Influence of Summer-run sockeye on the river entry timing of Late-run Fraser sockeye: "Stay with the School" Hypothesis

Karl K. English[1], Mike Lapointe[2], Keith Forrest[2] and Jim Cave[2]

Prepared for:

Pacific Salmon Commission
600-1155 Robson Street
Vancouver, BC, Canada
V6E 1B5

May 2005

[1] LGL Limited environmental research associates, 9768 Second Street, Sidney, BC V8L 3Y8
[2] Pacific Salmon Commission, 1155 Robson Street, Vancouver, BC V6E 1B5

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ABSTRACT

English, K.K., M.F. Lapointe, K. Forrest and J. Cave. 2005. Influence of Summer-run sockeye on the river entry timing of Late-run Fraser sockeye: "Stay with the School" Hypothesis. Pacific Salmon Commission Tech. Rep. No. X.

Early river entry timing and high pre-spawning mortality rates for Late-run Fraser sockeye has been a significant concern for fisheries managers since 1995. A number of studies were initiated in 2002 to provide quantitative estimates of in-river mortality by timing group and examine alternative explanations for the early entry phenomenon. In this report, we examined one of these potential explanations: the "Stay with the school" (SWTS) hypothesis, where the portion of Late-run sockeye that enter the Fraser River during the migration period of Summer-run sockeye is influenced by the run timing and abundance of Summer-run sockeye relative to Late-run stocks. We present the basis for this hypothesis and examine the available data for 1978 to 2003 to assess whether this hypothesis is consistent with variation in early entry behaviour observed in recent years and the possibility that early entry could have occurred prior to 1995. We describe a model that could be used prior to, and during, the fishing season to predict the extent to which Late-run stocks will enter the Fraser River early based on the relative timing and abundance of Summer-run and Late-run stocks from pre-season forecasts or in-season test fishing data. We compared the SWTS model estimates of the number of Late-run sockeye in Lower Georgia Strait (LGS) at the end of the Summer-run with the reported Pacific Salmon Commission (PSC) estimates for Late-run sockeye escapement past Mission after the end of the Summer-run. The PSC estimates varied from 12,000- 4,143,000 for the years examined and the annual estimates derived from the model were similar to the PSC estimates in most years. The model estimates ranged from 6,000 to 5,550,000 and tended to be slightly lower than the Mission estimates in years when the numbers of Late run sockeye entering LGS was less than 800,000. In years when Late-runs entering LGS were between 800,000 and 4,100,000, the model estimates were similar to the Mission values with no consistent bias. In 2002, when the Late-run abundance arriving in LGS was estimated to exceed 6.9 Million, the model estimate (5.5 Million) was higher than the PSC estimate (4.1 Million). The Model estimates of the daily escapement during the Summer-run period were combined with river water temperature data and timing-specific survival curves from the 2002 and 2003 radio-telemetry studies to compute an estimate of the expected en-route mortality for Late-run sockeye stocks. These mortality rates ranged from a low of 18% for 1991 to a high of 83% for 2000.

INTRODUCTION

Since 1995, Late-run Fraser River sockeye salmon (*Oncorhynchus nerka*) have shortened their normal period of delay in Georgia Strait and begun upriver spawning migrations significantly earlier than previously observed. The shortened delay and early migration has been associated with high levels of en route and pre-spawning mortality, exceeding 90% in some years. In 2002 and 2003, a number of studies were undertaken to provide quantitative estimates of in-river mortality by timing group and examine alternative explanations for the early entry phenomenon (Johannessen and Ross 2002; English et al. 2003; 2004; Cooke et al. 2004; Forrest 2004; Cook et al. in prep.; Wagner et al. in press). The combined results from the 2002 and 2003 sockeye radio-telemetry studies provided clear evidence that Late-run sockeye were entering the Fraser River with large abundances of Summer-run sockeye in August and these fish had a much lower probability of survival to their spawning areas than those that passed Mission after 1 September (English et al. in press). Given the large potential impact of changes in delay behaviour on spawning success, we examined potential influence of Summer-run sockeye on the delay behaviour and river entry timing for Late-run stocks.

The return timing of Fraser sockeye is typically sub-divided into three components:

1. the migration timing through the Juan de Fuca Strait and Johnstone Strait;
2. the migration delay in Lower Georgia Strait near the mouth of the Fraser River; and
3. the river entry run timing monitored at Mission.

While each component likely has some effect on the subsequent components, the factors that influence each component could be very different.

The migration timing of adult sockeye through the Juan de Fuca and Johnstone straits is likely influenced by large scale oceanographic conditions in the Alaska gyre. For example, in El Nino years, warmer coastal waters are believed to result in a more northern approach and later arrival of Fraser sockeye in south coast fisheries (Blackburn 1987). The peak migration timing in the approach areas for Summer-run and Late-run sockeye can vary by $\pm$ 2 weeks with timing overlaps ranging from 50-100%.

The migration delay of Summer-run sockeye in Lower Georgia Strait (LGS) has been relatively consistent and these stocks tend to migrate directly into the river with only occasional periods of short term delay (few days). In contrast, the historical data for Late-run stocks in the dominant and sub-dominant Adams River years indicates that these stocks delayed in LGS for several weeks (up to 6 weeks). However, recent DNA stock composition data indicates that a substantial portion of Late-run fish entered the river with little or no delay in 2000 and 2001 (off-cycle years) and "early entry" also occurred in 2002 and 2003. Although *subtle* changes in delay behaviour might be explained by *small* changes in a variety of factors, the *substantial* changes observed in recent years must have resulted from a *major* change in one or more of the key factors that influence sockeye behaviour and/or our ability to detect "early entry" behaviour. In this report, we discuss some of these key factors and changes in our ability to detect early entry for Late-run sockeye.

For those Late-run fish that delay for several weeks off the mouth of the Fraser River, it is likely that some combination of biological (fish size, maturity, etc.) and environmental conditions (winds, tides, river flow, lunar stage, etc) determines their eventual timing of river entry (Gilhousen 1960). The importance of understanding these factors is amplified by data collected in 2002 and 2003, which confirmed that Late-run sockeye that enter the Fraser River in August and early September have much lower in-river survival rates than those that enter in middle or late September. Therefore, we focus our assessment on the data that could help explain why Late-run sockeye enter the Fraser River in August and early September when their prospects for survival to spawning are poor.

Delay Behaviour

The large potential impact of changes in delay behaviour on spawning success of Late-run sockeye has resulted in a number of hypotheses and extensive research regarding the factors that could influence delay behaviour and river entry timing for Late-run stocks. Cook et al. (2004) described and discussed the following factors that have been hypothesized to affect migration timing of Late-run sockeye:

1) Energy status;
2) Osmoregulatory dysfunction and photoreception impairment;
3) Endocrine disturbance;
4) Oceanic and in-river environmental conditions;
5) Parasites and disease;
6) Contaminants; and
7) Threats of marine predation.

The hypothesis that lower energy reserves trigger sockeye to enter the Fraser River early is not supported by the available data for Late-run stocks. Recent biosampling data shows that early entry sockeye have equal or greater energy reserves than Late-run sockeye that enter later in September (Cooke et al. in prep). In addition, Late-run sockeye generally do not use all of their energy reserves to reach their spawning grounds. The best examples are Weaver and Cultus stocks located roughly 120 km from the mouth of the Fraser River.

While the available data is not sufficient to support or refute the other hypotheses listed above, there is no compelling evidence that changes in the marine environment along the approach routes to the Fraser River have been of sufficient magnitude to cause the observed shift in migration timing. In contrast, changes in the relative abundance of Summer-run and Late-run sockeye since 1994 and year to year variation in the abundance of these stocks has been substantial. Estimates of sockeye abundance for 1978-2003 show that Late-run portion of the combined abundance of summers and lates varies from as low as 2-7% in off-cycle years to highs of 77-87% in dominant cycle years (Table 1). Consequently, an alternative explanation for the early entry of Late-run sockeye has been proposed.

SWTS HYPOTHESIS

In general, we hypothesize that the migration behaviour of Summer-run sockeye will affect the behaviour of Late-run sockeye when Summer-run sockeye are more abundant. The biological mechanism for this behavioural effect is the tendency for sockeye to migrate in schools and the expectation that behaviour of the school will be determined by the stocks that are numerically dominant. Since Summer-run stocks migrate through coastal waters and into the Fraser River with little or no delay, the early entry of Late-run sockeye might be due to Late-run sockeye staying with the schools of Summer-run sockeye that they have been migrating with as they approach the mouth of the Fraser River. Hence, this explanation has been named the "stay with the school" (SWTS) hypothesis. The hypothesis is: "The portion of Late-run sockeye that enter the Fraser River during the migration period of Summer-run sockeye is influenced by the timing and abundance of Summer-run sockeye relative to Late-run stocks." The nature of this influence is as follows.

In years, or periods within a year, when the sockeye schools approaching the mouth of the Fraser River are predominantly comprised of Summer-run stocks, a large portion of the Late-run sockeye in these schools will continue to migrate with the Summer-run sockeye and enter the Fraser River in August. In other years, or periods within a year, when these schools are predominantly Late-run sockeye, the vast majority of Late-run sockeye will exhibit delay behaviour and schools of holding sockeye will accumulate near the mouth of the Fraser River. As more and more Late-run fish delay, there is an increasing probability that Late-run sockeye arriving in LGS will encounter and join these schools of delaying Late-run fish. Summer-run sockeye would continue to migrate into the river with little or no delay, even when Late-run stocks are numerically dominant, because of the more advanced state of maturity and earlier spawning time of Summer-run stocks.

The SWTS hypothesis is supported by the following observations:

1. Sockeye have a strong affinity to remain in a school therefore the behaviour of the school can affect the behaviour of individuals from different stocks (Larkin and Walton 1969; Freon and Misund 1999).
2. The large returns of Summer-run stocks combined with small returns of Late-run stocks and greater overlap in the run timing of these stocks in most years since 1995 has increased the potential for Summer-run behaviour to influence the delay behaviour of co-migrating Late-run sockeye.
3. In 2000 and 2001, a small return of Late-run sockeye migrated through coastal fisheries with large numbers of Summer-run sockeye and 90-100% of the Late-run fish were estimated to have entered the river in August along with the Summer-run sockeye.
4. In 2002, radio-tagged sockeye provided direct evidence that some Late-run sockeye migrated through the coastal waters and entered the Fraser River with comigrating Summer-run sockeye. Data from in-river tracking stations and tag recoveries was used to estimate the portion of the Late-run (the early entry component) that enter the river during the Summer-run migration period. The early entry component was estimated to be 63% for Late-run sockeye tagged from 3-7 August when Summer-run stocks represented 70% of the sockeye in the tagging areas. Later in 2002, when the abundance of Late-run

stocks entering and residing in lower Georgia Strait was much greater than the abundance of Summer-run stocks, the early entry component dropped to 10-11% (English et al. 2003).

5. The 2003 radio-tagging study provided additional evidence that the early entry component of the Late-run migration tends to be larger when Summer-run stocks are more abundant. In 2003, the early entry component for Late-run sockeye tagged from 11-15 August was 77% when Summer-run stocks represented 74% of the sockeye in the tagging areas. The early entry component for the later two release groups (62% and 57%) were higher than those observed in 2002. Summer-run abundance in 2003 was consistent greater than Late-run abundance in the tagging areas and the abundance of Late-run sockeye residing in lower Georgia Strait was substantially lower in 2003 (English et al. 2004). An indication of the relative abundance of Late-run sockeye in lower Georgia Strait can be obtained by comparing the estimated escapement of Late-run sockeye past Mission in September each year (almost 4 million in 2002 compared to 240,000 in 2003).

The questions and arguments against the SWTS hypothesis are:

Question 1: Why have we not observed early entry of Late-run stocks in years prior to 1995 when Summer-run abundance was much greater than Late-run abundance (e.g. the off-cycle years for Late-run Shuswap stocks)?

Question 2: How were Cultus sockeye able to maintain a consistently late river migration timing prior to 1995 independent of the relative abundance of Summer-run and other Late-run stocks?

In the following sections we examine information relevant to the above questions and attempt to determine whether this information is sufficient to refute the SWTS hypothesis.

Methods

The first step in addressing Question 1 was to identify those years prior to 1995 where the SWTS hypothesis would predict some early entry of Late-run and the numbers would be sufficient to detect this behaviour. Data were compiled and examined to answer the following three questions:

a) Was summer-run abundance sufficient to potentially influence the behaviour of Late-run sockeye stocks?
b) Was Late-run abundance sufficient to detect early entry of Late-run stocks?
c) Was marine return timing similar for Summer-run and Late-run stocks?

The total annual Mission escapement estimates for 1978-2003 were used as estimates of the relative annual abundance of Summer-run and Late-run sockeye near the mouth of the Fraser River (Jim Gable, PSC, pers. comm.). The annual 50% points for the migration through Area 20

were the estimates used to compare the marine migration timing for Summer-run and Late-run stocks (Jim Cave, PSC, pers. comm.).

Affirmative answers to each of the above questions identified those years when the SWTS hypothesis would have predicted that Late-run fish would enter the Fraser River in August and when that entry was detectable. These years were flagged for further analysis. Once all the years prior to 1995 had been assessed, we applied to the same logic to the recent years (1995-2003) for comparative purposes.

The second step related to Question 1 was to compile and examine all available information on the river entry timing for relevant Fraser sockeye stocks for each of the flagged years. This information included:

1) an initial assessment of the uncertainty in the stock composition estimates used to compute daily escapement past Mission;
2) daily Mission escapement estimates for Early summer-run Thompson stocks (Scotch/Seymour), Late-run stocks and Summer-run stocks;
3) daily Mission escapement estimates for Sub 1 Harrison River stocks;
4) daily escapement data for Cultus Lake sockeye at Sweltzer Creek fence; and
5) daily escapement data for early summer-run sockeye from Scotch Creek fence.

The historical time series of daily fence counts for Sweltzer Creek was the primary data used to address Question 2.

Results

The potential for Summer-runs to affect the behaviour of Late-run sockeye was very low in three dominant cycle years (1978, 1982, and 1986) due to both low Summer-run abundance and separation in run timing (Table 1). The potential was marginal in two sub-dominant years (1983, 1999) due to run timing separation. In most off-cycle years prior to 1995, early entry was almost impossible to detect using scale sample data because of low Late-run abundance (2-8% of the total return for summers and lates). Our criteria for detectable early entry of Late-run stocks were met in 6 (38%) of the 16 years prior to 1995 and 8 (89%) of the 9 years from 1995-2003. The six years prior to 1995 included: two dominant cycle years (1990 and 1994); three sub-dominant years (1979, 1987 and 1991) and one off-cycle year (1988). In the following sections, we examine the available data for these years in more detail.

Initial Assessment of Historical Stock Composition Estimate

Since 1977, statistical analyses of scale patterns have been used to help identify Fraser River sockeye stock proportions for catch and escapement. Furthermore, since 1987 the use of four scale variables has replaced the use of two–variable scale analysis. Discriminant function analysis is the statistical technique used to distinguish among spawning ground baseline standards, and to classify fishery mixtures to probable stocks of origin (Gable and Cox-Rogers, 1993). Key determinates of the discriminant function estimates are relative stock abundance and mean scale classification accuracy. Point-estimate bias can be large when similar stocks differ

greatly in abundance (Millar, 1987); without bias-correction, stocks in low proportion tend to be overestimated while stocks in high proportion tend to be underestimated. This becomes especially noticeable when using discriminant models that perform poorly (e.g., those with low mean classification accuracy) (Gable and Cox-Rogers, 1993). Stock selection for mixed fishery models are based on expected stock abundance and migration timing. Therefore, Late-run stocks were seldom included in the analysis of fishery samples obtained from the lower Fraser River before the beginning of September. Initially, we thought by including Late-run stocks in a re-analysis of lower Fraser River fishery samples taken before the beginning of September might reveal years prior to 1995 when Late-run sockeye enter the Fraser River. However, the reanalysis quickly revealed that whenever Late-run stocks were included in the analysis, some proportion was assigned to Late-run stocks. Not surprisingly, this occurred even for samples obtained in early to mid-July, well before any Late-run stocks could have been present. The over estimate of Late-runs is likely due to low Late-run abundance and low mean classification accuracy. Thus, we concluded that further re-analyses of the historical scale data was not warranted.

Daily Stock Composition and Abundance Estimates at Mission

Daily estimates of the number Summer-run, Late-run and Scotch/Seymour sockeye passing the Mission hydroacoustic site were plotted for four dominant cycle years (Figure 1) and four sub-dominant cycle years (Figure 2). The Scotch/Seymour stocks were included because, prior to the implementation of microsatellite DNA analyses in 2000, it was not possible to reliably distinguish these "Early Summer-run" stocks from the Late-run Shuswap stocks. These stocks rear in Shuswap Lake and thus they have very similar growth patterns on their scales. Before 2000, managers typically relied on scale analysis to identify Shuswap Lake stocks and used the period of declining abundance of Shuswap stocks in mid-late August as the indicator of the end of the Early Summer-runs and start of the Late-run stocks. If these criteria had been applied in 2002 and 2003, it is unlikely that any of the Late-run sockeye entering in the first half of August would have been assigned to Late-run stocks. Conversely, it is possible that some of fish assigned to the Scotch/Seymour stock group prior to 1995 were early entry Late-run Shuswap stocks.

Scotch Creek Fence Data

The data from the Scotch Creek counting fence provides an indication of run timing for Early Summer-run Shuswap stocks. Cumulative daily counts for 1994-2004 indicate that, on average, 87% of Scotch Creek sockeye pass the fence before the end of August (Figure 3). All four of the Scotch Creek sockeye radio-tagged in 2002 took 12 days to travel from Mission to Kamloops. Assuming a minimum travel time of 14 days between Mission and Scotch Creek, most Scotch Creek sockeye should have passed Mission by the middle of August as observed in 1998, 1999, 2002 and 2003. Therefore, a significant portion of the Mission counts assigned to the Scotch/Seymour stocks after 15 August in 1987, 1990, 1991 and 1994 were possibly early entry Late-run Shuswap sockeye (see Figures 1 and 2). It is possible that the migration timing of Scotch Creek sockeye may be earlier than estimated from fence data. Low water levels in Scotch Creek or fence operations could result in sockeye holding in Shuswap Lake or below the fence.

Harrison River Late-run Sockeye

The only direct evidence of early entry of Late-run stocks prior to 1995 is for Harrison Late-run sockeye in 1994. Scale data clearly indicated the presence of Sub 1 Harrison sockeye in sample obtained between 31 July and 13 August 1994 (Figure 4). While the estimates of the escapement past Mission during this period were very small, the distinctiveness of Sub 1 sockeye provides a higher degree of confidence that some Late-run fish entered very early in 1994. The Mission data for 2000-2004 show clear evidence of river entry in late July and throughout August and data from 1995-97 show entry starting in the middle of August. These data also show that there is no evidence of early entry for Harrison Sub 1 stocks in any year prior to 1994. With the exception of 1982 and 1991, abundances of Harrison Sub 1 sockeye were probably too low to detect any early entry of Harrison Sub 1's prior to 1994. In 1982, we would not have predicted that Late-run stocks would enter early because of the relative low abundance of Summer-run stocks. However, the abundance of Summer-run stocks in 1991 should have been sufficient to influence the entry timing of Late-run stocks. Further analysis of the daily abundance estimates for both stock groups is required to assess why early entry did not occur or was not detected in 1991 (see model results below).

Sweltzer Creek Fence Data (Cultus Sockeye)

Daily counts from the Sweltzer Creek fence represent the longest and most reliable time series of run timing information for a Late-run sockeye stock (1941-2003). These data show a clear and substantial shift towards earlier run timing after 1998 (Figure 5). The first observations of sockeye at the fence in 1996 and 1998 were earlier than most of the counts since the 1960's but there were several years prior to 1960 when sockeye were recorded at the fence in mid-September. In recent years, the earlier timing at the fence could be partially explained by lower harvest rates allowing more fish to escape. However, the much lower counts during the historical peak interval (late October and mid-November) clearly suggests that run timing has shifted. Historically, Cultus sockeye had one of the latest river entry and spawning times of all Fraser sockeye stocks. The Sweltzer Creek 50% date is approximately 10 – 14 days later than the Mission late-run 50% date (Forrest 2004). Consequently, it is possible that, of all Late-run sockeye, Cultus would have the least overlap with Summer-run stocks. The lack of early fence counts prior to 1994 may be a reflection of the lack of overlap in marine timing between Cultus sockeye and Summer-run sockeye. A shift towards earlier return timing in recent years, for whatever reason, would increase the overlap with Summer-run stocks in marine waters and the potential for Cultus sockeye be affected by the more abundant Summer-run stocks. Unfortunately, the data available on the historical marine run timing of Cultus sockeye is not adequate to resolve this question.

Weaver Spawning Channel Entry Timing

Information on entry timing into the Weaver Creek was obtained for 1938 to 2004. Data for 1938 to 1964 were for years prior to construction of the spawning channel. From 1965 to 2004, entry was largely controlled by spawning channel flows. The first entry into the spawning channel typically occurred within a few days after increasing the flows to a level where entry could occur. Information on sockeye arrival in Morris Lake is also of little use because Weaver

sockeye are believed to hold in Harrison Lake or the Harrison River for extended periods prior to entering Weaver Creek. This belief was supported by the 2003 and 2004 telemetry studies where many of the Weaver Creek sockeye that entered the Harrison River in August or early September were detected moving upstream into Harrison Lake. A few of these fish were detected moving downstream and into Weaver Creek in late September or early October but most we never tracked again and are believed to have died in Harrison Lake (English et al. 2004; Sliwinski et al. 2005).

Summary

The run timing data for Cultus and Harrison sockeye clearly supports the contention that there has been a significant shift in the river entry timing for these stocks in recent years (Figures 4 and 5). However, the lack of an early entry component for Cultus sockeye prior to 1995, is not conclusive evidence that other Late-run stocks did not have had an early entry component prior to 1995. For example, Harrison Sub 1's show clear evidence of an early entry component in 1994 yet no Cultus sockeye were counted past the Sweltzer Creek fence until 6 October 1994. It is also possible that the recent shift in Cultus and Harrison sockeye run timing could be due to earlier marine run timing and greater overlap with Summer-run stocks.

While there is no direct evidence of an early entry component for Late-run Shuswap stocks, there is clear evidence that our ability to detect early entry of Shuswap stocks changed substantially after 1995. The major reasons for this change were: 1) the awareness that early entry was occurring in lower river stocks (Figures 4 and 5); 2) the higher probability of occurrence of early entry after 1995 (Table 1); and 3) the collection and analyses of an increasing number of DNA samples (Steve Latham, PSC, pers. comm.). While the available data is inconclusive for Late-run stocks destined for Shuswap spawning areas, it is possible that some of these Late-run sockeye could have entered the river early in years before 1995 and were mistakenly assigned to the Scotch/Seymour Early-summer run stock group. It is also possible that early river entry is a recent year phenomenon for all Late-run sockeye, and physical changes in the LGS environment and/or changes in the distribution and behaviour of sockeye in LGS after 1994 may have altered the effect of Summer-run stocks on Late-run behaviour. Therefore, the available information is not sufficient to reject the possibility that Summer-run abundance could affect Late-run behaviour in some years.

In the next sections, we describe a model that can be used by fisheries managers during pre-season planning and in-season management process to estimate the potential influence of Summer-run stocks on the river entry timing and survival of Late-run sockeye.

SWTS MODEL

The primary purpose of the model was to estimate the number of Late-run sockeye that would likely enter the Fraser River with Summer-run stocks and provide the associated estimate of en-route survival rate for Late-run stocks. The most critical component of the SWTS Model was the data inputs. Consequently, the majority of the time and effort spent developing this model was expended in the compilation and validation of the input data.

Model Formula and Analysis Methods

The primary inputs to the model are daily abundance estimates for Summer-run and Late-run sockeye entering Lower Georgia Strait. Pre-season estimates were derived from DFO forecasts of run size and run timing for these stocks. In-season estimates were derived from a combination of test fishery data and in-season forecasts. Post-season estimates were obtained from the Pacific Salmon Commission (PSC) run reconstruction analyses. The post-season PSC analyses provided:

a) Estimates of the daily abundance of Summer-run and Late-run stocks entering the lower portion of the Strait of Georgia (derived from marine test fisheries and available stock identification data);
b) Estimates of the daily commercial harvest of Late-run stocks in terminal fisheries (derived from catch statistics and stock composition data for each fishery); and
c) Estimates of the daily escapement of Late-run stocks (derived from Mission hydroacoustic abundance estimates and stock composition data from in-river test fisheries);

The model uses the following formula to estimate the number of Late-run sockeye that will enter the Fraser River each day using the daily abundance estimates for Summer-run and Late-run stocks derived from marine test fisheries. The first step in the sequence of calculations is to estimate the number of Late-run sockeye residing in the Strait of Georgia off the mouth of the Fraser River on day t (LR_t):

$$LR_t = LR_{t-1} + LA_t - LGE_t \text{ when } LGE_t \geq LC_t$$
$$\text{or}$$
$$LR_t = LR_{t-1} + LA_t - LC_t \text{ when } LGE_t < LC_t$$

where LA_t is the number of Late-run sockeye arriving in lower Strait of Georgia on day t; LGE_t is the model estimate of the number of Late-run sockeye that escape into the Fraser River on day t (i.e. gross escapement) of those fish that arrived in lower Strait of Georgia on day t-2; and LC_t is the harvest of Late-run sockeye in the lower Fraser River on day t of those fish that arrived in lower Strait of Georgia on day t-2 and entered the Fraser River on day t. The comparison of gross escapement to the in-river catch for that day was necessary because there were occasions when the daily catch exceeded the estimated gross escapement. The estimated gross escapement on day t (LGE_t) is:

$$LGE_t = LA_{t-2}\,(1 - P1_{t-2} * P1_{t-2} * P2_{t-2})$$

where $P1_{t-2}$ was the portion of sockeye present of the mouth of the Fraser River that are Late-run stocks:

$$P1_{t-2} = \frac{(LR_{t-3} + LA_{t-2})}{(LR_{t-3} + LA_{t-2} + SA_{t-2})}$$

where SA_{t-2} is the daily estimates of the number of Summer-run sockeye arriving in the lower Strait of Georgia on day t-2.

$P2_{t-2}$ is an estimate of the probability that the arriving Late-run fish would encounter a school of resident Late-run fish. This probability was assumed to be 100% if the abundance of resident Late-run fish was greater than 100,000. When the abundance of Late-run sockeye is between zero and 100,000, P2 is estimated using the following equation for a sigmoid curve:

$$P2_{t-2} = \frac{1}{1 + e^{(0.0001 \bullet (50{,}000 - LR_{t-3}))}}$$

The shape of this sigmoid curve is shown in Figure 6. The parameter estimates were derived by comparing model results with PSC estimates for the number of Late-run sockeye migrating after Summer-run sockeye for all available years of data. Model results are not sensitive to these parameter values in years where the abundance of Late-run stocks was similar or larger than Summer-run stocks. The model results are more sensitive to these parameters in years where Late-run abundance was much lower than Summer-run abundance.

The biological rationale for the P1, P2 and the equation that uses these factors to compute the number of Late-run sockeye that delay in LGS and the daily gross escapement of Late-run sockeye was:

1. schools of sockeye arriving in LGS will contain both Summer-run and Late-run stocks;
2. the behaviour of the Late-run stocks will depend on their relative abundance in the arriving schools and the abundance of Late-run sockeye residing in LGS from the schools that arrived on previous days;
3. the potential for arriving sockeye to encounter schools of holding (i.e. delaying) Late-run sockeye in LGS will be very low when there are less than 30,000 Late-run sockeye holding in LGS, and this value will be the key determinant of the percent of Late-run sockeye that enter the river with summer-run stocks; and
4. once the number of Late-run sockeye holding in LGS exceeds a threshold (current set at 100,000), the key determinant of the percent of Late-run sockeye that enter the river with Summer-run stocks will be the portion that Late-run stocks represent of all the sockeye in LGS;
5. the shape of the relationship between the percent of Late-run sockeye that enter the river with Summer-run stocks, and the portion that Late-run stocks represent of all the sockeye in LGS, would not be linear (the current model uses a square function, $P1^2$).

Data Sources and Verification

During the preliminary analyses phase, we obtained the following estimates for variables required to run and evaluate the SWTS Model:

1. the number of Late-run sockeye arriving in lower Strait of Georgia each day (LA_t) derived from marine test fishery data;

2. the number of Summer-run sockeye arriving in lower Strait of Georgia each day (SA_t) derived from test fishery data for some years and Mission escapement estimates in other years;
3. the harvest of Late-run sockeye in the lower Fraser River each day (LC_t); and
4. estimates of the daily escapement of Late-run sockeye past the Mission hydroacoustic site.

These estimates were provided by the PSC for all years between 1990 and 2002 except 1992, 1993 and 1997. In 1992, 1993 and 1997, estimates of the number of Late-run sockeye arriving in LGS were considered unreliable because of the low abundance of Late-run stocks relative to Summer-run stocks (Jim Cave, PSC, pers. comm.). For our preliminary analyses, no attempt was made to determine or verify the sources for these estimates.

During the second phase of our analyses, we obtained detailed run reconstruction data for each year from 1998-2003 (Jim Cave, PSC, pers. comm.) and a complete revised set of daily Mission escapement estimates for each run timing group from 1977-2003 (Jim Gable, PSC, pers. comm.). The detailed run reconstruction data obtained for 1998-2003 were used to verify or adjust the preliminary PSC estimates for these years and identify adjustment to model input values for 1990, 1991, and 1994-1996.

Detailed examination of the 1998-2003 data revealed very few days when the test fishery estimate of the number of Late-run sockeye entering LGS was too low to account for the subsequent gross escapement to the Fraser River (i.e. lower river catch plus Mission escapement estimate). For these few days at the beginning of the Late-run in 2001 (July 23-31), we replaced the test fishery estimates with the back dated gross escapement estimates.

Assessment of Test Fisheries Data

Daily estimates of the number of Summer-run sockeye and Late-run sockeye entering Lower Georgia Strait were derived from the Juan de Fuca and Johnstone Strait purse seine test fishing data. The reliability of these data for estimates of sockeye run timing and abundance was assessed using by comparing the test fishery estimates for Summer-run stocks with those derived by summing daily lower river catches and Mission escapement estimates for the same Summer-run stocks. Assuming a travel time of 5 days between Area 20 and Mission, we found that the daily test fishery estimates can be substantially different from those derived from Mission plus catch (Appendix Figure A1-A3). These daily differences were largely due to the high variability in test fishery catches, so we also computed the 3-day moving average of the test fishery estimates. The moving average tended to track the Mission plus catch estimates fairly well with the exception of short intervals of 3-5 days each year. Within year variability in travel times is another possible explanation for these differences but an average travel time of 5 days (from test fishery to below bridge escapement) appears to be appropriate for each of the years examined in detail (1998-2003).

The estimates for Late-run sockeye could not be compared in this manner because of the within year variability in travel times from the test fishery locations to Mission due to the variability in delay behaviour for these stocks.

Adjustments to 1990-1996 Estimates

The above observations prompted us to convert the daily test fishery estimates provided for 1990-1996 into 3-day moving averages for both Summer-run and Late-run stocks entering LGS. Comparison of entry run size and daily catch estimates for Late-run stocks revealed many more instances when the catch exceeded the test fishery abundance estimate, especially in 1994 and 1995. For these instances and all other similar occurrences, the daily catch was subtracted from the number of Late-run fish residing in LGS, as described above.

Harrison River Late-run Migration in 1991

Our initial assessment of the relative abundance of Summer-run and Late-run returns in 1991 suggested that some Late-run sockeye should have entered early in 1991 and this early entry component would likely have including some Harrison River Sub 1 sockeye. Our ability to detect the presence of these fish in 1991 was assessed by estimating the potential contribution of Harrison Sub 1 sockeye to the daily sockeye escapement during the Summer-run migration period. In 1991, the total Mission escapement of Harrison Sub 1's (83,000) represented 5.4% of the Mission escapement estimate for all Late-run stocks (1,532,000). This percentage was applied to the model estimates of the daily escapement of Late-run stocks. The resulting values were combined with the daily escapement estimates for summer-run stocks to compute the portion that Harrison Sub 1's in each day's escapement.

Model Results

The SWTS model was used to estimate the number of Late-run sockeye that enter the Fraser River each day during the period when Summer-run and Late-run stocks are co-migrating through marine areas. Given the uncertainty associated with the daily Mission escapement and catch estimates for Late-run stocks in August prior to 2000, we did not compare the daily escapement estimates derived from the Model with the values reported by the PSC. Instead, we compared the SWTS model estimates of the number of Late-run sockeye in LGS at the end of the Summer-run with the reported PSC estimates for Late-run sockeye escapement past Mission after the end of the Summer-run. The end of the Summer-run was the date when more than 99.5% of the Summer-run had passed the Mission hydroacoustic site. The PSC estimates varied from 12,000- 4,143,000 for the years examined and the annual estimates derived from the SWTS model were similar to the PSC estimates in most years (Figure 7, Table 2). The SWTS model estimates ranged from 6,000 to 5,550,000 and tended to be slightly lower than the Mission estimates in years when the numbers of Late run sockeye entering LGS was less than 800,000 (1995, 1996, 2000, 2001). In years when Late-runs entering LGS were between 800,000 and 4,100,000 (1990, 1991, 1994, 1998, 1999), the Model estimates were similar to the Mission values with no consistent bias. In 2002, when the Late-run abundance arriving in LGS was estimated to exceed 6.9 Million, the model estimate (5.5 Million) was higher than the PSC estimate (4.1 Million).

The SWTS Model estimates for 1991 suggested that 367,000 (21%) of the Late-run sockeye would have entered during the Summer-run migration period. The Harrison Sub 1 component of the Late-run stocks (5.4%) was 19,800. Overall, this represented less than 1.5% of the total

sockeye escapement (1,360,000) during the period when Late-run stocks were migrating past Mission with Summer-run stocks and there were no days when the Harrison Sub 1 component was estimated to be more than 3% of the daily sockeye escapement. Therefore, the potential for detecting the presence of Harrison Sub 1's in the early entry components would have been very low in 1991. In other years, like 2002, there were periods when the % Sub 1's were a much larger component of the daily escapement (9-13%) than estimated for 1991 but there were other periods when Sub 1's were detected but they were less than 1% of the escapement. Once again, it is possible that the scale sampling data was adequate to detect this stock in 1991 and Harrison Sub 1's did not enter early in that year.

The Model estimates of the daily escapement during the Summer-run period were combined with timing-specific survival curves from the 2002 and 2003 radio-telemetry studies (English et al. 2003; 2004) to compute an estimate of the expected en-route mortality for the early entry component of the Late-run sockeye return. Water temperature data for the Fraser Canyon during the Late-run migration were used to select the appropriate survival curve for each year. The mean and maximum temperature observed during the 31-day period centered on the 50% date for the passage of Late-run sockeye through Hells Gate are provided in Table 3 along with the 50% timing dates for the Late-run at Mission and Hells Gate (Ian Guthrie, PSC, pers. comm.). The 2002 survival curve was used for all years when the mean water temperatures were less than 16.0°C (i.e. 1994, 1997, 1999 and 2002) and for the two years without temperature data (1991 and 1995). The 2003 survival curve was use for the other model analyses years (1990, 1998, 2000, 2001, 2003) where mean temperatures ranged from 16.3 °C to 17.5 °C.

The en-route mortality rate for Late-run sockeye that entered after the Summer-run migration was assumed to be 10% based on the combined results from the 2002 and 2003 radio-telemetry studies (English et al. 2003; 2004). The estimated mortalities for both periods were combined to compute a total in-river mortality rate for each year. These mortality rates ranged from a low of 18% for 1991 to a high of 83% for 2000 (Figure 8). As expected, the highest mortality rates were estimated for 2000 and 2001 when most of the Late-run entered the Fraser River before the end of August and the lowest mortality rates were estimated for 1990, 1991 and 2002 when most of the Late-run fish migrated past Mission after mid-September.

Table 3 includes a comparison of the DFO spawning escapement estimates and the PSC estimates for potential spawners (Ian Guthrie, PSC, pers. comm.). It should be noted that these estimates include both en-route and pre-spawn mortality and estimation errors. The current version of the SWTS model only estimates en-route mortality. Therefore, the model estimates of losses above Mission should be lower than those in Table 3 when estimation errors are small.

DISCUSSION

Detailed examination of the historical data clearly shows a substantial shift in the migration timing for some Late-run stocks. However, the available data are not sufficient to reject the possibility that early entry of some Late-run stocks could have occurred undetected prior to 1995. If it did occur, it was likely sporadic in a few stocks, which is different from the current behaviour which has been occurring in all late-run stocks since 1995. It is possible that some unknown environmental factor may have altered encounter rates of summer and late run fish in

Georgia Strait, resulting in different schooling related behaviour since 1995. Regardless, of whether or not early entry occurred prior to 1995, the SWTS model provides a useful tool for assessing the potential impact of the annual variation in the timing and abundance of Summer-run and Late-run stocks on the escapement timing of Late-run stocks. This information coupled with water temperature data can be used to estimate en-route mortality rates for Late-run stocks. These estimates should be useful in the definition of Mission escapement targets for Late-run sockeye and development of fishing plans for both summer-run and Late-run stocks. The current SWTS Model provides estimates of the Mission escapement of Late-run sockeye, after the Summer-run migration period, that are consistent with the PSC estimates for all years examined. However, there are only a few recent years where DNA analysis has provided reliable estimates of the Late-run component that entered the river during the Summer-run migration period. More years of years where stock composition is determined from representative DNA samples will be required before this or any subsequent version of the model can be thoroughly evaluated.

Additional studies could be undertaken using acoustic telemetry to obtain specific information on the distribution and behaviour of Summer-run and Late-run stocks in LGS. However, substantial resources would be required to conduct detailed tracking of sockeye movements in LGS in several years with different abundances of Summer-run and Late-run stocks. These studies could provide information on the extent to which marked Summer-run sockeye are separated from Late-run sockeye but this would not provide conclusive evidence of the spatial proximity of these stocks because we would still not know the distribution and stock composition of the larger group of unmarked sockeye. The most useful information that could be contributed from these studies would be similar to that obtained from the 2002 and 2003 radio telemetry projects where some Late-run sockeye were clearly documented migrating upstream past Mission with large numbers of Summer-run while others, tagged at the same time and locations, resided in LGS for extended periods of time and migrated upstream after the Summer-run stocks (English et al. 2003; 2004). The key variable that needs to be measured at different relative abundances of Summer-run and Late-run stocks is the portion of the Late-run fish that enter early. This could be obtain using either acoustic or radio telemetry techniques but both would be costly since a substantial number of tags would need to be applied to Late-run stocks as they migrate through Johnstone Strait or Juan de Fuca Strait, as in the 2002 and 2003 studies. This is not practical in the off-cycle years like 2004 and 2005 when Late-run abundance is very low compared to that of Summer-run stocks. However, it may be practical to consider additional marine tagging efforts in 2006 dominant cycle or 2007 sub-dominant cycle years for Late-run stocks.

ACKNOWLEDGEMENTS

Funding for this project was provided by the Southern Endowment Fund of the Canada-US Pacific Salmon Treaty under the auspices of the Pacific Salmon Commission. This project could not have been undertaken without the information collected annually by the Pacific Salmon Commission and Department of Fisheries and Oceans staff. Special thanks to Jim Gable and Ian Guthrie for organizing much of the critical data and providing it in a timely manner. We also thank those who assisted in the preparation and review of this report, Cezary Sliwinski, Dave Robichaud and Dorothy Baker of LGL Limited.

LITERATURE CITED

Blackburn, D.J. 1987. Sea surface temperature and pre-season prediction of return timing in Fraser River sockeye salmon. Canadian Special Publication Fisheries and Aquatic Science 96:296-306.

Cooke, S.J., S.G. Hinch, A.P. Farrell, M.F. Lapointe, S.R.M. Jones, J.S. Macdonald, D. A. Patterson, M.C. Healey and G. Van Der Kraak. 2004. Abnormal migration timing and high en route mortality of sockeye salmon in the Fraser River, British Columbia. Fisheries 2:22-33.

Cooke, S.J., G.T. Crossin, D. A. Patterson, S.G. Hinch, K.K. English, M.C. Healey, J.S. Macdonald, J.M. Shrimpton, J.L. Lister, G. Van Der Kraak and A.P. Farrell. In prep. Evaluating the physiological correlates of estuarine arrival and potential triggers of river entry in Late-run Fraser River sockeye salmon (Oncorhynchus nerka) by coupling telemetry of individual behaviour and non-lethal biopsies. Canadian Journal of Fisheries and Aquatic Sciences xx:xxxx.

English, K.K., W.R. Koski, C. Sliwinski, A. Blakley, A. Cass, and J. Woodey. in press. Migration timing and in-river survival of Late-run Fraser River sockeye using radio-telemetry techniques. Transactions of the American Fisheries Society xx:xxxx.

English, K.K., C. Sliwinski, M. Labelle, W.R. Koski, R. Alexander, A. Cass, and J. Woodey. 2004. Migration timing and in-river survival of Late-run Fraser River sockeye using radio-telemetry techniques, 2003. Report prepared by LGL Limited, Sidney, BC for the Pacific Biological Station of Fisheries and Oceans Canada. 103 p.

English, K.K., W.R. Koski, C. Sliwinski, A. Blakley, A. Cass, and J. Woodey. 2003. Migration timing and in-river survival of Late-run Fraser River sockeye using radio-telemetry techniques, 2002. Report prepared by LGL Limited, Sidney, B.C for the Pacific Biological Station of Fisheries and Oceans Canada.

Forrest, K.W. 2004. Late-run Fraser River sockeye salmon early upstream migration timing and the implications for sustainable management. M.Sc. Thesis Royal Roads University, Victoria, B.C. 79 p.

Freon, P. and O.A. Misund. 1999. Dynamics of pelagic fish distribution and behaviour: effects on fisheries and stock assessment. Fishing New Books, Malden, MA.

Gable, J. and S. Cox-Rogers, 1993. Stock Identification of Fraser River sockeye salmon. Pacific Salmon Commission Tech. Report No.5. October 1993. Pacific Salmon Commission, Vancouver, BC. p.36.

Gilhousen, P.A. 1960. Migratory behaviour of adult Fraser River sockeye. International Pacific Salmon Fisheries Commission. Progress Report no. 7. 78 p.

Johannessen, D.I. and P.S. Ross. 2002. Late-run sockeye at risk: an overview of environmental contaminants in Fraser River Salmon habitat. Can. Tech. Rep. Fish.Aquat. Sci. No. 2429.

Larkin, P.A. and A. Walton. 1969. Fish school size and migration. J. Fish. Res. Board Can. Vol. 26, 1372-1374.

Millar, R.B. 1987. Maximum Likelihood estimation of mixed-stock fishery composition. Canadian Journal of Fisheries and Aquatic Sciences. 44:583-590.

Sliwinski, C., K.K. English, A. Blakley, S.J. Cooke, S.G. Hinch, and T. Farrell. 2005. Migration timing and in-river survival of late-run Fraser sockeye returning to the Harrison watershed in 2004. Report prepared by LGL Limited, Sidney, BC for the University of British Columbia.

Wagner, G.N., Hinch, S.G., Kuchel, L.J., Lotto, A., Jones, S.R.M., Patterson, D.A., Macdonald, J.S., Van Der Kraak, G., Shrimpton, M., English, K.K., Larsson, S., Cooke, S.J., Healey, M.C., and Farrell, A.P. in press. Metabolic rates and swimming performance of adult Fraser River sockeye salmon after a controlled infection with *Parvicapsula minibicornis*. Canadian Journal of Fisheries and Aquatic Sciences xx:xxxx.

Table 1. Assessment of the potential for summer-run to influence late-run river entry timing and our ability to detect early entry of Late-run by cycle year before and after 1995.

	Mission Abundance			Area 20 Timing			Was Summer-run abundance sufficient to effect behavior of Late-run?	Was Late-run abundance sufficent to detect early entry?	Was marine return timing similar?	Could Summer-run have affected Late-run river entry timing and was it detectable?	
	Summers	Lates	%Lates	Summers	Lates	Diff (d)				1978-94	1995-03
Dominant Cycle											
1978	337,200	1,888,700	85%	3-Aug	20-Aug	17	No	Yes	No		
1982	520,200	3,533,100	87%	6-Aug	18-Aug	12	No	Yes	Marginal		
1986	1,021,653	3,499,388	77%	5-Aug	21-Aug	16	No	Yes	No		
1990	2,293,367	3,158,883	58%	16-Aug	20-Aug	4	Yes	Yes	Yes	Yes*	
1994	2,355,670	975,297	29%	10-Aug	17-Aug	7	Yes	Yes	Yes	Yes*	
1998	4,372,539	2,983,861	41%	9-Aug	15-Aug	6	Yes	Yes	Yes		Yes
2002	4,447,145	6,647,012	60%	7-Aug	13-Aug	6	Yes	Yes	Yes		Yes
Sub-dominant Cycle											
1979	715,379	543,240	43%	3-Aug	3-Aug	0	Marginal	Yes	Yes	Yes*	
1983	572,700	412,500	42%	4-Aug	17-Aug	13	Marginal	Yes	Marginal		
1987	640,521	647,652	50%	10-Aug	17-Aug	7	Marginal	Yes	Yes	Yes*	
1991	1,414,415	1,532,508	52%	10-Aug	19-Aug	9	Yes	Yes	Yes	Yes*	
1995	1,452,329	498,213	26%	10-Aug	18-Aug	8	Yes	Yes	Yes		Yes
1999	1,630,999	968,335	37%	3-Aug	15-Aug	12	Yes	Yes	Marginal		Yes
2003	2,086,526	870,621	29%	8-Aug	14-Aug	6	Yes	Yes	Yes		Yes
Off Cycle											
1980	743,600	159,300	18%	9-Aug			Yes	Marginal	Unknown		
1984	1,081,007	60,540	5%	5-Aug			Yes	No	Unknown		
1988	627,848	192,952	24%	29-Jul	3-Aug	5	Yes	Yes	Yes	Yes*	
1992	1,080,239	87,611	8%	14-Aug			Yes	No	Unknown		
1996	1,564,626	450,637	22%	7-Aug	9-Aug	2	Yes	Yes	Yes		Yes
2000	1,335,331	356,445	21%	4-Aug	7-Aug	3	Yes	Yes	Yes		Yes
Off Cycle											
1981	1,458,900	92,500	6%				Yes	No	Unknown		
1985	1,933,697	73,309	4%	8-Aug	14-Aug	6	Yes	No	Yes		
1989	2,882,933	140,452	5%	17-Aug			Yes	No	Unknown		
1993	4,341,731	85,688	2%	17-Aug			Yes	No	Unknown		
1997	4,244,736	79,448	2%	15-Aug	22-Aug	7	Yes	No	Yes		Yes
2001	4,170,794	309,828	7%	7-Aug	12-Aug	5	Yes	No	Yes		Yes
Total number of years										16	9
Number of years where Summer-run could have affected Late-run river entry timing and was it potentially detectable.										6	9
% potentially detectability*										38%	100%

* DNA analysis would be required to conclusively separate Early-summer Thompson stocks from Late-run Thompson stocks.

Table 2. Summary of model inputs and results for the 11 years analyzed between 1990 and 2003.

	Abundance Arriving in LGS			Late-run Escapement after Summer-run					
Year	Summers (x1000)	Lates (x1000)	% Lates	SWTS Model (x1000)	PSC Estimate (x1000)	Escapement from LGS[1] (x1000)	Early Entry (x1000)	% Early Entry	% In-river Mortality
1990	4280	4100	49%	2445	2896	4100	870	21%	26%
1991	1748	1757	50%	1304	1410	1757	367	21%	18%
1994	3460	2404	41%	524	851	1904	676	36%	43%
1995	1488	702	32%	291	357	702	292	42%	44%
1996	2277	529	19%	189	352	529	335	63%	43%
1998	3290	2368	42%	2303	2662	2368	830	35%	29%
1999	1654	1192	42%	611	506	1192	340	29%	36%
2000	1980	362	15%	51	70	362	342	94%	83%
2001	4238	334	7%	6	12	334	326	98%	78%
2002	4703	6909	59%	5550	4143	6909	1358	20%	23%
2003	2300	936	29%	463	247	936	470	50%	35%

[1] Escapement from LGS = Abundance arriving in LGS less the catch in LGS

Table 3. Summary of mean and maximum water temperature from the Fraser Canyon during the Late-run migration period along with the differences between the estimates of potential spawner and spawning escapement for all Late-run stocks (1990, 1994, 1996, 1998-2003).

					Late-run 50% Dates		Water Temperatures	
Year	Potential Spawners[1] (x1000)	Spawning Escapement (x1000)	Diff	% Diff	Mission Date	Hell Gate Date	Mean (°C)	Maximum (°C)
1990	3003	3761	758	25%	20-Sep	25-Sep	16.5	17.9
1994	910	1460	550	60%	24-Sep	29-Sep	15.7	16.2
1996	368	143	-225	-61%	6-Sep	11-Sep	14.9	17.7
1998	2834	1469	-1365	-48%	13-Sep	18-Sep	16.3	18.8
1999	961	370	-591	-62%	9-Sep	14-Sep	14.7	15.9
2000	335	15	-320	-96%	13-Aug	18-Aug	17.3	19.1
2001	305	45	-260	-85%	20-Aug	25-Aug	17.1	19.3
2002	6218	5727	-491	-8%	12-Sep	17-Sep	14.3	17.7
2003	642	447	-195	-30%	27-Aug	1-Sep	17.5	19.4

[1] Potential Spawners = Mission escapement estimate less the reported catch above Mission.

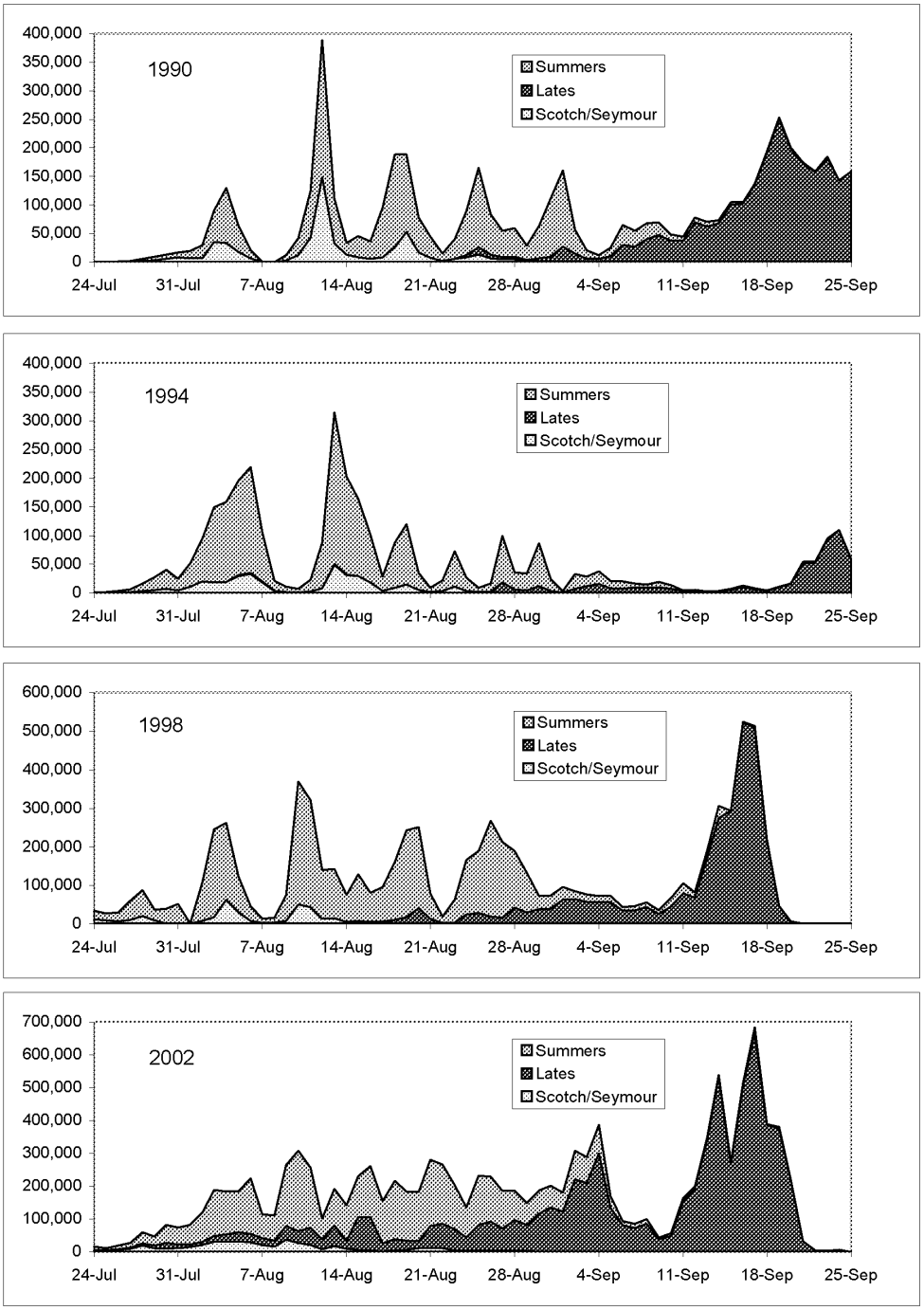


Figure 1. Daily escapement estimates for Summer-run, Late-run and Scotch/Seymour stock at Mission in four dominant cycle years for Late-run stocks.

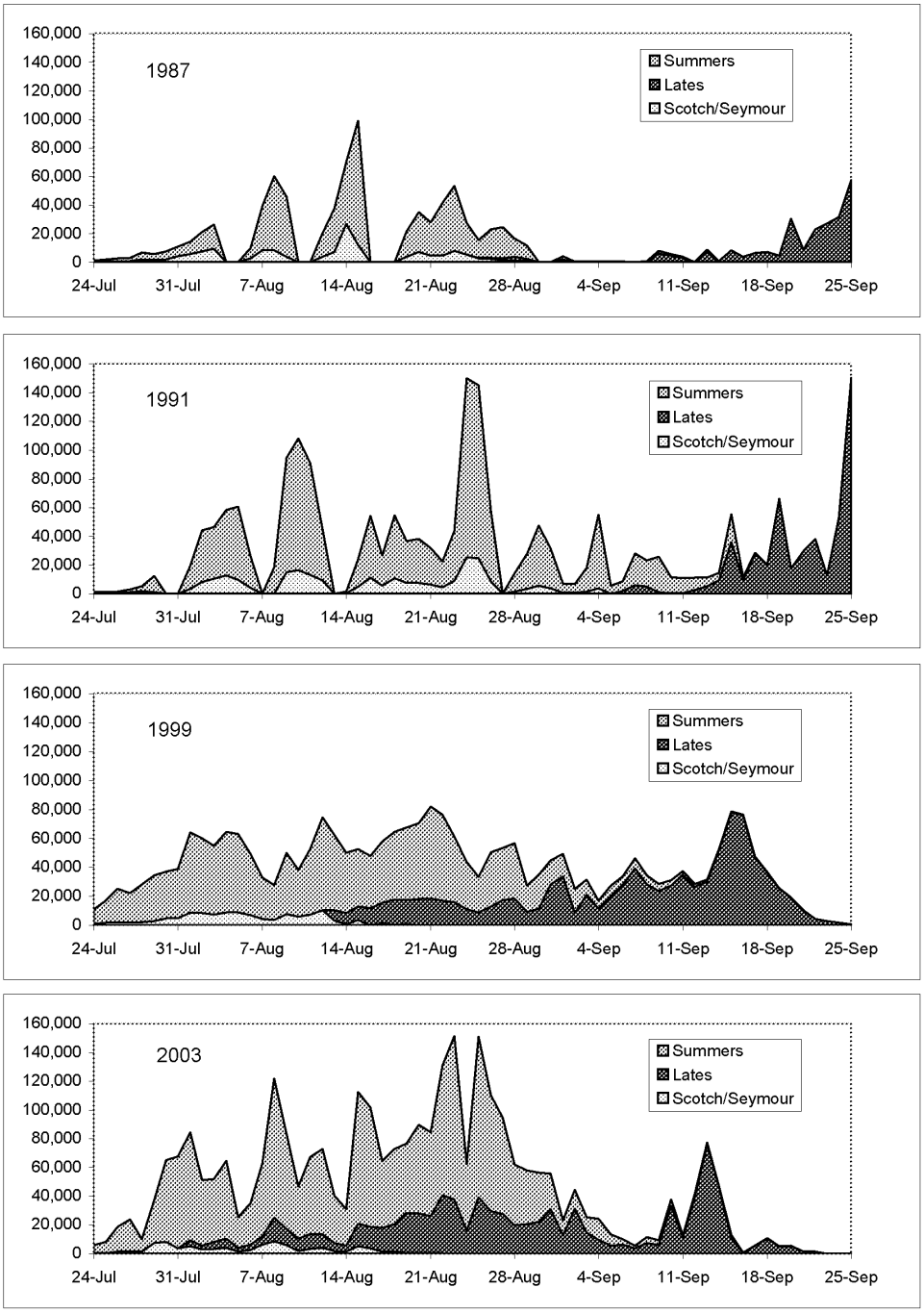


Figure 2. Daily escapement estimates for Summer-run, Late-run and Scotch/Seymour stock at Mission in four sub-dominant cycle years for Late-run stocks.

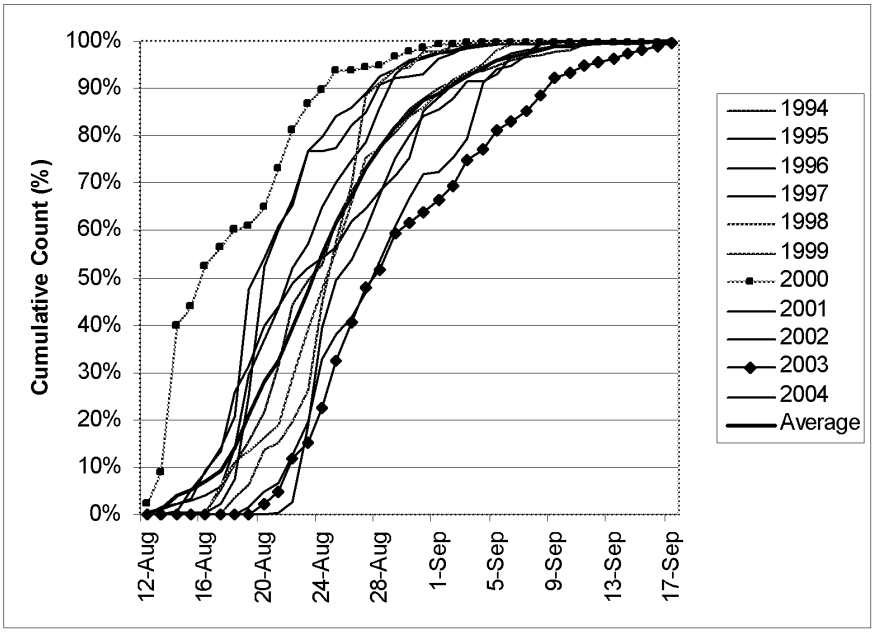


Figure 3. Cumulative count of sockeye at Scotch Creek fence, 1994-2004.

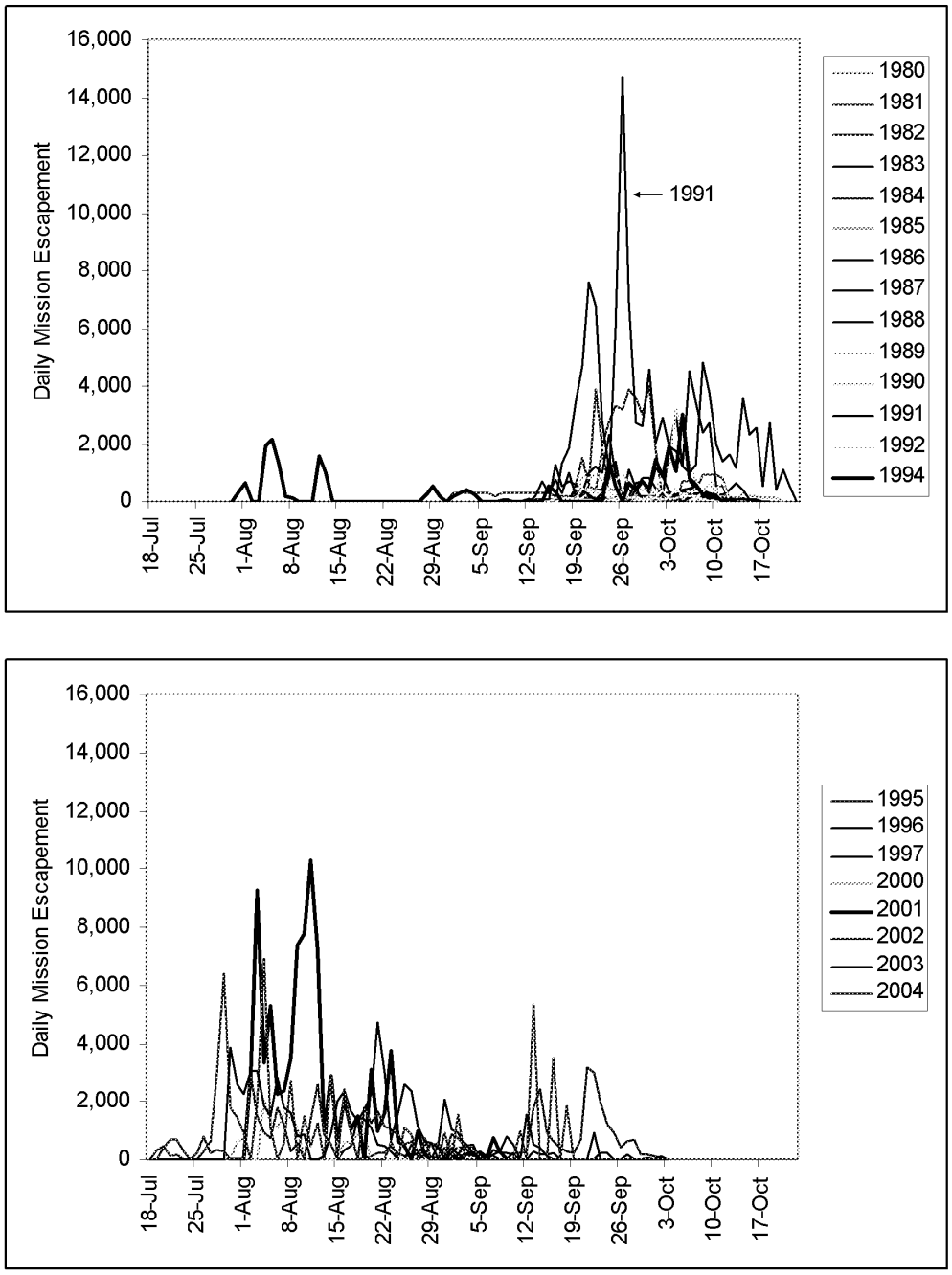


Figure 4. Daily escapement estimates for Harrison Sub 1 age sockeye at Mission for 1977-2004.

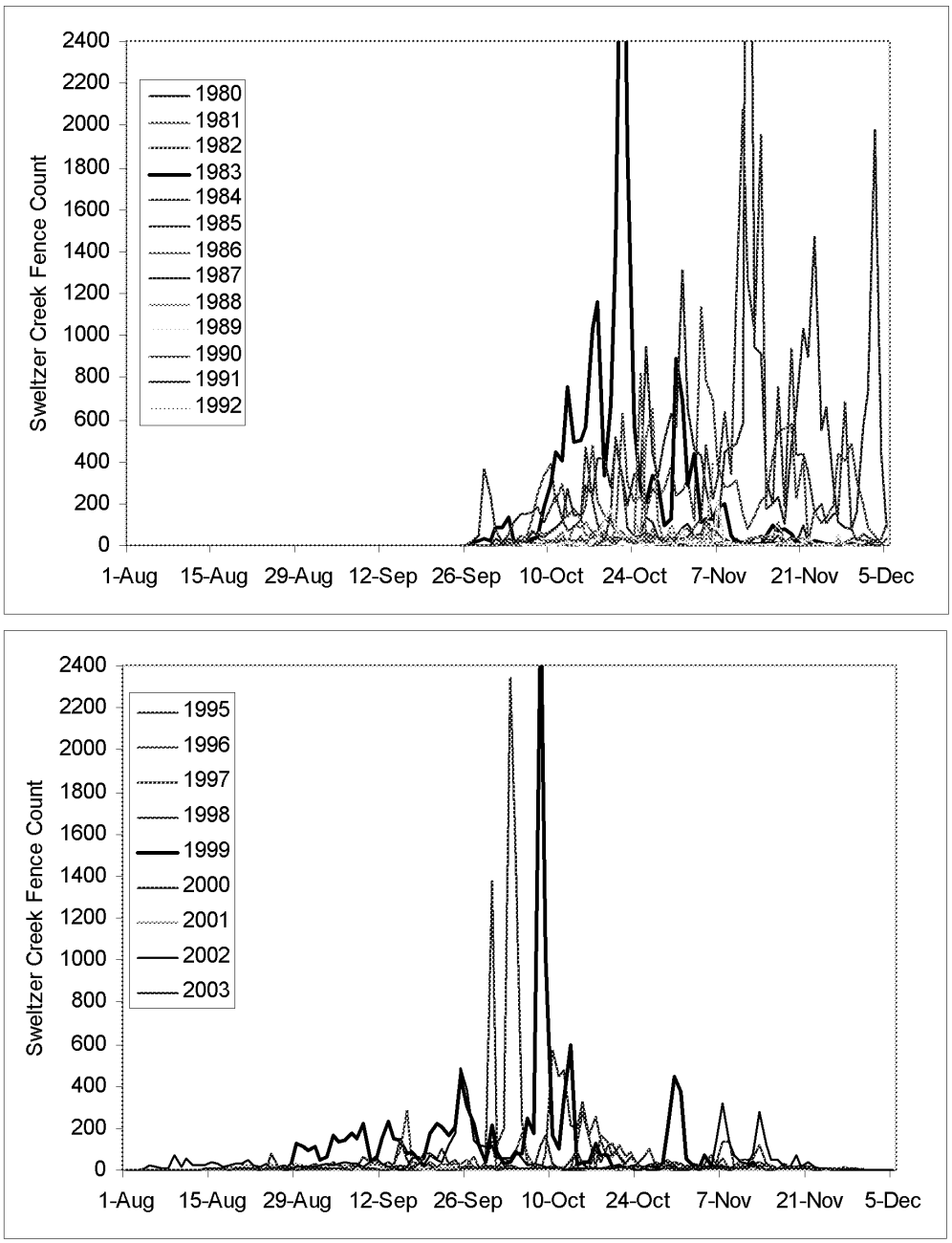


Figure 5. Daily counts of adult sockeye at the Sweltzer Creek fence, 1980-2003.

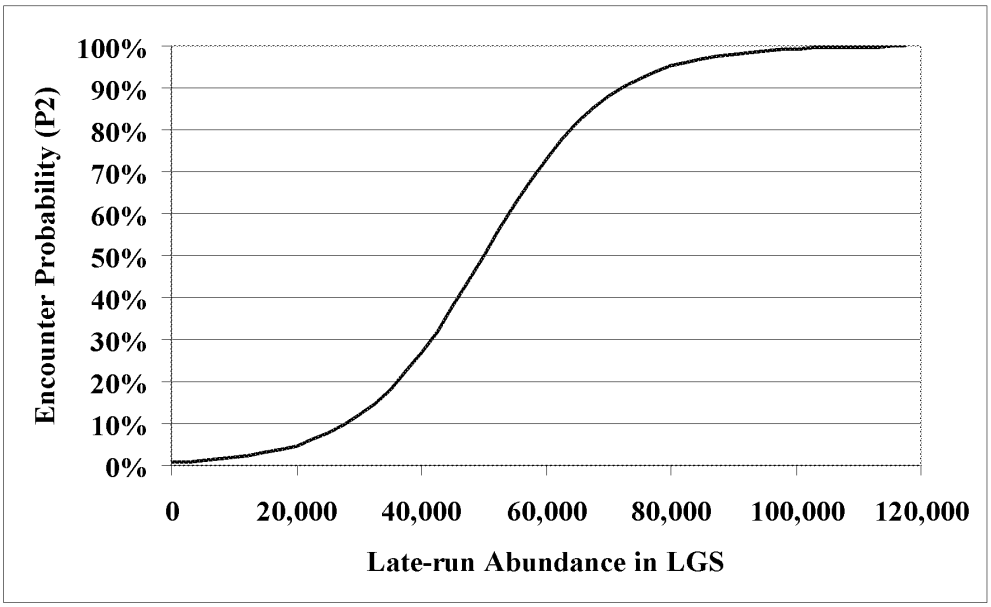


Figure 6. Sigmonid curve used to estimate encounter probability based on the abundance of Late-run sockeye in Lower Georgia Strait (LGS).

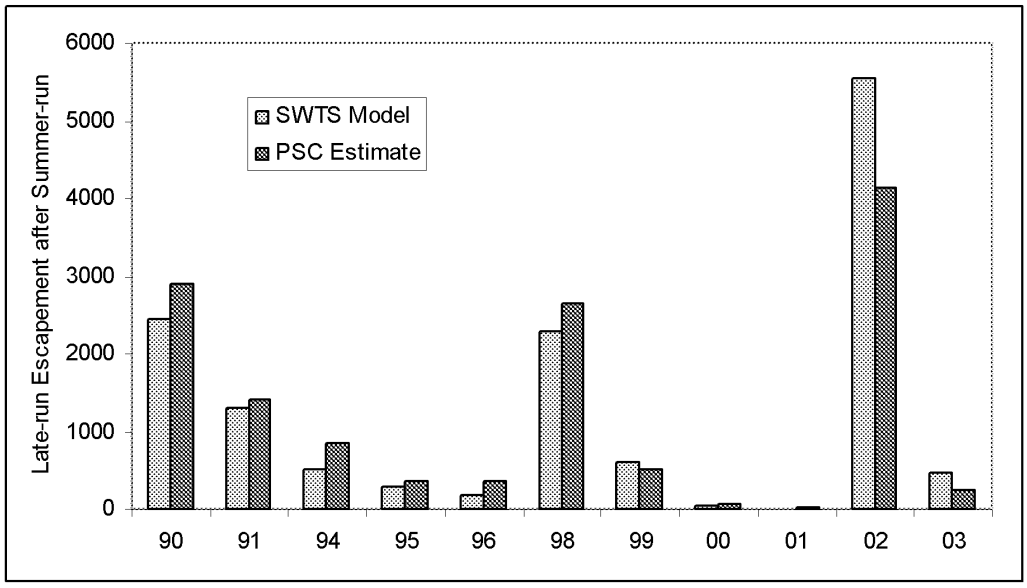


Figure 7. Comparison of SWTS Model estimates and Pacific Salmon Commission estimates of the number of Late-run sockeye that escape past Mission after the Summer-run.

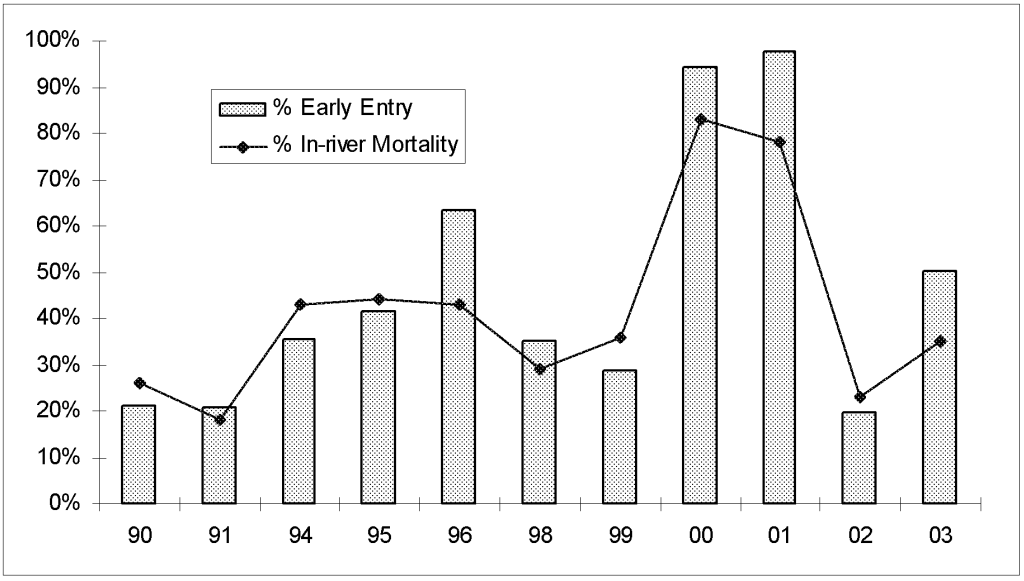
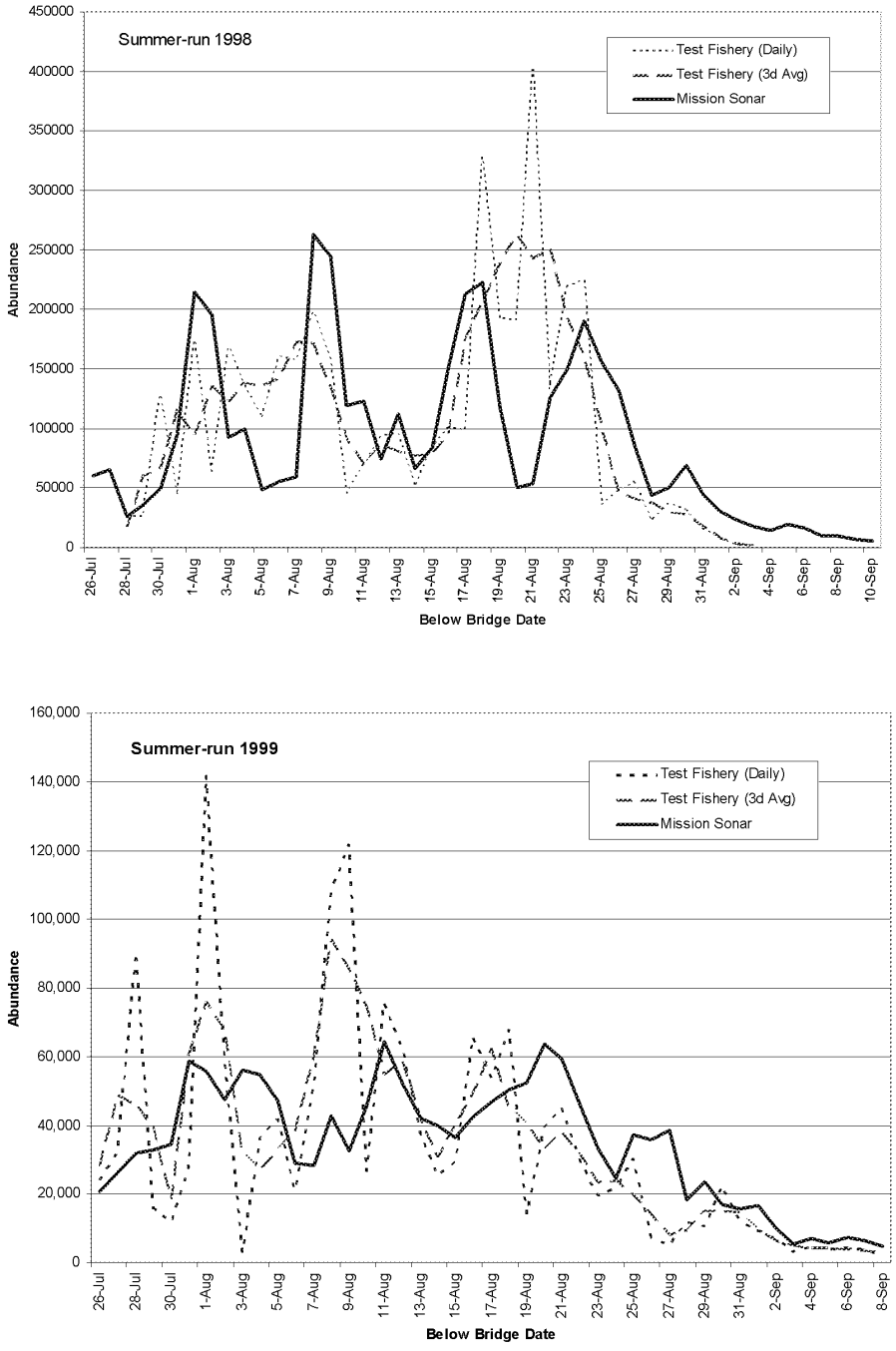
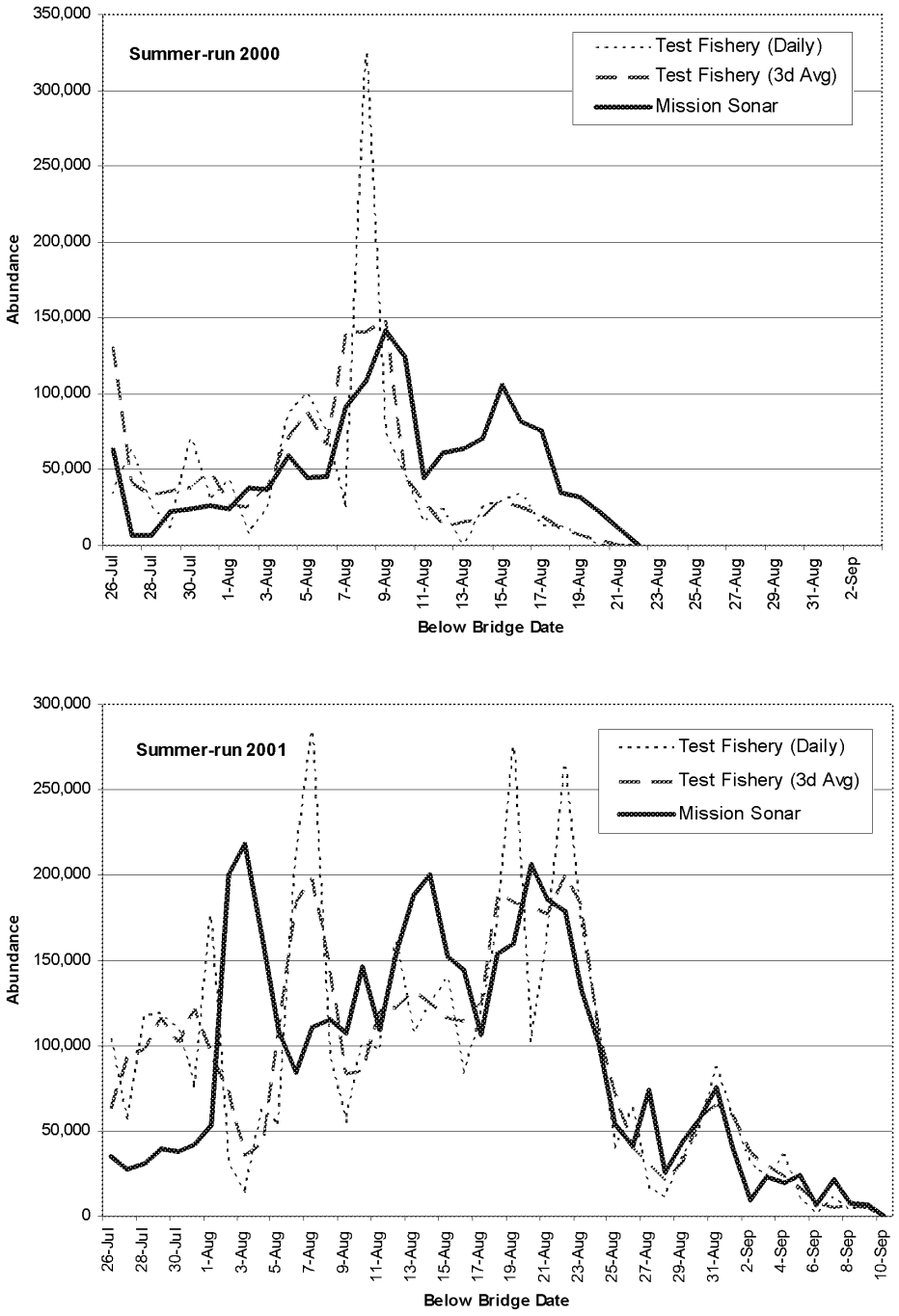


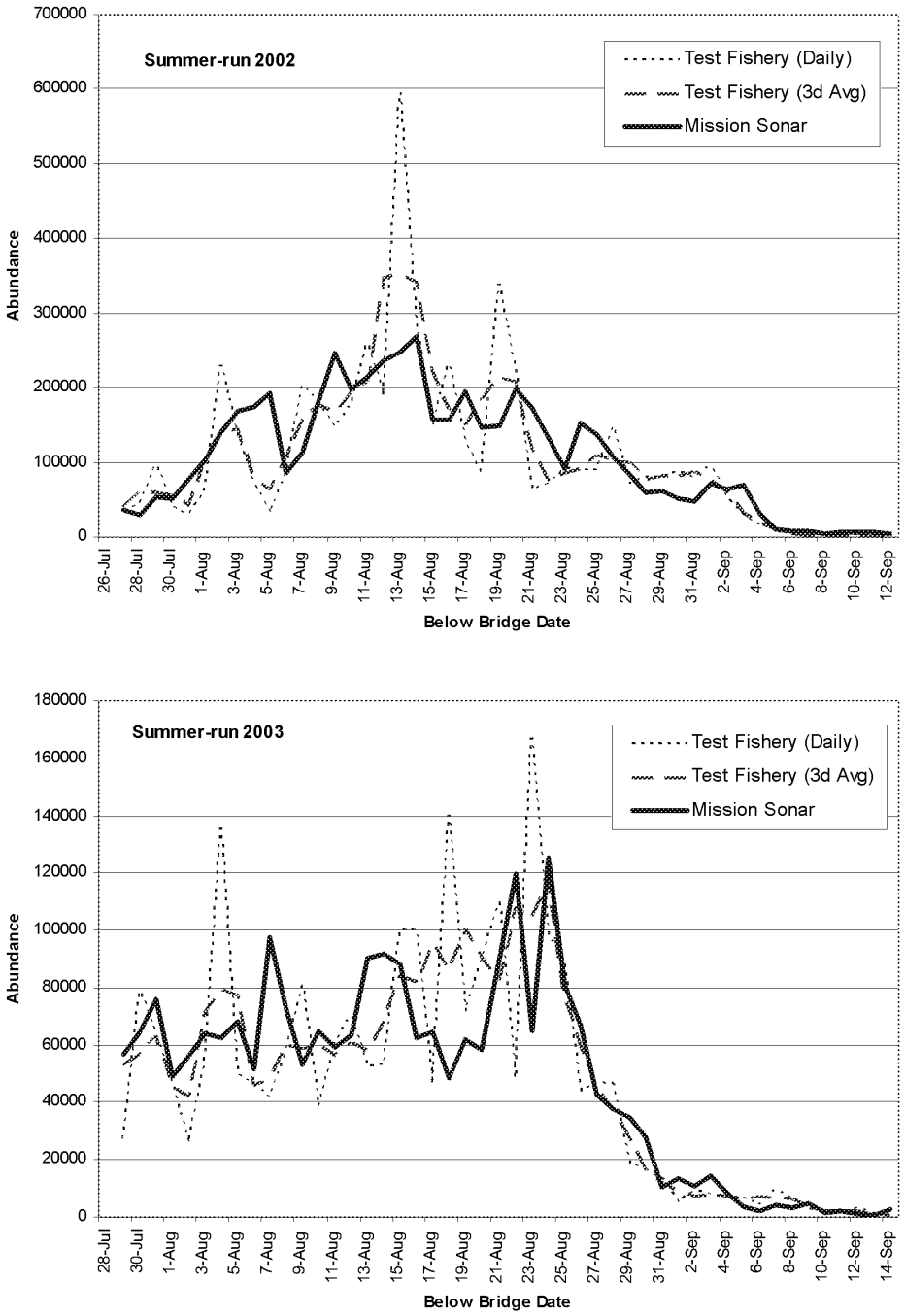
Figure 8. SWTS estimates of the portion of the Late-run that enters the Fraser River with the Summer-run stocks and the estimated mortality rate between Mission and the spawning grounds derived using the survival curves obtained from the 2002 and 2003 sockeye radio-telemetry studies (English et al. 2003; 2004).



Appendix Figure A1. Comparison of Mission escapement and test fishery estimates of daily abundance for Summer-run stocks, 1998 and 1999.



Appendix Figure A2. Comparison of Mission escapement and test fishery estimates of daily abundance for Summer-run stocks, 2000 and 2001.



Appendix Figure A3. Comparison of Mission escapement and test fishery estimates of daily abundance for Summer-run stocks, 2002 and 2003.

Appendix Table B1. Stay With the School (SWTS) model results for 1990.

Area 20 Date	Seine Test Fishery Summer-run Entry	Seine Test Fishery Summer-run 3d AVG	Seine Test Fishery Late-run Entry	Seine Test Fishery Late-run 3d AVG	Catch	Total Sockeye	Late-Run % in LGS	Late-Run Additions	Gross Escape	Mission Escape	Mort. Est.	Resident Lates	Encounter Rate	Below Bridge Date	PSC Escape	Summer Cum %
20 Jul	-	343	-	0								0		23 Jul		
21 Jul	686	433	-	0		433	0%	0	0			0		24 Jul		
22 Jul	612	737	-	0		737	0%	0	0	0	0	0		25 Jul		0%
23 Jul	914	1,308	-	0		1,308	0%	0	0	0	0	0		26 Jul		0%
24 Jul	2,398	2,541	-	0		2,541	0%	0	0	0	0	0		27 Jul		0%
25 Jul	4,311	5,037	-	0		5,037	0%	0	0	0	0	0		28 Jul		0%
26 Jul	8,402	7,248	-	0		7,248	0%	0	0	0	0	0		29 Jul		0%
27 Jul	9,031	8,217	-	0		8,217	0%	0	0	0	0	0		30 Jul		0%
28 Jul	7,217	11,589	-	0		11,589	0%	0	0	0	0	0		31 Jul		0%
29 Jul	18,518	28,271	-	0		28,271	0%	0	0	0	0	0		1 Aug		1%
30 Jul	59,079	49,934	-	375		50,309	1%	0	0	0	0	375		2 Aug		1%
31 Jul	72,205	57,361	1,126	15,770		73,507	22%	0	0	0	0	16,145	0.7%	3 Aug		2%
1 Aug	40,799	42,743	46,184	67,962		126,850	66%	5	375	375	375	83,732	3.3%	4 Aug		3%
2 Aug	15,225	34,821	156,575	84,108		202,660	83%	979	15,765	15,765	15,765	152,075	96.7%	5 Aug		4%
3 Aug	48,438	62,595	49,563	105,463		320,133	80%	55,776	66,983	66,983	66,983	190,555	100.0%	6 Aug		5%
4 Aug	124,122	72,049	110,251	73,134		335,738	79%	68,251	28,331	28,331	28,331	235,357	100.0%	7 Aug		6%
5 Aug	43,588	67,614	59,586	68,452		371,423	82%	45,113	37,213	37,213	37,213	266,596	100.0%	8 Aug	12	7%
6 Aug	35,133	58,998	35,520	44,204		369,798	84%	45,798	28,021	28,021	28,021	282,780	100.0%	9 Aug	44	9%
7 Aug	98,272	131,215	37,507	36,518		450,513	71%	31,225	22,654	22,654	22,654	296,643	100.0%	10 Aug	173	11%
8 Aug	260,241	146,672	36,526	43,040		486,355	70%	18,343	12,980	12,980	12,980	326,704	100.0%	11 Aug	68	12%
9 Aug	81,502	155,948	55,086	77,169		559,821	72%	20,995	18,174	18,174	18,174	385,698	100.0%	12 Aug	28	15%
10 Aug	126,102	161,030	139,894	106,934		653,663	75%	40,164	22,045	22,045	22,045	470,587	100.0%	13 Aug	56	18%
11 Aug	275,487	182,118	125,822	119,643	26,500	772,348	76%	60,737	37,005	10,505	10,505	553,225	100.0%	14 Aug	63	22%
12 Aug	144,763	240,217	93,214	91,739	-	885,181	73%	69,872	46,197	46,197	46,197	598,767	100.0%	15 Aug	215	26%
13 Aug	300,399	197,909	56,180	65,759	-	862,435	77%	48,703	49,771	49,771	49,771	614,756	100.0%	16 Aug	621	30%
14 Aug	148,563	196,136	47,884	62,949	-	873,841	78%	39,042	43,035	43,035	43,035	634,669	100.0%	17 Aug	900	36%
15 Aug	139,447	114,888	84,782	69,636	-	819,193	86%	37,862	26,718	26,718	26,718	677,588	100.0%	18 Aug	580	40%
16 Aug	56,654	139,582	76,243	74,655	-	891,824	84%	51,473	25,087	25,087	25,087	727,156	100.0%	19 Aug	430	45%
17 Aug	222,645	155,682	62,940	63,523	700	946,360	84%	53,115	18,163	17,463	15,556	772,516	100.0%	20 Aug	305	48%
18 Aug	187,746	166,840	51,386	107,673	86,100	1,047,029	84%	44,342	21,540	0	0	794,089	100.0%	21 Aug	1,270	51%
19 Aug	90,129	150,771	208,692	128,994	4,100	1,073,854	86%	76,092	19,181	15,081	10,914	903,902	100.0%	22 Aug	3,856	54%
20 Aug	174,436	131,461	126,904	178,205	-	1,213,568	89%	95,315	31,581	31,581	20,792	1,050,526	100.0%	23 Aug	9,364	58%
21 Aug	129,818	125,141	199,018	184,799	7,300	1,360,466	91%	141,687	33,679	26,379	15,876	1,201,646	100.0%	24 Aug	6,112	62%
22 Aug	71,169	113,385	228,474	186,701	-	1,501,731	92%	152,365	36,517	36,517	20,176	1,351,830	100.0%	25 Aug	4,921	65%
23 Aug	139,167	148,355	132,611	151,874	18,200	1,652,059	91%	159,572	32,433	14,233	7,245	1,471,270	100.0%	26 Aug	6,420	68%
24 Aug	234,730	159,082	94,539	117,276	-	1,747,628	91%	125,822	27,128	27,128	12,763	1,561,418	100.0%	27 Aug	3,606	71%
25 Aug	103,349	187,665	124,678	102,044	175,500	1,851,127	90%	96,897	26,052	0	0	1,487,962	100.0%	28 Aug	7,965	74%
26 Aug	224,916	136,178	86,915	138,791	-	1,762,931	92%	82,403	20,379	20,379	8,254	1,606,374	100.0%	29 Aug	10,998	78%
27 Aug	80,270	141,023	204,778	203,977	123,300	1,951,373	93%	118,177	19,641	0	0	1,687,050	100.0%	30 Aug	11,438	82%
28 Aug	117,884	77,819	320,236	227,591	-	1,992,460	96%	175,560	20,614	20,614	7,247	1,894,027	100.0%	31 Aug	12,432	85%
29 Aug	35,302	70,888	157,758	196,362	-	2,161,278	97%	210,160	28,417	28,417	9,331	2,061,972	100.0%	1 Sep	7,594	89%
30 Aug	59,479	49,316	111,091	124,659	21,600	2,235,948	98%	183,692	17,431	0	0	2,165,032	100.0%	2 Sep	5,425	90%
31 Aug	53,168	42,902	105,129	114,341	-	2,322,275	98%	119,221	12,670	12,670	3,644	2,266,703	100.0%	3 Sep	6,509	92%
1 Sep	16,060	59,892	126,804	103,755	218,100	2,430,350	98%	110,156	5,438	0	0	2,152,358	100.0%	4 Sep	4,992	93%
2 Sep	110,448	54,300	79,332	88,195	-	2,294,854	98%	98,704	4,186	4,186	1,059	2,236,368	100.0%	5 Sep	21,392	94%
3 Sep	36,392	55,702	58,451	55,429	94,000	2,347,499	98%	84,071	5,051	0	0	2,197,797	100.0%	6 Sep	19,701	96%
4 Sep	20,267	25,661	28,504	49,054	-	2,272,512	99%	52,830	4,124	4,124	920	2,242,726	100.0%	7 Sep	32,672	97%
5 Sep	20,325	17,622	60,207	63,666	30,000	2,324,014	99%	47,952	2,599	0	0	2,276,392	100.0%	8 Sep	42,543	98%
6 Sep	12,275	12,044	102,286	71,767	-	2,360,203	99%	62,704	1,102	1,102	217	2,347,057	100.0%	9 Sep	36,541	99%
7 Sep	3,533	5,440	52,808	58,194	-	2,410,691	100%	71,036	962	962	178	2,404,289	100.0%	10 Sep	35,936	99%
8 Sep	512	5,787	19,489	25,902	40,000	2,435,978	100%	57,932	731	0	0	2,390,191	100.0%	11 Sep	62,129	99%
9 Sep	13,316	4,853	5,410	11,543	-	2,406,588	100%	25,779	262	262	43	2,401,472	100.0%	12 Sep	58,450	100%
10 Sep	731	7,023	9,732	11,305	30,000	2,419,801	100%	11,497	123	0	0	2,382,778	100.0%	13 Sep	63,884	100%
11 Sep		731	18,774	15,760	-	2,399,269	100%	11,240	47	47	7	2,398,491	100.0%	14 Sep	95,848	100%
12 Sep			18,774	18,774	-	2,417,265	100%	15,750	66	66	9	2,417,199	100.0%	15 Sep	100,712	100%
13 Sep			18,774	17,522	-	2,434,722	100%	18,774	10	10	1	2,434,712	100.0%	16 Sep	136,671	100%
14 Sep			15,019	16,271	-	2,450,983	100%	17,522	0	0	0	2,450,983	100.0%	17 Sep	193,960	
15 Sep			15,019	13,767	38,000	2,464,750	100%	16,271	0	0	0	2,426,750	100.0%	18 Sep	252,722	
16 Sep			11,264	11,264	-	2,438,014	100%	13,767	0	0	0	2,438,014	100.0%	19 Sep	200,340	
17 Sep			7,510	8,761	-	2,446,775	100%	11,264	0	0	0	2,446,775	100.0%	20 Sep	174,413	
18 Sep			7,510	6,884	-	2,453,659	100%	8,761	0	0	0	2,453,659	100.0%	21 Sep	158,745	
19 Sep			5,633	6,258	-	2,459,917	100%	6,884	0	0	0	2,459,917	100.0%	22 Sep	184,464	
20 Sep			5,633	5,007	30,000	2,464,924	100%	6,258	0	0	0	2,434,924	100.0%	23 Sep	143,179	
21 Sep			3,755	3,880	-	2,438,804	100%	5,007	0	0	0	2,438,804	100.0%	24 Sep	158,684	
22 Sep			2,253	2,503	-	2,441,307	100%	3,880	0	0	0	2,441,307	100.0%	25 Sep	150,839	
23 Sep			1,502	1,502	-	2,442,809	100%	2,503	0	0	0	2,442,809	100.0%	26 Sep	92,909	
24 Sep			751	1,126	-	2,443,935	100%	1,502	0	0	0	2,443,935	100.0%	27 Sep	66,424	
25 Sep				751	-	2,444,686	100%	1,126	0	0	0	2,444,686	100.0%	28 Sep	38,023	
26 Sep					-									29 Sep	37,769	
27 Sep														30 Sep	45,200	
28 Sep														1 Oct	23,933	
29 Sep														2 Oct	54,682	
30 Sep														3 Oct	60,239	
1 Oct														4 Oct	106,500	
2 Oct														5 Oct	78,258	
3 Oct														6 Oct	29,795	
4 Oct														7 Oct	18,842	
5 Oct														8 Oct	8,379	
6 Oct														9 Oct	13,479	
7 Oct														10 Oct	9,900	
8 Oct														11 Oct	15,700	
9 Oct														12 Oct	2,420	
10 Oct														13 Oct	121,000	
Total	4,280,176	4,283,119	4,102,283	4,103,159	943,400				870,479	715,073	588,086				3,253,677	

PSC Escapement after Summer-run =	2,896,363
Model Escapement after Summer-run =	2,444,686
Model In-river Mortality Rate =	26%

Appendix Table B2. Stay With the School (SWTS) model results for 1991.

	Seine Test Fishery														
Area 20 Date	Summer-run Entry	Summer-run 3d AVG	Late-run Entry	Late-run 3d AVG	Catch	Total Sockeye	Late-Run % in LGS	Late-Run Additions	Gross Escape	Mission Escape	Mort. Est.	Resident Lates	Encounter Rate	Below Bridge Date	PSC Escape	Summer Cum %
20 Jul	-	5	-	0								0		23 Jul		
21 Jul	10	15	-	0		15	0%	0	0			0		24 Jul		
22 Jul	35	365	-	0		365	0%	0	0	0	0	0		25 Jul		0%
23 Jul	1,049	1,980	-	0		1,980	0%	0	0	0	0	0		26 Jul		0%
24 Jul	4,856	3,696	-	0		3,696	0%	0	0	0	0	0		27 Jul		0%
25 Jul	5,182	4,509	-	0		4,509	0%	0	0	0	0	0		28 Jul		0%
26 Jul	3,490	6,862	-	0		6,862	0%	0	0	0	0	0		29 Jul		0%
27 Jul	11,913	11,106	-	0		11,106	0%	0	0	0	0	0		30 Jul		1%
28 Jul	17,915	17,626	-	0		17,626	0%	0	0	0	0	0		31 Jul		1%
29 Jul	23,050	24,546	-	0		24,546	0%	0	0	0	0	0		1 Aug		2%
30 Jul	32,673	31,000	-	0		31,000	0%	0	0	0	0	0		2 Aug		3%
31 Jul	37,278	29,279	-	0		29,279	0%	0	0	0	0	0	0.7%	3 Aug		4%
1 Aug	17,885	25,369	-	0		25,369	0%	0	0	0	0	0	0.7%	4 Aug		6%
2 Aug	20,944	44,943	-	0		44,943	0%	0	0	0	0	0	0.7%	5 Aug		7%
3 Aug	95,999	69,859	-	0		69,859	0%	0	0	0	0	0	0.7%	6 Aug		9%
4 Aug	92,634	88,785	-	0		88,785	0%	0	0	0	0	0	0.7%	7 Aug		12%
5 Aug	77,722	78,418	-	476		78,894	1%	0	0	0	0	476	0.7%	8 Aug		16%
6 Aug	64,899	59,482	1,428	1,097		61,055	3%	0	0	0	0	1,573	0.7%	9 Aug		21%
7 Aug	35,825	50,263	1,863	1,719		53,554	6%	0	476	476	476	2,816	0.8%	10 Aug		25%
8 Aug	50,063	49,680	1,865	1,679		54,174	8%	0	1,097	1,097	1,097	3,398	0.9%	11 Aug		28%
9 Aug	63,151	44,809	1,309	10,256		58,462	23%	0	1,719	1,719	1,719	11,935	0.9%	12 Aug		31%
10 Aug	21,212	45,586	27,593	17,179	400	74,700	39%	5	1,679	1,279	1,279	27,435	2.2%	13 Aug		34%
11 Aug	52,395	33,737	22,635	28,580		89,752	62%	57	10,250	10,250	9,131	45,764	9.5%	14 Aug		37%
12 Aug	27,605	45,906	35,512	30,590		122,261	62%	1,055	17,122	17,122	13,701	59,232	39.6%	15 Aug		39%
13 Aug	57,718	41,041	33,624	39,123		139,396	71%	4,721	27,525	27,525	19,920	70,830	71.6%	16 Aug		41%
14 Aug	37,799	45,362	48,232	47,526		163,718	72%	13,940	25,870	25,870	17,032	92,487	88.9%	17 Aug		44%
15 Aug	40,568	37,876	60,722	58,071		188,434	80%	22,087	25,183	25,183	15,156	125,374	98.6%	18 Aug		46%
16 Aug	35,261	33,349	65,258	60,502		219,225	85%	36,550	25,439	25,439	14,055	160,438	99.9%	19 Aug		49%
17 Aug	24,217	34,587	55,526	57,311	6,300	252,336	86%	43,472	21,521	15,221	7,748	196,227	100.0%	20 Aug		51%
18 Aug	44,285	72,551	51,148	56,633		325,411	78%	42,676	17,030	17,030	8,012	235,831	100.0%	21 Aug		53%
19 Aug	149,150	108,238	63,226	69,728		413,797	74%	34,196	14,635	14,635	6,381	290,924	100.0%	22 Aug		55%
20 Aug	131,279	112,179	94,811	87,488		490,591	77%	38,021	22,438	22,438	9,087	355,974	100.0%	23 Aug		59%
21 Aug	56,107	78,095	104,428	96,534		530,603	85%	52,052	31,707	31,707	11,954	420,802	100.0%	24 Aug		65%
22 Aug	46,897	52,891	90,364	83,422		557,115	91%	70,210	35,436	35,436	12,458	468,788	100.0%	25 Aug		72%
23 Aug	55,670	41,981	55,475	63,794		574,563	93%	68,334	26,325	26,325	8,644	506,257	100.0%	26 Aug		76%
24 Aug	23,376	40,223	45,544	43,861	15,000	590,341	93%	54,813	15,088	88	27	535,030	100.0%	27 Aug		79%
25 Aug	41,623	31,088	30,563	47,308		613,425	95%	38,087	8,982	8,982	2,583	573,356	100.0%	28 Aug		82%
26 Aug	28,264	26,048	65,816	81,697	8,600	681,101	96%	42,634	5,773	0	0	646,453	100.0%	29 Aug		84%
27 Aug	8,257	15,033	148,713	137,315		798,801	98%	75,568	4,673	4,673	1,182	779,095	100.0%	30 Aug		86%
28 Aug	8,577	11,159	197,416	148,388		938,642	99%	132,195	6,129	6,129	1,455	921,354	100.0%	31 Aug		87%
29 Aug	16,642	24,495	99,036	109,020		1,054,869	98%	144,881	5,120	5,120	1,142	1,025,254	100.0%	1 Sep		88%
30 Aug	48,267	23,179	30,608	48,176		1,096,610	98%	104,016	3,507	3,507	735	1,069,923	100.0%	2 Sep		89%
31 Aug	4,629	19,949	14,885	18,112	38,500	1,107,985	98%	46,161	5,004	0	0	1,049,535	100.0%	3 Sep		90%
1 Sep	6,952	11,479	8,843	15,332		1,076,347	99%	17,466	2,015	2,015	373	1,062,852	100.0%	4 Sep	1,870	91%
2 Sep	22,857	15,939	22,268	19,953		1,098,743	99%	15,007	646	646	113	1,082,158	100.0%	5 Sep	5,967	93%
3 Sep	18,007	19,381	28,747	26,808		1,128,347	98%	19,378	325	325	53	1,108,641	100.0%	6 Sep	4,930	93%
4 Sep	17,278	25,321	29,409	23,270		1,157,232	98%	25,895	575	575	89	1,131,337	100.0%	7 Sep	1,236	94%
5 Sep	40,677	19,963	11,655	20,092		1,171,392	98%	22,263	913	913	132	1,150,516	100.0%	8 Sep	540	95%
6 Sep	1,932	15,959	19,213	19,894		1,186,369	99%	19,413	1,007	1,007	137	1,169,403	100.0%	9 Sep	504	97%
7 Sep	5,269	3,140	28,813	25,350	19,400	1,197,893	100%	19,362	679	0	0	1,175,353	100.0%	10 Sep	2,688	98%
8 Sep	2,220	3,055	28,024	26,095		1,204,503	100%	25,217	532	532	64	1,200,916	100.0%	11 Sep	5,280	99%
9 Sep	1,677	3,965	21,448	22,227		1,227,108	100%	25,963	133	133	15	1,223,011	100.0%	12 Sep	9,464	99%
10 Sep	7,998	4,837	17,210	13,944		1,241,792	100%	22,084	132	132	14	1,236,822	100.0%	13 Sep	36,088	99%
11 Sep		7,998	3,173	7,735		1,252,555	99%	13,835	143	143	14	1,244,414	100.0%	14 Sep	9,238	99%
12 Sep			2,822	4,942		1,249,356	100%	7,637	108	108	10	1,249,247	100.0%	15 Sep	27,676	100%
13 Sep			8,831	6,357		1,255,604	100%	4,942	98	98	98	1,255,506	100.0%	16 Sep	20,292	100%
14 Sep			7,419	8,907	600	1,264,413	100%	6,357	0	0	0	1,263,813	100.0%	17 Sep	66,240	
15 Sep			10,471	11,908		1,275,721	100%	8,907	0	0	0	1,275,721	100.0%	18 Sep	17,625	
16 Sep			17,833	12,489		1,288,209	100%	11,908	0	0	0	1,288,209	100.0%	19 Sep	29,625	
17 Sep			9,162	12,052		1,300,262	100%	12,489	0	0	0	1,300,262	100.0%	20 Sep	38,272	
18 Sep			9,162	8,399		1,308,660	100%	12,052	0	0	0	1,308,660	100.0%	21 Sep	12,789	
19 Sep			6,872	7,635		1,316,296	100%	8,399	0	0	0	1,316,296	100.0%	22 Sep	52,992	
20 Sep			6,872	6,108		1,322,404	100%	7,635	0	0	0	1,322,404	100.0%	23 Sep	150,625	
21 Sep			4,581	4,734	30,500	1,327,138	100%	6,108	0	0	0	1,296,638	100.0%	24 Sep	144,480	
22 Sep			2,749	3,054		1,299,692	100%	4,734	0	0	0	1,299,692	100.0%	25 Sep	235,584	
23 Sep			1,832	1,832		1,301,524	100%	3,054	0	0	0	1,301,524	100.0%	26 Sep	133,569	
24 Sep			916	1,374		1,302,898	100%	1,832	0	0	0	1,302,898	100.0%	27 Sep	66,934	
25 Sep				916		1,303,814	100%	1,374	0	0	0	1,303,814	100.0%	28 Sep	37,300	
26 Sep														29 Sep	57,400	
27 Sep														30 Sep	25,600	
28 Sep					400									1 Oct	32,000	
29 Sep														2 Oct	21,300	
30 Sep														3 Oct	19,200	
1 Oct														4 Oct	15,000	
2 Oct					7,600									5 Oct	12,400	
3 Oct														6 Oct	16,000	
4 Oct	PSC Escapement after Summer-run =						1,409,703							7 Oct	59,800	
5 Oct														8 Oct	47,000	
6 Oct	Model Escapement after Summer-run =						1,303,814							9 Oct	24,900	
7 Oct														10 Oct	17,600	
8 Oct	Model In-river Mortality Rate =						18%							11 Oct	20,100	
9 Oct														12 Oct	7,400	
Total		1,748,185	1,755,925	1,756,994	127,300				367,036	333,879	166,088				1,487,508	

Appendix Table B3. Stay With the School (SWTS) model results for 1994.

Area 20 Date	Seine Test Fishery Summer-run Entry	Seine Test Fishery Summer-run 3d AVG	Seine Test Fishery Late-run Entry	Seine Test Fishery Late-run 3d AVG	Catch	Total Sockeye	Late-Run % in LGS	Late-Run Additions	Gross Escape	Mission Escape	Mort. Est.	Resident Lates	Encounter Rate	Below Bridge Date	PSC Escape	Summer Cum %
20 Jul	-	1,248	-	0								0		23 Jul		
21 Jul	2,495	2,486	-	0		2,486	0%	0	0			0		24 Jul		
22 Jul	4,963	7,097	-	0		7,097	0%	0	0	0	0	0		25 Jul		0%
23 Jul	13,833	13,705	-	0		13,705	0%	0	0	0	0	0		26 Jul		0%
24 Jul	22,318	23,309	-	0		23,309	0%	0	0	0	0	0		27 Jul		0%
25 Jul	33,775	25,611	-	0		25,611	0%	0	0	0	0	0		28 Jul		1%
26 Jul	20,741	31,805	-	0		31,805	0%	0	0	0	0	0		29 Jul		1%
27 Jul	40,900	46,728	-	0		46,728	0%	0	0	0	0	0		30 Jul		2%
28 Jul	78,543	87,469	-	0		87,469	0%	0	0	0	0	0		31 Jul	352	3%
29 Jul	142,963	123,750	-	1,537		125,287	1%	0	0	0	0	1,537		1 Aug	640	4%
30 Jul	149,745	155,773	4,611	5,640		162,951	4%	0	0	0	0	7,177	0.8%	2 Aug	0	7%
31 Jul	174,612	173,695	12,310	9,953	-	190,825	9%	0	1,537	1,537	1,537	15,593	1.4%	3 Aug	0	10%
1 Aug	196,727	155,945	12,937	14,468	1,861	186,007	16%	1	5,640	3,779	3,779	24,421	3.1%	4 Aug	1,932	15%
2 Aug	96,497	123,096	18,158	18,014	1,643	165,531	26%	12	9,952	8,309	8,309	32,484	7.2%	5 Aug	2,171	20%
3 Aug	76,064	104,208	22,947	23,899	1,918	160,591	35%	85	14,457	12,539	12,539	41,926	14.8%	6 Aug	1,301	25%
4 Aug	140,063	74,114	30,593	28,859	1,720	144,899	49%	436	17,929	16,209	16,209	52,856	30.8%	7 Aug	202	28%
5 Aug	6,214	70,020	33,037	34,490	2,616	157,366	56%	2,124	23,464	20,848	20,848	63,883	57.1%	8 Aug	100	31%
6 Aug	63,782	100,535	39,841	34,110	2,942	198,528	49%	6,067	26,735	23,793	23,793	71,259	80.0%	9 Aug	0	33%
7 Aug	231,608	183,724	29,453	50,185	3,543	305,167	40%	6,651	28,424	24,881	24,881	93,020	89.3%	10 Aug	0	35%
8 Aug	255,781	217,273	81,261	53,316	343	363,609	40%	7,100	27,459	27,116	27,116	118,877	98.7%	11 Aug	0	38%
9 Aug	164,429	181,489	49,234	68,010	375	368,376	51%	8,520	43,085	42,710	42,710	143,803	99.9%	12 Aug	1,576	43%
10 Aug	124,257	121,911	73,536	51,633	5,114	317,347	62%	17,487	44,796	39,682	39,682	150,639	100.0%	13 Aug	1,013	50%
11 Aug	77,048	126,167	32,128	47,424	539	324,231	61%	19,581	50,524	49,985	44,527	147,540	100.0%	14 Aug	0	55%
12 Aug	177,196	149,408	36,609	31,186	721	328,134	54%	17,696	32,052	31,331	25,071	146,674	100.0%	15 Aug	0	59%
13 Aug	193,979	157,349	24,822	32,583	941	336,607	53%	9,252	29,728	28,787	20,834	149,529	100.0%	16 Aug	0	62%
14 Aug	100,873	108,350	36,318	71,960	5,886	329,839	67%	9,240	21,935	16,049	10,566	199,554	100.0%	17 Aug	0	66%
15 Aug	30,197	72,372	154,739	116,062	33,328	387,988	81%	32,447	23,343	0	0	282,288	100.0%	18 Aug	0	71%
16 Aug	86,047	64,004	157,128	136,273	40,022	482,565	87%	76,801	39,513	0	0	378,539	100.0%	19 Aug	0	74%
17 Aug	75,767	74,183	96,952	113,962	35,425	566,684	87%	102,522	39,260	3,835	1,952	453,241	100.0%	20 Aug	0	76%
18 Aug	60,736	55,402	87,806	94,410	25,115	603,053	91%	86,078	33,751	8,636	4,063	513,900	100.0%	21 Aug	0	78%
19 Aug	29,704	47,841	98,472	87,197	22,168	648,937	93%	77,860	27,884	5,716	2,492	573,212	100.0%	22 Aug	0	80%
20 Aug	53,082	64,504	75,312	98,877	21,025	736,593	91%	74,814	16,550	0	0	651,064	100.0%	23 Aug	0	82%
21 Aug	110,726	81,012	122,848	108,381	9,907	840,458	90%	82,318	12,383	2,476	933	747,063	100.0%	24 Aug	0	83%
22 Aug	79,229	73,062	126,983	129,275	10,777	949,400	92%	88,494	16,559	5,782	2,033	859,779	100.0%	25 Aug	0	85%
23 Aug	29,231	45,352	137,994	119,051	23,308	1,024,181	96%	110,144	19,887	0	0	955,522	100.0%	26 Aug	18,245	87%
24 Aug	27,595	42,202	92,176	96,815	75,956	1,094,538	96%	108,741	19,131	0	0	976,381	100.0%	27 Aug	6,628	90%
25 Aug	69,779	43,531	60,275	69,427	41,851	1,089,339	96%	89,493	10,310	0	0	1,003,957	100.0%	28 Aug	4,618	91%
26 Aug	33,219	35,831	55,831	49,986	27,934	1,089,774	97%	63,989	7,322	0	0	1,026,009	100.0%	29 Aug	11,846	92%
27 Aug	4,494	35,238	33,853	48,614	22,566	1,109,862	97%	46,753	5,438	0	0	1,052,057	100.0%	30 Aug	3,347	93%
28 Aug	68,002	40,267	56,158	81,673	14,967	1,173,998	97%	45,576	3,233	0	0	1,118,764	100.0%	31 Aug	840	94%
29 Aug	48,306	45,589	155,009	100,439	221,796	1,264,792	96%	76,167	3,038	0	0	997,407	100.0%	1 Sep	7,229	95%
30 Aug	20,459	26,065	90,150	84,822	255,642	1,108,294	98%	93,329	5,507	0	0	826,587	100.0%	2 Sep	11,724	97%
31 Aug	9,430	12,962	9,307	36,749	231,135	876,298	99%	80,879	7,110	0	0	632,201	100.0%	3 Sep	15,185	98%
1 Sep	8,997	8,058	10,790	20,412	207,230	660,671	99%	35,670	3,943	0	0	445,383	100.0%	4 Sep	7,931	99%
2 Sep	5,748	6,603	41,140	33,006	40,075	484,992	99%	19,917	1,079	0	0	438,314	100.0%	5 Sep	7,124	99%
3 Sep	5,064	5,514	47,087	40,464	40,075	484,291	99%	32,113	495	0	0	438,702	100.0%	6 Sep	10,345	99%
4 Sep	5,729	4,887	33,164	29,652	7,538	473,242	99%	39,548	893	0	0	460,817	100.0%	7 Sep	9,113	99%
5 Sep	3,869	3,370	8,706	18,634	7,539	482,821	99%	29,043	916	0	0	471,912	100.0%	8 Sep	10,486	100%
6 Sep	512	1,659	14,033	17,527	7,540	491,098	100%	18,375	609	0	0	481,899	100.0%	9 Sep	7,081	100%
7 Sep	597	457	29,841	22,453	7,541	504,809	100%	17,408	259	0	0	496,810	100.0%	10 Sep	3,402	100%
8 Sep	263	412	23,484	25,603	7,542	522,825	100%	22,412	118	0	0	514,871	100.0%	11 Sep	3,970	100%
9 Sep	375	477	23,484	23,484	7,543	538,832	100%	25,563	41	0	0	530,812	100.0%	12 Sep	1,936	100%
10 Sep	793	693	23,484	15,656	7,544	547,161	100%	23,442	40	0	0	538,924	100.0%	13 Sep	2,376	100%
11 Sep	911	759	-	7,828	7,545	547,511	100%	15,616	42	0	0	539,207	100.0%	14 Sep	5,024	100%
12 Sep	573	565	-	0	7,546	539,772	100%	7,806	40	0	0	531,661	100.0%	15 Sep	9,917	100%
13 Sep	211	333	-	0	7,547	531,995	100%	0	22	0	0	524,114	100.0%	16 Sep	6,237	100%
14 Sep	216	214	-	0										17 Sep	3,621	
15 Sep		216												18 Sep	10,085	
16 Sep														19 Sep	15,103	
17 Sep														20 Sep	52,030	
18 Sep														21 Sep	52,127	
19 Sep														22 Sep	94,529	
20 Sep														23 Sep	109,354	
21 Sep														24 Sep	58,100	
22 Sep														25 Sep	21,011	
23 Sep														26 Sep	93,584	
24 Sep														27 Sep	38,663	
25 Sep														28 Sep	23,197	
26 Sep														29 Sep	36,700	
27 Sep														30 Sep	25,500	
28 Sep														1 Oct	31,800	
29 Sep		PSC Escapement after Summer-run =					851,135							2 Oct	18,900	
30 Sep		Model Escapement after Summer-run =					524,114							3 Oct	40,501	
1 Oct		Model In-river Mortality Rate =					43%							4 Oct	21,601	
2 Oct														5 Oct	33,300	
3 Oct														6 Oct	8,700	
4 Oct														7 Oct	6,300	
5 Oct														8 Oct	2,801	
6 Oct														9 Oct	1,299	
7 Oct														10 Oct	1,900	
Total	3,459,267	3,459,898	2,404,001	2,404,001	1,505,889				676,430	373,998	333,872				974,597	

Appendix Table B4. Stay With the School (SWTS) model results for 1995.

Area 20 Date	Seine Test Fishery Summer-run Entry	Seine Test Fishery Summer-run 3d AVG	Seine Test Fishery Late-run Entry	Seine Test Fishery Late-run 3d AVG	Catch	Total Sockeye	Late-Run % in LGS	Late-Run Additions	Gross Escape	Mission Escape	Mort. Est.	Resident Lates	Encounter Rate	Below Bridge Date	PSC Escape	Summer Cum %
20 Jul		15,416	-	0								0		23 Jul		
21 Jul	15,416	19,119	-	0		19,119	0%	0	0			0		24 Jul		
22 Jul	22,822	16,260	-	0		16,260	0%	0	0	0	0	0		25 Jul		1%
23 Jul	10,541	17,407	-	0		17,407	0%	0	0	0	0	0		26 Jul		2%
24 Jul	18,857	22,192	-	0		22,192	0%	0	0	0	0	0		27 Jul		3%
25 Jul	37,177	30,940	-	0		30,940	0%	0	0	0	0	0		28 Jul		5%
26 Jul	36,786	32,498	-	0		32,498	0%	0	0	0	0	0		29 Jul		6%
27 Jul	23,532	27,334	-	0		27,334	0%	0	0	0	0	0		30 Jul		8%
28 Jul	21,684	26,580	-	0		26,580	0%	0	0	0	0	0		31 Jul		10%
29 Jul	34,525	40,934	-	0		40,934	0%	0	0	0	0	0		1 Aug		12%
30 Jul	66,592	57,182	-	219		57,400	0%	0	0	0	0	219	0.7%	2 Aug		14%
31 Jul	70,428	61,904	656	1,194		63,317	2%	0	0	0	0	1,413	0.7%	3 Aug		17%
1 Aug	48,691	61,435	2,927	7,306		70,154	12%	0	219	219	219	8,500	0.8%	4 Aug		20%
2 Aug	65,187	53,963	18,334	23,953		86,416	38%	1	1,194	1,194	1,194	31,258	1.6%	5 Aug		24%
3 Aug	48,012	53,924	50,597	25,409		110,592	51%	52	7,305	7,305	7,305	49,363	13.3%	6 Aug		29%
4 Aug	48,574	47,735	7,296	21,739		118,836	60%	888	23,900	23,900	23,900	47,201	48.4%	7 Aug		32%
5 Aug	46,619	44,669	7,323	6,304	259	98,174	55%	3,767	24,521	24,262	24,262	28,984	43.0%	8 Aug		36%
6 Aug	38,814	59,572	4,294	9,721	-	98,277	39%	806	17,972	17,972	17,972	20,734	10.9%	9 Aug		39%
7 Aug	93,283	87,336	17,547	10,772	-	118,841	27%	164	5,498	5,498	5,498	26,007	5.1%	10 Aug		42%
8 Aug	129,911	106,208	10,474	17,851	-	150,066	29%	38	9,557	9,557	9,557	34,301	8.3%	11 Aug		46%
9 Aug	95,431	97,761	25,532	19,392	352	151,454	35%	127	10,733	10,381	10,381	42,960	17.2%	12 Aug		52%
10 Aug	67,941	80,259	22,171	44,871	-	168,090	52%	420	17,724	17,724	17,724	70,107	33.1%	13 Aug		59%
11 Aug	77,404	58,467	86,909	42,566	-	171,140	66%	4,054	18,973	18,973	16,901	93,701	88.2%	14 Aug		65%
12 Aug	30,055	42,153	18,619	42,146	-	178,000	76%	16,272	40,816	40,816	32,661	95,030	98.8%	15 Aug		70%
13 Aug	19,001	29,159	20,910	21,743	-	145,932	80%	24,241	26,295	26,295	19,030	90,478	98.9%	16 Aug		74%
14 Aug	38,420	26,968	25,700	21,806	-	139,253	81%	13,770	17,905	17,905	11,788	94,380	98.3%	17 Aug	78	77%
15 Aug	23,484	27,550	18,809	19,485	850	141,415	81%	13,935	7,973	7,123	4,287	105,892	98.8%	18 Aug	98	79%
16 Aug	20,745	29,955	13,946	20,545	3,168	156,391	81%	12,485	7,872	4,704	2,599	118,565	99.6%	19 Aug	2,105	81%
17 Aug	45,635	29,280	28,879	27,853	5,813	175,698	83%	13,378	7,000	1,187	604	139,418	99.9%	20 Aug	3,596	83%
18 Aug	21,460	33,350	40,734	29,300	-	202,068	83%	19,323	7,166	7,166	3,372	161,551	100.0%	21 Aug	11,737	85%
19 Aug	32,956	32,565	18,287	23,045	-	217,161	85%	20,424	8,530	8,530	3,719	176,066	100.0%	22 Aug	5,429	87%
20 Aug	43,278	27,668	10,115	15,576	-	219,310	87%	16,652	8,876	8,876	3,595	182,766	100.0%	23 Aug	1,864	89%
21 Aug	6,771	18,078	18,325	18,621	698	219,464	92%	11,893	6,394	5,696	2,147	194,993	100.0%	24 Aug	1,792	91%
22 Aug	4,185	3,938	27,422	23,135	18,461	222,066	98%	15,679	3,682	0	0	199,667	100.0%	25 Aug	3,304	93%
23 Aug	857	4,181	23,658	18,714	23,728	222,562	98%	22,322	2,941	0	0	194,653	100.0%	26 Aug	3,010	94%
24 Aug	7,502	11,484	5,062	13,482	18,530	219,619	95%	18,017	813	0	0	189,605	100.0%	27 Aug	904	94%
25 Aug	26,093	14,273	11,726	11,851	8,252	215,729	93%	12,109	697	0	0	193,204	100.0%	28 Aug	1,867	95%
26 Aug	9,223	13,763	18,765	15,344	4,916	222,311	94%	10,335	1,373	0	0	203,632	100.0%	29 Aug	8,843	95%
27 Aug	5,974	6,961	15,540	13,506	8,155	224,099	97%	13,503	1,516	0	0	208,983	100.0%	30 Aug	7,470	96%
28 Aug	5,686	4,320	6,213	13,981	17,194	227,283	98%	12,680	1,841	0	0	205,769	100.0%	31 Aug	7,517	97%
29 Aug	1,299	3,281	20,189	10,261	2,686	219,311	99%	13,454	826	0	0	213,345	100.0%	1 Sep	7,153	98%
30 Aug	2,857	1,995	4,382	8,190	3,678	223,530	99%	9,957	526	0	0	217,857	100.0%	2 Sep	1,682	98%
31 Aug	1,829	2,190	-	1,842	3,678	221,889	99%	8,045	305	0	0	216,021	100.0%	3 Sep	3,703	98%
1 Sep	1,884	2,169	1,145	2,603	2,656	220,793	99%	1,806	146	0	0	215,968	100.0%	4 Sep	2,403	98%
2 Sep	2,794	2,984	6,663	6,142	2,656	225,094	99%	2,552	36	0	0	219,454	100.0%	5 Sep	2,528	99%
3 Sep	4,274	2,936	10,619	8,467	3,737	230,858	99%	5,981	51	0	0	224,185	100.0%	6 Sep	3,982	99%
4 Sep	1,741	2,597	8,120	7,530	1,820	234,312	99%	8,253	162	0	0	229,895	100.0%	7 Sep	6,091	99%
5 Sep	1,775	1,923	3,852	3,991	2,105	235,809	99%	7,364	214	0	0	231,781	100.0%	8 Sep	7,385	99%
6 Sep	2,253	1,965	-	1,284	2,105	235,030	99%	3,926	166	0	0	230,960	100.0%	9 Sep	7,530	99%
7 Sep	1,868	2,219	-	7,828	2,232	241,006	99%	1,263	65	0	0	236,556	100.0%	10 Sep	9,557	99%
8 Sep	2,535	1,593	23,484	15,656	2,232	253,804	99%	7,685	21	0	0	249,980	100.0%	11 Sep	29,064	99%
9 Sep	375	1,234	23,484	23,484	2,232	274,698	100%	15,460	143	0	0	271,232	100.0%	12 Sep	39,450	100%
10 Sep	793	693	23,484	15,656	2,616	287,581	100%	23,273	196	0	0	284,272	100.0%	13 Sep	34,106	100%
11 Sep	911	759	-	7,828	102	292,859	100%	15,581	211	109	11	291,889	100.0%	14 Sep	24,308	100%
12 Sep	573	565	-	0	102	292,454	100%	7,787	75	0	0	291,787	100.0%	15 Sep	11,121	100%
13 Sep	211	333	-	0	111	292,120	100%	0	41	0	0	291,676	100.0%	16 Sep	7,866	100%
14 Sep	216	214	-	0	111	291,889	100%	0	0	0	0	291,565	100.0%	17 Sep	6,238	100%
15 Sep		216			111	291,781	100%	0	0	0	0	291,454	100.0%	18 Sep	9,919	
16 Sep					111	291,454	100%	0	0	0	0	291,343	100.0%	19 Sep	43,996	
17 Sep					112	291,343	100%	0	0	0	0	291,231	100.0%	20 Sep	41,240	
18 Sep														21 Sep	53,183	
19 Sep														22 Sep	33,168	
20 Sep														23 Sep	15,588	
21 Sep														24 Sep	6,968	
22 Sep														25 Sep	10,500	
23 Sep														26 Sep	12,169	
24 Sep														27 Sep	1,700	
25 Sep														28 Sep	2,200	
26 Sep														29 Sep	1,500	
27 Sep														30 Sep	1,000	
28 Sep														1 Oct	400	
29 Sep														2 Oct	901	
30 Sep														3 Oct		
1 Oct														4 Oct		
2 Oct														5 Oct		
3 Oct														6 Oct		
4 Oct														7 Oct		
5 Oct														8 Oct		
6 Oct														9 Oct		
7 Oct														10 Oct		
Total	1,487,740	1,504,606	702,192	702,192	145,569				292,471	265,392	218,726				498,213	

PSC Escapement after Summer-run =	357,521
Model Escapement after Summer-run =	291,231
Model In-river Mortality Rate =	44%

Appendix Table B5. Stay With the School (SWTS) model results for 1996.

	Seine Test Fishery																
Area 20 Date	Summer-run Entry	Summer-run 3d AVG	Late-run Entry	Late-run 3d AVG	Catch	Total Sockeye	Late-Run % in LGS	Late-Run Additions	Gross Escape	Mission Escape	Mort. Est.	Resident Lates	Encounter Rate	Below Bridge Date	PSC Escape	Summer Cum %
20 Jul		2,565	-	0								0		23 Jul		
21 Jul	2,565	2,138	-	0		2,138	0%	0	0			0		24 Jul		
22 Jul	1,710	2,607	-	0		2,607	0%	0	0	0	0	0		25 Jul		0%
23 Jul	3,546	2,760	-	0		2,760	0%	0	0	0	0	0		26 Jul		0%
24 Jul	3,024	4,850	-	0		4,850	0%	0	0	0	0	0		27 Jul		0%
25 Jul	7,980	7,280	-	0		7,280	0%	0	0	0	0	0		28 Jul		0%
26 Jul	10,836	17,349	-	0		17,349	0%	0	0	0	0	0		29 Jul		1%
27 Jul	33,231	33,271	-	0		33,271	0%	0	0	0	0	0		30 Jul		1%
28 Jul	55,746	49,016	-	0		49,016	0%	0	0	0	0	0		31 Jul		2%
29 Jul	58,072	48,661	-	0		48,661	0%	0	0	0	0	0		1 Aug		3%
30 Jul	32,164	55,463	-	36		55,499	0%	0	0	0	0	36	0.7%	2 Aug		5%
31 Jul	76,152	59,629	109	430		60,095	1%	0	0	0	0	466	0.7%	3 Aug		7%
1 Aug	70,572	65,639	1,181	2,489		68,593	4%	0	36	36	36	2,918	0.7%	4 Aug		10%
2 Aug	50,192	65,795	6,177	3,932		72,645	9%	0	430	430	430	6,421	0.9%	5 Aug		13%
3 Aug	76,620	73,732	4,438	7,906		88,059	16%	0	2,489	2,489	2,489	11,838	1.3%	6 Aug		15%
4 Aug	94,384	86,818	13,104	10,114		108,771	20%	3	3,932	3,932	3,932	18,021	2.2%	7 Aug		18%
5 Aug	89,451	91,100	12,800	12,887		122,008	25%	9	7,904	7,904	7,904	23,004	3.9%	8 Aug		22%
6 Aug	89,466	116,503	12,757	15,166		154,672	25%	32	10,105	10,105	10,105	28,064	6.3%	9 Aug	776	25%
7 Aug	170,591	150,799	19,941	14,558	123	193,422	22%	58	12,854	12,731	12,731	29,768	10.0%	10 Aug	896	29%
8 Aug	192,341	170,251	10,976	19,325	-	219,345	22%	71	15,108	15,108	15,108	33,986	11.7%	11 Aug	0	34%
9 Aug	147,822	167,938	27,059	22,952	-	224,876	25%	113	14,487	14,487	14,487	42,451	16.8%	12 Aug	0	41%
10 Aug	163,651	166,870	30,821	31,359	841	240,680	31%	247	19,212	18,371	18,371	54,598	32.0%	13 Aug	0	48%
11 Aug	189,137	176,298	36,197	38,822	28,179	269,718	35%	943	22,705	0	0	65,241	61.3%	14 Aug	0	56%
12 Aug	176,105	191,362	49,449	38,985	11,806	295,588	35%	2,855	30,416	18,610	14,892	73,810	82.1%	15 Aug	658	63%
13 Aug	208,844	129,927	31,309	35,980	35,978	239,717	46%	3,980	35,967	0	0	73,812	91.5%	16 Aug	2,019	71%
14 Aug	4,832	93,757	27,181	20,759	-	188,328	50%	6,908	35,005	35,005	23,046	59,566	91.5%	17 Aug	2,558	79%
15 Aug	67,596	41,928	3,787	10,525	-	112,019	63%	4,792	29,071	29,071	17,497	41,020	72.2%	18 Aug	3,983	85%
16 Aug	53,356	58,021	608	7,547	-	106,588	46%	2,977	15,967	15,967	8,822	32,600	28.9%	19 Aug	3,782	89%
17 Aug	53,110	42,149	18,247	17,886	895	92,634	54%	454	7,548	6,653	3,387	42,937	14.9%	20 Aug	4,218	91%
18 Aug	19,980	27,297	34,803	32,016	895	102,250	73%	793	7,094	6,199	2,916	67,860	33.0%	21 Aug	2,027	93%
19 Aug	8,800	11,060	42,997	29,144		108,064	90%	5,685	17,093	17,093	7,452	79,911	85.6%	22 Aug	1,278	95%
20 Aug	4,400	5,433	9,632	20,281		105,625	95%	20,112	26,331	26,331	10,664	73,860	95.2%	23 Aug	901	97%
21 Aug	3,100	4,983	8,213	8,539		87,383	94%	17,375	9,032	9,032	3,405	73,368	91.6%	24 Aug	1,856	97%
22 Aug	7,450	7,506	7,773	5,329		86,203	91%	6,954	2,906	2,906	1,022	75,791	91.2%	25 Aug	1,694	97%
23 Aug	11,968	10,194	-	2,591		88,576	88%	4,050	1,586	1,586	521	76,796	93.0%	26 Aug	2,067	97%
24 Aug	11,165	9,163	-	2,636		88,595	90%	1,886	1,279	1,279	393	78,153	93.6%	27 Aug	941	98%
25 Aug	4,356	7,667	7,907	6,853		92,673	92%	1,983	705	705	203	84,301	94.3%	28 Aug	2,451	98%
26 Aug	7,480	4,292	12,653	10,346		98,938	96%	5,440	653	653	176	93,993	96.9%	29 Aug	4,576	99%
27 Aug	1,040	3,090	10,478	9,107		106,190	97%	9,171	1,413	1,413	357	101,687	98.8%	30 Aug	5,619	99%
28 Aug	750	2,579	4,189	9,427		113,693	98%	8,480	1,175	1,175	279	109,939	99.4%	31 Aug	23,450	99%
29 Aug	5,947	3,632	13,613	6,919		120,490	97%	8,953	626	626	140	116,232	99.8%	1 Sep	16,659	99%
30 Aug	4,199	3,638	2,955	5,523		125,392	97%	6,492	474	474	99	121,280	99.9%	2 Sep	16,001	99%
31 Aug	768	2,414	-	1,242		124,937	98%	5,200	427	427	84	122,096	99.9%	3 Sep	27,691	100%
1 Sep	2,275	1,522	772	1,755		125,372	99%	1,194	323	323	60	123,528	99.9%	4 Sep	33,058	100%
2 Sep		2,275	4,493	4,142		129,944	98%	1,711	48	48	8	127,621	99.9%	5 Sep	55,792	100%
3 Sep			7,160	5,709		133,330	100%	3,995	44	44	7	133,287	100.0%	6 Sep	26,371	100%
4 Sep			5,475	5,078		138,364	100%	5,707	146	146	23	138,218	100.0%	7 Sep	22,766	100%
5 Sep			2,597	2,691		140,909	100%	5,076	2	2	0	140,906	100.0%	8 Sep	32,605	100%
6 Sep			-	866		141,772	100%	2,690	1	1	0	141,771	100.0%	9 Sep	35,923	100%
7 Sep			-	5,278		147,049	100%	866	0	0	0	147,049	100.0%	10 Sep	21,999	
8 Sep			15,835	10,556		157,605	100%	5,278	0	0	0	157,605	100.0%	11 Sep	11,486	
9 Sep			15,835	15,835		173,440	100%	10,556	1	1	0	173,439	100.0%	12 Sep	4,886	
10 Sep			15,835	10,556		183,995	100%	15,834	1	1	0	183,995	100.0%	13 Sep	12,200	
11 Sep			-	5,278		189,273	100%	10,556	0	0	0	189,273	100.0%	14 Sep	12,000	
12 Sep			-	0		189,273	100%	5,278	0	0	0	189,273	100.0%	15 Sep	12,000	
13 Sep			-	0		189,273	100%	0	0	0	0	189,273	100.0%	16 Sep	7,689	
14 Sep			-	0		189,273	100%	0	0	0	0	189,273	100.0%	17 Sep	5,679	
15 Sep														18 Sep	6,160	
16 Sep														19 Sep	7,747	
17 Sep														20 Sep	5,100	
18 Sep														21 Sep	8,300	
19 Sep														22 Sep	2,775	
20 Sep														23 Sep		
21 Sep														24 Sep		
22 Sep														25 Sep		
23 Sep														26 Sep		
24 Sep														27 Sep		
25 Sep														28 Sep		
26 Sep														29 Sep		
27 Sep														30 Sep		
28 Sep														1 Oct		
29 Sep	PSC Escapement after Summer-run = 352,227													2 Oct		
30 Sep	Model Escapement after Summer-run = 189,273													3 Oct		
1 Oct	Model In-river Mortality Rate = 43%													4 Oct		
2 Oct														5 Oct		
3 Oct														6 Oct		
4 Oct														7 Oct		
5 Oct														8 Oct		
6 Oct														9 Oct		
7 Oct														10 Oct		
Total	2,276,774	2,281,220	529,354	529,354	78,717				334,597	261,364	181,045				450,637	

Appendix Table B6. Stay With the School (SWTS) model results for 1998.

Area 20 Date	Seine Test Fishery Summer-run Entry	Seine Test Fishery Late-run Entry	Adjusted Late-run Entry	Catch	Total Sockeye	Late-Run % in LGS	Late-Run Additions	Gross Escape	Mission Escape	Mort. Est.	Resident Lates	Encounter Rate	Below Bridge Date	PSC Escape	Summer Cum %
20 Jul	-		0	-							0		23 Jul	0	
21 Jul	-		0	-	-		0	0			0		24 Jul	0	
22 Jul	13,922	170	225	-	14,147		0	0	0	0	225	0.7%	25 Jul	0	0%
23 Jul	48,166	241	319	-	48,710	1%	0	0	0	0	544	0.7%	26 Jul	0	0%
24 Jul	52,957	2,386	3,159	-	56,660	7%	0	225	225	225	3,478	0.7%	27 Jul	0	0%
25 Jul	92,369	2,591	3,430	-	99,277	7%	0	319	319	319	6,589	0.9%	28 Jul	0	2%
26 Jul	74,673	5,053	6,689	-	87,951	15%	0	3,158	3,158	3158	10,120	1.3%	29 Jul	0	3%
27 Jul	107,750	3,305	4,375	-	122,244	12%	2	3,430	3,430	3430	11,064	1.8%	30 Jul	0	6%
28 Jul	97,521	3,825	5,063	-	113,648	14%	1	6,687	6,687	6687	9,440	2.0%	31 Jul	0	9%
29 Jul	109,769	2,664	3,527	-	122,735	11%	2	4,374	4,374	4374	8,593	1.7%	1 Aug	0	12%
30 Jul	107,652	5,320	7,043	-	123,289	13%	1	5,061	5,061	5061	10,575	1.6%	2 Aug	0	15%
31 Jul	113,273	6,860	9,081	-	132,930	15%	2	3,526	3,526	3526	16,130	1.9%	3 Aug	0	18%
1 Aug	137,274	15,143	20,046	-	173,450	21%	4	7,041	7,041	7041	29,135	3.3%	4 Aug	0	21%
2 Aug	136,602	34,905	46,206	-	211,943	36%	29	9,077	9,077	9077	66,264	11.0%	5 Aug	0	25%
3 Aug	107,133	43,824	58,014	14,175	231,411	54%	645	20,017	5,842	5842	104,261	83.6%	6 Aug	0	29%
4 Aug	72,659	46,246	61,220	-	238,139	69%	13,983	45,562	45,562	45562	119,919	99.6%	7 Aug	0	33%
5 Aug	55,439	38,619	51,123	-	226,480	76%	29,432	44,031	44,031	44031	127,010	99.9%	8 Aug	0	36%
6 Aug	68,826	45,368	60,057	-	255,893	73%	29,131	31,788	31,788	31788	155,279	100.0%	9 Aug	0	39%
7 Aug	64,231	45,233	59,879	50	279,389	77%	32,081	21,992	21,942	21942	193,166	100.0%	10 Aug	0	40%
8 Aug	61,752	37,948	50,235	874	305,153	80%	35,511	27,976	27,102	27102	215,425	100.0%	11 Aug	0	42%
9 Aug	62,821	38,978	51,598	456	329,844	81%	31,961	24,368	23,912	23912	242,655	100.0%	12 Aug	0	44%
10 Aug	75,476	57,771	76,476	-	394,608	81%	33,816	18,274	18,274	18274	300,857	100.0%	13 Aug	0	46%
11 Aug	140,287	80,131	106,076	-	547,220	74%	50,019	17,783	17,783	17783	389,150	100.0%	14 Aug	0	48%
12 Aug	164,646	146,200	193,537	25,656	747,334	78%	58,659	26,457	801	801	556,230	100.0%	15 Aug	0	50%
13 Aug	189,215	153,621	203,361	-	948,806	80%	117,654	47,416	47,416	47416	712,174	100.0%	16 Aug	10,940	55%
14 Aug	208,662	152,927	202,442	-	1,123,278	81%	130,338	75,883	75,883	75883	838,733	100.0%	17 Aug	16,612	60%
15 Aug	192,967	142,749	188,968	16,414	1,220,668	84%	134,216	73,023	56,609	56609	954,678	100.0%	18 Aug	40,496	65%
16 Aug	200,176	146,056	193,347	18,600	1,348,201	85%	133,945	68,226	49,626	49626	1,079,798	100.0%	19 Aug	12,778	72%
17 Aug	153,211	201,803	267,143	-	1,500,152	90%	140,194	55,023	55,023	49016	1,291,918	100.0%	20 Aug	2,096	78%
18 Aug	127,290	242,875	321,513	33,368	1,740,722	93%	215,363	53,153	19,785	15832	1,560,279	100.0%	21 Aug	3,856	84%
19 Aug	81,677	221,041	292,610	33,815	1,934,566	96%	276,211	51,780	17,965	13002	1,801,109	100.0%	22 Aug	24,393	88%
20 Aug	36,470	158,110	209,303	3,183	2,046,881	98%	268,424	45,302	42,119	27730	1,965,109	100.0%	23 Aug	27,913	92%
21 Aug	32,952	65,558	86,785	-	2,084,846	98%	201,911	24,186	24,186	14557	2,027,708	100.0%	24 Aug	18,933	95%
22 Aug	30,167	54,345	71,940	83	2,129,816	99%	84,063	7,392	7,309	4038	2,092,256	100.0%	25 Aug	15,026	96%
23 Aug	23,946	45,305	59,974	545	2,176,177	99%	69,917	2,722	2,177	1108	2,149,509	100.0%	26 Aug	42,198	97%
24 Aug	22,106	35,602	47,129	3,378	2,218,744	99%	58,662	2,024	0	0	2,193,260	100.0%	27 Aug	29,469	98%
25 Aug	14,536	33,300	44,082	-	2,251,878	99%	46,195	1,313	1,313	572	2,236,029	100.0%	28 Aug	37,698	99%
26 Aug	6,642	23,230	30,751	-	2,273,422	100%	43,515	934	934	378	2,265,846	100.0%	29 Aug	39,135	99%
27 Aug	3,130	11,747	15,550	-	2,284,526	100%	30,572	567	567	214	2,280,829	100.0%	30 Aug	62,128	100%
28 Aug	1,404	7,335	9,710	-	2,291,943	100%	15,507	179	179	63	2,290,359	100.0%	31 Aug	64,587	100%
29 Aug	-	5,262	6,965	-	2,297,325	100%	9,698	43	43	14	2,297,282	100.0%	1 Sep	57,545	100%
30 Aug	-	2,960	3,918	-	2,301,200	100%	6,965	12	12	4	2,301,188	100.0%	2 Sep	55,349	100%
31 Aug	-	1,200	1,589	-	2,302,777	100%	3,918	0	0	0	2,302,777	100.0%	3 Sep	55,701	100%
1 Sep	-	0	0	-	2,302,777	100%	1,589	0	0	0	2,302,777	100.0%	4 Sep	33,083	100%
2 Sep	-	0	0	-									5 Sep	35,029	100%
3 Sep	-	0	0	-									6 Sep	43,015	100%
4 Sep	-	0	0	-									7 Sep	25,032	100%
5 Sep	-	0	0	-									8 Sep	44,300	100%
6 Sep	-			-									9 Sep	79,324	100%
7 Sep	-												10 Sep	67,919	
8 Sep													11 Sep	170,467	
9 Sep	-												12 Sep	274,978	
10 Sep	-												13 Sep	293,243	
11 Sep													14 Sep	524,571	
12 Sep													15 Sep	508,941	
13 Sep													16 Sep	215,807	
14 Sep													17 Sep	45,200	
15 Sep													18 Sep	6,100	
Total	3,289,750	2,367,807	3,134,458	150,597				830,326	681,084	635,999				2,983,861	

PSC Escapement after Summer-run =	2,662,317
Model Escapement after Summer-run =	2,302,777
Model In-river Mortality Rate =	29%

Appendix Table B7. Stay With the School (SWTS) model results for 1999.

Area 20 Date	Seine Test Fishery Summer-run Entry	Late-run Entry	Adjusted Late-run Entry	Catch	Total Sockeye	Late-Run % in LGS	Late-Run Additions	Gross Escape	Mission Escape	Mort. Est.	Resident Lates	Encounter Rate	Mission Date	PSC Escape	Summer Cum %
20 Jul	30,039	0	0								0		23 Jul		
21 Jul	52,178	0	0	-	52,178	0%	0	0			0		24 Jul		
22 Jul	49,200	0	0	-	49,200	0%	0	0	0	0	0	0.7%	25 Jul		2%
23 Jul	42,023	0	0	-	42,023	0%	0	0	0	0	0	0.7%	26 Jul		5%
24 Jul	19,822	0	0	-	19,822	0%	0	0	0	0	0	0.7%	27 Jul		8%
25 Jul	64,825	0	0	-	64,825	0%	0	0	0	0	0	0.7%	28 Jul		10%
26 Jul	81,366	451	360	-	81,726	0%	0	0	0	0	360	0.7%	29 Jul		12%
27 Jul	72,437	372	297	-	73,095	1%	0	0	0	0	657	0.7%	30 Jul		16%
28 Jul	34,652	2,276	1,817	-	37,127	7%	0	360	360	360	2,115	0.7%	31 Jul		21%
29 Jul	28,724	5,420	4,329	-	35,167	18%	0	297	297	297	6,146	0.8%	1 Aug		25%
30 Jul	35,225	7,173	5,729	-	47,100	25%	1	1,817	1,817	1817	10,058	1.2%	2 Aug		27%
31 Jul	40,991	8,197	6,547	-	57,596	29%	4	4,328	4,328	4328	12,277	1.8%	3 Aug		29%
1 Aug	64,847	16,714	13,349	30	90,474	28%	10	5,725	5,694	5694	19,902	2.2%	4 Aug		31%
2 Aug	100,732	25,535	20,394	3	141,028	29%	24	6,537	6,535	6535	33,759	4.7%	5 Aug	0	33%
3 Aug	91,605	26,768	21,379	56	146,742	38%	78	13,325	13,269	13269	41,813	16.5%	6 Aug	0	37%
4 Aug	79,819	20,757	16,578	554	138,209	42%	497	20,316	19,762	19762	38,075	30.6%	7 Aug	0	43%
5 Aug	58,582	36,171	28,889	18	125,546	53%	906	20,882	20,864	20864	46,082	23.3%	8 Aug	0	49%
6 Aug	62,565	42,434	33,891	8	142,539	56%	1,913	15,672	15,664	15664	64,301	40.3%	9 Aug	0	54%
7 Aug	44,639	41,463	33,116	26	142,056	69%	4,303	26,976	26,950	26950	70,441	80.7%	10 Aug	0	57%
8 Aug	32,933	19,501	15,575	31	118,949	72%	12,566	29,589	29,558	29558	56,427	88.5%	11 Aug	0	61%
9 Aug	42,875	24,406	19,492	32	118,795	64%	7,211	20,549	20,517	20517	55,371	65.5%	12 Aug	7,163	64%
10 Aug	52,935	39,552	31,589	51	139,895	62%	5,218	8,364	8,313	8313	78,596	63.1%	13 Aug	7,602	66%
11 Aug	66,676	67,401	53,832	41	199,104	67%	7,704	14,275	14,234	12680	118,153	94.6%	14 Aug	9,202	68%
12 Aug	48,274	61,367	49,013	35	215,439	78%	22,524	23,886	23,851	19085	143,280	99.9%	15 Aug	11,824	71%
13 Aug	43,208	60,241	48,113	72	234,600	82%	29,477	31,308	31,236	22607	160,085	100.0%	16 Aug	13,973	75%
14 Aug	35,091	44,545	35,577	112	230,753	85%	32,020	19,536	19,424	12788	176,125	100.0%	17 Aug	17,566	78%
15 Aug	40,498	50,080	39,998	99	256,621	84%	25,579	16,093	15,994	9626	200,030	100.0%	18 Aug	16,544	81%
16 Aug	33,436	42,714	34,115	113	267,581	88%	28,370	9,998	9,886	5462	224,147	100.0%	19 Aug	18,201	83%
17 Aug	25,070	40,463	32,317	151	281,533	91%	26,122	11,628	11,477	5842	244,835	100.0%	20 Aug	18,365	86%
18 Aug	25,494	47,386	37,846	93	308,176	92%	26,818	7,993	7,900	3717	274,688	100.0%	21 Aug	17,122	88%
19 Aug	21,105	41,221	32,923	98	328,716	94%	31,843	5,499	5,401	2355	302,112	100.0%	22 Aug	16,055	89%
20 Aug	15,194	31,635	25,266	65	342,572	96%	28,831	6,003	5,938	2405	321,375	100.0%	23 Aug	10,972	91%
21 Aug	8,560	20,706	16,538	69	346,473	98%	23,075	4,092	4,023	1517	333,821	100.0%	24 Aug	8,894	92%
22 Aug	9,780	25,926	20,707	71	364,308	97%	15,731	2,192	2,120	745	352,336	100.0%	25 Aug	13,068	93%
23 Aug	15,966	41,079	32,809	82	401,112	96%	19,610	807	725	238	384,338	100.0%	26 Aug	17,512	93%
24 Aug	16,045	42,455	33,908	78	434,291	96%	30,249	1,097	1,019	313	417,149	100.0%	27 Aug	18,532	94%
25 Aug	15,610	43,297	34,581	119	467,341	97%	31,449	2,560	2,441	702	449,170	100.0%	28 Aug	9,119	95%
26 Aug	10,077	33,515	26,768	61	486,015	98%	32,309	2,459	2,398	646	473,479	100.0%	29 Aug	11,400	96%
27 Aug	6,991	27,485	21,952	67	502,422	99%	25,669	2,272	2,205	558	493,159	100.0%	30 Aug	28,150	97%
28 Aug	5,375	26,849	21,444	35	519,977	99%	21,345	1,098	1,063	253	513,504	100.0%	31 Aug	33,818	97%
29 Aug	4,288	27,133	21,671	196	539,463	99%	21,003	607	411	92	534,568	100.0%	1 Sep	8,509	98%
30 Aug	4,558	28,648	22,881	84	562,007	99%	21,327	441	357	75	557,008	100.0%	2 Sep	21,378	98%
31 Aug	4,238	22,491	17,963	71	579,209	99%	22,511	343	272	54	574,628	100.0%	3 Sep	11,552	98%
1 Sep	3,674	15,450	12,340	34	590,641	99%	17,701	370	336	62	586,598	100.0%	4 Sep	20,322	99%
2 Sep	3,272	9,945	7,943	244	597,813	99%	12,187	262	18	3	594,279	100.0%	5 Sep	27,964	99%
3 Sep	4,470	7,427	5,932	55	604,681	99%	7,856	153	98	16	600,058	100.0%	6 Sep	39,165	99%
4 Sep	5,486	7,207	5,756	65	611,300	99%	5,845	87	22	3	605,727	100.0%	7 Sep	28,269	99%
5 Sep	-	7,716	6,163	44	611,890	100%	5,653	87	43	43	611,803	100.0%	8 Sep	23,669	100%
6 Sep				-	611,803	100%	6,163	103	103	103	611,700	100.0%	9 Sep	27,295	100%
7 Sep													10 Sep	34,793	
8 Sep													11 Sep	26,586	
9 Sep	-												12 Sep	30,152	
10 Sep	-												13 Sep	51,764	
11 Sep													14 Sep	77,832	
12 Sep													15 Sep	76,117	
13 Sep													16 Sep	46,894	
14 Sep													17 Sep	36,331	
15 Sep													18 Sep	25,238	
16 Sep													19 Sep	19,510	
17 Sep													20 Sep	10,198	
18 Sep													21 Sep	4,327	
19 Sep													22 Sep	3,140	
20 Sep													23 Sep	1,952	
21 Sep													24 Sep	764	
22 Sep													25 Sep	1,188	
23 Sep													26 Sep	2,170	
24 Sep													27 Sep	1,221	
25 Sep													28 Sep	3,120	
26 Sep													29 Sep	1,831	
Total	1,655,451	1,191,575	951,687	3,064				339,987	336,923	275,917				948,623	

PSC Escapement after Summer-run =	506,093
Model Escapement after Summer-run =	611,700
Model In-river Mortality Rate =	36%

Appendix Table B8. Stay With the School (SWTS) model results for 2000.

	Seine Test Fishery		Adjusted										Below		Summer
Area 20	Summer-run	Late-run	Late-run		Total	Late-Run	Late-Run	Gross	Mission	Mort.	Resident	Encounter	Bridge	PSC	Cum
Date	Entry	Entry	Entry	Catch	Sockeye	% in LGS	Additions	Escape	Escape	Est.	Lates	Rate	Date	Escape	%
19 Jul	155,820	0	0		153,611	0%	0	0			0				
20 Jul	153,611	0	0		153,611	0%	0	0			0	0.7%	23 Jul	0	
21 Jul	169,486	0	0	-	169,486	0%	0	0	0	0	0	0.7%	24 Jul	0	8%
22 Jul	53,393	0	0	-	53,393	0%	0	0	0	0	0	0.7%	25 Jul	0	16%
23 Jul	43,773	0	0	-	43,773	0%	0	0	0	0	0	0.7%	26 Jul	0	24%
24 Jul	47,129	0	0	-	47,129	0%	0	0	0	0	0	0.7%	27 Jul	0	27%
25 Jul	48,464	0	0	-	48,464	0%	0	0	0	0	0	0.7%	28 Jul	0	29%
26 Jul	62,342	0	0	-	62,342	0%	0	0	0	0	0	0.7%	29 Jul	0	31%
27 Jul	35,084	0	0	-	35,084	0%	0	0	0	0	0	0.7%	30 Jul	2,446	34%
28 Jul	32,539	444	444	-	32,983	1%	0	0	0	0	444	0.7%	31 Jul	2,866	37%
29 Jul	50,943	1,687	1,687	106	53,074	4%	0	0	0	0	2,025	0.7%	1 Aug	6,966	39%
30 Jul	91,474	7,504	7,504	56	101,004	9%	0	444	388	388	9,085	0.8%	2 Aug	6,887	40%
31 Jul	112,975	13,639	13,639	36	135,699	17%	1	1687	1651	1651	21,037	1.6%	3 Aug	16,995	43%
1 Aug	85,856	17,224	17,224	1,671	124,117	31%	6	7504	5833	5833	30,756	5.2%	4 Aug	10,511	48%
2 Aug	182,343	46,319	46,319	2,047	259,419	30%	86	13632	11586	11586	63,443	12.7%	5 Aug	9,559	53%
3 Aug	182,410	55,872	55,872	90	301,725	40%	521	17138	17048	17048	102,177	79.3%	6 Aug	14,748	58%
4 Aug	192,389	60,126	60,126	45	354,692	46%	6930	45799	45754	45754	116,505	99.5%	7 Aug	36,165	67%
5 Aug	59,009	27,722	27,722	55	203,235	71%	12522	48942	48887	48887	95,285	99.9%	8 Aug	27,281	76%
6 Aug	37,677	15,577	15,577	23,232	148,540	75%	13943	47604	24372	24372	63,258	98.9%	9 Aug	5,679	86%
7 Aug	16,666	5,529	5,529	33,625	85,453	80%	8584	13779	0	0	35,162	79.0%	10 Aug	11,020	89%
8 Aug	20,732	8,440	8,440	137	64,334	68%	2831	6993	6856	6856	36,609	18.5%	11 Aug	11,624	91%
9 Aug	22,719	14,827	14,827	3,621	74,155	69%	717	2698	0	0	47,815	20.8%	12 Aug	11,892	92%
10 Aug	38,057	24,698	24,698	4,933	110,570	66%	1481	7723	2790	2790	64,790	44.6%	13 Aug	14,105	93%
11 Aug	32,441	22,879	22,879	370	120,110	73%	4733	13345	12975	12975	74,324	81.4%	14 Aug	21,086	94%
12 Aug	25,406	16,573	16,573	546	116,302	78%	9927	19965	19419	19419	70,932	91.9%	15 Aug	17,499	96%
13 Aug	13,742	10,210	10,210	736	94,884	86%	9306	12952	12216	12216	68,190	89.0%	16 Aug	16,255	97%
14 Aug	8,615	7,239	7,239	540	84,044	90%	6647	7267	6727	6727	68,162	86.0%	17 Aug	21,859	99%
15 Aug	4,706	3,665	3,665	37	76,534	94%	5017	3563	3526	3526	68,264	86.0%	18 Aug	20,204	99%
16 Aug	-	1,683	1,683	4,060	69,947	100%	2777	2222	0	0	65,887	86.1%	19 Aug	11,291	100%
17 Aug	-	0	0	6,404	65,887	100%	1450	889	0	0	59,483	83.0%	20 Aug	5,219	100%
18 Aug	-	0	0	3,349	59,483	100%	0	233	0	0	56,134	72.1%	21 Aug	0	100%
19 Aug	-	0	0	-	56,134	100%	0	0	0	0	56,134	64.9%	22 Aug	557	100%
20 Aug	-	0	0	39	56,134	100%	0	0	0	0	56,095	64.9%	23 Aug	2,183	100%
21 Aug	-	0	0	28	56,095	100%	0	0	0	0	56,067	64.8%	24 Aug	2,147	100%
22 Aug	-	0	0	946	56,067	100%	0	0	0	0	55,121	64.7%	25 Aug	2,583	100%
23 Aug	-	0	0	590	55,121	100%	0	0	0	0	54,531	62.5%	26 Aug	4,889	100%
24 Aug	-	0	0	-	54,531	100%	0	0	0	0	54,531	61.1%	27 Aug	2,204	100%
25 Aug	-	0	0	-	54,531	100%	0	0	0	0	54,531	61.1%	28 Aug	2,170	100%
26 Aug	-	0	0	1	54,531	100%	0	0	0	0	54,530	61.1%	29 Aug	6,718	100%
27 Aug	-	0	0	771	54,530	100%	0	0	0	0	53,759	61.1%	30 Aug	10,840	100%
28 Aug	-	0	0	978	53,759	100%	0	0	0	0	52,781	59.3%	31 Aug	9,716	100%
29 Aug	-	0	0	141	52,781	100%	0	0	0	0	52,640	56.9%	1 Sep	7,181	100%
30 Aug	-			1,333	52,640	100%	0	0	0	0	51,307	56.6%	2 Sep	3,098	100%
31 Aug				-									3 Sep	0	100%
Total	1,979,801	361,859	361,859	90,523				342,542	288,190	220,029				356,445	

PSC Escapement after Summer-run =	70,798
Model Escapement after Summer-run =	51,307
Model In-river Mortality Rate =	83%

Appendix Table B9. Stay With the School (SWTS) model results for 2001.

Area 20 Date	Seine Test Fishery Summer-run Entry	Seine Test Fishery Late-run Entry	Adjusted Late-run Entry	Catch	Total Sockeye	Late-Run % in LGS	Late-Run Additions	Gross Escape	Mission Escape	Mort. Est.	Resident Lates	Encounter Rate	Below Bridge Date	PSC Escape	Summer Cum %
20 Jul	53,769	0	0								0		23 Jul		
21 Jul	54,410	0	0		54,410		0	0			0	0.7%	24 Jul		
22 Jul	81,411	0	0	-	81,411		0	0	0	0	0	0.7%	25 Jul		
23 Jul	85,562	0	8	-	85,570	0%	0	0	0	0	8	0.7%	26 Jul		3%
24 Jul	101,298	0	29	-	101,335	0%	0	0	0	0	37	0.7%	27 Jul		5%
25 Jul	88,663	1,880	2,630	8	91,329	3%	0	8	0	0	2,658	0.7%	28 Jul		7%
26 Jul	105,570	4,142	4,572	29	112,800	6%	0	29	0	0	7,201	0.9%	29 Jul		10%
27 Jul	82,274	4,229	2,331	500	91,807	10%	0	2630	2130	2130	6,903	1.4%	30 Jul	2,130	12%
28 Jul	64,248	1,978	9,696	1,587	80,847	21%	0	4572	2985	2985	12,027	1.3%	31 Jul	2,985	15%
29 Jul	31,034	-160	13,272	-	56,332	45%	5	2331	2331	2331	22,968	2.2%	1 Aug	2,331	17%
30 Jul	37,614	103	9,377	499	69,959	46%	59	9690	9191	9191	22,655	6.3%	2 Aug	9,196	19%
31 Jul	95,612	2,179	4,825	3,634	123,092	22%	126	13213	9579	9579	14,267	6.1%	3 Aug	9,637	20%
1 Aug	160,554	3,110	3,421	1,256	178,242	10%	15	9252	7996	7996	8,437	2.7%	4 Aug	8,122	21%
2 Aug	172,168	4,080	4,488	912	185,093	7%	1	4810	3898	3898	8,114	1.5%	5 Aug	3,913	24%
3 Aug	126,466	3,516	3,868	208	138,448	9%	0	3420	3212	3212	8,562	1.5%	6 Aug	4,540	28%
4 Aug	72,861	3,455	3,800	732	85,223	15%	0	4488	3756	3756	7,875	1.6%	7 Aug	5,543	32%
5 Aug	74,290	2,950	3,245	1,231	85,410	13%	1	3867	2636	2636	7,252	1.5%	8 Aug	5,592	36%
6 Aug	105,255	4,723	5,195	1,258	117,702	11%	1	3799	2541	2541	8,648	1.4%	9 Aug	4,757	38%
7 Aug	106,868	5,292	5,821	640	121,337	12%	1	3244	2604	2604	11,225	1.6%	10 Aug	6,784	40%
8 Aug	114,500	7,027	7,730	989	133,455	14%	1	5194	4205	4205	13,760	2.0%	11 Aug	11,911	43%
9 Aug	108,384	10,695	11,764	2,869	133,909	19%	3	5820	2951	2951	19,705	2.6%	12 Aug	18,158	45%
10 Aug	101,109	12,675	13,942	187	134,756	25%	11	7726	7540	7540	25,921	4.6%	13 Aug	6,007	49%
11 Aug	99,788	13,625	14,988	842	140,696	29%	40	11753	10911	10911	29,155	8.3%	14 Aug	5,955	51%
12 Aug	108,796	11,699	12,869	586	150,820	28%	105	13902	13316	13316	28,122	11.1%	15 Aug	3,315	54%
13 Aug	165,168	16,955	18,651	332	211,941	22%	111	14883	14551	14551	31,890	10.1%	16 Aug	3,210	57%
14 Aug	160,327	16,746	18,420	818	210,638	24%	92	12759	11940	11940	37,552	14.1%	17 Aug	4,794	60%
15 Aug	157,972	14,794	16,273	385	211,797	25%	148	18559	18174	18174	35,266	22.4%	18 Aug	7,182	64%
16 Aug	154,553	13,064	14,370	142	204,189	24%	235	18273	18131	18131	31,363	18.6%	19 Aug	18,228	68%
17 Aug	174,125	17,872	19,659	1,384	225,148	23%	158	16038	14654	13054	34,984	13.4%	20 Aug	22,594	73%
18 Aug	158,499	22,282	24,510	1,001	217,993	27%	136	14212	13211	10571	45,282	18.2%	21 Aug	11,363	77%
19 Aug	92,754	16,369	18,006	1,037	156,043	41%	333	19523	18486	13379	43,765	38.4%	22 Aug	10,736	81%
20 Aug	61,881	10,289	11,318	10	116,964	47%	1138	24178	24167	15911	30,906	34.9%	23 Aug	11,549	86%
21 Aug	34,668	3,831	4,214	14	69,788	50%	876	16868	16854	10144	18,252	12.9%	24 Aug	8,827	88%
22 Aug	26,637	3,240	3,564	18	48,453	45%	138	10442	10424	5759	11,374	4.0%	25 Aug	18,750	90%
23 Aug	18,292	2,585	2,843	5	32,509	44%	29	4077	4072	2073	10,141	2.1%	26 Aug	14,281	91%
24 Aug	27,924	3,730	4,103	16	42,167	34%	11	3535	3520	1656	10,708	1.8%	27 Aug	6,944	91%
25 Aug	50,366	6,501	7,151	36	68,225	26%	9	2832	2796	1219	15,027	1.9%	28 Aug	1,450	92%
26 Aug	56,805	7,613	8,374	15	80,206	29%	9	4094	4079	1652	19,306	2.9%	29 Aug	9,227	93%
27 Aug	51,472	7,094	7,803	6	78,582	34%	21	7141	7135	2690	19,968	4.4%	30 Aug	11,956	94%
28 Aug	32,561	4,773	5,251	19	57,780	44%	41	8353	8334	2930	16,866	4.7%	31 Aug	12,354	96%
29 Aug	26,335	3,407	3,748	29	46,949	44%	47	7762	7733	2539	12,852	3.5%	1 Sep	6,544	97%
30 Aug	20,317	2,573	2,831	4	35,999	44%	25	5203	5199	1597	10,479	2.4%	2 Sep	792	98%
31 Aug	14,065	1,641	1,805	16	26,349	47%	13	3722	3706	1066	8,562	1.9%	3 Sep	2,033	98%
1 Sep	6,710	1,037	1,141	4	16,413	59%	7	2818	2814	759	6,885	1.6%	4 Sep	1,708	99%
2 Sep	4,781	587	646	5	12,311	61%	6	1798	1793	453	5,732	1.3%	5 Sep	2,076	99%
3 Sep	6,050	0	0	-									6 Sep	1,049	100%
4 Sep	4,259	0	0	-									7 Sep	3,291	100%
5 Sep													8 Sep	1,951	100%
6 Sep													9 Sep	1,722	
7 Sep													10 Sep	1,956	
8 Sep													11 Sep	214	
9 Sep													12 Sep	206	
10 Sep													13 Sep	172	
11 Sep													14 Sep	139	
12 Sep													15 Sep	799	
13 Sep													16 Sep	489	
14 Sep													17 Sep	367	
Total	3,739,021	274,181	332,552	23,266				326,820	303,554	242,030				309,828	

PSC Escapement after Summer-run =	12,355
Model Escapement after Summer-run =	5,732
Model In-river Mortality Rate =	78%

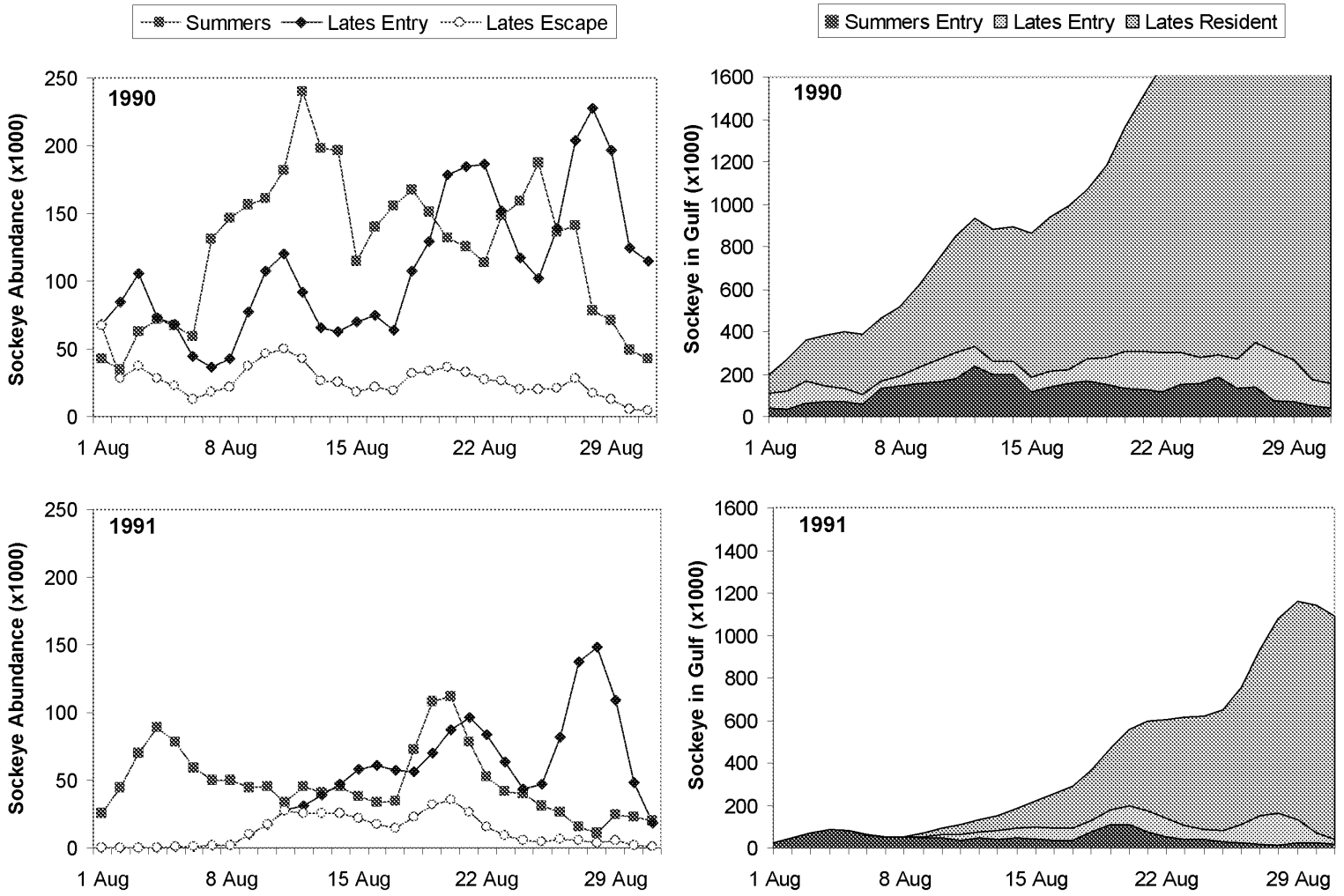
Appendix Table B10. Stay With the School (SWTS) model results for 2002.

Area 20 Date	Seine Test Fishery Summer-run Entry	Seine Test Fishery Late-run Entry	Adjusted Late-run Entry	Catch	Total Sockeye	Late-Run % in LGS	Late-Run Additions	Gross Escape	Mission Escape	Mort. Est.	Resident Lates	Encounter Rate	Below Bridge Date	PSC Escape	Summer Cum %
20 Jul	11,351	1,449	1,897								1897		23 Jul	0	
21 Jul	15,870	3,986	5,219		22,986	31%	0	0			7116	0.8%	24 Jul	0	
22 Jul	35,308	7,733	10,125		52,549	33%	4	1,897	1,897	1897	15344	1.4%	25 Jul	954	0%
23 Jul	52,623	17,059	22,337		90,304	42%	15	5,215	5,215	5215	32466	3.0%	26 Jul	2,793	1%
24 Jul	53,841	19,212	25,155		111,461	52%	118	10,110	10,110	10110	47510	14.8%	27 Jul	6,070	1%
25 Jul	49,576	19,319	25,295	641	122,382	59%	992	22,219	21,578	21578	50587	43.8%	28 Jul	7,284	2%
26 Jul	38,061	19,009	24,890	10	113,537	66%	3,922	24,162	24,152	24152	51314	51.5%	29 Jul	16,806	4%
27 Jul	95,258	47,842	62,642	9	209,214	54%	5,661	21,373	21,364	21364	92582	53.3%	30 Jul	12,329	5%
28 Jul	127,286	60,907	79,748	152	299,617	58%	9,902	19,229	19,077	19077	153102	98.6%	31 Jul	6,367	5%
29 Jul	130,843	59,479	77,879	138	361,824	64%	26,014	52,740	52,602	52602	178241	100.0%	1 Aug	9,180	7%
30 Jul	71,728	30,198	39,539	14	289,508	75%	31,737	53,734	53,720	53720	164046	100.0%	2 Aug	16,117	10%
31 Jul	56,552	30,738	40,246	4,879	260,845	78%	22,374	46,142	41,263	41263	158151	100.0%	3 Aug	21,386	13%
1 Aug	96,547	49,595	64,937	5,973	319,634	70%	24,687	17,165	11,193	11193	205922	100.0%	4 Aug	27,092	14%
2 Aug	140,337	71,188	93,209	5,228	439,468	68%	31,632	15,560	10,332	10332	283572	100.0%	5 Aug	25,665	16%
3 Aug	158,473	68,969	90,304	2,527	532,348	70%	43,184	33,305	30,778	30778	340571	100.0%	6 Aug	20,263	18%
4 Aug	150,110	60,651	79,413	7,460	570,093	74%	44,542	50,025	42,565	42565	369959	100.0%	7 Aug	18,682	21%
5 Aug	174,282	79,555	104,165	98	648,406	73%	43,099	45,762	45,664	45664	428362	100.0%	8 Aug	42,268	24%
6 Aug	186,733	121,949	159,673	99	774,768	76%	55,694	36,314	36,215	36215	551720	100.0%	9 Aug	35,120	27%
7 Aug	312,279	265,771	347,985	5,163	1,211,984	74%	91,980	48,471	43,308	43308	851234	100.0%	10 Aug	53,007	31%
8 Aug	318,093	301,157	394,317	61,589	1,563,645	80%	191,764	67,693	6,104	6104	1177859	100.0%	11 Aug	30,313	35%
9 Aug	306,560	284,385	372,357	51,600	1,856,775	83%	250,203	156,221	104,621	104621	1393995	100.0%	12 Aug	62,791	42%
10 Aug	197,980	199,200	260,821	30,603	1,852,796	89%	259,552	144,114	113,511	113511	1510702	100.0%	13 Aug	23,494	48%
11 Aug	153,218	147,773	193,486	51,800	1,857,406	92%	208,059	112,804	61,004	61004	1591383	100.0%	14 Aug	100,122	55%
12 Aug	133,654	192,274	251,753	209	1,976,790	93%	162,881	52,762	52,553	46816	1790374	100.0%	15 Aug	101,024	59%
13 Aug	165,309	247,464	324,014	6,024	2,279,697	93%	218,861	30,605	24,581	19669	2083783	100.0%	16 Aug	25,752	62%
14 Aug	192,581	331,267	433,741	3,249	2,710,106	93%	278,727	32,892	29,643	21454	2484633	100.0%	17 Aug	34,389	65%
15 Aug	186,367	275,800	361,117	97	3,032,116	94%	374,288	45,287	45,190	29752	2800462	100.0%	18 Aug	28,153	69%
16 Aug	106,452	192,643	252,236	113	3,159,150	97%	318,089	59,453	59,341	35715	2993245	100.0%	19 Aug	20,886	73%
17 Aug	68,018	131,191	171,774	481	3,233,037	98%	235,523	43,027	42,547	23507	3121992	100.0%	20 Aug	67,616	77%
18 Aug	75,990	150,775	197,416	195	3,395,398	98%	164,622	16,713	16,517	8408	3302696	100.0%	21 Aug	74,318	79%
19 Aug	81,170	150,810	197,461	155	3,581,327	98%	188,679	7,152	6,997	3292	3493005	100.0%	22 Aug	64,738	80%
20 Aug	97,970	182,296	238,688	718	3,829,663	97%	188,612	8,738	8,019	3496	3722955	100.0%	23 Aug	40,818	82%
21 Aug	92,670	162,956	213,366	3,173	4,028,991	98%	226,632	8,849	5,676	2299	3927471	100.0%	24 Aug	77,632	84%
22 Aug	89,647	159,055	208,257	3,155	4,225,375	98%	203,663	12,056	8,901	3356	4123672	100.0%	25 Aug	88,278	86%
23 Aug	69,011	122,001	159,741	396	4,352,424	98%	199,514	9,702	9,307	3272	4273711	100.0%	26 Aug	66,461	88%
24 Aug	73,697	165,928	217,257	421	4,564,664	98%	154,715	8,743	8,322	2733	4482224	100.0%	27 Aug	92,264	90%
25 Aug	73,735	181,673	237,872	139	4,793,832	98%	210,298	5,025	4,886	1501	4715071	100.0%	28 Aug	79,403	91%
26 Aug	78,781	211,230	276,573	690	5,070,425	98%	230,611	6,959	6,269	1803	4984685	100.0%	29 Aug	115,808	93%
27 Aug	67,932	175,497	229,785	197	5,282,403	99%	268,045	7,261	7,064	1904	5207209	100.0%	30 Aug	136,017	94%
28 Aug	52,994	130,757	171,205	4,145	5,431,408	99%	223,913	8,528	4,382	1108	5369887	100.0%	31 Aug	122,208	96%
29 Aug	29,127	65,510	85,774	5,034	5,484,788	99%	167,881	5,872	838	199	5449789	100.0%	1 Sep	220,619	98%
30 Aug	16,113	33,219	43,495	741	5,509,397	100%	84,866	3,325	2,584	576	5489960	100.0%	2 Sep	209,440	99%
31 Aug	8,160	18,266	23,916	262	5,522,035	100%	43,241	909	647	136	5512967	100.0%	3 Sep	300,076	99%
1 Sep	4,248	10,931	14,312	889	5,531,527	100%	23,845	254	0	0	5527025	100.0%	4 Sep	132,960	100%
2 Sep	2,208	5,541	7,255	796	5,536,488	100%	14,290	71	0	0	5534209	100.0%	5 Sep	80,185	100%
3 Sep	1,701	4,567	5,980	706	5,541,890	100%	7,249	22	0	0	5540167	100.0%	6 Sep	72,225	100%
4 Sep	1,194	3,876	5,075	207	5,546,436	100%	5,976	6	0	0	5545236	100.0%	7 Sep	85,861	100%
5 Sep	1,131	4,242	5,555	432	5,551,922	100%	5,073	4	0	0	5550787	100.0%	8 Sep	37,369	100%
6 Sep	-	0		388	5,550,787	100%	5,552	2	0	0	5550785	100.0%	9 Sep	48,023	100%
7 Sep	-			598	5,550,785	100%	0	2	0	0	5550783	100.0%	10 Sep	152,589	
8 Sep				651	5,550,783	100%	0	0	0	0	5550783	100.0%	11 Sep	192,835	
9 Sep													12 Sep	340,746	
10 Sep													13 Sep	533,141	
11 Sep													14 Sep	268,237	
12 Sep													15 Sep	506,128	
13 Sep													16 Sep	666,842	
14 Sep													17 Sep	386,014	
15 Sep													18 Sep	375,653	
16 Sep													19 Sep	219,900	
17 Sep													20 Sep	31,200	
18 Sep													21 Sep	4,500	
19 Sep													22 Sep	3,300	
20 Sep													23 Sep	5300	
Total	4,702,771	5,276,893	6,909,256	262,244				1,358,473	1,100,537	967,267				6,647,012	

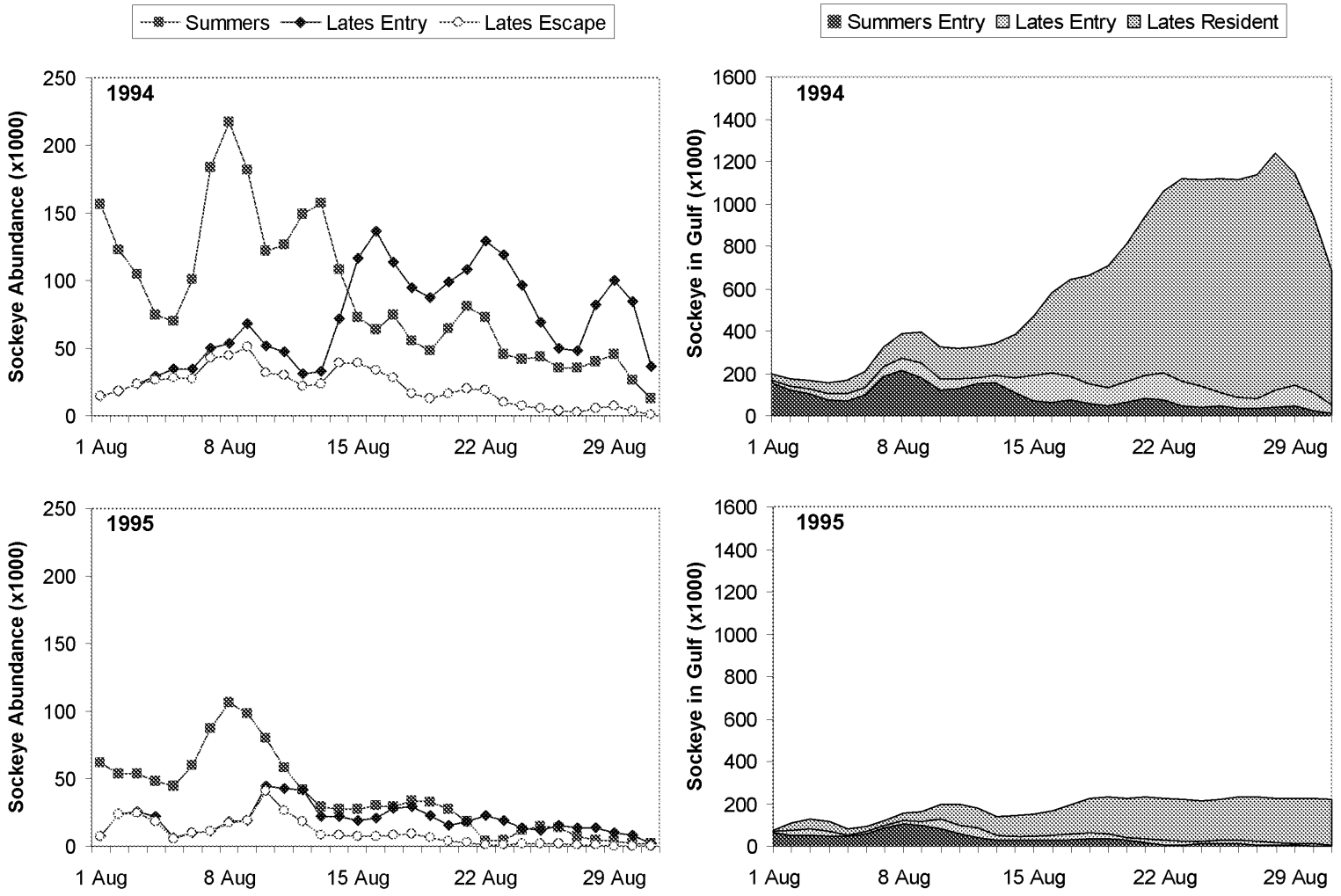
PSC Escapement after Summer-run =	4,143,006
Model Escapement after Summer-run =	5,550,783
Model In-river Mortality Rate =	23%

Appendix Table B11. Stay With the School (SWTS) model results for 2003.

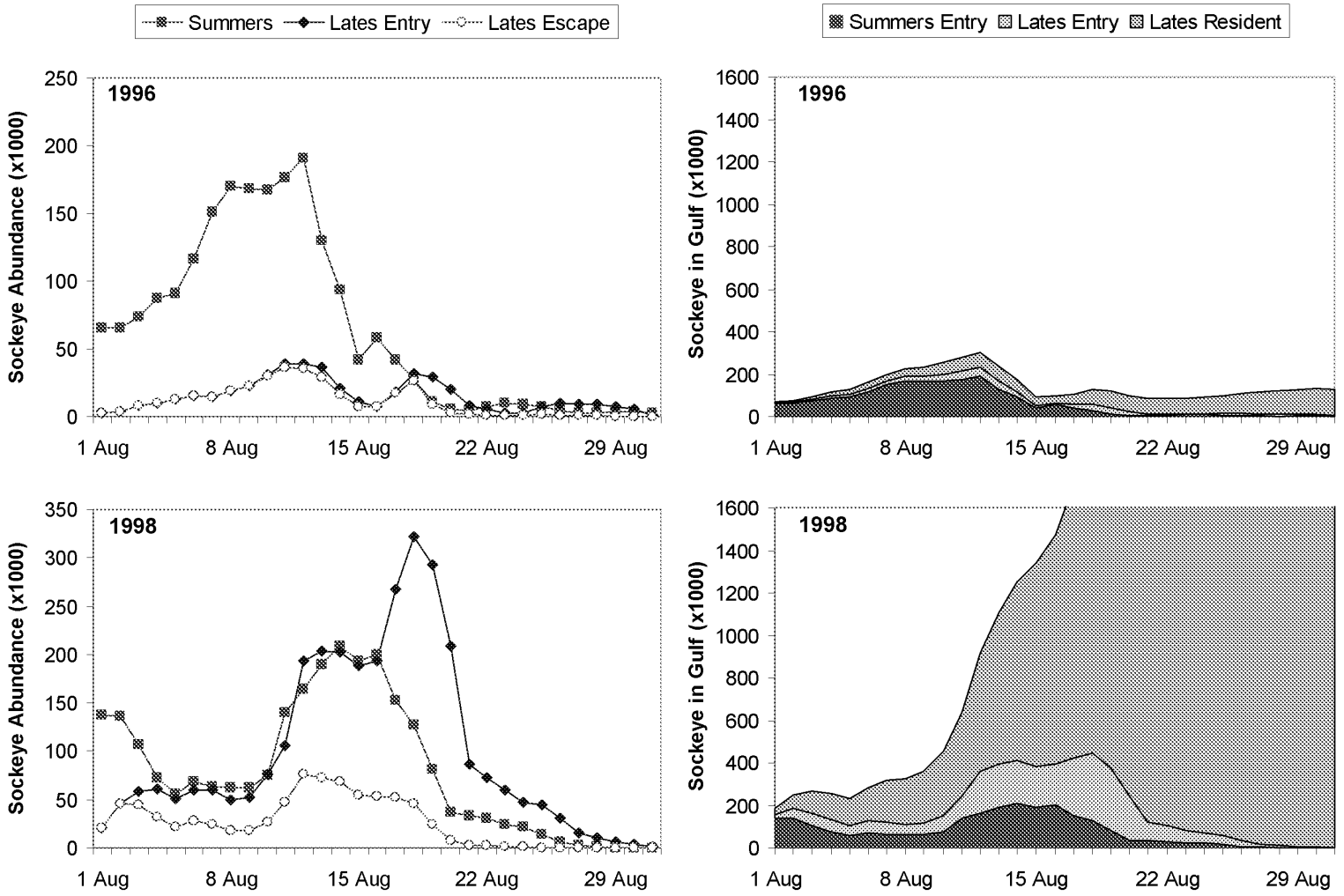
Area 20 Date	Seine Test Fishery Summer-run Entry	Late-run Entry	Adjusted Late-run Entry	Catch	Total Sockeye	Late-Run % in LGS	Late-Run Additions	Gross Escape	Mission Escape	Mort. Est.	Resident Lates	Encounter Rate	Below Bridge Date	PSC Escape	Summer Cum %
20 Jul		0	0								0		23 Jul		
21 Jul		0	0		-		0	0			0		24 Jul		
22 Jul		0	0	-	-		0	0	0	0	0		25 Jul		0%
23 Jul		0	0	-	-		0	0	0	0	0		26 Jul		0%
24 Jul	38,359	0	0	-	38,359	0%	0	0	0	0	0	0.7%	27 Jul		0%
25 Jul	40,960	672	672	-	41,632	2%	0	0	0	0	672	0.7%	28 Jul		0%
26 Jul	45,568	1,109	1,109	-	47,350	4%	0	0	0	0	1,782	0.7%	29 Jul		2%
27 Jul	32,847	2,690	2,690	-	37,319	12%	0	672	672	672	3,800	0.8%	30 Jul		5%
28 Jul	30,321	4,262	4,262	1	38,383	21%	0	1109	1108	1108	6,952	1.0%	31 Jul	4,099	7%
29 Jul	51,702	7,862	7,862	238	66,516	22%	2	2690	2452	2452	12,125	1.3%	1 Aug	2,482	9%
30 Jul	57,527	11,610	11,610	1,444	81,262	29%	5	4260	2816	2816	19,475	2.2%	2 Aug	4,939	11%
31 Jul	55,891	19,002	19,002	1,084	94,368	41%	22	7857	6773	6773	30,620	4.5%	3 Aug	6,132	14%
1 Aug	33,274	19,457	19,457	5,331	83,350	60%	142	11588	6258	6258	38,488	12.6%	4 Aug	2,741	18%
2 Aug	35,128	17,813	17,813	13,050	91,428	62%	884	18859	5810	5810	37,441	24.0%	5 Aug	3,403	21%
3 Aug	43,437	10,858	10,858	90	91,736	53%	1623	18573	18482	18482	29,727	22.2%	6 Aug	5,498	23%
4 Aug	42,728	10,166	10,166	121	82,621	48%	667	16190	16069	16069	23,703	11.6%	7 Aug	16,495	25%
5 Aug	43,411	9,272	9,272	1,151	76,386	43%	276	10191	9040	9040	22,784	6.7%	8 Aug	11,298	28%
6 Aug	40,739	9,552	9,552	3,006	73,074	44%	116	9890	6885	6885	22,445	6.2%	9 Aug	8,696	30%
7 Aug	44,175	11,174	11,174	2,378	77,794	43%	115	9155	6778	6778	24,464	6.0%	10 Aug	10,316	33%
8 Aug	42,344	17,454	17,454	27	84,261	50%	125	9436	9410	9410	32,481	7.2%	11 Aug	9,052	36%
9 Aug	49,527	22,768	22,768	5,059	104,776	53%	312	11049	5991	5991	44,200	14.8%	12 Aug	5,509	38%
10 Aug	60,946	23,890	23,890	14,965	129,036	53%	936	17142	2177	2177	50,948	35.9%	13 Aug	4,204	41%
11 Aug	59,393	21,296	21,296	19	131,637	55%	2388	21832	21814	19432	50,411	52.4%	14 Aug	15,336	44%
12 Aug	69,144	26,380	26,380	914	145,936	53%	3359	21502	20588	16474	55,290	51.0%	15 Aug	15,084	47%
13 Aug	62,256	30,653	30,653	5,709	148,199	58%	3727	17937	12228	8850	68,006	62.9%	16 Aug	16,528	51%
14 Aug	72,706	37,698	37,698	4,164	178,410	59%	6487	22653	18489	12173	83,050	85.8%	17 Aug	18,827	55%
15 Aug	65,395	45,748	45,748	32	194,193	66%	11357	24166	24134	14525	104,632	96.5%	18 Aug	27,843	59%
16 Aug	59,856	44,827	44,827	53	209,315	71%	19412	26341	26288	14524	123,118	99.6%	19 Aug	27,647	63%
17 Aug	78,424	70,781	70,781	37	272,324	71%	22759	26336	26299	13387	167,563	99.9%	20 Aug	26,026	67%
18 Aug	75,629	71,388	71,388	53	314,580	76%	35860	22068	22016	10357	216,883	100.0%	21 Aug	40,327	71%
19 Aug	85,183	82,601	82,601	1,883	384,666	78%	41189	34921	33038	14404	264,562	100.0%	22 Aug	37,818	75%
20 Aug	55,560	54,075	54,075	6,517	374,197	85%	50068	30199	23682	9591	288,438	100.0%	23 Aug	16,136	80%
21 Aug	43,128	43,589	43,589	4,632	375,154	89%	39209	32533	27901	10519	299,494	100.0%	24 Aug	39,060	85%
22 Aug	33,038	34,243	34,243	66	366,774	91%	34143	14866	14800	5203	318,871	100.0%	25 Aug	29,488	88%
23 Aug	26,889	28,156	28,156	89	373,916	93%	28352	9446	9356	3072	337,581	100.0%	26 Aug	27,661	91%
24 Aug	19,656	24,332	24,332	65	381,569	95%	24252	5891	5826	1789	356,022	100.0%	27 Aug	19,852	93%
25 Aug	11,747	18,712	18,712	54	386,481	97%	21890	3904	3850	1107	370,831	100.0%	28 Aug	20,433	95%
26 Aug	8,581	19,774	19,774	345	399,185	98%	17592	2442	2097	565	388,162	100.0%	29 Aug	22,207	96%
27 Aug	6,790	16,401	16,401	3,737	411,353	98%	18933	1120	0	0	400,826	100.0%	30 Aug	30,928	96%
28 Aug	5,390	13,906	13,906	30	420,122	99%	15864	841	811	193	413,891	100.0%	31 Aug	12,868	97%
29 Aug	5,717	11,090	11,090	24	430,698	99%	13552	537	513	114	424,445	100.0%	1 Sep	31,416	97%
30 Aug	5,147	8,407	8,407	37	437,998	99%	10798	355	318	67	432,497	100.0%	2 Sep	14,544	98%
31 Aug	4,319	6,020	6,020	146	442,835	99%	8210	292	146	29	438,224	100.0%	3 Sep	9,830	98%
1 Sep	5,125	5,805	5,805	6	449,154	99%	5903	196	190	35	443,833	100.0%	4 Sep	5,470	98%
2 Sep	5,000	6,483	6,483	3	455,315	99%	5673	117	114	20	450,199	100.0%	5 Sep	6,422	99%
3 Sep	4,545	5,848	5,848	4	460,591	99%	6341	132	127	21	455,914	100.0%	6 Sep	3,696	99%
4 Sep	2,585	3,437	3,437	2	461,937	99%	5733	142	139	21	459,210	100.0%	7 Sep	7,346	99%
5 Sep	1,466	1,379	1,379	6	462,054	100%	3398	115	109	16	460,473	100.0%	8 Sep	5,960	99%
6 Sep	1,621	1,379	1,379	10	463,473	100%	1370	38	29	29	461,814	100.0%	9 Sep	33,333	100%
7 Sep	1,430	895	895	38	464,139	100%	1369	9	0	0	462,670	100.0%	10 Sep	11,382	100%
8 Sep	1,152	624	624	11	464,446	100%	889	10	0	0	463,284	100.0%	11 Sep	39,237	100%
9 Sep	466	0	0	34	463,749	100%	621	6	0	0	463,249	100.0%	12 Sep	76,351	100%
10 Sep	222	0	0	69	463,471	100%	0	3	0	0	463,181	100.0%	13 Sep	46,560	100%
11 Sep	122	0	0	35	463,302	100%	0	0	0	0	463,146	100.0%	14 Sep	10,481	100%
12 Sep	-	0	0	6	463,146	100%	0	0	0	0	463,140	100.0%	15 Sep	582	
13 Sep													16 Sep	5,589	
14 Sep													17 Sep	10,449	
15 Sep													18 Sep	4,941	
16 Sep													19 Sep	5,184	
17 Sep													20 Sep	1,539	
18 Sep													21 Sep	1,377	
Total	1,666,560	935,536	935,536	76,776				469,614	395,621	257,238				870,621	



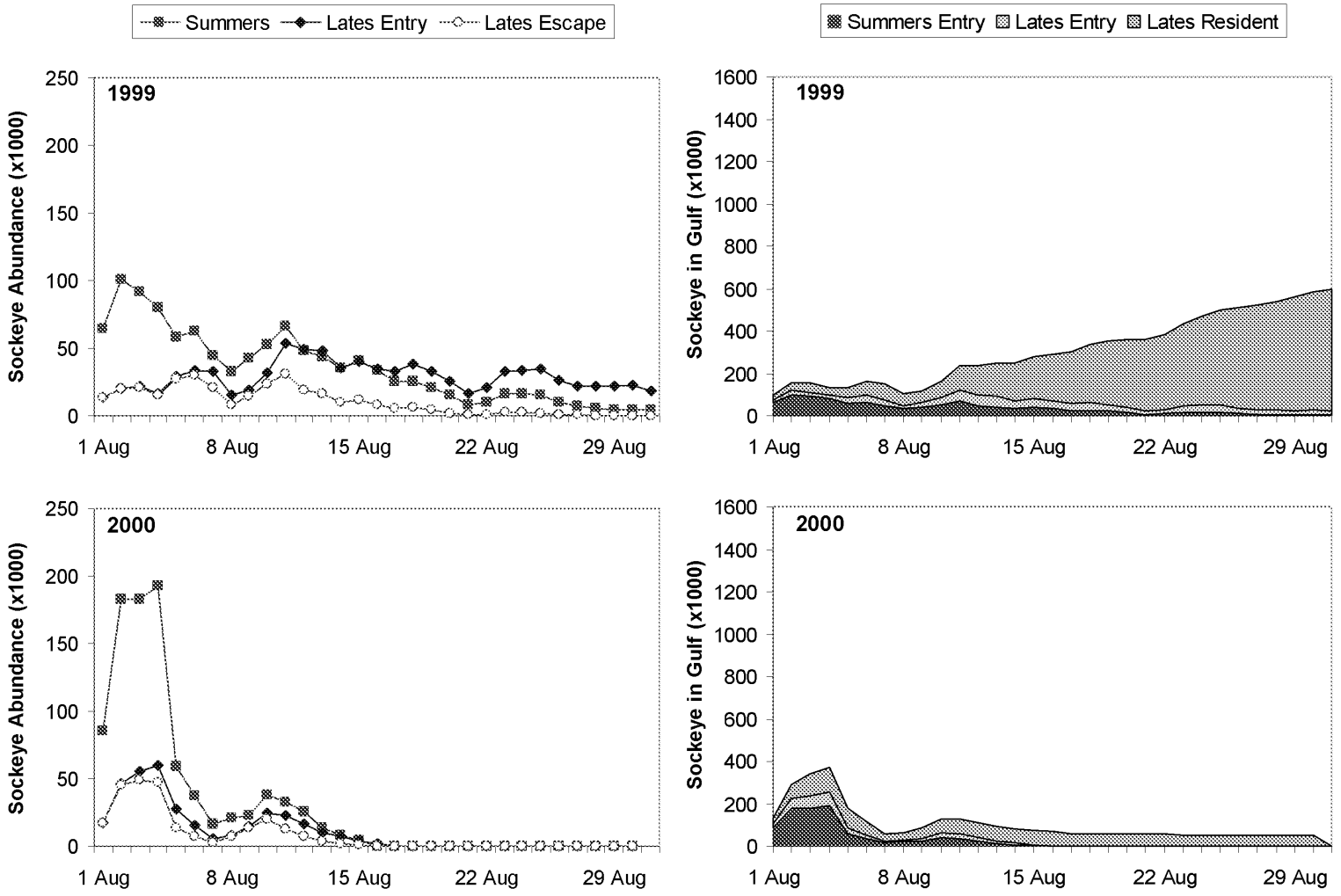
Appendix Figure B1. Daily estimates of arriving Summer-run and Late-run Sockeye, and of Late-run escapement (left panels); and daily estimates of the number of sockeye present in the Gulf, including the arriving Summer-run and Late-run sockeye, and the resident Late-run fish (right panels). Note that the Y axis range for 1998 and 2002 differs from that for other years.



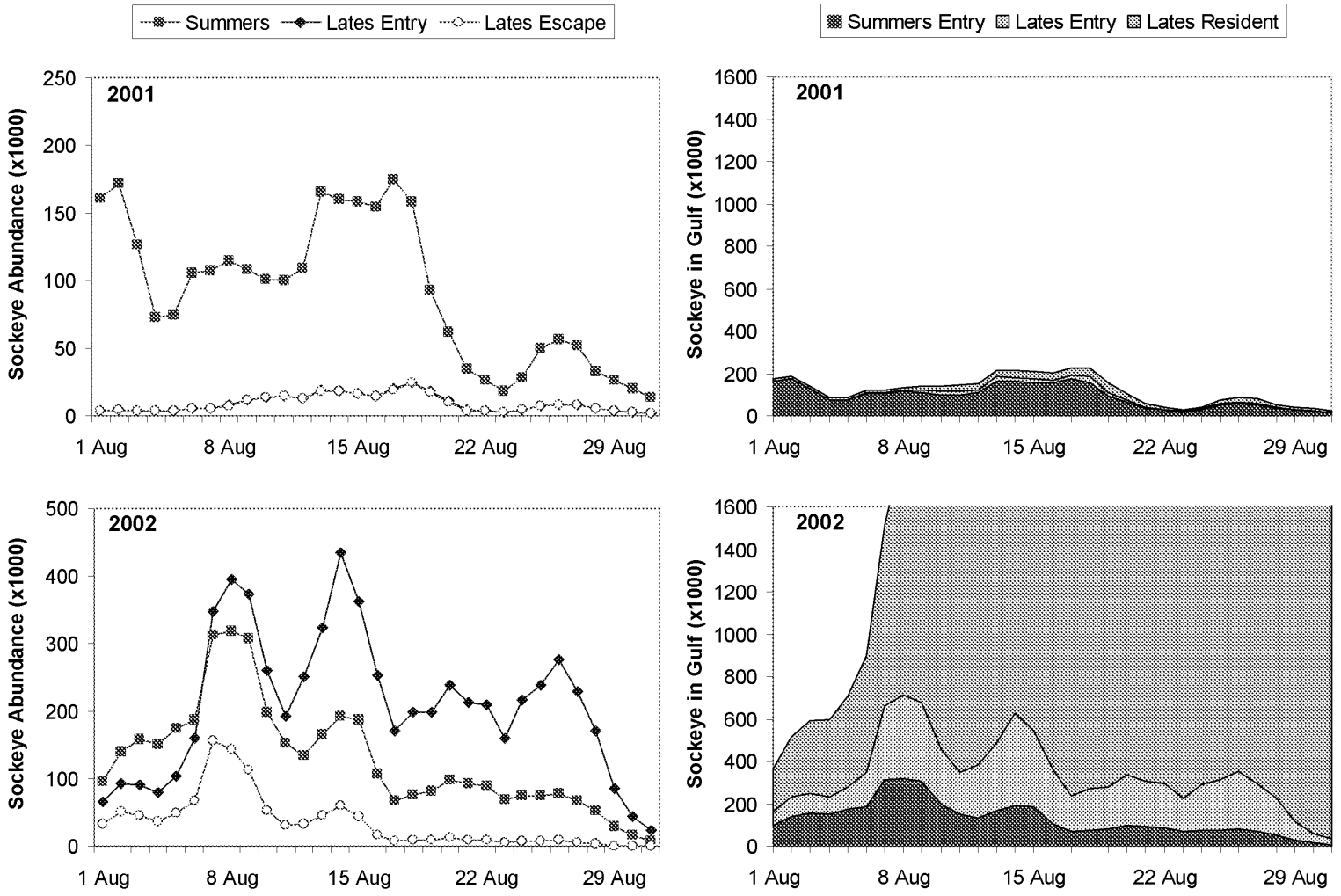
Appendix Figure B1 continued.



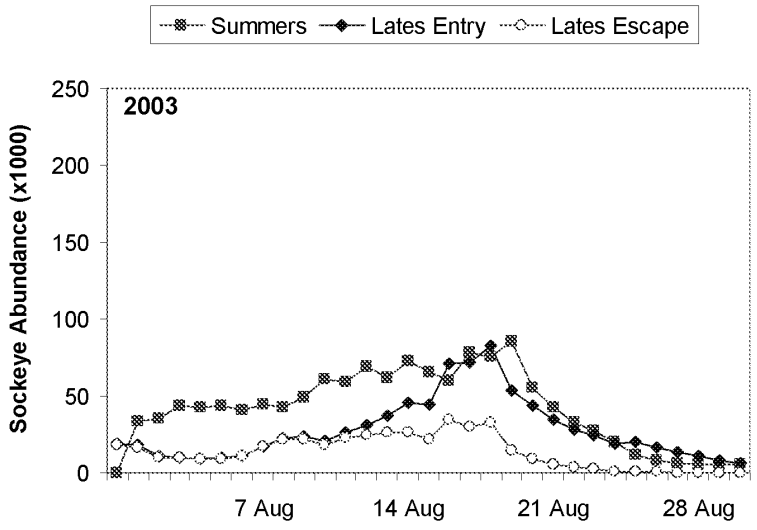
Appendix Figure B1 continued.

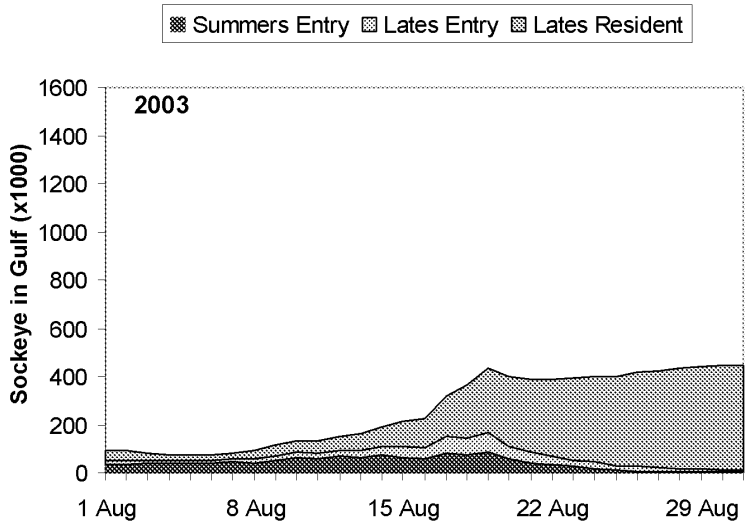


Appendix Figure B1 continued.



Appendix Figure B1 continued.





Appendix Figure B1 continued.