**Fishery Data Series No. 02-29**

# Production of Coho Salmon from the Unuk River, 2000–2001

**by**

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**and**

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**Alaska Department of Fish and Game** **Division of Sport Fish**

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**Weights and measures (metric)**

| | |
|---|---|
| centimeter | cm |
| deciliter | dL |
| gram | g |
| hectare | ha |
| kilogram | kg |
| kilometer | km |
| liter | L |
| meter | m |
| metric ton | mt |
| milliliter | ml |
| millimeter | mm |

**Weights and measures (English)**

| | |
|---|---|
| cubic feet per second | $ft^3/s$ |
| foot | ft |
| gallon | gal |
| Inch | in |
| mile | mi |
| ounce | oz |
| pound | lb |
| quart | qt |
| yard | yd |

Spell out acre and ton.

**Time and temperature**

| | |
|---|---|
| day | d |
| degrees Celsius | °C |
| degrees Fahrenheit | °F |
| hour (spell out for 24-hour clock) | h |
| minute | min |
| second | s |

Spell out year, month, and week.

**Physics and chemistry**

| | |
|---|---|
| all atomic symbols | |
| alternating current | AC |
| ampere | A |
| calorie | cal |
| direct current | DC |
| hertz | Hz |
| horsepower | hp |
| hydrogen ion activity | pH |
| parts per million | ppm |
| parts per thousand | ppt, ‰ |
| volts | V |
| watts | W |

**General**

| | |
|---|---|
| All commonly accepted abbreviations. | e.g., Mr., Mrs., a.m., p.m., etc. |
| All commonly accepted professional titles. | e.g., Dr., Ph.D., R.N., etc. |
| And | & |
| At | @ |
| Compass directions: | |
| east | E |
| north | N |
| south | S |
| west | W |
| Copyright | © |
| Corporate suffixes: | |
| Company | Co. |
| Corporation | Corp. |
| Incorporated | Inc. |
| Limited | Ltd. |
| et alii (and other people) | et al. |
| et cetera (and so forth) | etc. |
| Exempli gratia (for example) | e.g., |
| id est (that is) | i.e., |
| latitude or longitude | lat. or long. |
| monetary symbols (U.S.) | $, ¢ |
| months (tables and figures): first three letters | Jan,...,Dec |
| number (before a number) | # (e.g., #10) |
| pounds (after a number) | # (e.g., 10#) |
| registered trademark | ® |
| trademark | ™ |
| United States (adjective) | U.S. |
| United States of America (noun) | USA |
| U.S. state and District of Columbia abbreviations | use two-letter abbreviations (e.g., AK, DC) |

**Mathematics, statistics, fisheries**

| | |
|---|---|
| alternate hypothesis | $H_A$ |
| base of natural logarithm | e |
| catch per unit effort | CPUE |
| coefficient of variation | CV |
| common test statistics | F, t, $\chi^2$, etc. |
| confidence interval | C.I. |
| correlation coefficient | R (multiple) |
| correlation coefficient | r (simple) |
| covariance | cov |
| degree (angular or temperature) | ° |
| degrees of freedom | df |
| divided by | ÷ or / (in equations) |
| equals | = |
| expected value | E |
| fork length | FL |
| greater than | > |
| greater than or equal to | ≥ |
| harvest per unit effort | HPUE |
| less than | < |
| less than or equal to | ≤ |
| logarithm (natural) | ln |
| logarithm (base 10) | log |
| logarithm (specify base) | $\log_2$, etc. |
| mideye-to-fork | MEF |
| minute (angular) | ' |
| multiplied by | x |
| not significant | NS |
| null hypothesis | $H_O$ |
| percent | % |
| Probability | P |
| Probability of a type I error (rejection of the null hypothesis when true) | α |
| probability of a type II error (acceptance of the null hypothesis when false) | β |
| second (angular) | " |
| standard deviation | SD |
| standard error | SE |
| standard length | SL |
| total length | TL |
| variance | var |

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# ABSTRACT

In 2001, a stock assessment study of coho salmon *Oncorhynchus kisutch* was conducted on the Unuk River near Ketchikan, Alaska. A smolt coded-wire-tagging and an adult mark-recapture study were conducted to estimate a number of population parameters. Information based on recoveries of adult coho salmon with coded wire tags placed in smolt during the spring of 2000 was used to estimate smolt abundance and adult exploitation rate and production from the Unuk River. Baited minnow traps were fished daily on the Unuk River from 28 March through 4 May 2000. Coho salmon smolt ≥ 70 mm fork length (FL) were marked with valid coded wire tags; 11,020 with code 04-02-58 from 2 April to 21 April and 10, 279 with code 04-02-59 between 22 April and 4 May 2000. Sampled smolt averaged 84 mm FL and 6.1 g in weight. In 2001, 313 adult coho salmon were recovered bearing coded wire tags, 234 of which were random fishery recoveries. These random recoveries represent an estimated harvest of 32,633 (SE = 6,276) coho salmon in U.S. marine waters. Of this harvest, the troll fishery took an estimated 44%, seine fisheries took 37%, drift gillnet fisheries took 10%, and recreational fisheries took 8%. An estimated 35,022 (SE = 7,161) adults returned to the Unuk River, as determined by a mark-recapture study coupled with a radiotelemetry study. The latter study showed an estimated 425 failed to move upstream as a result of being handled in the mark-recapture experiment. Estimated total run (i.e., escapement, harvest, and inriver handling-induced loss) in 2001 for all coho salmon bound for the Unuk River is 68,080 (SE = 9,460); marine exploitation rate on this run was an estimated 48% (SE = 6.9%). Estimated smolt abundance in 2000 was 577,343 (SE = 70,720), as estimated using Chapman's modification of the Peterson estimator, and the estimated marine survival rate was 11.8% (SE = 2.2%) from 2000-1.



Key words: coho salmon, *Oncorhynchus kisutch*, Unuk River, harvest, troll fishery, seine fishery, drift gillnet fishery, recreational fishery, mark-recapture, radiotelemetry, escapement, total run, exploitation rate, marine survival


# INTRODUCTION

The Unuk River originates in a heavily glaciated area of northern British Columbia and flows for 129 km where it empties into Burroughs Bay 85 km northeast of Ketchikan, Alaska; the lower 39 km of the river is in Southeast Alaska (SEAK) (Figure 1). The percentage of coho salmon *Oncorhynchus kisutch* production originating from the Canadian portion of the river has not been estimated directly; however, information gathered during the first three years of study indicates that as much as 25% of the production likely occurs in Canada (Jones et al. 1999, 2001a, 2001b). Field observations from juvenile coded-wire-tagging (CWT) projects lead us to believe that most rearing takes place in the lower 39 km of the river (Dave Magnus, Alaska Department of Fish and Game, Juneau, personal communication) yet no substantial trapping has occurred above the border. The primary spawning tributary within Canada is at Boundary Lake, located about 2 km upriver of the border. While this lake itself offers rearing habitat, any movement by juvenile fish out of the lake and downriver will essentially mean the fish have moved into the U.S. portion of the river. In SEAK, coho salmon systems are surveyed annually for estimates of spawning abundance. Coho salmon spawning abundance is surveyed annually on the Eulachon River, the lowermost spawning tributary on the Unuk River, and peak counts since 1990 range from 235 to 929 fish, with an average of 540.

Juvenile coho salmon in the Unuk River were first marked with CWTs in 1983, and this study continued through 1986 (Hubartt and Kissner 1987). These efforts, combined with recent efforts, 1996–2001, indicate that Unuk River coho salmon contribute significantly to commercial and recreational fisheries in SEAK. Coho salmon returning to the Unuk River are caught in commercial troll, seine, and drift gillnet fisheries in Southeast Alaska. They also contribute to recreational fisheries in Sitka, Craig and Ketchikan before entering the Unuk River (Figure 2), and there is a small freshwater sport fishery on the Unuk River in which approximately 100 coho salmon are harvested annually. Coho salmon originating from the Unuk River produced total runs of 57,811, 55,147, and 31,740 salmon in 1998, 1999, and 2000, respectively (Table 1), and on average contributed

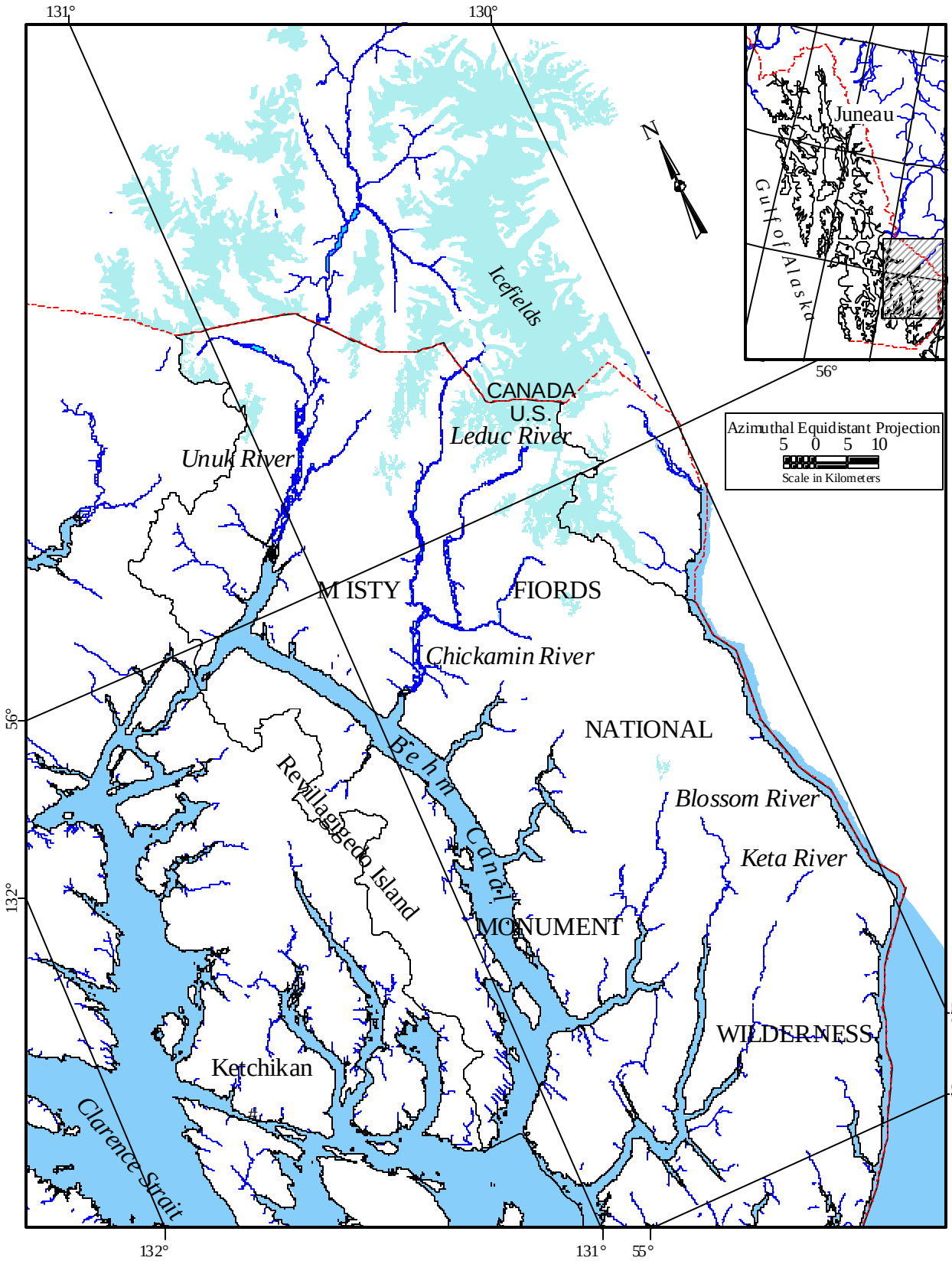


**Figure 1.–Behm Canal area in Southeast Alaska and location of major coho salmon systems.**

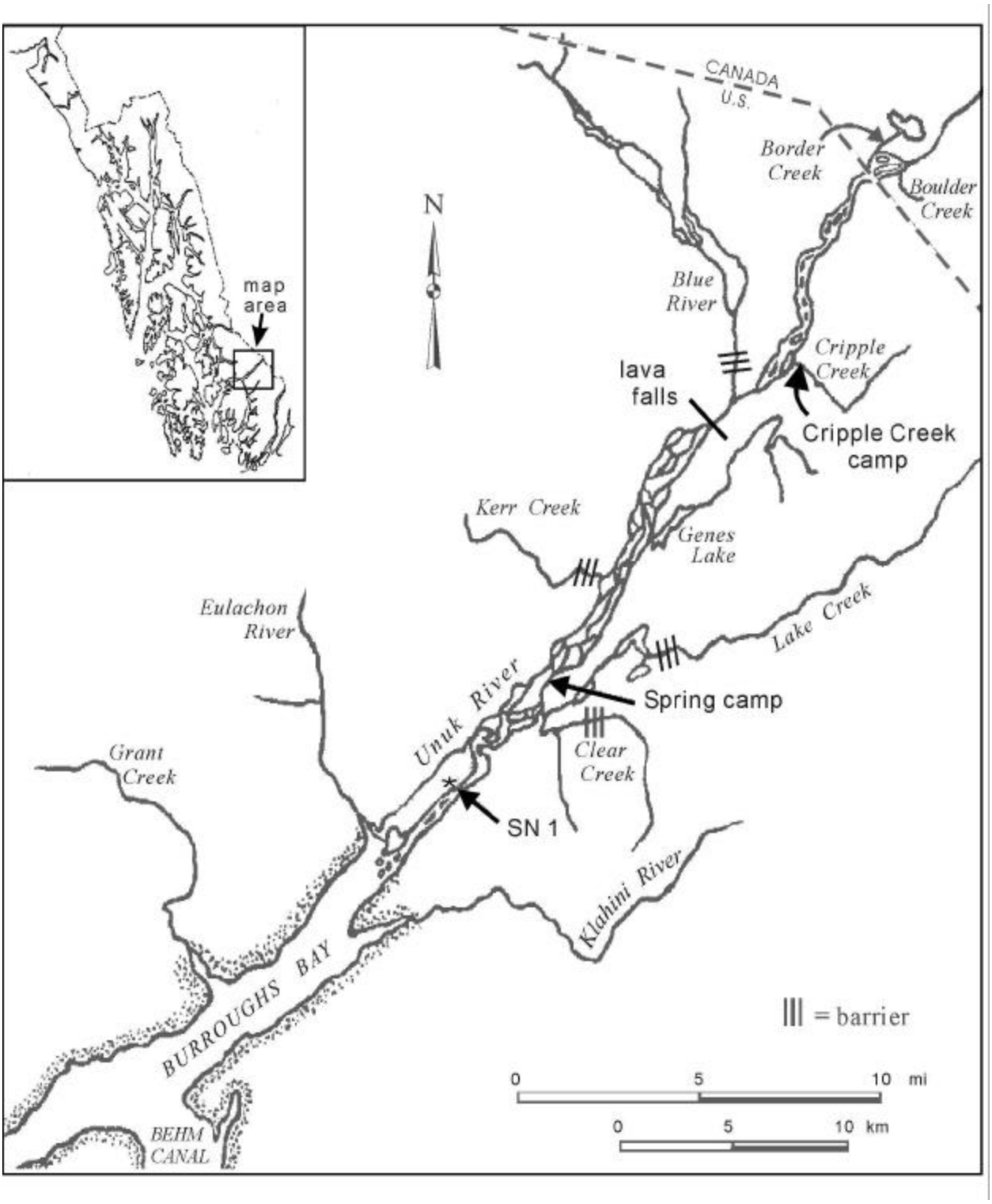


**Figure 2.–Unuk River area in Southeast Alaska, showing major tributaries, barriers to salmon migration, and location of ADF&G research sites.**

**Table 1.–Parameters estimated during coho salmon studies on the Unuk River, 1998–2001.**

| Parameters | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|
| Total run | 57,811 | 55,147 | 31,740 | 67,948 |
| SE | 8,158 | 13,201 | 6,764 | 9,521 |
| Total harvest | 45,388 | 29,300 | 14,826 | 32,502 |
| SE | 7,461 | 2,950 | 3,510 | 6,275 |
| Total escapement | 12,422 | 25,846 | 16,845 | 35,022 |
| SE | 3,298 | 12,867 | 5,782 | 7,161 |
| Marine survival | 7.1% | 9.8% | 3.9% | 11.8% |
| SE | 2.0% | 2.9% | 1.5% | 2.2% |
| Exploitation | 79% | 53% | 47% | 48% |
| SE | 5.3% | 12.6% | 10.3% | 6.9% |
| Tag loss | 181 | 258 | 69 | 425 |
| % | 24.4% | 28.2% | 15.2% | 26.5% |
| Smolt abundance | 809,677 | 562,796 | 819,475 | 577,343 |
| SE | 189,345 | 101,122 | 257,309 | 70,720 |
| Smolt avg. length (mm) | 84.04 | 88.87 | 86.47 | 83.88 |
| SE | 0.51 | 0.62 | 0.56 | 0.42 |
| Smolt avg. weight (g) | 5.76 | 6.92 | 6.51 | 6.12 |
| SE | 0.28 | 0.15 | 0.13 | 0.10 |

an estimated 4% of the District 101 gillnet catch and 9.3% of the Ketchikan marine recreational harvest (Jones et al. 1999, 2001a, 2001b). This is the fourth year of a full stock assessment study designed to estimate the production of coho salmon from the Unuk River.

Objectives of the 2000–2001 study were to estimate: (1) abundance, mean length, and age composition of coho salmon smolt leaving the Unuk River in 2000; (2) marine recreational and commercial harvest of adult coho salmon bound for the Unuk River in 2001; and (3) escapement and age composition of returning adult coho salmon in 2001. These objectives were accomplished by tagging and sampling smolt in the spring of 2000 and through the operation of an adult coho salmon mark-recapture study in 2001.

# METHODS

## SMOLT CAPTURE, CODED-WIRE-TAGGING, AND LENGTH-WEIGHT SAMPLING

Between 26 and 133 G-40 minnow traps, baited with salmon roe, were fished daily for 24 h from 28 March to 4 May between approximately river km 10 and 26 along both banks of the Unuk River. Traps were located along mainstem banks and in some backwater areas, depending on river levels. Minnow traps were checked daily when water levels were stable and more frequently when water levels were unstable. Two teams consisting of two personnel each were used to set and fish traps on a regular basis. Generally, one crew was responsible for traps set upstream of Spring Camp located at river km 14 and one crew responsible for traps downstream of camp. Early in the season, water levels were low and ice and snow restricted fishing to the mainstem banks. These conditions slowly changed within the first few weeks, and after that time, most suitable habitat was accessible.

Juvenile fish were removed from minnow traps during each visit, transported to holding pens at camp, and CWTd each day. Coho and chinook salmon *O. tshawytscha* smolt were separated by inspection from other species of salmon and Dolly Varden *Salvelinus malma*. Smolt were carefully examined and separated by species using a combination of external morphological characteristics. A lack of pigmentation or a clear 'window' in the adipose fin indicates a chinook salmon smolt (Meehan and Vania 1961; McConnell and Snyder 1972), whereas a coho salmon smolt has a mottled or speckled adipose fin. In addition, chinook salmon smolt generally appear silvery when viewed from the side, in contrast to coho salmon smolt, which are often darker with a purple hue. Coho salmon smolt often have narrower par marks, a greater number of small, darkly pigmented spots when viewed dorsally, and longer anterior rays on their anal fins (Pollard et al. 1997). All live coho salmon smolt ≥70 mm FL were tranquilized in a water solution of tricain methane-sulfonate (MS 222) buffered with sodium bicarbonate. To alleviate stress on fish, effort was made to keep the MS 222 solution at a constant river temperature by frequent water changes and tranquilized fish were kept at small numbers for quick sampling and tagging. All fish were tagged with a CWT and externally marked by removal of the adipose fin as described in Koerner (1977). All chinook salmon smolt =50 mm FL were also tagged, albeit with different tag codes for identification purposes.

Tagged fish were held overnight and then released the following morning after being checked for tag retention and mortality. The

number of fish tagged, the number that died in the holding pen, and the number of fish that had shed their tags were compiled and recorded on *ADF&G CWT Tagging Summary and Release Information Forms.* These forms are submitted to the Commercial Fisheries Division (CFMD) Tag Lab in Juneau after the field season. Length and weight composition of emigrating coho salmon smolt in 2000 was estimated by systematically sampling every 33rd smolt captured. Each sampled smolt was measured to the nearest mm FL and weighed to the nearest 0.1 g.

## ESTIMATE OF SMOLT ABUNDANCE

Abundance of smolt in 2000 was estimated with a two-event mark-recapture study using Chapman's modification of the Petersen estimate (Chapman 1951):

$$\hat{N}_s = \frac{(n_c+1)\,(n_e+1)}{(m_a+1)} - 1 \qquad (1)$$

$$\mathrm{var}\left[\hat{N}_s\right] = \frac{(n_c+1)(n_e+1)(n_c-m_a)(n_e-m_a)}{(m_a+1)^2(m_a+2)} \qquad (2)$$

where $N_s$ is number of smolt emigrating in 2000, $n_c$ is the number of smolt marked by removing the adipose fin in 2000, $n_e$ the number of adults sampled during Event 1 in 2001, and $m_a$ the number of adults in that sample missing adipose fins. The general assumptions (Seber 1982) that must hold for $\hat{N}$ to be a suitable estimate of abundance follow:

*(a)* every fish has an equal probability of being marked in Event 1, or every fish has an equal probability of being captured in Event 2, or marked fish mix completely with unmarked fish;

*(b)* recruitment and death (emigration) do not both occur between sampling events;

*(c)* marking does not affect the catchability of a fish;

*(d)* fish do not lose their marks in the time between the two events;

*(e)* all marks are reported on recovery in Event 2; and

*(f)* double-sampling does not occur.

The validity of these assumptions is evaluated in the Discussion section below.

## RADIOTELEMETRY

In 2001, in order to estimate the proportion of fish tagged during Event 1 which either suffered handling mortality or left the Unuk River prior to spawning, a radiotelemetry study was conducted. Between 17 August and 19 September, Advanced Telemetry Systems (ATS) radio transmitters (151 MHz) were inserted esophageally into the stomachs (Eiler 1990) of healthy adult coho salmon. Radio tags were placed in one out of approximately every 25 coho salmon captured in the set gillnet in an effort to distribute them in proportion to the immigration. Every fish that received a radio transmitter was also tagged with a spaghetti tag, given secondary marks, and sampled for age, sex, and length (ASL).

Aerial tracking flights were conducted 30 August, 14 September, 4 October, and 9 November to locate radio transmitters. The pilot and an experienced member of the crew surveyed the entire U.S. portion of the Unuk River and into Canada as far as river km 56 searching for transmitters. In addition to aerial surveys, two remote radio towers were placed just upstream of camp on each bank directly across from the other at approximately river km 15. Radiotagged fish that swam past these towers were recorded on remote data loggers. The radio towers were constructed and operated as described in Eiler (1995), except that they did not have satellite uplink capabilities. A reference tag was used to check whether or not each tower was operational and data loggers were checked periodically for the indication of fish movement. A handheld receiver was also used by project personnel at the set gillnets and during escapement sampling to locate transmitters. Fish were presumed to have spawned if they were tracked upstream of the tagging site (>river km 6) or to the Eulachon River by aerial survey, by a positive reading at one of the radio towers, or by detection via handheld receiver on the spawning grounds. Fish not located by any method or located below the set gillnet site (SN1; Figure 3, 4), or located outside the system, were considered mortalities.

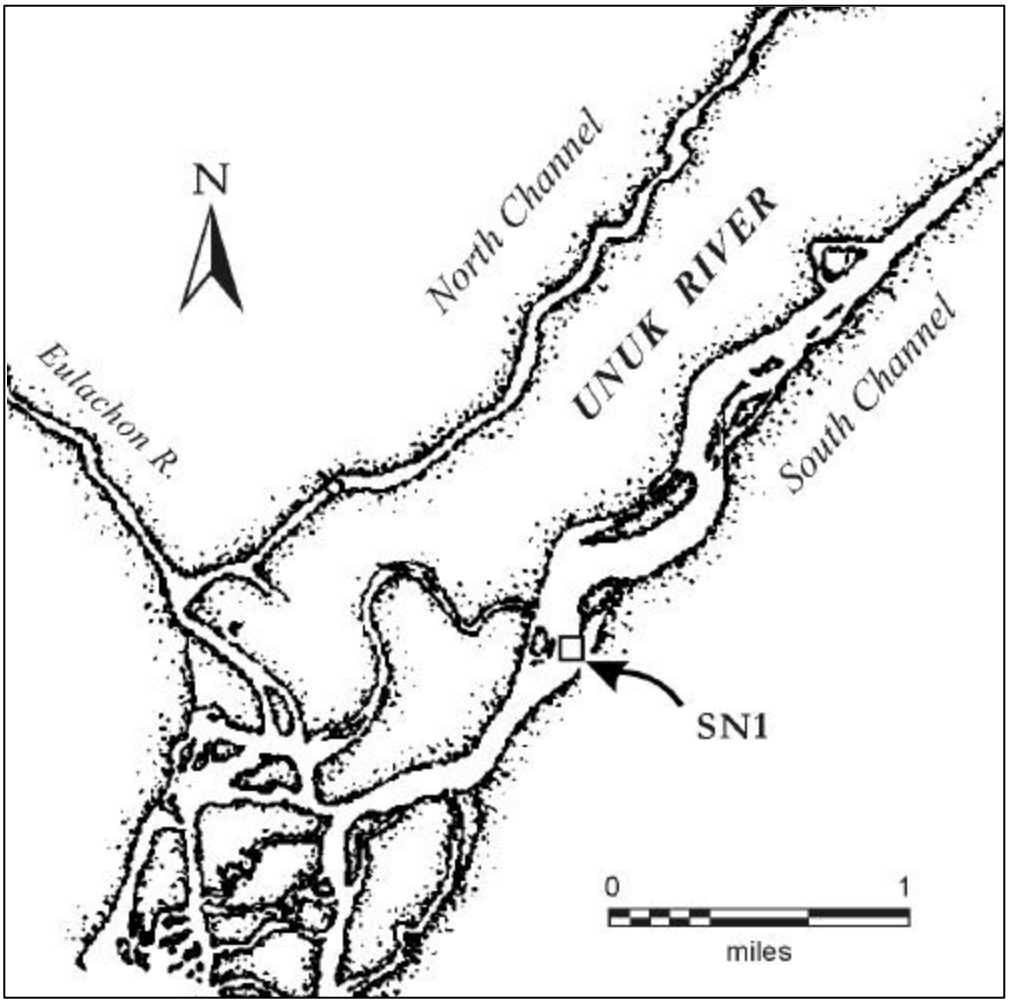


**Figure 3.–Location of the set gillnet site (SN1) on the lower Unuk River in 2001.**

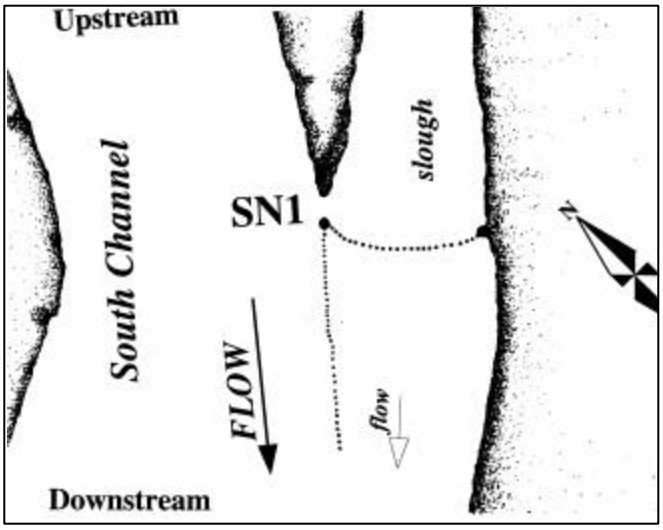


**Figure 4.–Detailed drawing of the net placement used at the set gillnet site (SN1) on the lower Unuk River in 2001.**

## ESTIMATE OF ESCAPEMENT

A two-event mark-recapture study was used to estimate the escapement of adult coho salmon into the Unuk River in 2001. In Event 1, fish were captured in the lower river at SN1 between 2 August and 21 September using two set gillnets. Both gillnets were 37 m (120 ft) long by 4 m (14 ft) deep. One gillnet used 14-cm (5? ") stretch mesh and the second gillnet had 11.5-cm (4½") stretch mesh. In the 1998–2000 Unuk coho salmon studies (Jones et al. 1999, 2001a, 2001b) and in previous studies on chinook salmon (Jones et al. 1998; Jones and McPherson 1999, 2000), sufficiently high numbers of fish were caught using gillnets fished at SN1. SN1 is located on the south channel of the lower Unuk River at approximately river km 3 and is downstream of all known coho salmon spawning tributaries with the exception of the Eulachon River (Figure 3). Later, during Event 2, fish were sampled on the spawning grounds for primary and secondary marks and sampled for ASL with a variety of gear types. During Event 1, set gillnets were fished at SN1 (Figure 4) by each crew (two crews) for 5 hours per day, 6 days a week. One net (a cross net) was attached to the shore and ran directly across a small slough to a fixed buoy placed just downstream of a small island (perpendicular to the main flow of the Unuk River). Another net (a lead net) was attached to the same buoy and fished downstream along the eddy line created between the mainstem flow and the side slough. The 11.5- and 14-cm stretch mesh gillnets were alternated daily between cross and lead net positions.

All fish captured, regardless of condition and not including recaptures, were sampled for age, sex, and length (ASL) prior to their release. Length in MEF was measured to the nearest 5 mm and sex was determined from secondary maturation characteristics. Four scales approximately 2 cm apart were taken from the preferred area on the left side of the fish. The preferred area is two to three rows above the lateral line and between the posterior terminus of the dorsal fin and the anterior margin of the anal fin (Scarnecchia 1979). Scales were mounted on gum cards capable of holding scales from 10 fish as described in ADF&G (1993). The age of each fish was later determined from the pattern of circuli as seen on images of scales impressed into acetate cards (Clutter and Whitesel 1956; Moser 1968) under 70× magnification. Fish missing adipose fins were noted as such and then sacrificed by having their heads removed and sent to the Tag Lab in Juneau for detection and decoding of CWTs.

Each captured fish possessing an adipose fin and not previously sampled was given three different marks: a uniquely numbered solid-core spaghetti tag, a clip of the left axillary appendage (LAA), and a left upper operculum punch (LUOP) ¼" in diameter. The two secondary marks enable detection of primary tag loss. The spaghetti tag (primary tag) consisted of a 5.71-cm (2¼") section of laminated Floy tubing shrunk onto a 38-cm (15") piece of 80-lb-test monofilament fishing line. The monofilament was sewn through the back just behind the dorsal fin and secured by crimping both ends of the monofilament in an aluminum line crimp and excess line was cut off. Each spaghetti tag was printed with a unique number and an ADF&G contact phone number.

In Event 2, salmon were sampled for the presence of spaghetti tags and secondary marks on the spawning grounds, specifically at the Eulachon River, Lake, Boundary, Gene's Lake, Kerr, Cripple, and Clear creeks, as well as Cutthroat and Grizzly sloughs (Figure 2). Various gear types, such as rod and reel snagging, bait and lures, and pieces of gillnet were used to sample fish. The use of multiple gear types has been shown to reduce bias in estimates of age, sex, and length composition when sampling chinook salmon (Jones et al. 1998; Jones and McPherson 1999, 2000). In addition, set gillnets were fished at three separate upriver locations in 2001 to collect additional recovery information. These sites were located at approximately km 13, 15, and 17, and each site used a net configuration similar to that at SN1. All fish inspected during Event 2 activities were given a left lower operculum punch (LLOP) to prevent double sampling of fish. Sampled fish were closely examined for the presence of adipose fins, the primary tag, LUOPs, LLOPs, and LAAs. All fish were sampled for ASL data using the same techniques applied at SN1.

Escapement of Unuk River coho salmon adults in 2001 was estimated using Chapman's modification of the Petersen estimate (Seber 1982):

$$\hat{N}_e = \frac{(\hat{n}_1 + 1)(n_2 + 1)}{(m_2 + 1)} - 1 \qquad (3)$$

where $\hat{N}_e$ is the number of adult coho salmon immigrating into the Unuk River in 2001, $\hat{n}_1$ is the estimated number of fish marked during Event 1 that immigrated into the river, $n_2$ is the number inspected for marks during Event 2, and $m_2$ is the number of $n_2$ that possessed marks applied during Event 1. To adjust for the proportion of fish tagged during Event 1 that either died as a result of handling induced stress or left the study area prior to spawning (i.e., determined by the radiotelemetry study), $\hat{n}_1$ was estimated:

$$\hat{n}_1 = n_1'(1 - \hat{y}) \qquad (4)$$

where $n_1'$ is the number of salmon marked and $\hat{y}$ is the estimated proportion of marked fish that either died or left the system prior to spawning. The general assumptions of the Petersen estimate are shown above under *Estimate of Smolt Abundance*. To provide evidence that assumption *a* was met, two $?^2$ tests were performed: (1) for equal marked fractions by sampling location in Event 2; and (2) equal probabilities of recapture in Event 2 independent of the time stratum of origin. If the null hypothesis of either test were accepted, the pooled Petersen estimator (equation 3) would be used to model the mark-recapture data; otherwise a temporally or spatially stratified estimator would be used. Tests were made separately using the SPAS software program (Arnason et al. 1996). We also tested the hypothesis that the marked fraction sampled in Event 2 did not vary with time. If this were the case, stratification of the experiment by time might be appropriate if the first $?^2$ test above was rejected.

The possibility of size- and sex-selective sampling was also investigated, because assumption *a* can be violated in this manner. The hypothesis that fish of different sizes were captured with equal probabilities was tested with two Kolmogorov-Smirnov (K-S) 2-sample tests ($\alpha = 0.1$) (Appendix A1). Sex-selective sampling was investigated using a $?^2$ test to compare the number of males and females caught in the lower river with those caught on the spawning grounds. If significant differences in recorded sex compositions were observed, the abundance estimate could be further stratified by sex to reduce bias. If sex compositions differed significantly, either marking or spawning grounds samples alone could be used to estimate sex composition, although sex determination is known to be more difficult early in the season while marking fish (Ericksen 1999).

Because sampling in the lower river spanned the known immigration timing of coho salmon into the Unuk River and continued without interruption, the study is essentially closed to recruitment (assumption *b*). Assumption *c* was tested using a radiotelemetry study described earlier in the *Radiotelemetry* section. The effect of tag loss (assumption *d*) is virtually eliminated by using the two secondary marks, and all fish captured during Event 2 were inspected for all marks (assumption *e*). Double sampling (assumption *f*) was avoided by marking all fish captured in Event 2 with the LLOP.

Variance, bias, and confidence intervals for $\hat{N}_e$ were estimated with modifications of bootstrap procedures in Buckland and Garthwaite (1991). First, a stochastic value for $\hat{n}_1$ was obtained by drawing a value for $\hat{q} = (1 - \hat{y})$, using the distribution binomial ($t$; $s$, $\hat{q}$) where $t$ is the number of radios associated with successful spawning and $s$ is the sample size to compute $\hat{q} = t / s$. Then a bootstrap sample was drawn with replacement from a sample of size $\hat{N}_e^+$, using the empirical distribution defined by the capture histories (Table 2).

A new set of statistics was generated from each bootstrap sample $\{\hat{n}_1^*, n_2^*, m_2^*\}$, along with a new estimate for abundance $\hat{N}_e^*$. One thousand such bootstrap samples were drawn, creating the empirical distribution $\hat{F}(\hat{N}^*)$, which is an estimate of $\hat{F}(\hat{N}_e)$. The difference between the average $\hat{N}_e^*$ of bootstrap estimates and $\hat{N}_e$ is an estimate of statistical bias in the latter statistic (Efron and Tibshirani 1993). Confidence intervals were estimated from $\hat{F}(\hat{N}_e^*)$ with the percentile method (Efron and Tibshirani 1993). Variance was estimated as

$$\text{var}(\hat{N}_e^*) = (B-1)^{-1}\sum_{b=1}^{B}(\hat{N}_{eb}^* - \overline{\hat{N}}_e^*)^2 \quad (5)$$

where $B$ is the number of bootstrap samples.

## AGE, SEX, AND LENGTH COMPOSITION

The proportion of the spawning population ($\hat{N}_e$) composed of a given age was estimated as a binomial variable from fish sampled during Event 1 using set gillnets:

$$\hat{p}_j = \frac{n_j}{n} \quad (6)$$

$$\text{var}(\hat{p}_j) = \frac{\hat{p}_j(1-\hat{p}_j)}{n-1} \quad (7)$$

where $\hat{p}_j$ is the estimated proportion of the sample of age $j$, $n_j$ is the number of coho salmon of age $j$, and $n$ is the number of coho salmon sampled during Event 1 for which age was determined.

Sex composition and age-sex composition for the escapement and its associated variances were also estimated with the equations above by first redefining the binomial variables in samples to produce estimated proportions by sex $\hat{p}_k$, where $k$ denotes gender (male or female), such that $\sum_k \hat{p}_k = 1$, and by age-sex $\hat{p}_{jk}$, such that $\sum_{jk} \hat{p}_{jk} = 1$. Average lengths by age and sex were calculated using standard procedures.

## ESTIMATE OF HARVEST

The harvest of coho salmon in 2001 originating from the Unuk River was estimated from catch samples in U.S. and Canadian marine commercial and U.S. recreational fisheries and from the escapement. Because several fisheries harvested coho salmon bound for the Unuk River over several months in 2001, harvest was estimated over several strata, each a combination of time, area, and type of fishery. Statistics from the commercial troll fishery were stratified by fishing period and by fishing quadrant. Statistics from drift gillnet and seine fisheries were stratified by week and by fishing district. Statistics from the recreational fishery were stratified by fortnight. Estimates of harvest $\hat{r}_i$ were calculated for each stratum and summed across strata and across fisheries to obtain an estimate of the total $\hat{T}$:

$$\hat{T} = \sum_i \hat{r}_i \quad (8)$$

$$\text{var}[\hat{T}] = \sum_i \text{var}[\hat{r}_i] \quad (9)$$

Variance of the sum of estimates was estimated as the sum of variances across strata, because sampling was independent across strata and across fisheries. A subset of the catch ($H$) in each stratum was counted and inspected, to find fish missing their adipose fin. Of those $a_i$ salmon in this sample

**Table 2.–Capture histories for coho salmon in the population spawning in the Unuk River in 2001** (notation explained in text).

| Capture history | Sample size | Source of statistics |
|---|---|---|
| Number marked | 1,602 | $m_1$ |
| Number marked that survived | 1,177 | $m_1(1-\hat{y})$ |
| Estimated number that failed to move upriver | 425 | $m_1\hat{y}$ |
| Estimated number marked, survived, and not sampled in tributaries | 1,152 | $\hat{n}_1 - m_2$ |
| Estimated number marked, survived, and recaptured in tributaries | 25 | $m_2$ |
| Not marked, but captured in tributaries | 747 | $n_2 - m_2$ |
| Estimated number not marked and not sampled in tributaries | 33,098 | $\hat{N}_e - \hat{n}_1 - n_2 + m_2$ |
| Effective population for simulations | 33,523 | $\hat{N}_e^+ = \hat{N}_e + n_1\hat{y}$ |

without the adipose fin, heads were retrieved from a subset, marked, and sent to Juneau for dissection. Of the $a_i'$ heads that arrived in Juneau, all were passed through a magnetometer to detect a CWT. Of the $t_i$ tags detected, $t_i'$ were successfully decoded under a microscope, after dissection of which $m_i$ had come from the Unuk River (Appendix A2). Oliver (1990) and Hubartt et al. (1999) present details of sampling commercial and recreational fisheries, respectively. The marked fraction with tags that returned to the Unuk River was estimated as $\hat{q}_h = m_e/n_e$, where $m_e$ is the number of adults sampled at SN1 in 2001 that possessed valid detectable CWTs and $n_e$ is the total number of adults sampled at SN1 in 2001. Information from catch and field sampling programs was expanded to estimate harvest and the associated variance of coho salmon bound for the Unuk River for each stratum, using methods and equations from Bernard and Clark (1996) (Table 3).

### MEAN DATE OF HARVEST

Estimates of the mean dates of harvest for marine commercial and recreational fisheries were calculated from the time series of estimated proportions of catches by strata within a fishery following the methods of Mundy (1982)

$$\hat{P}_d = \frac{\hat{H}_d}{\sum_i H_i} \tag{10}$$

where $P_d$ is the fraction of Unuk River coho salmon in a fishery on day $d$. The mean date of harvest $\bar{d}$ in each fishery was calculated as

$$\hat{\bar{d}} = \sum_d d\hat{P}_d \tag{11}$$

### ESTIMATES OF TOTAL RUN, EXPLOITATION, AND MARINE SURVIVAL

Estimates of total run (i.e., harvest and escapement) for coho salmon returning to the Unuk River in 2001 and the associated exploitation rate in marine recreational and commercial fisheries are based on the sum of the estimated harvest and escapement

$$\hat{N}_R = \hat{T} + \hat{N}_e \tag{12}$$

The variance of the estimated run was calculated as the sum of the variances for estimated escapement and harvest

$$\text{var}[\,\hat{N}_R\,] = \text{var}[\,\hat{T}\,] + \text{var}[\,\hat{N}_e\,] \tag{13}$$

The estimate of exploitation rate was calculated as

$$\hat{U} = \frac{\hat{T}}{\hat{N}_R} \tag{14}$$

$$\text{var}\left[\hat{U}\right] \approx \frac{\text{var}[\hat{T}]\,\hat{N}_e^2}{\hat{N}_R^4} + \frac{\text{var}[\hat{N}_e]\,\hat{T}^2}{\hat{N}_R^4} \tag{15}$$

The estimated survival rate of smolt to adults was calculated using

$$\hat{S} = \frac{\hat{N}_R}{\hat{N}_s} \tag{16}$$

$$\text{var}[\,\hat{S}\,] \approx \hat{S}^2\left[\frac{\text{var}[\,\hat{N}_R\,]}{\hat{N}_R^2} + \frac{\text{var}[\,\hat{N}_s\,]}{\hat{N}_s^2}\right] \tag{17}$$

Variances in equations (14) and (16) were approximated using the delta method (Seber 1982).

## RESULTS

### SMOLT CAPTURE, CODED-WIRE-TAGGING, AND SAMPLING

From 28 March to 21 April 2000, 11,084 coho salmon smolt ≥ 70 mm FL were captured and tagged with CWT code 04-02-58. An additional 10,284 coho smolt were captured and tagged from 22 April to 5 May with CWT code 04-02-59. All tagged fish were held overnight for 24 h then checked the following morning for mortality and presence of valid tags. On 1 April, shortly after trapping commenced, rain and snowmelt caused a brief high water event that was followed by a steady decline in water level through 12 April. The river then remained stable through 20 April, after which snowmelt caused a relatively steady rise in river depth through 5 May. Water temperature remained fairly constant throughout this period, at an average of 39°F and a range of 35–40.5°F. Several small dips in water temperature corresponded with concomitant rises in river level from snowmelt (Figure 5). Of the coho

**Table 3.–Estimated marine harvest of adult coho salmon bound for the Unuk River in 2001, where q = 0.0322 and $CV^2(1/q) = 0.0237$.**

| TROLL FISHERY | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stat. Wk. | Date/Period | Quad. | N | v(N) | n | a | a' | t | t' | mc | r^ | SE(r^) | RP(r^) |
| 27-32 | 8/20-9/9 (3) | SE | 65,935 | 0 | 29,793 | 448 | 433 | 317 | 316 | 6 | 428 | 182 | 83% |
| 33-39 | 6/25-8/5 (4) | SE | 60,314 | 0 | 26,651 | 548 | 519 | 421 | 420 | 24 | 1,785 | 434 | 48% |
| 27-32 | 6/25-8/19 (3) | SW | 198,715 | 0 | 114,056 | 1,456 | 1,405 | 1,113 | 1,108 | 29 | 1,633 | 372 | 45% |
| 33-39 | 8/6-8/19 (4) | SW | 36,381 | 0 | 20,201 | 313 | 309 | 256 | 256 | 13 | 736 | 224 | 60% |
| 27-32 | 6/25-8/5 (3) | NE | 144,658 | 0 | 31,008 | 393 | 391 | 327 | 327 | 6 | 874 | 372 | 83% |
| 33-39 | 8/6-8/19 (4) | NE | 73,563 | 0 | 24,190 | 445 | 443 | 379 | 379 | 3 | 285 | 167 | 115% |
| 27-32 | 8/6-8/19 (3) | NW | 828,146 | 0 | 201,968 | 3,821 | 3,801 | 3,198 | 3,191 | 48 | 6,158 | 1,215 | 39% |
| 33-39 | 6/25-8/5 (4) | NW | 432,752 | 0 | 144,857 | 3,368 | 3,338 | 2,926 | 2,923 | 27 | 2,530 | 591 | 46% |
| Subtotal troll fishery | | | 1,840,464 | 0 | 592,724 | 10,792 | 10,639 | 8,937 | 8,920 | 156 | 14,429 | 1,550 | 21% |
| **SEINE FISHERY** | | | | | | | | | | | | | |
| Stat. Wk. | Date | Dist. | N | v(N) | n | a | a' | t | t' | mc | r^ | SE(r^) | RP(r^) |
| 30 | 7/22-7/28 | 101 | 7,351 | 0 | 758 | 31 | 31 | 26 | 26 | 1 | 301 | 301 | 196% |
| 31 | 7/29-8/4 | 101 | 12,206 | 0 | 971 | 25 | 24 | 19 | 19 | 2 | 813 | 580 | 140% |
| 34 | 8/19-8/25 | 101 | 8,563 | 0 | 163 | 4 | 4 | 4 | 4 | 1 | 1,631 | 1,631 | 196% |
| 29 | 7/15-7/21 | 102 | 26,168 | 0 | 145 | 6 | 6 | 4 | 4 | 1 | 5,604 | 5,604 | 196% |
| 32 | 8/5-8/11 | 102 | 10,714 | 0 | 828 | 11 | 10 | 10 | 10 | 2 | 884 | 630 | 140% |
| 34 | 8/19-8/25 | 103 | 16,190 | 0 | 2,467 | 32 | 31 | 26 | 26 | 1 | 210 | 210 | 196% |
| 35 | 8/26-9/1 | 103 | 13,809 | 0 | 922 | 2 | 2 | 1 | 1 | 1 | 465 | 465 | 196% |
| 31 | 7/29-8/4 | 104 | 13,688 | 0 | 3,156 | 32 | 30 | 17 | 17 | 1 | 144 | 143 | 195% |
| 32 | 8/5-8/11 | 104 | 58,296 | 0 | 3,313 | 41 | 41 | 33 | 33 | 1 | 546 | 546 | 196% |
| 33 | 8/12-8/18 | 104 | 19,742 | 0 | 933 | 21 | 21 | 19 | 19 | 1 | 657 | 657 | 196% |
| 33 | 8/12-8/18 | 105 | 2,245 | 0 | 522 | 2 | 2 | 2 | 2 | 1 | 134 | 133 | 195% |
| 35 | 8/26-9/1 | 106 | 8,878 | 0 | 1,207 | 8 | 8 | 8 | 7 | 1 | 261 | 261 | 196% |
| 37 | 9/9-9/15 | 016 | 5,037 | 0 | 1,380 | 9 | 9 | 9 | 9 | 1 | 113 | 113 | 195% |
| 34 | 8/19-8/25 | 107 | 4,035 | 0 | 333 | 3 | 3 | 3 | 3 | 1 | 376 | 376 | 196% |
| 32 | 8/5-8/11 | 112 | 5,579 | 0 | 3,864 | 87 | 87 | 80 | 80 | 1 | 45 | 44 | 194% |
| Subtotal seine fishery | | | 212,501 | 0 | 20,962 | 314 | 309 | 261 | 260 | 17 | 12,186 | 6,012 | 97% |
| **SPORT FISHERY** | | | | | | | | | | | | | |
| Biweek | Date | Area | N | v(N) | n | a | a' | t | t' | mc | r^ | SE(r^) | RP(r^) |
| 15 | 7/16-7/29 | Craig | 14,307 | - | 2,761 | 45 | 45 | 37 | 37 | 2 | 322 | 229 | 139% |
| 16 | 7/30-8/12 | Craig | 15,200 | - | 3,051 | 46 | 45 | 42 | 42 | 2 | 316 | 225 | 139% |
| 15 | 7/16-7/29 | Ketchikan | 2,813 | 563,372 | 1,165 | 56 | 56 | 52 | 52 | 2 | 150 | 110 | 144% |
| 16 | 7/30-8/12 | Ketchikan | 3,368 | 575,161 | 1,283 | 21 | 21 | 20 | 20 | 2 | 163 | 119 | 142% |
| 17 | 8/13-8/26 | Ketchikan | 2,801 | 424,713 | 1,042 | 12 | 12 | 11 | 11 | 2 | 167 | 122 | 143% |
| 18 | 8/27-9/9 | Ketchikan | 9,663 | 2,916,079 | 3,585 | 76 | 76 | 67 | 67 | 9 | 753 | 295 | 77% |
| 19 | 9/10-9/23 | Ketchikan | 5,943 | 1,549,037 | 3,011 | 83 | 82 | 74 | 74 | 6 | 372 | 173 | 91% |
| 14 | 7/2-7/15 | Sitka | 10,816 | 11,969,993 | 2,947 | 43 | 41 | 38 | 37 | 1 | 123 | 122 | 195% |
| 17 | 8/13-8/26 | Sitka | 16,680 | 12,759,327 | 5,340 | 90 | 90 | 81 | 81 | 3 | 291 | 178 | 120% |
| Subtotal sport fishery | | | 81,591 | 30,757,682 | 24,185 | 472 | 468 | 422 | 421 | 29 | 2,657 | 555 | 41% |
| **GILLNET FISHERY** | | | | | | | | | | | | | |
| Stat. Wk. | Date | Dist. | N | v(N) | n | a | a' | t | t' | mc | r^ | SE(r^) | RP(r^) |
| 29 | 7/15-7-21 | 106 | 18,515 | 0 | 4,767 | 202 | 195 | 179 | 178 | 1 | 126 | 125 | 195% |
| 31 | 7/29-8/4 | 106 | 9,508 | 0 | 2,168 | 30 | 30 | 28 | 28 | 1 | 136 | 136 | 195% |
| 34 | 8/19-8/25 | 106 | 11,955 | 0 | 4,813 | 50 | 50 | 38 | 38 | 6 | 463 | 196 | 83% |
| 35 | 8/26-9/1 | 106 | 18,546 | 0 | 5,717 | 30 | 29 | 26 | 26 | 2 | 208 | 148 | 139% |
| 37 | 9/9-9/15 | 106 | 28,478 | 0 | 6,996 | 119 | 118 | 111 | 111 | 6 | 765 | 325 | 83% |
| 40 | 9/30-10/6 | 106 | 12,058 | 0 | 3,839 | 157 | 156 | 137 | 137 | 2 | 196 | 139 | 139% |
| 31 | 7/29-8/4 | 101 | 1,802 | 0 | 644 | 8 | 8 | 7 | 7 | 1 | 87 | 86 | 195% |
| 34 | 8/19-8/25 | 101 | 2,289 | 0 | 1,055 | 16 | 16 | 14 | 14 | 2 | 135 | 95 | 139% |
| 35 | 8/26-9/1 | 101 | 8,187 | 0 | 2,426 | 40 | 40 | 33 | 33 | 3 | 314 | 184 | 115% |
| 36 | 9/2-9/8 | 101 | 4,604 | 0 | 2,252 | 37 | 37 | 36 | 36 | 1 | 63 | 63 | 194% |
| 37 | 9/9-9/15 | 101 | 3,558 | 0 | 313 | 3 | 3 | 3 | 3 | 1 | 353 | 353 | 196% |
| 38 | 9/16-9/22 | 101 | 3,447 | 0 | 365 | 15 | 12 | 10 | 10 | 1 | 367 | 366 | 196% |
| 33 | 8/12-8/18 | 101* | 472 | 0 | 242 | 4 | 4 | 4 | 4 | 1 | 61 | 60 | 194% |
| 35 | 8/26-9/1 | 101'* | 1,929 | 0 | 696 | 11 | 11 | 10 | 10 | 1 | 86 | 86 | 195% |
| Subtotal gillnet fishery | | | 125,348 | 0 | 36,293 | 722 | 709 | 636 | 635 | 29 | 3,360 | 737 | 43% |
| TOTAL | | | 2,259,904 | 30,757,682 | 674,164 | 12,300 | 12,125 | 10,256 | 10,236 | 231 | 32,633 | 6,276 | 38% |

* Indicates MIC

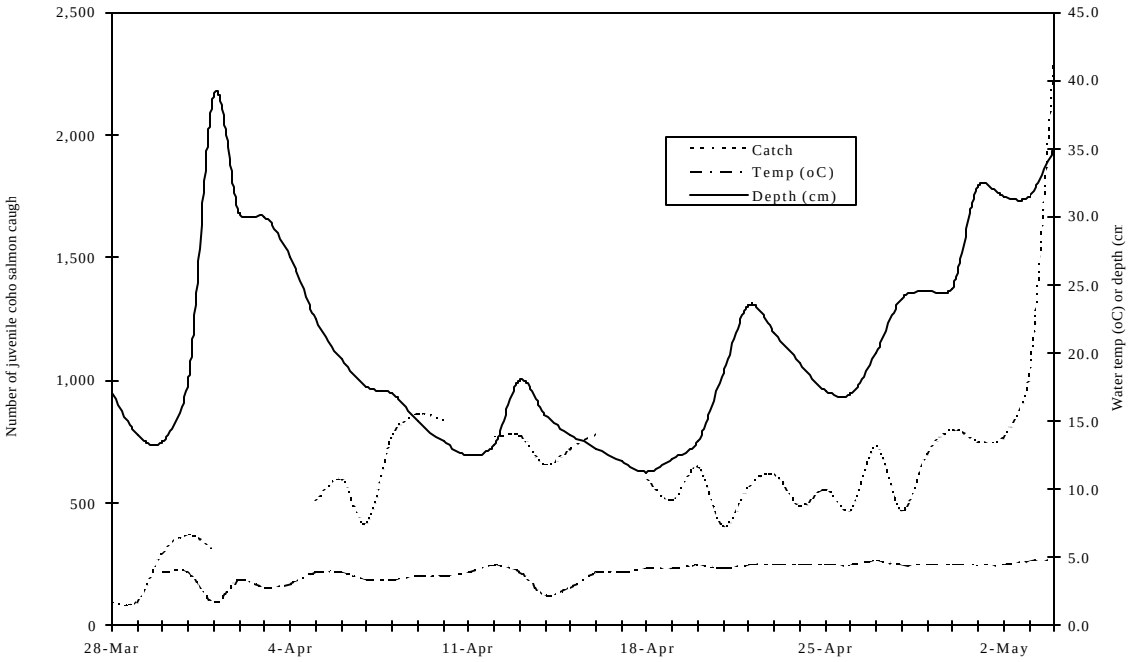


**Figure 5.–Catch of coho salmon smolt ³70 mm FL, daily water temperature, and water depth in the Unuk River in 2000.**

salmon smolt tagged with code 04-02-58, 7 died overnight and 57 lost their tag, resulting in 11,020 valid tags released (Table 4); there were 5 observed mortalities and 17 shed tags among tag code 04-02-59, leaving 10,282 valid tags released. Tagged coho salmon smolt averaged 84 mm FL and 6.1 g in weight (Table 4; Figure 6).

Chinook salmon smolt were also captured and tagged. We tagged 11,127 and 2,209 chinook smolt, respectively, with CWT codes 04-02-56 and 04-02-57. Three died overnight and none lost their tags, for a total of 13,333 valid tags released (Table 4; Figure 6). Tagged chinook smolt averaged 71 mm FL and 3.8 g in weight (Table 4; Figure 6). Detailed analysis of the chinook data will be reported in a separate document in the future.

## ESTIMATE OF SMOLT ABUNDANCE

The fraction of fish with adipose finclips that returned to the Unuk River is estimated as $\hat{q}_s = m_a/n_e$, where $m_a$ is the number of adults sampled in the Unuk River in 2001 during Event 1 that possessed adipose finclips. The estimate of $\hat{q}_s$ is 0.0363 (SE = 0.0045), and the estimate of smolt abundance $\hat{N}_s$ for 2000 is 577,343 (SE = 70,720). Both estimates are based on the 1,708 unique adult coho salmon handled during Event 1. Sixty-two (62) of the fish inspected were missing adipose fins, and 58 were sacrificed to determine the tag codes present; 55 contained valid Unuk River coho tags, two were without tags, and one contained a Unuk River chinook CWT tag.

## RADIOTELEMETRY

Forty-nine (49) fish were tagged with radio tags: 10 pulse-coded and 39 standard. These fish were tracked from the Eulachon River to river km 42 on the Unuk River in Canada (Figure 7; Appendix A3). Of the 49 radio tags released, 36 fish were found in the Unuk River or its tributaries and were presumed to have spawned (Appendix A3). Thus, we estimate $\hat{y}$ = 13/49, to adjust for the proportion of those fish tagged during Event 1 which failed to successfully spawn in the Unuk River as described in equation 4. Approximately 56% of these 36 fish

**Table 4.–Number of salmon smolt caught and subsequently released with valid coded wire tags on the Unuk River in 2000.**

| | | Coho salmon | | | Chinook salmon | | | Water conditions | |
|---|---|---|---|---|---|---|---|---|---|
| **Date** | **Traps checked** | Number | Avg. length (mm) | Weight (g) | Number | Avg. length (mm) | Weight (g) | Temp. (°C) | Depth (cm) |
| 28-Mar | 26 | | | | | | | | 17.0 |
| 29-Mar | 28 | | | | | | | | 14.0 |
| 30-Mar | 85 | | | | | | | 4.0 | 13.5 |
| 31-Mar | 105 | | | | | | | 4.0 | 18.0 |
| 1-Apr | 88 | | | | 1,193 | 68.70 | 3.41 | 1.5 | 39.0 |
| 2-Apr | | 1,165 | 86.68 | 6.69 | | | | 3.0 | 30.3 |
| 3-Apr | | | | | | | | 3.0 | 30.0 |
| 4-Apr | | | | | | | | 3.5 | 27.0 |
| 5-Apr | 103 | | | | | | | 4.0 | 22.5 |
| 6-Apr | 120 | | | | 1,487 | | | 4.0 | 19.5 |
| 7-Apr | 84 | 1,525 | | | | | | 3.0 | 17.5 |
| 8-Apr | 99 | | | | | | | 3.0 | 17.0 |
| 9-Apr | 110 | | | | | | | 3.5 | 15.0 |
| 10-Apr | 107 | | | | | | | 3.5 | 13.5 |
| 11-Apr | | 2,480 | 83.69 | 6.06 | 1,699 | 72.08 | 3.79 | 4.0 | 12.5 |
| 12-Apr | 115 | | | | | | | 4.5 | 13.3 |
| 13-Apr | 116 | | | | | | | 4.0 | 18.0 |
| 14-Apr | 98 | | | | 1,380 | 69.80 | 3.59 | 2.0 | 15.5 |
| 15-Apr | 108 | | | | | | | 3.0 | 14.0 |
| 16-Apr | 117 | | | | 1,432 | | | 4.0 | 13.0 |
| 17-Apr | | 3,699 | 83.97 | 5.88 | | | | 4.0 | 12.0 |
| 18-Apr | 122 | | | | | | | 4.5 | 11.3 |
| 19-Apr | 105 | | | | | | | 4.5 | 12.3 |
| 20-Apr | 133 | | | | 1,980 | 69.06 | 3.47 | 4.5 | 13.5 |
| 21-Apr | 83 | 2,151 | 88.36 | 7.37 | | | | 4.0 | 18.5 |
| 22-Apr | 113 | | | | | | | 4.5 | 23.5 |
| 23-Apr | 122 | | | | 1,203 | 72.48 | 3.98[a] | 4.5 | 21.5 |
| 24-Apr | 97 | 1,673 | | | | | | 4.5 | 19.3 |
| 25-Apr | 119 | | | | 482 | | | 4.5 | 17.3 |
| 26-Apr | 101 | 1,027 | 84.14 | 6.27 | | | | 4.5 | 17.0 |
| 27-Apr | 92 | 731 | | | 268 | | | 4.5 | 20.0 |
| 28-Apr | 127 | 467 | | | | | | 4.5 | 24.0 |
| 29-Apr | 87 | | | | 1,004 | 76.17 | 4.49 | 4.5 | 24.5 |
| 30-Apr | 99 | 1,501 | 82.72 | 5.86 | | | | 4.5 | 24.8 |
| 1-May | 92 | | | | | | | 4.5 | 32.3 |
| 2-May | 94 | | | | 848 | | | 4.5 | 31.5 |
| 3-May | 125 | 2,538 | | | | | | 4.5 | 31.5 |
| 4-May | 113 | 2,325 | 84.58 | 6.21 | 357 | 74.86 | 4.46 | 4.5 | 35.0 |
| 5-May | | | 81.16 | 5.39 | | | | 4.5 | 35.0 |
| **Total** | 3,333 | 21,282 | | | 13,333 | | | | |
| **Max.** | 133 | | | | | | | 4.5 | 39.0 |
| **Min.** | 26 | | | | | | | 1.5 | 11.3 |
| **Average** | 101 | | 83.88 | 6.12 | | 71.47 | 3.80 | 4.0 | 20.6 |
| **Total weighed and/or measured** | | 650 | | 650 | | 271 | 270 | | |
| | | **SD** | 10.69 | 2.67 | | 7.46 | 1.28 | | |
| | | **SE** | 0.42 | 0.10 | | 0.45 | 0.08 | | |

[a] One chinook weight missing on 23 April.

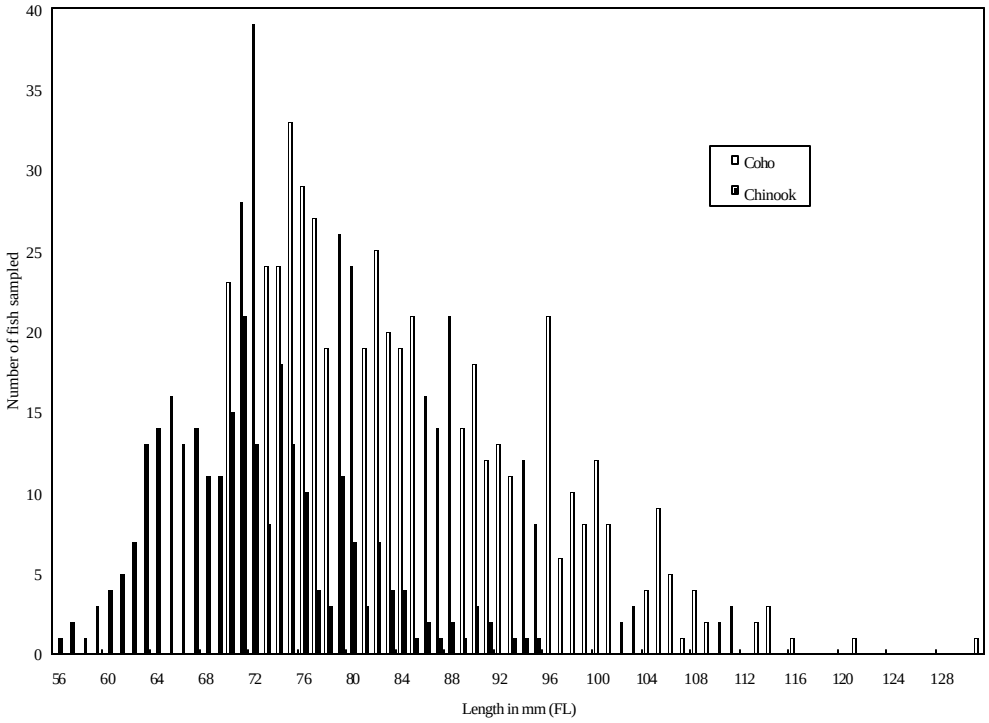


**Figure 6.–Length frequency of coho salmon smolt ³ 70 mm FL and chinook salmon smolt captured and measured in the spring in the Unuk River in 2000.**

were found in the main channel, 19% in the Eulachon River, 8% in Cripple Creek, and 5.5 % in each of Lake Creek, Gene's Lake, and the South Fork of the Unuk River. Twenty-four (24) fish were found past river km 15 where the radio towers were located; 5 fish were recorded at the remote radio towers, and 23 fish were located during aerial surveys upriver of the radio towers. Only 1 of the 5 fish recorded at the towers was not located during an aerial survey; however, 83% of the 23 fish located by aerial survey upriver of the towers were not recorded at the towers. A portable receiver used primarily by escapement sampling personnel located 7 radio-tagged fish. All of these fish were also located by aerial survey but only one of the two passing the radio towers was recorded. No radio tagged fish were recaptured in the set gillnet. One fish (frequency 151.874) was radiotagged at SN1 on 6 September, tracked to mile 25 via aerial survey on 14 September, and subsequently sampled by escapement personnel at Gene's Lake on 20 September. For the 13 fish that did not spawn in the Unuk River, 7 were never located, 4 were mortalities located at or near SN1, 1 was tracked to the Klehini River and 1 to Grant Creek.

## ESTIMATE OF ESCAPEMENT

Of 1,710 coho salmon sampled during Event 1, 1,602 were successfully tagged and released ($n_1'$), and 1,177 were estimated to have survived and spawned in the Unuk River (Table 5). Ninety-six percent (96%) of the catch at SN1 occurred between 11 August and 21 September (Figure 8). Of 106 fish not tagged, 58 were sacrificed for CWTs, 26 were in poor condition, and 22 died in the nets. Two of the tagged fish that were recaptured in the set gillnets died and were removed from the study. One tagged coho was subsequently caught in marine waters approximately 30 miles east of the Unuk River 31 days after being tagged. Of the 58 coho salmon sacrificed for CWTs in Event 1, 55 carried valid coho tags applied during smolt tagging operations on the Unuk River in spring 2000, two were without tags, and one carried a chinook CWT tag from the Unuk River.

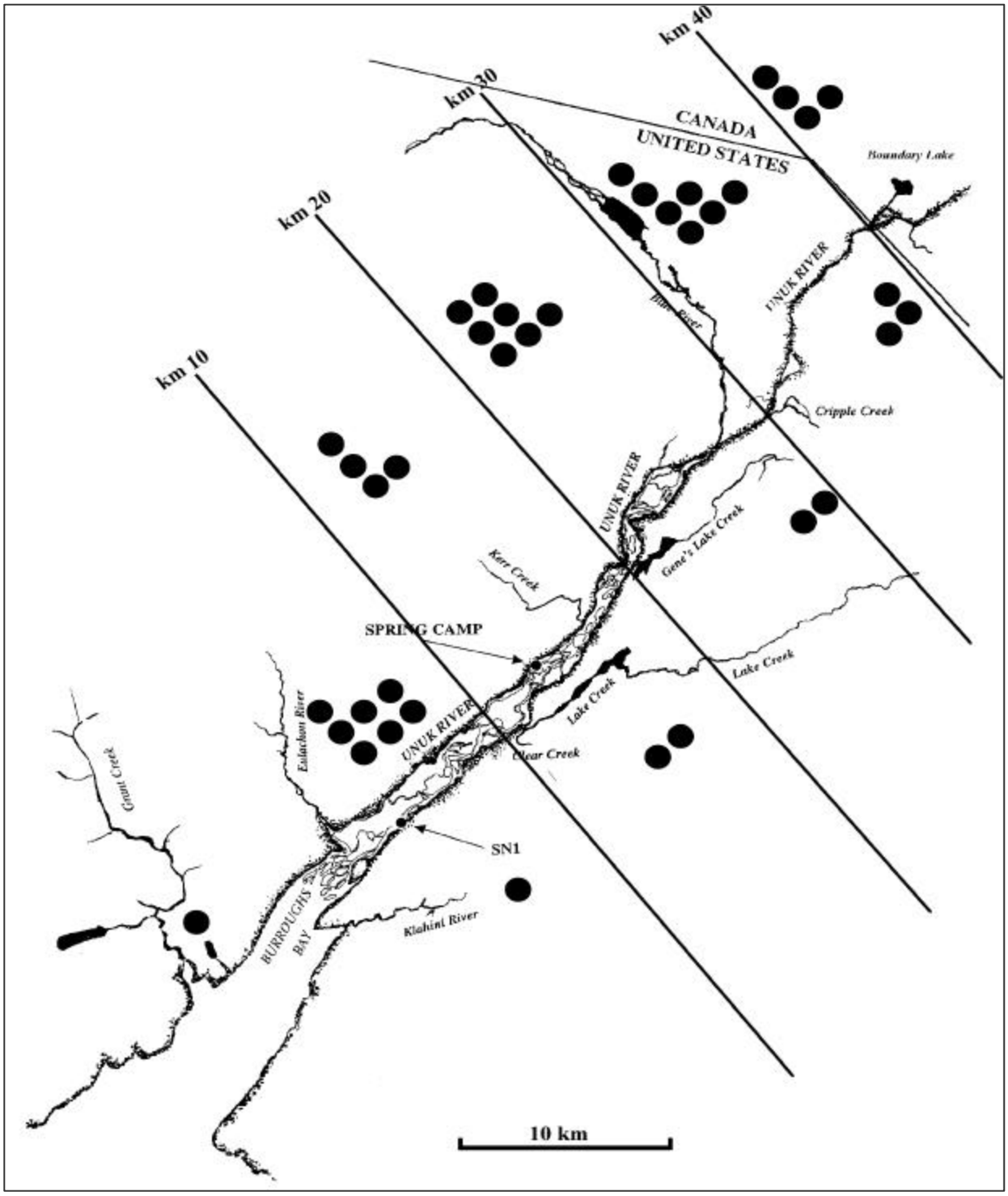


**Figure 7.–Radiotelemetry index map showing the Unuk River** (measured in 10-river-km sections) **and the main coho salmon spawning tributaries.** Each circle refers to the farthest upstream location identified for a radio tagged fish in 2001; dots on top indicate mainstem spawning and dots below refer to spawning in tributaries.

**Table 5.–Number of marked coho salmon released in the lower Unuk River and recaptured by marking period and recovery location and the number examined for marks at each recovery location, 2001.**

| Marking dates | Estimated number marked[a] | Estimated fraction recovered | Recovery location | | |
|---|---|---|---|---|---|
| | | | Downriver | Upriver | Total |
| 8/2–8/31 | 453 | 0.029 | 7 | 6 | 13 |
| 9/1–10/21 | 724 | 0.017 | 9 | 3 | 12 |
| Total/average | 1,177 | 0.021 | 16 | 9 | 25 |
| Number inspected | | | 572 | 200 | 772 |
| Fraction marked | | | 0.028 | 0.045 | 0.032 |

[a] Number marked discounted by the rate of mortality (y = 13/49) as determined by the radiotelemetry study to get the actual number available for sampling during Event 2.

Large catches of pink salmon (in excess of 100/h) severely curtailed fishing effort at SN1 during the first week of August, in order to minimize mortalities. High water and large amounts of debris precluded fishing the set gillnets from 26 to 28 August and from 1 to 2 September. Incessant rainfall caused the Unuk River to flood from 22 to 26 September (cresting at 5 feet above pre-flood levels), during which time fishing at SN1 was ended for the year. Otherwise, fishing effort was maintained at a relatively consistent level throughout the duration of this experiment (Figure 8). From 2 August to 21 September the set gillnets at SN1 were fished for a total of 874 hours. The number of coho captured per hour, or catch per unit effort (CPUE), averaged approximately 2.0 during this period with a maximum value of 13.6 on 14 September.

Sixty (60) coho salmon tagged during Event 1 were subsequently recaptured at SN1; 2 were recaptured twice. The time elapsed between capture events (sulking time) averaged slightly more than 7 days (Appendix A4). The minimum sulking time was 16 minutes as opposed to a maximum value of nearly 30 days.

We sampled 771 coho salmon during Event 2 by various methods at the Eulachon River, Cutthroat and Grizzly sloughs, and Lake, Boundary, Cripple, Genes Lake, and Kerr creeks. One fish was sampled at the upriver set gillnet sites which operated from 19 August to 25 August. Of the 772 coho sampled during Event 2, 25 fish had spaghetti tags applied during Event 1 and all of these had easily identifiable secondary marks. The largest samples were obtained using various gear types at the Eulachon River (328 fish with 6 recoveries), Lake Creek (190 fish with 6 recoveries), Boundary Creek (90 fish with 5 recoveries), and Cripple Creek (90 fish with 3 recoveries). Fish were sampled on the spawning grounds from 16 August through 22 October. Nineteen (19) fish were missing adipose fins and sacrificed and all but one of these fish carried CWTs from coho smolt tagging operations on the Unuk River in 2000.

The length distribution of fish captured during Event 1 in August varied noticeably from those captured in September (Figure 9). The length distributions of fish marked in Event 1 were not significantly different than the length distributions for fish recaptured in Event 2 (P = 0.43; Figure 10). The length distributions of marked fish, however, were significantly different from those of fish inspected on the spawning grounds. (P = 0.00; Figure 11), with generally smaller fish captured at SN1.

Coho salmon marked early in the experiment (before 1 September) and late in the experiment were equally likely to be recaptured ($?^2$ = 0.93; df = 1; P = 0.33). Similarly, the recapture rate during Event 2 did not vary by sampling date (before or after 21 September; $?^2$ = 0.48; df = 1; P = 0.49), or sampling location (downstream or upstream—i.e., Lake Creek, Kerr Creek, and Genes Lake, Mainstem, and Eulachon River vs. Boundary Lake, Cripple Creek, and Grizzly and Cutthroat sloughs; $?^2$ = 01.28; df = 1; P = 0.26).

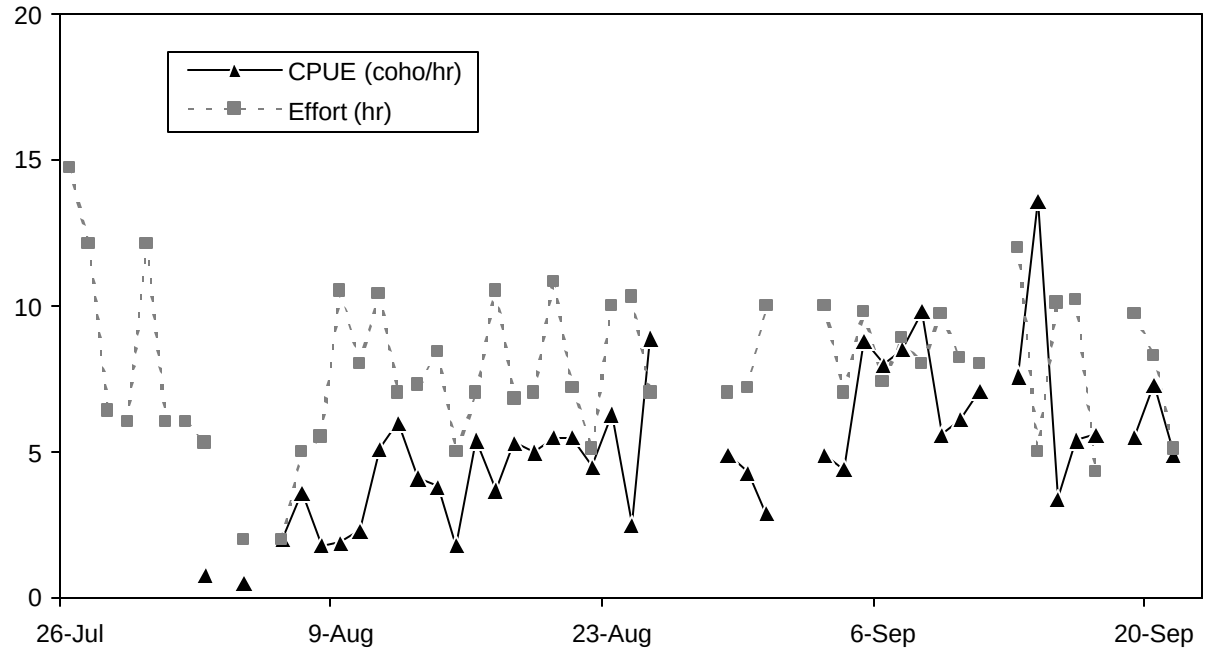


**Figure 8.–Effort (in hours per day) and coho salmon catch per unit effort (CPUE) at SN1 on the Unuk River in 2001.**

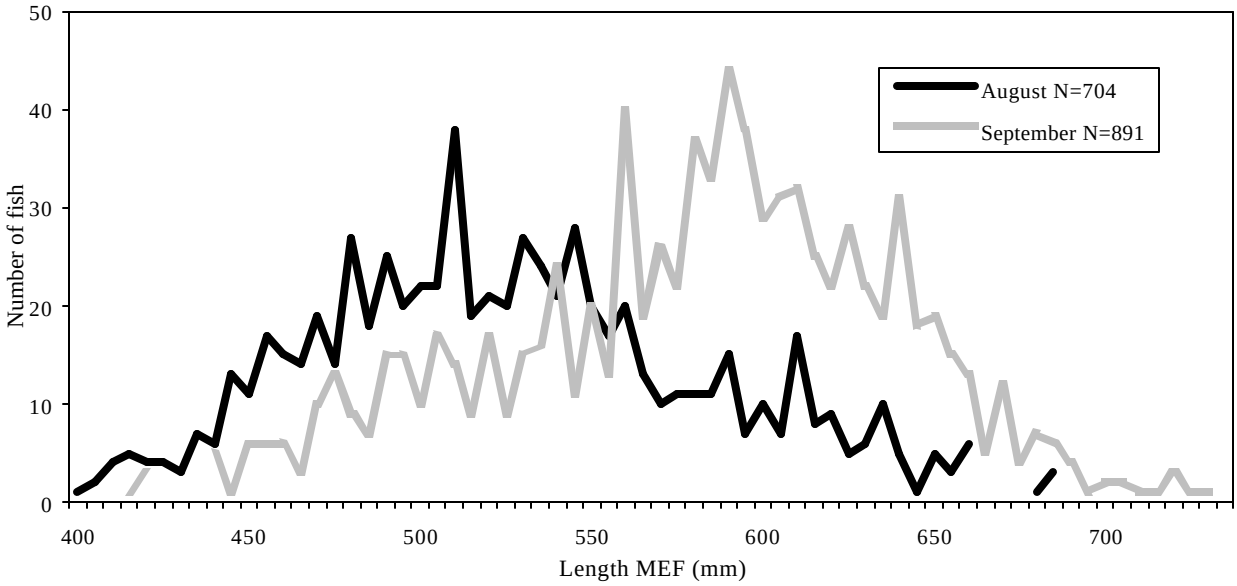


**Figure 9.–Length frequency distributions of coho salmon sampled at SN1 on the Unuk River in August and September, 2001.**

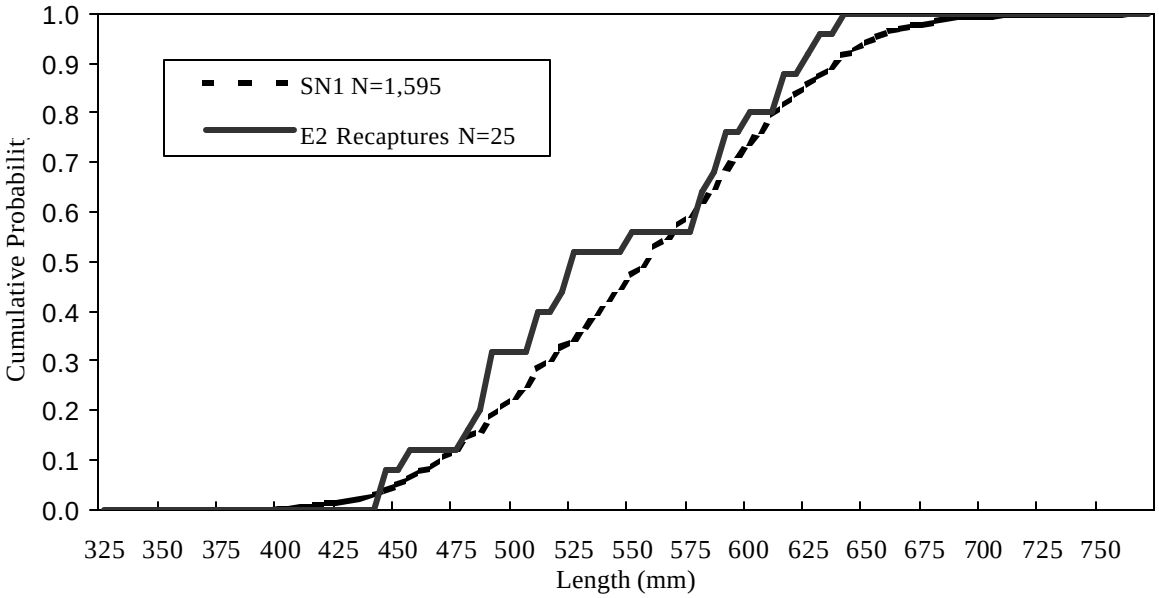


**Figure 10. –Cumulative relative frequencies of adult coho salmon marked at SN1 in 2001 compared to those recaptured during Event 2 (E2).**

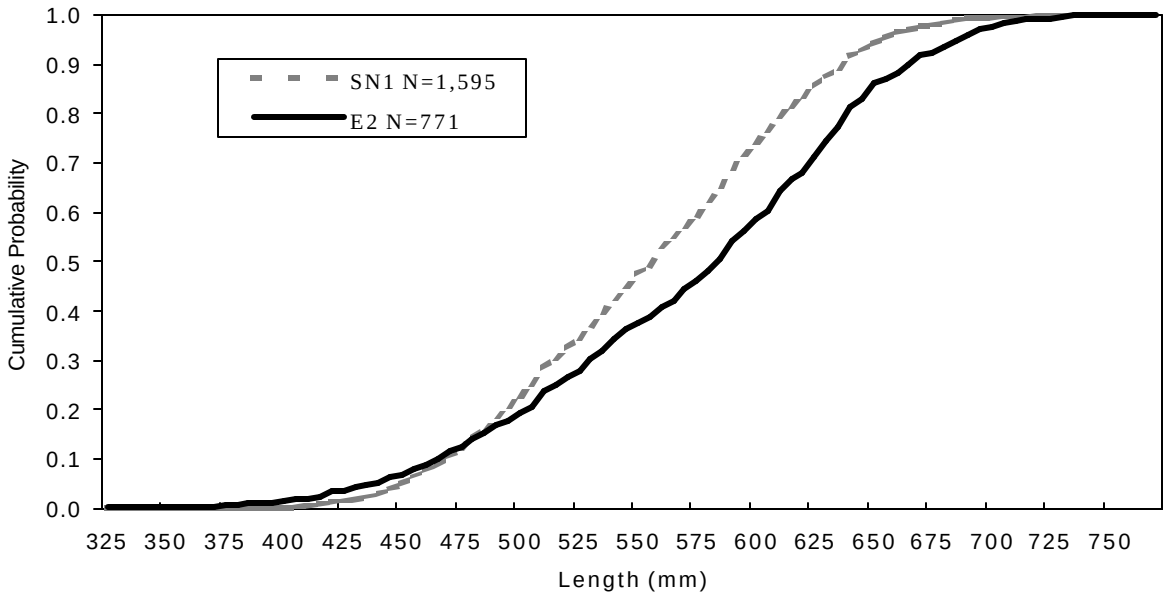


**Figure 11. –Cumulative relative frequencies of adult coho salmon marked at SN1 in 2001 compared to those inspected during Event 2.**

Sampling during Event 2 was not in proportion to abundance. For instance, 19% of the radio tagged fish presumed to have spawned were tracked to the Eulachon River; however the Eulachon River comprised 42% of the total Event 2 sample. In addition, at least 8% of the radio tagged fish were tracked to mainstem spawning locations not sampled during Event 2.

The estimated escapement of coho salmon in the Unuk River in 2001 was 35,022 (SE = 7,161).

From bootstrapping, statistical bias in $\hat{N}$ was estimated at 4.0% and the 95% confidence interval for the estimate is 22,179 to 47,864 (a relative precision of $\pm 40\%$).

## ESTIMATES OF AGE, SEX, AND LENGTH COMPOSITION

Tests for sex-selective sampling indicate that selectivity did not occur between events ($?^2 = 1.33$; df = 1; P = 0.25). A significant difference was found in the age composition between events ($?^2 = 6.56$; df = 2; P = 0.04). This difference is attributable to the capture of three age-2.0 fish during Event 2, without which, age composition selectivity would be contraindicated ($?^2 = 7.64E^{-05}$; df = 1; P = 0.99). Samples collected from Events 1 and 2 were combined to estimate the age, sex, and length composition of the escapement (Table 6). For Events 1 and 2 combined, age-1.1 fish accounted for 83.9% (SE = 0.8%), age-2.1 fish for 16% (SE = 0.8%), age-2.0 fish for 0.1% (SE = 0.1%) with 59% (SE = 1.1%) of the total escapement estimated as males (Appendix A5).

Of the 1,708 fish sampled in Event 1, 1,493 (87%) were successfully aged. Of the aged scales from Event 1, 84% (SE = 1.0%) were age-1.1 and 16% (SE = 1.0%) were age-2.1. No significant difference was observed in the age composition of coho salmon captured at SN1 between those fish with adipose clips versus those without ($?^2 = 0.62$; df = 1; P = 0.43). Males composed 60% (SE = 1.3%) of the aged sample in Event 1 (Table 6; Appendix A5). The largest fish sampled in Event 1 was 770 mm and the mean was 589 mm (SE = 1.7 mm) MEF in length. For the total run, an estimated 29,397 (SE = 6,020) were age-1.1 and 5,625 (SE = 1,196) were age-2.1 with 20,924 (SE = 5,535) estimated to be males (Table 6).

**Table 6.–Age and sex composition of Unuk River coho salmon escapement, harvest, and run in 2001.** Estimates based on the combined samples collected during Events 1 and 2.

| | | Age | | | |
|---|---|---|---|---|---|
| | | 1.1 | 2.0 | 2.1 | **Total** |
| **Females** | n | 735 | 2 | 154 | 891 |
| | % | 33.9 | 0.1 | 7.1 | 41.1 |
| | SE of % | 1.0 | 0.1 | 0.6 | 1.1 |
| | Escapement | 11,873 | 32 | 2,488 | 14,393 |
| | SE | 2,453 | 23 | 543 | 4,591 |
| | Harvest | 11,063 | 30 | 2,318 | 13,411 |
| | SE | 2,153 | 22 | 480 | 4,024 |
| | Total run | 23,080 | 63 | 4,836 | 27,979 |
| | SE | 3,300 | 45 | 772 | 6,104 |
| **Males** | n | 1,083 | 1 | 193 | 1,277 |
| | % | 50.0 | 0.0 | 8.9 | 58.9 |
| | SE of % | 1.1 | 0.0 | 0.6 | 1.1 |
| | Escapement | 17,495 | 16 | 3,118 | 20,629 |
| | SE | 3,596 | 16 | 671 | 5,496 |
| | Harvest | 16,301 | 15 | 2,905 | 19,221 |
| | SE | 3,154 | 15 | 592 | 4,817 |
| | Total run | 34,008 | 31 | 6,061 | 40,100 |
| | SE | 4,812 | 31 | 943 | 7,308 |
| **Total** | n | 1,818 | 3 | 347 | 2,168 |
| | % | 83.9 | 0.1 | 16.0 | 100.0 |
| | SE of % | 0.8 | 0.1 | 0.8 | |
| | Escapement | 29,368 | 48 | 5,605 | 35,022 |
| | SE | 6,011 | 29 | 1,178 | 7,161 |
| | Harvest | 27,364 | 45 | 5,223 | 32,633 |
| | SE | 5,269 | 27 | 1,036 | 6,276 |
| | Total run | 57,089 | 94 | 10,896 | 68,080 |
| | SE | 8,003 | 55 | 1,614 | 9,522 |

Of the 772 fish sampled in Event 2, all had scales sampled and 681 (88%) of those were successfully aged. Of the scales successfully aged, 83.6% (SE = 1.1%) were age-1.1, 16% (SE = 1.4%) were age-2.1, and 0.4% (SE = 0.3%) were age-2.0. A marginally significant difference was observed in the relative frequency between age-1.1 and age-2.1 coho salmon from fish with adipose clips versus those without in Event 2 ($?^2 = 2.79$; df = 1; P = 0.09). A highly significant difference is observed in this frequency for fish sampled in the Eulachon River ($?^2 = 18.56$; df = 1; P = $1.6E^{-05}$) while no significant difference is observed in a pooled sample of all other Unuk River sampling locations

($?^2$ = 1.05; df = 1; P = 0.31). Males constituted 57% (SE = 1.9%) of the Event 2 sample (Appendix A5). The largest fish sampled was 750 mm, the smallest was 325mm (age-2.0), and the mean was 573 mm MEF (SE = 2.9 mm) (Appendix A5).

### ESTIMATES OF HARVEST, MEAN DATE OF HARVEST, TOTAL RUN, EXPLOITATION RATE, AND MARINE SURVIVAL

In 2001, 234 coho salmon with CWTs released in the Unuk River in 1999 were recovered from various fisheries as random recoveries in the port and creel census sampling programs and an additional 73 recoveries were from escapement sampling (Table 3; Appendix A3). There were no recoveries reported for marine commercial fisheries in Canada. Recoveries in 2001 were primarily from troll gear (44%), purse seine (37%), drift gillnet (10%), and recreational (8%) gear. These recoveries were mostly from the Southeast (39%) and Northwest (35%) quadrants with the remainder being from the Southwest (22%) and Northeast (4%) quadrants.

Of the 154 CWTs recovered in the commercial troll fishery, 49%, 27%, 19%, and 6% were from the Northwest, Southwest, Southeast, and Northeast quadrants, respectively (Table 7). In the commercial gillnet fisheries, all 29 CWTs recovered were from the Southeast Quadrant. Of these fish, 18 were harvested in the northern Prince of Wales fishery (district 106), 9 were from Tree Point (district 101-11), and two were caught in the Metlakatla Indian Community gillnet fishery (district 101-28).

Twenty-nine (29) CWTs were recovered in the marine recreational fishery: 21 from Ketchikan, 4 from Sitka and 4 from Craig. From these recoveries we estimate that Unuk River coho comprised 6.0%, 0.5%, and 1.2% of the respective marine recreational harvests in Ketchikan, Sitka, and Craig. Seventeen (17) CWTs were recovered in seine fisheries, 11 from the Southeast, 5 from the Southwest, and 1 from the Northeast quadrants.

An estimated 32,633 (SE = 6,276) coho salmon originating from the Unuk River were harvested in marine commercial and sport fisheries in 2001 throughout SEAK (Table 3). These fish were mostly from the seine fishery in the Southeast Quadrant (31%), the troll fishery in the Northwest Quadrant (27%), and the troll fisheries in the Southeast and Southwest Quadrants (7% each; Appendix A6). Troll and gillnet harvests were relatively protracted (i.e., July through September) while 47% of the seine harvest occurred during one week (15–21 July). Estimated mean date of harvest in the troll fishery was 31 July, compared to 29 August for the gillnet fishery (Appendix A6). Coho salmon originating from the Unuk River contributed an estimated 3.7% of the Tree Point (District 101) gillnet harvest, 5.0% of the District 101 seine harvest, and 5.4% of the District 102 seine harvest. All Unuk River coho salmon CWTs recovered in the Northeast and Southwest Quadrants were harvested prior to 1 September. In the Northwest Quadrant, 80% of the recoveries were harvested prior to 1 September and 93% before 8 September. The last marine recovery of the year occurred in the Southeast Quadrant drift gillnet fishery (D106) on 3 October. An estimated 56% of the tag recoveries from the Southeast Quadrant were harvested before 1 September, 65% before 8 September, and 91% prior to 17 September. Of the 240 marine CWT recoveries (random and select), 8% occurred after 7 September and 3% after 14 September.

An estimated 68,080 (SE = 9,522) coho salmon bound for the Unuk River returned in 2001. The estimated marine survival rate was 11.8% (SE = 2.2%; Table 7), higher than what was seen in 1998 (7.1%; SE = 2.0%), 1999 (9.8%; SE = 2.9%), or 2000 (3.8%; SE = 1.4%) on the Unuk River (Jones et al. 1999, 2001a, 2001b).

The estimated exploitation rate in marine commercial and recreational fisheries was 47.8% (SE = 6.9%; Table 7). This exploitation rate was comparable to that estimated for 1999 (53.1%; SE = 12.7%) and 2000 (46.0%; SE = 10.1%) but was substantially lower than what was seen in 1998 (78.5%; SE = 5.3%) and in recent years from Hugh Smith Lake (70%) (Shaul 1998; Jones et al. 1999, 2000).

**Table 7.–Estimated marine harvest, exploitation, and total run of Unuk River coho salmon in 2001.**

| Fishery | Area | Estimated harvest | SE | Percent of marine harvest | Percent of total run |
|---|---|---|---|---|---|
| **TROLL** | SE Quadrant | 2,213 | 615 | 6.8 | 3.3 |
| | SW Quadrant | 2,370 | 596 | 7.3 | 3.5 |
| | NE Quadrant | 1,158 | 1,697 | 3.5 | 1.7 |
| | NW Quadrant | 8,688 | 1,806 | 26.6 | 12.8 |
| | Subtotal | 14,429 | 1,550 | 44.2 | 21.2 |
| **SEINE** | District 101 | 2,746 | 2,511 | 8.4 | 4.0 |
| | District 102 | 6,488 | 6,234 | 19.9 | 9.5 |
| | District 103 | 675 | 675 | 2.1 | 1.0 |
| | District 104 | 1,347 | 1,346 | 4.1 | 2.0 |
| | District 105 | 134 | 133 | 0.4 | 0.2 |
| | District 106 | 374 | 373 | 1.1 | 0.5 |
| | District 107 | 376 | 376 | 1.2 | 0.6 |
| | District 112 | 45 | 44 | 0.1 | 0.1 |
| | Subtotal | 12,186 | 6,012 | 37.3 | 17.9 |
| **SPORT** | Craig | 638 | 454 | 2.0 | 0.9 |
| | Ketchikan | 1,606 | 818 | | 2.4 |
| | Sitka | 414 | 300 | 1.3 | 0.6 |
| | Subtotal | 2,657 | 555 | 8.1 | 3.9 |
| **GILLNET** | District 101 | 1,319 | 1,148 | 4.0 | 1.9 |
| | District 101 MIC | 147 | 146 | | 0.2 |
| | District 106 | 1,894 | 1,070 | 5.8 | 2.8 |
| | Subtotal | 3,360 | 737 | 10.3 | 4.9 |
| Total marine harvest | | 32,633 | 6,276 | 100.0 | 47.9 |
| Mark-recapture tagging mortality | | 425 | | | 0.6 |
| Total escapement | | 35,022 | 7,161 | | 51.4 |
| Total run | | 68,080 | 9,522 | | 100.0 |
| Estimated marine survival | | 11.8% | 2.2% | | |
| Estimated exploitation rate | | 47.9% | 6.9% | | |

# DISCUSSION

Results from 1998, 1999, and 2000 on coho salmon (Jones et al. 1999, 2001a, 2001b) and since 1997 with chinook salmon (Jones et al. 1998; Jones and McPherson 1999, 2000) suggest that fish bound for the various spawning tributaries of the Unuk River could be proportionately sampled during Event 1 using set gillnets operated at SN1. The radiotelemetry data (Appendix A3; Figure 7) show that fish are distributed throughout the drainage after marking and fish marked throughout Event 1 are recovered in all segments of Event 2 (Figure 8). All recaptured fish sampled during Event 2 had retained their primary tags and the secondary marks were clearly visible.

Evidence of bimodal distributions in coho salmon populations have been seen at Steep Creek near Juneau (Jones and McPherson 1997), Hugh Smith Lake (Leon Shaul, Alaska Department of Fish and Game, Douglas, personal communication) south of Ketchikan, and the Unuk River (Jones et al. 2001b). The effort and CPUE data from SN1 on the Unuk River (Figure 8) suggest the possibility of a bimodal distribution of the coho salmon population in 2001. The length distribution graph of coho salmon sampled

at SN1 in August and September indicates that the bimodal distribution may be caused in part by the tendency of smaller coho salmon to migrate early relative to larger fish (Figure 9).

The spawning population of adults in this study was not strictly closed to losses from mortality; it was considered closed to recruitment, as tagging appeared to span a preponderance of the immigration. Similarly, the smolt population estimate was closed to recruitment, because Pacific salmon typically return to their natal streams to spawn. The models used to estimate adult and smolt population sizes rely on the complex assumption that every fish has an equal probability of being marked, or that every fish has an equal chance of being sampled as an adult, or that marked and unmarked fish mix completely between sampling events. Effort to capture smolt cannot be proportionally allocated to rearing areas, so consequently it is unlikely that every smolt has an equal probability of being marked. For example, Eulachon River smolt are less likely to be marked than main stem smolt as they tend to rear beyond the confines of our trapping area (Lava Falls to tidal influence on the main stem and its adjoining sloughs). The estimate of smolt abundance therefore relies largely on the latter portion of the assumption. Thus, we note that distribution of CWT recoveries obtained during marine harvest sampling illustrates considerable mixing of marked and unmarked fish during their 14 to 16 months at sea (Table 6).

Because adults are not captured in proportion to their abundance on the spawning grounds, the estimate of adult abundance relies largely on the assumption that every fish has an equal probability of being marked. Evidence supporting this conclusion comes from the radiotelemetry study, which indicated that disproportional sampling occurred on the Eulachon River and for areas located above Boundary Lake.

The chinook salmon study undertaken immediately prior to the coho salmon study has proven to be a good indicator of the commencement of the coho salmon immigration. The earliest date a coho salmon has been captured at SN1 was on July 26 in 1999 during chinook salmon tagging operations. In 2001, no coho salmon were captured during the chinook salmon project, and the first coho salmon capture occurred on 2 August during the initial day of coho salmon operations. It is therefore likely that Event 1 sampling began early enough to avoid missing a significant number of migrating coho salmon.

During the previous 3 years of this study, Event 1 tagging continued through the first week of October, after which catches were deemed negligible and operations ceased. In 2001, the set gillnets were operated through 22 September, and, due to an extended high water event and manpower shortages, Event 1 activities were discontinued on 25 September. The timing of marine CWT recoveries and the SN1 CPUE data suggests that a proportionally small segment of the latter portion of the run was therefore not sampled in 2001. Consequently, the estimates of escapement, catch, and total run are likely to be biased low by an unknown, but thought to be relatively small, percentage.

In the three previous years of this study, two 5? " set gillnets were used to capture fish at SN1. The results of these studies suggest that these nets were likely size-selective for larger coho salmon (Jones et al. 1999, 2001a, 2001b). In 2001 a 4½" net was substituted for one of the larger mesh nets to forestall this size-selectivity. The cumulative relative length frequencies of fish tagged at SN1 versus fish examined during Event 2 indicate that SN1 was size-selective for smaller sized coho salmon in 2001. As noted, operations at SN1 were terminated earlier than anticipated (22 September versus 7 October) and prior to the end of the migration. As the last, unsampled, segment of the immigration was likely composed predominantly of large fish (Figure 9), it is highly probable that not sampling this final segment of the run also contributed to the significant difference observed in the relative size frequency distribution of fish sampled during events 1 and 2.

The knowledge gained over successive years of study often leads to increased precision over time. During the first three years of study we achieved RPs of ±44% (CV = 27%) in 1998, ±82% (CV = 50%) in 1999, and ±54% (CV = 33%) in 2000. In 2001, our goal was to achieve an RP of ±40% which was attained (CV = 19%).

This ongoing study is designed to estimate total escapement, harvest, run, marine survival, and exploitation rate of Unuk River coho salmon. Concern over the status of coho salmon in southern SEAK has been prompted by recent changes in run strength in stocks near Ketchikan. During the previous three years of this study, total run size ranged from 31,740 to 57,811 and averaged 48,233 fish. This year the total run was estimated to be 67,948 fish. The smolt production of 577,343 in spring 2000 was one of the lowest seen during this study; however, the marine survival of 11.8% was the highest recorded. Smolt abundance and marine survival averaged 692,322 and 8.1%, respectively, during the four years of this study. Data gathered in four years of study on Unuk River coho salmon suggest that marine survival is probably the most important factor in determining adult coho salmon production.

Coho salmon in southern SEAK undergo the highest exploitation rates seen in the region and this project is currently one of only two full stock assessment projects conducted annually in southern SEAK. The other, Hugh Smith Lake, is much smaller producing runs of 2,000 to 5,000 fish annually (Shaul 1998). Coho salmon from the Unuk River contribute significantly to the marine and recreational fisheries in SEAK. Results of these studies and future years' studies are the crucial components for better managing coho salmon, not only in the Ketchikan Management Area, in SEAK as a whole.

## CONCLUSION AND RECOMMENDATIONS

We recommend the following strategies for continued success of this project on the Unuk River in upcoming years.

The use of aerial telemetry surveys as well as remote radio towers needs to be continued, as neither method has been shown to be failsafe for tracking fish. Hand-held receivers were employed sporadically in 2001 to locate radiotagged fish. These receivers proved fruitful, however, and their use should become routine during Event 2 activities. The unaccounted fraction of radio tags is a crucial component necessary in accurately and precisely estimating escapement.

By tagging more smolt each spring with CWTs, we can improve the precision of smolt abundance and harvest estimates, especially those in the sport fishery. Therefore, we recommend that at least 25,000 smolt be tagged annually to meet a target RP of 40%. In most years, this can be accomplished by running the smolt-tagging project longer thus covering a greater proportion of the smolt emigration. Typically, chinook salmon smolt catches decline dramatically by the end of April whereas coho salmon catches remain consistent or increase. Thus, concentrating efforts to capture coho salmon after this time should boost the numbers such that more tags are recovered from fisheries in the following year.

In an effort to improve the relative precision of the adult escapement estimate, effort should be increased during both sampling events. The set gillnets at SN1 were fished for an average of 30, 28, and 45 hours per week in 1999, 2000, and 2001 respectively. The goal in 2001 was to average 60 hours of fishing time per week at SN1 in order to double the number of tags available, which combined with the use of upriver set gillnets was expected to double the number of recaptures during Event 2. The goal of fishing 60 hours each week proved unattainable in 2001, primarily because of high water events and curtailed fishing time caused by large pink salmon catches. In addition, it would have been preferable to continue fishing at SN1 through the first week of October to ensure that the entire run was proportionally sampled. Of the three best available upriver locations for use as set gillnet sites during Event 2, all proved undesirable because of excessive current and underwater snags. The remaining site was unproductive, at which point personnel were redirected to focus on capturing fish on the spawning grounds and the upriver set gillnet effort was abandoned. Despite these problems, and due in large part to the largest escapement in the four years of this project, tag recoveries tripled from the previous year and the relative precision goal of 40% was achieved. Consequently, we recommend that a goal of 60 hours of fishing time per week at SN1 be established through the first week of October to ensure that the run is proportionally sampled and that an adequate number of tags are released. We further recommend that the goal of finding a suitable upriver site to fish set gillnets for recovery purposes be continued. Locating a productive

upriver gillnet site would increase the total number of fish examined during Event 2 as well as provide a more representative sample of the population. The extremely dynamic nature of the Unuk River makes this possibility likely, however if as in 2001 promising sites prove unproductive, effort needs to be redirected in a timely fashion to the spawning grounds.

Finally, the occurrence of naturally missing adipose fins should continue to be scrutinized during smolt tagging. Results from the first two years of study suggest either high rates of CWT loss (31% in 1998; 10% in 1999) or high rates of naturally missing adipose fins (0.42% in 1998; 0.23% in 1999). All fish with missing adipose fins sampled in 2000 tested positive for valid Unuk River coho CWTs. In 2001, 1.3% of the coho salmon without adipose fins were without valid CWTs. It has been shown in other coho salmon studies that the rate of naturally missing adipose fins is typically less than 0.10% (McPherson and Bernard 1996). Therefore, we assume that all fish sampled in the Unuk River with missing adipose fins were previously marked as smolt with CWTs. However, if the rate of missing adipose fins is found to be much higher than 1 in 1,000, or if the CWT marked fraction becomes much lower than it is at present (about 3 per 100), then difficulties may arise in distinguishing between the two rates.

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# APPENDIX A

**Appendix A1.–Detection of size-selectivity in sampling and its effects on estimation of abundance and age and size composition.**

**RESULTS OF HYPOTHESIS TESTS, K-S AND** $c^2$ on lengths of fish

| **MARKED** during Event 1 and **RECAPTURED** during Event 2 | **MARKED** during Event 1 and **INSPECTED** during Event 2 |
|---|---|
| *Case I:* | |
| Accept $H_O$ | Accept $H_O$ |
| There is no size-selectivity during either sampling event. | |
| *Case II:* | |
| Accept $H_O$ | Reject $H_O$ |
| There is no size-selectivity during Event 2 but there is during the Event 1. | |
| *Case III:* | |
| Reject $H_O$ | Accept $H_O$ |
| There is size-selectivity during both sampling events. | |
| *Case IV:* | |
| Reject $H_O$ | Reject $H_O$ |
| There is size-selectivity during Event 2; the status of size-selectivity during Event 1 is unknown. | |

Case I: Calculate one unstratified abundance estimate, and pool lengths, sexes, and ages from both sampling events to improve precision of proportions in estimates of composition.

Case II: Calculate one unstratified abundance estimate, and only use lengths, sexes, and ages from Event 2 to estimate proportions in compositions.

Case III: Completely stratify both sampling events, and estimate abundance for each stratum. Add abundance estimates across strata to get a single estimate for the population. Pool lengths, ages, and sexes from both sampling events to improve precision of proportions in estimates of composition, and apply formulae to correct for size bias to the pooled data (p. 17).

Case IV: Completely stratify both sampling events and estimate abundance for each stratum. Add abundance estimates across strata to get a single estimate for the population. Use lengths, ages, and sexes from only Event 2 to estimate proportions in compositions, and apply formulae to correct for size bias to the data from Event 2.

Whenever the results of the hypothesis tests indicate that there has been size-selective sampling (Case III or IV), there is still a chance that the bias in estimates of abundance from this phenomenon is negligible. Produce a second estimate of abundance by not stratifying the data as recommended above. If the two estimates (stratified and unbiased vs. biased and unstratified) are dissimilar, the bias is meaningful, the stratified estimate should be used, and data on compositions should be analyzed as described above for Cases III or IV. However, if the two estimates of abundance are similar, the bias is negligible in the UNSTRATIFIED estimate, and analysis can proceed as if there were no size-selective sampling during Event 2 (Cases I or II).

**Appendix A2.–Random and select recoveries of coded-wire-tagged coho salmon bound for the Unuk River in 2001.**

| Head number | Tag code | Gear | Recovery date | Stat. week | Quad. | Dist. | Length | Port survey site | Sample number |
|---|---|---|---|---|---|---|---|---|---|
| **RANDOM RECOVERIES** | | | | | | | | | |
| 29524 | 40259 | Troll | 7/4/01 | 27 | SW | 104 | 599 | Craig | 1070017 |
| 46460 | 40259 | Troll | 7/8/01 | 28 | SW | 103 | 609 | Craig | 1070062 |
| 27173 | 40258 | Troll | 7/13/01 | 28 | SW | 104 | 675 | Craig | 1070090 |
| 27174 | 40258 | Troll | 7/13/01 | 28 | SW | 104 | 592 | Craig | 1070090 |
| 511372 | 40259 | Troll | 7/13/01 | 28 | SW | | 666 | Ketchikan | 1060183 |
| 27198 | 40258 | Troll | 7/14/01 | 28 | SW | 104 | 670 | Craig | 1070093 |
| 511217 | 40258 | Troll | 7/14/01 | 28 | SW | | 628 | Ketchikan | 1060185 |
| 46525 | 40258 | Troll | 7/19/01 | 29 | SW | 104 | 597 | Craig | 1070152 |
| 46571 | 40258 | Troll | 7/20/01 | 29 | SW | 103 | 662 | Craig | 1070162 |
| 29477 | 40258 | Troll | 7/22/01 | 30 | SW | 104 | 612 | Craig | 1070171 |
| 38905 | 40259 | Troll | 7/24/01 | 30 | SW | 104 | 597 | Craig | 1070188 |
| 46596 | 40259 | Troll | 7/24/01 | 30 | SW | 104 | 585 | Craig | 1070191 |
| 38668 | 40259 | Troll | 7/26/01 | 30 | SW | 103 | 615 | Craig | 1070212 |
| 38834 | 40259 | Troll | 7/26/01 | 30 | SW | 104 | 653 | Craig | 1070204 |
| 38992 | 40258 | Troll | 7/27/01 | 30 | SW | 103 | 692 | Craig | 1070223 |
| 38682 | 40259 | Troll | 7/30/01 | 31 | SW | 103 | 592 | Craig | 1070238 |
| 46670 | 40259 | Troll | 7/31/01 | 31 | SW | 104 | 549 | Craig | 1070240 |
| 32929 | 40259 | Troll | 8/1/01 | 31 | SW | 104 | 586 | Craig | 1070256 |
| 509402 | 40258 | Troll | 8/2/01 | 31 | SW | 103 | 559 | Ketchikan | 1060276 |
| 46902 | 40258 | Troll | 8/3/01 | 31 | SW | 104 | 629 | Craig | 1070279 |
| 46808 | 40259 | Troll | 8/5/01 | 32 | SW | 103 | 691 | Craig | 1070289 |
| 509489 | 40259 | Troll | 8/6/01 | 32 | SW | | 553 | Ketchikan | 1060307 |
| 35853 | 40259 | Troll | 8/7/01 | 32 | SW | 103 | 658 | Craig | 1070308 |
| 46918 | 40258 | Troll | 8/7/01 | 32 | SW | 103 | 618 | Craig | 1070312 |
| 46942 | 40258 | Troll | 8/7/01 | 32 | SW | 103 | 561 | Craig | 1070309 |
| 46960 | 40259 | Troll | 8/7/01 | 32 | SW | 104 | 592 | Craig | 1070313 |
| 35891 | 40258 | Troll | 8/8/01 | 32 | SW | 103 | 581 | Craig | 1070329 |
| 509560 | 40258 | Troll | 8/10/01 | 32 | SW | | 658 | Ketchikan | 1060347 |
| 29906 | 40258 | Troll | 8/11/01 | 32 | SW | 103 | 685 | Craig | 1070350 |
| 34243 | 40259 | Troll | 8/13/01 | 33 | SW | 103 | 575 | Craig | 1070366 |
| 35915 | 40259 | Troll | 8/13/01 | 33 | SW | 104 | 632 | Craig | 1070375 |
| 35917 | 40259 | Troll | 8/13/01 | 33 | SW | 104 | 644 | Craig | 1070375 |
| 46888 | 40258 | Troll | 8/13/01 | 33 | SW | 104 | 633 | Craig | 1070368 |
| 46893 | 40259 | Troll | 8/13/01 | 33 | SW | 104 | 701 | Craig | 1070381 |
| 29980 | 40258 | Troll | 8/20/01 | 34 | SW | 104 | 651 | Craig | 1070387 |
| 29989 | 40258 | Troll | 8/21/01 | 34 | SW | 103 | 660 | Craig | 1070394 |
| 35933 | 40259 | Troll | 8/21/01 | 34 | SW | | 657 | Craig | 1070396 |
| 509509 | 40259 | Troll | 8/22/01 | 34 | SW | | 616 | Ketchikan | 1060392 |
| 509522 | 40259 | Troll | 8/22/01 | 34 | SW | | 717 | Ketchikan | 1060392 |
| 509532 | 40259 | Troll | 8/22/01 | 34 | SW | | 700 | Ketchikan | 1060392 |
| 29942 | 40258 | Troll | 8/30/01 | 35 | SW | 104 | 594 | Craig | 1070447 |
| 29943 | 40143 | Troll | 8/30/01 | 35 | SW | 104 | 709 | Craig | 1070447 |
| 511887 | 40258 | Troll | 7/18/01 | 29 | SE | 102 | 552 | Ketchikan | 1060205 |
| 29740 | 40259 | Troll | 7/23/01 | 30 | SE | 105 | 497 | Craig | 1070178 |
| 509234 | 40258 | Troll | 8/1/01 | 31 | SE | 101 | 612 | Ketchikan | 1060272 |
| 509428 | 40259 | Troll | 8/6/01 | 32 | SE | 102 | 469 | Ketchikan | 1060296 |
| 504487 | 40258 | Troll | 8/11/01 | 32 | SE | 105 | 671 | Petersburg | 1050783 |
| 509577 | 40259 | Troll | 8/11/01 | 32 | SE | 101 | 713 | Ketchikan | 1060351 |
| 46995 | 40259 | Troll | 8/12/01 | 33 | SE | 105 | 703 | Craig | 1070362 |
| 46998 | 40259 | Troll | 8/12/01 | 33 | SE | 105 | 648 | Craig | 1070362 |
| 509739 | 40258 | Troll | 8/12/01 | 33 | SE | 102 | 582 | Ketchikan | 1060352 |

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**Appendix A2.–Page 2 of 6.**

| Head number | Tag code | Gear | Recovery date | Stat. week | Quad. | Dist. | Length | Port survey site | Sample number |
|---|---|---|---|---|---|---|---|---|---|
| 509902 | 40259 | Troll | 8/21/01 | 34 | SE | 101 | 667 | Ketchikan | 1060384 |
| 509908 | 40258 | Troll | 8/21/01 | 34 | SE | 101 | 615 | Ketchikan | 1060384 |
| 55940 | 40259 | Troll | 8/23/01 | 34 | SE | 102 | 682 | Ketchikan | 1060398 |
| 509966 | 40259 | Troll | 8/24/01 | 34 | SE | 101 | 605 | Ketchikan | 1060404 |
| 509835 | 40259 | Troll | 8/27/01 | 35 | SE | 101 | 654 | Ketchikan | 1060417 |
| 509549 | 40258 | Troll | 9/1/01 | 35 | SE | 101 | 691 | Ketchikan | 1060437 |
| 51011 | 40259 | Troll | 9/5/01 | 36 | SE | | 711 | Ketchikan | 1060455 |
| 509786 | 40258 | Troll | 9/6/01 | 36 | SE | 101 | 681 | Ketchikan | 1060457 |
| 51758 | 40258 | Troll | 9/10/01 | 37 | SE | 102 | 706 | Ketchikan | 1060472 |
| 51760 | 40259 | Troll | 9/10/01 | 37 | SE | 102 | 723 | Ketchikan | 1060472 |
| 51762 | 40259 | Troll | 9/10/01 | 37 | SE | 102 | 691 | Ketchikan | 1060472 |
| 51908 | 40259 | Troll | 9/11/01 | 37 | SE | 101 | 705 | Ketchikan | 1060480 |
| 51766 | 40143 | Troll | 9/12/01 | 37 | SE | 101 | 734 | Ketchikan | 1060484 |
| 51767 | 40259 | Troll | 9/12/01 | 37 | SE | 101 | 689 | Ketchikan | 1060484 |
| 505602 | 40258 | Troll | 9/12/01 | 37 | SE | 106 | 601 | Petersburg | 1051123 |
| 51943 | 40258 | Troll | 9/13/01 | 37 | SE | | 677 | Ketchikan | 1060489 |
| 69278 | 40258 | Troll | 9/14/01 | 37 | SE | | 638 | Ketchikan | 1060487 |
| 54021 | 40258 | Troll | 9/18/01 | 38 | SE | 101 | 650 | Ketchikan | 1060503 |
| 54036 | 40258 | Troll | 9/18/01 | 38 | SE | 101 | 640 | Ketchikan | 1060504 |
| 51978 | 40258 | Troll | 9/21/01 | 38 | SE | 101 | 645 | Ketchikan | 1060524 |
| 51984 | 40259 | Troll | 9/21/01 | 38 | SE | 101 | 703 | Ketchikan | 1060523 |
| 156146 | 40258 | Troll | 7/2/01 | 27 | NW | 113 | 594 | Sitka | 1030393 |
| 16790 | 40258 | Troll | 7/3/01 | 27 | NW | | 563 | XIP | 1100016 |
| 16795 | 40258 | Troll | 7/3/01 | 27 | NW | | 716 | XIP | 1100016 |
| 151215 | 40259 | Troll | 7/3/01 | 27 | NW | 113 | 598 | Sitka | 1030412 |
| 165943 | 40258 | Troll | 7/3/01 | 27 | NW | 113 | 623 | Pelican | 1010057 |
| 151314 | 40258 | Troll | 7/4/01 | 27 | NW | 113 | 593 | Sitka | 1030434 |
| 151053 | 40259 | Troll | 7/5/01 | 27 | NW | 113 | 622 | Sitka | 1030516 |
| 151058 | 40259 | Troll | 7/5/01 | 27 | NW | 113 | 647 | Sitka | 1030516 |
| 151517 | 40259 | Troll | 7/5/01 | 27 | NW | 113 | 610 | Sitka | 1030481 |
| 151693 | 40259 | Troll | 7/5/01 | 27 | NW | 113 | 602 | Sitka | 1030479 |
| 151388 | 40258 | Troll | 7/6/01 | 27 | NW | 113 | 635 | Sitka | 1030498 |
| 16962 | 40258 | Troll | 7/7/01 | 27 | NW | | 690 | XIP | 1100023 |
| 190450 | 40258 | Troll | 7/7/01 | 27 | NW | 113 | 585 | Hoonah | 1119999 |
| 97453 | 40259 | Troll | 7/8/01 | 28 | NW | 113 | 542 | Juneau | 1040063 |
| 190504 | 40259 | Troll | 7/9/01 | 28 | NW | 113 | 655 | Hoonah | 1110226 |
| 190539 | 40258 | Troll | 7/11/01 | 28 | NW | 113 | 570 | Hoonah | 1110228 |
| 192151 | 40258 | Troll | 7/11/01 | 28 | NW | 113 | 650 | Pelican | 1010098 |
| 153047 | 40259 | Troll | 7/12/01 | 28 | NW | 113 | 616 | Sitka | 1030568 |
| 153367 | 40259 | Troll | 7/12/01 | 28 | NW | 113 | 615 | Sitka | 1030575 |
| 192164 | 40259 | Troll | 7/12/01 | 28 | NW | 113 | 637 | Pelican | 1010101 |
| 192166 | 40258 | Troll | 7/12/01 | 28 | NW | 113 | 672 | Pelican | 1010101 |
| 153401 | 40258 | Troll | 7/15/01 | 29 | NW | 113 | 588 | Sitka | 1030589 |
| 192205 | 40259 | Troll | 7/15/01 | 29 | NW | 116 | 648 | Pelican | 1010106 |
| 153430 | 40258 | Troll | 7/16/01 | 29 | NW | 113 | 679 | Sitka | 1030601 |
| 153459 | 40259 | Troll | 7/16/01 | 29 | NW | 113 | 651 | Sitka | 1030602 |
| 152901 | 40258 | Troll | 7/17/01 | 29 | NW | 113 | 645 | Sitka | 1030598 |
| 155857 | 40258 | Troll | 7/19/01 | 29 | NW | 113 | 570 | Sitka | 1030617 |
| 155885 | 40258 | Troll | 7/19/01 | 29 | NW | 113 | 655 | Sitka | 1030617 |
| 192272 | 40259 | Troll | 7/19/01 | 29 | NW | 113 | 569 | Pelican | 1010118 |
| 152094 | 40259 | Troll | 7/20/01 | 29 | NW | 113 | 618 | Sitka | 1030619 |
| 7956 | 40258 | Troll | 7/21/01 | 29 | NW | | 669 | XIP | 1100050 |
| 152704 | 40259 | Troll | 7/21/01 | 29 | NW | 113 | 636 | Sitka | 1030622 |
| 192317 | 40258 | Troll | 7/22/01 | 30 | NW | 116 | 662 | Pelican | 1010121 |

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**Appendix A2.–Page 3 of 6.**

| Head number | Tag code | Gear | Recovery date | Stat. week | Quad. | Dist. | Length | Port survey site | Sample number |
|---|---|---|---|---|---|---|---|---|---|
| 192332 | 40259 | Troll | 7/22/01 | 30 | NW | 113 | 675 | Pelican | 1010122 |
| 151572 | 40258 | Troll | 7/23/01 | 30 | NW | 113 | 562 | Sitka | 1030629 |
| 192346 | 40258 | Troll | 7/23/01 | 30 | NW | | 567 | Pelican | 1010126 |
| 192357 | 40259 | Troll | 7/23/01 | 30 | NW | | 625 | Pelican | 1010126 |
| 153241 | 40258 | Troll | 7/26/01 | 30 | NW | | 620 | Sitka | 1030640 |
| 153243 | 40259 | Troll | 7/26/01 | 30 | NW | | 649 | Sitka | 1030640 |
| 186039 | 40259 | Troll | 7/26/01 | 30 | NW | 113 | 604 | Sitka | 1030643 |
| 186090 | 40258 | Troll | 7/29/01 | 31 | NW | 113 | 635 | Sitka | 1030653 |
| 190780 | 40258 | Troll | 7/29/01 | 31 | NW | 113 | 655 | Hoonah | 1110259 |
| 153284 | 40258 | Troll | 7/31/01 | 31 | NW | 113 | 635 | Sitka | 1030666 |
| 192515 | 40258 | Troll | 7/31/01 | 31 | NW | 113 | 651 | Pelican | 1010149 |
| 152248 | 40259 | Troll | 8/1/01 | 31 | NW | 154 | 562 | Sitka | 1030667 |
| 152275 | 40259 | Troll | 8/3/01 | 31 | NW | 113 | 642 | Sitka | 1030679 |
| 192697 | 40258 | Troll | 8/8/01 | 32 | NW | 113 | 555 | Pelican | 1010175 |
| 192707 | 40259 | Troll | 8/8/01 | 32 | NW | 116 | 610 | Pelican | 1010178 |
| 192780 | 40259 | Troll | 8/13/01 | 33 | NW | 113 | 690 | Pelican | 1010190 |
| 192805 | 40258 | Troll | 8/13/01 | 33 | NW | 113 | 588 | Pelican | 1010195 |
| 5675 | 40258 | Troll | 8/20/01 | 34 | NW | | 628 | XIP | 1100136 |
| 187930 | 40258 | Troll | 8/20/01 | 34 | NW | 113 | 665 | Sitka | 1030753 |
| 192889 | 40259 | Troll | 8/21/01 | 34 | NW | 113 | 657 | Pelican | 1010217 |
| 187220 | 40259 | Troll | 8/24/01 | 34 | NW | 113 | 694 | Sitka | 1030814 |
| 187240 | 40259 | Troll | 8/25/01 | 34 | NW | 113 | 654 | Sitka | 1030827 |
| 193244 | 40258 | Troll | 8/27/01 | 35 | NW | 113 | 631 | Pelican | 1010256 |
| 24584 | 40258 | Troll | 8/28/01 | 35 | NW | | 702 | XIP | 1100143 |
| 191434 | 40259 | Troll | 8/30/01 | 35 | NW | | 690 | Hoonah | 1110376 |
| 193303 | 40258 | Troll | 9/3/01 | 36 | NW | 113 | 697 | Pelican | 1010277 |
| 193306 | 40259 | Troll | 9/3/01 | 36 | NW | 113 | 783 | Pelican | 1010277 |
| 193312 | 40259 | Troll | 9/3/01 | 36 | NW | 113 | 704 | Pelican | 1010277 |
| 193321 | 40259 | Troll | 9/3/01 | 36 | NW | 113 | 662 | Pelican | 1010277 |
| 187046 | 40258 | Troll | 9/4/01 | 36 | NW | 113 | 731 | Sitka | 1030859 |
| 193325 | 40259 | Troll | 9/4/01 | 36 | NW | 113 | 704 | Pelican | 1010278 |
| 187073 | 40258 | Troll | 9/5/01 | 36 | NW | 113 | 715 | Sitka | 1030861 |
| 193381 | 40259 | Troll | 9/5/01 | 36 | NW | 113 | 672 | Pelican | 1010289 |
| 186114 | 40258 | Troll | 9/6/01 | 36 | NW | 113 | 688 | Sitka | 1030893 |
| 187694 | 40259 | Troll | 9/6/01 | 36 | NW | 113 | 675 | Sitka | 1030879 |
| 186142 | 40258 | Troll | 9/7/01 | 36 | NW | 113 | 617 | Sitka | 1030896 |
| 193616 | 40258 | Troll | 9/12/01 | 37 | NW | 113 | 664 | Pelican | 1010316 |
| 186236 | 40258 | Troll | 9/14/01 | 37 | NW | 154 | 735 | Sitka | 1030929 |
| 193725 | 40258 | Troll | 9/17/01 | 38 | NW | 113 | 670 | Pelican | 1010331 |
| 193760 | 40258 | Troll | 9/19/01 | 38 | NW | 113 | 672 | Pelican | 1010339 |
| 193778 | 40258 | Troll | 9/20/01 | 38 | NW | 113 | 690 | Pelican | 1010341 |
| 193875 | 40259 | Troll | 9/29/01 | 39 | NW | 113 | 654 | Pelican | 1010350 |
| 167713 | 40258 | Troll | 7/4/01 | 27 | NE | 109 | 555 | Port Alexander | 1080004 |
| 503945 | 40259 | Troll | 7/16/01 | 29 | NE | 109 | 693 | Petersburg | 1050429 |
| 148734 | 40259 | Troll | 7/17/01 | 29 | NE | 109 | 710 | Wrangell | 1120025 |
| 504314 | 40259 | Troll | 7/20/01 | 29 | NE | 109 | 654 | Petersburg | 1050487 |
| 167874 | 40259 | Troll | 7/30/01 | 31 | NE | 109 | 665 | Port Alexander | 1080052 |
| 504619 | 40259 | Troll | 8/10/01 | 32 | NE | 109 | 603 | Petersburg | 1050774 |
| 152472 | 40258 | Troll | 8/12/01 | 33 | NE | 109 | 634 | Sitka | 1030710 |
| 504829 | 40258 | Troll | 8/23/01 | 34 | NE | 109 | 658 | Petersburg | 1050925 |
| 169032 | 40258 | Troll | 8/27/01 | 35 | NE | 109 | 553 | Port Alexander | 1080095 |
| 511269 | 40259 | Troll | 7/16/01 | 29 | | | 649 | Ketchikan | 1060221 |
| 29914 | 40259 | Troll | 8/22/01 | 34 | | | 559 | Craig | 1070413 |
| 51756 | 40258 | Troll | 9/10/01 | 37 | | | 650 | Ketchikan | 1060471 |

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**Appendix A2.–Page 4 of 6.**

| Head number | Tag code | Gear | Recovery date | Stat. Week | Quad. | Dist. | Length | Port survey site | Sample number |
|---|---|---|---|---|---|---|---|---|---|
| 511249 | 40259 | Purse | 7/17/01 | 29 | SW | 104 | 644 | Ketchikan | 1060202 |
| 504523 | 40258 | Purse | 8/4/01 | 31 | SW | 104 | 635 | Petersburg | 1050700 |
| 509374 | 40258 | Purse | 8/5/01 | 32 | SW | 104 | 515 | Ketchikan | 1060291 |
| 509825 | 40258 | Purse | 8/23/01 | 34 | SW | 103 | 455 | Ketchikan | 1060407 |
| 504736 | 40259 | Purse | 8/27/01 | 35 | SW | 103 | 650 | Petersburg | 1050990 |
| 511227 | 40259 | Purse | 7/16/01 | 29 | SE | 102 | 545 | Ketchikan | 1060193 |
| 511960 | 40259 | Purse | 7/23/01 | 30 | SE | 101 | 528 | Ketchikan | 1060225 |
| 511834 | 40258 | Purse | 7/31/01 | 31 | SE | 101 | 593 | Ketchikan | 1060269 |
| 504517 | 40259 | Purse | 8/4/01 | 31 | SE | 101 | 472 | Petersburg | 1050699 |
| 511787 | 40259 | Purse | 8/7/01 | 32 | SE | 102 | 526 | Ketchikan | 1060304 |
| 511796 | 40259 | Purse | 8/11/01 | 32 | SE | 102 | 594 | Ketchikan | 1060345 |
| 504586 | 40258 | Purse | 8/16/01 | 33 | SE | 105 | 742 | Petersburg | 1050850 |
| 504809 | 40259 | Purse | 8/20/01 | 34 | SE | 107 | 560 | Petersburg | 1050908 |
| 509817 | 40258 | Purse | 8/20/01 | 34 | SE | 101 | 622 | Ketchikan | 1060378 |
| 51958 | 40258 | Purse | 8/31/01 | 35 | SE | 106 | 546 | Ketchikan | 1060434 |
| 505568 | 40259 | Purse | 9/11/01 | 37 | SE | 106 | 713 | Petersburg | 1051107 |
| 9179 | 40258 | Purse | 8/5/01 | 32 | NE | 112 | 641 | XIP | 1100102 |
| 504156 | 40259 | Drift | 7/18/01 | 29 | SE | 106 | 515 | Petersburg | 1050452 |
| 504413 | 40258 | Drift | 7/30/01 | 31 | SE | 106 | 632 | Petersburg | 1050611 |
| 509222 | 40258 | Drift | 8/1/01 | 31 | SE | 101 | 639 | Ketchikan | 1060273 |
| 168447 | 40258 | Drift | 8/16/01 | 33 | SE | 101 | 661 | Metlakatla | 1090340 |
| 504721 | 40259 | Drift | 8/21/01 | 34 | SE | 106 | 696 | Petersburg | 1050913 |
| 510955 | 40259 | Drift | 8/22/01 | 34 | SE | 101 | 560 | Ketchikan | 1060394 |
| 503586 | 40258 | Drift | 8/23/01 | 34 | SE | 106 | 638 | Petersburg | 1050958 |
| 504678 | 40259 | Drift | 8/23/01 | 34 | SE | 106 | 647 | Petersburg | 1050935 |
| 504680 | 40259 | Drift | 8/23/01 | 34 | SE | 106 | 645 | Petersburg | 1050937 |
| 504732 | 40258 | Drift | 8/23/01 | 34 | SE | 106 | 642 | Petersburg | 1050952 |
| 504904 | 40259 | Drift | 8/23/01 | 34 | SE | 106 | 681 | Petersburg | 1050949 |
| 509974 | 40259 | Drift | 8/25/01 | 34 | SE | 101 | 603 | Ketchikan | 1060414 |
| 168466 | 40258 | Drift | 8/29/01 | 35 | SE | 101 | 741 | Metlakatla | 1090419 |
| 509644 | 40259 | Drift | 8/29/01 | 35 | SE | 101 | 637 | Ketchikan | 1060442 |
| 509863 | 40258 | Drift | 8/29/01 | 35 | SE | 101 | 640 | Ketchikan | 1060424 |
| 504932 | 40258 | Drift | 8/30/01 | 35 | SE | 106 | 694 | Petersburg | 1051038 |
| 504934 | 40258 | Drift | 8/30/01 | 35 | SE | 106 | 657 | Petersburg | 1051030 |
| 51957 | 40258 | Drift | 8/31/01 | 35 | SE | 101 | 642 | Ketchikan | 1060431 |
| 51331 | 40259 | Drift | 9/6/01 | 36 | SE | 101 | 668 | Ketchikan | 1060458 |
| 69253 | 40259 | Drift | 9/11/01 | 37 | SE | 106 | 695 | Ketchikan | 1060478 |
| 505584 | 40259 | Drift | 9/12/01 | 37 | SE | 106 | 667 | Petersburg | 1051119 |
| 505585 | 40258 | Drift | 9/12/01 | 37 | SE | 106 | 666 | Petersburg | 1051119 |
| 505665 | 40258 | Drift | 9/12/01 | 37 | SE | 106 | 755 | Petersburg | 1051125 |
| 504900 | 40258 | Drift | 9/13/01 | 37 | SE | 106 | 733 | Petersburg | 1051134 |
| 505758 | 40258 | Drift | 9/13/01 | 37 | SE | 106 | 695 | Petersburg | 1051136 |
| 51780 | 40259 | Drift | 9/14/01 | 37 | SE | 101 | 658 | Ketchikan | 1060491 |
| 54338 | 40258 | Drift | 9/20/01 | 38 | SE | 101 | 722 | Ketchikan | 1060515 |
| 505004 | 40258 | Drift | 10/3/01 | 40 | SE | 106 | 753 | Petersburg | 1051196 |
| 505066 | 40258 | Drift | 10/3/01 | 40 | SE | 106 | 671 | Petersburg | 1051199 |
| 184403 | 40259 | Recreational | 7/24/01 | 30 | SW | 104 | 670 | Craig | 1075093 |
| 184419 | 40259 | Recreational | 7/27/01 | 30 | SW | 104 | 640 | Craig | 1075094 |
| 184424 | 40259 | Recreational | 8/2/01 | 31 | SW | 104 | 665 | Craig | 1075114 |
| 184351 | 40258 | Recreational | 8/11/01 | 33 | SW | 103 | 625 | Craig | 1075132 |
| 82879 | 40258 | Recreational | 7/21/01 | 29 | SE | 101 |  | Ketchikan | 1065272 |
| 184565 | 40258 | Recreational | 7/24/01 | 30 | SE | 101 | 690 | Ketchikan | 1065284 |
| 184585 | 40258 | Recreational | 8/8/01 | 32 | SE | 102 |  | Ketchikan | 1065314 |

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**Appendix A2.–Page 5 of 6.**

| Head number | Tag code | Gear | Recovery date | Stat. week | Quad. | Dist. | Length | Port survey site | Sample number |
|---|---|---|---|---|---|---|---|---|---|
| 184586 | 40258 | Recreational | 8/8/01 | 32 | SE | 101 | 700 | Ketchikan | 1065319 |
| 184588 | 40258 | Recreational | 8/13/01 | 33 | SE | 101 | 680 | Ketchikan | 1065327 |
| 184593 | 40259 | Recreational | 8/19/01 | 34 | SE | 102 | 630 | Ketchikan | 1065325 |
| 184600 | 40259 | Recreational | 8/28/01 | 35 | SE | 101 | 710 | Ketchikan | 1065352 |
| 82277 | 40259 | Recreational | 8/30/01 | 35 | SE | 102 | 715 | Ketchikan | 1065347 |
| 82894 | 40258 | Recreational | 8/30/01 | 35 | SE | 101 | 695 | Ketchikan | 1065338 |
| 82279 | 40259 | Recreational | 9/2/01 | 36 | SE | 101 | 695 | Ketchikan | 1065343 |
| 82283 | 40259 | Recreational | 9/2/01 | 36 | SE | 101 | 640 | Ketchikan | 1065348 |
| 184624 | 40259 | Recreational | 9/3/01 | 36 | SE | 101 | 660 | Ketchikan | 1065376 |
| 184634 | 40259 | Recreational | 9/4/01 | 36 | SE | 101 | 530 | Ketchikan | 1065365 |
| 184660 | 40258 | Recreational | 9/9/01 | 37 | SE | 101 | 665 | Ketchikan | 1065406 |
| 184663 | 40259 | Recreational | 9/9/01 | 37 | SE | 102 | 770 | Ketchikan | 1065390 |
| 184673 | 40258 | Recreational | 9/11/01 | 37 | SE | 101 | 640 | Ketchikan | 1065458 |
| 184675 | 40258 | Recreational | 9/11/01 | 37 | SE | 101 | 790 | Ketchikan | 1065459 |
| 184686 | 40259 | Recreational | 9/14/01 | 37 | SE | 101 | 690 | Ketchikan | 1065414 |
| 205215 | 40259 | Recreational | 9/15/01 | 37 | SE | 101 | 630 | Ketchikan | 1065448 |
| 184691 | 40259 | Recreational | 9/16/01 | 38 | SE | 101 | 715 | Ketchikan | 1065423 |
| 205222 | 40259 | Recreational | 9/18/01 | 38 | SE | 101 | 710 | Ketchikan | 1065485 |
| 184838 | 40259 | Recreational | 7/6/01 | 27 | NW | 113 | 630 | Sitka | 1035270 |
| 184969 | 40259 | Recreational | 8/13/01 | 33 | NW | 113 | 700 | Sitka | 1035561 |
| 149659 | 40258 | Recreational | 8/17/01 | 33 | NW | 113 | 720 | Sitka | 1035621 |
| 185000 | 40259 | Recreational | 8/24/01 | 34 | NW | 113 | 720 | Sitka | 1035632 |
| 199868 | 40259 | Escapement | 9/7/01 | 36 | SE | 101 | 525 | Eulachon River | 1932013 |
| 199871 | 40259 | Escapement | 9/7/01 | 36 | SE | 101 | 510 | Eulachon River | 1932013 |
| 199872 | 40258 | Escapement | 9/8/01 | 36 | SE | 101 | 505 | Eulachon River | 1932014 |
| 147501 | 40259 | Escapement | 9/28/01 | 39 | SE | 101 | 630 | Eulachon River | 1932019 |
| 182071 | 40259 | Escapement | 8/9/01 | 32 | SE | 101 | 440 | Unuk River | 1930057 |
| 182072 | 40258 | Escapement | 8/11/01 | 32 | SE | 101 | 545 | Unuk River | 1930059 |
| 182073 | 40259 | Escapement | 8/12/01 | 33 | SE | 101 | 475 | Unuk River | 1930060 |
| 182074 | 40259 | Escapement | 8/12/01 | 33 | SE | 101 | 465 | Unuk River | 1930060 |
| 182075 | 40258 | Escapement | 8/14/01 | 33 | SE | 101 | 585 | Unuk River | 1930062 |
| 182076 | 40259 | Escapement | 8/14/01 | 33 | SE | 101 | 490 | Unuk River | 1930062 |
| 182077 | 40258 | Escapement | 8/16/01 | 33 | SE | 101 | 590 | Unuk River | 1930064 |
| 182078 | 40258 | Escapement | 8/17/01 | 33 | SE | 101 | 470 | Unuk River | 1930065 |
| 182079 | 40258 | Escapement | 8/18/01 | 33 | SE | 101 | 430 | Unuk River | 1930066 |
| 182080 | 40259 | Escapement | 8/19/01 | 34 | SE | 101 | 515 | Unuk River | 1930067 |
| 182081 | 40259 | Escapement | 8/19/01 | 34 | SE | 101 | 535 | Unuk River | 1930067 |
| 182082 | 40258 | Escapement | 8/20/01 | 34 | SE | 101 | 550 | Unuk River | 1930068 |
| 182083 | 40259 | Escapement | 8/20/01 | 34 | SE | 101 | 530 | Unuk River | 1930068 |
| 182084 | 40259 | Escapement | 8/20/01 | 34 | SE | 101 | 555 | Unuk River | 1930068 |
| 182085 | 40258 | Escapement | 8/21/01 | 34 | SE | 101 | 555 | Unuk River | 1930069 |
| 182086 | 40259 | Escapement | 8/21/01 | 34 | SE | 101 | 545 | Unuk River | 1930069 |
| 182088 | 40258 | Escapement | 8/24/01 | 34 | SE | 101 |  | Unuk River | 1930072 |
| 182089 | 40259 | Escapement | 8/29/01 | 35 | SE | 101 | 520 | Unuk River | 1930074 |
| 182090 | 40259 | Escapement | 8/30/01 | 35 | SE | 101 | 525 | Unuk River | 1930075 |
| 182091 | 40259 | Escapement | 8/31/01 | 35 | SE | 101 | 460 | Unuk River | 1930076 |
| 182092 | 40259 | Escapement | 8/31/01 | 35 | SE | 101 | 525 | Unuk River | 1930076 |
| 182093 | 40259 | Escapement | 9/3/01 | 36 | SE | 101 | 500 | Unuk River | 1930077 |
| 182094 | 40259 | Escapement | 9/3/01 | 36 | SE | 101 | 435 | Unuk River | 1930077 |
| 182095 | 40259 | Escapement | 9/4/01 | 36 | SE | 101 | 565 | Unuk River | 1930078 |
| 182096 | 40258 | Escapement | 9/5/01 | 36 | SE | 101 | 640 | Unuk River | 1930079 |
| 182097 | 40258 | Escapement | 9/5/01 | 36 | SE | 101 | 645 | Unuk River | 1930079 |
| 182098 | 40259 | Escapement | 9/5/01 | 36 | SE | 101 | 550 | Unuk River | 1930079 |
| 182100 | 40259 | Escapement | 9/6/01 | 36 | SE | 101 | 470 | Unuk River | 1930080 |

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**Appendix A2.–Page 6 of 6.**

| Head number | Tag code | Gear | Recovery date | Stat. week | Quad. | Dist. | Length | Port survey site | Sample number |
|---|---|---|---|---|---|---|---|---|---|
| 199869 | 40258 | Escapement | 9/6/01 | 36 | SE | 101 | 435 | Unuk River | 1930080 |
| 199870 | 40259 | Escapement | 9/7/01 | 36 | SE | 101 | 540 | Unuk River | 1930081 |
| 199875 | 40258 | Escapement | 9/8/01 | 36 | SE | 101 | 620 | Unuk River | 1930082 |
| 199876 | 40258 | Escapement | 9/8/01 | 36 | SE | 101 | 575 | Unuk River | 1930082 |
| 199877 | 40258 | Escapement | 9/9/01 | 37 | SE | 101 | 540 | Unuk River | 1930083 |
| 199878 | 40258 | Escapement | 9/9/01 | 37 | SE | 101 | 615 | Unuk River | 1930083 |
| 199879 | 40259 | Escapement | 9/9/01 | 37 | SE | 101 | 470 | Unuk River | 1930083 |
| 199880 | 40258 | Escapement | 9/10/01 | 37 | SE | 101 | 585 | Unuk River | 1930084 |
| 199881 | 40259 | Escapement | 9/10/01 | 37 | SE | 101 | 680 | Unuk River | 1930084 |
| 199882 | 40258 | Escapement | 9/10/01 | 37 | SE | 101 | 630 | Unuk River | 1930084 |
| 199883 | 40259 | Escapement | 9/10/01 | 37 | SE | 101 | 530 | Unuk River | 1930084 |
| 199884 | 40258 | Escapement | 9/11/01 | 37 | SE | 101 | 530 | Unuk River | 1930085 |
| 199885 | 40259 | Escapement | 9/11/01 | 37 | SE | 101 | 620 | Unuk River | 1930085 |
| 199886 | 40258 | Escapement | 9/11/01 | 37 | SE | 101 | 460 | Unuk River | 1930085 |
| 199887 | 40258 | Escapement | 9/13/01 | 37 | SE | 101 | 520 | Unuk River | 1930086 |
| 199888 | 40259 | Escapement | 9/13/01 | 37 | SE | 101 | 615 | Unuk River | 1930086 |
| 199889 | 40258 | Escapement | 9/13/01 | 37 | SE | 101 | 515 | Unuk River | 1930086 |
| 199890 | 40259 | Escapement | 9/14/01 | 37 | SE | 101 | 560 | Unuk River | 1930087 |
| 199891 | 40259 | Escapement | 9/14/01 | 37 | SE | 101 | 580 | Unuk River | 1930087 |
| 199892 | 40258 | Escapement | 9/15/01 | 37 | SE | 101 | 565 | Unuk River | 1930088 |
| 199893 | 40258 | Escapement | 9/16/01 | 38 | SE | 101 | 615 | Unuk River | 1930089 |
| 199894 | 40259 | Escapement | 9/16/01 | 38 | SE | 101 | 600 | Unuk River | 1930089 |
| 199895 | 40259 | Escapement | 9/17/01 | 38 | SE | 101 | 605 | Unuk River | 1930090 |
| 199896 | 40259 | Escapement | 9/19/01 | 38 | SE | 101 | 625 | Unuk River | 1930091 |
| 199897 | 40258 | Escapement | 9/19/01 | 38 | SE | 101 | 545 | Unuk River | 1930091 |
| 199898 | 40259 | Escapement | 9/19/01 | 38 | SE | 101 | 690 | Unuk River | 1930091 |
| 199900 | 40258 | Escapement | 9/20/01 | 38 | SE | 101 | 590 | Unuk River | 1930092 |
| 199867 | 40258 | Escapement | 9/1/01 | 35 | SE | 101 | 465 | Unuk River-Lake Creek | 1934005 |
| 199873 | 40258 | Escapement | 9/21/01 | 38 | SE | 101 | 560 | Unuk River-Lake Creek | 1934015 |
| 199874 | 40259 | Escapement | 9/25/01 | 39 | SE | 101 | 625 | Unuk River-Lake Creek | 1934017 |
| 147502 | 40258 | Escapement | 10/9/01 | 41 | SE | 101 | 635 | Unuk River-Lake Creek | 1934022 |
| 147503 | 40259 | Escapement | 10/11/01 | 41 | SE | 101 | 735 | Unuk River-Lake Creek | 1934023 |
| 147504 | 40258 | Escapement | 10/11/01 | 41 | SE | 101 | 590 | Unuk River-Lake Creek | 1934023 |
| 147513 | 40258 | Escapement | 10/22/01 | 43 | SE | 101 | 535 | Unuk River-Lake Creek | 1934027 |
| 147505 | 40258 | Escapement | 10/17/01 | 42 | SE | 101 | 515 | Unuk River-Cripple Creek | 1938007 |
| 147506 | 40259 | Escapement | 10/17/01 | 42 | SE | 101 | 380 | Unuk River-Cripple Creek | 1938007 |
| 147507 | 40258 | Escapement | 10/17/01 | 42 | SE | 101 | 650 | Unuk River-Cripple Creek | 1938007 |
| 147509 | 40259 | Escapement | 10/19/01 | 42 | SE | 101 | 650 | Unuk River-Cripple Creek | 1938008 |
| 147510 | 40258 | Escapement | 10/19/01 | 42 | SE | 101 | 590 | Unuk River-Cripple Creek | 1938008 |
| 147511 | 40259 | Escapement | 10/19/01 | 42 | SE | 101 | 695 | Unuk River-Cripple Creek | 1938008 |
| 147512 | 40258 | Escapement | 10/19/01 | 42 | SE | 101 | 695 | Unuk River-Cripple Creek | 1938008 |
| **SELECT RECOVERIES** | | | | | | | | | |
| 504671 | 40258 | Purse | 8/20/01 | 34 | SE | 105 | 510 | Petersburg | 1050897 |
| 82298 | 40259 | Recreational | 9/16/01 | 19 | SE | 101 | 675 | Ketchikan | 1065429 |
| 169580 | 40259 | Recreational | 7/22/01 | 15 | NW | 113 | | Sitka | 1035406 |
| 152327 | 40259 | Troll | 7/29/01 | 31 | NW | 113 | | Sitka | 1030673 |
| 187770 | 40259 | Troll | 7/29/01 | 31 | NW | 113 | | Sitka | 1030676 |
| 187841 | 40258 | Troll | 7/29/01 | 31 | NW | 113 | | Sitka | 1030739 |

**Appendix A3.–Fates and locations (km) of fish with radio transmitters as recorded at two remote radio towers, by hand-held receiver, and located during four Unuk River aerial surveys in 2001.**

| | | Radio tower | | Hand-held | Location by tracking flight | | | | Assumed |
|---|---|---|---|---|---|---|---|---|---|
| Date | Frequency | N. bank | S. bank | receiver | 30-Aug-01 | 14-Sep-01 | 4-Oct-01 | 9-Nov-01 | fate |
| 9/7/01 | 151.014 | | | | | M31 | ? | intertidal | Spawned |
| 8/18/01 | 151.034 | | | E6 (8/20/01) | E6 fork | E6 (fork) | E6 | | Spawned |
| 8/23/01 | 151.053 | | | | not found | not found | not found | not found | Lost |
| 9/11/01 | 151.074 | | | | | M3 | M23 | M26 | Spawned |
| 9/3/01 | 151.093 | | | | | not found | not found | not found | Lost |
| 8/29/01 | 151.115 | | | | M2 | M2 mort | not found | not found | M2 mort |
| 8/22/01 | 151.123 | | | L5 (9/7/01) | L2 | L5 | L5 | | Spawned |
| 8/24/01 | 151.144 | 9/7/01 | | | BL (41) | M21* | M21* | | Spawned |
| 8/20/01 | 151.164 | | | | CR2 | CR3 | CR2* | | Spawned |
| 9/13/01 | 151.203 | | | | | M8 | M29 | | Spawned |
| 9/16/01 | 151.223 | | | | | | M13 | M14 | Spawned |
| 8/23/01 | 151.244 | | | L2 (9/13/01) | Johnson Sl. | L6* | L5 | | Spawned |
| 9/6/01 | 151.264 | | | | | M14 | M37 | | Spawned |
| 8/20/01 | 151.284 | 9/8/01 | | | M6 | M31 | M31* | | Spawned |
| 9/14/01 | 151.303 | | | | | | not found | not found | Lost |
| 9/15/01 | 151.325 | | | | | | M31 | SF3 | Spawned |
| 9/19/01 | 151.335 | | | | | | Klahini 2 | not found | Klahini 1 |
| 8/20/01 | 151.345 | 9/9/01 | | G2 (9/7/01) | not found | G2* | M27* | | Spawned |
| 8/30/01 | 151.363 | | | | | not found | E2 (N) | E3 (N) | Spawned |
| 9/11/01 | 151.384 | | | | | M11 | not found | not found | Spawned |
| 9/5/01 | 151.403 | | | G2 (9/7/01) | | G5 | not found | | Spawned |
| 8/18/01 | 151.424 | | | M3 (8/20/01) | not found | not found | not found | not found | M3 mort |
| 9/8/01 | 151.443 | | | | | M3* | M3 | M3 | M3 |
| 8/21/01 | 151.464 | | | | not found | not found | not found | not found | Lost |
| 8/19/01 | 151.483 | | | | E5 | E6 (fork) | E6 | | Spawned |
| 9/13/01 | 151.505 | | | | | M2 | M31 | | Spawned |
| 9/5/01 | 151.525 | | | | | not found | not found | not found | Lost |
| 9/14/01 | 151.544 | | | | | | not found | Grant 1 | Grant 1 |
| 9/16/01 | 151.564 | | | | | | E5 | E5 | Spawned |
| 8/25/01 | 151.585 | 9/8/01 | | | M3 | CR3* | M22 | | Spawned |
| 8/25/01 | 151.604 | | | | M2* | not found | not found | not found | M2 mort |
| 8/23/01 | 151.624 | | | | M21 | not found | not found | not found | Spawned |
| 8/21/01 | 151.645 | | | | not found | not found | not found | not found | Lost |
| 8/17/01 | 151.675 | | | | not found | not found | not found | not found | Lost |
| 9/7/01 | 151.694 | | | | | M35 | not found | not found | Spawned |
| 9/10/01 | 151.714 | | | | | M2 | not found | SF/M fork | Spawned |
| 9/3/01 | 151.734 | | | | | | E5 | not found | Spawned |
| 9/19/01 | 151.754 | | | | | | M26 | CR2 | Spawned |
| 9/10/01 | 151.773 | 10/13/01 | | | | M2 | not found | not found | Spawned |
| 9/5/01 | 151.797 | | | | | M10 | not found | M26 | Spawned |
| 9/17/01 | 151.813 | | | | | | M26 | M26 | Spawned |
| 9/13/01 | 151.835 | | | | | M3 | M37 | | Spawned |
| 9/8/01 | 151.853 | | | | | M14 | M26 | | Spawned |
| 9/6/01 | 151.874 | | | | | M41 | not found | not found | Spawned |
| 9/7/01 | 151.895 | | | | | M34 | not found | not found | Spawned |
| 9/9/01 | 151.913 | | | | | M21* | not found | not found | Spawned |
| 9/4/01 | 151.934 | | | | | M11 | E3 | | Spawned |
| 9/901 | 151.954 | | | | | M10 | M3 | M2 | Spawned |
| 8/17/01 | 151.974 | | | E3 (8/20/01) | E6 (N) | E6 (N) | E6 | | Spawned |

M = Mainstem Unuk, E = Eulachon River, CR = Cripple Creek, SF = South Fork, L = Lake Creek, G = Genes Lake.

**Appendix A4.–Sulking time of adult coho salmon tagged at SN1 on the Unuk River in 2001.**

| | | | | | Sulk time | | |
|---|---|---|---|---|---|---|---|
| Spaghetti tag # | Date released | Time released | Date recaptured | Time recaptured | Days | Hours | Minutes |
| 1196 | 8/7/01 | 1235 | 8/30/01 | 1749 | 23 | 5 | 14 |
| 1205 | 8/7/01 | 1500 | 8/12/01 | 1734 | 5 | 2 | 34 |
| 1217 | 8/8/01 | 1049 | 8/9/01 | 622 | 0 | 19 | 33 |
| 1229 | 8/9/01 | 1136 | 8/20/01 | 1526 | 11 | 3 | 50 |
| 1233 | 8/9/01 | 1411 | 8/19/01 | 1355 | 9 | 23 | 44 |
| 1275 | 8/11/01 | 1530 | 8/19/01 | 1844 | 8 | 3 | 14 |
| 1307 | 8/11/01 | 1910 | 8/19/01 | 1913 | 8 | 0 | 3 |
| 1309 | 8/12/01 | 1036 | 8/19/01 | 1442 | 7 | 4 | 6 |
| 1366 | 8/13/01 | 1701 | 8/29/01 | 1354 | 15 | 20 | 53 |
| 1399 | 8/14/01 | 1814 | 8/22/01 | 853 | 7 | 14 | 39 |
| 1403 | 8/14/01 | 1848 | 8/18/01 | 1722 | 3 | 23 | 36 |
| 1422 | 8/16/01 | 1230 | 8/19/01 | 1636 | 3 | 4 | 6 |
| 1423 | 8/16/01 | 1313 | 8/19/01 | 1617 | 3 | 3 | 4 |
| 1441 | 8/16/01 | 1730 | 8/18/01 | 1722 | 1 | 23 | 52 |
| 1452 | 8/16/01 | 1830 | 8/19/01 | 700 | 2 | 12 | 30 |
| 1487 | 8/17/01 | 1555 | 9/7/01 | 1157 | 20 | 20 | 2 |
| 1488 | 8/17/01 | 1555 | 8/17/01 | 1626 | 0 | 0 | 31 |
| 1492 | 8/17/01 | 1645 | 8/20/01 | 1157 | 2 | 19 | 13 |
| 1577 | 8/20/01 | 1111 | 9/7/01 | 1257 | 18 | 1 | 46 |
| 1229 | 8/20/01 | 1526 | 9/8/01 | 1115 | 18 | 19 | 49 |
| 1633 | 8/21/01 | 1438 | 9/20/01 | 1225 | 29 | 21 | 47 |
| 1669 | 8/22/01 | 1115 | 9/3/01 | 1442 | 12 | 3 | 27 |
| 1675 | 8/22/01 | 1215 | 8/25/01 | 1614 | 3 | 3 | 59 |
| 1682 | 8/23/01 | 950 | 9/6/01 | 1642 | 14 | 6 | 52 |
| 1701 | 8/23/01 | 1354 | 8/24/01 | 1018 | 0 | 20 | 24 |
| 1783 | 8/25/01 | 1351 | 9/19/01 | 919 | 24 | 19 | 28 |
| 1855 | 8/29/01 | 1220 | 9/5/01 | 1537 | 7 | 3 | 17 |
| 1867 | 8/30/01 | 1551 | 9/7/01 | 1550 | 7 | 23 | 59 |
| 1874 | 8/30/01 | 1703 | 9/21/01 | 1225 | 20 | 19 | 22 |
| 1889 | 8/31/01 | 1143 | 9/3/01 | 1302 | 3 | 1 | 19 |
| 1896 | 8/31/01 | 1327 | 9/7/01 | 1055 | 6 | 21 | 28 |
| 1924 | 9/3/01 | 1103 | 9/8/01 | 1247 | 5 | 1 | 44 |
| 1961 | 9/4/01 | 1115 | 9/9/01 | 936 | 4 | 22 | 21 |
| 1962 | 9/4/01 | 1127 | 9/7/01 | 1550 | 3 | 4 | 23 |
| 1965 | 9/4/01 | 1211 | 9/7/01 | 1318 | 3 | 1 | 7 |
| 1997 | 9/5/01 | 918 | 9/9/01 | 1640 | 4 | 7 | 22 |
| 223 | 9/5/01 | 1256 | 9/5/01 | 1537 | 0 | 2 | 41 |
| 226 | 9/5/01 | 1322 | 9/15/01 | 818 | 9 | 18 | 46 |
| 259 | 9/5/01 | 1653 | 9/13/01 | 939 | 7 | 16 | 46 |
| 269 | 9/6/01 | 1200 | 9/21/01 | 1016 | 14 | 22 | 16 |
| 355 | 9/7/01 | 1259 | 9/16/01 | 1146 | 8 | 21 | 47 |
| 1924 | 9/8/01 | 1247 | 9/8/01 | 1314 | 0 | 0 | 27 |
| 439 | 9/8/01 | 1345 | 9/10/01 | 1509 | 2 | 1 | 24 |
| 1961 | 9/9/01 | 936 | 9/16/01 | 909 | 6 | 23 | 33 |
| 475 | 9/9/01 | 959 | 9/13/01 | 1500 | 4 | 5 | 1 |
| 510 | 9/9/01 | 1652 | 9/10/01 | 1401 | 0 | 21 | 9 |
| 531 | 9/10/01 | 1224 | 9/15/01 | 1156 | 4 | 23 | 32 |

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**Appendix A4.–Page 2 of 2.**

| Spaghetti tag # | Date released | Time released | Date recaptured | Time recaptured | Sulk time | | |
|---|---|---|---|---|---|---|---|
| | | | | | Days | Hours | Minutes |
| 552 | 9/10/01 | 1511 | 9/21/01 | 915 | 10 | 18 | 4 |
| 555 | 9/10/01 | 1550 | 9/13/01 | 1230 | 2 | 20 | 40 |
| 582 | 9/11/01 | 1107 | 9/17/01 | 1016 | 5 | 23 | 9 |
| 608 | 9/11/01 | 1320 | 9/13/01 | 1516 | 2 | 1 | 56 |
| 657 | 9/13/01 | 1114 | 9/21/01 | 1225 | 8 | 1 | 11 |
| 678 | 9/13/01 | 1500 | 9/13/01 | 1516 | 0 | 0 | 16 |
| 690 | 9/13/01 | 1639 | 9/15/01 | 1547 | 1 | 23 | 8 |
| 711 | 9/14/01 | 856 | 9/19/01 | 813 | 4 | 23 | 17 |
| 713 | 9/14/01 | 914 | 9/15/01 | 807 | 0 | 22 | 53 |
| 729 | 9/14/01 | 1121 | 9/15/01 | 1232 | 1 | 1 | 11 |
| 758 | 9/14/01 | 1546 | 9/16/01 | 1710 | 2 | 1 | 24 |
| 764 | 9/14/01 | 1627 | 9/17/01 | 855 | 2 | 16 | 28 |
| 778 | 9/15/01 | 828 | 9/20/01 | 1342 | 5 | 5 | 14 |
| 802 | 9/15/01 | 1630 | 9/17/01 | 906 | 1 | 16 | 36 |
| 833 | 9/16/01 | 1251 | 9/19/01 | 814 | 2 | 19 | 23 |

Average sulking time equals 7 days, 1 hour, and 26 minutes

Minimum sulking time equals 16 minutes

Maximum sulking time equals 29 days, 21 hours, and 47 minutes

**Appendix A5.–Age and sex composition of adult coho salmon sampled during the two-event mark-recapture experiment performed on the Unuk River in 2001.**

| | | AGE | | | |
|---|---|---|---|---|---|
| | | 1.1 | 2.0 | 2.1 | Total |
| **AGE COMPOSITION OF ADULT COHO SALMON** | | | | | |
| **PANEL A: ALL SAMPLES COMBINED** | | | | | |
| Female | n | 735 | 2 | 154 | 891 |
| | % | 33.9% | 0.1% | 7.1% | 41.1% |
| | SE of % | 1.0% | 0.1% | 0.6% | 1.1% |
| | Avg. Length | 580 | 430 | 594 | 582 |
| | SE Length | 2.17 | 49.50 | 5.40 | 2.05 |
| Male | n | 1,083 | 1 | 193 | 1,277 |
| | % | 50.0% | 0.0% | 8.9% | 58.9% |
| | SE of % | 1.1% | 0.0% | 0.6% | 1.1% |
| | Avg. Length | 544 | 325 | 569 | 548 |
| | SE Length | 2.06 | 0.00 | 5.48 | 1.96 |
| Total | n | 1,818 | 3 | 347 | 2,168 |
| | % | 83.9% | 0.1% | 16.0% | 100.0% |
| | SE of % | 0.8% | 0.1% | 0.8% | |
| | Avg. Length | 559 | 395 | 580 | 562 |
| | SE Length | 1.57 | 43.65 | 3.94 | 1.47 |
| | | | | *Unique fish sampled* | 2,455 |
| **PANEL B: EVENT 1-MARKING IN THE LOWER RIVER** | | | | | |
| | | SN1 | | | |
| Female | n | 499 | | 100 | 599 |
| | % | 33.5% | | 6.7% | 40.3% |
| | SE of % | 1.2% | | 0.6% | 1.3% |
| | Escapement | 11,745 | | 2,354 | 14,098 |
| | SE of Esc. | 2,438 | | 530 | 2,916 |
| | Avg. Length | 575 | | 583 | 576 |
| | SE Length | 2.52 | | 5.93 | 2.33 |
| Male | n | 750 | | 139 | 889 |
| | % | 50.4% | | 9.3% | 59.7% |
| | SE of % | 1.3% | | 0.8% | 1.3% |
| | Escapement | 17,652 | | 3,272 | 20,924 |
| | SE of Esc. | 3,637 | | 717 | 4,301 |
| | Avg. Length | 540 | | 563 | 544 |
| | SE Length | 1.72 | | 5.94 | 2.19 |
| Total | n | 1,249 | | 239 | 1,488 |
| | % | 83.9% | | 16.1% | 100.0% |
| | SE of % | 1.0% | | 1.0% | |
| | Escapement | 29,397 | | 5,625 | 35,022 |
| | SE of Esc. | 6,020 | | 1,196 | 7,161 |
| | Avg. Length | 554 | | 571 | 557 |
| | SE Length | 1.79 | | 4.30 | 1.66 |
| | | | | *Unique fish sampled* | 1,708 |
| | | | | *Spaghetti tags released* | 1,602 |

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**Appendix A5.–Page 2 of 5.**

| | | | | | |
|---|---|---|---|---|---|
| **PANEL C: EVENT 2-SAMPLING FOR MARKS** | | | | | |
| TOTAL | | | | | |
| Female | n | 236 | 2 | 54 | 292 |
| | % | 34.7% | 0.3% | 7.9% | 42.9% |
| | SE of % | 1.8% | 0.2% | 1.0% | 1.9% |
| | Avg. Length | 591 | 430 | 613 | 594 |
| | SE Length | 4.06 | 49.50 | 10.28 | 3.92 |
| Male | n | 333 | 1 | 55 | 389 |
| | % | 48.9% | 0.1% | 8.1% | 57.1% |
| | SE of % | 1.9% | 0.1% | 1.0% | 1.9% |
| | Avg. Length | 553 | 325 | 584 | 557 |
| | SE Length | 4.16 | | 11.90 | 4.02 |
| Total | n | 569 | 3 | 109 | 681 |
| | % | 83.6% | 0.4% | 16.0% | 100.0% |
| | SE of % | 1.4% | 0.3% | 1.4% | |
| | Avg. Length | 569 | 395 | 599 | 573 |
| | SE Length | 3.06 | 43.65 | 8.00 | 2.93 |
| | | | | *Total sampled* | 772 |
| | | | | *Spaghetti tags recovered* | 25 |
| EULOCHON RIVER | | | | | |
| Female | n | 134 | | 14 | 148 |
| | % | 45.4% | | 4.7% | 50.2% |
| | SE of % | 2.9% | | 1.2% | 2.9% |
| | Avg. Length | 573 | | 564 | 573 |
| | SE Length | 5.67 | | 16.70 | 5.38 |
| Male | n | 134 | | 13 | 147 |
| | % | 45.4% | | 4.4% | 49.8% |
| | SE of % | 2.9% | | 1.2% | 2.9% |
| | Avg. Length | 559 | | 488 | 553 |
| | SE Length | 5.94 | | 24.37 | 5.86 |
| Total | n | 268 | | 27 | 295 |
| | % | 90.8% | | 9.2% | 100.0% |
| | SE of % | 1.7% | | 1.7% | |
| | Avg. Length | 566 | | 528 | 563 |
| | SE Length | 4.13 | | 14.88 | 4.00 |
| | | | | *Total sampled* | 328 |
| | | | | *Spaghetti tags recovered* | 6 |
| LAKE CREEK | | | | | |
| Female | n | 34 | 2 | 30 | 66 |
| | % | 20.5% | 1.2% | 18.1% | 39.8% |
| | SE of % | 3.1% | 0.8% | 3.0% | 3.8% |
| | Avg. Length | 599 | 430 | 628 | 607 |
| | SE Length | 8.72 | 49.50 | 13.34 | 8.78 |
| Male | n | 71 | 1 | 28 | 100 |
| | % | 42.8% | 0.6% | 16.9% | 60.2% |
| | SE of % | 3.9% | 0.6% | 2.9% | 3.8% |
| | Avg. Length | 550 | 325 | 603 | 563 |
| | SE Length | 9.54 | | 14.42 | 8.58 |
| Total | n | 105 | 3 | 58 | 166 |
| | % | 63.3% | 1.8% | 34.9% | 100.0% |
| | SE of % | 3.8% | 1.0% | 3.7% | |
| | Avg. Length | 566 | 395 | 616 | 580 |
| | SE Length | 7.39 | 43.65 | 9.93 | 6.46 |
| | | | | *Total sampled* | 190 |
| | | | | *Spaghetti tags recovered* | 6 |

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**Appendix A5.–Page 3 of 5.**

| | | | | |
|---|---|---|---|---|
| BOUNDARY CREEK | | | | |
| Female | n | 17 | 5 | 22 |
| | % | 21.5% | 6.3% | 27.8% |
| | SE of % | 4.7% | 2.8% | 5.1% |
| | Avg. Length | 619 | 674 | 632 |
| | SE Length | 11.21 | 18.24 | 10.77 |
| Male | n | 51 | 6 | 57 |
| | % | 64.6% | 7.6% | 72.2% |
| | SE of % | 5.4% | 3.0% | 5.1% |
| | Avg. Length | 572 | 676 | 583 |
| | SE Length | 10.79 | 19.74 | 10.74 |
| Total | n | 68 | 11 | 79 |
| | % | 86.1% | 13.9% | 100.0% |
| | SE of % | 3.9% | 3.9% | |
| | Avg. Length | 584 | 675 | 597 |
| | SE Length | 8.92 | 13.59 | 8.67 |
| | | | *Total sampled* | 90 |
| | | | *Spaghetti tags recovered* | 5 |
| GENE'S LAKE CREEK | | | | |
| Female | n | 13 | 2 | 15 |
| | % | 32.5% | 5.0% | 37.5% |
| | SE of % | 7.5% | 3.5% | 7.8% |
| | Avg. Length | 618 | 525 | 606 |
| | SE Length | 12.54 | 31.82 | 14.26 |
| Male | n | 20 | 5 | 25 |
| | % | 50.0% | 12.5% | 62.5% |
| | SE of % | 8.0% | 5.3% | 7.8% |
| | Avg. Length | 560 | 545 | 557 |
| | SE Length | 18.27 | 26.65 | 15.61 |
| Total | n | 33 | 7 | 40 |
| | % | 82.5% | 17.5% | 100.0% |
| | SE of % | 6.1% | 6.1% | |
| | Avg. Length | 583 | 539 | 575 |
| | SE Length | 13.10 | 21.37 | 11.73 |
| | | | *Total sampled* | 47 |
| | | | *Spaghetti tags recovered* | 3 |
| CRIPPLE CREEK | | | | |
| Female | n | 30 | 3 | 33 |
| | % | 40.0% | 4.0% | 44.0% |
| | SE of % | 5.7% | 2.3% | 5.8% |
| | Avg. Length | 624 | 657 | 627 |
| | SE Length | 8.45 | 13.61 | 7.95 |
| Male | n | 40 | 2 | 42 |
| | % | 53.3% | 2.7% | 56.0% |
| | SE of % | 5.8% | 1.9% | 5.8% |
| | Avg. Length | 530 | 515 | 529 |
| | SE Length | 11.63 | 49.50 | 11.34 |
| Total | n | 70 | 5 | 75 |
| | % | 93.3% | 6.7% | 100.0% |
| | SE of % | 2.9% | 2.9% | |
| | Avg. Length | 570 | 600 | 572 |
| | SE Length | 9.41 | 37.71 | 9.18 |
| | | | *Total sampled* | 90 |
| | | | *Spaghetti tags recovered* | 3 |

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**Appendix A5.–Page 4 of 5.**

| | | | | |
|---|---|---|---|---|
| CUTTHROAT SLOUGH | | | | |
| Female | n | 2 | | 2 |
| | % | 22.2% | | 22.2% |
| | SE of % | 14.7% | | 14.7% |
| | Avg. Length | 620 | | 620 |
| | SE Length | 35.36 | | 35.36 |
| Male | n | 7 | | 7 |
| | % | 77.8% | | 77.8% |
| | SE of % | 14.7% | | 14.7% |
| | Avg. Length | 496 | | 496 |
| | SE Length | 22.35 | | 22.35 |
| Total | n | 9 | | 9 |
| | % | 100.0% | | 100.0% |
| | SE of % | 0.0% | | |
| | Avg. Length | 524 | | 524 |
| | SE Length | 25.40 | | 25.64 |
| | | | *Total sampled* | 10 |
| | | | *Spaghetti tags recovered* | 0 |
| GRIZZLY SLOUGH | | | | |
| Female | n | 2 | | 2 |
| | % | 20.0% | | 20.0% |
| | SE of % | 13.3% | | 13.3% |
| | Avg. Length | 620 | | 620 |
| | SE Length | 3.54 | | 3.54 |
| Male | n | 8 | | 8 |
| | % | 80.0% | | 80.0% |
| | SE of % | 13.3% | | 13.3% |
| | Avg. Length | 517 | | 517 |
| | SE Length | 27.57 | | 27.57 |
| Total | n | 10 | | 10 |
| | % | 100.0% | | 100.0% |
| | SE of % | 0.0% | | |
| | Avg. Length | 542 | | 542 |
| | SE Length | 27.01 | | 27.01 |
| | | | *Total sampled* | 10 |
| | | | *Spaghetti tags recovered* | 1 |
| KERR CREEK | | | | |
| Female | n | 3 | | 3 |
| | % | 60.0% | 0.0% | 60.0% |
| | SE of % | 24.5% | 0.0% | 24.5% |
| | Avg. Length | 650 | | 650 |
| | SE Length | 18.86 | #DIV/0! | 18.86 |
| Male | n | 1 | 1 | 2 |
| | % | 20.0% | 20.0% | 40.0% |
| | SE of % | 20.0% | 20.0% | 24.5% |
| | Avg. Length | 650 | 490 | 570 |
| | SE Length | 0.00 | 0.00 | 56.57 |
| Total | n | 4 | 1 | 5 |
| | % | 80.0% | 20.0% | 100.0% |
| | SE of % | 20.0% | 20.0% | |
| | Avg. Length | 650 | 490 | 618 |
| | SE Length | 14.14 | 0.00 | 30.78 |
| | | | *Total sampled* | 5 |
| | | | *Spaghetti tags recovered* | 0 |

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**Appendix A5.–Page 5 of 5.**

| | | MAINSTEM UNUK | | |
|---|---|---|---|---|
| Female | n | 1 | | 1 |
| | % | 50.0% | | 50.0% |
| | SE of % | 50.0% | | 50.0% |
| | Avg. Length | 615 | | 615 |
| | SE Length | 0.00 | | 0.00 |
| Male | n | 1 | | 1 |
| | % | 50.0% | | 50.0% |
| | SE of % | 50.0% | | 50.0% |
| | Avg. Length | 455 | | 455 |
| | SE Length | 0.00 | | 0.00 |
| Total | n | 2 | | 2 |
| | % | 100.0% | | 100.0% |
| | SE of % | 0.0% | | |
| | Avg. Length | 535 | | 535 |
| | SE Length | 56.57 | | 56.57 |
| | | | *Total sampled* | 2 |
| | | | *Spaghetti tags recovered* | 1 |

**Appendix A6.–Estimated harvests of coho salmon bound for the Unuk River in 2001 in marine commercial and recreational fisheries by statistical week.** Statistical week estimates for the troll and sport fisheries were approximated by weighting catch by period or biweek by the number of tags recovered in a statistical week.

| Stat | Week | Troll | | | | | Gillnet | Seine | | | | Sport | | | | Estimated weekly proportion by gear type | | | | | Estimated | Est. Cumulative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Week | Begins | NW | NE | SW | SE | Total | SE | SE | SW | NE | Total | SE | SW | NW | Total | Troll | Gillnet | Seine | Sport | Total | Cumulative Harvest | Proportion of Harvest |
| 27 | 1-Jul | 1,668 | 146 | 56 | | 1,870 | | | | | | | | 123 | 123 | 0.13 | | | 0.05 | 0.06 | 1,992 | 0.06 |
| 28 | 8-Jul | 1,026 | | 338 | | 1,364 | | | | | | | | | 0 | 0.10 | | | | 0.04 | 3,357 | 0.10 |
| 29 | 15-Jul | 1,411 | 437 | 113 | 71 | 2,032 | 126 | 5,604 | 144 | | 5,748 | 75 | | | 75 | 0.14 | 0.04 | 0.47 | 0.03 | 0.25 | 11,337 | 0.35 |
| 30 | 22-Jul | 1,026 | | 338 | 71 | 1,436 | | 301 | | | 301 | 75 | 322 | | 397 | 0.10 | | 0.02 | 0.15 | 0.07 | 13,471 | 0.41 |
| 31 | 29-Jul | 770 | 146 | 282 | 71 | 1,268 | 223 | 813 | 546 | | 1,360 | | 158 | | 158 | 0.09 | 0.07 | 0.11 | 0.06 | 0.09 | 16,480 | 0.51 |
| 32 | 5-Aug | 257 | 146 | 507 | 214 | 1,123 | | 884 | 657 | 45 | 1,586 | 163 | | | 163 | 0.08 | | 0.13 | 0.06 | 0.09 | 19,352 | 0.60 |
| 33 | 12-Aug | 187 | 95 | 283 | 223 | 789 | 61 | 134 | | | 134 | 83 | 158 | 194 | 436 | 0.06 | 0.02 | 0.01 | 0.16 | 0.04 | 20,771 | 0.64 |
| 34 | 19-Aug | 469 | 95 | 340 | 298 | 1,201 | 598 | 2,008 | 210 | | 2,218 | 83 | | 97 | 180 | 0.08 | 0.18 | 0.18 | 0.07 | 0.13 | 24,968 | 0.77 |
| 35 | 26-Aug | 281 | 95 | 57 | 149 | 581 | 609 | 261 | 465 | | 726 | 225 | | | 225 | 0.04 | 0.18 | 0.06 | 0.08 | 0.07 | 27,109 | 0.83 |
| 36 | 2-Sep | 1,031 | | | 149 | 1,180 | 63 | | | | | 300 | | | 300 | 0.08 | 0.02 | | 0.11 | 0.05 | 28,652 | 0.88 |
| 37 | 9-Sep | 187 | | | 595 | 782 | 1,118 | 113 | | | 113 | 450 | | | 450 | 0.05 | 0.33 | 0.01 | 0.17 | 0.08 | 31,116 | 0.96 |
| 38 | 16-Sep | 281 | | | 298 | 579 | 367 | | | | | 150 | | | 150 | 0.04 | 0.11 | | 0.06 | 0.03 | 32,212 | 0.99 |
| 39 | 23-Sep | 94 | | | | 94 | | | | | | | | | | 0.01 | | | | 0.00 | 32,305 | 0.99 |
| 40 | 30-Sep | | | | | | 196 | | | | | | | | | | 0.06 | | | 0.01 | 32,502 | 1.00 |
| Total | | 8,688 | 1,158 | 2,313 | 2,139 | 14,298 | 3,360 | 10,119 | 2,023 | 45 | 12,186 | 1,606 | 638 | 414 | 2,657 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | |
| Est. mean harvest date = | | 27 Jul | 25 Jul | 30 Jul | 24 Aug | 31 Jul | 29 Aug | 26 Jul | 7 Aug | 5 Aug | 29 Jul | 26 Aug | 28 Jul | 31 Jul | 15 Aug | | | | | 30 Jul | | |

**Appendix A7.–Computer data files on 2000 Unuk River coho salmon smolt and subsequent estimates of 2001 Unuk River adult coho salmon run parameters.**

| File name | Description |
|---|---|
| 01UNK43-R.XLS | Spreadsheet containing all the mark-recapture data, various pivot table results, Tables 1-7, Figures 5, 6, 8, and 9, Appendices A2-A6, harvest estimation calculations, abundance estimates, bootstrap results, Kolmogorov-Smirnov (K-S), various $c^2$ hypothesis test results, and output from SPAS.EXE for the 2001 Unuk River coho salmon data. |
| SPAS1.EXE | Stratified Population Analysis (SPAS) program used to perform computer analysis of 2-sample mark-recovery data where each sample is from a geographically or temporally stratified population. |
| 43Spas01.DAT | Data file containing the 2001 Unuk River coho salmon data for use in SPAS.exe. |
| 43KSUNUK01_R.XLS | Kolmogorov-Smirnov (K-S) 2-sample tests, Figures 10 and 11 |