2001 JUVENILE OUTMIGRATION

NECHAKO FISHERIES CONSERVATION PROGRAM
Technical Report No. M01-3

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EXECUTIVE SUMMARY

The distribution and abundance of juvenile chinook salmon (*Oncorhynchus tshawytscha*) were evaluated through electrofishing and rotary screw traps in 2001 in the upper 100 km of the Nechako River as part of the thirteenth year of the Nechako Fisheries Conservation Program (NFCP).

Mean daily water temperatures of the river at Bert Irvine's Lodge in 2001 generally fell within the minimum-maximum range observed in the previous 12 years. In-river temperatures in 2001 were slightly below the 12-year average during late spring, and above during mid-July-August.

Flows of the upper Nechako River at Cheslatta Falls in 2001 were stable for most of the year, except in July and August, when they increased as dictated by the Summer Temperature Management Program.

Based on growth curves, emergence of chinook fry in 2001 had ceased by mid-May. Monthly electrofishing surveys along the length of the upper river in April, May, June, July and November captured 68,517 fish from 15 species or families. Juvenile chinook salmon were the most common species, accounting for 49% of all captures or 33,627 fish (33,404 0+ and 223 1+), of which 65% 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. This may be an artefact of chinook territorial behaviour.

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: newly emerged chinook first stayed in the upper river, then spread within it.

The number of outmigrating 0+ chinook captured by rotary screw traps (9,037) at Diamond Island between April 1 and July 20, 2001, showed a bimodal distribution, with peaks in May and late June. 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 143,911 0+ and 15,128 1+ chinook. The index of 0+ outmigrants for the years 1992 to 2001 was positively and significantly correlated ($r = 0.77$, $P < 0.05$) with the number of parent spawners upstream of Diamond Island in the autumns of the years 1991 to 2000.

All comparisons with previous years indicated that the timing of chinook outmigration, the temperatures and the flows in 2001 were comparable with those of previous years, although the latter two parameters were close to the lower end of the range thus far observed. This indicates that the rearing environment for juvenile chinook of the Nechako has been stable over this period.

INTRODUCTION

This report describes juvenile chinook salmon (*Oncorhynchus tshawytscha*) distribution abundance in the upper 100 km of the Nechako River in 2001.

This study was part of the thirteenth year of the Nechako Fisheries Conservation Program (NFCP). The primary objectives of the 2001 juvenile chinook outmigration study were to describe 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 2001 with those measured over the previous 12 years.

NFCP monitoring efforts are concentrated in the upper 100 km of the Nechako River because it is the part of the river most subject to changes in flow due to fluctuations in discharge from the Nechako Reservoir. The lower part of the river, below Fort Fraser, is buffered by flows from the Nautley and Stuart Rivers and other tributaries.

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

In this report, all longitudinal distances are in kilometers from the foot of Kenney Dam. The first nine km of the river are within the Nechako River Canyon, which was dewatered by the closing of Kenney Dam in October 1952. The majority of the flows in the upper river occur downstream of Cheslatta Falls, itself situated at km 9.0.

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).

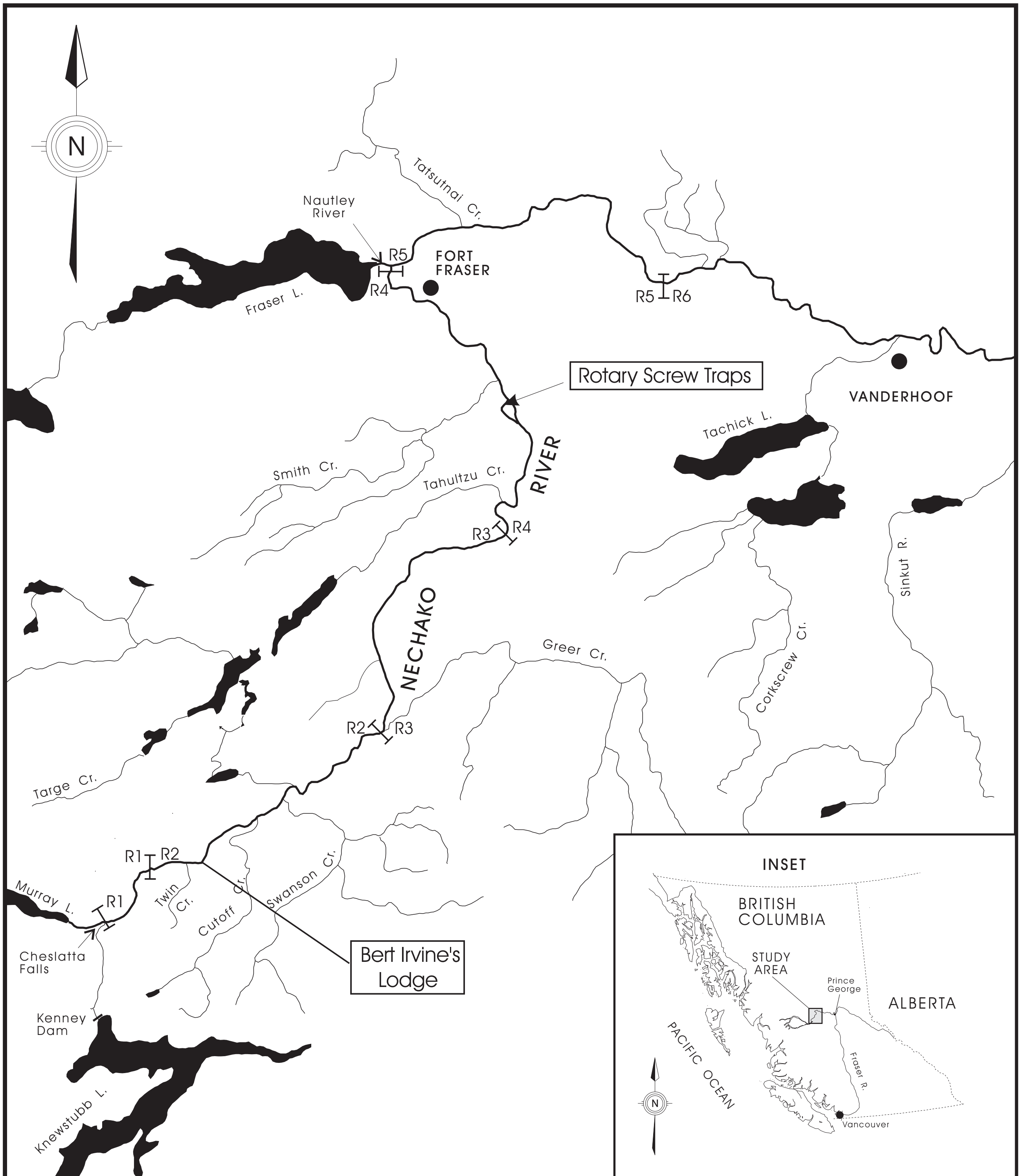
Electrofishing Surveys

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 began as a temporary replacement for inclined plane traps that were inoperable in 1990 because high river flows. Over the last ten years they have become one of the most important components of the chinook monitoring program, mainly because they show spatial variation in juvenile density during spring and summer—something no fixed gear can do—and because electrofishing can be done at high flow levels that would render some fixed gear inoperable.

Surveys

The distribution of juvenile chinook salmon was assessed from single-pass electrofishing surveys of each of the four reaches, as in previous years. Surveys began in April and continued through May, June and early July. They were discontinued during late July and August because summer cooling flows were too high to allow safe and effective electrofishing. Large flows are released into the upper river during July and August to cool the river to reduce prespawning mortality of sockeye salmon (*Oncorhynchus nerka*) migrating through the lower Nechako River to spawning grounds in the Stuart, Stellako and Nadina River systems. This program of releases is called the Summer



Nechako Fisheries Conservation Program

Map # M01-3-1

0 25 KM

FIGURE 1. 2001 NECHAKO RIVER STUDY AREA AND TRAP LOCATIONS

Temperature Management Program (STMP). A final electrofishing survey was conducted from November 4 to 7, 2001. Surveys of Reaches 1 through 4 were completed in each of the months sampled. Electrofishing surveys were carried out at night and during the day. Night was defined as the time period between sunset and sunrise.

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 15A backpack electrofisher, identified to species, 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. 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.

From 10 to 15 chinook at each site and each day or night sampling event were measured for body size. Fork length was measured to the nearest 1 mm with a 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 and lake trout were also measured, but not for non-salmonid fishes 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 (fishes 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. The upper Nechako River is too wide, deep and fast moving to allow any part of the mainstem to be blocked off with nets.

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 abundance 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.

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 wood beams with wire mesh. Although RST 1 was originally installed to be close to the left margin, the channel gradually changed course and widened during the eight years of the study, and this RST is now sampling fishes 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 early April 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 about 07:00 and 20:00. All fishes were collected from the live trap, counted and identified to species. A subsample of 10 to 15 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 = 162, $R^2 = 0.98$, $P<0.001$):

(3) $\ln(\text{flow}, m^3/s) = -3.48 + 1.69 \ln(\text{staff height, cm})$

That regression was calculated for steady flow conditions from April to December for the years 1992 to 2001. 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 Swoffler (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 vij 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.

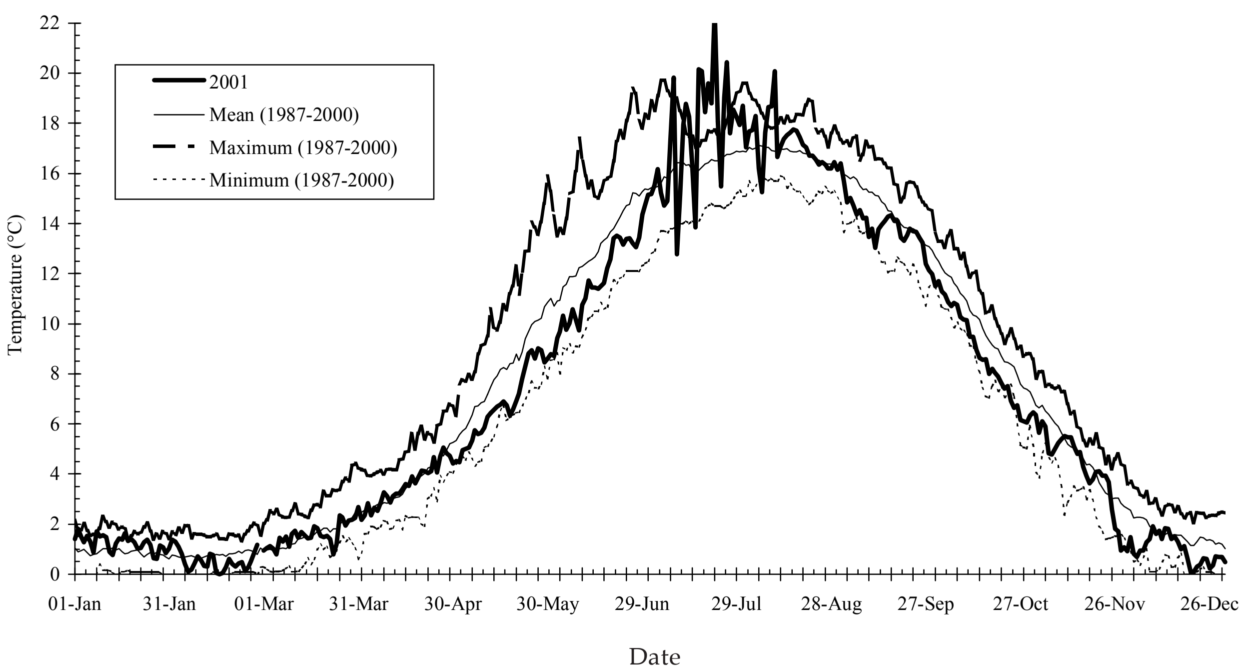
Since there were three RSTs, there were three estimates of total chinook number each day. The best estimate of the total index number of chinook salmon was the mean of the three estimates weighted by the flow that passed through each trap.

RESULTS AND DISCUSSION

Temperature

Mean daily water temperature of the upper Nechako River at Bert Irvine's Lodge rose from a minimum of near to 0°C for a few days in mid February to a maximum of 22.5 °C on July 22 and then decreased to a second minimum of 0.8°C on December 21-22 (Figure 2). Overall, the temperatures observed in 2001 were slightly below average during May-June, and slightly above average in July-August.

Figure 2
Comparison of Mean Daily Temperature of the Upper Nechako River at Bert Irvine's Lodge in 2001 with the Mean, Maximum and Minimum for the Years 1987 to 2000



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 at noon). Overall, during each sampling, water temperatures were fairly consistent throughout the river, with differences of roughly 2°C between one end of the river and the other, more so in July (4°C).

Generally, 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, releases from Skins Lake Spillway were roughly constant at 33 m^3/s (Figure 4). From April 20 to 24, releases rose from 32 to 52 m^3/s and then remained stable until July 7, when they once again rose, this time from 52 to 284 on July 21 as part of the Summer Temperature Management Program (STMP). Intermediate peaks occurred on July 21 and August 8 and a maximum peak of 453 m^3/s was reached on August 13, all according to the STMP protocol. Releases from September 5 to December 30 averaged 30 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 averaged 34 m^3/s from January 1 to April 21, and then gradually rose to 57 m^3/s from April 22 to July 10. (The difference in average 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 three separate maxima: 195 m^3/s on July 22, 203 on August 9 and 263 m^3/s on August 16. They then declined to an average of 33 m^3/s from September 11 to December 30.

In summary, the 2001 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.

Size and Growth of Chinook Salmon

Effect of Shelter on Chinook 0+ Size

The electrofishing dataset provides the opportunity to test for the effect of debris (shelter) on juvenile chinook growth as some sites have woody debris while others do not.

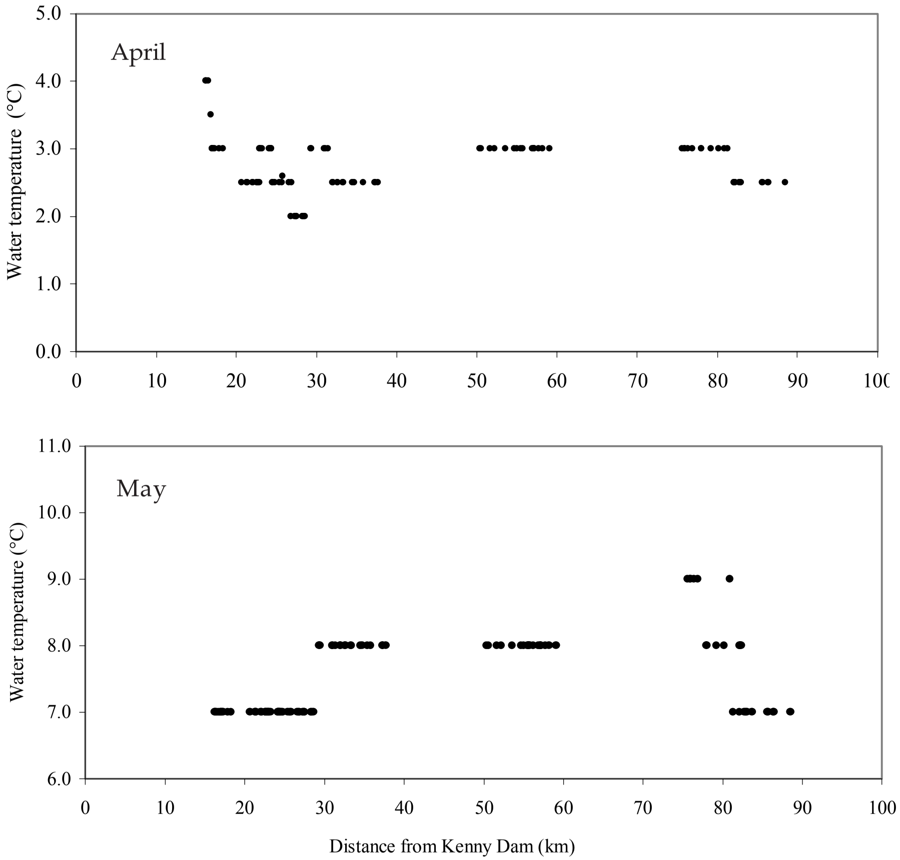
Sites were categorized as natural (without any manmade structure) or complex (modified by either the addition of materials, some structure or by excavating). The distribution of the sites among these categories and their respective locations are shown in Table 1.

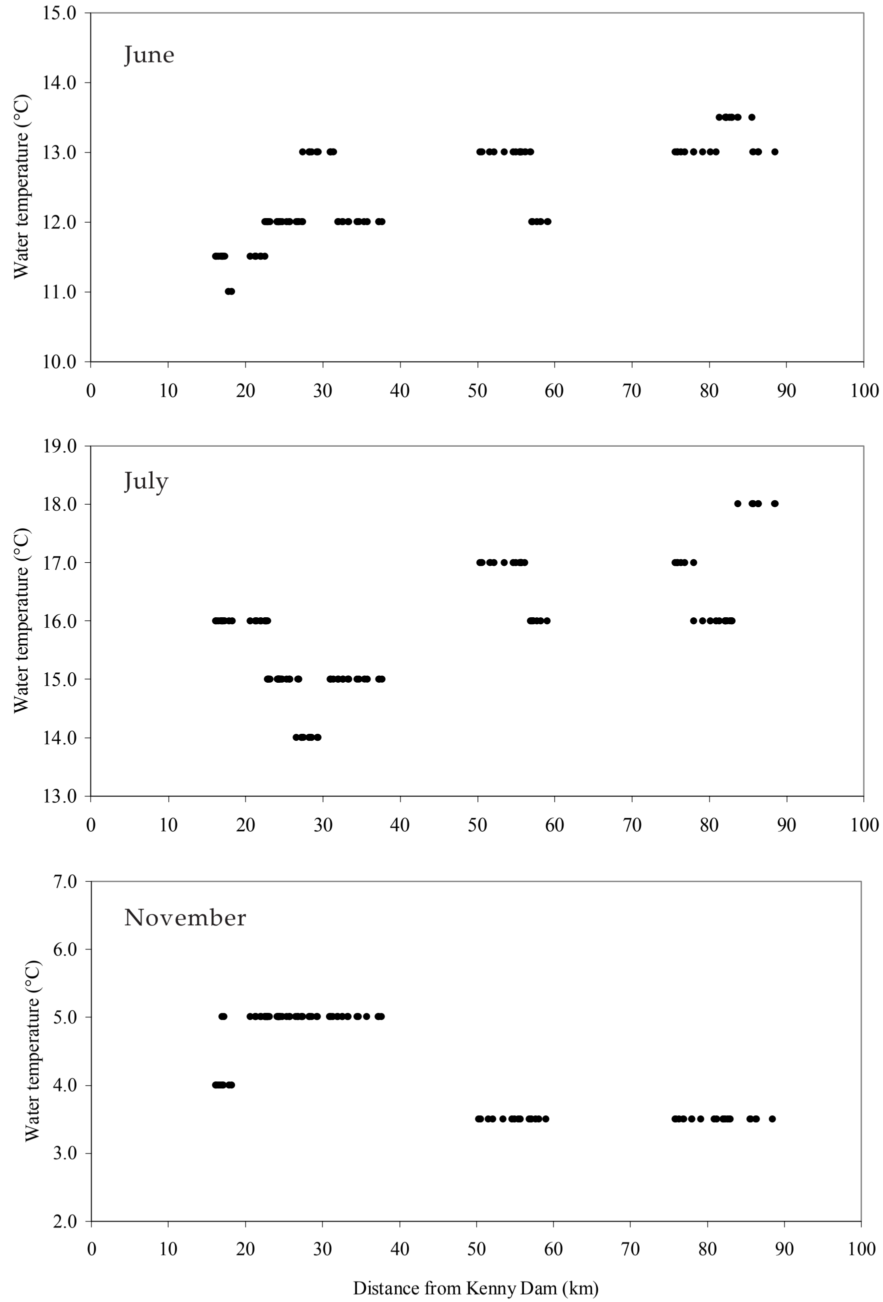
Factorial ANOVAs of fork length and wet weight (both ln-transformed to respect the assumptions of the test) with time of day (day or night) and time of year (April, May, June, July and November) showed that there was a significant interaction between time of day and time of year (Table 2). There were also, as expected, significant effects of time of year and time of day on these variables. The results were analyzed separately for day and night because of the significant interaction. Results are presented only for night catches, as the trends were identical for both, and night catches accounted for more than 65% of the total catch.

Fish size (fork length) was not significantly different between habitat complexes and natural habitats nor between habitats with and without debris (Figure 5). Fish caught in complex sites without debris tended to be slightly smaller than fish caught in other areas in June and July, but not significantly so. Juvenile chinook caught at night were significantly longer than fish caught during the day for all months except November (Figure 6; t tests).

The same patterns observed for chinook juveniles fork lengths held for wet weights: there were significant effects and interaction of the same variables (Table 2), and also no discernible pattern across months (Figure 7). Juvenile chinook 0+ were also heavier at night, in all months during which they were sampled (Figure 8).

Figure 3
Night Time Temperatures as Measured at Electrofishing Sites in the Nechako River, April to November, 2001





AVERAGE RANGE:	April	2
	May	2
	June	2
	July	4
	November	1.5
		2.3

Figure 4
Daily Flow of the Nechako River Below Cheslatta Falls
(WSC station 08JA017) and Releases from Skins Lake Spillway, 2001
(Nechako data incomplete)

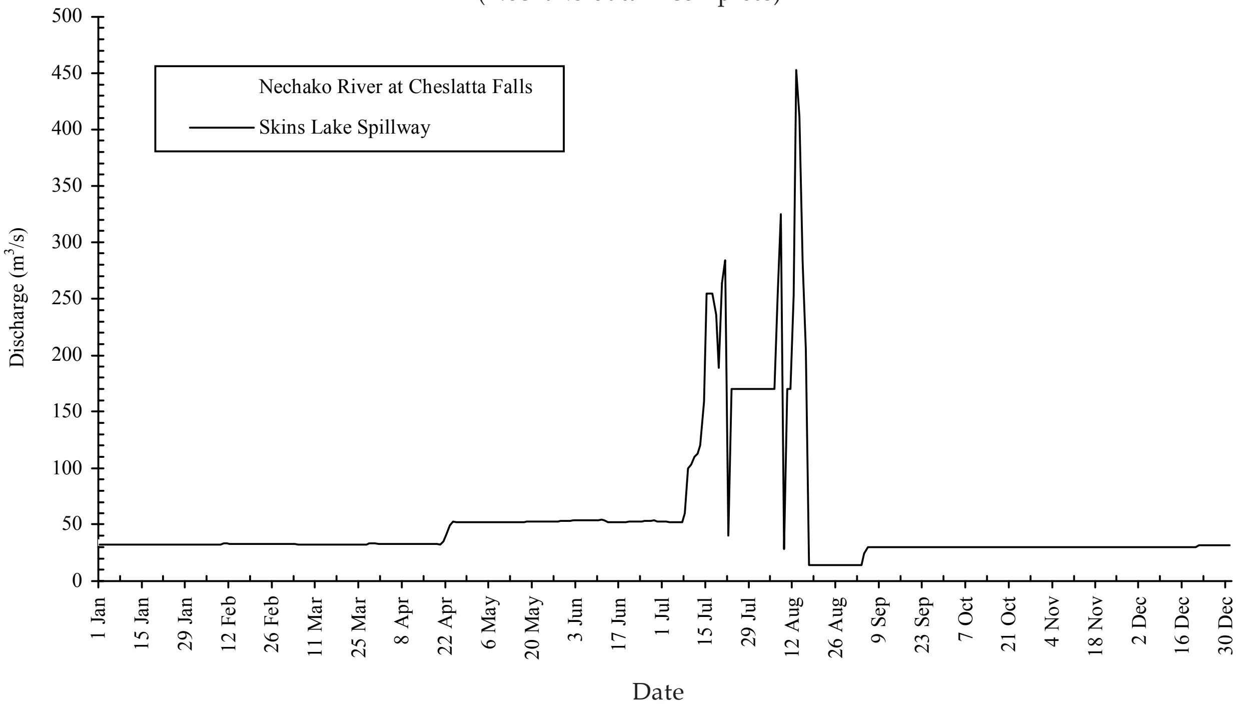


Figure 5
Fork Lengths (± SE) of Chinook 0+ Juveniles Electrofished at Night in
Habitat Complexes and Natural Habitats in the Nechako River, 2001

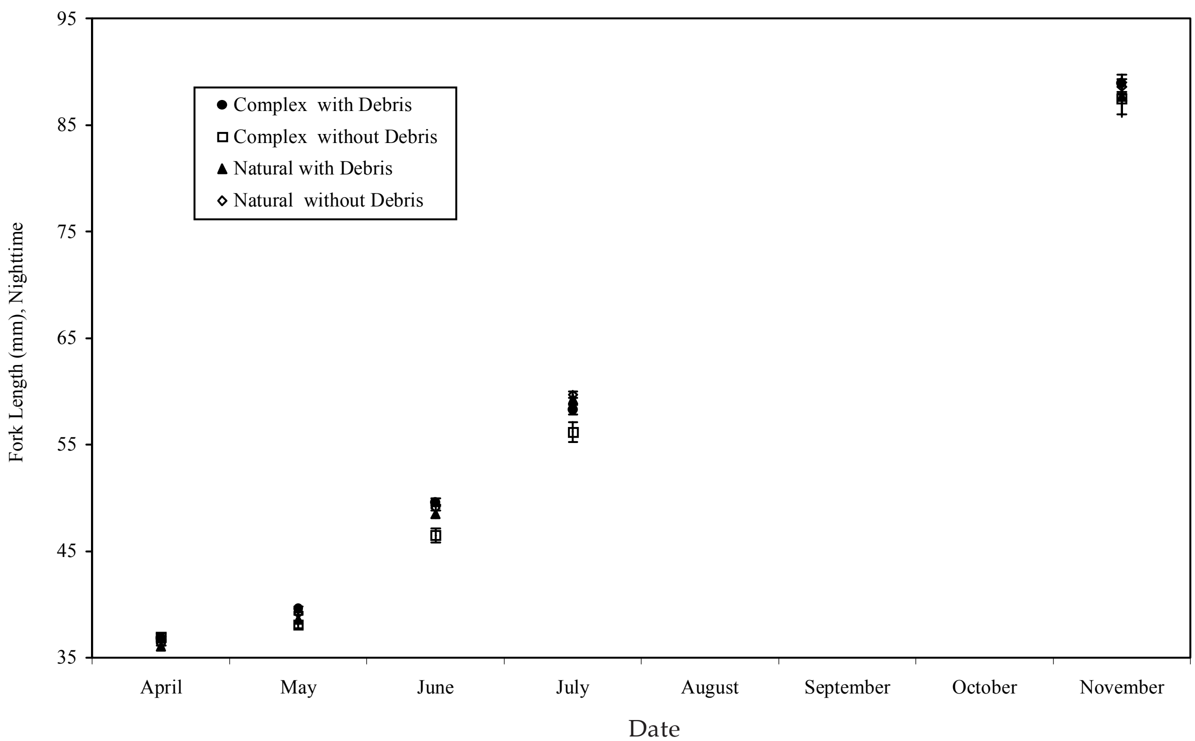


Table 1
Electrofishing Sites Sorted by Categories Used in the Analyses
Site name: RM = Right Margin, LM = Left margin, number = km from Kenney Dam, Nechako River, 2001.

Natural, with debris	Natural, without debris		Complex, with debris	Complex Type	Complex, without debris	Complex Type
LM13.9	LM9.5	RM9.0	LM15.6	Sweeper	RM17.0	Point Bar
LM17.0	LM10.8	RM9.1	LM18.3	Rail Debris Catcher	RM17.15	Point Bar
LM21.35	LM11.1	RM9.4	LM21.3	Rail Debris Catcher	RM17.3	Point Bar
LM22.7	LM13.7	RM10.3	LM21.4	Rail Debris Catcher	MC15.7	Pocket Pool
LM22.75	LM14.2	RM10.7	LM22.6	Rail Debris Catcher		
LM24.15	LM26.6	RM10.8	LM22.85	Rail Debris Catcher		
LM27.5	LM28.6	RM11.2	LM24.2	Rail Debris Catcher		
LM29.3	LM29.4	RM11.4	LM24.3	Rail Debris Catcher		
LM32.6	LM32.65	RM12.3	LM72.9	Sweeper		
LM50.4	LM33.3	RM12.4	LM75.9	Sweeper		
LM72.95	LM33.4	RM14.5	LM78.0	Sweeper		
LM75.6	LM37.3	RM14.85	LM78.0	Sweeper		
LM82.15	LM37.35	RM22.1	LM80.9	Rail Debris Catcher		
LM82.9	LM37.7	RM22.9	LM82.1	Sweeper		
LM88.5	LM50.6	RM22.95	LM82.3	Sweeper		
RM16.3	LM51.65	RM23.2	LM83.0	Rail Debris Catcher		
RM24.3	LM52.2	RM25.4	MC25.7	Rail Debris Catcher		
RM24.5	LM53.55	RM25.8	MC35.4	Pile Debris Catcher		
RM24.8	LM55.0	RM26.9	RM16.2	Sweeper		
RM26.8	LM55.75	RM28.3	RM16.5	Rail Debris Catcher		
RM27.3	LM56.2	RM31.0	RM16.8	Rail Debris Catcher		
RM34.5	LM57.2	RM31.1	RM17.9	Side Channel		
RM54.7	LM58.2	RM31.4	RM17.90	Side channel debris boom		
RM57.2	LM73.0	RM32.0	RM20.65	Rail Debris Catcher		
RM83.7	LM73.1	RM32.05	RM22.0	Rail Debris Catcher		
	LM73.5	RM35.8	RM22.55	Rail Debris Catcher		
	LM73.6	RM55.5	RM23.0	Rail Debris Catcher		
	LM75.95	RM56.9	RM24.35	Rootwad Sweeper		
	LM76.4	RM57.1	RM24.4	Floati ng crib		
	LM76.9	RM57.75	RM24.6	Pseudo Beaver Lodge		
	LM79.2	RM59.1	RM27.4	Floati ng crib		
	LM80.2	RM74.0	RM28.4	Rail Debris Catcher		
	LM82.2	RM74.1	RM34.7	Pile Debris Catcher		
	LM82.7	RM81.3	RM86.35	Rail Debris Catcher		
	MC78.0	RM82.1	RM86.375	Rail Debris Catcher		
	MC85.6	RM85.7				
25 sites	72 sites		35 sites		4 sites	

Table 2
Results of Factorial ANOVAs on Fork Length and Wet Weight of Juvenile Chinook Captured by Electrofishing in the Nechako River, 2001

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Ln (length)					
Month	4	207.40	51.85	1643.37	<.0001
Time	1	4.41	4.41	139.88	<.0001
Month * Time	4	0.68	0.17	5.41	0.0002
Residual	6,807	214.77	0.03		
Ln (weight)					
Month	4	2553.70	638.43	1753.90	<.0001
Time	1	54.66	54.66	150.17	<.0001
Month * Time	4	9.17	2.29	6.30	<.0001
Residual	6,807	2477.77	0.36		

Figure 6
Fork Lengths (± SE) of Chinook 0+ Electrofished in the Nechako River, 2001

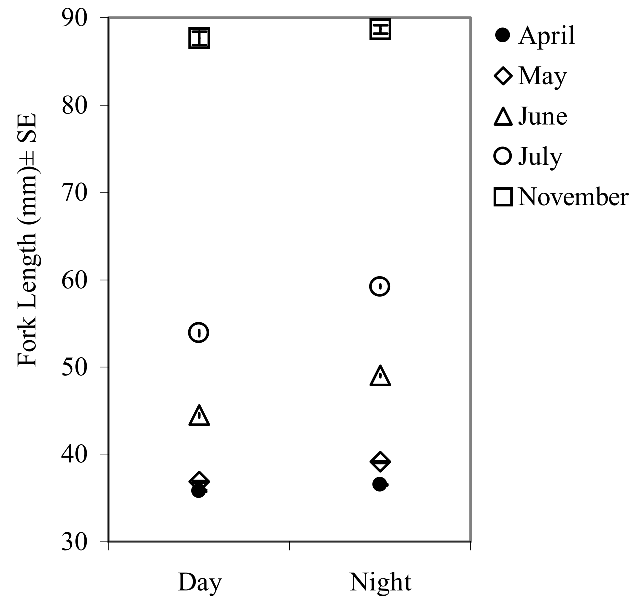


Figure 7
Wet Weights (± SE) of Chinook 0+ Juveniles Electrofished at Night in Habitat Complexes and Natural Habitats in the Nechako River, 2001

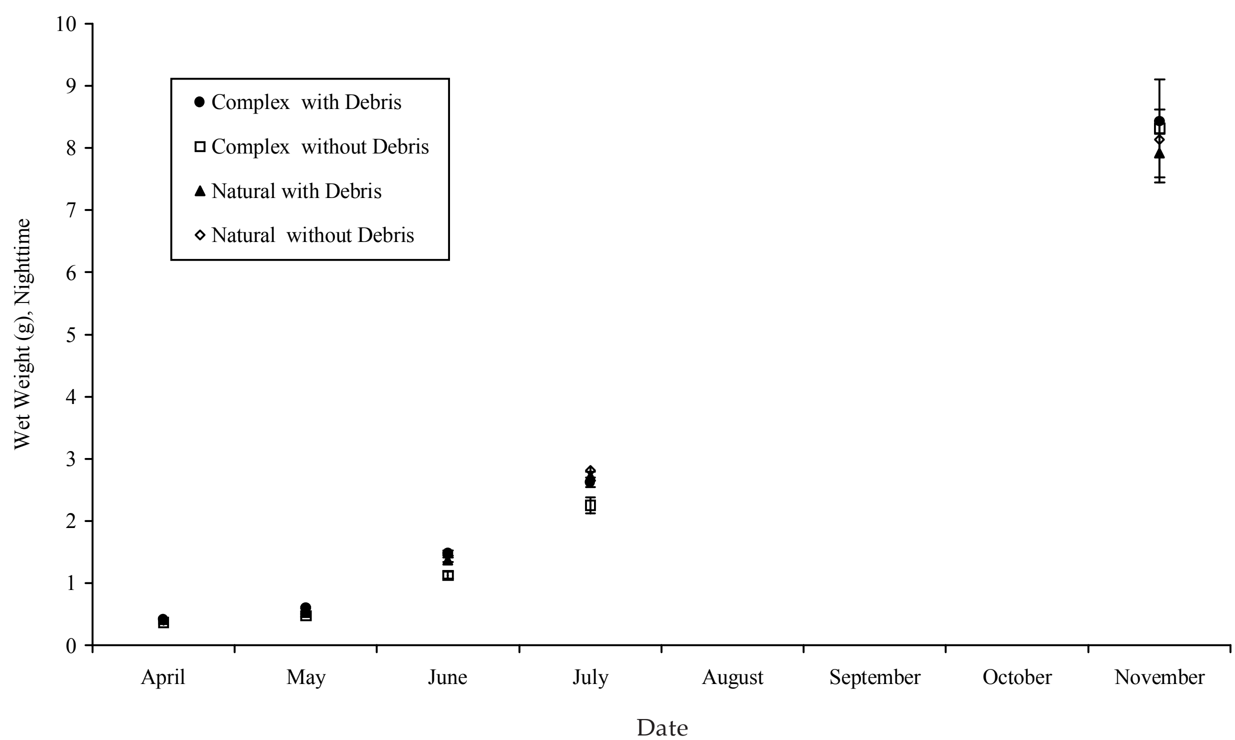
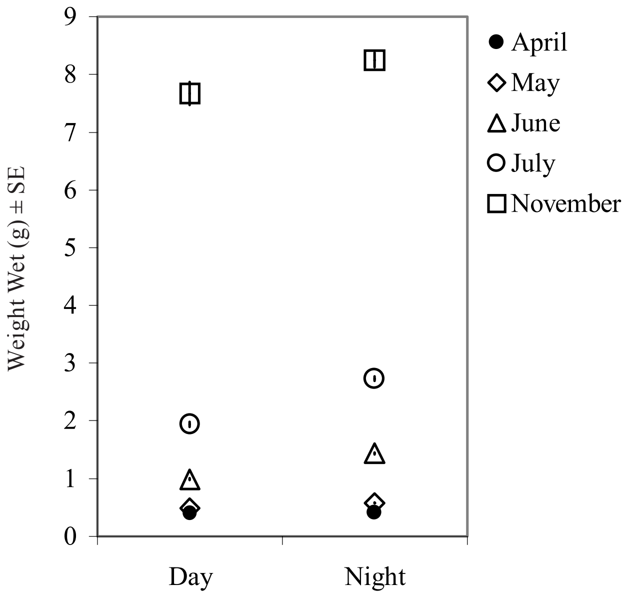


Figure 8
Wet Weights (± SE) of Chinook 0+
Electrofished in the Nechako River, 2001



The most likely reasons for the apparent day-night size differences are related to territoriality and diurnal movements: 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, which 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 at night to avoid predators. Fishes are often found in shallow margin water at night whereas none are to be seen during the day (P. Fredericksen, Triton, pers. comm.). The coefficient of variation for night-caught fish fork lengths was also slightly higher than that for day-caught fish (27% vs. 26%), indicating a wider range of size.

Overall, there was no effect of debris on fish size, as chinook 0+ size did not significantly differ between natural (no man-made structure) and complex (modified) sites, nor between those sites with or without debris, even with the effect of time of day taken into account.

Chinook 0+ Growth

Growth of chinook 0+ salmon electrofished along the river margins appeared to follow two separate growth stanzas (Ricker 1979). Growth was slow between April and May and then increased between May and November (Figures 9 and 10). The first stanza was 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. 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 on date, emergence appeared to have ceased by mid-May or shortly thereafter. This was confirmed by another study (Fry Emergence, NFCP 2001) which showed that chinook fry emergence tapered from late April to mid-May 60 km upstream of Diamond Island.

Chinook Salmon 1+ Growth

There were relatively few chinook 1+ caught (216), as most of them had left the stream. The majority were caught only at night. When chinook 1+ were caught during the day and at night, in April and May, their fork lengths and wet weights were not significantly different from night to day, as was the case for chinook 0+ (Figures 11 and 12).

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 13. Although a power function explained 97% of the overall variation ($Weight = 2.0^{-06} \cdot Fork\ Length^{3.463}$, $R^2 = 0.97$ for all chinook; $Weight = 1.8^{-06} \cdot Fork\ Length^{3.462}$, $R^2 = 0.97$ for chinook 0+ only), it was apparent that there was more variation among 1+ juveniles than among 0+. For example, 1+ juveniles showed more variation in weight than 0+ juveniles for their size (Figure 14). This may reflect their readiness to outmigrate.

0+ and 1+ Chinook Salmon Condition

Average condition of 0+ chinook increased from 0.85 g/mm^3 in April to 1.19 g/mm^3 in July and November (Figure 15). Average condition of 1+ chinook salmon was constant at about 1.28 g/mm^3 from April to early July (Figure 16).

Figure 9
Mean (±1 SE) Fork Lengths of Chinook 0+ Salmon Caught
by Electrofishing, Nechako River, 2001

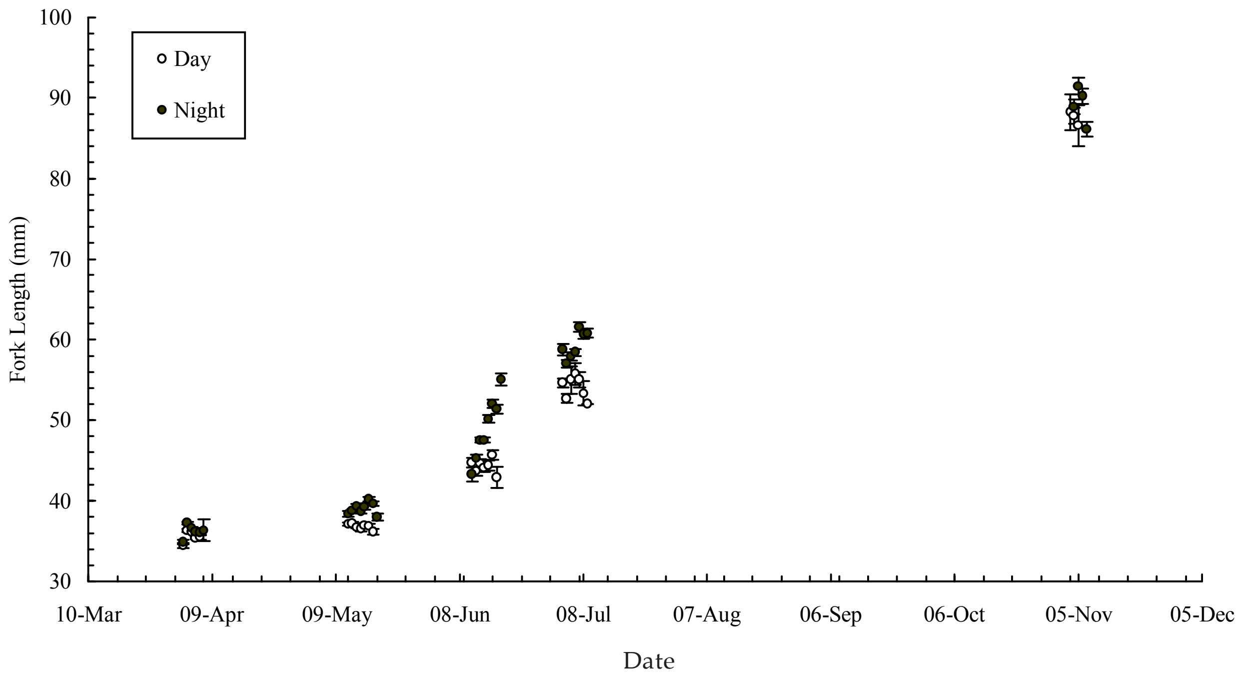


Figure 10
Mean (±1 SE) Wet Weights of Chinook 0+ Salmon Caught
by Electrofishing, Nechako River, 2001

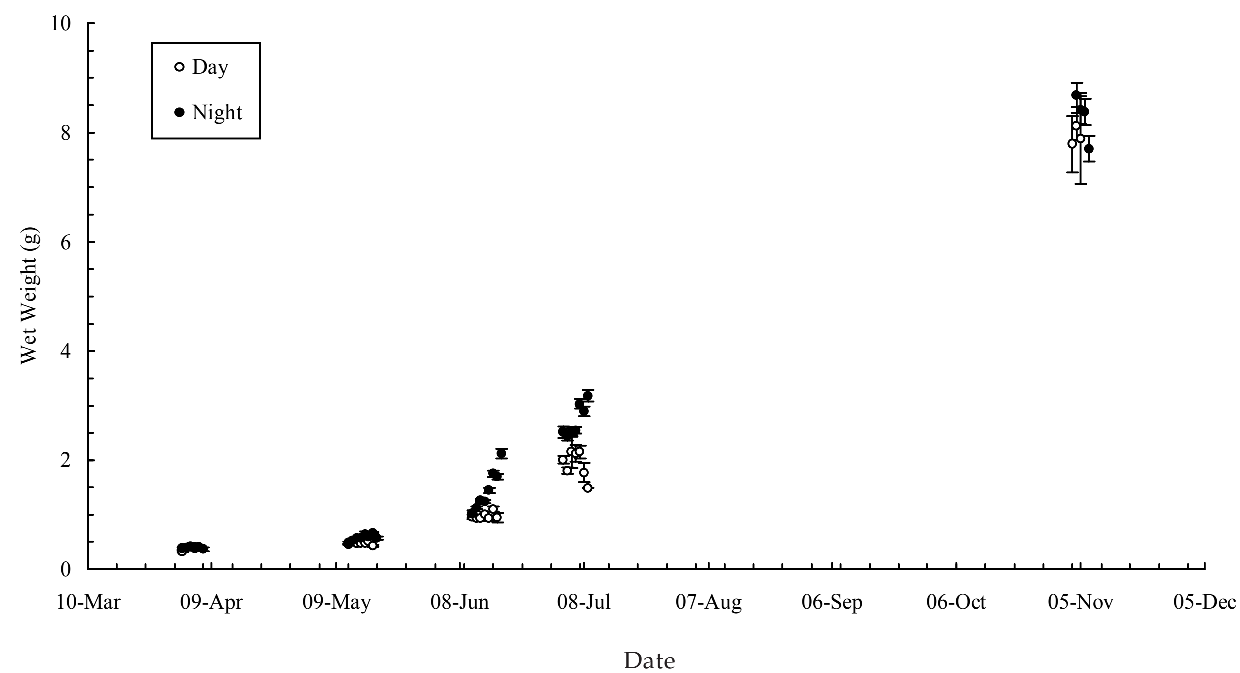


Figure 11
Chinook 1+ Fork Lengths Sampled from Electrofishing, Nechako River, 2001

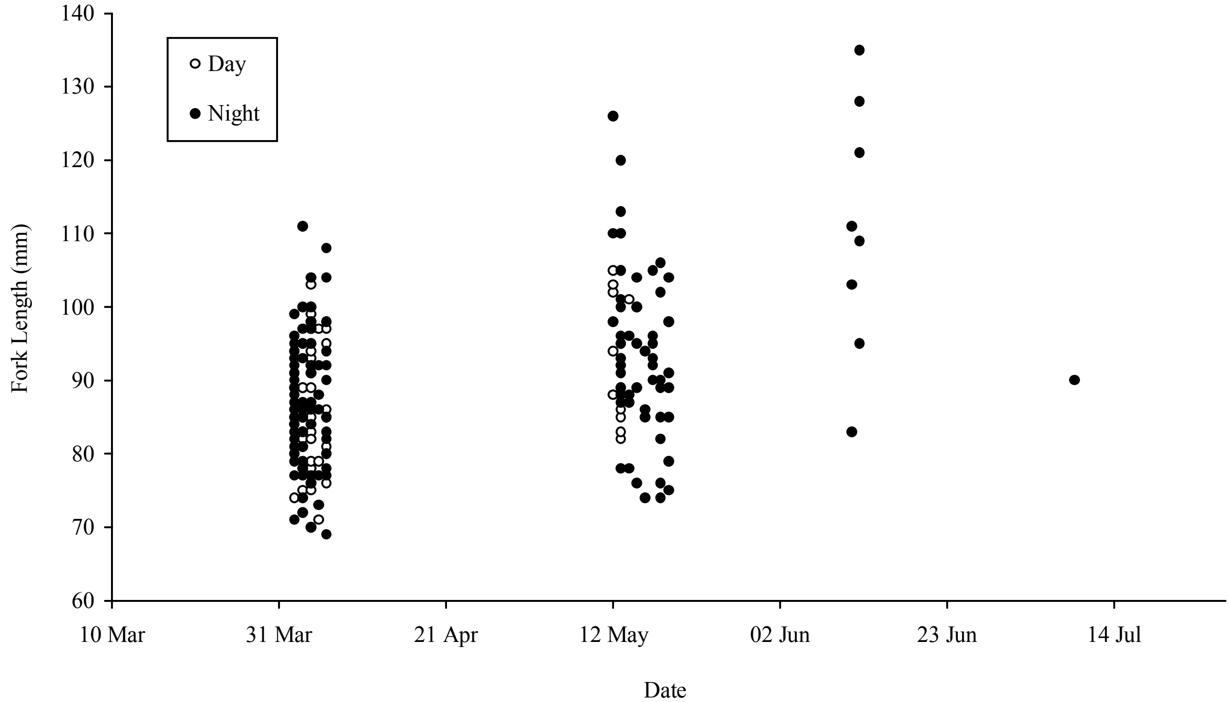


Figure 12
Chinook 1+ Wet Weights Sampled from Electrofishing, Nechako River, 2001

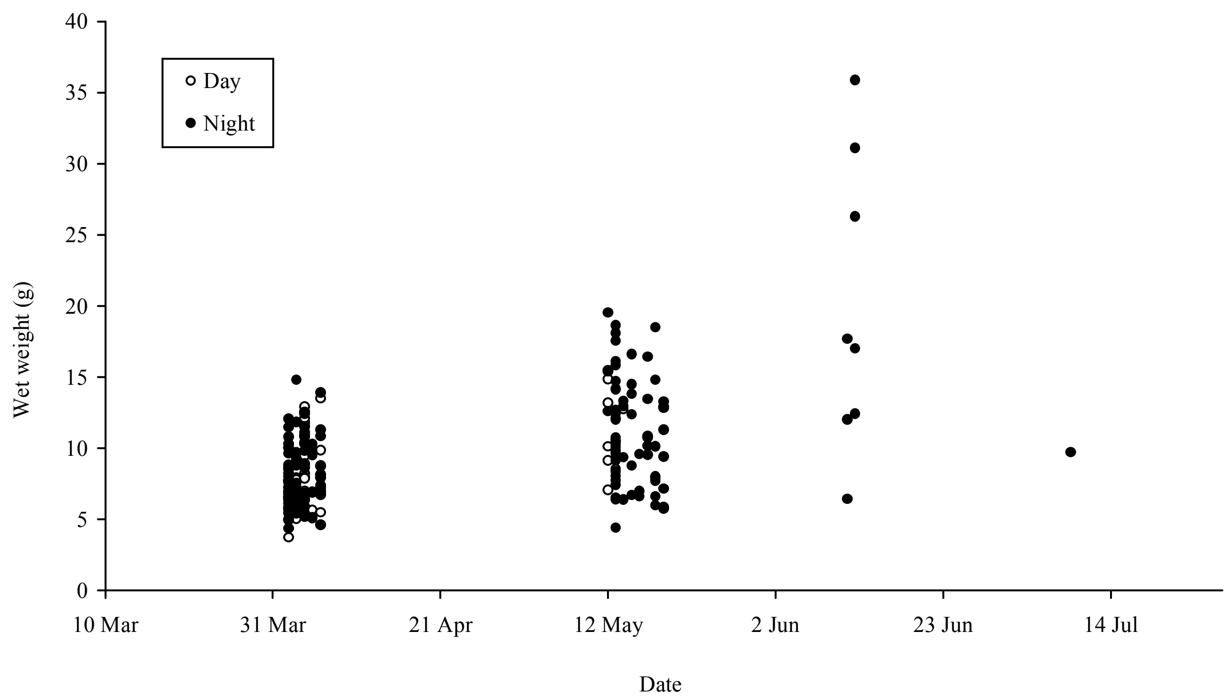


Figure 13
Wet Weight vs. Fork Length for Juvenile Chinook Salmon,
Nechako River, 2001: Electrofishing

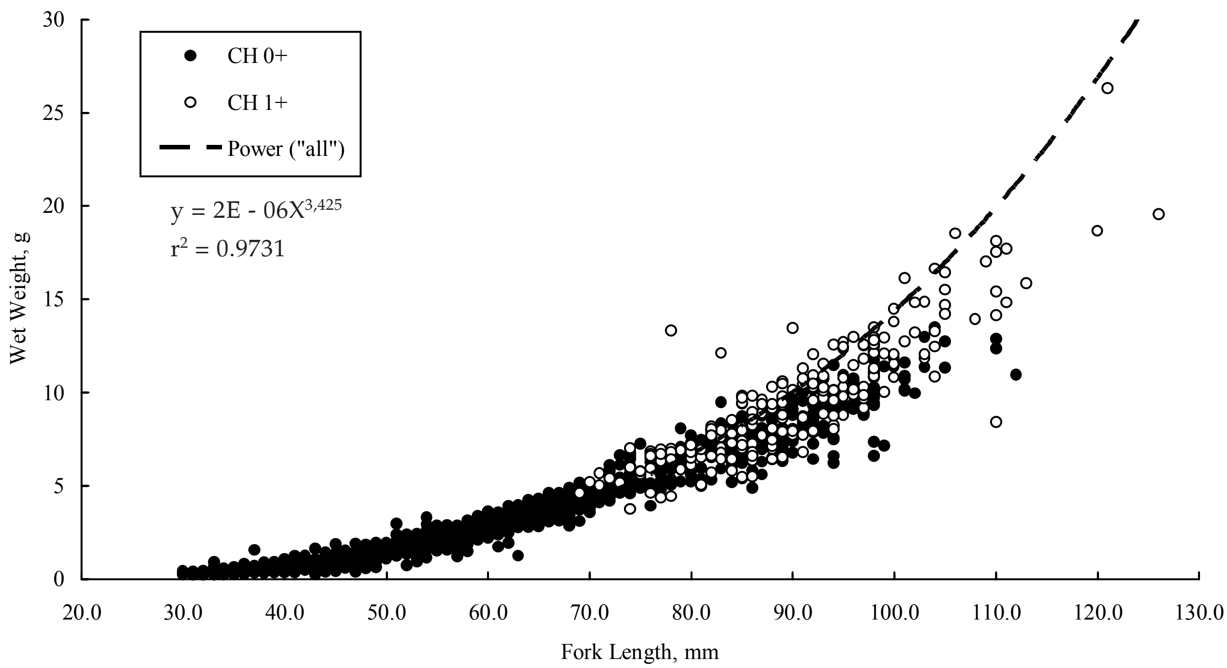


Figure 14
Variance in Juvenile Chinook Wet Weight vs. Fork Length,
Fish Caught Electrofishing, Nechako River, 2001

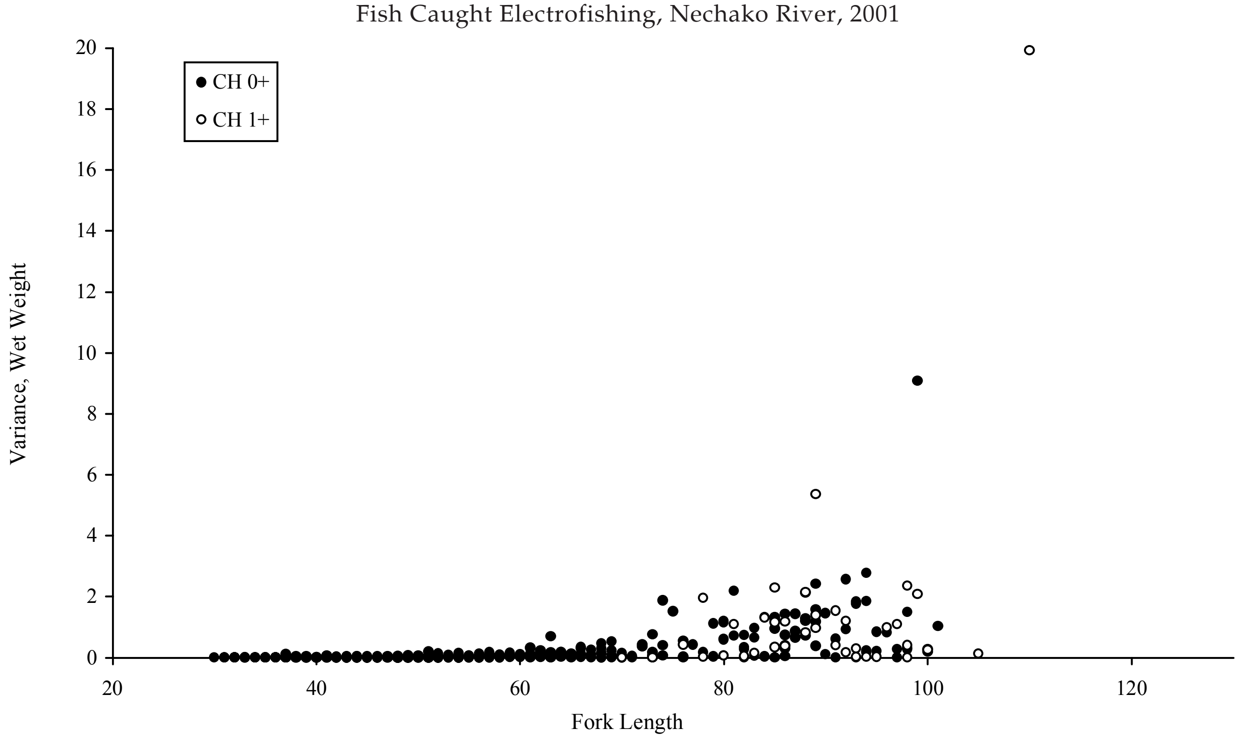


Figure 15
Condition Indices of Juvenile Chinook 0+ Caught by
Electrofishing in the Nechako River, 2001

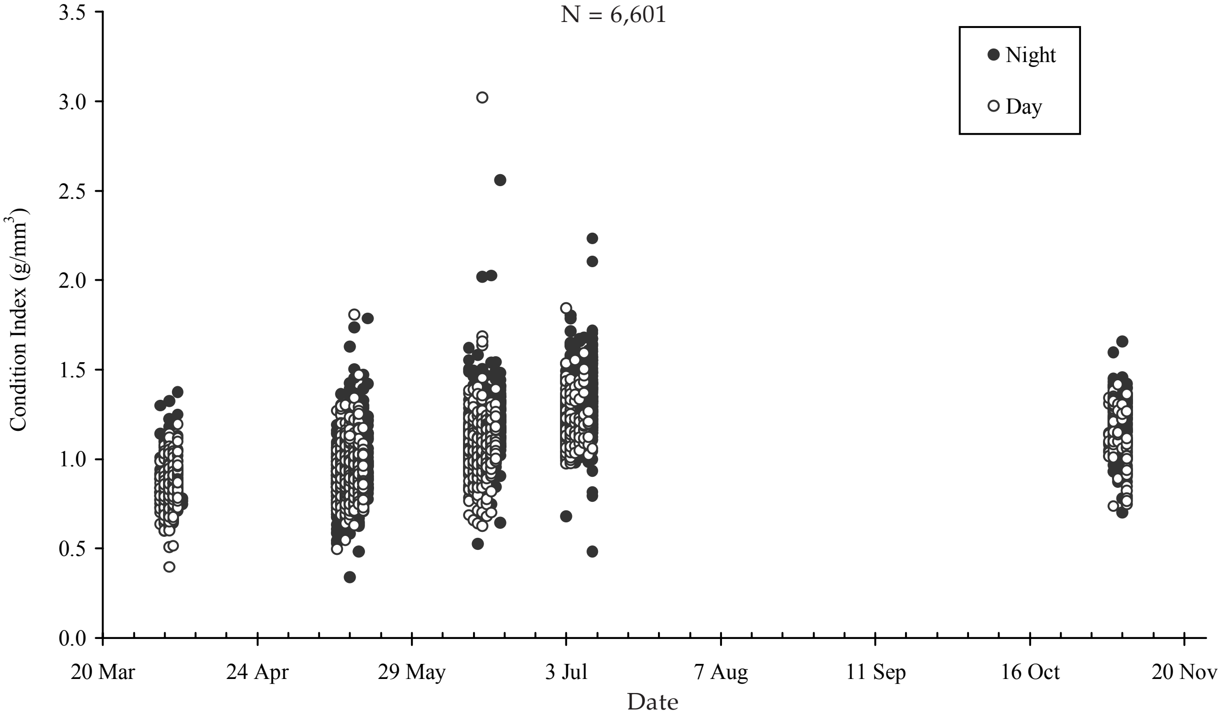
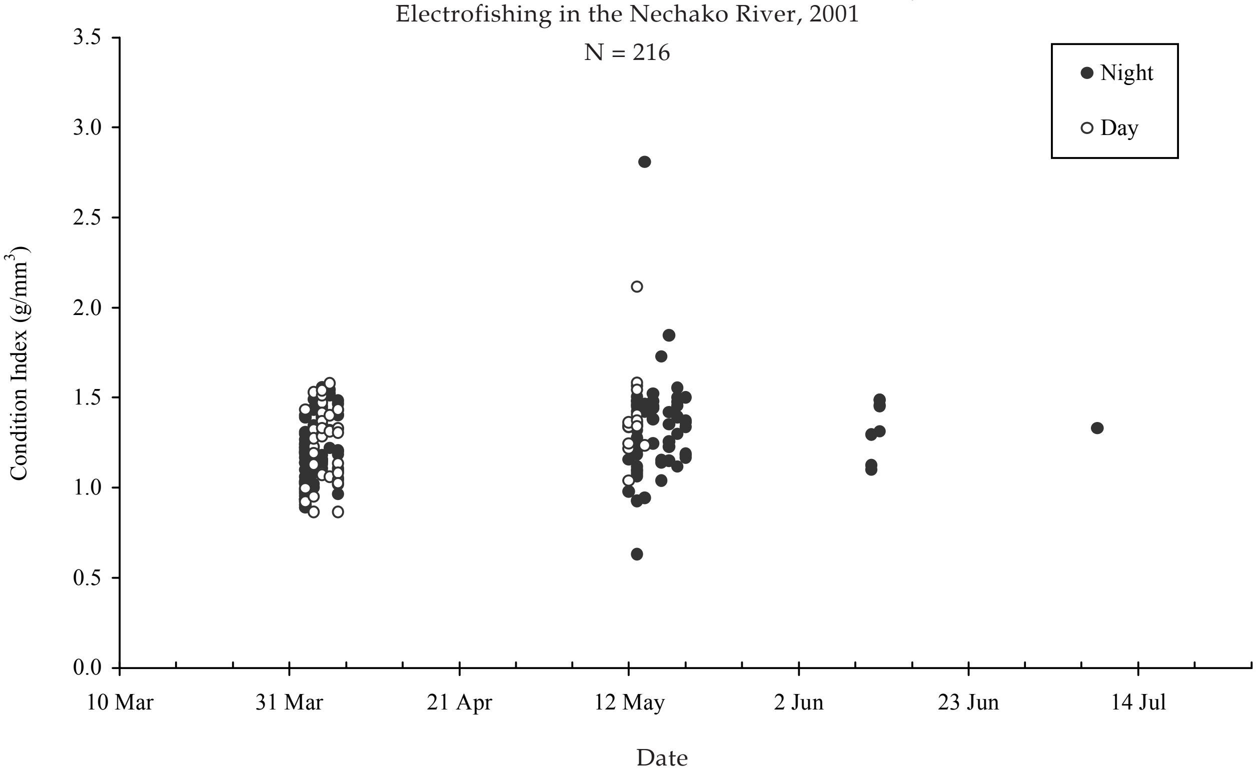


Figure 16
Condition Indices of Juvenile Chinook 1+ Caught by
Electrofishing in the Nechako River, 2001



Diamond Island Traps

Overall, 10,049 juvenile chinook salmon were caught by the rotary screw traps at Diamond Island in 2001 (Table 3 and Appendix 1): 9,037 0+ and 1,012 1+. Approximately 71% of all 0+ fish were caught at night, while 98% of 1+ were caught during that time. 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 over time was essentially bimodal, with two peaks of abundance: April 30 – May 15, and June 21 – July 4 (Figure 17).

The numbers of 0+ chinook estimated to have passed Diamond Island between April 1 and July 20 ranged from 78,863 for trap 2 to 239,541 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 143,911.

All analyses of juvenile chinook catch distributions among traps were done on volume-expanded numbers, 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 were no significant interactions between time of capture (day or night) and trap position for juvenile chinook 0+ (Table 4): the right margin trap caught significantly more fish in terms of absolute numbers and per average session (Table 3, Figure 18). The left margin and mid channel traps caught also significantly different numbers of chinook 0+ during the night, the mid-channel trap catching the least (Figure 18). The chinook 0+ morphological parameters (fork length, wet weight) also differed among traps (Figures 19a and b): the right margin trap, which sampled more fish, also caught significantly smaller juvenile chinook at night than either of the two other traps (tests done on ln-transformed data; differences of 11% in fork length from right margin to left margin fish and 45% in wet weight, both at night). This trap was the only one which sampled most of the water column (it almost touched the bottom, whereas the other traps sampled the upper portion of the water column) and it may have sampled a wider range of fish size, assuming that chinook partition themselves in the water column. However, the coefficients of variation of the right margin trap (22% vs. 26% for both mid and left for fork length and 84% vs. 93 % - also for the other two traps- for wet weight), and the range of fish it sampled were similar to those of other traps. It thus appears that smaller chinook tended to pass closer to the bank of the river at Diamond Island than in the middle of the river. This is consistent with electrofishing observations.

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.

<u>Chinook 1+</u>

The numbers of 1+ chinook estimated to have passed Diamond Island between April 2 and July 17 ranged from 5,477 for trap 3 to 27,258 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 15,128.

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 20). This may indicate a propensity of juvenile 1+ chinook to use the middle of the river more than its margins, as opposed to 0+ fish which were caught in greater numbers by the right margin trap.

The chinook 1+ morphological parameters (fork length, wet weight) were similar among the two channel traps, and slightly smaller in the right margin trap (Figure 21; tests done on ln-transformed data). Only night catches were tested as there were only 17 fish caught during the day (Table 3): there were differences of only 3 % and 11% 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 22 and 23; compare with Figures 9 and 10). The first growth stanza ran from early April to mid-May, at which time the rate of

Table 3
Summary of Rotary Screw Trap (RST) Catches of Chinook 0+ and 1+
at Diamond Is, Nechako River, April 1 to July 20, 2001

Trap Number	Trap Location	0+ Chinook			1+ Chinook		
		Day	Night	Total	Day	Night	Total
1	Left Margin	573	2,033	2,606	10	603	613
2	Mid Channel	443	1,173	1,616	7	261	268
3	Right Margin	1,638	3,177	4,815	0	131	131
	Total	2,654	6,383	9,037	17	995	1,012

Figure 17
Juvenile Chinook Salmon 0+ and 1+ Caught in Rotary Screw Traps, Nechako River, 2001
Day and night catches included

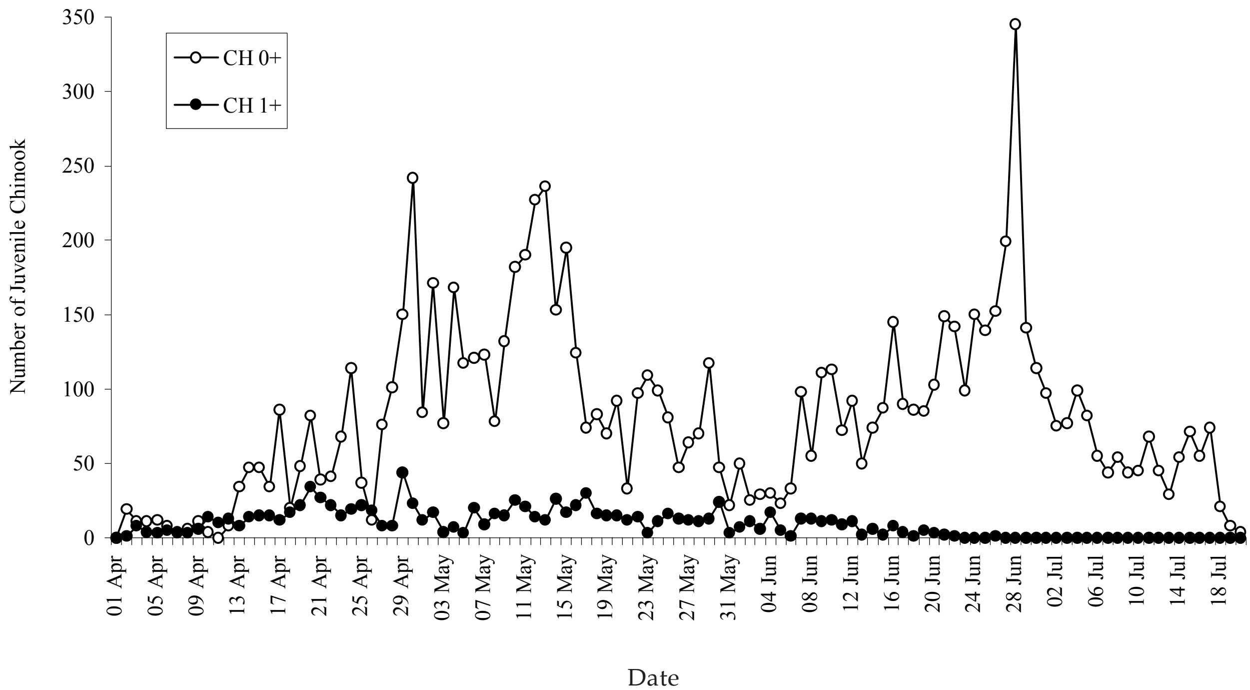
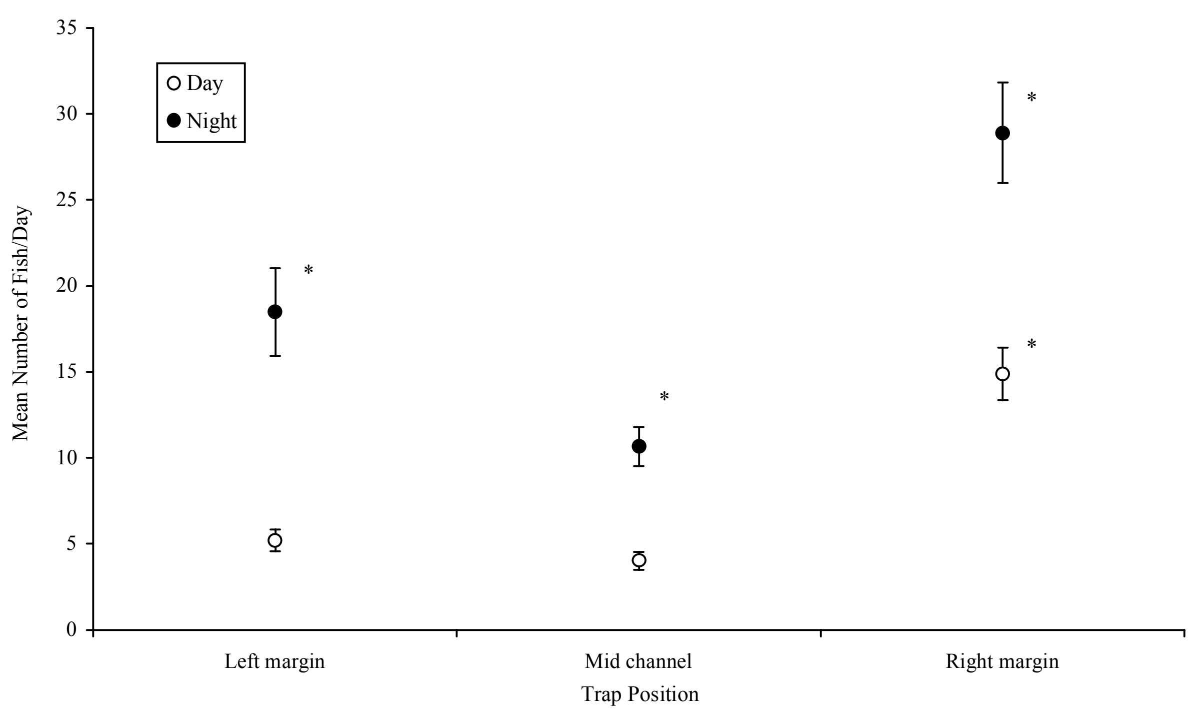


Table 4
Factorial ANOVA on Numbers of Juvenile Chinook 0+ Captured by
Rotary Screw Traps Standardized by Volume Sampled, Nechako, 2001
Ln- transformed values

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Day/Night	1	311.821	311.821	58.905	<.0001
Trap location	2	422.664	211.332	39.922	<.0001
Day/Night * trap location	2	3.509	1.755	0.331	0.718
Residual	654	3462.029	5.294		

Figure 18
Mean Numbers (± SE) of Juvenile Chinook 0+ Caught in Rotary Screw Traps,
Nechako River, April 01- July 20, 2001



fry emergence had dropped to a level that allowed the true population growth curve to become apparent. From May 20 to July 20, chinook 0+ grew at an average of 0.52 mm per day, based on night catches. This is very similar to last year, when they grew at an average of 0.49 mm per day from May 13 until July 17, 2000.

1+ Chinook Salmon Growth

The fork lengths and weights of 1+ chinook did not vary much in time, which would be expected in fishes about to leave the stream (Figures 24 and 25). Yearling chinook grew on average by 0.02 mm per day in 2001, less than the 0.16 mm/d reported in 2000 (results based on night catches). This could be due to several reasons, ranging from smaller sample size in 2000 (262 1+ chinook vs. 995 in 2001), higher competition, different temperature regimes, to conditions in the Nechako itself or in its tributaries (fish rearing in tributaries are typically smaller and leaner, and their survival rate in these areas, and hence their contribution to Nechako catches, may have been different in the two years). The determination of the most plausible explanation for this trend is however beyond the scope of this report.

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

The regression of weight on length for trap-caught juvenile chinook salmon at Diamond Island (N = 3,772, $Wt = 1.4^{-06} * FL^{3.5004}$, $R^2 = 0.96$, $P<0.001$) was similar to the regression for juvenile chinook salmon captured by electrofishing (N = 6,601, $Wt = 1.8^{-06} * FL^{3.4628}$, $R^2 = 0.97$, $P<0.001$).

0+ and 1+ Chinook Salmon: Condition

The average condition of 0+ chinook salmon was similar to that shown for electrofished fish—condition increased over April and May to an asymptote of 1.1 g/mm^3 in late June and July. Condition of 1+ chinook also increased with date from 1.02 g/mm^3 in early 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 2001. The curvature of the growth curves of 0+ chinook indicated that emergence had ceased by mid May and that growth was rapid over late May, June and July.

Figure 19
Mean Fork Length and Wet Weight of Juvenile Chinook Salmon Caught in Rotary Screw Traps, Diamond Island, Nechako River, April - July 2001
*= significantly different among traps, same time period. Tests on ln-tranformed data.

Figure 19A

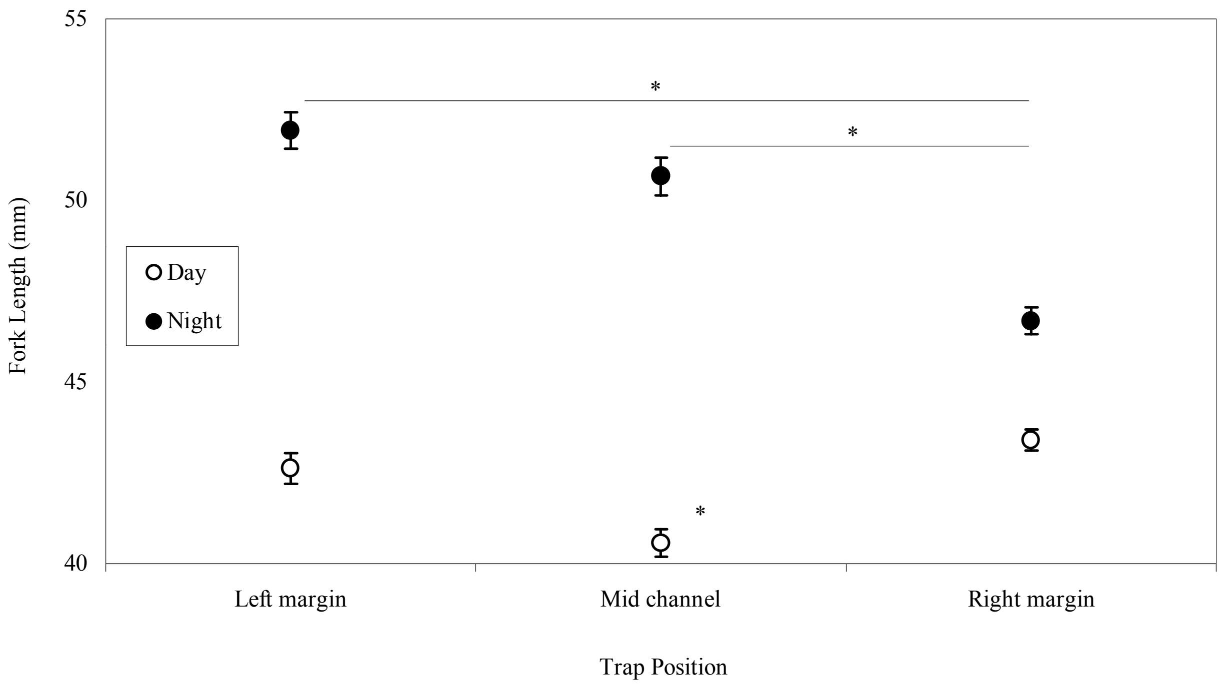


Figure 19B

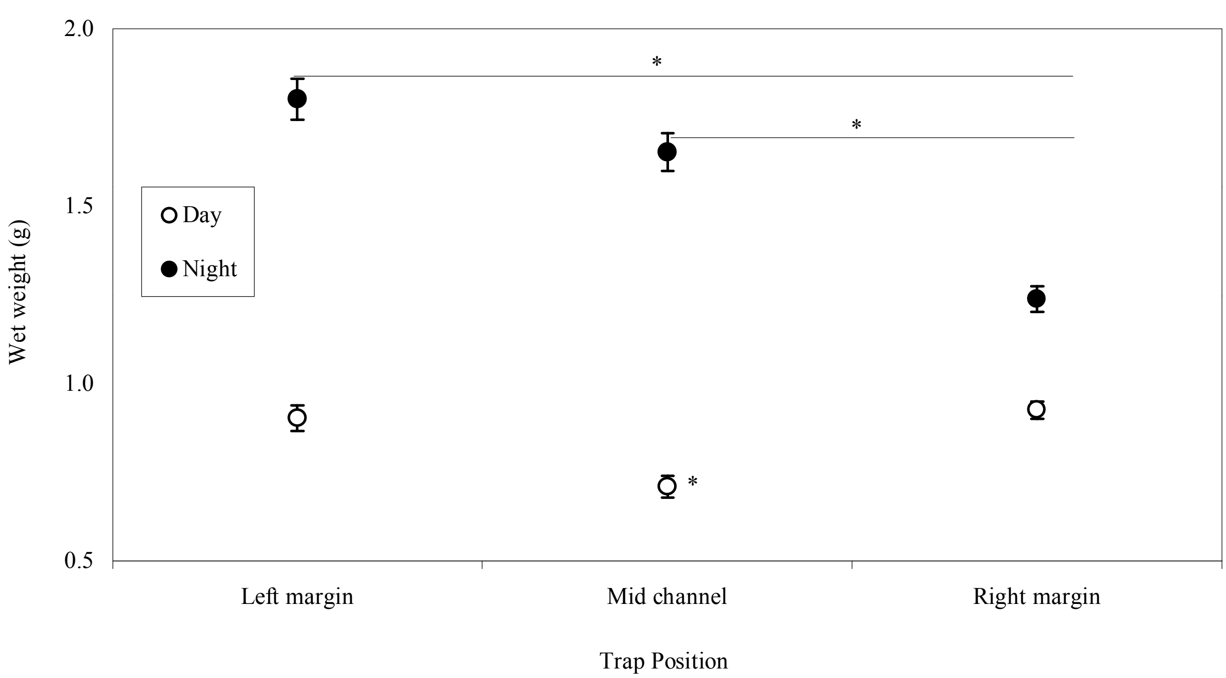


Table 5
Factorial ANOVA on Numbers of Juvenile Chinook 1+ Captured by Rotary Screw Traps Standardized by Volume Sampled, Nechako, 2001
Ln- transformed values

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Day/Night	1	1321.668	1321.668	370.883	<.0001
Trap location	2	95.591	47.796	13.412	<.0001
Day/Night * trap location	2	45.597	22.798	6.398	0.0018
Residual	654	2330.577	3.564		

Figure 20
Mean Numbers (± SE) of Juvenile Chinook 1+ Caught in Rotary Screw Traps, Nechako River, April 1- July 20, 2001
* = significantly different from other traps during same time period, ln-transformed data, PLSD test.

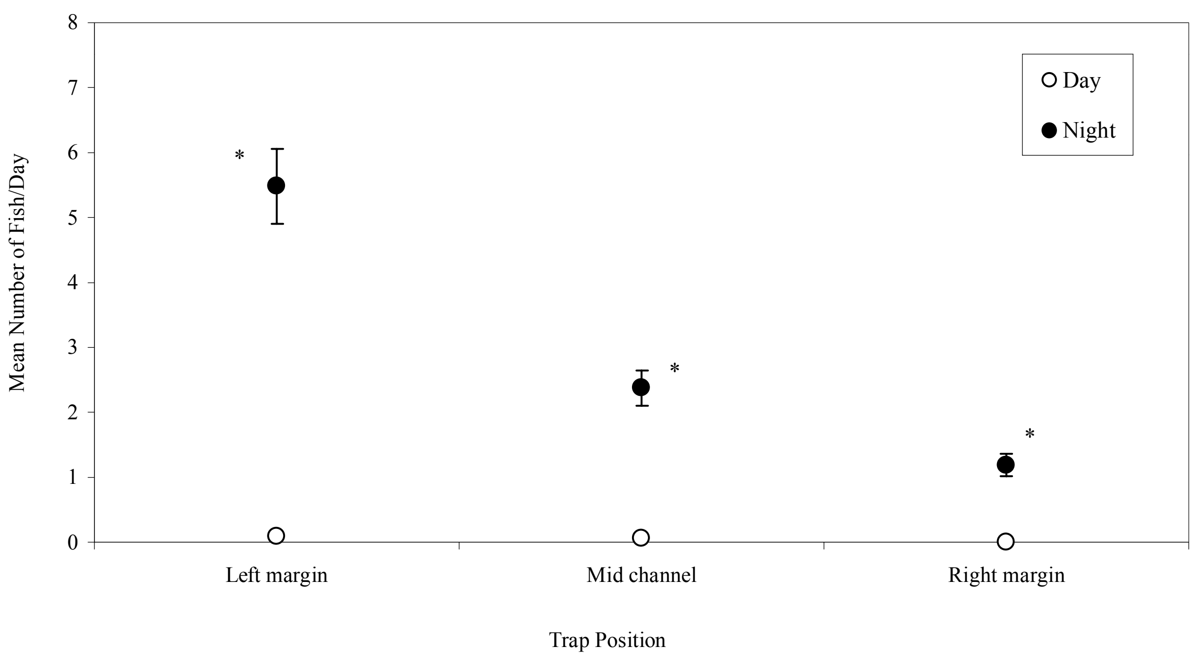


Figure 21
Mean Fork Length and Wet Weight (± SE) of Juvenile Chinook 1+ Caught in Rotary Screw Traps at Night, Nechako River, April 1- July 20, 2001
* = significantly different from other traps during same time period, ln-transformed data, PLSD test .

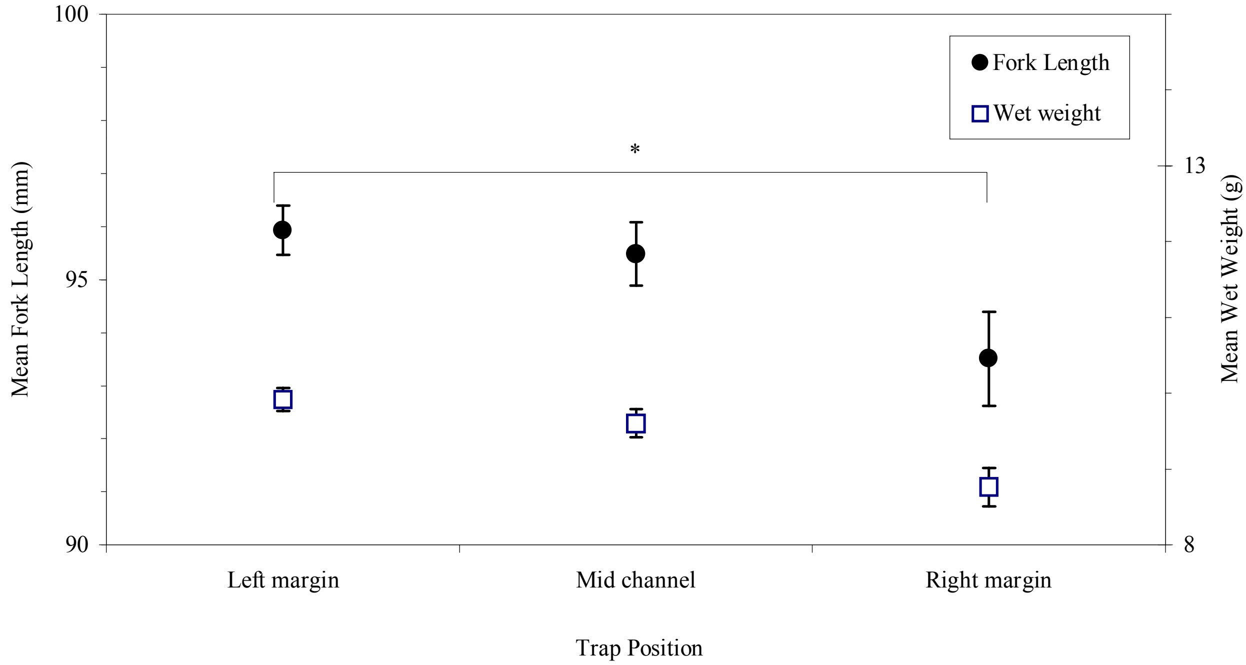


Figure 22
Mean Length (±SE) of 0+ Chinook Salmon Caught in Rotary Screw Traps, Nechako River, 2001

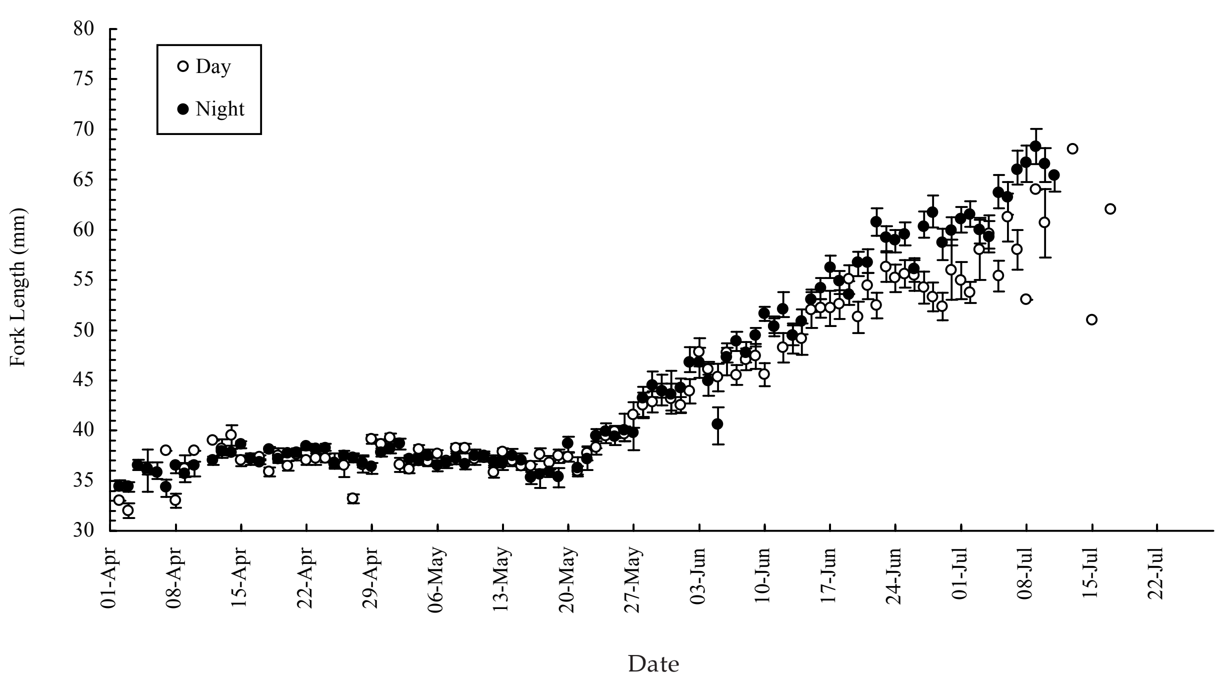


Figure 23
Mean Weight (±SE) of 0+ Chinook Salmon Caught in Rotary Screw Traps, Nechako River, 2001

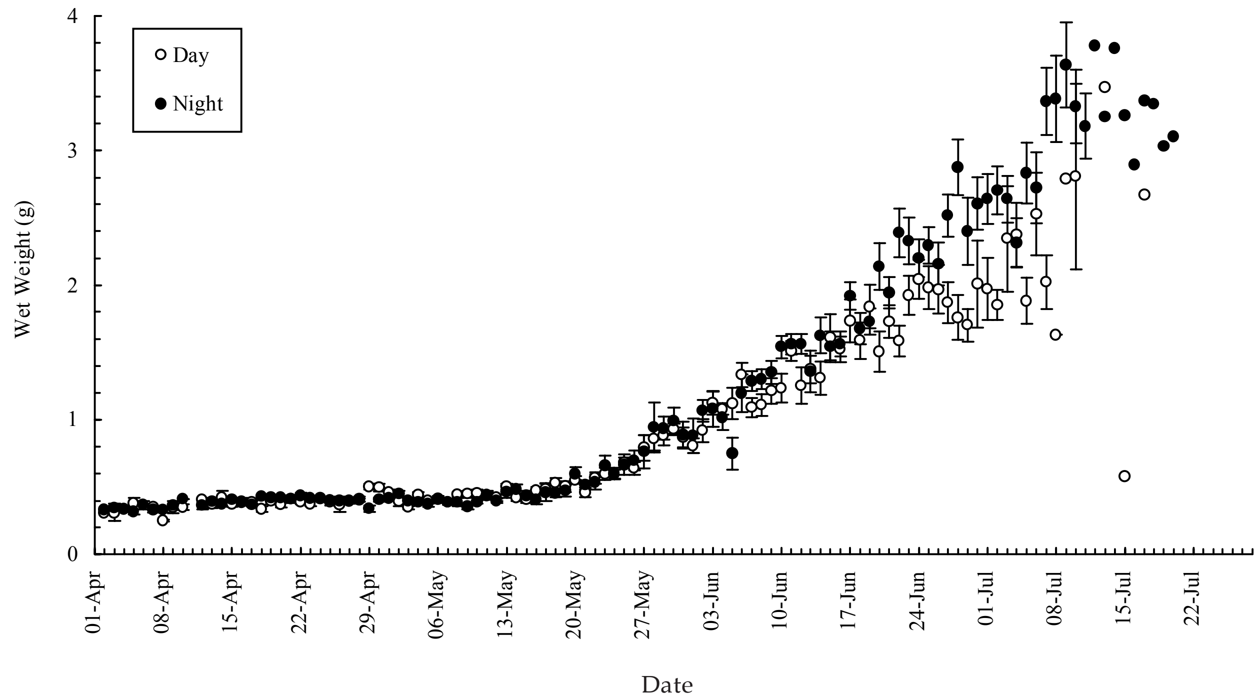


Figure 24
Mean (±1 SE) Length of 1+ Chinook Salmon, Nechako River, 2001, from Rotary Screw Traps

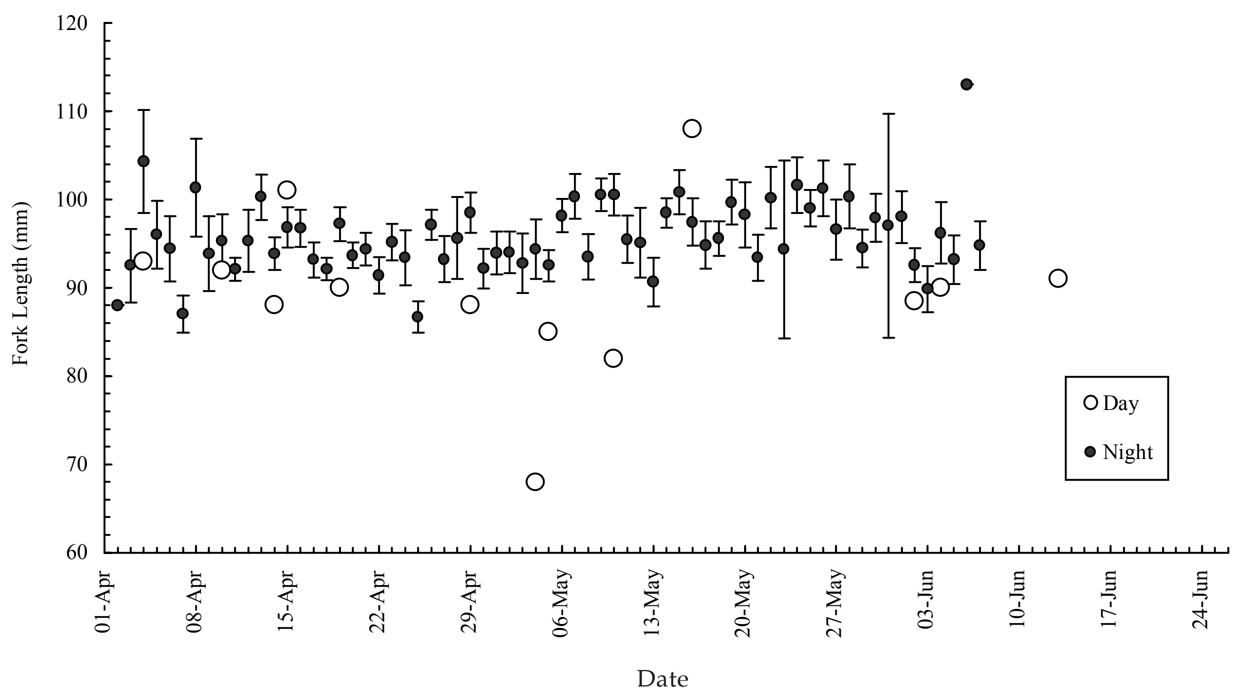
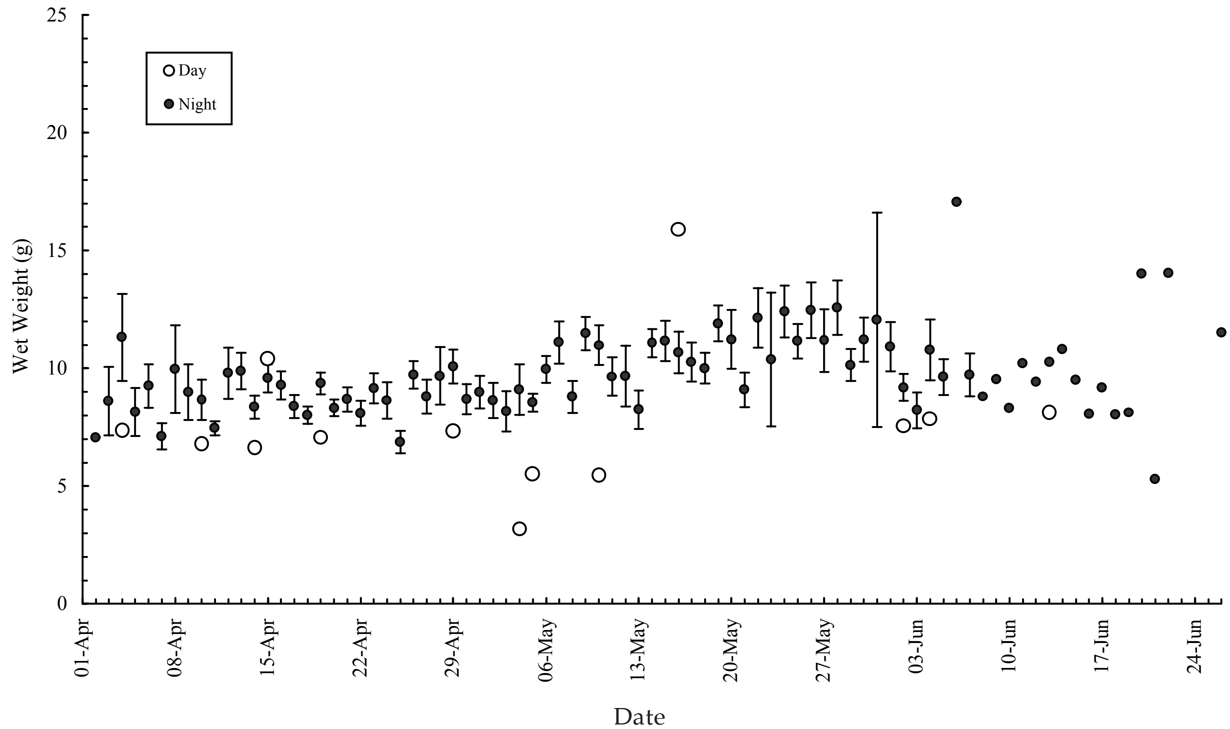


Figure 25
Mean (±1 SE) Weight of 1+ Chinook Salmon, Nechako River, 2001, from Rotary Screw Traps



Catches

Electrofishing/All Species

In total, 1,243 electrofishing sweeps were made along the margins of the upper Nechako River from April 2 to November 7, 2001: 628 during daylight and 615 at night. The average area covered by a sweep was 130 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 last year, to RM17.9, a 1600 m^2 side channel that was found to contain many fish. Effort ranged from 80 to 1639 s (median 248 s).

Overall, 68,517 fishes from 12 species or families were captured and then released (Table 6). Chinook salmon were the most common species (N = 33627 or 49% of the total number), followed by redside shiners (N = 7,991 or 11%) and largescale suckers (N = 6,438 or 9%). Sockeye salmon and burbot were the least common species (N = 23 in both cases). The vast majority of fish sampled were juveniles, with rainbow trout having the lowest proportion of juveniles (35%).

Electrofishing/0+ Chinook

Overall, 33,383 0+ chinook were captured by electrofishing (Table 7), of which 7,703 or 23% were taken during daylight. CPUE of electrofishing catches of 0+ chinook ranged from 0 to 429 fish/100 m^2.

Temporal Distribution of CPUE

CPUE for 0+ chinook salmon peaked in May for day and night catches, and then decreased through to November (Table 7).

Spatial Distribution of CPUE

According to CPUE distribution, newly emerged 0+ chinook salmon (April) were concentrated in the upper river (Figure 26 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

Table 6
Fish Captured by Electrofishing in the Upper Nechako River, 2001

Common Name	Scientific Name	Adult				Juvenile				Total			
		Day	Night	Total	Percent	Day	Night	Total	Percent	Day	Night	Total	Percent
Chinook salmon	*Oncorhynchus tshawytscha*	0	0	0	0.0	7,776	25,851	33,627	49.1	7,776	25,851	33,627	49.1
Redside shiner	*Richardsonius balteatus*	453	937	1,390	2.0	2,506	4,095	6,601	9.6	2,959	5,032	7,991	11.7
Longnose dace	*Rhinichthys cataractae*	373	132	505	0.7	4,680	888	5,568	8.1	5,053	1,020	6,073	8.9
Leopard dace	*Rhinichthys falcatus*	437	394	831	1.2	1,801	2,034	3,835	5.6	2,238	2,428	4,666	6.8
Largescale sucker	*Catostomus macrocheilus*	5	24	29	0.0	3,398	3,011	6,409	9.4	3,403	3,035	6,438	9.4
Northern pikeminnow[1]	*Ptychocheilus oregonensis*	0	8	8	0.0	1,018	3,418	4,436	6.5	1,018	3,426	4,444	6.5
Sculpins (General)	*Cottidae*	200	231	431	0.6	1,072	1,668	2,740	4.0	1,272	1,899	3,171	4.6
Rocky mountain whitefish	*Prosopium williamsoni*	23	55	78	0.1	189	1,124	1,313	1.9	212	1,179	1,391	2.0
Rainbow trout	*Oncorhynchus mykiss*	2	310	312	0.5	42	125	167	0.2	44	435	479	0.7
Peamouth chub	*Mylocheilus caurinus*	0	1	1	0.0	10	180	190	0.3	10	181	191	0.3
Burbot	*Lota lota*	0	2	2	0.0	4	17	21	0.0	4	19	23	0.0
Sockeye salmon	*Oncorhynchus nerka*	0	0	0	0.0	13	10	23	0.0	13	10	23	0.0
Total		1,493	2,094	3,587	5.2	14,733	16,570	31,303	45.7	16,226	18,664	68,517	100.0

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

Table 7
Mean Electrofishing Catch-Per-Unit-Effort (CPUE, number/100 m^2)
of Juvenile Chinook Salmon, Nechako River, 2001
N = number of date/site combinations electrofished (same for both ages).

Date	Number of fish		N	0+ CPUE		1+ CPUE	
	0+	1+		mean	SD	mean	SD
Day							
April	782	40	107	6.0	8.0	0.4	0.8
May	5,024	12	135	30.4	33.4	0.1	0.3
June	927	0	137	7.0	29.7	0.0	0.0
July	892	0	137	3.7	18.6	0.0	0.0
Nov	78	0	102	0.7	1.3	0.0	0.0
sum	7,703	52					
Night							
April	1,560	95	103	12.4	18.3	0.8	1.9
May	12,684	67	135	75.4	99.8	0.4	0.9
June	7,361	8	137	43.8	44.3	0.0	0.2
July	3,765	1	136	20.5	24.6	0.0	0.1
Nov	310	0	101	2.7	5.7	0.0	0.0
sum	25,680	171					
Total	33,383	223					

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, 223 1+ chinook were captured by electrofishing (Table 7), of which 77 % were captured at night. CPUE of 1+ chinook ranged from 0.0 to 3.9 fish/100 m^2, and decreased rapidly with date (Appendix 2).

Diamond Island Rotary Screw Traps/Incidental Species

Overall, 14,365 fish from 12 species or families were captured by the rotary screw traps in 2001 (Table 8). Chinook salmon were the most common species, making up 70% of all fish. The four most common non-salmonid fishes were northern pikeminnow, largescale sucker, leopard dace and redside shiner. The ranking of the species was different from that reported for the electrofishing surveys but, similary, juveniles were the most abundant life history stage. Electrofishing surveys sampled a greater and probably more representative proportion of the species inhabiting the Nechako River: they covered a greater area and different habitats. This was backed the greater species evenness[1] of the latter: 0.17 for rotary screw traps sampling and 0.29 for electrofishing (Simpson's measure of evenness[1] Krebs 1999). These are lower measures than last year, when rotary screw trap and electrofishing catches generated evenness indices of 0.48 and 0.30 respectively, and is attributable to the greater proportion of chinook (70% vs. 47% in 2000).

Comparisons with Previous Years

Temperature

Mean daily water temperatures at Bert Irvine's Lodge in 2001 fell for the most part within the minimum-maximum range observed in the previous 11 years (Figure 2). Temperatures in 2001 were generally below the 11-year average in May-June, and mostly above in July-August. Temperatures in the upper Nechako River in 2001 briefly passed the 20°C on July 22, 2001, when they reached 22.5°C for a few hours.

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

Figure 26
Mean (+ 1 SD) Monthly Catch-Per-Unit-Effort
(CPUE, in fish caught per 100 m^2) of 0+ Chinook Salmon,
Nechako River, 2001: Electrofishing

No sampling in the 40-49.9 km area.

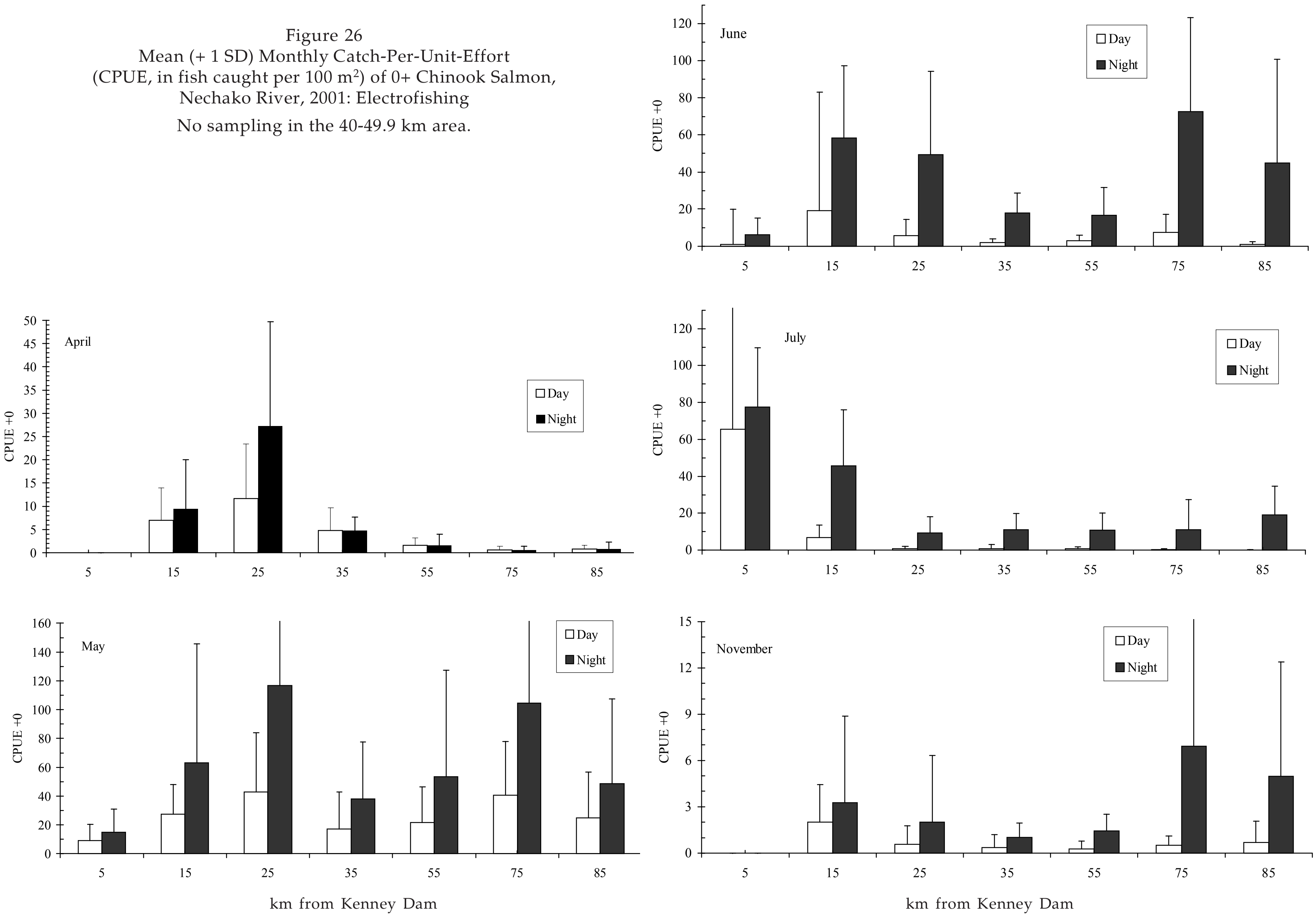


Table 8
Fish Captured in the Rotary Screw Traps in the Upper Nechako River, 2001

Common Name	Scientific Name	Adult				Juvenile				Total			
		Day	Night	Total	Percent	Day	Night	Total	Percent	Day	Night	Total	Percent
Chinook salmon	*Oncorhynchus tshawytscha* [1]	17	995	1,012	7	2,654	6,383	9,037	62.9	2,671	7,378	10,049	70.0
Northern pikeminnow[2]	*Ptychocheilus oregonensis*	0	1	1	0	92	677	769	5.4	92	678	770	5.4
Largescale sucker	*Catostomus macrocheilus*	2	11	13	0	60	917	977	6.8	62	928	990	6.9
Leopard dace	*Rhinichthys falcatus*	27	420	447	3	32	484	516	3.6	59	904	963	6.7
Redside shiner	*Richardsonius balteatus*	13	385	398	3	6	374	380	2.6	19	759	778	5.4
Sockeye salmon	*Oncorhynchus nerka* [1]	1	2	3	0	23	170	193	1.3	24	172	196	1.4
Rocky mountain whitefish	*Prosopium williamsoni*	0	4	4	0	24	97	121	0.8	24	101	125	0.9
Peamouth chub	*Mylocheilus caurinus*	0	1	1	0	7	165	172	1.2	7	166	173	1.2
Rainbow trout	*Oncorhynchus mykiss*	1	0	1	0	3	169	172	1.2	4	169	173	1.2
Longnose dace	*Rhinichthys cataractae*	3	21	24	0	11	85	96	0.7	14	106	120	0.8
Sculpins (General)	*Cottidae*	0	4	4	0	6	15	21	0.1	6	19	25	0.2
Burbot	*Lota lota*	0	0	0	0	0	3	3	0.0	0	3	3	0.0
Total		47	849	896	6.2	264	3,156	3,420	23.8	311	4,005	14,365	100.0

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

Flow

Daily flows of the upper Nechako River at Cheslatta Falls in 2001 were close to the 12-year average for most of the year, except from May to July when they were closer to the 12-year minimum (Figure 27). Cumulative daily flows for 2001 were close to the bottom of the range observed for 1987 to 2000 (Figure 28). As in the previous year, less water was released into the river compared to other years mainly because low air temperatures in spring and early summer meant that lower-than-average cooling flows had to be released from the reservoir in July and August.

Growth of 0+ Chinook Salmon

Mean fork length and wet weight of 0+ chinook salmon electrofished in 2001 were in the lower range for chinook measured in the previous 12 years, although their condition index was close to or above average (Figure 29). This continues the trend established in 2000, when fork length and wet weight were also low. Chinook caught in rotary screw trap catches at Diamond Island were however close to the average for the last 10 years (Figure 30).

Outmigration index

Daily indices (the sum of day and night catches of 0+ chinook for each day) of chinook outmigration measured at Diamond Island in 2001 fell within the range observed in the previous ten years (Figure 31).

The index of outmigrating 0+ chinook that passed Diamond Island between April and July of each year from 1992 to 2001 was significantly and positively correlated with the number of adults that spawned upstream of Diamond Island from 1991 to 2000 (Figure 32). The 2001 data, with their higher number of spawners, strengthen the relationship. This confirms that the index of outmigration reflects real biological processes.

Conclusions

The 2001 juvenile outmigration project continued to monitor the rearing environment of the Nechako river. The calculated index of juvenile outmigration appeared to reflect the biological processes as evidenced by the strong relationship between the spawners and the index in all years but the high flow years. The trends, from index of juvenile outmigration to morphological characteristics of rearing fry, indicate that the rearing environment in the Nechako River has been stable over the period from 1991 to 2001. The 2001 results further imply that the quality of the rearing environment in the upper Nechako River does not show any degradation from previous years.

Figure 27
Comparison of Mean, Maximum and Minimum Daily Flow of the Nechako River at Cheslatta Falls in 2001 with Flows for the Years 1987 to 2000

Data for 2001 still preliminary.

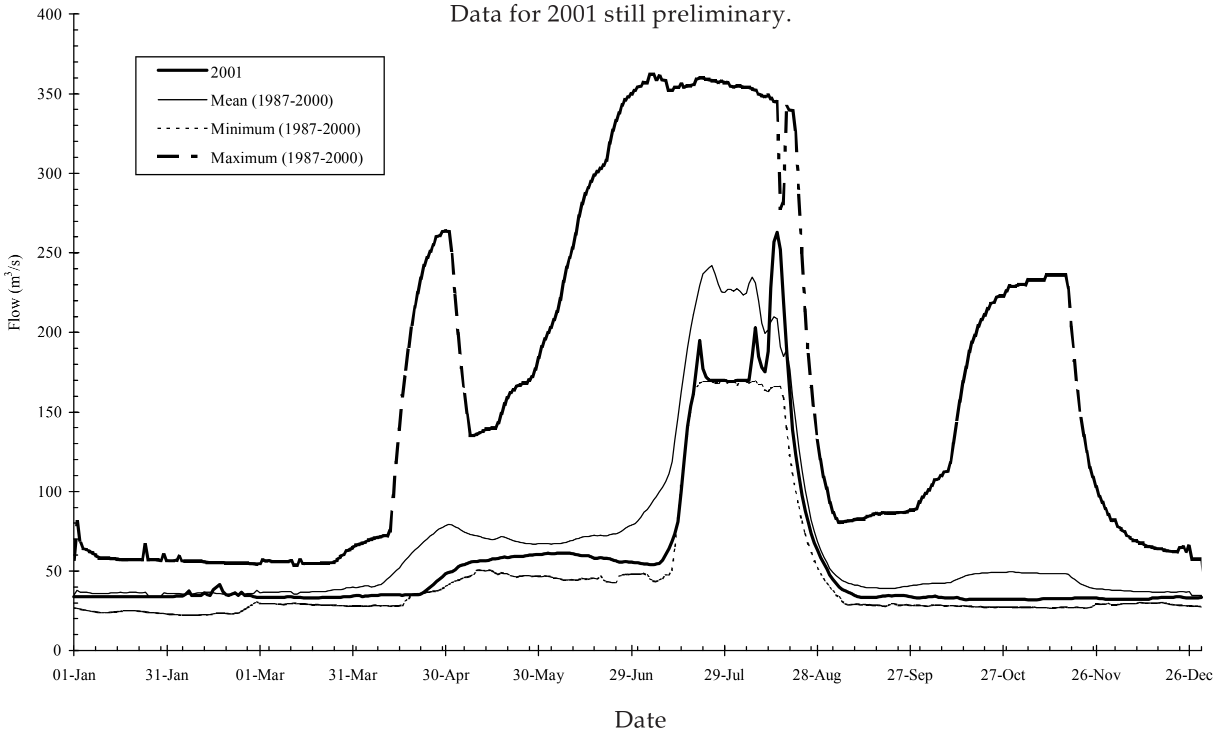


Figure 28
Cumulative Flows of the Nechako River at Cheslatta Falls, 1987 to 2001

Data for 2001 preliminary (thick line).

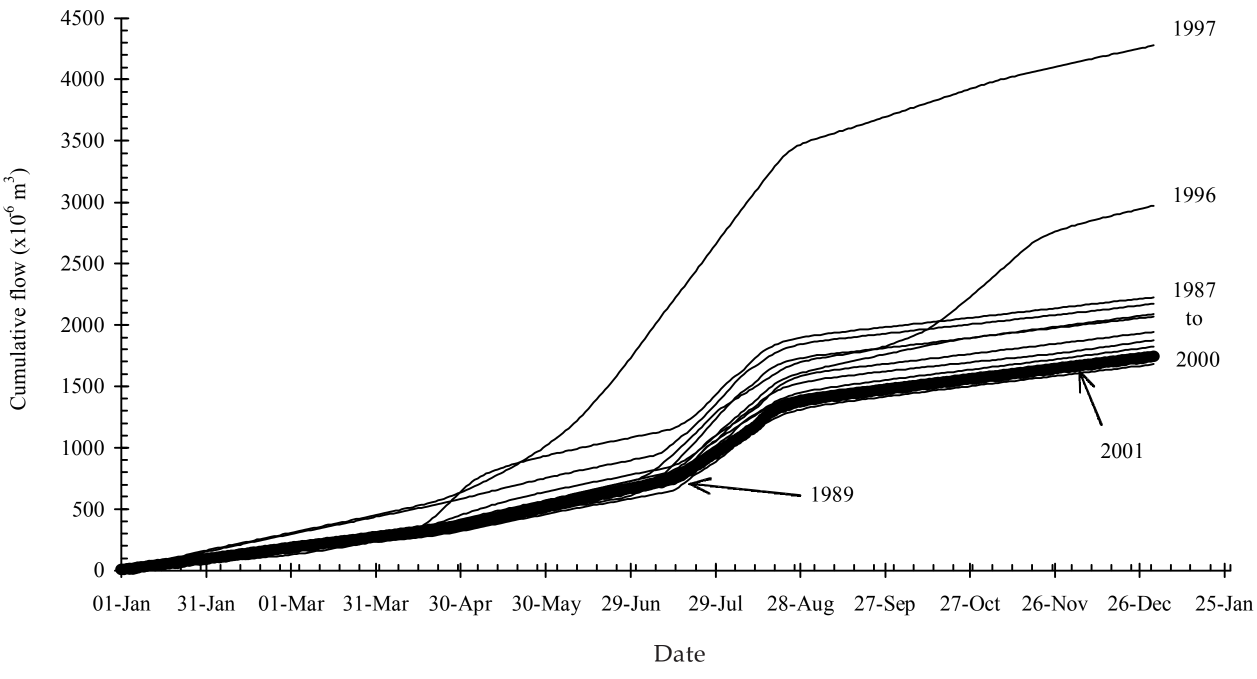


Figure 29
Comparison of Mean Size-at-Date of 0+ Chinook in the Upper Nechako River
in 2000 with Mean, Minimum and Maximum Size for 1989 to 1999 (electrofishing)

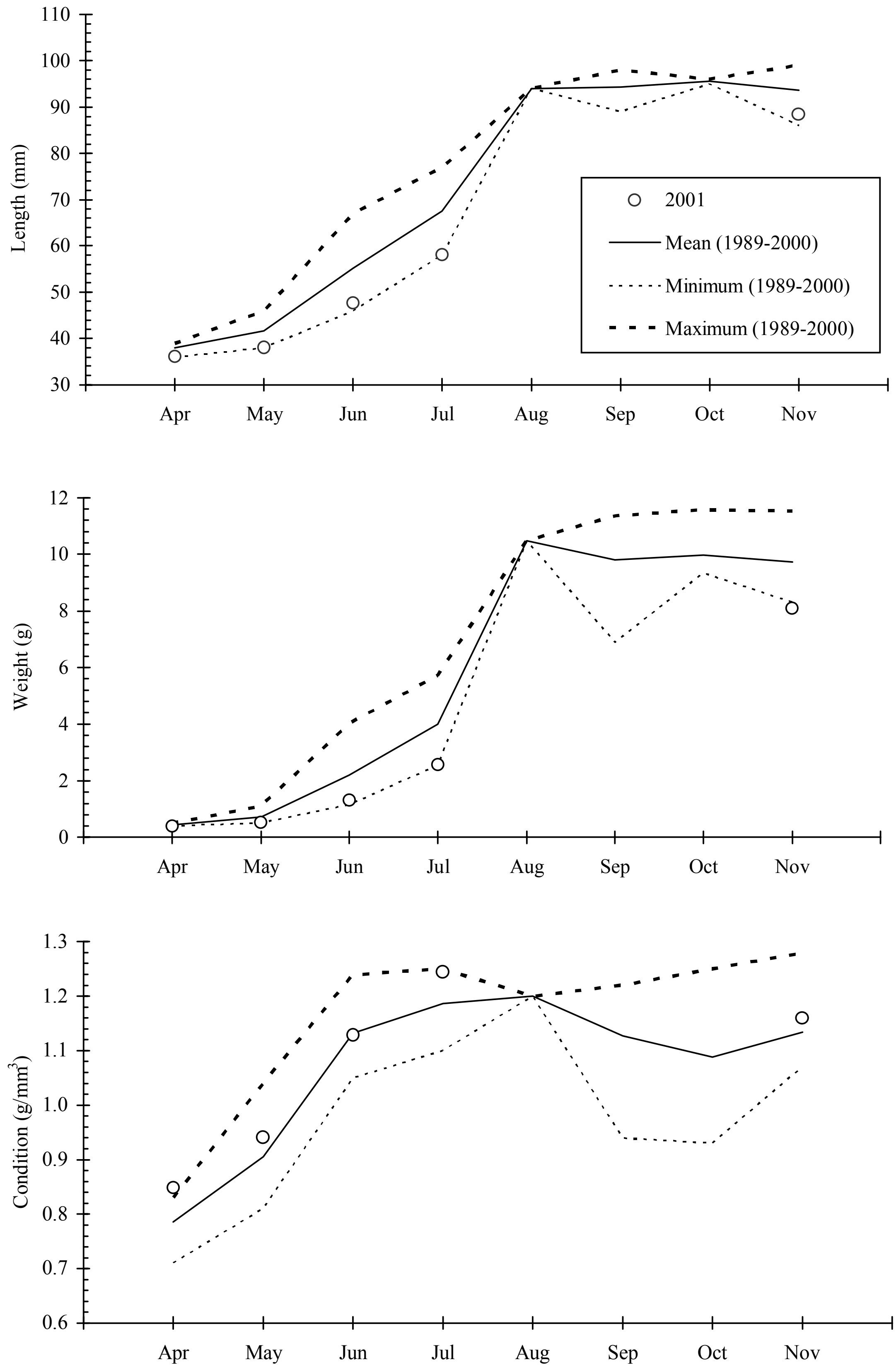


Figure 30
Comparison of Mean Size of 0+ Chinook in the Upper Nechako River in 2001
with Mean, Minimum and Maximum Size for 1991 to 2000 (Rotary Screw Traps)

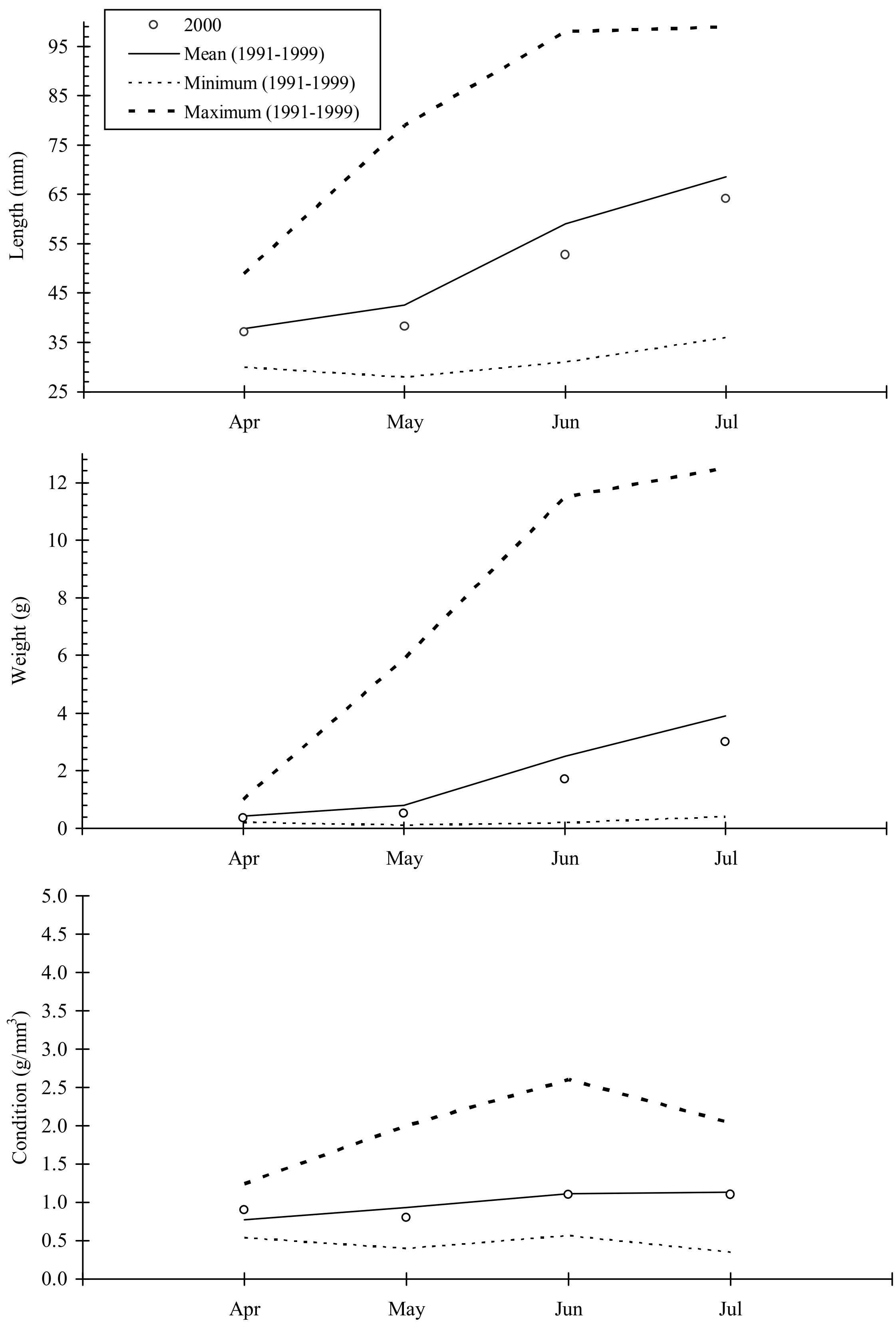


Figure 31
Daily Indices of Chinook 0+ Outmigrants, Diamond Island, Nechako River, 1991 to 2001
Dark line is 2001.

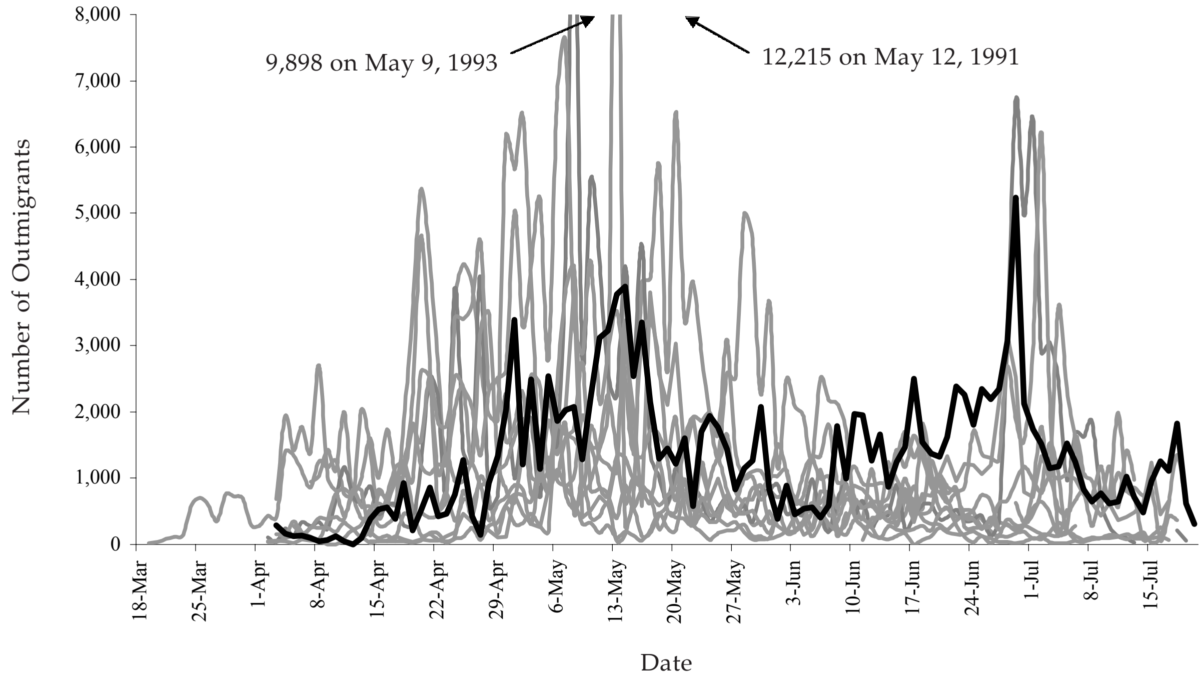
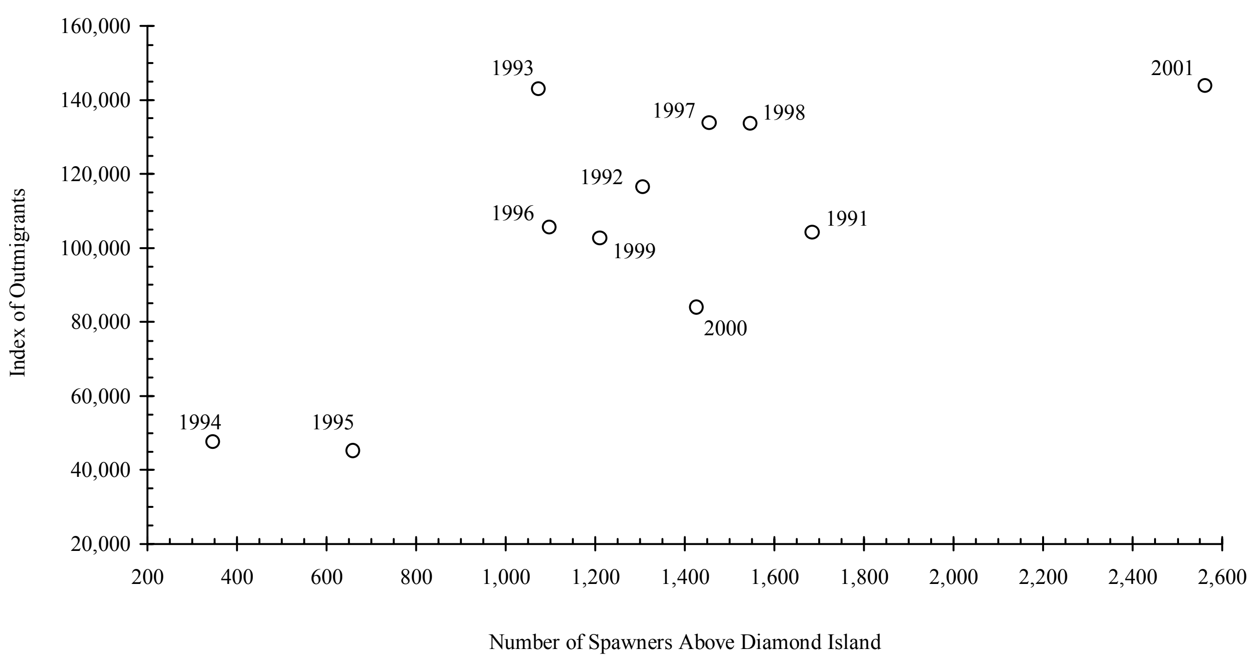


Figure 32
Index of Chinook Salmon 0+ Outmigrants Calculated from Rotary Screw Traps vs. the Number of Spawners Above Diamond Island the Previous Year, Nechako River 1991-2001



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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, 2001

APPENDIX

Daily Catch of Juvenile Chinook Salmon by Rotary Screw Traps, and Index of Outmigrants at Diamond Island, Nechako River, 2001

			RST No. 1 (left margin)						RST No. 2 (mid channel)						RST No. 3 (right margin)						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+
Day																								
1-Apr	78.9	49.4	1.13	2.3	0	0	0	0	1.01	2.1	0	0	0	0	1.14	2.3	0	0	0	0	0	0	0	0
2-Apr	78.9	49.4	1.13	2.3	0	0	0	0	1.01	2.1	0	0	0	0	1.14	2.3	0	1	0	43	0	1	0	15
3-Apr	78.9	49.4	1.13	2.3	0	2	0	87	1.01	2.1	0	0	0	0	1.14	2.3	0	0	0	0	0	2	0	30
4-Apr	64.9	35.5	1.13	3.2	0	0	0	0	1.01	2.9	1	0	35	0	1.14	3.2	0	0	0	0	1	0	11	0
5-Apr	64.9	35.5	1.13	3.2	0	1	0	31	1.01	2.9	0	0	0	0	1.14	3.2	0	1	0	31	0	2	0	22
6-Apr	84.9	55.9	1.16	2.1	0	1	0	48	1.07	1.9	0	0	0	0	1.06	1.9	0	0	0	0	0	1	0	17
7-Apr	64.9	35.5	1.16	3.3	0	0	0	0	1.07	3.0	0	1	0	33	1.06	3.0	0	0	0	0	0	1	0	11
8-Apr	65.4	35.9	1.15	3.2	0	2	0	62	1.04	2.9	0	0	0	0	1.19	3.3	0	0	0	0	0	2	0	21
9-Apr	65.4	35.9	1.15	3.2	0	1	0	31	1.04	2.9	0	2	0	69	1.19	3.3	0	2	0	60	0	5	0	53
10-Apr	65.9	36.4	0.95	2.6	1	1	38	38	1.09	3.0	0	0	0	0	0.94	2.6	0	1	0	39	1	2	12	24
11-Apr	65.4	35.9	0.95	2.6	0	0	0	0	1.09	3.0	0	0	0	0	0.94	2.6	0	0	0	0	0	0	0	0
12-Apr	65.4	35.9	1.10	3.1	0	1	0	33	1.09	3.0	0	1	0	33	0.98	2.7	0	0	0	0	0	2	0	23
13-Apr	64.9	35.5	1.10	3.1	0	3	0	97	1.09	3.1	0	0	0	0	0.98	2.8	0	2	0	72	0	5	0	56
14-Apr	64.4	35.0	1.05	3.0	1	2	33	67	0.97	2.8	0	0	0	0	0.94	2.7	0	2	0	74	1	4	12	47
15-Apr	64.4	35.0	1.05	3.0	1	1	33	33	0.97	2.8	0	1	0	36	0.94	2.7	0	4	0	149	1	6	12	71
16-Apr	63.9	34.6	1.13	3.3	0	2	0	61	1.10	3.2	0	0	0	0	1.02	3.0	0	6	0	203	0	8	0	85
17-Apr	64.4	35.0	1.13	3.2	0	1	0	31	1.10	3.1	0	1	0	32	1.02	2.9	0	4	0	137	0	6	0	65
18-Apr	64.4	35.0	1.16	3.3	0	2	0	60	1.17	3.3	0	1	0	30	1.07	3.1	0	6	0	196	0	9	0	93
19-Apr	64.9	35.5	1.16	3.3	0	1	0	31	1.17	3.3	1	0	30	0	1.07	3.0	0	5	0	166	1	6	10	63
20-Apr	65.4	35.9	1.16	3.2	0	1	0	31	1.17	3.2	0	2	0	62	1.07	3.0	0	11	0	369	0	14	0	148
21-Apr	65.4	35.9	1.15	3.2	0	1	0	31	1.09	3.0	0	0	0	0	1.01	2.8	0	7	0	248	0	8	0	88
22-Apr	65.4	35.9	1.15	3.2	0	0	0	0	1.09	3.0	0	0	0	0	1.01	2.8	0	21	0	745	0	21	0	232
23-Apr	65.9	36.4	1.11	3.0	0	0	0	0	1.13	3.1	0	2	0	64	1.05	2.9	0	9	0	311	0	11	0	121
24-Apr	66.4	36.9	1.11	3.0	0	4	0	133	1.13	3.1	0	5	0	163	1.05	2.9	0	12	0	420	0	21	0	235
25-Apr	66.9	37.3	1.19	3.2	0	1	0	31	1.16	3.1	0	2	0	64	1.11	3.0	0	3	0	101	0	6	0	65
26-Apr	69.4	39.7	1.19	3.0	0	0	0	0	1.16	2.9	0	1	0	34	1.11	2.8	0	3	0	108	0	4	0	46
27-Apr	71.9	42.2	1.18	2.8	0	10	0	357	1.08	2.6	0	3	0	117	1.19	2.8	0	27	0	960	0	40	0	489
28-Apr	72.9	43.2	1.25	2.9	0	1	0	35	1.20	2.8	0	11	0	394	1.15	2.7	0	31	0	1162	0	43	0	515
29-Apr	78.4	48.8	1.25	2.6	2	1	78	39	1.20	2.5	1	8	41	324	1.15	2.4	0	28	0	1187	3	37	41	501
30-Apr	78.7	49.1	1.23	2.5	0	1	0	40	1.24	2.5	0	6	0	237	1.22	2.5	0	71	0	2863	0	78	0	1038
1-May	81.9	52.6	1.23	2.3	0	4	0	171	1.24	2.4	0	4	0	169	1.22	2.3	0	32	0	1380	0	40	0	570
2-May	82.9	53.7	1.25	2.3	0	3	0	129	1.26	2.3	0	6	0	256	1.20	2.2	0	22	0	980	0	31	0	448
3-May	83.4	54.2	1.25	2.3	0	4	0	173	1.26	2.3	0	8	0	345	1.20	2.2	0	4	0	180	0	16	0	234
4-May	84.4	55.3	1.28	2.3	0	0	0	0	1.16	2.1	1	11	48	524	1.16	2.1	0	74	0	3519	1	85	15	1305
5-May	86.9	58.1	1.28	2.2	1	11	45	499	1.16	2.0	0	8	0	401	1.16	2.0	0	19	0	949	1	38	16	613
6-May	88.9	60.4	1.28	2.1	0	20	0	944	1.16	1.9	0	26	0	1353	1.16	1.9	0	45	0	2336	0	91	0	1525
7-May	90.9	62.7	1.29	2.1	0	13	0	632	1.31	2.1	0	13	0	621	1.19	1.9	0	18	0	949	0	44	0	727
8-May	90.9	62.7	1.31	2.1	0	16	0	766	1.25	2.0	0	19	0	956	1.25	2.0	0	31	0	1551	0	66	0	1086

Date	RST staff (cm)	River flow m^3/s	RST No. 1 (left margin) 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 (mid channel) 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 (right margin) 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+
9-May	91.9	63.9	1.31	2.1	0	9	0	439	1.25	2.0	0	14	0	718	1.25	2.0	0	62	0	3160	0	85	0	1425
10-May	91.9	63.9	1.27	2.0	0	9	0	453	1.29	2.0	1	15	50	743	1.18	1.8	0	48	0	2604	1	72	17	1231
11-May	90.9	62.7	1.27	2.0	0	16	0	790	1.29	2.1	0	12	0	583	1.18	1.9	0	46	0	2450	0	74	0	1242
12-May	92.4	64.5	1.29	2.0	0	8	0	400	1.30	2.0	0	11	0	547	1.29	2.0	0	19	0	953	0	38	0	633
13-May	91.9	63.9	1.29	2.0	0	38	0	1882	1.30	2.0	0	21	0	1035	1.29	2.0	0	39	0	1938	0	98	0	1617
14-May	91.9	63.9	1.29	2.0	0	21	0	1040	1.30	2.0	0	9	0	444	1.29	2.0	0	17	0	845	0	47	0	775
15-May	92.4	64.5	1.28	2.0	0	14	0	705	1.29	2.0	0	21	0	1049	1.17	1.8	0	37	0	2042	0	72	0	1242
16-May	92.9	65.1	1.28	2.0	1	27	51	1372	1.29	2.0	0	8	0	403	1.17	1.8	0	31	0	1727	1	66	17	1149
17-May	92.9	65.1	1.28	2.0	0	16	0	813	1.29	2.0	0	13	0	656	1.17	1.8	0	29	0	1616	0	58	0	1009
18-May	93.0	65.2	1.28	2.0	0	12	0	611	1.29	2.0	0	4	0	202	1.17	1.8	0	22	0	1228	0	38	0	663
19-May	92.9	65.1	1.28	2.0	0	9	0	457	1.29	2.0	0	9	0	454	1.17	1.8	0	0	0	0	0	18	0	313
20-May	92.9	65.1	1.28	2.0	0	16	0	813	1.29	2.0	0	14	0	706	1.17	1.8	0	27	0	1504	0	57	0	992
21-May	92.9	65.1	1.28	2.0	0	13	0	661	1.29	2.0	0	3	0	151	1.17	1.8	0	3	0	167	0	19	0	331
22-May	92.9	65.1	1.27	2.0	0	18	0	922	1.27	1.9	0	6	0	308	1.16	1.8	0	31	0	1732	0	55	0	967
23-May	93.4	65.6	1.27	1.9	0	25	0	1292	1.27	1.9	0	8	0	415	1.16	1.8	0	49	0	2763	0	82	0	1455
24-May	94.4	66.8	1.30	1.9	0	18	0	926	1.28	1.9	0	9	0	472	1.17	1.7	0	31	0	1779	0	58	0	1037
25-May	93.9	66.2	1.30	2.0	0	16	0	815	1.28	1.9	0	12	0	623	1.17	1.8	0	27	0	1535	0	55	0	974
26-May	93.4	65.6	1.30	2.0	0	6	0	303	1.28	1.9	0	4	0	206	1.17	1.8	0	16	0	902	0	26	0	456
27-May	94.4	66.8	1.38	2.1	0	4	0	194	1.25	1.9	0	2	0	107	1.13	1.7	0	24	0	1419	0	30	0	534
28-May	95.4	68.0	1.38	2.0	0	8	0	394	1.25	1.8	0	6	0	328	1.13	1.7	0	31	0	1866	0	45	0	815
29-May	94.4	66.8	1.38	2.1	0	5	0	242	1.30	1.9	0	7	0	361	1.14	1.7	0	57	0	3335	0	69	0	1208
30-May	94.9	67.4	1.38	2.0	0	11	0	538	1.30	1.9	0	1	0	52	1.14	1.7	0	13	0	767	0	25	0	442
31-May	93.9	66.2	1.38	2.1	0	0	0	0	1.30	2.0	0	0	0	0	1.14	1.7	0	6	0	348	0	6	0	104
1-Jun	94.9	67.4	1.42	2.1	0	7	0	332	1.30	1.9	0	17	0	883	1.10	1.6	0	13	0	794	0	37	0	653
2-Jun	95.9	68.6	1.42	2.1	2	2	97	97	1.30	1.9	0	3	0	159	1.10	1.6	0	6	0	373	2	11	36	197
3-Jun	96.9	69.9	1.41	2.0	0	3	0	149	1.23	1.8	0	1	0	57	1.10	1.6	0	16	0	1014	0	20	0	373
4-Jun	95.9	68.6	1.41	2.1	1	3	49	146	1.23	1.8	1	0	56	0	1.10	1.6	0	7	0	436	2	10	37	183
5-Jun	94.9	67.4	1.38	2.0	0	4	0	195	1.27	1.9	0	2	0	106	1.18	1.8	0	8	0	457	0	14	0	246
6-Jun	95.9	68.6	1.38	2.0	0	2	0	99	1.27	1.9	0	6	0	324	1.18	1.7	0	14	0	814	0	22	0	394
7-Jun	95.9	68.6	1.33	1.9	0	5	0	258	1.32	1.9	0	6	0	313	1.17	1.7	0	25	0	1465	0	36	0	647
8-Jun	95.9	68.6	1.33	1.9	0	7	0	361	1.32	1.9	0	6	0	313	1.17	1.7	0	9	0	528	0	22	0	396
9-Jun	96.4	69.3	1.47	2.1	0	3	0	141	1.30	1.9	0	2	0	107	1.22	1.8	0	37	0	2108	0	42	0	731
10-Jun	95.9	68.6	1.47	2.1	0	6	0	280	1.30	1.9	0	3	0	159	1.22	1.8	0	21	0	1186	0	30	0	517
11-Jun	94.9	67.4	1.35	2.0	0	5	0	250	1.28	1.9	0	2	0	105	1.12	1.7	0	22	0	1326	0	29	0	522
12-Jun	94.9	67.4	1.35	2.0	0	2	0	100	1.28	1.9	0	0	0	0	1.12	1.7	0	12	0	723	0	14	0	252
13-Jun	92.9	65.1	1.41	2.2	0	1	0	46	1.29	2.0	1	3	50	151	1.17	1.8	0	15	0	838	1	19	17	320
14-Jun	92.9	65.1	1.41	2.2	0	7	0	323	1.29	2.0	0	0	0	0	1.17	1.8	0	25	0	1396	0	32	0	538
15-Jun	92.9	65.1	1.41	2.2	0	2	0	92	1.29	2.0	0	1	0	50	1.17	1.8	0	22	0	1228	0	25	0	420
16-Jun	91.9	63.9	1.37	2.1	0	11	0	513	1.25	2.0	0	1	0	51	1.06	1.7	0	30	0	1803	0	42	0	729
17-Jun	91.9	63.9	1.37	2.1	0	5	0	233	1.29	2.0	0	1	0	49	1.30	2.0	0	10	0	490	0	16	0	258
18-Jun	90.9	62.7	1.46	2.3	0	3	0	129	1.29	2.1	0	2	0	97	1.30	2.1	0	16	0	770	0	21	0	325
19-Jun	90.9	62.7	1.46	2.3	0	2	0	86	1.25	2.0	0	5	0	250	1.22	1.9	0	8	0	412	0	15	0	239
20-Jun	89.9	61.5	1.38	2.2	0	1	0	45	1.25	2.0	0	3	0	147	1.22	2.0	0	13	0	658	0	17	0	272

			RST No. 1 (left margin)						RST No. 2 (mid channel)						RST No. 3 (right margin)						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+
21-Jun	89.9	61.5	1.38	2.2	0	3	0	134	1.25	2.0	0	2	0	98	1.22	2.0	0	14	0	708	0	19	0	304
22-Jun	89.9	61.5	1.38	2.2	0	8	0	357	1.28	2.1	0	4	0	192	1.30	2.1	0	21	0	992	0	33	0	512
23-Jun	89.9	61.5	1.32	2.1	0	4	0	186	1.28	2.1	0	1	0	48	1.30	2.1	0	6	0	283	0	11	0	173
24-Jun	88.9	60.4	1.32	2.2	0	8	0	366	1.28	2.1	0	1	0	47	1.23	2.0	0	16	0	784	0	25	0	394
25-Jun	88.9	60.4	1.32	2.2	0	5	0	229	1.28	2.1	0	5	0	236	1.23	2.0	0	13	0	637	0	23	0	362
26-Jun	87.9	59.2	1.32	2.2	0	1	0	45	1.28	2.2	0	0	0	0	1.23	2.1	0	12	0	577	0	13	0	201
27-Jun	87.4	58.7	1.32	2.2	0	3	0	133	1.23	2.1	0	2	0	96	1.40	2.4	0	8	0	336	0	13	0	194
28-Jun	88.4	59.8	1.35	2.3	0	3	0	133	1.23	2.0	0	2	0	98	1.40	2.3	0	5	0	214	0	10	0	151
29-Jun	87.9	59.2	1.35	2.3	0	7	0	307	1.20	2.0	0	1	0	49	1.33	2.2	0	9	0	400	0	17	0	259
30-Jun	87.9	59.2	1.28	2.2	0	3	0	139	1.20	2.0	0	2	0	98	1.33	2.2	0	2	0	89	0	7	0	109
1-Jul	88.4	59.8	1.28	2.1	0	1	0	47	1.28	2.1	0	1	0	47	1.30	2.2	0	10	0	460	0	12	0	186
2-Jul	87.9	59.2	1.25	2.1	0	0	0	0	1.28	2.2	0	2	0	92	1.30	2.2	0	6	0	274	0	8	0	124
3-Jul	86.9	58.1	1.25	2.2	0	2	0	93	1.21	2.1	0	2	0	96	1.31	2.3	0	1	0	44	0	5	0	77
4-Jul	86.9	58.1	1.30	2.2	0	7	0	313	1.21	2.1	0	1	0	48	1.31	2.3	0	2	0	89	0	10	0	152
5-Jul	86.9	58.1	1.30	2.2	0	1	0	45	1.23	2.1	0	0	0	0	1.30	2.2	0	4	0	179	0	5	0	76
6-Jul	86.9	58.1	1.29	2.2	0	1	0	45	1.23	2.1	0	0	0	0	1.30	2.2	0	3	0	134	0	4	0	61
7-Jul	85.9	57.0	1.29	2.3	0	2	0	88	1.27	2.2	0	0	0	0	1.47	2.6	0	6	0	233	0	8	0	113
8-Jul	85.9	57.0	1.35	2.4	0	1	0	42	1.27	2.2	0	0	0	0	1.47	2.6	0	0	0	0	0	1	0	14
9-Jul	85.9	57.0	1.35	2.4	0	0	0	0	1.27	2.2	0	0	0	0	1.35	2.4	0	1	0	42	0	1	0	14
10-Jul	86.9	58.1	1.35	2.3	0	1	0	43	1.27	2.2	0	1	0	46	1.35	2.3	0	1	0	43	0	3	0	44
11-Jul	88.9	60.4	1.35	2.2	0	0	0	0	1.27	2.1	0	0	0	0	1.35	2.2	0	0	0	0	0	0	0	0
12-Jul	90.9	62.7	1.35	2.2	0	0	0	0	1.27	2.0	0	0	0	0	1.35	2.2	0	0	0	0	0	0	0	0
13-Jul	93.9	66.2	1.35	2.0	0	0	0	0	1.28	1.9	0	0	0	0	1.25	1.9	0	1	0	53	0	1	0	17
14-Jul	96.9	69.9	1.49	2.1	0	0	0	0	1.28	1.8	0	0	0	0	1.25	1.8	0	0	0	0	0	0	0	0
15-Jul	99.9	73.6	1.49	2.0	0	0	0	0	1.17	1.6	0	0	0	0	1.36	1.8	0	1	0	54	0	1	0	18
16-Jul	110.9	87.8	1.43	1.6	0	0	0	0	1.17	1.3	0	0	0	0	1.36	1.6	0	0	0	0	0	0	0	0
17-Jul	122.9	104.4	1.43	1.4	0	0	0	0	1.17	1.1	0	1	0	89	1.36	1.3	0	0	0	0	0	1	0	26
18-Jul	133.9	120.7	1.43	1.2	0	0	0	0	1.19	1.0	0	0	0	0	0.82	0.7	0	0	0	0	0	0	0	0
19-Jul	143.9	136.4	1.40	1.0	0	0	0	0	1.19	0.9	0	0	0	0	0.82	0.6	0	0	0	0	0	0	0	0
20-Jul	143.9	136.4	1.40	1.0											0.82									
					10	573	425	27406			7	443	309	21581			0	1,638	0	83,611	17	2,654	242	43,085

			RST No. 1 (left margin)						RST No. 2 (mid channel)						RST No. 3 (right margin)						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+
Night																								
1-Apr																								
2-Apr	78.9	49.4	1.13	2.3	0	6	0	261	1.01	2.1	0	5	0	244	1.14	2.3	1	7	43	303	1	18	15	270
3-Apr	78.9	49.4	1.13	2.3	5	4	218	174	1.01	2.1	1	5	49	244	1.14	2.3	2	0	87	0	8	9	120	135
4-Apr	64.9	35.5	1.13	3.2	0	10	0	313	1.01	2.9	2	0	70	0	1.14	3.2	1	1	31	31	3	11	32	119
5-Apr	64.9	35.5	1.13	3.2	0	6	0	188	1.01	2.9	0	2	0	70	1.14	3.2	3	2	93	62	3	10	32	108
6-Apr	64.9	35.5	1.13	3.2	1	4	31	125	1.01	2.9	1	2	35	70	1.06	3.0	3	1	100	33	5	7	55	77
7-Apr	65.4	35.9	1.16	3.2	0	0	0	0	1.07	3.0	1	3	34	101	1.06	3.0	2	0	68	0	3	3	33	33
8-Apr	65.4	35.9	1.16	3.2	0	2	0	62	1.07	3.0	1	2	34	67	1.19	3.3	2	0	60	0	3	4	32	42
9-Apr	65.9	36.4	1.15	3.2	2	5	63	158	1.04	2.8	1	0	35	0	1.19	3.3	3	1	92	31	6	6	65	65
10-Apr	65.4	35.9	1.15	3.2	3	0	94	0	1.04	2.9	3	0	104	0	0.94	2.6	7	2	267	76	13	2	149	23
11-Apr	65.4	35.9	0.95	2.6	2	0	76	0	1.09	3.0	3	0	99	0	0.94	2.6	5	0	190	0	10	0	120	0
12-Apr	64.9	35.5	0.95	2.7	5	2	187	75	1.09	3.1	2	0	65	0	0.98	2.8	6	4	216	144	13	6	152	70
13-Apr	64.9	35.5	1.10	3.1	1	17	32	548	1.09	3.1	5	1	162	32	0.98	2.8	2	11	72	396	8	29	89	324
14-Apr	64.4	35.0	1.10	3.1	5	24	159	764	1.09	3.1	2	11	64	352	0.94	2.7	6	8	223	298	13	43	145	480
15-Apr	63.9	34.6	1.05	3.0	4	2	132	66	0.97	2.8	6	9	214	321	0.94	2.7	4	30	147	1102	14	41	163	479
16-Apr	64.4	35.0	1.05	3.0	6	9	200	300	0.97	2.8	5	1	181	36	1.02	2.9	4	16	137	548	15	26	173	299
17-Apr	64.4	35.0	1.13	3.2	7	31	217	960	1.10	3.1	4	13	127	414	1.02	2.9	1	36	34	1234	12	80	129	862
18-Apr	64.9	35.5	1.13	3.2	8	6	251	188	1.10	3.1	5	0	161	0	1.07	3.0	4	5	132	166	17	11	183	118
19-Apr	65.4	35.9	1.16	3.2	10	3	310	93	1.17	3.2	10	7	308	216	1.07	3.0	1	32	34	1074	21	42	222	444
20-Apr	64.9	35.5	1.16	3.3	23	11	703	336	1.17	3.3	8	8	243	243	1.07	3.0	3	49	99	1623	34	68	355	710
21-Apr	65.2	35.7	1.16	3.2	23	0	709	0	1.17	3.3	3	5	92	153	1.01	2.8	1	26	35	918	27	31	289	332
22-Apr	65.9	36.4	1.15	3.2	8	13	253	411	1.09	3.0	9	1	300	33	1.01	2.8	5	6	180	216	22	20	246	224
23-Apr	65.9	36.4	1.15	3.2	4	38	127	1203	1.09	3.0	6	9	200	300	1.05	2.9	5	10	173	346	15	57	166	630
24-Apr	66.4	36.9	1.11	3.0	11	40	365	1329	1.13	3.1	7	17	228	553	1.05	2.9	1	36	35	1261	19	93	212	1040
25-Apr	68.2	38.6	1.11	2.9	11	2	382	70	1.13	2.9	5	3	170	102	1.11	2.9	6	26	209	906	22	31	253	357
26-Apr	71.4	41.7	1.19	2.9	11	0	385	0	1.16	2.8	7	0	251	0	1.11	2.7	0	8	0	301	18	8	217	96
27-Apr	72.9	43.2	1.19	2.8	5	0	181	0	1.16	2.7	0	10	0	371	1.19	2.7	3	26	109	946	8	36	98	439
28-Apr	77.9	48.3	1.18	2.4	2	13	82	532	1.08	2.2	2	4	89	178	1.15	2.4	4	41	168	1720	8	58	113	820
29-Apr	78.6	49.0	1.25	2.5	27	0	1059	0	1.20	2.5	14	0	570	0	1.15	2.3	0	113	0	4812	41	113	558	1537
30-Apr	81.9	52.6	1.25	2.4	10	0	421	0	1.20	2.3	7	0	305	0	1.22	2.3	6	164	259	7073	23	164	329	2347
1-May	82.9	53.7	1.23	2.3	7	0	305	0	1.24	2.3	5	2	216	86	1.22	2.3	0	42	0	1849	12	44	174	640
2-May	82.9	53.7	1.23	2.3	6	0	262	0	1.24	2.3	9	6	389	259	1.20	2.2	2	134	89	5970	17	140	248	2043
3-May	83.9	54.8	1.25	2.3	1	3	44	131	1.26	2.3	1	31	44	1350	1.20	2.2	2	27	91	1228	4	61	59	900
4-May	83.9	54.8	1.25	2.3	2	24	88	1051	1.26	2.3	2	30	87	1306	1.16	2.1	2	29	94	1365	6	83	90	1238
5-May	85.9	57.0	1.28	2.2	1	4	45	178	1.16	2.0	1	7	49	344	1.16	2.0	0	68	0	3331	2	79	32	1249
6-May	88.4	59.8	1.28	2.1	11	0	514	0	1.16	1.9	7	2	361	103	1.16	1.9	2	28	103	1440	20	30	332	498
7-May	89.9	61.5	1.28	2.1	7	2	337	96	1.16	1.9	2	0	106	0	1.19	1.9	0	77	0	3985	9	79	153	1339
8-May	90.9	62.7	1.29	2.1	8	2	389	97	1.31	2.1	7	5	334	239	1.25	2.0	1	5	50	250	16	12	260	195
9-May	91.9	63.9	1.31	2.1	11	0	536	0	1.25	2.0	2	31	103	1589	1.25	2.0	2	16	102	815	15	47	252	788
10-May	91.9	63.9	1.31	2.1	19	8	926	390	1.25	2.0	4	37	205	1897	1.18	1.8	1	65	54	3526	24	110	411	1882
11-May	91.9	63.9	1.27	2.0	14	1	704	50	1.29	2.0	5	52	248	2575	1.18	1.8	2	63	108	3418	21	116	359	1983

Date	RST staff (cm)	River flow m³/s	RST No. 1 (left margin) Trap flow m³/s	Percent flow sampled	Catch 1+	Catch 0+	Population Estimate 1+	Population Estimate 0+	RST No. 2 (mid channel) Trap flow m³/s	Percent flow sampled	Catch 1+	Catch 0+	Population Estimate 1+	Population Estimate 0+	RST No. 3 (right margin) Trap flow m³/s	Percent flow sampled	Catch 1+	Catch 0+	Population Estimate 1+	Population Estimate 0+	Total Catch 1+	Total Catch 0+	Weighted Average 1+	Weighted Average 0+
12-May	91.9	63.9	1.27	2.0	13	17	654	855	1.29	2.0	0	47	0	2327	1.29	2.0	1	125	50	6211	14	189	233	3139
13-May	91.9	63.9	1.29	2.0	6	11	297	545	1.30	2.0	6	6	296	296	1.29	2.0	0	121	0	6012	12	138	198	2277
14-May	92.4	64.5	1.29	2.0	17	10	850	500	1.30	2.0	8	26	398	1293	1.29	2.0	1	70	50	3510	26	106	433	1765
15-May	92.4	64.5	1.29	2.0	10	5	500	250	1.30	2.0	6	1	298	50	1.17	1.8	1	117	55	6459	17	123	292	2112
16-May	92.4	64.5	1.28	2.0	15	1	755	50	1.29	2.0	6	1	300	50	1.17	1.8	0	56	0	3091	21	58	362	1000
17-May	93.0	65.2	1.28	2.0	22	1	1120	51	1.29	2.0	7	0	354	0	1.17	1.8	1	15	56	837	30	16	523	279
18-May	93.0	65.2	1.28	2.0	13	3	662	153	1.29	2.0	3	13	152	657	1.17	1.8	0	29	0	1618	16	45	279	785
19-May	92.9	65.1	1.28	2.0	9	0	457	0	1.29	2.0	6	1	303	50	1.17	1.8	0	51	0	2841	15	52	261	905
20-May	92.9	65.1	1.28	2.0	10	1	508	51	1.29	2.0	2	22	101	1109	1.17	1.8	3	12	167	669	15	35	261	609
21-May	92.9	65.1	1.28	2.0	7	1	356	51	1.29	2.0	3	1	151	50	1.17	1.8	2	12	111	669	12	14	209	244
22-May	92.9	65.1	1.28	2.0	13	5	661	254	1.29	2.0	1	4	50	202	1.16	1.8	0	33	0	1844	14	42	244	732
23-May	93.4	65.6	1.27	1.9	3	18	155	930	1.27	1.9	0	1	0	52	1.16	1.8	0	8	0	451	3	27	53	479
24-May	93.4	65.6	1.27	1.9	8	11	414	569	1.27	1.9	1	27	52	1400	1.17	1.8	2	3	113	169	11	41	195	727
25-May	94.4	66.8	1.30	1.9	9	5	463	257	1.28	1.9	7	5	367	262	1.17	1.7	0	16	0	918	16	26	286	465
26-May	93.9	66.2	1.30	2.0	11	1	561	51	1.28	1.9	2	15	104	779	1.17	1.8	0	5	0	284	13	21	230	372
27-May	93.9	66.2	1.30	2.0	9	3	459	153	1.28	1.9	3	3	156	156	1.13	1.7	0	28	0	1641	12	34	215	608
28-May	95.4	68.0	1.38	2.0	8	4	394	197	1.25	1.8	2	1	109	55	1.13	1.7	1	20	60	1204	11	25	199	453
29-May	95.4	68.0	1.38	2.0	11	7	542	345	1.25	1.8	2	1	109	55	1.14	1.7	0	40	0	2382	13	48	235	867
30-May	94.9	67.4	1.38	2.0	19	2	929	98	1.30	1.9	5	7	260	364	1.14	1.7	0	13	0	767	24	22	424	389
31-May	93.9	66.2	1.38	2.1	1	2	48	96	1.30	2.0	1	2	51	102	1.14	1.7	1	12	58	696	3	16	52	278
1-Jun	94.9	67.4	1.38	2.0	7	3	342	147	1.30	1.9	0	1	0	52	1.10	1.6	0	9	0	549	7	13	125	232
2-Jun	95.9	68.6	1.42	2.1	6	4	290	193	1.30	1.9	3	0	159	0	1.10	1.6	0	10	0	621	9	14	162	251
3-Jun	96.9	69.9	1.42	2.0	6	6	295	295	1.30	1.9	0	1	0	54	1.10	1.6	0	2	0	127	6	9	110	165
4-Jun	96.9	69.9	1.41	2.0	11	3	545	149	1.23	1.8	3	2	170	113	1.10	1.6	1	15	63	950	15	20	280	373
5-Jun	95.9	68.6	1.41	2.1	5	1	243	49	1.23	1.8	0	5	0	278	1.18	1.7	0	3	0	174	5	9	90	162
6-Jun	95.9	68.6	1.38	2.0	1	3	50	149	1.27	1.9	0	3	0	162	1.18	1.7	0	5	0	291	1	11	18	197
7-Jun	96.9	69.9	1.38	2.0	10	14	506	709	1.27	1.8	3	15	165	824	1.17	1.7	0	33	0	1968	13	62	238	1133
8-Jun	95.9	68.6	1.33	1.9	9	12	465	619	1.32	1.9	2	2	104	104	1.17	1.7	2	19	117	1114	13	33	234	593
9-Jun	96.4	69.3	1.33	1.9	9	28	469	1458	1.32	1.9	2	8	105	421	1.22	1.8	0	33	0	1880	11	69	197	1237
10-Jun	95.9	68.6	1.47	2.1	10	31	467	1448	1.30	1.9	2	10	106	530	1.22	1.8	0	42	0	2372	12	83	207	1431
11-Jun	94.9	67.4	1.47	2.2	6	17	275	780	1.30	1.9	3	10	156	520	1.12	1.7	0	16	0	965	9	43	156	747
12-Jun	94.9	67.4	1.35	2.0	10	31	500	1549	1.28	1.9	1	5	53	263	1.12	1.7	0	42	0	2532	11	78	198	1403
13-Jun	93.9	66.2	1.35	2.0	1	7	49	343	1.28	1.9	0	1	0	52	1.17	1.8	0	23	0	1308	1	31	17	541
14-Jun	92.9	65.1	1.41	2.2	5	7	231	323	1.29	2.0	1	5	50	252	1.17	1.8	0	30	0	1675	6	42	101	706
15-Jun	92.9	65.1	1.41	2.2	1	22	46	1015	1.29	2.0	1	6	50	302	1.17	1.8	0	34	0	1898	2	62	34	1043
16-Jun	92.9	65.1	1.41	2.2	0	54	0	2492	1.29	2.0	1	7	50	352	1.06	1.6	7	42	428	2570	8	103	138	1779
17-Jun	91.9	63.9	1.37	2.1	3	23	140	1072	1.25	2.0	0	13	0	665	1.06	1.7	1	38	60	2290	4	74	69	1285
18-Jun	91.9	63.9	1.37	2.1	0	24	0	1119	1.29	2.0	1	13	49	642	1.30	2.0	0	28	0	1373	1	65	16	1047
19-Jun	90.9	62.7	1.46	2.3	4	36	172	1546	1.29	2.1	1	12	48	582	1.30	2.1	0	22	0	1061	5	70	77	1083
20-Jun	89.9	61.5	1.46	2.4	0	37	0	1560	1.25	2.0	1	22	49	1079	1.22	2.0	2	27	101	1366	3	86	47	1346
21-Jun	89.9	61.5	1.38	2.2	2	65	89	2899	1.25	2.0	0	27	0	1324	1.22	2.0	0	38	0	1922	2	130	32	2077
22-Jun	89.9	61.5	1.38	2.2	1	31	45	1383	1.25	2.0	0	24	0	1177	1.22	2.0	0	54	0	2724	1	109	16	1740
23-Jun	99.9	73.6	1.38	1.9	0	42	0	2239	1.28	1.7	0	11	0	632	1.30	1.8	0	35	0	1976	0	88	0	1633

Date	RST staff (cm)	River flow m^3/s	RST No. 1 (left margin) 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 (mid channel) 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 (right margin) 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+
24-Jun	89.4	61.0	1.32	2.2	0	73	0	3372	1.28	2.1	0	19	0	904	1.30	2.1	0	33	0	1548	0	125	0	1953
25-Jun	88.9	60.4	1.32	2.2	0	55	0	2516	1.28	2.1	0	17	0	801	1.23	2.0	0	44	0	2156	0	116	0	1827
26-Jun	87.9	59.2	1.32	2.2	1	70	45	3142	1.28	2.2	0	32	0	1480	1.23	2.1	0	37	0	1778	1	139	15	2148
27-Jun	87.9	59.2	1.32	2.2	0	116	0	5206	1.28	2.2	0	50	0	2312	1.23	2.1	0	20	0	963	0	186	0	2876
28-Jun	88.4	59.8	1.32	2.2	0	200	0	9063	1.23	2.0	0	57	0	2783	1.40	2.3	0	78	0	3343	0	335	0	5085
29-Jun	88.4	59.8	1.35	2.3	0	70	0	3102	1.23	2.0	0	10	0	488	1.4	2.3	0	44	0	1880	0	124	0	1866
30-Jun	87.9	59.2	1.35	2.3	0	40	0	1755	1.20	2.0	0	15	0	738	1.33	2.2	0	52	0	2313	0	107	0	1631
1-Jul	88.4	59.8	1.28	2.1	0	33	0	1542	1.20	2.0	0	14	0	695	1.33	2.2	0	38	0	1707	0	85	0	1329
2-Jul	87.9	59.2	1.28	2.2	0	29	0	1342	1.28	2.2	0	16	0	738	1.30	2.2	0	22	0	1003	0	67	0	1027
3-Jul	86.9	58.1	1.25	2.2	0	19	0	883	1.28	2.2	0	32	0	1448	1.30	2.2	0	21	0	939	0	72	0	1091
4-Jul	86.9	58.1	1.25	2.2	0	38	0	1767	1.21	2.1	0	5	0	239	1.31	2.3	0	46	0	2044	0	89	0	1371
5-Jul	86.9	58.1	1.30	2.2	0	49	0	2190	1.21	2.1	0	10	0	479	1.31	2.3	0	18	0	800	0	77	0	1172
6-Jul	86.9	58.1	1.30	2.2	0	19	0	849	1.23	2.1	0	11	0	518	1.30	2.2	0	21	0	939	0	51	0	773
7-Jul	86.9	58.1	1.29	2.2	0	15	0	676	1.23	2.1	0	14	0	659	1.30	2.2	0	7	0	313	0	36	0	537
8-Jul	85.9	57.0	1.29	2.3	0	32	0	1414	1.27	2.2	0	13	0	584	1.47	2.6	0	8	0	311	0	53	0	750
9-Jul	85.9	57.0	1.35	2.4	0	22	0	929	1.27	2.2	0	12	0	539	1.47	2.6	0	9	0	350	0	43	0	607
10-Jul	85.9	57.0	1.35	2.4	0	23	0	971	1.27	2.2	0	9	0	404	1.35	2.4	0	10	0	421	0	42	0	602
11-Jul	87.9	59.2	1.35	2.3	0	34	0	1492	1.27	2.1	0	24	0	1120	1.35	2.3	0	10	0	438	0	68	0	1014
12-Jul	90.9	62.7	1.35	2.2	0	27	0	1254	1.27	2.0	0	11	0	543	1.35	2.2	0	7	0	324	0	45	0	710
13-Jul	92.9	65.1	1.35	2.1	0	10	0	482	1.27	2.0	0	13	0	666	1.35	2.1	0	5	0	240	0	28	0	464
14-Jul	95.9	68.6	1.35	2.0	0	31	0	1576	1.28	1.9	0	11	0	591	1.25	1.8	0	12	0	660	0	54	0	956
15-Jul	98.9	72.3	1.49	2.1	0	44	0	2136	1.28	1.8	0	21	0	1188	1.25	1.7	0	5	0	290	0	70	0	1234
16-Jul	105.9	81.2	1.49	1.8	0	16	0	872	1.17	1.4	0	28	0	1939	1.36	1.7	0	11	0	656	0	55	0	1110
17-Jul	117.9	97.3	1.43	1.5	0	52	0	3540	1.17	1.2	0	13	0	1080	1.36	1.4	0	8	0	572	0	73	0	1793
18-Jul	128.9	113.2	1.43	1.3	0	9	0	712	1.17	1.0	0	6	0	579	1.36	1.2	0	6	0	499	0	21	0	616
19-Jul	140.9	131.6	1.43	1.1	0	6	0	552	1.19	0.9	0	1	0	110	0.82	0.6	0	1	0	160	0	8	0	306
20-Jul	145.9	139.6	1.40	1.0	0	0	0	0	1.19	0.9	0	1	0	117	0.82	0.6	0	3	0	510	0	4	0	54
TOTALS (NIGHT)					603	2,033	26,833	92,476			261	1,173	11,256	57,282			131	3,177	5,477	155,930	995	6,383	14,875	100,827
TOTALS (D+N)					613	2,606	27,258	119,882			268	1,616	11,565	78,863			131	4,815	5,477	239,541	1,012	9,037	15,117	143,911

Appendix 2

Mean Monthly Electrofishing Catch-Per-Unit-Effort (CPUE, fish caught per m2) of Juvenile Chinook salmon by 10 km Intervals of the Upper Nechako River, 2001

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, 2001

Date	Time of Day	Distance from Kenney Dam	Distance Midpoint (km)	0+ CPUE		1+ CPUE	
				Mean	SD	Mean	SD
April	Day	0.0-9.9	5				
		10.0-19.9	15	7.00	4.92	0.75	0.69
		20.0-29.9	25	11.70	10.19	0.35	0.68
		30.0-39.9	35	4.86	2.81	0.21	0.81
		50.0-59.9	55	1.62	0.69	0.57	1.08
		70.0-79.9	75	0.69	0.69	0.10	0.28
		80.0-89.9	85	0.82	1.54	0.10	0.39
April	Night	0.0-9.9	5				
		10.0-19.9	15	9.50	10.53	0.25	0.53
		20.0-29.9	25	27.28	22.36	0.54	1.07
		30.0-39.9	35	4.86	2.81	0.13	0.33
		50.0-59.9	55	1.62	2.44	0.69	1.20
		70.0-79.9	75	0.69	0.69	0.87	1.25
		80.0-89.9	85	0.82	1.54	2.21	3.91
May	Day	0.0-9.9	5	8.92	11.42	0.25	0.43
		10.0-19.9	15	27.52	20.52	0.10	0.35
		20.0-29.9	25	42.85	41.32	0.07	0.30
		30.0-39.9	35	17.21	25.60	0.14	0.54
		50.0-59.9	55	21.74	24.70	0.00	0.00
		70.0-79.9	75	40.44	37.37	0.00	0.00
		80.0-89.9	85	24.91	31.84	0.00	0.00
May	Night	0.0-9.9	5	15.00	15.91	0.25	0.43
		10.0-19.9	15	63.02	82.59	0.61	1.09
		20.0-29.9	25	116.85	132.19	0.45	0.97
		30.0-39.9	35	38.18	39.51	0.16	0.34
		50.0-59.9	55	53.56	73.75	0.31	0.52
		70.0-79.9	75	104.61	107.55	0.17	0.45
		80.0-89.9	85	48.65	58.99	0.55	1.20
June	Day	0.0-9.9	5	0.83	19.15	0.00	0.00
		10.0-19.9	15	19.15	64.07	0.00	0.00
		20.0-29.9	25	5.77	8.66	0.00	0.00
		30.0-39.9	35	1.82	2.05	0.00	0.00
		50.0-59.9	55	2.94	2.97	0.00	0.00
		70.0-79.9	75	7.40	9.76	0.00	0.00
		80.0-89.9	85	0.89	1.55	0.00	0.00
June	Night	0.0-9.9	5	6.25	9.00	0.29	0.30
		10.0-19.9	15	58.24	39.03	0.17	0.43
		20.0-29.9	25	49.38	44.89	0.00	0.00
		30.0-39.9	35	18.02	10.65	0.00	0.00
		50.0-59.9	55	16.56	15.01	0.00	0.00
		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, 2001

Date	Time of Day	Distance from Kenney Dam	Distance Midpoint (km)	0+ CPUE		1+ CPUE	
				Mean	SD	Mean	SD
July	Day	0.0-9.9	5	65.38	85.80	0.00	0.00
		10.0-19.9	15	6.79	6.95	0.00	0.00
		20.0-29.9	25	0.74	1.46	0.00	0.00
		30.0-39.9	35	0.92	2.07	0.00	0.00
		50.0-59.9	55	0.67	1.07	0.00	0.00
		70.0-79.9	75	0.31	0.35	0.00	0.00
		80.0-89.9	85	0.05	0.20	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	0.05	0.20
Nov	Day	10.0-19.9	15	2.95	4.09	0.00	0.00
		20.0-29.9	25	0.91	1.70	0.00	0.00
		30.0-39.9	35	0.21	0.65	0.00	0.00
		50.0-59.9	55	0.13	0.57	0.00	0.00
		70.0-79.9	75	0.00	0.00	0.00	0.00
		80.0-89.9	85	0.05	0.20	0.00	0.00
Nov	Night	10.0-19.9	15	2.00	2.45	0.00	0.00
		20.0-29.9	25	0.57	1.20	0.00	0.00
		30.0-39.9	35	0.35	0.86	0.00	0.00
		50.0-59.9	55	0.28	0.51	0.00	0.00
		70.0-79.9	75	0.52	0.58	0.00	0.00
		80.0-89.9	85	0.69	1.37	0.00	0.00