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Stamp Falls Fishway Counts, Adipose Clip/CWT Recovery and Biological Sampling of Chinook Salmon Escapements in Stamp River and Robertson Creek Hatchery, 1993

T.C. Nelson

Department of Fisheries and Oceans
Biological Sciences Branch
#416, Suite 400-555 West Hastings Street
Vancouver, British Columbia V6B 5G3

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STAMP FALLS FISHWAY COUNTS, ADIPOSE CLIP/CWT RECOVERY AND BIOLOGICAL SAMPLING OF CHINOOK SALMON ESCAPEMENTS IN STAMP RIVER AND ROBERTSON CREEK HATCHERY, 1993

by

T. C. Nelson[1]

for

Department of Fisheries and Oceans
Biological Sciences Branch
#416,Suite 400-555 West Hastings Street
Vancouver, B.C.
V6B 5G3

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[1]LGL Limited environmental research associates, 9768 Second Street, Sidney, B.C. V8L 3Y8
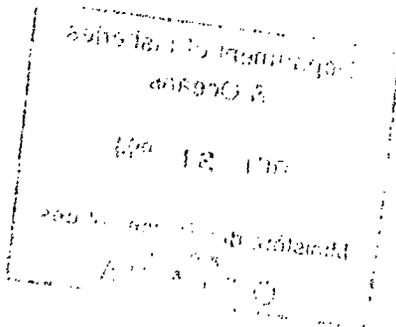
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TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

v

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES - Cont'd

LIST OF APPENDICES

Appendix   Page

ABSTRACT

Estimates of salmon escapement were derived for the Stamp River for 1993 using visual counts at the Stamp Falls Fishway. After adjusting for observer error, the total escapement of adult chinook salmon (*Oncorhynchus tshawytscha*) to the Stamp River was estimated at 96,254 $\pm$ 4707; the total escapement of jack chinook was estimated at 1806 (confidence limits are not presented due to the low number of observations of jack chinook during verification tests). Escapement estimates for adult and jack coho salmon are also presented, as well as partial estimates for sockeye. This study is part of the Chinook Key Stream Program.

The age, size, sex, and hatchery contributions for chinook salmon in the upper Stamp River are also described using data from carcass recovery operations and live returns to Robertson Creek Hatchery. The dominant male age groups for the in-river chinook population were age 4 and age 3, respectively, and the dominant male age groups for the hatchery chinook population were age 3 and age 4, respectively. The dominant female age groups for both the in-river and hatchery populations were age 4 and age 5, respectively. For both the in-river and hatchery populations, the mean lengths of all age groups of female chinook were larger than the corresponding mean lengths of males.

Escapement of adipose-clipped chinook to the entire Stamp River system (hatchery plus upper river returns) was 3,126 and represented 3.4% of the entire population. This estimate was further stratified by age, sex, and tag code. The total hatchery contribution (marked and unmarked) to the escapement was estimated by expanding the number of observed adipose clips by the adipose-clip mark rate at release. In 1993, Robertson Creek Hatchery contributed 82.0% of the total chinook escapement to the Stamp River. This hatchery contribution estimate was compared with a contribution estimate calculated using the Mark Recovery Program (MRP) method of coded wire tag expansions (Kuhn et al. 1988). Using the MRP method, the total contribution of Robertson Creek Hatchery to the 1993 chinook escapement was 74.7%. Reasons for the differences between hatchery contribution estimates using the two methods are discussed.

Key words: Stamp River, chinook, key stream, escapement, fishway, coded wire tags, hatchery contribution

RÉSUMÉ

Nelson, T. C. 1994. Stamp Falls Fishway counts, adipose clip/CWT recovery and biological sampling of chinook salmon escapements in Stamp River and Robertson Creek Hatchery, 1993. Can. Manuscr. Rep. Fish. Aquat. Sci. 2255: ix + 82 p.

L´échappée de saumon de la rivière Stamp (1993) a été estimée par dénombrements visuels au niveau de le passe migratoire des chutes Stamp. Après ajustement pour tenir compte de l'erreur due à l'observateur, 1´échappée totale de saumon quinnat (*Oncorhynchus tshawytscha*) dans ce cours d´eau a été évaluée à 96 254 ± 4 707; 1´échappée totale de jacks de cette espèce a été estimée à 1 806 (les limites de cónfiance ne sont pas indiquées en raison du peu d´observations de jacks pendant les vérifications). On présente également les estimations de l'échappée de jacks et d´adultes de saumon coho ainsi que des estimations partielles pour le saumon rouge. Cette étude fait partie du Programme des rivières clés pour le quinnat.

Grâce aux données obtenues par les récupérations de carcasses et les retours de poissons vivants à la pisciculture du ruisseau Robertson, on a pu indiquer également 1´âge, la taille, le sexe, et la contribution de la pisciculture concernant le saumon quinnat dans la partie amont de la rivière Stamp. En ce qui concerne la population de quinnat de la rivière, les mâles dominants appartenaient respectivement aux groupes d´âge 4 et 3, et les mâles dominants de la population de quinnat d´élevage, respectivement aux groupes d´âge 3 et 4. Relativement aux femelles, les groupes dominants pour les populations de rivière et les populations d´élevage étaient respectivement les groupes d´âge 4 et 5. Pour les populations de rivière et d´élevage, la longueur moyenne pour tous les groupes d´âge de quinnat femelle était supérieure à la longueur moyenne correspondante chez les mâles.

L´échappée de quinnat à nageoire adipeuse coupée dans tout le réseau de la rivière Stamp (retours à la pisciculture plus la partie amont) s´établissait à 3 126 et représentait 3,4 % de tout la population. Cette estimation était de plus stratifiée selon 1´âge, le sexe et le code de la marque. La contribution totale de la pisciculture (poissons marqués et non marqués) à 1´échappée a été estimée en multipliant le nombre de poissons à nageoire adipeuse coupée par le taux de poissons à nageoire adipeuse coupée au moment du lâcher. En 1993, la pisciculture du ruisseau Robertson a fourni 82,0 % de toute 1´échappée de quinnat de la rivière Stamp. Cette estimation a été comparée à celle calculée au moyen de la méthode utilisée dans le cadre du programme de récupération des micromarques codées (Kuhn et al., 1988). Selon cette méthode, la contribution totale de la pisciculture du ruisseau Robertson à l'échappée de quinnat pour 1993 s´établissait à de 74,7 %. On examine les raisons pour lesquelles les deux méthodes présentent des écarts au niveau des contributions des piscicultures.

Mots clés: Stamp, saumon quinnat, cours d'eau, clé, échappée, échelle à poissons, fil codé, contribution de piscicultures

INTRODUCTION

In 1984, the Somass River system was selected under the Chinook Key Stream Program as one of the systems used to assess the response of chinook salmon stocks to a new harvest management regime. The goal of the new management regime is to rebuild chinook stocks to historical levels. The Chinook Key Stream Program was initiated in response to objectives set out in the Canada - U.S. Salmon Treaty.

The major objectives of the Chinook Key Stream Program are:

1. to accurately estimate chinook escapement on key streams;

2. to estimate harvest rates and contributions to fisheries and escapement based on coded wire tagged/adipose-clip returns, including estimates of the total escapement of coded wire tags to the key stream system; and

3. to estimate the contribution of hatchery and natural production to the escapement.

This report deals with the determination of spawning escapement of chinook salmon to the Stamp River in 1993 and related biological information. The objectives of the study were:

1. to estimate the total chinook salmon escapement to the Stamp River;

2. to determine the age and sex composition of both the in-river population and hatchery returns of chinook salmon to the system; and

3. to estimate the total escapement of coded wire tagged chinook salmon to the system, thereby assessing the hatchery contribution to the total escapement.

Part I of this report addresses the first objective and Part II of the report addresses objectives 2 and 3. Escapement estimates for the Stamp River for 1993 were derived using visual counts at the Stamp Falls Fishway and brailer counts at Robertson Creek Hatchery. Estimates of coded wire tag (CWT) returns, adipose-clip returns, and hatchery contributions were produced using dead recoveries of chinook salmon throughout the Stamp River and live returns of chinook salmon to Robertson Creek Hatchery.

PART I: STAMP FALLS FISHWAY COUNTS

INTRODUCTION

The chinook salmon of the Somass River system (including Robertson Creek Hatchery production) are the most abundant stock of this species on Vancouver Island and make important contributions to troll, net, and sport fisheries in U.S. and Canadian waters. Coded wire tag returns for chinook released from Robertson Creek Hatchery have been used to estimate the contribution of hatchery production to coastal fisheries (Sibert and Schnute 1982; English and Griffiths 1984); however, these analyses were incomplete due to the lack of reliable data on escapement, aboriginal fishery catches, and terminal sport fishery harvests. In 1984, the Department of Fisheries and Oceans initiated several investigations for Somass River chinook, including:

1. escapement estimation using a combination of mark-recapture techniques, counts of fish passing through the Stamp Falls Fishway, deadpitch surveys and hatchery returns (Lightly et al. 1988);

2. catch estimates for the Indian food fishery from field surveys; and

3. catch estimates for the Alberni Inlet and Somass River sport fisheries derived from creel surveys.

In 1985, the responsibility for providing reliable escapement and estimates for Somass River chinook was allocated to the Key Stream Program as part of a coast-wide attempt to monitor the effect of new management action on chinook stock status. After a number of years of attempting various methods, the salmon run to the Stamp River was successfully monitored in 1989 using visual counts. The 1993 program was executed using the same methods as in 1990, 1991, and 1992. Our specific objectives in the 1993 study were to:

1. count all chinook, coho, sockeye, steelhead, and other salmonids passing through the Stamp Falls Fishway between 2 September and 10 November, 1993;

2. quantify the random error associated with species identification and incorrect counting of fish migrating through the fishway; and

3. to estimate the number of fish migrating through the fishway during periods when reliable counting could not be conducted.

STUDY AREA

The Somass River system is one of the largest on Vancouver Island and includes the Stamp and Sproat rivers near Port Alberni (Figure 1). The Stamp River drains Great Central Lake and flows northeast and southeast into the Somass River. The Sproat River drains Sproat Lake and flows eastward into the Stamp River.

The Somass River system supports sockeye, chinook, coho, chum, and pink salmon, as well as steelhead and cutthroat trout. The system supports the largest stock of chinook salmon on the west coast of Vancouver Island. The Somass River chinook stocks are comprised of wild populations that spawn in the Sproat and Stamp rivers and production from Robertson Creek Hatchery (Figure 1). Somass River chinook generally have a fall run timing with the majority of the population returning in September and October. The majority of the chinook return at age 4, although ages range from 2 to 7 years. Coho salmon appear to have a similar run timing (Wright 1990).

Sockeye returning to the Somass River system are from Sproat and Great Central lakes and their tributaries. Only a fraction of the sockeye that return to Great Central Lake are enumerated at Stamp Falls Fishway, as the majority of the run (> 85%) has usually passed prior to 1 September. Sockeye have not been rigorously counted at Stamp Falls Fishway as the counting systems used have allowed many of the small adults and jacks (< 45 cm) to pass through the counting bars undetected. Coho, pink, and chum salmon, and steelhead, are also enumerated during the counting period at Stamp Falls Fishway with a high level of rigor and success in recent years.

METHODS

Biophysical Observations

Maximum and minimum water temperatures were recorded daily at the fishway, usually between the hours of 0800 and 1000 am. Water levels were also recorded (to the nearest 1.0 cm) on a daily basis using a staff gauge positioned on the upstream corner of the fishway in the exit pool. Weather conditions were also monitored in terms of percent sun, cloud, and precipitation.

Fishway Counts

Visual counts of salmonids passing through the Stamp Falls Fishway were made between 2 September and 10 November, 1993. A counting station was installed at the upstream end of the fishway (Figure 2). Aluminum panels (2.4 m x 1 m frames of 7.6 cm channel aluminum) with
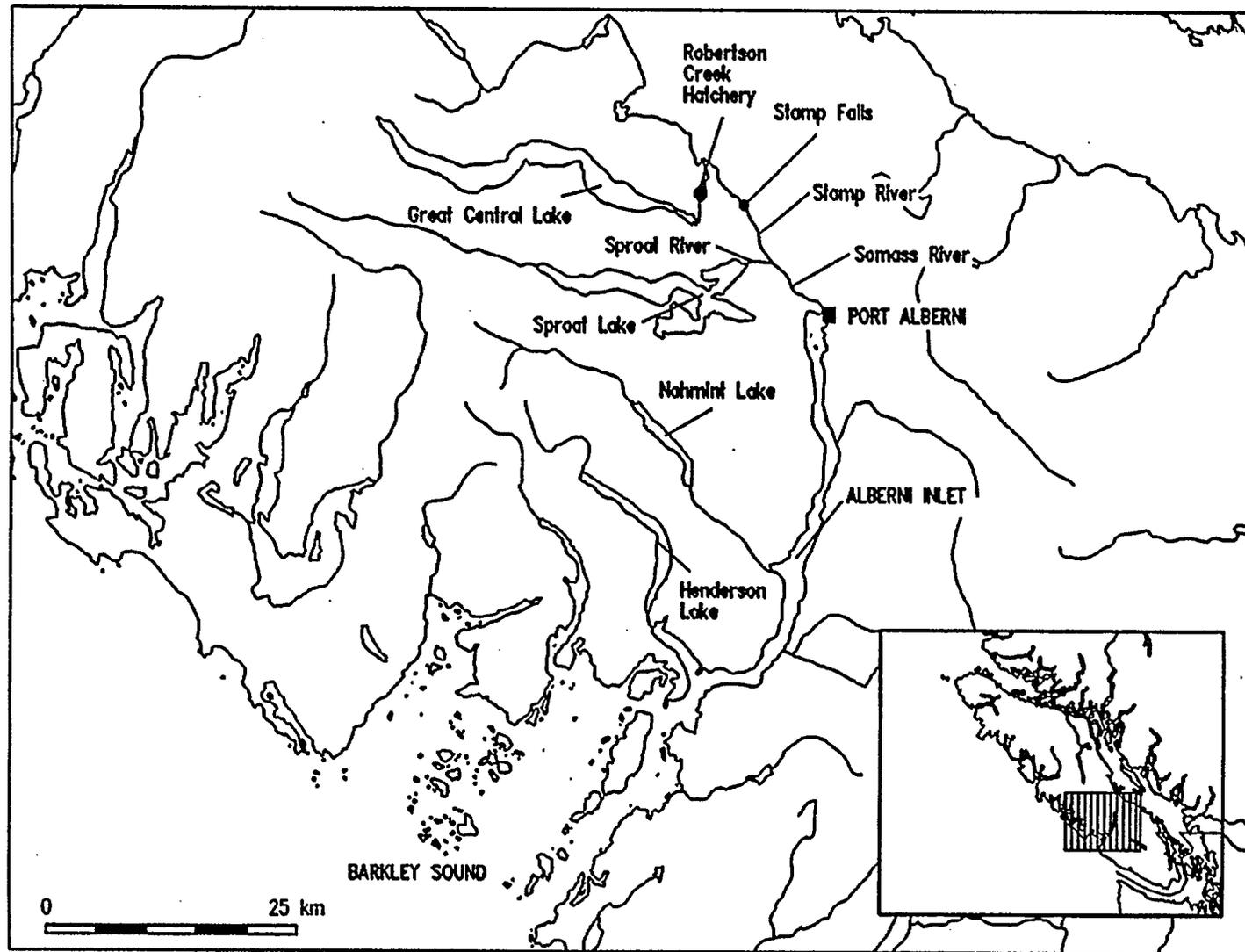
Figure 1.   Map of Somass River system and Stamp Falls.
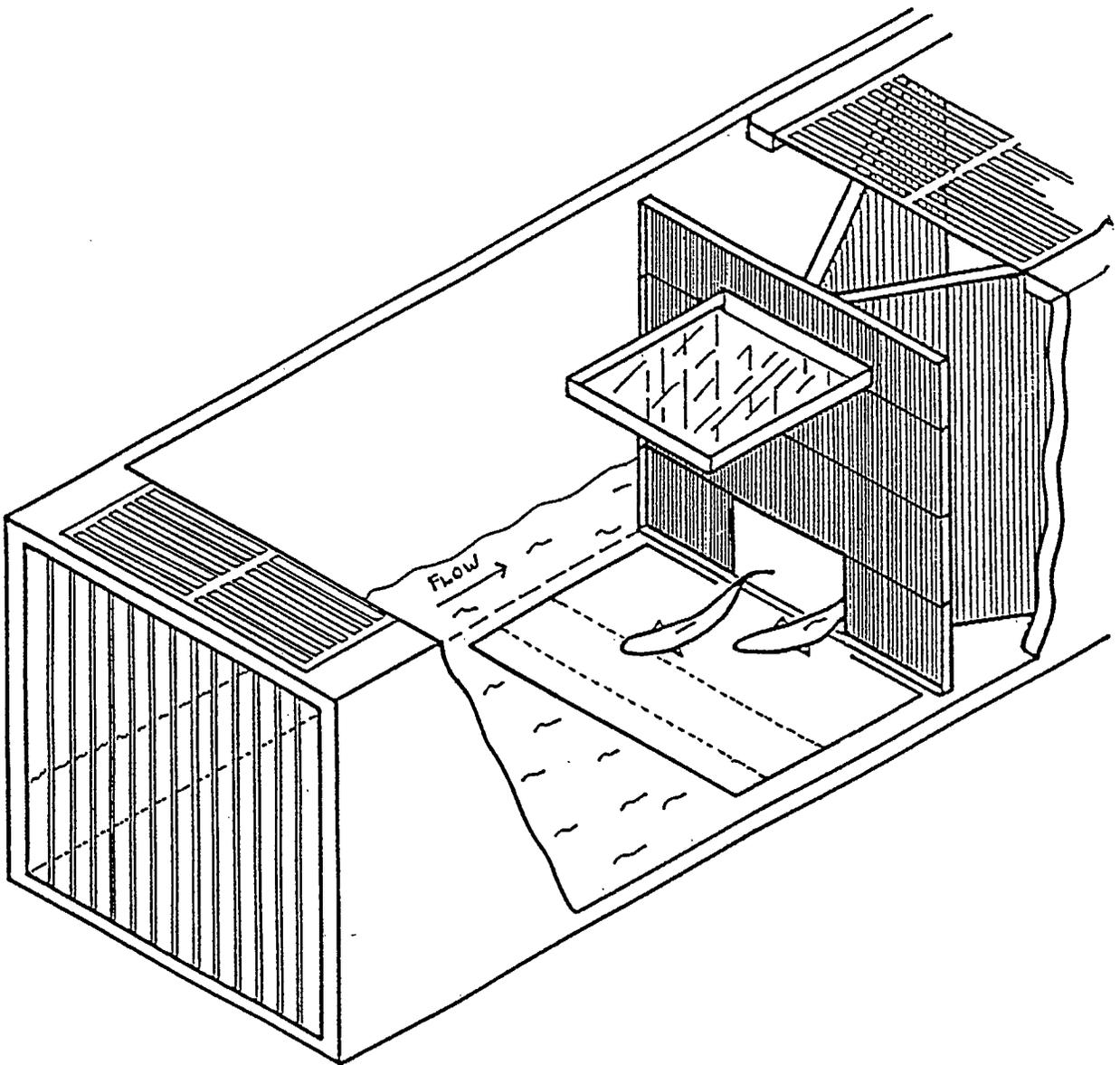
Figure 2.   Diagram of the fish counting facility installed at the upstream end of Stamp Falls Fishway, 2 September through 10 November 1993.

vertical bars (2.5 cm OD aluminum conduit, spaced 5.1 cm between bars) were set into channel aluminum tracks which were attached to the inside of the fishway. The panels were stacked one on top of the other, perpendicular to the flow, as needed for the top of the panels to be at least 30 cm above the water line. A white vexar fence (2.5 cm mesh), strung on an aluminum frame was placed on the upstream side of the panel to effectively close the gap between the bars and prevent small salmonids (i.e. sockeye and coho < 45 cm) from escaping between the panel bars. A semi-permanent set of large aluminum panels, situated immediately downstream of the stacked panels, were positioned in a VEE formation to funnel fish through an opening in the centre of the bottom panel. The opening was 30 cm high and 1.3 m wide, and was designed to prevent multi-layered schools of fish from entering. A gate across the opening could be closed to prevent fish passage during verification tests and at night when the counting station was unmanned.

Once through the opening, fish passed over a 1 m x 2.4 m aluminum grid and a 1 m x 2.4 m sheet of plywood. To improve visibility a 1 m x 1 m viewing window was floated on the surface over the flashboard. Observations were made from the top of the fishway and counts were made as fish passed under the viewing window. A thin film of water was placed on top of the viewing window to enhance the image of the fish below. To prevent glare, tarps were placed over the fishway at the counting site.

Counts were made daily between dawn and dusk (usually from 0800 to 1700) and the panel gate was closed during the night to prevent unaccounted fish passage. Two observers manned the station during counting hours and alternated counting every hour. The counting system described above worked well under most flow conditions.

Total counts of adult and jack chinook, adult and jack coho, sockeye, pink, chum, and steelhead were recorded hourly. Both the aluminum grid and plywood were marked at 34 cm and 59 cm to allow size range estimates of coho and chinook jacks, respectively. These total length size categories are based on age-length data from Robertson Creek Hatchery. Daily summaries that provided totals for each of the salmonid species (chinook adults, chinook jacks, coho adults, coho jacks, sockeye, and steelhead) counted at Stamp Falls Fishway were forwarded to Robertson Creek Hatchery twice weekly and used for in-season management at the hatchery.

Precision of Counts

Estimates of counting and species identification errors were derived from a program of sub-sampling referred to as verification tests. For approximately one hour each day (starting at the top of the hour), the panel gate was closed briefly while the exit from the fishway was blocked using aluminum panels covered with vexar mesh (2 cm) so that fish could be counted, then trapped and examined for species verification. Following the placement of the forward blockage panels, and a verification that no fish remained in the containment area, the panel gate was opened and fish were counted through the gate and over the aluminum grid as normal but were contained in a 2 m x 2.4 m area; this count was called the observed count. After 10-30 fish (of varying species composition) had passed into the containment area, the panel gate was closed (to prevent any downstream escape) and the captured fish were dipnetted from the containment area and carefully enumerated by species; this count was called the verified count. Both sets of counts (observed and verified) were recorded on a

specific block of the datasheet for later analysis. The tests were conducted at various times of the day and under varying light and water conditions. Tests were conducted daily during the entire counting period (2 September to 10 November).

Hourly visual counts and species identification were adjusted in proportion to the difference between the observed visual counts and the verified counts. These differences were calculated in terms of the weighted mean proportional error (PE) for each sampling interval (generally one week):

$$PE_k = \frac{(\sum_{j=1}^{n} VerC_j) + 1}{(\sum_{j=1}^{n} VC_j) + 1} \tag{1}$$

where PE_k is the weighted mean proportional error of the visual counts for sample period k, $VerC_j$ is the verified number of fish determined from each test (j), VC_j is the number of fish observed during the test, and n is the number of tests conducted in each sampling interval.

The hourly counts of each species could then be adjusted using the following equation:

$$VC'_{k,j,i} = VC_{k,j,i} \cdot PE_k \tag{2}$$

where $VC_{k,j,i}$ is the actual count of fish in hour i, on day j, and in sample period k, and $VC'_{k,j,i}$ is the corresponding adjusted count.

The variance can be calculated for the total number of fish estimated in each week using the following equation:

$$Var(VC_k) = \sum_{i=1}^{n} \sum_{j=1}^{n} (VC'_{k,j,i})^2 \cdot Var(PE_k) \tag{3}$$

where $Var(VC_k)$ is the variance for the total estimated weekly count, $VC'_{k,j,i}$ is the adjusted weekly count, and $Var(PE_k)$ is the variance for the weighted mean proportional error of the visual counts for sample period k:

$$Var\,(PE_k) = \frac{\sum\limits_{j=1}^{n} PE_{k,j}^{2} \cdot W_{k,j} - \dfrac{(\sum\limits_{j=1}^{n} PE_{k,j} \cdot W_{k,j})^{2}}{n}}{n-1} \qquad (4)$$

where $PE_{k,j}$ is the proportional error for sample period k for each test j:

$$PE_{k,j} = \frac{VerC_{k,j}+1}{VC_{k,j}+1}$$

and $W_{k,j}$ is the weight associated with each test:

$$W_{k,j} = \frac{n \cdot \sum\limits_{s=1}^{m} VerC_{k,j,s}}{\sum\limits_{j=1}^{n}\sum\limits_{s=1}^{m} VerC_{k,j,s}}$$

and n is the number of tests conducted in period k, s is the species of salmon observed, and m is the number of each species observed.

The adjusted hourly counts for each species were summed to give daily and weekly estimates of the number of fish moving through the fishway. Daily estimates were summed to provide a total population estimate. The square root of the sum of weekly variances produced the total standard error. The verification tests were used to compare the counting accuracy of each of the observers.

High water levels and/or turbid water conditions did not occur during the counting period in 1993. In past years, during extended periods of high or turbid water, when accurate visual counts could not be made, the panel gate was open and fish were allowed to pass upstream; estimates of the number of chinook and coho salmon passing through the fishway were calculated by using the relationship between fishway counts and hatchery counts during a time period when fishway counts were available. In 1993, observations were not precluded by water or other conditions and there were no occasions during the counting period when fish were allowed to pass unobserved.

RESULTS

Accuracy and Precision of Counts

Two factors were considered in assessing the accuracy and precision of the fishway counts. The first involved observer error in enumerating the fish and in species identification. The second involved a comparison of "between observer" error. To assess these sources of error, verification tests were conducted for approximately one hour each day. Tests were conducted at various times of the day to account for varying light conditions and diel migration patterns of the fish. Figure 3 shows the hourly distribution of tests conducted for each of three timing periods.

Species Identification and Enumeration Error

Species identification error was determined by comparing the observed counts made during the verification tests with the verified number and species composition of fish captured during the tests (Table 1). Scattergrams of the daily observed and verified counts were plotted for each of chinook adults, chinook jacks, coho adults, coho jacks, and sockeye (Figures 4 and 5). Insufficient test data precluded an evaluation of counting error for chum salmon, pink salmon, and steelhead. Table 1 presents the results of the verification tests for chinook, coho, and sockeye along with the weighted mean proportional error and weighted standard deviation for each sampling interval.

For the entire counting period, the mean weekly observer efficiencies for all species ranged from 0.90 (chinook adults) to 1.28 (coho jacks), where 1.00 = 100% efficiency (Table 1). The weekly efficiencies for chinook adults ranged from 0.73 to 1.00. The weekly efficiencies for chinook jacks ranged from 0.40 to 2.00, but the mean efficiency (for the entire counting period) was 1.02; chinook jacks were poorly represented during verification tests (n=19 for the entire counting period).

Between-observer Error

The average observer error was calculated for each of the five observers using the data from the verification tests (Table 2).

Adjusted Counts and Population Estimates

Table 3 presents the adjusted daily fishway counts for chinook adults, chinook jacks, coho adults, coho jacks, and sockeye, and unadjusted daily counts for pink salmon, chum salmon, and steelhead. The unadjusted hourly counts for chinook adults, chinook jacks, coho adults, coho jacks, and sockeye are provided in Appendix 1-1 to 1-5, respectively. The estimated number of adult chinook that passed through the fishway between 2 September and 10 November was 96,254 ± 4,707. The estimate of jack chinook was 1,806; confidence limits were not calculated due to the low
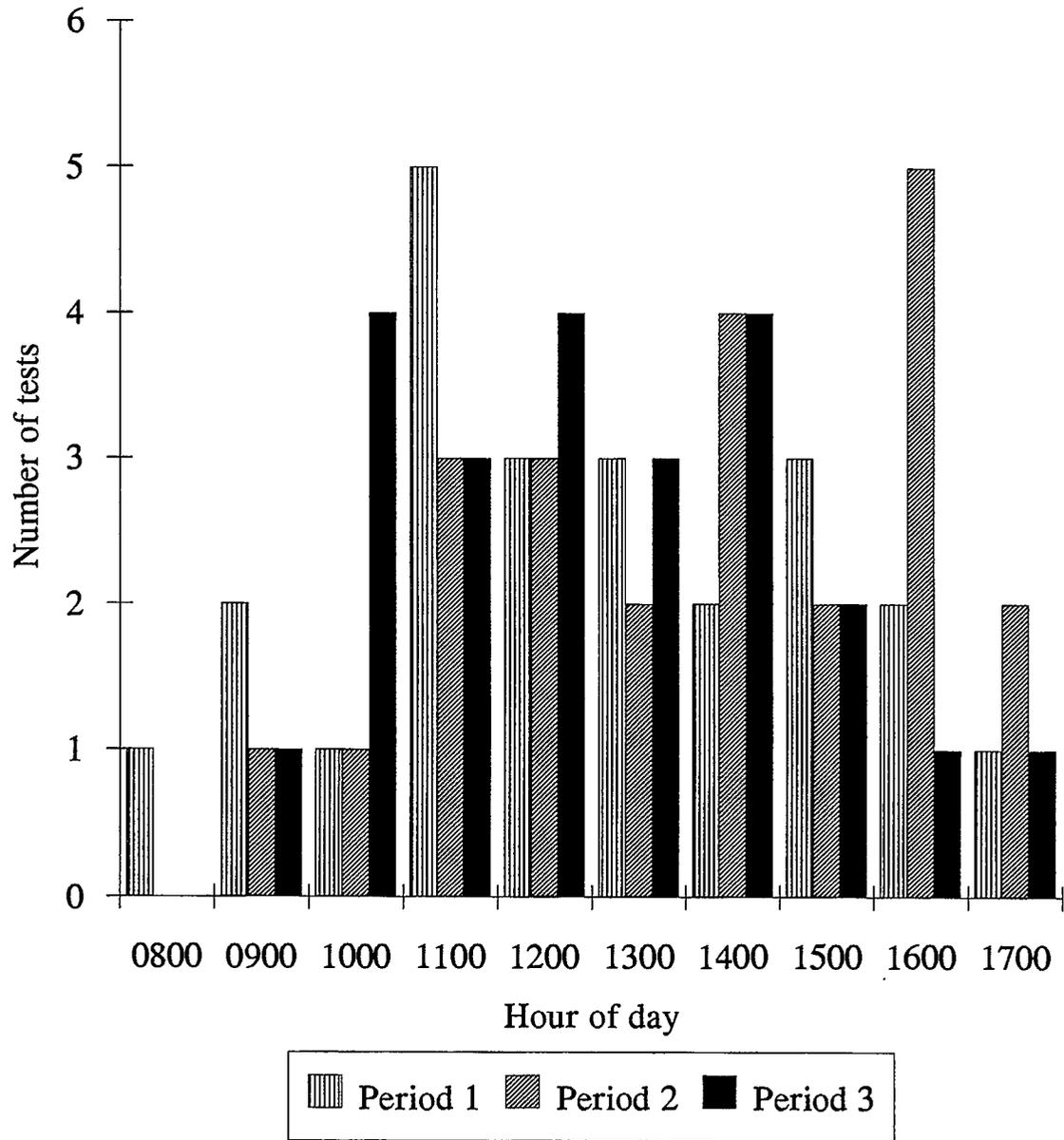
Figure 3. Frequency distribution of verification tests conducted at Stamp Falls Fishway, 1993.
Period 1 = 02-24 Sept.; Period 2 = 25 Sept.-17 Oct.; and Period 3 = 18 Oct.-10 Nov.

CHINOOK ADULTS

(a) All test observations

y = 0.99x + 0.48; r = 0.99

n = 69

Observed count (No. of fish)

Verified count (No. of fish)
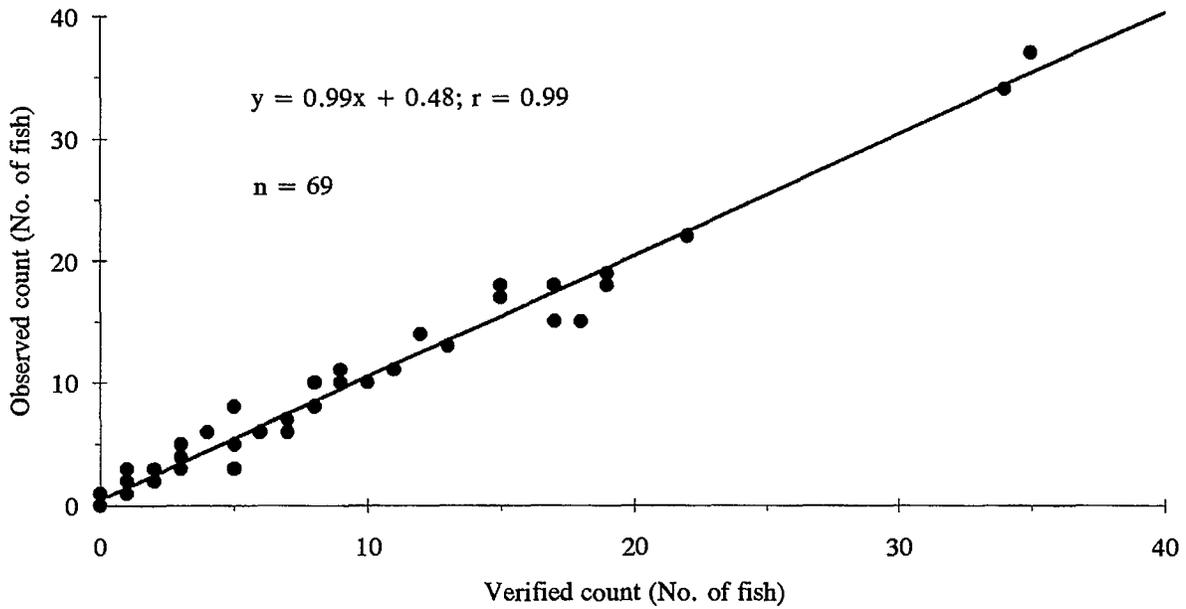
(b) Where test observations were less than or equal to 10

y = 1.02x + 0.40; r = 0.94

n = 54

Zero error line

Observed count (No. of fish)

Verified count (no. of fish)
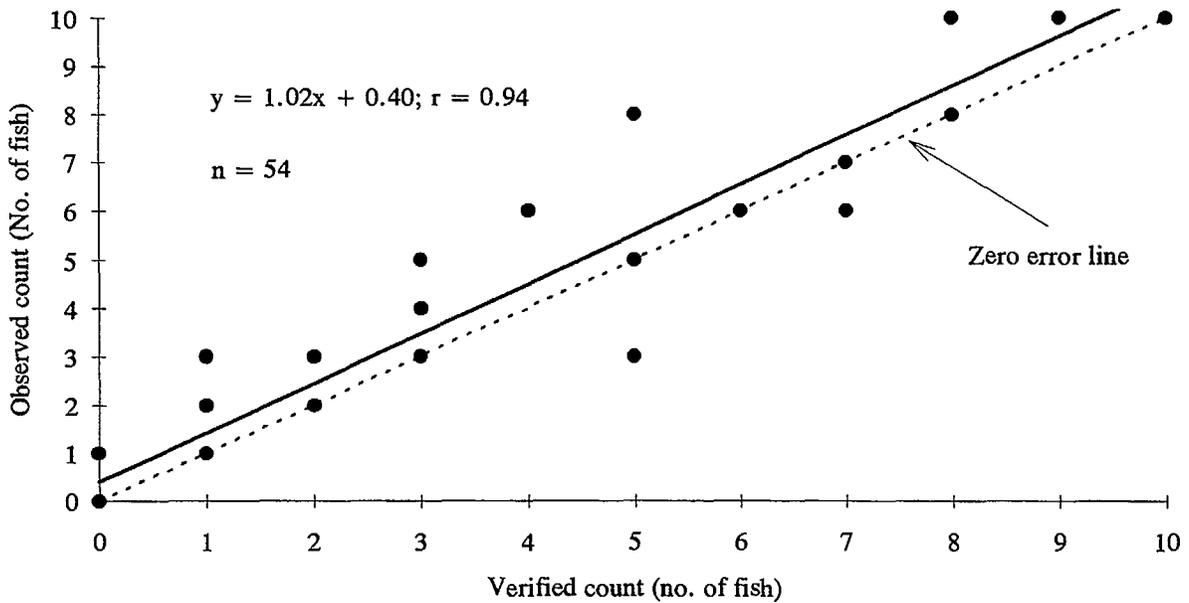
Figure 4. Scattergrams of observed counts versus verified counts of adult chinook from verification tests conducted at Stamp Falls Fishway, 1993. The top illustration (a) presents all test relationships and the bottom illustration (b) presents the relationship where observed counts were less than or equal to ten.
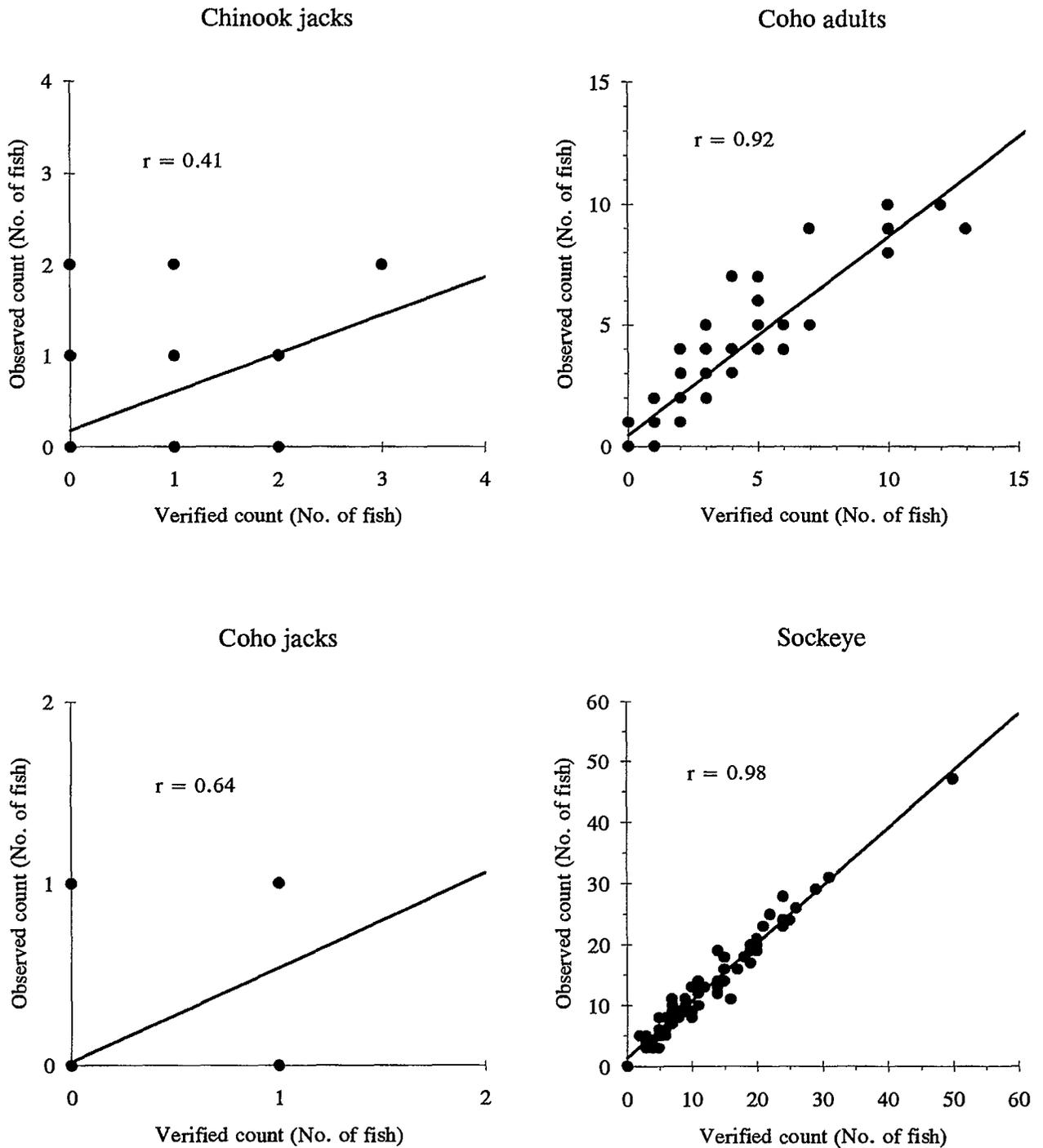
Figure 5. Scattergrams of observed counts versus verified counts of chinook jacks, coho adults, coho jacks, and sockeye, from all verification tests conducted at Stamp Falls Fishway, 1993; n = 69 in all cases.

number of observations of jack chinook during verification tests. The estimate for adult coho was 15,479 ± 1,197, and the estimate for jack coho was 856 (confidence limits not calculated due to low observations during tests). The estimated number of sockeye that passed through the fishway during the counting period was 61,531 ± 2,769.

Migration Timing

Seasonal Migration

Figure 6 shows the adjusted daily counts of chinook adults and jacks at the Stamp Falls Fishway along with daily maximum and minimum water temperatures and water levels. The adjusted counts of chinook adults peaked at 6,386 fish on 10 October. The adjusted counts of chinook jacks peaked at 149 on 16 September. Migration timing of chinook seemed to occur irrespective of water levels or levels. Figure 6 indicates that the counting period from 2 September to 10 November covered most of the migration of chinook, with some numbers missed at the start of the run and very low numbers of fish missed at the tail end of the migration. It was noted that several chinook (at least 500) were already in the holding pool at Robertson Creek Hatchery by 1 September (R. Volk, pers. comm.). By 30 October, counts of chinook adults were less than 50 per day, and the last four days of observations (7-10 November) produced counts of less than 10 per day (Table 3).

Figure 7 shows the adjusted counts of coho adults and jacks along with water temperatures and levels. The adjusted counts of coho adults peaked at 663 on 4 October. Coho jacks peaked at 68 on 6 October. Coho migration appeared to be independent of water levels and temperatures.

Counts of sockeye salmon at Stamp Falls peaked on 14 October with an adjusted daily count of 2,486 (Figure 8; Table 3). It should be noted that the count of sockeye at Stamp Falls Fishway does not represent the total escapement of sockeye to Great Central Lake as the majority of sockeye migrate prior to the commencement of counting.

Unadjusted steelhead counts are also presented in Figure 8. Daily steelhead numbers peaked at 74 on 3 September (Figure 8; Table 3). Due to the low water levels and good visibility encountered during the counting period, these unadjusted counts are believed to be representative of the number of steelhead passing through Stamp Falls during the counting period.

Diel Migration

To ensure complete counts of salmonids passing through the fishway, the gate to the counting facility was closed and fish migration was blocked from 1800 to 0800 hours. Hourly counts of each species were made during daylight hours. The mean hourly count of each species for four different counting periods were calculated and plotted in Figures 9, 10 and 11. Hourly counts during times when verification tests were conducted were excluded from the analysis.

It appears that the movement of chinook adults through the fishway tended to build slowly for the first hour after the gate was opened in the morning, peak during the second or third hour of

(a) Water levels and temperatures
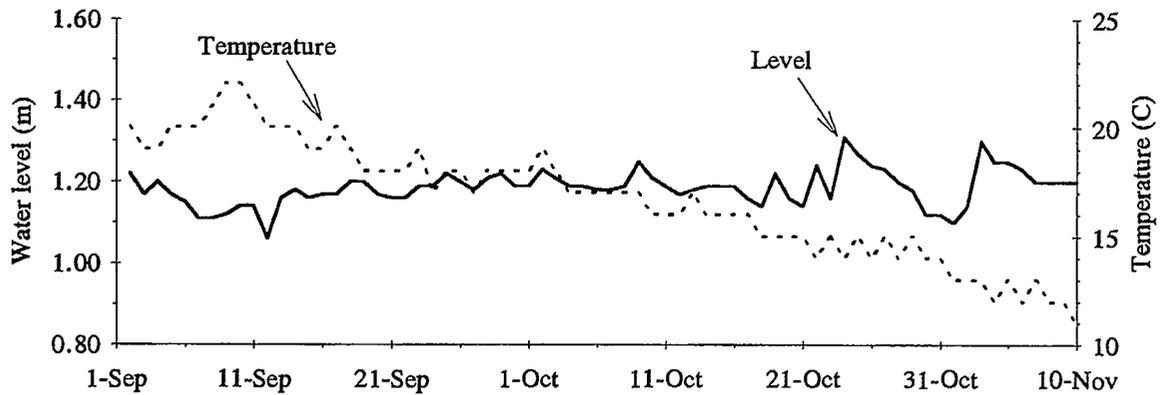
(b) Chinook adults
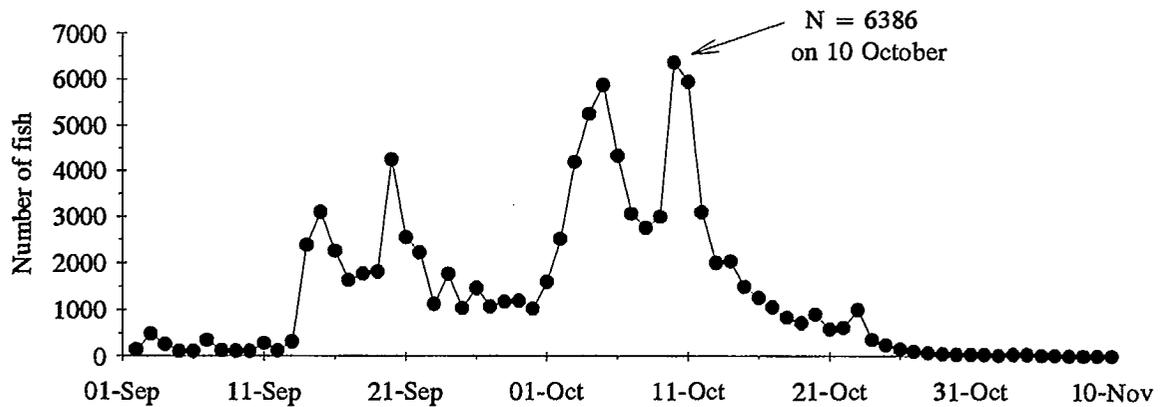
(c) Chinook jacks
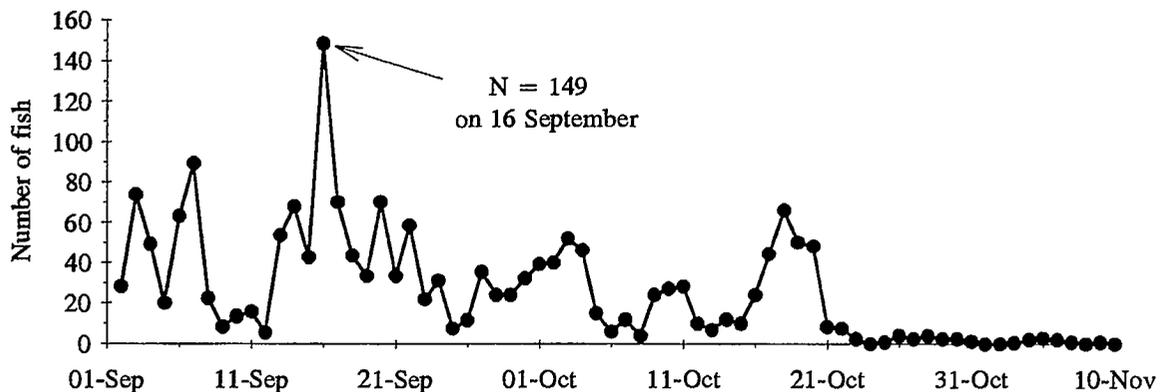
Figure 6. Figure (a) illustrates daily water levels and maximum water temperatures at Stamp Falls Fishway, 1993. Figures (b) and (c) illustrate adjusted daily counts of adult and jack chinook, respectively, (from Table 3) at Stamp Falls Fishway, 1993.

(a) Water levels and temperatures
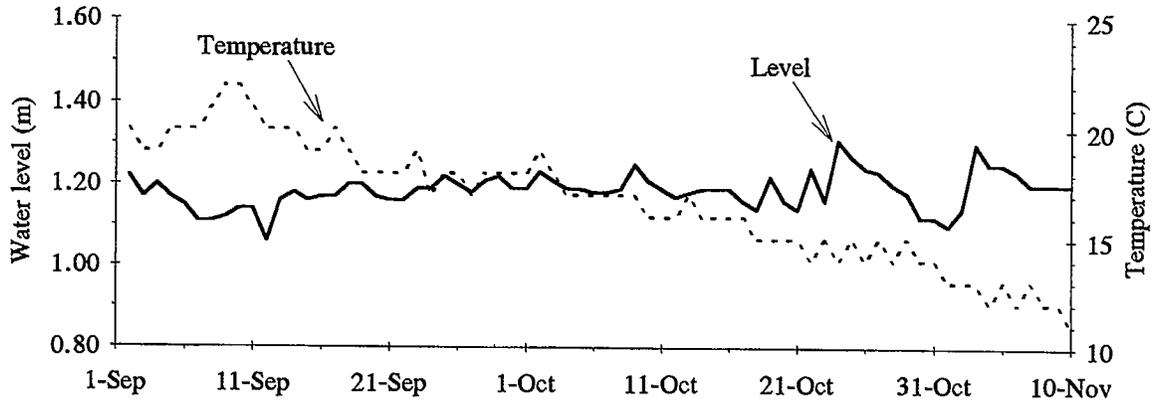
(b) Coho adults
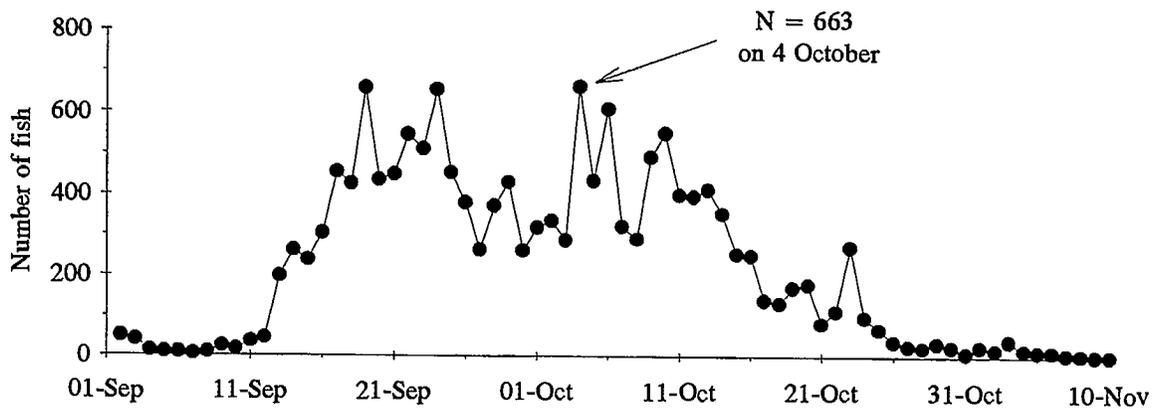
(c) Coho jacks
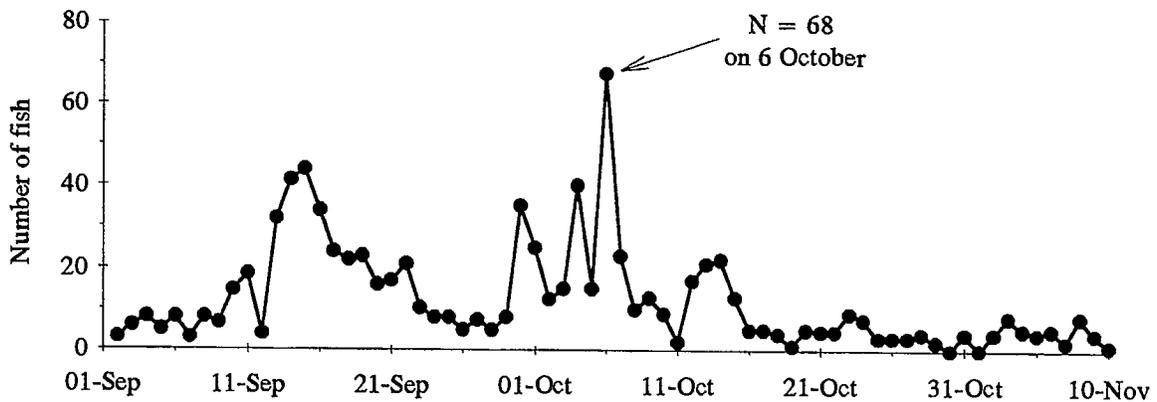
Figure 7.   Figure (a) illustrates daily water levels and maximum water temperatures at Stamp Falls Fishway, 1993. Figures (b) and (c) illustrate adjusted daily counts of adult and jack coho, respectively, (from Table 3) at Stamp Falls Fishway, 1993.

(a) Water levels and temperatures
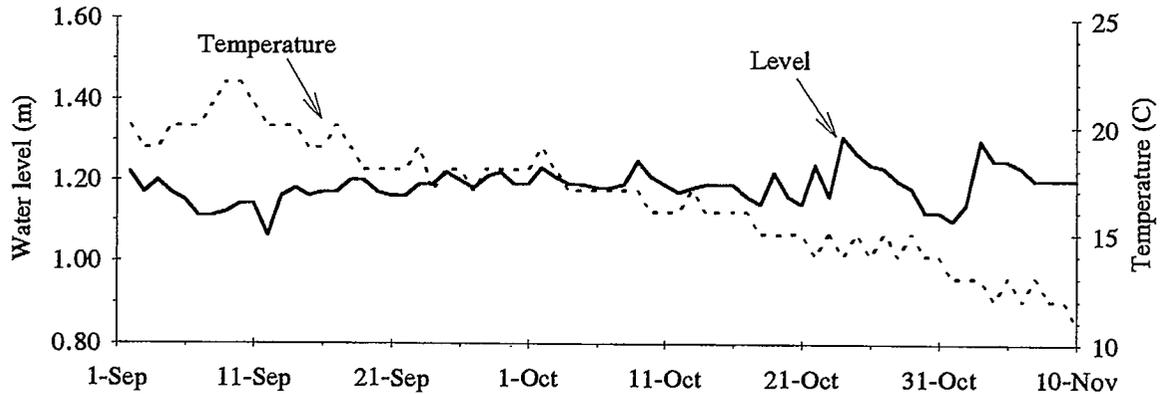
(b) Sockeye
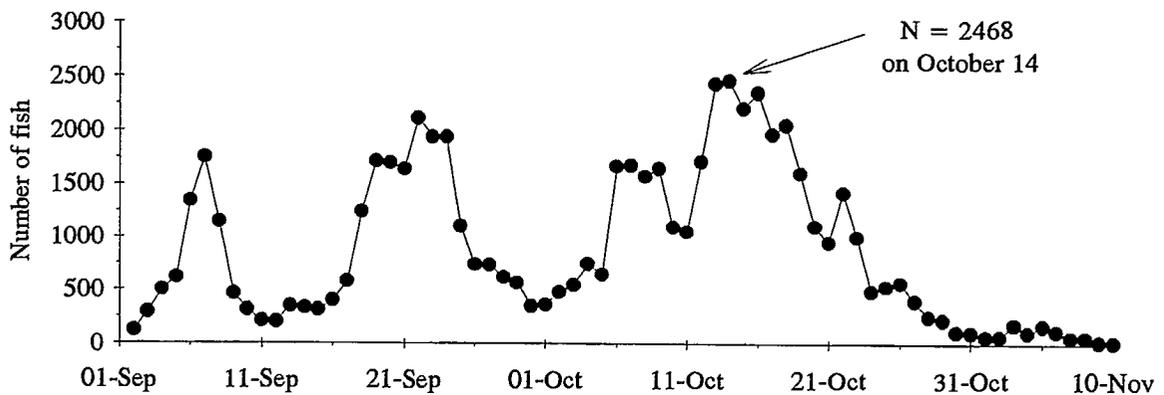
(c) Steelhead
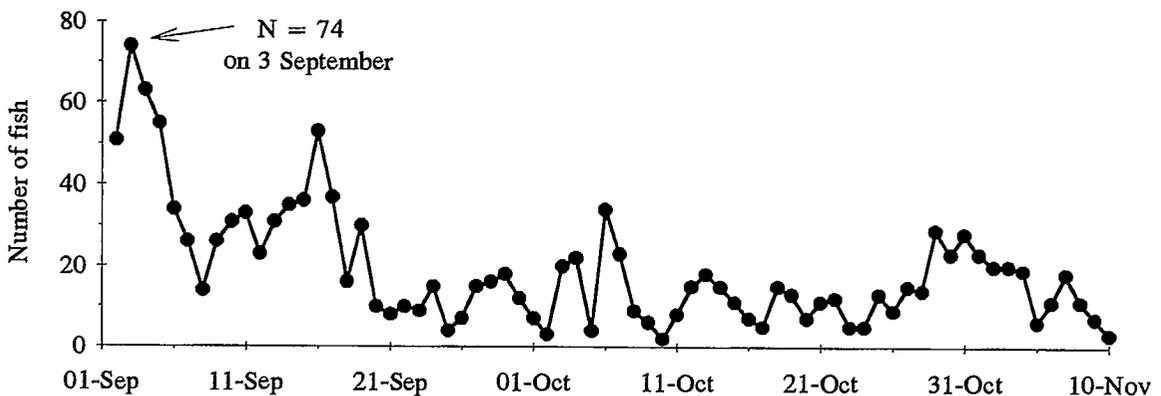
Figure 8. Figure (a) illustrates daily water levels and maximum water temperatures at Stamp Falls Fishway, 1993. Figures (b) and (c) illustrate the adjusted daily counts of sockeye and the observed daily counts of steelhead, respectively, (from Table 3) at Stamp Falls Fishway, 1993.
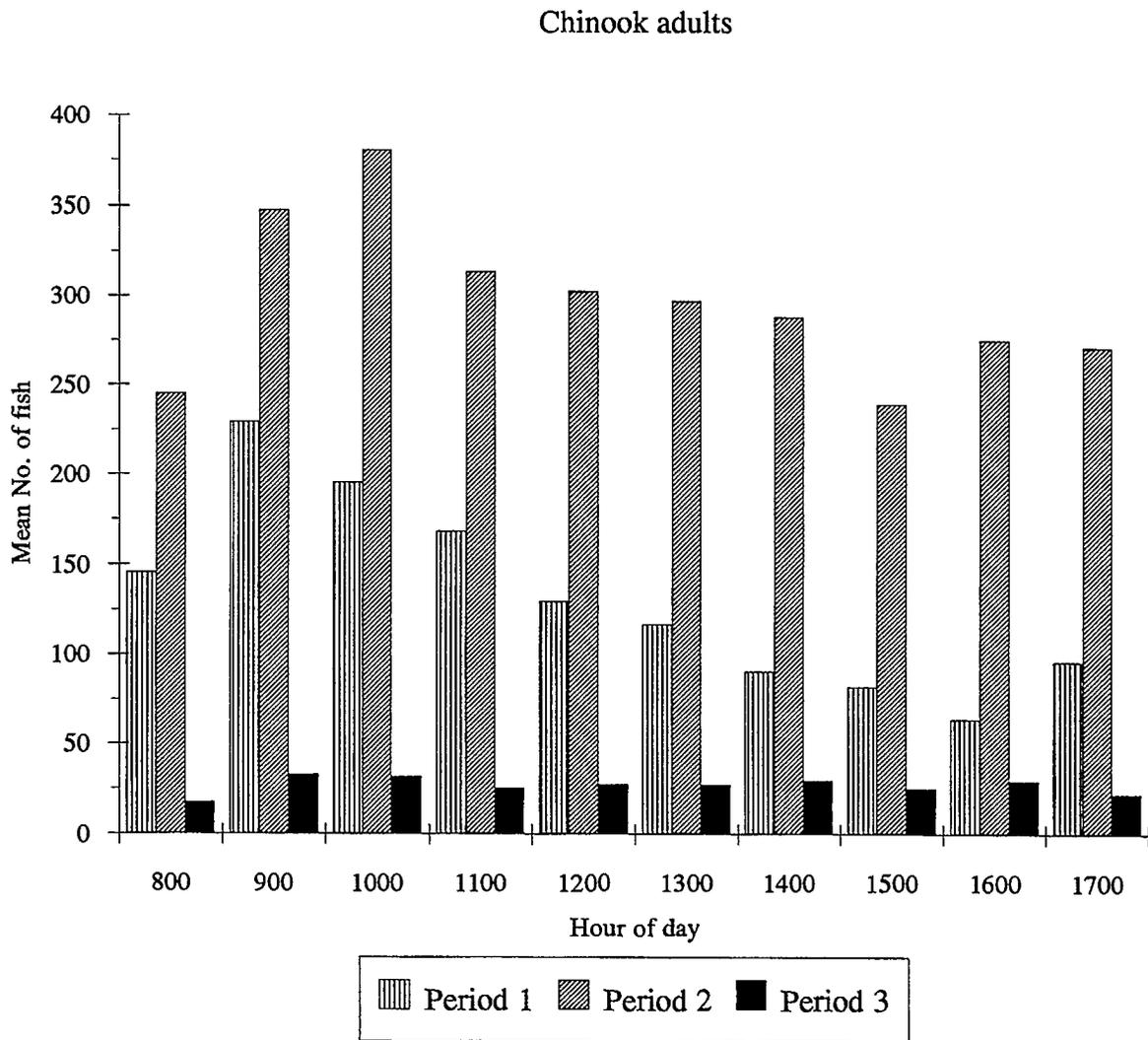
Chinook adults

Figure 9.   Hourly migration patterns of adult chinook salmon (mean adjusted numbers) passing
through Stamp Falls Fishway, by period, 1993. Period 1 = 02-24 Sept.; Period 2 = 25 Sept.-17 Oct.;
and Period 3 = 18 Oct.-10 Nov.

(a) Chinook jacks
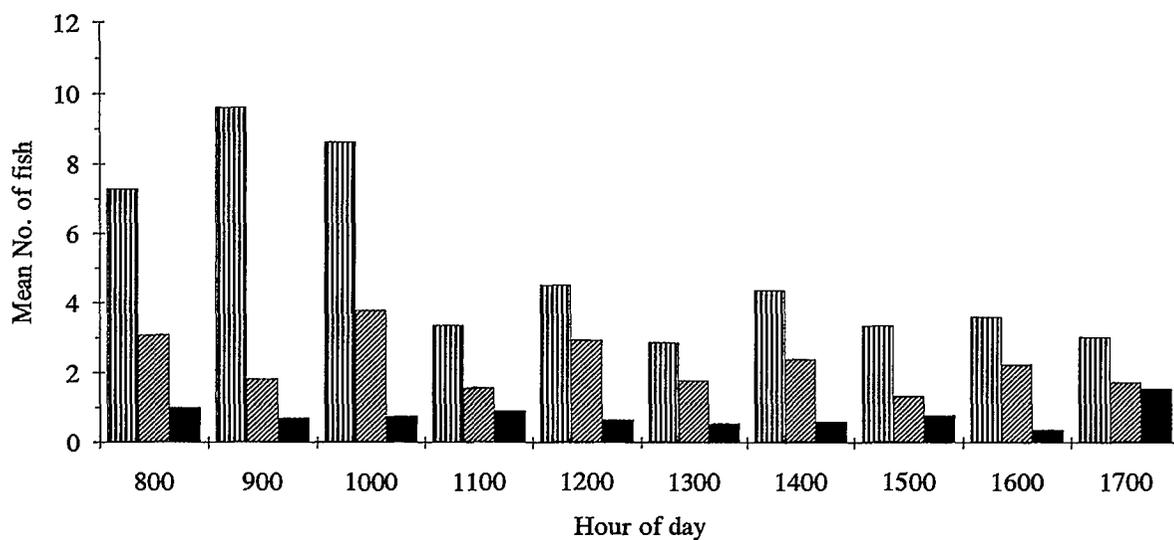
(b) Coho adults
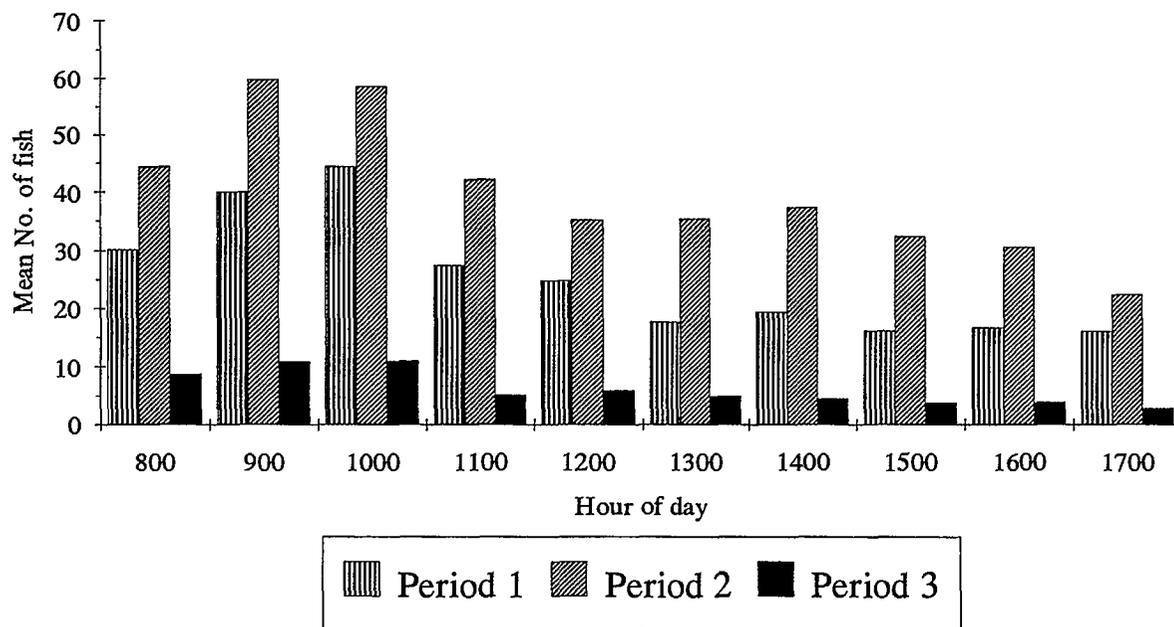
Figure 10. Hourly migration patterns of (a) chinook jacks and (b) coho adults (mean adjusted numbers) passing through Stamp Falls Fishway, by period, 1993. Period 1 = 02-24 Sept.; Period 2 = 25 Sept.-17 Oct.; and Period 3 = 18 Oct.-10 Nov.

(a) Coho jacks
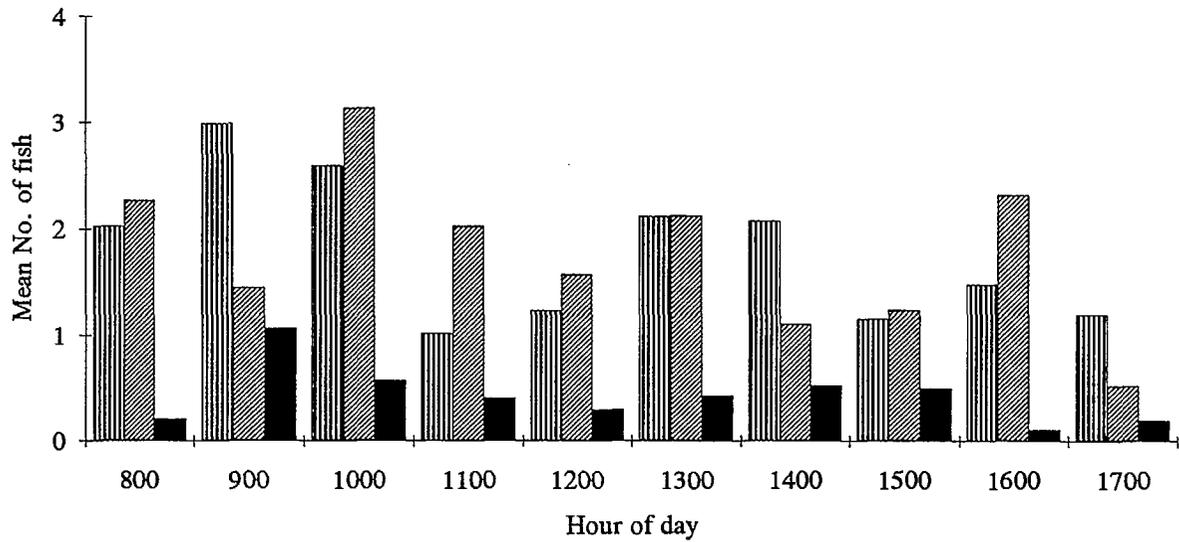
(b) Sockeye
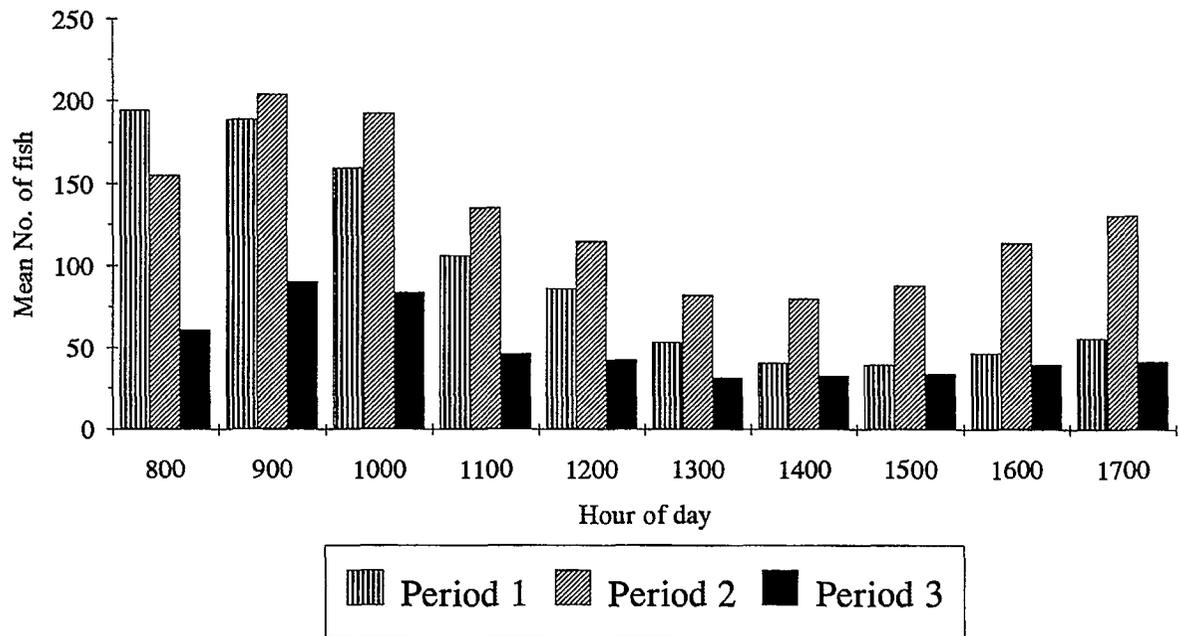
Figure 11. Hourly migration patterns of (a) coho jacks and (b) sockeye (mean adjusted numbers) passing through Stamp Falls Fishway, by period, 1993. Period 1 = 02-24 Sept.; Period 2 = 25 Sept.-17 Oct.; and Period 3 = 18 Oct.-10 Nov.

counting, and then decrease steadily throughout the day until the last one or two hours of counting (Figure 9). There was no obvious patterns of diel migration for chinook jacks (Figure 10), or coho adults (Figure 10), or coho jacks (Figure 11). Sockeye tended to follow the same general pattern as chinook adults (Figure 11).

DISCUSSION

Salmonids migrating through the Stamp Falls Fishway were visually enumerated at the upstream end of the fishway. The objectives of the program were to: 1) obtain highly accurate counts of all species of fish passing through the fishway with an emphasis on the number of chinook adults and jacks; and 2) quantify the errors associated with counting, speciation, and the ability of observers to discriminate between jacks and adults. Observer error was successfully quantified using daily verification tests.

Observer Error

There are a number of possible sources of error in the counts of salmonids passing through the Stamp Falls Fishway. The counting apparatus and counting techniques were designed to mitigate as many of these sources of error as possible. The primary sources of error include observer error (species identification and miscounts) and multiple passage of fish (layering of fish and fall-back within the fishway).

Multiple passage of fish was mitigated in the design of the counting apparatus. The opening in the panels was purposely kept small to prevent too many fish from passing over the observation area at one time. Fall-back was minimized by setting the main fishway gates in a Vee formation to funnel the fish through the opening. This system worked well to minimize fall-back and once fish nosed through the panel opening, they moved quickly over the observation area and out of the fishway.

The efficiency of observers in species identification and enumeration (observer efficiency), as determined from the verification tests at Stamp Falls, was calculated for each species at the end of each week and for the entire counting period. The observer efficiency for chinook adults ranged from 87%-100% on a weekly basis and averaged 90% for the entire counting period. After adjusting for counting error, the total counts for each species had 95% confidence intervals of between ±4.5% for sockeye and ±7.7% coho adults. The confidence interval for the population estimate for chinook adults was ±4.9%. Confidence intervals for the population estimates for chinook jacks and coho jacks were not calculated due to low numbers of these jacks observed and verified in the verification tests (Table 1).

These confidence intervals reflect the observers' ability to count each species of salmon. Sockeye were easily distinguished from the other species because of their distinct spawning colours and the presence of scarring on the body or fins. Coho jacks were more difficult to enumerate because small jacks (less than 30 cm in length) were able to escape from the containment area during the verification tests, and during normal counting operations, even with vexar screening (2.5 cm) covering the aluminum panels. Chinook adults were easy to identify because of their large size and body shape. However, some of the adult coho returning to the Stamp River are also very large and were sometimes confused with small adult or jack chinook. Observers relied on differences between body colour (coho tend to be darker) and spotting on the posterior end of the fish (larger and wider spaced spots on chinook). Difficulties in distinguishing between large coho and small adult or jack chinook were particularly pronounced when fish swam quickly through the viewing area. Steelhead were easily identified from the other salmonids based on colour, the shape of the caudal peduncle, and fin ray coloration. There is no estimate, however, on the accuracy and precision of our counts for steelhead, pink salmon, and chum salmon.

Migration Timing

The timing of migration of chinook salmon in 1993 was approximately the same as in 1992 (Nelson 1993c) and 1991 (Bocking and Nass 1992). This timing is approximately one week earlier than in 1989 (Wright 1990) and both 1972 and 1973 (DFO, unpublished data, cited in Lightly et al. 1988) and a week later than in 1990 (Bocking 1991a) and 1984 (Lightly et al. 1988). This degree of variability in run timing is not unusual.

The analysis of diel migration at Stamp Falls Fishway illustrates that there is very little variability in the diel migration of chinook. Sockeye tended to follow the same movement patterns as chinook.

PART II: AGE, LENGTH, AND SEX ANALYSIS AND CODED WIRE TAG RECOVERIES

INTRODUCTION

This section of the report deals with the population characteristics (age, length, and sex) of Stamp River chinook and the hatchery contributions to the total escapement. The Stamp River chinook escapement was stratified into two main groups: 1) those chinook spawning in the upper Stamp River between Stamp Falls and Robertson Creek Hatchery (the "in-river" population); and 2) those chinook returning to Robertson Creek Hatchery. The reason for this level of stratification was to compare differences in age, length, and sex attributes of these two components of the total escapement as well as different hatchery contributions. It was hypothesized that there would be significant differences in age structure, length, and sex between the in-river population and the hatchery population. As well, it was hypothesized that the percentage of hatchery-origin fish would be significantly higher in the hatchery than in the river.

Two approaches to estimating the hatchery contribution to the Stamp River were examined. The first of these methods (Method A) has been used in other documents for chinook key streams (Andrew et al. 1988; Bocking et al. 1990; Carolsfeld et al. 1990; Bocking 1991a; Bocking 1991b; Bocking and Nass 1992; Nelson 1993a; Nelson 1993b; Nelson 1993c) and uses the recovery rate of adipose-clipped chinook to expand recoveries of specific tag codes. The second method (Method B, Kuhn 1988) uses the recovery of CWTs in the escapement to estimate the hatchery contribution.

In this report the term "marking" refers to the marking of chinook juveniles with coded wire tags (CWT) and adipose fin clips (AFC).

METHODS

Dead Recovery

Dead recovery in the Stamp River was conducted from 5 October through 5 November, 1993. Sampling was conducted in 10 stratified areas from Robertson Creek Hatchery to the lower Somass River (Figure 12). For the purpose of the analyses conducted in this report these areas were amalgamated into three strata: 1) upstream of the carcass weir; 2) the carcass weir; and 3) downstream of the carcass weir to Stamp Falls (Figure 12). There was also some sampling

23
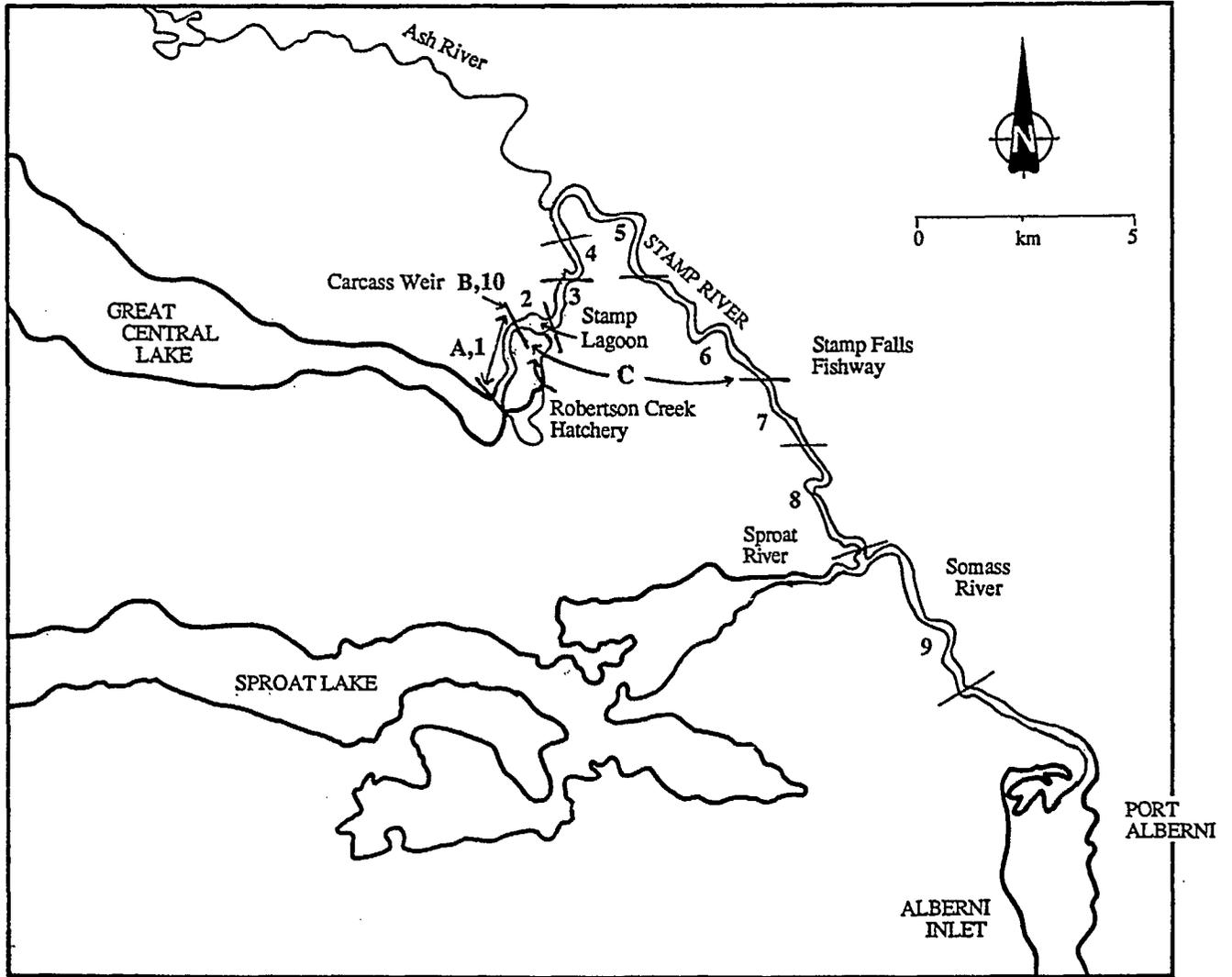
Figure 12.   Map of Stamp River and Robertson Creek Hatchery showing carcass recovery areas.

downstream of Stamp Falls (Area 7-9); **data for recoveries in this area (downstream of the falls) are presented in Appendix 2-1 but are not used in the analyses for this report as there is no estimate of the number of fish spawning downstream of the falls.** The carcass weir was located at the upstream end of Stamp Lagoon, and consisted of a 45 x 2.5 m net strung across a 75 m-wide section of the river. The net, made of polyweb with 15.5 cm mesh, was suspended between two 3/8 inch cables running the full width of the river and anchored to trees on each shore. The bottom cable was held to the river bottom by rebar hooks driven into the gravel. The top cable was connected to a winch on each shore to facilitate a total release of the top end in the event of high water. Dead fish were recovered primarily by gaffing from a boat, and by walking the stream bank and shallow water between Stamp Lagoon and the Ash River confluence.

Carcasses recovered were measured (postorbital-hypural length) and examined for sex and missing adipose fins. A portion of the recovered carcasses was also sampled for scales, and all chinook with missing adipose fins had their heads removed for coded wire tag analysis. All carcasses sampled were cut in half to prevent double counting.

Hatchery Returns

The staff at Robertson Creek Hatchery enumerated all chinook returning to the hatchery between 22 September and 8 November, 1993 (Appendix 2-2). Daily records included the number of males, females, and jacks, missing adipose fins, scale sampling, and length (postorbital-hypural) measurements. Heads from all adipose-clipped chinook were removed and analyzed for coded wire tags.

Population Estimates

The total population of chinook returning to the Robertson Creek Hatchery was determined from brailer counts and stratified by males, females and jacks. The in-river population of chinook adults (above Stamp Falls) was determined by subtracting the total number of adult returns to the hatchery from the fishway count (see Part I). This estimate for chinook adults was then apportioned between males and females using the ratio of males to females as determined from the in-river dead recovery sample. The in-river population of jack chinook was determined by subtracting the number of jack returns to the hatchery from the fishway count of jack chinook.

Age, Length and Sex Analysis

Biological sampling of chinook during dead recovery and at the hatchery included scales for age determination, length, sex, and presence of an adipose clip. At Stamp Falls fishway, males chinook were considered to be jacks when their total length was less than 59 cm; in the deadpitch and

at the carcass weir, males were classified as jacks when their <u>post-orbital hypural length</u> was less than 45 cm. Some adipose-clipped fish (CWT) were also sampled for age and length. Five scales were taken from the preferred area on each side of scale-sampled fish and placed in scale books.

Scales were read at the DFO scale laboratory in Vancouver. Ages were only read when a portion of the previous annulus was present and scales were not regenerated. Scales were classified as unreadable if the scales had regenerate centres, were resorbed, or if they were mounted upside down. Ages were recorded for fish for which there were at least two scales that could be read for both marine and freshwater ages. The aging system follows that described by Gilbert and Rich (1972).

The age composition determined with the available samples is valid only if age sampling was random and there was no bias in the readability of scales with age. Ages of older fish are usually more difficult to read than those of young fish because scales of older fish undergo more resorption and regeneration. The data were examined for this potential bias by comparing (t-test) mean lengths of known and unknown (scales unreadable or not sampled) aged males and females.

The age-specific population estimates were then determined by allocating portions of the population estimate to age classes according to the age composition determined from scale samples. Sex ratios were determined for both the in-river population and the hatchery.

Hatchery Contributions

Heads from adipose-clipped chinook were removed and sent to the DFO tag recovery laboratory in Vancouver for dissection and tag decoding.

The estimation of the contribution of hatchery-reared chinook to the total escapement utilizes the adipose-clip or coded wire tag mark rate in the escapement. Two different approaches (Method A and Method B) were used to determine the contribution of hatchery-reared chinook, by tag code, to the escapement. In the first approach (Method A), dead recovery samples were used to estimate the total number of adipose-clipped fish in the escapement, stratified by river location (in-river versus hatchery) and sex. It should be noted that CWT expansions by the Mark Recovery Program for commercial and sport fisheries use Method B and, therefore, CWT expansions for escapements using Method A are not directly comparable.

<u>Method A</u>

Adipose-clipped fish were enumerated separately for males and females in the Stamp River and at Robertson Creek Hatchery. The recovery of jack chinook was included with the adult male recoveries in this analysis. The first step in determining hatchery contributions was to estimate the number of adipose-clipped fish in each stratum (river versus hatchery) from the observed number of adipose clips:

$$EAD_{i,r} = \frac{OAD_{i,r} \cdot P_{i,r}}{C_{i,r}} \tag{7}$$

where EAD is the estimated number of adipose clips, OAD is the number of adipose clips observed, C is the number of fish examined, P is the population estimate, and i and r are subscripts denoting sex and river location (stratum), respectively. The sex-specific population estimates used here were from the age-structure analysis.

Given an estimate of the total number of adipose clips for each sex escaping to each portion of the system, the number of adipose clips for each tag code can be estimated by the allocation of adipose clips to tag code groups based on their relative frequency in the sample of decoded tags:

$$EAD_{i,r,tc} = \frac{EAD_{i,r} \cdot NDT_{i,r,tc}}{SumNDT_{i,r}} \tag{8}$$

where tc is a subscript denoting tag code and NDT is the number of successfully decoded tags for each sex, strata, and tag code (tc).

This approach of first estimating adipose-clipped fish and then allocating these among the successfully decoded CWTs assumes that any adipose-clipped fish not decoded (i.e. no pins) were once marked but lost their coded wire tag for some reason. If this assumption is incorrect, the calculation of the number of hatchery-origin fish using this method would be positively biased. It is possible, especially in the dead pitch, that some fish identified as hatchery releases by missing adipose fins may be fish that have naturally lost their adipose fins through some other means (e.g. carcass decomposition), or were misidentified. If decomposition of adipose fins is occurring, then the adipose clip rate among hatchery fish recovered in the dead pitch should be higher than that observed at release. Other potential sources of bias in the hatchery contribution estimate derived using Method A are discussed in Bocking (1991a).

The hatchery contribution to each year's escapement, stratified by river location and sex, was calculated by expanding the estimated number of adipose clips from each tag code group in proportion to the percentage of juvenile fish having an adipose clip at time of release:

$$EHC_{i,r,tc} = \frac{EAD_{i,r,tc} \cdot (RC_{tc} + RUC_{tc})}{RC_{tc}} \tag{9}$$

where EHC is the estimated hatchery contribution, RC is the number of chinook released with adipose clip for each tag code, and RUC is the number of chinook released without an adipose clip associated for each tag code.

These estimates of hatchery contribution, stratified by brood year (t), sex (i), river location (r), and tag code (tc) are summed to give the hatchery contribution of all tag codes to the entire escapement (EHC):

$$EHC_{i,r,t} = \sum_{i=1}^{n} EHC_{t,i,r,tc} \qquad (10)$$

where n is the number of tag codes for a given brood year t.

Due to the potentially different ages at maturity of males and females, it is important that allocation of adipose-clipped fish to tag codes be carried out separately by sex whenever possible. In this study, the sex of all fish sampled for CWTs was recorded so that it was possible to estimate the total escapement of tag codes by sex (males included jacks). Final hatchery contribution estimates were made separately for fish of Robertson Creek origin and for hatchery stays from other rivers.

Method B

In the second approach used to estimate the hatchery contribution, the number of successfully decoded CWT chinook in the escapement, stratified by river and sex, were estimated using the methods described for the Mark Recovery Program (Kuhn et al. 1988). The primary difference between this method and Method A is that Method B uses the number of actual CWTs present in the escapement from which to derive the hatchery contribution, whereas Method A uses the number of adipose clips present in the escapement.

Estimating the total number of CWT returns from each of the brood years, and for each tag code, was done as follows.

First, the observed number of CWT recoveries was adjusted to account for "no pin" (no tag) recoveries:

$$ADJ_{i,r,tc} = OBS_{i,r,tc} \cdot [1 + \frac{LP}{K} + \frac{ND \cdot (K+LP)}{K \cdot (K+LP+NP)}] \qquad (8)$$

where ADJ is the adjusted number of observed CWT fish, OBS is the observed number of CWT fish, K is the sum of all successfully decoded tags for all tag codes recovered, LP is the number of lost pin recoveries (CWT detected, but pin lost prior to reading), ND is the number of no data recoveries (adipose clip present, but head not taken; head taken and CWT present, but head lost or pin unreadable), NP is the number of no pin recoveries, and i, r, and tc are subscripts denoting sex, river section, and tag code, respectively.

This adjusted number of CWT recoveries is then used to estimate the total number of CWT returns for each tag code:

$$EST_{i,r,tc} = \frac{ADJ_{i,r,tc} \cdot P_{i,r}}{C_{i,r}} \qquad (12)$$

where EST is the estimated number of CWT recoveries for a single tag code, C is the number of fish examined, P is the population estimate, and i, r, and tc are subscripts denoting sex, river, and tag code, respectively.

This approach of estimating the number of CWT chinook in the escapement assumes that any adipose-clipped chinook found without CWTs were never marked. This assumption is only valid if chinook tagged with a particular tag code did not lose the CWT after release from the hatchery (i.e. after accounting for tag loss during a retention test). Since it has been demonstrated for CWT fish that 90% of tag loss occurs within four weeks of tagging (Blankenship 1990), any fish that have been released within this four-week period are likely to continue to have some tag loss prior to being recovered in the fishery or escapement. Violation of the assumption of no tag loss will result in a negative bias in the hatchery contribution estimates. Other potential sources of bias in the hatchery contribute estimates derived using Method B are discussed in Bocking (1991a).

The hatchery contribution to each year's escapement, stratified by river location and sex, was calculated by expanding the estimated number of CWT fish from each tag code group in proportion to the percentage of juvenile fish having a CWT at time of release:

$$EHC_{i,r,tc} = \frac{EST_{i,r,tc} \cdot (RM_{tc} + RUM_{tc})}{RM_{tc}} \qquad (10)$$

where EHC is the estimated hatchery contribution, RM is the number of chinook released with CWTs for each tag code, and RUM is the number of chinook released without CWTs for each tag code.

As for Method A, these estimates of hatchery contribution by tag code were then summed to give the hatchery contribution of all tag codes to the entire escapement, stratified by river, sex and brood year:

$$EHC_{i,r,t} = \sum_{i=1}^{n} EHC_{t,i,r,tc} \qquad (14)$$

where n is the number of tag codes for a given brood year t.

Percent hatchery contributions by sex and age were then calculated using the population estimates derived from the age structure analysis.

RESULTS

Age, Length and Sex Composition

All of the fish sampled in the Stamp River and Robertson Creek were ocean reared, i.e. they left the river to rear in the ocean during their first year of life and are termed sub-ones in this report (Table 4). Total ages of Stamp River chinook ranged from 2 to 6 years. Six-year-old chinook were poorly represented in 1993; less than one percent of the 1993 chinook escapement to Robertson Creek Hatchery were are 6 (Table 4). The dominant male age groups for the in-river chinook population were age 4 and age 3 (49.1% and 36.5%, respectively). The dominant male age groups for the hatchery chinook population were age 3 and age 4 (51.3% and 40.4%, respectively). The dominant female age groups both in-river and at the hatchery were age 4 (65.5% and 75.7%, respectively) and age 5 (31.0% and 21.7%, respectively).

Summaries of chinook mean lengths by age are presented in Table 4. In this table, total mean post-orbital hypural lengths (all ages) are calculated from the raw data for all ages. Aged Stamp River males (mean length = 618 mm) were equal to Robertson Creek Hatchery male returns (mean length = 618 mm). Aged hatchery females (mean length = 715 mm) were larger than aged Stamp River females (mean length = 705 mm) but the difference was not significant (t-test, $P > 0.05$). Similarly, there were no significant differences between the mean lengths of unaged Stamp River males and unaged hatchery males (t-test, $P > 0.20$) or unaged Stamp River females and unaged hatchery females (t-test, $P > 0.10$). There was a significant difference between the mean lengths of aged and unaged Stamp River males and females (t-tests, $P < 0.001$ in both cases; the unaged fish were larger). There was no significant difference between the mean lengths of aged and unaged hatchery males or females (t-tests, $P > 0.50$ and $P > 0.05$, respectively).

The population estimates, stratified by river location, sex and age class, are presented in Table 5. The sex ratio in the hatchery, as determined from brailer counts, was 58.9% adult males, 39.3% females, and 1.8% jacks (Table 6). Hatchery age structure analysis produced almost identical population ratios: 58.1:39.3:2.7 (M:F:J). The sex ratio for the upper Stamp in-river population of chinook as determined from fishway counts minus the hatchery returns was 33.0:65.1:1.8 (M:F:J). Upper Stamp age structure analysis produced population ratios of 33.4:65.1:1.5 (M:F:J). The difference between the adjusted count of jacks observed at the fishway (1806) and the combined estimate from Robertson Creek Hatchery and the upper Stamp River (1721; based on age composition, Table 6) suggests that approximately 85 adult males (0.09% of the total adjusted chinook escapement through Stamp Falls) were misidentified and recorded as jacks at the fishway counting operation. Table 6 lists the final, sex-specific population estimates using the observed counts and all age composition data.

Hatchery Contributions

The results of coded wire tag returns are presented below for the upper Stamp River and Robertson Creek Hatchery. Information includes the following:

1. the raw data and mark rates for the calculations;

2. estimates of the total escapement of adipose clips (Method A) and/or CWTs (Method B);

3. the observed and estimated escapement of adipose clips (Method A) or CWTs (Method B) by tag code, and the hatchery contribution to the escapement for each tag code; and

4. the estimated hatchery contribution to the escapement by age class.

In the upper Stamp River there were 452 adipose-clipped chinook recovered in the dead pitch for a mark rate of 3.1% (Table 7). At Robertson Creek Hatchery, there were 734 observed adipose clips for a mark rate of 3.6%. Table 7 presents the total estimated number of adipose clips in the in-river population and the hatchery returns. The mark rates represent the number of adipose-clipped chinook as a percentage of the total number of chinook in each population (wild + hatchery stock).

Hatchery Contributions - Method A

Results from the decoding of adipose-clipped fish from the upper Stamp River dead pitch and returns to Robertson Creek Hatchery are shown in Table 8. All CWT fish recovered that were released in another river system (strays) were included in the analysis. In 1993 a single stray from Gold River was observed in the in-river deadpitch, and a single stray from Conuma River was observed at the hatchery. A total of 405 CWT heads from adipose-clipped fish recovered in the in-river dead recovery were successfully decoded. A total of 599 CWT heads recovered at the hatchery were successfully decoded. Age-2 males (jacks) were included with all other (adult) males for this analysis. The allocations of the total escapement of adipose clips to tag codes recovered in-river and at the hatchery are shown in Tables 8 and 10. Table 9 lists the number of CWT fish and adipose-clipped fish released for each tag code (data from MRP database) . Using Method A, the estimated hatchery contributions to the 1993 escapements of chinook in the upper Stamp River and Robertson Creek Hatchery were 59,163 and 21,240, respectively (Table 10); these estimates do not include hatchery contributions from other systems (strays). The hatchery contribution to the total escapement of chinook by age class is presented in Table 11. The hatchery contribution to the in-river population of upper Stamp River chinook was estimated to be 73.8% for males and 77.5% for females. For returns to Robertson Creek Hatchery, this contribution increased to 100.0% for males and 88.1% for females. Hatchery strays from Gold River accounted for less than 0.1% of the population of in-river males, and hatchery strays from Conuma River accounted for 0.1% of the population of females returning to Robertson Creek Hatchery.

Hatchery Contributions - Method B

Results from the decoding of CWTs from the upper Stamp River dead pitch and returns to Robertson Creek Hatchery are shown in Table 12. This table shows the number of observed CWT fish in the escapement and the adjusted number of CWTs for each tag code. The allocations of the total escapement of CWT fish to tag codes recovered in-river and at the hatchery are shown in Tables 13 and 14. Using Method B, the estimated hatchery contributions to the 1993 escapements of chinook in the Stamp River and Robertson Creek Hatchery were 53,604 and 19,634, respectively (Table 14); these estimates do not include hatchery contributions from other systems (strays). The hatchery contribution to the total escapement of chinook by age class is presented in Table 15. The hatchery contribution to the in-river population of chinook was estimated to be 65.9% for males and 70.7% for females. For hatchery returns, this contribution increased to 100.0% for males and 82.9% for females. Hatchery strays from Gold River accounted for less than 0.1% of the population of in-river males, and hatchery strays from Conuma River accounted for 0.1% of the population of females returning to Robertson Creek Hatchery.

DISCUSSION

Age, Length and Sex Composition

The age-length composition obtained from sampling river carcasses was different from that obtained from hatchery returns. For all respective age classes (except for age-5 males), the mean lengths of aged chinook sampled in the Stamp River were smaller than the mean lengths of aged chinook sampled at the hatchery. The mean length of aged jacks from the Stamp River was less than the mean length of aged jacks from the hatchery. The mean lengths of all aged males and all aged females from the Stamp River were not significantly different than the mean lengths of all aged hatchery males and females. Similarly, a comparison of unaged Stamp River chinook and unaged hatchery chinook found no significant length differences for either males or females.

The sex composition of the 1993 escapements to the upper Stamp River and Robertson Creek Hatchery (as calculated using the age composition of successfully aged fish) suggests that the percentage of returning jacks was higher in the hatchery (2.7%) than in the river (1.5%); this is consistent with results of the same comparison for 1992, 1991, and 1990 escapements (Nelson 1993c; Bocking and Nass 1992; Bocking 1991b, respectively). The lower proportion of females observed in the hatchery returns (39.3%) compared to the in-river dead recovery (65.1%) has been observed in other hatchery populations (Nelson 1993c; Bocking and Nass 1992; Bocking 1991a; Bocking et al. 1990; Lightly et al. 1988; Sibert and Schnute 1982).

Hatchery Contributions

Hatchery contribution estimates for 1993 were similar to those for 1992, 1991, and 1990 (Nelson 1993c; Bocking and Nass 1992; Bocking 1991b, respectively). Method A produced higher contribution estimates than Method B; this is consistent with other studies (Nelson 1993a; Nelson 1993b; Nelson 1993c; Bocking et al. 1990; Bocking 1991a; Bocking 1991b; Bocking and Nass 1992). The reasons for this difference are discussed in detail in Bocking 1991a.

SUMMARY

Fishway Counts

Counts of adult salmon returning to spawn in the Stamp River in 1993 were conducted at Stamp Falls Fishway using visual observations from 2 September to 10 November. Raw counts of salmon passing through the fishway were adjusted for observer error by comparing observed counts with verified counts of fish. The final estimate of chinook salmon was 98,060 $\pm$ 4,707 (confidence limits for adults only). The final estimate for coho was 16,335 $\pm$ 1,197 (confidence limits for adults only), and for sockeye the estimate was 61,531 $\pm$ 2,769.

Age, Length and Sex Composition

The age, length and sex composition of 1993 Stamp River chinook salmon were determined from carcass recovery and sampling of live returns to Robertson Creek Hatchery. The in-river population of spawners and the hatchery returns were analyzed separately. The dominant male age groups for the in-river chinook population were age 4 and age 3, respectively, and the dominant male age groups for the hatchery chinook population were age 3 and age 4, respectively. The dominant female age groups for both the in-river and hatchery populations were age 4 and age 5, respectively.

For both the in-river and hatchery populations, the mean lengths of all age groups of female chinook were larger than the corresponding mean lengths of males. There was a larger proportion of females among river spawners (65.1%) than among hatchery returns (39.3%).

Hatchery Contribution Estimates

Adipose clip mark rates for the in-river carcass recovery samples and the hatchery returns were 3.1% and 3.6%, respectively. Two methods were described and used to estimate hatchery contributions to the escapement. Using Method A, which expands the number of observed adipose-clipped chinook, the contribution of Robertson Creek Hatchery for the total Stamp River escapement was estimated to be 82.0%. Using Method B, which expands the number of CWTs (excluding those with adipose clips only), the contribution of Robertson Creek Hatchery was estimated to be 74.7%. Contribution estimates varied between sexes and between in-river and hatchery spawners.

ACKNOWLEDGMENTS

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35

TABLES

Table 1. Results of Stamp Falls verification tests, 1993. O = observed count, V = verified count.

Week	Date	Time	Observer	Gauge height (m)	Chinook adults			Chinook jacks			Coho adults			Coho jacks			Sockeye		
					O	V	V/O	O	V	V/O	O	V	V/O	O	V	V/O	O	V	V/O
1	02-Sep	1000	1	1.22	3	1	0.50	0	2	3.00	4	4	1.00	0	0	1.00	6	5	0.86
1	03-Sep	1200	2	1.17	4	3	0.80	2	3	1.33	0	0	1.00	0	0	1.00	9	9	1.00
1	04-Sep	1600	1	1.20	1	1	1.00	0	0	1.00	0	0	1.00	0	0	1.00	11	9	0.83
1	05-Sep	1100	2	1.17	0	0	1.00	1	1	1.00	1	0	0.50	0	0	1.00	28	24	0.86
1	06-Sep	0900	1	1.15	1	1	1.00	2	0	0.33	0	0	1.00	0	0	1.00	47	50	1.06
1	07-Sep	1100	2	1.11	3	3	1.00	0	0	1.00	0	0	1.00	0	0	1.00	25	22	0.88
1	08-Sep	1300	1	1.11	2	1	0.67	0	0	1.00	0	0	1.00	0	0	1.00	18	15	0.84
			Weighted mean (a)				0.73			1.17			0.83			1.00			0.93
			Weighted SD				0.18			0.74			0.20			0.00			0.10
2	09-Sep	1500	2	1.12	1	1	1.00	0	0	1.00	0	0	1.00	0	0	1.00	10	9	0.91
2	10-Sep	0800	1	1.14	2	2	1.00	0	0	1.00	0	1	2.00	0	0	1.00	19	14	0.75
2	11-Sep	1200	2	1.14	1	1	1.00	1	0	0.50	0	1	2.00	1	1	1.00	11	7	0.67
2	12-Sep	1400	1	1.06	3	2	0.75	0	0	1.00	1	2	1.50	0	0	1.00	8	6	0.78
2	13-Sep	1100	2	1.16	3	1	0.50	2	0	0.33	10	10	1.00	1	1	1.00	5	3	0.67
2	14-Sep	1300	1	1.18	18	15	0.84	0	0	1.00	5	7	1.33	0	1	2.00	4	3	0.80
2	15-Sep	1100	2	1.16	34	34	1.00	1	1	1.00	1	1	1.00	0	0	1.00	5	2	0.50
			Weighted mean (a)				0.90			0.40			1.28			1.33			0.71
			Weighted SD				0.18			0.26			0.42			0.44			0.15
3	16-Sep	0900	1	1.17	22	22	1.00	1	1	1.00	4	5	1.20	0	0	1.00	10	7	0.73
3	17-Sep	1500	2	1.17	6	4	0.71	0	0	1.00	10	12	1.18	0	0	1.00	11	16	1.42
3	18-Sep	1400	1	1.20	3	2	0.75	0	0	1.00	7	5	0.75	0	0	1.00	12	11	0.92
3	19-Sep	1200	3	1.20	11	9	0.83	0	0	1.00	5	7	1.33	0	0	1.00	21	20	0.95
3	20-Sep	1600	1	1.17	34	34	1.00	1	2	1.50	2	3	1.33	0	0	1.00	8	5	0.67
3	21-Sep	1500	4	1.16	18	19	1.05	0	1	2.00	2	3	1.33	1	1	1.00	3	4	1.25
3	22-Sep	1700	1	1.16	5	3	0.67	0	0	1.00	3	4	1.25	0	0	1.00	16	15	0.94
			Weighted mean (a)				0.94			1.67			1.18			1.00			0.96
			Weighted SD				0.15			0.39			0.17			0.00			0.28

Table 1 (cont.). Results of Stamp Falls verification tests, 1993. O = observed count, V = verified count.

Week	Date	Time	Observer	Gauge height (m)	Chinook adults			Chinook jacks			Coho adults			Coho jacks			Sockeye		
					O	V	V/O	O	V	V/O	O	V	V/O	O	V	V/O	O	V	V/O
4	23-Sep	1100	4	1.19	8	5	0.67	0	1	2.00	4	6	1.40	0	0	1.00	23	21	0.92
4	24-Sep	1300	1	1.19	6	7	1.14	0	1	2.00	9	7	0.80	0	0	1.00	14	15	1.07
4	25-Sep	1400	3	1.22	5	3	0.67	0	0	1.00	5	7	1.33	1	0	0.50	16	17	1.06
4	26-Sep	1200	1	1.20	10	8	0.82	1	0	0.50	5	5	1.00	0	0	1.00	8	5	0.67
4	27-Sep	1000	2	1.18	5	5	1.00	2	0	0.33	5	6	1.17	0	0	1.00	14	14	1.00
4	28-Sep	1600	1	1.21	3	5	1.50	0	0	1.00	3	3	1.00	0	0	1.00	19	20	1.05
4	29-Sep	1100	2	1.22	10	10	1.00	0	0	1.00	4	2	0.60	0	0	1.00	12	14	1.15
			Weighted mean (a)				0.92			0.75			1.03			0.50			1.00
			Weighted SD				0.30			0.67			0.29			0.19			0.14
5	30-Sep	1300	1	1.19	8	5	0.67	0	0	1.00	8	10	1.22	1	1	1.00	5	6	1.17
5	01-Oct	1600	4	1.19	18	17	0.95	1	1	1.00	7	4	0.63	0	0	1.00	9	10	1.10
5	02-Oct	1200	1	1.23	10	9	0.91	0	0	1.00	3	2	0.75	0	1	2.00	10	11	1.09
5	03-Oct	1400	4	1.21	14	12	0.87	2	1	0.67	9	13	1.40	0	0	1.00	3	3	1.00
5	04-Oct	0900	1	1.19	15	18	1.19	0	0	1.00	9	10	1.10	0	1	2.00	9	8	0.90
5	05-Oct	1600	5	1.19	17	15	0.89	0	1	2.00	6	5	0.86	0	1	2.00	7	7	1.00
5	06-Oct	1500	1	1.18	11	11	1.00	0	0	1.00	3	2	0.75	0	0	1.00	13	14	1.07
			Weighted mean (a)				0.94			1.00			1.02			2.50			1.05
			Weighted SD				0.16			0.00			0.29			0.54			0.09
6	07-Oct	1100	5	1.18	13	13	1.00	0	0	1.00	2	3	1.33	0	0	1.00	14	14	1.00
6	08-Oct	1700	1	1.19	8	8	1.00	0	0	1.00	1	1	1.00	1	1	1.00	13	12	0.93
6	09-Oct	1400	4	1.25	15	17	1.13	0	0	1.00	4	2	0.60	0	0	1.00	8	10	1.22
6	10-Oct	1200	1	1.21	37	35	0.95	0	0	1.00	4	3	0.80	0	0	1.00	0	0	1.00
6	11-Oct	1600	4	1.19	19	19	1.00	0	0	1.00	3	3	1.00	0	0	1.00	9	9	1.00
6	12-Oct	1500	1	1.17	7	7	1.00	0	0	1.00	1	1	1.00	0	0	1.00	18	18	1.00
6	13-Oct	1700	5	1.18	1	1	1.00	0	0	1.00	0	0	1.00	0	0	1.00	29	29	1.00
			Weighted mean (a)				1.00			1.00			0.88			1.00			1.01
			Weighted SD				0.06			0.00			0.23			0.00			0.09

Table 1 (cont.). Results of Stamp Falls verification tests, 1993. O = observed count, V = verified count.

Week	Date	Time	Observer	Gauge height (m)	Chinook adults			Chinook jacks			Coho adults			Coho jacks			Sockeye		
					O	V	V/O	O	V	V/O	O	V	V/O	O	V	V/O	O	V	V/O
7	14-Oct	1100	1	1.19	0	0	1.00	0	0	1.00	5	5	1.00	0	0	1.00	26	26	1.00
7	15-Oct	1300	5	1.19	6	6	1.00	0	0	1.00	1	1	1.00	0	0	1.00	17	19	1.11
7	16-Oct	1400	1	1.19	3	3	1.00	0	1	2.00	3	3	1.00	0	0	1.00	19	19	1.00
7	17-Oct	1600	4	1.16	2	2	1.00	0	0	1.00	0	0	1.00	0	0	1.00	23	24	1.04
7	18-Oct	1000	1	1.14	1	1	1.00	0	0	1.00	3	3	1.00	0	0	1.00	24	24	1.00
7	19-Oct	1200	4	1.22	1	1	1.00	0	0	1.00	2	3	1.33	0	0	1.00	20	20	1.00
7	20-Oct	1500	1	1.16	1	1	1.00	0	0	1.00	5	3	0.67	0	0	1.00	24	25	1.04
			Weighted mean (a)				1.00			2.00			0.95			1.00			1.03
			Weighted SD				0.00			0.37			0.19			0.00			0.04
8	21-Oct	1300	4	1.14	7	7	1.00	1	0	0.50	1	2	1.50	0	1	2.00	20	19	0.95
8	22-Oct	1700	1	1.24	2	1	0.67	0	0	1.00	3	3	1.00	0	0	1.00	26	26	1.00
8	23-Oct	1100	5	1.16	2	2	1.00	0	0	1.00	2	2	1.00	0	0	1.00	23	24	1.04
8	24-Oct	1600	1	1.31	2	2	1.00	0	0	1.00	2	1	0.67	0	0	1.00	19	19	1.00
8	25-Oct	1400	5	1.27	1	1	1.00	0	0	1.00	0	0	1.00	0	0	1.00	21	20	0.95
8	26-Oct	1200	1	1.24	1	1	1.00	0	0	1.00	2	1	0.67	1	1	1.00	14	11	0.80
8	27-Oct	1000	4	.1.23	0	0	1.00	0	0	1.00	1	2	1.50	0	0	1.00	31	31	1.00
			Weighted mean (a)				0.94			0.50			1.00			1.50			0.97
			Weighted SD				0.29			0.32			0.45			0.50			0.27
9	28-Oct	1300	1	1.20	2	1	0.67	0	0	1.00	1	1	1.00	0	0	1.00	8	8	1.00
9	29-Oct	0900	4	1.18	1	0	0.50	1	0	0.50	3	3	1.00	0	1	2.00	14	14	1.00
9	30-Oct	1100	1	1.12	1	1	1.00	0	0	1.00	1	0	0.50	0	0	1.00	13	10	0.79
9	31-Oct	1400	4	1.12	5	5	1.00	1	1	1.00	0	0	1.00	0	0	1.00	9	7	0.80
9	01-Nov	1000	1	1.10	2	2	1.00	0	0	1.00	1	1	1.00	0	0	1.00	4	4	1.00
9	02-Nov	1200	6	1.14	3	2	0.75	0	0	1.00	1	1	1.00	0	0	1.00	3	5	1.50
9	03-Nov	1100	1	1.30	0	0	1.00	0	0	1.00	3	2	0.75	0	0	1.00	9	9	1.00
			Weighted mean (a)				0.80			0.67			0.82			2.00			0.95
			Weighted SD				0.46			0.49			0.49			0.72			0.54

38

Table 1 (cont.). Results of Stamp Falls verification tests, 1993. O = observed count, V = verified count.

Week	Date	Time	Observer	Gauge height (m)	Chinook adults			Chinook jacks			Coho adults			Coho jacks			Sockeye		
					O	V	V/O	O	V	V/O	O	V	V/O	O	V	V/O	O	V	V/O
10	04-Nov	1500	4	1.25	0	0	1.00	0	0	1.00	0	0	1.00	0	0	1.00	14	14	1.00
10	05-Jan	1300	1	1.25	1	0	0.50	0	0	1.00	1	1	1.00	1	1	1.00	10	9	0.91
10	06-Jan	1400	6	1.23	1	1	1.00	0	0	1.00	0	0	1.00	0	0	1.00	8	6	0.78
10	07-Nov	1000	1	1.20	0	0	1.00	0	0	1.00	2	2	1.00	0	0	1.00	6	5	0.86
10	08-Nov	1200	4	1.20	2	2	1.00	0	0	1.00	1	0	0.50	0	0	1.00	5	5	1.00
10	09-Nov	1400	1	1.20	0	0	1.00	0	0	1.00	1	0	0.50	0	0	1.00	6	6	1.00
		Weighted mean (a)					0.80			1.00			0.67			1.00			0.92
		Weighted SD					0.47			0.51			0.47			0.51			0.48
	Mean weekly observer efficiency (a)						0.90			1.02			0.96			1.28			0.95

(a) A mean of 1.00 represents 100% efficiency

Table 2. Comparison of observer error from verification tests at Stamp Falls Fishway, 1993.

Observer	Number of tests	Chinook Adults		Chinook Jacks		Coho Adults		Coho Jacks		Sockeye	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	35	0.92	0.20	1.10	0.44	0.99	0.29	1.09	0.28	0.93	0.13
2	10	0.90	0.17	0.85	0.34	1.04	0.40	1.00	0.00	0.91	0.26
3	2	0.75	0.12	1.00	0.00	1.33	0.00	0.75	0.35	1.01	0.07
4	14	0.94	0.16	1.05	0.45	1.09	0.34	1.14	0.36	1.02	0.11
5	6	0.98	0.05	1.17	0.41	1.03	0.16	1.17	0.41	1.02	0.05
6	2	0.88	0.18	1.00	0.00	1.00	0.00	1.00	0.00	1.14	0.51

Table 3. Total daily counts and 95% confidence limits for salmonids passing through Stamp Falls Fishway, September 2 to November 10, 1993. The counts for chinook, coho, and sockeye salmon are adjusted for species verification (Table 1). The daily counts for chum salmon, pink salmon, and steelhead are observed counts only (not adjusted for species identification). SE is the standard error for the total count, derived from verification tests.

| Date | Chinook | | Coho | | Sockeye | Pink | Chum | Steelhead |
	Adults	Jacks	Adults	Jacks				
Sep-02	138	28	50	3	118	0	0	51
Sep-03	475	74	41	6	287	0	0	74
Sep-04	263	49	13	8	499	0	0	63
Sep-05	115	20	8	5	611	0	0	55
Sep-06	96	63	9	8	1344	0	0	34
Sep-07	345	89	5	3	1752	0	0	26
Sep-08	125	22	7	8	1143	0	0	14
Sep-09	108	8	24	7	462	0	0	26
Sep-10	102	14	18	15	305	0	0	31
Sep-11	281	16	36	19	205	0	0	33
Sep-12	124	6	45	4	200	0	0	23
Sep-13	317	53	198	32	345	0	0	31
Sep-14	2384	68	261	41	326	0	0	35
Sep-15	3104	42	239	44	310	0	0	36
Sep-16	2266	149	306	34	391	0	0	53
Sep-17	1637	70	455	24	580	0	0	37
Sep-18	1775	43	426	22	1237	0	0	16
Sep-19	1828	33	660	23	1716	0	0	30
Sep-20	4262	70	437	16	1699	0	0	10
Sep-21	2554	33	451	17	1640	0	0	8
Sep-22	2237	58	546	21	2117	0	0	10
Sep-23	1118	22	511	11	1942	0	0	9
Sep-24	1778	31	655	8	1937	0	0	15
Sep-25	1037	8	453	8	1102	0	0	4
Sep-26	1476	11	380	5	736	0	0	7
Sep-27	1079	35	263	8	731	0	0	15
Sep-28	1172	24	372	5	613	0	0	16
Sep-29	1193	24	431	8	563	0	0	18
Sep-30	1018	32	262	35	344	2	0	12
Oct-01	1603	39	319	25	359	1	0	7
Oct-02	2522	40	337	13	475	0	0	3
Oct-03	4208	52	288	15	539	0	0	20
Oct-04	5250	46	663	40	743	0	0	22
Oct-05	5894	15	434	15	646	0	0	4
Oct-06	4339	6	608	68	1668	0	0	34
Oct-07	3064	12	322	23	1683	0	0	23
Oct-08	2768	4	290	10	1575	0	0	9
Oct-09	2989	24	493	13	1652	0	0	6
Oct-10	6386	27	549	9	1093	1	0	2
Oct-11	5966	28	399	2	1048	0	0	8

Table 3. Total daily counts and 95% confidence limits for salmonids passing through Stamp Falls Fishway, September 2 to November 10, 1993. The counts for chinook, coho, and sockeye salmon are adjusted for species verification (Table 1). The daily counts for chum salmon, pink salmon, and steelhead are observed counts only (not adjusted for species identification). SE is the standard error for the total count, derived from verification tests.

| Date | Chinook | | Coho | | Sockeye | Pink | Chum | Steelhead |
	Adults	Jacks	Adults	Jacks				
Oct-12	3106	10	395	17	1716	0	0	15
Oct-13	2002	7	413	21	2434	0	0	18
Oct-14	2050	12	352	22	2468	0	0	15
Oct-15	1502	10	255	13	2207	0	0	11
Oct-16	1270	24	251	5	2357	0	0	7
Oct-17	1047	44	142	5	1972	0	0	5
Oct-18	839	66	134	4	2059	0	0	15
Oct-19	716	50	171	1	1604	0	1	13
Oct-20	904	48	180	5	1102	0	0	7
Oct-21	576	9	83	5	949	0	0	11
Oct-22	610	8	113	5	1421	0	4	12
Oct-23	1010	3	271	9	1001	0	3	5
Oct-24	363	0	97	8	484	0	6	5
Oct-25	246	1	68	3	524	0	2	13
Oct-26	154	4	37	3	561	0	2	9
Oct-27	114	3	27	3	396	0	0	15
Oct-28	66	4	21	4	254	0	2	14
Oct-29	54	3	34	2	220	0	0	29
Oct-30	44	3	25	0	115	0	0	23
Oct-31	30	1	9	4	100	0	4	28
Nov-01	27	0	23	0	65	0	1	23
Nov-02	25	0	16	4	64	0	1	20
Nov-03	33	1	40	8	176	0	8	20
Nov-04	26	2	15	5	99	0	6	19
Nov-05	12	3	13	4	168	0	0	6
Nov-06	14	2	13	5	116	0	0	11
Nov-07	5	1	6	2	61	0	0	18
Nov-08	6	0	5	8	58	0	0	11
Nov-09	6	1	4	4	26	0	0	7
Nov-10	4	0	3	1	20	0	0	3
Total	96254	1806	15479	856	61531	4	40	1338
SE	2341.94	118.79	595.63	28.62	1377.51			
Upper 95% CL	100961	(a)	16676	(a)	64300			
Lower 95% CL	91546	(a)	14282	(a)	58763			

(a) Confidence limits for jack chinook and jack coho are not presented due to the low number of jacks observed and verified in the verification tests (Table 1)

43

Table 4. Age-length (post-orbital hypural) distribution of chinook salmon carcasses recovered in the Stamp River, and chinook salmon live returns to Robertson Creek Hatchery, 1993. Ages presented are total age; all specimens were freshwater age 1.

Location	Length class (mm)	Male (b) 2	3	4	5	6	Total	Unk (c)	Female 2	3	4	5	6	Total	Unk (c)
Stamp River dead recovery															
	250-299	0	0	1	0	0	1	0	0	0	0	0	0	0	0
	300-349	0	0	0	0	0	0	2	0	0	0	0	0	0	0
	350-399	1	0	0	0	0	1	3	0	0	0	0	0	0	1
	400-449	8	1	1	0	0	10	6	0	0	0	0	0	0	1
	450-499	0	5	0	0	0	5	10	0	0	0	0	0	0	0
	500-549	1	22	2	0	0	25	55	0	0	0	0	0	0	0
	550-599	0	28	1	0	0	29	156	0	2	1	0	0	3	9
	600-649	0	21	10	3	0	34	163	0	8	24	1	0	33	35
	650-699	0	6	33	2	0	41	223	0	3	82	8	0	93	238
	700-749	0	1	44	5	0	50	305	0	0	140	33	0	173	615
	750-799	0	0	17	6	0	23	167	0	2	48	60	0	110	506
	800-849	0	0	4	7	0	11	50	0	1	6	35	0	42	222
	850-899	0	0	0	0	0	0	4	0	0	1	5	0	6	21
	900-949	0	0	0	0	0	0	0	0	0	0	1	0	1	0
	950-999	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1000-1049	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	10	84	113	23	0	230	1144	0	16	302	143	0	461	1648
	Percent	4.3	36.5	49.1	10.0	0.0	100.0		0.0	3.5	65.5	31.0	0.0	100.0	
	Mean (d)	403	552	677	725	0	618 (e)	653	0	628	688	749	0	705 (e)	720
	SD (d)	32	52	72	70	0	101 (e)	83	0	68	43	47	0	55 (e)	51
Robertson Creek Hatchery															
	250-299	0	3	0	0	0	3	0	0	0	4	1	0	5	0
	300-349	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	350-399	1	0	0	0	0	1	0	0	0	0	0	0	0	0
	400-449	3	0	0	0	0	3	0	0	0	0	0	0	0	0
	450-499	4	0	0	0	0	4	0	0	0	0	0	0	0	0
	500-549	0	3	1	0	0	4	0	0	0	1	0	0	1	0
	550-599	0	41	1	0	0	42	2	0	0	0	0	0	0	0
	600-649	2	52	6	1	0	61	4	0	2	3	1	0	6	0
	650-699	0	15	29	2	0	46	3	0	3	32	1	0	36	1
	700-749	0	3	33	3	0	39	1	0	1	100	7	0	108	6
	750-799	0	0	19	2	0	21	0	0	1	75	32	0	108	6
	800-849	0	0	3	1	0	4	1	0	0	18	20	0	38	3
	850-899	0	0	0	0	0	0	0	0	0	1	3	0	4	0
	900-949	0	0	0	0	0	0	0	0	0	0	2	1	3	0
	950-999	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1000-1049	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	10	117	92	9	0	228	11	0	7	234	67	1	309	16
	Percent	4.4	51.3	40.4	3.9	0.0	100.0		0.0	2.3	75.7	21.7	0.3	100.0	
	Mean (d)	448	574	685	698	0	618 (e)	631	0	654	705	756	890	715 (e)	734
	SD (d)	79	93	52	60	0	101 (e)	69	0	46	94	95	0	96 (e)	35

(a) Data for calculations are from scale analysis and CWT age samples
(b) Includes jacks
(c) Unk = age unknown (scale unreadable)
(d) Values for post-orbital hypural length (mm)
(e) Calculated from raw data for all ages

Table 5. Escapement estimates, by age, of chinook salmon escapement to upper Stamp River (above Stamp Falls, excluding hatchery) and Robertson Creek Hatchery, 1993. Ages presented are total age; all specimens were freshwater age 1.

Location	Age	Male (a)		Female	
		Number	Percent (b)	Number	Percent (b)
Upper Stamp River					
	2	1177	4.3	0	0.0
	3	9889	36.5	1755	3.5
	4	13303	49.1	33127	65.5
	5	2708	10.0	15686	31.0
	6	0	0.0	0	0.0
	Total (c)	27077	100.0	50567	100.0
Robertson Creek Hatchery					
	2	544	4.4	0	0.0
	3	6361	51.3	182	2.3
	4	5002	40.4	6073	75.7
	5	489	3.9	1739	21.7
	6	0	0.0	26	0.3
	Total (d)	12396	100.0	8020	100.0

(a) Includes jacks

(b) From Table 4

(c) Adjusted adult fishway count (Table 3) minus adult hatchery returns (Appendix 2-2), apportioned by the male:female sex ratio (33.65:66.35) derived from dead recovery data from sampling locations upstream of the fishway (locations 1-6, 10; see Appendix 2-1); the total number of males is the sum of 33.65% of the in-river adult population plus 100% of the in-river jack population (see Table 6)

(d) Total hatchery returns

Table 6. Sex composition of escapement of chinook salmon into Robertson Creek Hatchery and of adjusted escapement through Stamp Falls Fishway using two different methods, 1993.

Location	Type of sampling		Male		Female		Jack		Total	
			Number (a)	%	Number (a)	%	Number (a)	%	Number	%
Hatchery	Braile	(a)	12021	58.9	8020	39.3	375	1.8	20416	100.0
Hatchery	Age-comp	(b)	11852	58.1	8020	39.3	544	2.7	20416	100.0
Upper Stamp	Fishway	(c)	25646	33.0	50567	65.1	1431	1.8	77644	100.0
Upper Stamp	Age-comp	(d)	25899	33.4	50567	65.1	1177	1.5	77644	100.0

(a) From actual counts of adult male, female, and jack chinook at the hatchery (Appendix 2-2)

(b) Male (adult and jack) numbers calculated using the adult male:jack ratio of successfully aged hatchery returns (Table 4); female numbers from actual count at hatchery

(c) From adjusted fishway counts for adults and jacks (Table 3) minus hatchery counts of adults and jacks (Appendix 2-2); the number of adult males and females is apportioned by the male:female sex ratio (33.65:66.35) observed in the dead recovery upstream of the fishway (locations 1-6, 10; see Appendix 2-1)

(d) Male numbers derived from the adult male:jack ratio of successfully aged fish carcasses recovered above the fishway (Table 5); female numbers calculated as in footnote (c)

Table 7. Estimates of the total escapement of adipose-clipped chinook salmon to the upper Stamp River (above falls) and Robertson Creek Hatchery, 1993. The escapement estimates to the upper Stamp River are calculated as the adjusted fishway counts minus the returns to the hatchery.

Location and sex	Sample size (a) A	Observed adipose clips (a) B	Mark rate (%) C=(B/A)x100	Escapement estimate (b) D	Percentage of population sampled E=(A/D)x100	Total estimated adipose clips F=(B/A)xD
Upper Stamp River						
Male (c)	5686	157	2.8	27077	21.0	748
Female	9074	295	3.3	50567	17.9	1644
Total	14760	452	3.1	77644	19.0	2392
Robertson Creek Hatchery						
Male (c)	12396	449	3.6	12396	100.0	449
Female	8020	285	3.6	8020	100.0	285
Total	20416	734	3.6	20416	100.0	734

(a) From Appendix 2-1 for upper Stamp River and Appendix 2-2 for Robertson Creek Hatchery; sample sizes and observed adipose clips are from dead recovery data from sampling locations upstream of the fishway (locations 1-6, 10)

(b) Estimates are stratified between sexes according to hatchery and Upper Stamp River age compositions (Table 5)

(c) Includes jacks

Table 8. Estimates of total escapement of adipose-clipped chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1993. One decimal place is carried for the estimated adipose clips for calculating the expanded hatchery contribution in Table 10 (Method A).

Brood year	CWT code	Upper Stamp River (a)				Robertson Creek Hatchery (a)			
		Decoded adipose clips		Estimated adipose clips		Decoded adipose clips		Estimated adipose clips	
		M (b)	F	M (b)	F	M (b)	F	M (b)	F
1991	180620	0	0	0.0	0.0	3	0	3.7	0.0
	180621	0	0	0.0	0.0	1	0	1.2	0.0
	180802	0	0	0.0	0.0	2	0	2.5	0.0
	180803	0	0	0.0	0.0	3	0	3.7	0.0
	180805	0	0	0.0	0.0	1	0	1.2	0.0
	Subtotal	0	0	0.0	0.0	10	0	12.3	0.0
1990	21208	4	0	21.7	0.0	18	0	22.1	0.0
	21209	0	1	0.0	6.2	12	0	14.8	0.0
	21549	10	0	54.2	0.0	34	1	41.8	1.2
	21550	4	2	21.7	12.3	25	0	30.8	0.0
	21551	9	1	48.8	6.2	28	0	34.4	0.0
	21552	2	0	10.8	0.0	11	0	13.5	0.0
	21553	1	0	5.4	0.0	28	0	34.4	0.0
	180224	3	0	16.3	0.0	2	0	2.5	0.0
	180225	2	0	10.8	0.0	1	0	1.2	0.0
	180226	1	0	5.4	0.0	8	0	9.8	0.0
	180227	0	0	0.0	0.0	2	0	2.5	0.0
	180228	0	0	0.0	0.0	1	0	1.2	0.0
	180229	0	0	0.0	0.0	2	0	2.5	0.0
	Subtotal	36	4	195.0	24.6	172	1	211.6	1.2
1989	20145	3	16	16.3	98.5	5	6	6.2	7.3
	20146	8	17	43.3	104.7	5	9	6.2	11.0
	20147	3	14	16.3	86.2	3	10	3.7	12.2
	20148	1	5	5.4	30.8	5	5	6.2	6.1
	20149	1	4	5.4	24.6	2	1	2.5	1.2
	20150	2	7	10.8	43.1	3	1	3.7	1.2
	20151	0	3	0.0	18.5	7	10	8.6	12.2
	20152	4	4	21.7	24.6	12	8	14.8	9.7
	20153	5	9	27.1	55.4	14	7	17.2	8.5
	20230	3	6	16.3	36.9	1	6	1.2	7.3
	20231	1	6	5.4	36.9	0	4	0.0	4.9
	20232	1	4	5.4	24.6	0	1	0.0	1.2
	20442	0	2	0.0	12.3	0	0	0.0	0.0
	20645	5	9	27.1	55.4	12	27	14.8	32.9
	20646	12	15	65.0	92.4	17	16	20.9	19.5
	20647	6	13	32.5	80.0	21	4	25.8	4.9
	20648	6	1	32.5	6.2	8	8	9.8	9.7
	20818	1	1	5.4	6.2	0	0	0.0	0.0

Table 8. Estimates of total escapement of adipose-clipped chinook salmon to the upper Stamp River and
(cont.) Robertson Creek Hatchery, by tag code, 1993. One decimal place is carried for the estimated
adipose clips for calculating the expanded hatchery contribution in Table 10 (Method A).

Brood year	CWT code	Upper Stamp River (a)				Robertson Creek Hatchery (a)			
		Decoded adipose clips		Estimated adipose clips		Decoded adipose clips		Estimated adipose clips	
		M (b)	F	M (b)	F	M (b)	F	M (b)	F
	20948	5	8	27.1	49.3	17	9	20.9	11.0
	20949	7	13	37.9	80.0	8	13	9.8	15.8
	20950	7	11	37.9	67.7	12	17	14.8	20.7
	20951	6	8	32.5	49.3	12	9	14.8	11.0
	82659	1	1	5.4	6.2	0	1	0.0	1.2
	Subtotal	88	177	476.8	1089.8	164	172	201.7	209.5
1988	25014	0	2	0.0	12.3	1	8	1.2	9.7
	25630	1	1	5.4	6.2	0	1	0.0	1.2
	25640	2	2	10.8	12.3	0	0	0.0	0.0
	25643	0	0	0.0	0.0	0	3	0.0	3.7
	25645	0	1	0.0	6.2	0	1	0.0	1.2
	25646	1	0	5.4	0.0	0	0	0.0	0.0
	25648	0	2	0.0	12.3	0	1	0.0	1.2
	25651	0	1	0.0	6.2	1	0	1.2	0.0
	25653	0	3	0.0	18.5	0	0	0.0	0.0
	25654	0	1	0.0	6.2	1	0	1.2	0.0
	25657	0	4	0.0	24.6	0	2	0.0	2.4
	25658	1	3	5.4	18.5	1	2	1.2	2.4
	25660	0	1	0.0	6.2	1	1	1.2	1.2
	25663	1	1	5.4	6.2	0	0	0.0	0.0
	25701	0	0	0.0	0.0	0	1	0.0	1.2
	25702	1	2	5.4	12.3	0	1	0.0	1.2
	25703	0	1	0.0	6.2	0	1	0.0	1.2
	25704	0	1	0.0	6.2	0	0	0.0	0.0
	25705	0	1	0.0	6.2	0	0	0.0	0.0
	25836	0	8	0.0	49.3	0	7	0.0	8.5
	25837	0	8	0.0	49.3	4	1	4.9	1.2
	25838	0	11	0.0	67.7	3	2	3.7	2.4
	25839	2	8	10.8	49.3	2	10	2.5	12.2
	26055	2	5	10.8	30.8	3	3	3.7	3.7
	26056	2	10	10.8	61.6	1	7	1.2	8.5
	26057	0	9	0.0	55.4	1	8	1.2	9.7
	Subtotal	13	86	70.43	529.52	19	60	23.4	73.1
	Total hatchery	137	267	742.2	1644	365	233	449	284

Table 8. Estimates of total escapement of adipose-clipped chinook salmon to the upper Stamp River and
(cont.) Robertson Creek Hatchery, by tag code, 1993. One decimal place is carried for the estimated
adipose clips for calculating the expanded hatchery contribution in Table 10 (Method A).

Brood year	CWT code	Upper Stamp River (a)				Robertson Creek Hatchery (a)			
		Decoded adipose clips		Estimated adipose clips		Decoded adipose clips		Estimated adipose clips	
		M (b)	F	M (b)	F	M (b)	F	M (b)	F
Strays (c)									
1990	180202	1	0	5.4	0.0	0	0	0.0	0.0
	Subtotal	1	0	5.4	0.0	0	0	0.0	0.0
1989	20657	0	0	0.0	0.0	0	1	0.0	1.2
	Subtotal	0	0	0.0	0.0	0	1	0.0	1.2
	Total strays	1	0	5.4	0.0	0	1	0.0	1.2
	Total CWT	138	267	748 (d)	1644 (d)	365	234	449 (d)	285 (d)
No head taken		2	2			43	33		
No data (5000)		0	0			2	2		
No pin (8000)		17	26			35	15		
Lost pin (9000)		0	0			4	1		
Observed adipose (d)		157	295			449	285		

(a) Abbreviations are: M = male, F = female
(b) Includes jacks
(c) Strays are defined as returning adipose-clipped (and decoded) fish that were tagged in other systems;
    strays in this analysis were released in Gold River and Conuma River, B.C.
(d) From Table 7

Table 9. CWT and adipose-clip release data for hatchery-reared chinook salmon returning to the Somass River system and Robertson Creek Hatchery, by tag code, 1993.

Brood year	CWT release group	Release numbers CWT A	Release numbers Untagged B	CWT loss (%) C	Days held D	Adipose release status Clipped E = A/(1-C/100)	Adipose release status Unclipped F = A+B-E
1991	180620	27018	969164	0.0	3	27018	969164
	180621	27475	1003967	0.0	3	27475	1003967
	180802	25540	818909	0.0	3	25540	818909
	180803	27083	875698	1.8	3	27579	875202
	180805	27238	658622	0.0	3	27238	658622
1990	21208	26147	1753547	0.3	3	26226	1753468
	21209	25729	427884	0.0	3	25729	427884
	21549	33896	829768	0.0	3	33896	829768
	21550	33676	1919372	0.0	3	33676	1919372
	21551	33245	1569608	1.0	3	33581	1569272
	21552	32863	699972	1.0	3	33195	699640
	21553	33298	1070833	0.0	3	33298	1070833
	180224	26202	26202	0.0	3	26202	26202
	180225	25901	262	1.0	3	26163	0
	180226	26708	134	0.5	2	26842	0
	180227	26415	26415	0.0	3	26415	26415
	180228	25803	261	1.0	2	26064	0
	180229	26106	264	1.0	2	26370	0
1989	20145	19800	0	0.0	3	19800	0
	20146	21721	0	0.0	3	21721	0
	20147	21804	0	0.0	3	21804	0
	20148	17750	0	0.0	3	17750	0
	20149	17207	0	0.0	3	17207	0
	20150	14812	0	0.0	3	14812	0
	20151	20326	0	0.0	3	20326	0
	20152	21044	0	0.0	3	21044	0
	20153	20950	0	0.0	3	20950	0
	20230	17104	0	0.0	3	17104	0
	20231	17022	0	0.0	3	17022	0
	20232	17648	0	0.0	3	17648	0
	20642	32634	24228	5.0	3	34352	22510
	20645	25653	683278	0.0	3	25653	683278
	20646	26670	968593	0.0	3	26670	968593
	20647	25670	1431972	0.7	3	25851	1431791
	20648	26729	1107766	0.0	3	26729	1107766
	20818	40743	17074	2.0	3	41574	16243
	20948	25262	618148	1.0	3	25517	617893
	20949	26660	1018290	0.0	3	26660	1018290
	20950	26771	908745	0.0	3	26771	908745
	20951	27078	1217114	0.0	3	27078	1217114
	82659	450	75	14.3	7	525	0

Table 9.   CWT and adipose-clip release data for hatchery-reared chinook salmon returning to the Somass
(cont.)   River system and Robertson Creek Hatchery, by tag code, 1993.

Brood year	CWT release group	Release numbers CWT A	Release numbers Untagged B	CWT loss (%) C	Days held D	Adipose release status Clipped E = A/(1-C/100)	Adipose release status Unclipped F = A+B-E
1988	25014	25393	627708	0.1	3	25418	627683
	25630	10385	9	0.1	3	10394	0
	25640	9780	9	0.1	3	9789	0
	25643	9704	8	0.1	3	9712	0
	25645	9645	8	0.1	3	9653	0
	25646	9723	8	0.1	3	9731	0
	25648	9805	9	0.1	3	9814	0
	25651	9783	9	0.1	3	9792	0
	25653	9805	9	0.1	3	9814	0
	25654	10091	9	0.1	3	10100	0
	25657	9875	9	0.1	3	9884	0
	25658	9882	9	0.1	3	9891	0
	25660	10258	9	0.1	3	10267	0
	25663	9902	9	0.1	3	9911	0
	25701	9893	9	0.1	3	9902	0
	25702	9878	9	0.1	3	9887	0
	25703	9864	9	0.1	3	9873	0
	25704	9730	8	0.1	3	9738	0
	25705	9888	9	0.1	3	9897	0
	25836	25389	1489437	0.1	3	25414	1489412
	25837	25026	1075504	0.1	3	25051	1075479
	25838	24734	1414607	0.1	3	24759	1414582
	25839	25298	936521	0.1	3	25323	936496
	26055	25330	676910	0.1	3	25355	676885
	26056	25079	1765174	0.1	3	25104	1765149
	26057	24939	901048	0.1	3	24964	901023
Total hatchery		1266576	25206872			1271662	25201786

Strays (a)

1990	180202	26674	684	2.5	1	27358	0
1989	20657	27057	136813	0.7	21	27248	136622

(a) Strays are defined as returning adipose-clipped (and decoded) fish that were tagged in other systems;
strays in this analysis were released in Gold River and Conuma River, B.C.

Table 10. Estimates of total escapement of hatchery-reared chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1993. The expansion factor is used to expand the estimated number of adipose-clipped chinook in the escapement (from Table 8) to account for unclipped hatchery releases and hence to derive hatchery contributions to escapement (Method A). Expansion factor = (adipose-clipped releases + unclipped releases) / adipose-clipped releases.

Brood year	CWT release group	Release numbers (c)		Expansion factor	Expanded hatchery contribution (a)			
		Clipped	Unclipped		Upper Stamp River		Robertson Cr. Hatchery	
					M (b)	F	M (b)	F
1991	180620	27018	969164	36.87	0	0	136	0
	180621	27475	1003967	37.54	0	0	46	0
	180802	25540	818909	33.06	0	0	81	0
	180803	27579	875202	32.73	0	0	121	0
	180805	27238	658622	25.18	0	0	31	0
	Subtotal				0	0	415	0
1990	21208	26226	1753468	67.86	1471	0	1503	0
	21209	25729	427884	17.63	0	109	260	0
	21549	33896	829768	25.48	1380	0	1066	31
	21550	33676	1919372	58.00	1257	714	1784	0
	21551	33581	1569272	47.73	2327	294	1644	0
	21552	33195	699640	22.08	239	0	299	0
	21553	33298	1070833	33.16	180	0	1142	0
	180224	26202	26202	2.00	33	0	5	0
	180225	26163	0	1.00	11	0	1	0
	180226	26842	0	1.00	5	0	10	0
	180227	26415	26415	2.00	0	0	5	0
	180228	26064	0	1.00	0	0	1	0
	180229	26370	0	1.00	0	0	2	0
	Subtotal				6903	1117	7722	31
1989	20145	19800	0	1.00	16	99	6	7
	20146	21721	0	1.00	43	105	6	11
	20147	21804	0	1.00	16	86	4	12
	20148	17750	0	1.00	5	31	6	6
	20149	17207	0	1.00	5	25	2	1
	20150	14812	0	1.00	11	43	4	1
	20151	20326	0	1.00	0	18	9	12
	20152	21044	0	1.00	22	25	15	10
	20153	20950	0	1.00	27	55	17	9
	20230	17104	0	1.00	16	37	1	7
	20231	17022	0	1.00	5	37	0	5
	20232	17648	0	1.00	5	25	0	1
	20642	34352	22510	1.66	0	20	0	0
	20645	25653	683278	27.64	749	1531	408	909
	20646	26670	968593	37.32	2426	3447	780	727
	20647	25851	1431791	56.39	1833	4513	1457	275
	20648	26729	1107766	42.44	1380	261	418	414

Table 10. Estimates of total escapement of hatchery-reared chinook salmon to the upper Stamp River and
(cont.)   Robertson Creek Hatchery, by tag code, 1993. The expansion factor is used to expand the
           estimated number of adipose-clipped chinook in the escapement (from Table 8) to account for
           unclipped hatchery releases and hence to derive hatchery contributions to escapement (Method A).
           Expansion factor = (adipose-clipped releases + unclipped releases) / adipose-clipped releases.

Brood year	CWT release group	Release numbers (c)		Expansion factor	Expanded hatchery contribution (a)			
					Upper Stamp River		Robertson Cr. Hatchery	
		Clipped	Unclipped		M (b)	F	M (b)	F
	20818	41574	16243	1.39	8	9	0	0
	20948	25517	617893	25.21	683	1242	527	276
	20949	26660	1018290	39.20	1486	3137	386	621
	20950	26771	908745	34.95	1325	2367	516	724
	20951	27078	1217114	45.95	1494	2263	678	504
	82659	525	0	1.00	5	6	0	1
	Subtotal				11562	19382	5240	4532
1988	25014	25418	627683	25.69	0	316	32	250
	25630	10394	0	1.00	5	6	0	1
	25640	9789	0	1.00	11	12	0	0
	25643	9712	0	1.00	0	0	0	4
	25645	9653	0	1.00	0	6	0	1
	25646	9731	0	1.00	5	0	0	0
	25648	9814	0	1.00	0	12	0	1
	25651	9792	0	1.00	0	6	1	0
	25653	9814	0	1.00	0	18	0	0
	25654	10100	0	1.00	0	6	1	0
	25657	9884	0	1.00	0	25	0	2
	25658	9891	0	1.00	5	18	1	2
	25660	10267	0	1.00	0	6	1	1
	25663	9911	0	1.00	5	6	0	0
	25701	9902	0	1.00	0	0	0	1
	25702	9887	0	1.00	5	12	0	1
	25703	9873	0	1.00	0	6	0	1
	25704	9738	0	1.00	0	6	0	0
	25705	9897	0	1.00	0	6	0	0
	25836	25414	1489412	59.60	0	2936	0	508
	25837	25051	1075479	43.93	0	2164	216	54
	25838	24759	1414582	58.13	0	3937	215	142
	25839	25323	936496	37.98	412	1871	93	463
	26055	25355	676885	27.70	300	853	102	101
	26056	25104	1765149	71.31	773	4391	88	608
	26057	24964	901023	37.09	0	2055	46	361
	Subtotal				1522	18678	796	2504
Total hatchery					19987	39176	14173	7067

Table 10. Estimates of total escapement of hatchery-reared chinook salmon to the upper Stamp River and
(cont.)   Robertson Creek Hatchery, by tag code, 1993. The expansion factor is used to expand the
           estimated number of adipose-clipped chinook in the escapement (from Table 8) to account for
           unclipped hatchery releases and hence to derive hatchery contributions to escapement (Method A).
           Expansion factor = (adipose-clipped releases + unclipped releases) / adipose-clipped releases.

Brood year	CWT release group	Release numbers (c)		Expansion factor	Expanded hatchery contribution (a)			
		Clipped	Unclipped		Upper Stamp River		Robertson Cr. Hatchery	
					M (b)	F	M (b)	F
Strays (d)								
1990	180202	27358	0	1.00	5	0	0	0
	Subtotal				5	0	0	0
1989	20657	27248	136622	6.01	0	0	0	7
	Subtotal				0	0	0	7
	Total strays				5	0	0	7

(a) Abbreviations are: M = male, F = female
(b) Includes jacks
(c) Adipose release status from Table 9
(d) Strays are defined as returning adipose-clipped (and decoded) fish that were tagged in other systems;
    strays in this analysis were released in Gold River and Conuma River, B.C.

Table 11. Estimated hatchery contributions to chinook salmon escapements of upper Stamp River and Robertson Creek Hatchery, 1993. Contributions were calculated using expansion Method A for the estimated number of adipose clips (Table 10).

| Location | Age | Estimated escapement (a) | | Hatchery contribution (b) | | | | Stray contribution (b) | | | |
| | | Male (c) | Female | Male | | Female | | Male | | Female | |
				Number	%	Number	%	Number	%	Number	%
Upper Stamp River											
	2	1177	0	0	0.0	0	0.0	0	0.0	0	0.0
	3	9889	1755	6903	69.8	1117	63.6	5	0.1	0	0.0
	4	13303	33127	11562	86.9	19382	58.5	0	0.0	0	0.0
	5	2708	15686	1522	56.2	18678	100.0 (d)	0	0.0	0	0.0
	6	0	0	0	0.0	0	0.0	0	0.0	0	0.0
	Total	27077	50567	19987	73.8	39176	77.5	5	0.0	0	0.0
Robertson Creek Hatchery											
	2	544	0	415	76.4	0	0.0	0	0.0	0	0.0
	3	6361	182	7722	100.0 (d)	31	17.1	0	0.0	0	0.0
	4	5002	6073	5240	100.0 (d)	4532	74.6	0	0.0	7	0.1
	5	489	1739	796	100.0 (d)	2504	100.0 (d)	0	0.0	0	0.0
	6	0	26	0	0.0	0	0.0	0	0.0	0	0.0
	Total	12396	8020	14173	100.0 (d)	7067	88.1	0	0.0	7	0.1

(a) From Table 5

(b) From Table 10

(c) Includes jacks

(d) The hatchery contribution was calculated to be greater than the estimated escapement; therefore, the hatchery contribution was assumed to be 100% of the escapement

Table 12. Adjusted number of CWT chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1993. One decimal place is carried for the adjusted CWTs for estimating the total number of CWTs in Table 13 (Method B).

| Brood year | CWT code | Upper Stamp River (a) | | | | Robertson Creek Hatchery (a) | | | |
| | | Decoded adipose clips (b) | | Adjusted adipose clips | | Decoded adipose clips (b) | | Adjusted adipose clips | |
		M (c)	F	M (c)	F	M (c)	F	M (c)	F
1991	180620	0	0	0.0	0.0	3	0	3.4	0.0
	180621	0	0	0.0	0.0	1	0	1.1	0.0
	180802	0	0	0.0	0.0	2	0	2.2	0.0
	180803	0	0	0.0	0.0	3	0	3.4	0.0
	180805	0	0	0.0	0.0	1	0	1.1	0.0
	Subtotal	0	0	0.0	0.0	10	0	11.2	0.0
1990	21208	4	0	4.1	0.0	18	0	20.2	0.0
	21209	0	1	0.0	1.0	12	0	13.5	0.0
	21549	10	0	10.1	0.0	34	1	38.2	1.1
	21550	4	2	4.1	2.0	25	0	28.1	0.0
	21551	9	1	9.1	1.0	28	0	31.5	0.0
	21552	2	0	2.0	0.0	11	0	12.4	0.0
	21553	1	0	1.0	0.0	28	0	31.5	0.0
	180224	3	0	3.0	0.0	2	0	2.2	0.0
	180225	2	0	2.0	0.0	1	0	1.1	0.0
	180226	1	0	1.0	0.0	8	0	9.0	0.0
	180227	0	0	0.0	0.0	2	0	2.2	0.0
	180228	0	0	0.0	0.0	1	0	1.1	0.0
	180229	0	0	0.0	0.0	2	0	2.2	0.0
	Subtotal	36	4	36.5	4.0	172	1	193.3	1.1
1989	20145	3	16	3.0	16.1	5	6	5.6	6.9
	20146	8	17	8.1	17.1	5	9	5.6	10.3
	20147	3	14	3.0	14.1	3	10	3.4	11.4
	20148	1	5	1.0	5.0	5	5	5.6	5.7
	20149	1	4	1.0	4.0	2	1	2.2	1.1
	20150	2	7	2.0	7.0	3	1	3.4	1.1
	20151	0	3	0.0	3.0	7	10	7.9	11.4
	20152	4	4	4.1	4.0	12	8	13.5	9.2
	20153	5	9	5.1	9.1	14	7	15.7	8.0
	20230	3	6	3.0	6.0	1	6	1.1	6.9
	20231	1	6	1.0	6.0	0	4	0.0	4.6
	20232	1	4	1.0	4.0	0	1	0.0	1.1
	20442	0	2	0.0	2.0	0	0	0.0	0.0
	20645	5	9	5.1	9.1	12	27	13.5	30.9
	20646	12	15	12.2	15.1	17	16	19.1	18.3
	20647	6	13	6.1	13.1	21	4	23.6	4.6
	20648	6	1	6.1	1.0	8	8	9.0	9.2
	20818	1	1	1.0	1.0	0	0	0.0	0.0

Table 12. Adjusted number of CWT chinook salmon to the upper Stamp River and Robertson Creek Hatchery,
(cont.) by tag code, 1993. One decimal place is carried for the adjusted CWTs for estimating the total
number of CWTs in Table 13 (Method B).

Brood year	CWT code	Upper Stamp River (a)				Robertson Creek Hatchery (a)			
		Decoded adipose clips (b)		Adjusted adipose clips		Decoded adipose clips (b)		Adjusted adipose clips	
		M (c)	F	M (c)	F	M (c)	F	M (c)	F
	20948	5	8	5.1	8.1	17	9	19.1	10.3
	20949	7	13	7.1	13.1	8	13	9.0	14.9
	20950	7	11	7.1	11.1	12	17	13.5	19.5
	20951	6	8	6.1	8.1	12	9	13.5	10.3
	82659	1	1	1.0	1.0	0	1	0.0	1.1
	Subtotal	88	177	89.1	178.2	164	172	184.3	196.9
1988	25014	0	2	0.0	2.0	1	8	1.1	9.2
	25630	1	1	1.0	1.0	0	1	0.0	1.1
	25640	2	2	2.0	2.0	0	0	0.0	0.0
	25643	0	0	0.0	0.0	0	3	0.0	3.4
	25645	0	1	0.0	1.0	0	1	0.0	1.1
	25646	1	0	1.0	0.0	0	0	0.0	0.0
	25648	0	2	0.0	2.0	0	1	0.0	1.1
	25651	0	1	0.0	1.0	1	0	1.1	0.0
	25653	0	3	0.0	3.0	0	0	0.0	0.0
	25654	0	1	0.0	1.0	1	0	1.1	0.0
	25657	0	4	0.0	4.0	0	2	0.0	2.3
	25658	1	3	1.0	3.0	1	2	1.1	2.3
	25660	0	1	0.0	1.0	1	1	1.1	1.1
	25663	1	1	1.0	1.0	0	0	0.0	0.0
	25701	0	0	0.0	0.0	0	1	0.0	1.1
	25702	1	2	1.0	2.0	0	1	0.0	1.1
	25703	0	1	0.0	1.0	0	1	0.0	1.1
	25704	0	1	0.0	1.0	0	0	0.0	0.0
	25705	0	1	0.0	1.0	0	0	0.0	0.0
	25836	0	8	0.0	8.1	0	7	0.0	8.0
	25837	0	8	0.0	8.1	4	1	4.5	1.1
	25838	0	11	0.0	11.1	3	2	3.4	2.3
	25839	2	8	2.0	8.1	2	10	2.2	11.4
	26055	2	5	2.0	5.0	3	3	3.4	3.4
	26056	2	10	2.0	10.1	1	7	1.1	8.0
	26057	0	9	0.0	9.1	1	8	1.1	9.2
	Subtotal	13	86	13.2	86.6	19	60	21.3	68.7
	Total hatchery	137	267	138.8	268.8	365	233	410.1	266.8

Table 12. Adjusted number of CWT chinook salmon to the upper Stamp River and Robertson Creek Hatchery,
(cont.) by tag code, 1993. One decimal place is carried for the adjusted CWTs for estimating the total
number of CWTs in Table 13 (Method B).

Brood year	CWT code	Upper Stamp River (a)				Robertson Creek Hatchery (a)			
		Decoded adipose clips (b)		Adjusted adipose clips		Decoded adipose clips (b)		Adjusted adipose clips	
		M (c)	F	M (c)	F	M (c)	F	M (c)	F
Strays (d)									
1990	180202	1	0	1.0	0.0	0	0	0.0	0.0
	Subtotal	1	0	1.0	0.0	0	0	0.0	0.0
1989	20657	0	0	0.0	0.0	0	1	0.0	1.1
	Subtotal	0	0	0.0	0.0	0	1	0.0	1.1
	Total strays	1	0	1.0	0.0	0	1	0.0	1.1
	Total CWT	138	267	139.8	268.8	365	234	410.1	267.9
No head taken		2	2			43	33		
No data (5000)		0	0			2	2		
No data (ND) (d)		2	2			45	35		
No pin (8000)		17	26			35	15		
Lost pin (9000)		0	0			4	1		
Observed adipose (e)		157	295			449	285		

(a) Abbreviations are: M = male, F = female
(b) From Table 8
(c) Includes jacks
(d) Includes "No head taken" and "No data (5000)"; all "ND" for Method B (see equation 8 in text)
(e) Strays are defined as returning adipose-clipped (and decoded) fish that were tagged in other systems;
    strays in this analysis were released in Gold River and Conuma River, B.C.

Table 13. Estimates of total escapement of CWT chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1993. One decimal place is carried for the estimated CWTs for calculating the expanded hatchery contribution in Table 14 (Method B).

Brood year	CWT code	Upper Stamp River (a)				Robertson Creek Hatchery (a)			
		Adjusted adipose clips (b)		Estimated adipose clips		Adjusted adipose clips (b)		Estimated adipose clips	
		M (c)	F	M (c)	F	M (c)	F	M (c)	F
1991	180620	0.0	0.0	0.0	0.0	3.4	0.0	3.4	0.0
	180621	0.0	0.0	0.0	0.0	1.1	0.0	1.1	0.0
	180802	0.0	0.0	0.0	0.0	2.2	0.0	2.2	0.0
	180803	0.0	0.0	0.0	0.0	3.4	0.0	3.4	0.0
	180805	0.0	0.0	0.0	0.0	1.1	0.0	1.1	0.0
	Subtotal	0.0	0.0	0.0	0.0	11.2	0.0	11.2	0.0
1990	21208	4.1	0.0	19.3	0.0	20.2	0.0	20.2	0.0
	21209	0.0	1.0	0.0	5.6	13.5	0.0	13.5	0.0
	21549	10.1	0.0	48.2	0.0	38.2	1.1	38.2	1.1
	21550	4.1	2.0	19.3	11.2	28.1	0.0	28.1	0.0
	21551	9.1	1.0	43.4	5.6	31.5	0.0	31.5	0.0
	21552	2.0	0.0	9.6	0.0	12.4	0.0	12.4	0.0
	21553	1.0	0.0	4.8	0.0	31.5	0.0	31.5	0.0
	180224	3.0	0.0	14.5	0.0	2.2	0.0	2.2	0.0
	180225	2.0	0.0	9.6	0.0	1.1	0.0	1.1	0.0
	180226	1.0	0.0	4.8	0.0	9.0	0.0	9.0	0.0
	180227	0.0	0.0	0.0	0.0	2.2	0.0	2.2	0.0
	180228	0.0	0.0	0.0	0.0	1.1	0.0	1.1	0.0
	180229	0.0	0.0	0.0	0.0	2.2	0.0	2.2	0.0
	Subtotal	36.5	4.0	173.6	22.4	193.3	1.1	193.3	1.1
1989	20145	3.0	16.1	14.5	89.8	5.6	6.9	5.6	6.9
	20146	8.1	17.1	38.6	95.4	5.6	10.3	5.6	10.3
	20147	3.0	14.1	14.5	78.6	3.4	11.4	3.4	11.4
	20148	1.0	5.0	4.8	28.1	5.6	5.7	5.6	5.7
	20149	1.0	4.0	4.8	22.4	2.2	1.1	2.2	1.1
	20150	2.0	7.0	9.6	39.3	3.4	1.1	3.4	1.1
	20151	0.0	3.0	0.0	16.8	7.9	11.4	7.9	11.4
	20152	4.1	4.0	19.3	22.4	13.5	9.2	13.5	9.2
	20153	5.1	9.1	24.1	50.5	15.7	8.0	15.7	8.0
	20230	3.0	6.0	14.5	33.7	1.1	6.9	1.1	6.9
	20231	1.0	6.0	4.8	33.7	0.0	4.6	0.0	4.6
	20232	1.0	4.0	4.8	22.4	0.0	1.1	0.0	1.1
	20442	0.0	2.0	0.0	11.2	0.0	0.0	0.0	0.0
	20645	5.1	9.1	24.1	50.5	13.5	30.9	13.5	30.9
	20646	12.2	15.1	57.9	84.2	19.1	18.3	19.1	18.3
	20647	6.1	13.1	28.9	72.9	23.6	4.6	23.6	4.6
	20648	6.1	1.0	28.9	5.6	9.0	9.2	9.0	9.2
	20818	1.0	1.0	4.8	5.6	0.0	0.0	0.0	0.0

Table 13. Estimates of total escapement of CWT chinook salmon to the upper Stamp River and
(cont.)   Robertson Creek Hatchery, by tag code, 1993. One decimal place is carried for the estimated
           CWTs for calculating the expanded hatchery contribution in Table 14 (Method B).

| Brood year | CWT code | Upper Stamp River (a) | | | | Robertson Creek Hatchery (a) | | | |
| | | Adjusted adipose clips (b) | | Estimated adipose clips | | Adjusted adipose clips (b) | | Estimated adipose clips | |
		M (c)	F	M (c)	F	M (c)	F	M (c)	F
	20948	5.1	8.1	24.1	44.9	19.1	10.3	19.1	10.3
	20949	7.1	13.1	33.8	72.9	9.0	14.9	9.0	14.9
	20950	7.1	11.1	33.8	61.7	13.5	19.5	13.5	19.5
	20951	6.1	8.1	28.9	44.9	13.5	10.3	13.5	10.3
	82659	1.0	1.0	4.8	5.6	0.0	1.1	0.0	1.1
	Subtotal	89.1	178.2	424.5	993.1	184.3	196.9	184.3	196.9
1988	25014	0.0	2.0	0.0	11.2	1.1	9.2	1.1	9.2
	25630	1.0	1.0	4.8	5.6	0.0	1.1	0.0	1.1
	25640	2.0	2.0	9.6	11.2	0.0	0.0	0.0	0.0
	25643	0.0	0.0	0.0	0.0	0.0	3.4	0.0	3.4
	25645	0.0	1.0	0.0	5.6	0.0	1.1	0.0	1.1
	25646	1.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0
	25648	0.0	2.0	0.0	11.2	0.0	1.1	0.0	1.1
	25651	0.0	1.0	0.0	5.6	1.1	0.0	1.1	0.0
	25653	0.0	3.0	0.0	16.8	0.0	0.0	0.0	0.0
	25654	0.0	1.0	0.0	5.6	1.1	0.0	1.1	0.0
	25657	0.0	4.0	0.0	22.4	0.0	2.3	0.0	2.3
	25658	1.0	3.0	4.8	16.8	1.1	2.3	1.1	2.3
	25660	0.0	1.0	0.0	5.6	1.1	1.1	1.1	1.1
	25663	1.0	1.0	4.8	5.6	0.0	0.0	0.0	0.0
	25701	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1
	25702	1.0	2.0	4.8	11.2	0.0	1.1	0.0	1.1
	25703	0.0	1.0	0.0	5.6	0.0	1.1	0.0	1.1
	25704	0.0	1.0	0.0	5.6	0.0	0.0	0.0	0.0
	25705	0.0	1.0	0.0	5.6	0.0	0.0	0.0	0.0
	25836	0.0	8.1	0.0	44.9	0.0	8.0	0.0	8.0
	25837	0.0	8.1	0.0	44.9	4.5	1.1	4.5	1.1
	25838	0.0	11.1	0.0	61.7	3.4	2.3	3.4	2.3
	25839	2.0	8.1	9.6	44.9	2.2	11.4	2.2	11.4
	26055	2.0	5.0	9.6	28.1	3.4	3.4	3.4	3.4
	26056	2.0	10.1	9.6	56.1	1.1	8.0	1.1	8.0
	26057	0.0	9.1	0.0	50.5	1.1	9.2	1.1	9.2
	Subtotal	13.2	86.6	62.7	482.5	21.3	68.7	21.3	68.7
	Total hatchery	138.8	268.8	660.8	1498.1	410.1	266.8	410.1	266.8

Table 13. Estimates of total escapement of CWT chinook salmon to the upper Stamp River and
(cont.)   Robertson Creek Hatchery, by tag code, 1993. One decimal place is carried for the estimated
CWTs for calculating the expanded hatchery contribution in Table 14 (Method B).

		Upper Stamp River (a)				Robertson Creek Hatchery (a)			
		Adjusted adipose clips (b)		Estimated adipose clips		Adjusted adipose clips (b)		Estimated adipose clips	
Brood year	CWT code	M (c)	F	M (c)	F	M (c)	F	M (c)	F
Strays (d)									
1990	180202	1.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0
	Subtotal	1.0	0.0	4.8	0.0	0.0	0.0	0.0	0.0
1989	20657	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1
	Subtotal	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.1
	Total strays	1.0	0.0	4.8	0.0	0.0	1.1	0.0	1.1
	Total CWT	139.8	268.8	665.6	1498.1	410.1	267.9	410.1	267.9
Escapement estimate (e)		27077	50567			12396	8020		
Sample size (e)		5686	9074			12396	8020		

(a) Abbreviations are: M = male, F = female
(b) From Table 12
(c) Includes jacks
(d) Strays are defined as returning adipose-clipped (and decoded) fish that were tagged in other systems;
    strays in this analysis were released in Gold River and Conuma River, B.C.
(e) From Table 7

Table 14. Estimates of total escapement of hatchery-reared chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1993. The expansion factor is used to expand the estimated number of CWT chinook in the escapement (from Table 13) to account for untagged hatchery releases and hence to derive hatchery contributions to escapement (Method B).
Expansion factor = (CWT releases + untagged releases) / CWT releases.

Brood year	CWT release group	Release numbers (c)		Expansion factor	Expanded hatchery contribution (a)			
		Clipped	Unclipped		Upper Stamp River		Robertson Cr. Hatchery	
					M (b)	F	M (b)	F
1991	180620	27018	969164	36.87	0	0	124	0
	180621	27475	1003967	37.54	0	0	42	0
	180802	25540	818909	33.06	0	0	74	0
	180803	27083	875698	33.33	0	0	112	0
	180805	27238	658622	25.18	0	0	28	0
	Subtotal				0	0	381	0
1990	21208	26147	1753547	68.06	1313	0	1377	0
	21209	25729	427884	17.63	0	99	238	0
	21549	33896	829768	25.48	1229	0	973	29
	21550	33676	1919372	58.00	1119	651	1629	0
	21551	33245	1569608	48.21	2093	271	1517	0
	21552	32863	699972	22.30	215	0	276	0
	21553	33298	1070833	33.16	160	0	1043	0
	180224	26202	26202	2.00	29	0	4	0
	180225	25901	262	1.01	10	0	1	0
	180226	26708	134	1.01	5	0	9	0
	180227	26415	26415	2.00	0	0	4	0
	180228	25803	261	1.01	0	0	1	0
	180229	26106	264	1.01	0	0	2	0
	Subtotal				6173	1020	7075	29
1989	20145	19800	0	1.00	14	90	6	7
	20146	21721	0	1.00	39	95	6	10
	20147	21804	0	1.00	14	79	3	11
	20148	17750	0	1.00	5	28	6	6
	20149	17207	0	1.00	5	22	2	1
	20150	14812	0	1.00	10	39	3	1
	20151	20326	0	1.00	0	17	8	11
	20152	21044	0	1.00	19	22	13	9
	20153	20950	0	1.00	24	50	16	8
	20230	17104	0	1.00	14	34	1	7
	20231	17022	0	1.00	5	34	0	5
	20232	17648	0	1.00	5	22	0	1
	20642	32634	24228	1.74	0	20	0	0
	20645	25653	683278	27.64	666	1396	373	854
	20646	26670	968593	37.32	2160	3141	713	684
	20647	25670	1431972	56.78	1643	4142	1340	260
	20648	26729	1107766	42.44	1228	238	382	389

Table 14. Estimates of total escapement of hatchery-reared chinook salmon to the upper Stamp River and
(cont.)   Robertson Creek Hatchery, by tag code, 1993. The expansion factor is used to expand the estimated
number of CWT chinook in the escapement (from Table 13) to account for untagged hatchery releases
and hence to derive hatchery contributions to escapement (Method B).
Expansion factor = (CWT releases + untagged releases) / CWT releases.

Brood year	CWT release group	Release numbers (c)		Expansion factor	Expanded hatchery contribution (a)			
					Upper Stamp River		Robertson Cr. Hatchery	
		Clipped	Unclipped		M (b)	F	M (b)	F
	20818	40743	17074	1.42	7	8	0	0
	20948	25262	618148	25.47	614	1143	486	262
	20949	26660	1018290	39.20	1323	2859	352	583
	20950	26771	908745	34.95	1180	2157	471	680
	20951	27078	1217114	45.95	1330	2062	620	473
	82659	450	75	1.17	6	7	0	1
	Subtotal				10312	17705	4800	4265
1988	25014	25393	627708	25.72	0	289	29	236
	25630	10385	9	1.00	5	6	0	1
	25640	9780	9	1.00	10	11	0	0
	25643	9704	8	1.00	0	0	0	3
	25645	9645	8	1.00	0	6	0	1
	25646	9723	8	1.00	5	0	0	0
	25648	9805	9	1.00	0	11	0	1
	25651	9783	9	1.00	0	6	1	0
	25653	9805	9	1.00	0	17	0	0
	25654	10091	9	1.00	0	6	1	0
	25657	9875	9	1.00	0	22	0	2
	25658	9882	9	1.00	5	17	1	2
	25660	10258	9	1.00	0	6	1	1
	25663	9902	9	1.00	5	6	0	0
	25701	9893	9	1.00	0	0	0	1
	25702	9878	9	1.00	5	11	0	1
	25703	9864	9	1.00	0	6	0	1
	25704	9730	8	1.00	0	6	0	0
	25705	9888	9	1.00	0	6	0	0
	25836	25389	1489437	59.66	0	2678	0	478
	25837	25026	1075504	43.98	0	1974	198	50
	25838	24734	1414607	58.19	0	3592	196	133
	25839	25298	936521	38.02	367	1707	85	435
	26055	25330	676910	27.72	267	778	93	95
	26056	25079	1765174	71.38	689	4005	80	572
	26057	24939	901048	37.13	0	1875	42	340
	Subtotal				1357	17037	728	2356
Total hatchery					17842	35762	12984	6650

Table 14. Estimates of total escapement of hatchery-reared chinook salmon to the upper Stamp River and
(cont.) Robertson Creek Hatchery, by tag code, 1993. The expansion factor is used to expand the estimated
number of CWT chinook in the escapement (from Table 13) to account for untagged hatchery releases
and hence to derive hatchery contributions to escapement (Method B).
Expansion factor = (CWT releases + untagged releases) / CWT releases.

Brood year	CWT release group	Release numbers (c)		Expansion factor	Expanded hatchery contribution (a)			
					Upper Stamp River		Robertson Cr. Hatchery	
		Clipped	Unclipped		M (b)	F	M (b)	F
Strays (d)								
1990	180202	26674	684	1.03	5	0	0	0
	Subtotal				5	0	0	0
1989	20657	27057	136813	6.06	0	0	0	7
	Subtotal				0	0	0	7
	Total strays				5	0	0	7

(a) Abbreviations are: M = male, F = female
(b) Includes jacks
(c) Adipose release status from Table 9
(d) Strays are defined as returning adipose-clipped (and decoded) fish that were tagged in other systems;
strays in this analysis were released in Gold River and Conuma River, B.C.

Table 15. Estimated hatchery contributions to chinook salmon escapements of upper Stamp River and Robertson Creek Hatchery, 1993. Contributions were calculated using expansion Method B for the estimated number of CWTs (Table 14).

Location	Age	Estimated escapement (a) Male (c)	Female	Hatchery contribution (b) Male Number	%	Female Number	%	Stray contribution (b) Male Number	%	Female Number	%
Upper Stamp River											
	2	1177	0	0	0.0	0	0.0	0	0.0	0	0.0
	3	9889	1755	6173	62.4	1020	58.1	5	0.1	0	0.0
	4	13303	33127	10312	77.5	17705	53.4	0	0.0	0	0.0
	5	2708	15686	1357	50.1	17037	100.0 (d)	0	0.0	0	0.0
	6	0	0	0	0.0	0	0.0	0	0.0	0	0.0
	Total	27077	50567	17842	65.9	35762	70.7	5	0.0	0	0.0
Robertson Creek Hatchery											
	2	544	0	381	70.2	0	0.0	0	0.0	0	0.0
	3	6361	182	7075	100.0 (d)	29	16.1	0	0.0	0	0.0
	4	5002	6073	4800	96.0	4265	70.2	0	0.0	7	0.1
	5	489	1739	728	100.0 (d)	2356	100.0 (d)	0	0.0	0	0.0
	6	0	26	0	0.0	0	0.0	0	0.0	0	0.0
	Total	12396	8020	12984	100.0 (d)	6650	82.9	0	0.0	7	0.1

(a) From Table 5
(b) From Table 14
(c) Includes jacks
(d) The hatchery contribution was calculated to be greater than the estimated escapement; therefore, the hatchery contribution was assumed to be 100% of the escapement

APPENDICES

Appendix 1-1. Actual counts of adult chinook salmon at Stamp Falls Fishway, 1993. Bold numbers that are underlined indicate when verification tests were conducted.

Date	800	900	1000	1100	1200	1300	1400	1500	1600	1700	Total
Sep-02	8	71	**3**	1	17	8	0	4	8	69	189
Sep-03	46	187	179	168	**4**	0	9	13	14	30	650
Sep-04		56	75	48	52	60	32	34	**1**	2	360
Sep-05	17	84	25	**0**	6	8	0	6	6	5	157
Sep-06	45	**7**	39	8	7	5	4	3	4	9	131
Sep-07	93	147	148	**11**	19	6	18	12	10	9	473
Sep-08	6	53	10	30	24	**2**	3	14	11	18	171
Sep-09	38	24	19	1	14	4	13	**1**	0	6	120
Sep-10	**3**	14	27	6	12	9	18	3	13	8	113
Sep-11	19	68	31	83	**1**	4	37	39	11	19	312
Sep-12	2	39	33	3	5	15	**3**	1	13	24	138
Sep-13	73	48	54	**0**	3	10	28	50	50	36	352
Sep-14	247	525	412	399	311	**18**	83	204	184	266	2649
Sep-15	539	709	511	**77**	312	383	276	280	182	180	3449
Sep-16	348	**22**	476	391	339	304	144	101	98	188	2411
Sep-17	332	482	290	229	119	71	79	**6**	33	100	1741
Sep-18	214	262	266	268	242	220	**3**	117	128	168	1888
Sep-19	289	408	325	223	**11**	113	90	115	132	239	1945
Sep-20	407	752	563	634	400	586	390	436	**34**	332	4534
Sep-21	220	485	307	369	280	353	256	**18**	117	312	2717
Sep-22	299	286	321	201	282	207	253	203	304	**24**	2380
Sep-23	50	361	219	**34**	125	163	71	47	25	120	1215
Sep-24	209	273	259	249	254	**29**	257	116	120	167	1933
Sep-25	113	210	167	150	65	118	**5**	77	91	131	1127
Sep-26	242	311	231	134	**10**	74	211	153	125	113	1604
Sep-27	163	300	**5**	130	196	127	127	41	18	66	1173
Sep-28	81	229	211	107	86	144	140	228	**3**	45	1274
Sep-29	87	226	214	**15**	154	159	170	65	88	119	1297
Sep-30	95	164	160	77	112	**8**	93	128	138	108	1083
Oct-01	331	371	272	156	116	73	86	130	**18**	152	1705
Oct-02	261	434	335	270	**10**	97	50	168	406	652	2683
Oct-03	486	666	766	586	635	401	**14**	301	357	265	4477
Oct-04	474	**235**	783	557	633	579	626	288	727	683	5585
Oct-05	373	601	901	663	827	684	786	644	**212**	579	6270
Oct-06	388	509	655	538	552	511	484	**11**	570	398	4616
Oct-07	219	355	380	**97**	426	424	312	332	255	264	3064
Oct-08	435	334	403	335	269	252	200	216	274	**50**	2768
Oct-09	235	413	472	385	315	242	**15**	376	244	292	2989
Oct-10	570	775	557	777	**266**	773	714	655	614	685	6386
Oct-11	495	686	788	720	743	676	586	457	**260**	555	5966
Oct-12	169	371	434	302	305	319	381	**130**	472	223	3106
Oct-13	152	267	258	210	216	231	141	221	239	**67**	2002
Oct-14	138	207	224	**47**	227	254	245	240	254	214	2050

Appendix 1-1. Actual counts of adult chinook salmon at Stamp Falls Fishway, 1993. Bold numbers that are underlined indicate when verification tests were conducted.

Date	800	900	1000	1100	1200	1300	1400	1500	1600	1700	Total
Oct-15	115	175	192	174	170	**6**	221	186	133	130	1502
Oct-16	114	146	142	139	110	175	**36**	165	111	132	1270
Oct-17	102	172	127	78	112	121	86	103	**46**	100	1047
Oct-18	50	102	**26**	95	74	98	95	125	91	83	839
Oct-19	67	135	117	91	**1**	76	48	48	43	90	716
Oct-20	64	85	94	92	103	82	99	**1**	172	112	904
Oct-21	56	86	87	81	54	**7**	69	59	57	57	613
Oct-22			79	53	130	91	85	81	128	**2**	649
Oct-23	94	188	143	**37**	105	105	98	123	84	97	1074
Oct-24	20	55	42	51	38	43	49	41	**2**	45	386
Oct-25	29	44	35	19	20	31	**1**	24	37	22	262
Oct-26	10	22	8	19	**1**	7	18	21	35	23	164
Oct-27	9	21	**2**	17	12	17	17	12	14		121
Oct-28	9	9	16	11	5	**2**	2	15	14		83
Oct-29	10	**1**	6	9	6	14	7	7	7		67
Oct-30	4	6	10	**1**	1	8	6	10	9		55
Oct-31	2	4	2	5	6	6	**5**	0	7		37
Nov-01	1	8	**2**	1	6	5	4	3	4		34
Nov-02	1	9	4	4	**3**	0	3	2	5		31
Nov-03	5	10	6	**0**	2	5	7	6			41
Nov-04	4	5	6	4	5	3	5	**0**			32
Nov-05	4	0	4	2	2	**1**	1	1			15
Nov-06	3	0	7	2	5	0	**1**	0			18
Nov-07	0	1	**0**	0	0	0	4	1			6
Nov-08	1	0	0	2	**2**	1	0	1			7
Nov-09	1	0	1	1	2	1	**0**	1			7
Nov-10	1	0	1	1	2	0	0	0			5
Total	9787	14311	13967	10678	9979	9629	8420	7720	7862	8885	101238

Appendix 1-2. Actual counts of jack chinook salmon at Stamp Falls Fishway, 1993. Bold numbers that are underlined indicate when verification tests were conducted.

Date	800	900	1000	1100	1200	1300	1400	1500	1600	1700	Total
Sep-02	1	5	**0**	0	3	2	0	1	2	10	24
Sep-03	12	20	8	14	**2**	0	0	3	1	3	63
Sep-04		8	8	9	7	4	2	4	**0**	0	42
Sep-05	3	2	1	**1**	2	1	2	0	2	3	17
Sep-06	21	**3**	18	3	3	0	3	0	3	0	54
Sep-07	11	40	8	**3**	2	4	1	4	0	3	76
Sep-08	4	4	3	0	6	**0**	0	0	2	0	19
Sep-09	0	11	0	0	6	0	0	**0**	0	4	21
Sep-10	**1**	13	3	2	0	6	2	3	1	3	34
Sep-11	8	5	14	2	**1**	2	3	3	1	0	39
Sep-12	0	1	9	1	0	1	**0**	0	0	2	14
Sep-13	25	24	24	**0**	2	0	26	12	16	4	133
Sep-14	21	18	40	8	29	**0**	8	17	22	7	170
Sep-15	5	30	6	**6**	6	19	8	14	3	9	106
Sep-16	26	**1**	20	7	10	5	11	0	9	0	89
Sep-17	2	11	5	7	1	7	2	**0**	0	7	42
Sep-18	7	5	2	2	3	3	**0**	0	2	2	26
Sep-19	1	2	2	3	**0**	1	1	3	1	6	20
Sep-20	3	1	6	3	6	5	14	2	**1**	1	42
Sep-21	1	4	0	4	3	2	4	**0**	0	2	20
Sep-22	3	1	8	2	3	3	4	3	8	**0**	35
Sep-23	0	11	2	**0**	2	1	2	7	2	2	29
Sep-24	5	1	11	0	7	**0**	7	1	7	2	41
Sep-25	0	1	2	1	4	1	**0**	0	0	1	10
Sep-26	0	2	3	1	**1**	0	2	1	3	2	15
Sep-27	18	4	**2**	0	7	0	5	3	8	0	47
Sep-28	1	14	1	2	2	4	5	3	**0**	0	32
Sep-29	0	5	4	**1**	7	9	3	0	0	3	32
Sep-30	4	0	9	0	5	**0**	5	2	5	2	32
Oct-01	10	6	9	2	4	1	4	1	**1**	1	39
Oct-02	2	3	2	13	**0**	5	1	3	4	7	40
Oct-03	7	0	16	0	11	4	**2**	2	8	2	52
Oct-04	7	**0**	12	2	10	2	4	1	7	1	46
Oct-05	1	1	3	2	1	1	1	2	**2**	1	15
Oct-06	0	1	0	2	1	2	0	**0**	0	0	6
Oct-07	0	0	2	**0**	3	1	4	0	2	0	12
Oct-08	1	0	0	0	0	3	0	0	0	**0**	4
Oct-09	8	1	7	0	3	2	**0**	1	2	0	24
Oct-10	0	1	1	2	**0**	1	0	5	2	15	27
Oct-11	8	0	9	0	0	0	9	1	**0**	1	28
Oct-12	0	0	0	3	0	1	2	**1**	3	0	10
Oct-13	0	1	0	0	2	0	2	0	2	**0**	7
Oct-14	0	0	1	**1**	0	2	0	1	0	1	6

Appendix 1-2. Actual counts of jack chinook salmon at Stamp Falls Fishway, 1993. Bold numbers that are underlined indicate when verification tests were conducted.

Date	\multicolumn{10}{c}{Hour of day}	Total
	800	900	1000	1100	1200	1300	1400	1500	1600	1700	
Oct-15	0	0	0	0	2	0	3	0	0	0	5
Oct-16	1	1	0	3	0	1	0	3	0	3	12
Oct-17	3	1	4	1	5	1	3	1	3	0	22
Oct-18	0	2	3	10	0	4	1	9	0	4	33
Oct-19	4	2	5	2	0	0	3	7	1	1	25
Oct-20	9	3	2	1	0	2	3	0	0	4	24
Oct-21	1	3	1	3	0	1	3	1	0	4	17
Oct-22			1	0	10	1	0	0	3	0	15
Oct-23	1	0	3	0	0	0	1	0	0	0	5
Oct-24	0	0	0	0	0	0	0	0	0	0	0
Oct-25	0	0	0	1	0	0	0	1	0	0	2
Oct-26	2	2	0	2	0	0	0	0	1	1	8
Oct-27	1	1	0	1	2	0	0	0	0		5
Oct-28	2	0	2		0	2	0	0	0		6
Oct-29	1	1	1	0	1	0	0	0	0		4
Oct-30	1	2	0	0	0	0	0	0	1		4
Oct-31	0	0	0	0	1	0	1	0	0		2
Nov-01	0	0	0	0	0	0	0	0	0		0
Nov-02	0	0	0	0	0	0	0	0	0		0
Nov-03	0	0	0	0	0	0	0	1	0		1
Nov-04	0	0	0	1	0	0	1	0			2
Nov-05	1	0	0	0	1	0	1	0			3
Nov-06	0	0	0	0	0	2	0	0			2
Nov-07	0	0	0	0	1	0	0	0			1
Nov-08	0	0	0	0	0	0	0	0			0
Nov-09	0	0	0	0	0	1	0	0			1
Nov-10	0	0	0	0	0	0	0	0			0
Total	254	279	303	134	188	120	169	127	141	124	1839

Appendix 1-3. Actual counts of adult coho salmon at Stamp Falls Fishway, 1993. Bold numbers that are underlined indicate when verification tests were conducted.

| | Hour of day | | | | | | | | | | |
Date	800	900	1000	1100	1200	1300	1400	1500	1600	1700	Total
Sep-02	11	26	**4**	0	8	3	0	1	7	0	60
Sep-03	3	31	5	8	**0**	0	1	0	0	1	49
Sep-04		7	1	1	1	4	1	1	**0**	0	16
Sep-05	1	2	3	**1**	0	1	0	1	0	1	10
Sep-06	4	**0**	1	1	0	0	2	1	1	1	11
Sep-07	0	0	3	**0**	1	1	1	0	0	0	6
Sep-08	1	3	0	0	1	**0**	0	1	1	2	9
Sep-09	6	4	1	2	2	2	0	**0**	0	2	19
Sep-10	**0**	8	1	0	0	2	1	0	0	2	14
Sep-11	6	3	5	2	**0**	1	7	1	1	2	28
Sep-12	0	0	7	2	2	8	**1**	1	1	13	35
Sep-13	20	12	24	**0**	10	20	31	10	18	10	155
Sep-14	23	27	38	12	27	**5**	12	28	8	24	204
Sep-15	14	30	32	**2**	21	14	17	16	17	24	187
Sep-16	50	**4**	47	29	27	31	16	15	14	26	259
Sep-17	97	90	59	44	14	23	18	**10**	9	22	386
Sep-18	70	37	57	44	35	19	**7**	22	45	25	361
Sep-19	45	79	92	83	**5**	46	39	47	56	67	559
Sep-20	50	56	98	43	55	22	19	19	**2**	6	370
Sep-21	93	41	93	16	75	10	24	**2**	18	10	382
Sep-22	11	122	81	55	28	42	42	50	18	**14**	463
Sep-23	26	73	94	**28**	74	57	42	29	47	26	496
Sep-24	40	96	106	89	56	**37**	86	36	48	42	636
Sep-25	54	74	79	48	41	43	**5**	35	32	29	440
Sep-26	75	82	46	34	**5**	35	27	23	21	21	369
Sep-27	29	55	**5**	44	35	17	25	8	17	20	255
Sep-28	42	47	60	37	47	54	23	40	**3**	8	361
Sep-29	65	79	45	**7**	56	54	40	15	23	34	418
Sep-30	28	42	32	16	23	**9**	48	27	16	16	257
Oct-01	70	53	55	26	13	16	32	19	**7**	22	313
Oct-02	48	70	45	20	**3**	7	33	34	43	27	330
Oct-03	28	50	27	26	15	24	**9**	34	47	22	282
Oct-04	55	**80**	135	74	66	65	61	43	38	33	650
Oct-05	13	48	47	57	37	56	47	54	**34**	32	425
Oct-06	72	83	75	76	46	67	69	**3**	74	31	596
Oct-07	5	65	84	**25**	51	43	19	32	21	21	366
Oct-08	60	58	64	33	22	32	18	12	11	**20**	330
Oct-09	68	131	117	52	53	27	**4**	55	37	16	560
Oct-10	73	112	51	88	**28**	62	50	56	54	50	624
Oct-11	54	38	56	47	46	42	63	57	**20**	30	453
Oct-12	35	59	71	60	48	44	66	**21**	30	15	449
Oct-13	57	61	91	63	49	33	25	46	29	**15**	469
Oct-14	48	48	58	**31**	32	31	39	30	32	22	371

Appendix 1-3. Actual counts of adult coho salmon at Stamp Falls Fishway, 1993. Bold numbers that are underlined indicate when verification tests were conducted.

Date	800	900	1000	1100	1200	1300	1400	1500	1600	1700	Total
Oct-15	31	24	37	23	24	1	44	46	25	13	268
Oct-16	31	62	39	38	15	12	7	30	21	9	264
Oct-17	15	28	31	17	13	8	6	14	3	14	149
Oct-18	18	20	20	12	10	10	11	10	19	11	141
Oct-19	33	37	21	22	2	19	9	8	7	22	180
Oct-20	31	41	29	18	20	10	11	5	14	10	189
Oct-21	10	21	12	4	5	1	7	10	5	8	83
Oct-22			31	12	19	18	4	16	10	3	113
Oct-23	56	47	55	17	23	18	16	18	13	8	271
Oct-24	5	11	27	7	13	9	10	4	2	9	97
Oct-25	9	16	10	13	8	2	0	5	5	0	68
Oct-26	9	9	5	1	2	2	2	2	3	2	37
Oct-27	3	13	2	4	2	1	1	1	0		27
Oct-28	0	5	2	2	1	1	1	3	11		26
Oct-29	10	3	10	10	3	1	2	0	3		42
Oct-30	5	8	3	1	2	5	2	2	3		31
Oct-31	3	0	1	0	6	1	0	0	0		11
Nov-01	1	8	1	2	2	2	5	6	1		28
Nov-02	5	5	4	1	1	0	1	0	2		19
Nov-03	3	16	10	3	1	7	6	3			49
Nov-04	11	0	3	0	2	5	2	0			23
Nov-05	5	1	2	4	4	1	2	0			19
Nov-06	3	6	5	2	3	1	0	0			20
Nov-07	0	0	2	1	0	1	3	2			9
Nov-08	1	2	1	1	1	0	1	0			7
Nov-09	4	0	0	0	1	0	1	0			6
Nov-10	1	1	0	0	1	0	1	0			4
Total	1853	2470	2458	1541	1342	1245	1225	1120	1047	913	15214

Appendix 1-4. Actual counts of jack coho salmon at Stamp Falls Fishway, 1993. Bold numbers that are underlined indicate when verification tests were conducted.

Date	Hour of day										Total
	800	900	1000	1100	1200	1300	1400	1500	1600	1700	
Sep-02	0	2	**0**	0	0	0	0	0	0	1	3
Sep-03	0	2	3	1	**0**	0	0	0	0	0	6
Sep-04		5	0	0	0	0	1	2	**0**	0	8
Sep-05	0	3	0	**0**	0	2	0	0	0	0	5
Sep-06	4	**0**	2	0	1	0	1	0	0	0	8
Sep-07	0	1	0	**0**	0	0	0	0	1	1	3
Sep-08	4	0	0	0	3	**0**	0	0	1	0	8
Sep-09	0	2	0	0	1	2	0	**0**	0	0	5
Sep-10	**0**	6	1	1	1	0	0	0	0	2	11
Sep-11	5	0	4	0	**1**	1	3	0	0	0	14
Sep-12	0	0	0	0	0	2	**0**	0	0	1	3
Sep-13	7	4	1	**0**	1	0	7	1	2	1	24
Sep-14	2	3	9	0	2	**0**	5	1	8	1	31
Sep-15	1	10	1	**1**	0	11	0	3	1	5	33
Sep-16	8	**0**	4	5	3	2	3	4	3	2	34
Sep-17	2	4	5	3	0	4	4	**0**	2	0	24
Sep-18	1	0	4	3	1	5	**0**	2	1	5	22
Sep-19	3	2	2	0	**0**	3	5	2	4	2	23
Sep-20	0	4	3	3	2	1	1	2	**0**	0	16
Sep-21	1	2	2	2	2	1	1	**1**	3	2	17
Sep-22	1	1	6	0	4	2	5	1	1	**0**	21
Sep-23	0	6	5	**0**	2	2	3	3	0	0	21
Sep-24	1	1	4	0	2	**1**	2	4	1	0	16
Sep-25	2	2	4	1	3	1	**1**	1	1	0	16
Sep-26	2	2	0	1	**0**	3	0	0	2	0	10
Sep-27	6	0	**0**	1	4	0	1	1	2	0	15
Sep-28	0	4	0	2	0	1	1	1	**0**	1	10
Sep-29	1	2	2	**0**	1	8	1	1	0	0	16
Sep-30	2	0	5	0	1	**1**	1	2	2	0	14
Oct-01	4	0	0	2	0	4	0	0	**0**	0	10
Oct-02	2	0	0	0	**0**	1	0	1	1	0	5
Oct-03	1	0	0	0	0	1	**0**	1	3	0	6
Oct-04	1	**2**	5	1	1	3	1	0	1	1	16
Oct-05	2	1	0	2	0	0	0	0	**0**	1	6
Oct-06	1	1	8	5	3	1	3	**0**	5	0	27
Oct-07	2	4	1	**0**	4	5	0	3	2	2	23
Oct-08	2	2	2	1	1	0	0	0	0	**2**	10
Oct-09	1	6	2	2	0	1	**0**	1	0	0	13
Oct-10	1	0	0	2	**2**	1	0	2	1	0	9
Oct-11	1	0	0	0	1	0	0	0	**0**	0	2
Oct-12	2	0	5	2	2	1	2	**0**	3	0	17
Oct-13	1	5	1	3	1	4	0	4	0	**2**	21
Oct-14	1	1	6	**0**	5	1	4	1	3	0	22

Appendix 1-4. Actual counts of jack coho salmon at Stamp Falls Fishway, 1993. Bold numbers that are underlined indicate when verification tests were conducted.

| Date | \multicolumn{10}{c}{Hour of day} | Total |
	800	900	1000	1100	1200	1300	1400	1500	1600	1700	
Oct-15	1	2	2	3	1	**0**	0	2	0	2	13
Oct-16	2	0	1	0	0	0	**2**	0	0	0	5
Oct-17	0	2	1	0	0	0	1	1	**0**	0	5
Oct-18	0	0	**0**	0	0	0	1	0	1	2	4
Oct-19	0	1	0	0	**0**	0	0	0	0	0	1
Oct-20	0	1	1	0	1	0	1	**0**	0	1	5
Oct-21	0	1	0	0	0	**0**	2	0	0	0	3
Oct-22			0	1	2	0	0	0	0	**0**	3
Oct-23	0	3	1	**0**	0	0	0	2	0	0	6
Oct-24	0	1	1	0	0	1	1	0	**0**	1	5
Oct-25	0	0	1	0	0	1	**0**	0	0	0	2
Oct-26	0	1	0	0	**1**	0	0	0	0	0	2
Oct-27	0	1	**0**	0	0	0	0	0	1		2
Oct-28	1	0	0	1	0	**0**	0	0	0		2
Oct-29	0	**0**	1	0	0	0	0	0	0		1
Oct-30	0	0	0	**0**	0	0	0	0	0		0
Oct-31	0	2	0	0	0	0	**0**	0	0		2
Nov-01	0	0	**0**	0	0	0	0	0	0		0
Nov-02	0	0	0	0	**0**	0	1	1	0		2
Nov-03	0	2	0	**0**	0	1	0	1			4
Nov-04	1	0	1	0	0	2	1	**0**			5
Nov-05	0	1	0	1	0	**1**	0	1			4
Nov-06	0	1	0	2	0	2	**0**	0			5
Nov-07	0	0	**0**	0	1	0	1	0			2
Nov-08	0	2	1	2	**0**	0	0	3			8
Nov-09	1	0	2	0	1	0	**0**	0			4
Nov-10	1	0	0	0	0	0	0	0			1
Total	82	111	110	54	62	84	67	56	56	38	720

Appendix 1-5. Actual counts of sockeye salmon at Stamp Falls Fishway, 1993. Bold numbers that are underlined indicate when verification tests were conducted.

Date	800	900	1000	1100	1200	1300	1400	1500	1600	1700	Total
Sep-02	30	36	**6**	2	24	11	1	4	2	11	127
Sep-03	147	71	47	10	**9**	0	4	4	11	6	309
Sep-04		220	88	31	66	25	45	41	**11**	10	537
Sep-05	207	124	99	**28**	88	42	21	13	9	26	657
Sep-06	488	**265**	259	119	55	57	50	60	61	31	1445
Sep-07	720	473	316	**94**	98	37	51	27	27	41	1884
Sep-08	341	368	159	123	85	**18**	11	25	29	70	1229
Sep-09	254	124	104	53	48	11	17	**10**	3	26	650
Sep-10	**82**	147	79	19	29	14	18	11	8	23	430
Sep-11	86	59	32	39	**11**	23	9	9	6	15	289
Sep-12	44	93	49	10	22	17	**8**	3	17	18	281
Sep-13	187	55	43	**0**	5	15	35	27	47	72	486
Sep-14	90	111	72	32	31	**4**	16	20	20	63	459
Sep-15	81	69	104	**23**	42	27	15	29	19	27	436
Sep-16	54	**10**	97	68	39	34	18	15	16	56	407
Sep-17	180	106	106	46	36	13	37	**11**	37	32	604
Sep-18	260	256	178	131	186	70	**12**	79	60	57	1289
Sep-19	199	315	214	229	**21**	173	77	133	204	223	1788
Sep-20	209	287	216	353	196	230	107	91	**8**	73	1770
Sep-21	273	285	305	233	166	124	81	**3**	90	148	1708
Sep-22	377	468	474	257	171	84	71	90	131	**82**	2205
Sep-23	170	392	402	**161**	218	128	84	69	118	200	1942
Sep-24	283	252	336	273	225	**80**	146	93	133	116	1937
Sep-25	147	197	214	153	79	89	**16**	75	58	74	1102
Sep-26	135	178	125	53	**8**	45	38	42	40	72	736
Sep-27	143	113	**14**	150	57	62	37	28	41	86	731
Sep-28	·87	95	109	54	51	39	53	58	**19**	48	613
Sep-29	98	106	90	**15**	75	21	58	14	33	53	563
Sep-30	74	68	31	36	10	**5**	32	29	23	20	328
Oct-01	56	70	61	26	18	19	14	18	**9**	51	342
Oct-02	77	83	81	43	**10**	32	17	33	21	55	452
Oct-03	52	59	74	92	62	27	**3**	28	44	72	513
Oct-04	95	**102**	108	100	109	57	44	34	16	43	708
Oct-05	46	38	87	58	87	53	62	62	**36**	86	615
Oct-06	146	212	286	213	207	122	100	**13**	149	141	1589
Oct-07	189	323	246	**176**	199	145	80	94	63	151	1666
Oct-08	340	219	233	179	76	98	88	88	132	**106**	1559
Oct-09	194	306	245	192	187	91	**8**	153	116	144	1636
Oct-10	117	140	94	120	**57**	102	83	102	119	148	1082
Oct-11	82	101	130	122	95	83	83	79	**93**	170	1038
Oct-12	175	245	274	213	149	105	142	**108**	203	85	1699
Oct-13	245	391	351	296	224	158	108	186	227	**224**	2410
Oct-14	303	374	391	**160**	164	134	161	189	271	249	2396

Appendix 1-5. Actual counts of sockeye salmon at Stamp Falls Fishway, 1993. Bold numbers that are underlined indicate when verification tests were conducted.

Date	Hour of day										Total
	800	900	1000	1100	1200	1300	1400	1500	1600	1700	
Oct-15	257	350	247	208	139	**17**	215	249	199	262	2143
Oct-16	255	398	339	191	122	114	**90**	160	250	369	2288
Oct-17	183	334	321	159	138	93	69	90	**224**	304	1915
Oct-18	309	411	**194**	172	105	119	101	136	182	270	1999
Oct-19	202	343	266	156	**20**	67	71	81	134	217	1557
Oct-20	162	196	157	75	70	53	58	**24**	156	119	1070
Oct-21	144	214	111	72	67	**20**	52	80	99	119	978
Oct-22			484	186	312	162	99	84	112	**26**	1465
Oct-23	105	203	175	**127**	98	61	65	83	56	59	1032
Oct-24	25	70	87	57	35	44	51	49	**19**	62	499
Oct-25	49	113	81	55	38	30	**21**	46	48	59	540
Oct-26	75	188	93	37	**14**	33	31	30	30	47	578
Oct-27	72	102	**94**	42	26	11	14	28	19		408
Oct-28	29	52	49	31	18	**8**	26	35	19		267
Oct-29	27	**14**	65	27	18	9	19	32	21		232
Oct-30	18	22	13	**13**	7	13	9	10	16		121
Oct-31	17	15	17	10	14	12	**9**	5	6		105
Nov-01	25	13	**4**	3	2	4	5	4	8		68
Nov-02	9	10	6	6	**3**	0	19	5	9		67
Nov-03	36	34	36	**9**	16	27	16	11			185
Nov-04	33	25	18	5	4	5	4	**14**			108
Nov-05	67	33	16	11	14	**10**	11	21			183
Nov-06	34	26	20	19	8	8	**8**	3			126
Nov-07	9	15	**6**	6	8	6	8	8			66
Nov-08	16	4	**15**	7	**5**	4	5	7			63
Nov-09	9	4	0	3	4	1	**6**	1			28
Nov-10	4	3	1	2	3	2	3	4			22
Total	9734	11198	9944	6474	5103	3657	3246	3600	4387	5417	62760

Appendix 2-1. Dead recovery and adipose-clipped status of chinook salmon recovered in the Stamp River, by location, 1993. (a)

| | Location 1 | | | | | | Location 2 | | | | | |
| | Total recovered | | | Adipose clipped | | | Total recovered | | | Adipose clipped | | |
Date	M	F	J	M	F	J	M	F	J	M	F	J
05-Oct	8	38	1	1	1	0	15	27	6	1	0	0
06-Oct	14	18	5	0	0	0	13	19	0	0	2	0
07-Oct	14	24	1	0	1	0	3	18	0	0	1	0
08-Oct	19	22	0	1	1	0	14	14	1	0	0	0
12-Oct	63	139	10	1	2	0	35	64	5	1	0	1
13-Oct	37	75	7	2	2	1	19	49	8	2	4	0
14-Oct	49	91	8	0	7	0	23	44	7	2	4	0
15-Oct	71	126	12	3	6	1	18	42	0	1	3	0
17-Oct	166	282	44	5	6	3	0	0	0	0	0	0
18-Oct	138	209	25	3	7	0	68	150	21	4	4	0
19-Oct	116	202	21	7	9	1	0	0	0	0	0	0
20-Oct	235	415	66	3	13	2	0	0	0	0	0	0
21-Oct	190	281	59	5	8	0	0	0	0	0	0	0
22-Oct	195	321	40	8	11	0	0	0	0	0	0	0
23-Oct	107	198	38	0	6	2	80	193	44	4	4	1
24-Oct	0	0	0	0	0	0	37	51	10	2	2	0
25-Oct	184	353	37	5	10	0	0	0	0	0	0	0
26-Oct	47	163	14	1	4	0	0	0	0	0	0	0
27-Oct	118	280	35	3	10	0	0	0	0	0	0	0
28-Oct	0	0	0	0	0	0	0	0	0	0	0	0
29-Oct	201	463	22	1	16	2	0	0	0	0	0	0
01-Nov	55	137	7	1	2	0	82	98	26	3	3	0
02-Nov	110	289	25	0	8	0	0	0	0	0	0	0
03-Nov	69	188	7	3	5	1	21	47	4	0	1	0
04-Nov	0	0	0	0	0	0	0	0	0	0	0	0
05-Nov	14	40	3	0	1	0	0	0	0	0	0	0
Total	2220	4354	487	53	136	13	428	816	132	20	28	2

(a) Abbreviations are: M = male, F = female, J = jack

Appendix 2-1 (cont.).   Dead recovery and adipose-clipped status of chinook salmon recovered in the Stamp River, by location, 1993. (a)

	Location 3						Location 4					
	Total recovered			Adipose clipped			Total recovered			Adipose clipped		
Date	M	F	J	M	F	J	M	F	J	M	F	J
05-Oct	2	7	0	0	0	0	5	33	0	0	0	0
06-Oct	0	1	0	0	0	0	9	28	2	0	2	0
07-Oct	0	0	0	0	0	0	3	11	2	0	0	0
08-Oct	0	0	0	0	0	0	0	0	0	0	0	0
12-Oct	0	0	0	0	0	0	42	109	3	1	5	0
13-Oct	6	16	0	0	2	0	35	78	3	0	4	0
14-Oct	0	0	0	0	0	0	43	82	9	1	1	0
15-Oct	0	0	0	0	0	0	45	71	5	3	6	1
17-Oct	0	0	0	0	0	0	46	95	11	1	6	0
18-Oct	0	0	0	0	0	0	0	0	0	0	0	0
19-Oct	0	0	0	0	0	0	123	282	37	8	22	2
20-Oct	0	0	0	0	0	0	116	259	38	7	5	0
21-Oct	0	0	0	0	0	0	116	165	22	4	4	1
22-Oct	0	0	0	0	0	0	122	199	18	2	5	0
23-Oct	0	0	0	0	0	0	0	0	0	0	0	0
24-Oct	0	0	0	0	0	0	0	0	0	0	0	0
25-Oct	0	0	0	0	0	0	0	0	0	0	0	0
26-Oct	0	0	0	0	0	0	82	292	12	2	13	0
27-Oct	0	0	0	0	0	0	102	254	18	3	7	2
28-Oct	0	0	0	0	0	0	0	0	0	0	0	0
29-Oct	0	0	0	0	0	0	36	139	1	1	2	0
01-Nov	23	36	3	1	1	0	45	169	7	1	3	0
02-Nov	0	0	0	0	0	0	20	94	4	0	6	0
03-Nov	1	9	0	0	0	0	5	50	5	0	1	0
04-Nov	0	0	0	0	0	0	0	0	0	0	0	0
05-Nov	0	0	0	0	0	0	0	0	0	0	0	0
Total	32	69	3	1	3	0	995	2410	197	34	92	6

(a) Abbreviations are: M = male, F = female, J = jack

Appendix 2-1 (cont.).   Dead recovery and adipose-clipped status of chinook salmon recovered in the Stamp River, by location, 1993. (a)

| | Location 5 | | | | | | Location 6 | | | | | |
| | Total recovered | | | Adipose clipped | | | Total recovered | | | Adipose clipped | | |
Date	M	F	J	M	F	J	M	F	J	M	F	J
05-Oct	6	22	2	0	1	0	0	0	0	0	0	0
06-Oct	0	0	0	0	0	0	0	0	0	0	0	0
07-Oct	0	0	0	0	0	0	0	0	0	0	0	0
08-Oct	0	0	0	0	0	0	0	0	0	0	0	0
12-Oct	0	0	0	0	0	0	0	0	0	0	0	0
13-Oct	1	0	0	0	0	0	0	0	0	0	0	0
14-Oct	0	0	0	0	0	0	0	0	0	0	0	0
15-Oct	15	34	3	1	2	0	0	0	0	0	0	0
17-Oct	0	0	0	0	0	0	0	0	0	0	0	0
18-Oct	0	0	0	0	0	0	0	0	0	0	0	0
19-Oct	0	0	0	0	0	0	0	0	0	0	0	0
20-Oct	0	0	0	0	0	0	0	0	0	0	0	0
21-Oct	0	0	0	0	0	0	0	0	0	0	0	0
22-Oct	0	0	0	0	0	0	0	0	0	0	0	0
23-Oct	0	0	0	0	0	0	0	0	0	0	0	0
24-Oct	0	0	0	0	0	0	0	0	0	0	0	0
25-Oct	0	0	0	0	0	0	0	0	0	0	0	0
26-Oct	0	0	0	0	0	0	0	0	0	0	0	0
27-Oct	0	0	0	0	0	0	0	0	0	0	0	0
28-Oct	0	0	0	0	0	0	0	0	0	0	0	0
29-Oct	0	0	0	0	0	0	0	0	0	0	0	0
01-Nov	0	0	0	0	0	0	0	0	0	0	0	0
02-Nov	0	0	0	0	0	0	0	0	0	0	0	0
03-Nov	0	0	0	0	0	0	0	0	0	0	0	0
04-Nov	0	0	0	0	0	0	0	0	0	0	0	0
05-Nov	0	0	0	0	0	0	0	0	0	0	0	0
Total	22	56	5	1	3	0	0	0	0	0	0	0

(a) Abbreviations are: M = male, F = female, J = jack

Appendix 2-1 (cont.).   Dead recovery and adipose-clipped status of chinook salmon recovered in the Stamp River, by location, 1993. (a)

	Location 7						Location 8					
	Total recovered			Adipose clipped			Total recovered			Adipose clipped		
Date	M	F	J	M	F	J	M	F	J	M	F	J
05-Oct	0	0	0	0	0	0	0	0	0	0	0	0
06-Oct	0	0	0	0	0	0	0	0	0	0	0	0
07-Oct	0	0	0	0	0	0	0	0	0	0	0	0
08-Oct	0	0	0	0	0	0	0	0	0	0	0	0
12-Oct	0	0	0	0	0	0	0	0	0	0	0	0
13-Oct	0	0	0	0	0	0	0	0	0	0	0	0
14-Oct	0	0	0	0	0	0	0	0	0	0	0	0
15-Oct	0	0	0	0	0	0	0	0	0	0	0	0
17-Oct	0	0	0	0	0	0	0	0	0	0	0	0
18-Oct	0	0	0	0	0	0	0	0	0	0	0	0
19-Oct	0	0	0	0	0	0	0	0	0	0	0	0
20-Oct	0	0	0	0	0	0	0	0	0	0	0	0
21-Oct	0	0	0	0	0	0	0	0	0	0	0	0
22-Oct	0	0	0	0	0	0	0	0	0	0	0	0
23-Oct	0	0	0	0	0	0	0	0	0	0	0	0
24-Oct	0	0	0	0	0	0	0	0	0	0	0	0
25-Oct	0	0	0	0	0	0	0	0	0	0	0	0
26-Oct	0	0	0	0	0	0	0	0	0	0	0	0
27-Oct	0	0	0	0	0	0	0	0	0	0	0	0
28-Oct	0	0	0	0	0	0	0	0	0	0	0	0
29-Oct	0	0	0	0	0	0	0	0	0	0	0	0
01-Nov	0	0	0	0	0	0	0	0	0	0	0	0
02-Nov	0	0	0	0	0	0	0	0	0	0	0	0
03-Nov	0	0	0	0	0	0	0	0	0	0	0	0
04-Nov	0	0	0	0	0	0	0	0	0	0	0	0
05-Nov	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0

(a) Abbreviations are: M = male, F = female, J = jack

Appendix 2-1 (cont.).   Dead recovery and adipose-clipped status of chinook salmon recovered in the Stamp River, by location, 1993. (a)

	Location 9						Location 10					
	Total recovered			Adipose clipped			Total recovered			Adipose clipped		
Date	M	F	J	M	F	J	M	F	J	M	F	J
05-Oct	0	0	0	0	0	0	1	9	0	0	0	0
06-Oct	0	0	0	0	0	0	2	5	0	0	0	0
07-Oct	0	0	0	0	0	0	4	8	0	0	0	0
08-Oct	0	0	0	0	0	0	6	6	0	1	0	0
12-Oct	0	0	0	0	0	0	28	33	1	0	0	0
13-Oct	0	0	0	0	0	0	20	17	4	1	0	0
14-Oct	0	0	0	0	0	0	15	23	2	1	1	0
15-Oct	0	0	0	0	0	0	12	35	6	0	2	0
17-Oct	0	0	0	0	0	0	54	58	7	3	3	0
18-Oct	0	0	0	0	0	0	47	51	12	1	1	0
19-Oct	0	0	0	0	0	0	56	84	8	2	4	1
20-Oct	0	0	0	0	0	0	16	57	10	0	1	0
21-Oct	0	0	0	0	0	0	60	92	32	3	1	0
22-Oct	0	0	0	0	0	0	95	123	18	1	3	2
23-Oct	0	0	0	0	0	0	109	137	25	0	6	0
24-Oct	0	0	0	0	0	0	95	175	40	3	1	1
25-Oct	0	0	0	0	0	0	117	171	32	3	5	0
26-Oct	0	0	0	0	0	0	82	161	25	1	2	3
27-Oct	0	0	0	0	0	0	86	124	38	0	3	0
28-Oct	16	31	1	0	4	0	0	0	0	0	0	0
29-Oct	0	0	0	0	0	0	0	0	0	0	0	0
01-Nov	0	0	0	0	0	0	0	0	0	0	0	0
02-Nov	0	0	0	0	0	0	0	0	0	0	0	0
03-Nov	0	0	0	0	0	0	0	0	0	0	0	0
04-Nov	3	8	0	0	0	0	0	0	0	0	0	0
05-Nov	0	0	0	0	0	0	0	0	0	0	0	0
Total	19	39	1	0	4	0	905	1369	260	20	33	7

(a) Abbreviations are: M = male, F = female, J = jack

Appendix 2-2.   Total numbers and adipose-clip status of chinook salmon returning to Robertson Creek
Hatchery, by date, 1993. (a)

Date	Total returns			Adipose clips		
	M	F	J	M	F	J
22-Sep	8	3	18	0	0	1
28-Sep	73	12	5	2	0	1
29-Sep	185	113	36	5	4	2
30-Sep	1	0	0	0	0	0
04-Oct	287	192	3	3	2	0
05-Oct	1	378	18	0	3	0
06-Oct	1248	360	6	37	10	1
07-Oct	576	395	12	20	6	0
08-Oct	779	411	12	27	4	1
09-Oct	8	0	0	2	0	0
12-Oct	1264	453	7	47	5	0
13-Oct	992	553	27	28	22	1
14-Oct	923	562	16	42	22	1
15-Oct	999	493	23	32	18	0
18-Oct	866	410	44	21	21	3
19-Oct	1186	628	38	40	28	2
20-Oct	456	253	9	13	17	2
21-Oct	821	535	24	26	23	0
22-Oct	319	278	20	13	17	0
23-Oct	62	168	2	7	3	0
24-Oct	356	349	15	18	10	2
25-Oct	136	402	9	4	23	0
26-Oct	190	157	9	22	17	3
27-Oct	131	640	12	9	23	2
29-Oct	88	135	1	6	1	0
01-Nov	2	0	0	0	0	0
02-Nov	35	54	4	1	0	1
05-Nov	27	25	3	1	1	0
08-Nov	2	61	2	0	5	0
Total	12021	8020	375	426	285	23

(a) Abbreviations are: M = male, F = female, J = jack