-17	random	6.0
104-40	seine	33	4-20-17	random	6.0
103-70	seine	37	4-20-17	random	2.8
102-10	seine	31	4-20-17	random	2.3
113-22	troll	34	4-20-17	select	-
109	troll	31	4-20-17	select	-
101	troll	29	4-20-17	select	-
104	seine	30	4-20-17	select	-
101	gillnet	33	4-20-17	select	-
113-S	unknown	33	4-20-17	select	-
104-40	unknown	31	4-20-17	select	-
104-40	unknown	36	4-20-17	select	-

[1] P - landed in Pelican; S - landed in Sitka; NOUT - Districts 116, 157, 181, 183, 186, 189; COUT - Districts 113, 154; SIN - Districts 101, 102; CIN - Districts 106-108.

Appendix Table 9. Recoveries of coded-wire tagged Klakas Lake coho salmon from area specific fishery samples, 1982.

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
116	troll	31	4-20-23	random	2.2
113-31	troll	30	4-20-23	random	2.7
113-P	troll	31	4-20-23	random	3.3
NOUT, COUT	troll	29	4-20-23	random	-
105, 109, 110	troll	30	4-20-23	random	1.5
109-61	troll	31	4-20-23	random	2.3
103-70	troll	31	4-20-23	random	5.7
104-40	seine	29	4-20-23	random	2.6
104-40	seine	29	4-20-23	random	2.6
104	seine	31	4-20-23	random	4.4
104-40	seine	33	4-20-23	random	6.0
104	seine	33	4-20-23	random	6.0
103-21	seine	35	4-20-23	random	8.8
101, 102	seine	35	4-20-23	random	6.6
101-25	seine	37	4-20-23	random	4.4
104-40	unknown	29	4-20-23	select	-
104-40	unknown	31	4-20-23	select	-
104-40	unknown	35	4-20-23	select	-

[1] P - landed in Pelican; S - landed in Sitka; NOUT - Districts 116, 157, 181, 183, 186, 189; COUT - Districts 113, 154.

Appendix Table 10. Recoveries of coded-wire tagged Hugh Smith Lake coho salmon from area specific fishery samples, 1982.

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
113	troll	29	4-20-16	random	3.1
113-S	troll	29	4-20-16	random	3.1
154	troll	30	4-20-16	random	2.7
113-21	troll	30	4-20-16	random	2.7
113-S	troll	30	4-20-16	random	2.7
113-P	troll	30	4-20-16	random	3.3
113-S	troll	30	4-20-18	random	2.7
113-S	troll	30	4-20-18	random	2.7
113-P	troll	31	4-20-16	random	3.3
113	troll	31	4-20-18	random	3.3
113-P	troll	31	4-20-18	random	3.3
113-S	troll	31	4-20-18	random	3.3
113-91	troll	31	4-20-18	random	3.3
113-P	troll	33	4-20-16	random	13.2
113-21	troll	33	4-20-16	random	13.2
113-S	troll	34	4-20-16	random	5.1
113-S	troll	34	4-20-16	random	5.1
113-41	troll	34	4-20-16	random	5.1
113-P	troll	34	4-20-16	random	5.1
113-41	troll	34	4-20-16	random	5.1
113-22	troll	34	4-20-16	random	5.1
113-S	troll	34	4-20-18	random	5.1
113-S	troll	35	4-20-16	random	5.1
113-S	troll	35	4-20-16	random	5.1
113-P	troll	35	4-20-16	random	5.1
113-S	troll	36	4-20-18	random	1.4
NOUT, COUT	troll	29	4-20-16	random	-
NOUT, COUT	troll	29	4-20-18	random	-
NOUT, COUT	troll	31	4-20-16	random	-
NOUT, COUT	troll	33	4-20-16	random	-
NOUT, COUT	troll	34	4-20-16	random	-
NOUT, COUT	troll	35	4-20-16	random	-
NOUT, COUT	troll	35	4-20-16	random	-
NOUT, COUT	troll	35	4-20-18	random	-
NOUT, COUT	troll	35	4-20-18	random	-
NOUT, COUT	troll	40	4-20-16	random	-
114	troll	30	4-20-16	random	6.6
109	troll	29	4-20-18	random	2.2
109-10	troll	33	4-20-16	random	8.5
109	troll	35	4-20-16	random	7.3
109-62	troll	35	4-20-18	random	7.3
109-10	troll	35	4-20-18	random	7.3
105	troll	36	4-20-18	random	5.8
106	troll	31	4-20-16	random	1.3

-Continued-

Appendix Table 10. (continued)

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
104-40	troll	29	4-20-16	random	10.6
104-10	troll	29	4-20-16	random	10.6
104-40	troll	31	4-20-16	random	5.7
104-40	troll	33	4-20-18	random	35.3
102	troll	27	4-20-18	random	1.5
102	troll	27	4-20-18	random	1.5
102-30	troll	30	4-20-16	random	1.6
102-80	troll	33	4-20-16	random	6.7
102-80	troll	35	4-20-16	random	2.0
102-10	troll	38	4-20-16	random	5.2
101	troll	31	4-20-16	random	1.5
101	troll	31	4-20-18	random	1.5
101	troll	31	4-20-18	random	1.5
101	troll	33	4-20-18	random	6.7
101-21	troll	35	4-20-16	random	2.0
101	troll	35	4-20-16	random	2.0
101	troll	36	4-20-16	random	3.2
101	troll	36	4-20-18	random	3.2
101	troll	39	4-20-16	random	9.7
101, 102	troll	34	4-20-16	random	3.0
104-10	seine	29	4-20-16	random	2.6
104-40	seine	30	4-20-16	random	2.0
104-40	seine	33	4-20-16	random	6.0
104-40	seine	37	4-20-16	random	2.8
104-40	seine	37	4-20-16	random	2.8
101-41	seine	33	4-20-16	random	4.2
101-23	seine	33	4-20-18	random	4.2
101	seine	35	4-20-16	random	6.6
101-41	seine	36	4-20-16	random	6.3
101-30	seine	36	4-20-16	random	6.3
101-11	seine	37	4-20-16	random	4.4
101-25	seine	37	4-20-16	random	4.4
101, 102	seine	33	4-20-18	random	4.2
106-108	gillnet	36	4-20-16	random	4.0
101-11	gillnet	31	4-20-16	random	3.1
101-11	gillnet	32	4-20-16	random	3.2
101-11	gillnet	34	4-20-16	random	8.3
101-11	gillnet	38	4-20-16	random	5.1
116	troll	39	4-20-16	select	-
116	troll	39	4-20-16	select	-
104	unknown	33	4-20-16	select	-
104	unknown	33	4-20-16	select	-
104	unknown	33	4-20-16	select	-

-Continued-

Appendix Table 10. (continued)

District(s)[1]	Gear	Statistical Week	Tag Code	Recovery Type	Expansion
104	unknown	33	4-20-18	select	-
101-30	unknown	35	4-20-16	select	-
101	unknown	36	4-20-16	select	-
101	unknown	37	4-20-16	select	-
101	unknown	37	4-20-16	select	-
101-41	unknown	37	4-20-16	select	-
101	unknown	37	4-20-18	select	-
101, 102	unknown	33	4-20-18	select	-

[1] P - landed in Pelican; S - landed in Sitka; NOUT - Districts 116, 157, 181, 183, 186, 189; COUT - Districts 113, 154.

Appendix Table 11. Wild coho salmon escapement counts at the Auke Creek weir, 1971-1983.

Year	Adults	Jacks[1]	Comments
1971	308	608	
1972	967	146	
1973	399	238	
1974	768	379	
1975	1,310	98	
1976	272	182	Washed out 3 Oct.
1977	908	596	
1978	683	356	
1979	596	107	Washed out 3 days
1980	698	276	
1981	644	231	
1982	447	338	
1983	694	261	

[1] Age .0.

Appendix Table 12. Berners River coho salmon escapement surveys, 1960-1983.

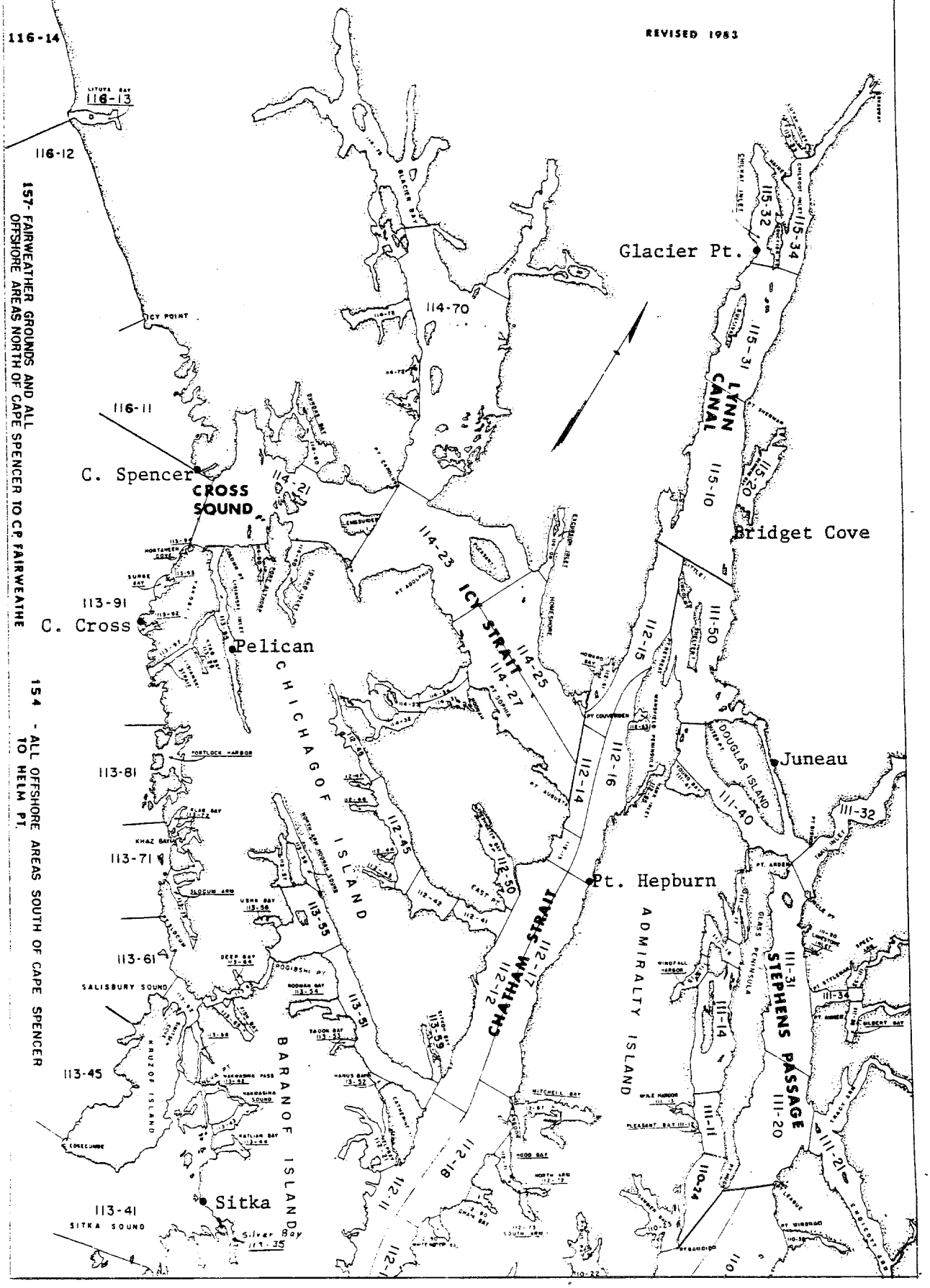
Year	Date	Count	Method	Remarks
1960	6 Oct.	6,000	aerial	
1961	25 Sept.	600	aerial	poor visibility
1968	23 Sept.	2,500	aerial	
	11 Oct.	5,000	aerial	schooled in pools
1969	1 Oct.	5,000	aerial	
	14 Oct.	320	aerial	
	22 Oct.	345	boat	lower 11 km surveyed
	23 Oct.	1,600	aerial	
1970	5 Oct.	3,000	aerial	
1971	12 Oct.	3,600	aerial	
1972	6 Oct.	4,200	aerial	
	13 Oct.	3,800	aerial	
	20 Oct.	1,500	aerial	
	2 Nov.	1,100	aerial	
1973	5 Oct.	300	aerial	lower 3 km surveyed
	10 Oct.	2,000	aerial	300 intertidal; 1,700 river
1974	4 Oct.	820	aerial	
	28 Oct.	620	aerial	lower river surveyed
	6 Nov.	4,121	foot	
1975	24 Sept.	140	aerial	
	22 Oct.	3,500	aerial	
	28 Oct.	4,342	foot	
1976	12 Oct.	1,500	aerial	
	21 Oct.	3,600	aerial	
	5 Nov.	1,820	foot	
1977	1 Sept.	-	aerial	
	26 Sept.	700	aerial	
	3 Oct.	1,600	aerial	
	19 Oct.	2,500	aerial	
	23 Oct.	3,200	aerial	
	26 Oct.	1,400	aerial	
	9 Nov.	2,200	helicopter	

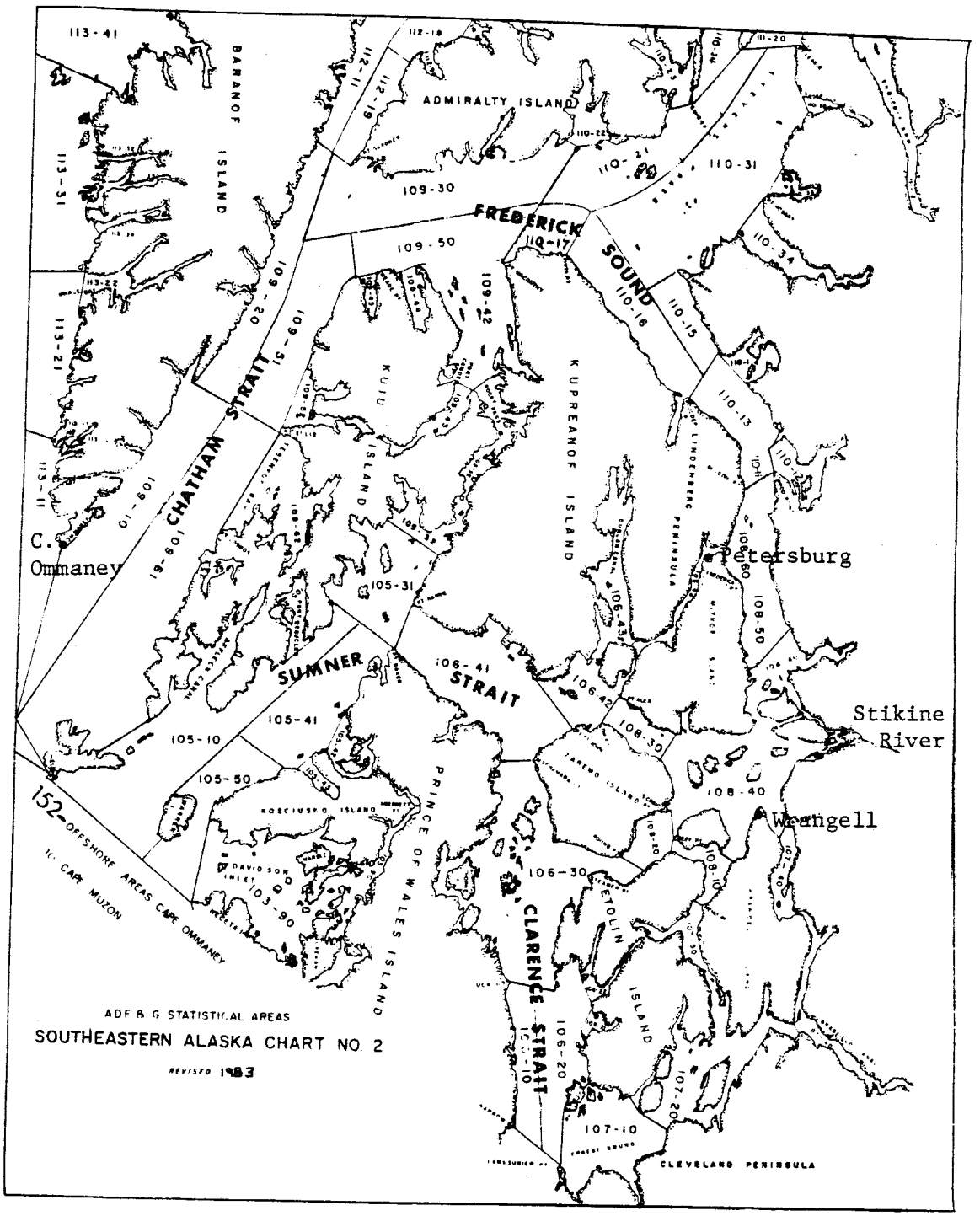
-Continued-

Appendix Table 12. (continued)

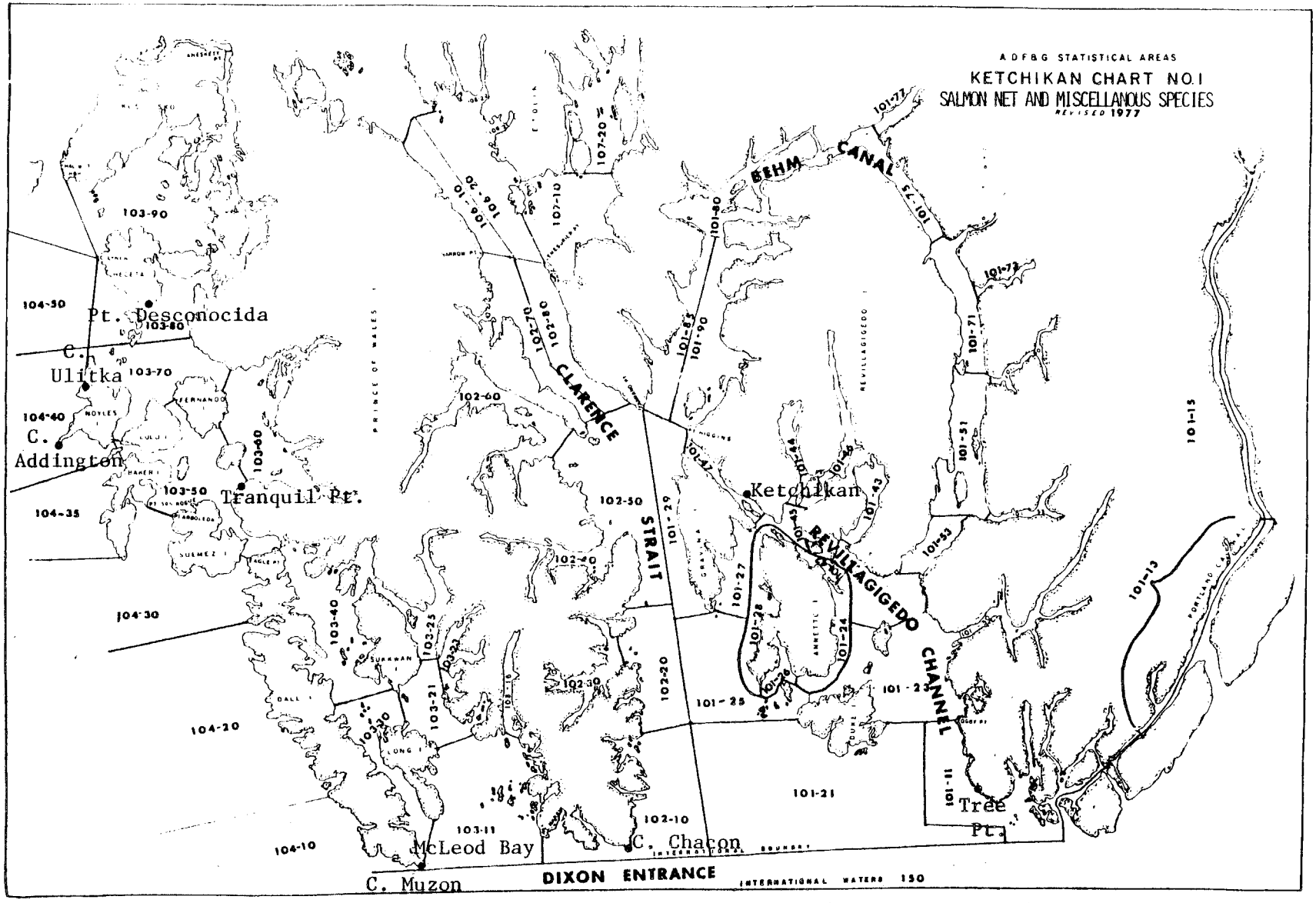
Year	Date	Count	Method	Remarks
1978	21 Sept.	50	aerial	
	25 Sept.	200	aerial	
	16 Oct.	1,370	aerial	300 in lower river
	8 Nov.	3,108	foot	
	13 Nov.	500	aerial	poor visibility
1979	10 Sept.	90	aerial	poor visibility
	19 Sept.	-	aerial	poor visibility
	19 Oct.	900	aerial	all in pools
	25 Oct.	910	aerial	
	4 Nov.	3,460	foot	
	6 Nov.	1,600	aerial	
	7 Nov.	2,900	aerial	
1980	12 Sept.	840	aerial	
	13 Oct.	890	aerial	all in pools
	31 Oct.	2,300	aerial	most in pools
	7 Nov.	2,820	helicopter	some foot counts
1981	7 Oct.	7,170	aerial	all in pools
	2 Nov.	4,420	helicopter	most in pools
1982	9 Sept.	20	aerial	
	22 Sept.	850	aerial	
	19 Oct.	9,000	aerial	still in pools
	1 Nov.	3,500	aerial	400 in Moose Slough
	5 Nov.	7,505	foot	400 in Moose Slough
1983	7 Sept.	125	aerial	
	20 Sept.	1,000	foot	lower 3 km surveyed
	27 Sept.	9,800	aerial	1,500 in Moose Slough
	27 Sept.	13,000	aerial	in pools
	31 Oct.	9,840	foot	770 in Moose Slough

Appendix Figure 1. Northern Southeastern Alaska statistical areas.

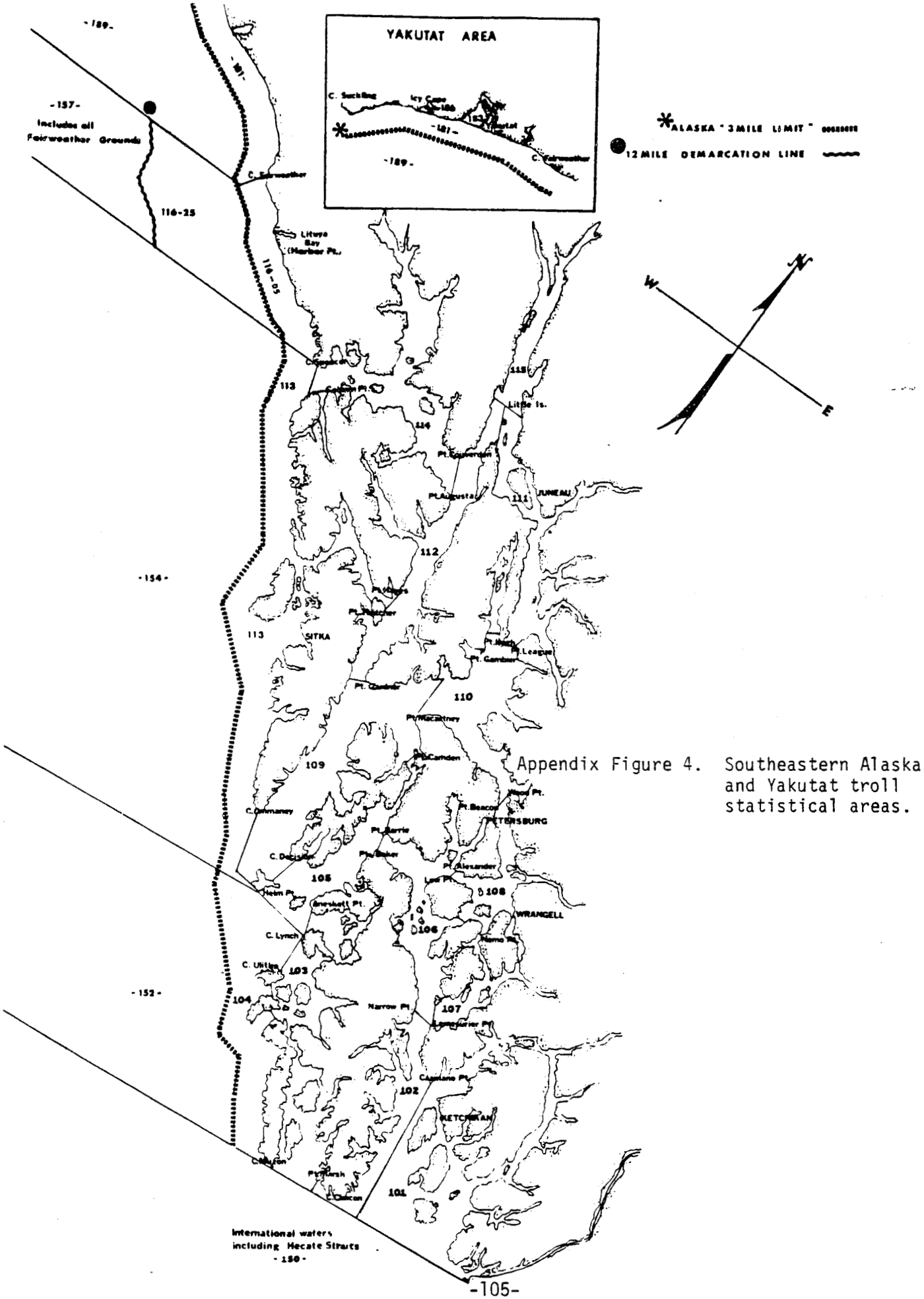




Appendix Figure 2. Central Southeastern Alaska statistical areas.



Appendix Figure 3. Southern Southeastern Alaska statistical areas.



Appendix Figure 4. Southeastern Alaska and Yakutat troll statistical areas.

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