JUVENILE OUTMIGRATION 2002

NECHAKO FISHERIES CONSERVATION PROGRAM
Technical Report No. M02-3

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EXECUTIVE SUMMARY

The distribution and abundance of juvenile chinook salmon (*Oncorhynchus tshawytscha*) were evaluated through electrofishing and rotary screw trapping in 2002 in the upper 100 km of the Nechako River as part of the fourteenth year of the Nechako Fisheries Conservation Program (NFCP).

Mean daily water temperatures of the river at Bert Irvine's Lodge in 2002 were within the minimum-maximum range observed between the years 1987 and 2001. In-river temperatures in 2002 were however slightly below average during the salmon growing season but within the acceptable range for chinook rearing. Flows of the upper Nechako River at Cheslatta Falls in 2002 followed a pattern similar to previous years.

Based on growth curves, emergence of chinook fry in 2002 had ceased by early June. Monthly electrofishing surveys along the length of the upper river in April, May, June, July and November captured 54,646 fish from 12 species or families. Juvenile chinook salmon were the most common species, accounting for 65% of all captures or 36,836 fish (36,656 0+ and 180 1+), of which 86% were captured at night. As in previous years, juvenile chinook were more active at night than during the day, and also heavier during that time.

The catch-per-unit-effort (CPUE, number per 100 m^2 surveyed) of electrofished 0+ chinook peaked in May for both day and night catches. Spatial distribution of 0+ chinook along the length of the upper Nechako River, as indicated by electrofishing CPUE, was similar to that of previous years (e.g. 2001): newly emerged chinook were most abundant first in the upper river (15 – 25 km from Kenny Dam), more evenly distributed throughout the river in May and June, and increased in abundance in Reach 1 in July.

The number of outmigrating 0+ chinook (30,736) captured by rotary screw traps at Diamond Island between April 21 and July 20, 2002, was essentially unimodal, with the peak of abundance centred around mid May. Their morphological characteristics (fork length, wet weight and condition index) were comparable to those of fish caught in previous years.

The index of juvenile downstream migration was 874,676 0+ and 11,155 1+ chinook, the largest it has ever been since the inception of the program. This was due in part to higher than usual returns of spawners the previous year. As well, the index of 0+ outmigrants for the years 1992 to 2002 was positively and significantly correlated (rho = 0.65, $P < 0.05$) with the number of parent spawners upstream of Diamond Island in the autumns of the years 1991 to 2001.

All comparisons with previous years indicated that the timing of chinook outmigration, the temperatures and the flows in 2002 were comparable with those of previous years, although the latter two parameters were close to the bottom of the range thus far observed.

INTRODUCTION

This report describes juvenile chinook salmon (Oncorhynchus tshawytscha), distribution and abundance in the upper 100 km of the Nechako River in the year 2002.

This study was part of the fourteenth year of the Nechako Fisheries Conservation Program (NFCP). The primary objectives of the 2002 juvenile chinook outmigration study were to describe the relative abundance, growth and spatial distribution of juvenile chinook in the upper Nechako River, and to calculate an index of the number of juvenile chinook that migrated downstream of Diamond Island from March to July. The secondary objective was to compare the biological parameters measured in 2002 with those measured over the previous 13 years.

METHODS

Study Sites

The study area included the upper 100 km of the Nechako River from Kenney Dam to Fort Fraser (Figure 1). It was divided into four reaches with the following boundaries, as originally defined by Envirocon Ltd. (1984):

Reach	Distance (km) from Kenney Dam
1	9.0-14.5
2	14.6-42.9
3	43.0-66.5
4	66.6-100.6

All longitudinal distances are in kilometres from the centre of Kenney Dam. The first nine kilometres of the river are within the Nechako River Canyon, which was dewatered by the closing of Kenney Dam in October 1952. Water released from the Nechako Reservoir at the Skins Lake Spillway (87 km west of Kenney Dam) joins the Nechako River at Cheslatta Falls, 9 km downstream from Kenney Dam.

Temperature and Flow

Mean daily water temperatures were measured by a datalogger installed at Bert Irvine's Lodge in Reach 2 of the river, 19 km below Kenney Dam. They are reported as preliminary data from Environment Canada.

Spot water temperatures were recorded by hand-held thermometers during electrofishing surveys, and are reported as data from Triton Environmental Consultants Ltd.

Daily water flows were recorded at Skins Lake Spillway (WSC station 08JA013) and at the Nechako River below Cheslatta Falls (WSC station 08JA017), and are reported as preliminary data from Water Survey of Canada (WSC).

Electrofishing Surveys

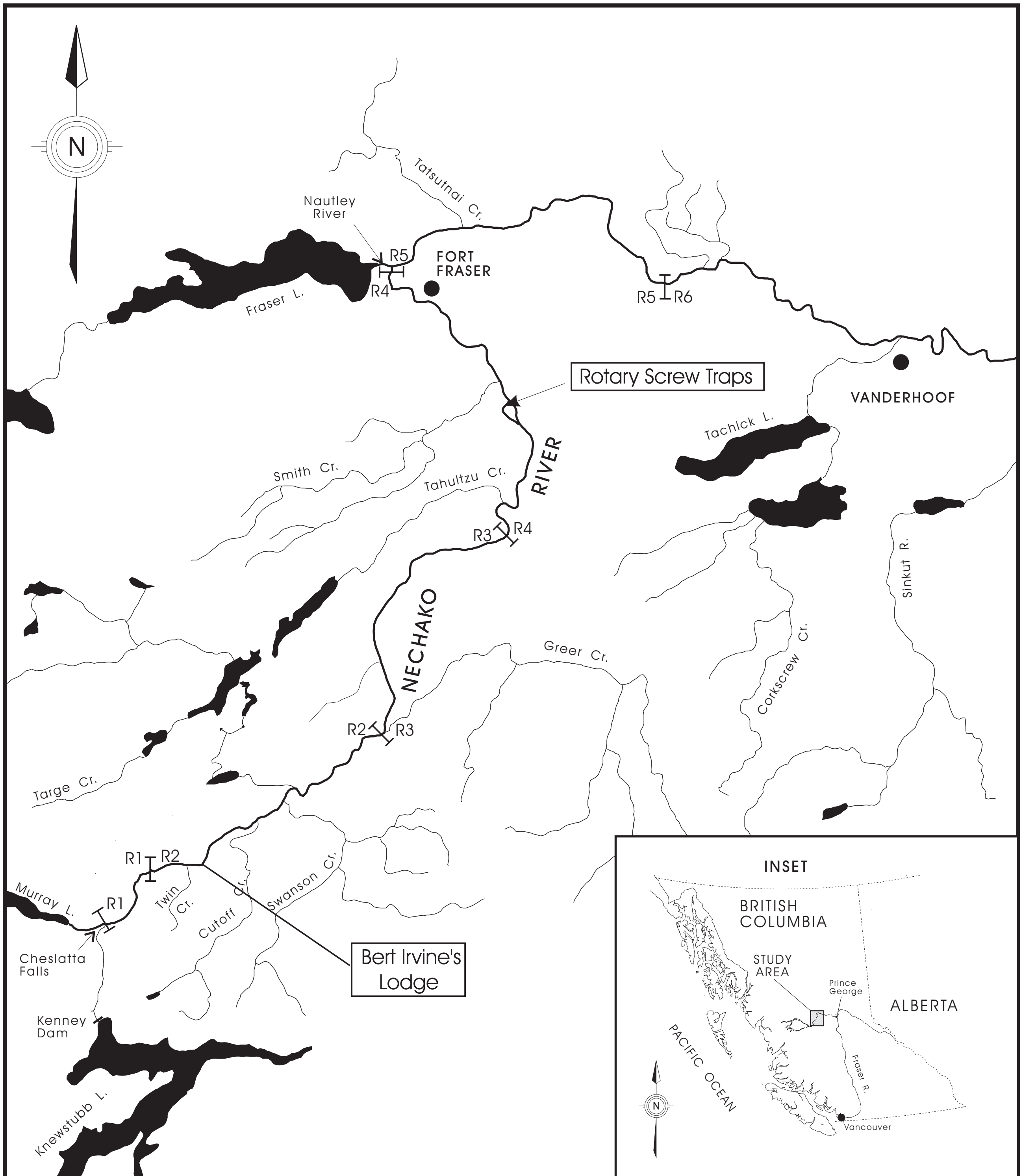
History

Each year since 1990, the NFCP has conducted electrofishing surveys of the upper Nechako River to measure the relative abundance and spatial distribution of juvenile chinook. The surveys were initiated in 1990 when a downstream trapping fence could not be operated because of high river flows. In subsequent years the surveys have become an important component of the chinook monitoring program showing the spatial variation in juvenile density during spring and summer—something fixed gear cannot do.

Surveys

The distribution of juvenile chinook salmon was assessed from single-pass electrofishing surveys of Reaches 1-4, as in previous years. Surveys began in April and continued through May, June and early July. They were not done during late July and August because summer cooling flows were too high to allow safe and effective electrofishing[1]. A final electrofishing survey was conducted from November 1 to 5, 2002. Surveys of Reaches 1 through 4 were completed in each of the months sampled, except April and November when low river discharge prevented safe boat access to Reach 1. Electrofishing surveys were carried out at night and during the day, with night defined as the time period between sunset and sunrise.

[1]Large flows are released into the upper river during July and August to cool the river to mitigate potential increases in water temperatures during the summer and reduce the risk to sockeye salmon (*Oncorhynchus nerka*) migrating through the lower Nechako River to spawning grounds in the Stuart, Stellako and Nadina River systems.



Nechako Fisheries Conservation Program

Map # M02-3-1

0 25 KM

FIGURE 1. 2001 NECHAKO RIVER STUDY AREA AND TRAP LOCATIONS

Surveys were conducted on prime habitat for juvenile chinook salmon, defined as depth greater than 0.5 m, velocity greater than 0.3 m/s and a substrate of gravel and cobble (Envirocon Ltd. 1984). That habitat was found mainly along the margins of the river, so electrofishing surveys did not sample the portion of the population that may have occupied the mid-channel. However, mid-channel residents are a minor component of the population of juvenile chinook. Electrofishing surveys conducted by the Department of Fisheries and Oceans (DFO) have shown that mid-channel densities of chinook were 70 times lower than densities along river margins (Nechako River Project 1987). The same study also showed that 97% of observed juvenile chinook were found along river margins.

Fish were captured with a single pass of a Smith Root model 12B POW backpack electrofisher, identified to species (except for cottids), counted, and released live back into the river. This yielded a measure of catch-per-unit-effort (CPUE) of juvenile chinook, in this case the number of fish caught at a site divided by the area electrofished. Area was expressed in units of 100 m^2 to avoid fractional CPUE. CPUE thus has units of fish numbers/100 m^2.

The age of juvenile chinook was recorded as 0+ or 1+, based on fork length. During spring and early summer juvenile chinook less than 90 mm long were classified as 0+. Those over 90 mm in length in the spring and early summer were classified as 1+, but those over 90 mm long in late summer were classified as 0+ because by that time all 1+ chinook had migrated out of the upper Nechako River. Rainbow trout were classified as juveniles if their fork length was <200 mm and adults if their length was >200 mm.

Fork length and wet weight were measured from approximately 10 chinook at each site and each day or night sampling event. Fork length was measured to the nearest 1 mm with a fry measuring board, and wet weight was measured to the nearest 0.01 g with an electronic balance.

Lengths and weights of subsamples of other salmonids such as rainbow trout were also measured, but were not taken for non-salmonid fish other than burbot (*Lota lota*), which is a rare species in the Nechako River.

Fulton's condition factor (Ricker 1975) was used as an index of physical condition:

(1) $CF = \text{weight (g)} \times 10^5 / [\text{fork length (mm)}]^3$

Mean daily length and weight of 0+ and 1+ chinook were calculated separately for day and night catches because previous statistical analyses have shown that juvenile chinook lengths and weights are significantly different between night and day (fish caught at night being larger), and also because the behaviour of juvenile chinook varies with time of day—they tend to remain near instream cover during the day and to migrate between dusk and dawn.

It is important to note that electrofished areas were not blocked off with nets, which meant that some fish could avoid capture by leaving a sampling area during a pass. That meant that electrofishing catch was an underestimate of the total number of fish in a survey area. Two-pass or three-pass sampling of blocked-off survey areas would have been necessary to estimate total numbers. However, the Nechako River electrofishing survey was not designed to estimate absolute numbers—it was designed to provide an index of relative abundance that could be compared between years.

That sampling strategy is called "semi-quantitative" (Crozier and Kennedy 1995). It has two advantages over the fully quantitative method. First, it is the only electrofishing technique that can be used when it is impractical to enclose a survey area in blocking nets because the area is too large to be enclosed or flows through the area are too strong to allow nets to be installed. For example, almost all electrofishing conducted in lakes and reservoirs (DeVries *et al.* 1995; Van Den Ayle *et al*. 1995; Miranda et al. 1996), and in large rivers (R.L.&L. Environmental Services Ltd. 1994), is semi-quantitative.

Second, it is often necessary to use semi-quantitative methods when the region to be surveyed contains many possible survey sites, but the time and resources available for sampling are limited (Crozier and Kennedy 1995). The upper Nechako River is too long for cost-effective quantitative sampling of its entire length several times a year.

There are two disadvantages of the semi-quantitative method. First, semi-quantitative electrofishing CPUE cannot be compared to fully quantitative CPUE unless the former are calibrated by the latter. That is, unless total numbers are estimated for a subset of the same areas that are semi-quantitatively surveyed, and a calibration relationship is developed from a comparison of the two types of CPUE (*e.g.*, Serns 1982; Hall 1986; Coble 1992; McInerny and Degan 1993; Edwards *et al*. 1987). At present, conversion of electrofishing CPUE to absolute CPUE is not an NFCP objective because the purpose of the electrofishing surveys is to search for among-year variations in relative abundance of juvenile chinook and not to compare it with absolute abundances of other chinook streams.

Second, semi-quantitative sampling assumes that the efficiency of capture, the fraction of total number of fish in a survey area that are caught in a single electrofishing pass, is constant for all sites and species of fish. However, electrofishing catch efficiency varies significantly with fish species, fish body size, type of habitat, time of day, water temperature, and the training and experience of personnel conducting the survey (Bohlin et al. 1989, 1990). The NFCP electrofishing project reduced error in estimation of CPUE by sampling only one type of habitat (prime juvenile chinook habitat), by focusing analysis on only one species (chinook), by analysing CPUE from night and day surveys separately, and by using the same experienced crew leaders each year. However, the study plan does not account for changes in catch efficiency due to seasonal changes in fish size and water temperature.

Rotary Screw Traps

Rotary screw traps (RSTs) were used to estimate the number of juvenile chinook that migrated downstream past Diamond Island (Figure 1).

An RST consists of a floating platform on top of which is a rotating cone. In front of the cone is an A-frame with a winch used to set the vertical position of the mouth of the cone, half of which is always submerged. In the back of the cone is a box where captured fish are kept alive until the trap is emptied. The cone is 1.43 m long and made of 3 mm thick aluminium sheet metal with multiple perforations to allow water to drain. The diameter of the cone tapers from 1.55 m at the mouth to 0.3 m at the downstream end. Inside the cone is an auger or screw, the blades of which are painted black to reduce avoidance by fish. As the current of the river strikes the blades of the screw, it forces the cone to rotate. Any fish entering the cone is trapped in a temporary chamber formed by the screw blades. As the cone rotates, the chamber moves down the cone until its contents are deposited into the live box.

Three RSTs were suspended from a cable strung across the river channel off Diamond Island: RST 1 near the left bank (left margin), RST 2 in the middle of the river (mid channel), and RST 3 near the right bank (right margin). The 1.5 m space between the right bank of the river and RST 3 was blocked with a wing made of wire mesh fence panels. Although RST 1 was originally installed to be close to the left margin, the channel gradually changed course and widened over the years of the study, and this RST is now sampling in mid channel. It was decided early on not to change its position from year to year. Thus, “left margin” is now a slight misnomer.

The RSTs were installed in late April once the river was free of ice, and removed in mid-July to avoid high cooling flows in July and August. The traps were not re-installed in September because too few chinook salmon had been caught in the fall of previous years to justify re-installation of traps.

Each trap was emptied twice each day at 08:00 and 19:00. All fish were collected from the live trap, counted and identified to species. A subsample of 10 chinook salmon was measured for length and weight with the same methods described above for the electrofishing surveys, after which all fish, including the subsampled fish, were released live back into the river.

An index of the number of juvenile chinook passing Diamond Island was calculated by multiplying the total number of fish caught in an RST in a time period (day or night) by the ratio of the total flow of the river to the flow that passes through the RST:

(2) $N_{ij} = n_{ij}(V_j/v_{ij})$

where N_{ij} = number of juvenile salmon passing Diamond Island on the jth date as estimated by the catches of the *ith* trap, n_{ij} = number of chinook salmon caught in the *ith* trap on the *jth* date, V_j = total water flow

(m^3/s) of the Nechako River past Diamond Island on the *jth* date, and v_{ij} = water flow (m^3/s) through the *ith* trap on the *jth* date. All analyses of rotary screw trap data were based on the numbers expanded by equation (2) rather than on catches.

V_j was estimated from measurements on a staff gauge placed near the confluence with Smith Creek, using a linear regression between flow and the height of the staff gauge ($N = 182$, $R^2 = 0.98$, $P<0.001$):

(3) $\ln(\text{flow}, m^3/s) = -3.49 + 1.69 \ln(\text{staff height, cm})$

That regression was calculated for steady flow conditions from April to December for the years 1992 to 2002. Flows and staff gauge height were ln-transformed to respect the assumptions of the model.

Water flow though a trap (v_{ij}) was the product of one half the cross-sectional area (1.61 m^2) of the mouth of the trap (the trap mouth was always half-submerged) and average water velocity in front of the trap. Average water velocity (m/s) was measured with a Swoffer (model 2100) flow meter at three different places in the front of the mouth of the RST. The one exception to this rule was RST 3, where v_{ij} was increased to include the water that flowed between it and the right bank of the river because the fish that would ordinarily have passed through this gap were diverted into RST 3 by the right wing.

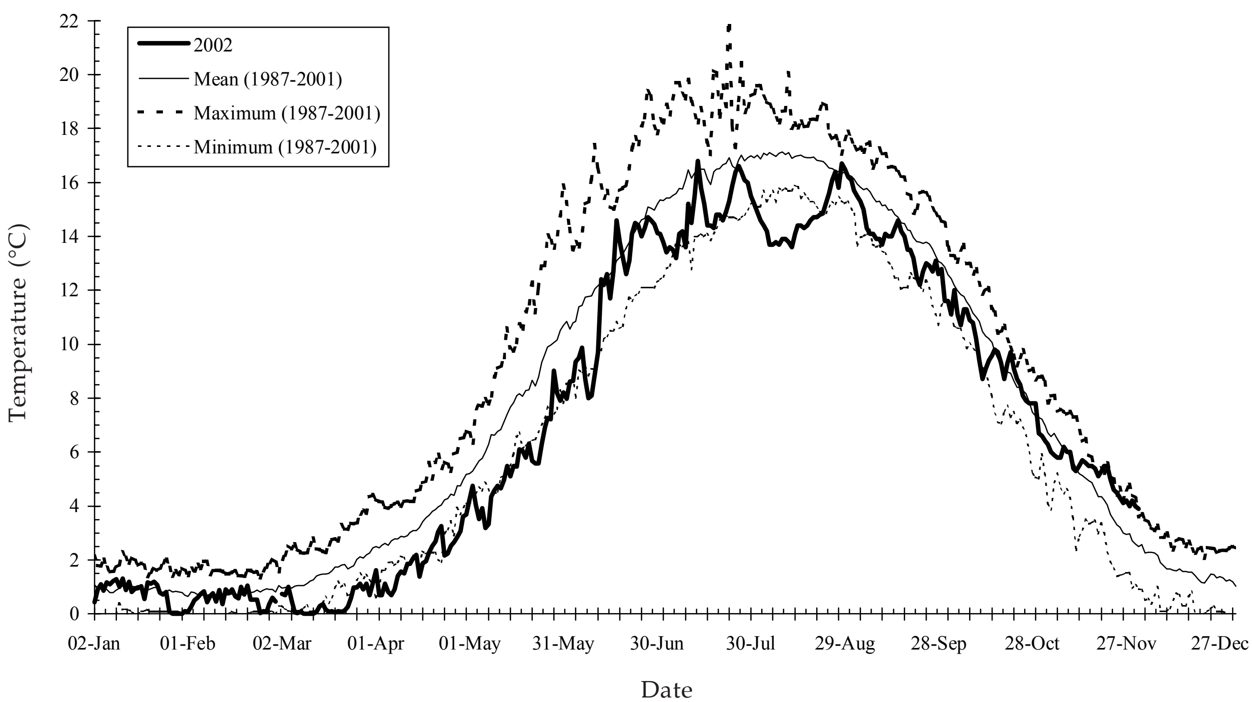
Since there were three RSTs, there were three estimates of total chinook number each day. The best estimate of the total index number of chinook salmon was the mean of the three estimates weighted by the flow that passed through each trap.

RESULTS AND DISCUSSION

Temperature

Mean daily water temperature of the upper Nechako River at Bert Irvine's Lodge rose from a minimum of near 0°C for several days in late January and early March to a maximum of 16.8 °C in mid July (Figure 2). Overall, the temperatures recorded thus far in 2002 were below average during the main period of chinook growth (April – September), and slightly above average in November.

Figure 2
Comparison of Mean Daily Temperature of the Upper Nechako River at Bert Irvine's Lodge in 2002 with the Mean, Maximum and Minimum for the Years 1987 to 2002
(data available until Nov 30, 2002)



Spot temperatures measured during electrofishing surveys are plotted per month in function of their distance from Kenney Dam in Figure 3. Only sites which were sampled during all months (April, May, June, July and November) are shown, and only night time temperatures are plotted to minimize variations due to time of sampling (*e.g.*, sites sampled in early morning would be expected to have lower temperatures than sites sampled in the afternoon). Overall, water temperature varied more throughout the river than during the previous year, with an average temperature range of 4°C from km 17 to km 86, as compared to 2 °C along the same distance in 2001. Water temperature became progressively warmer downstream (April to July) as the water released from the reservoir tended to warm as it passed down the river. There was a reverse trend in November as the deep reservoir water released to the system cooled as it passed downstream.

In summary, temperature of the upper Nechako River varied with season and downstream distance. The temperatures that were actually experienced by juvenile chinook in the upper river may have been up to ±4°C different from the average daily temperatures at Bert Irvine's Lodge depending on their distance downstream. These variations in temperature may tend to obscure relationships between temperature and growth of juvenile chinook salmon in the Nechako River.

Flow

From January 1 to April 25, 2002, releases from Skins Lake Spillway were roughly constant at 30 m^3/s (Figure 4). From April 25 to May 1, releases rose from 30 to 54 m^3/s and then remained stable until July 11, when they once again rose, this time from 54 to 226 m^3/s on July 13 as part of the Summer Temperature Management Program (STMP). Intermediate peaks occurred on July 25 and August 4-5 and a maximum peak of 377 m^3/s was reached on July 25 (lower than last year's peak of 453 m^3/s), all according to the STMP protocol. There were two small forced spills (85 m^3/s each) between October 26 and November 8, 2002, and between December 5 and 24. Releases from September 4 to December 30 averaged 56.5 m^3/s.

Flows at Cheslatta Falls varied less rapidly than releases at Skins Lake Spillway due to the buffering effect of the Murray-Cheslatta Lake chain. Flows gradually rose to 56 m^3/s from April to July 10. (The difference in avergae flows between Skins Lake Spillway and Cheslatta Falls was due to tributary inflows from the Murray-Cheslatta watershed). Flows rose rapidly in July in response to STMP releases, and reached a maximum of 283 m^3/s on August 5, 2002. They then declined starting on August 14 and remained relatively constant in September and most of October. Flows increased in November and December in response to the forced spills from the Reservoir. In summary, the 2002 flows of the upper Nechako River at Cheslatta Falls were stable for most of the year, except during the rapid rise and fall in flows in July and August due to the STMP and the spill in November and December.

Size and Growth of Chinook Salmon

Effect of time of day

Factorial ANOVAs of fork length and wet weight (both ln-transformed to respect the assumptions of the test) with time of day (day or night) and time of year (April, May, June, July and November) showed that there was a significant interaction between time of day and time of year (Table 1). A significant interaction means that the effect of one independent variable (*e.g.*, 'time of day') on the dependent variable (Fork Length or Wet Weight in this case) depends on the level of the other independent variable ('time of year'). In the present case, the significant interaction between time of day and time of year forces one to test whether FL_{night} is greater than FL_{day} for each month sampled rather than lumping all FL_{day} across months. There were also, as expected, significant effects of time of year and time of day on these variables.

Juvenile chinook caught at night were also significantly longer than fish caught during the day for June and July (Figure 5; t-tests on ln-transformed data). Unlike previous years, however, juveniles caught in April did not exhibit any significant day-night fork length difference, and those caught in May were significantly longer during the day than during the night, which is the opposite of the trend recorded in previous years. As in 2001, there were no significant day-night difference in fork length among juvenile chinook 0+ in November.

The most likely reasons for these apparent day-night fork length differences in summer months (June and July) could be related to territoriality and diurnal move-

Figure 3
Night Time Temperatures Measured at Electrofishing Sites in the Nechako River, April to November, 2002

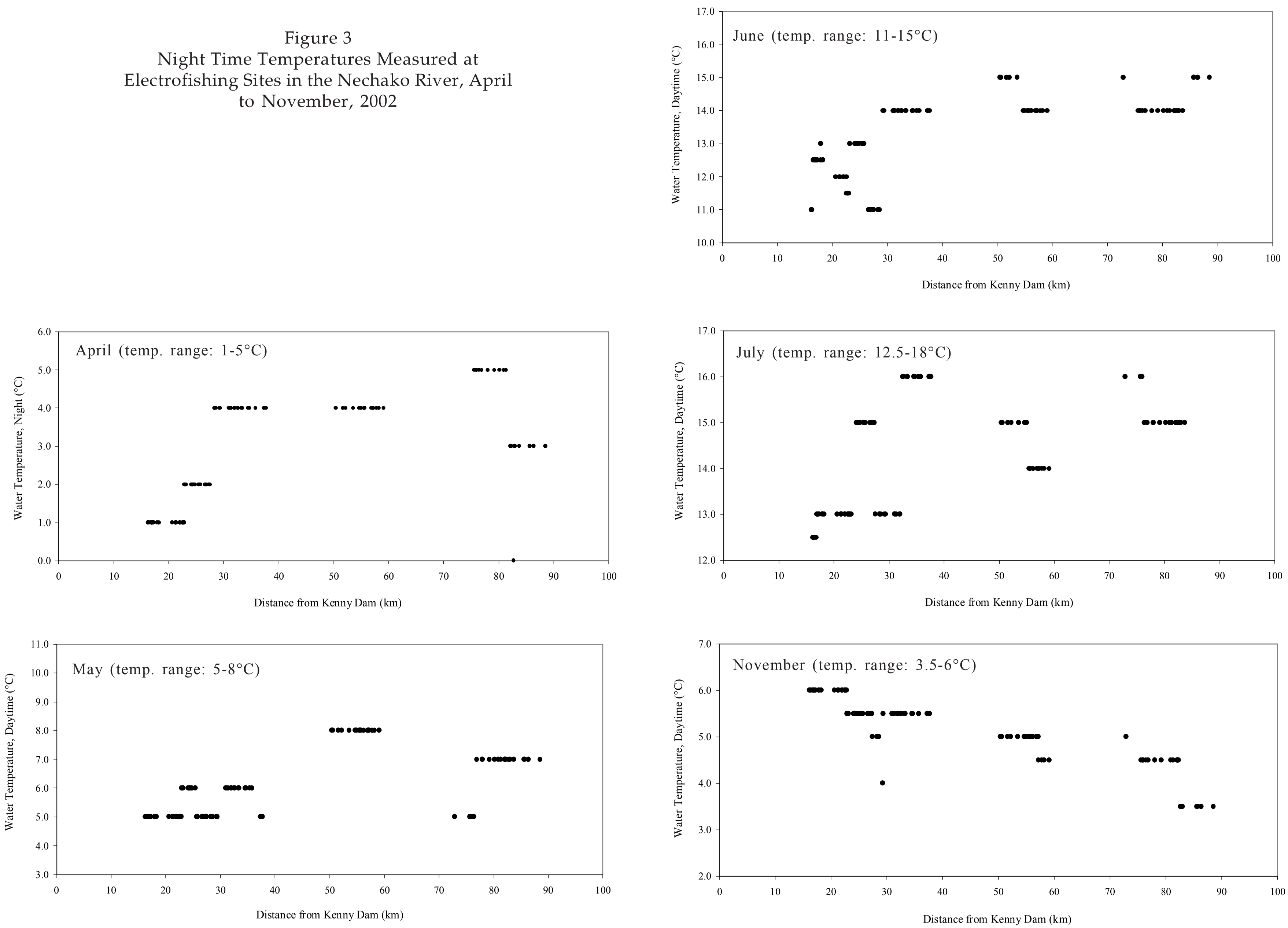


Figure 4
Daily Flow of the Nechako River Below Cheslatta Falls (WSC station 08JA017)
and Releases from Skins Lake Spillway, 2002
(data incomplete)

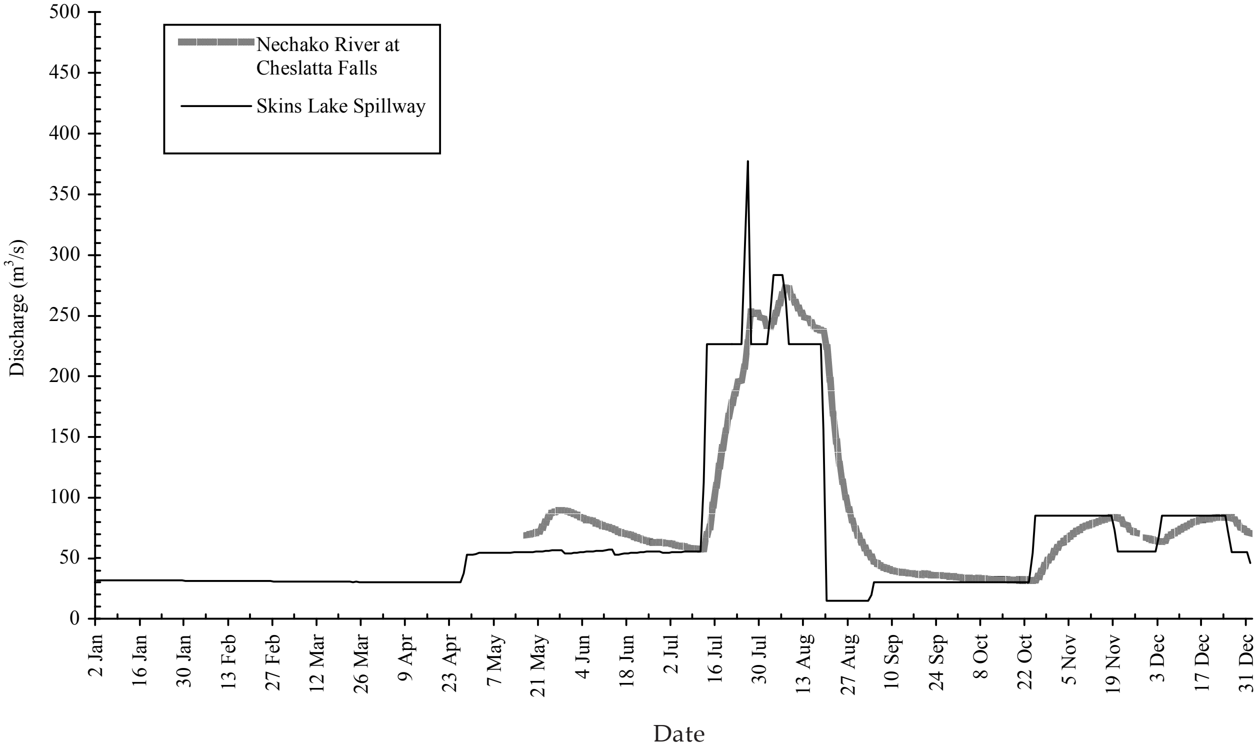


Table 1
Results of Factorial ANOVAs on Fork Length and Wet Weight of Juvenile Chinook
Captured by Electrofishing in the Nechako, 2002

	DF	Sum of Squares	Mean Square	F-Value	Significance
Ln (length)					
Month	4	197.96	49.49	5596.31	S
Day or Night	1	0.74	0.74	83.80	S
Month * D or N	4	2.48	0.62	70.04	S
Residual	6,987	61.79	0.01		
Ln (weight)					
Month	4	2,801.83	700.46	6,422.37	S
Day or Night	1	18.34	18.34	168.11	S
Month * D or N	4	18.43	4.61	42.24	S
Residual	6,985	761.82	0.11		

Figure 5
Fork Lengths (± SE) of Chinook 0+ Electrofished in the Nechako River, 2002

*significant difference between Day and Night, P< 0.05, t-test on ln-transformed values. Day-caught fish were larger in May.

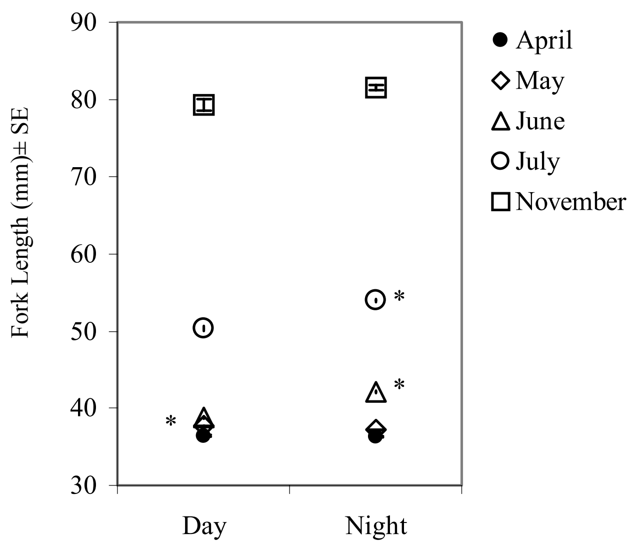
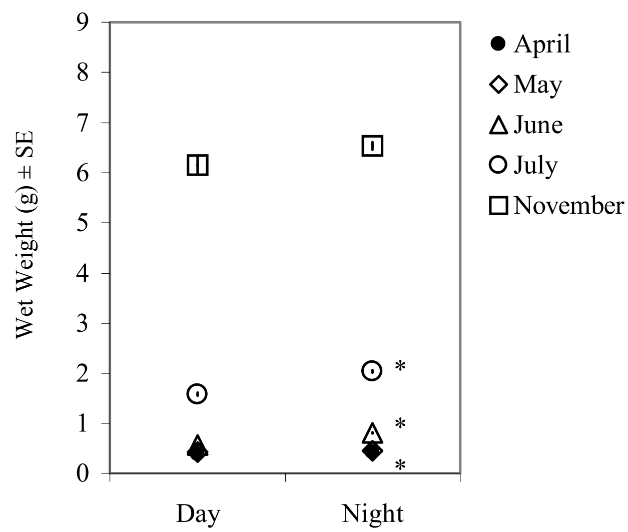


Figure 6
Wet Weights (± SE) of Chinook 0+ Electrofished in the Nechako River, 2002.

*significant difference between Day and Night, P< 0.05, t-test on ln-transformed values.



ments: juvenile chinook, like most juvenile salmonids, hold feeding territories which they visually defend against cohort members. These feeding territories are usually in sheltered areas with high drift, and are harder to sample. Larger fish keep smaller fish out on the periphery where they are more easily sampled during the day. At night a wider size range of fish are active along the river margins than during the day because juvenile chinook tend to migrate more during night time to avoid predators. Fish are often found in shallow margin water at night whereas none are to be seen there during the day (P. Fredericksen, Triton, pers. comm.). Fish sampled in April 2002 had just emerged because of the late spring whereas they had had almost one month to start growing in previous years. This extra time may explain the day – night size differential recorded in previous years. The difference between day and night-caught fish in May amounted to 1.3% of their fork length, whereas it was 7 and 8% in June and July respectively. Thus while the difference observed in May was statistically significant, it may not be biologically significant.

Chinook juveniles' wet weights showed a more uniform trend among months, as the fish tended to be heavier at night in all months during which they were sampled but November (Figure 6). It may be that chinook fed more at night than during the day.

<u>*Chinook Salmon 1+*</u>

There were relatively few chinook 1+ caught (180), as most of them had left the river (Table 2). Most of these (86%) were caught at night. The only day-night statistical difference was between fork lengths of fish caught in April, which were larger during the day (Figure 7). Chinook 1+ did not differ in terms of wet weight between night and day (Figure 8).

Chinook 0+ Growth

Growth of chinook 0+ salmon electrofished along the river margins appeared to follow two separate growth stanzas: growth appeared to be slow between April and May and then increased between June and November (Figures 9 and 10). However, the apparent slow growth during the first stanza was more likely due to continuous emergence of fry over a period of several weeks—the numbers of emergent fry were large enough to force the mean size of all fish caught to stay close to the mean size of emergent fry—as well as the cool spring. After emergence ceased, the second stanza began and the true growth rate of juvenile chinook became apparent. Based on the curvature of the relationship between mean length and weight vs. date, emergence appeared to have ceased by early June or shortly thereafter.

Table 2
Fish Captured by Electrofishing in the Upper Nechako River, 2002

Common Name	Scientific Name	Adult[1]				Juvenile				Total			
		Day	Night	Total	Percent	Day	Night	Total	Percent	Day	Night	Total	Percent
Chinook salmon	*Oncorhynchus tshawytscha*	26	154	180	0.3	5292	31364	36,656	64.7	5,318	31,518	36,836	65.0
Redside shiner	*Richardsonius balteatus*	331	977	1,308	2.3	909	3210	4,119	7.3	1,240	4,187	5,427	9.6
Longnose dace	*Rhinichthys cataractae*	181	39	220	0.4	2761	595	3,356	5.9	2,942	634	3,576	6.3
Leopard dace	*Rhinichthys falcatus*	223	216	439	0.8	765	543	1,308	2.3	988	759	1,747	3.1
Largescale sucker	*Catostomus macrocheilus*	2	9	11	0.0	1445	1421	2,866	5.1	1,447	1,430	2,877	5.1
Northern pikeminnow[2]	*Ptychocheilus oregonensis*	0	3	3	0.0	823	1398	2,221	3.9	823	1,401	2,224	3.9
Sculpins (General)	*Cottidae*	117	182	299	0.5	1101	751	1,852	3.3	1,218	933	2,151	3.8
Rocky mountain whitefish	*Prosopium williamsoni*	17	7	24	0.0	55	1553	1,608	2.8	72	1,560	1,632	2.9
Rainbow trout	*Oncorhynchus mykiss*	0	8	8	0.0	18	103	121	0.2	18	111	129	0.2
Peamouth chub	*Mylocheilus caurinus*	0	0	0	0.0	2	2	4	0.0	2	2	4	0.0
Burbot	*Lota lota*	0	1	1	0.0	3	16	19	0.0	3	17	20	0.0
Coho salmon	*Oncorhynchus kisutch*	0	0	0	0.0	3	0	3	0.0	3	0	3	0.0
Sockeye salmon	*Oncorhynchus nerka*	1	1	2	0.0	9	9	18	0.0	10	10	20	0.0
Total		872	1,443	2,315	4.1	7,894	9,601	17,495	30.9	14,084	42,562	56,646	100.0

[1] chinook coho and sockeye salmon data are for 1+ juveniles or smolts.

[2] previously known as "northern squawfish" (Nelson et al. 1998).

Figure 7
Chinook 1+ Fork Lengths Sampled from Electrofishing, Nechako River, 2002

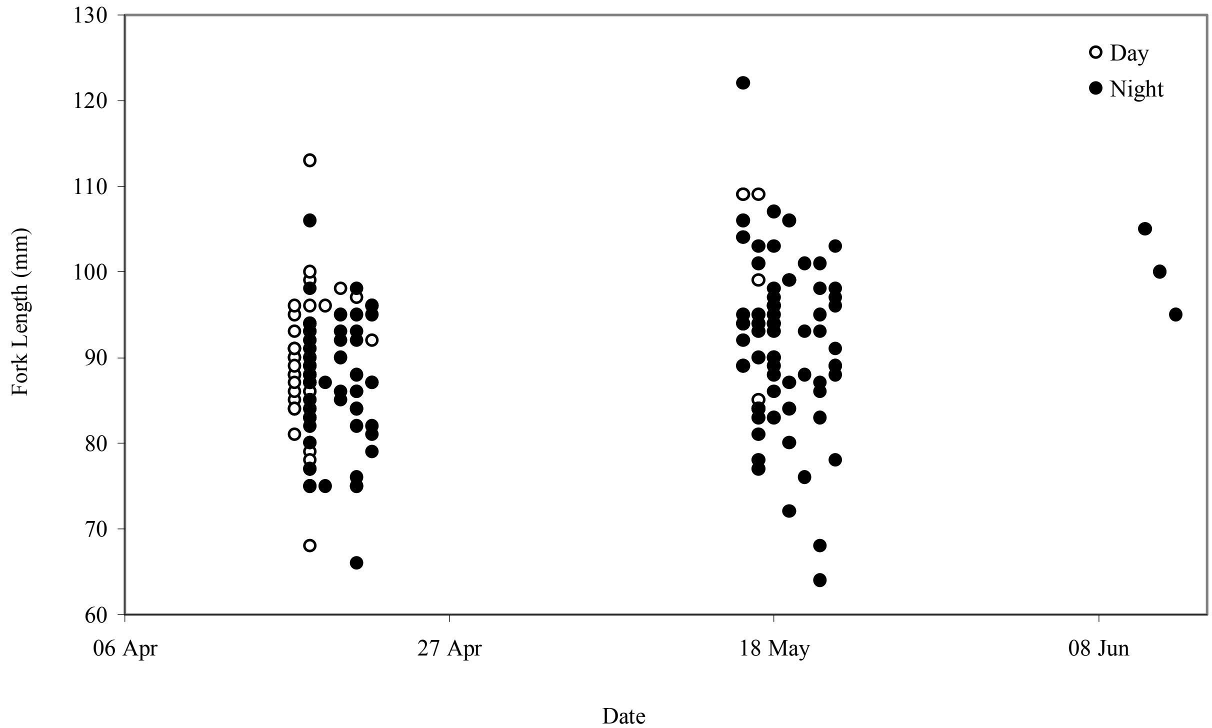
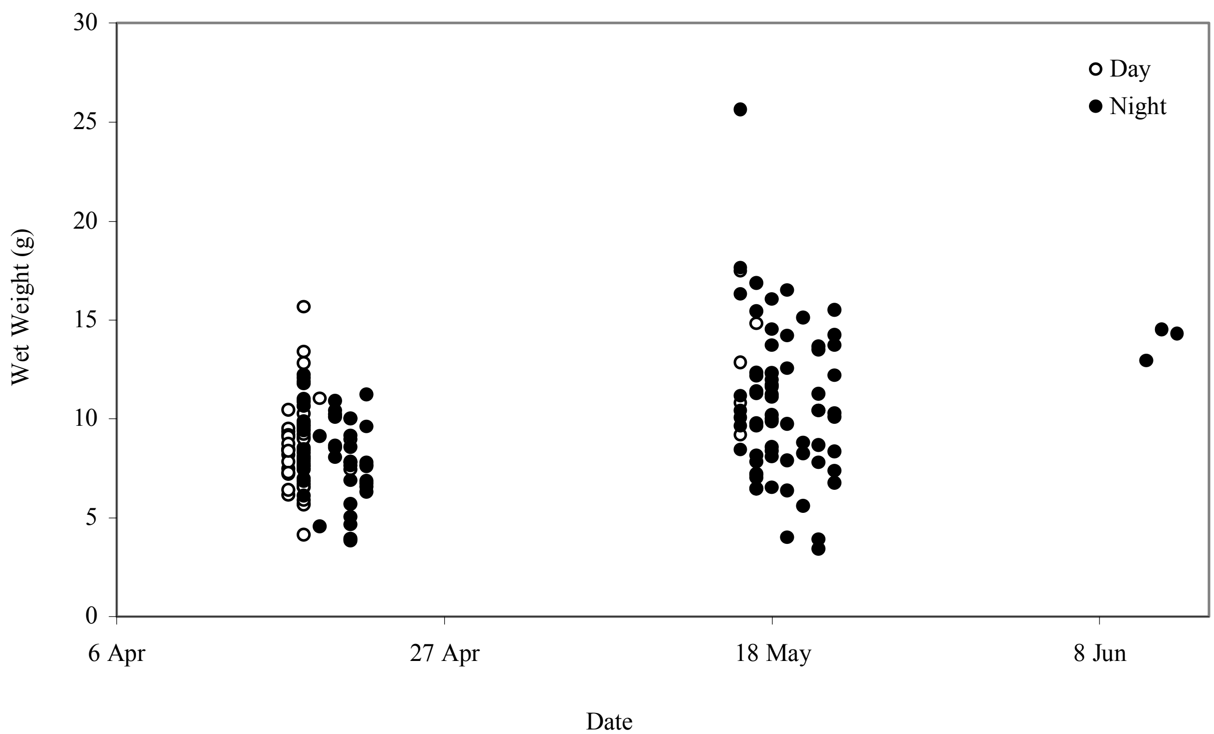


Figure 8
Chinook 1+ Wet Weights Sampled from Electrofishing, Nechako River, 2002



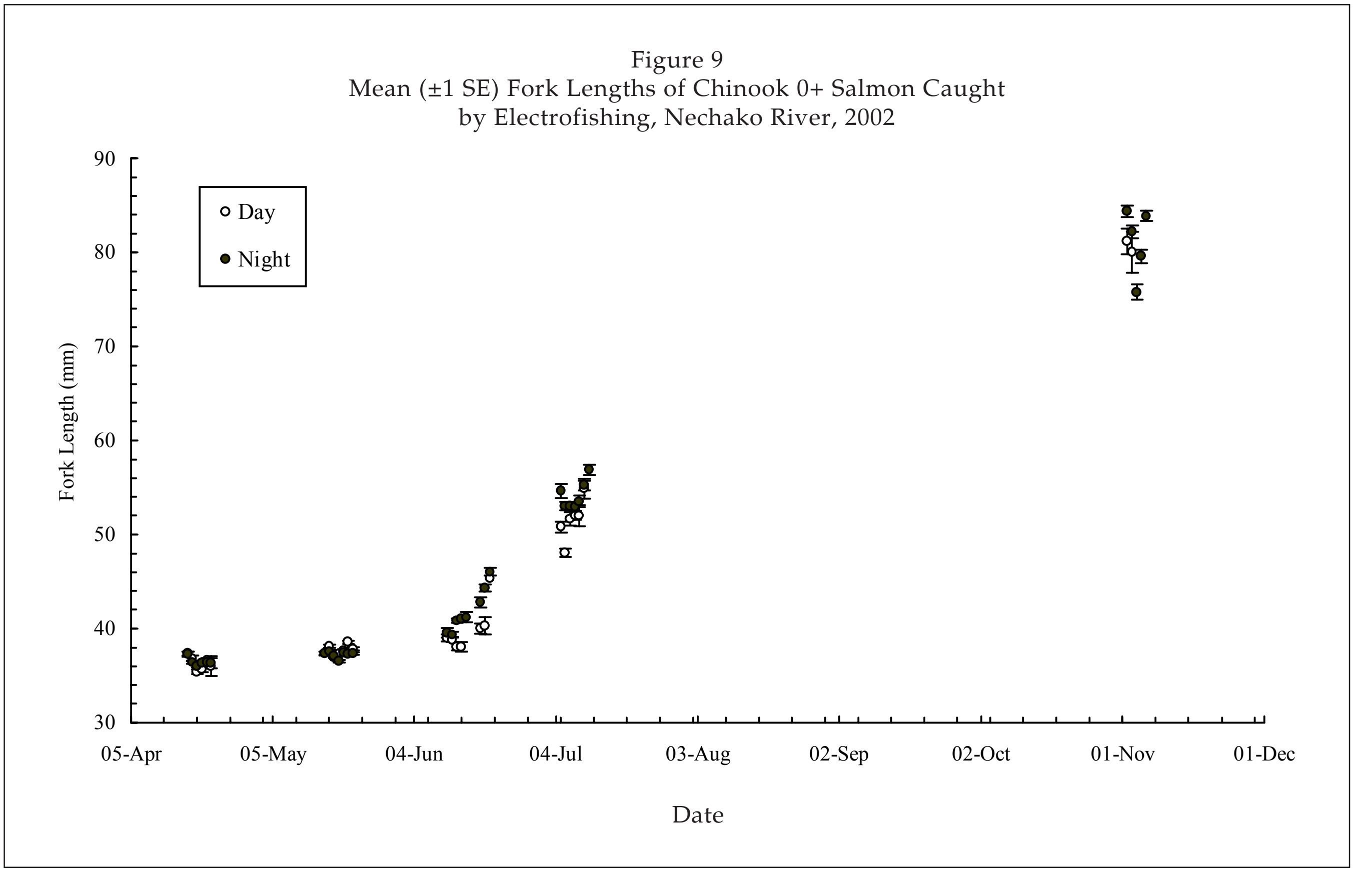


Figure 9
Mean (±1 SE) Fork Lengths of Chinook 0+ Salmon Caught
by Electrofishing, Nechako River, 2002
Day
Night
90
80
70
60
50
40
30
Fork Length (mm)
05-Apr
05-May
04-Jun
04-Jul
03-Aug
02-Sep
02-Oct
01-Nov
01-Dec
Date

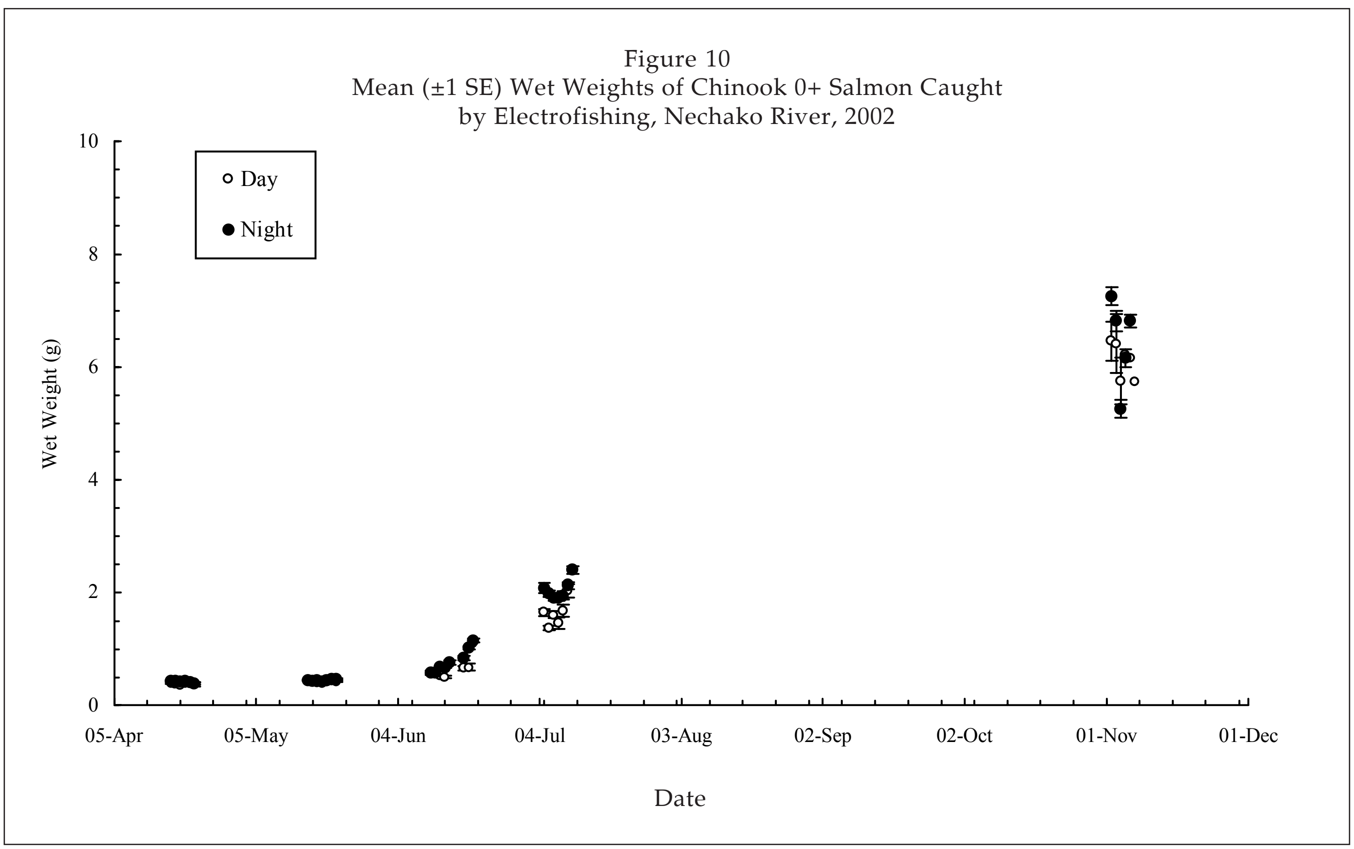


Figure 10
Mean (±1 SE) Wet Weights of Chinook 0+ Salmon Caught
by Electrofishing, Nechako River, 2002
Day
Night
10
8
6
4
2
0
Wet Weight (g)
05-Apr
05-May
04-Jun
04-Jul
03-Aug
02-Sep
02-Oct
01-Nov
01-Dec
Date

Chinook 1+ Growth

Chinook 1+ grew from April to May: the average fork length increased from 87.1 mm in April to 91.6 mm in May ($t_{150,\ 0.05}$ = 3.004, P<0.05, t-test on night-caught fish, ln-transformed values) and their weight increased from 8.5 g to 10.7 g during the same time ($t_{150,\ 0.05}$ = 3.9, P<0.05, t-test on night-caught fish, ln-transformed values).

0+ and 1+ Chinook Salmon Weight-Length Relationship

The relationship between wet weight and fork length of 0+ and 1+ chinook salmon is shown in Figure 11. Although a power function explained 97% of the overall variation (Weight = 1.5^{-01} . Fork Length 3.488, R^2 = 0.97 for all chinook), it was apparent that there was more variation among 1+ juveniles than among 0+ juveniles. Most juvenile 1+ were below the predicted weight for given fork lengths which indicates that the power function is a more accurate predictor of weight for shorter fork lengths (*i.e.,* 0+ chinook).

Overall, 1+ juveniles showed more variation in weight than 0+ juveniles for their size (Figure 12). The most likely explanation for this relates to the length of time taken to attain a given length. For example, 90 mm 0+ chinook will have been captured as part of the November sampling trip and will have spent approximately six months rearing in the river. Conversely, 90 mm 1+ chinook will likely have been captured during the May or June sampling trip, after having spent more than one year rearing in the river. Differences in feeding success and rearing habitat quality (which affect weight) on fish of similar length should be more apparent with time.

<u>*0+ and 1+ Chinook Salmon Condition*</u>

Average condition of 0+ chinook increased from 0.85 g/mm^3 in April (same value as in previous year) to 1.21 and 1.19 g/mm^3 in July and November, respectively (Figure 13; also same values as in previous year). Average condition of 1+ chinook salmon was constant at about 1.28 g/mm^3 from April to early July (Figure 14; once again, same value than last year).

Diamond Island Traps

Overall, 31,184 juvenile chinook salmon were caught by the rotary screw traps at Diamond Island in 2002 (Table 3 and Appendix 1): 30,736 0+ and 448 1+. Approximately 68% of all 0+ fish (as compared to 87% of all 1+ fish) were caught at night. This may reflect slightly different movement patterns or better avoidance of the traps during the day by older, more mobile, fish.

<u>*Chinook 0+*</u>

The distribution of juvenile 0+ chinook catches over time was essentially unimodal, with the peak of abundance centered around May 19, 2002 (Figure 15).

The numbers of 0+ chinook estimated to have passed Diamond Island between April 1 and July 20 ranged from 792,921 for trap 2 to 1,111,252 for trap 3 (Appendix 1). The total index number of 0+ chinook that passed Diamond Island, weighted by the average percent of river flow filtered by each trap, was 874,676.

All analyses of juvenile chinook catch distributions among traps were done on volume-expanded numbers unless mentioned otherwise, as they take into account the different water volumes sampled by different traps, and thus standardize the catches among traps. Analyses of morphological parameters were done on subsampled fish (not all fish caught were measured, see section on Rotary Screw Traps).

There was a significant interaction between time of capture (day or night) and trap position for juvenile chinook 0+ (Table 4). Therefore, the trap data were analysed separately by night and by day. The right margin trap caught significantly fewer chinook 0+ (absolute numbers) during the night than the two other traps, but there were no significant differences among traps during the day (Table 3, Figure 16). Overall, all traps caught more chinook 0+ at night (Figure 16). When water volume filtered by traps was taken into account (*i.e.*, standardized catches), no trap caught more fish than the others, although all traps caught significantly more chinook 0+ at night.

The chinook 0+ morphological parameters (fork length, wet weight) also differed among traps (Figures 17a and b): the left margin trap, which sampled more fish, tended to catch significantly larger juvenile chinook at night than either of the two other traps (tests done on ln-transformed data; differences of 4% in fork length from left margin to mid channel trap fish and 13% in wet weight, both at night). In past years, traps which have caught more fish (the two margin traps alternate in that regard) have also caught larger fish.

Figure 11
Wet Weight vs. Fork Length for Juvenile Chinook Salmon,
Nechako River, 2002: Electrofishing

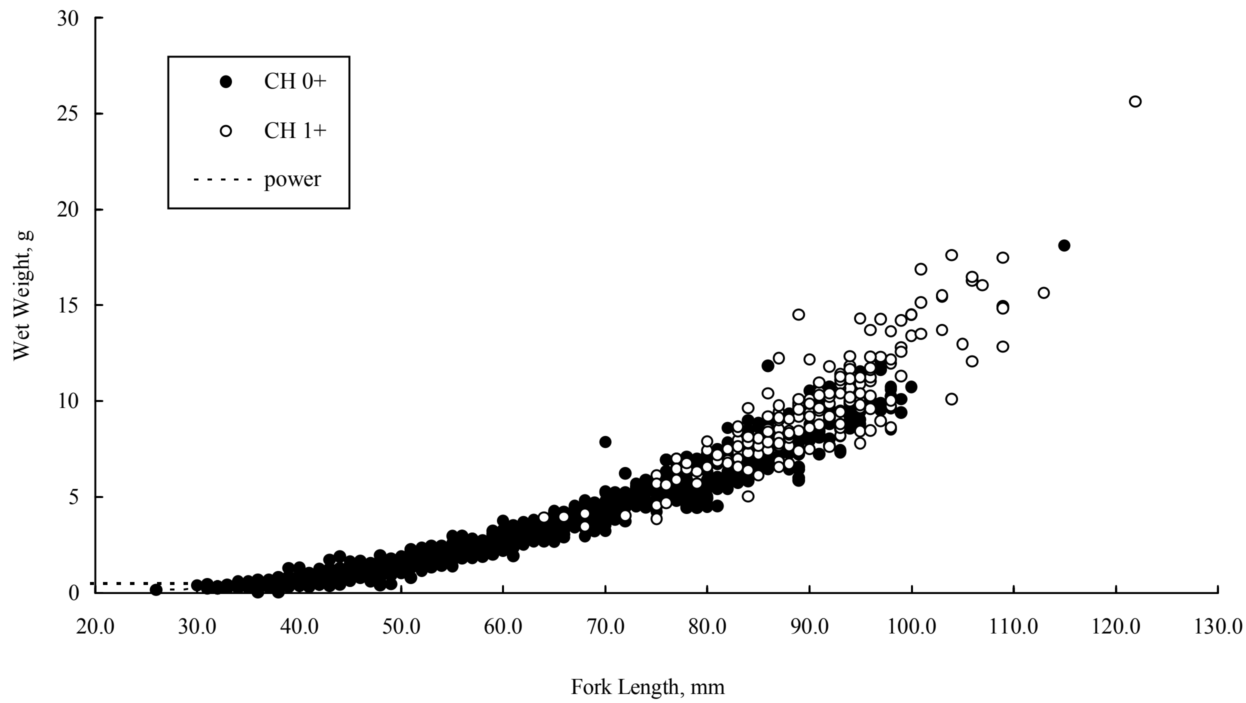


Figure 12
Variance in Juvenile Chinook Wet Weight per Fork Length
Fork lengths sorted per per day.
Fish caught electrofishing, Nechako River, 2002.

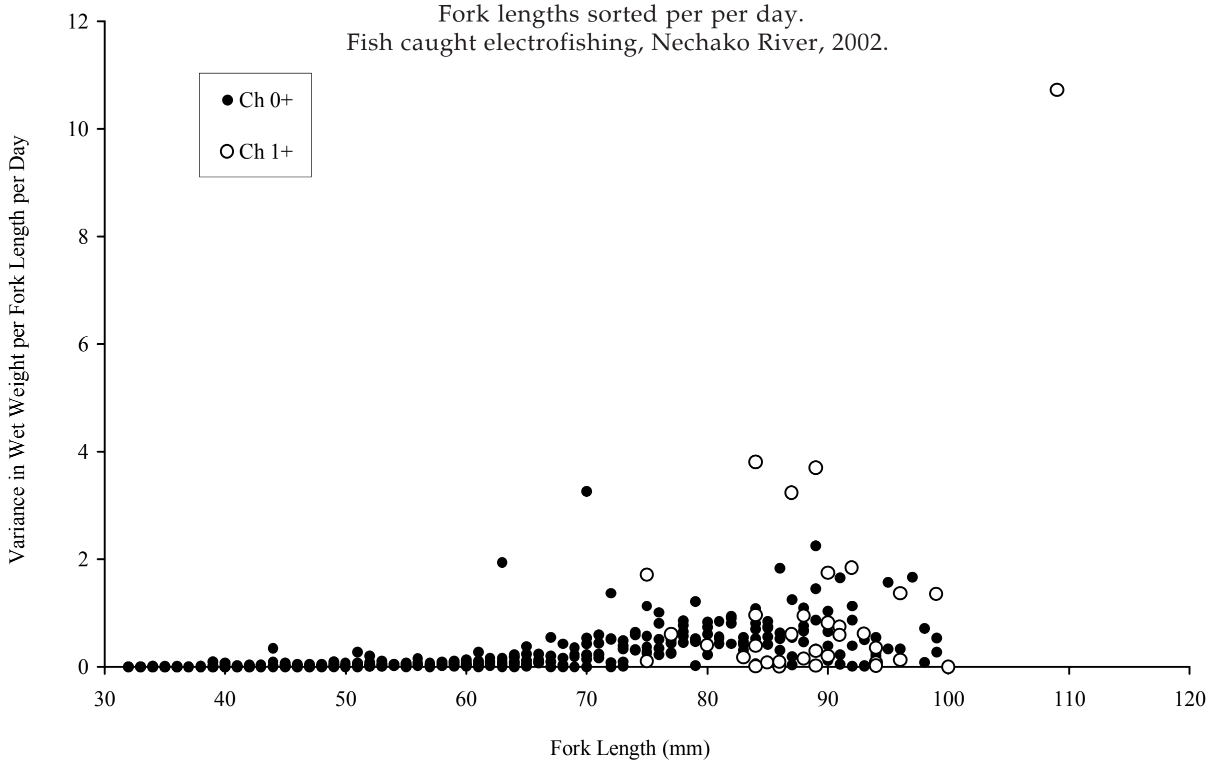


Figure 13
Mean Condition Indices of Juvenile Chinook 0+ Caught
by Electrofishing in the Nechako River, 2002
Error bars are 95% confidence intervals.

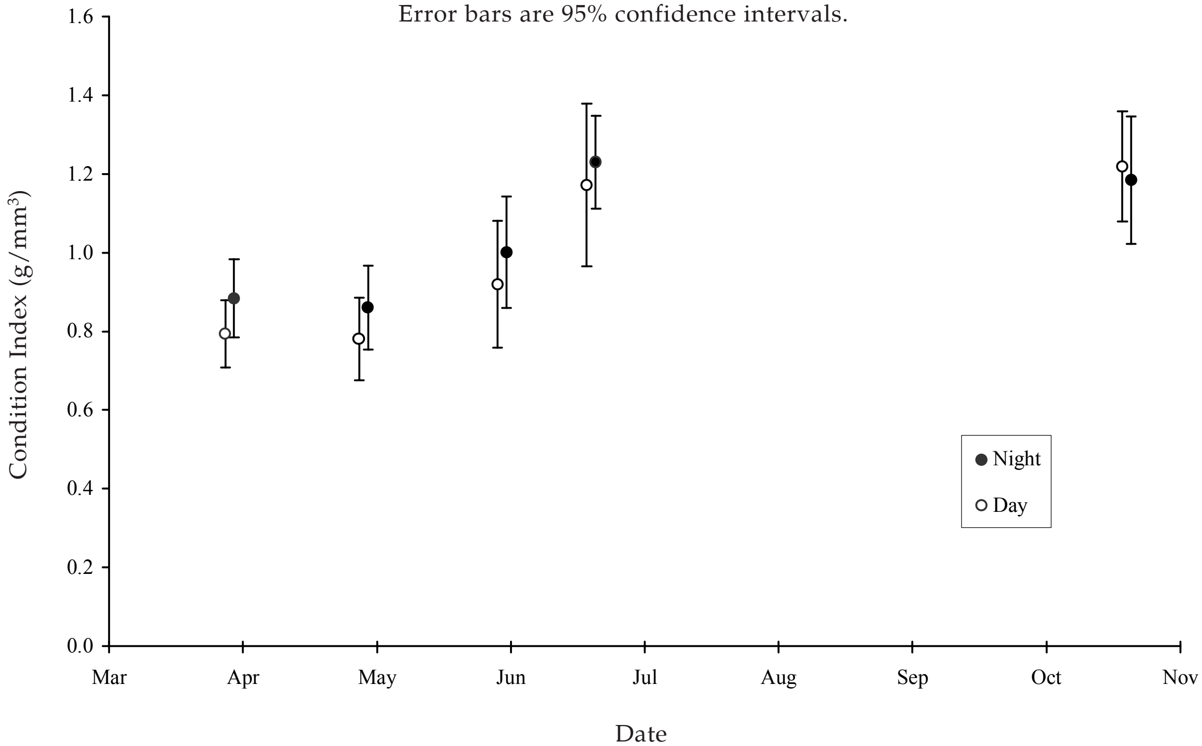


Figure 14
Condition Indices of Juvenile Chinook 1+ Caught by Electrofishing in the Nechako River, 2002
Error bars are 95% confidence intervals.
No ch 1+ were captured during the day in June.

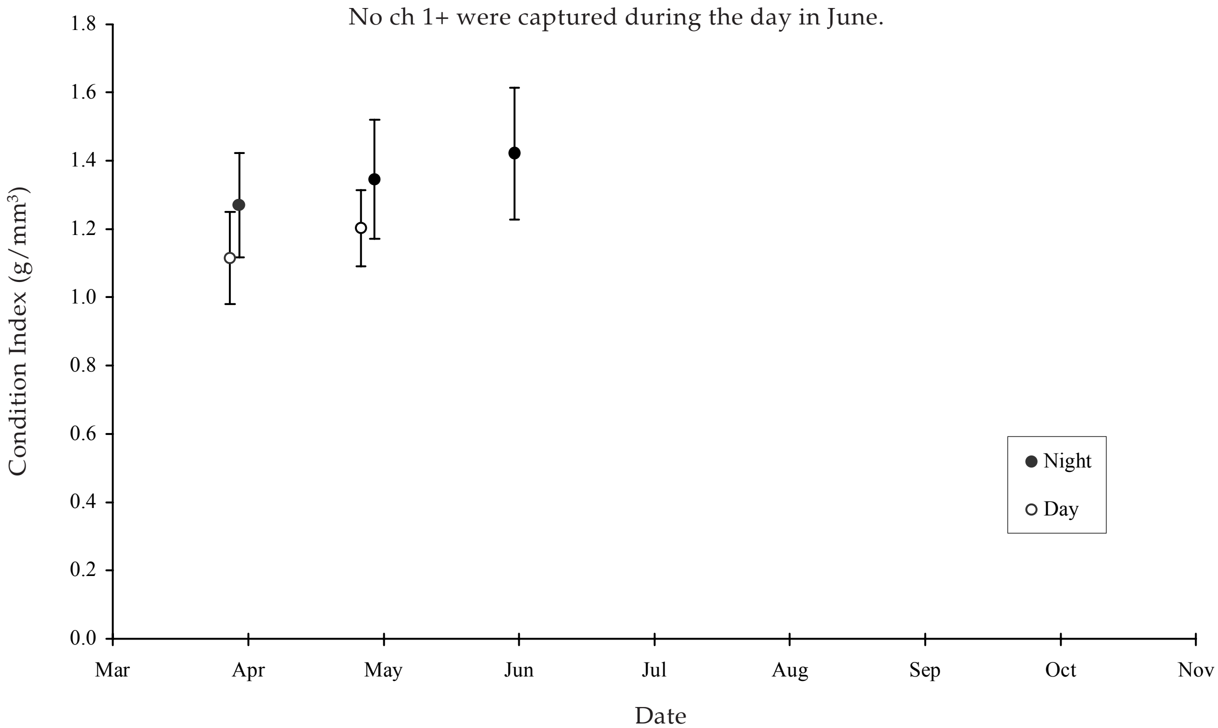


Table 3
Summary of Rotary Screw Trap (RST) Catches of Chinook 0+ and 1+
at Diamond Is, Nechako River, April 21 to July 20, 2002

Trap Number	Trap Location	0+ chinook			1+ chinook		
		day	night	total	day	night	total
1	Left Margin	3,707	8,549	12,256	32	218	250
2	Mid Channel	2,356	7,112	9,468	20	110	130
3	Right Margin	3,870	5,142	9,012	7	61	68
	Total	9,933	20,803	30,736	59	389	448

Figure 15
Juvenile Chinook Salmon 0+ and 1+ Caught in Rotary Screw Traps, Nechako River, 2002
Day and night catches included. Note different scales for Ch 0+ and 1+.

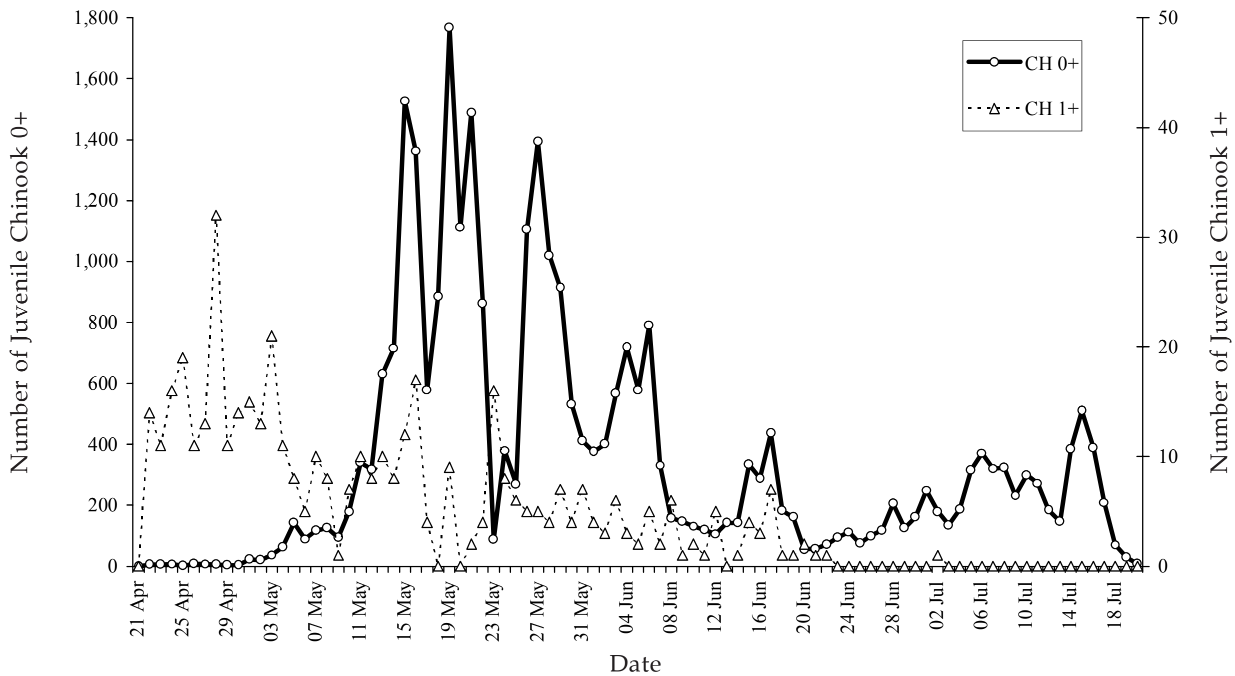
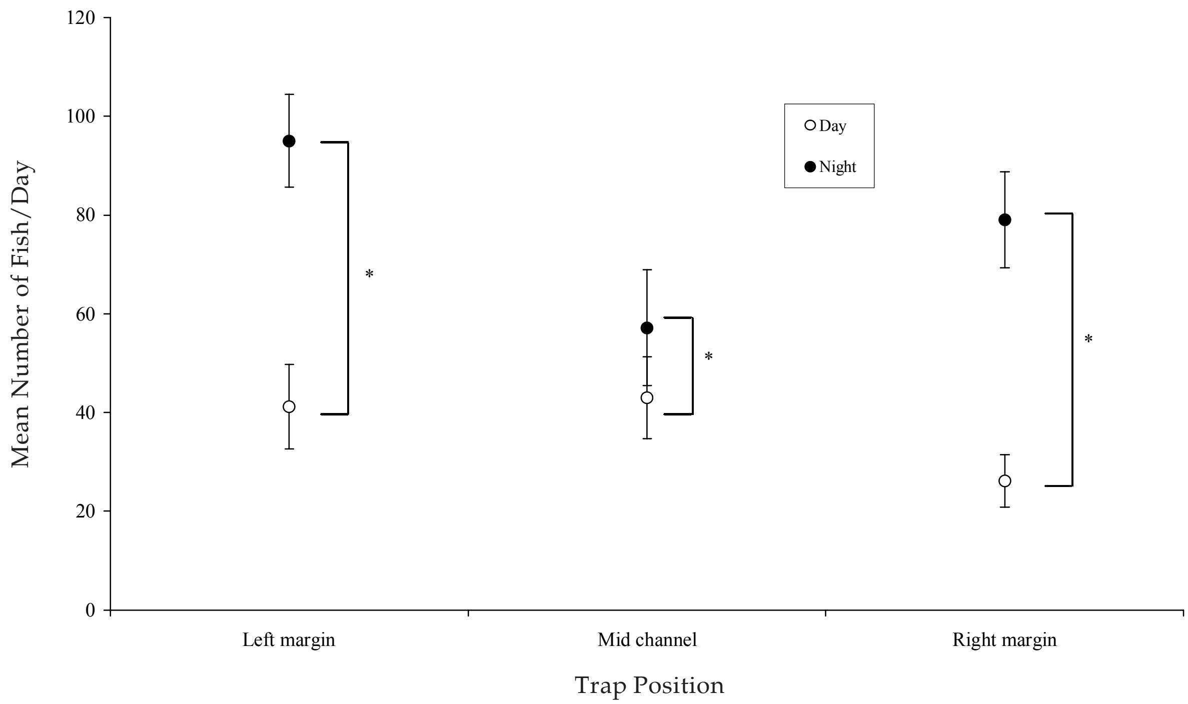


Table 4
Factorial ANOVA on Numbers of Juvenile Chinook 0+ Captured by
Rotary Screw Traps Standardized by Volume Sampled, Nechako, 2002
Ln-transformed values.

	DF	Sum of Squares	Mean Square	F-Value	Significance
Day/Night	1	403.851	403.851	55.38	S
Trap location	2	3.311	1.656	0.227	NS
Day/Night * trap location	2	47.317	23.658	3.244	S
Residual	534	3894.126	7.292		

Figure 16
Mean Numbers (± SE) of Juvenile Chinook 0+ Caught in Rotary Screw Traps,
Nechako River, April 21- July 20, 2002.

*: Night and day catches are significantly different for all traps, PLSD test on ln-transformed values.



The significant effect of time of day was probably due to a combination of greater avoidance of traps during the day (larger fish having better control) and to greater numbers of fish moving at night.

Chinook 1+

The numbers of 1+ chinook estimated to have passed Diamond Island between April 2 and July 17 ranged from 5,353 for trap 3 to 16,456 for trap 1 (Appendix 1). The total index number of 1+ chinook that passed Diamond Island, weighted by the average percent of river flow filtered by each trap, was 11,155.

There were significant interactions between time of capture (day or night) and trap position for juvenile chinook 1+ (Table 5): there were more fish caught at night, and the left margin trap caught significantly more fish in terms of absolute numbers and per average session (Table 3; Figure 18). Both juvenile 0+ and 1+ chinook thus tended to use the middle of the river more than its margins in 2002, as opposed to 2001 when 0+ fish were caught in greater numbers along the margin (in the right margin trap).

Chinook 1+ morphological parameters (fork length, wet weight) were slightly larger in the left margin trap (Figure 19; tests done on ln-transformed data). Only night catches were tested as there were only 59 fish caught during the day (Table 2): there were differences of 4 % and 19% among traps for fork length and wet weight, respectively.

0+ Chinook Salmon Growth

Lengths and weights of 0+ chinook captured at Diamond Island followed trajectories similar to those of electrofished 0+ chinook (Figures 20 and 21; compare with Figures 9 and 10). The first growth stanza ran from early April to early to mid-June, at which time the rate of fry emergence had dropped to a level that allowed the true population growth curve to become apparent. From June 10 to July 20, chinook 0+ grew at an average of 0.59 mm per day, based on night catches. This growth rate is higher than the two previous years,

Figure 17
Mean Fork Length and Wet Weight of Juvenile Chinook Salmon Caught in Rotary Screw Traps,
Diamond Island, Nechako River, April - July 2002

*: significantly different among traps, same time period.
Tests on ln-tranformed data.

Figure 17A

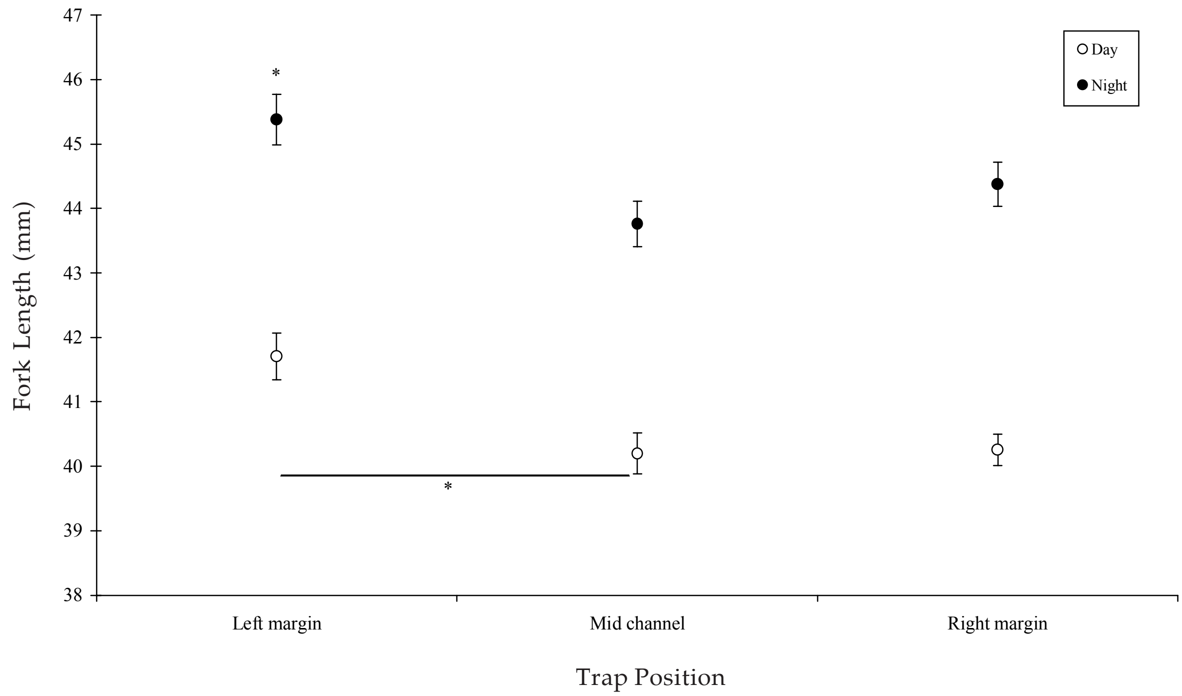


Figure 17B

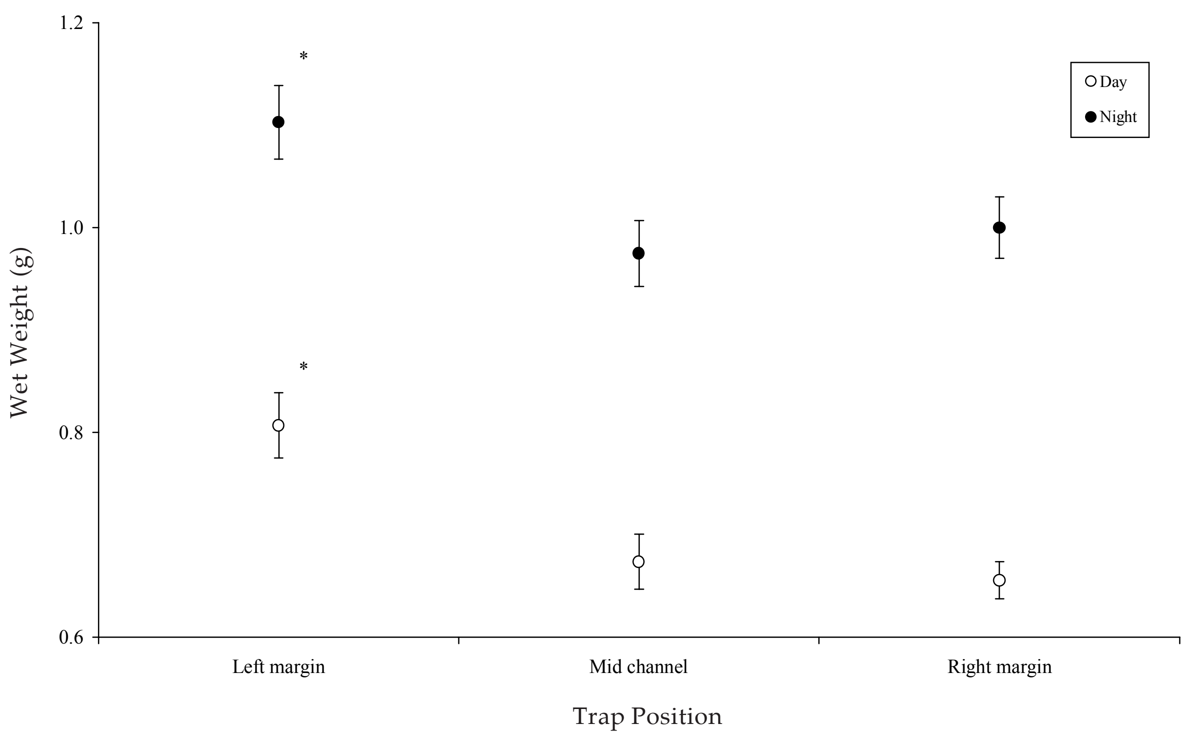


Table 5
Factorial ANOVA on Numbers of Juvenile Chinook 1+ Captured by Rotary Screw Traps Standardized by Volume Sampled, Nechako, 2002
Ln-transformed values.

	DF	Sum of Squares	Mean Square	F-Value	Significance
Day/Night	1	27.599	27.599	91.953	S
Trap location	2	11.314	5.657	18.848	S
Day/Night * trap location	2	4.592	2.296	7.65	S
Residual	534	160.278	0.3		

Figure 18
Mean Numbers (± SE) of Juvenile Chinook 1+ Caught in Rotary Screw Traps,
Nechako River, April 21- July 20, 2002

* = significantly different from other traps during same time period, PLSD test on ln-transformed values.

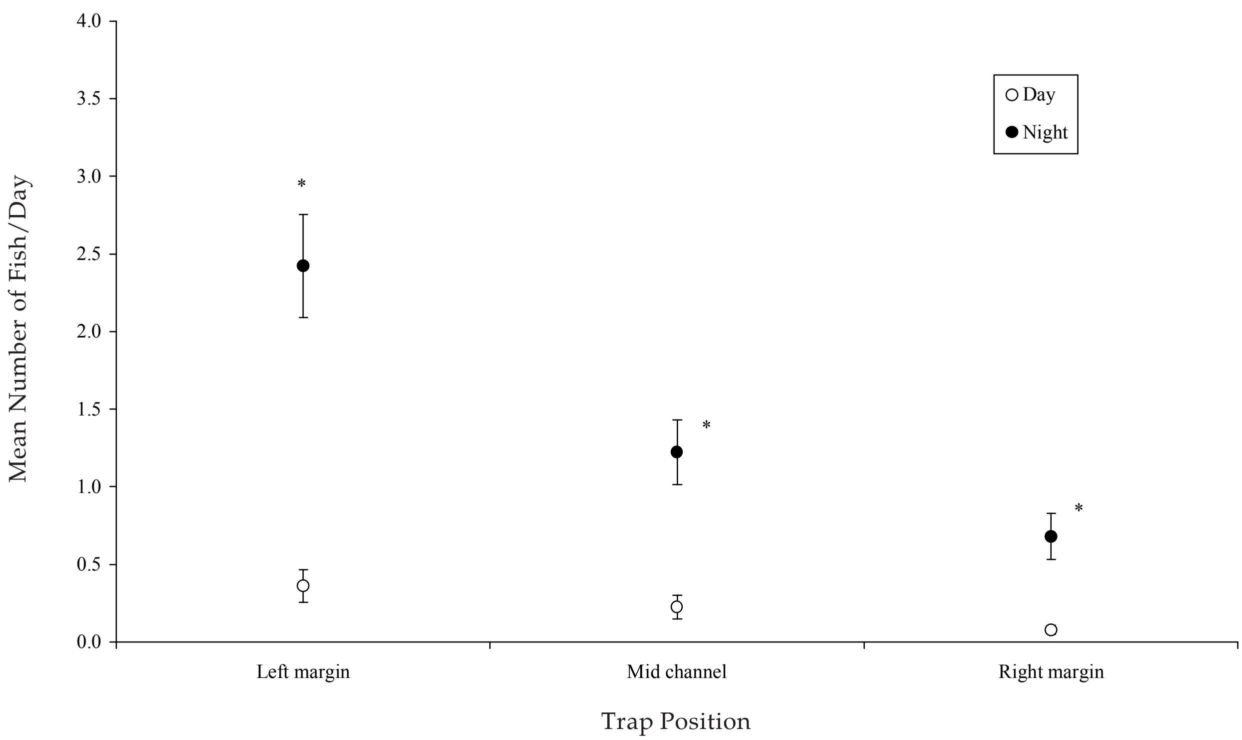


Figure 19
Mean Fork Length and Wet Weight (± SE) of Juvenile Chinook 1+ Caught in Rotary Screw Traps at Night, Nechako River, April 21- July 20, 2002
* = significantly different from other traps, PLSD test on ln-transformed values.

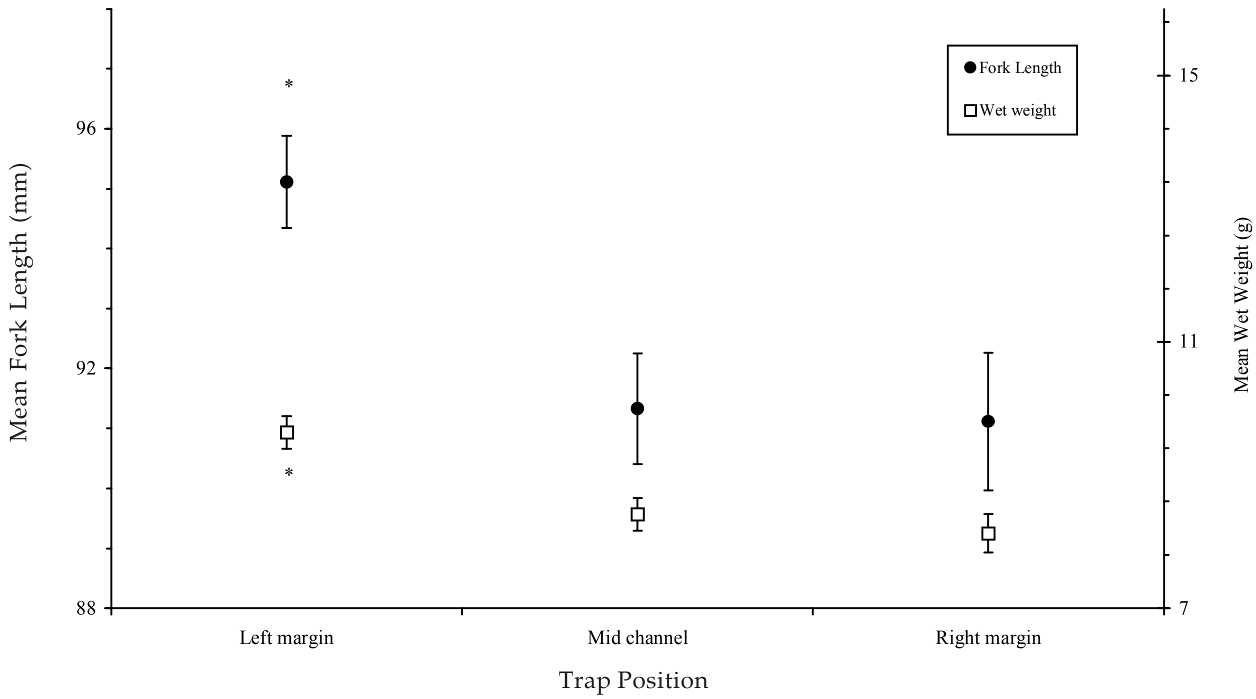


Figure 20
Mean Length (±SD) of 0+ Chinook Salmon Caught in Rotary Screw Traps, Nechako River, 2002

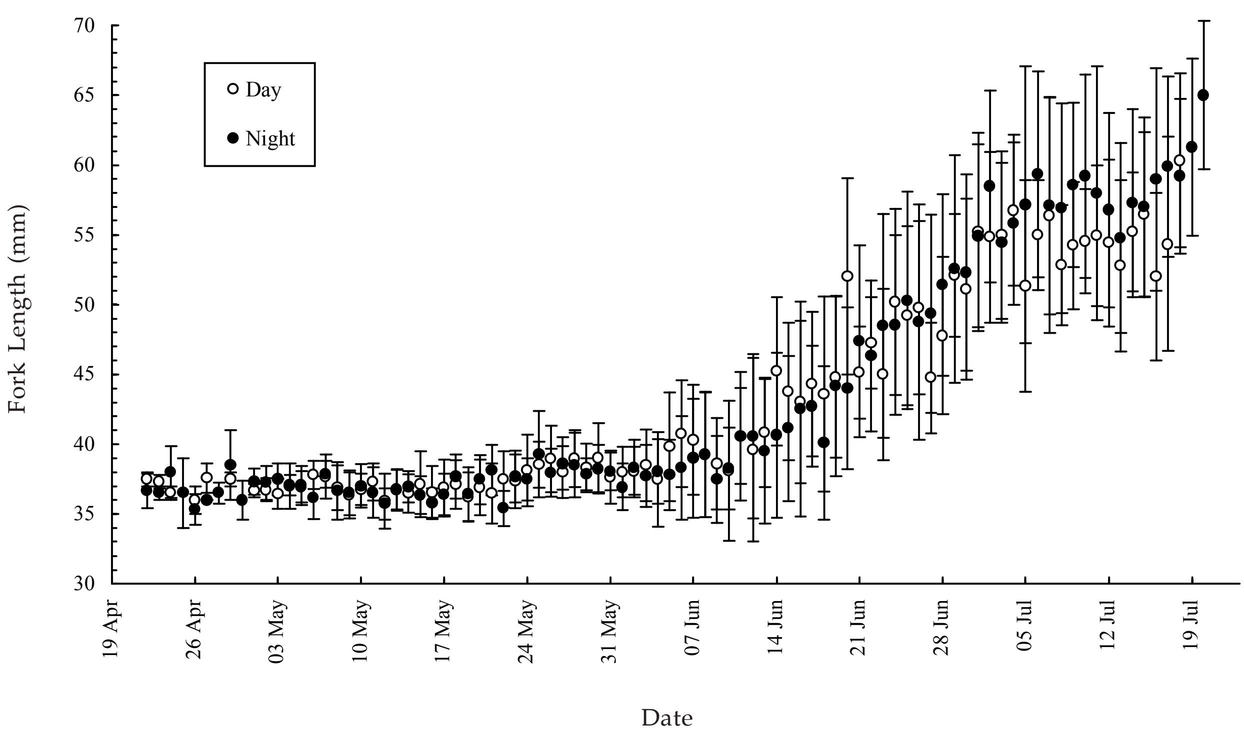
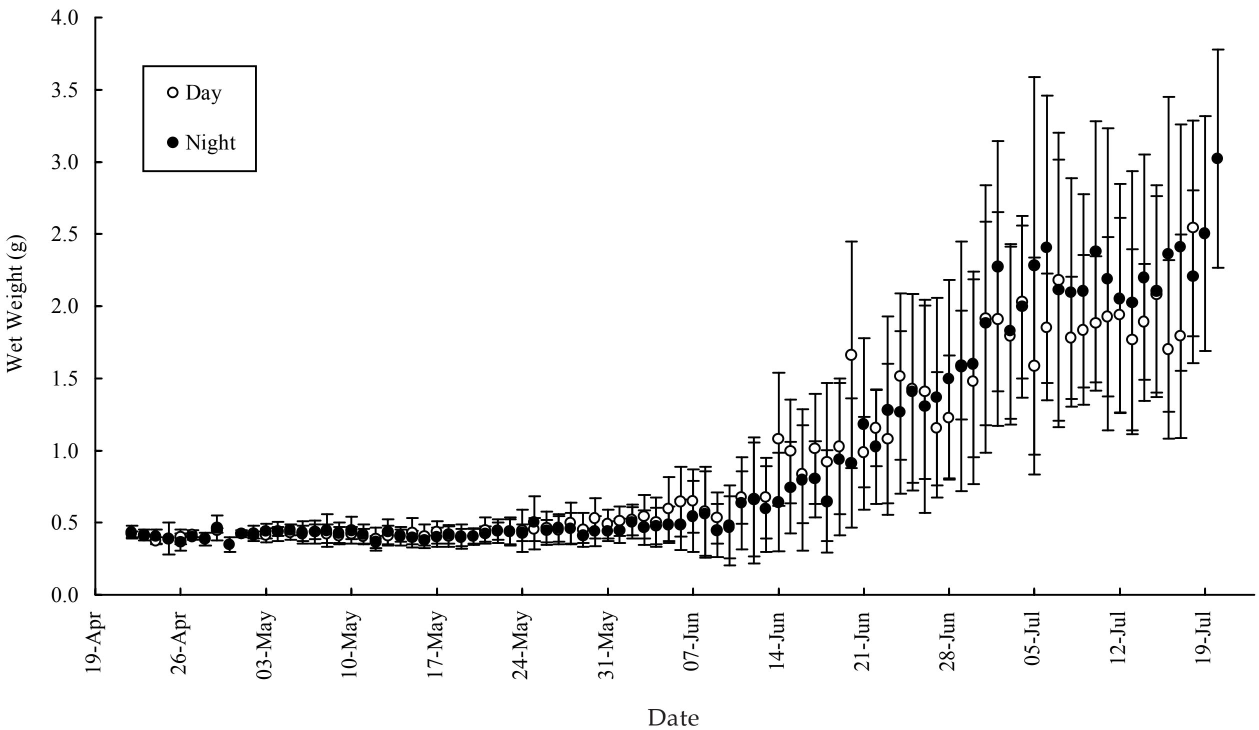


Figure 21
Mean Weight (±SD) of 0+ Chinook Salmon Caught in Rotary Screw Traps , Nechako River, 2002



when they grew at an average of 0.52 and 0.49 mm per day from mid May until July 20. This may constitute compensatory growth for the delayed time of emergence compared to the previous two years.

1+ Chinook Salmon Growth

The fork lengths and weights of 1+ chinook did not vary much in time, which would be expected in fish about to leave the stream (Figures 22 and 23). Yearling chinook grew on average by 0.16 mm, much more than the 0.02 mm per day reported in 2001, and identical to the 2000 value (results based on night catches). Last year's low rate may have thus been an anomaly.

0+ and 1+ Chinook Salmon: Weight-Length Relationship

The regression of weight on length for trap-caught juvenile chinook salmon at Diamond Island (N = 3,678, Wt = 1.4^{-01} * $FL^{3.562}$, R^2 = 0.96, P<0.001) was similar to the regression for juvenile chinook salmon caught by electrofishing (N = 7,178, Wt = 1.5^{-01} . Fork Length $^{3.488}$, P<0.001).

0+ and 1+ Chinook Salmon Condition

The trajectory of the average condition of 0+ chinook salmon was similar to that shown for electrofished fish—it hovered around 0.83 over April and May (emerging fish) and climbed to an asymptote of 1.1 g/mm^3 in early July. Condition of 1+ chinook also increased slightly with date from 1.02 g/mm^3 in late April to 1.12 g/mm^3 in July.

In summary, electrofishing surveys and rotary screw trap catches measured similar trends in length, weight and condition of juvenile chinook salmon in the upper Nechako River in 2002. The curvature of the growth curves of 0+ chinook indicated that emergence had ceased by early June and that growth was rapid over June and July.

Figure 22
Mean (±1 SD) Length of 1+ Chinook Salmon, Nechako River, 2002, from Rotary Screw Traps

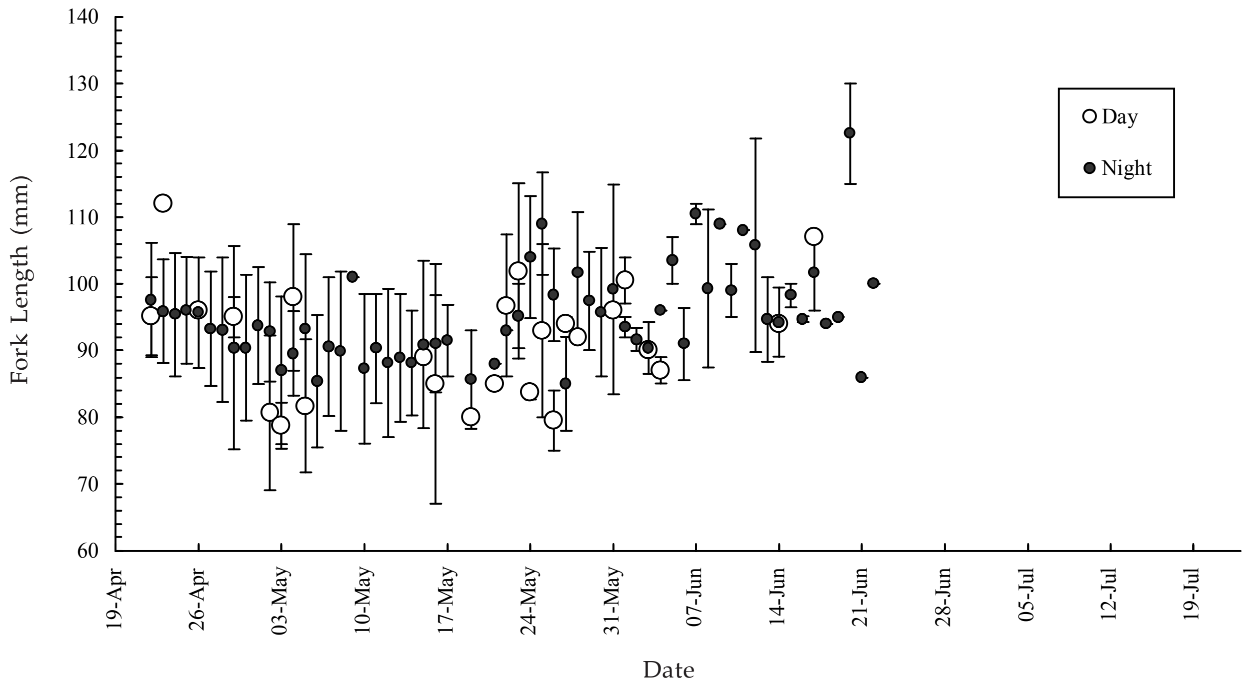
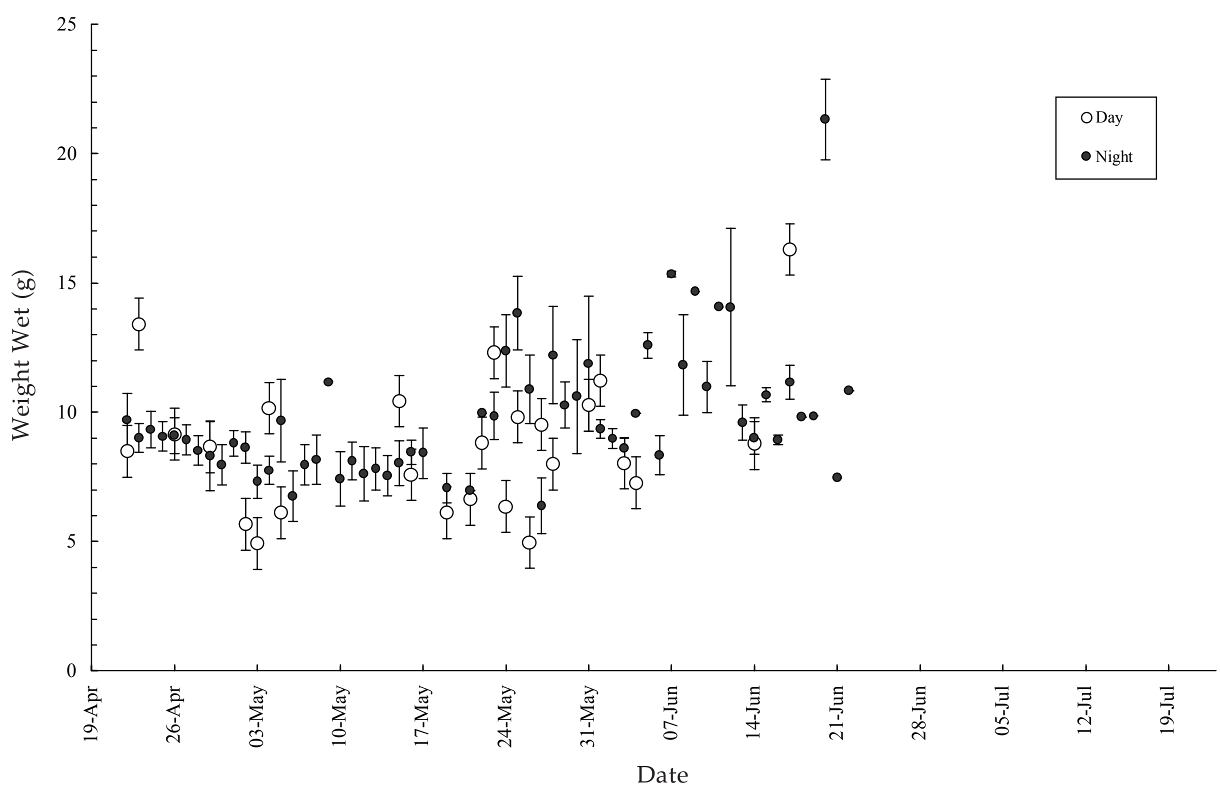


Figure 23
Mean (±1 SE) Weight of 1+ Chinook Salmon, Nechako River, 2002, from Rotary Screw Traps



Catches

Electrofishing/All Species

In total, 1,274 electrofishing sweeps were made along the margins of the upper Nechako River from April 16 to November 5, 2002: 637 during daylight and 637 at night. The average area covered by a sweep was 133 m^2 (median 120 m^2, range = 40 to 1,600 m^2). Most of the sweeps were less than 200 m^2 in area. The greatest amount of effort directed to a single site was applied, as in previous years, to RM17.9, a 1600 m^2 side channel that was found to contain many fish. Effort at individual sites ranged from 101 to 1800 s (median 242 s).

Overall, 54,646 fish from 12 species or families were captured and then released (Table 2). This is a decrease from last year, when 68,517 fish were caught. Chinook salmon were as usual the most common species but accounted for higher percentage than usual (36,836 or 65% of the total, as compared to 49% last year), followed by redside shiners (N = 5,427 or 10%) and longnose dace (N = 3,576 or 6%). Coho salmon and peamouth chubs were the least common species (N = 3 and 4, respectively). The vast majority of fish sampled were juveniles, with leopard dace having the lowest proportion of juveniles (75%).

Electrofishing/0+ Chinook

Overall, 36,656 0+ chinook were captured by electrofishing (Table 6), of which 7,703 or 14% were taken during daylight. CPUE of electrofishing catches of 0+ chinook ranged from 0 to 472 fish/100 m^2.

<u>Temporal Distribution of CPUE</u>

CPUE for 0+ chinook salmon peaked in May for day and night catches, and then decreased through to November (Table 6).

<u>Spatial Distribution of CPUE</u>

Based on the distribution of CPUE, newly emergent chinook salmon (April) were concentrated in the upper river (Figure 24 and Appendix 2). Over the next two months (May to June), the fish spread themselves throughout the river, although there generally were more fish at either end of the upper river (10-30 km and 50-80 km). This may indicate both active upstream migration of juveniles, presumably in search of rearing habitat, as well as downstream movement of outmigrating juveniles. Most fish appeared to favour the first 20 km of the river in July, which may indicate the outmigration fish from the lower reaches. By early November, many of the juveniles remaining in the river (the CPUE was then at its lowest since April) occupied the lower river.

Electrofishing/1+ Chinook

Overall, of the 180 1+ chinook that were captured by electrofishing (Table 6), most (86%) were caught at night. CPUE of 1+ chinook ranged from 0.0 to 11.1 fish/100 m^2, and decreased rapidly with date (Appendix 2).

Diamond Island Rotary Screw Traps/Incidental Species

Overall, 36,664 fish from 12 species or families were captured by the rotary screw traps in 2002 (Table 7). Chinook salmon were the most common species, accounting for 85% of all fish. The five most common non-salmonid fish were northern pikeminnow, largescale sucker, leopard dace, sockeye salmon and redside shiner. The ranking of the species was different from that reported for the electrofishing surveys, juveniles were the most abundant life history stage sampled by both techniques. Electrofishing surveys sampled a greater and probably more representative proportion of the species inhabiting the Nechako River: the electrofishing surveys covered a greater area and more diverse habitats. This was backed by the greater species evenness[1]: 0.11 for rotary screw traps sampling and 0.19 for electrofishing (Simpson's measure of evenness; Krebs 1999). Both measures were lower than the two previous years (0.17 for 2001 and 0.48 for 2000 — rotary screw traps and 0.29 and 0.30 for electrofishing). This suggests that was increased dominance and abundance of chinook in the past years when compared to 2002.

[1] Species evenness is the proportional representation of species within the sampled community, evenness being greatest when all species have equal representation (Krebs 1999).

Table 6
Mean Electrofishing Catch-Per-Unit-Effort (CPUE, number/100 m^2)
of Juvenile Chinook Salmon, Nechako River, 2002

Date	Number of fish		N	0+ CPUE		1+ CPUE	
	0+	1+		mean	SD	mean	SD
Day							
Apr	157	19	108	1.22	1.5	0.16	0.42
May	3,222	7	137	18.74	19.3	0.04	0.20
Jun	776	0	137	4.35	7.6	0.00	0.00
Jul	1,071	0	137	5.85	16.2	0.00	0.00
Nov	66	0	117	0.49	0.8	0.00	0.00
sum	5,292	26					
Night							
Apr	469	88	109	3.4	5.0	0.68	1.62
May	11,299	56	137	63.8	72.8	0.35	0.89
Jun	9,987	10	137	58.7	60.4	0.06	0.44
Jul	8,554	0	137	52.4	61.8	0.00	0.00
Nov	1,055	0	117	7.8	8.5	0.00	0.00
sum	31,364	154					
Total	36,656	180					

Comparisons with Previous Years

Temperature

Mean daily water temperatures at Bert Irvine's Lodge in 2002 were for the most part below the average observed in the previous 12 years (Figure 2). Temperatures in the upper Nechako River in 2002 never approached the 20°C.

Flows

Daily flows of the upper Nechako River at Cheslatta Falls in 2002 were close to the 15-year average (1987-2001) for most of the year, except for mid- to late July (Figure 25). It is not possible to quantitatively compare cumulative daily flows for 2002 with those of previous years as data from Jan 1 until May 16, 2002 are missing (Figure 26) due to a failure of equipment at the Water Survey of Canada gauging site. The shape of the distribution appears however similar to those of previous years, as cooling flows were released from the reservoir in July and August.

Growth of 0+ Chinook Salmon

Mean fork length of 0+ chinook salmon electrofished in 2002 ranged from 36 mm in April to 81 mm in November, while mean wet weight ranged from 0.4 g in April to 6.5 g in November. Both mean fork length and mean wet weight were in the lower range for chinook measured in the previous 13 years (1989 – 2001), as were those of 2001 and 2000. The condition index for 0+ chinook salmon ranged from 0.8 in May to 1.2 in both July and November. Condition index values were below the 13-year average for May and June, but above the average for April, July and November (Figure 27) possibly the result of the cooler then normal water temperatures throughout the year.

Mean fork length of 0+ chinook salmon caught in rotary screw catches in 2002 ranged from just over 37 mm in April and May to 57 mm in July, while mean wet weight ranged from 0.4 g in April and May to 2.13 g in July. Both mean fork length and mean wet weight were below the average for the last 11 years (1991 – 2001). The condition index for chinook caught in rotary screw catches at Diamond Island ranged from 0.8 in April to 1.1 in July, values that were close to the average for the last 11 years (1991 – 2001, Figure 28).

Table 7
fsFish Captured in the Rotary Screw Traps in the Upper Nechako River, 2002

		Adult				Juvenile				Total			
Common Name	Scientific Name	Day	Night	Total	Percent	Day	Night	Total	Percent	Day	Night	Total	Percent
Chinook salmon	*Oncorhynchus tshawytscha* [1]	59	389	448	1.2	9,933	20,803	30,736	83.8	9,992	21,192	31,184	85.1
Northern pikeminnow[2]	*Ptychocheilus oregonensis*	0	7	7	0.0	84	1,020	1,104	3.0	84	1,027	1,111	3.0
Largescale sucker	*Catostomus macrocheilus*	1	10	11	0.0	127	1,010	1,137	3.1	128	1,020	1,148	3.1
Leopard dace	*Rhinichthys falcatus*	81	393	474	1.3	98	487	585	1.6	179	880	1,059	2.9
Redside shiner	*Richardsonius balteatus*	37	350	387	1.1	59	190	249	0.7	96	540	636	1.7
Sockeye salmon	*Oncorhynchus nerka* [1]	0	1	1	0.0	69	762	831	2.3	69	763	832	2.3
Rocky mountain whitefish	*Prosopium williamsoni*	0	3	3	0.0	27	109	136	0.4	27	112	139	0.4
Peamouth chub	*Mylocheilus caurinus*	0	0	0	0.0	39	90	129	0.4	39	90	129	0.4
Rainbow trout	*Oncorhynchus mykiss*	0	1	1	0.0	5	112	117	0.3	5	113	118	0.3
Longnose dace	*Rhinichthys cataractae*	8	71	79	0.2	21	147	168	0.5	29	218	247	0.7
Sculpins (General)	*Cottidae*	1	20	21	0.1	8	28	36	0.1	9	48	57	0.2
Burbot	*Lota lota*	0	1	1	0.0	0	3	3	0.0	0	4	4	0.0
Total		128	857	985	2.7	537	3,958	4,495	12.3	665	4,815	36,664	100.0

[1] "adult" = 1+ fish in this case
[2]previously known as "northern squawfish" (Nelson et al. 1998).

Figure 24
Mean (+ 1 SD) Monthly Catch-Per-Unit-Effort (CPUE, in fish caught per 100 m²) of 0+ Chinook Salmon, Nechako River, 2002: Electrofishing

No sampling in the 40-49.9 km area.

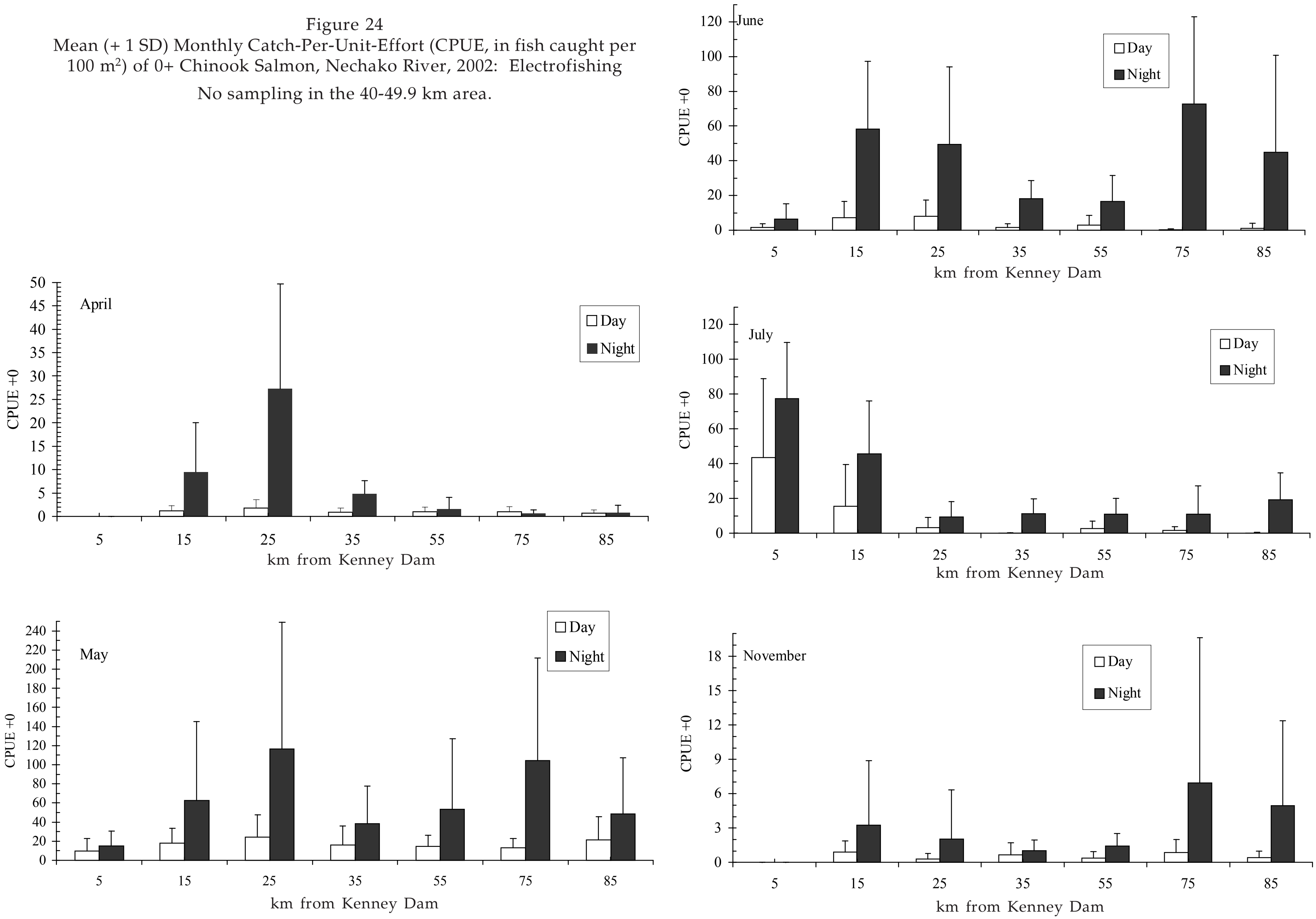


Figure 25
Comparison of Mean, Maximum and Minimum Daily Flow of the Nechako River at Cheslatta Falls in 2002 with Flows for the Years 1987 to 2001

Data for 2002 still preliminary and incomplete.

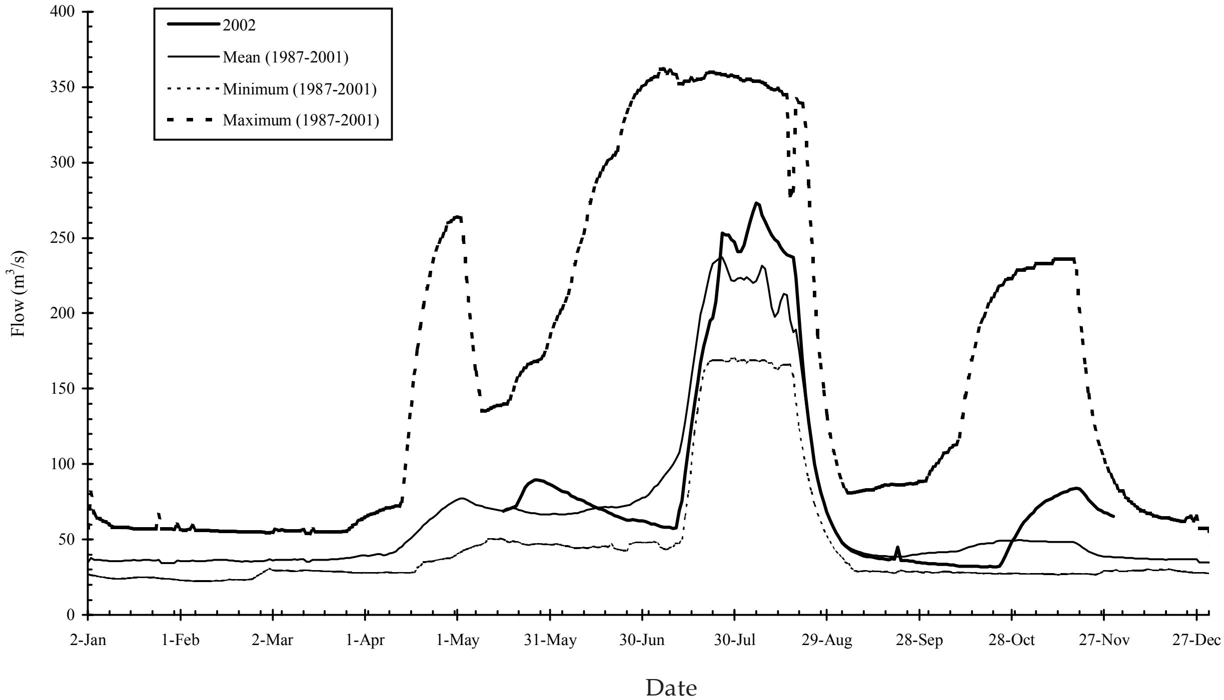


Figure 26
Cumulative Flows of the Nechako River at Cheslatta Falls, 1987 to 2002

Data for 2002 preliminary and missing from Jan1 - May 16 and from Nov 30 until the end of the year.

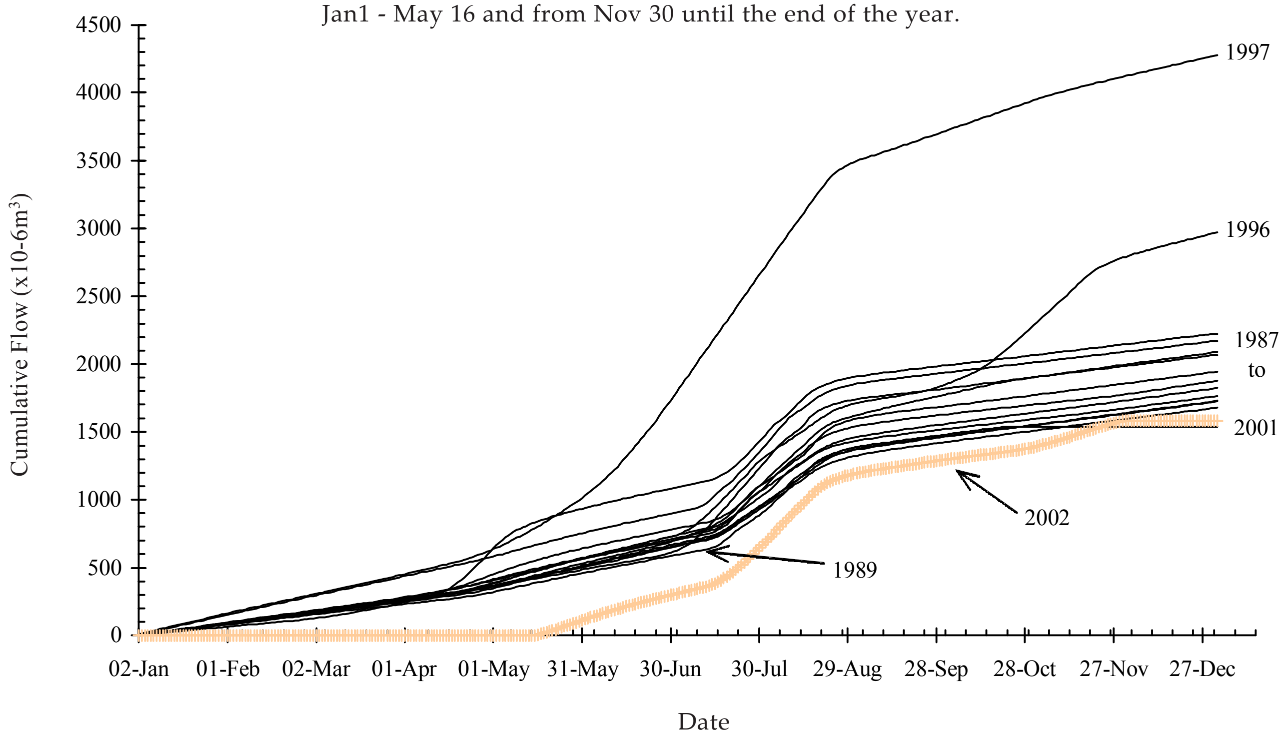


Figure 27
Comparison of Mean Size of 0+ Chinook in the Upper Nechako River in 2002 with Mean, Minimum and Maximum Size for 1989 to 2001 (Electrofishing)

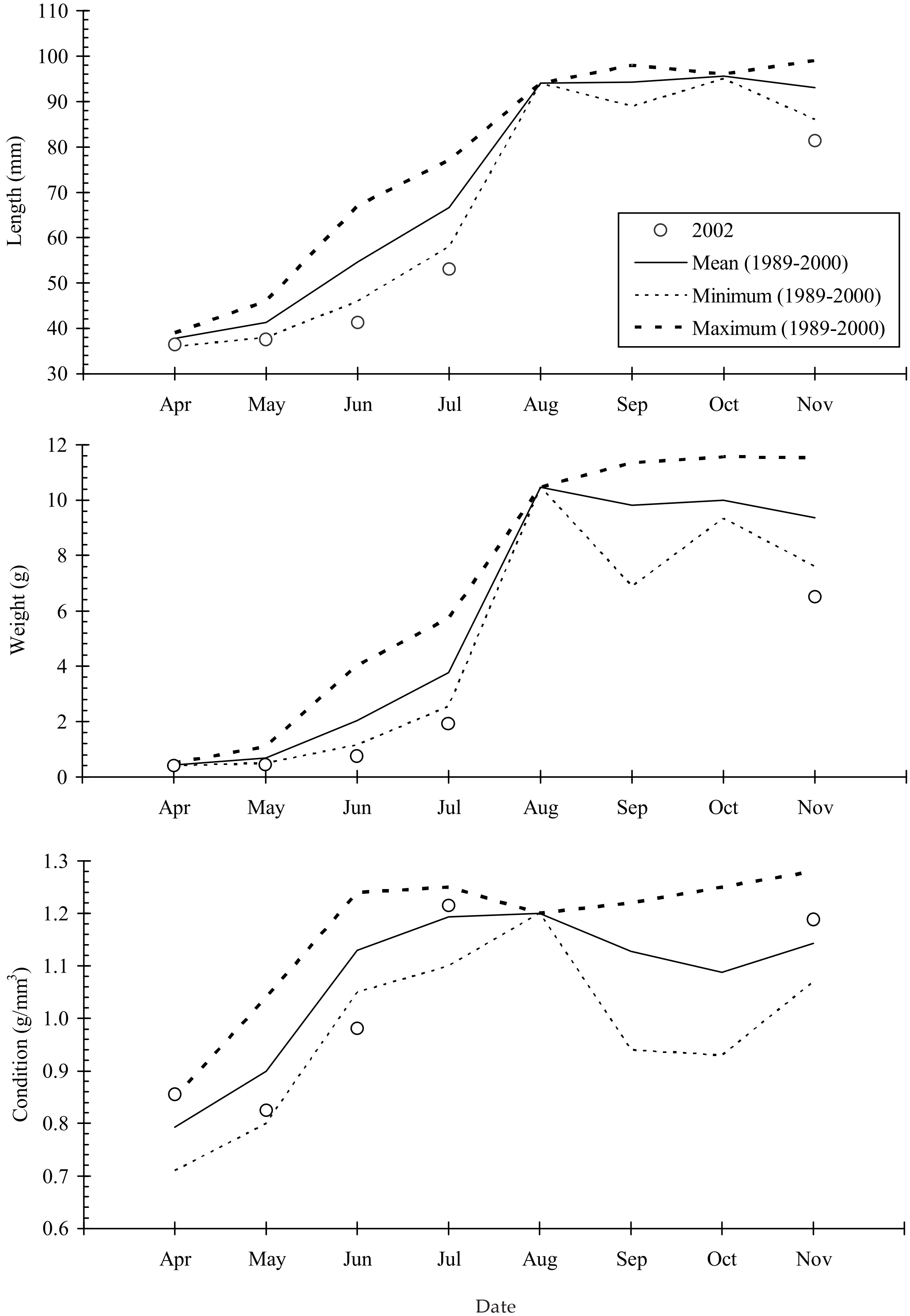
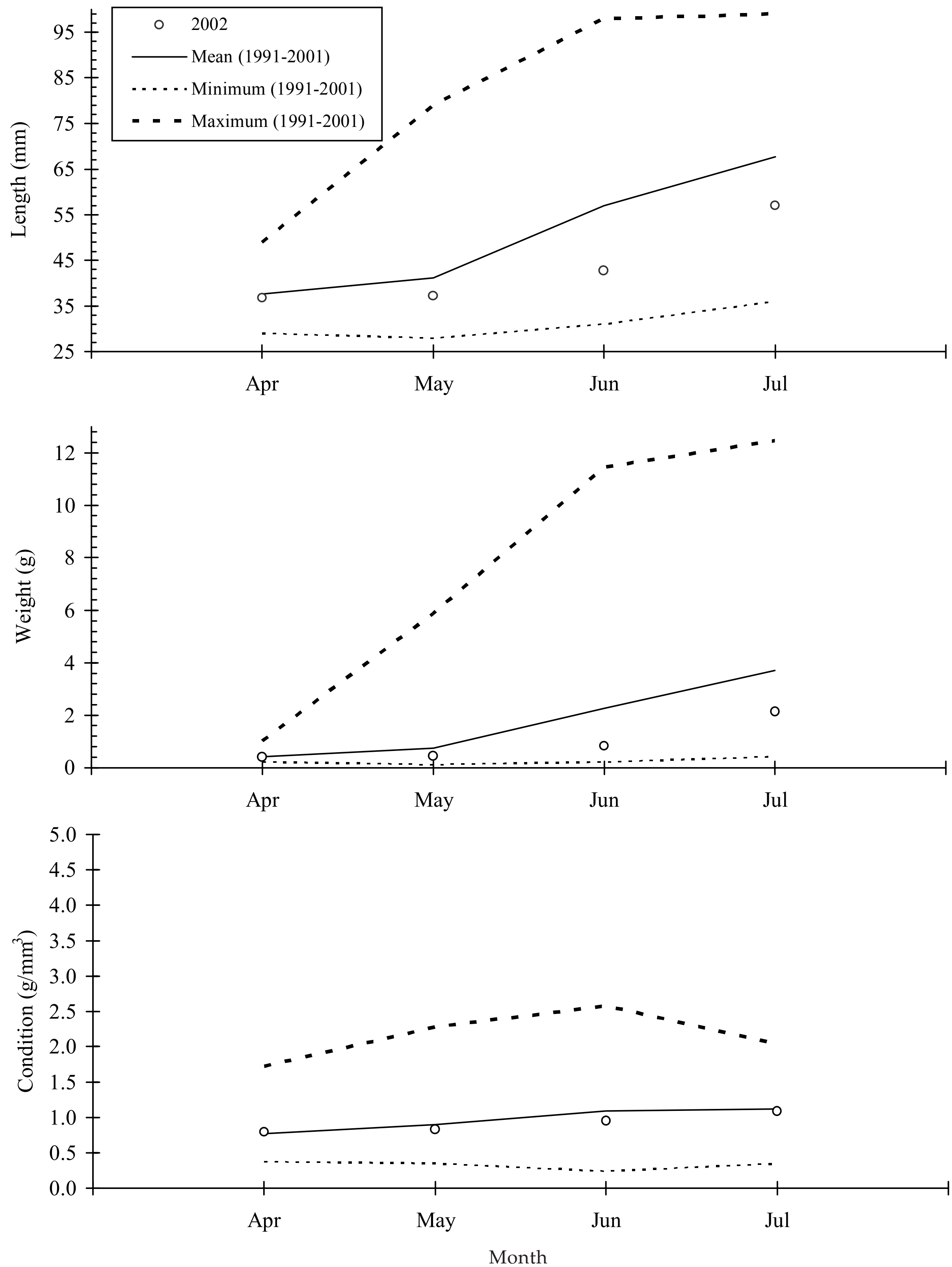


Figure 28
Comparison of Mean Size of 0+ Chinook in the Upper Nechako River in 2002 with
Mean, Minimum and Maximum Size for 1991 to 2001 (Rotary Screw Traps)



Outmigration index

Daily indices (the sum of day and night catches for each day) of chinook outmigration measured at Diamond Island in 2002 were well above the range observed in the previous eleven years (Figure 29): 2002 represented by far the largest cohort of outmigrating juvenile chinook. The 2002 index, 874,676, was more than six times that of the previous maxima in 1993 and 2001. This large outmigration index likely resulted from the largest spawner return during the current record, and the possibility exists that this large return produced offspring that exceeded available rearing space.

The index of outmigration of 0+ chinook that passed Diamond Island between April and July of each year from 1992 to 2002 was significantly and positively correlated with the number of adults that spawned upstream of Diamond Island from 1991-2002 (Figure 30). Although as noted, the higher number of spawners in 2001 generated a higher index than predicted by the previous relationship, the correlation was nonetheless significant. This confirms that the index of outmigration reflects real biological processes.

Conclusions

The calculated index of juvenile outmigration appeared to reflect the biological processes as evidenced by the continued strong relationship between spawners and juveniles leaving the system, even with the high index value seen in 2002. The strength of the spawner/fry relationship, as well as the consistent trends of morphological characteristics of rearing fry, indicate a stable rearing environment capable of supporting populations seen in the river over the range of spawners seen during the data collection period.

In 2001 the number of spawners returning to the river exceeded the upper bounds of the target population that is part of the Conservation Goal by almost 40%. As a result of this large return, the progeny from the 2001 spawners may have resulted in a saturation of upper river juvenile rearing habitat. More fry per spawner left the river than usual, while the index did not increase beyond maximum values seen previously.

Figure 29
Daily Indices of Chinook 0+ Outmigrants, Diamond Island, Nechako River, 1991 to 2002
Dark line is 2002.

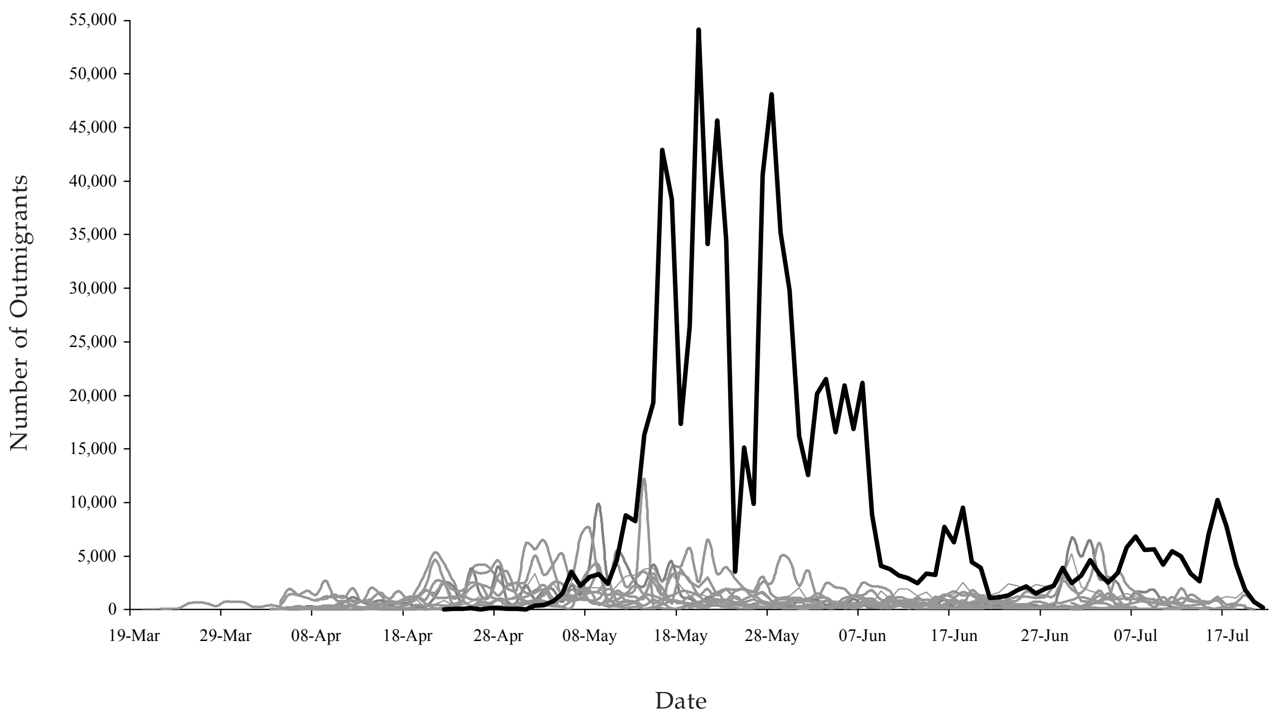
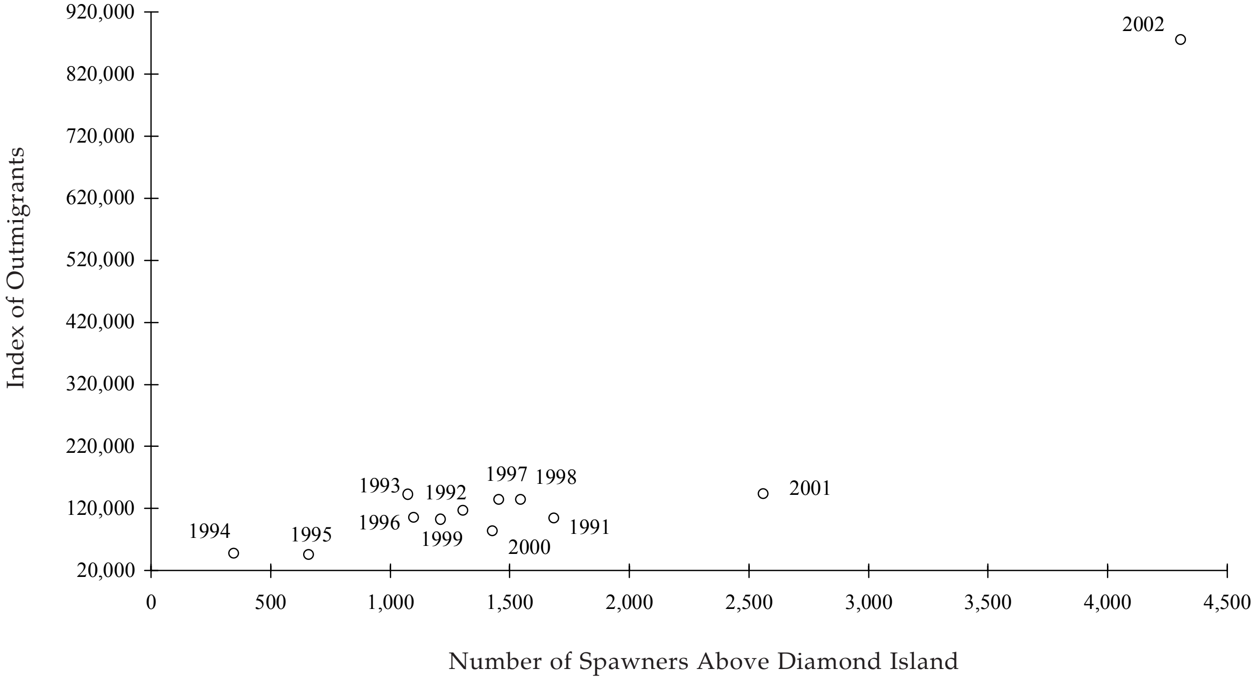


Figure 30
Index of Chinook Salmon 0+ Outmigrants Calculated from Rotary Screw Traps vs. the Number of Spawners Above Diamond Island the Previous Year, Nechako River 1991-2002



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Appendix 1

Daily Catch of Juvenile Chinook Salmon by Rotary Screw Traps, and Index of Outmigrants at Diamond Island, Nechako River, 2002

Appendix 1
Daily Catch of Juvenile Chinook Salmon by Rotary Screw Traps, and Index of Outmigration of Diamond Island, Nechako River, 2002

Date	RST staff (cm)	River flow m^3/s	RST No. 1 Trap flow m^3/s	RST No. 1 Percent flow sampled	RST No. 1 Catch 1+	RST No. 1 Catch 0+	RST No. 1 Population Estimate 1+	RST No. 1 Population Estimate 0+	RST No. 2 Trap flow m^3/s	RST No. 2 Percent flow sampled	RST No. 2 Catch 1+	RST No. 2 Catch 0+	RST No. 2 Population Estimate 1+	RST No. 2 Population Estimate 0+	RST No. 3 Trap flow m^3/s	RST No. 3 Percent flow sampled	RST No. 3 Catch 1+	RST No. 3 Catch 0+	RST No. 3 Population Estimate 1+	RST No. 3 Population Estimate 0+	Total Catch 1+	Total Catch 0+	Weighted Average 1+	Weighted Average 0+
Day																								
21-Apr	90.0	61.6	1.3	2.1	0	0	0	0	1.1	1.7	0	0	0	0	1.08	1.8	0	0	0	0	0	0	0	0
22-Apr	90.0	61.6	1.3	2.1	6	0	292	0	1.1	1.7	0	1	0	58	1.08	1.8	0	1	0	57	6	2	108	36
23-Apr	90.0	61.6	1.3	2.1	0	1	0	49	1.1	1.7	0	2	0	115	1.08	1.8	1	0	57	0	1	3	18	54
24-Apr	90.0	61.6	1.3	2.1	0	1	0	49	1.1	1.7	0	1	0	58	1.08	1.8	0	1	0	57	0	3	0	54
25-Apr	90.0	61.6	1.3	2.1	0	0	0	0	1.1	1.7	0	0	0	0	1.08	1.8	0	0	0	0	0	0	0	0
26-Apr	90.0	61.6	1.3	2.1	0	0	0	0	1.1	1.7	0	2	0	115	1.08	1.8	1	0	57	0	1	2	18	36
27-Apr	90.0	61.6	1.3	2.1	0	0	0	0	1.1	1.7	0	4	0	230	1.08	1.8	0	2	0	114	0	6	0	108
28-Apr	90.0	61.6	1.3	2.1	0	0	0	0	1.1	1.7	0	0	0	0	1.08	1.8	0	0	0	0	0	0	0	0
29-Apr	90.0	61.6	1.3	2.1	1	1	49	49	1.1	1.7	1	0	58	0	1.08	1.8	0	1	0	57	2	2	36	36
30-Apr	90.0	61.6	1.3	2.1	0	0	0	0	1.1	1.7	0	0	0	0	1.08	1.8	0	0	0	0	0	0	0	0
01-May	90.0	61.6	1.3	2.1	0	0	0	0	1.1	1.7	0	1	0	58	1.08	1.7	0	2	0	115	0	3	0	54
02-May	100.5	74.2	1.3	1.7	1	1	57	57	1.1	1.5	2	1	132	66	1.04	1.4	0	7	0	499	3	9	64	193
03-May	100.5	74.2	1.3	1.7	1	2	57	115	1.1	1.5	1	0	66	0	1.04	1.4	1	13	71	926	3	15	64	321
04-May	104.5	79.3	1.3	1.6	2	0	122	0	1.2	1.5	0	18	0	1,236	0.82	1.0	0	3	0	289	2	21	48	509
05-May	105.5	80.6	1.4	1.7	2	0	118	0	1.1	1.4	0	16	0	1,123	0.74	0.9	1	36	110	3,947	3	52	74	1,290
06-May	105.5	80.6	1.4	1.7	0	0	0	0	1.1	1.4	0	11	0	772	0.74	0.9	0	10	0	1,096	0	21	0	521
07-May	106.5	81.9	1.2	1.5	0	2	0	133	1.2	1.4	0	4	0	282	0.74	0.9	0	13	0	1,434	0	19	0	497
08-May	106.5	81.9	1.2	1.5	0	8	0	533	1.2	1.4	0	6	0	423	0.74	0.9	0	9	0	993	0	23	0	602
09-May	107.5	83.2	1.4	1.6	0	6	0	367	1.1	1.3	0	3	0	224	0.76	0.9	0	13	0	1,416	0	22	0	565
10-May	107.5	83.2	1.4	1.6	0	14	0	856	1.1	1.3	0	8	0	598	0.76	0.9	0	8	0	871	0	30	0	771
11-May	107.5	83.2	1.3	1.5	0	16	0	1,061	1.2	1.4	0	18	0	1,274	0.78	0.9	0	32	0	3,405	0	66	0	1,710
12-May	107.5	83.2	1.3	1.5	0	16	0	1,061	1.2	1.4	0	9	0	637	0.78	0.9	0	20	0	2,128	0	45	0	1,166
13-May	107.5	83.2	1.3	1.5	0	32	0	2,122	1.2	1.4	0	24	0	1,699	0.78	0.9	0	20	0	2,128	0	76	0	1,969
14-May	111.5	88.5	1.2	1.4	0	123	0	8,947	1.2	1.3	0	78	0	5,873	0.89	1.0	0	118	0	11,766	0	319	0	8,608
15-May	114.5	92.5	1.4	1.5	1	246	67	16,376	1.2	1.3	0	93	0	7,127	0.70	0.8	0	186	0	24,748	1	525	28	14,753
16-May	114.5	92.5	1.4	1.5	1	138	67	9,187	1.2	1.3	0	94	0	7,204	0.70	0.8	1	145	133	19,293	2	377	56	10,594
17-May	114.5	92.5	1.3	1.4	0	184	0	13,572	1.2	1.3	0	110	0	8,728	0.67	0.7	0	111	0	15,348	0	405	0	12,128
18-May	114.5	92.5	1.3	1.4	0	282	0	20,800	1.2	1.3	0	154	0	12,219	0.67	0.7	0	258	0	35,673	0	694	0	20,783
19-May	118.5	98.1	1.4	1.4	0	358	0	25,636	1.1	1.1	1	201	89	17,896	0.73	0.7	0	308	0	41,415	1	867	31	26,568
20-May	118.5	98.1	1.4	1.4	0	114	0	8,163	1.1	1.1	0	159	0	14,156	0.73	0.7	0	157	0	21,111	0	430	0	13,177
21-May	118.5	98.1	1.4	1.4	1	315	72	22,557	1.1	1.1	0	224	0	19,943	0.73	0.7	0	253	0	34,020	1	792	31	24,270
22-May	137.5	126.1	1.3	1.1	1	12	94	1,132	1.1	0.9	2	30	220	3,302	0.67	0.5	1	253	188	47,608	4	295	160	11,797
23-May	137.5	126.1	1.3	1.1	6	1	566	94	1.1	0.9	5	10	550	1,101	0.67	0.5	0	7	0	1,317	11	18	440	720
24-May	137.5	126.1	1.3	1.1	1	49	94	4,620	1.1	0.9	2	39	220	4,292	0.67	0.5	0	188	0	35,377	3	276	120	11,037
25-May	140.5	130.8	1.4	1.1	0	89	0	8,354	1.1	0.8	2	18	237	2,137	1.07	0.8	0	107	0	13,087	2	214	73	7,852
26-May	140.5	130.8	1.4	1.1	0	252	0	23,655	1.1	0.8	1	132	119	15,670	1.07	0.8	1	342	122	41,829	2	726	73	26,639

Appendix 1

Daily Catch of Juvenile Chinook Salmon by Rotary Screw Traps, and Index of Outmigration of Diamond Island, Nechako River, 2002

			RST No. 1						RST No. 2						RST No. 3						Total Catch		Weighted Average	
		River flow	Trap flow	Percent flow	Catch		Population Estimate		Trap flow	Percent flow	Catch		Population Estimate		Trap flow	Percent flow	Catch		Population Estimate					
Date	RST staff (cm)	m^3/s	m^3/s	sampled	1+	0+	1+	0+	m^3/s	sampled	1+	0+	1+	0+	m^3/s	sampled	1+	0+	1+	0+	1+	0+	1+	0+
27-May	135.5	123.0	1.3	1.1	1	255	92	23,509	1.2	1.0	1	186	104	19,420	1.05	0.9	0	259	0	30,251	2	700	69	24,149
28-May	135.5	123.0	1.3	1.1	0	257	0	23,693	1.2	1.0	1	174	104	18,167	1.05	0.9	0	174	0	20,323	1	605	34	20,872
29-May	131.5	116.9	1.3	1.1	0	228	0	19,938	1.2	1.0	0	112	0	11,089	1.06	0.9	0	167	0	18,353	0	507	0	16,549
30-May	128.5	112.5	1.3	1.2	0	117	0	9,884	1.2	1.1	0	64	0	5,763	1.10	1.0	0	97	0	9,914	0	278	0	8,495
31-May	128.5	112.5	1.3	1.2	1	26	84	2,196	1.2	1.1	0	34	0	3,062	1.10	1.0	0	45	0	4,601	1	105	31	3,209
01-Jun	123.5	105.2	0.5	0.5	2	60	397	11,902	0.5	0.5	0	33	0	6,546	0.90	0.9	0	36	0	4,206	2	129	107	6,920
02-Jun	123.5	105.2	0.5	0.5	0	57	0	11,307	0.5	0.5	0	35	0	6,943	0.90	0.9	0	57	0	6,660	0	149	0	7,993
03-Jun	118.5	98.1	1.3	1.3	0	37	0	2,781	1.2	1.3	1	28	80	2,230	0.83	0.8	0	26	0	3,091	1	91	29	2,655
04-Jun	118.5	98.1	1.3	1.3	2	30	150	2,255	1.2	1.3	0	20	0	1,593	0.83	0.8	0	19	0	2,259	2	69	58	2,013
05-Jun	118.5	98.1	1.3	1.3	0	92	0	6,915	1.2	1.3	0	51	0	4,063	0.83	0.8	0	97	0	11,531	0	240	0	7,003
06-Jun	115.5	93.9	1.4	1.5	0	68	0	4,623	1.3	1.3	0	27	0	2,012	0.87	0.9	0	47	0	5,077	0	142	0	3,798
07-Jun	115.5	93.9	1.4	1.5	0	33	0	2,244	1.3	1.3	0	8	0	596	0.87	0.9	0	27	0	2,916	0	68	0	1,819
08-Jun	111.5	88.5	1.3	1.5	0	8	0	531	1.3	1.4	0	2	0	140	0.82	0.9	0	14	0	1,502	0	24	0	621
09-Jun	111.5	88.5	1.3	1.5	0	4	0	265	1.3	1.4	0	5	0	351	0.82	0.9	0	4	0	429	0	13	0	336
10-Jun	107.5	83.2	1.4	1.6	0	5	0	305	1.2	1.5	0	2	0	135	0.82	1.0	0	3	0	305	0	10	0	244
11-Jun	107.5	83.2	1.4	1.6	0	8	0	488	1.2	1.5	0	4	0	271	0.82	1.0	0	2	0	203	0	14	0	342
12-Jun	105.5	80.6	1.4	1.7	0	5	0	296	1.2	1.5	0	1	0	65	0.85	1.1	0	4	0	379	0	10	0	233
13-Jun	105.5	80.6	1.4	1.7	0	1	0	59	1.2	1.5	0	3	0	195	0.85	1.1	0	2	0	190	0	6	0	140
14-Jun	102.5	76.8	1.4	1.8	1	4	57	226	1.2	1.5	0	4	0	264	0.80	1.0	0	10	0	959	1	18	23	416
15-Jun	102.5	76.8	1.4	1.8	0	12	0	678	1.2	1.5	0	6	0	396	0.80	1.0	0	18	0	1,725	0	36	0	832
16-Jun	100.5	74.2	1.4	1.9	0	21	0	1,114	1.2	1.7	0	13	0	784	0.77	1.0	0	33	0	3,177	0	67	0	1,462
17-Jun	100.5	74.2	1.4	1.9	1	3	53	159	1.2	1.7	0	3	0	181	0.77	1.0	0	7	0	674	1	13	22	284
18-Jun	99.5	73.0	1.3	1.7	0	6	0	346	1.0	1.4	0	6	0	439	0.74	1.0	0	13	0	1,279	0	25	0	607
19-Jun	99.5	73.0	1.3	1.7	0	2	0	115	1.0	1.4	0	3	0	219	0.74	1.0	0	14	0	1,377	0	19	0	461
20-Jun	97.5	70.5	1.4	2.1	0	1	0	49	1.2	1.8	0	1	0	56	0.78	1.1	0	2	0	181	0	4	0	81
21-Jun	97.5	70.5	1.4	2.1	0	3	0	146	1.2	1.8	0	0	0	0	0.78	1.1	0	6	0	544	0	9	0	183
22-Jun	94.5	66.9	1.4	2.1	0	0	0	0	1.2	1.8	0	2	0	111	0.84	1.3	0	2	0	160	0	4	0	77
23-Jun	94.5	66.9	1.4	2.1	0	3	0	141	1.2	1.8	0	0	0	0	0.84	1.3	0	4	0	320	0	7	0	135
24-Jun	94.5	66.9	1.4	2.1	0	4	0	188	1.2	1.8	0	0	0	0	0.84	1.3	0	6	0	480	0	10	0	193
25-Jun	92.5	64.5	1.3	2.0	0	2	0	101	1.2	1.8	0	1	0	56	0.81	1.3	0	2	0	160	0	5	0	99
26-Jun	92.5	64.5	1.3	2.0	0	0	0	0	1.2	1.8	0	2	0	112	0.81	1.3	0	7	0	559	0	9	0	179
27-Jun	92.5	64.5	1.4	2.1	0	2	0	94	1.2	1.9	0	1	0	52	0.77	1.2	0	1	0	83	0	4	0	76
28-Jun	92.5	64.5	1.4	2.1	0	2	0	94	1.2	1.9	0	9	0	467	0.77	1.2	0	3	0	250	0	14	0	266
29-Jun	93.8	66.1	1.4	2.1	0	1	0	49	1.2	1.8	0	5	0	277	0.79	1.2	0	4	0	335	0	10	0	198
30-Jun	93.8	66.1	1.4	2.1	0	5	0	243	1.2	1.8	0	4	0	222	0.79	1.2	0	1	0	84	0	10	0	198
01-Jul	91.5	63.4	1.4	2.2	0	7	0	324	1.2	1.9	0	1	0	52	0.81	1.3	0	2	0	156	0	10	0	186
02-Jul	91.5	63.4	1.4	2.2	0	2	0	93	1.2	1.9	0	3	0	156	0.81	1.3	0	1	0	78	0	6	0	112
03-Jul	91.5	63.4	1.4	2.2	0	4	0	185	1.2	1.9	0	3	0	156	0.81	1.3	0	1	0	78	0	8	0	149

Appendix 1

Daily Catch of Juvenile Chinook Salmon by Rotary Screw Traps, and Index of Outmigration of Diamond Island, Nechako River, 2002

Date	RST staff (cm)	River flow m^3/s	RST No. 1 Trap flow m^3/s	RST No. 1 Percent flow sampled	RST No. 1 Catch 1+	RST No. 1 Catch 0+	RST No. 1 Population Estimate 1+	RST No. 1 Population Estimate 0+	RST No. 2 Trap flow m^3/s	RST No. 2 Percent flow sampled	RST No. 2 Catch 1+	RST No. 2 Catch 0+	RST No. 2 Population Estimate 1+	RST No. 2 Population Estimate 0+	RST No. 3 Trap flow m^3/s	RST No. 3 Percent flow sampled	RST No. 3 Catch 1+	RST No. 3 Catch 0+	RST No. 3 Population Estimate 1+	RST No. 3 Population Estimate 0+	Total Catch 1+	Total Catch 0+	Weighted Average 1+	Weighted Average 0+
04-Jul	90.5	62.2	1.4	2.2	0	2	0	91	1.2	1.9	0	1	0	52	0.82	1.3	0	1	0	76	0	4	0	73
05-Jul	90.5	62.2	1.4	2.2	0	2	0	91	1.2	1.9	0	1	0	52	0.82	1.3	0	0	0	0	0	3	0	55
06-Jul	90.5	62.2	1.4	2.2	0	4	0	182	1.2	1.9	0	0	0	0	0.82	1.3	0	0	0	0	0	4	0	73
07-Jul	88.5	59.9	1.4	2.3	0	1	0	44	1.2	2.0	0	7	0	355	0.89	1.5	0	2	0	134	0	10	0	174
08-Jul	88.5	59.9	1.4	2.3	0	2	0	88	1.2	2.0	0	1	0	51	0.89	1.5	0	2	0	134	0	5	0	87
09-Jul	87.5	58.7	1.3	2.2	0	11	0	493	1.2	2.0	0	2	0	99	0.73	1.2	0	5	0	404	0	18	0	328
10-Jul	87.5	58.7	1.3	2.2	0	13	0	583	1.2	2.0	0	2	0	99	0.73	1.2	0	1	0	81	0	16	0	292
11-Jul	87.5	58.7	1.3	2.2	0	13	0	583	1.2	2.0	0	0	0	0	0.73	1.2	0	5	0	404	0	18	0	328
12-Jul	87.5	58.7	1.3	2.2	0	6	0	271	1.1	1.9	0	4	0	206	0.78	1.3	0	2	0	151	0	12	0	219
13-Jul	87.5	58.7	1.3	2.2	0	2	0	90	1.1	1.9	0	4	0	206	0.78	1.3	0	3	0	226	0	9	0	164
14-Jul	87.5	58.7	1.3	2.2	0	3	0	135	1.1	1.9	0	1	0	51	0.78	1.3	0	1	0	75	0	5	0	91
15-Jul	93.5	65.7	1.4	2.2	0	3	0	136	1.2	1.8	0	3	0	165	0.63	1.0	0	3	0	315	0	9	0	181
16-Jul	93.5	65.7	1.4	2.2	0	1	0	45	1.2	1.8	0	1	0	55	0.63	1.0	0	0	0	0	0	2	0	40
17-Jul	93.5	65.7	1.4	2.2	0	4	0	181	1.2	1.8	0	1	0	55	0.63	1.0	0	4	0	420	0	9	0	181
18-Jul	116.5	95.3	1.5	1.6	0	2	0	128	1.2	1.2	0	1	0	81	0.93	1.0	0	0	0	0	0	3	0	79
19-Jul	116.5	95.3	1.5	1.6	0	0	0	0	1.2	1.2	0	0	0	0	0.93	1.0	0	0	0	0	0	0	0	0
20-Jul	116.5	95.3	1.5	1.6					1.18	1.2	0													
					32	3,707	2,488	300,223			20	2,356	1,979	216,781			7	3,870	739	499,393	59	9,933	1,818	315,371

Appendix 1
Daily Catch of Juvenile Chinook Salmon by Rotary Screw Traps, and Index of Outmigration of Diamond Island, Nechako River, 2002

			RST No. 1						RST No. 2						RST No. 3						Total Catch		Weighted Average	
Date	RST staff (cm)	River flow m^3/s	Trap flow m^3/s	Percent flow sampled	Catch 1+	Catch 0+	Population Estimate 1+	Population Estimate 0+	Trap flow m^3/s	Percent flow sampled	Catch 1+	Catch 0+	Population Estimate 1+	Population Estimate 0+	Trap flow m^3/s	Percent flow sampled	Catch 1+	Catch 0+	Population Estimate 1+	Population Estimate 0+	1+	0+	1+	0+
Night																								
22-Apr	90.0	61.6	1.3	2.1	4	0	195	0	1.07	1.7	1	3	58	173	1.08	1.8	3	0	171	0	8	3	144	54
23-Apr	90.0	61.6	1.3	2.1	5	0	243	0	1.07	1.7	0	2	0	115	1.08	1.8	5	0	285	0	10	2	180	36
24-Apr	90.0	61.6	1.3	2.1	7	0	341	0	1.07	1.7	8	4	461	230	1.08	1.8	1	0	57	0	16	4	289	72
25-Apr	90.0	61.6	1.3	2.1	13	0	632	0	1.07	1.7	3	2	173	115	1.08	1.8	3	0	171	0	19	2	343	36
26-Apr	90.0	61.6	1.3	2.1	5	1	243	49	1.07	1.7	3	5	173	288	1.08	1.8	2	0	114	0	10	6	180	108
27-Apr	90.0	61.6	1.3	2.1	5	0	243	0	1.07	1.7	3	1	173	58	1.08	1.8	5	0	285	0	13	1	234	18
28-Apr	90.0	61.6	1.3	2.1	18	0	876	0	1.07	1.7	8	2	461	115	1.08	1.8	6	4	342	228	32	6	577	108
29-Apr	90.0	61.6	1.3	2.1	4	0	195	0	1.07	1.7	3	2	173	115	1.08	1.8	2	0	114	0	9	2	162	36
30-Apr	90.0	61.6	1.3	2.1	4	0	195	0	1.07	1.7	5	3	288	173	1.08	1.8	5	0	285	0	14	3	252	54
01-May	90.0	61.6	1.3	2.1	1	17	49	827	1.07	1.7	9	2	519	115	1.08	1.7	5	0	286	0	15	19	271	343
02-May	100.5	74.2	1.3	1.7	3	1	172	57	1.13	1.5	4	3	263	197	1.04	1.4	3	7	214	499	10	11	214	236
03-May	100.5	74.2	1.3	1.7	8	12	458	687	1.13	1.5	6	9	395	592	1.04	1.4	4	1	285	71	18	22	386	471
04-May	104.5	79.3	1.3	1.6	6	1	367	61	1.15	1.5	1	9	69	618	0.82	1.0	2	31	193	2,987	9	41	218	993
05-May	105.5	80.6	1.4	1.7	2	10	118	591	1.15	1.4	2	1	140	70	0.74	0.9	1	80	110	8,770	5	91	124	2,258
06-May	105.5	80.6	1.4	1.7	3	1	177	59	1.15	1.4	2	59	140	4,139	0.74	0.9	0	8	0	877	5	68	124	1,688
07-May	106.5	81.9	1.2	1.5	6	1	400	67	1.16	1.4	2	95	141	6,704	0.74	0.9	2	2	221	221	10	98	262	2,563
08-May	106.5	81.9	1.2	1.5	5	9	333	600	1.16	1.4	1	72	71	5,081	0.74	0.9	2	22	221	2,427	8	103	209	2,694
09-May	107.5	83.2	1.4	1.6	1	1	61	61	1.11	1.3	0	47	0	3,512	0.76	0.9	0	24	0	2,614	1	72	26	1,850
10-May	107.5	83.2	1.4	1.6	4	3	245	183	1.11	1.3	2	111	149	8,294	0.76	0.9	1	35	109	3,812	7	149	180	3,828
11-May	107.5	83.2	1.3	1.5	5	115	332	7,625	1.18	1.4	2	83	142	5,875	0.78	0.9	3	76	319	8,087	10	274	259	7,097
12-May	107.5	83.2	1.3	1.5	6	21	398	1,392	1.18	1.4	2	145	142	10,264	0.78	0.9	0	107	0	11,386	8	273	207	7,071
13-May	107.5	83.2	1.3	1.5	8	69	530	4,575	1.18	1.4	2	206	142	14,582	0.78	0.9	0	279	0	29,689	10	554	259	14,350
14-May	111.5	88.5	1.2	1.4	3	98	218	7,129	1.18	1.3	4	207	301	15,586	0.89	1.0	1	91	100	9,074	8	396	216	10,686
15-May	114.5	92.5	1.4	1.5	8	163	533	10,851	1.21	1.3	3	202	230	15,481	0.70	0.8	0	637	0	84,755	11	1002	309	28,157
16-May	114.5	92.5	1.4	1.5	9	161	599	10,718	1.21	1.3	6	149	460	11,419	0.70	0.8	0	676	0	89,944	15	986	422	27,708
17-May	114.5	92.5	1.3	1.4	1	73	74	5,384	1.17	1.3	3	55	238	4,364	0.67	0.7	0	46	0	6,360	4	174	120	5,211
18-May	114.5	92.5	1.3	1.4	0	69	0	5,089	1.17	1.3	0	36	0	2,856	0.67	0.7	0	85	0	11,753	0	190	0	5,690
19-May	118.5	98.1	1.4	1.4	2	264	143	18,905	1.10	1.1	6	448	534	39,887	0.73	0.7	0	188	0	25,280	8	900	245	27,579
20-May	118.5	98.1	1.4	1.4	0	238	0	17,043	1.10	1.1	0	325	0	28,936	0.73	0.7	0	120	0	16,136	0	683	0	20,929
21-May	118.5	98.1	1.4	1.4	1	53	72	3,795	1.10	1.1	0	433	0	38,551	0.73	0.7	0	211	0	28,372	1	697	31	21,358
22-May	137.5	126.1	1.3	1.1	0	165	0	15,559	1.15	0.9	0	291	0	32,025	0.67	0.5	0	111	0	20,887	0	567	0	22,675
23-May	137.5	126.1	1.3	1.1	3	30	283	2,829	1.15	0.9	2	25	220	2,751	0.67	0.5	0	15	0	2,823	5	70	200	2,799
24-May	137.5	126.1	1.3	1.1	2	37	189	3,489	1.15	0.9	1	20	110	2,201	0.67	0.5	2	46	376	8,656	5	103	200	4,119
25-May	140.5	130.8	1.4	1.1	3	23	282	2,159	1.10	0.8	0	18	0	2,137	1.07	0.8	1	14	122	1,712	4	55	147	2,018
26-May	140.5	130.8	1.4	1.1	3	18	282	1,690	1.10	0.8	0	74	0	8,785	1.07	0.8	0	287	0	35,102	3	379	110	13,907
27-May	135.5	123.0	1.3	1.1	3	110	277	10,141	1.18	1.0	0	295	0	30,800	1.05	0.9	0	289	0	33,755	3	694	103	23,942

Appendix 1
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			RST No. 1						RST No. 2						RST No. 3						Total Catch		Weighted Average	
Date	RST staff (cm)	River flow m^3/s	Trap flow m^3/s	Percent flow sampled	Catch 1+	Catch 0+	Population Estimate 1+	Population Estimate 0+	Trap flow m^3/s	Percent flow sampled	Catch 1+	Catch 0+	Population Estimate 1+	Population Estimate 0+	Trap flow m^3/s	Percent flow sampled	Catch 1+	Catch 0+	Population Estimate 1+	Population Estimate 0+	1+	0+	1+	0+
28-May	135.5	123.0	1.3	1.1	1	210	92	19,360	1.18	1.0	2	98	209	10,232	1.05	0.9	0	107	0	12,497	3	415	103	14,317
29-May	131.5	116.9	1.3	1.1	5	67	437	5,859	1.18	1.0	2	215	198	21,286	1.06	0.9	0	125	0	13,737	7	407	228	13,285
30-May	128.5	112.5	1.3	1.2	3	53	253	4,477	1.25	1.1	1	150	90	13,508	1.10	1.0	0	50	0	5,110	4	253	122	7,731
31-May	128.5	112.5	1.3	1.2	5	97	422	8,194	1.25	1.1	1	104	90	9,366	1.10	1.0	0	106	0	10,837	6	307	183	9,382
01-Jun	123.5	105.2	0.5	0.5	1	90	198	17,853	0.53	0.5	0	118	0	23,408	0.90	0.9	1	39	117	4,557	2	247	107	13,250
02-Jun	123.5	105.2	0.5	0.5	2	157	397	31,144	0.53	0.5	0	72	0	14,283	0.90	0.9	1	23	117	2,687	3	252	161	13,519
03-Jun	118.5	98.1	1.3	1.3	4	172	301	12,928	1.23	1.3	1	192	80	15,295	0.83	0.8	0	112	0	13,314	5	476	146	13,890
04-Jun	118.5	98.1	1.3	1.3	1	380	75	28,563	1.23	1.3	0	218	0	17,366	0.83	0.8	0	51	0	6,062	1	649	29	18,938
05-Jun	118.5	98.1	1.3	1.3	0	156	0	11,726	1.23	1.3	2	155	159	12,347	0.83	0.8	0	28	0	3,328	2	339	58	9,892
06-Jun	115.5	93.9	1.4	1.5	3	187	204	12,714	1.26	1.3	2	222	149	16,539	0.87	0.9	0	240	0	25,923	5	649	134	17,358
07-Jun	115.5	93.9	1.4	1.5	2	66	136	4,487	1.26	1.3	0	182	0	13,559	0.87	0.9	0	15	0	1,620	2	263	53	7,034
08-Jun	111.5	88.5	1.3	1.5	5	48	332	3,183	1.26	1.4	1	76	70	5,335	0.82	0.9	0	10	0	1,073	6	134	155	3,467
09-Jun	111.5	88.5	1.3	1.5	1	51	66	3,382	1.26	1.4	0	76	0	5,335	0.82	0.9	0	7	0	751	1	134	26	3,467
10-Jun	107.5	83.2	1.4	1.6	1	85	61	5,185	1.23	1.5	1	34	68	2,303	0.82	1.0	0	2	0	203	2	121	49	2,952
11-Jun	107.5	83.2	1.4	1.6	1	30	61	1,830	1.23	1.5	0	60	0	4,064	0.82	1.0	0	16	0	1,627	1	106	24	2,586
12-Jun	105.5	80.6	1.4	1.7	4	76	237	4,501	1.24	1.5	1	15	65	973	0.85	1.1	0	5	0	474	5	96	117	2,240
13-Jun	105.5	80.6	1.4	1.7	0	58	0	3,435	1.24	1.5	0	43	0	2,788	0.85	1.1	0	36	0	3,415	0	137	0	3,197
14-Jun	102.5	76.8	1.4	1.8	0	65	0	3,674	1.16	1.5	0	50	0	3,299	0.80	1.0	0	9	0	863	0	124	0	2,865
15-Jun	102.5	76.8	1.4	1.8	4	185	226	10,458	1.16	1.5	0	80	0	5,278	0.80	1.0	0	33	0	3,163	4	298	92	6,886
16-Jun	100.5	74.2	1.4	1.9	3	116	159	6,156	1.23	1.7	0	66	0	3,980	0.77	1.0	0	39	0	3,755	3	221	65	4,824
17-Jun	100.5	74.2	1.4	1.9	6	277	318	14,700	1.23	1.7	0	114	0	6,875	0.77	1.0	0	32	0	3,081	6	423	131	9,233
18-Jun	99.5	73.0	1.3	1.7	0	107	0	6,167	1.00	1.4	1	37	73	2,705	0.74	1.0	0	14	0	1,377	1	158	24	3,836
19-Jun	99.5	73.0	1.3	1.7	0	88	0	5,072	1.00	1.4	1	30	73	2,193	0.74	1.0	0	24	0	2,361	1	142	24	3,447
20-Jun	97.5	70.5	1.4	2.1	2	40	97	1,947	1.25	1.8	0	7	0	395	0.78	1.1	0	4	0	363	2	51	41	1,035
21-Jun	97.5	70.5	1.4	2.1	1	30	49	1,460	1.25	1.8	0	11	0	621	0.78	1.1	0	7	0	635	1	48	20	974
22-Jun	94.5	66.9	1.4	2.1	1	43	47	2,022	1.21	1.8	0	12	0	663	0.84	1.3	0	12	0	959	1	67	19	1,292
23-Jun	94.5	66.9	1.4	2.1	0	59	0	2,775	1.21	1.8	0	24	0	1,327	0.84	1.3	0	4	0	320	0	87	0	1,677
24-Jun	94.5	66.9	1.4	2.1	0	63	0	2,963	1.21	1.8	0	19	0	1,050	0.84	1.3	0	20	0	1,598	0	102	0	1,967
25-Jun	92.5	64.5	1.3	2.0	0	51	0	2,569	1.15	1.8	0	8	0	447	0.81	1.3	0	11	0	879	0	70	0	1,393
26-Jun	92.5	64.5	1.3	2.0	0	57	0	2,871	1.15	1.8	0	16	0	894	0.81	1.3	0	17	0	1,358	0	90	0	1,791
27-Jun	92.5	64.5	1.4	2.1	0	76	0	3,566	1.24	1.9	0	14	0	727	0.77	1.2	0	24	0	2,000	0	114	0	2,168
28-Jun	92.5	64.5	1.4	2.1	0	105	0	4,926	1.24	1.9	0	32	0	1,661	0.77	1.2	0	55	0	4,583	0	192	0	3,652
29-Jun	93.8	66.1	1.4	2.1	0	71	0	3,455	1.19	1.8	0	31	0	1,717	0.79	1.2	0	14	0	1,173	0	116	0	2,296
30-Jun	93.8	66.1	1.4	2.1	0	85	0	4,136	1.19	1.8	0	51	0	2,825	0.79	1.2	0	15	0	1,257	0	151	0	2,988
01-Jul	91.5	63.4	1.4	2.2	0	144	0	6,662	1.22	1.9	0	48	0	2,494	0.81	1.3	0	47	0	3,676	0	239	0	4,455
02-Jul	91.5	63.4	1.4	2.2	1	89	46	4,117	1.22	1.9	0	53	0	2,754	0.81	1.3	0	31	0	2,425	1	173	19	3,225
03-Jul	91.5	63.4	1.4	2.2	0	75	0	3,470	1.22	1.9	0	39	0	2,027	0.81	1.3	0	13	0	1,017	0	127	0	2,367
04-Jul	90.5	62.2	1.4	2.2	0	135	0	6,157	1.20	1.9	0	27	0	1,397	0.82	1.3	0	21	0	1,589	0	183	0	3,360

Appendix 1

Daily Catch of Juvenile Chinook Salmon by Rotary Screw Traps, and Index of Outmigration of Diamond Island, Nechako River, 2002

			RST No. 1						RST No. 2						RST No. 3						Total Catch		Weighted Average	
		River flow	Trap flow	Percent flow	Catch		Population Estimate		Trap flow	Percent flow	Catch		Population Estimate		Trap flow	Percent flow	Catch		Population Estimate					
Date	RST staff (cm)	m^3/s	m^3/s	sampled	1+	0+	1+	0+	m^3/s	sampled	1+	0+	1+	0+	m^3/s	sampled	1+	0+	1+	0+	1+	0+	1+	0+
05-Jul	90.5	62.2	1.4	2.2	0	225	0	10,262	1.20	1.9	0	66	0	3,416	0.82	1.3	0	22	0	1,665	0	313	0	5,747
06-Jul	90.5	62.2	1.4	2.2	0	263	0	11,995	1.20	1.9	0	79	0	4,089	0.82	1.3	0	25	0	1,892	0	367	0	6,739
07-Jul	88.5	59.9	1.4	2.3	0	221	0	9,685	1.18	2.0	0	78	0	3,955	0.89	1.5	0	11	0	739	0	310	0	5,399
08-Jul	88.5	59.9	1.4	2.3	0	249	0	10,912	1.18	2.0	0	59	0	2,992	0.89	1.5	0	10	0	672	0	318	0	5,538
09-Jul	87.5	58.7	1.3	2.2	0	162	0	7,262	1.18	2.0	0	40	0	1,985	0.73	1.2	0	12	0	969	0	214	0	3,902
10-Jul	87.5	58.7	1.3	2.2	0	204	0	9,144	1.18	2.0	0	61	0	3,027	0.73	1.2	0	18	0	1,454	0	283	0	5,160
11-Jul	87.5	58.7	1.3	2.2	0	183	0	8,203	1.18	2.0	0	63	0	3,126	0.73	1.2	0	8	0	646	0	254	0	4,632
12-Jul	87.5	58.7	1.3	2.2	0	126	0	5,686	1.14	1.9	0	40	0	2,056	0.78	1.3	0	7	0	528	0	173	0	3,153
13-Jul	87.5	58.7	1.3	2.2	0	101	0	4,558	1.14	1.9	0	22	0	1,131	0.78	1.3	0	15	0	1,131	0	138	0	2,515
14-Jul	87.5	58.7	1.3	2.2	0	295	0	13,313	1.14	1.9	0	65	0	3,342	0.78	1.3	0	20	0	1,508	0	380	0	6,925
15-Jul	93.5	65.7	1.4	2.2	0	331	0	15,011	1.20	1.8	0	158	0	8,683	0.63	1.0	0	12	0	1,261	0	501	0	10,067
16-Jul	93.5	65.7	1.4	2.2	0	290	0	13,152	1.20	1.8	0	94	0	5,166	0.63	1.0	0	3	0	315	0	387	0	7,777
17-Jul	93.5	65.7	1.4	2.2	0	129	0	5,850	1.20	1.8	0	35	0	1,923	0.63	1.0	0	36	0	3,782	0	200	0	4,019
18-Jul	116.5	95.3	1.5	1.6	0	45	0	2,877	1.18	1.2	0	6	0	485	0.93	1.0	0	16	0	1,635	0	67	0	1,773
19-Jul	116.5	95.3	1.5	1.6	0	13	0	831	1.18	1.2	0	3	0	243	0.93	1.0	0	13	0	1,328	0	29	0	767
20-Jul	116.5	95.3	1.5	1.6	0	4	0	256	1.18	1.2	0	0	0	0	0.93	1.0	0	4	0	409	0	8	0	212
					218	8,549	13,968	538,761			110	7,112	7,687	576,140			61	5,142	4,615	611,859	389	20,803	9,337	559,305

Appendix 2

Mean Monthly Electrofishing Catch-Per-Unit-Effort (CPUE, fish caught per m^2) of Juvenile Chinook Salmon by 10 km Intervals of the Upper Nechako River, 2002

Appendix 2
Mean Monthly Electrofishing Catch-Per-Unit-Effort (CPUE, fish caught per m^2)
of Juvenile Chinook Salmon by 10 km Intervals of the Upper Nechako River, 2002

Date	Time of day	Distance from Kenney Dam	Distance midpoint (km)	0+ CPUE mean	0+ CPUE SD	1+ CPUE mean	1+ CPUE SD
April	Day	10.0-19.9	15	1.14	1.02	0.45	0.74
		20.0-29.9	25	1.76	1.64	0.21	0.42
		30.0-39.9	35	0.90	1.24	0.00	0.00
		50.0-59.9	55	1.01	1.75	0.09	0.37
		70.0-79.9	75	1.04	1.60	0.00	0.00
		80.0-89.9	85	0.70	0.92	0.16	0.36
April	Night	10.0-19.9	15	9.50	10.53	0.83	1.59
		20.0-29.9	25	27.28	22.36	1.12	2.33
		30.0-39.9	35	4.86	2.81	0.13	0.28
		50.0-59.9	55	1.62	2.44	0.29	0.57
		70.0-79.9	75	0.69	0.69	0.10	0.28
		80.0-89.9	85	0.82	1.54	0.81	1.17
May	Day	0.0-9.9	5	9.6	13.0	0.3	0.4
		10.0-19.9	15	18.1	15.7	0.1	0.4
		20.0-29.9	25	24.4	23.2	0.0	0.0
		30.0-39.9	35	16.1	20.1	0.0	0.0
		50.0-59.9	55	14.6	11.4	0.0	0.0
		70.0-79.9	75	13.1	9.8	0.0	0.0
		80.0-89.9	85	21.7	24.0	0.0	0.0
May	Night	0.0-9.9	5	15.00	15.91	0.1	0.2
		10.0-19.9	15	63.02	82.59	0.5	1.2
		20.0-29.9	25	116.85	132.19	0.5	1.1
		30.0-39.9	35	38.18	39.51	0.2	0.4
		50.0-59.9	55	53.56	73.75	0.4	0.9
		70.0-79.9	75	104.61	107.55	0.1	0.3
		80.0-89.9	85	48.65	58.99	0.2	0.4
June	Day	0.0-9.9	5	1.7	2.0	0.00	0.00
		10.0-19.9	15	7.1	9.5	0.00	0.00
		20.0-29.9	25	7.8	9.3	0.00	0.00
		30.0-39.9	35	1.6	2.1	0.00	0.00
		50.0-59.9	55	2.9	5.6	0.00	0.00
		70.0-79.9	75	0.3	0.5	0.00	0.00
		80.0-89.9	85	1.0	2.9	0.00	0.00
June	Night	0.0-9.9	5	6.25	9.00	0.13	0.22
		10.0-19.9	15	58.24	39.03	0.06	0.20
		20.0-29.9	25	49.38	44.89	0.02	0.13
		30.0-39.9	35	18.02	10.65	0.00	0.00
		50.0-59.9	55	16.56	15.01	0.26	1.12
		70.0-79.9	75	72.76	50.45	0.00	0.00
		80.0-89.9	85	44.72	56.02	0.00	0.00

Appendix 2 (continued)
Mean Monthly Electrofishing Catch-Per-Unit-Effort (CPUE, fish caught per m^2)
of Juvenile Chinook Salmon by 10 km Intervals of the Upper Nechako River, 2002

Date	Time of day	Distance from Kenney Dam	Distance midpoint (km)	0+ CPUE mean	0+ CPUE SD	1+ CPUE mean	1+ CPUE SD
July	Day	0.0-9.9	5	43.7	45.4	0.00	0.00
		10.0-19.9	15	15.6	24.0	0.00	0.00
		20.0-29.9	25	3.2	5.9	0.00	0.00
		30.0-39.9	35	0.2	0.3	0.00	0.00
		50.0-59.9	55	2.6	4.3	0.00	0.00
		70.0-79.9	75	1.7	2.1	0.00	0.00
		80.0-89.9	85	0.2	0.4	0.00	0.00
July	Night	0.0-9.9	5	77.50	32.16	0.00	0.00
		10.0-19.9	15	45.84	30.16	0.00	0.00
		20.0-29.9	25	9.48	8.74	0.00	0.00
		30.0-39.9	35	11.24	8.62	0.00	0.00
		50.0-59.9	55	10.97	9.03	0.00	0.00
		70.0-79.9	75	11.11	16.28	0.00	0.00
		80.0-89.9	85	19.20	15.50	0.00	0.00
		10.0-19.9	15	0.91	0.97	0.00	0.00
		20.0-29.9	25	0.26	0.51	0.00	0.00
November	Day	30.0-39.9	35	0.64	1.09	0.00	0.00
		50.0-59.9	55	0.37	0.58	0.00	0.00
		70.0-79.9	75	0.83	1.14	0.00	0.00
		80.0-89.9	85	0.41	0.60	0.00	0.00
November	Night	10.0-19.9	15	3.25	5.62	0.00	0.00
		20.0-29.9	25	2.01	4.32	0.00	0.00
		30.0-39.9	35	1.02	0.92	0.00	0.00
		50.0-59.9	55	1.42	1.09	0.00	0.00
		70.0-79.9	75	6.94	12.69	0.00	0.00
		80.0-89.9	85	4.96	7.43	0.00	0.00