2001 FRY EMERGENCE

NECHAKO FISHERIES CONSERVATION PROGRAM
Technical Report No. M00-5

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ABSTRACT

The Nechako Fisheries Conservation Program (NFCP) has conducted a chinook salmon (*Oncorhynchus tshawytscha*) fry emergence trapping project in the upper Nechako River since 1990 to monitor the incubation environment in the river. During the 2001 trapping program emergence peaked in mid to late April, as in previous years. Accumulated thermal units (ATUs) at the time of 50% emergence (April 21) was 893, below the 10 year average of 914 (range of 840 to 1,004)

The index of fry emergence for 2001 was 1,235,554, the highest since 1997, and the second highest overall. The number of female spawners estimated above the trapping site was the highest on record (n = 336). This translated into an index of emergence success of 63.7% when the estimated egg deposition above the trapping site the previous fall was taken into account. Emergent success was lower than in the four previous years but above the average for 1991-1996 (47%). The data from 2001 strengthened the positive correlation between the index and the number of spawners in the river above the trap site (Spearman rho = 0.83), which confirmed that the index was a reliable estimate of fry abundance. Emergent fry in 2001 were of similar average length (37.6 mm), weight (0.38 g), and development index (K_D; 1.9) to those of previous years.

Mark recapture estimates provided an index of 2,138,766 ± 1,268,786. The data from 2001 fell within the range of mark recapture indices developed over the period of the project and added strength to the relationship of the mark recapture and emergence indexes (Spearman rho = 0.80).

Species other than chinook made up 2.1% of the total number of fish sampled in the four IPTs. The most common species was sockeye salmon (*Oncorhynchus nerka*) followed by longnose dace (*Rhinichthys cataractae*), largescale sucker (*Catostomus macrocheilus*), redside shiner (*Richardsonius balteatus*) and leopard dace (*Rhinichthys falcatus*).

Overall, the results from the 2001 fry emergence trapping program are as would be expected: a high index of fry emergence resulting from the largest estimate of spawners upstream of the trapping site on record, a normal progression of emergence, and typical morphological characteristics of emergent fry. The 2001 index of fry emergence indicates that the quality of the incubation environment in the upper Nechako River appears to be stable.

INTRODUCTION

The Nechako Fisheries Conservation Program (NFCP) initiated the chinook salmon (*Oncorhynchus tshawytscha*) fry emergence trapping project in 1990. It is part of the Early Warning Monitoring Program developed by the NFCP Technical Committee. With juvenile outmigration, it is one of two secondary monitoring projects aiming at providing information about the quality of salmonid rearing habitat in the Nechako River. The specific objectives of the program are to monitor changes in the quality of the incubation environment in the upper Nechako River by developing an index of fry emergence timing and abundance; to monitor egg-to-fry survival using this index; and to monitor the average size and condition of emerging chinook fry. While the index calculated is not a true estimate of the population (cf. Methods), large deviations in the index from year to year may serve as an indication of a change in the quality of the incubation environment of the Nechako River. The project also estimates emergence success to take into account the effect of the number of spawners returning the previous fall on the index, and monitors the condition of the fry, as sudden changes in fry condition may also indicate a change in the quality of the incubation environment of the Nechako River.

METHODS

Study Site and traps

The field portion of the project is usually initiated in the first week of March as this is the first opportunity to set up Inclined Plane Traps (IPTs) following ice break-up. The traps were assembled on the river banks and placed in position when large ice pans stopped flowing downstream and air temperatures were high enough to prevent ice from forming in the traps. Ice build-up on the traps decreases their catch efficiency and the added weight could snap the cable crossing used to keep them in place during operation.

Four 2 x 3 m IPTs were installed near Bert Irvine's Lodge, 19 km downstream from Kenney Dam (Figure 1). The traps were suspended from a cable strung across the river channel. The position and location of the traps were the same as in the previous ten years (1991- 2000). The four traps were positioned on a line across the river channel, one stationary trap on each river margin (IPTs 1 and 4), and two floating traps in mid-channel (IPTs 2 and 3, Figure 2).

The left margin trap (IPT 1) was approximately 17 m from the shore with a 30 m diversion wing angled from the inshore edge of the trap to the shore upstream. The right margin trap (IPT 4) was approximately 5 m from the shore with a 12 m diversion wing angled from its inshore edge to the shore upstream. The margin traps were anchored on the river bed, in approximately 0.5 m of water, and the diversion wing and trap location adjusted according to flows to maintain 0.5 m water depth. The mid channel traps were floating and set-up on a pulley system so that they could be pulled into shore for trap check. The mid-channel traps required pontoon adjustments when discharge and debris load increased.

Nechako River - Physical Data

Mean daily water temperatures were measured by a data logger maintained by the Water Survey of Canada (WSC) at the study site (WSC station # 08JA017). Daily flows were also recorded at the study site by the WSC data logger and at Skins Lake Spillway (SLS) (WSC station # 08JA013). Releases at SLS were calculated by Alcan personnel based on the position of radial gates and elevation of the reservoir in relation to a rating curve and forwarded to WSC. All flow data used in this report are preliminary.

Accumulated Thermal Units (ATUs), the running total of degrees Celsius measured each day from the water temperature, were calculated from the peak of chinook spawning in mid-September to the end of the fry emergence project. Most chinook fry are expected to emerge from the gravel by approximately 1,000 ATUs (March and Walsh 1987; Shepherd 1984). Thus ATUs serve as an indicator of the start of the fry emergence program.

Sampling Program

The IPTs were cleaned of debris and catches sampled twice a day, morning (8:00) and evening (19:00). Water temperature was measured during each trap check with a maximum minimum thermometer and staff gauge measurements were recorded daily at the traps.

The mid-channel traps were pulled to shore for each trap check. All fish found in the traps were placed in buckets and taken to a weighing trailer for identification to species and enumeration. For each sampling period, a subsample of a maximum of 10 chinook per trap were anaesthetized with Metomadate and measured to the nearest 1.0 mm (fork length) and weighed to the nearest 0.01 g (wet weight). Sampled fish were allowed to recover from the anesthetic and then released downstream of the traps.

Bams' (1970) development index (K_D) was calculated for the measured fry:

$$(1)\ K_D = \frac{10\sqrt[3]{\text{weight in mg}}}{\text{length in mm}}$$

Index of Fry Emergence

The index of fry emergence was calculated using daily catches, flows in the Nechako River below Cheslatta Falls and the volume of water sampled by each trap. The volume of discharge sampled by each trap was determined by measuring the cross sectional area of the water flowing into the trap mouth and the average velocity at three points across the mouth of each IPT. The volume of discharge sampled by each of the margin traps was estimated as the sum of the discharge through the IPT and the discharge diverted into the traps by the diversion wings. Wing discharge was estimated by measuring the upstream cross sectional area created by the diversion wing, and recording ve-

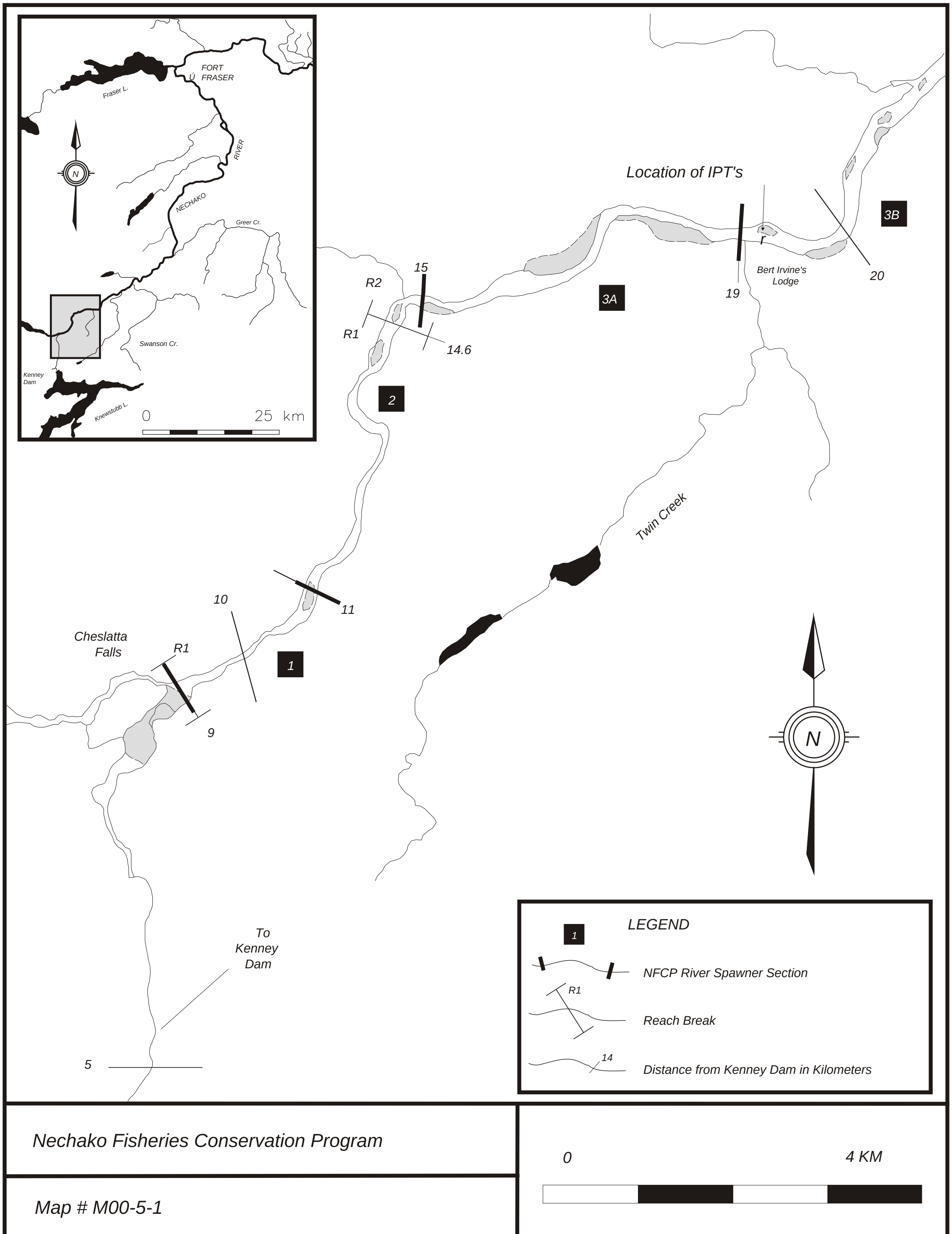
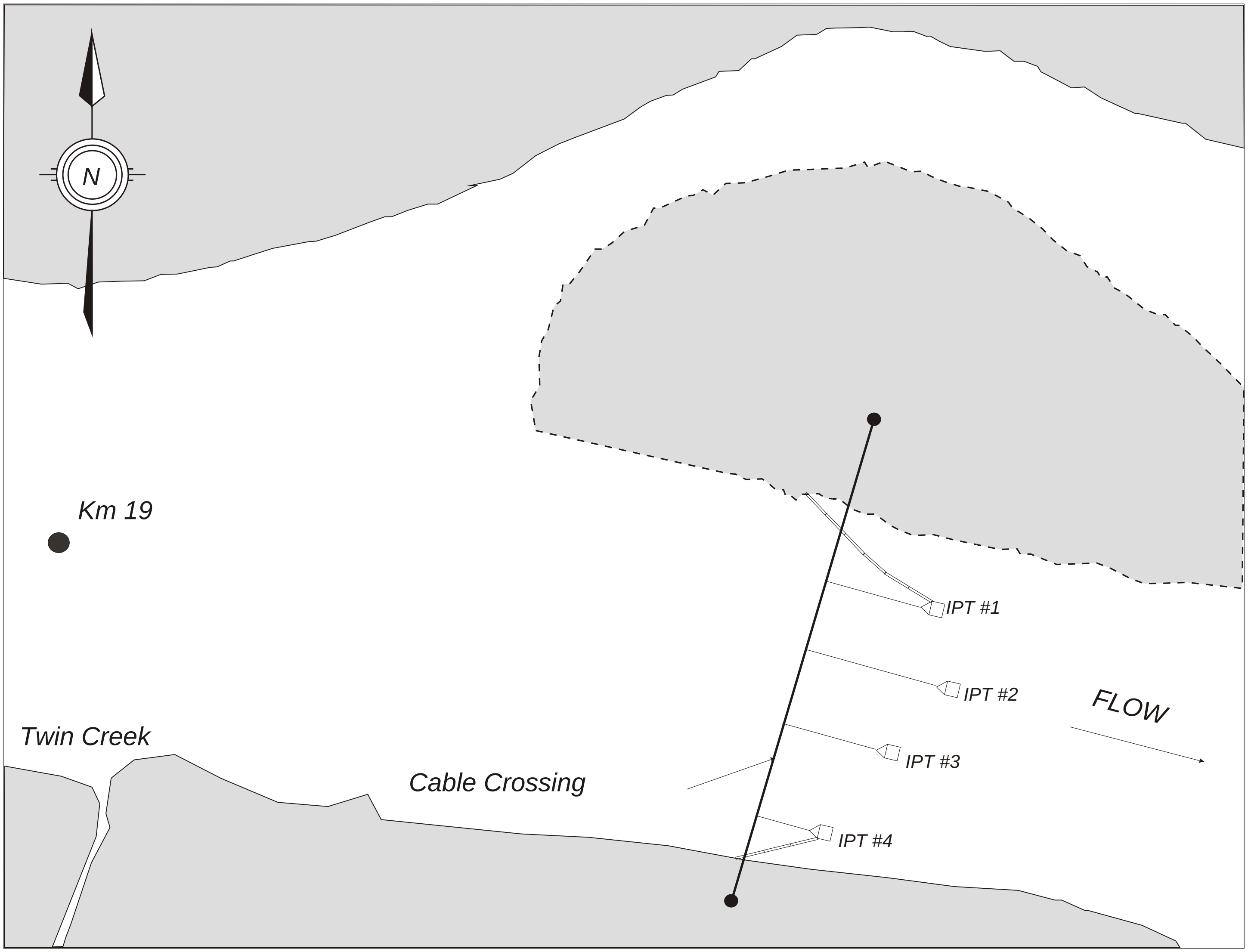


FIGURE 1. *Location of fry emergence sampling, Bert Irvine's, km 19 of the Nechako River.*



Nechako Fisheries Conservation Program

Map # M00-5-2

Scale ~1:1200

Figure 2: Location of Inclined Plane Traps (IPT) at Bert Irvine's, km 19 of the Nechako River, 2001

locities along a line perpendicular to the shore extending from the upstream edge of the diversion wing to the point opposite the junction of the trap and the downstream end of the diversion wing. Velocity was measured with a Swoffer Model 2100 current velocity meter and measurements were taken every second day when possible.

The total number of emerging chinook moving downstream past the IPTs, which constitutes the index of fry emergence, was estimated from the proportion of total river discharge sampled by each IPT as:

(2) $N_i = n_i (V_i / v_i)$

where N_i = expanded number of fish,

n_i = number of fish observed,

V_i = total river flow,

v_i = flow through trap,

and $_i$ = the *ith* sampling date.

Because statistical independence among IPTs could not be assumed (the IPTs are not replicates), a combined fry emergence estimate was calculated for each day. This estimate is the sum of all four IPTs' estimated catches expanded by the water volume filtered by each IPT. It was equivalent to an estimate weighted by the volume filtered:

(3) Index of fry emergence =
$\Sigma(N_i v_i)$ for all traps / $\Sigma(v_i$ of all traps)

As the sampling program progressed in the season, the risk increased of including already emerged fry, as opposed to emerging fry, in the calculation of the fry emergence index. Already emerged fry may have established residence along the banks in the vicinity of the IPTs, and their inclusion in the calculation was judged undesirable, as it would overestimate the index (some fry could be captured and counted more than once). A more conservative approach was to base the index of fry emergence only on fry which have just emerged from the substrate.

To separate emerging fry from already emerged ones, the date at which post-emergent fry started to make a significant contribution to the number of fry caught in the IPTs was inferred from examination of the variance in wet weight. This was based on the assumption that already emerged fry have started to feed, and are thus heavier than emerging fry. Their pooling with emerging fry should result in an increase in the variance in wet weight of fry caught in the IPTs. The cutoff date was considered to be the point at which the variability in pooled wet weights was significantly affected by the addition of the next day's samples, as determined by an F-test ($P<0.05$). The mean pooled wet weight of all the chinook fry sampled to this date plus one standard deviation was considered to be the upper limit of mean wet weight of newly emergent fry. To separate growing fish from emergent fry after the cutoff date, the proportion of fry subsampled that were smaller than the limit was determined. For all days after the cut-off date, the daily index of emergence was multiplied by the percentage for that day. For example, if 90% of the fish subsampled were smaller than or equal to the upper limit, the daily catches after the cutoff date were used in the calculation of the index of fry emergence and multiplied by the percentage for each day.

Estimates of Emergence Success

The percent of chinook salmon spawning above the study site (river sections 1, 2 and section 3A) were obtained from the Nechako River spawner enumeration data (unpublished data, Department of Fisheries and Oceans). The Area-Under-the-Curve (AUC) estimate of the total number of spawners in the river was multiplied by the percent of spawners in these river sections to obtain an estimate of the numbers of chinook spawners in the upper river. To estimate the potential number of chinook eggs deposited upstream of the traps, the total number of spawning females was assumed to be one half of the population above the study site. A mean fecundity of 5,769 eggs per female was assumed, based on data from Jaremovic and Rowland (1988) on Nechako chinook (N = 8, range = 5,000 to 7,200, standard deviation = 869). The emergence success is the total daily weighted population index divided by the number of spawning females times the fecundity, expressed as a percentage.

Trap Efficiency/Mark Recapture Estimates

The index of the number of emergent fry relies on the accuracy of the assessment of the proportion of the population sampled by the IPTs, and is based on the proportion of the total river discharge sampled by the traps. Another method of inferring fry abundance is to calculate trap efficiency from mark-recapture trials. These trials were conducted to back up the flow ratio method of calculating the fry emergence index.

For each trial, chinook fry were collected from the four IPTs and held in a live box for a maximum of four days. Chinook fry from the live box were counted and transferred into an aerated staining container, where they were stained with Bismark brown for two hours. They were then transferred to transport containers and held for a couple of hours prior to release. Mortalities were noted and subtracted from the total released. Fry were released at dusk at km 18.3 (0.5 km upstream of the IPTs). A sub-sample of marked fish, not included in the count of those released, were retained in the live well to demonstrate dye intensity over time. On subsequent sampling days, the number of marked chinook recaptured in each trap was noted along with the total catch (marked and unmarked). Marked fry were not included in the total catch that was used for the emergence index. The time between mark-recapture trials was sufficiently long to ensure that previously marked fish would not bias the next trial. Trap efficiency was calculated as the ratio of the number of recaptured fry to the number of released fry. The estimated population index was the average of the number of chinook fry estimated at each trial weighed by the number of fry released at each of these trials.

Statistical Analyses

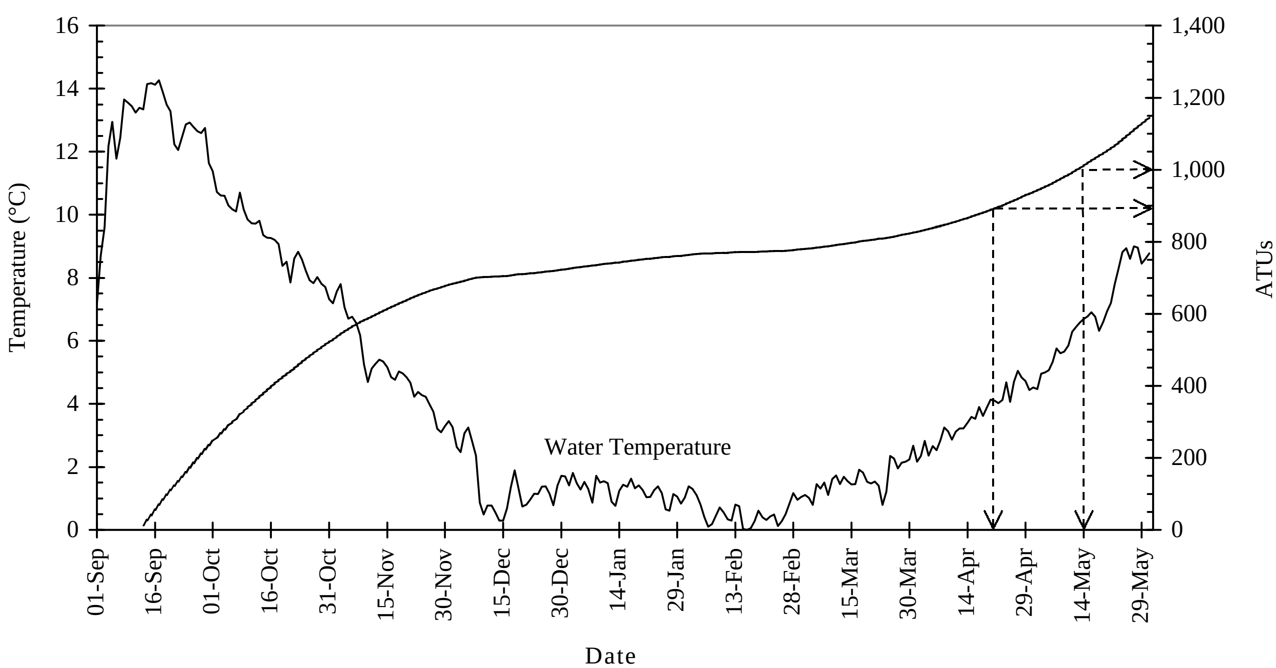
The influence of time of day and trap location on the biological variables (fork length, wet weight, and K_D) were determined through factorial ANOVAs. Correlations were Spearman rho, a non parametric association measure. The significance level was set at $P<0.05$ for all tests.

RESULTS AND DISCUSSION

Nechako River - Physical Data

The 2001 fry emergence program extended from March 10 to May 20, 2001. Mean daily water temperatures in the Nechako River and ATUs from September 13, 2000 (peak of spawning period) to May 20, 2001 (end of the fry emergence project) are shown in Figure 3. During the incubation period, the mean daily water tempera-

Figure 3
Mean Daily Water Temperatures of the Nechako River at Bert Irvine's (km 19), September 2000 to June 2001 (preliminary data from WSC and DFO) and Accumulated Thermal Units (ATU) from Peak of Spawning (September 13, 2000)



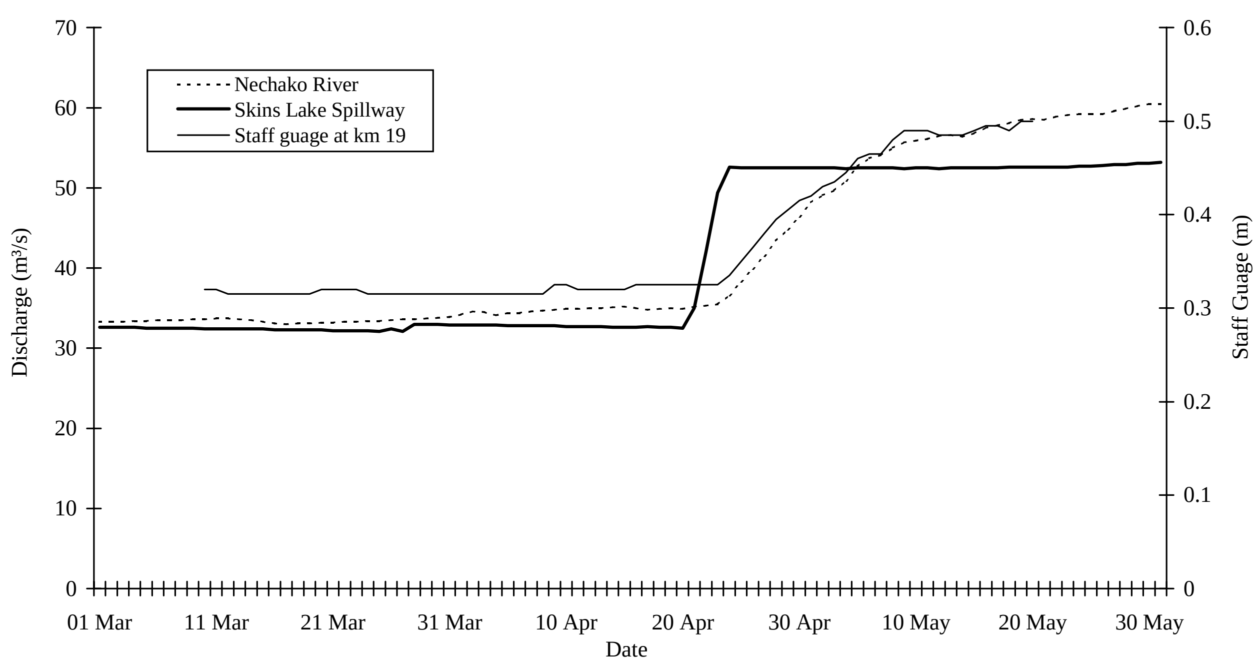
tures ranged from 14°C in September to 0°C in January and February. The ATUs for the fry emergence period ranged from 789 to 1,051. The predicted date of peak fry emergence at 1,000 ATUs was May 13 whereas the observed peak occurred between April 21-23 at 893-900 ATUs. The date at which 50% of fry had emerged was April 21, at 893 ATUs and falls within the range observed in previous years of the project. The range of ATUs at 50% emergence has been between 840 and 1,004, with an average of 916 (Table 1).

The releases from SLS, the flows measured at Bert Irvine's and the staff gauge records at the trap site from March 1 to May 31, 2001, are shown in Figure 4. Releases from SLS were maintained at an average of 32.8 m^3/s from March 1 to April 23, when they were increased to 49.4 m^3/s. From April 23 to May 31, the average discharge was 52.5 m^3/s. The average discharge at Bert Irvine's from March 1 to April 20 was 33.9 m^3/s and then steadily increased to 58.6 m^3/s on May 20. Staff gauge readings taken at Bert Irvine's from March 10 to April 22 averaged at 0.318 m, and then steadily increased to 0.500 m on May 20. There is a clear correlation between the Nechako River dis-

Table 1
Accumulated Thermal Units (ATUs) Recorded from Peak of Spawning in the Nechako River at Bert Irvine's (km 19) at the Time of 50% of Emergence of Juvenile Chinook Captured in Inclined Plane Traps

Year	Date of 50% of Emergence	ATUs
1990	Apr 13	935
1991	Apr 25	840
1992	Apr 19	903
1993	Apr 22	938
1994	Apr 15	962
1995	Apr 29	856
1996	May 06	887
1997	Apr 30	862
1998	May 01	1,004
1999	Apr 28	962
2000	Apr 25	922
2001	Apr 21	893

Figure 4
Daily Discharge of the Nechako River at Bert Irvine's (km 19) and Skins Lake Spillway releases, March to May, 2001 (Preliminary data from WSC)



charge and the staff gauge readings, which validates the use of the staff gauge as a backup should there be any failure in Nechako River flow measurements during fry emergence.

Fry Emergence

Trap Catches

From March 10 to May 20, 2001, 93,091 chinook fry were caught in the four inclined plane traps. Most of the fry (77%) were captured in traps 1 and 4 (Table 2). Individual trap catches over time are shown in Figure 5. The ratio of catches between traps is consistent with previous years. However, the highest catch numbers alternate between traps 1 and 4 from year to year. Most fry (98%) were caught at night, consistent with observations from previous years. The majority of fry emerge at night and move to occupy the margins of the river channel.

The pattern of emergence was essentially uni-modal, with the peak emergence period between April 10 and April 30 (Figure 6). The peak catch was 6,720 fry on April 17 and the median capture date (when 50% of the total catch had been captured) was April 21. The river discharge was fairly constant through the peak period, and then steadily increased following the median capture date. The discharge had no obvious effect on catch rates.

Table 2
Summary of Inclined Plane Trap Catches of Chinook 0+ and the Percent Contributed by Each Trap to the Total Catch at Bert Irvine's, km 19 of the Nechako River, March 10 to May 20, 2001

	Night (morning check)		Day (evening check)			
Trap	Number	Percent	Number	Percent	Total	Total Percent
1	35,869	38.5	575	0.6	36,444	39.1
2	9,741	10.5	177	0.2	9,918	10.7
3	11,696	12.6	241	0.3	11,937	12.8
4	34,255	36.8	537	0.6	34,792	37.4
Total	91,561	98.4	1,530	1.6	93,091	100.0

Figure 5
Number of Chinook Fry Sampled Daily by Four IPTs at Bert Irvine's, km 19 of the Nechako River, March to May 2001

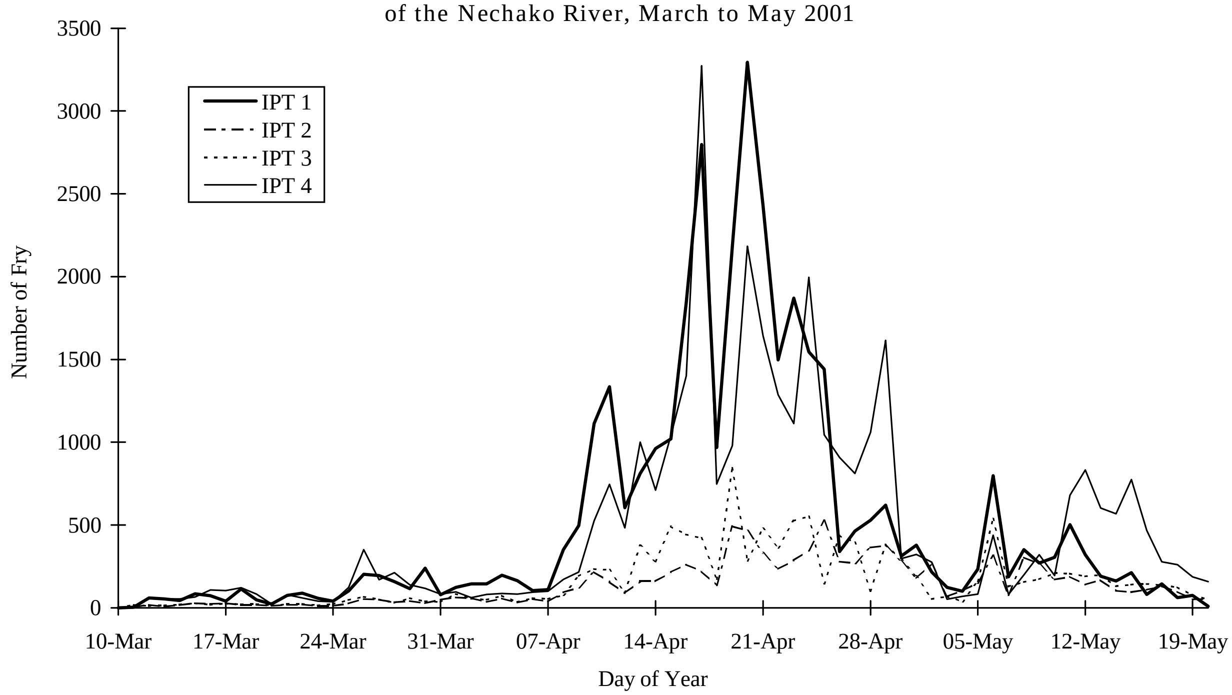
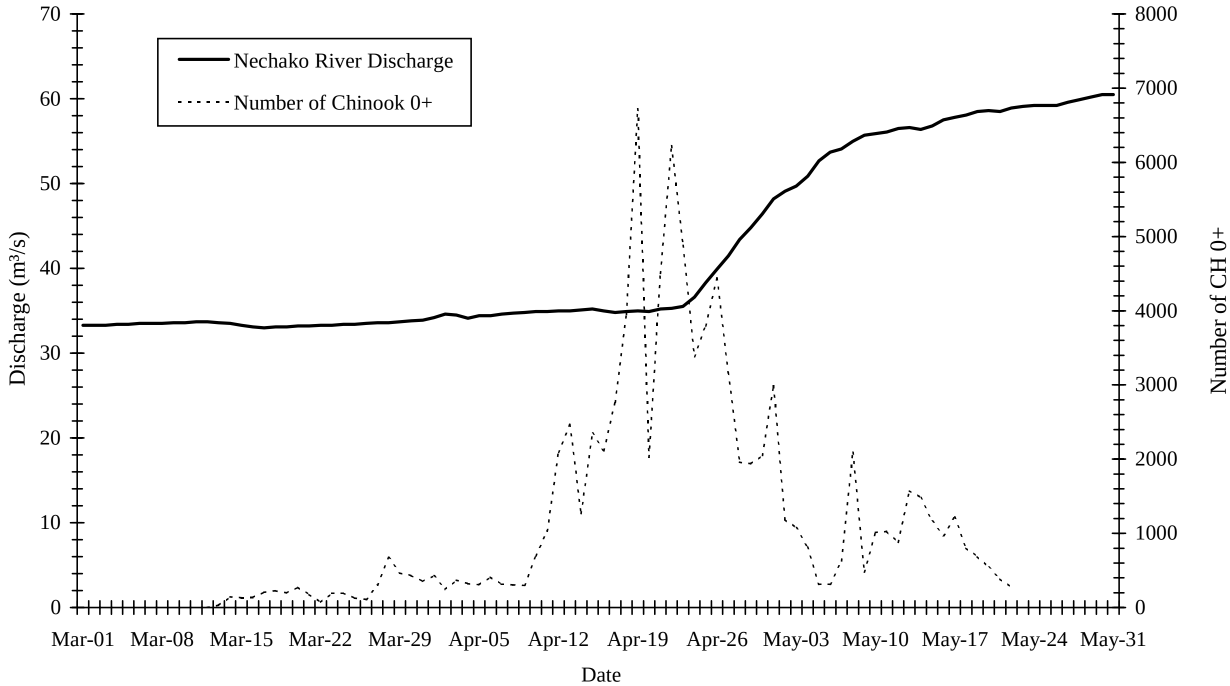


Figure 6
Nechako River Discharge and Daily Total of CH 0+ Captured in All Four Inclined Plane Traps Located at Bert Irvine's (km 19) on the Nechako River, March 10 to May 20, 2001



Index of Fry Emergence

The fry emergence index was calculated from the proportion of volume sampled daily by each IPT. The proportions of volume sampled for both the day and night periods were measured for each trap from March 10 to May 20. Individual trap indices were calculated from percent volume sampled and actual catch results (Appendix 1). The indices calculated from each of the four traps ranged from 825,478 to 2,593,671 chinook fry, while the overall index (weighted by the volume of water sampled by each trap) was 1,201,414 (Appendix 1). The variation in wet weight of chinook fry began to differ significantly after April 30. Analysis of the data revealed that inclusion of wet weights measured after April 30 increased the variance, while the variance of the weights measured between April 30 and May 20 was three times greater than before April 30. This signalled that post emergent fry were making a contribution to the number of fry caught. It was determined that 8.7% of the fry captured between April 30 and May 20 were post emergent, and an adjustment to the daily index of emergence was required (Figure 7).

With the exception of IPT 1 , the percentage of the river flow sampled by the IPTs was relatively constant until April 29. Then the percentage of volume sampled decreased, particularly in IPT 1, as the discharge in the Nechako River started to increase (Figure 8). During the period of April 29 – May 20, the volume sampled by the margin IPTs decreased by an average of 38.7% (Appendix 1). The flows below Cheslatta Falls increased by 31% during the same period.

Trap Efficiency/Mark Recapture Estimates

Three mark recapture trials were conducted on April 10, April 19, and April 30. The average trap efficiency for these four trials was 6.3% resulting in an estimated population index of 1,489,901. The individual mark recapture trials had combined trap efficiencies and population estimates ranging from 2.4% (3,892,712) to 9.7% (958,520) (Table 3). The overall estimate (mean of all four trials weighed by the number of fish released) of emerging fry was 2,138,766 ± 1,268,786 (95% confidence interval), which does overlap with the index of fry emergence (1,201,414).

Figure 7
Box Plots of Wet Weight of Juvenile Chinook Subsampled in IPTs at km 19 (Bert Irvine's), Nechako River, 2001, as a Function of Sampling Date

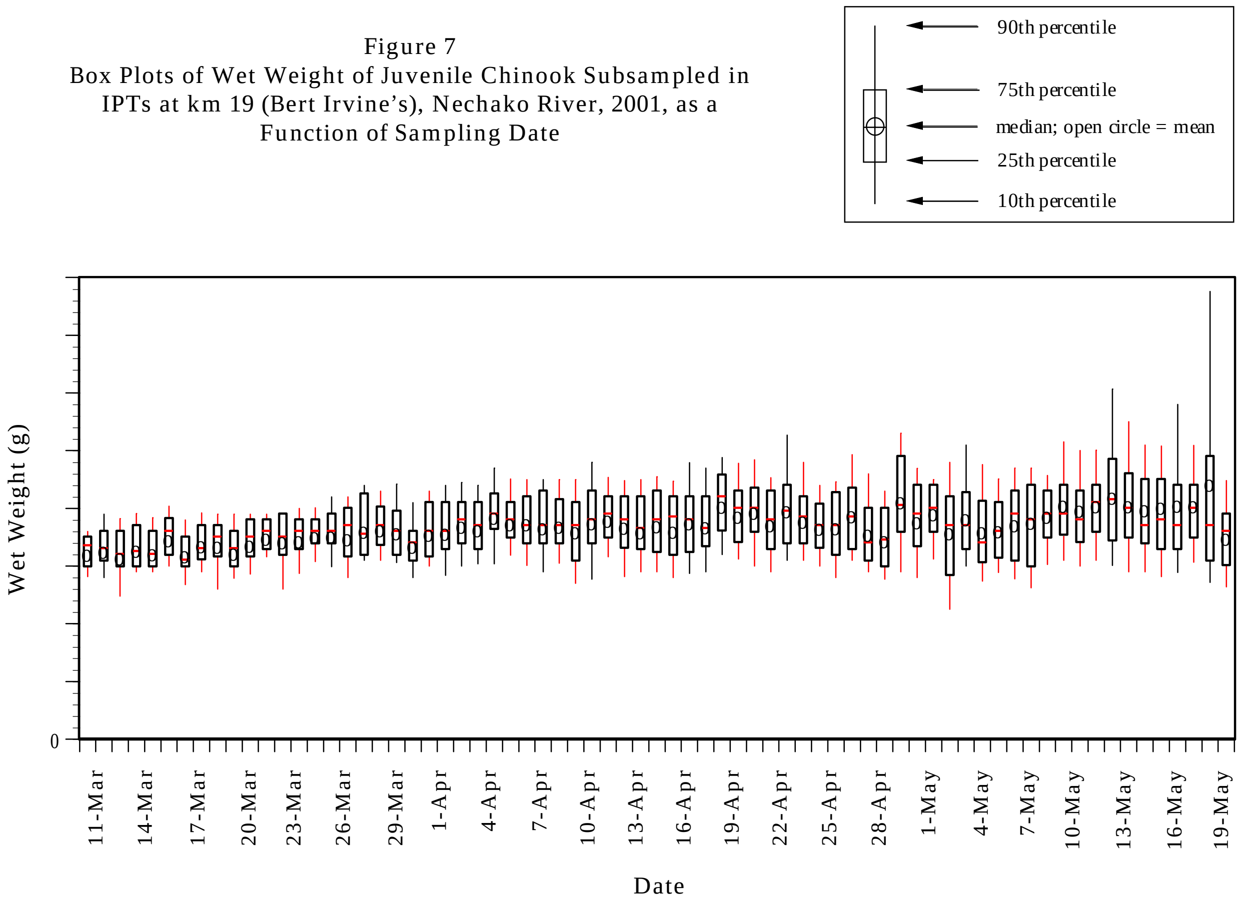


Figure 8
Flow Released Below Cheslatta Falls During the Fry Emergence Program of 2001 and the Percentage of this Flow Sampled by the IPTs

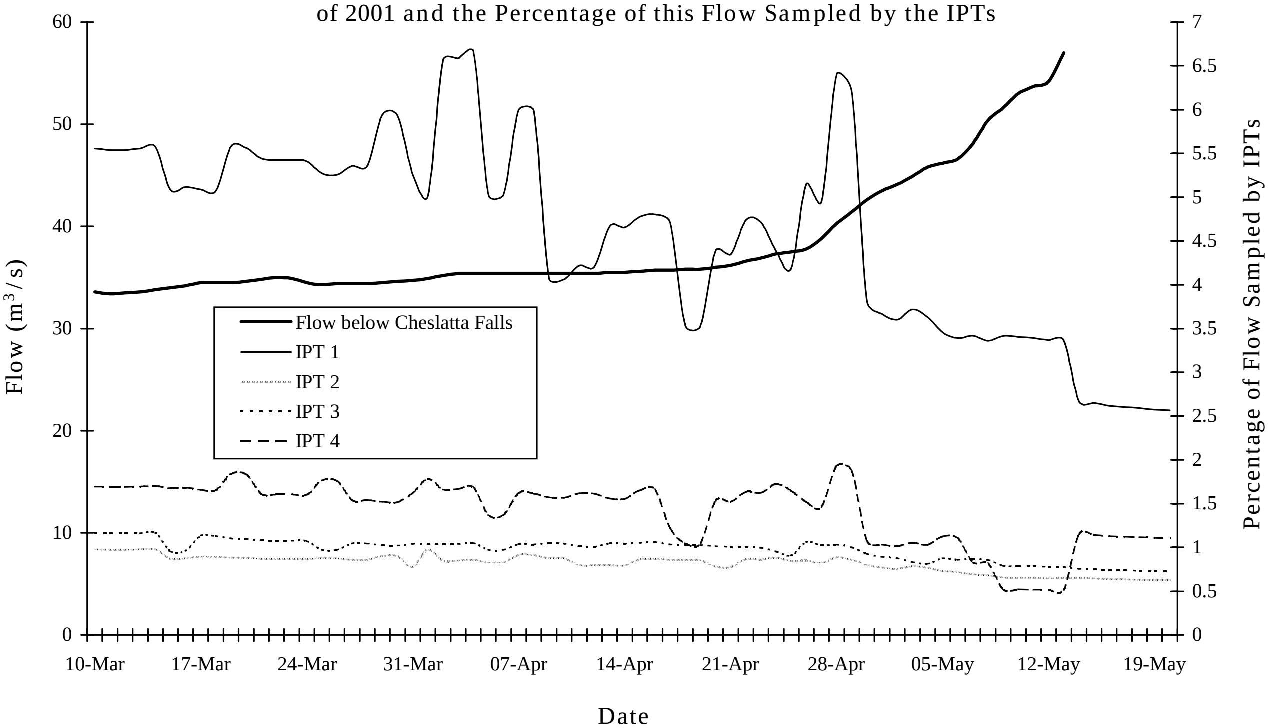


Table 3
Summary of Mark Recapture Trials on Emergent Chinook Fry at Bert Irvine's, km 19 of the Nechako River, 2001

Date	Number Released	Trap Number	Number Recaptured	Combined Efficiency	Total Seasons Catch	Estimated Population
10-Apr	3,900	1	113	6.64%	93,091	1,401,756
		2	15			
		3	16			
		4	115			
		Total	259			
19-Apr	9,061	1	315	9.71%	93,091	958,520
		2	37			
		3	22			
		4	506			
		Total	880			
30-Apr	7,736	1	54	2.39%	93,091	3,892,713
		2	28			
		3	28			
		4	75			
		Total	185			
		Average combined efficiency		6.25%	93,091	1,489,901
Total	20,697		1,324			
			Weighed mean estimate		2,138,766	
			95% confidence interval upper limit		3,407,552	
			95% confidence interval lower limit		869,979	

Although the index of fry emergence is usually a smaller estimate of the number of fry than the mark-recapture estimate (Figure 9) and has not always overlapped with that estimate since the inception of the program (5 times out of 10, Table 4), there is a strong correlation between the two estimates (Spearman rho = 0.83, Figure 10). Considering that both indices are estimated independently, this indicates that they probably reflect the true number of emerging fry. There might be a bias in each estimate, but the direction of this bias is unknown. The years 1998 and 1997 appear to be outliers (they were forced spill years), and if they are removed from the data set, the correlation increases from 0.83 to 0.90 (Spearman rho, P< 0.01). The correlation between mark-recaptures estimates and number of female spawners the previous year was also significant (rho = 0.78, P <0.01).

Relationship Between Escapement and Index of Fry Emergence

The index of fry emergence was significantly correlated with the number of female spawners above the study site (Figure 11, Spearman rho = 0.80, P<0.01), which indicates that the index reliably reflects fry abundance. In 1997 and 1998 the index appeared to have been affected by the higher than usual flow conditions in the river, and the indices were approximately twice as high as would be expected from the number of spawners. If these two years are excluded, the correlation increases to 0.92 (P<0.01).

The index of fry emergence is likely to overestimate the true number of fry because the traps did not proportionately sample the river flow as it increased. Also, the fry were clearly favouring the margins (the margin traps sampled more fish), whereas the calculation of

Figure 9
Index of Fry Emergence and Mark-Recapture Estimate as a Function of Time, Nechako River at Bert Irvine's

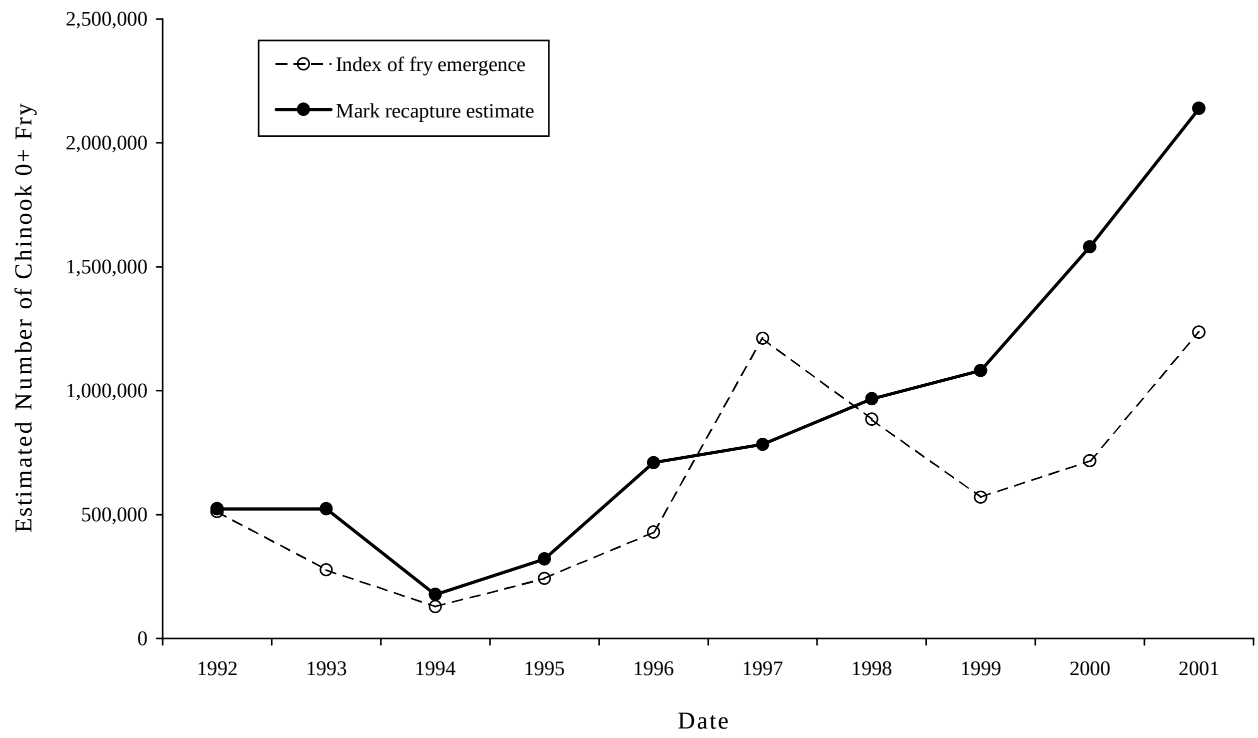


Figure 10
Mark-Recaptures Estimates vs. Index of Fry Emergence, Nechako River, 1992-2001

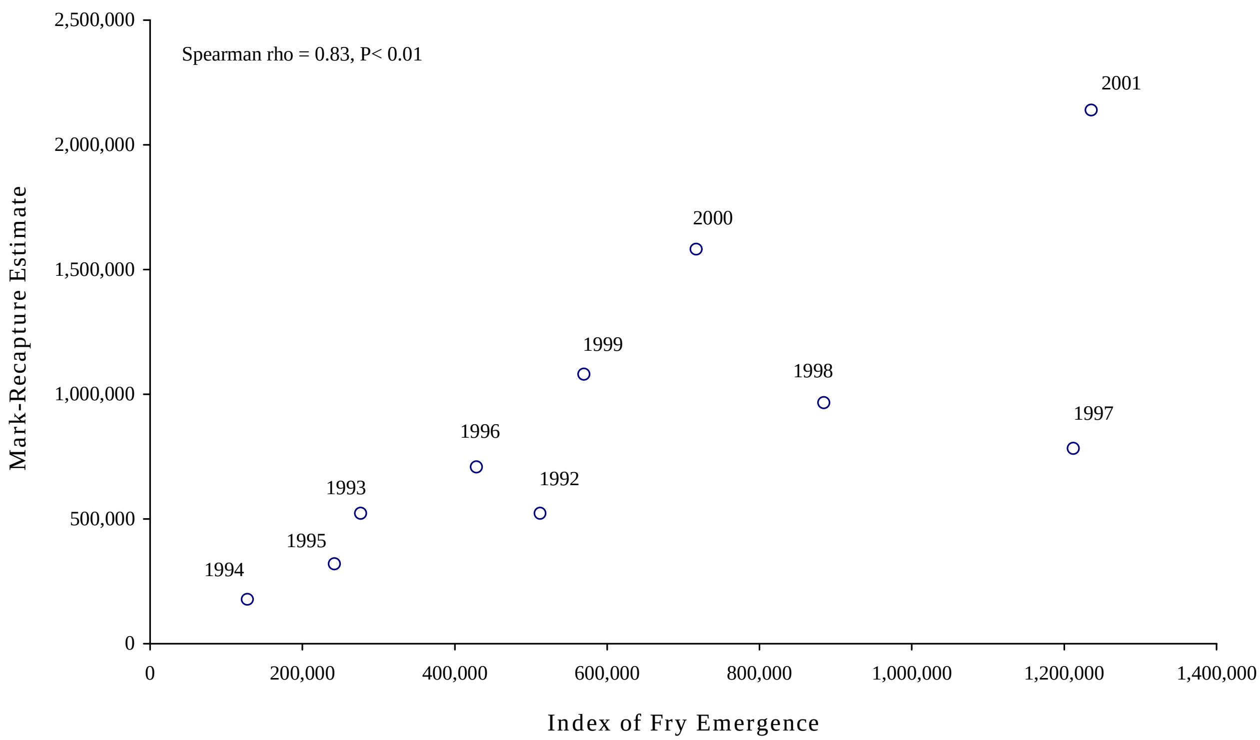


Table 4
Comparison of Chinook Fry Estimates Values Between Index of Fry Emergence and Mark-Recapture 95% Confidence Intervals, Nechako River, 1992-2001

Year	Index of Fry Emergence	Mark-Recapture Estimate 95% c.i.		Overlap?
2001	1,235,554	3,407,552	869,979	Y
2000	716,921	2,265,130	896,571	N
1999	569,703	1,390,264	771,633	N
1998	884,467	1,144,606	788,884	Y
1997	1,211,894	1,358,870	207,383	Y
1996	428,663	867,689	550,388	N
1995	242,058	386,692	254,162	N
1994	127,947	240,528	112,747	Y
1993	276,613	626,583	418,254	N
1992	512,247	733,620	312,069	Y

Table 5
Index of Fry Emergence and Estimated Emergence Success in the Nechako River Above Bert Irvine's (km 19), 1991-2001

Year	Number of Spawners (females) Above km 19	Index of Fry Emergence	Emergence Success (%) (*)
1991	241	589,456	42.4
1992	187	512,247	47.5
1993	112	276,613	42.8
1994	38	127,947	58.4
1995	74	242,058	56.7
1996	152	428,663	48.9
1997	208	1,211,894	100.1 (**)
1998	163	884,467	94.1 (**)
1999	129	569,703	76.6
2000	189	716,921	65.8
2001	336	1,235,554	63.7

the index assumes an equal distribution of the juvenile chinook in the water column and across the river, and equal weight is given to each trap. This means that the emergence success is also overestimated. Nevertheless, the significant correlation between the index of fry emergence and the number of spawners the previous year points that it reflects real biological processes. Furthermore, the year to year comparisons of the index values provide a valuable tool to assess the quality of the incubation environment. Further, the relationship between the index of fry emergence and the number of spawners upstream of the site remained linear. This provides some evidence that there was no density dependence was not reflected in the relationship even though there was the largest number of spawners upstream of the site since monitoring started in 1988.

As stated earlier, there is a strong correlation between the mark recapture and fry emergence indices (Spearman rho = 0.83) (Figure 10). The mark recapture estimate is not affected by fluctuating levels of flow, and may serve as a more accurate measure of the fry population during years of greater flow fluctuations. Examples of this exist in the data from years 1997 and 1998, which were forced spill years. When data for these years are removed from the data set, the correlation between the two indices increases from 0.83 to 0.90 (Spearman rho, $P < 0.01$).

Index of Emergence Success

The number of female chinook spawners above the study site in September 2000 was estimated at 336, the highest recorded during the duration of this project. Assuming 5,769 eggs / spawner (Jaremovic and Rowland 1988), the number of eggs deposited upstream of the traps was 1,938,384 which, based on the index of fry results in an emergence success of 63.7 %.

Emergence success has been very high in recent years (Table 5), and this is likely due to two factors. First, the index of fry emergence probably overestimates the true number of emerging fry. Second, the fecundity of Nechako chinook females is based on a small sample size, and this number might be a lower range estimate: although fecundity in chinook salmon ranges from 2,000-17,000 eggs per female, it does increase with latitude and females in most populations are reported as having fecundities of 4,000-7,000 eggs (Healey and Heard 1984, Beacham and Murray 1993).

Morphological Data

Average morphological parameters for emerging fry sampled by the IPTs are shown in Table 6. Condition factors are good, ranging from 1.89 to 1.94. Table 7 shows the results of ANOVAs on the effects of time of

Figure 11
Index of Fry Emergence Versus the Spawner Escapement (females only)
Above km 19 of the Nechako River During the Previous Year

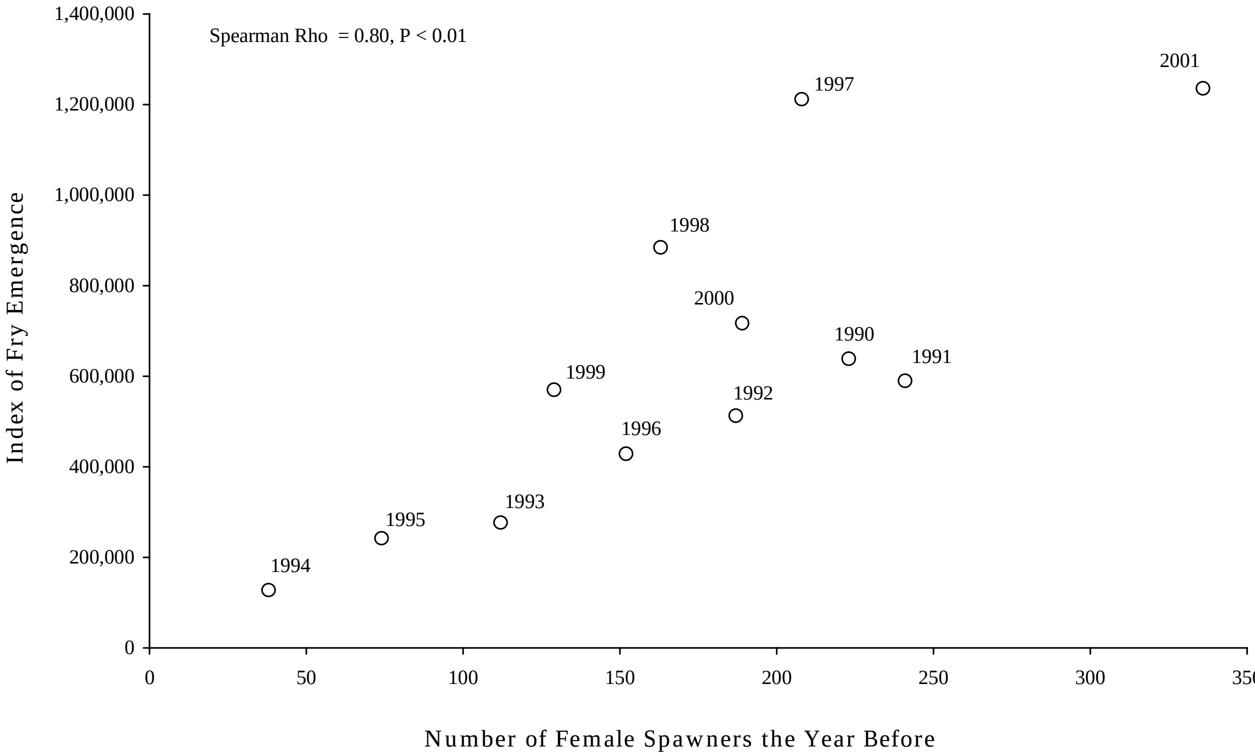


Table 6
Average Morphological Parameters for Emerging Fry Subsampled in the
IPTs at Bert Irvine's, km 19 of the Nechako River, March - May 2001

	Trap Number							
	1		2		3		4	
	Day	Night	Day	Night	Day	Night	Day	Night
N	348	687	165	694	221	702	339	689
Mean Fork Length (mm)	38.20	37.51	37.73	37.20	37.01	37.23	37.90	37.25
SD	1.81	1.63	2.19	1.89	2.04	1.76	1.78	1.82
Mean Wet Weight (g)	0.41	0.37	0.37	0.36	0.35	0.36	0.40	0.36
SD	0.07	0.06	0.07	0.06	0.07	0.06	0.07	0.06
Mean K_D (g/mm^3)	1.94	1.91	1.89	1.90	1.89	1.90	1.93	1.91
SD	0.07	0.06	0.09	0.07	0.08	0.07	0.07	0.07

N = sample size; SD = standard deviation
Excluding non-emergent fry between April 30 and May 20.

Table 7
ANOVAs for Morphological Characters of Chinook Fry Sampled at
Bert Irvine's, km 19 of the Nechako River (Bert Irvine's), 2001

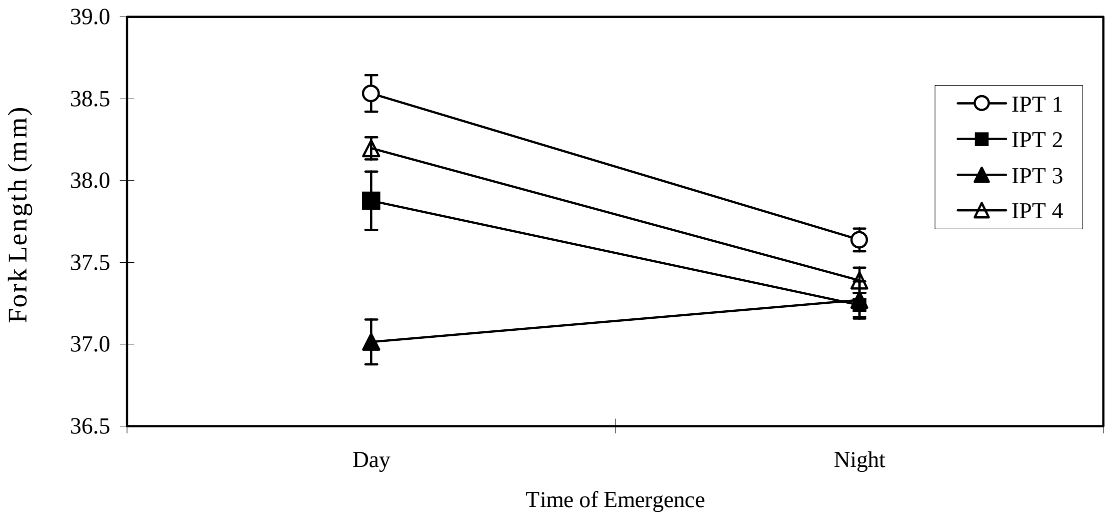
Tests done on In-transformed values

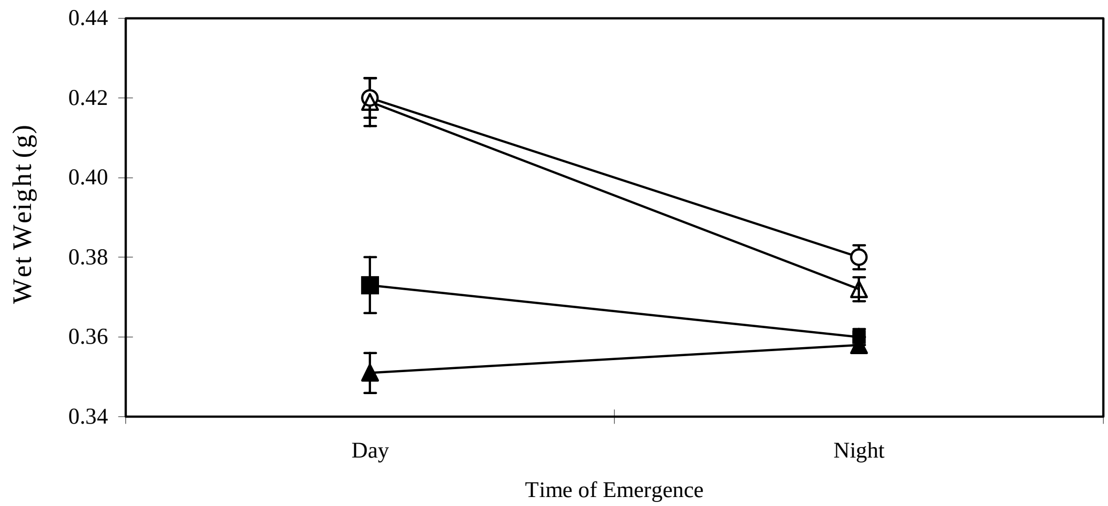
Source of Variation	Degrees of Freedom	Mean Square	F	P
Fork Length				
Time of Emergence	1	0.043	18.94	0.0000
Trap	3	0.031	13.77	0.0000
Interaction	3	0.014	6.06	0.0000
Explained	7	0.033	14.75	0.0000
Residual	3119	0.002		

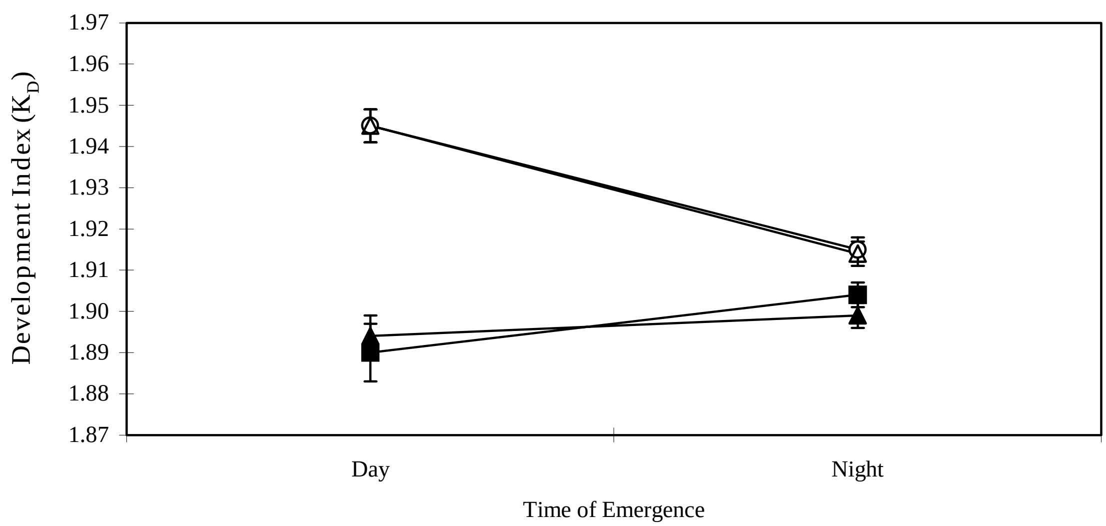
Source of Variation	Degrees of Freedom	Mean Square	F	P
Wet Weight				
Time of Emergence	1	0.053	25.45	0.0000
Trap	3	0.053	25.69	0.0000
Interaction	3	0.03	14.4	0.0000
Explained	7	0.054	25.97	0.0000
Residual	3119	0.002		

Source of Variation	Degrees of Freedom	Mean Square	F	P
Development Index				
Time of Emergence	1	0.001	3.49	0.0000
Trap	3	0.007	16.87	0.0000
Interaction	3	0.004	10.4	0.0000
Explained	7	0.005	12.57	0.0000
Residual	3119	0.000		

Figure 12
Morphological Characters (± 1 sem) at Each IPT as a Function of Time of Emergence







emergence and trap position on fork length, wet weight and development index. Both factors and their interactions had significant effects on fish size. Significant interactions meant that the effects could not be analyzed separately. The direction of the interactions between traps position (equivalent to trap number) and time of emergence for fork length, wet weight and development index for all four traps are shown in Figure 12. From this it appears that there was more variation in juvenile chinook morphological characteristics during the day than during the night, when most fish caught were of similar size. Moreover, fish were consistently larger in both margin traps (1 and 4) than in the mid-river traps (2 and 3) during the day. For example fish caught in IPT 1 were on average 19% heavier than those from IPT 3.

Average length, weight and development index of emergent fry have not varied much in the years of the program (Figure 13), supporting the assertion of a stable incubating environment.

Incidental Catch

There were 1,954 fish other than chinook caught in the four IPTs, 2.1% of the total number of fish caught. Of these, the most common species were sockeye salmon (*Oncorhynchus nerka* 1.2%), longnose dace (*Rhinichthys cataractae*, 0.3%), followed by largescale sucker (*Catostomus macrocheilus*, 0.2%), redside shiner (*Richardsonius balteatus*, 0.1%) and leopard dace (*Rhinichthys falcatus*, 0.1%) (Table 8). Salmonidae (rainbow trout, sockeye salmon and mountain whitefish) accounted for 57.2% of the incidental catch. This is greater than the ten year average of 8.3%. The overall 2001 incidental catch fell within the range, although at the lower end, observed in previous years. The incidental catch of 2001 represents the first year since 1993 that sockeye salmon are the most common species: longnose dace are usually the most abundant species other than chinook, and have been ranked as such for eight of the last eleven years.

CONCLUSIONS

The 2001 fry emergence project continued to monitor the incubation environment of the river. The calculated index of fry emergence appeared to reflect the biological processes as evidenced by the strong relationship between the number of spawners above the trap site and the index of emergence in all but the high flow years. The trends, from index of fry emergence to morphological characteristics of emerging fry, indicate that the incubation environment in the Nechako River has been stable over the period of 1991 to 2001. Despite the record number of spawners in 2000, no evidence of density dependence was seen in the results of the 2001 emergence project.

Figure 13
Mean Fork Length, Wet Weight, and Development Index of Emergent Chinook Fry Sampled by IPTs at Bert Irvine's, km 19 of the Nechako River, 1990-2001
Sample size above each year

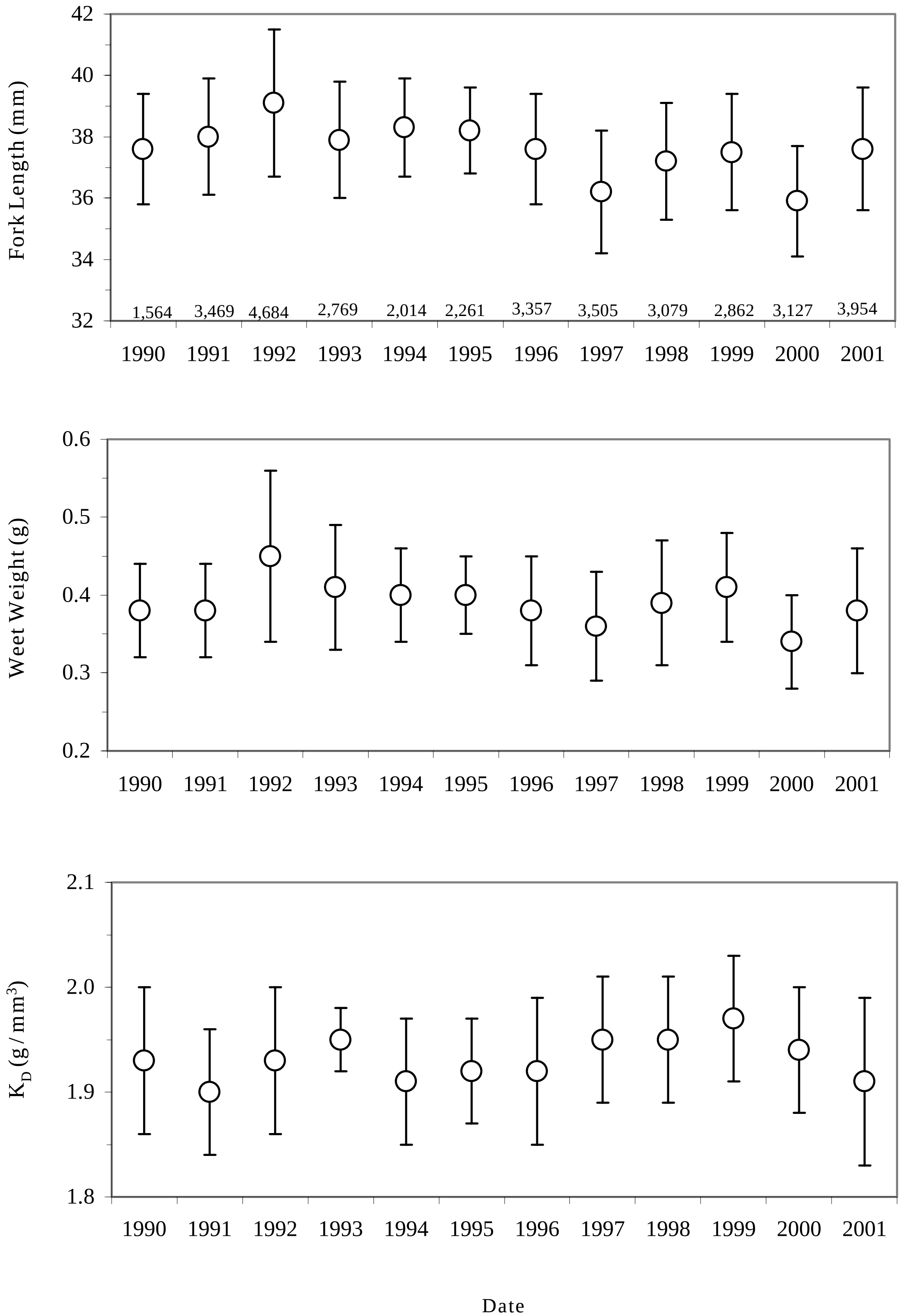


Table 8
Percent of Total Catch and Ranking of Incidental Species Caught in IPTs at Bert Irvine's, km 19 of the Nechako River, 1991 - 2001

		Percent of Total Catch										
Species		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
burbot	*Lota lota*	0.12	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
chubbs		0.00	0.00	0.00	0.19	0.04	0.54	0.20	0.20	0.50	0.30	0.01
lake trout	*Salvelinus namaycush*	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.02	0.00	0.00	0.00
largescale sucker	*Catostomus macrocheilus*	2.69	2.11	3.11	4.02	3.52	2.09	0.50	0.23	2.03	0.48	0.23
leopard dace	*Rhinichthys falcatus*	0.73	1.63	0.75	7.24	3.06	4.07	0.54	0.38	1.30	0.32	0.12
longnose dace	*Rhinichthys cataractae*	3.78	2.97	3.23	21.85	4.29	4.24	2.34	0.68	3.69	0.58	0.30
mountain whitefish	*Prosopium williamsoni*	0.02	0.66	0.13	0.13	4.21	0.06	0.02	0.24	0.06	0.01	0.01
northern pikeminnow	*Ptychocheilus oregonensis*	4.26	1.84	1.68	1.17	1.64	1.41	0.63	0.18	1.49	0.49	0.02
rainbow trout	*Salmo gairdneri*	0.00	0.03	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01
redside shiner	*Richardsonius balteatus*	4.32	2.54	0.78	3.57	3.12	3.26	1.69	0.31	0.70	0.38	0.09
sculpin	*Cottus sp.*	0.56	0.45	0.79	3.11	0.99	0.41	0.42	0.18	0.17	0.23	0.10
sockeye salmon	*Oncorhynchus nerka*	0.02	2.15	3.32	0.03	0.89	0.83	0.82	0.05	0.38	0.05	1.16
Total		16.49	14.40	21.50	41.37	21.76	16.93	7.22	2.47	10.32	2.85	2.06

		Ranking										
Species		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
longnose dace	*Rhinichthys cataractae*	3	1	2	1	1	1	1	1	1	1	2
largescale sucker	*Catostomus macrocheilus*	4	4	3	3	3	4	6	5	2	3	3
northern pikeminnow	*Ptychocheilus oregonensis*	2	5	4	6	6	5	4	8	3	2	8
leopard dace	*Rhinichthys falcatus*	5	6	7	2	5	2	5	2	4	5	4
redside shiner	*Richardsonius balteatus*	1	2	6	4	4	3	2	3	5	4	7
chubbs		-	-	-	7	9	7	8	6	6	6	5
sockeye salmon	*Oncorhynchus nerka*	10	3	1	9	8	6	3	9	7	8	1
sculpin	*Cottus sp.*	6	8	5	5	7	8	7	7	8	7	6
mountain whitefish	*Prosopium williamsoni*	8	7	8	8	2	9	10	4	9	9	9
rainbow trout	*Salmo gairdneri*	-	9	9	-	10	-	-	-	10	10	10
burbot	*Lota lota*	7	-	-	10	-	-	-	-	-	-	-
lake trout	*Salvelinus namaycush*	-	-	-	-	-	-	9	-	-	-	-

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Appendix 1

Estimates of the Numbers of Emerging Chinook Fry, Sampled by IPTs at km 19 (Bert Irvine's Lodge), 2001

APPENDIX 1

Estimates of the Numbers of Emerging Chinook Fry, Sampled by IPTs at km 19 (Bert Irvine's Lodge), 2001

				IPT 1				IPT 2				IPT 3				IPT 4					
Date	D/N	Staff Gauge (cm)	Flows below Cheslatta Falls (m^3/s)	Volume Sampled (m^3/s)	% of Total volume Sampled	Actual Catch	Population Index	Volume Sampled (m^3/s)	% of Total Volume Sampled	Actual Catch	Population Index	Volume Sampled (m^3/s)	% of total Volume Sampled	Actual Catch	Population Index	Volume Sampled (m^3/s)	% of Total Volume Sampled	Actual Catch	Population Index	Total Catch	Daily Weighed Population Index
10-Mar	D	32	33.6	1.87	5.57	0	0	0.33	0.98	0	0	0.39	1.16	0	0	0.57	1.70	0	0	0	0
11-Mar	D	31	33.7	1.87	5.55	0	0	0.33	0.98	0	0	0.39	1.16	1	86	0.57	1.69	1	59	2	21
11-Mar	N	32	33.7	1.87	5.55	4	72	0.33	0.98	4	408	0.39	1.16	16	1383	0.57	1.69	7	414	31	331
12-Mar	D	31.5	33.7	1.87	5.55	0	0	0.33	0.98	0	0	0.39	1.16	0	0	0.57	1.69	0	0	0	0
12-Mar	N	31.5	33.7	1.87	5.55	60	1081	0.33	0.98	17	1736	0.39	1.16	11	951	0.57	1.69	56	3311	144	1536
13-Mar	D	31.5	33.6	1.87	5.57	0	0	0.33	0.98	1	102	0.39	1.16	0	0	0.57	1.70	4	236	5	53
13-Mar	N	31.5	33.6	1.87	5.57	54	970	0.33	0.98	8	815	0.39	1.16	15	1292	0.57	1.70	50	2947	127	1350
14-Mar	D	31.5	33.5	1.87	5.58	0	0	0.33	0.99	2	203	0.39	1.16	1	86	0.57	1.70	1	59	4	42
14-Mar	N	31.5	33.5	1.87	5.58	43	770	0.33	0.99	15	1523	0.39	1.16	19	1632	0.57	1.70	54	3174	131	1389
15-Mar	D	31.5	33.3	1.69	5.08	0	0	0.29	0.87	0	0	0.32	0.96	0	0	0.56	1.68	1	59	1	12
15-Mar	N	31.5	33.3	1.69	5.08	84	1655	0.29	0.87	29	3330	0.32	0.96	27	2810	0.56	1.68	64	3806	204	2375
16-Mar	D	31.5	33.1	1.69	5.11	0	0	0.29	0.88	0	0	0.32	0.97	0	0	0.56	1.69	1	59	1	12
16-Mar	N	31.5	33.1	1.69	5.11	74	1449	0.29	0.88	24	2739	0.32	0.97	19	1965	0.56	1.69	107	6324	224	2592
17-Mar	D	31.5	33.0	1.68	5.09	1	20	0.30	0.91	0	0	0.37	1.12	0	0	0.55	1.67	2	120	3	34
17-Mar	N	31.5	33.0	1.68	5.09	39	766	0.30	0.91	27	2970	0.37	1.12	26	2319	0.55	1.67	101	6060	193	2196
18-Mar	D	31.5	33.1	1.68	5.08	0	0	0.30	0.91	0	0	0.37	1.12	3	268	0.55	1.66	0	0	3	34
18-Mar	N	31.5	33.1	1.68	5.08	115	2266	0.30	0.91	16	1765	0.37	1.12	18	1610	0.55	1.66	122	7342	271	3093
19-Mar	D	31.5	33.1	1.85	5.59	2	36	0.29	0.88	2	228	0.37	1.12	1	89	0.61	1.84	0	0	5	53
19-Mar	N	31.5	33.1	1.85	5.59	47	841	0.29	0.88	18	2054	0.37	1.12	21	1879	0.61	1.84	83	4504	169	1793
20-Mar	D	32	33.2	1.85	5.57	1	18	0.29	0.87	0	0	0.37	1.11	0	0	0.61	1.84	3	163	4	43
20-Mar	N	32	33.2	1.85	5.57	21	377	0.29	0.87	12	1374	0.37	1.11	14	1256	0.61	1.84	21	1143	68	724
21-Mar	D	32	33.2	1.81	5.45	0	0	0.29	0.87	0	0	0.36	1.08	1	92	0.54	1.63	0	0	1	11
21-Mar	N	32	33.2	1.81	5.45	75	1376	0.29	0.87	16	1832	0.36	1.08	21	1937	0.54	1.63	80	4919	192	2125
22-Mar	D	31.5	33.3	1.81	5.44	0	0	0.29	0.87	0	0	0.36	1.08	0	0	0.54	1.62	1	62	1	11
22-Mar	N	32	33.3	1.81	5.44	89	1637	0.29	0.87	20	2297	0.36	1.08	24	2220	0.54	1.62	59	3638	192	2131
23-Mar	D	32	33.3	1.81	5.44	0	0	0.29	0.87	0	0	0.36	1.08	0	0	0.54	1.62	1	62	1	11
23-Mar	N	32	33.3	1.81	5.44	59	1085	0.29	0.87	13	1493	0.36	1.08	15	1388	0.54	1.62	39	2405	126	1399
24-Mar	D	31.5	33.4	1.81	5.42	0	0	0.29	0.87	0	0	0.36	1.08	2	186	0.54	1.62	0	0	2	22
24-Mar	N	31.5	33.4	1.81	5.42	41	757	0.29	0.87	10	1152	0.36	1.08	20	1856	0.54	1.62	37	2289	108	1202
25-Mar	D	31.5	33.4	1.76	5.27	1	19	0.29	0.87	0	0	0.33	0.99	0	0	0.59	1.77	3	170	4	45
25-Mar	N	31.5	33.4	1.76	5.27	101	1917	0.29	0.87	26	2994	0.33	0.99	47	4757	0.59	1.77	122	6906	296	3329
26-Mar	D	31.5	33.5	1.76	5.25	0	0	0.29	0.87	0	0	0.33	0.99	0	0	0.59	1.76	4	227	4	45
26-Mar	N	31.5	33.5	1.76	5.25	203	3864	0.29	0.87	54	6238	0.33	0.99	67	6802	0.59	1.76	347	19703	671	7569
27-Mar	D	31.5	33.6	1.80	5.36	1	19	0.29	0.86		0	0.35	1.04	0	0	0.52	1.55	4	258	5	57
27-Mar	N	31.5	33.6	1.80	5.36	193	3603	0.29	0.86	50	5793	0.35	1.04	51	4896	0.52	1.55	165	10662	459	5210
28-Mar	D	31.5	33.6	1.80	5.36	3	56	0.29	0.86	0	0	0.35	1.04	3	288	0.52	1.55	1	65	7	79
28-Mar	N	31.5	33.6	1.80	5.36	155	2893	0.29	0.86	31	3592	0.35	1.04	27	2592	0.52	1.55	211	13634	424	4813
29-Mar	D	31.5	33.7	2.00	5.93	3	51	0.30	0.89	0	0	0.35	1.04	1	96	0.51	1.51	0	0	4	43
29-Mar	N	31.5	33.7	2.00	5.93	113	1904	0.30	0.89	40	4493	0.35	1.04	57	5488	0.51	1.51	138	9119	348	3711
30-Mar	D	31.5	33.8	2.00	5.92	2	34	0.30	0.89	0	0	0.35	1.04	1	97	0.51	1.51	0	0	3	32
30-Mar	N	31.5	33.8	2.00	5.92	237	4005	0.30	0.89	28	3155	0.35	1.04	39	3766	0.51	1.51	118	7820	422	4514

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Date	D/N	Staff Gauge (cm)	Flows below Cheslatta Falls (m³/s)	Volume Sampled (m³/s)	% of Total volume Sampled	Actual Catch	Population Index	Volume Sampled (m³/s)	% of Total Volume Sampled	Actual Catch	Population Index	Volume Sampled (m³/s)	% of total Volume Sampled	Actual Catch	Population Index	Volume Sampled (m³/s)	% of Total Volume Sampled	Actual Catch	Population Index	Total Catch	Daily Weighed Population Index
31-Mar	D	31.5	33.9	1.78	5.25	3	57	0.26	0.77	3	391	0.35	1.03	5	484	0.55	1.62	5	308	16	184
31-Mar	N	31.5	33.9	1.78	5.25	76	1447	0.26	0.77	45	5867	0.35	1.03	30	2906	0.55	1.62	78	4808	229	2641
01-Apr	D	31.5	34.2	1.78	5.20	2	38	0.26	0.76	0	0	0.35	1.02	0	0	0.55	1.61	3	187	5	58
01-Apr	N	31.5	34.2	1.78	5.20	123	2363	0.26	0.76	63	8287	0.35	1.02	84	8208	0.55	1.61	93	5783	363	4223
02-Apr	D	31.5	34.6	2.27	6.56	3	46	0.29	0.84	1	119	0.36	1.04	1	96	0.58	1.68	4	239	9	89
02-Apr	N	31.5	34.6	2.27	6.56	143	2180	0.29	0.84	57	6801	0.36	1.04	55	5286	0.58	1.68	58	3460	313	3094
03-Apr	D	31.5	34.5	2.27	6.58	3	46	0.29	0.84	0	0	0.36	1.04	1	96	0.58	1.68	6	357	10	99
03-Apr	N	31.5	34.5	2.27	6.58	141	2143	0.29	0.84	35	4164	0.36	1.04	48	4600	0.58	1.68	75	4461	299	2947
04-Apr	D	31.5	34.1	2.27	6.66	6	90	0.29	0.85	1	118	0.36	1.06	3	284	0.58	1.70	2	118	12	117
04-Apr	N	31.5	34.1	2.27	6.66	191	2869	0.29	0.85	54	6350	0.36	1.06	70	6631	0.58	1.70	84	4939	399	3887
05-Apr	D	31.5	34.4	1.73	5.03	7	139	0.28	0.81	0	0	0.33	0.96	2	208	0.47	1.37	3	220	12	147
05-Apr	N	31.5	34.4	1.73	5.03	157	3122	0.28	0.81	29	3563	0.33	0.96	33	3440	0.47	1.37	79	5782	298	3648
06-Apr	D	31.5	34.4	1.73	5.03	3	60	0.28	0.81	3	369	0.33	0.96	7	730	0.47	1.37	1	73	14	171
06-Apr	N	31.5	34.4	1.73	5.03	100	1988	0.28	0.81	46	5651	0.33	0.96	52	5421	0.47	1.37	94	6880	292	3575
07-Apr	D	31.5	34.6	2.08	6.01	7	116	0.32	0.92	1	108	0.36	1.04	9	865	0.56	1.62	9	556	26	271
07-Apr	N	31.5	34.6	2.08	6.01	104	1730	0.32	0.92	30	3244	0.36	1.04	45	4325	0.56	1.62	91	5623	270	2814
08-Apr	D	32.5	34.7	2.08	5.99	4	67	0.32	0.92	7	759	0.36	1.04	5	482	0.56	1.61	11	682	27	282
08-Apr	N	31.5	34.7	2.08	5.99	348	5806	0.32	0.92	88	9543	0.36	1.04	72	6940	0.56	1.61	161	9976	669	6992
09-Apr	D	32.5	34.8	1.42	4.08	17	417	0.31	0.89	5	561	0.37	1.06	3	282	0.55	1.58	2	127	27	355
09-Apr	N	32.5	34.8	1.42	4.08	479	11739	0.31	0.89	119	13359	0.37	1.06	188	17682	0.55	1.58	214	13540	1000	13132
10-Apr	D	32.5	34.9	1.42	4.07	9	221	0.31	0.89	4	450	0.37	1.06	3	283	0.55	1.58	11	698	27	356
10-Apr	N	32.5	34.9	1.42	4.07	1103	27109	0.31	0.89	214	24092	0.37	1.06	231	21789	0.55	1.58	514	32616	2062	27156
11-Apr	D	32	34.9	1.47	4.21	16	380	0.28	0.80	1	125	0.35	1.00	1	100	0.56	1.60	16	997	34	446
11-Apr	N	32	34.9	1.47	4.21	1318	31291	0.28	0.80	156	19444	0.35	1.00	228	22735	0.56	1.60	729	45432	2431	31895
12-Apr	D	32	35.0	1.47	4.20	11	262	0.28	0.80	1	125	0.35	1.00	2	200	0.56	1.60	18	1125	32	421
12-Apr	N	32	35.0	1.47	4.20	594	14143	0.28	0.80	86	10750	0.35	1.00	89	8900	0.56	1.60	465	29063	1234	16237
13-Apr	D	32	35.0	1.63	4.66	16	344	0.28	0.80	3	375	0.37	1.06	4	378	0.55	1.57	14	891	37	458
13-Apr	N	32	35.0	1.63	4.66	796	17092	0.28	0.80	156	19500	0.37	1.06	373	35284	0.55	1.57	986	62745	2311	28581
14-Apr	D	32	35.1	1.63	4.64	9	194	0.28	0.80	2	251	0.37	1.05	5	474	0.55	1.57	3	191	19	236
14-Apr	N	32	35.1	1.63	4.64	953	20522	0.28	0.80	156	19556	0.37	1.05	275	26088	0.55	1.57	708	45183	2092	25947
15-Apr	D	32.5	35.2	1.68	4.77	9	189	0.30	0.85	1	117	0.37	1.05	3	285	0.58	1.65	8	486	21	252
15-Apr	N	32	35.2	1.68	4.77	1011	21183	0.30	0.85	212	24875	0.37	1.05	488	46426	0.58	1.65	1033	62692	2744	32965
16-Apr	D	32	35.0	1.68	4.80	14	292	0.30	0.86	1	117	0.37	1.06	3	284	0.58	1.66	4	241	22	263
16-Apr	N	32.5	35.0	1.68	4.80	1831	38146	0.30	0.86	260	30333	0.37	1.06	440	41622	0.58	1.66	1396	84241	3927	46910
17-Apr	D	33	34.8	1.64	4.71	31	658	0.30	0.86	8	928	0.36	1.03	4	387	0.42	1.21	10	829	53	678
17-Apr	N	32.5	34.8	1.64	4.71	2768	58736	0.30	0.86	217	25172	0.36	1.03	418	40407	0.42	1.21	3264	270446	6667	85298
18-Apr	D	32.5	34.9	1.23	3.52	23	653	0.30	0.86	3	349	0.36	1.03	2	194	0.37	1.06	6	566	34	525
18-Apr	N	32.5	34.9	1.23	3.52	945	26813	0.30	0.86	134	15589	0.36	1.03	171	16578	0.37	1.06	741	69894	1991	30746
19-Apr	D	32.5	35.0	1.23	3.51	16	455	0.30	0.86	5	583	0.36	1.03	2	194	0.37	1.06	22	2081	45	697
19-Apr	N	32.5	35.0	1.23	3.51	2167	61663	0.30	0.86	491	57283	0.36	1.03	842	81861	0.37	1.06	958	90622	4458	69040
20-Apr	D	32.5	34.9	1.53	4.38	11	251	0.27	0.77	4	517	0.35	1.00	7	698	0.54	1.55	17	1099	39	506

APPENDIX 1
Estimates of the Numbers of Emerging Chinook Fry, Sampled by IPTs at km 19 (Bert Irvine's Lodge), 2001

				IPT 1				IPT 2				IPT 3				IPT 4					
Date	D/N	Staff Gauge (cm)	Flows below Cheslatta Falls (m³/s)	Volume Sampled (m³/s)	% of Total volume Sampled	Actual Catch	Population Index	Volume Sampled (m³/s)	% of Total Volume Sampled	Actual Catch	Population Index	Volume Sampled (m³/s)	% of total Volume Sampled	Actual Catch	Population Index	Volume Sampled (m³/s)	% of Total Volume Sampled	Actual Catch	Population Index	Total Catch	Daily Weighed Population Index
20-Apr	N	32.5	34.9	1.53	4.38	3282	74864	0.27	0.77	458	59201	0.35	1.00	276	27521	0.54	1.55	2166	139988	6182	80205
21-Apr	D	32.5	35.2	1.53	4.35	22	506	0.27	0.77	2	261	0.35	0.99	2	201	0.54	1.53	15	978	41	537
21-Apr	N	32.5	35.2	1.53	4.35	2405	55331	0.27	0.77	330	43022	0.35	0.99	477	47973	0.54	1.53	1627	106056	4839	63321
22-Apr	D	32.5	35.3	1.67	4.73	20	423	0.31	0.88	1	114	0.35	0.99	3	303	0.58	1.64	9	548	33	400
22-Apr	N	32.5	35.3	1.67	4.73	1478	31242	0.31	0.88	232	26418	0.35	0.99	360	36309	0.58	1.64	1277	77721	3347	40601
23-Apr	D	32.5	35.5	1.67	4.70	19	404	0.31	0.87	4	458	0.35	0.99	4	406	0.58	1.63	13	796	40	488
23-Apr	N	32.5	35.5	1.67	4.70	1852	39369	0.31	0.87	282	32294	0.35	0.99	521	52844	0.58	1.63	1099	67266	3754	45796
24-Apr	D	34.5	36.6	1.60	4.37	34	778	0.32	0.87	6	686	0.35	0.96	6	627	0.63	1.72	67	3892	113	1426
24-Apr	N	33.5	36.6	1.60	4.37	1511	34564	0.32	0.87	342	39116	0.35	0.96	546	57096	0.63	1.72	1929	112066	4328	54622
25-Apr	D	36	38.3	1.60	4.18	6	144	0.32	0.84	4	479	0.35	0.91		0	0.63	1.64	5	304	15	198
25-Apr	N	35	38.3	1.60	4.18	1435	34350	0.32	0.84	527	63075	0.35	0.91	146	15977	0.63	1.64	1040	63225	3148	41425
26-Apr	D	37	39.9	2.05	5.14	14	272	0.34	0.85	0	0	0.42	1.05	5	475	0.61	1.53	4	262	23	268
26-Apr	N	36.5	39.9	2.05	5.14	327	6365	0.34	0.85	273	32037	0.42	1.05	430	40850	0.61	1.53	904	59130	1934	22563
27-Apr	D	38.5	41.5	2.05	4.94	13	263	0.34	0.82	5	610	0.42	1.01	9	889	0.61	1.47	8	544	35	425
27-Apr	N	38	41.5	2.05	4.94	451	9130	0.34	0.82	260	31735	0.42	1.01	387	38239	0.61	1.47	803	54630	1901	23068
28-Apr	D	40	43.4	2.78	6.41	6	94	0.39	0.90	6	668	0.45	1.04	11	1061	0.84	1.94	12	620	35	341
28-Apr	N	39.5	43.4	2.78	6.41	522	8149	0.39	0.90	353	39283	0.45	1.04	90	8680	0.84	1.94	1048	54147	2013	19588
29-Apr	D	41	44.8	2.78	6.21	3	48	0.39	0.87	2	230	0.45	1.00	10	996	0.84	1.88	7	373	22	221
29-Apr	N	40.5	44.8	2.78	6.21	616	9927	0.39	0.87	366	42043	0.45	1.00	372	37035	0.84	1.88	1609	85813	2963	29763
30-Apr	D	41.5	46.4	1.77	3.81	15	359	0.37	0.80	2	229	0.43	0.93	2	197	0.50	1.08	4	339	23	317
30-Apr	N	41.5	46.4	1.77	3.81	298	7132	0.37	0.80	280	32059	0.43	0.93	292	28768	0.50	1.08	293	24825	1163	16048
01-May	D	42.5	48.2	1.77	3.67	6	149	0.37	0.77	3	357	0.43	0.89	2	205	0.50	1.04	5	440	16	229
01-May	N	42	48.2	1.77	3.67	373	9274	0.37	0.77	177	21052	0.43	0.89	189	19342	0.50	1.04	319	28076	1058	15166
02-May	D	43.5	49.1	1.77	3.60	3	76	0.37	0.75	0	0	0.43	0.88	0	0	0.50	1.02	4	359	7	102
02-May	N	43	49.1	1.77	3.60	214	5420	0.37	0.75	267	32349	0.43	0.88	52	5421	0.50	1.02	272	24387	805	11755
03-May	D	43.5	49.7	1.85	3.72	28	687	0.39	0.78	2	233	0.41	0.82	6	664	0.52	1.05	2	175	38	544
03-May	N	43.5	49.7	1.85	3.72	97	2379	0.39	0.78	63	7330	0.41	0.82	62	6862	0.52	1.05	50	4363	272	3893
04-May	D	45	50.9	1.85	3.63	1	25	0.39	0.77	5	596	0.41	0.81	6	680	0.52	1.02	4	357	16	235
04-May	N	44.5	50.9	1.85	3.63	98	2462	0.39	0.77	97	11558	0.41	0.81	33	3740	0.52	1.02	66	5898	294	4310
05-May	D	46.5	52.7	1.82	3.45	7	185	0.39	0.74	0	0	0.46	0.87	0	0	0.59	1.12	2	163	9	133
05-May	N	46	52.7	1.82	3.45	227	6001	0.39	0.74	150	18506	0.46	0.87	161	16840	0.59	1.12	81	6606	619	9136
06-May	D	46.5	53.7	1.82	3.39	12	323	0.39	0.73	4	503	0.46	0.86	5	533	0.59	1.10	5	415	26	391
06-May	N	46.5	53.7	1.82	3.39	787	21201	0.39	0.73	311	39097	0.46	0.86	533	56809	0.59	1.10	433	35982	2064	31041
07-May	D	47	54.1	1.85	3.42	12	320	0.37	0.68	6	801	0.47	0.87	1	105	0.45	0.83	6	659	25	393
07-May	N	46.5	54.1	1.85	3.42	174	4646	0.37	0.68	75	10012	0.47	0.87	128	13452	0.45	0.83	75	8232	452	7110
08-May	D	48.5	55.0	1.85	3.36	20	543	0.37	0.67	13	1764	0.47	0.85	12	1282	0.45	0.82	7	781	52	832
08-May	N	48	55.0	1.85	3.36	331	8984	0.37	0.67	291	39493	0.47	0.85	144	15385	0.45	0.82	192	21425	958	15320
09-May	D	49	55.7	1.90	3.41	29	776	0.37	0.66	10	1374	0.44	0.79	13	1503	0.29	0.52	9	1578	61	1034
09-May	N	49	55.7	1.90	3.41	242	6477	0.37	0.66	253	34773	0.44	0.79	160	18492	0.29	0.52	311	54537	966	16375
10-May	D	49	55.9	1.90	3.40	5	134	0.37	0.66	2	276	0.44	0.79	3	348	0.29	0.52	2	352	12	204
10-May	N	49	55.9	1.90	3.40	301	8085	0.37	0.66	167	23035	0.44	0.79	206	23894	0.29	0.52	192	33790	866	14733

APPENDIX 1

Estimates of the Numbers of Emerging Chinook Fry, Sampled by IPTs at km 19 (Bert Irvine's Lodge), 2001

				IPT 1				IPT 2				IPT 3				IPT 4					
Date	D/N	Staff Gauge (cm)	Flows below Cheslatta Falls (m^3/s)	Volume Sampled (m^3/s)	% of Total volume Sampled	Actual Catch	Population Index	Volume Sampled (m^3/s)	% of Total Volume Sampled	Actual Catch	Population Index	Volume Sampled (m^3/s)	% of total Volume Sampled	Actual Catch	Population Index	Volume Sampled (m^3/s)	% of Total Volume Sampled	Actual Catch	Population Index	Total Catch	Daily Weighed Population Index
11-May	D	49.5	56.1	1.90	3.39	15	404	0.37	0.66	8	1107	0.44	0.78	10	1164	0.29	0.52	3	530	36	615
11-May	N	49.5	56.1	1.90	3.39	488	13155	0.37	0.66	178	24641	0.44	0.78	196	22816	0.29	0.52	676	119394	1538	26258
12-May	D	48.5	56.5	1.90	3.36	15	407	0.37	0.65	7	976	0.44	0.78	7	821	0.29	0.51	11	1957	40	688
12-May	N	48.5	56.5	1.90	3.36	305	8281	0.37	0.65	133	18543	0.44	0.78	183	21454	0.29	0.51	822	146215	1443	24812
13-May	D	48.5	56.6	1.90	3.36	7	190	0.37	0.65	12	1676	0.44	0.78	12	1409	0.29	0.51	15	2673	46	792
13-May	N	48.5	56.6	1.90	3.36	185	5032	0.37	0.65	156	21788	0.44	0.78	187	21962	0.29	0.51	587	104599	1115	19206
14-May	D	48.5	56.4	1.51	2.68	13	443	0.37	0.66	4	557	0.43	0.76	0	0	0.65	1.15	35	2773	52	905
14-May	N	48.5	56.4	1.51	2.68	149	5081	0.37	0.66	103	14335	0.43	0.76	131	15687	0.65	1.15	534	42304	917	15952
15-May	D	49	56.8	1.51	2.66	3	103	0.37	0.65	1	140	0.43	0.76	3	362	0.65	1.14	30	2393	37	648
15-May	N	49	56.8	1.51	2.66	209	7178	0.37	0.65	91	12754	0.43	0.76	138	16643	0.65	1.14	745	59438	1183	20726
16-May	D	49.5	57.5	1.51	2.63	6	209	0.37	0.64	5	709	0.43	0.75	6	733	0.65	1.13	10	808	27	479
16-May	N	49.5	57.5	1.51	2.63	75	2607	0.37	0.64	104	14756	0.43	0.75	138	16848	0.65	1.13	458	36991	775	13745
17-May	D	49.5	57.8	1.51	2.61	5	175	0.37	0.64	0	0	0.43	0.74	4	491	0.65	1.12	6	487	15	267
17-May	N	49.5	57.8	1.51	2.61	139	4858	0.37	0.64	127	18113	0.43	0.74	133	16322	0.65	1.12	273	22164	672	11981
18-May	D	49	58.1	1.51	2.60	0	0	0.37	0.64	4	573	0.43	0.74	8	987	0.65	1.12	20	1632	32	573
18-May	N	49	58.1	1.51	2.60	61	2143	0.37	0.64	89	12760	0.43	0.74	117	14433	0.65	1.12	241	19668	508	9104
19-May	D	50	58.5	1.51	2.58	2	71	0.37	0.63	0	0	0.43	0.74	5	621	0.65	1.11	15	1233	22	397
19-May	N	50	58.5	1.51	2.58	73	2582	0.37	0.63	46	6640	0.43	0.74	71	8819	0.65	1.11	172	14133	362	6532
20-May	N	50	58.6	1.51	2.58	9	319	0.37	0.63	54	7808	0.43	0.73	51	6346	0.65	1.11	159	13087	273	4934
Totals						36,444	835,697			9,918	1,217,074			11,937	1,218,139			34,792	2,666,548	93,091	1,235,554

Appendix 2
Daily Mean Fork Length, Wet Weight and Development Index (K_D) for Chinook 0+ Sampled by IPTs at km 19 of the Nechako River (Bert Irvine's) in 2001

APPENDIX 2

Daily Mean Fork Length, Wet Weight and Development Index (K_D) for Chinook 0+ Sampled by IPTs at km 19 of the Nechako River (Bert Irvine's) in 2001

N = sample size, SD = standard deviation

Date	N	Fork Length (mm)		Wet Weight (g)		Development Index (g/mm^3)	
		Mean	SD	Mean	SD	Mean	SD
Mar-10	0	0	0	0	0	0	0
Mar-11	26	36.96	1.00	0.33	0.04	1.86	0.07
Mar-12	39	35.69	1.10	0.33	0.04	1.94	0.06
Mar-13	43	35.93	1.50	0.32	0.05	1.90	0.04
Mar-14	44	36.57	1.44	0.33	0.04	1.89	0.07
Mar-15	41	36.22	1.21	0.33	0.04	1.90	0.04
Mar-16	41	36.63	1.68	0.35	0.04	1.92	0.06
Mar-17	43	36.33	1.30	0.32	0.05	1.89	0.05
Mar-18	43	36.65	1.07	0.34	0.04	1.90	0.05
Mar-19	45	36.40	1.89	0.34	0.05	1.92	0.10
Mar-20	44	36.34	1.36	0.33	0.05	1.89	0.04
Mar-21	41	36.85	1.51	0.34	0.05	1.89	0.05
Mar-22	41	37.15	1.13	0.35	0.03	1.90	0.03
Mar-23	41	37.05	1.61	0.35	0.05	1.90	0.07
Mar-24	42	37.12	1.29	0.35	0.05	1.89	0.04
Mar-25	44	37.36	1.10	0.36	0.04	1.90	0.05
Mar-26	44	37.11	1.02	0.36	0.04	1.91	0.06
Mar-27	45	37.02	1.45	0.35	0.05	1.90	0.05
Mar-28	44	37.41	1.67	0.37	0.06	1.91	0.06
Mar-29	45	36.89	1.32	0.37	0.05	1.94	0.08
Mar-30	43	36.74	1.22	0.36	0.05	1.94	0.07
Mar-31	55	37.38	1.41	0.34	0.05	1.86	0.04
Apr-01	45	37.82	1.53	0.36	0.05	1.88	0.04
Apr-02	49	37.24	1.59	0.36	0.06	1.91	0.06
Apr-03	50	37.00	1.81	0.38	0.07	1.94	0.06
Apr-04	52	36.98	1.42	0.37	0.06	1.93	0.07
Apr-05	52	36.92	1.22	0.39	0.05	1.98	0.07
Apr-06	54	37.94	1.28	0.38	0.05	1.90	0.05
Apr-07	66	37.21	1.51	0.38	0.06	1.94	0.05
Apr-08	63	37.60	1.78	0.37	0.06	1.91	0.05
Apr-09	60	37.87	1.21	0.38	0.05	1.90	0.06
Apr-10	66	37.70	1.78	0.37	0.07	1.89	0.06
Apr-11	62	38.16	1.77	0.38	0.07	1.89	0.07
Apr-12	63	38.22	1.79	0.39	0.06	1.90	0.06
Apr-13	67	38.09	2.33	0.37	0.07	1.88	0.08
Apr-14	60	37.97	1.79	0.37	0.07	1.88	0.06
Apr-15	60	37.83	1.85	0.38	0.07	1.90	0.06
Apr-16	58	37.53	1.58	0.37	0.07	1.90	0.06
Apr-17	72	37.13	1.79	0.38	0.07	1.94	0.07
Apr-18	60	37.17	2.00	0.37	0.07	1.93	0.07
Apr-19	67	38.84	1.71	0.41	0.07	1.91	0.06
Apr-20	67	38.19	1.82	0.39	0.06	1.91	0.07
Apr-21	64	38.25	1.97	0.40	0.07	1.92	0.06
Apr-22	62	37.60	1.62	0.38	0.06	1.92	0.06
Apr-23	68	38.62	1.80	0.40	0.08	1.90	0.06
Apr-24	72	38.17	1.60	0.38	0.06	1.90	0.06

APPENDIX 2 (continued)

Daily Mean Fork Length, Wet Weight and Development Index (K_D) for Chinook 0+ Sampled by IPTs at km 19 of the Nechako River (Bert Irvine's) in 2001

N = sample size, SD = standard deviation

		Fork Length (mm)		Wet Weight (g)		Development Index (g/mm^3)	
Date	N	Mean	SD	Mean	SD	Mean	SD
Apr-25	55	37.73	1.53	0.37	0.05	1.90	0.05
Apr-26	59	37.49	1.71	0.37	0.06	1.91	0.07
Apr-27	72	37.33	1.95	0.39	0.08	1.95	0.09
Apr-28	72	36.93	2.01	0.36	0.07	1.92	0.06
Apr-29	62	37.34	1.85	0.35	0.06	1.88	0.05
Apr-30	58	38.66	2.24	0.42	0.11	1.92	0.08
May-01	56	38.20	1.73	0.38	0.07	1.89	0.05
May-02	47	38.47	1.63	0.40	0.07	1.90	0.06
May-03	60	37.47	2.39	0.36	0.10	1.89	0.09
May-04	55	38.36	2.26	0.39	0.09	1.89	0.06
May-05	49	37.59	2.11	0.37	0.09	1.89	0.07
May-06	64	37.75	1.87	0.37	0.08	1.89	0.05
May-07	63	37.90	1.92	0.38	0.08	1.89	0.07
May-08	77	37.75	2.62	0.38	0.11	1.90	0.10
May-09	78	38.79	1.85	0.39	0.07	1.88	0.10
May-10	52	38.87	2.54	0.41	0.11	1.90	0.06
May-11	71	38.61	2.62	0.40	0.10	1.90	0.08
May-12	74	38.57	2.48	0.41	0.10	1.92	0.09
May-13	76	37.33	2.73	0.43	0.12	2.00	0.08
May-14	65	36.45	2.09	0.41	0.10	2.02	0.09
May-15	57	35.70	2.60	0.40	0.14	2.05	0.07
May-16	67	38.15	2.62	0.41	0.14	1.92	0.08
May-17	54	37.56	2.79	0.41	0.14	1.96	0.08
May-18	62	38.39	2.08	0.41	0.10	1.92	0.09
May-19	57	38.72	3.73	0.45	0.22	1.93	0.11
May-20	39	37.49	2.22	0.35	0.07	1.88	0.08

Appendix 3
Summary of 2001 IPT Catches by Month and Trap Number

APPENDIX 3

Summary of 2001 IPT Catches by Month and Trap Number

Month	Day/Night	Trap	Salmonidae										Catostomidae		Cyprinidae										Cottidae	
		No.	CH 1+	CH 0+	CO 0+	CO 1+	RB_A	RB_J	SK_1+	SK_0+	MW_A	MW_J	CSU_A	CSU_J	RSC_A	RSC_J	NSC_A	NSC_J	LNC_A	LNC_J	LDC_A	LDC_J	PCC_A	PCC_J	CC_A	CC_J
March	Day	1	1	17	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	3
		2	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	0	32	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1
March	Night	1	0	1,883	0	0	0	0	0	0	0	6	0	7	1	1	0	0	0	1	1	2	0	1	1	7
		2	0	503	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
		3	0	584	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
		4	1	2,059	0	0	0	0	0	8	0	0	0	21	3	4	0	1	1	7	8	5	0	0	1	21
	March Total		2	5105	0	0	0	0	0	9	0	7	0	31	4	5	0	1	1	8	10	7	0	1	2	36
April	Day	1	2	369	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	3
		2	0	83	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3	0	119	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		4	2	314	0	0	0	0	3	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	4
April	Night	1	1	29,449	0	0	0	1	0	128	0	2	1	23	1	7	0	1	0	25	9	16	0	0	4	6
		2	0	6,306	0	0	0	0	23	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2
		3	0	8,099	0	0	0	0	0	23	0	1	1	2	0	0	0	0	0	1	0	0	0	0	0	3
		4	0	25,538	0	0	0	1	0	216	0	1	0	57	2	54	0	7	3	115	5	19	0	0	3	25
	April Total		1	70,277	0	0	0	2	26	369	0	4	2	85	3	62	0	8	3	144	14	35	0	0	8	43
May	Day	1	0	189	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	0
		2	0	86	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		3	0	103	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
		4	0	191	0	0	0	1	0	4	0	1	0	0	0	0	0	0	0	5	0	1	0	0	0	2
May	Night	1	0	4,537	0	0	0	0	0	167	0	0	0	18	0	0	0	0	1	5	0	4	0	0	1	1
		2	0	2,932	0	0	0	0	0	113	0	0	0	1	0	1	0	0	0	1	1	4	0	0	0	0
		3	1	3,013	0	0	0	0	0	114	0	0	0	1	0	1	0	0	0	4	1	1	0	0	0	1
		4	0	6,658	0	0	0	3	0	279	0	1	0	81	0	12	0	13	0	100	0	38	0	11	1	3
	May Total		1	17709	0	0	0	4	0	695	0	2	0	101	0	14	0	13	1	118	2	48	0	12	2	7
Grand Total			4	93091	0	0	0	6	26	1073	0	13	2	217	7	81	0	22	5	270	26	90	0	13	12	86

Key to Species

A Adults
J Juveniles

CH	Chinook salmon	*Oncorhynchus tshawytscha*
RB	Rainbow trout	*Oncorhynchus mykiss*
SK	Sockeye salmon	*Oncorhynchus nerka*
MW	Rocky Mountain whitefish	*Prosopium williamsoni*
CC	Sculpin species	*Cottus sp.*
CSU	Largescale sucker	*Catostomus macrocheilus*
RSC	Redside shiner	*Richardsonius balteatus*
NSC	Northern pikeminnow	*Ptychocheilus oregonensis*
LNC	Longnose dace	*Rhinichthys cataractae*
LDC	Leopard dace	*Rhinichthys falcatus*
PCC	Peamouth chubb	*Mylocheilus caurinus*