

FISHERY CONTRIBUTIONS, ESCAPEMENTS, HARVEST RATES, MIGRATORY PATTERNS AND
SURVIVAL RATES OF WILD COHO SALMON (*Oncorhynchus kisutch*) STOCKS
IN SOUTHEAST ALASKA BASED ON CODED-WIRE TAGGING STUDIES, 1987-1988

By

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and

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TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES	v
LIST OF FIGURES	vii
LIST OF APPENDICES	viii
ABSTRACT	ix
INTRODUCTION	1
SMOLT AND JUVENILE TAGGING	2
Methods and Procedures	2
Results	2
Ford Arm Lake Juveniles	2
Kadashan River Juveniles and Smolts	2
Hugh Smith Lake Smolts	3
McDonald Lake Smolts	3
Badger Lake Smolts	3
Berners River Juveniles	3
TAG RECOVERY FROM FISHERIES	3
ESCAPEMENT ENUMERATION AND SAMPLING	4
Methods and Procedures	4
Results	5
Berners River Surveys	5
Ford Arm Lake Weir	5
Salmon Bay Lake Weir	5
Hugh Smith Lake Weir	6
HARVEST BY GEAR TYPE AND ESCAPEMENT	6
Methods and Procedures	6
Results and Discussion	7

TABLE OF CONTENTS (Continued)

	<u>Page</u>
HARVEST RATES	8
Methods and Procedures	8
Results and Discussion	9
HARVEST DISTRIBUTION	10
Methods and Procedures	10
Results and Discussion	10
MIGRATORY TIMING	12
Methods and Procedures	12
Results and Discussion	12
SURVIVAL RATES	13
Methods and Procedures	13
Results and Discussion	13
DISCUSSION	14
LITERATURE CITED	17
APPENDICES	40

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Summary of coded-wire tagging of wild coho salmon, 1 July 1987 - 30 June 1988	19
2. Estimated harvest and percent by gear type, escapement and total return of coho salmon returning to the Berners River, 1982, 1983 and 1985-1987	20
3. Estimated harvest and percent by gear type, escapement and total return of coho salmon returning to Ford Arm Lake, 1982, 1983 and 1985-1987	21
4. Estimated harvest and percent by gear type, escapement and total return of coho salmon returning to Salmon Bay Lake, 1986-1987	22
5. Estimated harvest and percent by gear type, escapement and total return of coho salmon returning to Hugh Smith Lake, 1982-1987	23
6. Estimated harvest rate by fishery for coho salmon returns to the Berners River, 1982, 1983 and 1985-1987	24
7. Estimated harvest rate by area for coho salmon returns to Hugh Smith Lake, 1982-1987	25
8. Estimated harvest distribution of Berners River coho salmon by area and gear type, 1982, 1983 and 1985-1987	26
9. Estimated harvest distribution of Ford Arm Lake coho salmon by area and gear type, 1982, 1983 and 1985-1987	27
10. Estimated harvest distribution of Warm Chuck Lake coho salmon by area and gear type, 1982, 1983 and 1985-1987	28
11. Estimated harvest distribution of Salmon Bay Lake coho salmon by area and gear type, 1986-1987	29
12. Estimated harvest distribution of Hugh Smith Lake coho salmon by area and gear type, 1982-1987	30
13. Estimated harvest distribution of Unuk River coho salmon by area and gear type, 1985-1987	31
14. Estimated harvest distribution of Chickamin River coho salmon by area and gear type, 1984-1987	32

LIST OF TABLES (Continued)

<u>Table</u>		<u>Page</u>
15.	Estimated survival rate of coded-wire tagged wild Hugh Smith Lake coho salmon smolts, 1981-1986	33
16.	Estimated survival rates of predominantly age 1+ and older wild juvenile coho salmon from the time of tagging until entry into the fisheries, 1979-1984	34

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1.	Annual commercial catch of coho salmon in Southeast Alaska and decade averages, in millions of fish, 1890-1988	35
2.	Wild coho salmon coded-wire tagging locations in Southeast Alaska, 1976-1988	36
3.	Average weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged coho salmon from the Berners River, Ford Arm Lake and Warm Chuck Lake (bar graph) in Southeast Alaska, 1982, 1983 and 1985-1987	37
4.	Average weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged coho salmon from Salmon Bay Lake (1986-1987), the Unuk River (1985-1987) and the Chickamin River (1984-1987) in Southeast Alaska . .	38
5.	Average weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged Hugh Smith Lake coho salmon (bar graph) in: (1) the Northwest, North-east and Southwest Quadrants; (2) the Southeast Quadrant and (3); all areas of Southeast Alaska combined, 1982-1987	39

LIST OF APPENDICES

	<u>Page</u>
APPENDIX A: AREAS AND STATISTICAL WEEKS	
A.1 - Map of Southeast Alaska statistical fishing districts	41
A.2 - Statistical areas of Southeast Alaska belonging to Pacific Marine Fisheries Commission (PMFC) areas and quadrants	42
A.3 - Statistical weeks used in recording and compiling Southeast Alaska commercial fisheries catch data	43
APPENDIX B: TIMING OF THE TROLL CATCH	
B.1 - Estimated weekly proportion of the total troll catch of coded-wire tagged Berners River coho salmon, 1982, 1983 and 1985-1987	44
B.2 - Estimated weekly proportion of the total troll catch of coded-wire tagged Ford Arm Lake coho salmon, 1982, 1983 and 1985-1987	45
B.3 - Estimated weekly proportion of the total troll catch of coded-wire tagged Warm Chuck Lake coho salmon, 1982, 1983 and 1985-1987	46
B.4 - Estimated weekly proportion of the total troll catch of coded-wire tagged Salmon Bay Lake coho salmon, 1986 and 1987.	47
B.5 - Estimated weekly proportion of the total troll catch of coded-wire tagged Unuk River coho salmon, 1985-1987	48
B.6 - Estimated weekly proportion of the total troll catch of coded-wire tagged Chickamin River coho salmon, 1984-1987	49
B.7 - Estimated weekly proportion of the total troll catch of coded-wire tagged Hugh Smith Lake coho salmon, 1982-1987	50
B.8 - Estimated weekly proportion of the troll catch of coded-wire tagged Hugh Smith Lake coho salmon in the Northwest, North- east and Southwest Quadrants, 1982-1987	51
B.9 - Estimated weekly proportion of the troll catch of coded-wire tagged Hugh Smith Lake coho salmon in the Southeast Quadrant, 1982-1987	52

ABSTRACT

Wild juvenile coho salmon were coded-wire tagged and returning adults were enumerated and sampled in several stream systems in Southeast Alaska in order to estimate stock parameters including total escapement, fishery contribution, migratory patterns, age structure and survival rates. A total of 40,295 coho salmon smolts and rearing juveniles was captured, coded-wire tagged and released at six sites in Southeast Alaska during 1 July 1987 - 30 June 1988. Also, during this period, coded-wire tagged adult coho salmon returned to nine sites of which four were sampled for total escapement and the incidence of coded-wire tags. The spatial and temporal distribution of the fishery harvest of individual stocks was estimated for the seven stocks for which sufficient fishery tag recoveries were available. In addition, total return, harvest rates by fishery and survival rates were estimated for those stocks for which escapements were enumerated and sampled. Three stocks that were selected for continued annual tagging and recovery based on the relative success of tagging and escapement enumeration efforts included Ford Arm Lake, Hugh Smith Lake and the Berners River. Estimated adult coho salmon returns to the three systems in 1987 were the lowest recorded since the initiation of investigations in 1982. Estimated total returns to the Berners River during 1982, 1983 and 1985-1987 ranged from 14,058-34,036 fish and averaged 25,587 while total harvest rate estimates ranged from 0.711-0.929 (average 0.782). The Berners River stock exhibited a relatively late migration that was restricted largely to northern fishing districts, with peak troll catches occurring in late August to mid-September primarily in Icy Strait, Cross Sound and waters north of Cape Spencer. The Ford Arm stock was significantly available over a broad time period from the beginning of July through the first week of September with nearly 75% of the harvest occurring in Central Outside districts (113, 154) and most of the remainder taken in Cross Sound and Northern Outside districts. Ford Arm Lake, which is located centrally in the area of most intensive troll fishing effort on the outer coast, incurred an average estimated total harvest rate of 0.548 (range 0.436-0.691) of which 0.505 (0.413-0.607) was attributed to the troll fishery while 0.043 (0-0.148) was attributed to purse seine gear. The total estimated adult return to Ford Arm Lake ranged from 3,229-6,287 fish (average 4,623). The total 1987 return to Salmon Bay Lake on northeast Prince of Wales Island was estimated at 2,954 with a total harvest rate of 0.573. During 1982-1987, estimated total returns to Hugh Smith Lake south of Ketchikan ranged from 2,352 to 6,287 (average 4,623) while harvest rate estimates ranged from 0.525-0.651 (average 0.613). Rearing juvenile coho salmon tagged in the summer of 1984 at the Berners River and Hugh Smith Lake returned to the fisheries and escapements at estimated rates of 5.1% and 10.2%, respectively. Smolts tagged at Hugh Smith Lake in 1986 survived at an estimated rate of 10.7%.

KEY WORDS: Coho salmon, coded-wire, indicator stock, migration patterns, migratory timing, harvest rate, Southeast Alaska.

INTRODUCTION

The coho salmon (*Oncorhynchus kisutch*) is an important species to commercial, sport and subsistence fisheries in Southeast Alaska. The annual commercial harvest and decade averages since 1890 are shown in Figure 1. Annual catches increased until the early 1950's, while a peak decade average of 2.05 million occurred in the 1940's. The commercial catch remained at a depressed level, averaging 1.10 million fish annually from the mid-1950's to early 1980's, followed by a resurgence in the early to mid-1980's to 2.01 million fish (1980-1987 average). The 1986 commercial harvest of 3.33 million coho salmon was the largest on record. In recent years commercial fisheries have accounted for the vast majority of the total harvest, while sport and subsistence fisheries have taken only about 3%. The 1970-1984 average harvest by gear type as a percentage of the total commercial catch was as follows: troll-60%; purse seine-20%; drift gillnet-13%; and set gillnet-7%.

The majority of the coho salmon harvested in Southeast Alaska are produced in over 2,000 endemic 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. Management of fisheries for coho salmon in Southeast Alaska is complicated by the scattered distribution of the resource and highly mixed stock nature of most of the fisheries. Effective management requires an understanding of the migratory characteristics, status, productivity, harvest rates and contribution to the fisheries of contributing stocks or groups of stocks.

In order to better understand the migratory nature of wild coho salmon stocks and the effects of the fisheries, a juvenile and smolt marking program was initiated in 1972. In the early studies, fish were marked with fluorescent pigment (Gray et al. 1978), while coded-wire tagging equipment was employed in more recent studies beginning in 1976. To date, wild coho salmon have been marked in 23 systems throughout the main part of Southeastern Alaska (Figure 2) and five systems near Yakutat.

The majority of Southeast Alaska coho salmon that were tagged as 1+ rearing juveniles returned as adults 2 years later (Gray et al. 1981). Most fish tagged as outmigrating smolts returned to spawn the following year.

This report includes a summary and analysis of tag release and recovery data for wild Southeast Alaska coho salmon stocks under study by the ADF&G, Commercial Fisheries Division during the period from 1 July 1987 - 30 June 1988. For comparison, data from prior years is included for those systems for which it is available. Coded-wire tag data for wild coho salmon populations at Salmon Lake near Sitka, Auke Lake and Yehring Creek near Juneau, Chilkoot Lake near Haines, and Vallenar Creek near Ketchikan are reported in the ADF&G, Sport Fish Division's Fishery Report Series.

SMOLT AND JUVENILE TAGGING

Wild coho salmon smolts and rearing juveniles were coded-wire tagged in five systems in Southeast Alaska.

Methods and Procedures

Outmigrating smolts were captured for tagging at Hugh Smith Lake, McDonald Lake, Badger Lake and the Kadashan River in smolt weirs and fyke traps. Wire-mesh minnow traps were used to capture age-1+ and older juveniles at the Kadashan River, McDonald Lake, Ford Arm Lake, and the Berners River. Fifty traps baited with salmon roe were checked and set four times daily at 2-hour intervals under normal water conditions. Up to 100 traps were set and checked twice daily under cold water conditions (less than 11° C) when fish were less active. Traps were moved frequently to maintain the highest possible catch rates. Juveniles were held in pens before tagging until a total of 1,000 to 4,000 was captured, but not for a period longer than 4 days. Gray and Marriott (1986) describe the minnow trapping method in detail. Outmigrating smolts captured by weir and fyke trap were tagged and released daily. A description of the coded-wire tagging technique under field conditions is found in Koerner (1977).

Results and Discussion

A total of 40,295 outmigrating smolts and rearing juveniles was coded-wire tagged during 1 July 1987 - 30 June 1988. Numbers tagged by system, year and code are listed in Table 1.

Ford Arm Lake Juveniles

A total of 11,054 juvenile coho salmon was trapped and tagged at Ford Arm Lake during 6 - 17 July 1987. Of those, an estimated 10,799 retained their tags of which 6,971 were 62-79 mm, 3,516 were 80-100 mm, and 312 were larger than 100 mm snout-fork length. Trapping success was excellent at an average of 9.3 coho salmon 62 mm and larger per trap, while the surface water temperature averaged 12.6° C.

Kadashan River Juveniles and Smolts

A revolving screen Humphrey trap was operated on the lower Kadashan River during by the U.S. Forest Service, Forestry Sciences Laboratory. A total of 3,072 juvenile coho salmon and smolts was captured during 28 April - 14 May of which 3,037 were tagged and released. Minnow traps were used to capture juvenile coho salmon in several beaver ponds along the lower river as part of

a habitat study. A total of 2,191 coho salmon that were captured in these ponds during 14 May - 5 June were tagged and released.

Hugh Smith Lake Smolts

A smolt weir at the outlet of Hugh Smith Lake was operated during 13 April - 25 May. The first coho salmon smolts entered the trap on 26 April and the count had peaked at over 500 per day and dwindled to the range of 50 - 100 per day by the end of the project. A total of 5,319 smolts was counted of which 5,292 were tagged and released. Of the total number tagged, 5,202 (98.3%) were estimated to retain their tags based on overnight tag retention samples.

McDonald Lake Smolts

A total of 5,761 coho salmon smolts was captured and tagged at McDonald Lake during 20 April - 24 May 1988 using a fyke trap at the outlet and minnow traps in the outlet area and in a side pond. Of the total number tagged, 5,617 (97.5%) were estimated to have retained their tags.

Badger Lake Smolts

A total of 3,559 coho salmon smolts was captured with a smolt weir and tagged at the outlet of Badger Lake during May 1988. Of those, an estimated 3,523 (98.9%) retained their tags.

Berners River Juveniles

A total of 9,926 juvenile coho salmon was captured and coded-wire tagged at the Berners River during 17 - 30 June 1988. The average catch was relatively poor at 4.6 coho salmon per trap for fish that were 60 mm and larger. The mean length of tagged fish was 79.0 mm (N = 827) and was not significantly different for the slough (mean = 78.3 mm; N = 440) and Det's Pond (mean = 79.7 mm; N = 387). The temperature in the slough averaged 7.5° C while the surface of Det's Pond averaged 13.9° C.

TAG RECOVERY FROM FISHERIES

Marine fisheries in Southeast Alaska and northern British Columbia were sampled for coded-wire tags. Commercial catch sampling for coded-wire tagged coho salmon in Southeast Alaska was conducted by ADF&G sampling personnel stationed at fish processors and buying stations located throughout the region. The samplers watched for adipose clipped coho salmon during off-

loading and sorting operations. Skippers of fishing vessels and tenders were interviewed to determine fishing districts (Appendix A.1). The heads of all adipose fin clipped fish were sent to the ADF&G Coded-wire Tag Lab in Juneau for removal and decoding of tags. Areas used in expanding random recoveries from the troll fishery were four quadrants, while recoveries from net and trap fisheries were expanded by Pacific Marine Fisheries Commission (PMFC) area. Time strata used for expanding net and trap recoveries were statistical weeks (Appendix A.2), while troll fishery samples were expanded over the total catch for open periods. Exceptions were that troll recoveries were expanded by statistical week-quadrant for analysis of migratory timing and period-PMFC area for analysis of harvest distribution. Randomly recovered tags were expanded by the inverse of the proportion of the catch that was sampled within area, gear type and weekly strata while adjustments were made to account for lost samples (Clark and Bernard 1987).

The ADF&G Sport Fish Division conducted a creel census and survey of the Juneau and Ketchikan marine recreational fisheries. Tags recovered from random samples were expanded over five strata for the Juneau area and three strata for the Ketchikan area. Fish entered in the salmon derbies were sampled at a 100% rate while other landings were sampled at an overall rate of 11.3% for the Juneau fishery and 16.7% for the Ketchikan fishery.

Sampling of British Columbia coastal fisheries and reporting of coded-wire tag recoveries was conducted by the Canada Department of Fisheries and Oceans (DFO).

ESCAPEMENT ENUMERATION AND SAMPLING

Methods and Procedures

Coho salmon escapements were enumerated or estimated at Ford Arm Lake, Salmon Bay Lake, Hugh Smith Lake and the Berners River. As many fish as possible were examined for adipose clips at weir sites and during sampling operations on the spawning grounds. Marked fish that were counted at weirs were examined with a magnetic field detector to determine whether or not a tag was present. Only fish that did not register a positive signal were sacrificed and the heads sent to the tag lab for further verification. Age-length-sex data was taken from a target sample of 600 fish from all segments of the run. Daily weir counts and age-sex-length data are reported by Wood and Van Alen (In press).

Results

Berners River Surveys

The coho salmon escapement to the Berners River was surveyed and sampled during 20-27 October. A total 3,260 adult coho salmon was counted of which 1,501 were captured with a 12 m beach seine and sampled for coded-wire tags. Thirty-nine adipose clipped fish were recovered from which the heads were taken and tags decoded. Tags were found in 31 of the 39 heads. Of the 31 tags recovered, 27 were implanted in 1985 while 3 were implanted in 1986 and one was lost before reading.

Ford Arm Lake Weir

The Ford Arm Lake Weir was operated during 11 August - October 31 and remained fish-tight throughout the period of operation. The first coho salmon passed the weir on 15 August and a total of 1,579 adults (age .1) was counted during the period of operation, all of which were marked with a partial dorsal clip. In addition, 115 adults that did not pass the weir were enumerated including: 16 unspawned dead adults observed during downstream surveys (one of which was ad clipped), 2 unmarked adults (without ad clips) that washed up on the weir, and 97 adults that were counted downstream of the weir on October 30. Overall, a total of 1,597 adults was sampled for ad clips of which 216 were marked. Of the marked fish, 215 were examined for tags of which 208 registered positive with the magnetic field detector while 7 did not. Tags were subsequently found in 3 of the 7 fish that did not register a signal on the field detector. Therefore, the sample of 215 marked fish was assumed to contain 211 tags. A total of 129 jacks (age .0) was counted at the weir of which 14 had adipose clips (all registered positive for tags). An additional 7 jacks were counted downstream on 30 October.

Salmon Bay Lake Weir

The Salmon Bay Lake Weir was operated from late June through 22 October and remained effective throughout the period. The first coho salmon passed the weir on 1 September and a total of 1,235 adults (age .1) and 31 jacks (age .0) was captured in the trap. In addition, 16 adults were counted downstream of the weir at the time it was removed and a peak survey of 11 adults was made in a side tributary below the weir on 8 October for a total estimated escapement to the system of 1,262 adults. Of the 1,235 adults examined at the weir, 73 were missing adipose fins. All were checked for coded-wire tags with a magnetic field detector of which 33 did not register a positive signal. Upon examination of the heads at the tag lab, only one of the 33 was found not to contain a tag implanted at Salmon Bay Lake in 1985. The weir crew noted that the field detector did not appear to function properly and did not have adequate sensitivity. All of the fish that did register a positive signal

were assumed to contain a tag. None of the jacks that were enumerated at the weir were marked.

Hugh Smith Lake Weir

The Hugh Smith Lake Weir was operated from early June through 21 October. The first coho salmon passed the weir on 3 August and a total of 722 adults and 13 jacks was counted. Seventy adults were enumerated below the weir just before it was removed on 21 October. The weir was inoperational during a period of extreme high water for a total of 18 hours from 2 p.m., 30 September until 10 a.m., 1 October. A total of 465 fish that entered the lake was tagged with Floy tags and the posterior three rays of the dorsal fin were clipped just above the back as a secondary mark. Tag recovery surveys were conducted in and around the inlet streams (Buschman and Cobb Creeks) during December and November. Only 37 adults were captured with dipnets and sport gear of which 14 had Floy tags, while one fish had a secondary mark that indicated a lost tag. An additional dorsal fin mark was placed on all recovery samples to avoid repeat sampling. A total of 1,107 adults passed into the lake during and after the weir operation based on a simple Peterson estimate. After adding 11 weir mortalities and fish sacrificed for samples, the gross escapement to the system was estimated at 1,118 adults (95% C.I. 725-1,511). A total of 500 adults was examined at the weir and during the recovery surveys of which 131 had adipose clips. Of the adipose clipped fish, 124 were examined with a magnetic field detector of which 123 registered a positive signal, while one recovered on 15 September did not. The fish that did not register a signal had been tagged and released in the Babine River in the upper Skeena River system in northern B.C. in April 1986 (code: 2-34-31). The recovery of this fish was considered to be a rare event and it was not included in the weir count or tag recovery sample. Heads were taken from five other adults and all contained tags implanted in Hugh Smith Lake smolts in 1986. Only one of the 13 jacks in the weir count had an adipose clip.

HARVEST BY GEAR TYPE AND ESCAPEMENT

Methods and Procedures

The estimated harvest by gear type and escapement were computed for coho salmon returns to four systems (Tables 2-5). Alaska troll fishery tag recoveries were expanded to total catch by quadrant (Appendix A.2) and fishing period (time between fishery openings and closures). Recoveries from net fisheries were expanded by PMFC area (Appendix A.2) and statistical week (Appendix A.3). Fishery contribution estimates for tagged fish were divided by the proportion tagged in escapement samples to estimate total stock contributions.

Results and Discussion

During 1982, 1983 and 1985-1987, the total return to the Berners River in lower Lynn Canal averaged an estimated 25,587 fish (range 14,058-34,036; Table 2). The estimated contribution to the Alaska troll fishery and the Lynn Canal drift gillnet fishery averaged 12,334 (range 7,206-17,153) and 7,358 (range 3,301-10,568), respectively. Estimated total contributions to the purse seine and marine sport fisheries averaged only 40 fish and 102 fish, respectively. The estimated total contribution to all fisheries averaged 19,882 fish (range 10,798-24,196) while the total escapement survey count averaged 5,705 (range 1,752-9,840). The 1987 return was the poorest recorded with a total estimated return of only 14,058 and an estimated total fishery contribution of only 10,798. Of the total return, an estimated average of 49.0% was harvested by troll gear, while 28.6% and 0.2% was harvested by drift gillnet and purse seine fisheries, respectively. The Juneau Sport fisheries harvested an estimated average of only 0.4% of the total run. These percentages are all undoubtedly biased upward somewhat because escapement estimates are based on an intensive survey count rather than a weir count or mark-recapture estimate.

The estimated total return to Ford Arm Lake on the outer coast of Chichagof Island averaged 4,623 fish (range 3,229-6,287) during 1982, 1983 and 1985-1987 (Table 3). Tag recovery data indicated that the Ford Arm Lake stock was harvested by only the troll and purse seine fisheries with average estimated contribution rates 2,351 (range 1,456-3,412) and 238 (range 0-931), respectively. The estimated total fishery contribution averaged 2,589 (range 1,535-4,343) while the total escapement averaged 2,034 (range 1,546-2,662). The 1987 return to Ford Arm Lake was the lowest on record with an estimated total return of only 3,229 and an estimated fishery contribution of only 1,535. An average of 50.5% of the estimated total return was harvested by the troll fishery (range 41.3-60.7%) while 4.3% was taken by purse seine gear (range 0-14.8%).

The 1987 total return to Salmon Bay Lake in upper Clarence Strait was estimated at 2,954, with a catch of 1,692 (57.3%) and an escapement of 1,262 (42.7%; Table 4). The estimated contribution to the Alaska troll and drift gill net fisheries was 1,311 (44.4%) and 192 (6.5%). The troll fishery in northern B.C. harvested an estimated 189 Salmon Bay Lake coho salmon or 6.4% of the total return. The contribution to the fisheries by this stock was substantially lower in 1987 compared with 1986 when the troll and drift gill net fisheries harvested an estimated 3,774 and 1,430 fish, respectively, for a total harvest of 5,204. Unfortunately, an escapement estimate is not available for 1986 because fish escaped past the weir uncounted during high water, and tag recovery efforts were unsuccessful.

The total return to Hugh Smith Lake in Boca de Quadra southeast of Ketchikan, averaged an estimated 3,876 fish (range 2,352-6,149) during 1982-1987 (Table 5). The estimated total return of 2,352 fish in 1987 was the lowest recorded. The harvest of Hugh Smith Lake coho salmon was distributed across a variety of fisheries. On the average, an estimated 41.3% of the total return was

harvested by troll gear of which 35.0% was taken in Alaska and 6.3% was taken in British Columbia. An estimated average of 10.6% and 7.8%, respectively, of the total return was harvested by Alaska purse seine and drift gillnet fisheries while 1.1% was harvested by B.C. net fisheries. An average of 0.3% of the estimated total return was harvested by Annette Island fish traps while 0.2% was harvested by the Ketchikan marine sport fishery. However, sport contribution data is incomplete before 1986 because inadequate sampling throughout parts of the season. Overall, Alaska fisheries harvested an estimated average of 53.9% of the total return to Hugh Smith Lake compared with 7.4% for B.C. fisheries.

HARVEST RATES

Methods and Procedures

Three different harvest related parameters are defined below.

1. Harvest distribution is the relative distribution of the catch among the fisheries by area and/or gear type expressed as a proportion of the total catch.
2. Stock distribution is the relative distribution of the catch and escapement expressed as a proportion of the total return (catch and escapement).
3. Harvest rate is the total harvest within a defined fishery divided by the total number of fish available within that fishery.
4. Total harvest rate is the total harvest of a stock by all fisheries divided by the total return (catch and escapement).

In sequential "gauntlet" type fisheries such as occur for coho salmon in Southeast Alaska, harvest rate estimates for distinct fisheries provide a clearer understanding of management options for achieving desired escapement than do harvest or stock distribution estimates. Harvest rates are independent of removal by previous fisheries and, therefore, provide a measure of the effect of a particular fishery on a migrating population of fish. Therefore, harvest rate estimates are an important component of postseason management assessment and are useful for developing future management strategies.

For this analysis the number of fish available to a fishery is considered to be the total number of fish that migrate through the area where the fishery occurs. The number of fish that pass through a fishing area is the estimated total return (catch and escapement) minus fish harvested in preceding fisheries. 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:

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

Where F = estimated number of tagged fish harvested (expanded sum of random fishery recoveries); and

E = estimated number of tagged fish in the escapement

Harvest rates were estimated by gear type (fishery) for the Berners River (Table 6) stock and by area for the Hugh Smith Lake (Table 7) and Salmon Bay Lake stocks. Total harvest rate estimates were generated for the Ford Arm Lake stock (Table 3) but estimates for individual areas and fisheries were not made because most of the catch occurred in outside districts with no clearly defined migration through sequential fisheries. The Ford Arm Lake stock was considered to be harvested simultaneously by all fisheries.

Results and Discussion

Harvest rate estimates for the Berners River are biased upward because foot surveys on that system provide a less thorough accounting of the escapement compared with total weir counts or mark-recapture estimates on other systems. The Berners River stock was considered to migrate from the troll and purse seine fisheries through the Juneau sport fishery before entering Lynn Canal. During 1982, 1983 and 1985-1987, the estimated average combined troll and purse seine harvest rate for the Berners River stock averaged 0.491 (range 0.416-0.551; Table 6). Because of its relatively late migratory timing (see section on migratory timing), the Berners River stock was subjected to only minor fishing pressure in purse seine and marine sport fisheries. The estimated harvest rate in the Juneau marine sport fishery averaged only 0.009. On the average, the Berners River stock was estimated to incur the greatest harvest rate in the Lynn Canal (District 115) drift gillnet fishery with annual estimates averaging 0.574 (range 0.415-0.836). Total harvest rate estimates for the Berners River stock averaged 0.782 (range 0.711-0.929).

Total harvest rate estimates for the Ford Arm Lake stock averaged 0.548 (range 0.436-0.691). The estimated portion attributed to the troll fishery averaged 0.505 (range 0.413-0.607) while purse seine gear accounted for an average of 0.043 (range 0-0.148).

Coho salmon returning to Salmon Bay and Hugh Smith Lakes were considered to be harvested simultaneously in northern B.C. and outside and intermediate districts of Southeast Alaska before becoming available in inside waters of southern Southeast. The 1987 combined harvest rate for the Salmon Bay Lake stock in northern B.C. and outside and intermediate areas of Southeast Alaska was estimated to be 0.481 of which 0.417 was attributed to Alaska fisheries and 0.064 was attributed to northern B.C. fisheries. That stock was estimated to have incurred a harvest rate of 0.177 in inside fisheries and a total harvest rate by all fisheries of 0.573.

The combined estimated harvest rate for Hugh Smith Lake coho salmon in northern B.C. and outside and intermediate areas of Southeast Alaska averaged 0.396 (range 0.357-0.435) during 1982-1987 of which 0.322 (0.278-0.377) was attributed to Alaska fisheries and 0.074 (0.056-0.088) was attributed to northern B.C. fisheries (Table 7). The estimated harvest rate in inside areas averaged 0.360 (range 0.385-0.430), while the estimated total harvest rate for all fisheries averaged 0.613 (range 0.525-0.651).

HARVEST DISTRIBUTION

Methods and Procedures

The harvest distribution (percent by area and gear type) was estimated for tagged stocks (Tables 6-12). Tag recoveries from the Alaska troll fishery were expanded by PMFC area (Appendix A.2) and fishing period while recoveries from the net and trap fisheries were expanded by PMFC area and statistical week.

Results and Discussion

The harvest of the Berners River coho salmon stock was restricted largely to northern fishing areas (Northern Outside, Central Outside, Central Intermediate, Lynn Canal) which accounted for an estimated average of 98.3% of the during 1982, 1983 and 1985-1987 (Table 8). Small percentages (less than 1%) were taken by troll gear in the Southern Intermediate area and by the sport fishery in Stephens Passage. Overall, Lynn Canal was the most important single harvest area for the Berners River stock, accounting for an estimated average of 40.0%. The most important harvest areas in the troll fishery were the Northern Outside area (north of Cape Spencer; 22.7%) and the Central Intermediate area (Icy Strait and Cross Sound; 23.3%).

The Ford Arm coho salmon stock on the central outside coast was harvested primarily in the Central Outside area which accounted for an average of 74.4% of the estimated catch (Table 9). Other important locations where Ford Arm Lake coho salmon were harvested included the Northern Outside and Central Intermediate areas with 14.6% and 6.7%, respectively. In addition, minor

harvest was estimated to have occurred in the Southern Outside (3.0%), Southern Intermediate (0.4%) and Central Inside areas (1.0%).

The Warm Chuck Lake stock on the southern outside coast was harvested primarily by the troll and purse seine fisheries in the Southern Outside area which accounted for an average of 66.6% of the estimated catch (Table 10). The troll fishery in the Central Outside area also accounted for a significant percentage (19.0%) of the total catch while lesser percentages were taken in Northern Outside (4.1%), Central Intermediate (0.3%), Southern Intermediate (7.3%), Central Inside (0.7%), Southern Inside (1.7%) and British Columbia fisheries (0.3%).

Salmon Bay Lake coho salmon were harvested in outside waters of northern Southeast, in northern B.C., and in intermediate and inside areas of southern Southeast (Table 11). Based on the 1986-1987 average, an estimated 66.3% of the harvest occurred in outside districts with the Central and Southern Outside areas being most important. A significant harvest also occurred in the Northern Outside (9.4%), Central Inside (21.8%), Southern Intermediate (6.0%), and northern B.C. (5.1%) fishing areas. A relatively small harvest (1.0%) occurred in the Southern Inside area.

Hugh Smith Lake coho salmon were harvested over a relatively broad area from Yakutat to northern British Columbia. During 1982-1987, the two most important harvest areas were, on the average, the local Southern Inside area which accounted for an estimated average of 31.0% of the catch and the Central Outside area which accounted for 25.4% (Table 12). Significant catch also occurred in the Southern Outside area (16.7%), the Southern Intermediate area (5.4%) and northern B.C. (12.0%). Hugh Smith Lake coho salmon were also harvested in the Northern Outside area (4.2%), the Central Intermediate area (2.4%), and the Central Inside area (3.0%).

Coho salmon returns to the Unuk and Chickamin Rivers in Behm Canal near Ketchikan were also harvested over a relatively broad area (Tables 13 and 14). The most important harvest areas for both stocks were the Central Outside, Southern Outside and Southern Inside areas which together accounted for an estimated 81.0% of the harvest of Unuk River fish and 72.5% of the harvest of Chickamin River fish. The Unuk River stock showed a more northern distribution compared with the Chickamin River stock during 1985-1987. During all three years, a higher estimated percentage of the total harvest of the Unuk River stock occurred in the combined Northern Outside, Central Outside, and Central Intermediate areas compared with the Chickamin River stock while a higher estimated percentage of the catch of Chickamin River fish occurred in the Southern Inside area and northern B.C.

MIGRATORY TIMING

Methods and Procedures

The migratory timing of seven coho salmon stocks in troll fishing districts was estimated from the distribution of the harvest of tagged fish by week. Troll fishery tag recoveries were expanded to total catch by quadrant and week. The weekly proportion of the total troll catch of each stock was estimated for each year when data was available (Appendices B.1-B.9). These estimates are based on the dates of landing of tagged fish at fishing ports. Since the average trip length for a troll vessel is 4-6 days, the average time of capture of landed fish probably occurred 2-3 days previously.

Results and Discussion

Although it was available to some extent during most of the season, the Berners River stock was characteristically late in migratory timing in all fisheries. On the average, it peaked in the troll fishery during late August through mid-September (Figure 3; Appendix B.1). The average period of greatest harvest (more than 10% per week) occurred during approximately 17 August-13 September while the peak weekly harvest occurred during 31 August-6 September. On the average, the troll harvest of all coho salmon stocks combined peaked during late July and had declined substantially before the Berners River stock began to peak. Part of the reason for the decline in total catch and low catch of Berners River fish during this period was implementation of 10-day troll closures with beginning dates ranging from late July to mid-August.

The Ford Arm Lake stock was characterized by relatively protracted timing in the troll fishery with significant weekly catches occurring from the first week of July through the first week of September (Figure 3; Appendix B.2).

The Warm Chuck Lake stock was available from at least late June through the second week of September, with the estimated average peak troll catch occurring in late July (Figure 3; Appendix B.3).

The Salmon Bay Lake stock was available, on the average from at least the second week of July until mid-September and appeared to be most available from late July to late August (Figure 4; Appendix B.4).

Unuk River coho salmon were available to the troll fishery during the entire season from late June through mid-September with peak catches occurring in mid to late July (Figure 4; Appendix B.5). Chickamin River fish were available, on the average, from at least early July to mid-September and a significant weekly proportion was taken during most weeks until near the end of the season (Figure 4; Appendix B.6).

On the average, Hugh Smith Lake coho salmon were available to the regionwide troll fishery from late June through the end of the season on 20 September during 1982-1987 (Figure 5; Appendix B.7). While average peak catches occurred in late July and late August, the Hugh Smith Lake stock contributed proportionally the most to the overall troll catch from mid-August to mid-September. Significant differences existed in the timing of the Hugh Smith Lake stock in intermediate and outer coastal areas compared with inside waters. In the Northeast, Northwest and Southwest Quadrants, it underwent significant harvest from mid-July through early September with a peak proportional contribution in late August (Figure 5; Appendix B.8). However, in inside waters of southern Southeast (Southeast Quadrant), it displayed substantially later timing compared with the total troll harvest of coho salmon (Figure 5; Appendix B.9). In the Southeast Quadrant, the Hugh Smith Lake stock was most heavily harvested during the last week of August through the second week of September, on the average, while the total catch of all stocks peaked during late July.

SURVIVAL RATES

Methods and Procedures

Survival rates were estimated for coho salmon smolts outmigrating from Hugh Smith Lake in 1986 (Table 15) and for juvenile coho salmon tagged in the Berners River and Ford Arm Lake in 1984 (Table 16). Survival from the time of tagging (smolt or age 1+ juvenile) to the adult stage (age .1) was estimated as follows:

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

Where F = estimated number of marked fish harvested

E = number of marked fish in the escapement

T = number of smolts or juveniles tagged

Results and Discussion

The survival rate for Hugh Smith Lake smolts that outmigrated in 1986 was estimated at 10.7%, compared with estimates of 10.4-14.5% in 1981, 13.2% in 1982, 7.4% in 1983, 7.8% in 1984, and 19.2% in 1985 (Table 15). The range for 1981 estimates resulted from uncertainty in whether estimated tag loss was attributed to smolts tagged in 1981 or rearing juveniles tagged in 1980.

Survival rates for predominantly age 1+ rearing juveniles tagged at the Berners River and Ford Arm Lake during the summer of 1984 were estimated at 5.1% and 10.2%, respectively (Table 16). Comparable estimates for other tagging experiments throughout Southeast Alaska during 1979-1983 are shown for comparison. The average for all tag releases through 1984 was 6.5% with individual estimates ranging from 2.2-15.2%.

DISCUSSION

Estimated 1987 total adult (age .1) coho salmon returns (catch and escapement) to the Berners River, Ford Arm Lake and Hugh Smith Lake were the lowest since investigations were initiated in 1982 which also coincided with a drop in total regionwide catch from an average of 2.40 million fish (range 1.91-3.33 million) during a recent peak in production (1982-1986) to 1.53 million in 1987 (Figure 1).

Of the four systems for which total returns were estimated in 1987, continued annual tagging and recovery should be conducted on three (Berners River, Ford Arm Lake and Hugh Smith Lake). The fourth, Salmon Bay Lake, has presented difficulties for both tagging and escapement assessment. Low catch rates of juvenile coho salmon in minnow traps fished in this system have necessitated expending a large amount of effort to tag only 5,000-6,000 fish. Although the lake outlet weir can be expanded and reinforced for effective operation during high water conditions, a side tributary downstream of the weir site cannot be effectively weired because of extreme flow rates during freshets. It appeared that most fish entered the lake, but significant spawning did take place in the side tributary where fish could easily hide under banks and woody debris. In addition, estimating the escapement into the lake becomes problematic in the event of a weir failure, as occurred in 1986, because of difficulty in capturing adults from the upper lake and inlet streams for a tag recovery sample.

The large mainland rivers in Southeast Alaska are important contributors of coho salmon in the region's fisheries, incurring relatively high harvest rates and benefitting several fishery user groups. The Berners River is currently the only large river indicator stock for which total production estimates are made. In view of this, the Berners River project should given top priority for continued funding and should be strengthened where possible. Current weaknesses in the Berners River project include downward bias in escapement estimates, low tagging rates and a lack of smolt outmigration estimates. While the escapement in the Berners River is relatively compressed in time and is easily surveyed by foot and helicopter in all known areas that are frequented by significant numbers of adults, the survey counts are, by nature, undoubtably low. An adult enumeration weir is not a feasible option for the Berners River system because of extreme flow rates and a highly unstable bottom in the lower river. The feasibility of capturing adults for tagging in the lower river should be investigated with the objective of obtaining mark-

recapture estimates of the total escapement using recovery samples from headwaters spawning areas. Low coded-wire tagging rates (average 1.8%; range 0.9-2.8%) have result from expending relatively limited effort capturing and tagging juvenile fish that spend nearly a year in fresh water between tagging and outmigrating and, therefore, suffer substantial freshwater mortality. The feasibility of capturing smolts for tagging should be investigated with the objectives of substantially increasing the tagging rate for the system and estimating total smolt production by age class using adult recovery samples to determine marked:unmarked ratios. Estimating smolt production should provide an improved method of determining stock-recruitment parameters, compared with estimating only adult production, by reducing statistical variability in production estimates and eliminating variability resulting from largely density-independent fluctuations in marine survival.

The Ford Arm Lake stock was selected for continued coded-wire tagging and escapement assessment because natural characteristics of the system make it possible to tag a significant proportion of the population at relatively low expense and account for the total escapement with a relatively low degree of bias and variability. While relatively small numbers of rearing juveniles (3,882-7,662; average 6,210) were tagged annually during the summers of 1980-1984, exceptional overall survival rates (6.3-14.3%; average 10.1%) resulted in relatively large returns of tagged adults and a percent tagged ranging from 7.6-17.7% (average 11.6%). The weir has remained operational throughout the run during the past three seasons, while a tag recovery sample was relatively easily obtained from the lake and inlet streams during the first two years of operation when fish escaped past the weir uncounted. Smolt population estimates and increased tagging rates could be achieved at Ford Arm Lake at substantially greater expense compared with juvenile marking. While the regionwide coho salmon indicator stock program is relatively biased toward lake systems compared with non-lake systems and the Sport Fish Division is conducting a similar, more intensive study at Salmon Lake on the outer coast 50 miles south of Ford Arm (Schmidt 1989), continuation of the Ford Arm Lake project is recommended because of its operational suitability and because its location in the area of most intensive troll effort in the region makes it a good indicator stock for monitoring harvest rate trends in the outside troll fishery.

Continuation of the project at Hugh Smith Lake is also recommended because it is currently the only wild indicator stock in southern Southeast and because of its continuous data base of escapement, smolt outmigration, total adult production and age composition estimates since 1982. There have been continual problems with effectiveness of both the smolt and adult weirs. The adult weir is subjected to extreme pressure during fall freshets in most years and pickets have been removed to avoid severely damaging or losing the structure which would be rapidly flushed out to saltwater in the event of a structural failure. Escapement estimates for several years have been accompanied by substantial statistical uncertainty related to tagging and recovery sample sizes. Efforts need to be made to reinforce the weir to reduce the danger of loss or severe damage and increase the reliability of

escapement estimates. The smolt weir appears to form a continuous barrier between shores and from surface to bottom. However, smolt population estimates based on tagged rates of returning adults indicated that an average of 51% (range 29-74%) of smolts outmigrated uncounted during 1983-1986 (Shaul et al. In Press). It is apparent that the smolts are very adept at finding small passages under the weir along the rough bottom and/or through small holes torn in the weir material by otters. Improvements can be made in the integrity of the smolt weir but, assessment of the total smolt population in the system may continue to rely on mark-recapture estimates.

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Table 1. Summary of coded-wire tagging of wild coho salmon, 1 July 1987 - 30 June 1988.

Location	Dates	Number Tagged	Code (Number)	Adult Return Year
Ford Arm Lake	July 6-17	10,799 juveniles	4-26-57 (10,138)	1989
			4-23-15 (661)	1989
Kadashan River	April 28-June 5	5,228 juveniles	4-29-17 (3,037)	1989, 1990
			4-29-16 (2,191)	1989, 1990
Hugh Smith Lake	April 13-May 25	5,202 smolts	4-29-24 (5,202)	1989
McDonald Lake	April 20-May 24	5,617 juveniles and smolts	4-29-32 (5,617)	1989, 1990
Badger Lake		3,523 smolts	4-29-28 (3,523)	1989
Berners River	June 17-July 1	9,926 juveniles	4-29-42 (9,926)	1990
Total		40,295 juveniles and smolts		1989, 1990

Table 2. Estimated harvest and percent by gear type, escapement, and total return of coho salmon returning to the Berners River, 1982, 1983 and 1985-1987.

Year	Fishery Sample Size ^a	Harvest: Number of fish and percent by gear type				Total Catch	Escapement	Total Return
		Troll	Purse Seine	Drift Gill Net	Sport			
1982	48	12,887 (41.6%)	0	10,568 (34.1%)	0	23,455 (75.7%)	7,505 (24.3%)	30,960 (100%)
1983	125	17,153 (50.4%)	0	6,978 (20.5%)	65 (0.2%)	24,196 (71.1%)	9,840 (28.9%)	34,036 (100%)
1985	93	10,865 (44.8%)	198 (0.8%)	7,015 (28.9%)	0	18,078 (74.5%)	6,169 (25.5%)	24,247 (100%)
1986	157	13,560 (55.1%)	0	8,928 (36.2%)	395 (1.6%)	22,883 (92.9%)	1,752 (7.1%)	24,635 (100%)
1987	53	7,448 ^b (53.0%)	0	3,301 (23.5%)	48 (0.3%)	10,798 (76.8%)	3,260 (23.2%)	14,058 (100%)
Average Number of Fish		12,383	40	7,358	102	19,882	5,705	25,587
Average Percent of Total		49.0	0.2	28.6	0.4	78.2	21.8	100

^aIncludes only expandable random recoveries.

^bEstimated troll catch in 1987 includes 242 fish (1.7%) harvested in the northern British Columbia troll fishery. The estimated average number and percent harvested in the Southeast Alaska troll fishery was 12,334 (48.6%).

Table 3. Estimated harvest and percent by gear type, escapement, and total return of coho salmon returning to Ford Arm Lake, 1982, 1983 and 1985-1987.

Year	Fishery Sample Size ^a	Harvest: Number of fish and percent by gear type				
		Troll	Purse Seine	Total Catch	Escapement	Total Return
1982	38	1,948 (41.3%)	107 (2.3%)	2,055 (43.6%)	2,662 (56.4%)	4,717 (100%)
1983	93	3,412 (54.3%)	931 (14.8%)	4,343 (69.1%)	1,944 (30.9%)	6,287 (100%)
1985	49	2,438 (51.2%)	0	2,438 (51.2%)	2,324 (48.8%)	4,762 (100%)
1986	87	2,500 (60.7%)	76 (1.8%)	2,576 (62.5%)	1,546 (37.5%)	4,122 (100%)
1987	71	1,456 (45.1%)	79 (2.4%)	1,535 (47.5%)	1,694 (52.5%)	3,229 (100%)
Average Number of Fish		2,351	238	2,589	2,034	4,623
Average Percent of Total		50.5	4.3	54.8	45.2	100

^aIncludes only expandable random recoveries.

Table 4. Estimated harvest and percent by gear type, escapement, and total return of coho salmon returning to Salmon Bay Lake, 1986-1987.

Year	Fishery Sample Size ^a	Harvest: Number of fish and percent by gear type				Total Escapement	Total Return
		Alaska Troll	Alaska Gill Net	B.C. Troll	Total Catch		
1986	66	3,774	1,430	0	5,204	b	b
1987	30	1,311 (44.4%)	192 (6.5%)	189 (6.4%)	1,692 (57.3%)	1,262 (42.7%)	2,954 (100%)
Average Number of Fish		2,543	811	94	3,448	-	-

^aIncludes only expandable random recoveries.

^bEscapement and total return estimates are unavailable for 1986 because an unknown number of fish escaped uncounted past the weir.

Table 5. Estimated harvest and percent by gear type, escapement, and total return of coho salmon returning to Hugh Smith Lake, 1982-1987.

Year	Fishery Sample Size ^a	Harvest: Number of fish and percent by gear type							Total Catch	Escapement	Total Return
		Alaska Troll	Alaska Seine	Alaska Gill Net	Alaska Trap	Alaska Sport	B.C. Troll	B.C. Net			
1982	93	2,780 (45.2%)	640 (10.4%)	243 (4.0%)	0	0	264 (4.3%)	78 (1.2%)	4,005 (65.1%)	2,144 (34.9%)	6,149 (100%)
1983	200	1,374 (35.5%)	399 (10.3%)	292 (7.6%)	49 (1.3%)	0	211 (5.5%)	50 (1.3%)	2,375 (61.5%)	1,490 (38.5%)	3,865 (100%)
1984	152	1,225 (31.3%)	493 (12.6%)	461 (11.8%)	18 (0.5%)	0	316 (8.1%)	27 (0.7%)	2,540 (65.0%)	1,367 (35.0%)	3,907 (100%)
1985	227	867 (35.2%)	338 (13.7%)	137 (5.6%)	5 (0.2%)	0	199 (8.1%)	13 (0.5%)	1,559 (63.3%)	903 (36.7%)	2,462 (100%)
1986	267	1,585 (35.1%)	565 (12.5%)	311 (6.9%)	1 (0.0%)	15 (0.3%)	234 (5.2%)	26 (0.6%)	2,737 (60.6%)	1,783 (39.4%)	4,520 (100%)
1987	100	656 (27.9%)	102 (4.3%)	249 (10.6%)	0	23 (1.0%)	154 (6.6%)	50 (2.1%)	1,234 (52.5%)	1,118 (47.5%)	2,352 (100%)
Average Number of Fish		1,414	423	282	12	6	230	41	2,408	1,468	3,876
Average Percent of Total		35.0	10.6	7.8	0.3	0.2	6.3	1.1	61.3	38.7	100

^aIncludes only expandable random recoveries.

Table 6. Estimated harvest rate by fishery for coho salmon returns to the Berners River, 1982, 1983 and 1985-1987.

Year	Troll and Purse Seine	Marine Sport	115 Gill Net	Gill Net and Sport Total	Grand Total
1982	0.416	0	0.585	0.585	0.757
1983	0.504	0.004	0.415	0.417	0.711
1985	0.456	0	0.532	0.532	0.745
1986	0.551	0.036	0.836	0.842	0.929
1987	0.530	0.007	0.503	0.507	0.768
Average	0.491	0.009	0.574	0.577	0.782

Table 7. Estimated harvest rate by area for coho salmon returns to Hugh Smith Lake, 1982-1987.

Year	Outside and Intermediate	Northern B.C.	Total	Inside ^a	Grand Total
1982	0.377	0.056	0.433	0.385	0.651
1983	0.289	0.068	0.357	0.400	0.615
1984	0.298	0.088	0.386	0.430	0.650
1985	0.312	0.086	0.398	0.391	0.633
1986	0.377	0.058	0.435	0.302	0.606
1987	0.278	0.087	0.365	0.251	0.525
Average	0.322	0.074	0.396	0.360	0.613

^aInside area includes Districts 101, 102, 105, 106, 107 and 108.

Table 8. Estimated harvest distribution of Berners River coho salmon by area and gear type, 1982, 1983, and 1985-1987.

Area	Gear Type	Year (Percent)					Ave.
		1982	1983	1985	1986	1987	
Northern Outside	Troll	20.3	29.6	18.3	28.4	16.9	22.7
Central Outside	Troll	3.7	11.7	15.5	15.7	13.9	12.1
Central Intermediate	Troll	35.6	26.9	23.3	7.7	22.9	23.3
	Seine	<u>0.0</u>	<u>0.0</u>	<u>1.2</u>	<u>0.0</u>	<u>0.0</u>	<u>0.2</u>
	Total	35.6	26.9	24.5	7.7	22.9	23.5
Southern Intermediate	Troll	0.0	1.0	0.0	1.5	0.0	0.5
Stephens Passage	Sport	0.0	0.3	0.0	2.0	0.6	0.6
Lynn Canal	Gill Net	40.4	30.5	41.7	44.7	42.6	40.0
British Columbia	Troll	0.0	0.0	0.0	0.0	3.1	0.6
Grand Total		100	100	100	100	100	100
Sample Size (Tags)		40	98	81	122	32	

Table 9. Estimated harvest distribution of Ford Arm Lake coho salmon by area and gear type, 1982, 1983 and 1985-1987.

Area	Gear Type	<u>Year (Percent)</u>					Ave.
		1982	1983	1985	1986	1987	
Northern Outside	Troll	9.4	19.2	15.3	4.9	24.0	14.6
Central Outside	Troll	62.4	51.0	84.7	87.5	55.8	68.3
	Seine	<u>0.0</u>	<u>23.0</u>	<u>0.0</u>	<u>0.7</u>	<u>6.8</u>	<u>6.1</u>
	Total	62.4	74.0	84.7	88.2	62.6	74.4
Southern Outside	Troll	5.3	1.0	0.0	1.2	0.0	1.5
	Seine	<u>5.0</u>	<u>0.0</u>	<u>0.0</u>	<u>2.4</u>	<u>0.0</u>	<u>1.5</u>
	Total	10.3	1.0	0.0	3.6	0.0	3.0
Central Intermediate	Troll	13.0	5.8	0.0	1.3	13.4	6.7
Southern Intermediate	Troll	0.0	0.0	0.0	2.0	0.0	0.4
Central Inside	Troll	4.9	0.0	0.0	0.0	0.0	1.0
Grand Total		100	100	100	100	100	100
Sample Size (Tags)		31	71	31	65	129	

Table 10. Estimated harvest distribution of Warm Chuck Lake coho salmon by area and gear type, 1982, 1983, and 1985-1987.

Area	Gear Type	<u>Year (Percent)</u>					Ave.
		1982	1983	1985	1986	1987	
Northern Outside	Troll	14.2	0.0	0.0	0.0	6.4	4.1
Central Outside	Troll	15.5	15.3	20.8	25.9	17.3	19.0
Southern Outside	Troll	42.4	21.4	37.5	47.8	66.8	43.2
	Seine	<u>25.1</u>	<u>47.4</u>	<u>32.9</u>	<u>11.6</u>	<u>0.0</u>	<u>23.4</u>
	Total	67.5	68.8	70.4	59.4	66.8	66.6
Central Intermediate	Troll	0.0	0.0	0.0	1.7	0.0	0.3
Southern Intermediate	Troll	0.0	11.0	7.5	9.7	8.3	7.3
Central Inside	Troll	0.0	0.0	1.3	1.1	1.2	0.7
Southern Inside	Troll	1.2	0.0	0.0	0.9	0.0	0.4
	Seine	<u>1.6</u>	<u>4.9</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>1.3</u>
	Total	2.8	4.9	0.0	0.9	0.0	1.7
British Columbia	Troll	0.0	0.0	0.0	1.3	0.0	0.3
Grand Total		100	100	100	100	100	100
Sample Size (Tags)		22	11	28	65	34	

Table 11. Estimated harvest distribution of Salmon Bay Lake, McDonald Lake and Kadashan River coho salmon by area and gear type, 1986-1987.

Area	Gear Type	Year (Percent)				
		<u>Salmon Bay Lake</u>			<u>McDonald Lake</u>	<u>Kadashan River</u>
		1986	1987	Ave.	1987	1987
Northern Outside	Troll	8.7	10.0	9.4	0.0	21.3
Central Outside	Troll	43.2	24.2	33.7	34.8	19.0
Southern Outside	Troll	7.5	38.8	23.2	22.1	0.0
Central Intermediate	Troll	0.0	0.0	0.0	0.0	39.0
	Seine	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>11.5</u>
	Total	0.0	0.0	0.0	0.0	50.5
Southern Intermed.	Troll	8.7	3.3	6.0	22.7	9.2
Central Inside	Troll	6.2	1.5	3.9	0.0	0.0
	Gill Net	<u>25.7</u>	<u>10.2</u>	<u>18.0</u>	<u>0.0</u>	<u>0.0</u>
	Total	31.9	11.7	21.8	0.0	0.0
Southern Inside	Troll	0.0	1.9	1.0	0.0	0.0
	Seine	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>20.4</u>	<u>0.0</u>
	Total	0.0	1.9	1.0	20.4	0.0
British Columbia	Troll	0.0	10.1	5.1	0.0	0.0
Grand Total		100	100	100	100	100
Sample Size (Tags)		60	30		8	9

Table 12. Estimated harvest distribution of Hugh Smith Lake coho salmon by area and gear type, 1982-1987.

Area	Gear Type	Year (Percent)						Ave.
		1982	1983	1984	1985	1986	1987	
Northern Outside	Troll	0.0	8.0	5.6	5.6	2.6	3.3	4.2
Central Outside	Troll	29.8	21.7	19.7	32.0	37.2	11.2	25.3
	Seine	<u>0.0</u>	<u>0.4</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.1</u>
	Total	29.8	22.1	19.7	32.0	37.2	11.2	25.4
Southern Outside	Troll	10.9	10.1	7.0	8.3	5.6	22.5	10.7
	Seine	<u>5.0</u>	<u>3.0</u>	<u>8.2</u>	<u>2.9</u>	<u>11.1</u>	<u>5.5</u>	<u>6.0</u>
	Total	15.9	13.1	15.2	11.2	16.6	28.0	16.7
Central Intermed.	Troll	1.4	2.2	6.8	0.0	2.6	1.2	2.4
Southern Intermed.	Troll	10.6	4.4	0.7	2.7	3.8	9.8	5.3
	Seine	<u>0.0</u>	<u>0.0</u>	<u>0.6</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.1</u>
	Total	10.6	4.4	1.3	2.7	3.8	9.8	5.4
Central Inside	Troll	0.3	2.9	1.2	0.7	1.1	0.0	1.0
	Seine	0.0	0.6	0.0	0.0	0.0	0.0	0.1
	Gill Net	<u>1.1</u>	<u>6.1</u>	<u>0.8</u>	<u>0.3</u>	<u>3.0</u>	<u>0.0</u>	<u>1.9</u>
	Total	1.4	9.6	2.0	1.0	4.1	0.0	3.0
Southern Inside	Troll	14.4	9.1	9.3	7.0	4.4	6.0	8.4
	Seine	12.0	12.6	9.8	18.4	9.8	2.6	10.9
	Gill Net	5.4	6.0	16.7	8.4	8.5	19.9	10.8
	Trap	0.0	2.0	0.7	0.3	0.1	0.0	0.5
	Sport	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.6</u>	<u>1.8</u>	<u>0.4</u>
	Total	31.8	29.7	36.5	34.1	23.4	30.3	31.0
British Columbia	Troll	7.0	8.8	11.9	12.6	8.6	12.2	10.2
	Net	<u>2.1</u>	<u>2.1</u>	<u>1.0</u>	<u>0.8</u>	<u>1.0</u>	<u>4.0</u>	<u>1.8</u>
	Total	9.1	10.9	12.9	13.4	9.6	16.2	12.0
Grand Total		100	100	100	100	100	100	100
Sample Size (Tags)		85	182	144	211	238	99	

Table 13. Estimated harvest distribution of Unuk River coho salmon by area and gear type, 1985-1987.

Area	Gear Type	Year (Percent)			Ave.
		1985	1986	1987	
Northern Outside	Troll	2.8	1.5	0.0	1.4
Central Outside	Troll	27.7	41.4	24.3	31.1
	Seine	<u>0.0</u>	<u>0.0</u>	<u>10.7</u>	<u>3.6</u>
	Total	27.7	41.4	35.0	34.7
Southern Outside	Troll	11.2	2.7	33.5	15.8
	Seine	<u>5.9</u>	<u>14.7</u>	<u>0.0</u>	<u>6.9</u>
	Total	17.1	17.4	33.5	22.7
Central Intermediate	Troll	0.0	2.3	0.0	0.8
Southern Intermediate	Troll	5.3	4.6	7.9	5.9
	Seine	<u>0.8</u>	<u>0.0</u>	<u>0.0</u>	<u>0.3</u>
	Total	6.1	4.6	7.9	6.2
Central Inside	Troll	0.0	1.8	5.6	2.5
	Gillnet	<u>3.1</u>	<u>3.9</u>	<u>0.0</u>	<u>2.3</u>
	Total	3.1	5.7	5.6	4.8
Southern Inside	Troll	9.3	5.5	0.0	4.9
	Seine	24.7	10.1	13.7	16.2
	Gill Net	1.4	0.6	4.3	2.1
	Trap	<u>1.1</u>	<u>0.1</u>	<u>0.0</u>	<u>0.4</u>
	Total	36.5	16.3	18.0	23.6
British Columbia	Troll	6.7	10.8	0.0	5.8
Grand Total		100	100	100	100
Sample Size (Tags)		89	94	13	

Table 14. Estimated harvest distribution of Chickamin River coho salmon by area and gear type, 1984-1987.

Area	Gear Type	Year (Percent)				Ave.
		1984	1985	1986	1987	
Northern Outside	Troll	0.0	0.0	2.9	3.0	1.5
Central Outside	Troll	30.3	17.2	16.5	29.7	23.4
Southern Outside	Troll	0.0	9.3	11.0	19.1	9.9
	Seine	<u>9.9</u>	<u>4.9</u>	<u>15.2</u>	<u>6.3</u>	<u>9.1</u>
	Total	9.9	14.2	26.2	25.4	18.9
Central Intermed.	Troll	5.0	6.0	3.7	0.0	3.7
Southern Intermed.	Troll	8.9	3.0	6.9	4.1	5.7
	Seine	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
	Total	8.9	3.0	6.9	4.1	5.7
Central Inside	Troll	1.5	0.4	1.6	0.0	0.9
	Gill Net	<u>2.9</u>	<u>4.4</u>	<u>2.2</u>	<u>0.0</u>	<u>2.4</u>
	Total	4.4	4.8	3.8	0.0	3.3
Southern Inside	Troll	2.4	4.8	6.2	4.8	4.6
	Seine	22.3	26.8	14.5	3.7	16.8
	Gill Net	2.4	5.1	4.1	11.2	5.7
	Trap	10.1	0.0	0.0	0.0	2.5
	Sport	<u>1.3</u>	<u>0.9</u>	<u>0.0</u>	<u>0.0</u>	<u>0.6</u>
	Total	38.5	37.6	24.8	19.7	30.2
British Columbia	Troll	3.0	13.4	15.2	18.1	12.4
	Net	<u>0.0</u>	<u>3.8</u>	<u>0.0</u>	<u>0.0</u>	<u>1.0</u>
	Total	3.0	17.2	15.2	18.1	13.4
Grand Total		100	100	100	100	100
Sample Size (Tags)		23	39	56	28	

Table 15. Estimated survival rate of coded-wire tagged wild Hugh Smith Lake coho salmon smolts, 1981-1986.

Year of out-migration	Estimated survival rate to age .1
1981	10.4 - 14.5%*
1982	13.2%
1983	7.4%
1984	7.8%
1985	19.2%
1986	10.7%

* Range depending on whether tag loss estimates were attributed to juvenile tagging in 1980 or smolt tagging in 1981.

Table 16. Estimated survival rates of predominantly age 1+ and older wild juvenile coho salmon from the time of tagging until entry into the fisheries the following year, 1979-1984.

Stock	<u>Year of Tagging</u>					Ave.
	1979	1980	1981	1983	1984	
Speel Lake	6.0%	6.0%	6.0%			6.0%
Berners River		2.9%	6.7%	5.9%	5.1%	5.2%
Chilkoot Lake			7.0%			7.0%
Chilkat Lake ^a			15.2%			15.2%
Ford Arm Lake		6.3%	9.6%	14.3%	10.2%	10.1%
Politofski Lake		4.8%	2.2%			3.5%
Warm Chuck Lake		5.8%	2.4%	4.7%		4.3%
Klakas Lake		2.5%	4.0%			3.2%
Hugh Smith Lake		8.5- 10.4% ^b	6.2%			7.8%
Average	6.0%	5.4%	5.9%	8.3%	6.7%	6.5% ^c

^a The estimate for Chilkat Lake is based on an adjusted estimate of the escapement that equalizes the combined troll and purse seine harvest rate with the average for Chilkoot Lake and the Berners River.

^b Range depending on whether tag loss estimates were attributed to juvenile tagging in 1980 or smolt tagging in 1981. The mid-point of the range was used to compute averages.

^c Overall average for all estimates.

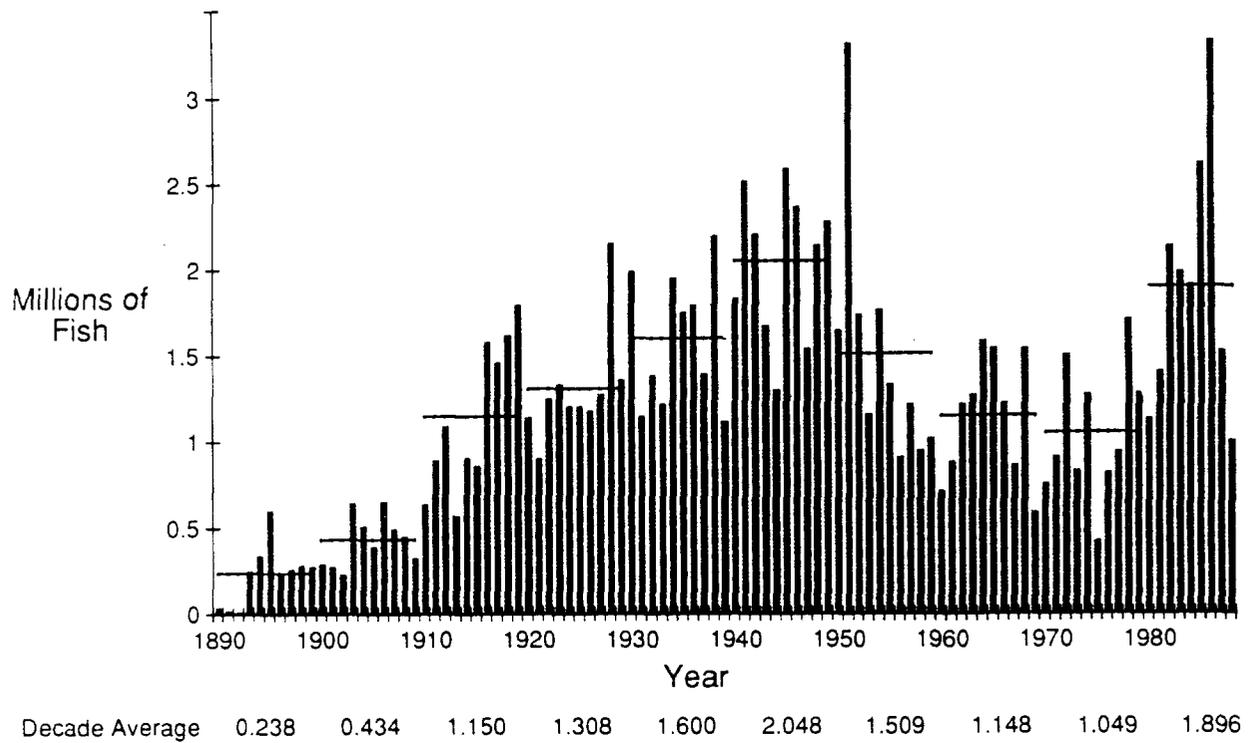


Figure 1. Annual commercial catch of coho salmon in Southeast Alaska and decade averages, in millions of fish, 1890-1988.

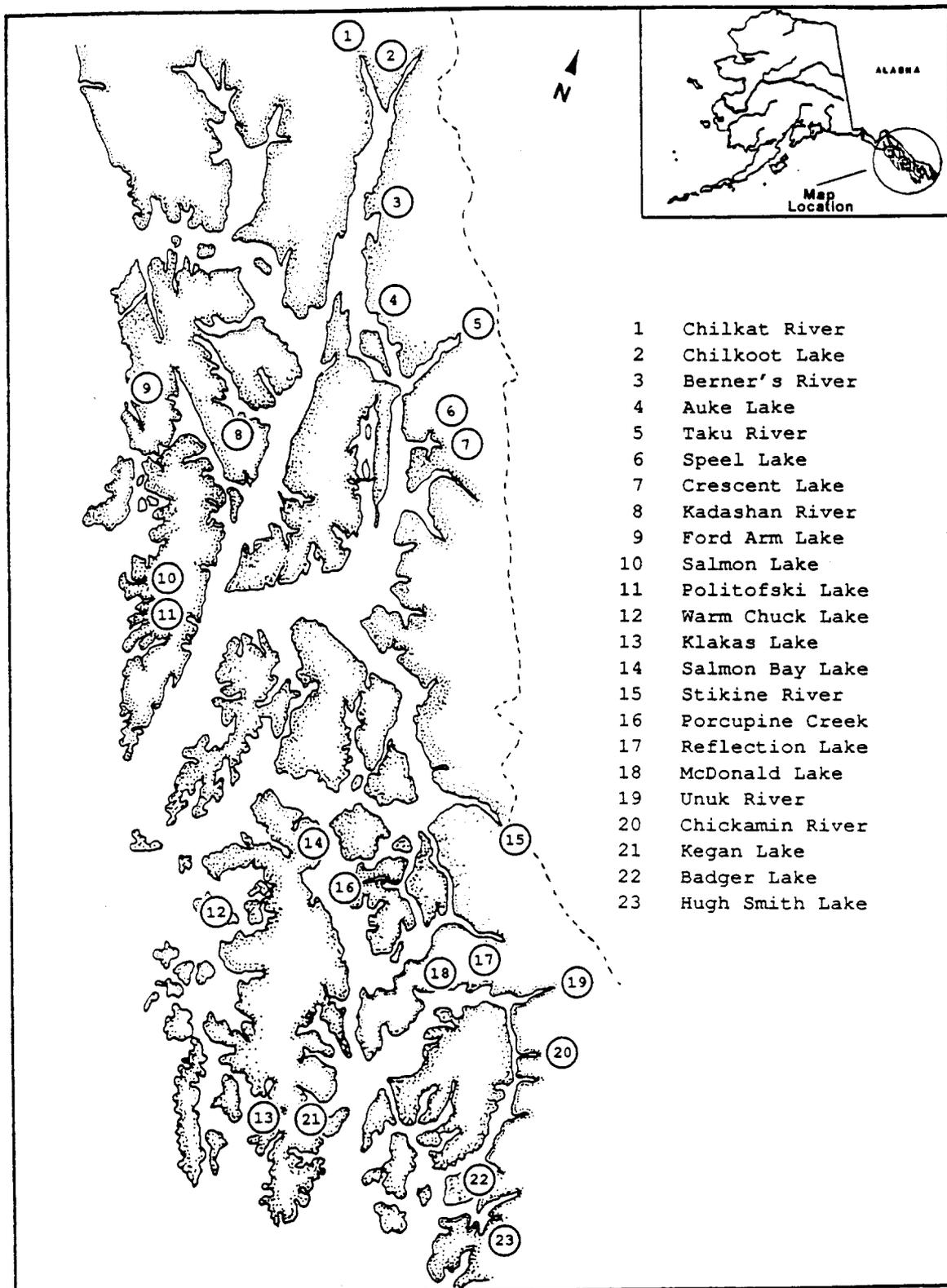


Figure 2. Wild coho salmon coded-wire tagging locations in Southeast Alaska, 1976-1988.

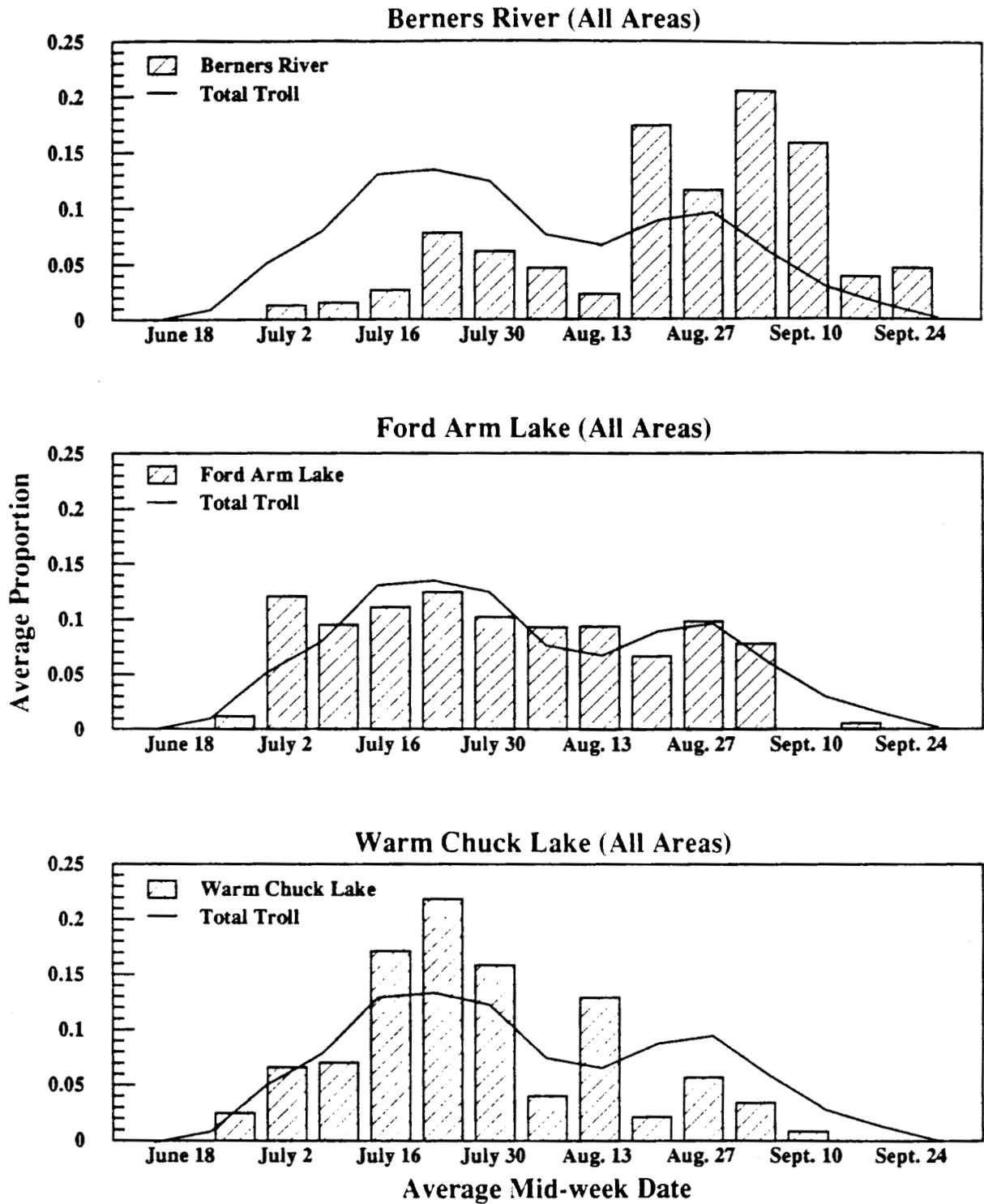


Figure 3. Average weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged coho salmon from the Berners River, Ford Arm Lake and Warm Chuck Lake in Southeast Alaska, 1982, 1983 and 1985-1987.

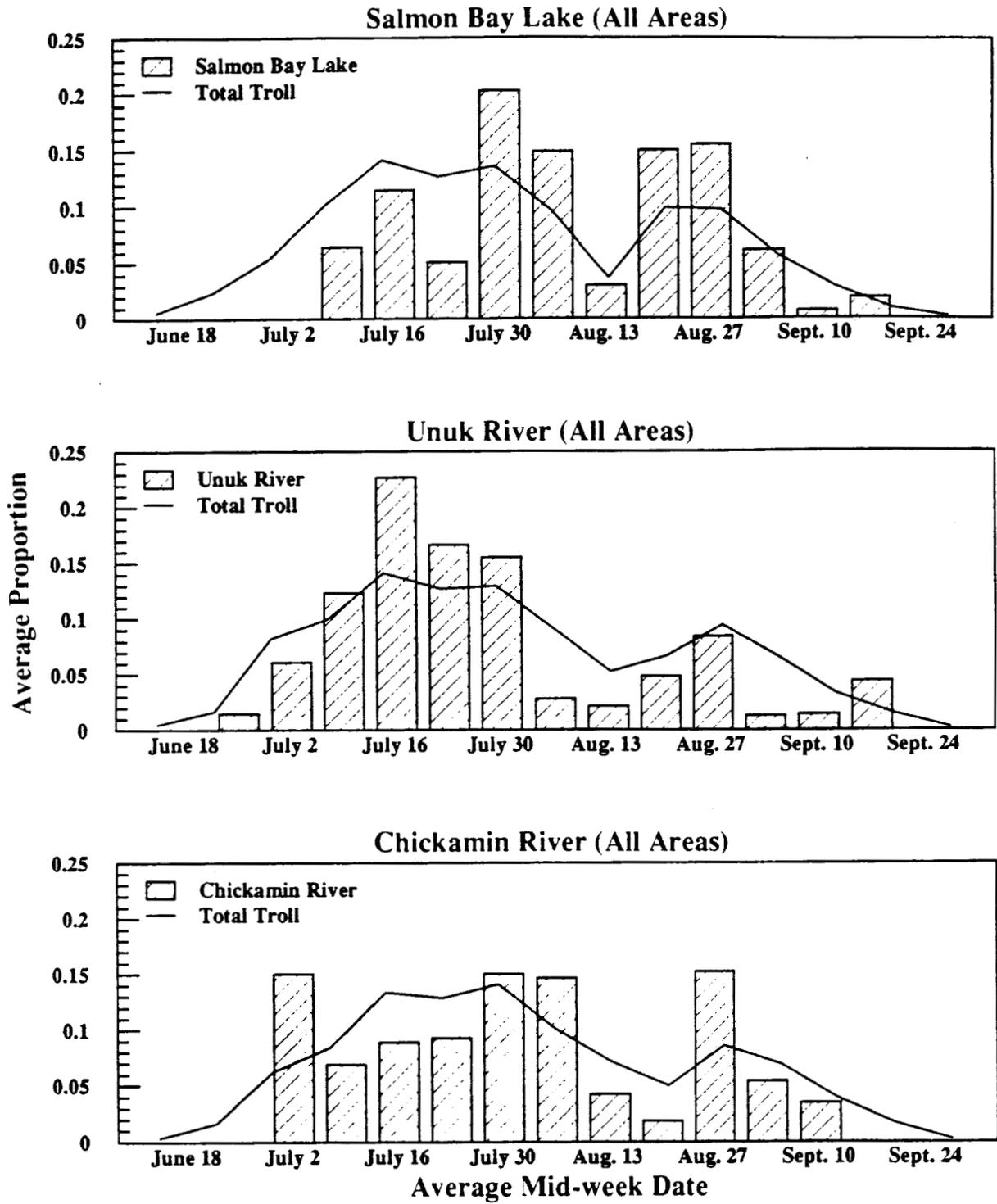


Figure 4. Average weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged coho salmon from Salmon Bay Lake (1986-1987), the Unuk River (1985-1987) and the Chickamin River (1984-1987) in Southeast Alaska.

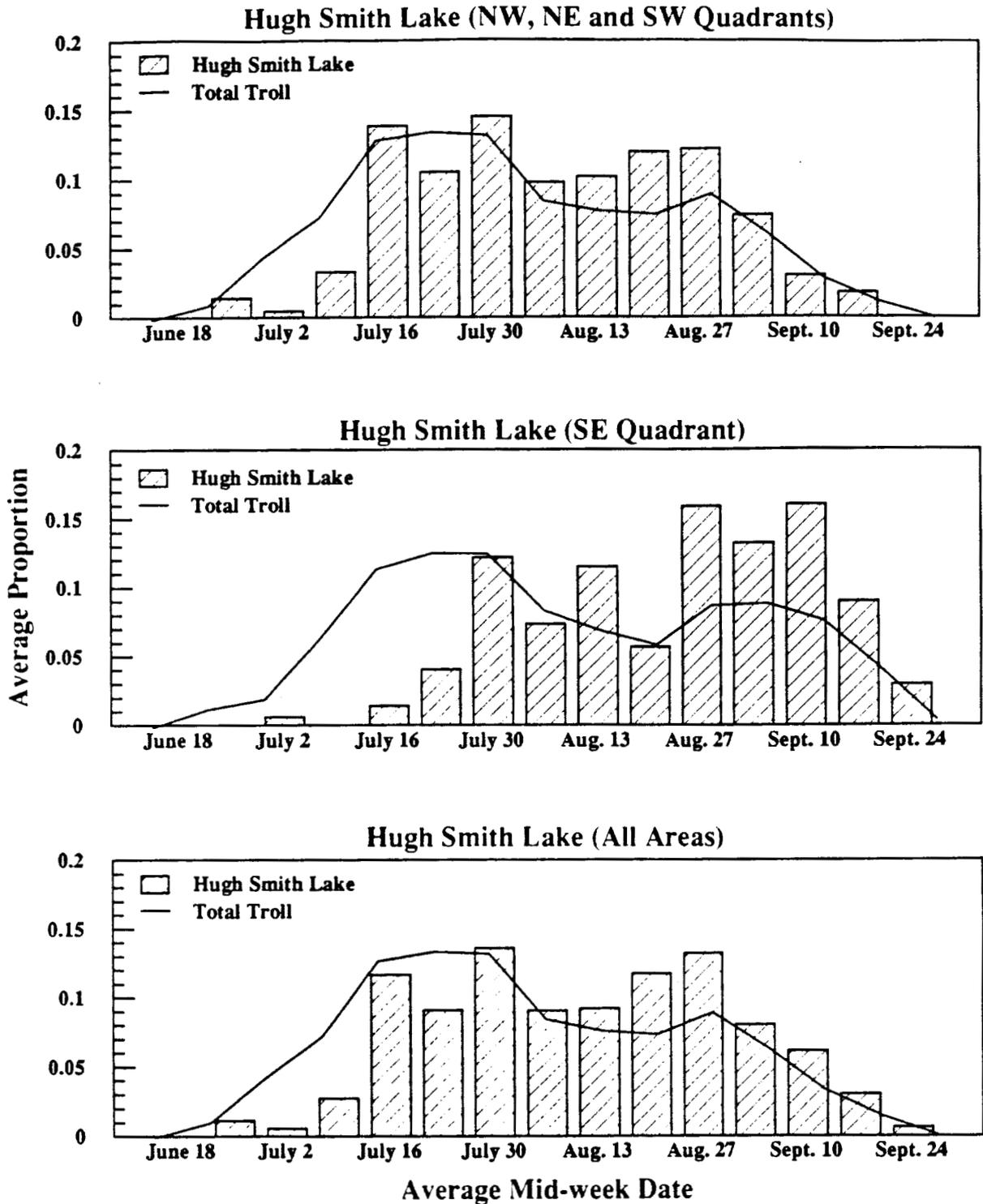
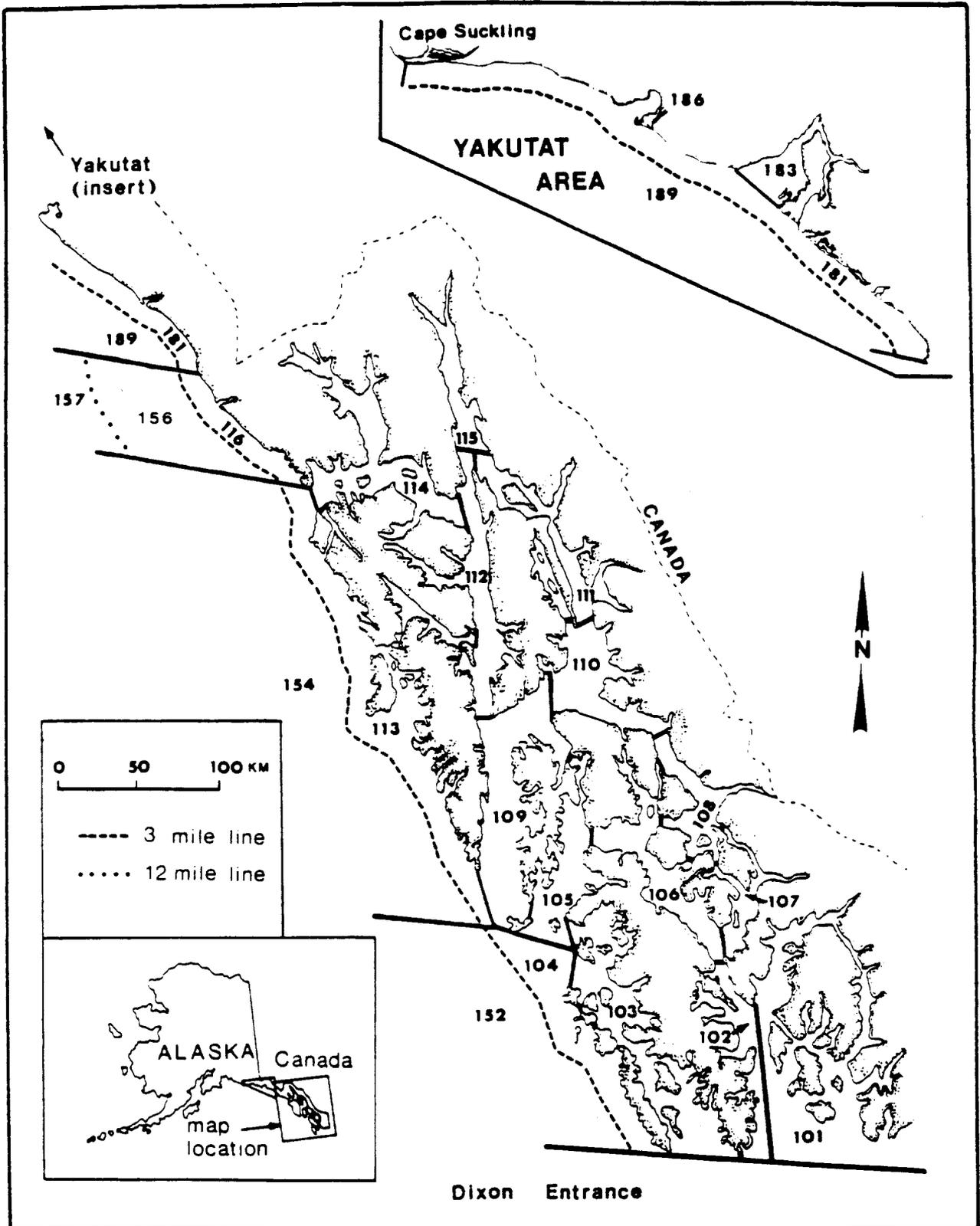


Figure 5. Average weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged Hugh Smith Lake coho salmon (bar graph) in: (1) the Northeast, Northwest and Southwest Quadrants; (2) the Southeast Quadrant and (3); all areas of Southeast Alaska combined, 1982-1987.

APPENDICES



Appendix A.1. Map of Southeast Alaska statistical fishing districts.

Appendix A.2. Statistical areas of Southeast Alaska belonging to Pacific Marine Fisheries Commission (PMFC) areas and quadrants.

PMFC Area	Abbreviation	Statistical Areas (Districts)
Northern Outside	NOUT	116, 156, 157, 181, 183, 189, 191
Central Outside	COUT	113, 154
Southern Outside	SOUT	103, 104, 152
Southern Inside	SIN	101, 102, 150
Southern Intermediate	SNTR	105, 109, 110
Central Inside	CIN	106, 107, 108
Stephens Passage	STEP	111
Central Intermediate	CNTR	112, 114
Lynn Canal	LYNN	115

Quadrant	Abbreviation	Statistical Areas (Districts)
Northwest	NW	113, 114, 116, 154, 156, 157, 181, 183, 186, 189, 191
Northeast	NE	109, 110, 111, 112, 115
Southwest	SW	103, 104, 150, 152
Southeast	SE	101, 102, 105, 106, 107, 108

Appendix A.3. Statistical weeks used in recording and compiling Southeast Alaska commercial fisheries catch data.

STAT WEEK	YEAR/DATE 1982		YEAR/DATE 1983		YEAR/DATE 1984		YEAR/DATE 1985		YEAR/DATE 1986		YEAR/DATE 1987		YEAR/DATE 1988		YEAR/DATE 1989	
1	0101	- 0102	0101	- 0101	0101	- 0107	0101	- 0105	0101	- 0104	0101	- 0103	0101	- 0102	0101	- 0107
2	0103	- 0109	0102	- 0108	0108	- 0114	0106	- 0112	0105	- 0111	0104	- 0110	0103	- 0109	0108	- 0114
3	0110	- 0116	0109	- 0115	0115	- 0121	0113	- 0119	0112	- 0118	0111	- 0117	0110	- 0116	0115	- 0121
4	0117	- 0123	0116	- 0122	0122	- 0128	0120	- 0126	0119	- 0125	0118	- 0124	0117	- 0123	0122	- 0128
5	0124	- 0130	0123	- 0129	0129	- 0204	0127	- 0202	0126	- 0201	0125	- 0131	0124	- 0130	0129	- 0204
6	0131	- 0206	0130	- 0205	0205	- 0211	0203	- 0209	0202	- 0208	0201	- 0207	0131	- 0206	0205	- 0211
7	0207	- 0213	0206	- 0212	0212	- 0218	0210	- 0216	0209	- 0215	0208	- 0214	0207	- 0213	0212	- 0218
8	0214	- 0220	0213	- 0219	0219	- 0225	0217	- 0223	0216	- 0222	0215	- 0221	0214	- 0220	0219	- 0225
9	0221	- 0227	0220	- 0226	0226	- 0303	0224	- 0302	0223	- 0301	0222	- 0228	0221	- 0227	0226	- 0304
10	0228	- 0306	0227	- 0305	0304	- 0310	0303	- 0309	0302	- 0308	0301	- 0307	0228	- 0305	0305	- 0311
11	0307	- 0313	0306	- 0312	0311	- 0317	0310	- 0316	0309	- 0315	0308	- 0314	0306	- 0312	0312	- 0318
12	0314	- 0320	0313	- 0319	0318	- 0324	0317	- 0323	0316	- 0322	0315	- 0321	0313	- 0319	0319	- 0325
13	0321	- 0327	0320	- 0326	0325	- 0331	0324	- 0330	0323	- 0329	0322	- 0328	0320	- 0326	0326	- 0401
14	0328	- 0403	0327	- 0402	0401	- 0407	0331	- 0406	0330	- 0405	0329	- 0404	0327	- 0402	0402	- 0408
15	0404	- 0410	0403	- 0409	0408	- 0414	0407	- 0413	0406	- 0412	0405	- 0411	0403	- 0409	0409	- 0415
16	0411	- 0417	0410	- 0416	0415	- 0421	0414	- 0420	0413	- 0419	0412	- 0418	0410	- 0416	0416	- 0422
17	0418	- 0424	0417	- 0423	0422	- 0428	0421	- 0427	0420	- 0426	0419	- 0425	0417	- 0423	0423	- 0429
18	0425	- 0501	0424	- 0430	0429	- 0505	0428	- 0504	0427	- 0503	0426	- 0502	0424	- 0430	0430	- 0506
19	0502	- 0508	0501	- 0507	0506	- 0512	0505	- 0511	0504	- 0510	0503	- 0509	0501	- 0507	0507	- 0513
20	0509	- 0515	0508	- 0514	0513	- 0519	0512	- 0518	0511	- 0517	0510	- 0516	0508	- 0514	0514	- 0520
21	0516	- 0522	0515	- 0521	0520	- 0526	0519	- 0525	0518	- 0524	0517	- 0523	0515	- 0521	0521	- 0527
22	0523	- 0529	0522	- 0528	0527	- 0602	0526	- 0601	0525	- 0531	0524	- 0530	0522	- 0528	0528	- 0603
23	0530	- 0605	0529	- 0604	0603	- 0609	0602	- 0608	0601	- 0607	0531	- 0606	0529	- 0604	0604	- 0610
24	0606	- 0612	0605	- 0611	0610	- 0616	0609	- 0615	0608	- 0614	0607	- 0613	0605	- 0611	0611	- 0617
25	0613	- 0619	0612	- 0618	0617	- 0623	0616	- 0622	0615	- 0621	0614	- 0620	0612	- 0618	0618	- 0624
26	0620	- 0626	0619	- 0625	0624	- 0630	0623	- 0629	0622	- 0628	0621	- 0627	0619	- 0625	0625	- 0701
27	0627	- 0703	0626	- 0702	0701	- 0707	0630	- 0706	0629	- 0705	0628	- 0704	0626	- 0702	0702	- 0708
28	0704	- 0710	0703	- 0709	0708	- 0714	0707	- 0713	0706	- 0712	0705	- 0711	0703	- 0709	0709	- 0715
29	0711	- 0717	0710	- 0716	0715	- 0721	0714	- 0720	0713	- 0719	0712	- 0718	0710	- 0716	0716	- 0722
30	0718	- 0724	0717	- 0723	0722	- 0728	0721	- 0727	0720	- 0726	0719	- 0725	0717	- 0723	0723	- 0729
31	0725	- 0731	0724	- 0730	0729	- 0804	0728	- 0803	0727	- 0802	0726	- 0801	0724	- 0730	0730	- 0805
32	0801	- 0807	0731	- 0806	0805	- 0811	0804	- 0810	0803	- 0809	0802	- 0808	0731	- 0806	0806	- 0812
33	0808	- 0814	0807	- 0813	0812	- 0818	0811	- 0817	0810	- 0816	0809	- 0815	0807	- 0813	0813	- 0819
34	0815	- 0821	0814	- 0820	0819	- 0825	0818	- 0824	0817	- 0823	0816	- 0822	0814	- 0820	0820	- 0826
35	0822	- 0828	0821	- 0827	0826	- 0901	0825	- 0831	0824	- 0830	0823	- 0829	0821	- 0827	0827	- 0902
36	0829	- 0904	0828	- 0903	0902	- 0908	0901	- 0907	0831	- 0906	0830	- 0905	0828	- 0903	0903	- 0909
37	0905	- 0911	0904	- 0910	0909	- 0915	0908	- 0914	0907	- 0913	0906	- 0912	0904	- 0910	0910	- 0916
38	0912	- 0918	0911	- 0917	0916	- 0922	0915	- 0921	0914	- 0920	0913	- 0919	0911	- 0917	0917	- 0923
39	0919	- 0925	0918	- 0924	0923	- 0929	0922	- 0928	0921	- 0927	0920	- 0926	0918	- 0924	0924	- 0930
40	0926	- 1002	0925	- 1001	0930	- 1006	0929	- 1005	0928	- 1004	0927	- 1003	0925	- 1001	1001	- 1007
41	1003	- 1009	1002	- 1008	1007	- 1013	1006	- 1012	1005	- 1011	1004	- 1010	1002	- 1008	1008	- 1014
42	1010	- 1016	1009	- 1015	1014	- 1020	1013	- 1019	1012	- 1018	1011	- 1017	1009	- 1015	1015	- 1021
43	1017	- 1023	1016	- 1022	1021	- 1027	1020	- 1026	1019	- 1025	1018	- 1024	1016	- 1022	1022	- 1028

Appendix B.1. Estimated weekly proportion of the total troll catch of coded-wire tagged Berners River coho salmon, 1982, 1983, and 1985-1987.

Statistical Week	<u>Year</u>					Average
	1982	1983	1985	1986	1987	
25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
27	0.0000	0.0000	0.0000	0.0647	0.0000	0.0129
28	0.0000	0.0193	0.0370	0.0199	0.0000	0.0152
29	0.0000	0.0000	0.0000	0.1329	0.0000	0.0266
30	0.0244	0.0761	0.1039	0.0791	0.1037	0.0774
31	0.0486	0.0566	0.0664	0.0245	0.1108	0.0614
32	0.0000	0.0832	0.0377	0.0592	0.0513	0.0463
33	0.0952	0.0000	0.0000	0.0181	0.0000	0.0227
34	0.3578	0.2010	0.0000	0.1107	0.2010	0.1741
35	0.0985	0.1663	0.1227	0.1585	0.0323	0.1157
36	0.0000	0.1655	0.3482	0.2243	0.2880	0.2052
37	0.1449	0.1165	0.2380	0.1081	0.1839	0.1583
38	0.0000	0.1155	0.0461	0.0000	0.0290	0.0381
39	0.2306	0.0000	0.0000	0.0000	0.0000	0.0461
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Sample Size	25	77	50	87	43	

Appendix B.2. Estimated weekly proportion of the total troll catch of coded-wire tagged Ford Arm Lake coho salmon, 1982, 1983, and 1985-1987.

Statistical Week	<u>Year</u>					Average
	1982	1983	1985	1986	1987	
25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0000	0.0000	0.0106	0.0484	0.0118
27	0.0000	0.0000	0.4280	0.1164	0.0613	0.1211
28	0.0000	0.1662	0.0429	0.1967	0.0682	0.0948
29	0.1584	0.1326	0.0205	0.1584	0.0843	0.1108
30	0.0844	0.1376	0.0752	0.1347	0.1918	0.1247
31	0.1006	0.1775	0.0385	0.0828	0.1094	0.1018
32	0.0000	0.1025	0.0546	0.1558	0.1500	0.0926
33	0.2394	0.0157	0.1003	0.0611	0.0509	0.0935
34	0.1235	0.0895	0.0000	0.0000	0.1208	0.0668
35	0.1020	0.0991	0.1660	0.0297	0.0955	0.0985
36	0.1917	0.0567	0.0673	0.0538	0.0194	0.0778
37	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
38	0.0000	0.0226	0.0067	0.0000	0.0000	0.0059
39	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Sample Size	37	83	49	85	65	

Appendix B.3. Estimated weekly proportion of the total troll catch of coded-wire tagged Warm Chuck Lake coho salmon, 1982, 1983 and 1985-1987.

Statistical Week	<u>Year</u>					Average
	1982	1983	1985	1986	1987	
25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0000	0.0000	0.0485	0.0756	0.0248
27	0.0000	0.0000	0.2885	0.0167	0.0250	0.0660
28	0.0000	0.0000	0.1146	0.0732	0.1642	0.0704
29	0.1390	0.2013	0.1145	0.2731	0.1292	0.1714
30	0.0275	0.6805	0.1387	0.1847	0.0599	0.2183
31	0.1065	0.1182	0.1698	0.1571	0.2403	0.1584
32	0.0000	0.0000	0.0000	0.0916	0.1094	0.0402
33	0.5831	0.0000	0.0377	0.0247	0.0000	0.1291
34	0.0241	0.0000	0.0000	0.0000	0.0852	0.0219
35	0.1198	0.0000	0.0000	0.0862	0.0796	0.0571
36	0.0000	0.0000	0.1191	0.0186	0.0316	0.0339
37	0.0000	0.0000	0.0171	0.0256	0.0000	0.0085
38	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
39	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Sample Size	20	6	21	62	35	

Appendix B.4. Estimated weekly proportion of the total troll catch of coded-wire tagged Salmon Bay Lake coho salmon, 1986-1987.

Statistical Week	<u>Year</u>		Average
	1986	1987	
25	0.0000	0.0000	0.0000
26	0.0000	0.0000	0.0000
27	0.0000	0.0000	0.0000
28	0.1288	0.0000	0.0644
29	0.1804	0.0477	0.1141
30	0.1006	0.0000	0.0503
31	0.0986	0.3068	0.2027
32	0.1279	0.1686	0.1483
33	0.0598	0.0000	0.0299
34	0.0000	0.2988	0.1494
35	0.1313	0.1781	0.1547
36	0.1214	0.0000	0.0607
37	0.0139	0.0000	0.0070
38	0.0373	0.0000	0.0187
39	0.0000	0.0000	0.0000
Total	1.0000	1.0000	1.0000
Sample Size	47	25	

Appendix B.5. Estimated weekly proportion of the total troll catch of coded-wire tagged Unuk River coho salmon, 1985-1987.

Statistical Week	<u>Year</u>			Average
	1985	1986	1987	
25	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0443	0.0000	0.0148
27	0.0376	0.0815	0.0645	0.0612
28	0.1194	0.2503	0.0000	0.1232
29	0.2328	0.1850	0.2624	0.2267
30	0.2715	0.0757	0.1528	0.1667
31	0.1665	0.1648	0.1339	0.1551
32	0.0593	0.0248	0.0000	0.0280
33	0.0449	0.0189	0.0000	0.0213
34	0.0000	0.0000	0.1453	0.0484
35	0.0000	0.1105	0.1417	0.0841
36	0.0209	0.0171	0.0000	0.0127
37	0.0261	0.0162	0.0000	0.0141
38	0.0210	0.0109	0.0994	0.0438
39	0.0000	0.0000	0.0000	0.0000
Total	1.0000	1.0000	1.0000	1.0000
Sample Size	49	64	12	

Appendix B.6. Estimated weekly proportion of the total troll catch of coded-wire tagged Chickamin River coho salmon, 1984-1987.

Statistical Week	<u>Year</u>				Average
	1984	1985	1986	1987	
25	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0000	0.0000	0.0000	0.0000
27	0.0000	0.5594	0.0416	0.0000	0.1503
28	0.0996	0.0000	0.0295	0.1479	0.0693
29	0.0519	0.0324	0.2708	0.0000	0.0888
30	0.1142	0.0180	0.0749	0.1635	0.0927
31	0.1054	0.0890	0.1313	0.2758	0.1504
32	0.2309	0.0492	0.1899	0.1159	0.1465
33	0.0000	0.1139	0.0552	0.0000	0.0423
34	0.0000	0.0000	0.0000	0.0748	0.0187
35	0.1748	0.0620	0.1847	0.1882	0.1524
36	0.1067	0.0761	0.0000	0.0339	0.0542
37	0.1165	0.0000	0.0221	0.0000	0.0347
38	0.0000	0.0000	0.0000	0.0000	0.0000
39	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1.0000	1.0000	1.0000	1.0000	1.0000
Sample Size	11	17	30	17	

Appendix B.7. Estimated weekly proportion of the total troll catch of coded-wire tagged Hugh Smith Lake coho salmon, 1982-1987.

Statistical Week	<u>Year</u>						Average
	1982	1983	1984	1985	1986	1987	
25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0000	0.0402	0.0000	0.0000	0.0276	0.0113
27	0.0085	0.0000	0.0000	0.0000	0.0073	0.0183	0.0057
28	0.0000	0.0415	0.0000	0.0492	0.0723	0.0000	0.0272
29	0.1134	0.0867	0.0655	0.1351	0.1081	0.1910	0.1166
30	0.0628	0.1481	0.0000	0.1689	0.1246	0.0430	0.0912
31	0.0950	0.1010	0.2028	0.1394	0.1216	0.1554	0.1359
32	0.0000	0.1224	0.1365	0.0713	0.1217	0.0924	0.0907
33	0.2632	0.0154	0.1014	0.1189	0.0553	0.0000	0.0924
34	0.1111	0.2405	0.0000	0.0000	0.1007	0.2527	0.1175
35	0.2396	0.0745	0.0764	0.1498	0.1378	0.1152	0.1322
36	0.0481	0.0626	0.1317	0.0747	0.0794	0.0863	0.0805
37	0.0170	0.0686	0.1871	0.0521	0.0284	0.0181	0.0619
38	0.0055	0.0348	0.0584	0.0406	0.0428	0.0000	0.0304
39	0.0358	0.0039	0.0000	0.0000	0.0000	0.0000	0.0066
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Sample Size	64	107	67	114	155	52	

Appendix B.8. Estimated weekly proportion of the total troll catch of coded-wire tagged Hugh Smith Lake coho salmon in the Northwest, Northeast and Southwest Quadrants, 1982-1987.

Statistical Week	<u>Year</u>						Average
	1982	1983	1984	1985	1986	1987	
25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0000	0.0534	0.0000	0.0000	0.0310	0.0141
27	0.0000	0.0000	0.0000	0.0000	0.0084	0.0205	0.0048
28	0.0000	0.0556	0.0000	0.0601	0.0827	0.0000	0.0331
29	0.1453	0.1084	0.0871	0.1515	0.1236	0.2139	0.1383
30	0.0735	0.1800	0.0000	0.2001	0.1424	0.0320	0.1047
31	0.0861	0.1144	0.2695	0.1310	0.1276	0.1394	0.1447
32	0.0000	0.1322	0.1814	0.0516	0.1285	0.0898	0.0973
33	0.2845	0.0207	0.1348	0.1147	0.0528	0.0000	0.1012
34	0.1229	0.2301	0.0000	0.0000	0.1151	0.2477	0.1193
35	0.2728	0.0562	0.0000	0.1470	0.1239	0.1291	0.1215
36	0.0149	0.0593	0.1263	0.0748	0.0673	0.0966	0.0732
37	0.0000	0.0231	0.1062	0.0359	0.0147	0.0000	0.0300
38	0.0000	0.0200	0.0413	0.0333	0.0130	0.0000	0.0179
39	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Sample Size	44	73	44	87	128	45	

Appendix B.9. Estimated weekly proportion of the total troll catch of coded-wire tagged Hugh Smith Lake coho salmon in the Southeast Quadrant, 1982-1987.

Statistical Week	<u>Year</u>						Average
	1982	1983	1984	1985	1986	1987	
25	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
26	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
27	0.0386	0.0000	0.0000	0.0000	0.0000	0.0000	0.0064
28	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
29	0.0000	0.0227	0.0000	0.0614	0.0000	0.0000	0.0140
30	0.0250	0.0542	0.0000	0.0292	0.0000	0.1350	0.0406
31	0.1266	0.0613	0.0000	0.1771	0.0797	0.2883	0.1222
32	0.0000	0.0934	0.0000	0.1595	0.0735	0.1139	0.0734
33	0.1874	0.0000	0.0000	0.1377	0.0730	0.2940	0.1154
34	0.0692	0.2711	0.0000	0.0000	0.0000	0.0000	0.0567
35	0.1213	0.1284	0.3086	0.1622	0.2347	0.0000	0.1592
36	0.1659	0.0723	0.1483	0.0745	0.1638	0.1688	0.1323
37	0.0774	0.2026	0.4327	0.1247	0.1243	0.0000	0.1603
38	0.0253	0.0784	0.1104	0.0737	0.2510	0.0000	0.0898
39	0.1633	0.0156	0.0000	0.0000	0.0000	0.0000	0.0298
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Sample Size	20	34	23	27	27	7	