Stamp Falls Fishway Counts, Adipose Clip/CWT Recovery and Biological Sampling of Chinook Salmon Escapements in Stamp River and Robertson Creek Hatchery, 1994

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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, 1994

by

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ABSTRACT

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Estimates of salmon escapement were derived for the Stamp River for 1994 using visual counts at the Stamp Falls Fishway. This study is part of the Chinook Key Stream Program. After adjusting for observer error, the total escapement of adult chinook salmon (*Oncorhynchus tshawytscha*) to the Stamp River was estimated at 57,678 $\pm$ 144; the total escapement of jack chinook was estimated at 954 (confidence limits are not presented due to the low number of observations of jack chinook during verification tests). This final escapement estimate for chinook is the lowest since the inception of the Chinook Key Stream Program in 1985; the reliability of this escapement estimate is very high (the standard error associated with the estimate is also the lowest since the inception of the Program). Escapement estimates for adult and jack coho salmon are also presented, as well as partial estimates for sockeye. The 1994 escapement estimates for coho salmon are also the lowest since the inception of the 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 5, respectively, and the dominant male age groups for the hatchery chinook population were age 4 and age 3, 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 (hatchery plus upper Stamp River returns) was 1,544 and represented 2.6% 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 1994, Robertson Creek Hatchery contributed 75.8% 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 1994 chinook escapement was 65.2%. 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. 1995. Stamp Falls Fishway counts, adipose clip/CWT recovery and biological sampling of chinook salmon escapements in Stamp River and Robertson Creek Hatchery, 1994. Can. Manuscr. Rep. Fish. Aquat. Sci. 2324: ix + 80 p.

Les taux d'échappées du saumon dans la rivière Stamp en 1994 ont été établis au moyen de la méthode de dénombrement visuel à la passe migratoire des chutes Stamp. L'étude s'inscrit dans le cadre du programme concernant les principaux cours d'eau fréquentés par le quinnat (Chinook Key Stream Program). Rajusté pour tenir compte des erreurs de dénombrement visuel, le taux d'échappées du saumon quinnat adulte (*Oncorhynchus tshawytscha*) dans la rivière Stamp s'élève au total à 57 678 $\pm$ 144; pour ce qui est du saumon quinnat juvénile, ce taux est de 954 (les critères de fiabilité ne sont pas présentés en raison du faible nombre de juvéniles observés durant les tests de contrôle). Ce dernier est le taux le plus bas obtenu depuis la mise en oeuvre du programme concernant les principaux cours d'eau fréquentés par le saumon quinnat, en 1985; la fiabilité de ces données est très élevée (le taux d'erreur normal n'a jamais été aussi bas depuis la mise en oeuvre du programme). On présente également les taux d'échappées du saumon coho (adulte et juvénile), de même que des taux partiels pour le saumon rouge. Les taux d'échappées du saumon coho en 1994 sont également les plus bas depuis la mise en oeuvre du programme.

Les chiffres concernant l'âge, la taille et le sexe des saumons quinnats dans la partie supérieure de la rivière Stamp, ainsi que le nombre de poissons qui proviennent de l'écloserie, sont fondés sur les données de récupération des carcasses et sur les remontes vers l'écloserie du ruisseau Robertson. On a dénombré le plus de saumons quinnats mâles de la rivière dans les groupes d'âge de quatre et de cinq ans; pour ce qui est de l'écloserie, on en a dénombré le plus dans les groupes d'âge de quatre et de trois ans. En ce qui concerne les saumons quinnats femelles, les populations provenant de la rivière et de l'écloserie en comptaient le plus dans les groupes d'âge de quatre et de cinq ans respectivement. Dans les deux cas, les saumons quinnats femelles étaient en moyenne plus longues que les mâles, et ce, pour tous les groupes d'âge.

Pour l'ensemble de la rivière Stamp (écloserie et remontes de la partie supérieure de la rivière Stamp), le taux d'échappées du saumon quinnat dont la nageoire adipeuse a été coupée est de 1 544, soit 2,6 p. 100 de la population totale. Ce taux a été ventilé par âge, sexe et codes des micromarques. On a déterminé le total des échappées de poissons (marqués et non marqués) qui proviennent de l'écloserie en faisant une extrapolation à partir des remontées observées de saumons à nageoire adipeuse coupée et du nombre de saumons à nageoire adipeuse coupée qui avaient été relâchés. En 1994, 75,8 p. 100 des saumons quinnats qui ont atteint la rivière Stamp provenaient de l'écloserie du ruisseau Robertson. Ce pourcentage a été comparé au taux obtenu au moyen de la méthode du Programme de reprise des poissons étiquetés, qui repose sur un facteur d'extrapolation du nombre portant des micromarques magnétisées codées (Kuhn et al. 1988). Selon cette méthode, 65,2 p. 100 du nombre total de ces saumons provenaient en 1994 de l'écloserie du ruisseau Robertson. On expose également les raisons pour lesquelles il y a variation des données selon la méthode utilisée.

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 1994 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 1994 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 1994 program was executed using the same methods as in 1990, 1991, 1992, and 1993. Our specific objectives in the 1994 study were to:

1. count all chinook, coho, sockeye, steelhead, and other salmonids passing through the Stamp Falls Fishway between 1 September and 10 November, 1994;

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 (in °C), 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 1 September and 8 November, 1994. 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

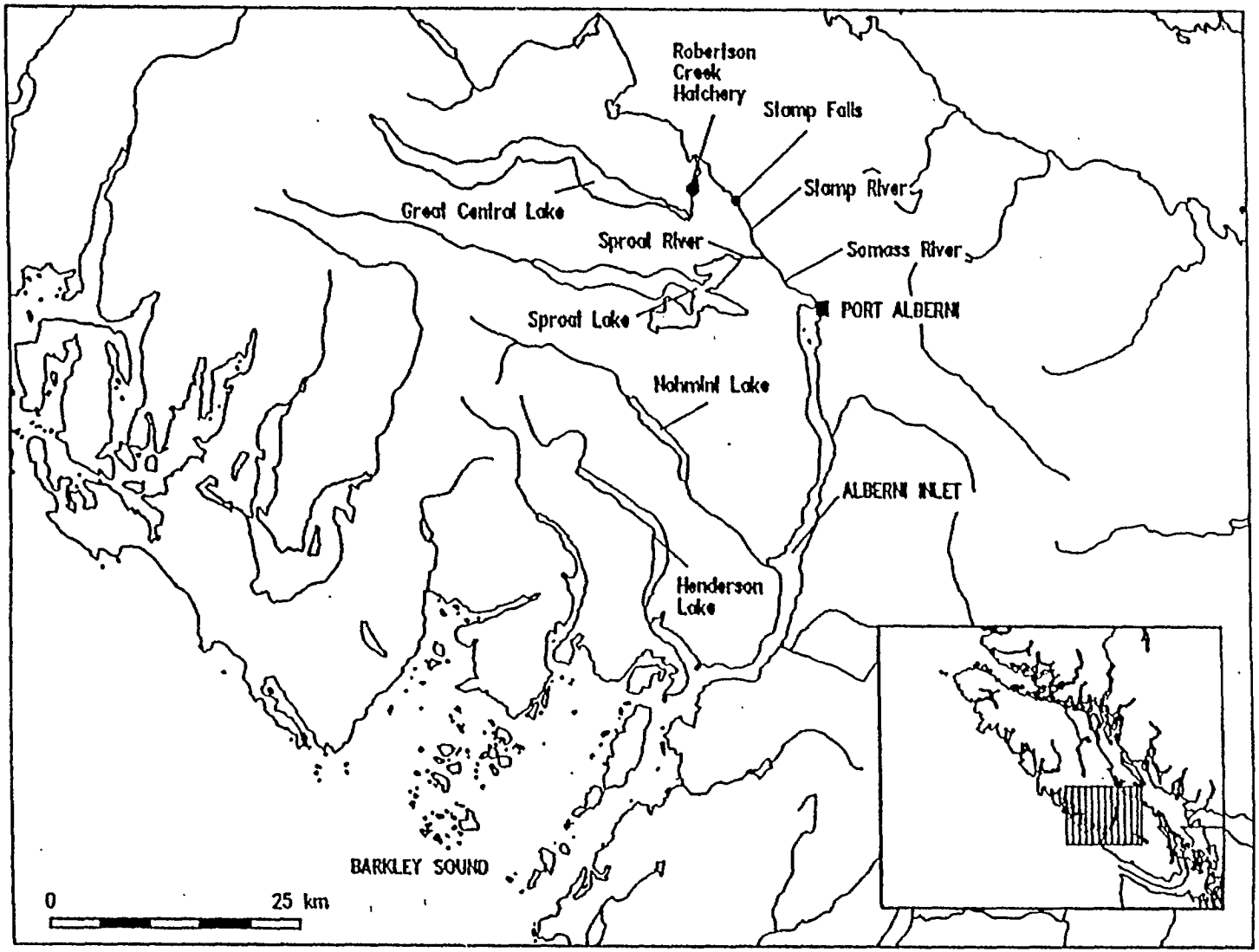


Figure 1. Map of Somass River system and Stamp Falls.

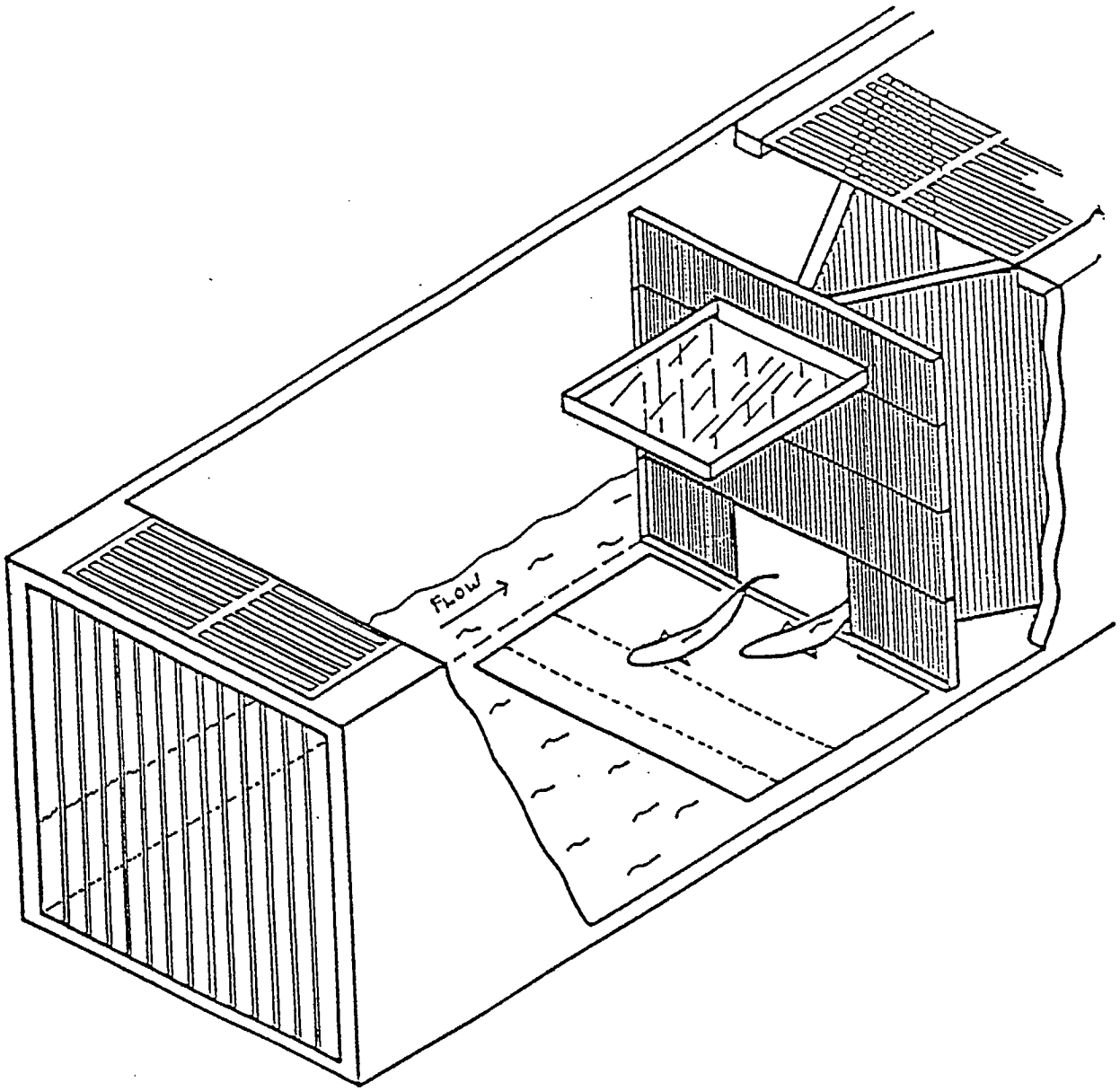


Figure 2. Diagram of the fish counting facility installed at the upstream end of Stamp Falls Fishway, 1 September to 10 November 1994.

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 from 2 September through 25 October (with the exception of 21 October due to high turbidity); high and turbid water conditions precluded verification tests after 25 October.

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):

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

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:

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

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:

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

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:

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

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

$$Var(PE_k) = \frac{\sum_{j=1}^{n} PE_{k,j}^{2} \cdot W_{k,j} - \frac{(\sum_{j=1}^{n} PE_{k,j} \cdot W_{k,j})^2}{n}}{n - 1} \quad (4)$$

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

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

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.

Interpolation of Missing Counts

In 1994, a flood period from 26 October through 2 November percluded the accurate visual counts of fish passing through the fishway. During this period the panel gate was open and fish were allowed to pass upstream. Estimates of the number of all species of salmon and steelhead passing through the fishway during this flood period were calculated using linear interpolation. In past years, estimates of chinook and coho passage at the fishway during flood periods were calculated by using the relationship between daily fishway counts and daily hatchery counts (during a time period when fishway counts were available), and then applying this relationship to the counts of chinook and coho into the hatchery during the flood period (Nelson 1993a). In 1994, counts of chinook and coho at Robertson Creek Hatchery during the flood period were low and a functional relationship could not be applied.

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 0.76 (chinook jacks) to 1.10 (coho jacks), where 1.00 = 100% efficiency (Table 1). The weekly efficiencies for chinook adults ranged from 0.95 to 1.00, and the mean weekly observer efficiency was 0.99. The weekly efficiencies for chinook jacks ranged from 0.33 to 1.00; chinook jacks were poorly represented during verification tests (verified n = 8 for the entire counting period).

Between-observer Error

The average observer error was calculated for each of the three 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 chinook adults that passed through the fishway between 1 September and 8 November was 57,678 ± 144. The estimate of chinook jacks was 954; confidence limits were not calculated due to the low

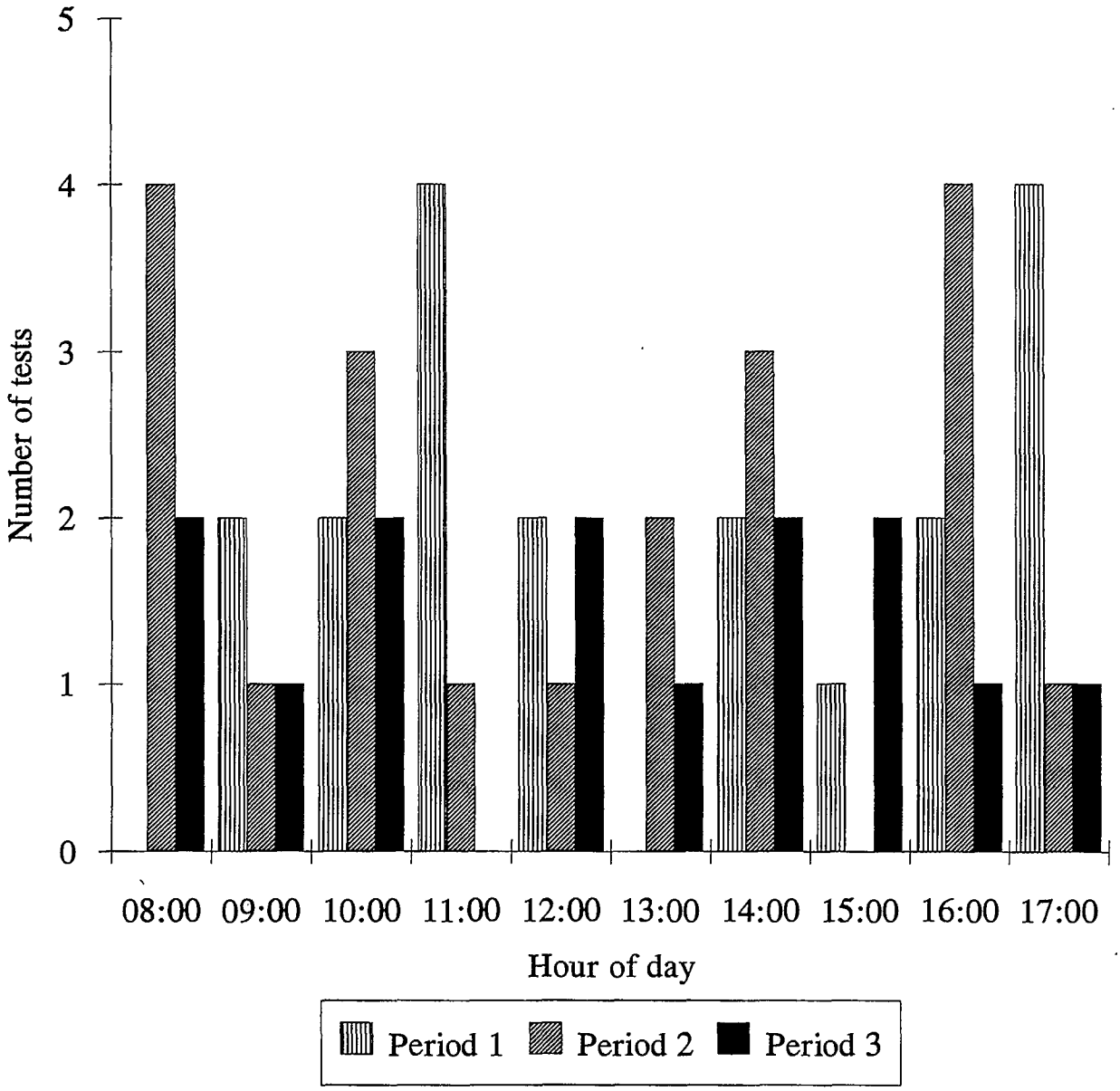
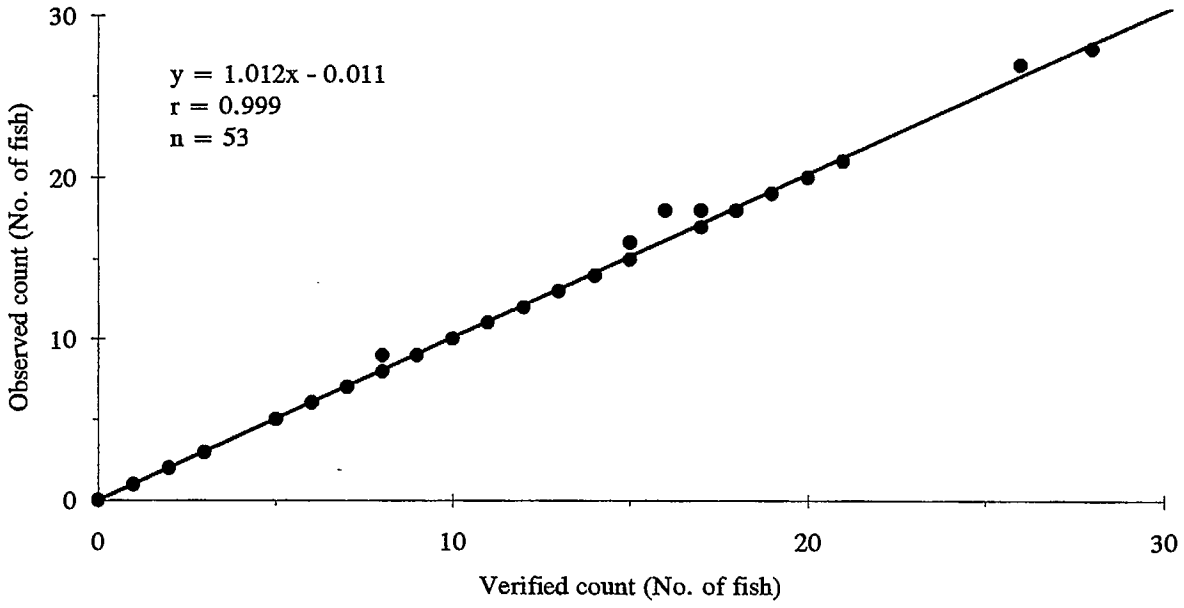


Figure 3. Frequency distribution of verification tests, by hour, conducted at Stamp Falls Fishway, 1994. Period 1 = 01-20 Sept.; Period 2 = 21 Sept.-10 Oct.; and Period 3 = 11-25 Oct.

CHINOOK ADULTS

(a) All test observations



(b) Where test observations were less than or equal to 10

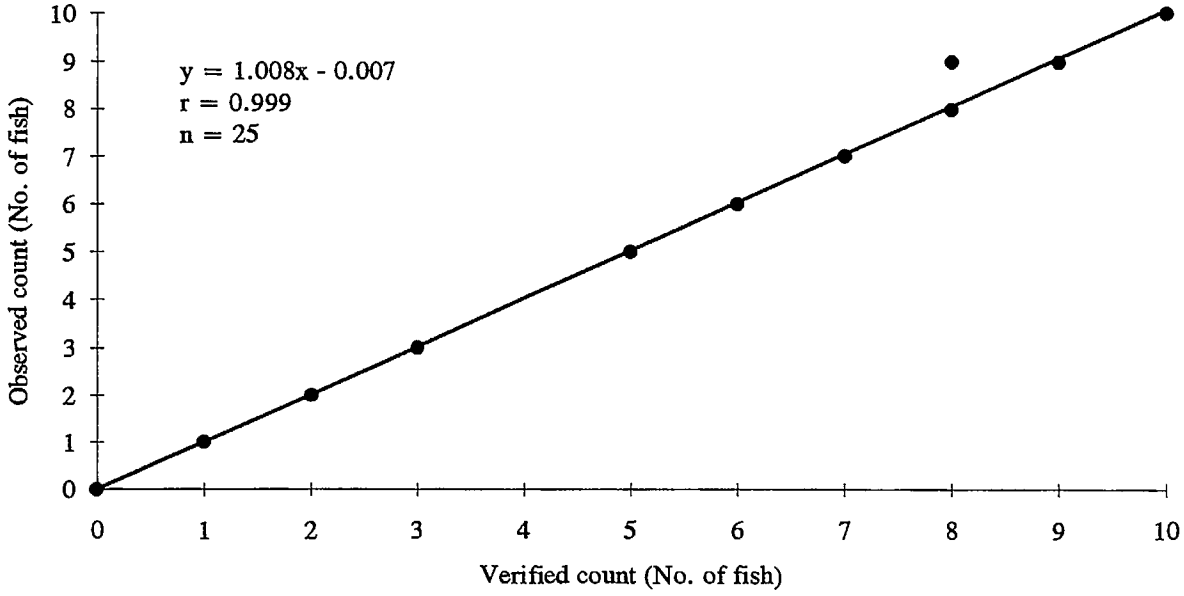


Figure 4. Scattergrams of observed counts versus verified counts of adult chinook from verification tests conducted at Stamp Falls Fishway, 1994. The top illustration (a) presents all test relationships and the bottom illustration (b) presents the relationship where observed counts were less than or equal to ten.

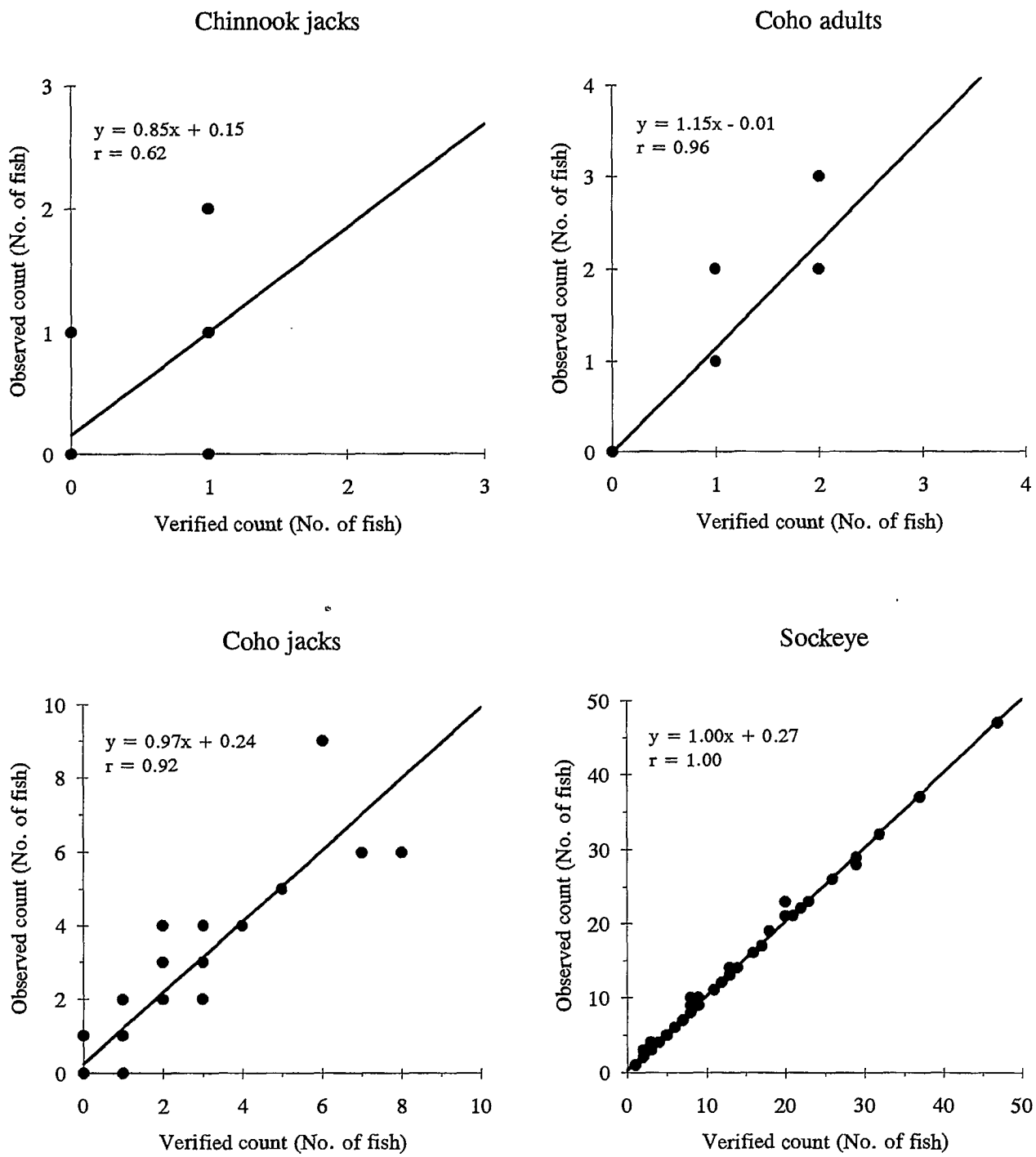


Figure 5. Scattergrams of observed counts versus verified counts of chinook jacks, coho adults, coho jacks, and sockeye, from all verification tests conducted at Stamp Falls Fishway, 1994. n = 53 in all cases.

number of observations of jack chinook during verification tests. The estimate for adult coho was 976 ± 25, and the estimate for jack coho was 2,985 ± 202. The estimated number of sockeye that passed through the fishway during the counting period was 38,141 ± 329. The observed (unadjusted) number of pink salmon, chum salmon, and steelhead were 0, 8, and 418, respectively.

Migration Timing

Water Levels and Temperatures

Figure 6 illustrates the daily water levels and average water temperatures at Stamp Falls Fishway. Water levels remained low (near the 1.1 to 1.2 m level on the staff gauge at the fishway) from 1 September through 20 October. An increase in water level began on 21 October and peaked on 30 October at 2.2 m on the staff gauge. Water temperatures remained very high (18 - 20 °C) through all of September; temperatures decreased to a low of 9 °C on 22 and 23 October.

Seasonal Migration

Figure 7 shows the adjusted daily counts of chinook adults and jacks at the Stamp Falls Fishway along with daily water levels. The adjusted counts of chinook adults peaked at 4,141 fish on 9 September, followed by a second peak of 4,061 on 3 October. The adjusted counts of chinook jacks peaked at 61 on 13 September. Migration timing of chinook seemed to occur irrespective of water levels or levels. Figure 7 indicates that the counting period from 1 September to 8 November covered most of the migration of chinook, with low numbers missed at the start of the run and very low numbers of fish missed at the tail end of the migration.

Figure 8 shows the adjusted counts of coho adults and jacks along with water levels. The adjusted counts of coho adults peaked at 58 on 7 October. Coho jacks peaked at 137 on 24 October. Coho migration appeared to be independent of water levels and temperatures.

Figure 9 shows the adjusted counts of sockeye and the observed counts of steelhead along with water levels. Counts of sockeye salmon at Stamp Falls peaked on 9 September with an adjusted daily count of 3,142. Counts of steelhead peaked on 7 September with an observed daily count of 23. 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.

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 10, 11 and 12. Hourly counts during times when verification tests were conducted were excluded from the analysis.

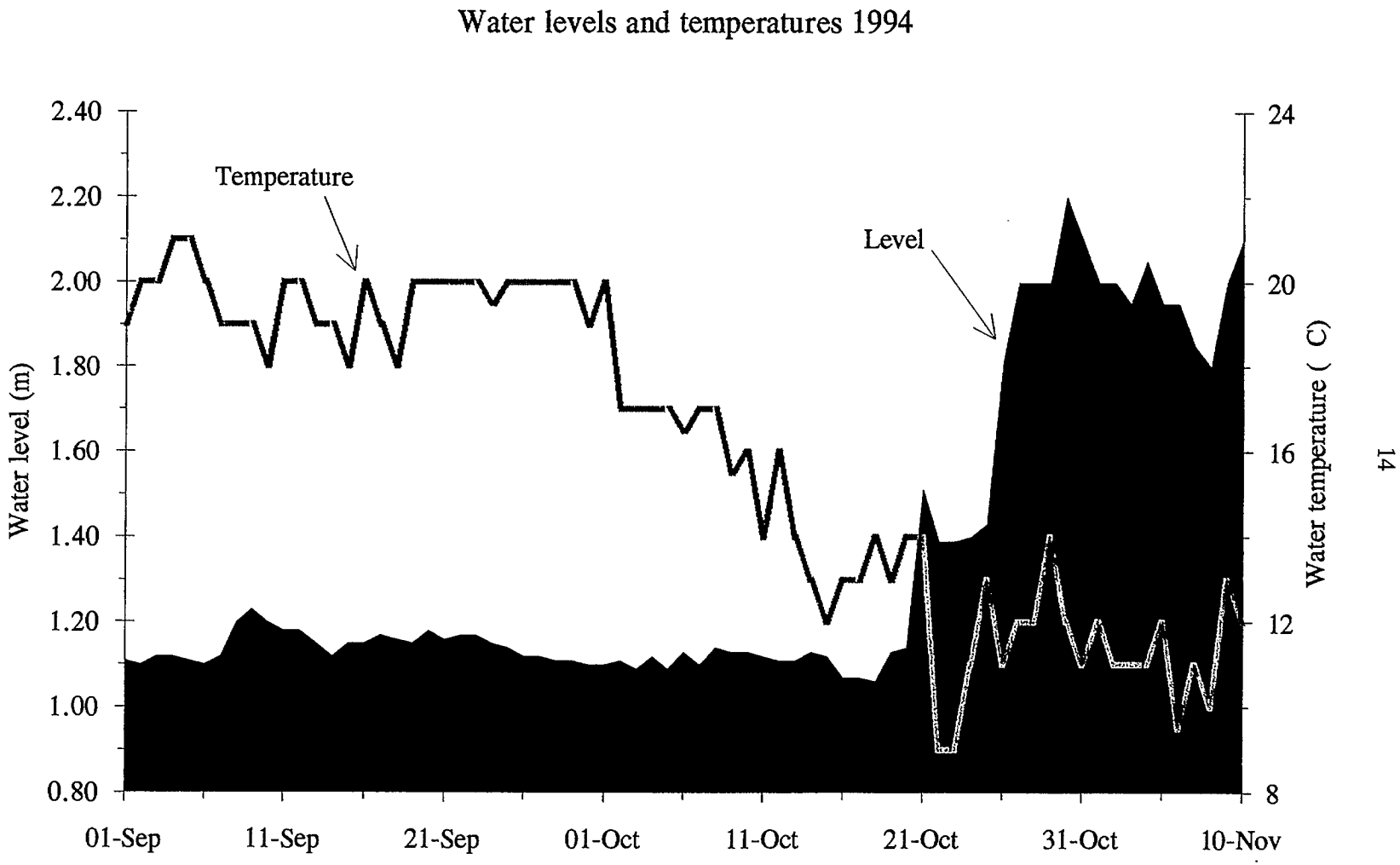


Figure 6. Daily water levels and average water temperatures at Stamp Falls Fishway, 1994.

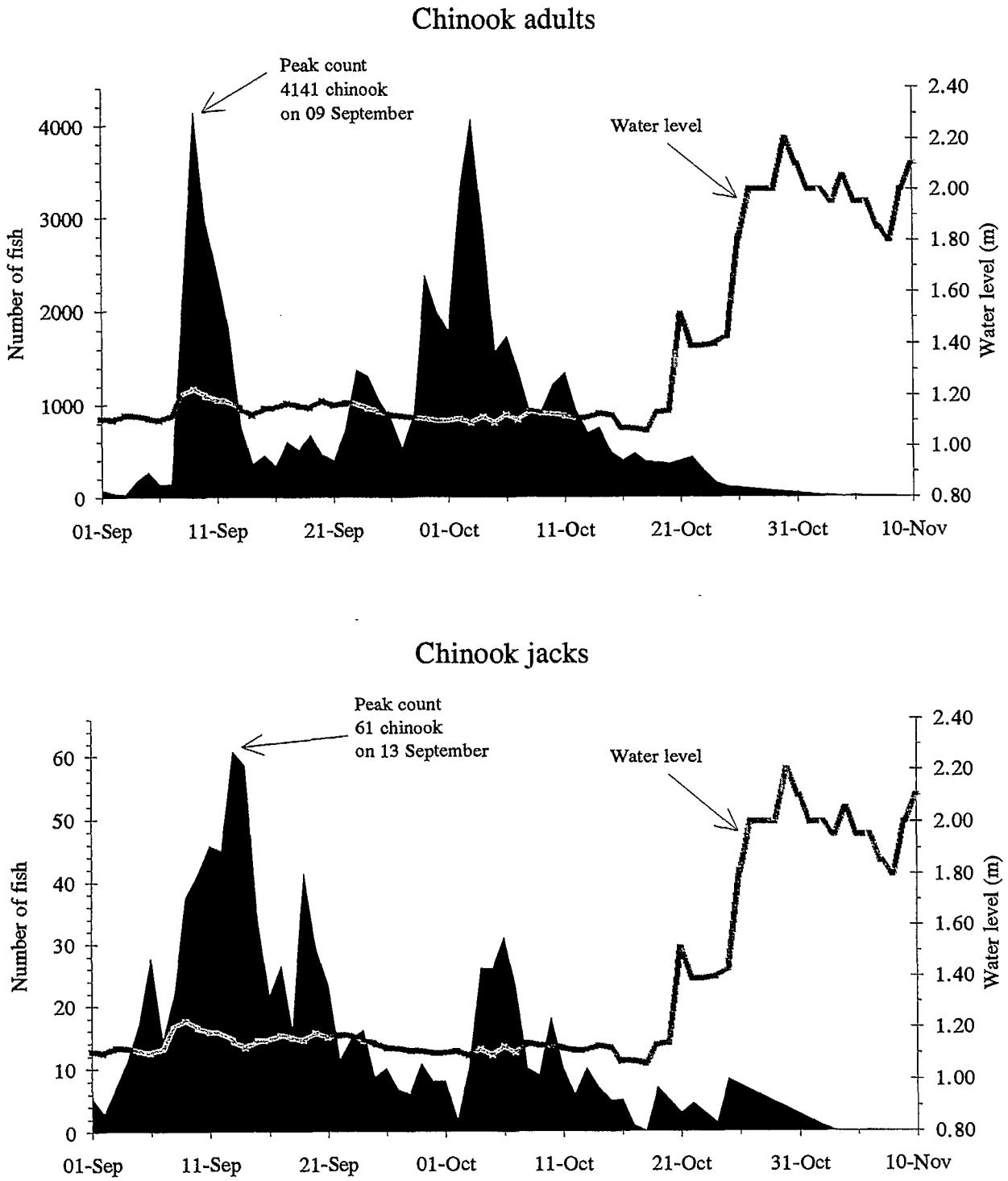


Figure 7. Adjusted numbers of chinook adults and chinook jacks (from Table 3) passing through Stamp Falls Fishway, and associated water levels, by date, 1994.

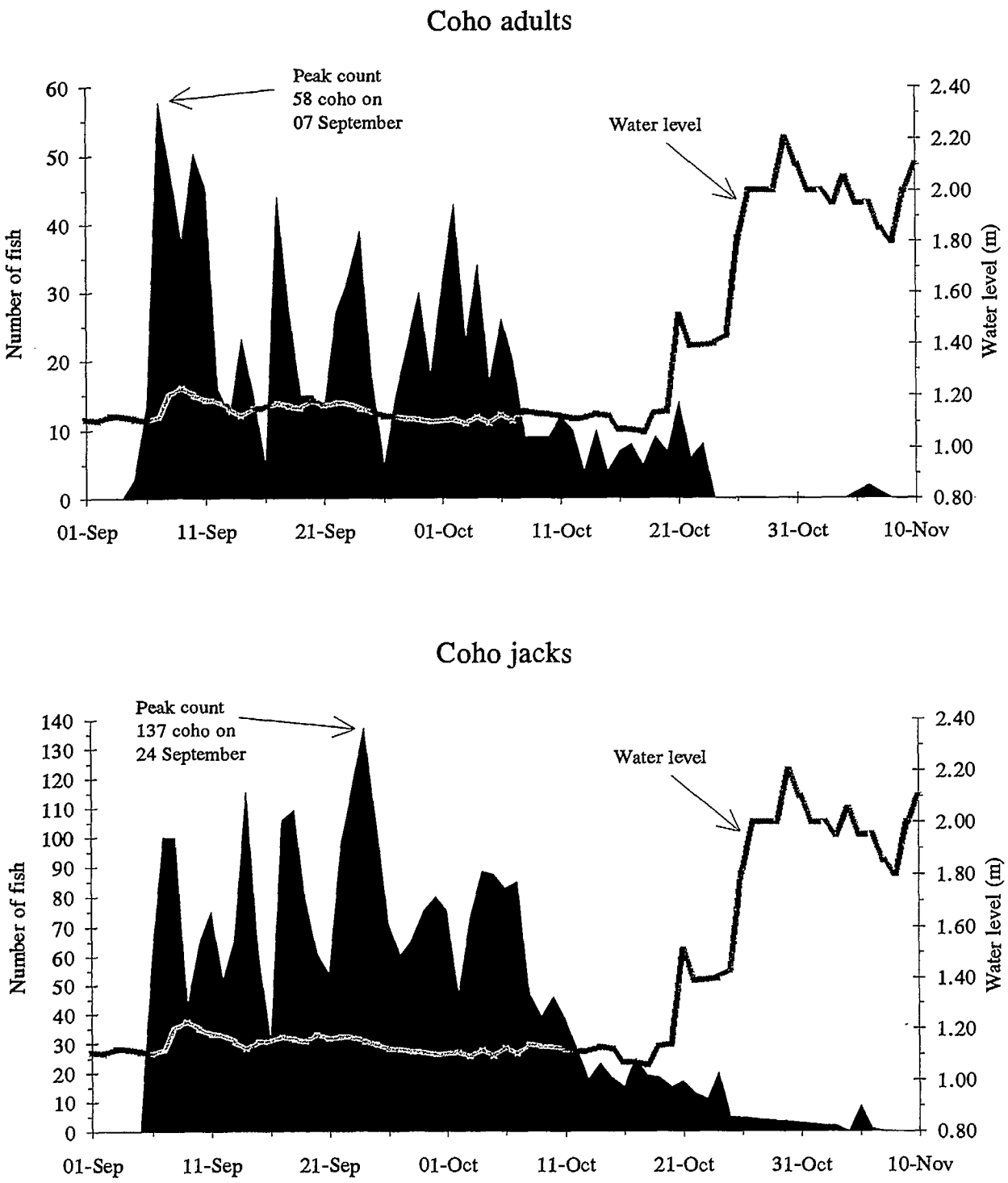


Figure 8. Adjusted numbers of coho adults and coho jacks (from Table 3) passing through Stamp Falls Fishway, and associated water levels, by date, 1994.

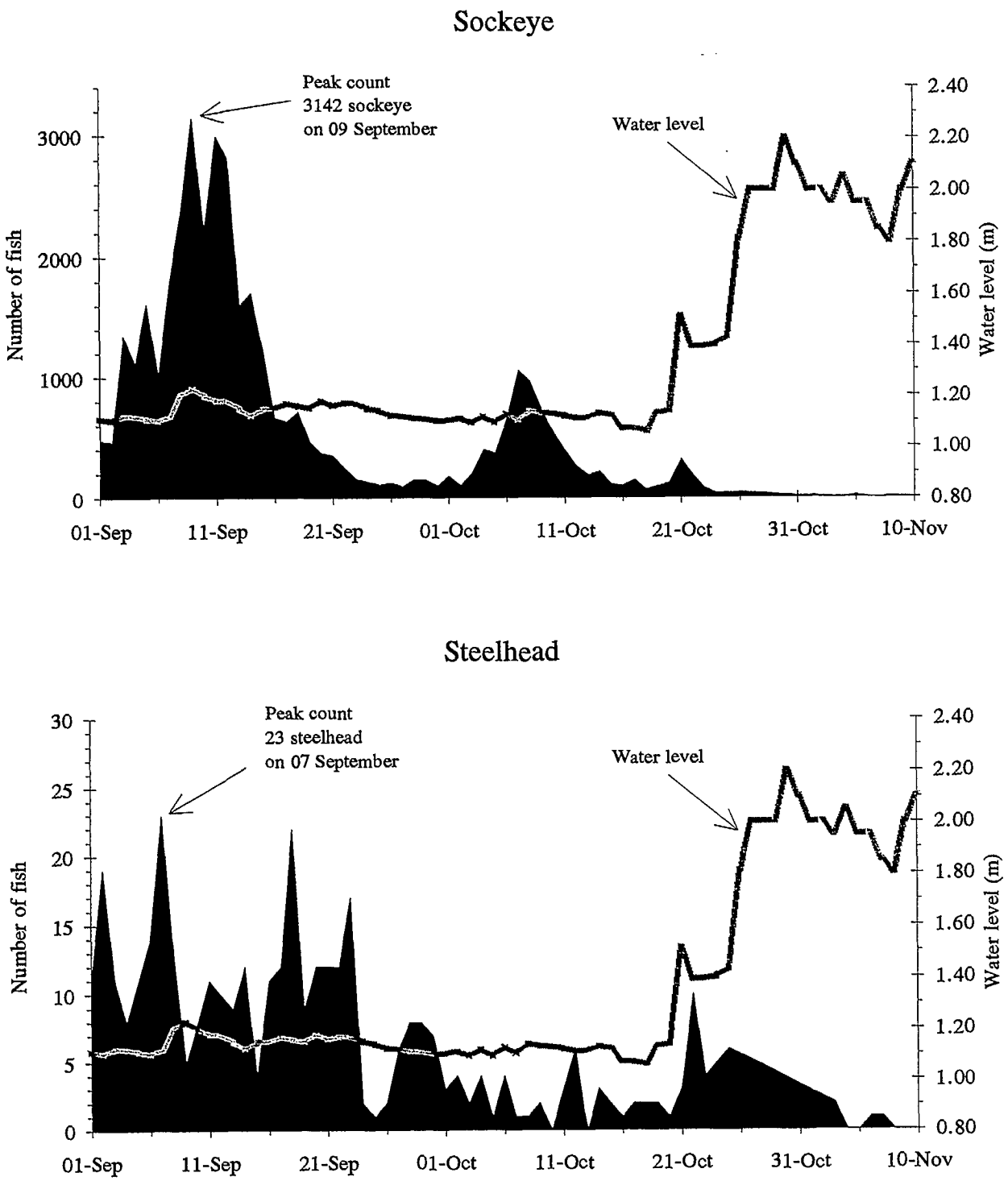


Figure 9. Adjusted numbers of sockeye and observed counts of steelhead (from Table 3) passing through Stamp Falls Fishway, and associated water levels, by date, 1994.

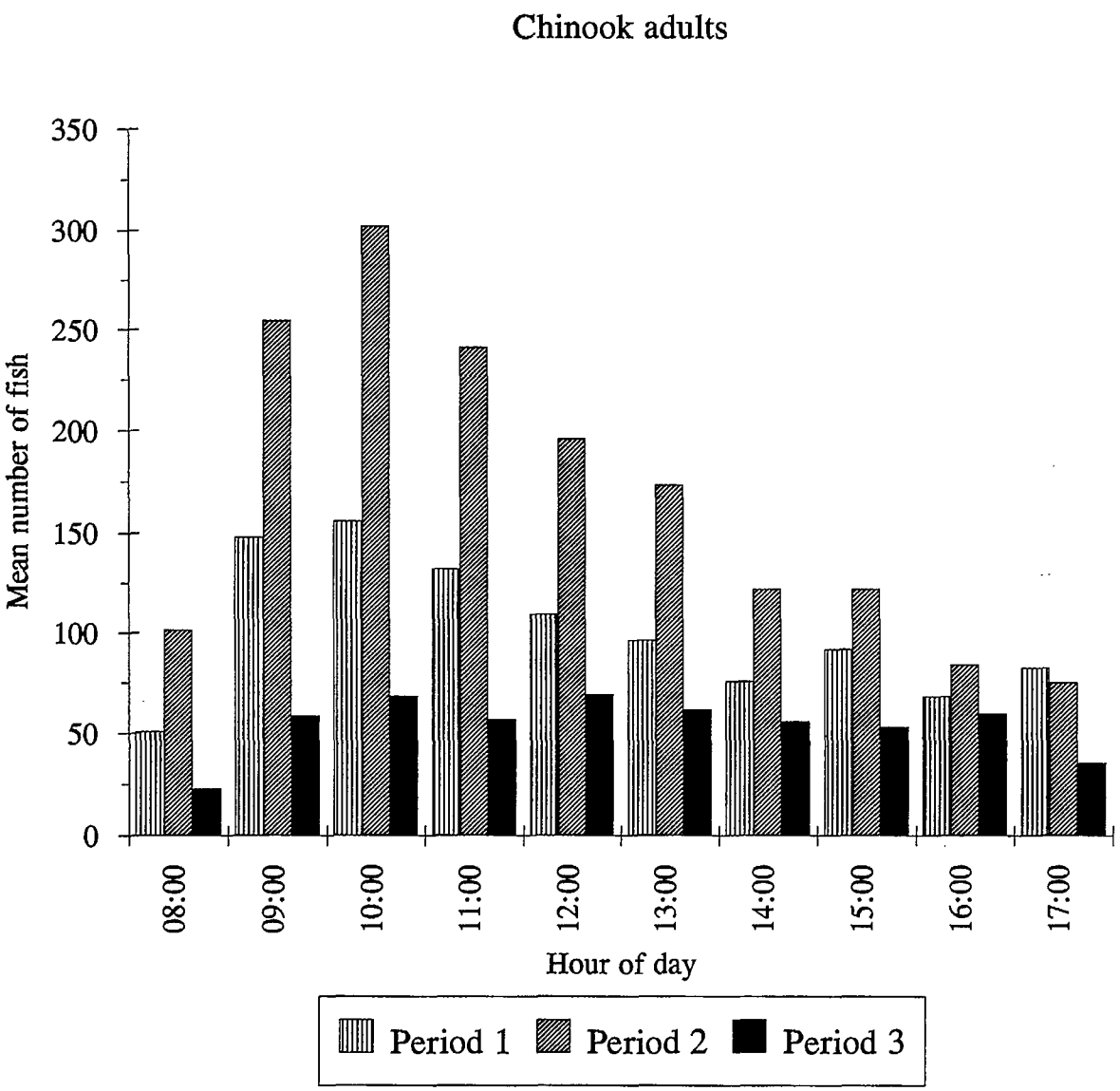


Figure 10. Hourly migration patterns of chinook adults (mean adjusted numbers) passing through Stamp Falls Fishway, by period, 1994. Period 1 = 01-20 Sept.; Period 2 = 21 Sept.-10 Oct.; and Period 3 = 11-25 Oct. Fish counts during hours when verification tests were conducted (see Appendix 1-1) were excluded from the calculation of means.

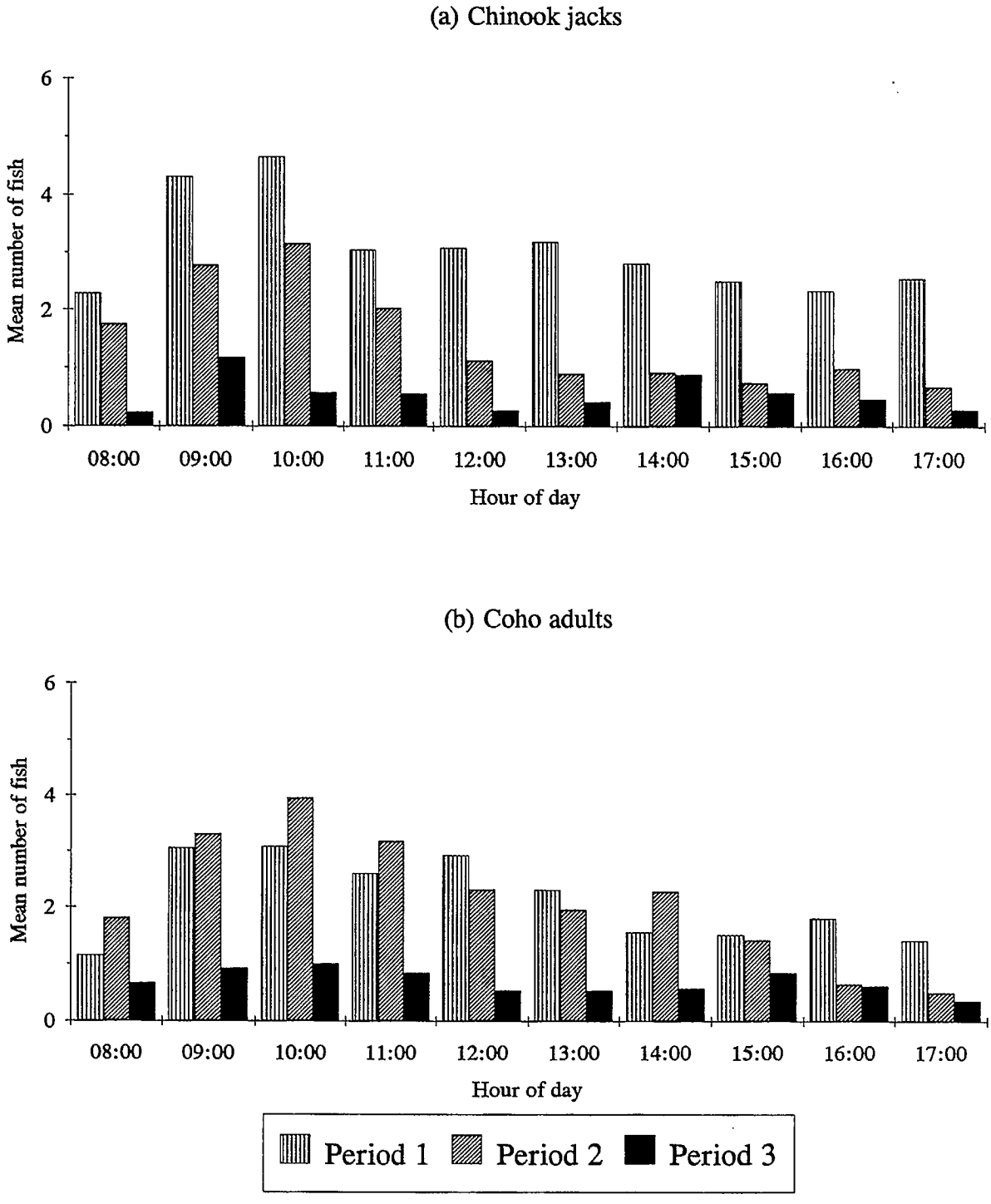


Figure 11. Hourly migration patterns of (a) chinook jacks and (b) coho adults (mean adjusted numbers) passing through Stamp Falls Fishway, by period, 1994. Period 1 = 01-20 Sept.; Period 2 = 21 Sept.-10 Oct.; and Period 3 = 11-25 Oct. Fish counts during hours when verification tests were conducted (see Appendix 1-1) were excluded from the calculation of means.

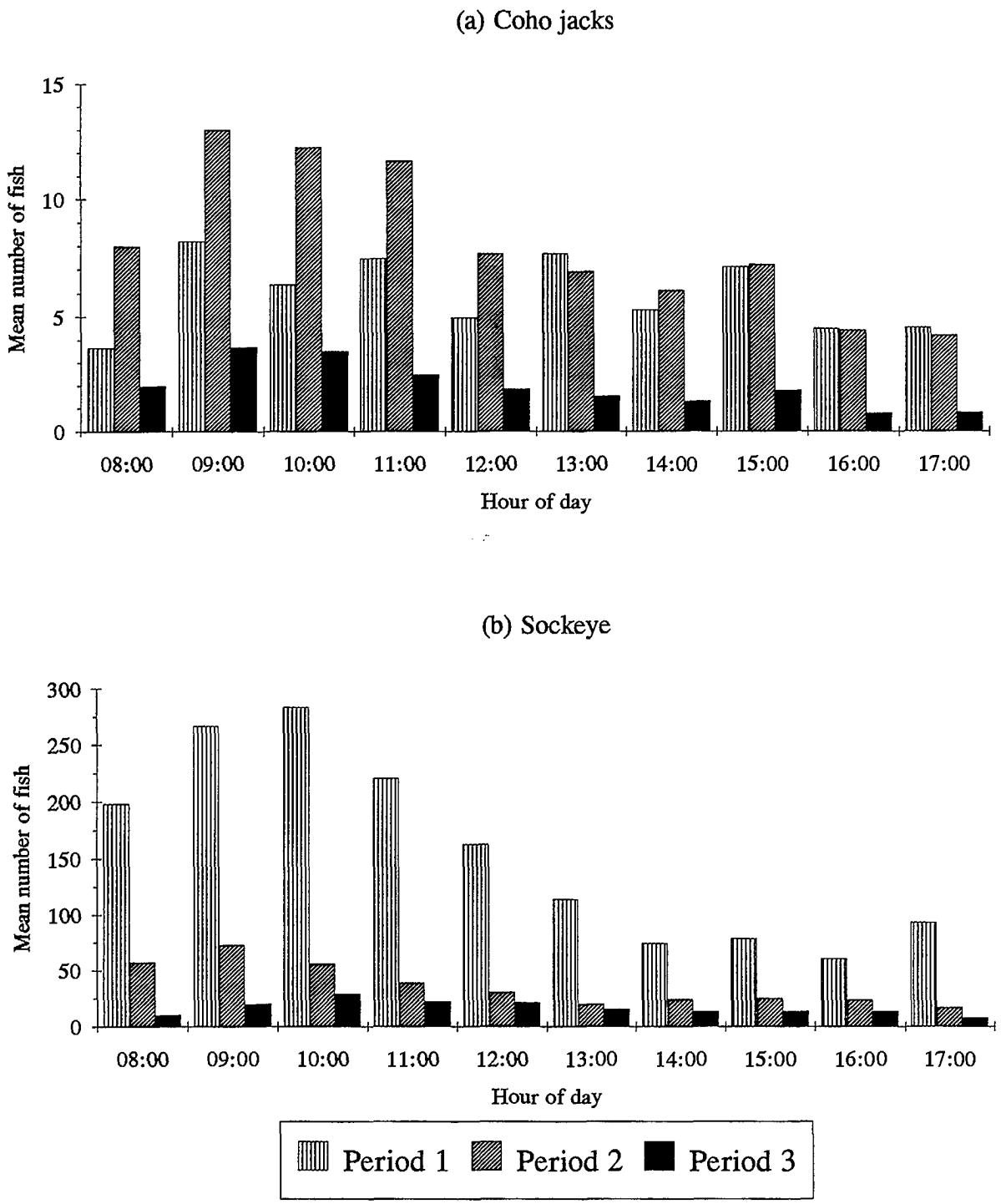


Figure 12. Hourly migration patterns of (a) coho jacks and (b) sockeye (mean adjusted numbers) passing through Stamp Falls Fishway, by period, 1994. Period 1 = 01-20 Sept.; Period 2 = 21 Sept.-10 Oct.; and Period 3 = 11-25 Oct. Fish counts during hours when verification tests were conducted (see Appendix 1-1) were excluded from the calculation of means.

It appears that the movement of chinook adults through the fishway tended to build slowly for the first two hours after the gate was opened in the morning, peak during the third hour of counting, and then decrease steadily throughout the day until a slight increase during the last one or two hours of counting (Figure 10). There was no obvious patterns of diel migration for chinook jacks (Figure 11), or coho adults (Figure 11), or coho jacks (Figure 12). Sockeye tended to follow the same general pattern as chinook adults (Figure 12).

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 in 1994 was very high, ranging from 95%-100% on a weekly basis and averaging 99% for the entire counting period. The 95% confidence intervals for chinook adults were less than 1% of the population estimate ($\pm$ 0.25%). 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). Narrow confidence intervals were also produced for coho adults ($\pm$ 2.3% of the

population estimate), coho jacks (± 6.8% of the population estimate), and sockeye (± 0.9% of the population estimate).

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

Figure 13 presents the run-timing of chinook adults through Stamp Falls Fishway from 1990 - 1994. The timing of migration of chinook salmon in 1994 was slightly earlier than in 1993 (Nelson 1994b), 1992 (Nelson 1993a), 1991 (Bocking and Nass 1992) and 1990 (Bocking 1991a). This degree of variability in run timing is not unusual, but the emerging pattern of progressively earlier run timing could be a reflection of annual hatchery broodstock collections from the early group of returning chinook, or other hatchery related factors.

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.

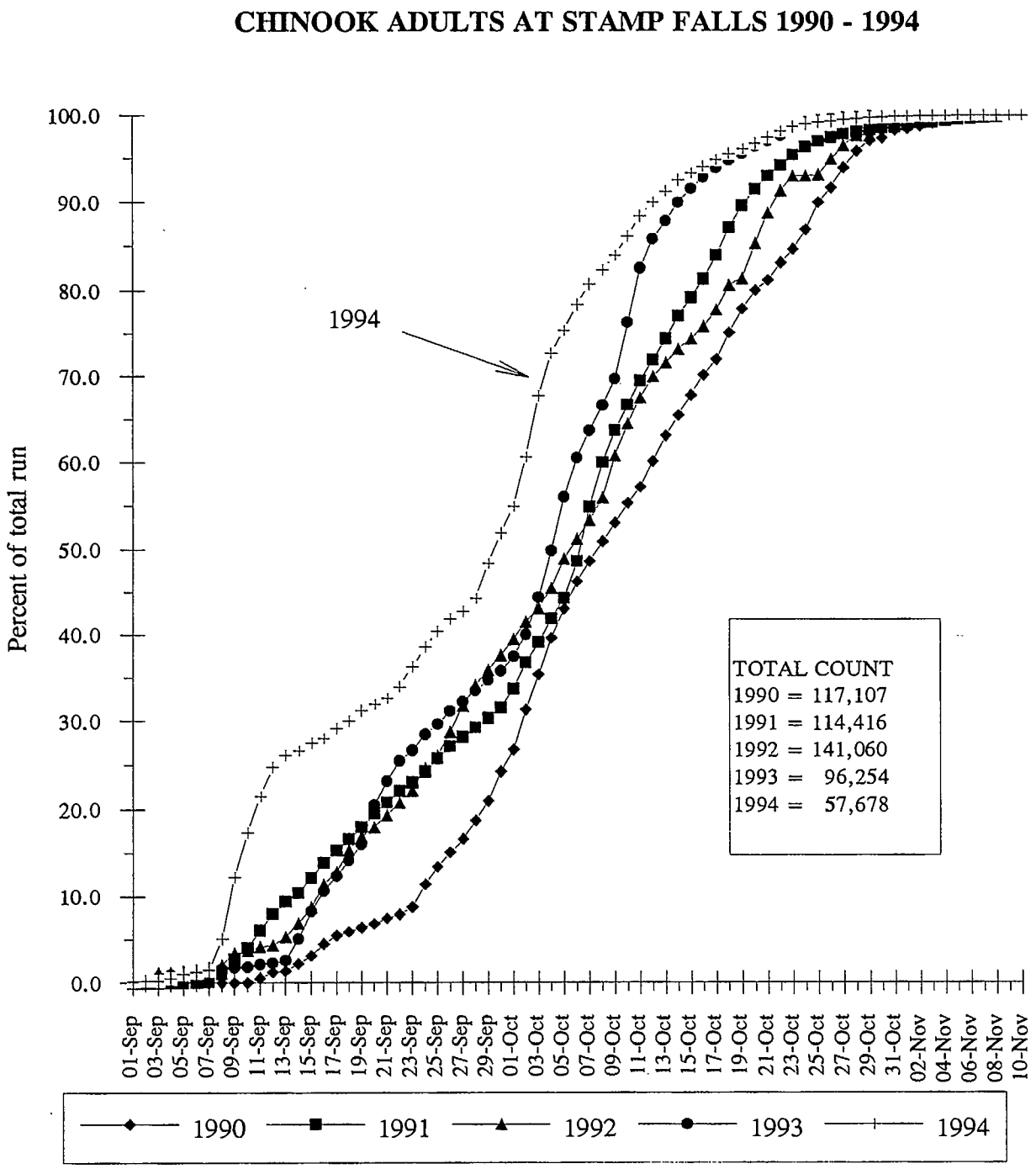


Figure 13. Run timing of chinook adults through Stamp Falls Fishway, 1990 - 1994. Data are cumulative adjusted daily counts as a percetntage of the total count.

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 1994a; Nelson 1994b) 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 3 October through 2 November, 1994. Sampling was conducted in 10 stratified areas from Robertson Creek Hatchery to the lower Somass River (Figure 14). 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 were no carcasses recovered

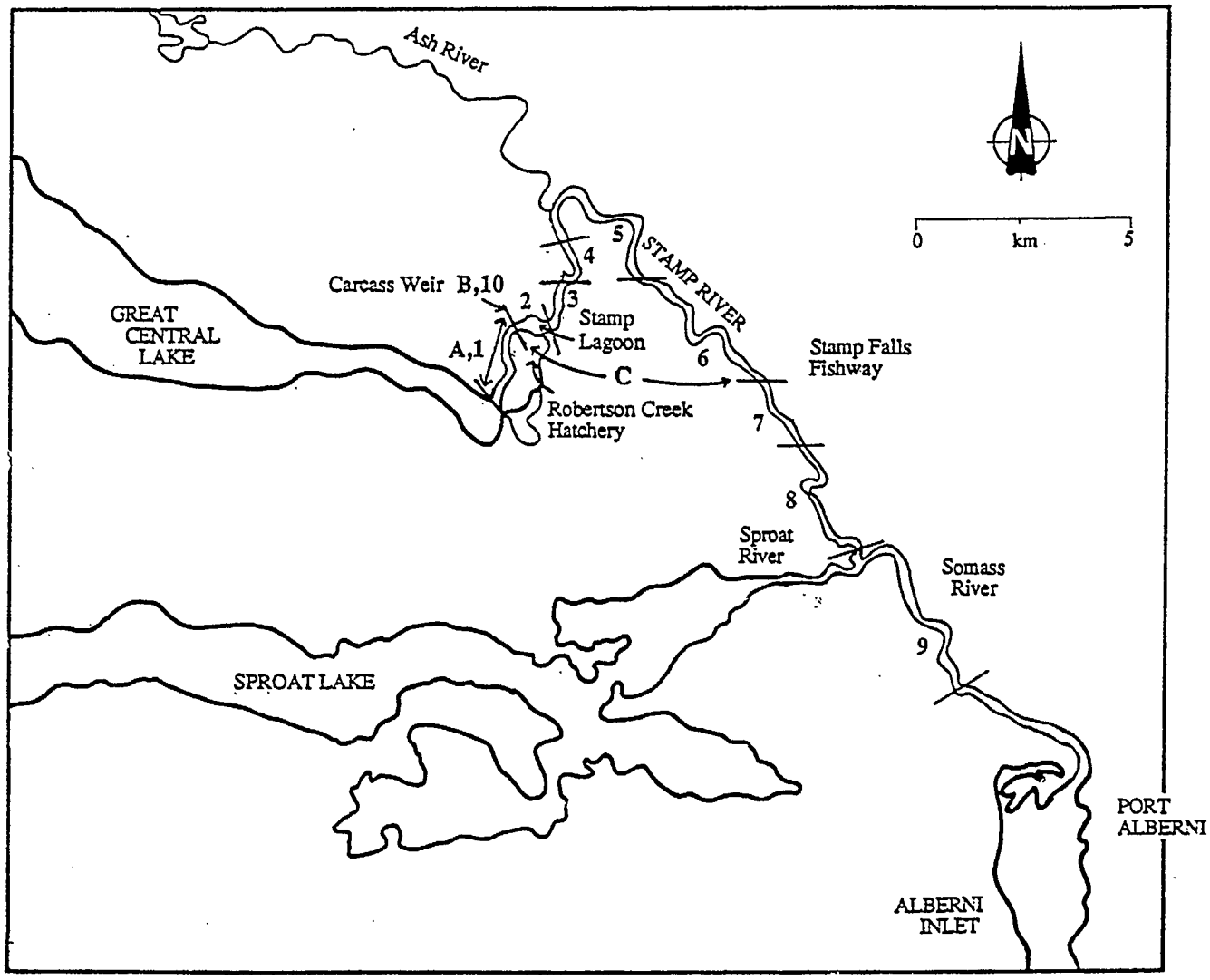


Figure 14. Map of Stamp River and Robertson Creek Hatchery showing carcass recovery areas.

downstream of Stamp Falls (Area 7-9) in 1994; regardless of this lack of recoveries in this area, **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 10 October and 4 November, 1994 (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 post-orbital hypural length 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.

Method A

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:

$$EAD_{i,r} = \frac{OAD_{i,r} \cdot P_{i,r}}{C_{i,r}} \quad (7)$$

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:

$$EAD_{i,r,tc} = \frac{EAD_{i,r} \cdot NDT_{i,r,tc}}{SumNDT_{i,r}} \quad (8)$$

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:

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

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):

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

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:

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

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:

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

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:

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

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 (or freshwater age 1) 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 1994; no males, and less than one percent of the females, from the 1994 chinook escapement to both the upper Stamp River and Robertson Creek Hatchery were are 6 (Table 4). The dominant male age groups for the in-river chinook population were age 4 and age 5 (72.5% and 19.4%, respectively). The dominant male age groups for the hatchery chinook population were age 4 and age 3 (68.6% and 20.5%, respectively). The dominant female age groups both in-river and at the hatchery were age 3 (53.5% and 66.2%, respectively) and age 4 (44.9% and 33.1%, 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 = 689 mm) were larger than aged Robertson Creek Hatchery males (mean length = 649 mm) and the difference was significant (t-test, $P<0.001$). Aged hatchery females (mean length = 724 mm) were larger than aged Stamp River females (mean length = 697 mm) but the difference was not significant (t-test, $P>0.10$). There were significant differences between both the mean lengths of unaged Stamp River males and unaged hatchery males (t-tests, $P<0.02$) and the mean lengths of unaged Stamp River females and unaged hatchery females (t-test, $P<0.001$). In the upper Stamp River, there were not significant differences between the mean lengths of both aged and unaged males or aged and unaged females (t-test, $P>0.5$) in both cases). At Robertson Creek Hatchery, there was not a significant difference between the mean lengths of aged and unaged males (t-test, $P>0.10$); however, there was a significant difference between the mean lengths of aged and unaged females (t-test, $P<0.001$).

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 49.4% adult males, 48.4% females, and 2.2% jacks (Table 6). Hatchery age structure analysis produced almost identical population ratios: 48.5:48.4:3.1 (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 33.4:65.0:1.6 (M:F:J). Upper Stamp age structure analysis produced population ratios of 33.8:65.0:0.2 (M:F:J). The difference between the adjusted count of jacks observed at the fishway (954) and the combined estimate from Robertson Creek Hatchery and the upper Stamp River (138; based on age composition, Table 6) suggests that approximately 816 adult males (1.4% 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 170 adipose-clipped chinook recovered in the dead pitch for a mark rate of 2.1% (Table 7). At Robertson Creek Hatchery, there were 311 observed adipose clips for a mark rate of 25.7%. 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). Escapement of adipose-clipped chinook to the entire Stamp River (hatchery plus upper Stamp River returns) was 1,544 and represented 2.6% of the entire population.

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 1994 a single female stray from Gold River was observed in the in-river deadpitch, and a three strays (a male and female from Gold River and a female from Raft River) were observed at the hatchery. A total of 145 CWT heads from adipose-clipped fish recovered in the in-river dead recovery were successfully decoded. A total of 263 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 1994 escapements of chinook in the upper Stamp River and Robertson Creek Hatchery were 33,995 and 10,446, 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 66.1% for males and 55.5% for females. For returns to Robertson Creek Hatchery, this contribution increased to 100.0% for males and 100.0% for females. Hatchery strays from Gold River accounted for less than 0.1% of the population of in-river females. Hatchery strays from Gold River accounted for 0.3% of the population of males returning to Robertson Creek Hatchery, and hatchery strays from Gold and Raft rivers accounted for 0.6% 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 1994 escapements of chinook in the Stamp River and Robertson Creek Hatchery were 29,095 and 9,132, 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 53.5% for males and 49.1% for females. For hatchery returns, this contribution increased to 100.0% for males and 100.0% for females. Hatchery strays from Gold River accounted for less than 0.1% of the population of in-river females. Hatchery strays from Gold River accounted for 0.3% of the population of males returning to Robertson Creek Hatchery, and hatchery strays from Gold and Raft rivers accounted for 0.5% of the population of females returning to Robertson Creek Hatchery.

DISCUSSION

Age, Length and Sex Composition

The age-length composition obtained from chinook carcasses sampled from the upper Stamp River was different from that obtained from hatchery returns. The mean length of aged jacks (n = 2) from the upper Stamp River (420 mm) was greater than the mean length of aged jacks (397 mm) from the hatchery (n = 27). The mean length of all aged males from the upper Stamp River was significantly different than the mean length of all aged hatchery males ($P < 0.001$; the upper Stamp males were larger). In contrast, the mean length of all aged females from the upper Stamp River was not significantly different than the mean length of all aged hatchery females ($P > 0.10$). A comparison of unaged Stamp River chinook and unaged hatchery chinook found significant differences in length for both males and females ($P < 0.02$ and $P < 0.001$, respectively).

The sex composition of the 1994 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 (3.1%) than in the river (0.2%); this is consistent with results of the same comparison for 1993, 1992, 1991, and 1990 escapements (Nelson 1994a; Nelson 1993a; Bocking and Nass 1992; Bocking 1991a, respectively). The lower proportion of females observed in the hatchery returns (48.4%) compared to the in-river dead recovery (65.0%) has been observed in other hatchery populations (Nelson 1994a; Nelson 1993a; Bocking and Nass 1992; Bocking 1991a; Bocking et al. 1990; Lightly et al. 1988; Sibert and Schnute 1982).

Hatchery Contributions

Hatchery contribution estimates for 1994 were lower than those for 1993, 1992, 1991, and 1990 (Nelson 1994a; Nelson 1993a; Bocking and Nass 1992; Bocking 1991a, respectively). In 1994, the estimated hatchery contributions of Robertson Creek Hatchery only (no strays) to the total chinook escapement (both the upper Stamp River and hatchery) was 75.8% (Method A) and 65.2% (Method B). Method A produced higher contribution estimates than Method B; this is consistent with other studies (Nelson 1994a; Nelson 1994b; Nelson 1993a; Nelson 1993b; Bocking and Nass 1992; Bocking 1991a; Bocking 1991b; Bocking et al. 1990). 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 1994 were conducted at Stamp Falls Fishway using visual observations from 1 September to 8 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 58,632 $\pm$ 144 (confidence limits for adults only). This final escapement estimate for chinook is the lowest since the inception of the Chinook Key Stream Program in 1985; the reliability of this escapement estimate is very high (the standard error associated with the estimate is also the lowest since the inception of the Program). The final estimate for coho was 3,961 $\pm$ 227, which is also a the lowest since the inception of the Program. The adjusted count for sockeye was 38,141 $\pm$ 329, and the observed (unadjusted) numbers of pink salmon, chum salmon, and steelhead were 0, 8, and 418, respectively.

Age, Length and Sex Composition

The age, length and sex composition of 1994 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 5, respectively, and the dominant male age groups for the hatchery chinook population were age 4 and age 3, 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 (65.0%) than among hatchery returns (48.4%).

Hatchery Contribution Estimates

Adipose-clip mark rates for the in-river carcass recovery samples and the hatchery returns were 2.1% and 25.7%, respectively. Escapement of adipose-clipped chinook to the entire Stamp River (hatchery plus upper Stamp River returns) was 1,544 and represented 2.6% of the entire population. 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 75.8%. 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 65.2%. Hatchery contribution estimates (using both methods) were the lowest since the inception of the Chinook Key Stream Program. Contribution estimates varied between sexes and between in-river and hatchery spawners.

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TABLES

Table 1. Results of Stamp Falls verification tests, 1994. 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	09:00	1	1.10	0	0	1.00	1	0	0.50	0	0	1.00	0	0	1.00	21	21	1.00
1	03-Sep	11:00	2	1.12	1	1	1.00	0	0	1.00	0	0	1.00	0	0	1.00	21	21	1.00
1	04-Sep	09:00	1	1.12	0	0	1.00	0	0	1.00	0	0	1.00	0	0	1.00	37	37	1.00
1	05-Sep	11:00	2	1.11	2	2	1.00	0	0	1.00	0	0	1.00	0	0	1.00	28	29	1.03
1	06-Sep	10:00	1	1.10	1	1	1.00	1	0	0.50	0	0	1.00	0	1	2.00	29	29	1.00
1	07-Sep	10:00	4	1.12	0	0	1.00	0	0	1.00	2	1	0.67	0	0	1.00	47	47	1.00
1	08-Sep	12:00	1	1.20	11	11	1.00	0	0	1.00	1	1	1.00	0	0	1.00	23	23	1.00
				Weighted mean (a)			1.00			0.33			0.75			2.00			1.00
				Weighted SD			0.00			0.23			0.15			0.37			0.01
2	09-Sep	16:00	2	1.23	19	19	1.00	0	0	1.00	0	0	1.00	0	0	1.00	11	11	1.00
2	10-Sep	14:00	1	1.20	17	17	1.00	1	1	1.00	1	1	1.00	1	1	1.00	13	13	1.00
2	11-Sep	17:00	3	1.18	5	5	1.00	0	0	1.00	3	2	0.75	0	0	1.00	21	20	0.95
2	12-Sep	11:00	1	1.18	3	3	1.00	1	0	0.50	0	0	1.00	0	0	1.00	32	32	1.00
2	13-Sep	11:00	2	1.15	7	7	1.00	0	0	1.00	0	0	1.00	0	1	2.00	17	17	1.00
2	14-Sep	16:00	1	1.12	10	10	1.00	1	1	1.00	0	0	1.00	0	0	1.00	19	18	0.95
2	15-Sep	14:00	2	1.15	0	0	1.00	0	0	1.00	0	0	1.00	0	0	1.00	26	26	1.00
				Weighted mean (a)			1.00			0.75			0.80			1.50			0.99
				Weighted SD			0.00			0.20			0.09			0.35			0.02
3	16-Sep	12:00	1	1.15	11	11	1.00	1	1	1.00	0	0	1.00	0	0	1.00	22	22	1.00
3	17-Sep	17:00	3	1.17	6	6	1.00	0	0	1.00	2	2	1.00	9	6	0.70	6	6	1.00
3	18-Sep	17:00	1	1.16	12	12	1.00	0	0	1.00	0	0	1.00	2	2	1.00	4	4	1.00
3	19-Sep	17:00	2	1.15	10	10	1.00	1	1	1.00	0	0	1.00	1	0	0.50	12	12	1.00
3	20-Sep	15:00	1	1.18	15	15	1.00	1	0	0.50	1	1	1.00	2	1	0.67	13	13	1.00
3	21-Sep	13:00	2	1.16	15	15	1.00	0	0	1.00	0	0	1.00	1	1	1.00	14	14	1.00
3	22-Sep	09:00	1	1.17	13	13	1.00	1	0	0.50	0	0	1.00	6	8	1.29	8	8	1.00
				Weighted mean (a)			1.00			0.60			1.00			0.86			1.00
				Weighted SD			0.00			0.25			0.00			0.27			0.00

Table 1 (cont.). Results of Stamp Falls verification tests, 1994. 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	08:00	1	1.17	12	12	1.00	0	0	1.00	0	0	1.00	2	2	1.00	7	7	1.00
4	24-Sep	16:00	3	1.15	8	8	1.00	0	0	1.00	0	0	1.00	0	0	1.00	1	1	1.00
4	25-Sep	10:00	2	1.14	15	15	1.00	0	0	1.00	0	0	1.00	3	3	1.00	5	5	1.00
4	26-Sep	14:00	1	1.12	21	21	1.00	1	1	1.00	1	1	1.00	2	2	1.00	3	3	1.00
4	27-Sep	10:00	2	1.12	8	8	1.00	0	0	1.00	1	1	1.00	3	2	0.75	4	4	1.00
4	28-Sep	08:00	1	1.11	14	14	1.00	1	0	0.50	1	1	1.00	4	4	1.00	7	7	1.00
4	29-Sep	12:00	2	1.11	20	20	1.00	0	0	1.00	0	0	1.00	3	2	0.75	2	2	1.00
				Weighted mean (a)			1.00			0.67			1.00			0.89			1.00
				Weighted SD			0.00			0.21			0.00			0.12			0.00
5	30-Sep	08:00	1	1.10	20	20	1.00	0	0	1.00	1	1	1.00	4	4	1.00	5	5	1.00
5	01-Oct	16:00	2	1.10	15	15	1.00	0	0	1.00	1	1	1.00	5	5	1.00	7	7	1.00
5	02-Oct	16:00	2	1.11	28	28	1.00	0	0	1.00	0	0	1.00	0	0	1.00	2	2	1.00
5	03-Oct	14:00	1	1.09	28	28	1.00	0	0	1.00	0	0	1.00	1	1	1.00	2	2	1.00
5	04-Oct	16:00	2	1.12	19	19	1.00	0	1	2.00	0	0	1.00	4	2	0.60	4	3	0.80
5	05-Oct	08:00	1	1.09	12	12	1.00	1	0	0.50	1	1	1.00	6	7	1.14	10	9	0.91
5	06-Oct	14:00	2	1.13	19	19	1.00	0	0	1.00	0	0	1.00	3	2	0.75	7	7	1.00
				Weighted mean (a)			1.00			1.00			1.00			0.92			0.95
				Weighted SD			0.00			0.43			0.00			0.18			0.07
6	07-Oct	10:00	1	1.10	7	7	1.00	0	0	1.00	1	1	1.00	1	1	1.00	23	20	0.88
6	08-Oct	17:00	3	1.14	9	9	1.00	0	0	1.00	1	1	1.00	2	3	1.33	14	13	0.93
6	09-Oct	13:00	1	1.13	9	9	1.00	0	0	1.00	0	0	1.00	2	1	0.67	12	12	1.00
6	10-Oct	11:00	2	1.13	7	7	1.00	0	0	1.00	0	0	1.00	1	0	0.50	21	20	0.95
6	11-Oct	15:00	1	1.12	15	15	1.00	0	0	1.00	0	0	1.00	4	3	0.80	16	16	1.00
6	12-Oct	13:00	2	1.11	19	19	1.00	0	0	1.00	0	0	1.00	1	1	1.00	9	9	1.00
6	13-Oct	17:00	1	1.11	27	26	0.96	0	0	1.00	0	0	1.00	1	1	1.00	4	4	1.00
				Weighted mean (a)			0.99			1.00			1.00			0.85			0.95
				Weighted SD			0.01			0.00			0.00			0.26			0.05

Table 1 (cont.). Results of Stamp Falls verification tests, 1994. 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	15:00	2	1.13	7	7	1.00	0	0	1.00	1	1	1.00	1	0	0.50	10	9	0.91
7	15-Oct	10:00	3	1.12	9	8	0.90	0	0	1.00	0	0	1.00	2	2	1.00	10	8	0.82
7	16-Oct	08:00	1	1.07	18	17	0.95	0	0	1.00	0	0	1.00	4	3	0.80	7	7	1.00
7	17-Oct	12:00	2	1.07	9	9	1.00	0	0	1.00	0	0	1.00	1	1	1.00	7	7	1.00
7	18-Oct	14:00	1	1.06	18	18	1.00	0	0	1.00	0	0	1.00	2	2	1.00	4	4	1.00
7	19-Oct	10:00	2	1.13	8	8	1.00	0	0	1.00	0	0	1.00	2	1	0.67	9	8	0.90
7	20-Oct	16:00	1	1.14	18	16	0.89	0	0	1.00	1	1	1.00	2	2	1.00	5	5	1.00
				Weighted mean (a)			0.95			1.00			1.00			0.80			0.92
				Weighted SD			0.05			0.00			0.00			0.19			0.07
8	21-Oct	-	-	1.51	**(no test; water too turbid)**														
8	22-Oct	14:00	3	1.39	9	9	1.00	0	0	1.00	0	0	1.00	1	1	1.00	14	14	1.00
8	23-Oct	09:00	1	1.39	16	15	0.94	2	1	0.67	0	0	1.00	1	1	1.00	1	1	1.00
8	24-Oct	12:00	5	1.40	3	3	1.00	1	1	1.00	0	0	1.00	0	0	1.00	3	2	0.75
8	25-Oct	08:00	1	1.43	3	3	1.00	0	0	1.00	0	0	1.00	0	0	1.00	3	3	1.00
				Weighted mean (a)			0.97			0.75			1.00			1.00			0.95
				Weighted SD			0.03			0.18			0.00			0.00			0.09
				Mean weekly observer efficiency (a)			0.99			0.76			0.94			1.10			0.97

(a) A mean of 1.00 represents 100% efficiency

Table 2. Comparison of observer error from verification tests at Stamp Falls Fishway, 1994.

Observer	Number	Chinook Adults		Chinook Jacks		Coho Adults		Coho Jacks		Sockeye	
(a)	of tests	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	26	0.99	0.03	0.85	0.23	1.00	0.00	1.01	0.24	0.99	0.03
2	19	1.00	0.00	1.05	0.23	1.00	0.00	0.90	0.33	0.98	0.05
3	6	0.98	0.04	1.00	0.00	0.96	0.10	1.01	0.20	0.95	0.07

(a) Data for observers 4 and 5 not presented because each of these observers were tested only once during the study

Table 3. Total daily counts and 95% confidence limits for salmonids passing through Stamp Falls Fishway, September 1 to November 8, 1994. 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). Numbers in bold italics are daily estimates during the flood period (26 October - 02 November), derived from linear interpolation. SE is the standard error for the total count, derived from verification tests.

	Chinook		Coho					
Date	Adults	Jacks	Adults	Jacks	Sockeye	Pink	Chum	Steelhead
Sep-01	74	5	0	0	474	0	0	11
Sep-02	37	3	0	0	461	0	0	19
Sep-03	25	7	0	0	1343	0	0	11
Sep-04	175	11	0	0	1117	0	0	8
Sep-05	272	17	3	0	1615	0	0	11
Sep-06	142	28	14	60	1017	0	0	14
Sep-07	143	15	58	100	1782	0	0	23
Sep-08	2045	22	48	100	2371	0	0	13
Sep-09	4141	38	38	44	3142	0	0	5
Sep-10	2967	41	50	65	2235	0	0	8
Sep-11	2416	46	46	75	2997	0	0	11
Sep-12	1819	45	16	53	2820	0	0	10
Sep-13	775	61	12	66	1602	0	0	9
Sep-14	363	59	23	116	1709	0	0	12
Sep-15	452	35	15	62	1219	0	0	4
Sep-16	341	22	5	31	667	0	0	11
Sep-17	601	26	44	106	637	0	0	12
Sep-18	515	16	28	109	716	0	0	22
Sep-19	670	41	15	79	463	0	0	9
Sep-20	456	29	15	61	370	0	0	12
Sep-21	398	23	13	54	348	0	0	12
Sep-22	717	11	27	97	255	0	0	12
Sep-23	1377	15	32	118	156	0	0	17
Sep-24	1315	16	39	137	136	0	0	2
Sep-25	1050	9	17	105	105	0	0	1
Sep-26	850	10	5	71	123	0	0	2
Sep-27	533	7	15	61	93	0	0	6
Sep-28	892	6	22	66	151	0	0	8
Sep-29	2371	11	30	76	152	0	0	8
Sep-30	1990	8	18	80	104	0	0	7
Oct-01	1787	8	31	75	177	0	0	3
Oct-02	3257	2	43	47	104	0	0	4
Oct-03	4061	10	23	74	203	0	0	2
Oct-04	2869	26	34	88	401	0	0	4
Oct-05	1572	26	17	87	370	0	0	1
Oct-06	1725	31	26	83	652	0	0	4
Oct-07	1353	23	20	85	1056	0	0	1
Oct-08	918	10	9	47	969	0	0	1
Oct-09	935	9	9	39	734	0	0	2
Oct-10	1222	18	9	46	542	0	0	0
Oct-11	1345	10	12	38	392	0	0	3
Oct-12	933	6	10	28	260	0	0	6

Table 3. (cont.) Total daily counts and 95% confidence limits for salmonids passing through Stamp Falls Fishway, September 1 to November 8, 1994. 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). Numbers in bold italics are daily estimates during the flood period (26 October - 02 November), derived from linear interpolation. SE is the standard error for the total count, derived from verification tests.

	Chinook		Coho					
Date	Adults	Jacks	Adults	Jacks	Sockeye	Pink	Chum	Steelhead
Oct-13	696	10	4	18	185	.0	0	0
Oct-14	750	7	10	23	212	0	0	3
Oct-15	487	5	4	18	109	0	0	2
Oct-16	395	5	7	15	97	0	0	1
Oct-17	472	1	8	25	148	0	0	2
Oct-18	377	0	5	19	67	0	0	2
Oct-19	373	7	9	18	94	0	2	2
Oct-20	355	5	7	15	118	0	3	1
Oct-21	395	3	14	17	316	0	3	3
Oct-22	430	5	6	13	185	0	0	10
Oct-23	279	3	8	11	76	0	0	4
Oct-24	160	2	0	20	36	0	0	5
Oct-25	108	8	0	5	42	0	0	6
Oct-26	***97***	***7***	***0***	***5***	***38***	***0***	***0***	***6***
Oct-27	***86***	***6***	***0***	***4***	***33***	***0***	***0***	***5***
Oct-28	***75***	***6***	***0***	***4***	***29***	***0***	***0***	***5***
Oct-29	***64***	***5***	***0***	***4***	***25***	***0***	***0***	***4***
Oct-30	***53***	***4***	***0***	***3***	***21***	***0***	***0***	***4***
Oct-31	***42***	***3***	***0***	***3***	***17***	***0***	***0***	***3***
Nov-01	***32***	***2***	***0***	***3***	***12***	***0***	***0***	***3***
Nov-02	***21***	***1***	***0***	***2***	***8***	***0***	***0***	***2***
Nov-03	10	0	0	2	4	0	0	2
Nov-04 (b)	0	0	0	0	0	0	0	0
Nov-05	14	0	1	9	21	0	0	0
Nov-06	4	0	2	1	1	0	0	1
Nov-07	2	0	1	0	3	0	0	1
Nov-08	2	0	0	0	5	0	0	0
Nov-09 (c)								
Nov-10 (c)								
Total	57678	954	976	2985	38141	0	8	418
SE	71.65	50.61	12.13	100.50	163.60			
Upper 95% CL	57822	(a)	1001	3187	38470			
Lower 95% CL	57534	(a)	952	2783	37812			

(a) Confidence limits for jack chinook are not presented due to the low number of jacks (n = 8) verified in the verification tests (Table 1)

(b) November 4: water too turbid to count fish; gate not opened (no fish passage)

(c) November 9-10: water too high and turbid to count fish

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, 1994. Ages presented are total age; all specimens were freshwater age 1.

Location	Length class (mm)	Age (a) 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	0	0	0	0	1	0	0	0	0	0	0	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	0	0	1	0	0	1	0	0	0	0	0	0	0	0
	450-499	1	1	0	0	0	2	1	0	0	0	0	0	0	0
	500-549	0	3	2	0	0	5	1	0	0	1	0	0	1	1
	550-599	0	10	7	1	0	18	8	0	2	2	1	0	5	1
	600-649	0	10	35	3	0	48	17	0	1	16	4	0	21	3
	650-699	0	4	110	13	0	127	52	0	2	97	25	0	124	29
	700-749	0	2	113	32	0	147	49	0	3	197	101	0	301	66
	750-799	0	1	22	26	0	49	22	0	0	57	134	2	193	50
	800-849	0	0	2	2	0	4	3	0	0	2	44	1	47	8
	850-899	0	0	0	1	0	1	0	0	0	1	4	0	5	0
	900-949	0	0	0	0	0	0	0	0	0	0	0	0	0	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	2	31	292	78	0	403	154	0	8	373	313	3	697	158
	Percent	0.5	7.7	72.5	19.4	0.0	100.0		0.0	1.1	53.5	44.9	0.4	100.0	
	Mean (d)	420	606	689	729	0	689 (e)	687	0	656	709	752	787	728 (e)	728
	SD (d)	42	62	49	45	0	60 (e)	66	0	68	40	44	15	48 (e)	43
Robertson Creek Hatchery															
	250-299	0	0	0	0	0	0	0	0	0	0	0	0	0	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	13	0	0	0	0	13	0	0	0	0	0	0	0	0
	450-499	12	2	0	0	0	14	0	0	0	0	0	0	0	0
	500-549	1	9	1	0	0	11	0	0	0	0	0	0	0	0
	550-599	0	8	1	0	0	9	1	0	0	0	0	0	0	0
	600-649	0	28	8	2	0	38	5	0	0	0	0	0	0	0
	650-699	0	34	33	1	0	68	15	0	1	9	1	0	11	4
	700-749	0	10	145	1	0	156	18	0	0	89	11	0	100	14
	750-799	0	0	102	7	0	109	13	0	0	146	49	1	196	14
	800-849	0	0	13	7	0	20	3	0	0	30	56	0	86	5
	850-899	0	0	1	3	0	4	0	0	0	2	20	1	23	1
	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	27	91	304	21	0	443	55	0	1	276	138	2	417	38
	Percent	6.1	20.5	68.6	4.7	0.0	100.0		0.0	0.2	66.2	33.1	0.5	100.0	
	Mean (d)	397	584	685	733	0	649 (e)	665	0	628	710	752	768	724 (e)	699
	SD (d)	26	57	41	70	0	90 (e)	58	0	0	32	40	67	40 (e)	42

(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, 1994. Ages presented are total age; all specimens were freshwater age 1.

		Male (a)		Female	
Location	Age	Number	Percent (b)	Number	Percent (b)
Upper Stamp River					
	2	100	0.5	0	0.0
	3	1545	7.7	429	1.1
	4	14549	72.5	19985	53.5
	5	3886	19.4	16770	44.9
	6	0	0.0	161	0.4
	Total (c)	20079 (e)	100.0	37344 (e)	100.0
Robertson Creek Hatchery					
	2	38	6.1	0	0.0
	3	128	20.5	1	0.2
	4	428	68.6	387	66.2
	5	30	4.7	194	33.1
	6	0	0.0	3	0.5
	Total (d)	624	100.0	585	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 (33.90:66.10) 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 33.90% of the in-river adult population plus 100% of the in-river jack population (see Table 6); thus, the total number of males that returned to the Upper Stamp River is calculated as:

$$(0.3390 * (57678-597-585)) + (954-27) = 20079$$

and the total number of females that returned to the Upper Stamp River is calculated as:

$$0.6610 * (57678-597-585) = 37344$$

(d) Total hatchery returns (Appendix 2-2)

(e) Summation is a result of rounding

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, 1994.

Location	Type of sampling		Male		Female		Jack		Total	
			Number (a)	%	Number (a)	%	Number (a)	%	Number	%
Hatchery	Braile	(a)	597	49.4	585	48.4	27	2.2	1209	100.0
Hatchery	Age-comp	(b)	586	48.5	585	48.4	38	3.1	1209	100.0
Upper Stamp	Fishway	(c)	19152	33.4	37344	65.0	927	1.6	57423	100.0
Upper Stamp	Age-comp	(d)	19979	34.8	37344	65.0	100	0.2	57423	100.0

(a) Adjusted total returns 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 (33.90:66.10) 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, 1994. 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,b) A	Observed adipose clips (a,b) B	Mark rate (%) C=(B/A)x100	Escapement estimate (c,b) D	Percentage of population sampled E=(A/D)x100	Total estimated adipose clips F=(B/A)xD
Upper Stamp River						
Male (d)	2687	57	2.1	20079	13.4	426
Female	5231	113	2.2	37344	14.0	807
Total	7918	170	2.1	57423	13.8	1233
Robertson Creek Hatchery						
Male (d)	624	151	24.2	624	100.0	151
Female	585	160	27.4	585	100.0	160
Total	1209	311	25.7	1209	100.0	311

(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) Includes recoveries with no sex designation (11 from Upper Stamp River, 18 from Robertson Creek Hatchery; see Appendices 2-1 and 2-2, respectively), apportioned by the male:female sex ratio (33.90:66.10) derived from the dead recovery (this resulted in the addition of four male and seven female adipose clips to the Upper Stamp, and nine male and nine female adipose clips to the Hatchery)

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

(d) 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, 1994. One decimal place is carried for the estimated adipose clips for calculating the expanded hatchery contribution in Table 10 (Method A).

		Upper Stamp River (a)				Robertson Creek Hatchery (a)			
		Decoded adipose clips		Estimated adipose clips		Decoded adipose clips		Estimated adipose clips	
Brood year	CWT code	M (b)	F	M (b)	F	M (b)	F	M (b)	F
1991	180620	0	0	0.0	0.0	2	0	2.3	0.0
	180621	2	0	18.5	0.0	7	0	8.1	0.0
	180623	0	0	0.0	0.0	1	0	1.2	0.0
	180802	0	0	0.0	0.0	3	0	3.5	0.0
	180803	1	0	9.3	0.0	6	0	7.0	0.0
	180804	1	0	9.3	0.0	4	0	4.6	0.0
	180805	0	0	0.0	0.0	4	0	4.6	0.0
	Subtotal	4	0	37.0	0.0	27	0	31.4	0.0
1990	21208	4	6	37.0	48.9	7	8	8.1	9.6
	21209	1	0	9.3	0.0	13	2	15.1	2.4
	21549	5	10	46.3	81.5	8	14	9.3	16.8
	21550	6	4	55.6	32.6	24	14	27.9	16.8
	21551	2	3	18.5	24.4	8	12	9.3	14.4
	21552	3	8	27.8	65.2	11	8	12.8	9.6
	21553	3	9	27.8	73.3	10	13	11.6	15.6
	180224	3	0	27.8	0.0	2	3	2.3	3.6
	180225	1	1	9.3	8.1	0	2	0.0	2.4
	180226	2	3	18.5	24.4	3	4	3.5	4.8
	180227	2	0	18.5	0.0	2	0	2.3	0.0
	180229	0	0	0.0	0.0	0	1	0.0	1.2
	Subtotal	32	44	296.3	358.5	88	81	102.2	97.4
1989	20145	0	4	0.0	32.6	0	4	0.0	4.8
	20146	0	3	0.0	24.4	0	1	0.0	1.2
	20147	0	3	0.0	24.4	0	3	0.0	3.6
	20148	1	0	9.3	0.0	1	0	1.2	0.0
	20149	0	1	0.0	8.1	0	2	0.0	2.4
	20150	0	1	0.0	8.1	0	2	0.0	2.4
	20151	1	4	9.3	32.6	0	2	0.0	2.4
	20152	0	3	0.0	24.4	0	2	0.0	2.4
	20153	0	1	0.0	8.1	0	1	0.0	1.2
	20230	0	1	0.0	8.1	0	1	0.0	1.2
	20231	0	3	0.0	24.4	1	0	1.2	0.0
	20232	0	5	0.0	40.7	0	0	0.0	0.0
	20645	1	1	9.3	8.1	2	0	2.3	0.0
	20646	2	5	18.5	40.7	1	4	1.2	4.8
	20647	0	2	0.0	16.3	3	4	3.5	4.8
	20648	0	1	0.0	8.1	1	4	1.2	4.8
	20948	3	1	27.8	8.1	1	8	1.2	9.6

Table 8. (cont.) Estimates of total escapement of adipose-clipped chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1994. 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
	20949	1	6	9.3	48.9	1	4	1.2	4.8
	20950	1	4	9.3	32.6	1	4	1.2	4.8
	20951	0	4	0.0	32.6	2	4	2.3	4.8
	Subtotal	10	53	92.6	431.9	14	50	16.3	60.2
1988	25837	0	1	0.0	8.1	0	0	0.0	0.0
	Subtotal	0	1	0.0	8.1	0	0	0.0	0.0
	Total hatchery	46	98	425.9	798.6	129	131	149.8	157.6
Strays (c)									
1990	180201	0	0	0.0	0.0	0	1	0.0	1.2
	180202	0	1	0.0	8.1	0	0	0.0	0.0
	180203	0	0	0.0	0.0	1	0	1.2	0.0
	Subtotal	0	1	0.0	8.1	1	1	1.16	1.2
1989	20620	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	0	1	0.0	8.1	1	2	1.2	2.4
	Total CWT	46	99	426 (d)	807 (d)	130	133	151 (d)	160 (d)
No head taken		0	0			0	0		
No data (5000)		1	0			5	4		
No pin (8000)		10	14			16	23		
Lost pin (9000)		0	0			0	0		
Observed adipose (d)		57	113			151	160		

(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 Raft River (Thompson 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, 1994.

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
	180623	26482	727356	0.0	3	26482	727356
	180802	25540	818909	0.0	3	25540	818909
	180803	27083	875698	1.8	3	27579	875202
	180804	27574	891574	0.0	3	27574	891574
	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
	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
	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
	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
1988	25837	25026	1075504	0.1	3	25051	1075479
Total hatchery		1001303	23298961			1003667	23296597

Table 9. (cont.) CWT and adipose-clip release data for hatchery-reared chinook salmon returning to the Somass River system and Robertson Creek Hatchery, by tag code, 1994.

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
Strays (a)							
1990	180201	29209	445	1.5	1	29654	0
	180202	26674	684	2.5	1	27358	0
	180203	27070	17525	1.6	1	27510	17085
1989	20620	24992	25797	0.5	40	25118	25671

(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 Raft River (Thompson 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, 1994. 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
1991	180620	27018	969164	36.87	0	0	86	0
	180621	27475	1003967	37.54	695	0	305	0
	180623	26482	727356	28.47	0	0	33	0
	180802	25540	818909	33.06	0	0	115	0
	180803	27579	875202	32.73	303	0	228	0
	180804	27574	891574	33.33	309	0	155	0
	180805	27238	658622	25.18	0	0	117	0
	Subtotal				1307	0	1039	0
1990	21208	26226	1753468	67.86	2513	3318	552	653
	21209	25729	427884	17.63	163	0	266	42
	21549	33896	829768	25.48	1180	2076	237	429
	21550	33676	1919372	58.00	3222	1890	1617	977
	21551	33581	1569272	47.73	884	1167	444	689
	21552	33195	699640	22.08	613	1439	282	212
	21553	33298	1070833	33.16	921	2432	385	519
	180224	26202	26202	2.00	56	0	5	7
	180225	26163	0	1.00	9	8	0	2
	180226	26842	0	1.00	19	24	3	5
	180227	26415	26415	2.00	37	0	5	0
	180229	26370	0	1.00	0	0	0	1
	Subtotal				9617	12355	3795	3537
1989	20145	19800	0	1.00	0	33	0	5
	20146	21721	0	1.00	0	24	0	1
	20147	21804	0	1.00	0	24	0	4
	20148	17750	0	1.00	9	0	1	0
	20149	17207	0	1.00	0	8	0	2
	20150	14812	0	1.00	0	8	0	2
	20151	20326	0	1.00	9	33	0	2
	20152	21044	0	1.00	0	24	0	2
	20153	20950	0	1.00	0	8	0	1
	20230	17104	0	1.00	0	8	0	1
	20231	17022	0	1.00	0	24	1	0
	20232	17648	0	1.00	0	41	0	0
	20645	25653	683278	27.64	256	225	64	0
	20646	26670	968593	37.32	691	1520	43	180
	20647	25851	1431791	56.39	0	919	196	271
	20648	26729	1107766	42.44	0	346	49	204

Table 10. (cont.) Estimates of total escapement of hatchery-reared chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1994. 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
	20948	25517	617893	25.21	700	205	29	243
	20949	26660	1018290	39.20	363	1916	46	189
	20950	26771	908745	34.95	324	1139	41	168
	20951	27078	1217114	45.95	0	1498	107	221
	Subtotal				2352	8005	578	1497
1988	25837	25051	1075479	43.93	0	358	0	0
	Subtotal				0	358	0	0
Total hatchery					13277	20718	5412	5034
Strays (d)								
1990	180201	29654	0	1.00	0	0	0	1
	180202	27358	0	1.00	0	8	0	0
	180203	27510	17085	1.62	0	0	2	0
	Subtotal				0	8	2	1
1989	20620	25118	25671	2.02	0	0	0	2
	Subtotal				0	0	0	2
Total strays					0	8	2	4

(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 Raft River (Thompson River), B.C.

Table 11. Estimated hatchery contributions to chinook salmon escapements of upper Stamp River and Robertson Creek Hatchery, 1994. Contributions were calculated using expansion Method A for the estimated number of adipose clips (Table 10).

				Hatchery contribution (b)				Stray contribution (b)			
		Estimated escapement (a)		Male		Female		Male		Female	
Location	Age	Male (c)	Female	Number	%	Number	%	Number	%	Number	%
Upper Stamp River											
	2	100	0	0	0.0	0	0.0	0	0.0	0	0.0
	3	1545	429	1307	84.6	0	0.0	0	0.0	0	0.0
	4	14549	19985	9617	66.1	12355	61.8	0	0.0	8	0.0
	5	3886	16770	2352	60.5	8005	47.7	0	0.0	0	0.0
	6	0	161	0	0.0	358	100.0 (d)	0	0.0	0	0.0
	Total	20079	37344	13277	66.1	20718	55.5	0	0.0	8	0.0
Robertson Creek Hatchery											
	2	38	0	0	0.0	0	0.0	0	0.0	0	0.0
	3	128	1	1039	100.0 (d)	0	0.0	0	0.0	0	0.0
	4	428	387	3795	100.0 (d)	3537	100.0 (d)	2	0.4	1	0.3
	5	30	194	578	100.0 (d)	1497	100.0 (d)	0	0.0	2	1.3
	6	0	3	0	0.0	0	0.0	0	0.0	0	0.0
	Total	624	585	5412	100.0 (d)	5034	100.0 (d)	2	0.3	4	0.6

(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, 1994. One decimal place is carried for the adjusted CWTs for estimating the total number of CWTs in Table 13 (Method B).

		Upper Stamp River (a)				Robertson Creek Hatchery (a)			
		Decoded adipose clips (b)		Adjusted adipose clips		Decoded adipose clips (b)		Adjusted adipose clips	
Brood year	CWT code	M (c)	F	M (c)	F	M (c)	F	M (c)	F
1991	180620	0	0	0.0	0.0	2	0	2.1	0.0
	180621	2	0	2.0	0.0	7	0	7.2	0.0
	180623	0	0	0.0	0.0	1	0	1.0	0.0
	180802	0	0	0.0	0.0	3	0	3.1	0.0
	180803	1	0	1.0	0.0	6	0	6.2	0.0
	180804	1	0	1.0	0.0	4	0	4.1	0.0
	180805	0	0	0.0	0.0	4	0	4.1	0.0
	Subtotal	4	0	4.1	0.0	27	0	27.9	0.0
1990	21208	4	6	4.1	6.0	7	8	7.2	8.2
	21209	1	0	1.0	0.0	13	2	13.4	2.1
	21549	5	10	5.1	10.0	8	14	8.3	14.4
	21550	6	4	6.1	4.0	24	14	24.8	14.4
	21551	2	3	2.0	3.0	8	12	8.3	12.3
	21552	3	8	3.1	8.0	11	8	11.4	8.2
	21553	3	9	3.1	9.0	10	13	10.3	13.3
	180224	3	0	3.1	0.0	2	3	2.1	3.1
	180225	1	1	1.0	1.0	0	2	0.0	2.1
	180226	2	3	2.0	3.0	3	4	3.1	4.1
	180227	2	0	2.0	0.0	2	0	2.1	0.0
	180229	0	0	0.0	0.0	0	1	0.0	1.0
	Subtotal	32	44	32.6	44.0	88	81	91.0	83.1
1989	20145	0	4	0.0	4.0	0	4	0.0	4.1
	20146	0	3	0.0	3.0	0	1	0.0	1.0
	20147	0	3	0.0	3.0	0	3	0.0	3.1
	20148	1	0	1.0	0.0	1	0	1.0	0.0
	20149	0	1	0.0	1.0	0	2	0.0	2.1
	20150	0	1	0.0	1.0	0	2	0.0	2.1
	20151	1	4	1.0	4.0	0	2	0.0	2.1
	20152	0	3	0.0	3.0	0	2	0.0	2.1
	20153	0	1	0.0	1.0	0	1	0.0	1.0
	20230	0	1	0.0	1.0	0	1	0.0	1.0
	20231	0	3	0.0	3.0	1	0	1.0	0.0
	20232	0	5	0.0	5.0	0	0	0.0	0.0
	20645	1	1	1.0	1.0	2	0	2.1	0.0
	20646	2	5	2.0	5.0	1	4	1.0	4.1
	20647	0	2	0.0	2.0	3	4	3.1	4.1
	20648	0	1	0.0	1.0	1	4	1.0	4.1
	20948	3	1	3.1	1.0	1	8	1.0	8.2

Table 12. (cont.) Adjusted number of CWT chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1994. One decimal place is carried for the adjusted CWTs for estimating the total number of CWTs in Table 13 (Method B).

		Upper Stamp River (a)				Robertson Creek Hatchery (a)			
		Decoded adipose clips (b)		Adjusted adipose clips		Decoded adipose clips (b)		Adjusted adipose clips	
Brood year	CWT code	M (c)	F	M (c)	F	M (c)	F	M (c)	F
	20949	1	6	1.0	6.0	1	4	1.0	4.1
	20950	1	4	1.0	4.0	1	4	1.0	4.1
	20951	0	4	0.0	4.0	2	4	2.1	4.1
	Subtotal	10	53	10.2	53.0	14	50	14.5	51.3
1988	25837	0	1	0.0	1.0	0	0	0.0	0.0
	Subtotal	0	1	0.0	1.0	0	0	0.0	0.0
	Total hatchery	46	98	46.8	98.0	129	131	133.4	134.4
Strays (d)									
1990	180201	0	0	0.0	0.0	0	1	0.0	1.0
	180202	0	1	0.0	1.0	0	0	0.0	0.0
	180203	0	0	0.0	0.0	1	0	1.0	0.0
	Subtotal	0	1	0.0	1.0	1	1	1.0	1.0
1989	20620	0	0	0.0	0.0	0	1	0.0	1.0
	Subtotal	0	0	0.0	0.0	0	1	0.0	1.0
	Total strays	0	1	0.0	1.0	1	2	1.0	2.1
	Total CWT	46	99	46.8	99.0	130	133	134.5	136.4
No head taken		0	0			0	0		
No data (5000)		1	0			5	4		
No data (ND) (e)		1	0			5	4		
No pin (8000)		10	14			16	23		
Lost pin (9000)		0	0			0	0		
Observed adipose (f)		57	113			151	160		

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

(b) From Table 8

(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 Raft River (Thompson River), B.C.

(e) Includes "No head taken" and "No data (5000)"; all "ND" for Method B (see equation 8 in text)

(f) From Table 7

Table 13. Estimates of total escapement of CWT chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1994. 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
1991	180620	0.0	0.0	0.0	0.0	2.1	0.0	2.1	0.0
	180621	2.0	0.0	14.9	0.0	7.2	0.0	7.2	0.0
	180623	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0
	180802	0.0	0.0	0.0	0.0	3.1	0.0	3.1	0.0
	180803	1.0	0.0	7.5	0.0	6.2	0.0	6.2	0.0
	180804	1.0	0.0	7.5	0.0	4.1	0.0	4.1	0.0
	180805	0.0	0.0	0.0	0.0	4.1	0.0	4.1	0.0
	Subtotal	4.0	0.0	29.9	0.0	27.7	0.0	27.7	0.0
1990	21208	4.0	6.1	29.9	43.2	7.2	8.3	7.2	8.3
	21209	1.0	0.0	7.5	0.0	13.4	2.1	13.4	2.1
	21549	5.0	10.1	37.4	72.0	8.2	14.4	8.2	14.4
	21550	6.0	4.0	44.8	28.8	24.7	14.4	24.7	14.4
	21551	2.0	3.0	14.9	21.6	8.2	12.4	8.2	12.4
	21552	3.0	8.1	22.4	57.6	11.3	8.3	11.3	8.3
	21553	3.0	9.1	22.4	64.8	10.3	13.4	10.3	13.4
	180224	3.0	0.0	22.4	0.0	2.1	3.1	2.1	3.1
	180225	1.0	1.0	7.5	7.2	0.0	2.1	0.0	2.1
	180226	2.0	3.0	14.9	21.6	3.1	4.1	3.1	4.1
	180227	2.0	0.0	14.9	0.0	2.1	0.0	2.1	0.0
	180229	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
	Subtotal	32.0	44.4	239.1	316.9	90.4	83.6	90.4	83.6
1989	20145	0.0	4.0	0.0	28.8	0.0	4.1	0.0	4.1
	20146	0.0	3.0	0.0	21.6	0.0	1.0	0.0	1.0
	20147	0.0	3.0	0.0	21.6	0.0	3.1	0.0	3.1
	20148	1.0	0.0	7.5	0.0	1.0	0.0	1.0	0.0
	20149	0.0	1.0	0.0	7.2	0.0	2.1	0.0	2.1
	20150	0.0	1.0	0.0	7.2	0.0	2.1	0.0	2.1
	20151	1.0	4.0	7.5	28.8	0.0	2.1	0.0	2.1
	20152	0.0	3.0	0.0	21.6	0.0	2.1	0.0	2.1
	20153	0.0	1.0	0.0	7.2	0.0	1.0	0.0	1.0
	20230	0.0	1.0	0.0	7.2	0.0	1.0	0.0	1.0
	20231	0.0	3.0	0.0	21.6	1.0	0.0	1.0	0.0
	20232	0.0	5.0	0.0	36.0	0.0	0.0	0.0	0.0
	20645	1.0	1.0	7.5	7.2	2.1	0.0	2.1	0.0
	20646	2.0	5.0	14.9	36.0	1.0	4.1	1.0	4.1
	20647	0.0	2.0	0.0	14.4	3.1	4.1	3.1	4.1
	20648	0.0	1.0	0.0	7.2	1.0	4.1	1.0	4.1
	20948	3.0	1.0	22.4	7.2	1.0	8.3	1.0	8.3

Table 13. (cont.) Estimates of total escapement of CWT chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1994. 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
	20949	1.0	6.1	7.5	43.2	1.0	4.1	1.0	4.1
	20950	1.0	4.0	7.5	28.8	1.0	4.1	1.0	4.1
	20951	0.0	4.0	0.0	28.8	2.1	4.1	2.1	4.1
	Subtotal	10.0	53.5	74.7	381.7	14.4	51.6	14.4	51.6
1988	25837	0.0	1.0	0.0	7.2	0.0	0.0	0.0	0.0
	Subtotal	0.0	1.0	0.0	7.2	0.0	0.0	0.0	0.0
	Total hatchery	46.0	98.9	343.7	705.8	132.5	135.2	132.5	135.2
Strays (d)									
1990	180201	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
	180202	0.0	1.0	0.0	7.2	0.0	0.0	0.0	0.0
	180203	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0
	Subtotal	0.0	1.0	0.0	7.2	1.0	1.0	1.0	1.0
1989	20620	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
	Subtotal	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0
	Total strays	0.0	1.0	0.0	7.2	1.0	2.1	1.0	2.1
	Total CWT	46.0	99.9	343.7	713.0	133.6	137.3	133.6	137.3
Escapement estimate (e)		20079	37344			624	585		
Sample size (e)		2687	5231			624	585		

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

(b) From Table 8

(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 Raft River (Thompson River), B.C.

(e) Includes "No head taken" and "No data (5000)"; all "ND" for Method B (see equation 8 in text)

(f) 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, 1994. 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	
		CWT	Untagged		M (b)	F	M (b)	F
1991	180620	27018	969164	36.87	0	0	76	0
	180621	27475	1003967	37.54	561	0	270	0
	180623	26482	727356	28.47	0	0	29	0
	180802	25540	818909	33.06	0	0	102	0
	180803	27083	875698	33.33	249	0	205	0
	180804	27574	891574	33.33	249	0	137	0
	180805	27238	658622	25.18	0	0	103	0
	Subtotal				1059	0	923	0
1990	21208	26147	1753547	68.06	2035	2941	490	562
	21209	25729	427884	17.63	132	0	235	36
	21549	33896	829768	25.48	952	1835	209	368
	21550	33676	1919372	58.00	2600	1671	1430	838
	21551	33245	1569608	48.21	721	1042	396	597
	21552	32863	699972	22.30	500	1285	252	184
	21553	33298	1070833	33.16	743	2149	341	445
	180224	26202	26202	2.00	45	0	4	6
	180225	25901	262	1.01	8	7	0	2
	180226	26708	134	1.01	15	22	3	4
	180227	26415	26415	2.00	30	0	4	0
	180229	26106	264	1.01	0	0	0	1
	Subtotal				7780	10952	3365	3044
1989	20145	19800	0	1.00	0	29	0	4
	20146	21721	0	1.00	0	22	0	1
	20147	21804	0	1.00	0	22	0	3
	20148	17750	0	1.00	7	0	1	0
	20149	17207	0	1.00	0	7	0	2
	20150	14812	0	1.00	0	7	0	2
	20151	20326	0	1.00	7	29	0	2
	20152	21044	0	1.00	0	22	0	2
	20153	20950	0	1.00	0	7	0	1
	20230	17104	0	1.00	0	7	0	1
	20231	17022	0	1.00	0	22	1	0
	20232	17648	0	1.00	0	36	0	0
	20645	25653	683278	27.64	207	199	57	0
	20646	26670	968593	37.32	558	1344	38	154
	20647	25670	1431972	56.78	0	818	175	234
	20648	26729	1107766	42.44	0	306	44	175

Table 14. (cont.) Estimates of total escapement of hatchery-reared chinook salmon to the upper Stamp River and Robertson Creek Hatchery, by tag code, 1994. 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	
		CWT	Untagged		M (b)	F	M (b)	F
	20948	25262	618148	25.47	571	183	26	210
	20949	26660	1018290	39.20	293	1694	40	162
	20950	26771	908745	34.95	261	1007	36	144
	20951	27078	1217114	45.95	0	1324	94	190
	Subtotal				1904	7083	513	1288
1988	25837	25026	1075504	43.98	0	317	0	0
	Subtotal				0	317	0	0
Total hatchery					10743	18352	4800	4332
Strays (d)								
1990	180201	29209	445	1.02	0	0	0	1
	180202	26674	684	1.03	0	7	0	0
	180203	27070	17525	1.65	0	0	2	0
	Subtotal				0	7	2	1
1989	20620	24992	25797	2.03	0	0	0	2
	Subtotal				0	0	0	2
Total strays					0	7	2	3

(a) Abbreviations are: M = male, F = female
(b) Includes jacks
(c) Release numbers 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 Raft River (Thompson River), B.C.

Table 15. Estimated hatchery contributions to chinook salmon escapements of upper Stamp River and Robertson Creek Hatchery, 1994. Contributions were calculated using expansion Method B for the estimated number of CWTs (Table 14).

				Hatchery contribution (b)				Stray contribution (b)			
		Estimated escapement (a)		Male		Female		Male		Female	
Location	Age	Male (c)	Female	Number	%	Number	%	Number	%	Number	%
Upper Stamp River											
	2	100	0	0	0.0	0	0.0	0	0.0	0	0.0
	3	1545	429	1059	68.6	0	0.0	0	0.0	0	0.0
	4	14549	19985	7780	53.5	10952	54.8	0	0.0	7	0.0
	5	3886	16770	1904	49.0	7083	42.2	0	0.0	0	0.0
	6	0	161	0	0.0	317	100.0 (d)	0	0.0	0	0.0
	Total	20079	37344	10743	53.5	18352	49.1	0	0.0	7	0.0
Robertson Creek Hatchery											
	2	38	0	0	0.0	0	0.0	0	0.0	0	0.0
	3	128	1	923	100.0 (d)	0	0.0	0	0.0	0	0.0
	4	428	387	3365	100.0 (d)	3044	100.0 (d)	2	0.4	1	0.3
	5	30	194	513	100.0 (d)	1288	100.0 (d)	0	0.0	2	1.1
	6	0	3	0	0.0	0	0.0	0	0.0	0	0.0
	Total	624	585	4800	100.0 (d)	4332	100.0 (d)	2	0.3	3	0.5

(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, 1994. 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-01	17	26	17	3	0	1	1	3	3	3	74
Sep-02	4	**0**	2	3	2	6	6	2	2	10	37
Sep-03	4	4	3	**1**	0	0	2	4	5	2	25
Sep-04	26	**0**	21	46	24	20	14	5	11	8	175
Sep-05	44	67	83	**3**	36	17	1	11	3	7	272
Sep-06	10	58	**1**	2	5	22	8	13	13	10	142
Sep-07	3	5	**6**	13	20	18	23	6	15	34	143
Sep-08	35	192	339	272	**11**	106	255	297	279	259	2045
Sep-09	315	598	523	448	488	529	453	418	**96**	273	4141
Sep-10	106	462	477	456	450	291	**35**	311	223	156	2967
Sep-11	227	442	439	367	327	272	137	127	73	**5**	2416
Sep-12	75	257	252	**3**	180	201	207	204	240	200	1819
Sep-13	22	50	108	**7**	46	139	83	69	66	185	775
Sep-14	9	21	63	64	57	14	27	48	**35**	25	363
Sep-15	10	22	18	21	21	23	**0**	78	158	101	452
Sep-16	19	79	47	67	**18**	38	7	14	31	21	341
Sep-17	5	62	96	99	89	115	51	38	40	**6**	601
Sep-18	16	46	98	110	95	48	39	36	15	**12**	515
Sep-19	41	156	165	76	60	31	13	59	28	**41**	670
Sep-20	29	116	53	65	65	32	36	**15**	19	26	456
Sep-21	21	63	59	27	45	**49**	30	18	29	57	398
Sep-22	83	**25**	146	76	81	89	96	48	34	39	717
Sep-23	**33**	226	364	295	206	54	56	70	53	20	1377
Sep-24	93	245	239	196	211	152	93	51	**10**	25	1315
Sep-25	72	225	**15**	165	191	131	130	66	21	34	1050
Sep-26	28	157	190	136	115	57	**55**	63	28	21	850
Sep-27	41	114	**8**	49	124	28	45	67	29	28	533
Sep-28	**14**	203	222	158	102	54	47	24	22	46	892
Sep-29	350	451	385	364	**20**	204	192	177	128	100	2371
Sep-30	**84**	256	296	328	269	246	159	166	102	84	1990
Oct-01	10	154	377	351	261	207	175	157	**15**	80	1787
Oct-02	300	522	589	503	405	292	196	121	**217**	112	3257
Oct-03	167	629	672	616	571	488	**143**	336	256	183	4061
Oct-04	86	465	579	446	377	301	257	185	**19**	154	2869
Oct-05	**12**	183	254	183	181	182	193	175	104	105	1572
Oct-06	50	224	276	223	137	183	**79**	274	169	110	1725
Oct-07	126	241	**75**	206	115	151	134	109	127	83	1367
Oct-08	56	124	159	128	83	106	98	115	49	**9**	927
Oct-09	54	167	131	133	105	**9**	48	129	97	71	944
Oct-10	87	197	201	**7**	148	203	122	88	101	80	1234
Oct-11	83	204	194	138	148	156	157	**15**	156	108	1359
Oct-12	60	139	137	119	107	**19**	53	103	118	87	942
Oct-13	28	71	104	40	93	80	75	84	101	**27**	703

Appendix 1-1. Actual counts of adult chinook salmon at Stamp Falls Fishway, 1994. 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-14	27	93	111	113	87	85	83	**7**	85	98	789
Oct-15	29	55	**9**	57	66	73	64	59	48	53	513
Oct-16	**18**	44	34	46	41	43	45	62	44	39	416
Oct-17	13	39	72	51	**9**	46	75	78	70	44	497
Oct-18	28	36	49	47	33	31	**18**	50	52	53	397
Oct-19	17	48	**8**	39	53	56	60	40	41	31	393
Oct-20	15	51	56	46	41	49	46	52	**18**		374
Oct-21	0	36	70	94	85	71	17	34			407
Oct-22				25	115	151	**9**	69	74		443
Oct-23	16	**16**	27	33	37	47	39	40	33		288
Oct-24	11	22	28	27	**3**	3	22	28	21		165
Oct-25	**3**	7	30	7	21	3	11	16	13		111
Oct-26											0
Oct-27											0
Oct-28	Counts suspended 26 October - 02 November due to high and										0
Oct-29	turbid water. Panels and gate removed to allow fish passage.										0
Oct-30	Counts resumed on 03 Nov. at 08:00.										0
Oct-31											0
Nov-01											0
Nov-02											0
Nov-03	1	1	1	1	1	1	3	1			10
Nov-04	Water too turbid to count fish on Nov. 4; gate not opened (no fish passage)										0
Nov-05	0	2	1	3	2	1	3	2			14
Nov-06	0	1	0	3	0	0					4
Nov-07	0	0	0	0	2	0	0	0			2
Nov-08	0	0	0	1	0	0	1	0			2
Nov-09	Water too high and turbid to count fish on Nov. 9 and 10;										0
Nov-10	gate opened Nov. 9 and 10										0
Total	3133	8399	8979	7606	6685	6024	4527	4937	3839	3365	57494

Appendix 1-2. Actual counts of jack chinook salmon at Stamp Falls Fishway, 1994. 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-01	2	3	4	4	0	0	2	1	0	0	16
Sep-02	2	**1**	0	2	1	3	0	0	0	0	9
Sep-03	1	6	0	**0**	1	2	2	3	2	4	21
Sep-04	4	**0**	4	3	2	4	6	5	4	2	34
Sep-05	3	14	7	**1**	7	2	4	5	8	1	52
Sep-06	11	19	**0**	2	15	6	8	8	14	1	84
Sep-07	0	7	**2**	7	2	2	2	9	2	11	44
Sep-08	10	4	10	3	**0**	11	14	2	10	3	67
Sep-09	0	2	1	6	1	10	3	9	**4**	14	50
Sep-10	2	0	12	4	9	5	**1**	6	10	6	55
Sep-11	3	10	8	14	7	4	10	0	5	**0**	61
Sep-12	2	7	8	**1**	12	11	8	6	2	3	60
Sep-13	11	12	15	**0**	6	4	10	7	6	10	81
Sep-14	6	14	17	9	8	8	7	4	**2**	3	78
Sep-15	4	7	10	2	5	5	**0**	4	5	4	46
Sep-16	3	7	6	6	**1**	4	3	4	0	2	36
Sep-17	5	5	9	2	4	4	6	7	2	**0**	44
Sep-18	0	5	8	4	3	5	0	2	0	**0**	27
Sep-19	8	10	6	11	4	13	4	3	7	**3**	69
Sep-20	7	8	8	3	6	5	3	**1**	4	4	49
Sep-21	5	4	6	6	2	**2**	4	2	6	2	39
Sep-22	6	**2**	5	2	1	0	1	1	1	0	19
Sep-23	**0**	3	11	1	3	1	3	0	0	0	22
Sep-24	6	1	5	2	2	0	4	4	**0**	0	24
Sep-25	3	3	**0**	3	4	0	0	0	0	0	13
Sep-26	0	5	6	0	1	0	**1**	1	1	0	15
Sep-27	0	7	**0**	1	0	0	1	1	0	0	10
Sep-28	**1**	4	2	1	0	1	0	0	0	0	9
Sep-29	2	6	3	2	**0**	0	2	0	0	1	16
Sep-30	**0**	0	0	4	0	3	0	0	1	0	8
Oct-01	0	0	2	3	2	0	0	0	**0**	1	8
Oct-02	0	0	1	1	0	0	0	0	**0**	0	2
Oct-03	0	1	3	1	1	1	**1**	0	2	0	10
Oct-04	0	7	5	5	0	1	0	2	**1**	5	26
Oct-05	**1**	4	7	4	1	3	1	2	1	2	26
Oct-06	1	7	7	5	3	2	**0**	2	3	1	31
Oct-07	5	6	**2**	2	1	1	3	1	2	0	23
Oct-08	5	0	2	1	1	1	0	0	0	**0**	10
Oct-09	0	5	0	1	1	**0**	0	1	0	1	9
Oct-10	3	1	2	**0**	3	3	2	1	2	1	18
Oct-11	0	4	0	2	0	1	2	**0**	1	0	10
Oct-12	1	1	0	0	0	**0**	2	0	1	1	6
Oct-13	1	5	2	0	0	0	0	1	1	**0**	10

Appendix 1-2. Actual counts of jack chinook salmon at Stamp Falls Fishway, 1994. 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
Oct-14	1	1	1	0	0	1	2	**0**	0	1	7
Oct-15	0	1	**0**	1	0	0	1	1	1	0	5
Oct-16	**0**	1	1	0	1	0	0	1	1	0	5
Oct-17	0	0	0	0	**0**	0	0	0	0	1	1
Oct-18	0	0	0	0	0	0	**0**	0	0	0	0
Oct-19	0	1	**0**	0	0	3	2	0	0	1	7
Oct-20	0	1	2	0	1	0	1	0	**0**		5
Oct-21	0	2	1	1	0	0	0	0			4
Oct-22				1	2	1	**0**	1	1		6
Oct-23	0	**2**	0	0	0	0	2	0	0		4
Oct-24	0	0	0	0	**1**	0	0	0	1		2
Oct-25	**0**	0	1	5	0	0	0	5	0		11
Oct-26											0
Oct-27											0
Oct-28		Counts suspended 26 October - 02 November due to high and									0
Oct-29		turbid water. Panels and gate removed to allow fish passage.									0
Oct-30		Counts resumed on 03 Nov. at 08:00.									0
Oct-31											0
Nov-01											0
Nov-02											0
Nov-03	0	0	0	0	0	0	0	0			0
Nov-04		Water too turbid to count fish on Nov. 4; gate not opened (no fish passage)									0
Nov-05	0	0	0	0	0	0	0	0			0
Nov-06	0	0	0	0	0	0					0
Nov-07	0	0	0	0	0	0	0	0			0
Nov-08	0	0	0	0	0	0	0	0			0
Nov-09		Water too high and turbid to count fish on Nov. 9 and 10;									0
Nov-10		gate opened Nov. 9 and 10									0
Total	125	226	212	139	125	133	128	113	114	89	1404

Appendix 1-3. Actual counts of adult coho salmon at Stamp Falls Fishway, 1994. 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-01	0	0	0	0	0	0	0	0	0	0	0
Sep-02	0	**0**	0	0	0	0	0	0	0	0	0
Sep-03	0	0	0	**0**	0	0	0	0	0	0	0
Sep-04	0	**0**	0	0	0	0	0	0	0	0	0
Sep-05	0	2	1	**0**	1	0	0	0	0	0	4
Sep-06	1	6	**0**	2	3	1	1	2	0	2	18
Sep-07	8	4	**8**	2	20	2	5	2	16	10	77
Sep-08	0	13	5	5	**1**	12	11	2	9	6	64
Sep-09	2	6	2	5	4	8	4	11	**0**	5	47
Sep-10	1	4	2	6	11	10	**2**	12	8	7	63
Sep-11	1	3	15	15	8	9	2	2	2	**0**	57
Sep-12	2	4	2	**0**	5	2	0	2	3	0	20
Sep-13	0	2	4	**0**	1	1	0	4	1	2	15
Sep-14	0	3	6	3	0	4	6	3	**0**	4	29
Sep-15	3	1	4	1	3	0	**0**	1	4	2	19
Sep-16	1	1	1	0	**0**	1	1	0	0	0	5
Sep-17	1	10	4	12	1	9	1	4	0	**2**	44
Sep-18	3	7	8	1	2	1	5	0	1	**0**	28
Sep-19	0	2	3	5	3	2	0	0	0	**0**	15
Sep-20	4	4	1	1	2	0	0	**1**	1	1	15
Sep-21	0	5	2	0	1	**2**	0	2	0	1	13
Sep-22	7	**0**	11	1	2	2	4	0	0	0	27
Sep-23	**0**	7	3	11	0	3	3	5	0	0	32
Sep-24	2	4	10	8	8	2	3	2	**0**	0	39
Sep-25	4	2	**0**	3	1	3	1	1	1	1	17
Sep-26	0	1	2	0	0	0	**2**	0	0	0	5
Sep-27	0	1	**1**	2	6	0	4	1	0	0	15
Sep-28	**1**	5	6	2	3	1	2	0	0	2	22
Sep-29	3	6	5	6	**0**	5	3	1	1	0	30
Sep-30	**3**	1	2	3	2	2	1	2	0	2	18
Oct-01	0	2	9	4	5	3	3	2	**1**	2	31
Oct-02	3	9	6	6	2	5	5	0	**3**	4	43
Oct-03	2	4	7	3	1	2	**1**	2	1	0	23
Oct-04	2	5	6	4	8	3	1	4	**0**	1	34
Oct-05	**1**	5	2	1	2	2	4	0	0	0	17
Oct-06	6	5	7	3	0	3	**0**	1	0	1	26
Oct-07	1	4	**2**	3	2	2	2	2	2	0	20
Oct-08	0	1	4	0	0	0	2	0	2	**0**	9
Oct-09	1	1	0	2	1	**0**	1	2	1	0	9
Oct-10	0	3	1	**0**	1	2	0	0	1	1	9
Oct-11	1	3	2	4	0	1	0	**0**	1	0	12
Oct-12	2	2	2	0	0	**0**	0	2	1	1	10
Oct-13	0	0	1	0	0	0	2	0	1	**0**	4

Appendix 1-3. Actual counts of adult coho salmon at Stamp Falls Fishway, 1994. 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-14	0	1	2	0	1	0	2	**1**	3	0	10
Oct-15	0	0	**0**	0	0	0	1	2	0	1	4
Oct-16	**0**	0	2	1	0	1	1	0	1	1	7
Oct-17	1	2	0	0	**0**	1	0	2	0	2	8
Oct-18	1	0	0	1	1	0	**0**	2	0	0	5
Oct-19	2	0	**0**	0	3	0	1	2	1	0	9
Oct-20	3	1	0	0	1	1	0	0	**1**		7
Oct-21	0	3	5	4	0	1	0	1			14
Oct-22				0	0	3	**0**	1	2		6
Oct-23	0	**0**	2	1	2	0	1	1	1		8
Oct-24	0	0	0	0	**0**	0	0	0	0		0
Oct-25	**0**	0	0	0	0	0	0	0	0		0
Oct-26											0
Oct-27											0
Oct-28	Counts suspended 26 October - 02 November due to high and										0
Oct-29	turbid water. Panels and gate removed to allow fish passage.										0
Oct-30	Counts resumed on 03 Nov. at 08:00.										0
Oct-31											0
Nov-01											0
Nov-02											0
Nov-03	0	0	0	0	0	0	0	0			0
Nov-04	Water too turbid to count fish on Nov. 4; gate not opened (no fish passage)										0
Nov-05	0	0	1	0	0	0	0	0			1
Nov-06	0	0	0	2	0	0					2
Nov-07	1	0	0	0	0	0	0	0			1
Nov-08	0	0	0	0	0	0	0	0			0
Nov-09	Water too high and turbid to count fish on Nov. 9 and 10;										0
Nov-10	gate opened Nov. 9 and 10										0
Total	74	155	169	133	118	112	88	87	70	61	1067

Appendix 1-4. Actual counts of jack coho salmon at Stamp Falls Fishway, 1994. 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-01	0	0	0	0	0	0	0	0	0	0	0
Sep-02	0	**0**	0	0	0	0	0	0	0	0	0
Sep-03	0	0	0	**0**	0	0	0	0	0	0	0
Sep-04	0	**0**	0	0	0	0	0	0	0	0	0
Sep-05	0	0	0	**0**	0	0	0	0	0	0	0
Sep-06	0	0	**0**	5	5	9	1	7	2	1	30
Sep-07	6	3	**6**	5	6	1	7	1	10	5	50
Sep-08	2	5	3	3	**0**	7	9	8	8	5	50
Sep-09	1	1	0	1	4	7	3	6	**2**	4	29
Sep-10	0	0	0	5	4	7	**3**	9	6	9	43
Sep-11	2	4	3	7	3	12	2	13	1	**3**	50
Sep-12	3	4	6	**0**	5	3	8	3	3	0	35
Sep-13	0	11	4	**0**	0	6	1	10	0	12	44
Sep-14	0	22	4	13	3	13	8	6	**3**	5	77
Sep-15	7	6	11	3	4	1	**0**	0	7	2	41
Sep-16	2	13	2	12	**0**	4	0	3	0	0	36
Sep-17	4	21	12	17	7	25	2	25	1	**9**	123
Sep-18	19	12	38	9	20	4	19	2	2	**2**	127
Sep-19	6	15	12	16	5	16	4	8	5	**5**	92
Sep-20	13	8	13	4	6	4	8	**2**	10	3	71
Sep-21	5	12	8	11	4	**6**	3	7	3	4	63
Sep-22	14	**6**	25	18	13	6	9	5	9	8	113
Sep-23	**2**	21	16	38	7	16	6	18	4	5	133
Sep-24	14	22	30	25	20	15	15	9	**0**	4	154
Sep-25	10	19	**3**	19	20	17	4	8	6	12	118
Sep-26	7	20	18	8	3	5	**6**	11	1	1	80
Sep-27	14	12	**3**	5	7	7	10	0	4	6	68
Sep-28	**4**	19	14	7	8	2	6	7	3	4	74
Sep-29	13	13	8	16	**2**	9	10	5	6	3	85
Sep-30	**6**	12	9	14	7	9	3	15	3	9	87
Oct-01	0	15	11	13	4	7	7	15	**5**	5	82
Oct-02	3	2	8	4	13	2	7	5	**4**	3	51
Oct-03	2	14	14	15	8	6	**2**	9	5	5	80
Oct-04	5	10	25	8	15	7	12	8	**2**	4	96
Oct-05	**6**	21	13	13	5	9	7	9	4	8	95
Oct-06	7	15	16	9	8	8	**3**	9	13	2	90
Oct-07	22	26	**7**	17	7	5	4	7	3	2	100
Oct-08	14	7	5	6	5	3	4	6	3	**2**	55
Oct-09	9	10	3	2	3	**2**	6	3	7	1	46
Oct-10	7	7	9	**1**	6	6	4	5	6	3	54
Oct-11	8	3	8	4	2	3	6	**4**	2	5	45
Oct-12	5	8	4	9	3	**1**	0	0	0	3	33
Oct-13	2	9	3	0	2	2	0	1	1	**1**	21

Appendix 1-4. Actual counts of jack coho salmon at Stamp Falls Fishway, 1994. 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
Oct-14	6	5	6	2	3	3	2	**0**	1	1	29
Oct-15	0	5	**2**	3	1	3	1	3	3	2	23
Oct-16	**4**	2	4	2	2	2	0	2	0	1	19
Oct-17	7	6	1	2	**1**	4	3	5	2	0	31
Oct-18	2	3	5	3	2	1	**2**	4	2	0	24
Oct-19	1	5	**2**	6	2	1	3	1	0	2	23
Oct-20	0	7	0	3	1	0	2	4	**2**		19
Oct-21	0	4	4	3	1	1	2	2			17
Oct-22				3	4	2	**1**	2	1		13
Oct-23	0	**1**	1	2	3	0	0	3	1		11
Oct-24	0	4	13	0	**0**	2	1	0	0		20
Oct-25	**0**	0	2	1	1	1	0	0	0		5
Oct-26											0
Oct-27											0
Oct-28	Counts suspended 26 October - 02 November due to high and										0
Oct-29	turbid water. Panels and gate removed to allow fish passage.										0
Oct-30	Counts resumed on 03 Nov. at 08:00.										0
Oct-31											0
Nov-01											0
Nov-02											0
Nov-03	0	0	0	0	0	0	1	1			2
Nov-04	Water too turbid to count fish on Nov. 4; gate not opened (no fish passage)										0
Nov-05	0	2	1	2	1	0	2	1			9
Nov-06	0	0	1	0	0	0					1
Nov-07	0	0	0	0	0	0	0	0			0
Nov-08	0	0	0	0	0	0	0	0			0
Nov-09	Water too high and turbid to count fish on Nov. 9 and 10;										0
Nov-10	gate opened Nov. 9 and 10										0
Total	264	472	416	394	266	292	229	297	166	171	2967

Appendix 1-5. Actual counts of sockeye salmon at Stamp Falls Fishway, 1994. 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-01	181	88	64	41	0	6	35	23	27	9	474
Sep-02	112	**21**	30	17	26	31	50	50	42	82	461
Sep-03	297	275	286	**21**	85	80	85	67	65	82	1343
Sep-04	368	**37**	300	163	91	58	29	27	32	12	1117
Sep-05	532	385	411	**65**	155	30	9	16	5	7	1615
Sep-06	244	347	**29**	115	46	42	68	78	30	18	1017
Sep-07	131	281	**153**	373	126	113	60	89	201	255	1782
Sep-08	275	407	377	346	**23**	319	153	128	156	187	2371
Sep-09	164	335	504	549	392	329	284	271	**132**	214	3174
Sep-10	111	265	315	412	328	323	**63**	198	89	154	2258
Sep-11	250	427	612	670	523	302	120	66	36	**21**	3027
Sep-12	354	496	594	**32**	521	212	181	122	150	186	2848
Sep-13	243	292	382	**17**	211	133	88	58	65	129	1618
Sep-14	192	333	353	308	148	62	63	117	**75**	75	1726
Sep-15	96	173	264	180	118	95	**26**	100	109	70	1231
Sep-16	91	166	133	107	**31**	52	25	26	29	7	667
Sep-17	95	150	151	89	52	42	33	12	7	**6**	637
Sep-18	64	192	211	102	74	27	31	7	4	**4**	716
Sep-19	104	109	83	39	24	18	16	43	15	**12**	463
Sep-20	69	101	64	34	30	13	17	**13**	24	5	370
Sep-21	42	90	55	26	56	**12**	19	17	13	18	348
Sep-22	58	**34**	69	19	28	14	16	12	4	1	255
Sep-23	**8**	59	32	13	17	10	6	3	5	3	156
Sep-24	22	31	21	16	15	14	11	4	**1**	1	136
Sep-25	20	21	**5**	19	18	7	7	5	2	1	105
Sep-26	17	29	20	16	15	6	**3**	8	4	5	123
Sep-27	23	18	**4**	9	16	1	11	6	4	1	93
Sep-28	**7**	50	32	14	12	12	8	6	6	4	151
Sep-29	28	14	33	27	**2**	14	9	9	9	7	152
Sep-30	**10**	15	15	15	11	16	8	9	4	6	109
Oct-01	1	39	33	31	20	13	7	19	**7**	16	186
Oct-02	13	19	14	12	14	10	9	4	**11**	3	109
Oct-03	24	30	33	31	28	16	**11**	14	12	15	214
Oct-04	34	63	75	62	31	32	47	42	**3**	33	422
Oct-05	**10**	70	64	35	27	23	33	57	48	22	389
Oct-06	87	120	97	72	48	37	**7**	61	84	73	686
Oct-07	230	239	**123**	149	48	54	66	78	65	60	1112
Oct-08	172	267	171	96	73	49	56	75	47	**14**	1020
Oct-09	97	156	114	107	67	**12**	56	59	61	44	773
Oct-10	92	107	110	**21**	55	46	55	38	26	21	571
Oct-11	35	59	76	47	30	29	32	**16**	53	36	413
Oct-12	42	46	49	40	22	**9**	11	24	17	14	274
Oct-13	10	39	37	22	22	20	15	13	13	**4**	195

Appendix 1-5. Actual counts of sockeye salmon at Stamp Falls Fishway, 1994. 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-14	19	32	44	21	20	19	17	**9**	36	13	230
Oct-15	8	17	**10**	18	7	4	17	13	15	10	119
Oct-16	**7**	10	13	6	11	9	5	16	15	13	105
Oct-17	10	15	29	21	**7**	19	19	20	14	7	161
Oct-18	6	12	6	4	5	9	**4**	8	6	13	73
Oct-19	3	11	**9**	15	19	11	19	7	4	4	102
Oct-20	3	12	21	38	20	11	9	9	**5**		128
Oct-21	0	36	105	68	49	33	15	27			333
Oct-22				36	66	40	**14**	23	16		195
Oct-23	2	**1**	5	6	11	16	19	14	6		80
Oct-24	2	4	7	10	**3**	6	4	2	0		38
Oct-25	**3**	3	5	1	11	3	6	8	4		44
Oct-26											0
Oct-27											0
Oct-28	Counts suspended 26 October - 02 November due to high and										0
Oct-29	turbid water. Panels and gate removed to allow fish passage.										0
Oct-30	Counts resumed on 03 Nov. at 08:00.										0
Oct-31											0
Nov-01											0
Nov-02											0
Nov-03	0	0	1	0	0	1	1	1			4
Nov-04	Water too turbid to count fish on Nov. 4; gate not opened (no fish passage)										0
Nov-05	2	3	6	3	2	3	1	1			21
Nov-06	1	0	0	0	0	0					1
Nov-07	0	0	0	2	0	0	1	0			3
Nov-08	1	1	0	0	0	1	0	2			5
Nov-09	Water too high and turbid to count fish on Nov. 9 and 10;										0
Nov-10	gate opened Nov. 9 and 10										0
Total	5122	6652	6859	4828	3910	2928	2090	2250	1913	1997	38549

Appendix 2-1. Dead recovery and adipose-clipped status of chinook salmon recovered in the Stamp River, by location, 1994. (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
03-Oct	4	26	0	0	1	0	0	0	0	0	0	0
04-Oct	3	5	0	0	1	0	6	18	0	0	0	0
05-Oct	3	3	0	0	0	0	3	7	0	0	0	0
07-Oct	4	7	0	1	0	0	6	9	0	0	1	0
10-Oct	24	76	0	1	1	0	0	0	0	0	0	0
11-Oct	26	13	0	0	0	0	37	62	0	0	2	0
12-Oct	150	250	0	2	3	0	7	23	0	0	0	0
13-Oct	69	159	0	2	4	0	34	92	0	0	0	0
14-Oct	180	261	0	1	2	0	0	0	0	0	0	0
17-Oct	288	321	0	5	8	0	0	0	0	0	0	0
18-Oct	126	347	0	2	9	0	0	0	0	0	0	0
19-Oct	0	0	0	0	0	0	157	323	1	5	7	1
20-Oct	16	82	0	1	0	0	0	0	0	0	0	0
21-Oct	10	100	0	0	0	0	0	0	0	0	0	0
22-Oct	4	8	0	0	0	0	0	0	0	0	0	0
24-Oct	107	317	0	3	3	0	0	27	0	0	0	0
25-Oct	66	162	0	2	4	0	0	0	0	0	0	0
26-Oct	0	0	0	0	0	0	27	54	0	0	0	0
27-Oct	42	99	0	5	3	0	9	15	0	0	0	0
28-Oct	55	132	0	2	7	0	0	0	0	0	0	0
31-Oct	77	174	0	1	5	0	35	43	0	1	2	0
01-Nov	14	36	0	0	0	0	16	23	0	0	0	0
02-Nov	33	67	0	1	1	0	0	0	0	0	0	0
Total	1301	2645	0	29	52	0	337	696	1	6	12	1

(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, 1994. (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
03-Oct	0	0	0	0	0	0	0	0	0	0	0	0
04-Oct	1	3	0	0	0	0	6	19	0	1	0	0
05-Oct	2	6	0	0	0	0	1	5	0	0	0	0
07-Oct	1	4	0	0	0	0	3	3	0	0	0	0
10-Oct	0	0	0	0	0	0	0	0	0	0	0	0
11-Oct	0	0	0	0	0	0	10	30	1	2	0	0
12-Oct	23	42	0	0	0	0	30	55	0	0	2	0
13-Oct	0	0	0	0	0	0	0	0	0	0	0	0
14-Oct	0	0	0	0	0	0	42	117	0	2	3	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	90	213	0	0	6	0
21-Oct	0	0	0	0	0	0	27	31	0	0	2	0
22-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	1	23	0	0	1	0	24	83	0	0	1	0
26-Oct	0	0	0	0	0	0	40	126	0	0	1	0
27-Oct	0	0	0	0	0	0	52	128	0	0	3	0
28-Oct	0	0	0	0	0	0	19	46	0	0	0	0
31-Oct	0	0	0	0	0	0	44	38	0	3	2	0
01-Nov	0	0	0	0	0	0	20	41	0	0	0	0
02-Nov	0	0	0	0	0	0	12	12	0	0	0	0
Total	28	78	0	0	1	0	420	947	1	8	20	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, 1994. (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
03-Oct	0	0	0	0	0	0	0	0	0	0	0	0
04-Oct	1	8	0	0	0	0	0	0	0	0	0	0
05-Oct	0	5	0	0	1	0	0	0	0	0	0	0
07-Oct	0	5	0	0	0	0	0	0	0	0	0	0
10-Oct	0	0	0	0	0	0	0	0	0	0	0	0
11-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
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
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
31-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
Total	1	18	0	0	1	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, 1994. (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
03-Oct	0	0	0	0	0	0	0	0	0	0	0	0
04-Oct	0	0	0	0	0	0	0	0	0	0	0	0
05-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
10-Oct	0	0	0	0	0	0	0	0	0	0	0	0
11-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
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
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
31-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
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, 1994. (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
03-Oct	0	0	0	0	0	0	1	4	0	0	0	0
04-Oct	0	0	0	0	0	0	0	0	0	0	0	0
05-Oct	0	0	0	0	0	0	0	6	0	0	0	0
07-Oct	0	0	0	0	0	0	0	0	0	0	0	0
10-Oct	0	0	0	0	0	0	0	0	0	0	0	0
11-Oct	0	0	0	0	0	0	0	0	0	0	0	0
12-Oct	0	0	0	0	0	0	46	51	1	0	3	1
13-Oct	0	0	0	0	0	0	56	44	0	1	1	0
14-Oct	0	0	0	0	0	0	0	0	0	0	0	0
17-Oct	0	0	0	0	0	0	81	96	0	1	3	0
18-Oct	0	0	0	0	0	0	49	50	1	1	0	0
19-Oct	0	0	0	0	0	0	28	52	0	1	1	0
20-Oct	0	0	0	0	0	0	38	52	0	1	1	0
21-Oct	0	0	0	0	0	0	71	117	0	0	3	0
22-Oct	0	0	0	0	0	0	38	27	0	0	0	0
24-Oct	0	0	0	0	0	0	93	206	0	1	5	0
25-Oct	0	0	0	0	0	0	49	51	0	2	2	0
26-Oct	0	0	0	0	0	0	23	27	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	19	57	0	0	1	0
31-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
Total	0	0	0	0	0	0	592	840	2	8	20	1

(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, 1994. (a)

	Locations 1-6, 10							
	Total recovered				Adipose clipped			
Date	M	F	J	UNK	M	F	J	UNK
03-Oct	5	30	0	0	0	1	0	0
04-Oct	17	53	0	0	1	1	0	0
05-Oct	9	32	0	0	0	1	0	0
07-Oct	14	28	0	0	1	1	0	0
10-Oct	24	76	0	0	1	1	0	0
11-Oct	73	105	1	0	2	2	0	0
12-Oct	256	421	1	0	2	8	1	0
13-Oct	159	295	0	0	3	5	0	0
14-Oct	222	378	0	0	3	5	0	0
17-Oct	369	417	0	0	6	11	0	0
18-Oct	175	397	1	0	3	9	0	0
19-Oct	185	375	1	0	6	8	1	0
20-Oct	144	347	0	0	2	7	0	0
21-Oct	108	248	0	0	0	5	0	0
22-Oct	42	35	0	0	0	0	0	0
24-Oct	200	550	0	0	4	8	0	0
25-Oct	140	319	0	0	4	8	0	0
26-Oct	90	207	0	0	0	1	0	0
27-Oct	103	242	0	0	5	6	0	0
28-Oct	93	235	0	0	2	8	0	0
31-Oct	156	255	0	0	5	9	0	0
01-Nov	50	100	0	0	0	0	0	0
02-Nov	45	79	0	0	1	1	0	0
Unknown	0	0	0	11	0	0	0	11
Total	2679	5224	4	11	51	106	2	11
Adjusted Total (b)	**2683**	**5231**	**4**		**55**	**113**	**2**	

(a) Abbreviations are: M = male, F = female, J = jack; UNK = unknown sex

(b) Here the 11 unknown sex recoveries are apportioned to the total recoveries by the male:female sex ratios observed in the total recovery, and adipose-clip recovery, in the Stamp River, respectively; this resulted in the addition of four adult males and seven females to both the total recovery and total adipose-clip recovery (jack numbers remain unaffected)

Appendix 2-2. Total numbers and adipose-clip status of chinook salmon returning to Robertson Creek Hatchery, by date, 1994. (a)

	Total returns				Adipose clips			
Date	M	F	J	UNK	M	F	J	UNK
10-Oct	1	10	0	0	1	0	0	0
11-Oct	31	22	0	0	4	12	0	0
12-Oct	21	16	0	0	10	6	0	0
13-Oct	38	34	1	0	12	9	0	0
14-Oct	41	34	1	0	9	9	0	0
15-Oct	25	51	0	0	0	1	0	0
16-Oct	56	32	0	0	6	7	0	0
17-Oct	19	33	3	0	12	8	0	0
18-Oct	53	45	2	0	14	20	0	0
19-Oct	10	35	2	0	8	10	0	0
20-Oct	15	37	1	0	5	12	0	0
21-Oct	15	51	0	0	5	6	0	0
22-Oct	27	9	0	0	7	9	0	0
23-Oct	26	6	1	0	1	6	0	0
24-Oct	5	17	1	0	5	17	0	0
25-Oct	20	97	0	0	10	7	0	0
26-Oct	116	38	5	0	20	3	0	0
27-Oct	58	5	4	0	3	5	0	0
01-Nov	2	3	0	0	2	3	0	0
02-Nov	0	1	1	0	0	1	0	0
04-Nov	0	0	1	0	0	0	0	0
Unknown	9	0	4	18	8	0	0	18
Total	588	576	27	18	142	151	0	18
Adjusted Total (b)	**597**	**585**	**27**		**151**	**160**	**0**	

(a) Abbreviations are: M = male, F = female, J = jack; UNK = unknown sex

(b) Here the 18 unknown sex returns are apportioned to the total returns by the male:female sex ratios observed in the total return, and adipose-clip return, at the hatchery, respectively; this resulted in the addition of nine adult males and nine females to both the total return and total adipose-clip return (jack numbers remain unaffected)