

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, 1988-1989

By

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## 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 32,873 coho salmon smolts and rearing juveniles was captured, coded-wire tagged and released at six sites in Southeast Alaska during 1 July 1988 - 30 June 1989. Also, during this period, coded-wire tagged adult coho salmon returned to six systems, including three in northern Southeast and three in Southern Southeast. The spatial and temporal distribution of the fishery harvest of individual stocks was estimated for all of the systems. In addition, total return, harvest rates by fishery and survival rates were estimated for three stocks that were sampled for total escapement and the incidence of coded-wire tags. The estimated 1988 total return of 14,972 fish to the Berners River in lower Lynn Canal was very close to the estimated 1987 return of 14,058 and was only 59% of the 1982, 1983 and 1984-1986 average of 25,587. The 1988 total harvest rate for that system was estimated at 0.818 compared with the previous average of 0.782. The Ford Arm Lake stock returned at higher than average abundance with an estimated total return of 5,960 fish compared with the previous average of 4,620. The estimated total harvest rate for the Ford Arm Lake stock was 0.492 compared with the previous average of 0.548. The 1988 estimated total return to Hugh Smith Lake of 1,530 fish was the lowest recorded and represented a 60% reduction from the 1982-1987 average of 3,868 fish. The low 1988 return to Hugh Smith Lake was largely attributed to a marine survival rate of only 4.2% which represented a 64% reduction from the previous average of 11.6%. Analysis of migratory timing data indicated that the Kadashan River stock was most available to the troll fishery relatively late in the season (late August and September) while the harvest of Salmon Bay Lake fish was greatest from late July to early September. Klakas Lake fish were most available from mid-July through mid-August. Migratory timing information from the Berners River and Hugh Smith Lake stocks largely confirmed previously reported findings. In 1988, an estimated 42.1% of the troll catch of Ford Arm Lake coho salmon (20.7% of the total stock) was harvested during a single week (August 25-31). An increased catch rate for that stock during late August appeared to largely compensate an additional 13 day reduction in fishing time compared with past years.

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. During 1969-1988, the annual commercial catch averaged 1.41 million fish and ranged from 0.43-3.33 million fish. Commercial fisheries have accounted for the vast majority of the total harvest, while sport and subsistence fisheries have taken only about 3%.

The majority of the coho salmon harvested in Southeast Alaska are produced in over 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. 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 Southeast Alaska (Figure 1) and five systems near Yakutat. Earlier studies focused on characterizing the rates and time-area distributions of the harvest of stocks from different areas of the region. As more of this type of information has become available, program emphasis has shifted to long-term research on selected "indicator stocks". In addition to providing additional information on harvest rates and patterns, these ongoing studies are directed at providing data on population dynamics that are expected to be useful in establishing objective escapement goals and developing models to predict abundance. Established wild stock indicator systems include the Berners River and Auke Lake north of Juneau, Ford Arm and Salmon Lakes on the outer coast, and Hugh Smith Lake south of Ketchikan.

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 1988 - 30 June 1989. 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 and Auke Creek and Yehring Creek near Juneau are reported in the ADF&G, Sport Fish Division's Fishery Report Series (Elliott et al. 1989). In addition, an analysis of tag recovery data collected from coho salmon stocks throughout the Taku River system in 1988 was reported by Shaul (1989).

## SMOLT AND JUVENILE TAGGING

Wild coho salmon smolts and rearing juveniles were coded-wire tagged in three systems in Southeast Alaska during July 1, 1988 - June 30, 1989. The majority of surviving fish that were tagged as 1+ rearing juveniles were expected to return as adults 2 years later, while those tagged as outmigrating smolts were expected to return to the fisheries and spawning grounds after only one year.

## Methods and Procedures

Outmigrating smolts were captured for tagging at Hugh Smith Lake and the Berners River. A smolt weir was installed at the outlet of Hugh Smith Lake, while smolts in the Berners River were captured at beaver dams using trough traps of the design described by Elliott and Kuntz (1988). Wire-mesh minnow traps baited with salmon roe were used to capture age-1+ and older juveniles at the Ford Arm Lake and the Berners River. Fifty traps were set and checked 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 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 32,873 outmigrating smolts and rearing juveniles was coded-wire tagged during July 1, 1988 - June 30, 1989.

### Ford Arm Lake Juveniles

A total of 12,567 juvenile coho salmon was trapped and tagged at Ford Arm Lake during July 5-16, 1988. Of those, 5,533 were 60-79 mm, 5,335 were 80-100 mm, and 1,699 were larger than 100 mm snout-fork length. A total of 11,108 fish was tagged with code 04-29-22 while 1,459 were tagged with code 04-29-18. Trapping success was good at an average of 8.3 coho salmon 60 mm and larger per trap. The surface water temperature at the outlet averaged 12.6° C.

### Hugh Smith Lake Smolts

A smolt weir at the outlet of Hugh Smith Lake was operated during April 21 - June 11. The first coho salmon smolt entered the trap on April 23 and the daily count peaked at 894 on May 16. The outmigration dwindled to fewer than 50 fish per day after June 2. A total of 7,187 smolts was counted and tagged with code 04-27-18. Outmigrant counts for other species included 427,366 sockeye smolts, 116 steelhead smolts, 1,536 Dolly Varden and 41 cutthroat trout.

### Berners River Smolts and Juveniles

Coho salmon smolts and rearing juveniles were captured and coded-wire tagged at the Berners River during April 27 - June 8, 1989. A total of 6,438 outmigrant smolts was captured in outmigrant trough traps and tagged with code 04-29-27. Based on a sample of 603 fish, these outmigrants were predominantly age 2+ (60.9%) followed by ages 1+ (35.6%) and 3+ (3.5%). The overall average length was 105.4 mm. The average length by age class was as follows: 1+ 94.5 mm; 2+ 110.6 mm; and 3+ 127.1 mm. An additional 6,681 fish were captured in minnow traps in Brown Slough. These were divided into two groups: one which exhibited definite smolt characteristics and another group that exhibited primarily rearing juvenile characteristics. A total of 1,021 was classified in the smolt group and tagged with code 04-29-23. These fish averaged 98.5 mm and were distributed by age class as follows: 1+ 33.9%; 2+ 61.5%; and 3+ 4.6% (N=130). The remaining

5,660 fish were tagged with code 04-29-26. These fish averaged 81.5 mm in length and were primarily age 1+ (73.9%) followed by age 2+ (23.9%) and age 3+ (2.2%; N=180). The water temperature in the slough during May ranged from 5.0-11.1 C (average 7.4 C).

## ADULT TAG RETURNS

### *Methods and Procedures*

#### 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 B.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 (Appendix B.2), while recoveries from net and trap fisheries were expanded by district. Time strata used for expanding net and trap recoveries were statistical weeks (Appendix B.3), while troll fishery samples were expanded over the total catch for open periods (between closures). 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 or period strata while adjustments were made to account for lost samples (Clark and Bernard 1987). An adjustment for lost samples was made by multiplying expansions by the inverse of the proportion of heads and tags lost.

The ADF&G Sport Fish Division conducted a creel census and survey of the Juneau and Ketchikan marine recreational fisheries (Suchanek and Bingham 1989). Tags recovered from random samples were expanded over biweekly strata that contained additional stratifications including weekdays, mornings vs. afternoons and low use vs. heavy use docks. In the Juneau fishery, 3,459 fish (28.8%) were sampled from the total estimated season's catch of 12,016. The Ketchikan fishery harvested only 5,512 fish, of which 584 (10.6%) were sampled.

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

Coho salmon escapements were enumerated or estimated at Ford Arm 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 500 fish from all segments of the run. Daily weir counts and age-sex-length data are reported by Wood (In press).

## Analysis of Tag Recovery Data

**Harvest by Gear Type and Escapement.** The estimated harvest by gear type and escapement were computed for coho salmon returns to three systems (Tables 1-3). Alaska troll fishery tag recoveries were expanded to total catch by quadrant (Appendix B.2) and fishing period (time between fishery openings and closures). Recoveries from net fisheries were expanded by District and statistical week (Appendix B.3). Fishery contribution estimates for tagged fish were divided by the proportion tagged in escapement samples to estimate total stock contributions.

**Harvest Rates.** 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 stock (Table 4) and by area for the Hugh Smith Lake stock (Table 5). Total harvest rate estimates were generated for the Ford Arm Lake stock (Table 2) 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.

*Harvest Distribution.* The harvest distribution (percent by area and gear type) was estimated for tagged stocks (Tables 6-11). 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. In addition, the distribution of the Southeast Alaska troll catch of selected stocks was estimated using quadrant-period strata (Tables 12 and 13).

*Migratory Timing.* The migratory timing of six 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 C.1-C.8). 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.

*Survival Rates.* Survival rates were estimated for tagged coho salmon smolts outmigrating from Hugh Smith Lake in 1987 and juvenile coho salmon tagged in the Berners River (1985 and 1986) and at Ford Arm Lake in 1985 (Table 14). 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

### Escapement Enumeration and Sampling

*Berners River Surveys.* A total of 222 adult coho salmon was captured with a beach seine and marked on the lower Berners River during September 17 - October 7. The period was divided into three weekly strata. A total of 114 adults was marked with a left-bottom opercular punch during September 17-23 while 108 fish were marked with a left-center opercular punch during September 24-30. No fish were captured during the last period (October 1-7), when seining was made ineffective by high water. Of a total of 228 adults captured in the lower river, 8 had adipose clips. Six of the marked fish were sacrificed, of which 4 had tags from 1986 Berners River tagging while 2 did not. The other two ad clipped fish were examined with a magnetic field detector of which both registered positive for tags.

The upper Berners River was surveyed by foot and helicopter during October 18-27. A total of 2,724 adult coho salmon was counted of which 958 were captured and examined for marks. Twenty eight of the sampled fish had adipose clips. Tags were detected in 25 of the ad clipped fish but not in the other three. Of

the three fish that did not register a signal, further examination by the tag lab indicated that one contained a tag from 1986 Berners River tagging while the other two contained no tags.

Of the 958 fish examined in the upper river, only 14 had opercular punch marks (six left-bottom; eight left-center). The tagging and recapture data yielded a simple Peterson estimate of the escapement of 14,257 (95% C.I. 7,563-20,951). This estimate is much higher than expected based on survey counts and available information on spawning areas and the timing of migration and spawning. Further studies are needed to determine the spatial and temporal distribution of spawning in the system and to evaluate the assumptions inherent in mark-recapture estimation.

Overall, a total of 1,186 age .1 Berners River coho salmon was examined for coded-wire tags in 1988 of which 36 had ad clips and 32 had tags.

*Ford Arm Lake Weir.* The Ford Arm Lake Weir was operated during August 13 - October 24. Coho salmon were observed downstream immediately after the weir was installed and 22 adults (age .1) passed the weir during the first 3 days of operation. A total of 2,353 adults and 293 jacks (age .0) was counted during the period of operation. In addition, it appeared likely that some fish passed across the weir uncounted during high water conditions on October 8 through a hole that was made by a bear in the wire extension. Therefore, mark-recovery sampling was conducted using beach seines, sport gear and dipnets during October 13-23 in an effort to estimate the number of uncounted fish upstream of the weir.

A total of 2,330 adults was marked with a partial dorsal clip and released upstream of the weir during August 13 - October 13. Of those, 2,329 were upstream migrants while one was an unmarked adult captured above the weir which was marked and released. Adults passing after the beginning of mark-recovery sampling on October 13 were marked with an opercular punch. A total of 114 adults was captured from the portion of the system upstream of the weir during October 13-24 which was before the occurrence of any significant spawning activity. Of those, 99 had partial dorsal clips while 15 had no marks. The simple Peterson estimate of the escapement past the weir through October 12 was 2,681 adults (95% C.I. 2,481 - 2,849). Therefore, it was estimated that a total of 352 adults had entered the lake before the weir was installed or had passed through the hole on October 8. Other adults that were added to the mark-recapture estimate were: 323 counted downstream on October 11 minus 4 that passed the weir during October 12-24; 3 counted through the weir and marked with an opercular punch after October 13; 4 natural mortalities observed downstream of the weir during stream surveys; 7 coded-wire tag samples; 11 fish killed in the weir trap by bears; and 3 other mortalities in the trap. Therefore, the total gross escapement to the system was estimated at 3,028 age .1 adults. This estimate was reduced to a net escapement of 3,007 adults after accounting for 21 known mortalities that were attributed to the weir and sampling operation.

A total of 2,371 adults was examined for adipose clips of which 325 (13.7%) were marked. Of 323 ad clipped adults that were examined with the coded-wire field detector, tags were detected in all but seven. The heads from those seven adults were sent to the coded-wire tag recovery lab in Juneau where it was verified that they did not contain tags. The total gross escapement estimate of 3,028 adults contained an expanded estimate of 406.015 coded-wire tags.

Of the 293 jacks counted at the weir, 38 were adipose clipped. Six of the marked jacks did not register tags and were later verified not to have tags.

*Hugh Smith Lake Weir.* The Hugh Smith Lake Weir was operated from early June through October 20. The first coho salmon passed the weir on August 4 and a

total of 303 adults and 57 jacks was counted. In addition, an estimated 180 adults that were holding downstream of the weir entered the lake while the weir was inoperable for 7.5 hours during high water on September 27. Thirty adults were counted downstream of the weir when it was removed on October 20 for a total estimated escapement of 513 fish. A total of 242 adults was marked with a partial dorsal clip. On January 13, a total of 7 adults was sampled at the inlet streams of which none were marked with partial dorsal clips. Heavy ice cover on the inlet streams prevented further successful tag recovery effort for the remainder of the spawning period. Therefore, the combined count of 513 adults remains the best escapement estimate.

A total of 249 adults was examined for adipose clips of which 33 were marked. Of the marked fish, 30 were examined with the field detector of which all registered a positive signal indicating that they contained tags. The escapement contained an expanded estimate of 67,988 coded-wire tagged adults. Of the 56 jacks sampled at the weir, 14 had adipose clips while 42 did not. All of the 14 marked fish registered positive for tags.

#### Harvest by Gear Type and Escapement

During 1982, 1983 and 1985-1988, the total return to the Berners River in lower Lynn Canal averaged an estimated 23,818 fish (range 14,058-34,036; Table 1). The estimated contribution to the Alaska troll fishery and the Lynn Canal drift gill net fishery averaged 11,307 (range 5,926-17,153) and 7,155 (range 3,301-10,568), respectively. Estimated total contributions to the purse seine and marine sport fisheries averaged only 63 fish and 85 fish, respectively. The estimated total contribution to all fisheries averaged 18,610 fish (range 10,798-24,196) while the total escapement survey count averaged 5,208 (range 1,752-9,840). The 1988 estimated return of 14,972 fish was only slightly above the low 1988 estimate of 14,058 and was only 63% of the 1982-1988 average of 23,818. The escapement survey count of 2,724 fish was the second lowest recorded.

An estimated 81.8% of the total return to the Berners River was harvested of which the troll fishery and drift gill net fishery accounted for 39.6% and 41.0%, respectively. In prior years, the troll fishery accounted for a greater share of the run (41.6-55.5%) of the run compared with 20.5-36.2% for the drift gill net fishery. Overall, the purse seine and marine sport fisheries accounted for an average of only 0.3% and 0.4%, respectively, of the estimated total return. These percentages are all undoubtedly biased upward somewhat because escapement estimates are based on an intensive survey count rather than a total weir count or mark-recapture estimate.

The estimated total return to Ford Arm Lake on the outer coast of Chichagof Island averaged 4,844 fish (range 3,229-6,287) during 1982, 1983 and 1985-1988 (Table 2). 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 of 2,440 (range 1,456-3,412) and 204 (range 0-931), respectively. The estimated total fishery contribution averaged 2,644 (range 1,535-4,343) while the total escapement averaged 2,200 (range 1,546-3,028). The 1988 escapement of 3,028 age .1 fish was the highest on record. An average of 53.8% 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 total return to Hugh Smith Lake in Boca de Quadra southeast of Ketchikan, averaged an estimated 3,534 fish (range 1,530-6,096) during 1982-1988 (Table 3). The estimated total return of 1,530 fish in 1988 was the lowest recorded and represented a 60% reduction from the 1982-1987 average of 3,868 fish. The harvest of Hugh Smith Lake coho salmon is typically distributed across a variety of fisheries. On the average, an estimated 41.7% of the total return was

harvested by troll gear of which 34.1% was taken in Alaska and 7.6% was taken in British Columbia. An estimated average of 10.9% and 7.6%, respectively, of the total return was harvested by Alaska purse seine and drift gill net 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 53.1% of the total return to Hugh Smith Lake compared with 8.7% for B.C. fisheries.

#### Harvest Rates

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 1985-1988, the estimated average combined troll and purse seine harvest rate for the Berners River stock averaged 0.478 (range 0.408-0.551; Table 4). 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 0.008. On the average, the Berners River stock was estimated to incur the greatest harvest rate in the Lynn Canal (District 115) drift gill net fishery with annual estimates averaging 0.594 (range 0.415-0.836). Total harvest rate estimates for the Berners River stock averaged 0.788 (range 0.711-0.929).

During 1982, 1983 and 1985-1988, total harvest rate estimates for the Ford Arm Lake stock averaged 0.538 (range 0.436-0.691). The estimated portion attributed to the troll fishery averaged 0.502 (range 0.413-0.609) while purse seine gear accounted for an average of 0.036 (range 0-0.148).

Coho salmon returning to Hugh Smith Lake was 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. During 1982-1988, the combined harvest rate estimate for Hugh Smith Lake coho salmon in northern B.C. and outside and intermediate areas of Southeast Alaska averaged 0.415 (range 0.356-0.511) of which 0.328 (0.279-0.382) was attributed to Alaska fisheries and 0.087 (0.056-0.168) was attributed to northern B.C. fisheries (Table 5). The estimated harvest rate in inside areas averaged 0.346 (range 0.247-0.424), while the estimated total harvest rate for all fisheries averaged 0.618 (range 0.523-0.665).

#### Harvest Distribution

The harvest of the Berners River coho salmon stock was restricted largely to northern fishing areas (Northern Outside, Central Outside, Central Intermediate, Lynn Canal, Stephens Passage) which accounted for an estimated average of 98.8% of the during 1982, 1983 and 1985-1988 (Table 6). Small percentages (less than 1%) were taken in the Southern Outside area, Southern Intermediate area, and northern B.C. Overall, Lynn Canal was the most important single harvest area for the Berners River stock, accounting for an estimated average of 41.7%. The most important harvest areas in the troll fishery were the Northern Outside area (north of Cape Spencer; 22.3%) and the Central Intermediate area (Icy Strait and Cross Sound; 23.7%).

The Ford Arm Lake coho salmon stock on the central outside coast was harvested primarily in the local Central Outside area which accounted for an average of 72.5% of the estimated catch (Table 7). Other important locations where Ford Arm Lake coho salmon were harvested included the Northern Outside and Central Intermediate areas with 17.1% and 6.5%, respectively. In addition, a minor harvest was estimated to have occurred in the Southern Outside (2.7%), Southern Intermediate (0.4%) and Central Inside areas (0.8%).

Hugh Smith Lake coho salmon were harvested over a relatively broad area from Yakutat to northern British Columbia. During 1982-1988, the two most important harvest areas were, on the average, the local Southern Inside area which accounted for an estimated average of 28.8% of the catch and the Central Outside area which accounted for 25.4% (Table 8). Significant catch also occurred in the Southern Outside area (17.8%), the Southern Intermediate area (5.2%) and northern B.C. (13.8%). Hugh Smith Lake coho salmon were also harvested in the Northern Outside area (4.6%), the Central Intermediate area (2.1%), and the Central Inside area (2.3%).

During 1987-1988, Kadashan River coho salmon were harvested primarily in the Central Intermediate and Northern Outside areas with estimated average percentages of 55.8% and 28.4%, respectively (Table 9). Smaller percentages were estimated to have been taken in the Central Outside (9.5%) and Southern Intermediate (6.3%) areas.

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 10). Based on the 1986-1988 average, an estimated 58.0% of the harvest occurred in outside districts with the Central and Southern Outside areas being most important with average estimates of 29.7% and 21.0%, respectively. A significant harvest also occurred in the Northern Outside (7.3%), Central Inside (18.1%), Southern Intermediate (9.3%), Southern Inside (11.2%) and northern B.C. (3.4%) fishing areas.

During 1982, 1983 and 1988, the most important harvest area for Klakas Lake coho salmon was the local Southern Outside area which accounted for an estimated average of 72.5% of the total harvest of that stock. Klakas Lake fish were also caught in several other areas (Northern Outside 2.2%; Central Outside 12.4%; Southern Intermediate 4.1%; Central Inside 0.3%; Southern Inside 6.0%; and British Columbia 2.5%).

The harvest distribution of the Southeast Alaska troll catch of selected stocks was estimated by quadrant. Nearly all of the estimated troll catch of Berners River and Ford Arm Lake coho salmon occurred in the Northwest Quadrant with average estimates of 98.0% and 97.8%, respectively (Table 12). Kadashan River coho salmon were also harvested primarily in the Northwest Quadrant (average 80.9%) with a significant percentage (17.3%) also being taken in the Northeast Quadrant (Table 13). The troll harvest of southern Southeast stocks was distributed over a larger area. The majority of the troll harvest of stocks in inside districts of southern Southeast occurred in northern Southeast, but a substantial proportion was also taken in the southern quadrants. Hugh Smith Lake fish displayed the following average distribution by quadrant (Northwest 55.0%; Northeast 7.4%; Southwest 19.2%; Southeast 18.4%). During 1986-1988, an average of approximately half (49.6%) of the estimated troll harvest of Salmon Bay Lake coho salmon was taken in the Northwest Quadrant while the remainder was distributed over the other three quadrants as follows: Northeast 12.8%; Southwest 30.2%; Southeast 7.5%.

## Migratory Timing

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 2; Appendix C.1). The average period of greatest harvest (more than 10% per week) occurred during approximately August 17 - September 13 while the peak weekly harvest occurred during August 31 - September 6. 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 troll catch and the low catch of Berners River fish during early to mid-August was implementation of annual 10-day troll closures during that period since 1980.

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 2). In 1988, the troll catch of Ford Arm Lake fish was low early in the season and displayed an unusually late peak in late August and early September (Appendix C.2). In spite of 23 days of closures during the main part of the coho salmon season, the 1988 estimated harvest rate for the Ford Arm Lake stock by the Alaska troll fishery was only reduced to 0.479 from the previous average of 0.506. An estimated 42.1% of the troll catch (20.7% of the total stock) was taken during a single 7 day open period (August 25-31). An increased catch rate of Ford Arm Lake fish during that period appeared to largely compensate for a substantial reduction in fishing time compared with other recent years.

The Kadashan River stock was available, on the average, from at least the last week of July through the end of the troll season (September 20) and appeared to peak between mid-August and mid-September (Figure 3; Appendix C.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 3; Appendix C.4).

Tagged Klakas Lake fish were recovered from the second week of July until early September and the stock appeared to be available in relatively high abundance from early to mid-July until late August (Figure 4; Appendix C.5).

On the average, Hugh Smith Lake coho salmon were available to the Alaska troll fishery from late June through the end of the season on 20 September during 1982-1988 (Figure 4; Appendix C.6). 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 early 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 6; Appendix C.7). However, in inside waters of southern Southeast (Southeast Quadrant), it displayed substantially later timing compared with the total troll harvest of coho salmon (Figure 6; Appendix C.8). 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

The survival rate for Hugh Smith Lake smolts that outmigrated in 1987 was estimated at only 4.2%, compared with estimates of ranging from 7.4-19.1%

(average 11.6%) during 1982-1986 (Table 14). The 1988 estimate showed a 63% reduction from the previous average estimated smolt survival rate which largely accounted for a 60% reduction in estimated total return. If it is indicative of other systems, the high degree of variability observed in smolt survival rates at Hugh Smith Lake is sufficient to explain the majority of the variability inherent in returns and catches of coho salmon in southern Southeast.

Survival rates for predominantly age 1+ rearing juveniles tagged at the Berners River and Ford Arm Lake during the summer of 1985 were estimated at 3.2% and 6.0%, respectively. Berners river juveniles tagged in 1986 were estimated to have survived at 5.3%. On the average, juveniles tagged at the Berners River in late June have survived at an average of 4.8% (range 2.9-6.7%). An estimated 6.0% of juvenile coho salmon tagged at Ford Arm Lake in 1985 returned to the fisheries and escapement as age .1 adults. Ford Arm Lake juveniles tagged during July and August of 1980, 1981 and 1983-1985 have survived at an estimated average rate of 9.3% (range 6.0-14.4%).

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Table 1. Estimated harvest and percent by gear type, escapement, and total return of coho salmon returning to the Berners River, 1982, 1983 and 1985-1988.

| Year                     | Fishery Sample Size <sup>a</sup> | 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<br>(41.6%)                                | 0             | 10,568<br>(34.1%) | 0             | 23,455<br>(75.7%) | 7,505<br>(24.3%) | 30,960<br>(100%) |
| 1983                     | 125                              | 17,153<br>(50.4%)                                | 0             | 6,978<br>(20.5%)  | 65<br>(0.2%)  | 24,196<br>(71.1%) | 9,840<br>(28.9%) | 34,036<br>(100%) |
| 1985                     | 93                               | 10,865<br>(44.8%)                                | 198<br>(0.8%) | 7,015<br>(28.9%)  | 0             | 18,078<br>(74.5%) | 6,169<br>(25.5%) | 24,247<br>(100%) |
| 1986                     | 157                              | 13,560<br>(55.1%)                                | 0             | 8,928<br>(36.2%)  | 395<br>(1.6%) | 22,883<br>(92.9%) | 1,752<br>(7.1%)  | 24,635<br>(100%) |
| 1987                     | 53                               | 7,448 <sup>b</sup><br>(53.0%)                    | 0             | 3,301<br>(23.5%)  | 48<br>(0.3%)  | 10,798<br>(76.8%) | 3,260<br>(23.2%) | 14,058<br>(100%) |
| 1988                     | 102                              | 5,926<br>(39.6%)                                 | 181<br>(1.2%) | 6,141<br>(41.0%)  | 0             | 12,248<br>(81.8%) | 2,724<br>(18.2%) | 14,972<br>(100%) |
| Average Number of Fish   |                                  | 11,307   | 63            | 7,155             | 85            | 18,610            | 5,208            | 23,818           |
| Average Percent of Total |                                  | 47.4   | 0.3           | 30.7              | 0.4           | 78.8              | 21.2             | 100              |

<sup>a</sup> Includes only expandable random recoveries.

<sup>b</sup> Estimated 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 2. Estimated harvest and percent by gear type, escapement, and total return of coho salmon returning to Ford Arm Lake, 1982, 1983 and 1985-1988.

| Year                        | Fishery<br>Sample<br>Size <sup>a</sup> | Harvest: Number of fish and percent by gear type |                |                  |                  |                 |
|-----------------------------|--|--|----------------|------------------|------------------|-----------------|
|                             |  | Troll  | Purse<br>Seine | Total<br>Catch   | Escapement       | Total<br>Return |
| 1982                        | 38                                     | 1,948<br>(41.3%)                                 | 106<br>(2.3%)  | 2,054<br>(43.6%) | 2,662<br>(56.4%) | 4,716<br>(100%) |
| 1983                        | 93                                     | 3,412<br>(54.3%)                                 | 931<br>(14.8%) | 4,343<br>(69.1%) | 1,944<br>(30.9%) | 6,287<br>(100%) |
| 1985                        | 49                                     | 2,438<br>(51.2%)                                 | 0              | 2,438<br>(51.2%) | 2,324<br>(48.8%) | 4,762<br>(100%) |
| 1986                        | 87                                     | 2,500<br>(60.9%)                                 | 62<br>(1.5%)   | 2,562<br>(62.4%) | 1,546<br>(37.6%) | 4,108<br>(100%) |
| 1987                        | 71                                     | 1,456<br>(45.1%)                                 | 79<br>(2.4%)   | 1,535<br>(47.5%) | 1,694<br>(52.5%) | 3,229<br>(100%) |
| 1988                        | 151                                    | 2,887 <sup>b</sup><br>(48.4%)                    | 46<br>(0.8%)   | 2,933<br>(49.2%) | 3,028<br>(50.8%) | 5,961<br>(100%) |
| Average Number<br>of Fish   |  | 2,440  | 204            | 2,644            | 2,200            | 4,844           |
| Average Percent<br>of Total |  | 50.2   | 3.6            | 53.8             | 46.2             | 100             |

<sup>a</sup> Includes only expandable random recoveries.

<sup>b</sup> Estimated troll catch in 1988 included 30 fish (0.5%) harvested in the northern British Columbia troll fishery. The estimated average number and percent harvested in the Southeast Alaska troll fishery was 2,435 (50.1%).

Table 3. Estimated harvest and percent by gear type, escapement, and total return of coho salmon returning to Hugh Smith Lake, 1982-1988.

| Year                        | Fishery<br>Sample<br>Size* | Harvest: Number of fish and percent by gear type |                 |                    |                |                 |                |              | Total<br>Catch   | Escapement       | Total<br>Return |
|-----------------------------|----------------------------|--|-----------------|--------------------|----------------|-----------------|----------------|--------------|------------------|------------------|-----------------|
|                             |                            | Alaska<br>Troll                                  | Alaska<br>Seine | Alaska<br>Gill Net | Alaska<br>Trap | Alaska<br>Sport | B.C.<br>Troll  | B.C.<br>Net  |                  |                  |                 |
| 1982                        | 91                         | 2,780<br>(45.6%)                                 | 627<br>(10.3%)  | 203<br>(3.3%)      | 0              | 0               | 264<br>(4.3%)  | 78<br>(1.3%) | 3,952<br>(64.8%) | 2,144<br>(35.2%) | 6,096<br>(100%) |
| 1983                        | 189                        | 1,373<br>(35.4%)                                 | 424<br>(10.9%)  | 277<br>(7.2%)      | 49<br>(1.3%)   | 0               | 211<br>(5.4%)  | 51<br>(1.3%) | 2,385<br>(61.5%) | 1,490<br>(38.5%) | 3,875<br>(100%) |
| 1984                        | 151                        | 1,260<br>(31.4%)                                 | 501<br>(12.5%)  | 470<br>(11.7%)     | 18<br>(0.5%)   | 0               | 325<br>(8.1%)  | 28<br>(0.7%) | 2,602<br>(64.9%) | 1,408<br>(35.1%) | 4,010<br>(100%) |
| 1985                        | 212                        | 868<br>(36.0%)                                   | 287<br>(11.9%)  | 137<br>(5.7%)      | 5<br>(0.2%)    | 0               | 199<br>(8.3%)  | 13<br>(0.5%) | 1,509<br>(62.6%) | 903<br>(37.4%)   | 2,412<br>(100%) |
| 1986                        | 257                        | 1,585<br>(35.4%)                                 | 515<br>(11.5%)  | 315<br>(7.0%)      | 2<br>(0.1%)    | 14<br>(0.3%)    | 234<br>(5.2%)  | 26<br>(0.6%) | 2,691<br>(60.1%) | 1,783<br>(39.9%) | 4,474<br>(100%) |
| 1987                        | 100                        | 656<br>(28.0%)                                   | 95<br>(4.1%)    | 249<br>(10.6%)     | 0              | 23<br>(1.0%)    | 153<br>(6.5%)  | 50<br>(2.2%) | 1,226<br>(52.3%) | 1,118<br>(47.7%) | 2,344<br>(100%) |
| 1988                        | 42                         | 408<br>(28.0%)                                   | 230<br>(15.0%)  | 122<br>(8.0%)      | 0              | 0               | 234<br>(15.3%) | 23<br>(1.5%) | 1,017<br>(66.5%) | 513<br>(33.5%)   | 1,530<br>(100%) |
| Average Number<br>of Fish   |                            | 1,276  | 383             | 253                | 11             | 5               | 231            | 38           | 2,197            | 1,337            | 3,534           |
| Average Percent<br>of Total |                            | 34.1   | 10.9            | 7.6                | 0.3            | 0.2             | 7.6            | 1.1          | 61.8             | 38.2             | 100             |

\* Includes only expandable random recoveries.

Table 4. Estimated harvest rate by fishery for coho salmon returns to the Berners River, 1982, 1983 and 1985-1988.

| Year           | Troll and<br>Purse Seine | Marine<br>Sport | 115<br>Gill Net | Gill Net and<br>Sport Total | Grand<br>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          |
| 1988           | 0.408                    | 0               | 0.693           | 0.693                       | 0.818          |
| <b>Average</b> | 0.478                    | 0.008           | 0.594           | 0.596                       | 0.788          |

Table 5. Estimated harvest rate by area for coho salmon returns to Hugh Smith Lake, 1982-1988.

| Year    | Outside and Intermediate | Northern B.C. | Total | Inside <sup>a</sup> | Grand Total |
|---------|--------------------------|---------------|-------|---------------------|-------------|
| 1982    | 0.381                    | 0.056         | 0.437 | 0.375               | 0.648       |
| 1983    | 0.289                    | 0.067         | 0.356 | 0.403               | 0.615       |
| 1984    | 0.302                    | 0.088         | 0.390 | 0.424               | 0.649       |
| 1985    | 0.318                    | 0.088         | 0.406 | 0.370               | 0.626       |
| 1986    | 0.382                    | 0.058         | 0.440 | 0.288               | 0.601       |
| 1987    | 0.279                    | 0.087         | 0.366 | 0.247               | 0.523       |
| 1988    | 0.343                    | 0.168         | 0.511 | 0.314               | 0.665       |
| Average | 0.328                    | 0.087         | 0.415 | 0.346               | 0.618       |

<sup>a</sup> Inside area includes Districts 101, 102, 105, 106, 107 and 108.

Table 6. Estimated harvest distribution of Berners River coho salmon by area and gear type, 1982, 1983, and 1985-1988.

| Area                  | Gear Type | Year (Percent) |            |            |            |            |            | Ave.       |
|-----------------------|-----------|----------------|------------|------------|------------|------------|------------|------------|
|                       |           | 1982           | 1983       | 1985       | 1986       | 1987       | 1988       |            |
| Northern Outside      | Troll     | 20.3           | 29.6       | 18.3       | 28.4       | 16.9       | 20.3       | 22.3       |
| Central Outside       | Troll     | 3.7            | 11.7       | 15.5       | 15.7       | 13.9       | 2.1        | 10.4       |
| Southern Outside      | Seine     | 0.0            | 0.0        | 0.0        | 0.0        | 0.0        | 1.5        | 0.3        |
| Central Intermediate  | Troll     | 35.6           | 26.9       | 23.3       | 7.7        | 22.9       | 25.9       | 23.7       |
|                       | Seine     | <u>0.0</u>     | <u>0.0</u> | <u>1.2</u> | <u>0.0</u> | <u>0.0</u> | <u>0.0</u> | <u>0.2</u> |
|                       | Total     | 35.6           | 26.9       | 24.5       | 7.7        | 22.9       | 25.9       | 23.9       |
| Southern Intermediate | Troll     | 0.0            | 1.0        | 0.0        | 1.5        | 0.0        | 0.0        | 0.4        |
| Stephens Passage      | Sport     | 0.0            | 0.3        | 0.0        | 2.0        | 0.6        | 0.0        | 0.5        |
| Lynn Canal            | Gill Net  | 40.4           | 30.5       | 41.7       | 44.7       | 42.6       | 50.2       | 41.7       |
| British Columbia      | Troll     | 0.0            | 0.0        | 0.0        | 0.0        | 3.1        | 0.0        | 0.5        |
| Grand Total           |           | 100            | 100        | 100        | 100        | 100        | 100        | 100        |
| Sample Size (Tags)    |           | 40             | 98         | 81         | 122        | 32         | 103        |            |

Table 7. Estimated harvest distribution of Ford Arm Lake coho salmon by area and gear type, 1982, 1983 and 1985-1988.

| Area                  | Gear Type | Year (Percent) |             |            |            |            |            | Ave.       |
|-----------------------|-----------|----------------|-------------|------------|------------|------------|------------|------------|
|                       |           | 1982           | 1983        | 1985       | 1986       | 1987       | 1988       |            |
| Northern Outside      | Troll     | 9.4            | 19.2        | 15.3       | 4.9        | 24.0       | 29.8       | 17.1       |
| Central Outside       | Troll     | 62.4           | 51.0        | 84.7       | 88.0       | 55.8       | 62.5       | 67.4       |
|                       | Seine     | <u>0.0</u>     | <u>23.0</u> | <u>0.0</u> | <u>0.7</u> | <u>6.8</u> | <u>0.0</u> | <u>5.1</u> |
|                       | Total     | 62.4           | 74.0        | 84.7       | 88.7       | 62.6       | 62.5       | 72.5       |
| Southern Outside      | Troll     | 5.3            | 1.0         | 0.0        | 1.2        | 0.0        | 0.0        | 1.3        |
|                       | Seine     | <u>5.0</u>     | <u>0.0</u>  | <u>0.0</u> | <u>1.9</u> | <u>0.0</u> | <u>1.7</u> | <u>1.4</u> |
|                       | Total     | 10.3           | 1.0         | 0.0        | 3.1        | 0.0        | 1.7        | 2.7        |
| Central Intermediate  | Troll     | 13.0           | 5.8         | 0.0        | 1.3        | 13.4       | 5.5        | 6.5        |
| Southern Intermediate | Troll     | 0.0            | 0.0         | 0.0        | 2.0        | 0.0        | 0.5        | 0.4        |
| Central Inside        | Troll     | 4.9            | 0.0         | 0.0        | 0.0        | 0.0        | 0.0        | 0.8        |
| Grand Total           |           | 100            | 100         | 100        | 100        | 100        | 100        | 100        |
| Sample Size (Tags)    |           | 31             | 71          | 31         | 65         | 49         | 131        |            |

Table 8. Estimated harvest distribution of Hugh Smith Lake coho salmon by area and gear type, 1982-1988.

| Area               | Gear Type | Year (Percent) |            |            |            |             |            |             | Ave.       |
|--------------------|-----------|----------------|------------|------------|------------|-------------|------------|-------------|------------|
|                    |           | 1982           | 1983       | 1984       | 1985       | 1986        | 1987       | 1988        |            |
| Northern Outside   | Troll     | 0.0            | 8.0        | 5.6        | 5.8        | 2.7         | 3.3        | 6.7         | 4.6        |
| Central Outside    | Troll     | 30.2           | 21.6       | 19.8       | 33.0       | 37.9        | 11.3       | 23.8        | 25.4       |
|                    | 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>0.0</u>  | <u>0.0</u> |
|                    | Total     | 30.2           | 22.0       | 19.8       | 33.0       | 37.9        | 11.3       | 23.8        | 25.4       |
| Southern Outside   | Troll     | 11.1           | 10.0       | 7.0        | 8.6        | 5.7         | 22.6       | 5.6         | 10.1       |
|                    | Seine     | <u>5.2</u>     | <u>3.0</u> | <u>8.7</u> | <u>3.0</u> | <u>11.5</u> | <u>5.6</u> | <u>17.1</u> | <u>7.7</u> |
|                    | Total     | 16.3           | 13.0       | 15.7       | 11.6       | 17.1        | 28.2       | 22.7        | 17.8       |
| Central Intermed.  | Troll     | 1.4            | 2.2        | 6.9        | 0.0        | 2.7         | 1.2        | 0.0         | 2.1        |
| Southern Intermed. | Troll     | 10.7           | 4.4        | 0.7        | 2.8        | 3.9         | 9.9        | 3.3         | 5.1        |
|                    | Seine     | <u>0.0</u>     | <u>0.0</u> | <u>0.5</u> | <u>0.0</u> | <u>0.0</u>  | <u>0.0</u> | <u>0.0</u>  | <u>0.1</u> |
|                    | Total     | 10.7           | 4.4        | 1.2        | 2.8        | 3.9         | 9.9        | 3.3         | 5.2        |
| Central Inside     | Troll     | 0.3            | 2.9        | 1.2        | 0.7        | 1.1         | 0.0        | 0.0         | 0.9        |
|                    | Seine     | 0.0            | 0.6        | 0.0        | 0.0        | 0.0         | 0.0        | 0.0         | 0.1        |
|                    | Gill Net  | <u>0.0</u>     | <u>5.5</u> | <u>0.6</u> | <u>0.3</u> | <u>3.2</u>  | <u>0.0</u> | <u>0.0</u>  | <u>1.3</u> |
|                    | Total     | 0.3            | 9.0        | 1.8        | 1.0        | 4.3         | 0.0        | 0.0         | 2.3        |
| Southern Inside    | Troll     | 14.7           | 9.0        | 9.4        | 7.2        | 4.4         | 6.0        | 5.1         | 8.0        |
|                    | Seine     | 11.7           | 13.6       | 9.2        | 15.8       | 7.9         | 2.0        | 3.9         | 9.1        |
|                    | Gill Net  | 5.5            | 6.0        | 16.7       | 8.6        | 8.6         | 20.0       | 11.1        | 10.9       |
|                    | Trap      | 0.0            | 2.0        | 0.7        | 0.4        | 0.1         | 0.0        | 0.0         | 0.4        |
|                    | Sport     | <u>0.0</u>     | <u>0.0</u> | <u>0.0</u> | <u>0.0</u> | <u>0.5</u>  | <u>1.8</u> | <u>0.0</u>  | <u>0.4</u> |
|                    | Total     | 31.9           | 30.6       | 36.0       | 32.0       | 21.5        | 29.8       | 20.1        | 28.8       |
| British Columbia   | Troll     | 7.1            | 8.7        | 12.0       | 13.0       | 8.8         | 12.3       | 21.3        | 11.9       |
|                    | 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>2.1</u>  | <u>1.9</u> |
|                    | Total     | 9.2            | 10.8       | 13.0       | 13.8       | 9.8         | 16.3       | 23.4        | 13.8       |
| Grand Total        |           | 100            | 100        | 100        | 100        | 100         | 100        | 100         | 100        |
| Sample Size (Tags) |           | 83             | 175        | 143        | 196        | 228         | 99         | 42          |            |

Table 9. Estimated harvest distribution of Kadashan River coho salmon by area and gear type, 1987-1988.

| Area                 | Gear Type | <u>Year (Percent)</u> |             | Average     |
|----------------------|-----------|-----------------------|-------------|-------------|
|                      |           | 1987                  | 1988        |             |
| Northern Outside     | Troll     | 21.3                  | 35.4        | 28.4        |
| Central Outside      | Troll     | 19.0                  | 0.0         | 9.5         |
| Central Intermediate | Troll     | 39.0                  | 42.3        | 40.6        |
|                      | Seine     | <u>11.5</u>           | <u>18.9</u> | <u>15.2</u> |
|                      | Total     | 50.5                  | 61.2        | 55.8        |
| Southern Intermed.   | Troll     | 9.2                   | 3.4         | 6.3         |
| Grand Total          |           | 100                   | 100         | 100         |
| Sample Size (Tags)   |           | 9                     | 27          |             |

Table 10. Estimated harvest distribution of Salmon Bay Lake coho salmon by area and gear type, 1986-1988.

| Area                 | Gear Type | <u>Year (Percent)</u> |             |             | Average     |
|----------------------|-----------|-----------------------|-------------|-------------|-------------|
|                      |           | 1986                  | 1987        | 1988        |             |
| Northern Outside     | Troll     | 8.7                   | 10.0        | 3.2         | 7.3         |
| Central Outside      | Troll     | 43.2                  | 24.2        | 21.7        | 29.7        |
| Southern Outside     | Troll     | 7.5                   | 38.8        | 16.7        | 21.0        |
| Central Intermediate | Troll     | 0.0                   | 0.0         | 0.0         | 0.0         |
|                      | Seine     | <u>0.0</u>            | <u>0.0</u>  | <u>0.0</u>  | <u>0.0</u>  |
|                      | Total     | 0.0                   | 0.0         | 0.0         | 0.0         |
| Southern Intermed.   | Troll     | 8.7                   | 3.3         | 16.0        | 9.3         |
| Central Inside       | Troll     | 6.2                   | 1.5         | 2.5         | 3.4         |
|                      | Gill Net  | <u>25.7</u>           | <u>10.2</u> | <u>8.3</u>  | <u>14.7</u> |
|                      | Total     | 31.9                  | 11.7        | 10.8        | 18.1        |
| Southern Inside      | Troll     | 0.0                   | 1.9         | 0.0         | 0.6         |
|                      | Seine     | <u>0.0</u>            | <u>0.0</u>  | <u>31.6</u> | <u>10.5</u> |
|                      | Total     | 0.0                   | 1.9         | 31.6        | 11.2        |
| British Columbia     | Troll     | 0.0                   | 10.1        | 0.0         | 3.4         |
| Grand Total          |           | 100                   | 100         | 100         | 100         |
| Sample Size (Tags)   |           | 60                    | 30          | 20          |             |

Table 11. Estimated harvest distribution of Klakas Lake coho salmon by area and gear type, 1982, 1983 and 1988.

| Area               | Gear Type | <u>Year (Percent)</u> |             |             | Average     |
|--------------------|-----------|-----------------------|-------------|-------------|-------------|
|                    |           | 1982                  | 1983        | 1988        |             |
| Northern Outside   | Troll     | 2.6                   | 0.0         | 4.1         | 2.2         |
| Central Outside    | Troll     | 7.4                   | 19.6        | 10.1        | 12.4        |
| Southern Outside   | Troll     | 10.1                  | 39.0        | 37.8        | 29.0        |
|                    | Seine     | <u>68.4</u>           | <u>26.3</u> | <u>35.9</u> | <u>43.5</u> |
|                    | Total     | 78.5                  | 65.3        | 73.7        | 72.5        |
| Southern Intermed. | Troll     | 6.7                   | 4.4         | 1.2         | 4.1         |
| Central Inside     | Troll     | 0.0                   | 0.0         | 1.0         | 0.3         |
| Southern Inside    | Troll     | 0.0                   | 10.7        | 1.0         | 3.9         |
|                    | Seine     | <u>4.8</u>            | <u>0.0</u>  | <u>1.5</u>  | <u>2.1</u>  |
|                    | Total     | 4.8                   | 10.7        | 2.5         | 6.0         |
| British Columbia   | Troll     | 0.0                   | 0.0         | 7.4         | 2.5         |
| Grand Total        |           | 100                   | 100         | 100         | 100         |
| Sample Size (Tags) |           | 14                    | 26          | 47          |             |

Table 12. Estimated distribution by quadrant of the troll catch of Berners River, Ford Arm Lake and Hugh Smith Lake coho salmon, 1982-1988.

| Berners River |                    |           |           |           |       |                |
|---------------|--------------------|-----------|-----------|-----------|-------|----------------|
| Year          | Quadrant (Percent) |           |           |           | Total | Number of Tags |
|               | Northwest          | Northeast | Southwest | Southeast |       |                |
| 1982          | 100.0              | 0.0       | 0.0       | 0.0       | 100   | 25             |
| 1983          | 97.0               | 3.0       | 0.0       | 0.0       | 100   | 77             |
| 1985          | 100.0              | 0.0       | 0.0       | 0.0       | 100   | 50             |
| 1986          | 96.6               | 3.4       | 0.0       | 0.0       | 100   | 87             |
| 1987          | 96.4               | 3.6       | 0.0       | 0.0       | 100   | 43             |
| 1988          | 97.6               | 2.4       | 0.0       | 0.0       | 100   | 64             |
| Ave.          | 98.0               | 2.0       | 0.0       | 0.0       | 100   |                |

| Ford Arm Lake |                    |           |           |           |       |                |
|---------------|--------------------|-----------|-----------|-----------|-------|----------------|
| Year          | Quadrant (Percent) |           |           |           | Total | Number of Tags |
|               | Northwest          | Northeast | Southwest | Southeast |       |                |
| 1982          | 91.3               | 0.0       | 5.8       | 2.9       | 100   | 37             |
| 1983          | 98.8               | 0.0       | 1.2       | 0.0       | 100   | 83             |
| 1985          | 100.0              | 0.0       | 0.0       | 0.0       | 100   | 49             |
| 1986          | 97.0               | 1.8       | 1.2       | 0.0       | 100   | 85             |
| 1987          | 100.0              | 0.0       | 0.0       | 0.0       | 100   | 65             |
| 1988          | 99.5               | 0.5       | 0.0       | 0.0       | 100   | 148            |
| Ave.          | 97.8               | 0.4       | 1.4       | 0.5       | 100   |                |

| Hugh Smith Lake |                    |           |           |           |       |                |
|-----------------|--------------------|-----------|-----------|-----------|-------|----------------|
| Year            | Quadrant (Percent) |           |           |           | Total | Number of Tags |
|                 | Northwest          | Northeast | Southwest | Southeast |       |                |
| 1982            | 47.0               | 14.8      | 14.8      | 23.3      | 100   | 64             |
| 1983            | 52.1               | 5.6       | 17.6      | 24.6      | 100   | 107            |
| 1985            | 59.7               | 1.3       | 15.1      | 23.8      | 100   | 67             |
| 1986            | 65.5               | 2.4       | 15.2      | 16.9      | 100   | 114            |
| 1987            | 73.9               | 5.2       | 9.5       | 11.4      | 100   | 155            |
| 1988            | 31.8               | 14.8      | 42.8      | 10.7      | 100   | 52             |
| Ave.            | 55.0               | 7.4       | 19.2      | 18.4      | 100   |                |

Table 13. Estimated distribution by quadrant of the troll catch of Kadashan River, Salmon Bay Lake and Klakas Lake Coho salmon, 1982-1988.

| Kadashan River |                           |           |           |           |       |                |
|----------------|---------------------------|-----------|-----------|-----------|-------|----------------|
| Year           | <u>Quadrant (Percent)</u> |           |           |           | Total | Number of Tags |
|                | Northwest                 | Northeast | Southwest | Southeast |       |                |
| 1987           | 82.6                      | 17.4      | 0.0       | 0.0       | 100   | 9              |
| 1988           | 79.2                      | 17.3      | 0.0       | 3.5       | 100   | 24             |
| Ave.           | 80.9                      | 17.3      | 0.0       | 1.7       | 100   |                |

| Salmon Bay Lake |                           |           |           |           |       |                |
|-----------------|---------------------------|-----------|-----------|-----------|-------|----------------|
| Year            | <u>Quadrant (Percent)</u> |           |           |           | Total | Number of Tags |
|                 | Northwest                 | Northeast | Southwest | Southeast |       |                |
| 1986            | 67.9                      | 10.1      | 11.0      | 10.9      | 100   | 47             |
| 1987            | 35.1                      | 3.9       | 55.0      | 6.0       | 100   | 25             |
| 1988            | 45.7                      | 24.3      | 24.4      | 5.5       | 100   | 18             |
| Ave.            | 49.6                      | 12.8      | 30.2      | 7.5       | 100   |                |

| Klakas Lake |                           |           |           |           |       |                |
|-------------|---------------------------|-----------|-----------|-----------|-------|----------------|
| Year        | <u>Quadrant (Percent)</u> |           |           |           | Total | Number of Tags |
|             | Northwest                 | Northeast | Southwest | Southeast |       |                |
| 1982        | 48.6                      | 11.7      | 39.7      | 0.0       | 100   | 7              |
| 1983        | 23.3                      | 2.9       | 53.3      | 20.5      | 100   | 21             |
| 1988        | 21.2                      | 2.7       | 72.5      | 3.5       | 100   | 29             |
| Ave.        | 31.1                      | 5.8       | 55.2      | 8.0       | 100   |                |

Table 14. Estimated survival rates of predominantly age 1+ and older wild juvenile coho salmon and smolts from the time of tagging until entry into the fisheries the following year, 1980-1987.

| Year Tagged | <u>Survival Rate</u>            |                                 |                                     |
|-------------|---------------------------------|---------------------------------|-------------------------------------|
|             | Berners River Rearing Juveniles | Ford Arm Lake Rearing Juveniles | Hugh Smith Lake Outmigrating Smolts |
| 1980        | 2.9%                            | 6.3%                            | -                                   |
| 1981        | 6.7%                            | 9.6%                            | -                                   |
| 1982        | -                               | -                               | 13.3%                               |
| 1983        | 5.9%                            | 14.4%                           | 7.4%                                |
| 1984        | 5.1%                            | 10.2%                           | 7.5%                                |
| 1985        | 3.2%                            | 6.0%                            | 19.1%                               |
| 1986        | 5.3%                            | -                               | 10.6%                               |
| 1987        | -                               | -                               | 4.2%                                |
| Average     | 4.8%                            | 9.3%                            | 10.4%                               |

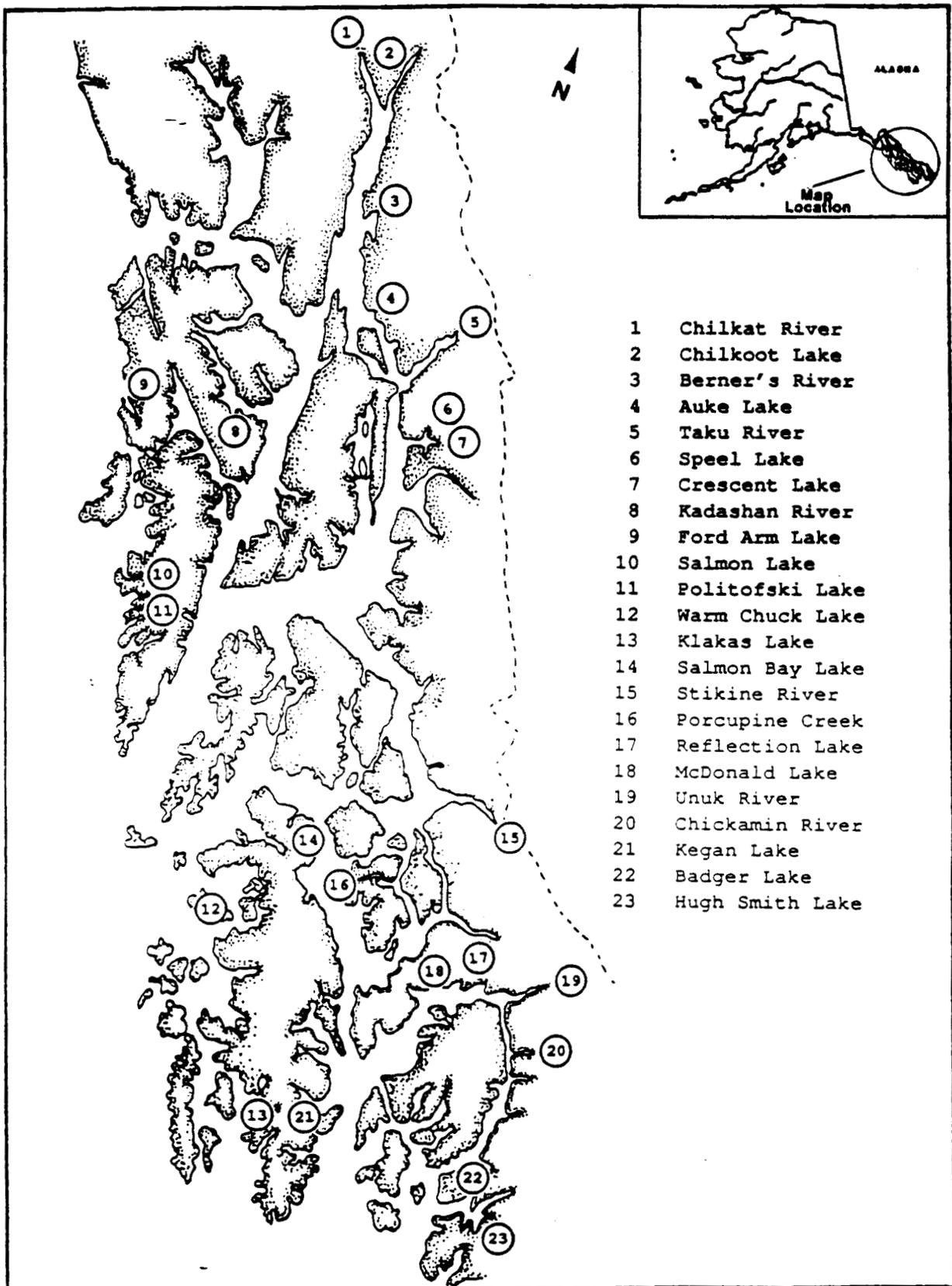
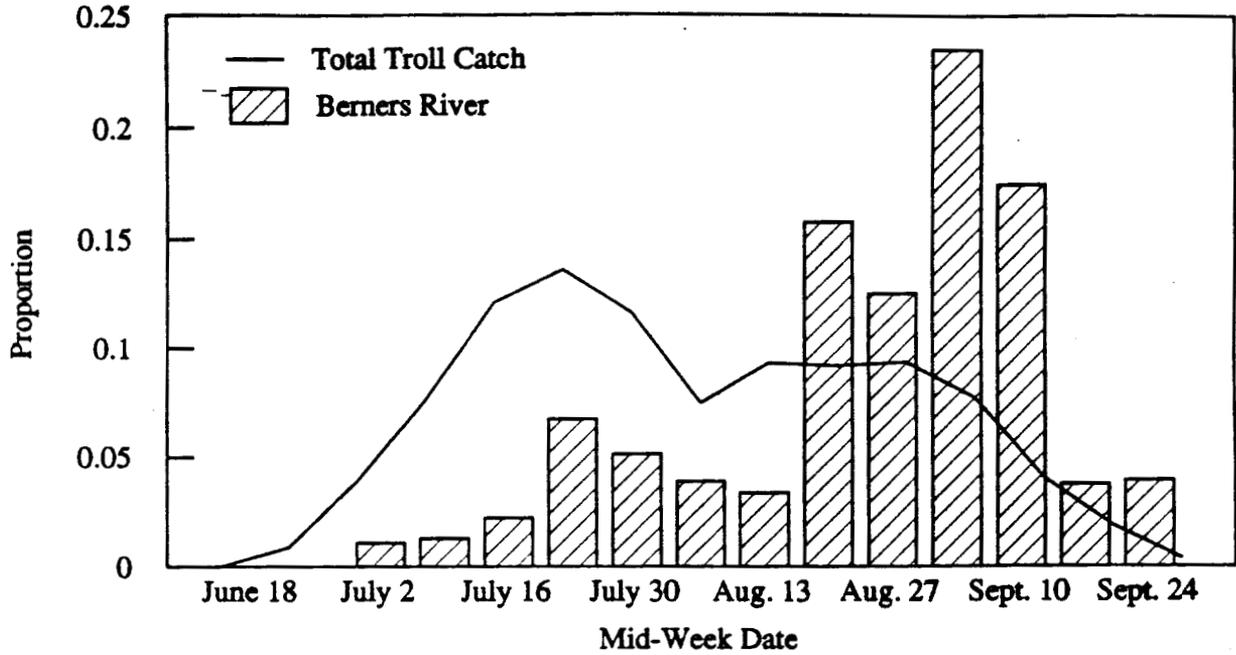


Figure 1. Wild coho salmon coded-wire tagging locations in Southeast Alaska, 1976-1988.

### Berners River (1982, 1983 and 1985-1988)



### Ford Arm Lake (1982, 1983 and 1985-1988)

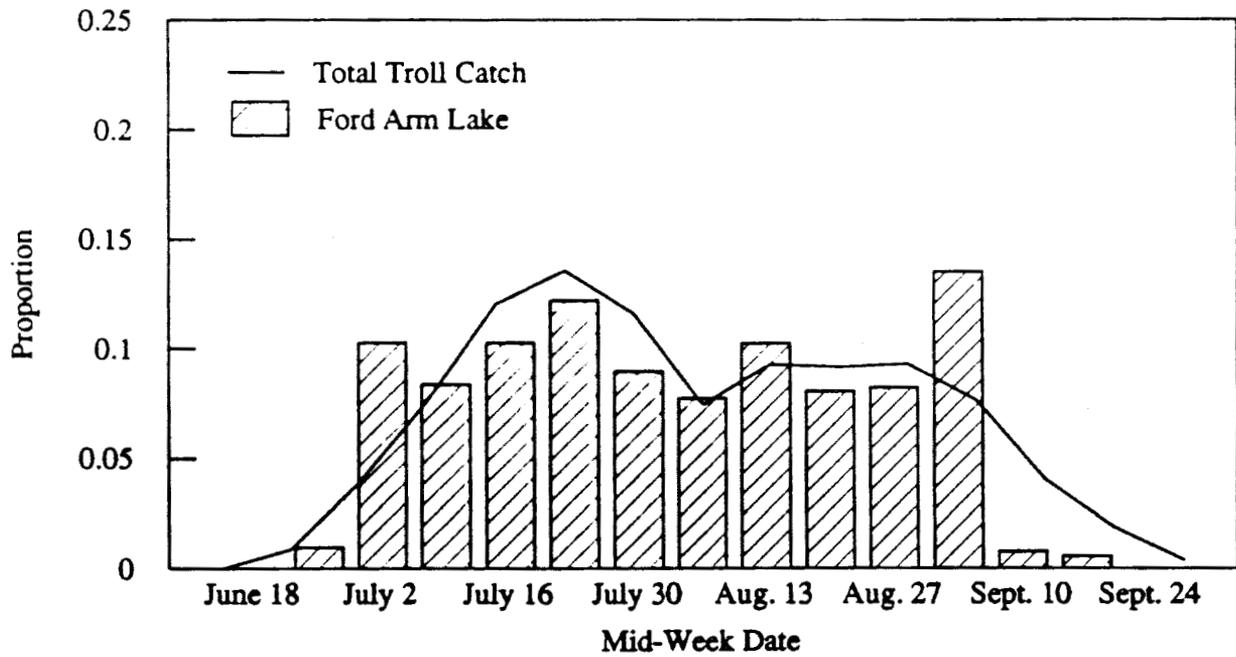
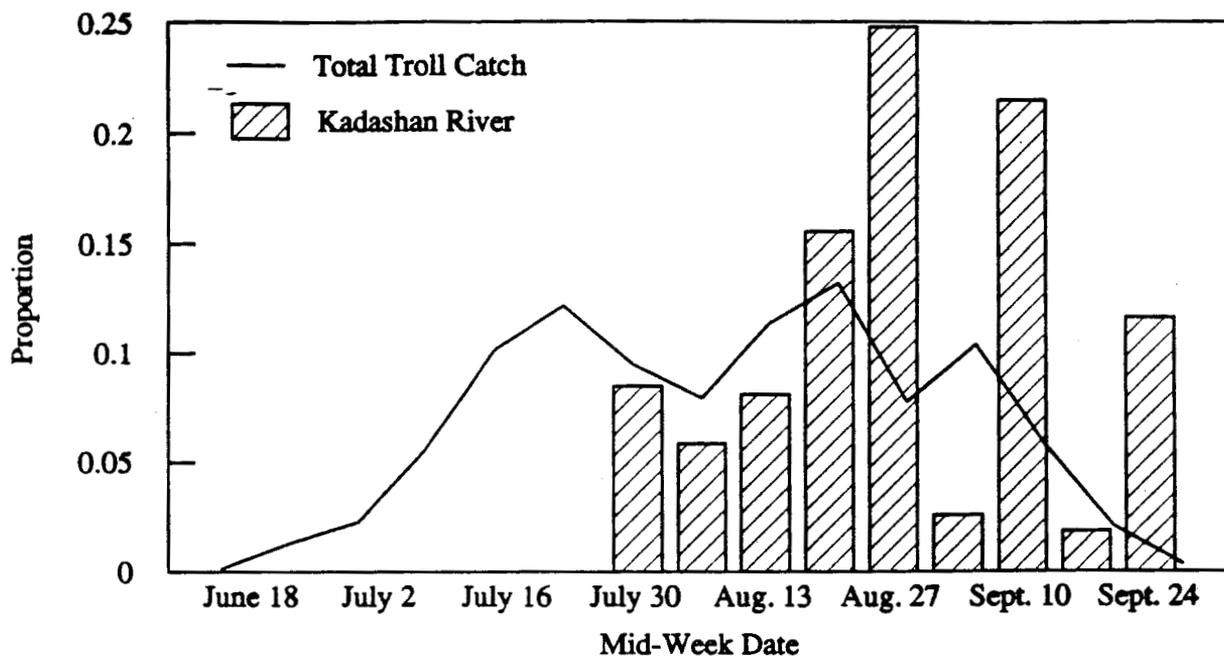


Figure 2. Average weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged Berners River and Ford Arm Lake coho salmon (bar graph), 1982, 1983 and 1985-1988.

### Kadashan River (1987 and 1988)



### Salmon Bay Lake (1986-1988)

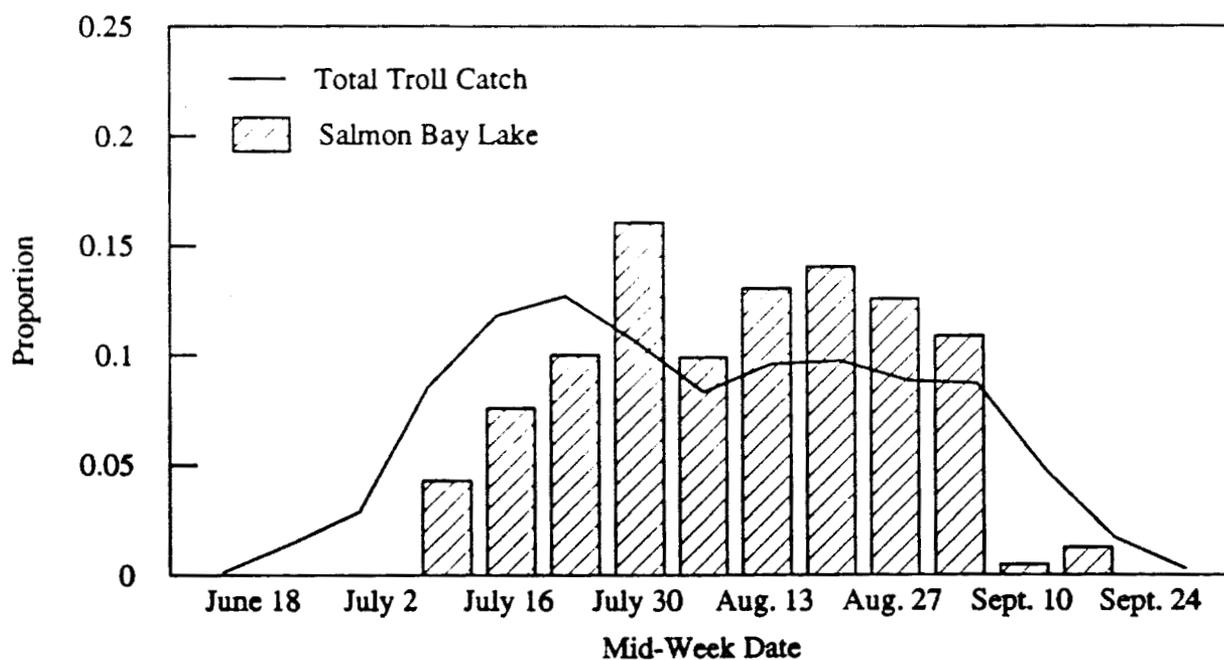


Figure 3. Average weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged Kadashan River and Salmon Bay Lake coho salmon (bar graph).

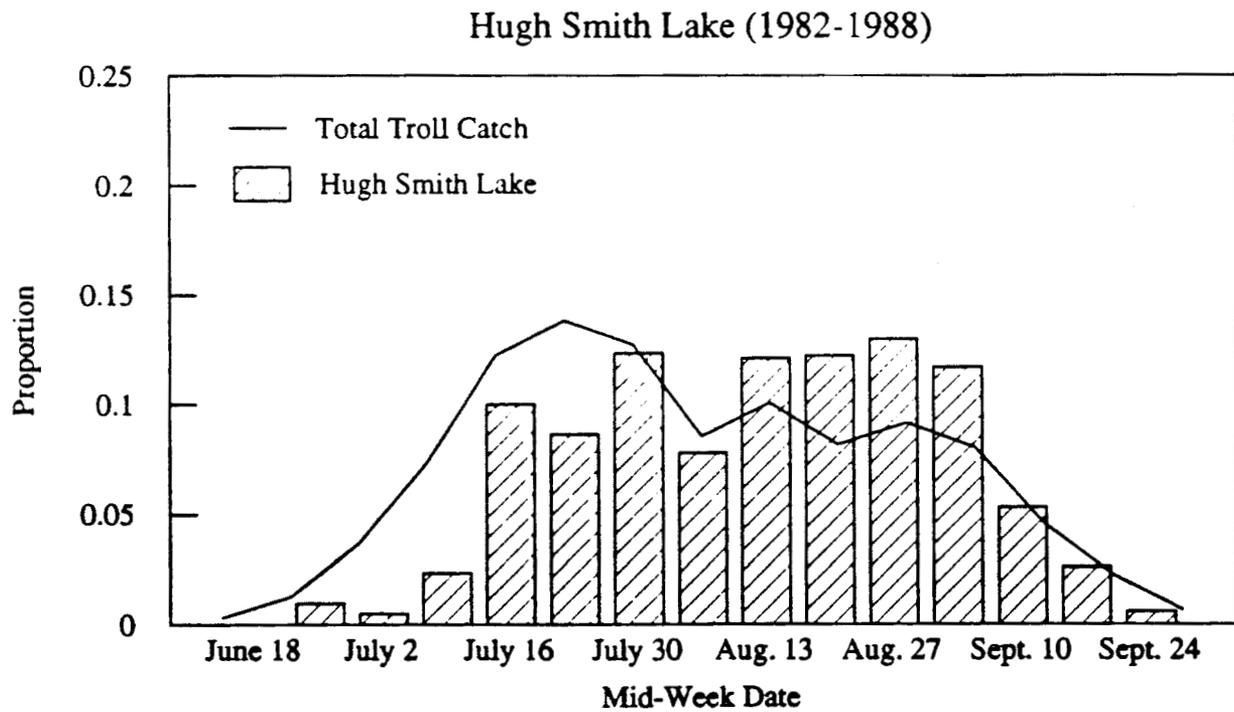
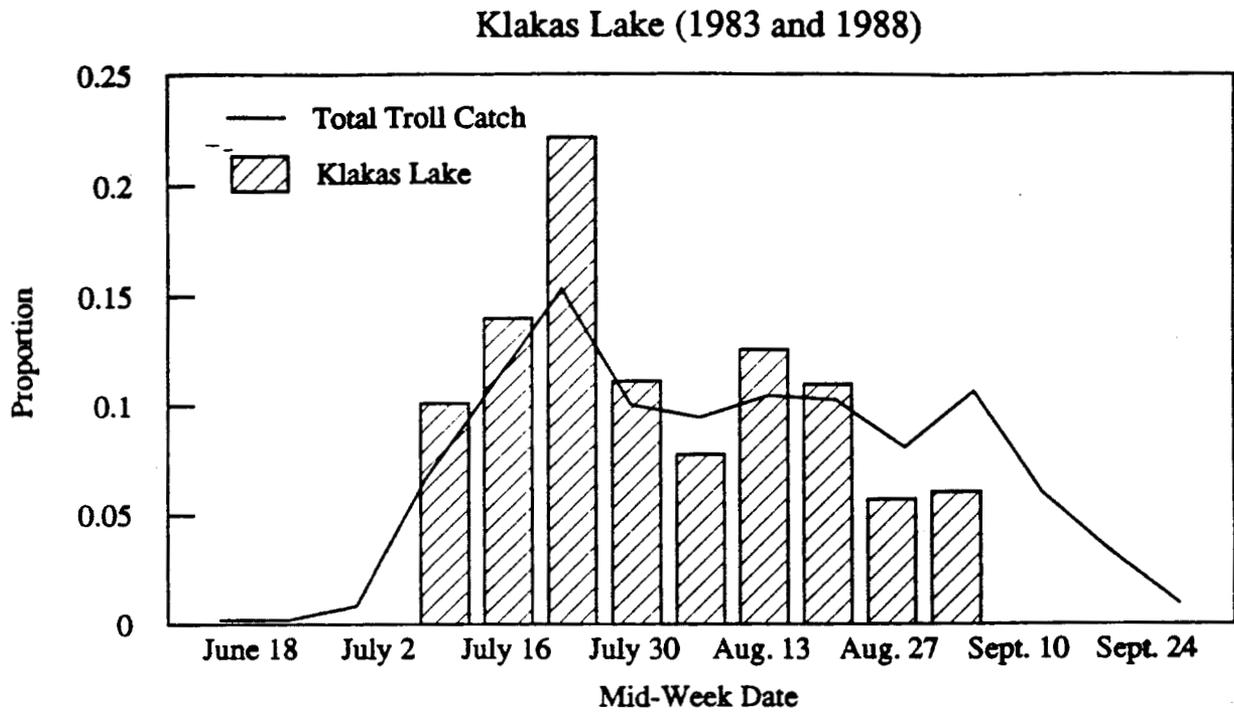
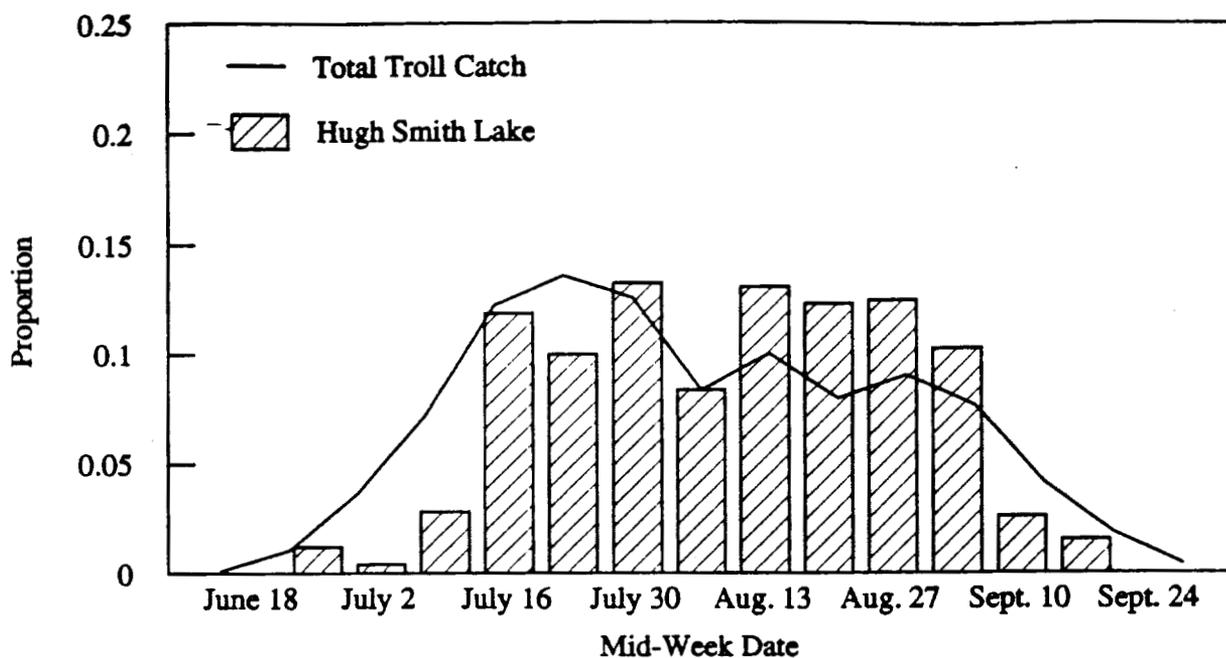


Figure 4. Average weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged Klakas Lake and Hugh Smith Lake coho salmon (bar graph).

### Hugh Smith Lake (NW, NE and SW Quadrants)



### Hugh Smith Lake (SE Quadrant)

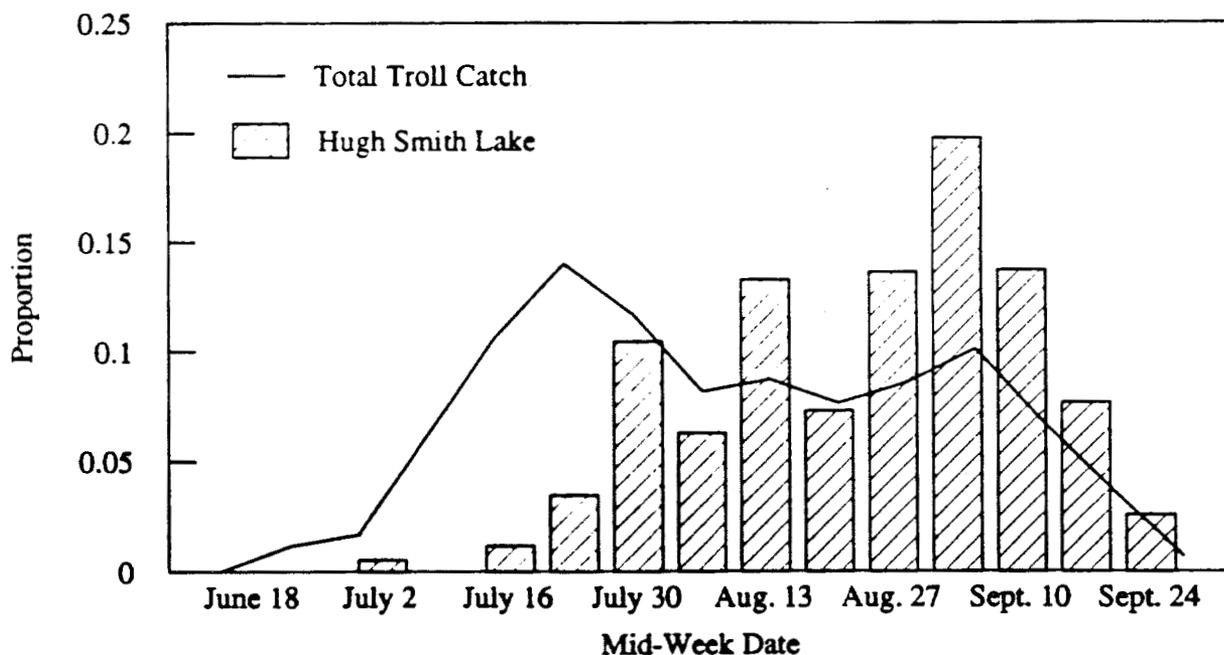
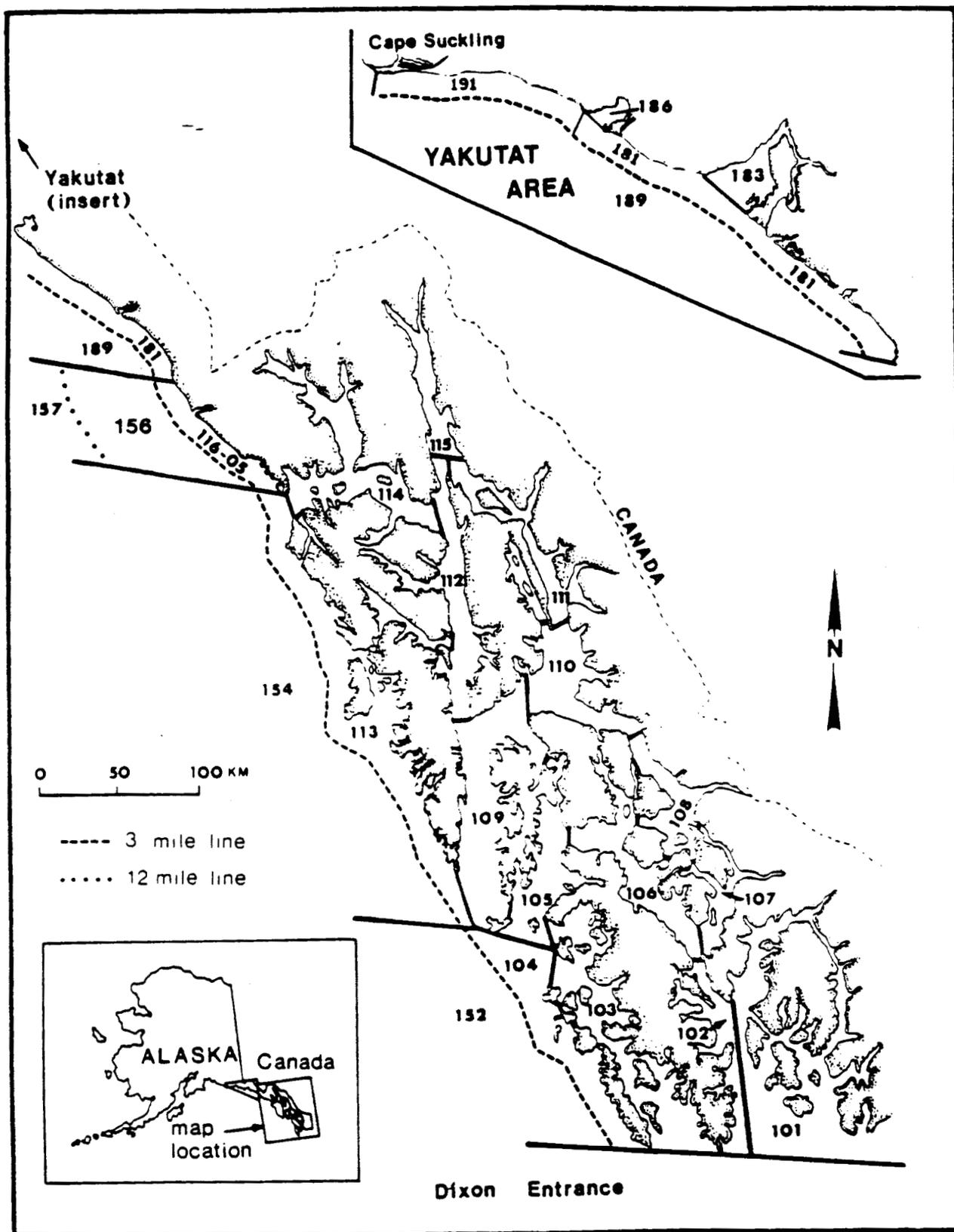


Figure 5. Average weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged Hugh Smith Lake coho salmon (bar graph) in: (1) the Northwest, Northeast and Southwest Quadrants and (2) the Southeast Quadrant, 1982-1988.

**APPENDICES**

Appendix A.1. Daily and cumulative counts and proportions of the coho salmon smolt migration at Hugh Smith Lake, 1989.

| Date   | Daily Count | Cumulative Count | Daily Proportion | Cumulative Proportion | Comments       |
|--------|-------------|------------------|------------------|-----------------------|----------------|
| 21-Apr | 0           | 0                | 0.0000           | 0.0000                | Weir installed |
| 22-Apr | 0           | 0                | 0.0000           | 0.0000                | Fish tight     |
| 23-Apr | 1           | 1                | 0.0001           | 0.0001                |                |
| 24-Apr | 0           | 1                | 0.0000           | 0.0001                |                |
| 25-Apr | 2           | 3                | 0.0003           | 0.0004                |                |
| 26-Apr | 0           | 3                | 0.0000           | 0.0004                |                |
| 27-Apr | 0           | 3                | 0.0000           | 0.0004                |                |
| 28-Apr | 1           | 4                | 0.0001           | 0.0006                |                |
| 29-Apr | 4           | 8                | 0.0006           | 0.0011                |                |
| 30-Apr | 9           | 17               | 0.0013           | 0.0024                |                |
| 01-May | 18          | 35               | 0.0025           | 0.0049                |                |
| 02-May | 41          | 76               | 0.0057           | 0.0106                |                |
| 03-May | 52          | 128              | 0.0072           | 0.0178                |                |
| 04-May | 39          | 167              | 0.0054           | 0.0232                |                |
| 05-May | 31          | 198              | 0.0043           | 0.0275                |                |
| 06-May | 13          | 211              | 0.0018           | 0.0294                |                |
| 07-May | 24          | 235              | 0.0033           | 0.0327                |                |
| 08-May | 327         | 562              | 0.0455           | 0.0782                |                |
| 09-May | 332         | 894              | 0.0462           | 0.1244                |                |
| 10-May | 89          | 983              | 0.0124           | 0.1368                |                |
| 11-May | 78          | 1,061            | 0.0109           | 0.1476                |                |
| 12-May | 186         | 1,247            | 0.0259           | 0.1735                |                |
| 13-May | 697         | 1,944            | 0.0970           | 0.2705                |                |
| 14-May | 163         | 2,107            | 0.0227           | 0.2932                |                |
| 15-May | 296         | 2,403            | 0.0412           | 0.3344                |                |
| 16-May | 894         | 3,297            | 0.1244           | 0.4587                |                |
| 17-May | 449         | 3,746            | 0.0625           | 0.5212                |                |
| 18-May | 174         | 3,920            | 0.0242           | 0.5454                |                |
| 19-May | 222         | 4,142            | 0.0309           | 0.5763                |                |
| 20-May | 374         | 4,516            | 0.0520           | 0.6284                |                |
| 21-May | 202         | 4,718            | 0.0281           | 0.6565                |                |
| 22-May | 355         | 5,073            | 0.0494           | 0.7059                |                |
| 23-May | 476         | 5,549            | 0.0662           | 0.7721                |                |
| 24-May | 34          | 5,583            | 0.0047           | 0.7768                |                |
| 25-May | 191         | 5,774            | 0.0266           | 0.8034                |                |
| 26-May | 358         | 6,132            | 0.0498           | 0.8532                |                |
| 27-May | 101         | 6,233            | 0.0141           | 0.8673                |                |
| 28-May | 163         | 6,396            | 0.0227           | 0.8899                |                |
| 29-May | 164         | 6,560            | 0.0228           | 0.9128                |                |
| 30-May | 78          | 6,638            | 0.0109           | 0.9236                |                |
| 31-May | 136         | 6,774            | 0.0189           | 0.9425                |                |
| 01-Jun | 220         | 6,994            | 0.0306           | 0.9731                |                |
| 02-Jun | 70          | 7,064            | 0.0097           | 0.9829                |                |
| 03-Jun | 18          | 7,082            | 0.0025           | 0.9854                |                |
| 04-Jun | 9           | 7,091            | 0.0013           | 0.9866                |                |
| 05-Jun | 0           | 7,091            | 0.0000           | 0.9866                |                |
| 06-Jun | 49          | 7,140            | 0.0068           | 0.9935                |                |
| 07-Jun | 0           | 7,140            | 0.0000           | 0.9935                |                |
| 08-Jun | 23          | 7,163            | 0.0032           | 0.9967                |                |
| 09-Jun | 0           | 7,163            | 0.0000           | 0.9967                |                |
| 10-Jun | 0           | 7,163            | 0.0000           | 0.9967                |                |
| 11-Jun | - 24        | 7,187            | 0.0033           | 1.0000                | Weir removed   |



Appendix B.1. Southeast Alaska statistical fishing districts.

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

| PMFC Area             | Abbreviation | Statistical Areas<br>(Districts)     |
|-----------------------|--------------|--------------------------------------|
| Northern Outside      | NOUT         | 116, 156, 157, 181,<br>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<br>(Districts)                            |
|-----------|--------------|---|
| Northwest | NW           | 113, 114, 116, 154,<br>156, 157, 181, 183,<br>186, 189, 191 |
| Northeast | NE           | 109, 110, 111, 112,<br>115                                  |
| Southwest | SW           | 103, 104, 150, 152  |
| Southeast | SE           | 101, 102, 105, 106,<br>107, 108                             |

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

| STAT WEEK | YEAR/DATE<br>1982 | YEAR/DATE<br>1983 | YEAR/DATE<br>1984 | YEAR/DATE<br>1985 | YEAR/DATE<br>1986 | YEAR/DATE<br>1987 | YEAR/DATE<br>1988 | YEAR/DATE<br>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 C.1. Estimated weekly proportion of the total troll catch of coded-wire tagged Berners River coho salmon, 1982, 1983 1985-1988.

| Statistical<br>Week | <u>Year</u> |        |        |        |        |        | Average |
|---------------------|-------------|--------|--------|--------|--------|--------|---------|
|                     | 1982        | 1983   | 1985   | 1986   | 1987   | 1988   |         |
| 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                  | 0.0000      | 0.0000 | 0.0000 | 0.0647 | 0.0000 | 0.0000 | 0.0108  |
| 28                  | 0.0000      | 0.0193 | 0.0370 | 0.0199 | 0.0000 | 0.0000 | 0.0127  |
| 29                  | 0.0000      | 0.0000 | 0.0000 | 0.1329 | 0.0000 | 0.0000 | 0.0222  |
| 30                  | 0.0244      | 0.0761 | 0.1039 | 0.0791 | 0.1037 | 0.0167 | 0.0673  |
| 31                  | 0.0486      | 0.0566 | 0.0664 | 0.0245 | 0.1108 | 0.0000 | 0.0512  |
| 32                  | 0.0000      | 0.0832 | 0.0377 | 0.0592 | 0.0513 | 0.0000 | 0.0386  |
| 33                  | 0.0952      | 0.0000 | 0.0000 | 0.0181 | 0.0000 | 0.0869 | 0.0334  |
| 34                  | 0.3578      | 0.2010 | 0.0000 | 0.1107 | 0.2010 | 0.0684 | 0.1565  |
| 35                  | 0.0985      | 0.1663 | 0.1227 | 0.1585 | 0.0323 | 0.1664 | 0.1241  |
| 36                  | 0.0000      | 0.1655 | 0.3482 | 0.2243 | 0.2880 | 0.3805 | 0.2344  |
| 37                  | 0.1449      | 0.1165 | 0.2380 | 0.1081 | 0.1839 | 0.2449 | 0.1727  |
| 38                  | 0.0000      | 0.1155 | 0.0461 | 0.0000 | 0.0290 | 0.0329 | 0.0373  |
| 39                  | 0.2306      | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0033 | 0.0390  |
| Total               | 1.0000      | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000  |
| Sample Size         | 25          | 77     | 50     | 87     | 43     | 63     |         |

Appendix C.2. Estimated weekly proportion of the total troll catch of coded-wire tagged Ford Arm Lake coho salmon, 1982, 1983 and 1985-1988.

| Statistical<br>Week | Year   |        |        |        |        |        | Average |
|---------------------|--------|--------|--------|--------|--------|--------|---------|
|                     | 1982   | 1983   | 1985   | 1986   | 1987   | 1988   |         |
| 25                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000  |
| 26                  | 0.0000 | 0.0000 | 0.0000 | 0.0106 | 0.0484 | 0.0000 | 0.0098  |
| 27                  | 0.0000 | 0.0000 | 0.4280 | 0.1164 | 0.0613 | 0.0092 | 0.1025  |
| 28                  | 0.0000 | 0.1662 | 0.0429 | 0.1967 | 0.0682 | 0.0278 | 0.0836  |
| 29                  | 0.1584 | 0.1326 | 0.0205 | 0.1584 | 0.0843 | 0.0608 | 0.1025  |
| 30                  | 0.0844 | 0.1376 | 0.0752 | 0.1347 | 0.1918 | 0.1081 | 0.1220  |
| 31                  | 0.1006 | 0.1775 | 0.0385 | 0.0828 | 0.1094 | 0.0278 | 0.0894  |
| 32                  | 0.0000 | 0.1025 | 0.0546 | 0.1558 | 0.1500 | 0.0000 | 0.0772  |
| 33                  | 0.2394 | 0.0157 | 0.1003 | 0.0611 | 0.0509 | 0.1464 | 0.1023  |
| 34                  | 0.1235 | 0.0895 | 0.0000 | 0.0000 | 0.1208 | 0.1496 | 0.0806  |
| 35                  | 0.1020 | 0.0991 | 0.1660 | 0.0297 | 0.0955 | 0.0000 | 0.0821  |
| 36                  | 0.1917 | 0.0567 | 0.0673 | 0.0538 | 0.0194 | 0.4212 | 0.1350  |
| 37                  | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0450 | 0.0075  |
| 38                  | 0.0000 | 0.0226 | 0.0067 | 0.0000 | 0.0000 | 0.0041 | 0.0056  |
| 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         | 37     | 83     | 49     | 85     | 65     | 148    |         |

Appendix C.3. Estimated weekly proportion of the total troll catch of coded-wire tagged Kadashan River coho salmon, 1987-1988.

| Statistical<br>Week | <u>Year</u> |        | Average |
|---------------------|-------------|--------|---------|
|                     | 1987        | 1988   |         |
| 25                  | 0.0000      | 0.0000 | 0.0000  |
| 26                  | 0.0000      | 0.0000 | 0.0000  |
| 27                  | 0.0000      | 0.0000 | 0.0000  |
| 28                  | 0.0000      | 0.0000 | 0.0000  |
| 29                  | 0.0000      | 0.0000 | 0.0000  |
| 30                  | 0.0000      | 0.0000 | 0.0000  |
| 31                  | 0.1385      | 0.0306 | 0.0846  |
| 32                  | 0.1164      | 0.0000 | 0.0582  |
| 33                  | 0.0000      | 0.1613 | 0.0807  |
| 34                  | 0.1874      | 0.1222 | 0.1548  |
| 35                  | 0.2595      | 0.2361 | 0.2478  |
| 36                  | 0.0000      | 0.0515 | 0.0258  |
| 37                  | 0.0670      | 0.3617 | 0.2144  |
| 38                  | 0.0000      | 0.0366 | 0.0183  |
| 39                  | 0.2312      | 0.0000 | 0.1156  |
| Total               | 1.0000      | 1.0000 | 1.0000  |
| Sample Size         | 9           | 24     |         |

Appendix C.4. Estimated weekly proportion of the total troll catch of coded-wire tagged Salmon Bay Lake coho salmon, 1986-1988.

| Statistical<br>Week | <u>Year</u> |        |        | Average |
|---------------------|-------------|--------|--------|---------|
|                     | 1986        | 1987   | 1988   |         |
| 25                  | 0.0000      | 0.0000 | 0.0000 | 0.0000  |
| 26                  | 0.0000      | 0.0000 | 0.0000 | 0.0000  |
| 27                  | 0.0000      | 0.0000 | 0.0000 | 0.0000  |
| 28                  | 0.1288      | 0.0000 | 0.0000 | 0.0429  |
| 29                  | 0.1804      | 0.0477 | 0.0000 | 0.0760  |
| 30                  | 0.1006      | 0.0000 | 0.1992 | 0.0999  |
| 31                  | 0.0986      | 0.3068 | 0.0758 | 0.1604  |
| 32                  | 0.1279      | 0.1686 | 0.0000 | 0.0988  |
| 33                  | 0.0598      | 0.0000 | 0.3309 | 0.1302  |
| 34                  | 0.0000      | 0.2988 | 0.1218 | 0.1402  |
| 35                  | 0.1313      | 0.1781 | 0.0676 | 0.1257  |
| 36                  | 0.1214      | 0.0000 | 0.2047 | 0.1087  |
| 37                  | 0.0139      | 0.0000 | 0.0000 | 0.0046  |
| 38                  | 0.0373      | 0.0000 | 0.0000 | 0.0124  |
| 39                  | 0.0000      | 0.0000 | 0.0000 | 0.0000  |
| Total               | 1.0000      | 1.0000 | 1.0000 | 1.0000  |
| Sample Size         | 47          | 25     | 18     |         |

Appendix C.5. Estimated weekly proportion of the total troll catch of coded-wire tagged Klakas Lake coho salmon, 1983 and 1988.

| Statistical<br>Week | <u>Year</u> |        | Average |
|---------------------|-------------|--------|---------|
|                     | 1983        | 1988   |         |
| 25                  | 0.0000      | 0.0000 | 0.0000  |
| 26                  | 0.0000      | 0.0000 | 0.0000  |
| 27                  | 0.0000      | 0.0000 | 0.0000  |
| 28                  | 0.1537      | 0.0476 | 0.1007  |
| 29                  | 0.1022      | 0.1770 | 0.1396  |
| 30                  | 0.3173      | 0.1250 | 0.2212  |
| 31                  | 0.1762      | 0.0454 | 0.1108  |
| 32                  | 0.1541      | 0.0000 | 0.0771  |
| 33                  | 0.0000      | 0.2497 | 0.1249  |
| 34                  | 0.0637      | 0.1546 | 0.1092  |
| 35                  | 0.0328      | 0.0810 | 0.0569  |
| 36                  | 0.0000      | 0.1197 | 0.0599  |
| 37                  | 0.0000      | 0.0000 | 0.0000  |
| 38                  | 0.0000      | 0.0000 | 0.0000  |
| 39                  | 0.0000      | 0.0000 | 0.0000  |
| Total               | 1.0000      | 1.0000 | 1.0000  |
| Sample Size         | 21          | 29     |         |

Appendix C.6. Estimated weekly proportion of the total troll catch of coded-wire tagged Hugh Smith Lake coho salmon, 1982-1988.

| Statistical<br>Week | <u>Year</u> |        |        |        |        |        |        | Average |
|---------------------|-------------|--------|--------|--------|--------|--------|--------|---------|
|                     | 1982        | 1983   | 1984   | 1985   | 1986   | 1987   | 1988   |         |
| 25                  | 0.0000      | 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 | 0.0000 | 0.0097  |
| 27                  | 0.0085      | 0.0000 | 0.0000 | 0.0000 | 0.0073 | 0.0183 | 0.0000 | 0.0049  |
| 28                  | 0.0000      | 0.0415 | 0.0000 | 0.0492 | 0.0723 | 0.0000 | 0.0000 | 0.0233  |
| 29                  | 0.1134      | 0.0867 | 0.0655 | 0.1351 | 0.1081 | 0.1910 | 0.0000 | 0.1000  |
| 30                  | 0.0628      | 0.1481 | 0.0000 | 0.1689 | 0.1246 | 0.0430 | 0.0573 | 0.0864  |
| 31                  | 0.0950      | 0.1010 | 0.2028 | 0.1394 | 0.1216 | 0.1554 | 0.0474 | 0.1232  |
| 32                  | 0.0000      | 0.1224 | 0.1365 | 0.0713 | 0.1217 | 0.0924 | 0.0000 | 0.0778  |
| 33                  | 0.2632      | 0.0154 | 0.1014 | 0.1189 | 0.0553 | 0.0000 | 0.2941 | 0.1212  |
| 34                  | 0.1111      | 0.2405 | 0.0000 | 0.0000 | 0.1007 | 0.2527 | 0.1498 | 0.1221  |
| 35                  | 0.2396      | 0.0745 | 0.0764 | 0.1498 | 0.1378 | 0.1152 | 0.1156 | 0.1298  |
| 36                  | 0.0481      | 0.0626 | 0.1317 | 0.0747 | 0.0794 | 0.0863 | 0.3358 | 0.1169  |
| 37                  | 0.0170      | 0.0686 | 0.1871 | 0.0521 | 0.0284 | 0.0181 | 0.0000 | 0.0530  |
| 38                  | 0.0055      | 0.0348 | 0.0584 | 0.0406 | 0.0428 | 0.0000 | 0.0000 | 0.0260  |
| 39                  | 0.0358      | 0.0039 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0057  |
| Total               | 1.0000      | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000  |
| Sample Size         | 64          | 107    | 67     | 114    | 155    | 52     | 22     |         |

Appendix C.7. Estimated weekly proportion of the total troll catch of coded-wire tagged Hugh Smith Lake coho salmon in the Northwest, Northeast and Southwest Quadrants, 1982-1988.

| Statistical<br>Week | <u>Year</u> |        |        |        |        |        |        | Average |
|---------------------|-------------|--------|--------|--------|--------|--------|--------|---------|
|                     | 1982        | 1983   | 1984   | 1985   | 1986   | 1987   | 1988   |         |
| 25                  | 0.0000      | 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 | 0.0000 | 0.0121  |
| 27                  | 0.0000      | 0.0000 | 0.0000 | 0.0000 | 0.0084 | 0.0205 | 0.0000 | 0.0041  |
| 28                  | 0.0000      | 0.0556 | 0.0000 | 0.0601 | 0.0827 | 0.0000 | 0.0000 | 0.0283  |
| 29                  | 0.1453      | 0.1084 | 0.0871 | 0.1515 | 0.1236 | 0.2139 | 0.0000 | 0.1185  |
| 30                  | 0.0735      | 0.1800 | 0.0000 | 0.2001 | 0.1424 | 0.0320 | 0.0705 | 0.0998  |
| 31                  | 0.0861      | 0.1144 | 0.2695 | 0.1310 | 0.1276 | 0.1394 | 0.0583 | 0.1323  |
| 32                  | 0.0000      | 0.1322 | 0.1814 | 0.0516 | 0.1285 | 0.0898 | 0.0000 | 0.0834  |
| 33                  | 0.2845      | 0.0207 | 0.1348 | 0.1147 | 0.0528 | 0.0000 | 0.3070 | 0.1306  |
| 34                  | 0.1229      | 0.2301 | 0.0000 | 0.0000 | 0.1151 | 0.2477 | 0.1449 | 0.1230  |
| 35                  | 0.2728      | 0.0562 | 0.0000 | 0.1470 | 0.1239 | 0.1291 | 0.1423 | 0.1245  |
| 36                  | 0.0149      | 0.0593 | 0.1263 | 0.0748 | 0.0673 | 0.0966 | 0.2770 | 0.1023  |
| 37                  | 0.0000      | 0.0231 | 0.1062 | 0.0359 | 0.0147 | 0.0000 | 0.0000 | 0.0257  |
| 38                  | 0.0000      | 0.0200 | 0.0413 | 0.0333 | 0.0130 | 0.0000 | 0.0000 | 0.0154  |
| 39                  | 0.0000      | 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 | 1.0000  |
| Sample Size         | 44          | 73     | 44     | 87     | 128    | 45     | 18     |         |

Appendix C.8. Estimated weekly proportion of the total troll catch of coded-wire tagged Hugh Smith Lake coho salmon in the Southeast Quadrant, 1982-1988.

| Statistical<br>Week | Year   |        |        |        |        |        |        | Average |
|---------------------|--------|--------|--------|--------|--------|--------|--------|---------|
|                     | 1982   | 1983   | 1984   | 1985   | 1986   | 1987   | 1988   |         |
| 25                  | 0.0000 | 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 | 0.0000  |
| 27                  | 0.0386 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0055  |
| 28                  | 0.0000 | 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 | 0.0000 | 0.0120  |
| 30                  | 0.0250 | 0.0542 | 0.0000 | 0.0292 | 0.0000 | 0.1350 | 0.0000 | 0.0348  |
| 31                  | 0.1266 | 0.0613 | 0.0000 | 0.1771 | 0.0797 | 0.2883 | 0.0000 | 0.1047  |
| 32                  | 0.0000 | 0.0934 | 0.0000 | 0.1595 | 0.0735 | 0.1139 | 0.0000 | 0.0629  |
| 33                  | 0.1874 | 0.0000 | 0.0000 | 0.1377 | 0.0730 | 0.2940 | 0.2384 | 0.1329  |
| 34                  | 0.0692 | 0.2711 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.1709 | 0.0730  |
| 35                  | 0.1213 | 0.1284 | 0.3086 | 0.1622 | 0.2347 | 0.0000 | 0.0000 | 0.1365  |
| 36                  | 0.1659 | 0.0723 | 0.1483 | 0.0745 | 0.1638 | 0.1688 | 0.5907 | 0.1978  |
| 37                  | 0.0774 | 0.2026 | 0.4327 | 0.1247 | 0.1243 | 0.0000 | 0.0000 | 0.1374  |
| 38                  | 0.0253 | 0.0784 | 0.1104 | 0.0737 | 0.2510 | 0.0000 | 0.0000 | 0.0770  |
| 39                  | 0.1633 | 0.0156 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0256  |
| Total               | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000 | 1.0000  |
| Sample Size         | 20     | 34     | 23     | 27     | 27     | 7      | 4      |         |