TAKU RIVER COHO SALMON INVESTIGATIONS, 1989

By

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ABSTRACT

Tagging and escapement studies were conducted on coho salmon (*Oncorhynchus kisutch*) populations in the Taku River system in cooperation with the Canada Department of Fisheries and Oceans. A total of 10,672 juvenile coho salmon was coded-wire tagged at Little Tatsamenie Lake. Tag recovery data from fish tagged as rearing juveniles in 1987 and smolts in 1988 was analyzed. The total coho salmon return to the Tatsamenie River was estimated at 3,195 fish of which an estimated 1,521 (77.3%) were harvested by sport and commercial fisheries (73.5% in Alaska and 1.9% in Canada). The 1989 marine harvest distribution by gear type for all tagged Taku River coho salmon was estimated as follows: troll 59.4%; purse seine 3.1%; drift gill net 33.7% (30.6% in District 111 and 3.1% in other districts); trap 0.1%; and sport 3.7%. Taku River coho salmon displayed a strong migratory pattern from the north with the majority of the troll and purse seine catch occurring in outside waters and migration corridors in northern Southeast. Two tags were recovered in Prince William Sound fisheries. Similar to 1988, the highest concentrations of Taku River tags in the troll and purse seine fisheries were found in the Icy Strait-Cross Sound area, northern Chatham Strait and in outside waters north of Cape Spencer. Overall, the highest concentration of Taku River tags was found in the District 111 drift gill net fishery (9.92 tags per 1,000 fish) followed by the Juneau sport fishery (2.63 tags per 1,000 fish). Relatively few Taku River tags were present in catches from southern Southeast. Tagged Taku River coho salmon were available to the troll fishery throughout the entire season with apparent maximum abundance and relative contribution occurring mid to late August. Helicopter surveys were conducted on two upper system tributaries (upper Nahlin and Dudidontu Rivers) and a mainstem tributary (Flannigan Slough - Wilms Creek).

KEY WORDS: Coho salmon, coded-wire tag, Taku River, indicator stock, harvest rates, migration patterns, transboundary rivers, Southeast Alaska.

INTRODUCTION

The Taku River supports coho salmon populations that are harvested by both the United States and Canada. In order to understand the exploitation patterns and production limitations of this resource, it is necessary to determine the migratory patterns of the various stocks and to estimate escapement levels. Juvenile and smolt tagging studies have been initiated to study coho salmon harvest rates and distributions. The first tagged fish were released in 1986 while the first tag returns occurred in 1988. Methods that have been investigated to estimate escapement in the system have included aerial surveys, weirs and and mark-recapture estimation.

Ratification of the Pacific Salmon Treaty in 1985 opened the way for cooperative research on factors that determine production from stocks of mutual concern. Transboundary stocks from rivers such as the Taku are of special interest since they spawn in Canadian sections of the river, pass through and perhaps rear in U.S. sections of the river or adjacent bays and coastal waters, and are then exploited by fisheries of both countries on their journey back to spawn.

Joint coded-wire tagging investigations were initiated by the Alaska Department of Fish and Game (ADF&G) and the Canada Department of Fisheries and Oceans (DFO) in 1986 to determine the harvest rates, harvest distributions and migratory patterns of coho salmon populations in the Taku River (Shaul 1987 and 1988). These investigations were intended to complement other projects directed at assessing and monitoring escapements. Rearing juvenile coho salmon were tagged at four locations in 1986 including the Nahlin River by the ADF&G, Commercial Fisheries Division (CF), sloughs and ponds along the Sheslay River and the Canadian portion of the mainstem Taku River (DFO), and Little Tatsamenie Lake (ADF&G/CF and DFO in cooperation; Figure 1). The ADF&G, Sport Fish Division (ADF&G/SF) tagged outmigrating smolts at Yehring Creek, a U.S. tributary of the Taku River in May-June 1987. Coded-wire tagging was repeated in 1987 and 1988 at Little Tatsamenie Lake, Yehring Creek and rearing areas in the lower mainstem valley of the Taku River. Juvenile coho salmon were tagged at the Dudidontu River in 1987 (ADF&G/CF) and at the Nahlin River in 1988 (ADF&G/SF). In addition, juveniles were tagged at Speel Lake located south of the Taku River in 1987. Rearing juveniles tagged during 1986-87 and smolts tagged during 1987-88 returned as adults (age .1) in 1988-89 when they were sampled in fisheries and escapements.

In addition to coded-wire tagging investigations, several tributaries were examined for their potential as escapement indicators. Three of those (the Dudidontu River, upper Nahlin River and Flannigan Slough - Wilms Creek) were judged to be suitable for conducting aerial surveys. Adult enumeration weirs were operated on the Tatsamenie River and Yehring Creek. Mainstem escapement estimation for the portion of the system upstream of the border is under development. Mark-recapture estimates for the period through mid-September have been made in recent years (McGregor and Clark 1989). Problems remain, however, in accounting for late-season escapement because of the difficulty in operating the Canyon Island fishwheels late in the season, combined with inadequate tag recovery effort after the inriver fishery is curtailed.

The results reported here are from a program conducted jointly by the Alaska Department of Fish and Game (Commercial Fisheries and Sport Fish Divisions) and the Canada Department of Fisheries and Oceans (DFO). Each agency had individual responsibility for some components while others were undertaken in direct cooperation by personnel from different agencies. While focusing on project components undertaken by ADF&G (CF), results reported here include interrelated data collected by other agencies as part of the cooperative program. More detailed analyses of specific projects conducted by DFO and ADF&G (SF) will be published by those agencies.

LITTLE TATSAMENIE LAKE CODED-WIRE TAGGING

Methods and Procedures

Rearing juvenile coho salmon were tagged at Little Tatsamenie Lake during the period July 20 to August 10, 1989 in a cooperative field project conducted by ADF&G (CF) and DFO. Wire-mesh minnow traps were used to capture juvenile salmon for tagging. Approximately 100 traps baited with salmon roe were checked and set twice daily at 4-hour intervals in suitable appearing habitat. Salmon roe was disinfected prior to use by immersion in a 5% betadyne solution for 15 minutes. 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. Trapping was conducted until recapture rates of tagged fish reached approximately 50%.

Fish were sorted into four groups for tagging: 60-69 mm, 70-79 mm, 80-100 mm and >100 mm. Separate tag machine settings were used for each size group. A sample of scales was aged and snout-fork lengths were taken. Based on a sample read in the field, it was determined that fish under 70 mm were predominantly age 0 while larger fish were primarily age 1. The smaller size group was tagged with a separate code. A description of the coded-wire tagging technique under field conditions is found in Koerner (1977).

Results

A total of 10,672 juvenile coho salmon was captured and coded-wire tagged during the 2 1/2 week period. The overall mean length of tagged fish was 76.1 mm (N = 926; Appendix A.1). Fish under 70 mm (predominantly age 0) comprised 4,725 (44%) of the total while 5,947 (53%) were 70 mm or larger (predominantly age 1). Fish under 70 mm were tagged with code 2-63-29. Those 70 mm and larger were tagged with codes 2-50-48 (5,749) and 2-61-59 (198).

The average catch rate of 6.9 fish per trap was comparable to past rates of 6.9 per trap in July-August 1987 and 6.5 per trap in July-August 1988 but was lower than the average rate of 12.0 per trap in September 1986. Total numbers tagged in 1986, 1987 and 1988 were 13,328, 11,426 and 10,482, respectively, compared with 10,672 in 1989.

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 by period-PMFC area (Appendix B.2) 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 (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. Tags recovered from random samples were expanded over biweekly strata that contained additional stratifications including weekdays vs. weekends, mornings vs. afternoons and low use vs. heavy use docks. In the Juneau fishery, 5,257 fish (22.1%) were sampled from the total estimated season catch of 23,819. The Ketchikan fishery harvested only 10,781 fish, of which 1,434 (13.3%) 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). Tag recovery from the Taku River Canadian commercial fishery was conducted by DFO under a program in which fishermen were paid a reward for voluntary recoveries.

Harvest Estimate for Inriver Fisheries

Only four tags were recovered from Canadian mainstem fisheries which included: one from the Nahlin River, one from Little Tatsamenie Lake, one from Yehring Creek and one from Canadian mainstem tributaries. The lack of a thorough inriver sampling program for coded-wire tags suggested that an alternative method of estimating the contribution of Tatsamenie River fish was necessary.

A mark-recapture program involving tagging at the Canyon Island fishwheels and recovery in the Canadian inriver commercial and test fisheries was used to estimate the seasonal total abundance of coho salmon at the fishwheels (McGregor and Clark 1990). Weekly estimates of abundance were made by weighting the season total estimate by weekly fishwheel CPUE proportions. Weekly removal rate estimates for the inriver fisheries were computed from these abundance estimates. Weekly catches were referenced back to the fishwheel using the weekly average time period between tagging at the fishwheels and recovery of tags in the fishery. The seasonal average lag time for fishery tag recoveries was 5.4 days (range 0-34 days) with 90% of recoveries occurring from 1 to 10 days after tagging. Tags recovered at the weirs were referenced to date of tagging at the fishwheels and adjustments were applied to account for weekly fishwheel effort and the proportion of captured fish that were tagged.

Harvest rate estimates by period (H_i) were computed by dividing catch (F_i) by estimated abundance (N_i).

$$H_i = \frac{F_i}{N_i}$$

The proportion of the spawning escapement that passed the fishwheels by period $P(w)_i$ was estimated as follows:

$$P(w)_i = \frac{R_i t_i e_i}{\sum (R_i t_i e_i)}$$

where: R_i = Number of weir recoveries by tagging period.

t_i = Weekly proportion of the number of coho salmon caught in the fishwheels that was tagged.

e_i = Total combined number of hours fished by both fishwheels divided twice the total number of hours in each period.

Total catch (C_i) of the stock of interest was estimated as follows:

$$C_i = \sum \left[\frac{P(w)_i \, H_i \, E}{(1-H_i)} \right]$$

where: H_i = Weekly coho salmon harvest rate estimate for the inriver fishery referenced to the time of passage at the fishwheels.

E = Total escapement count for the stock of interest.

Estimates of stock specific harvests were not made for the inriver food fishery (Canada) and the personal use fishery (Alaska), however, the harvest rate by those fisheries on any stock was probably low given total catches of only 146 and 73 fish, respectively.

The sport harvest of coho salmon in the Tatsamenie River was determined by DFO staff through interviews with anglers and lodge owners. No catch occurred in 1989.

Escapement Enumeration and Sampling

The coho salmon escapement at Little Tatsamenie Lake was enumerated and sampled for tags by DFO. As many fish as possible were examined for adipose clips at the weir site. Marked fish were examined with a magnetic field detector to determine whether or not a tag was present. Samples of Fish that both did and did not register a positive signal were sacrificed and the heads sent to the Vancouver tag lab for further verification.

Analysis of Tag Recovery Data

The proportion of fish in the escapement that were tagged (Θ_t) was estimated as follows:

$$\Theta_t = \left(\frac{m_1}{s}\right)\left(\frac{t}{m_2}\right)$$

where S = number of fish in the escapement sampled for adipose clips

m_1 = number of fish in sample (S) that had adipose clips

m_2 = number of adipose clips in the escapement sampled for tags

t = number of adipose clipped fish in the escapement that were sampled for tags and were found to have tags.

The total number of tagged fish in the escapement (E) was estimated by multiplying the total estimated escapement (N) by the proportion tagged (Θ_t).

$$E = N\Theta_t$$

Four harvest related parameters are defined below.

1. Stock distribution is the distribution of the catch and escapement of a stock expressed as a proportion of the total return (catch and escapement).

2. Harvest rate is the total harvest of a stock by one or more fisheries divided by the total return (catch and escapement).

3. Removal rate is the total harvest within a defined fishery divided by the total number of fish available within that fishery.

4. Harvest distribution is the distribution of the catch of a stock among the fisheries by area and/or gear type expressed as a proportion of the total catch of that stock.

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

$$C_i = \frac{F_i}{\theta_t}$$

where F_i = estimated number of tagged fish harvested (expanded sum of random fishery recoveries) in fishery i

The total run size (X) was estimated by adding the sum of the estimated catch of the stock in all fisheries and escapement.

$$\textit{Total run size } (X) = \sum C_i + N$$

Harvest Rates. The harvest rate (H) for a stock in fishery i was estimated as follows:

$$\textit{Harvest Rate } (H_i) = \frac{F_i}{\sum F_i + E}$$

The total harvest rate by all fisheries was estimated as follows:

$$\textit{Total Harvest Rate } (\sum H_i) = \frac{\sum F_i}{\sum F_i + E}$$

Removal Rates. In sequential "gauntlet" type fisheries such as occur for coho salmon in Southeast Alaska, removal rate estimates for distinct fisheries provide a clearer understanding of management options for achieving desired escapement than do stock distribution or harvest rate estimates. Removal rates are independent of harvest by previous fisheries and, therefore, provide a measure of the effect of a particular fishery on a migrating population of fish. Therefore, removal 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 and that they could not pass around the fisheries. Suppose that T_2 is the number of tagged fish available to the first fishery and that F_i is the harvest of tagged fish by fishery i. The removal rate (R) by the first fishery is estimated as follows:

$$R_1 = \frac{F_1}{T_2}$$

For subsequent fisheries where i>1, R_i is estimated as follows:

$$R_i = \frac{F_i}{T_2 \prod_{j=1}^{L} (1-H_j)} \qquad where\ L = i-1$$

Removal rates were estimated by fishery for the Tatsamenie River stock (Table 2). It was assumed to be harvested simultaneously by the troll, purse seine and trap fisheries before becoming available to subsequent fisheries. Surviving fish then became available to the District 115 drift gill net fishery and the Juneau marine sport fishery before becoming available to the District 111 drift gill net fishery. The mainstem Taku River fisheries were assumed to harvest the stock subsequent to the District 111 drift gill net fishery and before the sport fishery in the Tatsamenie River.

Harvest Distribution. The harvest distribution (percent by area and gear type) was estimated for tagged Taku River and Speel Lake fish (Tables 3-4). Expanded tag recoveries in each fishery (F_i) were divided by the sum of expanded fishery recoveries in all fisheries (ΣF_i). The harvest distribution by gear type (Table 3) was estimated using a quadrant-period expansion for the troll fishery and a district-statistical week expansion for the net and trap fisheries. For estimating the distribution by PMFC area (Table 4), the net and trap fishery expansions remained the same while recoveries from the Alaska troll fishery were expanded by PMFC area (Appendix A.2) and fishing period.

Migratory Timing. The migratory timing of Taku River and Speel Lake coho salmon in the troll fishery and the District 111 drift gill net fishery 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 while drift gill net recoveries were expanded by statistical area and week. The weekly proportion of the total troll catch and District 111 gill net catch was estimated for six tag groupings (Appendiices B.1 and B.2). Expanded weekly recoveries were divided by the sum of expanded recoveries from throughout the season to estimate weekly proportions of total catch. 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 about 6 days, the average time of capture of landed fish probably occurred 3 days previously.

Survival Rates. The survival rate for tagged juvenile coho salmon from the Tatsamenie River from the time of tagging until entry into the fisheries was estimated. It was assumed that all marked adults returning to to the stream had been tagged there as juveniles and that there was no incidence of naturally missing adipose fins. Therefore, all adipose clipped fish that did not contain tags were assumed to have shed their tags. A sample of adipose clipped fish (m_2) was drawn from the escapement and sampled for coded-wire tags, of which t fish were found to be tagged. The survival rate from the time of tagging (smolt or age 1+ juvenile) to the adult stage (age .1) was estimated as follows:

$$Survival\ Rate\ (S) = \frac{(\sum F_i + E)\left(\frac{m_2}{t}\right)}{T_1}$$

where m_2 = number of adipose clipped fish in the escapement that were examined for tags

t = number of sampled adipose clipped fish in the escapement that contained tags

T_1 = number of juveniles tagged

Typically, 90% or more of recoveries from juvenile tag groups have been recovered in a single return year while virtually all tagged smolts have returned in a single year. Tag retention was assumed to be the same in fish from a single return year because it was impossible to determine when adipose clipped fish without tags had been marked. Potential bias occurs in the estimates to the extent that different tag retention rates have occurred in releases from different years. The survival rate estimate for juveniles tagged in 1987 is preliminary as it does not yet include tagged fish that returned in 1990.

Results and Discussion

Escapement Enumeration and Sampling

Tatsamenie Weir. The Canada Department of Fisheries and Oceans (DFO) operated a weir at the outlet of Little Tatsamenie Lake (Figure 1) during August 4 - October 30. The first adult coho salmon passed the weir on August 23 and a total of 694 fish was counted and sampled for adipose clips during the period of operation. In addition, a downstream foot survey indicated that 18 fish remained below the weir for a total escapement count of 712. Seventy-five (10.8%) of the 694 fish sampled had adipose clips of which positive signals for coded-wire tags were registered in only 57. Heads were taken and examined from ten clipped fish that registered signals and ten fish that did not register signals. Of the fish that did not register signals, three had tags while seven did not. Of the ten fish that did register signals, tags were found in only seven. The number of fish that did register positive signals (57) was multiplied by the proportion of heads sampled from that group that contained tags (0.7) while the number that did not register signals (18) was multiplied by the proportion of heads sampled from that group that contained tags (0.3). The two resulting numbers were then added to estimate the number of tagged fish (45.30) in the sample of 694 fish counted at the weir. The weir sample was expanded to the total escapement estimate of 712 fish to estimate the total number of coded-wire tagged fish in the escapement (46.48). An estimated 6.5% of the escapement was tagged. Tag retention was estimated at only 60.4%.

Stock Contribution and Distribution

A total of 43 tagged Tatsamenie River coho salmon was recovered in Alaska fisheries, while an estimated 45 were present in a sample of 75 adipose clipped fish observed in the escapement (Table 1). Eighteen sphagetti tags applied at Canyon Island were recovered at the Tatsamenie Weir. The total return to the Tatsamenie River was estimated at 3,195 fish of which 2,483 (77.7%) were harvested. Marine commercial fisheries accounted for the majority of the returning run (64.5%) while smaller estimated percentages were taken in the marine sport fishery (10.9%), the inriver commercial fishery (1.9%) and the inriver test fishery (0.4%). The commercial catch was divided as follows: troll 35.3%, drift gill net 28.9% and trap 0.3%.

The 1989 estimated total run of 3,195 fish was larger than the 1988 run of 2,191 (Shaul 1989). However, the escapement was only slightly higher in 1989 (712 compared with 663 in 1988) because of a higher harvest rate (77.7% vs. 69.7%).

Removal Rates

Fishery removal rates were estimated for the Tatsamenie River stock (Table 2). Estimated removal rates of 0.353, 0.169 and 0.530, respectively, were incurred by the Tatsamenie River stock in the troll, Juneau Sport and District 111 drift gill net fisheries. The total removal rate by inriver commercial and test fisheries was estimated at 0.093. The inriver commercial fishery accounted for an estimated removal rate of only 0.077.

Harvest Distribution

Harvest by Gear Type. Based on 466 tag recoveries, the marine harvest distribution by gear type for all tagged Taku River coho salmon was as follows: troll 59.4%; purse seine 3.1%; trap 0.1%; drift gill net 33.7%; and sport 3.7% (Table 3). These estimates show a higher percentage harvested in the troll fishery compared with 1988 estimates of: troll 39.5%; purse seine 0.9%; drift gill net 49.4%; and sport 10.2%. In 1989, the troll fishery was less restricted compared with 1988 because of overall greater abundance of coho salmon while the District 111 drift gillnet fishery was limited because of weak fall chum returns. Data from both 1988 and 1989 indicated a higher percentage harvested in the drift gill net fishery and a lower percntage harvested in the troll fishery compared with earlier studies. Data from 1977-1979 (Shaul 1987; preliminary data) indicated the following marine harvest distribution based on 159 recoveries from fish tagged in mainstem valley rearing areas: troll 60.9%; purse seine 2.5%; drift gill net 29.2%; and sport 7.4%. Earlier investigations that employed fluorescent pigment marking of rearing juveniles in Yehring and Johnson Creeks (Gray et al. 1978) resulted in commercial harvest distribution estimates for 1974 returns as follows: troll 71.9%; purse seine 0.4%; and drift gill net 27.7% (no sport estimate). The 1988 percentages were affected by extensive closures in the troll fishery which reduced the troll catch and resulted in a larger harvest by inside fisheries.

Based on 98 recoveries, the harvest of Speel Lake coho salmon was distributed as follows: troll 93.8%, purse seine 3.5%, and drift gill net 2.7%. It is remarkable that no tags were recovered in the drift gill net fishery in District 111 in which Speel Lake is located. However, this is not totally inconsistent with the results of previous tagging at Speel Lake which indicated that in 1981, 1982, 1983 and 1985 the District 111 drift gill net fishery accounted for only 8.2%, 4.2%, 1.9% and 24.4%, respectively, of the total harvest of that stock (average 9.6%; Shaul et al. In press). It appears that Port Snettisham coho salmon stocks are typically affected far less by the fall drift gill net fishery compared with Taku River stocks.

In 1989, the vast majority of the troll harvest of Taku River stocks occurred in the northwest quadrant which accounted for 56.7% of the total marine catch compared with only 2.0% for the northeast quadrant, 0.6% for the southwest quadrant and 0.1% for the southeast quadrant. Of the total estimated drift gill net share of 33.7%, 30.6% was harvested in District 111 while 3.1% was taken in District 115. The Speel Lake stock was also harvested primarily in the troll fishery in the northwest quadrant (83.9%) while 9.9% was estimated for the northeast quadrant.

Recoveries in 1989 further supported indications from 1988 data that differences existed in the harvest distributions of fish from different mainstem tributaries of the Taku River. In 1988, an estimated 49.6% of the marine harvest of Canadian mainstem fish were taken in the troll fishery compared with only 34.5% for Yehring Creek while the estimated percentages taken in the District 111 drift gill net fishery were 31.0% and 52.3%, respectively (Shaul 1989). In 1989, an estimated 65.9% of the harvest of Canadian mainstem fish were taken in the troll fishery compared with 57.7% for Yehring Creek while 27.5% and 31.2%,

respectively, were taken in the District 111 drift gill net fishery (Table 3). Yehring Creek fish also again demonstrated slightly earlier and more protracted timing in the troll and drift gill net fisheries (see section on migratory timing).

Harvest by Area. In 1989, the data again indicated that the most important harvest areas for tagged Taku River coho salmon in outside and intermediate waters were the central intermediate area which accounted for an estimated 30.8% of the total marine harvest and the northern outside area north of Cape Spencer (20.5%; Table 4). The central outside and southern outside areas accounted for only 6.8% and 0.7% of the estimated total marine harvest, respectively. The southern intermediate area accounted for only 1.9% of the total. An estimated 2.9% of the harvest occurred in Lynn Canal, while 35.8% was taken in Stephens Passage (District 111).

Concentration of Tags. As expected, tagged Taku River coho salmon were most concentrated in the Taku/Snettisham drift gill net fishery in Stephens Passage (District 111) at an estimated 9.92 tags per 1,000 fish (Table 5). They also contributed substantially to the Juneau marine sport fishery (2.63 tags/1,000 fish). In more distant areas, tagged Taku River fish were most prevalent in catches from the Central Intermediate area (Cross Sound, Icy Strait, upper Chatham Strait) with a concentration of 2.02 tags/1,000 fish and the Northern Outside area (north of Cape Spencer) at 1.35 tags/1,000 fish. This indicates that Taku River coho salmon were approximately five to seven times more prevalent in catches in the drift gill net fishery near the river mouth compared with the more mixed-stock troll and purse seine fisheries along their primary migration route through outside waters and straits. Tagged Taku River fish were found in relatively low concentrations in the Central Outside area (0.23 tags/1,000 fish), Southern Intermediate area (0.17 tags/1,000 fish) and Southern Outside area (0.02 tags/1,000 fish) indicating an overall north-south migration pattern along the coast. Tagged Taku River coho salmon were also recovered from the Lynn Canal (District 115) drift gill net fishery with an estimated concentration of 0.92 tags/1,000 fish. Very small concentrations of tagged Taku River fish were found in the Central Inside (0.05/1,000 fish) and Southern Inside (0.01/1,000 fish) areas.

Migratory Timing

The region-wide troll catch showed two distict peaks with a trough corresponding to a fishery closure during August 14-23. Fish tagged at Yehring Creek appeared to be slightly earlier in timing that those tagged in Canadian mainstem rearing areas based on a sample size of 147 and 131 tags, respectively (Figure 2 and Appendix B.1). The harvest timing distributions of both stocks were relatively protracted with cumulative 50% dates of August 21 for Yehring Creek and August 29 for Canadian mainstem tributaries. A small sample of 22 tags from Tatsamenie River coho salmon indicated that they reached peak abundance in the troll fishery earlier than fish from mainstem tributaries with a cumulative 50% date of August 17 (Figure 3 and Appendix B.1). Overall, tagged Taku River coho salmon were distributed in the troll catch over the entire season with a peak contribution in late August after the closure (Figure 4 and Appendix B.1). Tagged Speel Lake fish showed a similar distribution to those from the Taku River with a cumulative 50% date of August 21.

Yehring Creek and Canadian mainstem fish peaked in the District 111 drift gill net fishery in late August as did the total catch of all stocks (Figure 5 and Appendix B.2). Yehring Creek and Canadian mainstem fish had estimated cumulative 50% dates of August 30 and September 1, respectively. Based on a small sample (N=16), Tatsamenie River fish showed a peak and cumulative 50% date near the end of August.

The Canyon Island fishwheels showed two peaks in coho CPUE on approximately August 9 and September 13 (Figure 7 and Appendix B.3). A total of 18 spaghetti tagged coho salmon from Canyon Island were recovered from the Tatsamenie River. The tagging dates ranged from July 21 to September 11. Peak CPUE of Tagged Tatsamenie River fish was estimated to have occurred in mid-August.

Survival Rates

The Survival rate for juvenile coho salmon tagged at the Tatsamenie River in late July and early August 1987 was estimated 2.9%. This estimate does not include the few fish that were expected to return in 1990. The estimated survival rate for 1987 juveniles was higher than the estimate of 2.0% for fish tagged in September 1986. The estimate for 1986 juveniles increased from the survival rate of 1.9% reported by Shaul (1989) after 1989 returns were included. These estimates are lower than the average for juvenile coho salmon tagged at the Berners River in late June (average 4.8%; range 2.9-6.7%) and at Ford Arm Lake in July and August (average 8.9%; range 6.0-14.4%; Shaul In press). The survival rate for Nahlin River coho salmon tagged in 1986 was estimated at only 1.5%. The poor survival rates estimated for these two upper Taku River stocks suggests that interior coho stocks may suffer greater freshwater mortality than coastal coho stocks.

ESCAPEMENT COUNTS AND ESTIMATES

Methods and Procedures

McGregor and Clark (1990) estimated the number of coho salmon that escaped past Canyon Island Island in the mainstem Taku River through September . Upstream migrant adults were captured in fishwheels operated at Canyon Island, tagged and released. Tag recovery was conducted using commercial and test fish catches from the Canadian portion of the mainstem. The authors applied a mark-recapture technique (Darroch 1961) to estimate gross escapement past Canyon Island. The mainstem estimation program was a joint effort between ADF&G (CF) and DFO.

Adult enumeration weirs were operated throughout the majority of the coho salmon migration at the Tatsamenie River and Yehring Creek. At the weirs, fish were enumerated as they passed through a trap, while fish remaining when the weir was removed were surveyed by foot or helicopter and their number added to the cumulative weir count.

Helicopter surveys were conducted on the upper Nahlin and Dudidontu Rivers and at Flannigan Slough (Wilms Creek). Surveys were conducted from an altitude of 6-15 m unless obstructions required flying higher. Airspeed varied from approximately 5-50 km per hour depending on terrain, visibility and the presence or absence of fish. Surveys were conducted from a Bell 206 B Jet Ranger helicopter. The door on the observer's side was removed and the helicopter was maneuvered so that the observer was able to look down into the stream continuously from the left side. The observer wore polarized glasses to reduce reflective glare and a billed hat to keep prop wash out of the observer's eyes.

Results and Discussion

Mainstem Mark-Recapture Estimate

The gross coho salmon escapement past Canyon Island was estimated at 60,841 (95% C.I. 38,940-82,742). The gross escapement was reduced by Canadian commercial, food and test fishery catches to 56,808 fish. McGregor and Clark (In press) describe the details of their estimate which included only fish migrating through October 1.

Tributary Surveys and Weir Counts

Upper Nahlin River Survey. The upper Nahlin River was surveyed on September 12 beginning at 11:30 a.m. This date was determined to be near optimum by Shaul (1989) based on a weir count and two surveys conducted in 1988. The survey was conducted under excellent visibility conditions with a clear sky, calm winds and a low water level. A total of 322 coho salmon was counted of which 310 were live and 12 were carcasses. The distribution of spawners was different from that observed in previous years. A large beaver dam near the upper end of the lower valley appeared to be blocking most of the fish from the main spawning area. This was the first serious blockage downstream from the main spawning grounds that has been observed since surveys were initiated in 1986. Of the total count, only 19 fish were seen upstream from the dam while the largest concentration was observed in a pool immediately downstream from the dam. A total of 10 sockeye salmon was also counted, all of which were above the dam.

The 1989 count of 322 coho salmon was higher than 1986 and 1987 survey counts of 318 and 165, respectively, but lower than the 1988 peak count of 694 fish (Table 6).

Dudidontu River Surveys. The Dudidontu River was surveyed on September 12 beginning at 8:30 a.m. The sky was clear, winds calm and water low resulting in excellent visibility. Only 101 coho salmon (96 live; 5 dead) were seen during the survey downstream from Ketchum Lake to Kakuchuya Creek. Twelve live fish and two carcasses were observed in an upstream survey of Kakachuya Creek. The section from Kakuchuya Creek downstream to the canyon was not surveyed because surveys in previous years indicated that no fish held in that area. The total survey count included 115 coho salmon of which 108 were live fish and 7 were carcasses.

The 1989 count of 115 fish was higher than the 1986 count of 108 fish but lower than the 1987 and 1988 counts of 276 and 367, respectively (Table 6). The low 1989 count is consistent with an extremely sparse population of rearing coho salmon observed while coded-wire tagging in 1987. Only 1,712 juvenile coho salmon was captured in 1,237 trap sets of which nearly all were small young-of-the-year fish while fewer than 2% were age 1 (Shaul 1987). In 1989, extensive beaver dams in the marshy valley near Camp Island Lake appeared to block spawners from the uppermost reaches of spawning and rearing habitat as also occurred in 1986.

The 1986 count was revised downward from 798 (Shaul 1989) to only 108 based on observations in subsequent years that suggested that 690 of the fish counted in 1986 were in fact large resident rainbow trout that were concentrated in three pools in the middle reaches of the river. Tall trees along the pools necessitated counting from a higher altitude that was necessary along most of the open Dudidontu River valley. The increased altitude combined with limited visibility due to the depth of the pools probably caused an error in species identification. Schools of 30-40 large rainbow trout were positively identified at the pools by a coded-wire tagging crew which camped near the side in late August 1987. Close examination of the pools during helicopter surveys in September 1987 and 1988 indicated that they contained only rainbow trout, although the total number of fish was much lower than had been observed in 1986. No adult coho salmon were observed within several kilometers of the site during 1987-1989 surveys while the vast majority were counted much farther upstream in pools near better substrate for spawning. The pools were examined again in 1989 and a large number of fish was observed, similar to 1986. The total number of fish present was estimated at between 600-1,000, all of which all appeared to be rainbow trout. Species identification problems of this type point out the value of observer experience in conducting surveys in systems where similar sized species are present.

Flannigan Slough Surveys. Flannigan Slough (also known as Wilms Creek) was surveyed on October 23 (Table 7). Counts made by two different observers during the same survey were 1,259 fish and 1,670 fish, respectively (average 1,465).

Yehring Creek Weir. The Yehring Creek weir was operated during August 13-October 3 when it was disabled in a flood. A total of 1,444 adult coho salmon was counted during the period of operation. Based on the results of a mark-recapture study, Elliott and Sterritt (1990) estimated the total escapement at 2,183 fish. the first year when the weir remained relatively fish-tight throughout the season. Adult (age .1) estimates for weir counts in 1986, 1987 and 1988 were 1,988, 1,622 and 1,423, respectively (Table 7). However, an unknown number of fish passed the weir uncounted during 1986 and 1987. Daily counts for 1989 and other details of the Yehring Creek coho salmon research project were reported by Elliott et al. (In Press).

Tatsamenie River Weir. An adult enumeration weir was operated on the Tatsamenie River by DFO from August 4 through October 30. A total of 694 fish was counted through the weir while 18 were counted during a survey below the weir for a total escapement of 712. The 1989 count was similar to the 1988 count of 663 fish (Appendix B.4). The operation of the weir was described in more detail in the previous section on adult tag returns.

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Table 1. Estimated harvest, stock distribution and escapement of Tatsamenie River coho salmon by fishery, 1989.

Fishery	Number of Tags Recovered	Expanded Recoveries	Number of Fish	Percent
Troll	22	73.604	1,128	35.3
Trap	1	0.619	9	0.3
Drift Gill Net (111)	16	57.691	884	27.7
(115)	1	2.551	39	1.2
Subtotal	17	60.242	923	28.9
Juneau Sport	3	22.773	349	10.9
Alaska Fisheries (Subtotal)	43	157.238	2,409	75.4
Inriver Commercial	-	-	60	1.9[1]
Inriver Test	-	-	14	0.4[1]
Inriver Food	-	-	-	-
Inriver Personal Use (U.S.)	-	-	-	-
Inriver Sport	-	-	-	-
Inriver (Subtotal)	-	-	74	2.3
Total Catch (Subtotal)	-	-	2,483	77.7
Escapement	10	46.475	712	22.3
Total Return	53	-	3,195	100.0

[1] Harvest by Canadian inriver commercial and test fisheries was estimated from spaghetti tag data (see text). No estimate was available for the Canadian inriver food fishery which harvested a total of 146 fish or for the U.S. personal use fishery which accounted for an estimated 73 fish.

Table 2. Estimated removal rate by fishery for coho salmon returns to the Tatsamenie River, 1988-1989.

Fishery	Removal Rate (Proportion) 1988	1989	Average
Troll	0.220	0.353	0.287
Purse Seine	0.014	0.000	0.007
Trap	0.000	0.003	0.001
Lynn Canal Gill Net	0.000	0.019	0.010
Juneau Sport	0.055	0.169	0.112
District 111 Gill Net	0.542	0.530	0.536
Marine (Subtotal)	0.668	0.754	0.711
Inriver Commercial	0.051	0.077	0.064
Inriver Test	0.010	0.016	0.013
Inriver Food	-	-	-
Inriver Sport	0.029	0.000	0.015
Inriver (Subtotal)	0.088	0.093	0.091
Total	0.697	0.777	0.737

Table 3. Estimated harvest distribution of Taku River and Speel Lake coho salmon in marine fisheries by gear type, 1989. The troll percentage is listed by quadrant while the drift gill net percentage is listed by district. Stratification is by quadrant (troll), district (seine and gill net) and port (sport).

		Tagging Location (Percent)						
Gear Type	Area	Yehring Creek	Canadian Mainstem	Yehring Creek & Mainstem	Tatsamenie River	Dudidontu River	All Taku Tags	Speel Lake
Troll	Northwest	54.4	63.1	58.1	46.7	0.0	56.7	83.9
	Northeast	2.5	1.7	2.2	0.0	0.0	2.0	9.9
	Southwest	0.5	1.1	0.7	0.0	0.0	0.6	0.0
	Southeast	0.3	0.0	0.2	0.0	0.0	0.1	0.0
	Total	57.7	65.9	61.2	46.7	0.0	59.4	93.8
Seine	Total	4.8	1.8	3.5	0.0	0.0	3.1	3.5
Trap	Total	0.0	0.0	0.0	0.8	0.0	0.1	0.0
Gill Net	P.W. Sound	0.2	0	0.1	0	0	0.1	0
	Dist. 106	0.4	0	0.2	0	0	0.2	0
	Dist. 115	1.7	4.0	2.7	1.6	24.8	2.8	2.7
	Dist. 111	31.2	27.5	29.6	36.5	75.2	30.6	0.0
	Total	33.5	31.5	32.6	38.1	100.0	33.7	2.7
Sport	Total	4.0	0.8	2.7	14.4	0.0	3.7	0.0
Grand Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sample Size		233	186	419	43	4	466	98

Table 4. Estimated harvest distribution of Taku River and Speel Lake coho salmon in marine fisheries by area and gear type, 1989.

Area	Gear Type	Tagging Location (Percent) Yehring Creek	Canadian Mainstem	Yehring Creek & Mainstem	Tatsamenie River	Dudidontu River	All Taku Tags	Speel Lake
P.W. Sound	Seine	0.2	0.0	0.1	0.0	0.0	0.1	0.0
	G. Net	0.1	0.0	0.1	0.0	0.0	0.1	0.0
	Total	0.3	0.0	0.2	0.0	0.0	0.2	0.0
N. Outside	Troll	17.5	25.6	21.0	17.7	0.0	20.5	22.9
C. Outside	Troll	6.6	8.9	7.6	0.0	0.0	6.8	24.4
S. Outside	Troll	0.5	1.1	0.8	0.0	0.0	0.7	0.0
C. Intermed.	Troll	29.0	27.9	28.5	28.7	0.0	28.3	41.1
	Seine	4.3	0.2	2.5	0.0	0.0	2.2	0.8
	Sport	0.2	0.0	0.1	2.7	0.0	0.3	0.0
	Total	33.5	28.1	31.1	31.4	0.0	30.8	41.9
S. Intermed.	Troll	1.3	0.5	1.0	0.0	0.0	0.9	4.9
	Seine	0.7	1.7	1.1	0.0	0.0	1.0	3.0
	Total	2.0	2.2	2.1	0.0	0.0	1.9	7.9
S. Inside	Trap	0.0	0.0	0.0	0.8	0.0	0.1	0.0
C. Inside	Troll	0.2	0.0	0.1	0.0	0.0	0.1	0.0
	G. Net	0.4	0.0	0.2	0.0	0.0	0.2	0.0
	Total	0.6	0.0	0.3	0.0	0.0	0.3	0.0
Lynn Canal	G. Net	1.8	4.2	2.9	1.6	24.8	2.9	2.9
Steph. Pass	G. Net	33.1	29.0	31.3	36.7	75.2	32.2	0.0
	Sport	4.1	0.9	2.7	11.8	0.0	3.6	0.0
	Total	37.2	29.9	34.0	48.5	75.2	35.8	0.0
Grand Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sample Size		204	163	367	40	4	411	78

Table 5. Estimated concentration (tags per 1,000 fish) of coded-wire tagged Taku River coho salmon in Southeast Alaska commercial fisheries by PMFC area and in the Juneau sport fishery, 1989.

Area	Gear Type(s)	Expanded Recoveries	Total Catch	Concentration (tags/1,000 fish)
Northern Outside	Troll	328.280	243,824	1.35
Central Outside	Troll & Seine	108.663	468,132	0.23
Southern Outside	Troll & Seine	10.741	437,332	0.02
Central Intermediate	Troll & Seine	488.181	242,201	2.02
Southern Intermediate	Troll & Seine	30.410	176,945	0.17
Central Inside	Troll, Seine, Gill Net	5.536	119,318	0.05
Southern Inside	Troll, Seine, Trap, Gill Net, Sport	1.295	221,529	0.01
Lynn Canal	Gill Net	46.194	50,307	0.92
Stephens Passage	Gill Net	513.892	51,812	9.92
Juneau	Sport	62.693	23,819	2.63

Table 6. Escapement counts for three upper Taku River coho salmon stocks, 1985-1989.

Location	Year	Type	Date(s)	Agency	No. of Fish
Upper Nahlin River	1986	Helicopter	09/18-19	ADF&G	318
	1987	Helicopter	09/15	ADF&G	165
	1988	Helicopter	09/08	ADF&G	694
	1988	Helicopter	09/15	ADF&G	655
	1988	Weir	07/25-09/23	ADF&G	1,322
	1989	Helicopter	09/12	ADF&G	322
Dudidontu River	1986	Helicopter	09/18	ADF&G	108
	1987	Helicopter	09/15	ADF&G	276
	1988	Helicopter	09/08	ADF&G	330
	1988	Helicopter	09/15	ADF&G	367
	1989	Helicopter	09/12	ADF&G	115
Tatsamenie River[1]	1988	Weir	07/31-11/08	DFO	663
	1989	Weir	08/04-10/30	ADF&G	712

[1]Canada Department of Fisheries and Oceans data.

Table 7. Coho salmon escapement weir counts and peak and near-peak survey counts for two lower Taku River tributaries, 1984-1989.

Location	Year	Type	Date(s)	Agency	No. of Fish
Flannigan Slough	1984	Helicopter	10/21	ADF&G-SF	1,480
	1985	Helicopter	10/21	ADF&G-SF	2,320
	1986	Helicopter	10/31	ADF&G-SF	860-1,330[1]
	1987	Helicopter	11/04	ADF&G-SF/CF	1,950-2,250[1]
	1988	Helicopter	10/22	ADF&G-SF/CF	1,260-1,320[1]
	1988	Helicopter	10/27	DFO	1,102-1,150
	1988	Helicopter	11/03	ADF&G-SF/CF	1,115-1,500[1]
	1989	Helicopter	10/23	ADF&G-SF/CF	1,259-1,670[1]
Yehring Creek	1986	Weir	08/23-10/03	ADF&G-SF	1,988[2]
	1987	Weir	08/16-09/30	ADF&G-SF	1,622[2]
	1988	Weir	08/12-10/23	ADF&G-SF	1,423
	1989	Weir	08/13-10/03	ADF&G-SF	2,183[3]

[1] Counts by two independent observers.

[2] It is probable that some fish escaped uncounted during high water periods when the weir was inoperative in 1986 and 1987. The counts for Yehring Creek represent age .1 fish only. In addition, there were estimated to be 128 age .0 jacks in the escapement count in 1986 and 5 in 1987. No jacks were counted in 1988 when the weir pickets were more widely spaced.

[3] The 1989 escapement of 2,183 fish in Yehring Creek includes an actual count of 1,444 fish plus a mark-recapture estimate of 739 fish that escaped after the weir was damaged by a flood on October 3 (Elliott et al. 1990).

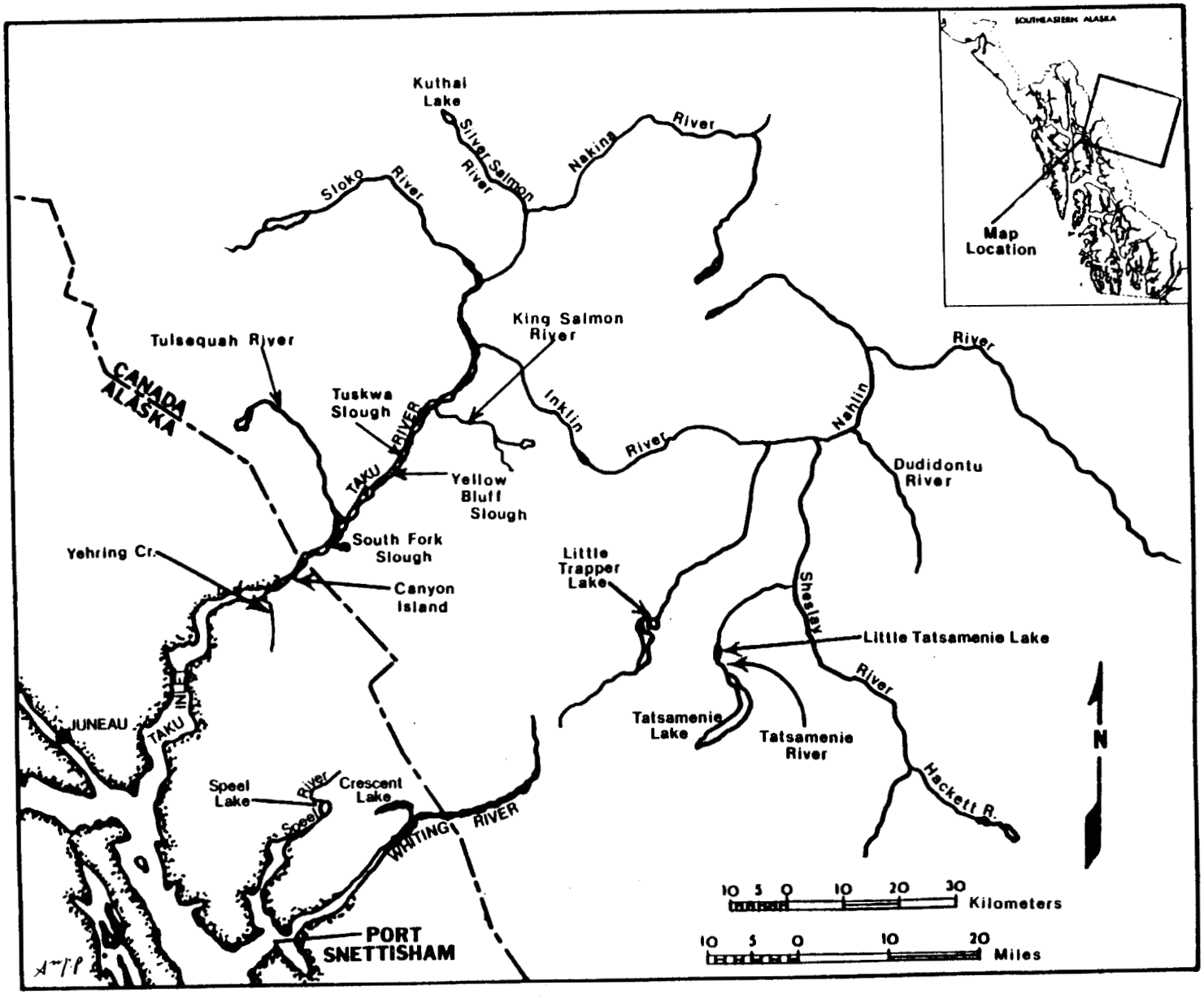
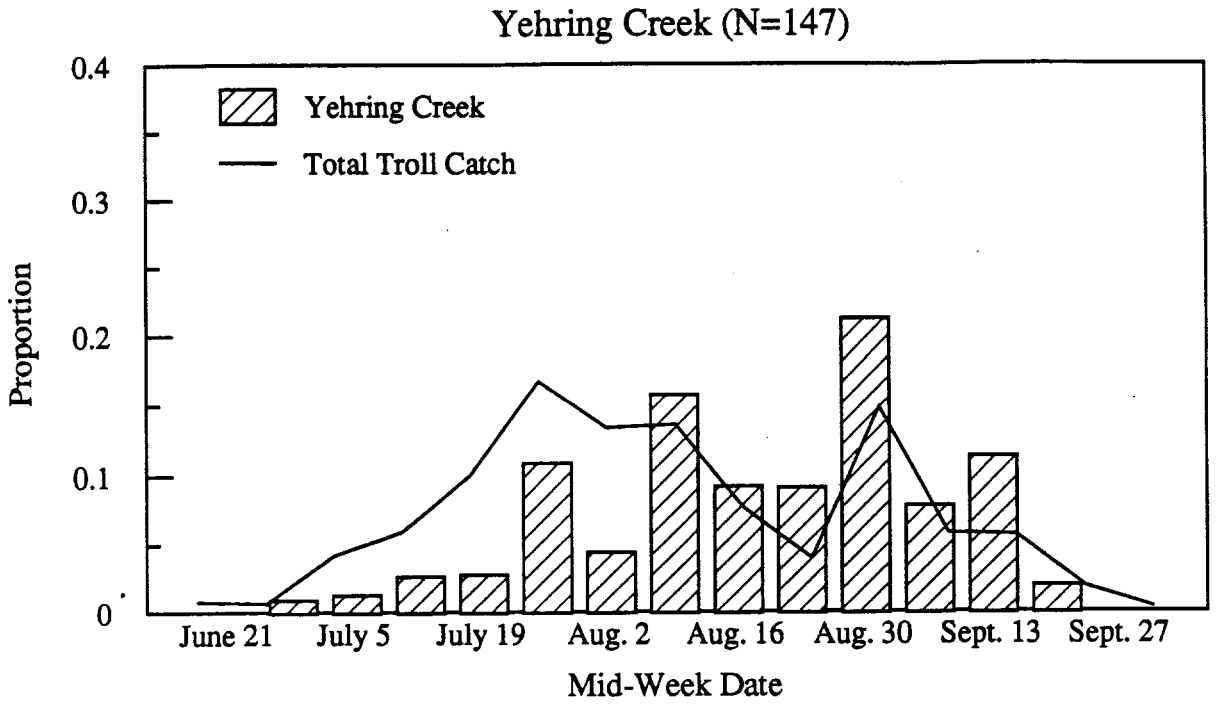


Figure 1. Taku River and Port Snettisham Drainages.



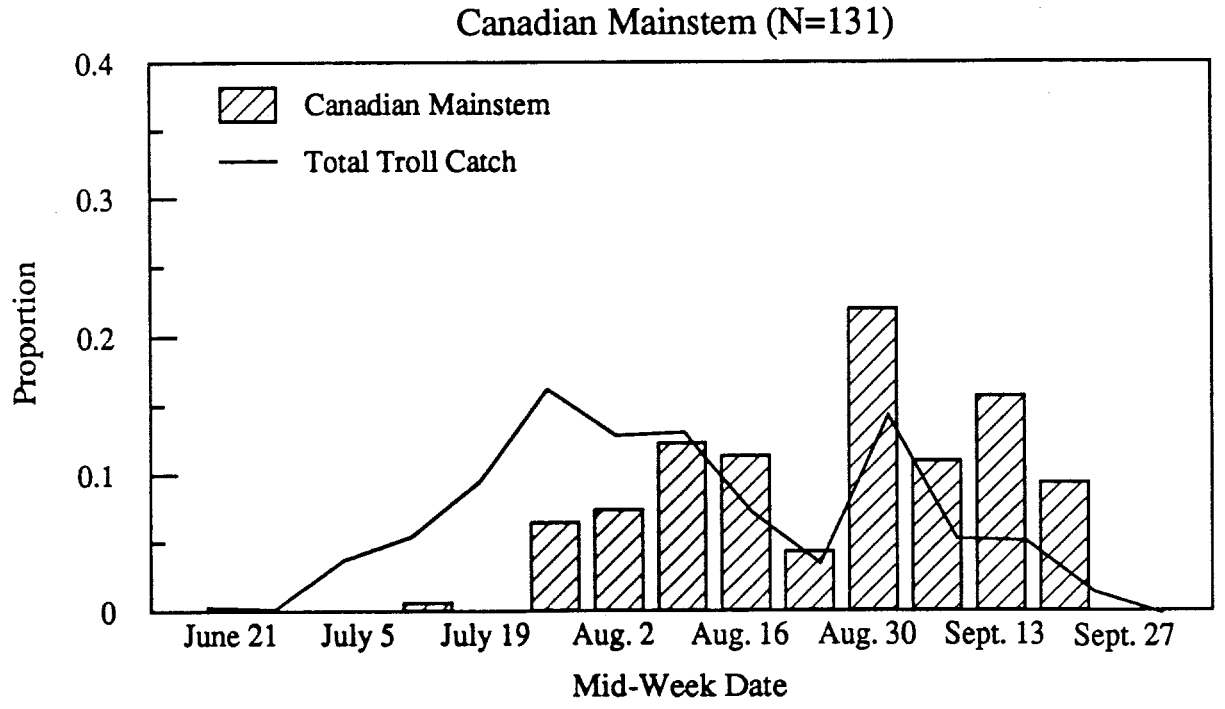


Figure 2. Weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged coho salmon from Yehring Creek and rearing areas along the Canadian mainstem (bar graph), 1989.

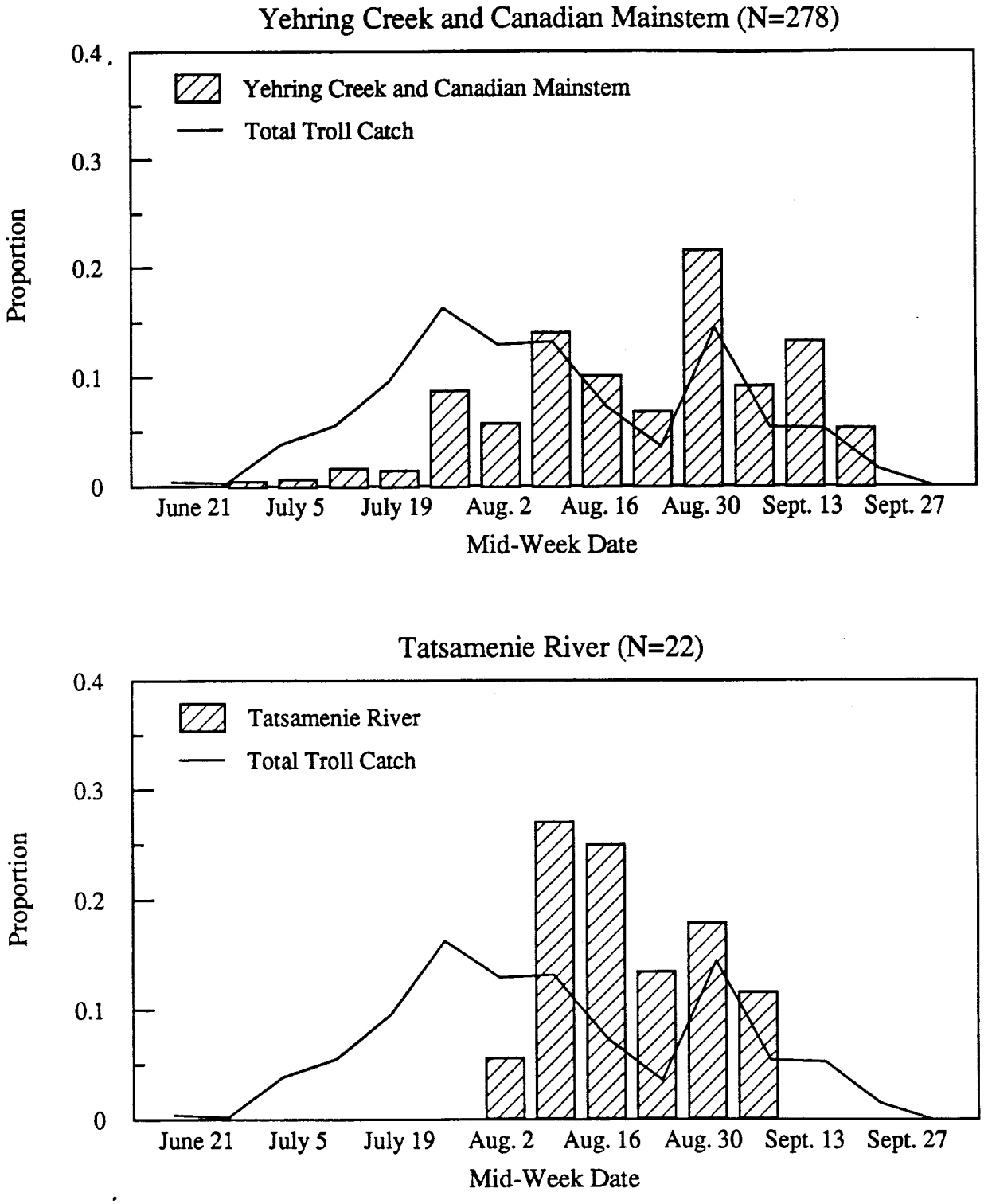
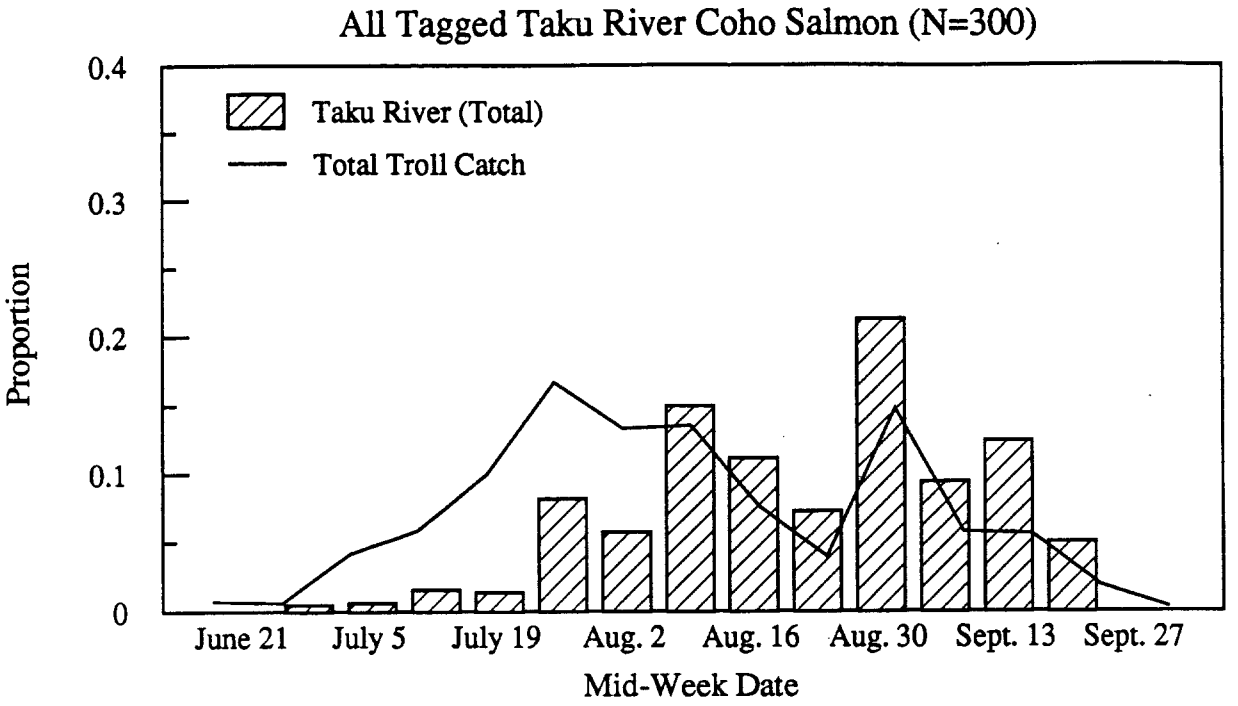


Figure 3. Weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged coho salmon from the Taku River mainstem valley (Yehring Creek and Canadian mainstem) and the Tatsamenie River (bar graph), 1989.



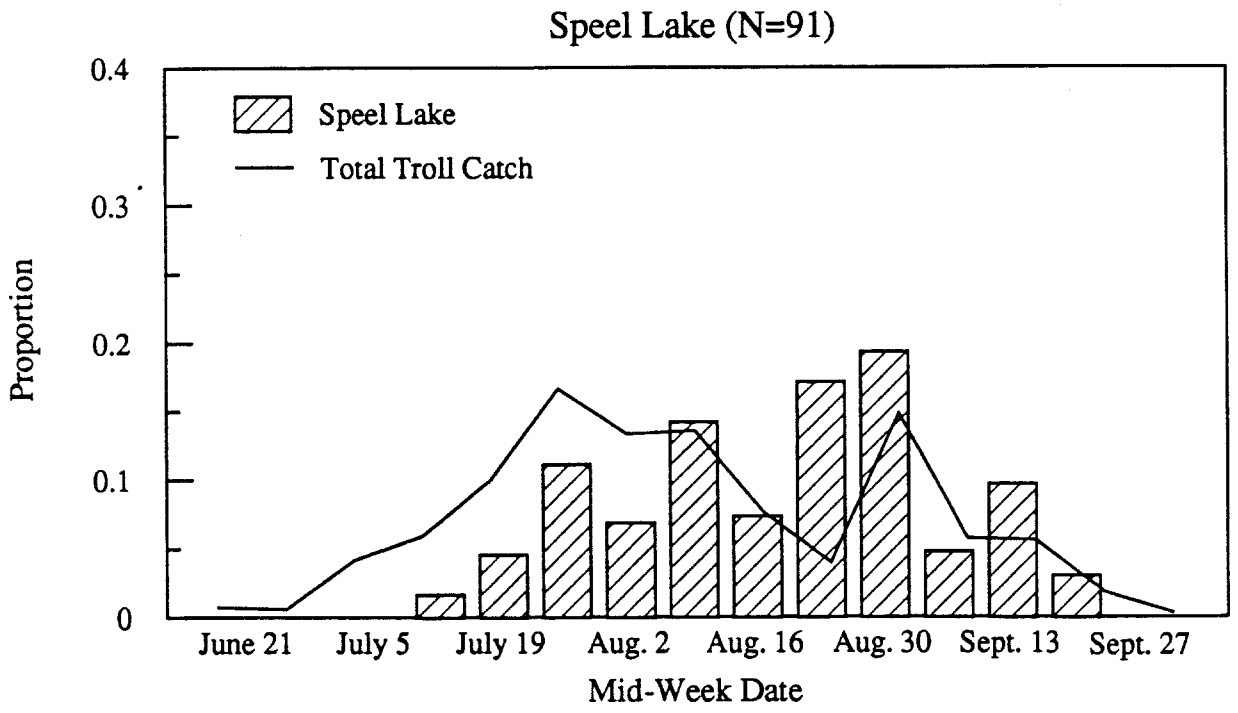
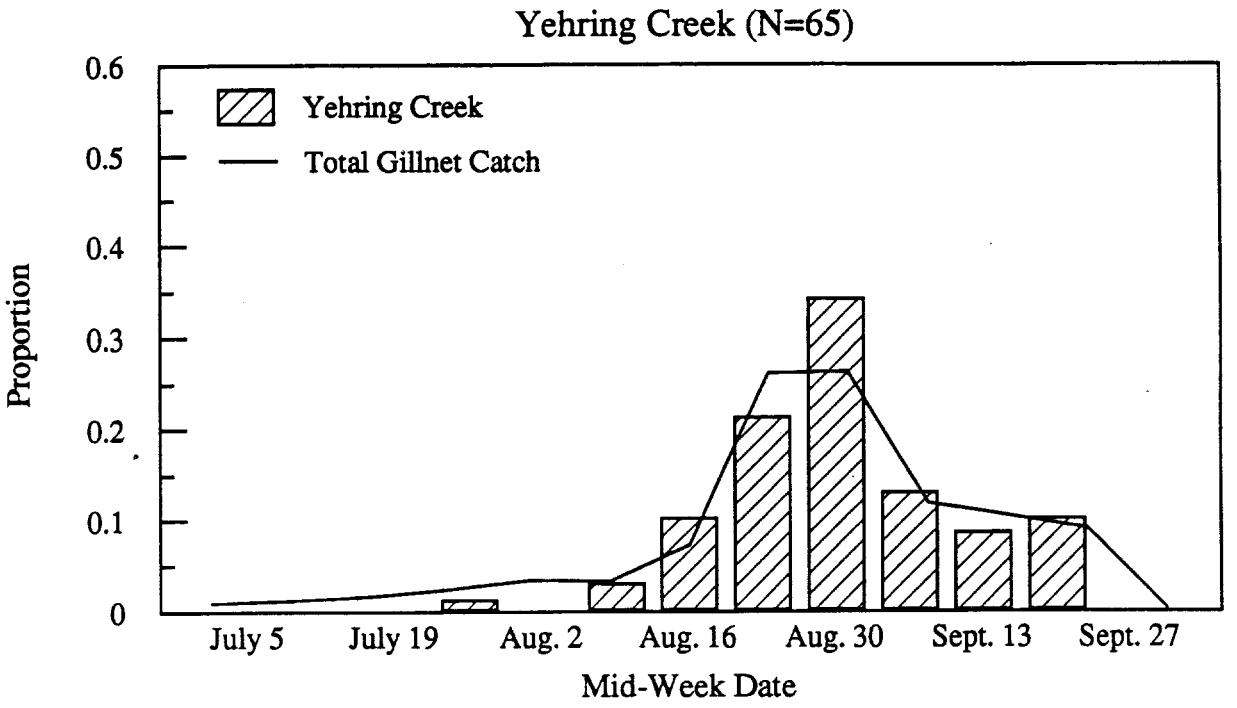


Figure 4. Weekly proportion of the total coho salmon troll catch (line graph) and estimated troll catch of coded-wire tagged coho salmon from the Taku River and Speel Lake (bar graph), 1989.



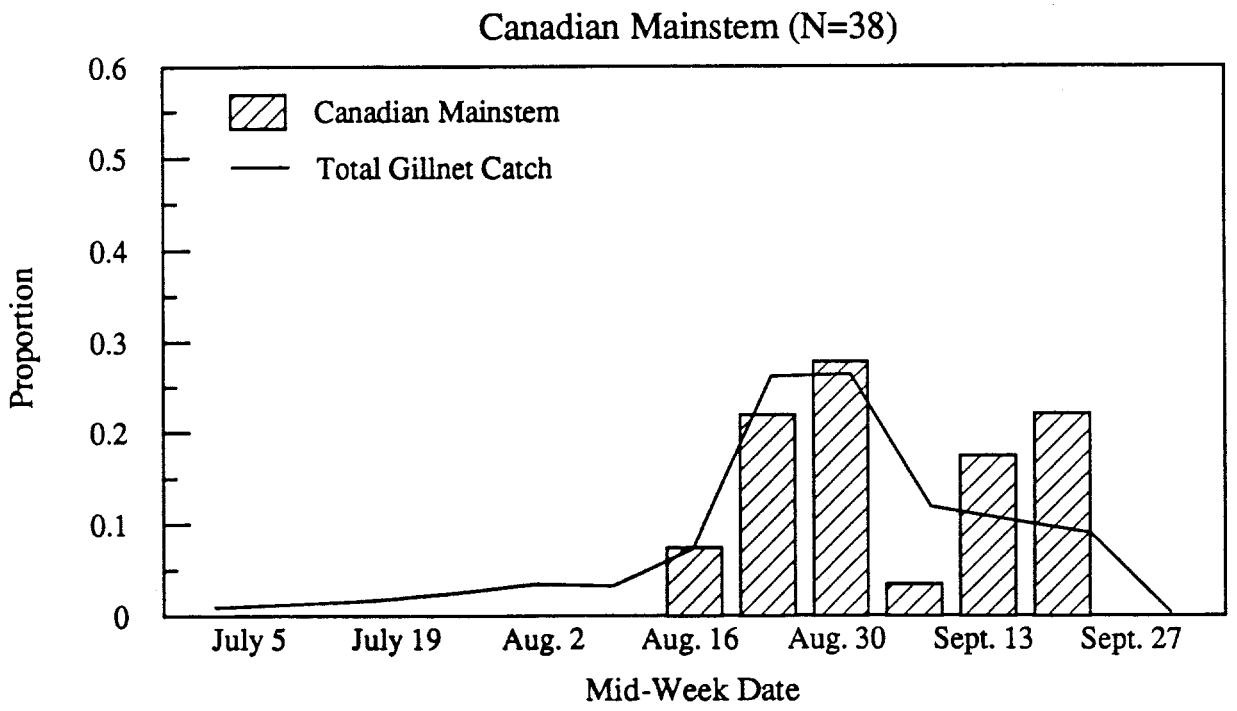
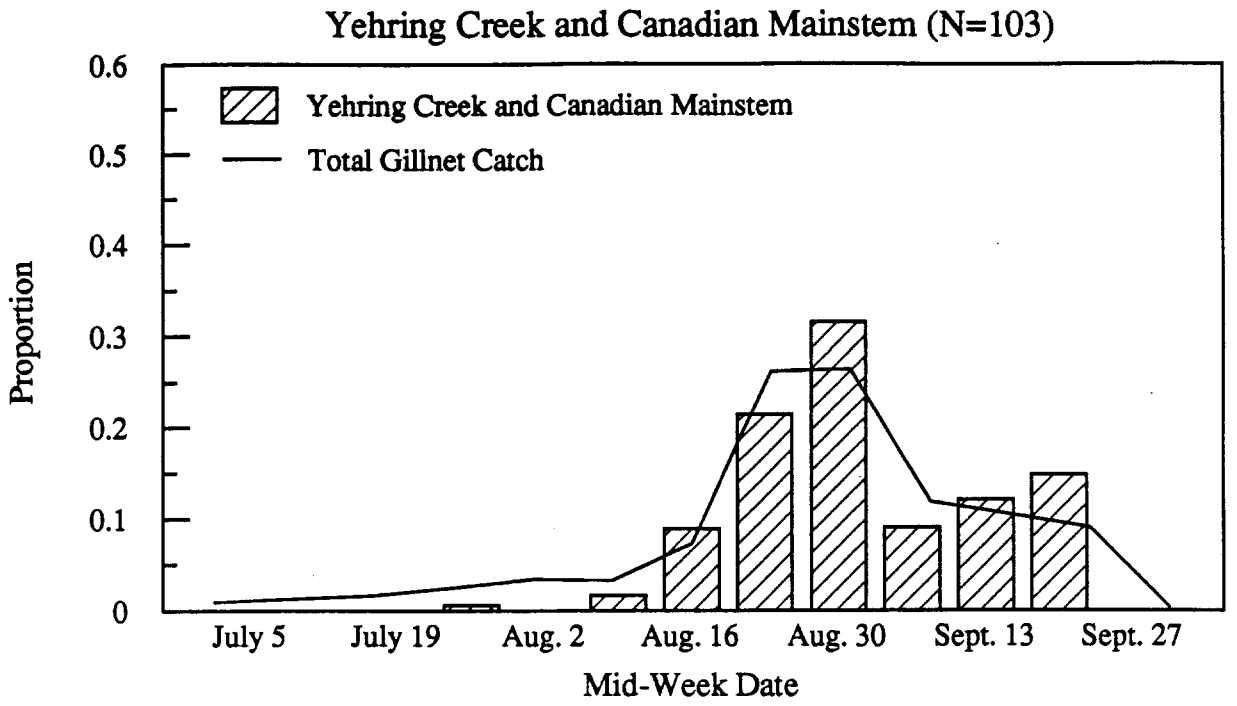


Figure 5. Weekly proportion of the total District 111 drift gillnet coho salmon catch (line graph) and estimated catch of coded-wire tagged coho salmon from Yehring Creek and rearing areas along the Canadian mainstem (bar graph), 1989.



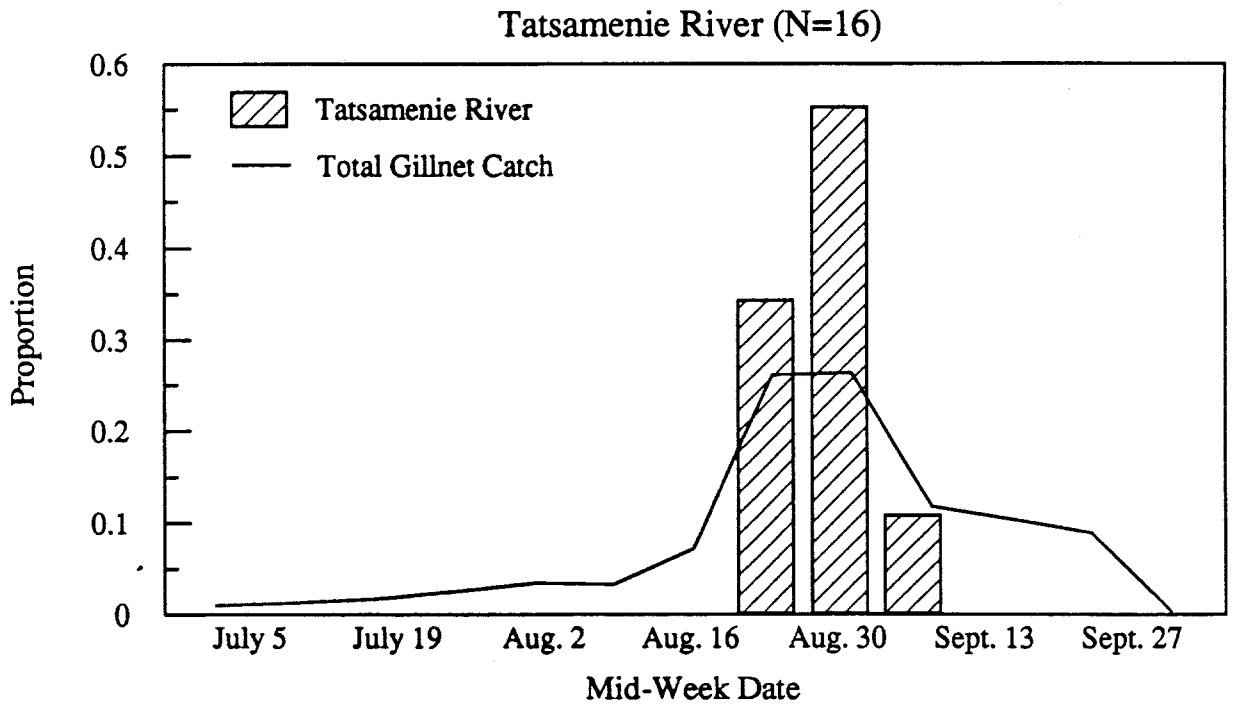


Figure 6. Weekly proportion of the total District 111 drift gill net coho salmon catch (line graph) and estimated catch of coded-wire tagged coho salmon from the Taku River mainstem valley (Yehring Creek and Canadian mainstem) and the Tatsamenie River (bar graph), 1989.

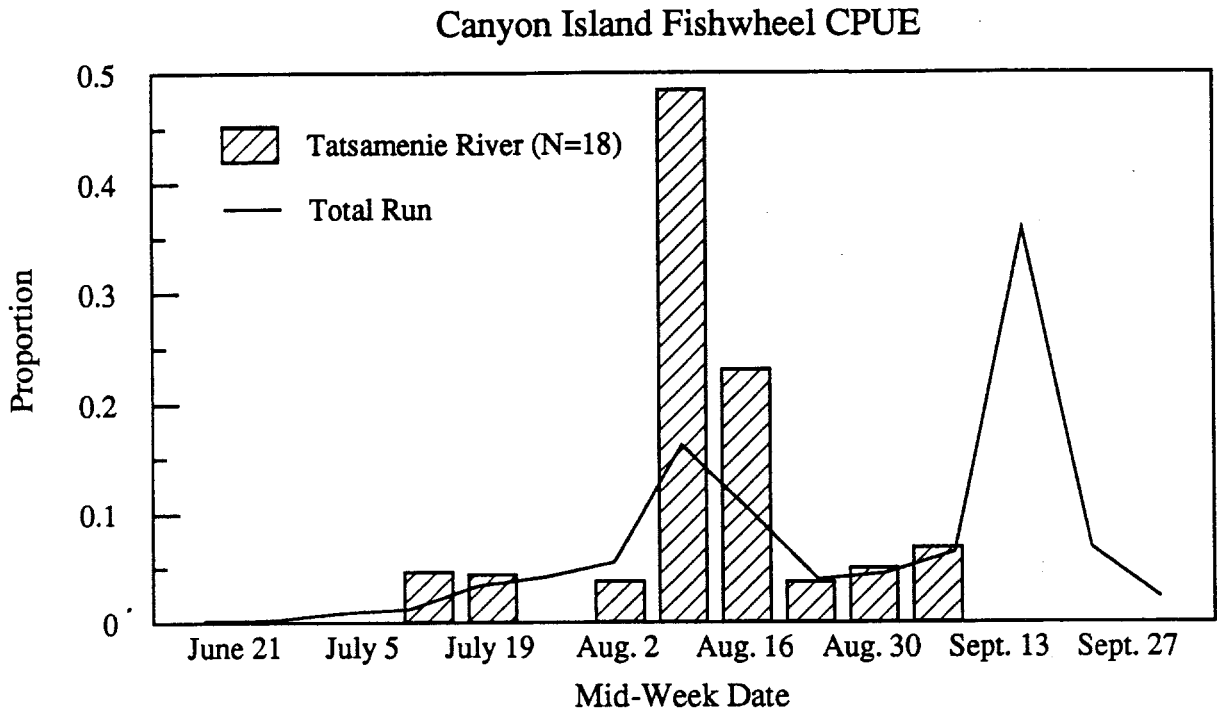
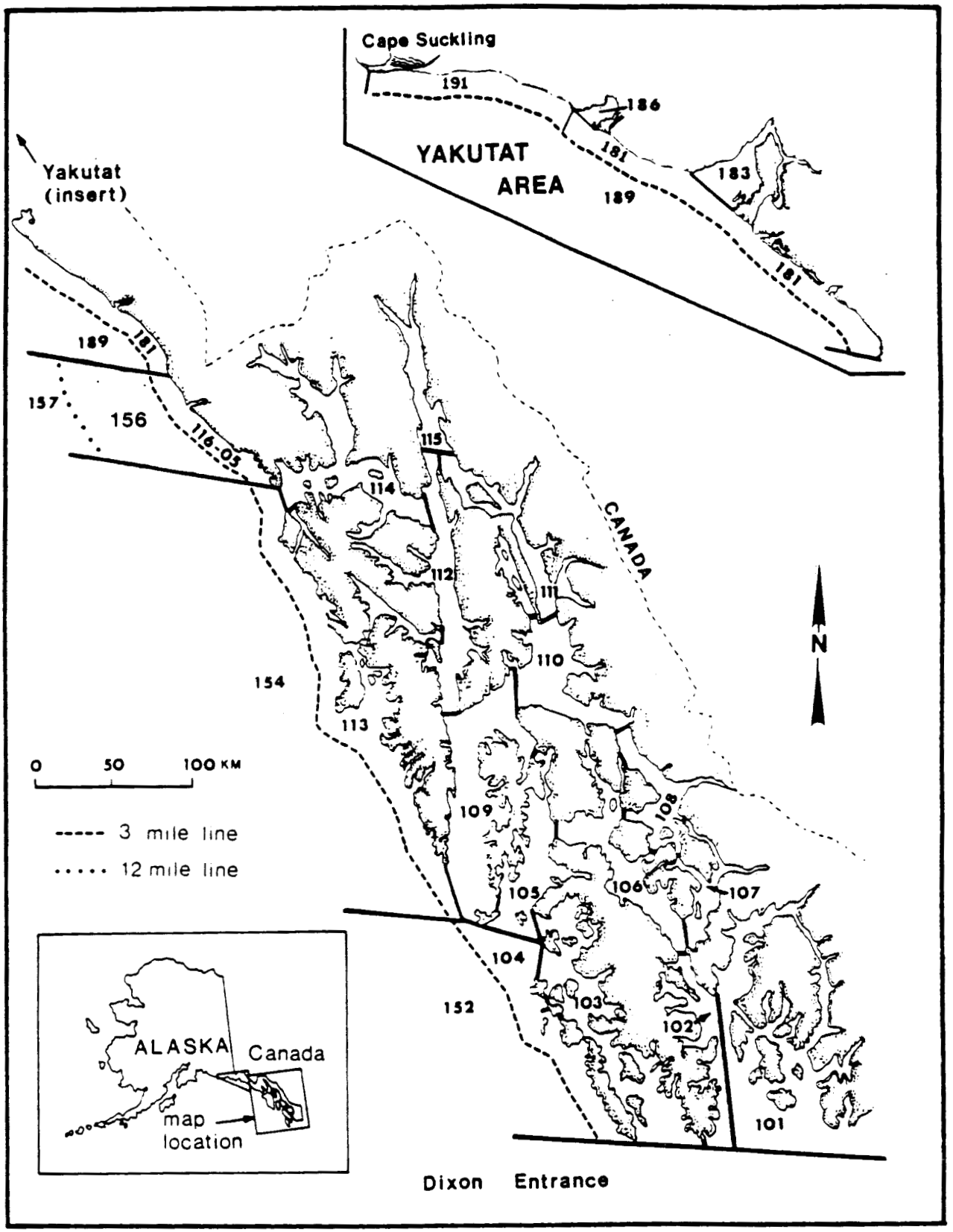


Figure 7. Estimated weekly proportion of cumulative CPUE at Canyon Island for the total coho salmon run and spaghetti tagged Tatsamenie River fish, 1989.

APPENDICES



Appendix A.1. Southeast Alaska statistical fishing districts.

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

PMFC Area	Abbreviation	Statistical Areas (Districts)
Northern Outside	NOUT	116, 156, 157, 181, 183, 186, 189, 191
Central Outside	COUT	113, 154
Southern Outside	SOUT	103, 104, 152
Southern Inside	SIN	101, 102, 150
Southern Intermediate	SNTR	105, 109, 110
Central Inside	CIN	106, 107, 108
Stephens Passage	STEP	111
Central Intermediate	CNTR	112, 114
Lynn Canal	LYNN	115

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

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

STAT WEEK	YEAR/DATE 1983	YEAR/DATE 1984	YEAR/DATE 1985	YEAR/DATE 1986	YEAR/DATE 1987	YEAR/DATE 1988	YEAR/DATE 1989	YEAR/DATE 1990
1	0101 - 0101	0101 - 0107	0101 - 0105	0101 - 0104	0101 - 0103	0101 - 0102	0101 - 0107	0101 - 0106
2	0102 - 0108	0108 - 0114	0106 - 0112	0105 - 0111	0104 - 0110	0103 - 0109	0108 - 0114	0107 - 0113
3	0109 - 0115	0115 - 0121	0113 - 0119	0112 - 0118	0111 - 0117	0110 - 0116	0115 - 0121	0114 - 0120
4	0116 - 0122	0122 - 0128	0120 - 0126	0119 - 0125	0118 - 0124	0117 - 0123	0122 - 0128	0121 - 0127
5	0123 - 0129	0129 - 0204	0127 - 0202	0126 - 0201	0125 - 0131	0124 - 0130	0129 - 0204	0128 - 0203
6	0130 - 0205	0205 - 0211	0203 - 0209	0202 - 0208	0201 - 0207	0131 - 0206	0205 - 0211	0204 - 0210
7	0206 - 0212	0212 - 0218	0210 - 0216	0209 - 0215	0208 - 0214	0207 - 0213	0212 - 0218	0211 - 0217
8	0213 - 0219	0219 - 0225	0217 - 0223	0216 - 0222	0215 - 0221	0214 - 0220	0219 - 0225	0218 - 0224
9	0220 - 0226	0226 - 0303	0224 - 0302	0223 - 0301	0222 - 0228	0221 - 0227	0226 - 0304	0225 - 0303
10	0227 - 0305	0304 - 0310	0303 - 0309	0302 - 0308	0301 - 0307	0228 - 0305	0305 - 0311	0304 - 0310
11	0306 - 0312	0311 - 0317	0310 - 0316	0309 - 0315	0308 - 0314	0306 - 0312	0312 - 0318	0311 - 0317
12	0313 - 0319	0318 - 0324	0317 - 0323	0316 - 0322	0315 - 0321	0313 - 0319	0319 - 0325	0318 - 0324
13	0320 - 0326	0325 - 0331	0324 - 0330	0323 - 0329	0322 - 0328	0320 - 0326	0326 - 0401	0325 - 0331
14	0327 - 0402	0401 - 0407	0331 - 0406	0330 - 0405	0329 - 0404	0327 - 0402	0402 - 0408	0401 - 0407
15	0403 - 0409	0408 - 0414	0407 - 0413	0406 - 0412	0405 - 0411	0403 - 0409	0409 - 0415	0408 - 0414
16	0410 - 0416	0415 - 0421	0414 - 0420	0413 - 0419	0412 - 0418	0410 - 0416	0416 - 0422	0415 - 0421
17	0417 - 0423	0422 - 0428	0421 - 0427	0420 - 0426	0419 - 0425	0417 - 0423	0423 - 0429	0422 - 0428
18	0424 - 0430	0429 - 0505	0428 - 0504	0427 - 0503	0426 - 0502	0424 - 0430	0430 - 0506	0429 - 0505
19	0501 - 0507	0506 - 0512	0505 - 0511	0504 - 0510	0503 - 0509	0501 - 0507	0507 - 0513	0506 - 0512
20	0508 - 0514	0513 - 0519	0512 - 0518	0511 - 0517	0510 - 0516	0508 - 0514	0514 - 0520	0513 - 0519
21	0515 - 0521	0520 - 0526	0519 - 0525	0518 - 0524	0517 - 0523	0515 - 0521	0521 - 0527	0520 - 0526
22	0522 - 0528	0527 - 0602	0526 - 0601	0525 - 0531	0524 - 0530	0522 - 0528	0528 - 0603	0527 - 0602
23	0529 - 0604	0603 - 0609	0602 - 0608	0601 - 0607	0531 - 0606	0529 - 0604	0604 - 0610	0603 - 0609
24	0605 - 0611	0610 - 0616	0609 - 0615	0608 - 0614	0607 - 0613	0605 - 0611	0611 - 0617	0610 - 0616
25	0612 - 0618	0617 - 0623	0616 - 0622	0615 - 0621	0614 - 0620	0612 - 0618	0618 - 0624	0617 - 0623
26	0619 - 0625	0624 - 0630	0623 - 0629	0622 - 0628	0621 - 0627	0619 - 0625	0625 - 0701	0624 - 0630
27	0626 - 0702	0701 - 0707	0630 - 0706	0629 - 0705	0628 - 0704	0626 - 0702	0702 - 0708	0701 - 0707
28	0703 - 0709	0708 - 0714	0707 - 0713	0706 - 0712	0705 - 0711	0703 - 0709	0709 - 0715	0708 - 0714
29	0710 - 0716	0715 - 0721	0714 - 0720	0713 - 0719	0712 - 0718	0710 - 0716	0716 - 0722	0715 - 0721
30	0717 - 0723	0722 - 0728	0721 - 0727	0720 - 0726	0719 - 0725	0717 - 0723	0723 - 0729	0722 - 0728
31	0724 - 0730	0729 - 0804	0728 - 0803	0727 - 0802	0726 - 0801	0724 - 0730	0730 - 0805	0729 - 0804
32	0731 - 0806	0805 - 0811	0804 - 0810	0803 - 0809	0802 - 0808	0731 - 0806	0806 - 0812	0805 - 0811
33	0807 - 0813	0812 - 0818	0811 - 0817	0810 - 0816	0809 - 0815	0807 - 0813	0813 - 0819	0812 - 0818
34	0814 - 0820	0819 - 0825	0818 - 0824	0817 - 0823	0816 - 0822	0814 - 0820	0820 - 0826	0819 - 0825
35	0821 - 0827	0826 - 0901	0825 - 0831	0824 - 0830	0823 - 0829	0821 - 0827	0827 - 0902	0826 - 0901
36	0828 - 0903	0902 - 0908	0901 - 0907	0831 - 0906	0830 - 0905	0828 - 0903	0903 - 0909	0902 - 0908
37	0904 - 0910	0909 - 0915	0908 - 0914	0907 - 0913	0906 - 0912	0904 - 0910	0910 - 0916	0909 - 0915
38	0911 - 0917	0916 - 0922	0915 - 0921	0914 - 0920	0913 - 0919	0911 - 0917	0917 - 0923	0916 - 0922
39	0918 - 0924	0923 - 0929	0922 - 0928	0921 - 0927	0920 - 0926	0918 - 0924	0924 - 0930	0923 - 0929
40	0925 - 1001	0930 - 1006	0929 - 1005	0928 - 1004	0927 - 1003	0925 - 1001	1001 - 1007	0930 - 1006
41	1002 - 1008	1007 - 1013	1006 - 1012	1005 - 1011	1004 - 1010	1002 - 1008	1008 - 1014	1007 - 1013
42	1009 - 1015	1014 - 1020	1013 - 1019	1012 - 1018	1011 - 1017	1009 - 1015	1015 - 1021	1014 - 1020
43	1016 - 1022	1021 - 1027	1020 - 1026	1019 - 1025	1018 - 1024	1016 - 1022	1022 - 1028	1021 - 1027
44	1023 - 1029	1028 - 1103	1027 - 1102	1026 - 1101	1025 - 1031	1023 - 1029	1029 - 1104	1028 - 1103

Appendix B.1. Estimated weekly proportion of the total troll catch of coded-wire tagged Taku River and Speel Lake coho salmon, 1989.

	Tagging Location					
Mid-Week Date	Yehring Creek	Canadian Mainstem	Yehring Creek & Mainstem	Tatsamenie River	All Taku R. Tags	Speel Lake
June 21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
June 28	0.0099	0.0000	0.0053	0.0000	0.0050	0.0000
July 5	0.0135	0.0000	0.0073	0.0000	0.0068	0.0000
July 12	0.0270	0.0058	0.0172	0.0000	0.0160	0.0170
July 19	0.0287	0.0000	0.0154	0.0000	0.0143	0.0461
July 26	0.1090	0.0643	0.0883	0.0000	0.0823	0.1111
Aug. 2	0.0451	0.0736	0.0583	0.0550	0.0580	0.0686
Aug. 9	0.1579	0.1223	0.1415	0.2691	0.1502	0.1426
Aug. 16	0.0924	0.1129	0.1018	0.2489	0.1119	0.0736
Aug. 23	0.0912	0.0424	0.0686	0.1335	0.0731	0.1718
Aug. 30	0.2130	0.2196	0.2161	0.1786	0.2135	0.1938
Sept. 6	0.0785	0.1094	0.0928	0.1149	0.0943	0.0478
Sept. 13	0.1136	0.1565	0.1334	0.0000	0.1243	0.0969
Sept. 20	0.0202	0.0932	0.0540	0.0000	0.0503	0.0307
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Sample Size	147	131	278	22	300	91

Appendix B.2. Estimated weekly proportion of the total drift gill net catch of coded-wire tagged Taku River coho salmon in District 111, 1989.

	Tagging Location					
Mid-Week Date	Yehring Creek	Canadian Mainstem	Yehring Creek & Mainstem	Tatsamenie River	Dudidontu River	All Taku Tags
June 21	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
June 28	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
July 5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
July 12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
July 19	0.0000	0.0000	0.0000	0.0000	0.4428	0.0077
July 26	0.0110	0.0000	0.0066	0.0000	0.0000	0.0057
Aug. 2	0.0000	0.0000	0.0000	0.0000	0.3476	0.0061
Aug. 9	0.0281	0.0000	0.0168	0.0000	0.2096	0.0183
Aug. 16	0.0996	0.0740	0.0893	0.0000	0.0000	0.0777
Aug. 23	0.2108	0.2191	0.2141	0.3415	0.0000	0.2247
Aug. 30	0.3400	0.2777	0.3149	0.5510	0.0000	0.3359
Sept. 6	0.1276	0.0344	0.0902	0.1075	0.0000	0.0905
Sept. 13	0.0839	0.1744	0.1203	0.0000	0.0000	0.1047
Sept. 20	0.0990	0.2204	0.1478	0.0000	0.0000	0.1287
Total	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Sample Size	65	38	103	16	3	122

Appendix B.3. Estimated weekly proportion of the total migration of Tatsamenie River coho salmon at Canyon Island based on spaghetti tag recoveries compared with the weekly proportion of total total fishwheel CPUE of coho salmon, 1988-1989.

	1988			1989		
Stat. Week	Mid-Week Date	Tatsamenie River	Fishwheel CPUE	Mid-Week Date	Tatsamenie River	Fishwheel CPUE
27	June 29	0.000	0.000	July 5	0.000	0.001
28	July 6	0.000	0.003	July 12	0.000	0.008
29	July 13	0.000	0.016	July 19	0.046	0.013
30	July 20	0.000	0.040	July 26	0.044	0.038
31	July 27	0.000	0.031	Aug. 2	0.000	0.053
32	Aug. 3	0.000	0.051	Aug. 9	0.038	0.070
33	Aug. 10	0.062	0.086	Aug. 16	0.485	0.215
34	Aug. 17	0.218	0.194	Aug. 23	0.231	0.132
35	Aug. 24	0.193	0.087	Aug. 30	0.037	0.050
36	Aug. 31	0.326	0.256	Sept. 6	0.050	0.047
37	Sept. 7	0.201	0.144	Sept. 13	0.069	0.063
38	Sept. 14	0.000	0.091	Sept. 20	0.000	0.187
39	Sept. 21	-	-	Sept. 27	0.000	0.092
40	Sept. 28	-	-	Oct. 4	0.000	0.031
Total		1.000	1.000		1.000	1.000
Sample Size		33	2,158		18	2,243

Appendix B.4. Weekly coho salmon escapement count at the Tatsamenie Weir, 1988-1989.

Mid-Week Date	Year (Weekly Weir Count) 1988	1989
Aug. 24	1	3
Aug. 31	4	4
Sept. 7	4	16
Sept. 14	6	10
Sept. 21	26	75
Sept. 28	52	129
Oct. 5	218	155
Oct.12	225	101
Oct. 19	36	86
Oct. 26	37	102
Nov. 2	23	13
Nov. 9	11	-
Number remaining downstream from the weir	20	18
Total Escapement	663	712
Dates of Operation	July 31- Nov. 8	Aug. 4- Oct. 30