FRY EMERGENCE PROJECT 1999

NECHAKO FISHERIES CONSERVATION PROGRAM
Technical Report No. M98-6

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ABSTRACT

The Nechako Fisheries Conservation Program 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. The index of fry emergence for 1999 was 569,703. This translated into an index of emergence success of 77% when the estimated egg deposition above the trapping site the previous fall was taken into account. This was lower than in the two previous years (when the values were above 94%) but above the average for 1991-1996 (47%). The data from 1999 strengthened the positive correlation between the index and the number of spawners in the river above the trap site, which confirmed that the index was a reliable measure of fry abundance. Emergent fry in 1999 were of similar average length, weight and development index to those of previous years. Species other than chinook made up 10% of the total number of fish sampled in the four IPTs. The most common species was longnose dace (*Rhinichthys cataractae*) followed by largescale sucker (*Catostomus macrocheilus*), northern pikeminnow (*Ptychocheilus oregonensis*), leopard dace (*Rhinichthys falcatus*) and redside shiner (*Richardsonius balteatus*). This is slightly different from previous years, when largescale suckers are usually less abundant. Overall the 1999 results from the fry emergence trapping program indicate that the quality of the incubation environment in the upper Nechako River does not show any degradation from previous years and 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.

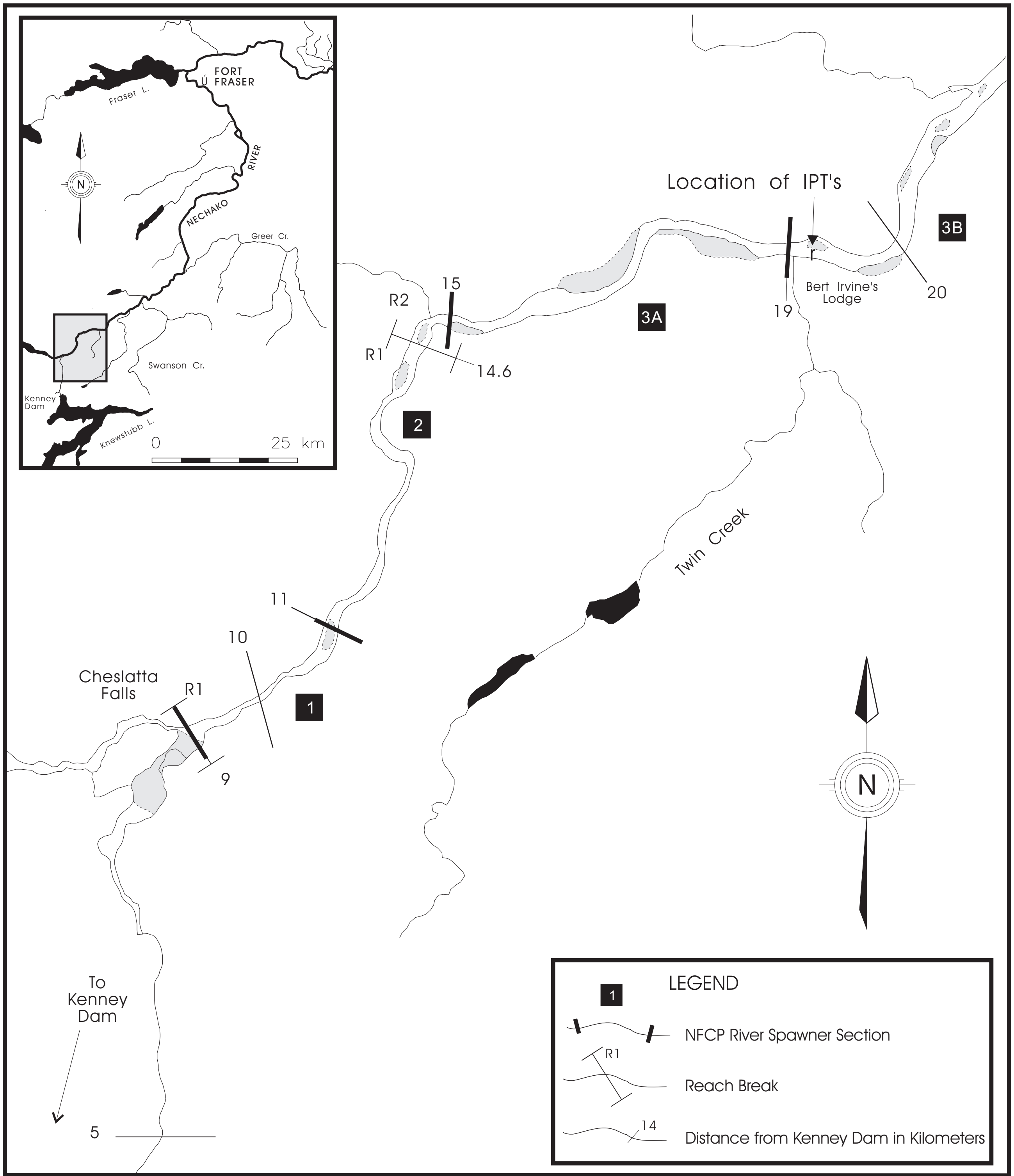
METHODS

Study Site and Traps

Four 2 x 3 m Inclined Plane Traps (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 eight years (1991- 1998). The four traps were positioned on a line across the river channel, one on each river margin (IPTs 1 and 4), and two in mid-channel (IPTs 2 and 3, Figure 2).

The left margin trap (IPT 1) was approximately 15 m from the shore with a 26 m diversion wing angled from the inshore edge of the trap to the shore upstream. The right margin trap (IPT 4) was approximately 6 m from the shore with a 14 m diversion wing angled from its inshore edge to the shore upstream. The margin traps rested on the river bed, in approximately 0.5 m of water, but the mid channel traps did not touch the bottom. Operation of the traps started on March 10 and continued until May 19, 1999.

A fifth IPT (IPT 0, Figure 2) was installed in the side channel in 1999, to provide additional fish for the mark recapture studies. It was operated from April 9

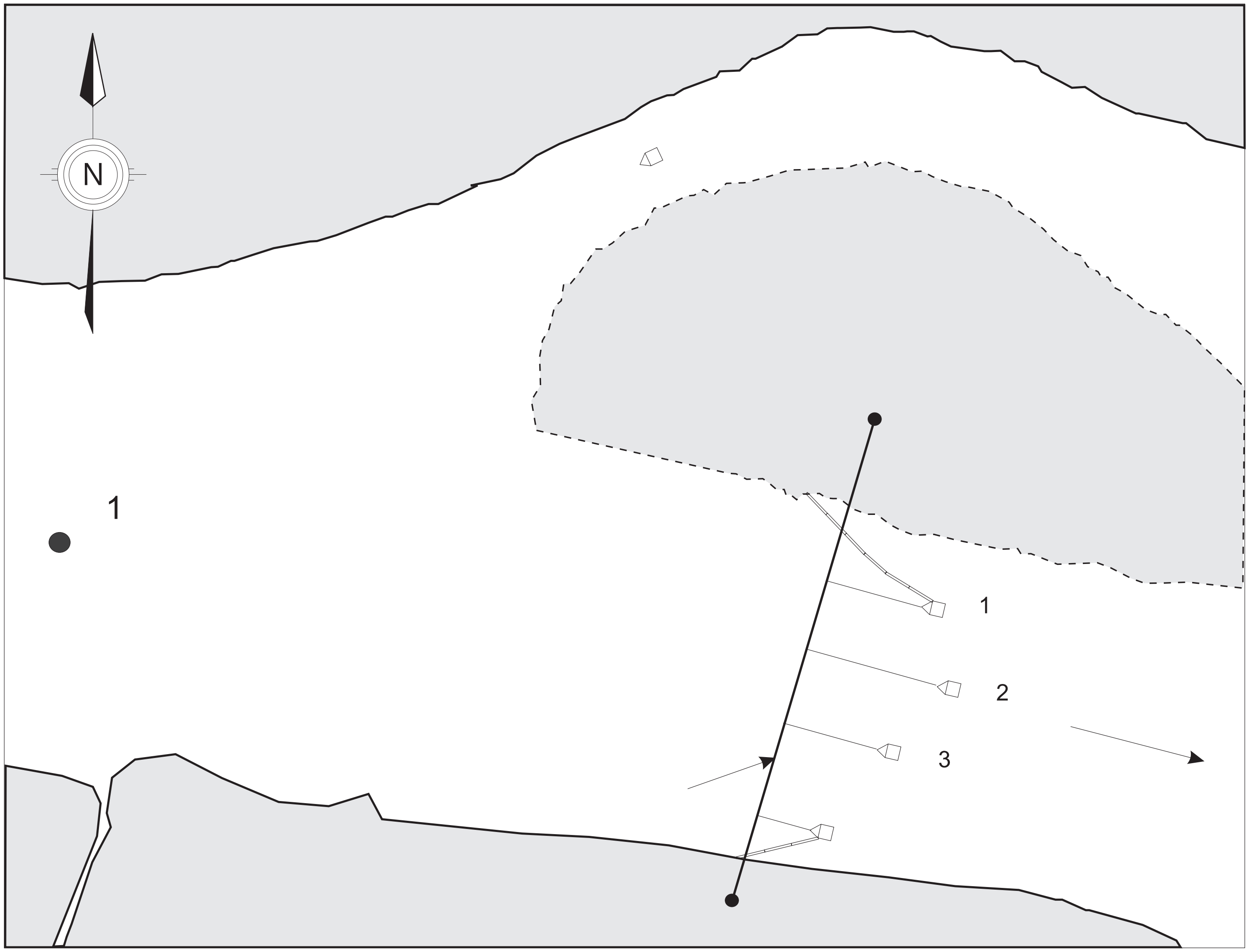


Nechako Fisheries Conservation Program

Map # M98-6FG1

0 4 KM

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



Nechako Fisheries Conservation Program

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Fig re Location of Incline lane raps I at Bert Irvine's, km 19 of
the Nechako River, 1999

to 26 and from May 3 to 9. The catches from this trap were not included in the index calculations to permit comparison of the emergence index with previous years.

Nechako River - Physical Data

Mean daily water temperatures were measured by a datalogger 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 datalogger and at Skins Lake Spillway (SLS) (WSC station # 08JA013).

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 and wings were cleaned of debris as necessary and the catches sampled twice a day, morning (8:00) and evening (18:00). Water temperature was measured with a hand-held thermometer and staff gauge measurements were recorded daily at the traps.

All fish found in the traps were identified to species and counted. At each sampling period, a subsample of a maximum of 10 chinook per trap (IPTs 1 to 4) were anaesthetized with Metomadate (MS-222) and measured to the nearest 1.0 mm (fork length) and to the nearest 0.01 g (wet weight). All fish caught were released downstream of the traps. Bams' (1970) development index (KD) 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 discharge sampled by each trap. The volume of discharge sampled by each trap was determined by measuring the cross sectional area of 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 diversion wings. Wing discharge was estimated by measuring the upstream cross sectional area created by the diversion wing and recording several velocities 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. An index of the total number of emerging chinook moving downstream past the IPTs was estimated from the proportion of discharge sampled by each IPT as:

$$(2)\qquad N_i = n_i\,(V_i / v_i)$$

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 (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 cut-off 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 using 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. In order to separate growing fish from emergent fry after the cut-off 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 this percentage. For example, if 50% of the fish subsampled were smaller than or equal to the upper limit, 50% of the catches after the cut-off date were used in the calculation of the index of fry emergence.

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 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).

Trap Efficiency

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 flow sampled by the traps. Another method of inferring fry abundance is to calculate trap efficiency through mark-recapture trials. These trials were conducted to verify the accuracy of the flow ratio method of calculating the fry emergence index.

For each trial, chinook fry caught in all five IPTs were held in a live box until there were over 1,500 fry available to mark and release or 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 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). On subsequent sampling days, the number of marked chinook recaptured in each trap was noted along with the total catch (marked and unmarked). 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 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 KD) were determined through factorial ANOVAs. If the ANOVA indicated a significant effect, t-tests were used to test the effect of time of day (day vs. night) on each trap and one-way ANOVAs were used to test the effect of trap position for each time period. LSD tests ($P<0.05$ level of significance) were used as *a posteriori* tests to determine which traps differed.

RESULTS AND DISCUSSION

Nechako River - Physical Data

Mean daily water temperatures in the Nechako River and ATUs from September 9, 1998 (peak spawning period) to May 19, 1999 (end of the fry emergence project) are shown in Figure 3. During the incubation period, the mean daily water temperatures ranged from 15.4 °C in September to 0.1 °C in January. The ATUs for the fry emergence period (March 13 to May 18) ranged from 885 to 1070. The predicted peak of fry emergence at 1,000 ATUs was on April 29-30 whereas the observed peak occurred on April 19-21 at 960-965 ATUs. This falls within previous years of the program, when the range of ATUs at that date is between 840 and 1,004, with an average of 915 (Table 1). It thus appears that the 1,000 ATUs figure is a reasonably good predictor of fry emergence.

The releases from Skins Lake Spillway and the flows measured below Cheslatta Falls from March 1 to May 31, 1999 are shown in Figure 4. Also shown are the staff gauge records at the trap site. There is a clear correlation between the discharge and the staff gauge readings. Releases from Skins Lake Spillway were maintained at approximately 30 m^3/s from March 1 to April 26, when they were increased to 49 m^3/s. Discharge in the river at Bert Irvine's increased from approximately 32 m^3/s to approximately 65 m^3/s from April 19 to May 7.

Fry Emergence

Trap catches

From March 10 to May 19, 1999, 31,821 chinook fry were caught in the four inclined plane traps at Bert Irvine's (Table 2). Most of these were caught at night (98%), and in the two margin traps (44 and 34%). The majority of fry thus appeared to emerge at night and to occupy the margins of the channel.

Sampling in the side channel yielded 820 chinook fry. The results from this trap are not included in Table 2 as it was only operational for a limited time (cf. Methods).

The pattern of emergence was essentially bimodal, with a first peak centered around April 19-21 and a second, smaller and wider one, centered around May 6-15. The first peak occurred at the start of the increasing flows (Figure 5). This bimodal pattern was driven primarily by the margin traps, especially the right one (IPT 4, Figure 6).

The percentage of the flow sampled by the IPTs did not remain constant, and decreased as the Nechako River flows increased (Figure 7). This decrease averaged 29 % from April 19 until the end of the sampling (19, 38, 33 and 26% for IPTs 1, 2, 3 and 4 respectively). This means that the index of fry emergence is likely to overestimate the number of emerging fry.

Index of Fry Emergence

The variation in wet weight of chinook fry did not differ significantly among days until May 13, 1999 (Figure 8). After this date, it was estimated that 25 % of the fry caught in the traps were 1 standard deviation heavier than the average wet weight of emergent fry (0.42 g + 0.07 = 0.49g), and the calculation of the daily index estimate for each trap was reduced by this proportion. Thus the index for each of the four traps ranged from 354,521 to 950,106 chinook fry, while the overall estimate (weighted by the volume of water sampled by each trap) was 569,703 (Appendix 1).

Four mark recapture trials were conducted on March 30, April 10, April 20, and May 2. The overall trap efficiency, 3.3%, resulted in an estimated population of 956,992, and all four traps ranged from 2.0% (1,623,520) to 4.7% (672,748) (Table 3). The overall estimate (mean of all four trials weighed by the number of fish released) of emerging fry was 1,080,949 ± 309,315 (95% confidence interval). This is a higher estimate than the index of fry emergence.

Emergence Success

The number of female chinook spawners above the study site in September 1998 was estimated at 129. Based on an assumed 5,769 eggs / spawner (Jaremovic and Rowland 1988), the potential number of eggs deposited was 744,201 which, based on the index of fry emergence, translated in an emergence success of 77 %.

Figure 3
Mean Daily Water Temperatures of the Nechako River at Bert Irvine's (km 19), September 1998 to 1999 (preliminary data from WSC) and Accumulated Thermal Units (ATU) from Peak of Spawning (September 9, 1998)

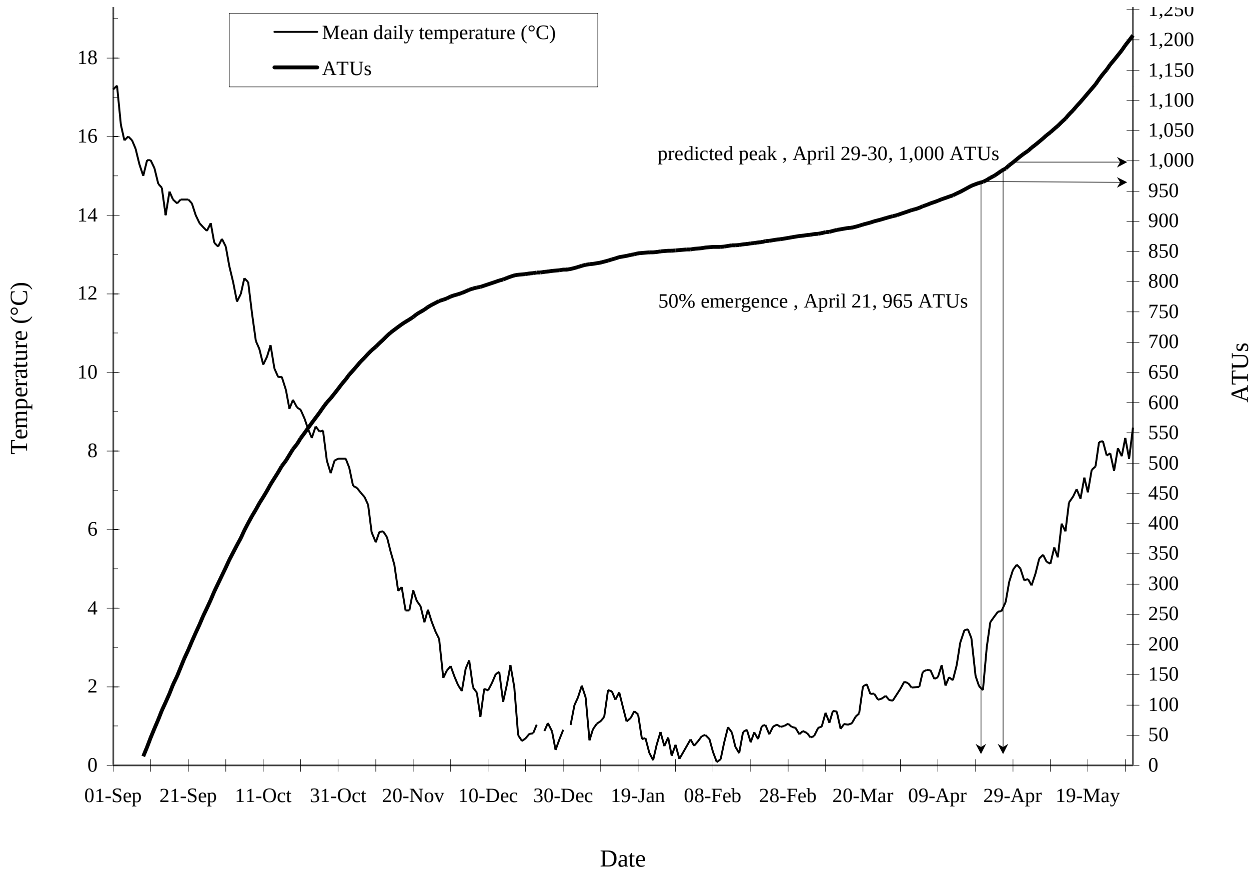


Table 1
Accumulated Thermal Units (ATUs) from Peak of Spawning Recorded in the Nechako River at Bert Irvine's (km 19) at the Time of 50% of Emergence of Juvenile Chinook Captured in Inclined Plane Traps

Year	Date of 50% of Emergence	ATUs
1990	14-Apr	935
1991	26-Apr	840
1992	20-Apr	903
1993	23-Apr	938
1994	16-Apr	962
1995	30-Apr	856
1996	07-May	887
1997	01-May	862
1998	02-May	1,004
1999	29-Apr	962

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 ($r = 0.73$, $P < 0.05$, Figure 9), which indicates that the index is a reliable measure of 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 jumps to 0.88.

As previously mentioned, the index of fry emergence is likely to be an overestimate of the real 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 the index as-

Figure 4
Daily Discharge of the Nechako River at Bert Irvine's (km 19) and Skins Lake Spillway Releases, March to May 1999 (preliminary data from WSC)

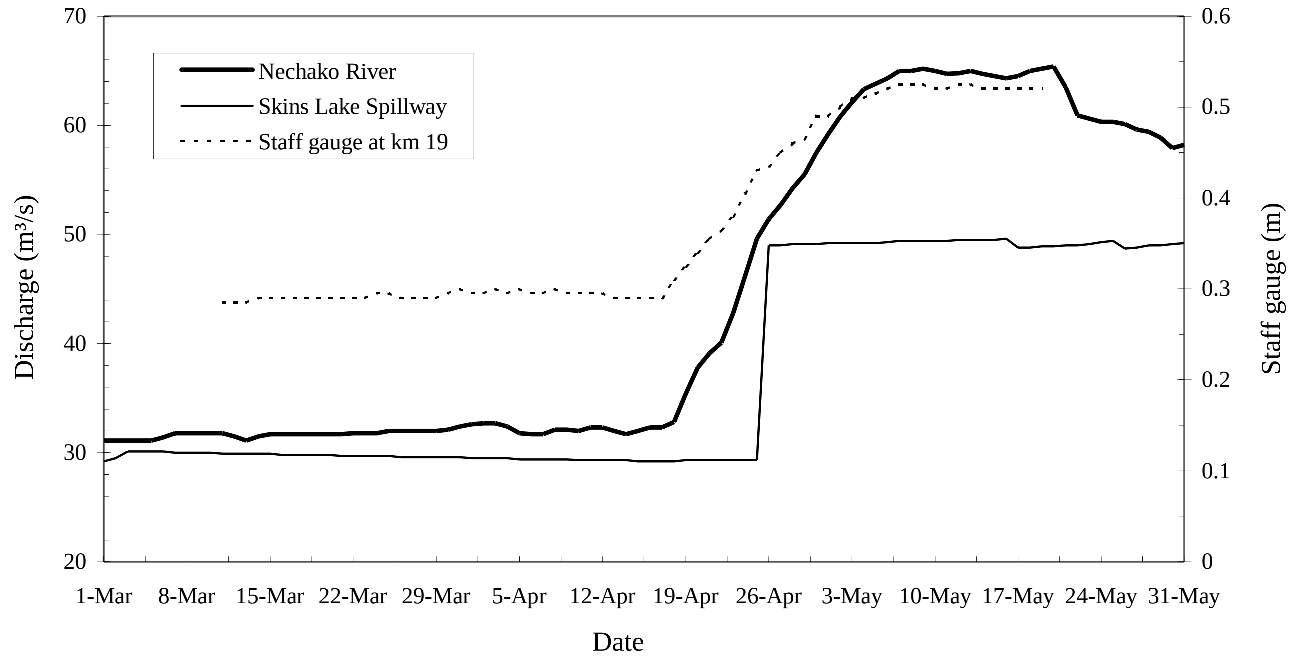
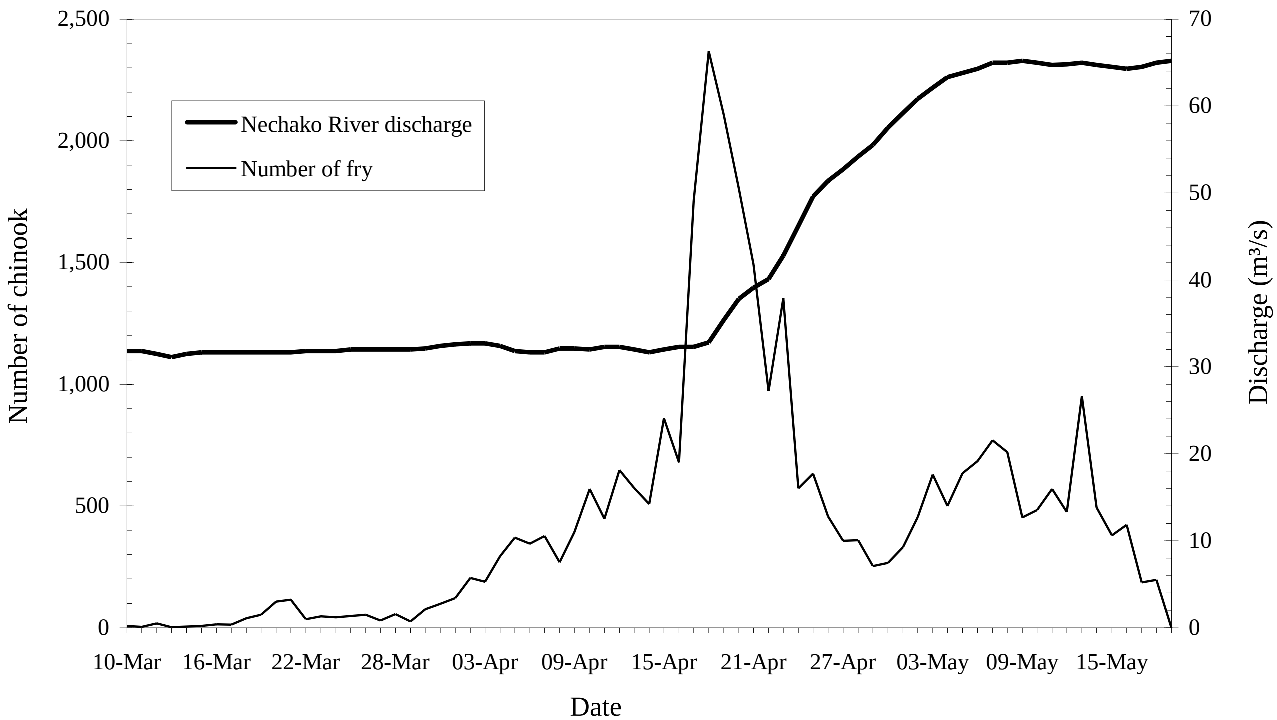


Table 2
Summary of Inclined Plane Trap Catches of Chinook 0+ and the Percent Contributed by Each Trap to the Total Catch at Bert Irvine's, km 19 of the Nechako River, March to May, 1999

	Night (morning check)		Day (evening check)			
Trap	Number	Percent	Number	Percent	Total	Total Percent
1	13,978	43.9	355	1.1	14,333	45.0
2	3,015	9.5	93	0.3	3,108	9.8
3	3,243	10.2	108	0.3	3,351	10.5
4	10,791	33.9	238	0.7	11,029	34.7
Total	31,027	97.5	794	2.5	31,821	100.0

Figure 5
Discharge Recorded in the Nechako River and Total Number of Chinook Fry Counted by Four IPTs at Bert Irvine's, km 19 of the Nechako River, March 10 to May 19, 1999



sumes 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 upstream of the trapsite during the previous year indicates that the index reflects real biological processes. And the year to year comparisons of the index values provide a valuable tool to monitor the quality of the incubation environment.

Morphological Data

Average morphological parameters for emerging fry sampled by the IPTs are shown in Table 4. Tables 5, 6 and 7 show the results of ANOVAs on the effects of time of emergence and trap position on fork length, wet weight and the 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 trap 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 10. 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, there was an average fork length difference of 1.8 mm, or 5%, between fish caught in traps 1 and 3. The same fish caught in trap 1 were on average 25% heavier than those from trap 3.

Average length, weight and development index of emergent fry have not varied much in the years of the program (Figure 11), which supports the assertion of a stable incubating environment.

Incidental Catch

There were 3,677 fish other than chinook 0+ caught in the four IPTs (only one fish other than chinook was caught in IPT 0), making up 10% of the total number

Figure 6
Number of Fry Sampled Daily by Four IPTs at Bert Irvine's, km 19 of the Nechako River, March to May, 1999

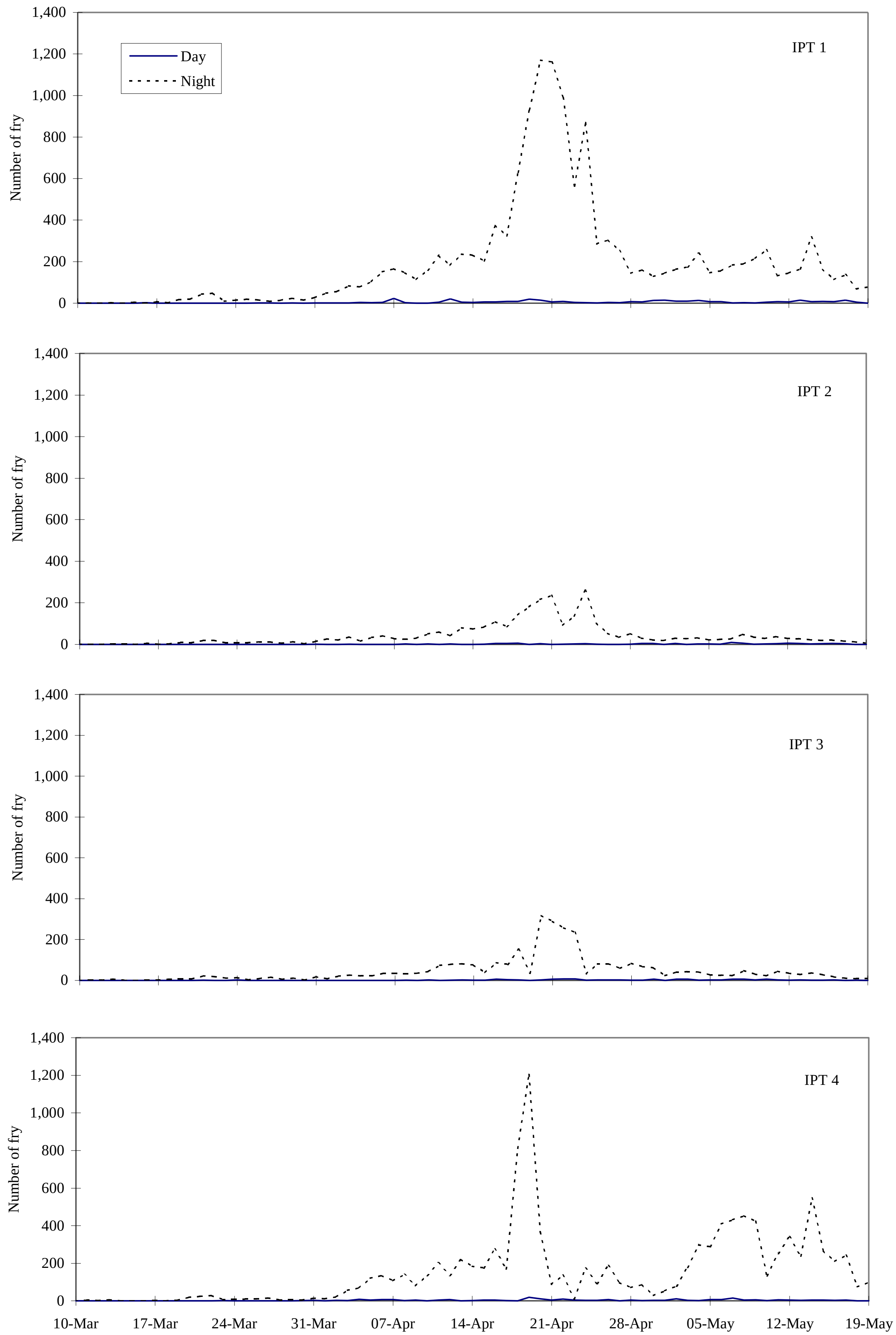


Figure 7
Flow Released Below Cheslatta Falls During the Fry Emergence Program of 1999
and the Percentage of this Flow Sampled by the IPTs

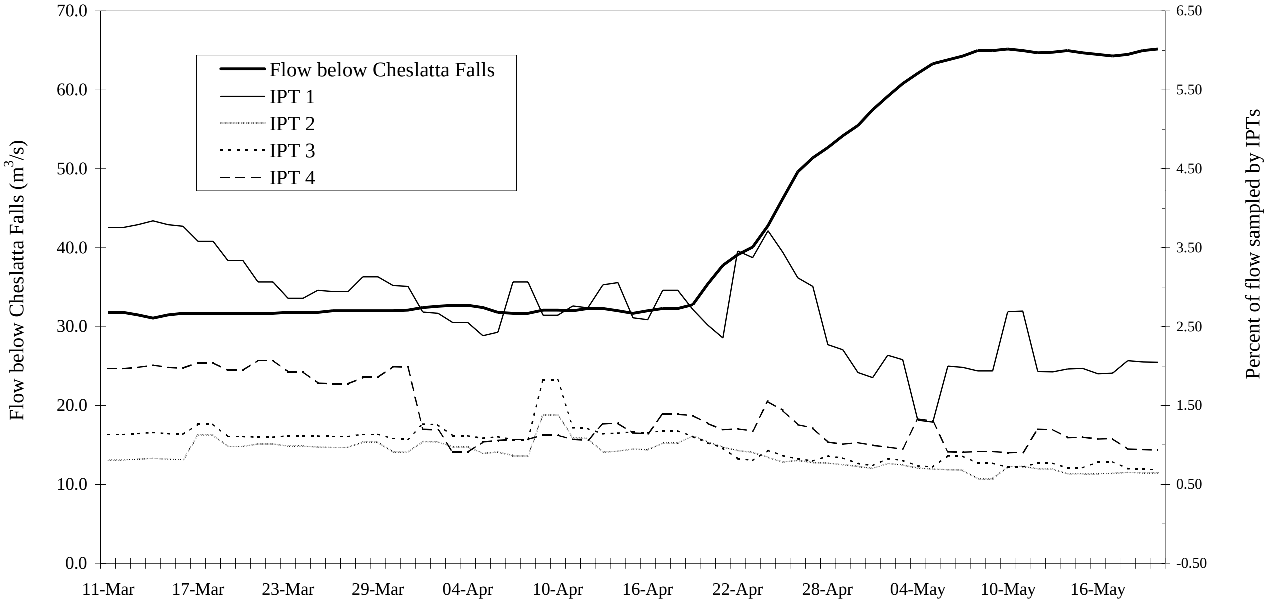


Figure 8
Frequency Distributions of Juvenile Chinook Wet Weights Subsampled in the IPTs in the
Nechako River at Irvine's from March 11 to May 19, 1999.
All IPTs pooled, day and night samples. N = 3, 165. May 13 is the cut-off date for inclusion
of all fish in the calculation of the index of fry emergence.

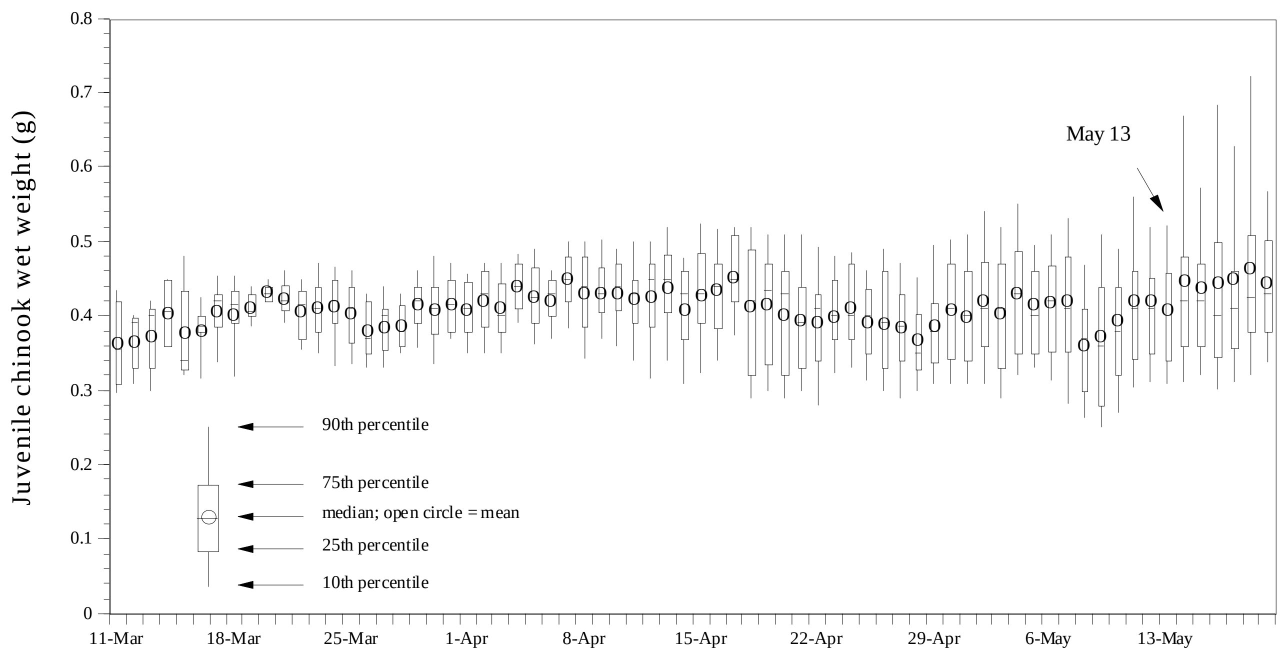


Table 3
Summary of Mark-Recapture Trials on Emergent Chinook Fry at
Bert Irvine's, km 19 of the Nechako River, 1999

Date	Number Released	Trap Number	Number Recaptured	Trap Efficiency (%)	Total Catch	Estimated Population
31 Mar	247	1	0	2.8%	31,821	1,124,417
		2	4			
		3	3			
		4	0			
			7			
11 Apr	1,783	1	10	2.0%	31,821	1,623,520
		2	4			
		3	7			
		4	12			
			33			
21 Apr	4,000	1	130	4.7%	31,821	672,748
		2	16			
		3	19			
		4	18			
			183			
03 May	1,669	1	12	2.2%	31,821	1,473,194
		2	2			
		3	2			
		4	17			
			33			
Total	7,699		256			
Weighed mean estimate						1,080,949
95 % confidence interval					upper	1,390,264
					lower	771,633

of fish caught. Of these, the most common species were longnose dace (*Rhinichthys cataractae*, 3.6%), followed by largescale sucker (*Catostomus macrocheilus*, 2.0%), northern pikeminnow (*Ptychocheilus oregonensis*, 1.5%), leopard dace (*Rhinichthys falcatus*, 1.3%) and redside shiner (*Richardsonius balteatus*, 0.7%) (Table 8). Salmonidae (lake and rainbow trout, sockeye salmon and mountain whitefish) accounted for 4% of the incidental catch. This is below the nine years average of 9%. Taking into account the increase in incidental catch from last year, largescale suckers were roughly twice as abundant. Usually, the incidence of longnose suckers ranks 4th, whereas they were the second most abundant incidental species in 1999. The overall 1999 incidental catch fell within range of previous years, both in numbers and ranking of the most common species: longnose dace are usually the most abundant species other than chinook, and have been ranked as such for seven of the last nine years.

CONCLUSIONS

The 1999 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 upstream of the trapsite and the index of emergent fry in all years but the high flow years. The trends, from index of fry emergence to morphological characteristics of emerging fry, indicate that the quality of the incubation environment in the upper Nechako River has been stable over the period of 1991 to 1999.

Figure 9
Index of Emergent Chinook vs. Spawner Escapement During the Previous Year
Above Bert Irvine's, km 19 of the Nechako River, 1991-1999.
1997 and 1998 had higher flows than usual.

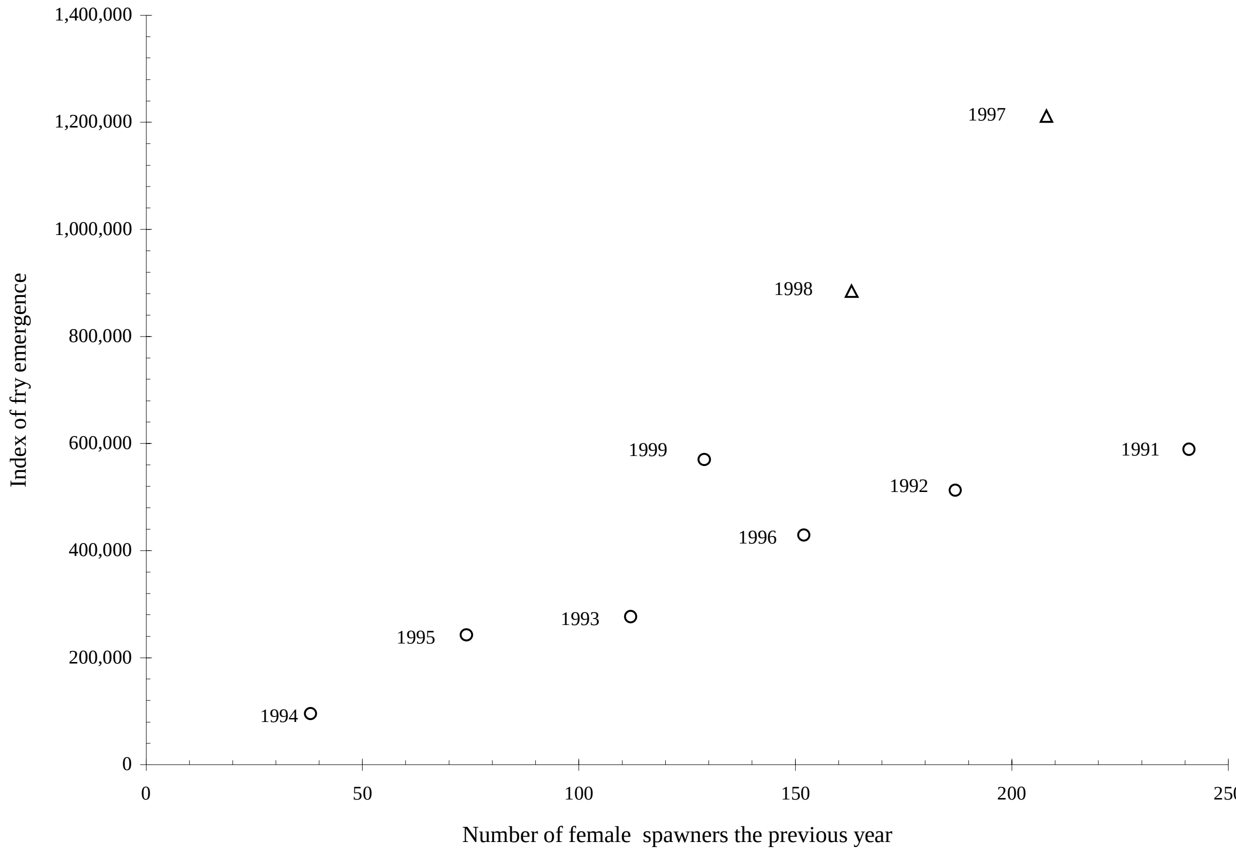


Table 4
Average Morphological Parameters for Emerging Fry Subsampled in the IPTs at Bert Irvine's,
km 19 of the Nechako River, March - May 1999.
Values calculated until and including cut-off date of May 13.
N = number of chinook fry; SD = standard deviation.

Trap Number	1		2		3		4	
	Day	Night	Day	Night	Day	Night	Day	Night
N	253	578	79	551	102	546	203	550
Mean fork length (mm)	38.6	37.5	37.4	37.4	36.7	37.3	38.0	37.3
SD	1.9	1.7	2.5	1.8	2.3	1.7	1.9	1.7
Mean weight (g)	0.47	0.41	0.41	0.40	0.43	0.40	0.44	0.41
SD	0.10	0.06	0.09	0.07	0.09	0.06	0.07	0.07
Mean KD (g/mm3)	2.00	1.97	1.97	1.97	1.96	1.97	1.98	1.97
SD	0.07	0.06	0.07	0.05	0.06	0.05	0.06	0.05

Table 5
ANOVA for Fork Length of Chinook Fry Sampled at Bert Irvine's, km 19 of the Nechako River, 1999

Source of variation	Degrees of freedom	Mean square	F value	P
Time of day	1	35.291	10.787	<0.001
Trap	3	87.739	26.818	<0.001
Interaction	3	62.482	19.098	<0.001
Residual	2,854	3.272		

Table 6
ANOVA for Wet Weight of Chinook Fry Sampled at Bert Irvine's, km 19 of the Nechako River, 1999

Source of variation	Degrees of freedom	Mean square	F value	P
Time of day	1	0.135	26.583	<0.001
Trap	3	0.189	37.259	<0.001
Interaction	3	0.14	27.577	<0.001
Residual	2,853	0.005		

Table 7
ANOVA for Development Index of Chinook Fry Sampled at Bert Irvine's, km 19 of the Nechako River, 1999

Source of variation	Degrees of freedom	Mean square	F value	P
Time of day	1	0.025	8.209	<0.01
Trap	3	0.04	13.34	<0.001
Interaction	3	0.03	9.859	<0.001
Residual	2,853	0.003		

Figure 10
Average Fork Length, Wet Weight and Development Index (± 1 SE) of Chinook Fry at Each IPT at Bert Irvine's, km 19 of the Nechako River, as a Function of Time of Day.

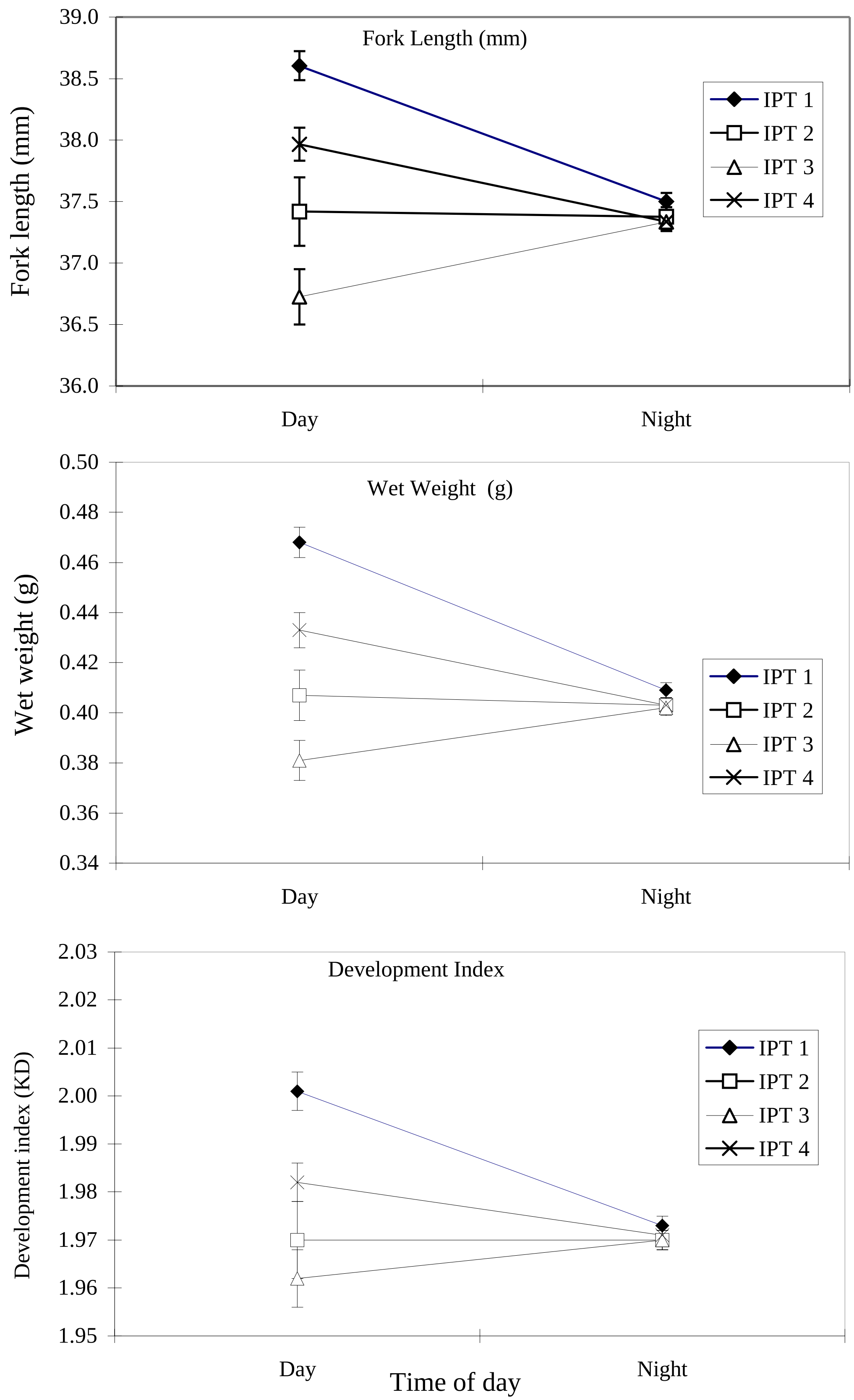


Figure 11
Mean Fork Length, Wet Weight and Development Index (±SD) of Emergent Chinook Fry Sampled by IPTs at Bert Irvine's, km 19 of the Nechako River, 1990-1999. N below each year.

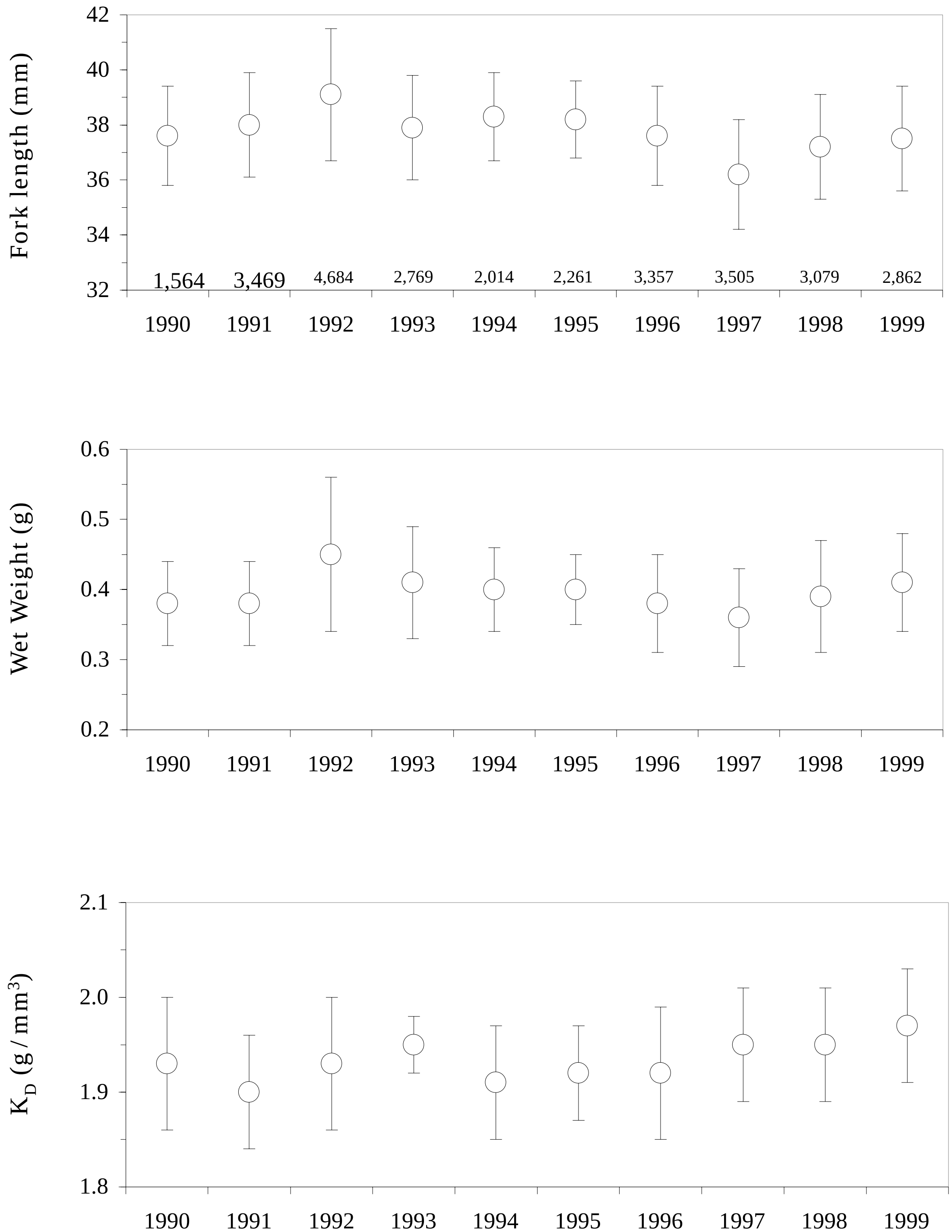


Table 8
Percent of Total Catch and Ranking of Incidental Species Caught in IPTs at Bert Irvine's, km 19 of the Nechako River 1991 - 1999

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

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

Appendix 1. **Estimates of the numbers of emerging chinook fry, sampled by IPTs at km 19 (Bert Irvine's Lodge), 1999.**

				IPT 1				IPT 2				IPT 3				IPT 4				Total	
Date	D/N	Staff gauge (cm)	Flows below Cheslatta Falls (m/s)	Volume sampled (m/s)	% of total volume sampled	Actual Catch	Population estimate	Volume sampled (m/s)	% of total volume sampled	Actual Catch	Population estimate	Volume sampled (m/s)	% of total volume sampled	Actual Catch	Population estimate	Volume sampled (m/s)	% of total volume sampled	Actual Catch	Population estimate	Total Catch	Daily weighted population estimate
10-Mar	D	28.5	31.8	1.19	3.76	0	0	0.26	0.81	0	0	0.36	1.13	0	0	0.63	1.97	0	0	0	0
11-Mar	D	28.5	31.8	1.19	3.76	0	0	0.26	0.81	0	0	0.36	1.13	0	0	0.63	1.97	0	0	0	0
11-Mar	N	28.5	31.8	1.19	3.76	2	53	0.26	0.81	1	123	0.36	1.13	1	88	0.63	1.97	4	203	8	104
12-Mar	D	28.5	31.5	1.19	3.79	0	0	0.26	0.82	0	0	0.36	1.14	0	0	0.63	1.98	0	0	0	0
12-Mar	N	28.5	31.5	1.19	3.79	0	0	0.26	0.82	0	0	0.36	1.14	1	88	0.63	1.98	2	101	3	39
13-Mar	D	28.5	31.1	1.19	3.84	0	0	0.26	0.83	0	0	0.36	1.16	0	0	0.63	2.01	0	0	0	0
13-Mar	N	28.5	31.1	1.19	3.84	3	78	0.26	0.83	3	362	0.36	1.16	6	518	0.63	2.01	6	298	18	230
14-Mar	D	29	31.5	1.19	3.79	0	0	0.26	0.82	0	0	0.36	1.14	0	0	0.63	1.98	0	0	0	0
14-Mar	N	28.5	31.5	1.19	3.79	0	0	0.26	0.82	2	244	0.36	1.14	0	0	0.63	1.98	0	0	2	26
15-Mar	D	29	31.7	1.19	3.77	0	0	0.26	0.81	0	0	0.36	1.14	0	0	0.63	1.97	0	0	0	0
15-Mar	N	29	31.7	1.19	3.77	5	133	0.26	0.81	0	0	0.36	1.14	0	0	0.63	1.97	0	0	5	65
16-Mar	D	29	31.7	1.14	3.58	3	84	0.36	1.13	0	0	0.40	1.26	0	0	0.65	2.04	0	0	3	37
16-Mar	N	29	31.7	1.14	3.58	0	0	0.36	1.13	5	444	0.40	1.26	1	79	0.65	2.04	1	49	7	87
17-Mar	D	29	31.7	1.14	3.58	0	0	0.36	1.13	0	0	0.40	1.26	0	0	0.65	2.04	0	0	0	0
17-Mar	N	29	31.7	1.14	3.58	7	195	0.36	1.13	0	0	0.40	1.26	2	158	0.65	2.04	2	98	11	137
18-Mar	D	29	31.7	1.06	3.34	0	0	0.31	0.98	0	0	0.35	1.11	0	0	0.62	1.94	0	0	0	0
18-Mar	N	29	31.7	1.06	3.34	2	60	0.31	0.98	3	306	0.35	1.11	6	542	0.62	1.94	1	51	12	163
19-Mar	D	29	31.7	1.06	3.34	0	0	0.31	0.98	0	0	0.35	1.11	0	0	0.62	1.94	0	0	0	0
19-Mar	N	29	31.7	1.06	3.34	18	539	0.31	0.98	9	917	0.35	1.11	7	632	0.62	1.94	4	206	38	515
20-Mar	D	29	31.7	0.97	3.07	0	0	0.32	1.01	0	0	0.35	1.10	0	0	0.66	2.07	0	0	0	0
20-Mar	N	29	31.7	0.97	3.07	19	620	0.32	1.01	8	791	0.35	1.10	7	638	0.66	2.07	19	917	53	731
21-Mar	D	29	31.7	0.97	3.07	0	0	0.32	1.01	0	0	0.35	1.10	1	91	0.66	2.07	0	0	1	14
21-Mar	N	29	31.7	0.97	3.07	44	1,435	0.32	1.01	18	1,781	0.35	1.10	22	2,004	0.66	2.07	24	1,158	108	1,490
22-Mar	D	29	31.8	0.91	2.86	0	0	0.31	0.98	0	0	0.35	1.11	0	0	0.61	1.93	0	0	0	0
22-Mar	N	29	31.8	0.91	2.86	48	1,679	0.31	0.98	19	1,932	0.35	1.11	19	1,706	0.61	1.93	28	1,452	114	1,656
23-Mar	D	29	31.8	0.91	2.86	0	0	0.31	0.98	0	0	0.35	1.11	0	0	0.61	1.93	2	104	2	29
23-Mar	N	29	31.8	0.91	2.86	10	350	0.31	0.98	7	712	0.35	1.11	11	988	0.61	1.93	7	363	35	508
24-Mar	D	29.5	31.8	0.94	2.96	0	0	0.31	0.97	0	0	0.35	1.11	2	180	0.57	1.79	1	56	3	44
24-Mar	N	29	31.8	0.94	2.96	15	506	0.31	0.97	8	821	0.35	1.11	13	1,167	0.57	1.79	8	448	44	644
25-Mar	D	29	32.0	0.94	2.94	0	0	0.31	0.97	0	0	0.35	1.11	0	0	0.57	1.78	0	0	0	0
25-Mar	N	29.5	32.0	0.94	2.94	19	646	0.31	0.97	8	827	0.35	1.11	3	271	0.57	1.78	10	563	40	589
26-Mar	D	29	32.0	0.94	2.94	1	34	0.31	0.97	0	0	0.35	1.11	0	0	0.57	1.78	0	0	1	15
26-Mar	N	29	32.0	0.94	2.94	16	544	0.31	0.97	12	1,240	0.35	1.11	9	813	0.57	1.78	11	619	48	707
27-Mar	D	29	32.0	1.00	3.13	1	32	0.33	1.04	0	0	0.36	1.14	0	0	0.59	1.85	0	0	1	14
27-Mar	N	29	32.0	1.00	3.13	9	288	0.33	1.04	11	1,063	0.36	1.14	16	1,409	0.59	1.85	16	863	52	727
28-Mar	D	29	32.0	1.00	3.13	0	0	0.33	1.04	0	0	0.36	1.14	0	0	0.59	1.85	0	0	0	0
28-Mar	N	29	32.0	1.00	3.13	14	447	0.33	1.04	5	483	0.36	1.14	5	440	0.59	1.85	5	270	29	405
29-Mar	D	29	32.0	0.97	3.02	2	66	0.29	0.91	0	0	0.35	1.08	0	0	0.64	1.99	0	0	2	29
29-Mar	N	29	32.0	0.97	3.02	24	795	0.29	0.91	13	1,428	0.35	1.08	12	1,113	0.64	1.99	6	301	55	786
30-Mar	D	29.5	32.1	0.97	3.01	0	0	0.29	0.91	0	0	0.35	1.07	0	0	0.64	1.99	2	101	2	29
30-Mar	N	29.5	32.1	0.97	3.01	15	498	0.29	0.91	3	331	0.35	1.07	1	93	0.64	1.99	5	252	24	344
31-Mar	D	30	32.4	0.87	2.68	2	74	0.34	1.04	1	96	0.41	1.27	0	0	0.39	1.20	3	250	6	97
31-Mar	N	29.5	32.4	0.87	2.68	27	1,006	0.34	1.04	14	1,341	0.41	1.27	18	1,422	0.39	1.20	15	1,252	74	1,195
01-Apr	D	29.5	32.6	0.87	2.67	1	37	0.34	1.04	0	0	0.41	1.26	0	0	0.39	1.19	1	84	2	32
01-Apr	N	29.5	32.6	0.87	2.67	48	1,799	0.34	1.04	26	2,505	0.41	1.26	7	557	0.39	1.19	12	1,007	93	1,511
02-Apr	D	29.5	32.7	0.83	2.55	1	39	0.32	0.98	0	0	0.37	1.12	0	0	0.30	0.91	3	330	4	72
02-Apr	N	29.5	32.7	0.83	2.55	57	2,233	0.32	0.98	20	2,051	0.37	1.12	21	1,881	0.30	0.91	21	2,313	119	2,143
03-Apr	D	30	32.7	0.83	2.55	2	78	0.32	0.98	1	103	0.37	1.12	0	0	0.30	0.91	2	220	5	90
03-Apr	N	29.5	32.7	0.83	2.55	83	3,252	0.32	0.98	36	3,691	0.37	1.12	26	2,329	0.30	0.91	56	6,168	201	3,620
04-Apr	D	29.5	32.4	0.77	2.38	4	168	0.29	0.89	0	0	0.35	1.08	0	0	0.34	1.04	9	868	13	241
04-Apr	N	29.5	32.4	0.77	2.38	78	3,271	0.29	0.89	15	1,679	0.35	1.08	22	2,030	0.34	1.04	69	6,652	184	3,408
05-Apr	D	30	31.8	0.77	2.43	3	123	0.29	0.91	0	0	0.35	1.10	0	0	0.34	1.06	5	473	8	145

				IPT 1				IPT 2				IPT 3				IPT 4				Total	
Date	D/N	Staff gauge (cm)	Flows below Cheslatta Falls (m³/s)	Volume sampled (m³/s)	% of total volume sampled	Actual Catch	Population estimate	Volume sampled (m³/s)	% of total volume sampled	Actual Catch	Population estimate	Volume sampled (m³/s)	% of total volume sampled	Actual Catch	Population estimate	Volume sampled (m³/s)	% of total volume sampled	Actual Catch	Population estimate	Total Catch	Daily weighted population estimate
05-Apr	N	29.5	31.8	0.77	2.43	104	4,281	0.29	0.91	33	3,625	0.35	1.10	22	1,992	0.34	1.06	121	11,450	280	5,090
06-Apr	D	29.5	31.7	0.97	3.07	4	130	0.27	0.87	0	0	0.34	1.07	0	0	0.34	1.07	7	654	11	181
06-Apr	N	29.5	31.7	0.97	3.07	151	4,922	0.27	0.87	41	4,735	0.34	1.07	35	3,273	0.34	1.07	135	12,607	362	5,960
07-Apr	D	29.5	31.7	0.97	3.07	24	782	0.27	0.87	0	0	0.34	1.07	0	0	0.34	1.07	7	654	31	510
07-Apr	N	29.5	31.7	0.97	3.07	166	5,411	0.27	0.87	27	3,118	0.34	1.07	34	3,179	0.34	1.07	108	10,085	335	5,515
08-Apr	D	30	32.1	0.85	2.64	3	113	0.44	1.38	2	145	0.59	1.82	1	55	0.36	1.12	2	178	8	115
08-Apr	N	30	32.1	0.85	2.64	147	5,561	0.44	1.38	25	1,816	0.59	1.82	33	1,809	0.36	1.12	141	12,547	346	4,965
09-Apr	D	29.5	32.1	0.85	2.64	0	0	0.44	1.38	0	0	0.59	1.82	0	0	0.36	1.12	4	356	4	57
09-Apr	N	29.5	32.1	0.85	2.64	114	4,313	0.44	1.38	30	2,179	0.59	1.82	35	1,918	0.36	1.12	81	7,208	260	3,731
10-Apr	D	29	32.0	0.88	2.76	0	0	0.35	1.09	2	183	0.39	1.22	3	246	0.34	1.07	0	0	5	81
10-Apr	N	29.5	32.0	0.88	2.76	160	5,793	0.35	1.09	50	4,571	0.39	1.22	44	3,610	0.34	1.07	135	12,601	389	6,330
11-Apr	D	29.5	32.3	0.88	2.74	5	183	0.35	1.08	0	0	0.39	1.21	0	0	0.34	1.06	4	377	9	148
11-Apr	N	29.5	32.3	0.88	2.74	229	8,369	0.35	1.08	60	5,537	0.39	1.21	74	6,129	0.34	1.06	202	19,032	565	9,280
12-Apr	D	29	32.3	0.98	3.03	21	693	0.29	0.91	2	219	0.37	1.14	1	88	0.41	1.27	7	553	31	488
12-Apr	N	28.5	32.3	0.98	3.03	183	6,039	0.29	0.91	41	4,498	0.37	1.14	79	6,931	0.41	1.27	136	10,744	439	6,916
13-Apr	D	29	32.0	0.98	3.06	5	163	0.29	0.92	0	0	0.37	1.15	3	261	0.41	1.28	1	78	9	140
13-Apr	N	29	32.0	0.98	3.06	236	7,716	0.29	0.92	80	8,696	0.37	1.15	81	7,040	0.41	1.28	220	17,218	617	9,630
14-Apr	D	29	31.7	0.83	2.61	4	153	0.30	0.95	0	0	0.37	1.17	1	86	0.37	1.15	2	174	7	119
14-Apr	N	29	31.7	0.83	2.61	232	8,881	0.30	0.95	74	7,799	0.37	1.17	75	6,433	0.37	1.15	184	15,964	565	9,609
15-Apr	D	29	32.0	0.83	2.59	6	232	0.30	0.94	1	106	0.37	1.16	1	87	0.37	1.14	4	350	12	206
15-Apr	N	29	32.0	0.83	2.59	204	7,883	0.30	0.94	83	8,830	0.37	1.16	38	3,290	0.37	1.14	176	15,414	501	8,601
16-Apr	D	29	32.3	0.96	2.96	6	202	0.33	1.02	4	391	0.38	1.18	5	424	0.45	1.39	4	288	19	290
16-Apr	N	29	32.3	0.96	2.96	376	12,689	0.33	1.02	109	10,650	0.38	1.18	87	7,379	0.45	1.39	276	19,884	848	12,940
17-Apr	D	29	32.3	0.96	2.96	9	304	0.33	1.02	4	391	0.38	1.18	4	339	0.45	1.39	2	144	19	290
17-Apr	N	29	32.3	0.96	2.96	324	10,935	0.33	1.02	86	8,403	0.38	1.18	79	6,701	0.45	1.39	170	12,248	659	10,056
18-Apr	D	31	32.8	0.89	2.72	9	331	0.37	1.12	5	446	0.36	1.11	2	181	0.45	1.37	1	73	17	269
18-Apr	N	30	32.8	0.89	2.72	629	23,157	0.37	1.12	141	12,584	0.36	1.11	152	13,719	0.45	1.37	812	59,108	1,734	27,444
19-Apr	D	32.5	35.4	0.89	2.52	19	755	0.37	1.04	0	0	0.36	1.03	0	0	0.45	1.27	19	1,493	38	649
19-Apr	N	31.5	35.4	0.89	2.52	931	36,992	0.37	1.04	181	17,435	0.36	1.03	35	3,409	0.45	1.27	1204	94,589	2,351	40,158
20-Apr	D	34	37.8	0.89	2.36	15	636	0.37	0.97	3	309	0.36	0.96	3	312	0.45	1.19	11	923	32	584
20-Apr	N	33.5	37.8	0.89	2.36	1,170	49,640	0.37	0.97	216	22,217	0.36	0.96	317	32,974	0.45	1.19	365	30,619	2,068	37,719
21-Apr	D	35.5	39.1	1.35	3.46	6	173	0.36	0.93	0	0	0.32	0.82	5	606	0.47	1.20	5	415	16	249
21-Apr	N	35	39.1	1.35	3.46	1,161	33,552	0.36	0.93	235	25,280	0.32	0.82	289	35,038	0.47	1.20	88	7,307	1,773	27,621
22-Apr	D	36.5	40.1	1.35	3.37	9	267	0.36	0.91	1	110	0.32	0.80	7	870	0.47	1.17	10	852	27	431
22-Apr	N	0	40.1	1.35	3.37	989	29,312	0.36	0.91	92	10,150	0.32	0.80	257	31,956	0.47	1.17	137	11,666	1,475	23,566
23-Apr	D	38	42.8	1.59	3.72	4	108	0.36	0.84	2	237	0.40	0.93	7	751	0.66	1.55	5	322	18	255
23-Apr	N	37	42.8	1.59	3.72	564	15,180	0.36	0.84	136	16,102	0.40	0.93	235	25,208	0.66	1.55	10	644	945	13,413
24-Apr	D	40.5	46.2	1.59	3.44	3	87	0.36	0.78	3	383	0.40	0.86	1	116	0.66	1.44	3	209	10	153
24-Apr	N	39.5	46.2	1.59	3.44	869	25,247	0.36	0.78	261	33,356	0.40	0.86	32	3,705	0.66	1.44	174	12,093	1,336	20,469
25-Apr	D	43	49.6	1.55	3.12	1	32	0.40	0.81	1	124	0.41	0.83	2	242	0.62	1.26	3	239	7	117
25-Apr	N	42.5	49.6	1.55	3.12	286	9,172	0.40	0.81	103	12,788	0.41	0.83	81	9,809	0.62	1.26	92	7,316	562	9,356
26-Apr	D	43.5	51.4	1.55	3.01	4	133	0.40	0.78	0	0	0.41	0.80	3	376	0.62	1.21	7	577	14	242
26-Apr	N	43.5	51.4	1.55	3.01	305	10,136	0.40	0.78	53	6,819	0.41	0.80	81	10,165	0.62	1.21	187	15,410	626	10,799
27-Apr	D	45	52.7	1.20	2.27	3	132	0.41	0.77	0	0	0.45	0.86	2	233	0.55	1.04	1	96	6	122
27-Apr	N	44	52.7	1.20	2.27	253	11,146	0.41	0.77	33	4,279	0.45	0.86	59	6,867	0.55	1.04	97	9,354	442	8,952
28-Apr	D	46	54.2	1.20	2.21	7	317	0.41	0.75	1	133	0.45	0.84	1	120	0.55	1.01	5	496	14	292
28-Apr	N	45.5	54.2	1.20	2.21	145	6,570	0.41	0.75	52	6,935	0.45	0.84	83	9,936	0.55	1.01	71	7,042	351	7,312
29-Apr	D	46.5	55.5	1.07	1.92	6	313	0.40	0.73	4	551	0.42	0.76	1	131	0.57	1.03	2	194	13	293
29-Apr	N	46.5	55.5	1.07	1.92	161	8,388	0.40	0.73	30	4,129	0.42	0.76	67	8,760	0.57	1.03	87	8,439	345	7,767
30-Apr	D	49	57.5	1.07	1.85	14	756	0.40	0.70	4	570	0.42	0.74	6	813	0.57	1.00	3	301	27	630
30-Apr	N	47.5	57.5	1.07	1.85	129	6,963	0.40	0.70	21	2,994	0.42	0.74	62	8,398	0.57	1.00	28	2,814	240	5,598
01-May	D	49	59.2	1.27	2.14	15	701	0.45	0.76	0	0	0.49	0.83	0	0	0.58	0.97	3	308	18	383
01-May	N	49	59.2	1.27	2.14	145	6,779	0.45	0.76	18	2,353	0.49	0.83	23	2,786	0.58	0.97	53	5,441	239	5,081
02-May	D	50	60.8	1.27	2.08	10	480	0.45	0.74	4	537	0.49	0.80	5	622	0.58	0.95	11	1,160	30	655

				IPT 1				IPT 2				IPT 3				IPT 4				Total	
Date	D/N	Staff gauge (cm)	Flows below Cheslatta Falls (m³/s)	Volume sampled (m³/s)	% of total volume sampled	Actual Catch	Population estimate	Volume sampled (m³/s)	% of total volume sampled	Actual Catch	Population estimate	Volume sampled (m³/s)	% of total volume sampled	Actual Catch	Population estimate	Volume sampled (m³/s)	% of total volume sampled	Actual Catch	Population estimate	Total Catch	Daily weighted population estimate
02-May	N	49.5	60.8	1.27	2.08	163	7,826	0.45	0.74	30	4,028	0.49	0.80	41	5,100	0.58	0.95	79	8,329	313	6,834
03-May	D	51	62.1	0.82	1.32	10	760	0.44	0.71	0	0	0.46	0.73	5	681	0.83	1.33	3	226	18	440
03-May	N	50	62.1	0.82	1.32	175	13,301	0.44	0.71	27	3,815	0.46	0.73	43	5,857	0.83	1.33	179	13,465	424	10,375
04-May	D	51	63.3	0.82	1.29	13	1,007	0.44	0.69	2	288	0.46	0.72	1	139	0.83	1.30	2	153	18	449
04-May	N	51	63.3	0.82	1.29	240	18,595	0.44	0.69	32	4,609	0.46	0.72	41	5,693	0.83	1.30	298	22,850	611	15,239
05-May	D	51.5	63.8	1.27	2.00	8	400	0.44	0.69	2	291	0.55	0.86	2	232	0.58	0.92	7	764	19	426
05-May	N	51.5	63.8	1.27	2.00	147	7,358	0.44	0.69	21	3,059	0.55	0.86	27	3,127	0.58	0.92	288	31,440	483	10,820
06-May	D	52	64.3	1.27	1.98	7	353	0.44	0.68	1	147	0.55	0.86	3	350	0.58	0.91	8	880	19	429
06-May	N	52	64.3	1.27	1.98	156	7,869	0.44	0.68	24	3,523	0.55	0.86	26	3,035	0.58	0.91	409	44,999	615	13,886
07-May	D	52	65.0	1.26	1.94	2	103	0.37	0.57	10	1,754	0.50	0.77	5	649	0.60	0.92	15	1,635	32	762
07-May	N	52.5	65.0	1.26	1.94	184	9,480	0.37	0.57	26	4,561	0.50	0.77	23	2,984	0.60	0.92	432	47,086	665	15,837
08-May	D	52.5	65.0	1.26	1.94	3	155	0.37	0.57	5	877	0.50	0.77	5	649	0.60	0.92	4	436	17	405
08-May	N	52	65.0	1.26	1.94	190	9,790	0.37	0.57	48	8,421	0.50	0.77	47	6,098	0.60	0.92	453	49,375	738	17,575
09-May	D	52.5	65.2	1.75	2.69	2	74	0.47	0.73	1	138	0.47	0.72	3	417	0.59	0.90	6	666	12	238
09-May	N	52	65.2	1.75	2.69	216	8,033	0.47	0.73	35	4,823	0.47	0.72	30	4,173	0.59	0.90	423	46,950	704	13,984
10-May	D	52	65.0	1.75	2.70	5	185	0.47	0.73	2	275	0.47	0.72	6	832	0.59	0.90	2	221	15	297
10-May	N	52	65.0	1.75	2.70	257	9,528	0.47	0.73	28	3,847	0.47	0.72	22	3,051	0.59	0.90	134	14,827	441	8,733
11-May	D	52	64.7	1.25	1.93	8	414	0.45	0.70	3	431	0.50	0.77	3	389	0.78	1.20	6	501	20	435
11-May	N	52	64.7	1.25	1.93	132	6,839	0.45	0.70	38	5,464	0.50	0.77	45	5,829	0.78	1.20	252	21,025	467	10,160
12-May	D	52.5	64.8	1.25	1.93	6	311	0.45	0.69	6	864	0.50	0.77	1	130	0.78	1.20	4	334	17	370
12-May	N	52	64.8	1.25	1.93	146	7,576	0.45	0.69	28	4,032	0.50	0.77	35	4,541	0.78	1.20	341	28,495	550	11,985
13-May	D	52	65.0	1.27	1.96	15	765	0.41	0.63	4	633	0.46	0.71	2	283	0.71	1.09	3	275	24	546
13-May	N	52.5	65.0	1.27	1.96	165	8,412	0.41	0.63	27	4,270	0.46	0.71	29	4,107	0.71	1.09	238	21,779	459	10,449
14-May	D	52	64.7	1.27	1.97	8	406	0.41	0.64	2	315	0.46	0.71	1	141	0.71	1.10	5	455	16	272
14-May	N	52	64.7	1.27	1.97	319	16,188	0.41	0.64	22	3,463	0.46	0.71	37	5,215	0.71	1.10	548	49,914	926	15,737
15-May	D	52	64.5	1.23	1.90	9	473	0.41	0.64	3	471	0.51	0.79	1	127	0.69	1.08	5	465	18	307
15-May	N	52	64.5	1.23	1.90	164	8,622	0.41	0.64	19	2,982	0.51	0.79	28	3,561	0.69	1.08	267	24,819	478	8,145
16-May	D	52	64.3	1.23	1.91	7	367	0.41	0.64	4	626	0.51	0.79	2	254	0.69	1.08	3	278	16	272
16-May	N	52	64.3	1.23	1.91	114	5,974	0.41	0.64	20	3,129	0.51	0.79	17	2,155	0.69	1.08	211	19,553	362	6,149
17-May	D	52	64.5	1.33	2.07	15	725	0.42	0.65	3	459	0.45	0.70	0	0	0.61	0.95	4	421	22	378
17-May	N	52	64.5	1.33	2.07	137	6,621	0.42	0.65	16	2,449	0.45	0.70	11	1,576	0.61	0.95	243	25,591	407	6,985
18-May	D	52	65.0	1.33	2.05	5	244	0.42	0.65	0	0	0.45	0.69	1	144	0.61	0.94	0	0	6	104
18-May	N	52	65.0	1.33	2.05	69	3,361	0.42	0.65	12	1,851	0.45	0.69	8	1,155	0.61	0.94	75	7,960	164	2,836
19-May	D	52	65.2	1.33	2.05	0	0	0.42	0.65	0	0	0.45	0.69	0	0	0.61	0.94	0	0	0	0
19-May	N	52	65.2	1.33	2.05	78	3,811	0.42	0.65	5	774	0.45	0.69	8	1,158	0.61	0.94	99	10,539	190	3,296
Totals						14,333	548,598			3,108	354,521			3,351	360,568			11,029	950,106	31,821	569,703

APPENDIX 2

Daily Mean Fork Length, Wet Weight and Development Index (KD) for Chinook 0+ Sampled by IPTs at km 19 of the Nechako River (Bert Irvine's) in 1999

Appendix 2
Daily Mean Fork Length, Wet Weight and Development Index (KD) for Chinook 0+
Sampled by IPTs at km 19 of the Nechako River (Bert Irvine's) in 1999

Date	N	Fork length (mm) Mean	SD	Wet weight (g) Mean	SD	Development Index (g/mm³) Mean	SD
12 / 03 / 1999	8	36.5	1.3	0.36	0.06	1.95	0.05
13 / 03 / 1999	3	36.0	2.0	0.37	0.05	1.99	0.05
14 / 03 / 1999	18	36.3	1.7	0.37	0.05	1.98	0.05
15 / 03 / 1999	2	37.0	1.4	0.41	0.06	2.00	0.03
16 / 03 / 1999	5	36.8	1.1	0.38	0.07	1.96	0.06
17 / 03 / 1999	10	37.1	1.0	0.38	0.04	1.95	0.03
18 / 03 / 1999	11	37.2	1.6	0.41	0.04	1.99	0.05
19 / 03 / 1999	12	36.8	1.5	0.40	0.05	2.00	0.03
20 / 03 / 1999	30	37.5	0.7	0.41	0.02	1.98	0.03
21 / 03 / 1999	35	37.7	0.7	0.43	0.02	2.01	0.03
22 / 03 / 1999	41	37.6	1.0	0.42	0.03	2.00	0.03
23 / 03 / 1999	40	37.3	1.0	0.41	0.04	1.98	0.04
24 / 03 / 1999	35	37.3	1.3	0.41	0.04	1.99	0.04
25 / 03 / 1999	39	37.5	1.4	0.41	0.05	1.98	0.05
26 / 03 / 1999	31	36.9	1.5	0.40	0.05	2.00	0.05
27 / 03 / 1999	39	36.8	1.2	0.38	0.04	1.96	0.04
28 / 03 / 1999	40	37.2	1.2	0.38	0.04	1.95	0.06
29 / 03 / 1999	25	37.3	0.8	0.39	0.04	1.95	0.03
30 / 03 / 1999	38	38.3	1.2	0.42	0.04	1.95	0.05
31 / 03 / 1999	21	37.2	1.2	0.41	0.05	1.99	0.05
01 / 04 / 1999	46	37.8	1.1	0.42	0.04	1.97	0.04
02 / 04 / 1999	39	37.5	1.2	0.41	0.04	1.98	0.04
03 / 04 / 1999	44	37.3	1.2	0.42	0.05	2.00	0.05
04 / 04 / 1999	44	37.8	1.1	0.41	0.04	1.97	0.05
05 / 04 / 1999	53	38.0	1.0	0.44	0.04	2.00	0.04
06 / 04 / 1999	48	37.6	0.9	0.43	0.05	2.00	0.05
07 / 04 / 1999	51	38.1	1.1	0.42	0.04	1.97	0.05
08 / 04 / 1999	57	38.3	1.1	0.45	0.05	2.00	0.05
09 / 04 / 1999	48	37.8	1.4	0.43	0.06	1.99	0.05
10 / 04 / 1999	44	37.6	1.2	0.43	0.05	2.01	0.05
11 / 04 / 1999	45	37.9	1.6	0.43	0.05	1.99	0.04
12 / 04 / 1999	49	37.6	1.7	0.42	0.06	1.99	0.05
13 / 04 / 1999	60	37.7	1.8	0.43	0.07	1.99	0.05
14 / 04 / 1999	49	38.0	1.8	0.44	0.07	1.99	0.05
15 / 04 / 1999	47	37.5	1.7	0.41	0.07	1.97	0.05
16 / 04 / 1999	52	38.2	1.8	0.43	0.07	1.97	0.05
17 / 04 / 1999	59	37.9	1.9	0.44	0.09	1.99	0.06
18 / 04 / 1999	58	38.7	1.6	0.45	0.06	1.98	0.04
19 / 04 / 1999	57	37.5	2.2	0.41	0.09	1.98	0.06
20 / 04 / 1999	60	38.0	1.9	0.42	0.08	1.96	0.05
21 / 04 / 1999	65	37.6	2.1	0.40	0.09	1.95	0.07
22 / 04 / 1999	55	37.5	2.0	0.40	0.07	1.95	0.06
23 / 04 / 1999	67	37.6	2.2	0.39	0.08	1.94	0.07
24 / 04 / 1999	58	37.7	1.5	0.40	0.06	1.95	0.05
25 / 04 / 1999	49	38.0	1.4	0.41	0.06	1.95	0.06
26 / 04 / 1999	47	37.7	1.9	0.39	0.06	1.94	0.04

Appendix 2 (continued)
Daily Mean Fork Length, Wet Weight and Development Index (KD) for Chinook 0+
Sampled by IPTs at km 19 of the Nechako River (Bert Irvine's) in 1999

		Fork length (mm)		Wet weight (g)		Development Index (g/mm³)	
Date	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
27/04/1999	54	37.3	1.8	0.39	0.07	1.95	0.06
28/04/1999	46	37.3	1.8	0.39	0.07	1.95	0.05
29/04/1999	53	36.8	1.7	0.37	0.07	1.94	0.05
30/04/1999	53	37.0	2.0	0.39	0.07	1.96	0.04
01/05/1999	63	37.8	2.1	0.41	0.08	1.95	0.06
02/05/1999	53	37.5	2.1	0.40	0.07	1.96	0.04
03/05/1999	69	37.6	2.0	0.42	0.09	1.98	0.07
04/05/1999	58	37.5	2.2	0.40	0.09	1.96	0.05
05/05/1999	55	37.7	1.9	0.43	0.10	1.99	0.07
06/05/1999	59	37.5	2.2	0.42	0.10	1.98	0.05
07/05/1999	59	37.7	2.0	0.42	0.08	1.98	0.05
08/05/1999	67	37.4	2.4	0.42	0.11	1.99	0.07
09/05/1999	57	36.1	2.4	0.36	0.07	1.96	0.06
10/05/1999	52	36.2	2.7	0.37	0.11	1.97	0.06
11/05/1999	55	36.5	2.9	0.39	0.11	1.99	0.06
12/05/1999	59	37.4	2.4	0.42	0.10	1.99	0.06
13/05/1999	57	37.2	2.4	0.42	0.11	2.00	0.06
14/05/1999	59	37.2	2.1	0.41	0.09	1.98	0.06
15/05/1999	56	38.2	2.4	0.45	0.13	1.98	0.08
16/05/1999	58	38.2	2.3	0.44	0.11	1.98	0.08
17/05/1999	56	37.8	3.0	0.45	0.16	1.99	0.08
18/05/1999	57	38.4	3.0	0.45	0.17	1.97	0.08
19/05/1999	44	38.9	2.8	0.47	0.14	1.97	0.07
20/05/1999	33	38.3	1.8	0.45	0.09	1.98	0.06

APPENDIX 3
Summary of 1999 IPT Catches by Month and Trap Number

Appendix 3. Summary of 1999 IPT catches by month and trap number

			Salmonidae										Cyprinidae										Cottidae		
Month	**Day/Night**	**Trap No.**	**CH_1+**	**CH_0+**	**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**	**total**
March	Day	1	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	15
		2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
		3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
		4	0	8	0	0	0	0	0	0	0	2	0	0	0	1	0	0	1	0	0	1	0	1	14
																									0
March	Night	1	1	297	0	0	0	0	0	0	0	14	2	7	0	3	2	1	41	14	0	17	1	3	403
		2	1	149	0	0	0	0	0	0	0	2	0	0	0	0	0	0	4	0	0	2	0	1	159
		3	0	160	0	0	0	0	0	0	0	0	0	0	0	0	1	1	8	0	0	1	0	2	173
		4	2	174	0	0	0	0	0	0	0	44	1	9	0	47	1	17	27	10	0	15	1	10	358
																									0
April	Day	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	21
		1	0	198	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3	0	0	0	2	204
		2	0	40	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	43
		3	0	59	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	61
		4	0	139	0	0	0	2	0	0	0	3	0	4	0	2	0	8	0	0	0	1	2	1	162
																									0
April	Night	0	0	697	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	697
		1	1	10,484	0	0	0	0	0	0	0	110	5	44	0	47	10	47	19	33	0	40	3	5	10,848
		2	1	2,390	0	0	0	0	2	0	0	2	0	0	0	3	1	0	5	2	0	3	0	1	2,410
		3	4	2,542	0	0	0	0	0	0	0	9	0	2	0	0	3	2	4	1	0	6	0	0	2,573
		4	0	5,595	0	0	0	61	0	0	0	101	10	37	1	105	9	116	10	19	1	43	1	8	6,117
																									0
May	Day	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	6
		1	1	148	0	0	0	1	0	0	0	1	0	0	0	1	1	2	1	4	0	0	0	1	161
		2	0	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	52
		3	0	46	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47
		4	0	91	0	0	0	2	0	1	0	1	0	2	0	0	0	0	0	2	0	1	0	1	101
																									0
May	Night	0	0	97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	97
		1	0	3,197	0	0	0	5	0	3	9	127	19	51	8	57	123	419	77	99	0	11	0	1	4,206
		2	1	476	0	0	0	3	0	0	0	17	1	0	0	2	6	2	2	0	0	2	0	4	516
		3	0	541	0	1	0	9	0	1	0	11	0	0	0	6	10	3	0	1	0	3	0	0	586
		4	0	5,022	0	0	0	53	0	12	1	264	5	46	0	247	79	446	38	34	0	30	3	4	6,284
Grand	**Total**		12	32,641	0	1	0	136	2	18	10	710	43	205	9	521	246	1065	240	223	1	176	11	48	36,318

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*
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*
CC	Sculpin species	*Cottus sp.*