SIZE, DISTRIBUTION AND ABUNDANCE OF JUVENILLE CHINOOK SALMON OF THE NECHAKO RIVER, 2004

NECHAKO FISHERIES CONSERVATION PROGRAM
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EXECUTIVE SUMMARY

The distribution and abundance of juvenile chinook salmon *(Oncorhynchus tshawytscha)* were evaluated through sampling using electrofishing and rotary screw traps in 2004 in the upper 100 km of the Nechako River as part of the seventeenth year of the Nechako Fisheries Conservation Program (NFCP).

Mean daily water temperatures below the Cheslatta Falls in 2004 were close to the average observed between the years 1987 and 2003 until mid-April, after which they remained close to the maximum until late August. Flows of the upper Nechako River at Cheslatta Falls in 2003 paralleled the 17-year median (1987 - 2003) for most of the year, and cumulative daily flows for 2004 were similar to that of previous years.

Based on growth curves, emergence of chinook fry in 2004 had ceased by late May. Monthly electrofishing surveys along the length of the upper river in April, May, June, July and November captured 49,264 fish from 14 species or families. As usual, juvenile chinook salmon were the most common species, accounting for 52% of all captures or 25,631 fish (25,508 0+ and 123 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 night catches and in April for day catches. Spatial distribution of 0+ chinook along the length of the upper Nechako River, as indicated by electrofishing CPUE, reflected a general upstream movement of juvenile chinook 0+ from May to July and a large overall drop in abundance of fish residing in the river in October / November.

The number of outmigrating 0+ chinook (21,547) captured by rotary screw traps at Diamond Island between April 02 and July 20, 2004, was once again essentially unimodal, with the peak of abundance centred around early May. Two of their morphological characteristics (fork length and wet weight) were average for those of fish caught in previous years, while condition index values were close to or above the maxima observed in the previous 13 years

The index of juvenile downstream migration was 372,958 for chinook 0+ and 11,182 for chinook 1+. The index of chinook 0+ was much larger than that for 2003 (129,004 0+) and the chinook 1+ index much smaller than the previous year (21,031 1+ chinook), the latter reflecting the smaller 2003 chinook 0+ cohort. The index of 0+ outmigrants for the years 1992 to 2004 was positively and significantly correlated with the number of parent spawners upstream of Diamond Island in the autumns of the years 1991 to 2003.

All comparisons with previous years indicate that the timing of chinook outmigration, the temperatures and the flows in 2004 were comparable with those of previous years.

1.0 INTRODUCTION

This report describes juvenile chinook salmon *(Oncorhynchus tshawytscha)*, distribution and abundance in the upper 100 km of the Nechako River in 2004.

The study was part of the seventeenth year of the Nechako Fisheries Conservation Program (NFCP). The primary objectives of the 2004 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 abundance of the number of juvenile chinook migrating downstream of Diamond Island from March to July. The secondary objective was to compare the biological parameters measured in 2004 with those measured over previous years.

2.0 METHODS

2.1 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 center line 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. The majority of the flows in the upper river occur downstream of Cheslatta Falls (km 9.0).

2.2 Temperature and Flow

Mean daily water temperatures were measured by the Water Survey of Canada Station located at the Nechako River below Cheslatta Falls (WSC station 08JA017). 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).

2.3 Electrofishing Surveys

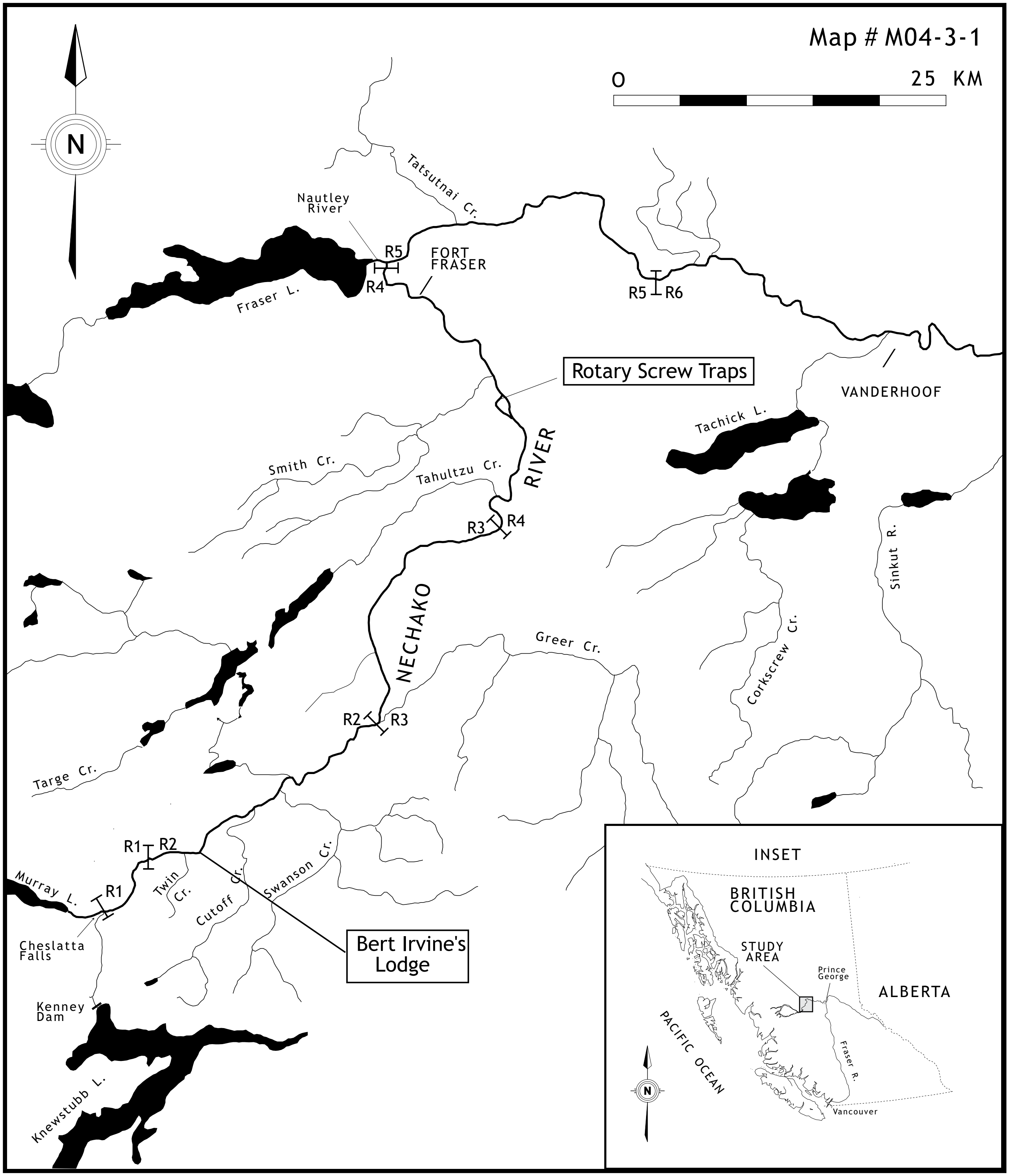
2.3.1 History

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 due to the capability of the surveys to show spatial variation in juvenile density during spring and summer — something no fixed gear can do.

2.2.2 Surveys

The distribution of juvenile chinook salmon was assessed from single-pass electrofishing surveys of Reaches 1-4, as in previous years. Electrofishing surveys were carried out at night and during the day, with night defined as the time period between sunset and sunrise. Surveys began in April and continued in May, June, early July, with the final survey completed from late October into early November. The surveys in April, May, June and July provide information on the abundance and distribution of juvenile chinook during the period of greatest habitat use by juvenile chinook within the upper Nechako River. The November sampling provides information on the juveniles that reside in the river in the fall and winter.

FIGURE 1 **2004 Nechako River study area and traps location**



Surveys were not conducted in late July and August because the release of summer cooling flows results in water levels too high to allow safe and effective electrofishing. During this period, large flows are released into the upper river 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.

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 and the upper portion of Reach 4. Fall sampling is typically scheduled for November, but cold air temperatures in 2004 (approximately -15ºC) and rapidly declining water temperatures during the last weeks of October suggested that ice formation on the river might prevent sampling if the start date was delayed into November. Additionally, water temperatures were below 5°C in Vanderhoof (WSC station 08JC001), an indicator that chinook not overwintering in the Nechako River have usually left the system. Therefore the final electrofishing survey was initiated on October 28th and all scheduled sites were sampled prior to ice formation on the river. The survey schedule for 2004 is shown in **Figure 2**.

All electrofishing surveys were conducted over prime juvenile chinook salmon habitat, 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 is found mainly along the margins of the river, so the electrofishing surveys did not sample the portion of the population that may have occupied the mid-channel. Mid-channel residents are however a minor component of the population of juvenile chinook, as 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 sampled, expressed in units of 100 m^2.

The age of juvenile chinook was recorded as 0+ or 1+, based on fork length and month of capture. During early spring juvenile chinook less than 90 mm long were classified as 0+ and those over 90 mm in length in early spring were classified as 1+. Juvenile chinook over 90 mm long in summer or fall were classified as 0+ because by that time 1+ chinook had migrated out of the upper Nechako River. There is however an overlap between the two age classes during late spring (early June). The classification as 0+ or 1+ was then based on professional judgment of the biologist and on a comparison of the fish in question with other fish captured that day.

FIGURE 2 **Schedule for 2004 outmigration sampling, Nechako River**

Month	April					May				June				July					August				September				October					November			
Week	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Electrofishing, day	X	X					X	X	X		X	X			X	X															X	X			
Electrofishing, night	X	X					X	X	X		X	X			X	X															X	X			
Rotary Screw Traps, day	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																		
Rotary Screw Traps, night	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																		

Fork length and wet weight were measured from ten chinook (or all fish if less than ten were captured) at each site and each day or night sampling event. Fork length was measured to the nearest 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 other salmonids such as rainbow trout were also measured but were not taken for non-salmonid fish other than burbot *(Lota lota)*, 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. Chinook tend to remain near instream cover during the day and to migrate between dusk and dawn.

It is important to note that areas sampled with electrofishing were not isolated with nets, meaning that some fish could avoid capture by leaving a sampling area during a pass. Similarly, fish from outside the sampling area could move into the site during the completion of the pass. Electrofishing catch was likely an underestimate of the total number of fish in a survey area, as fish are more likely to scatter away from a site than be attracted to the site. An accurate estimate of the total number of fish within a survey area would require multi-pass sampling of isolated areas, but the isolation of river margins can be difficult (*e.g.,* in areas of sharp drop-offs or fast water velocities) and time consuming. 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.

This 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 (~100 km) 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 reduces 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 analyzing 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 that may result from seasonal changes in either fish size or water temperature.

2.4 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 which supports a current-driven 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. The back of the cone funnels into a live box where captured fish are kept 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 during the multiple 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 on April 1, once the river was free of ice, and removed in mid-July to avoid high cooling flows in July and August **(Figure 2)**.

The live box of each trap was emptied twice each day at 08:00 and 19:00. All fishes were collected from the live box, 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 approximately 300 m downstream of the trapping site.

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:

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

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 located at the trapping site, using a regression equation between river discharge measured upstream of Smith Creek (downstream of the trapping site; **Figure 1**) and the height of the staff gauge ($N = 19$, $R^2 = 0.98$, $P<0.001$):

$$(3)\ \text{Flow}(m^3/s) = 68.69(\text{staff height, m})^{1.93}$$

That regression was calculated for steady flow conditions from April to July, 2004.

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.

3.0 RESULTS AND DISCUSSION

3.1 Temperature

Mean daily water temperatures below Cheslatta Falls fluctuated from around 0 - 3°C from January to mid-March, to just over 19°C on June 24 and August 20 (**Figure 3**). Overall, water temperatures in 2004 were in the upper range of the variation in the 1987 - 2003 temperatures recorded during most of the period of chinook growth (April - September) and there was a fairly pronounced cooling of the water in the first week of September.

Spot temperatures measured during electrofishing surveys are plotted by month as a function of their distance from Kenney Dam in **Figure 4**. Only sites that were sampled during all months (April, May, June, July and November) are shown, and only night time temperatures are plotted to minimize large

FIGURE 3 **Comparisons of mean daily temperature of the upper Nechako River at Bert Irvine's lodge in 2004 with the mean, maximum and minimum for the years 1987 to 2003 (data available until Dec. 8, 2004)**

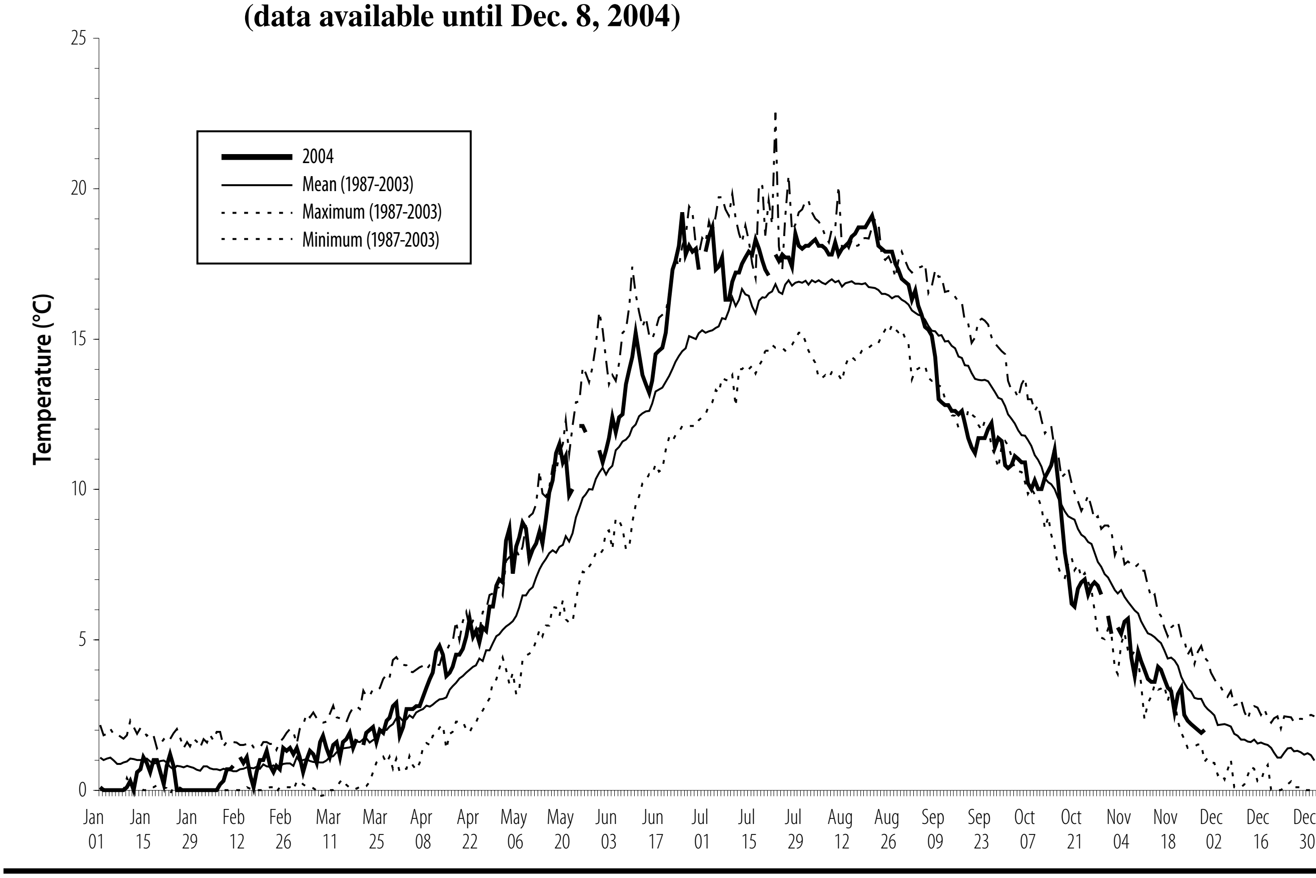
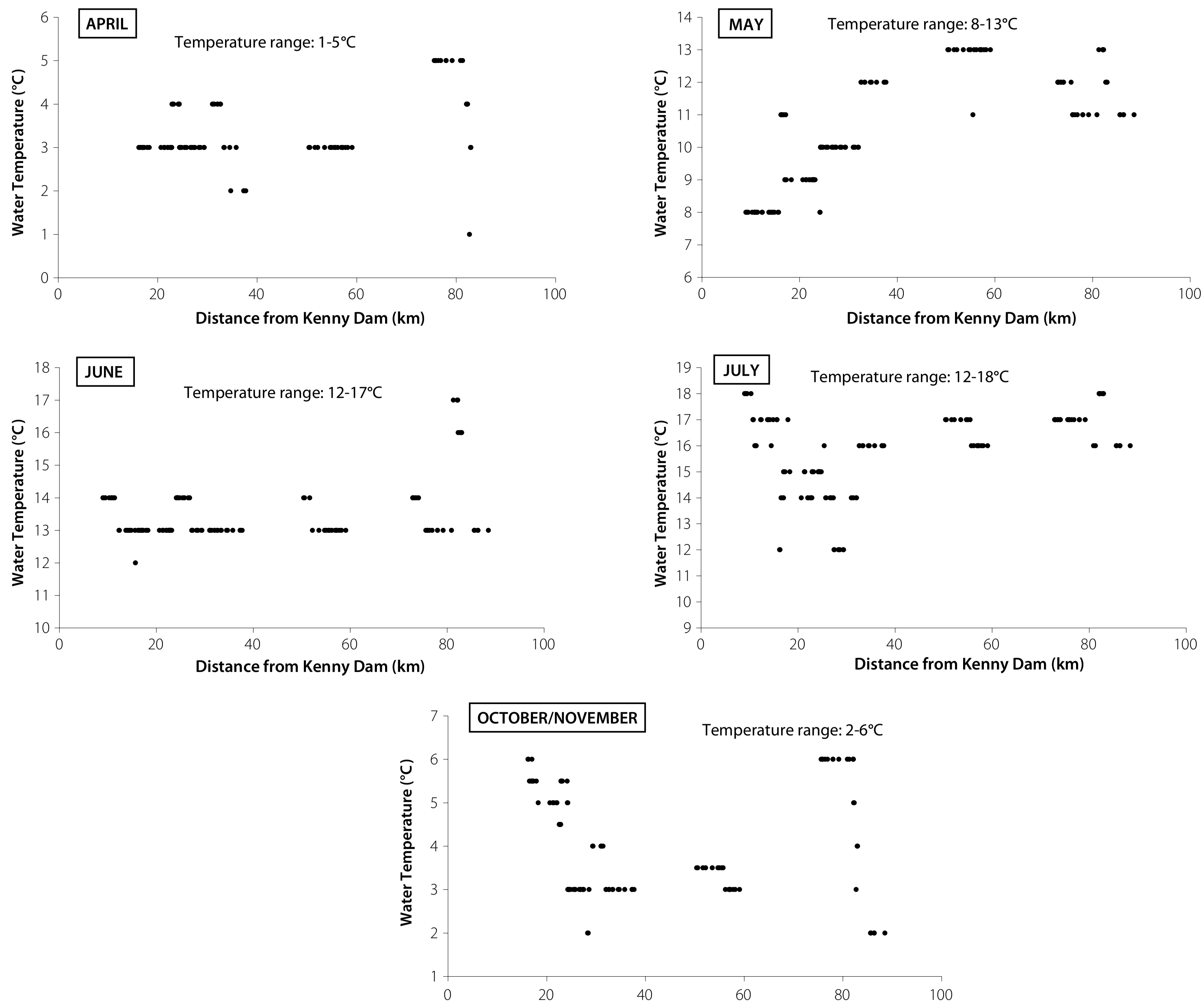


FIGURE 4 Night time temperatures measured at electrofishing sites in the Nechako River, April to November, 2004



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).

In general, April and November water temperatures will decrease with increasing distance from Cheslatta Falls as reservoir water is cooled by cold spring and fall air temperatures. Conversely, in May, June and July water index sampling water temperatures will increase with distance from Cheslatta Falls as reservoir water is warmed by summer air. However, the observed water temperatures became progressively warmer downstream in May, varied throughout the reaches in October/November and were fairly stable throughout the river during the other months. Such results may have reflected more micro climate, sampling order and weather conditions than location. For example, site RM24.6 was the last site completed on night 1 (which happened to be the last night of a cold snap) and had a measured water temperature of 4°C, while the site immediately adjacent to it, RM24.8, was the first site completed on the following night (which had noticeably warmer air temperatures), and had a measured water temperature of 8°C.

Although it is difficult to establish specific trends in river water temperature based on the data collected during index sampling, the following general observations can be made:

- May was the only month that showed an obvious trend of increasing water temperature with increasing distance downstream.
- The maximum range in water temperature between sites in a month was 6°C (July).
- Spot water temperatures in April and May were the warmest recorded in the past four years: April average of 3.4°C vs. 1.8 - 2.8°C for April 2001 - 2003, and May average of 10.5°C vs. 6.1 - 7.5 May 2001 - 2003.

These variations in temperature may tend to obscure relationships between temperature and growth of juvenile chinook salmon in the Nechako River.

3.2 Flow

From January 1 to April 22, 2004, releases from Skins Lake Spillway were relatively constant at approximately 33 m^3/s (**Figure 5**). From April 22 to 24, releases rose from 33 to 53 m^3/s and then remained stable until July 10, after which they rose to 452 m^3/s on July 16 as part of the Summer Temperature Management Program (STMP). Similar or intermediate peaks occurred on July 19 (451 m^3/s), July 26 (335 m^3/s), July 30 (297 m^3/s) and August 8 (449 m^3/s) with the maximum peak of 452 m^3/s occurring at the beginning of the forced summer spills on July 16 (same as last year's peak of 452 m^3/s, but greater than the 2002 peak of 377 m^3/s). There were no fall or winter forced spills as of early December based on the data available at the time of this report. Releases from August 19 to November 30 ranged between 14 - 31 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 ranged between 34 m^3/s and 60 m^3/s between January 1 and July 12. It should be noted that the difference in average flows between Skins Lake Spillway and Cheslatta Falls was due to the addition of flows from tributaries to the Murray-Cheslatta system. Flows rose rapidly on July 12 in response to STMP releases, and reached a maximum of 285 m^3/s on July 22, 2004, with a secondary peak of 283 m^3/s on August 15, 2004. Flows then declined to an average of 36 m^3/s from September 8 to early December.

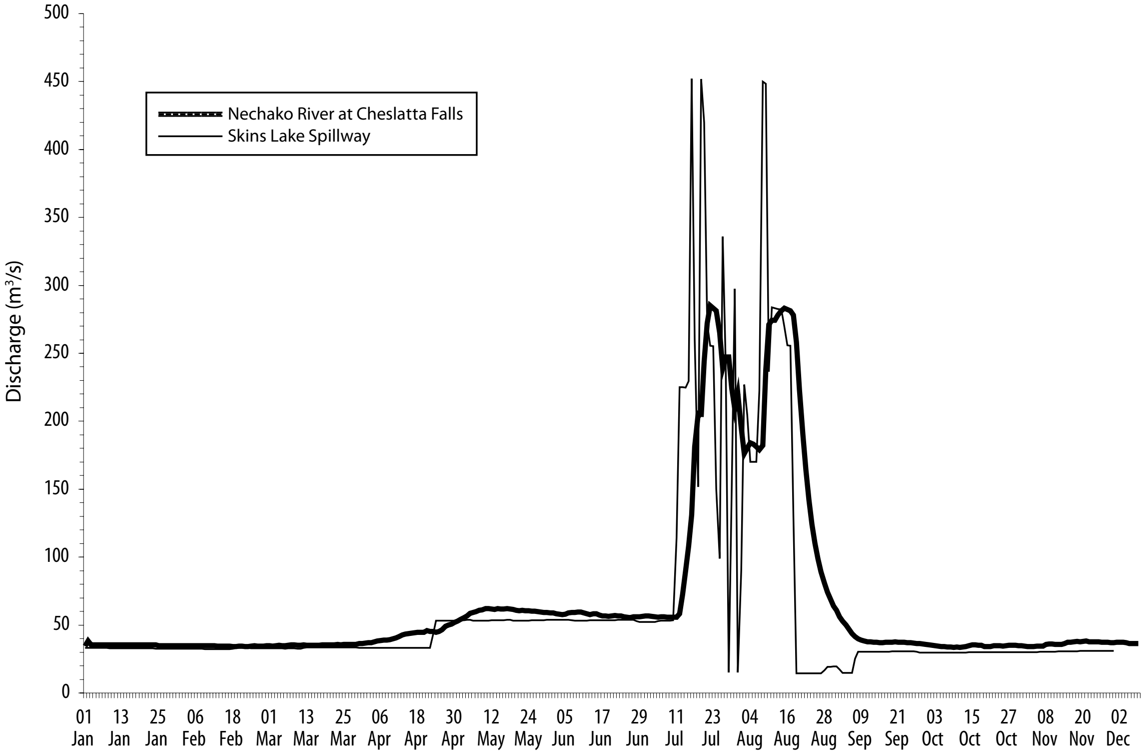
In summary, the 2004 flows of the upper Nechako River at Cheslatta Falls were stable for most of the year and exhibited the typical changes in flows associated with the STMP in July and August.

3.3 Size and Growth of Chinook Salmon

3.3.1 Effect of time of day – electroshocking

Factorial ANOVAs of fork length and wet weight (both *l*n-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

FIGURE 5 **Daily flow of the Nechako River below Cheslatta Falls (WSC station 08JA017) and releases from Skins Lake Spillway, 2004 (data until December 8, 2004)**



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 (FL) or Wet Weight (WW) 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.

There were significant day-night difference in fork length among juvenile chinook 0+ for all months (**Figure 6**; t-tests on *l*n-transformed data). Juvenile chinook caught at night were significantly longer than fish caught during the day in all months except November, although the size difference never exceeded 10% (maximum of 9% in June and July). Thus while the differences observed in April, May and November were statistically significant, they may not be biologically significant.

Chinook juveniles' wet weights showed a similar trend among months, as the fish tended to be heavier at night in all months during which they were sampled with the exception of November **(Figure 7)**. The night-day weight differences in June and July were highest (49% and 38% respectively) whereas they were below 10% in April and November.

The most likely reasons for these apparently large day-night differences in summer months (June and July) could be related to territoriality and diurnal movements. During the day, the larger juvenile chinook hold feeding territories which they visually defend against smaller cohort members. These feeding territories are usually in sheltered areas with high drift making fish in these areas harder to sample. In addition, by defending the sheltered areas the larger fish force the smaller fish to the periphery of the habitat where they are more easily sampled. A wider size range of fish are active

TABLE 1 **Results of factorial ANOVAs on Fork Length and Wet Weight of juvenile chinook captured by electrofishing in the Nechako River, 2004**

Ln (length)

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Month	4	176.37	44.09	3,912.21	<.0001
Day or Night	1	0.64	0.64	56.45	<.0001
Month x D or N	4	1.18	0.30	26.26	<.0001
Residual	5,665	63.85	0.01		

Ln (weight)

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Month	4	2,233.81	558.45	4,440.47	<.0001
Day or Night	1	13.89	13.89	110.47	<.0001
Month x D or N	4	18.24	4.56	36.25	<.0001
Residual	5,651	710.69			

FIGURE 6 **Mean (± SE) fork lengths of chinook 0+electrofished, Nechako River, 2004**

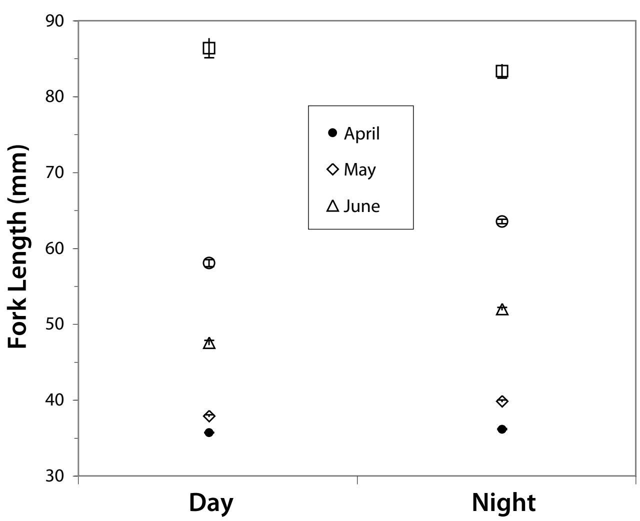
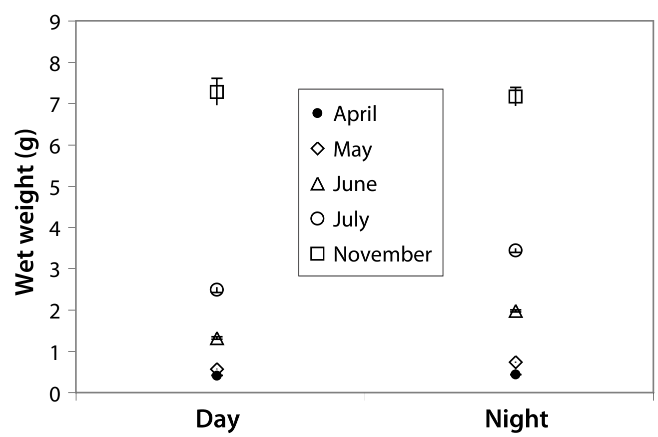


FIGURE 7 **Mean (± SE)wet weights of chinook 0+electrofished, Nechako River, 2004**



along the river margins at night than during the day because juvenile chinook tend to migrate more during night time when they are better able to avoid predators. As a result, the larger fish leave the sheltered areas making them more susceptible to sampling than during the day. Most of the chinook 0+ (86%) were caught at night (**Table 2**).

Chinook Salmon 1+

There were fewer chinook 1+ caught by electrofishing than in the previous year: 123 chinook 1+ were caught in 2004 vs. 590 in 2003, a sum closer to the average of 158 for the previous three years. Most of these 1+ chinook (66%) were caught at night (**Table 2**) and the vast majority (90%) were caught in April. No chinook 1+ were caught during the day in May and only three were caught in the whole month of June. This partly explains the fact that there were no significant day-night differences in fork lengths or wet weights (**Figures 8 and 9**).

TABLE 2 Fish captured by electrofishing in the upper Nechako River, 2003

Common Name	Scientific Name	Adult (1+ for salmon)				Juvenile (0+ for salmon)				Total			
		Day	Night	Total	Percent	Day	Night	Total	Percent	Day	Night	Total	Percent
Chinook salmon	*Oncorhynchus tshawytscha*[1]	42	81	123	0.2	3,458	22,050	25,508	51.8	3,500	22,131	25,631	52.0
Largescale sucker	*Catostomus macrocheilus*	6	25	31	0.1	2,823	3,425	6,248	12.7	2,829	3,450	6,279	12.7
Redside shiner	*Richardsonius balteatus*	150	441	591	1.2	1,703	2,816	4,519	9.2	1,853	3,257	5,110	10.4
Longnose dace	*Rhinichthys cataractae*	156	78	234	0.5	3,339	1,317	4,656	9.5	3,495	1,395	4,890	9.9
Northern pikeminnow	*Ptychocheilus oregonensis*	2	7	9	0.0	739	2,283	3,022	6.1	741	2,290	3,031	6.2
Leopard dace	*Rhinichthys falcatus*	124	83	207	0.4	1,495	710	2,205	4.5	1,619	793	2,412	4.9
Sculpins (General)	*Cottidae*	134	175	309	0.6	361	614	975	2.0	495	789	1,284	2.6
Mountain whitefish	*Prosopium williamsoni*	1	12	13	0.0	14	328	342	0.7	15	340	355	0.7
Rainbow trout	*Oncorhynchus mykiss*	1	3	4	0.0	35	108	143	0.3	36	111	147	0.3
Sockeye salmon	*Oncorhynchus nerka1*	0	0	0	0.0	8	44	52	0.1	8	44	52	0.1
Peamouth chub	*Mylocheilus caurinus*	0	0	0	0.0	37	16	53	0.1	37	16	53	0.1
Burbot	*Lota lota*	0	3	3	0.0	1	14	15	0.0	1	17	18	0.0
Bull trout	*Salvelinus confluentus*	0	1	1	0.0	0	0	0	0.0	0	1	1	0.0
Pacific lamprey	*Lampetra tridentata*	0	0	0	0.0	1	0	1	0.0	1	0	1	0.0
Total		**616**	**909**	**1,525**	**3.1**	**14,014**	**33,725**	**47,739**	**96.9**	**14,630**	**34,634**	**49,264**	**100.0**

[1] "adult" = 1+ fish in this case

FIGURE 8 **Fork lengths (± SE) of chinook 1+ electrofished in the Nechako River, 2004. No fish caught during the day in May and one fish caught in daytime in June.**

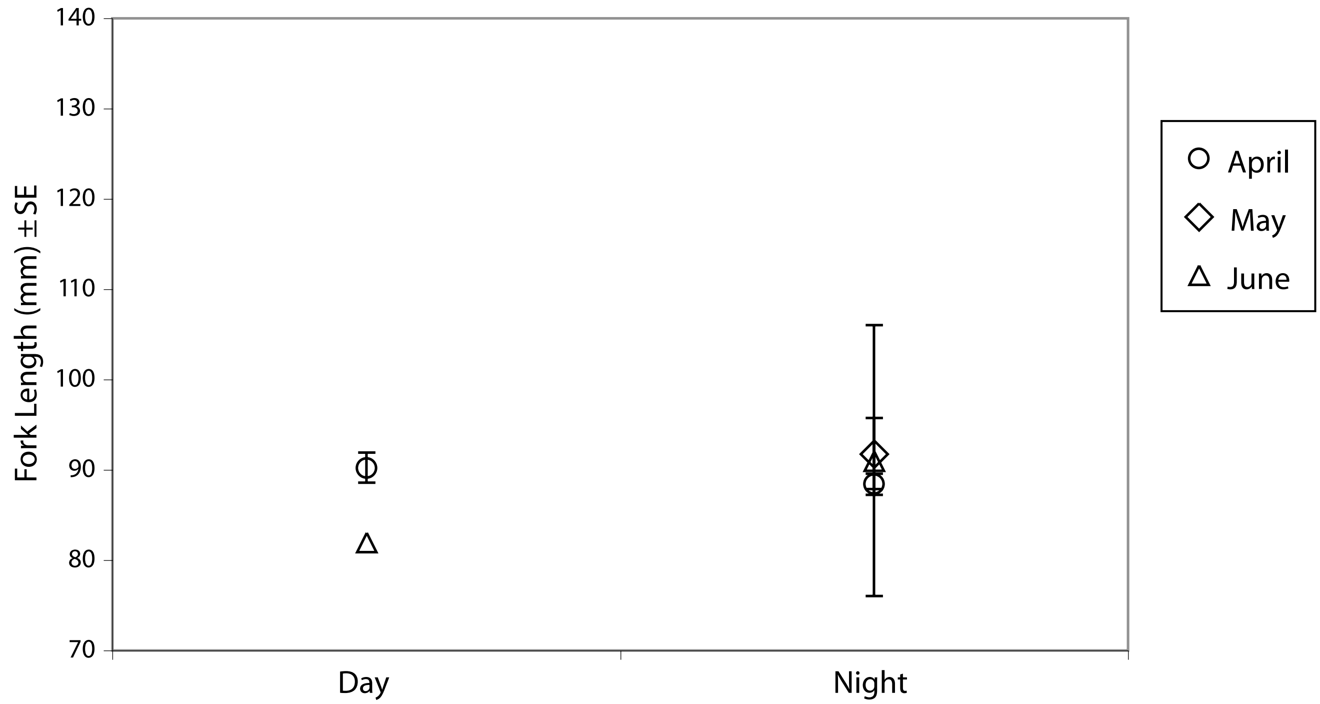
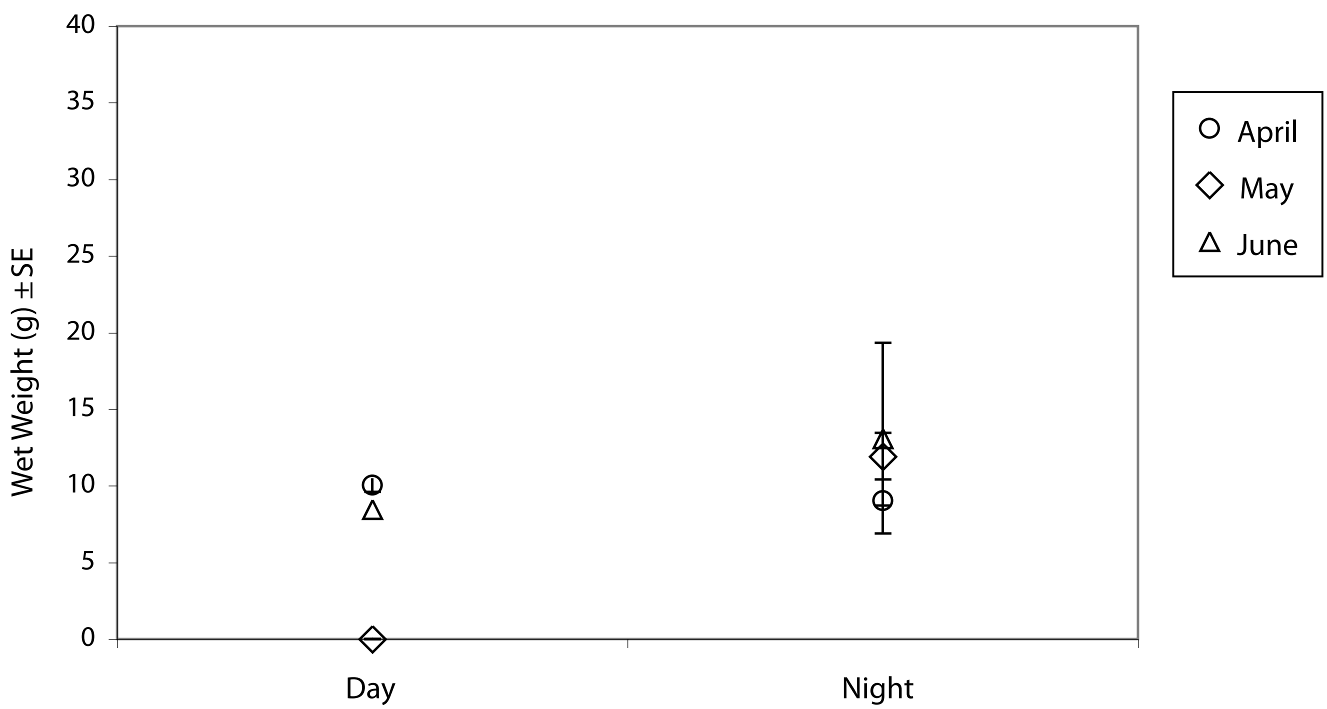


FIGURE 9 **Wet weights (± SE) of chinook 1+ electrofished in the Nechako River, 2004. No fish caught during the day in May and one fish caught in daytime in June.**



3.3.2 Chinook 0+ Growth

The growth of chinook 0+ salmon electrofished along the river margins appeared to follow two separate growth stanzas: as in previous years, growth was slow during April and May and then increased in June **(Figures 10 and 11)**. 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. 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 late May in 2004. There might have been a third growth stanza in late summer-fall when juvenile salmon growth is expected to slow because of decreasing water temperatures. However the lack of sampling between July and November precludes any conclusion in this regard.

3.3.3 Chinook 1+ Growth

In contrast to chinook 0+, chinook 1+ did not appear to show any significant growth: their average fork length went from 89.0 mm in April to 91.7 mm in May and their average weight from 9.4 g to 11.9 g during the same time. This is however most likely due to the small sample size in May.

3.3.4 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 12**. Although a power function explained 97% of the overall variation (Weight = 6.3^{-5}. Fork Length$^{2.667}$, $R^2 = 0.97$ for all chinook), there were more variations among larger juveniles. Most juvenile 0+ above 90 mm were below the predicted weight whereas juvenile 1+ were above the predicted weight for fork lengths >90 mm.

Contrary to previous years, 0+ juveniles showed more variation in weight than 1+ juveniles for the same fork lengths **(Figure 13)**. This is partly due to the relatively small sample size of chinook 1+, but given that most of the variation occurred among 0+ fish >75 mm, this may also reflect differences in feeding success and variations in rearing habitat quality (which affect weight) in late summer. There were also less variations in weight at fork lengths <65 mm than in previous years, which may indicate that there was ample food for these fish in early summer.

0+ and 1+ Chinook Salmon Condition

Average condition of 0+ chinook increased from 91 g/mm^3 in April (a higher value than the 0.84 g/mm^3 observed in the previous three years) to 1.30 g/mm^3 in June and July (1.25 in 2003) and decreased to 1.18 g/mm^3 in November **(Figure 14)**. There was much less variation in November condition indices (range of 0.9 to 2.0) than in June (0.6 to 3.6). These results are as expected since condition, which is a reflection of weight per unit length, would tend to increase most during the early growth stanza (*i.e.,* April through July) when both length and weight are increasing steadily. However, between July and November when growth has slowed, condition tends to stabilize with only slight variations being observed primarily as a result of weight fluctuations associated with food availability. Average condition of 1+ chinook salmon increased slightly from 1.31 g/mm^3 in April (n = 108) to 1.57 in June (n = 3; **Figure 15**).

3.3.5 Diamond Island Rotary Screw Traps

Overall, 22,236 juvenile chinook salmon were caught by the rotary screw traps at Diamond Island in 2004 **(Table 3 and Appendix 1)**: 21,547 0+ and 689 1+. This is a significantly larger number than in 200 3, when 9,174 chinook 0+ were caught in the same traps.Approximately 86% of all 0+ fish and 98% of all 1+ fish were caught at night. This may reflect slightly different movement patterns or better avoidance of the traps during the day.

Chinook 0+

The distribution of juvenile 0+ chinook catches over time was essentially unimodal, with the peak of abundance centered around May 6, 2004 and a secondary, much smaller peaks around June 10 and 21 **(Figure 16)**. Last year's peak of abundance was also unimodal and centered one week earlier, in late April, 2003.

FIGURE 10 **Fork lengths (±1 SE) of chinook 0+ electrofished in the Nechako River, 2004**

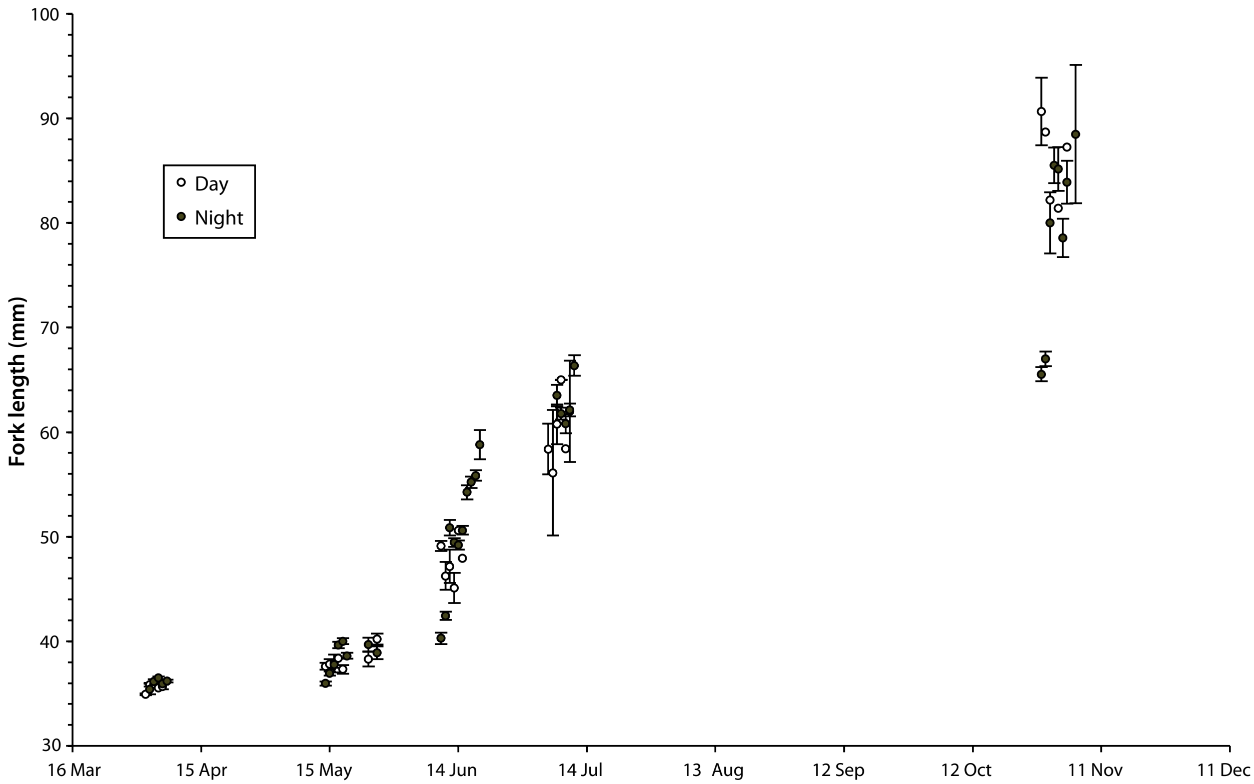


FIGURE 11 **Wet weights (±1 SE) of chinook 0+ electrofished in the Nechako River, 2004**

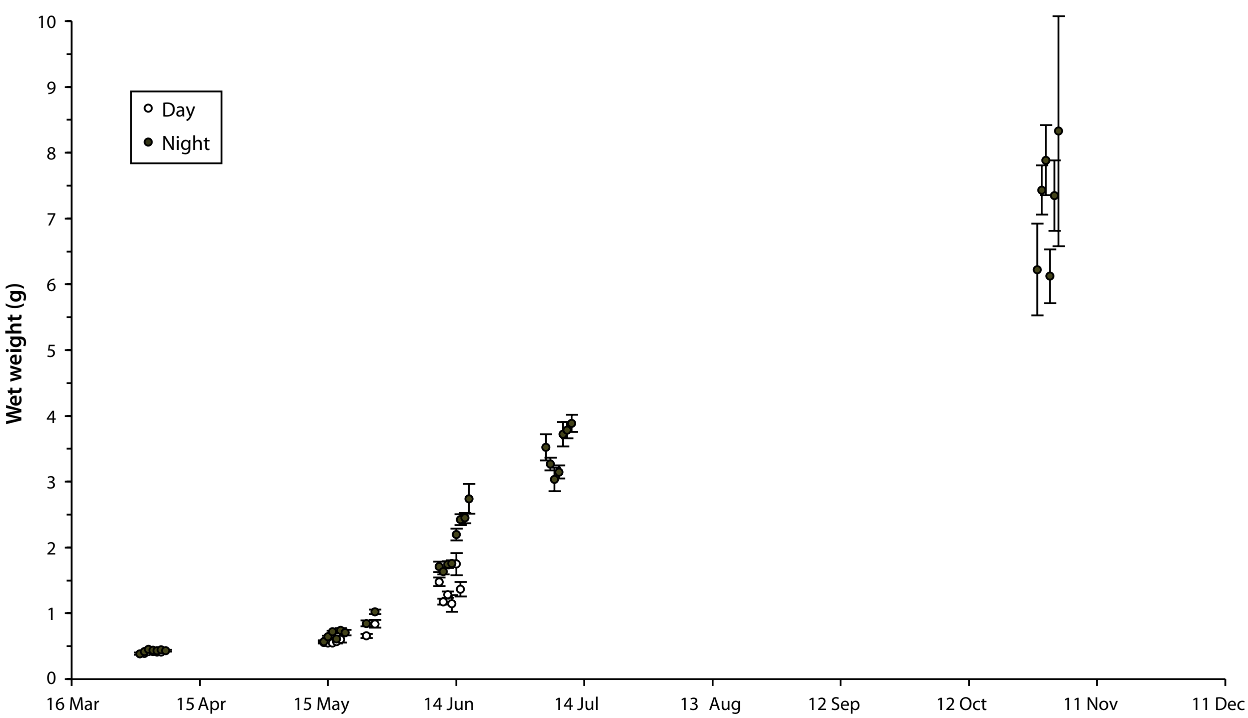


FIGURE 12 Wet weight vs. fork length for juvenile chinook salmon, Nechako River, 2004: electrofishing

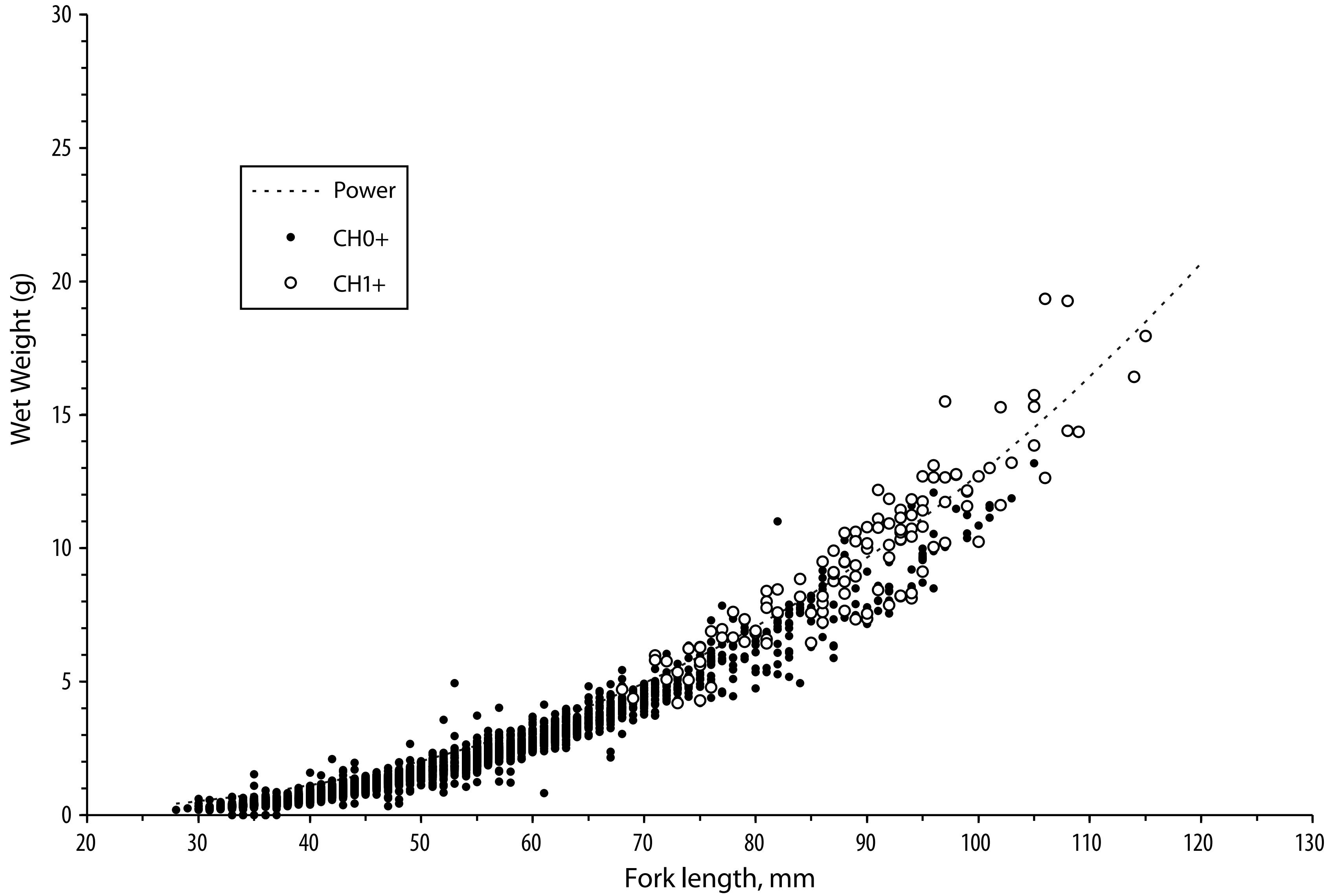


FIGURE 13 **Variance in juvenile chinook wet weight per fork length. Fork lengths sorted per day. Fish caught electrofishing, Nechako River, 2004**

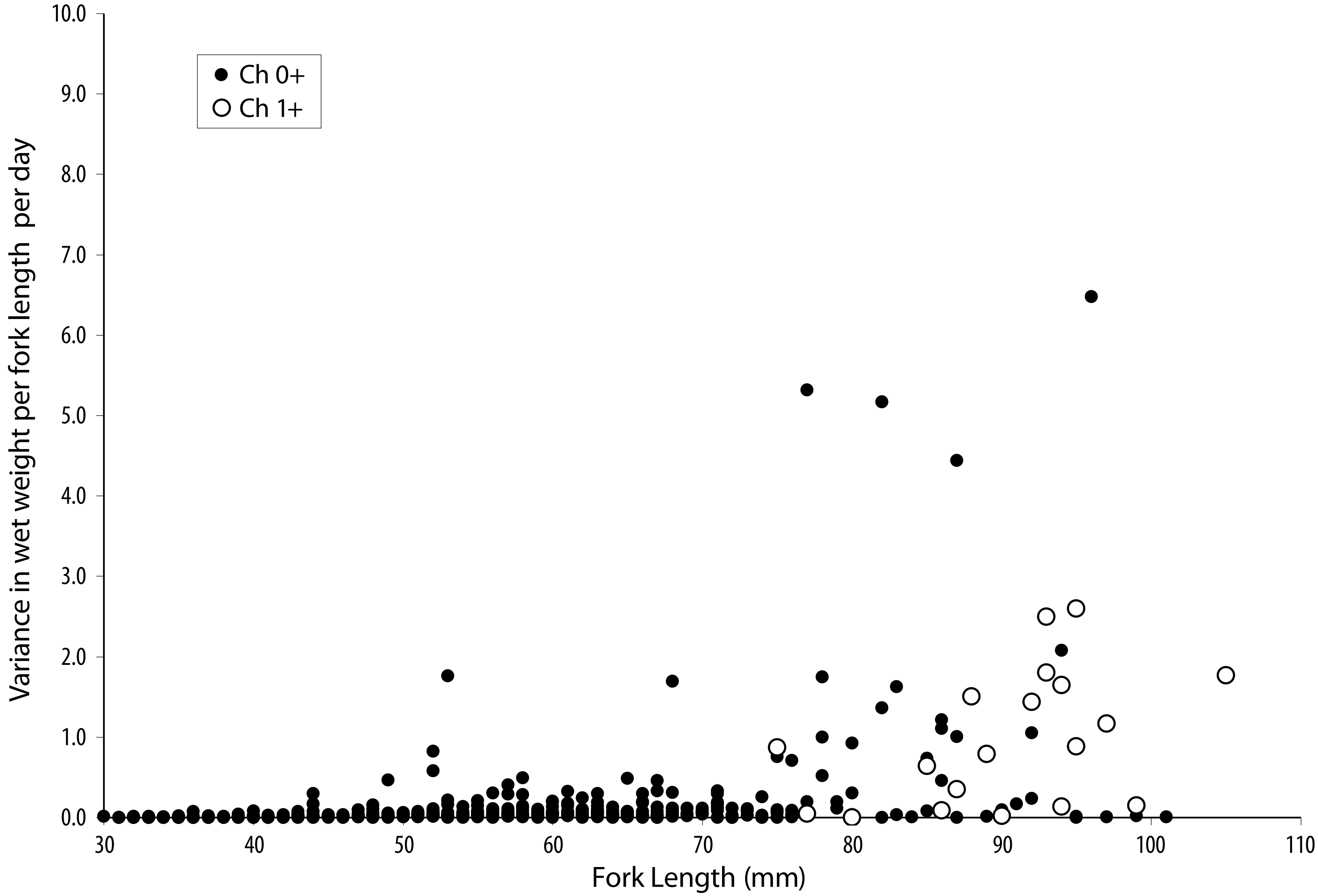


FIGURE 14 **Condition indices of juvenile chinook 0+ electrofished in the Nechako River, 2004. N = 5,674.**

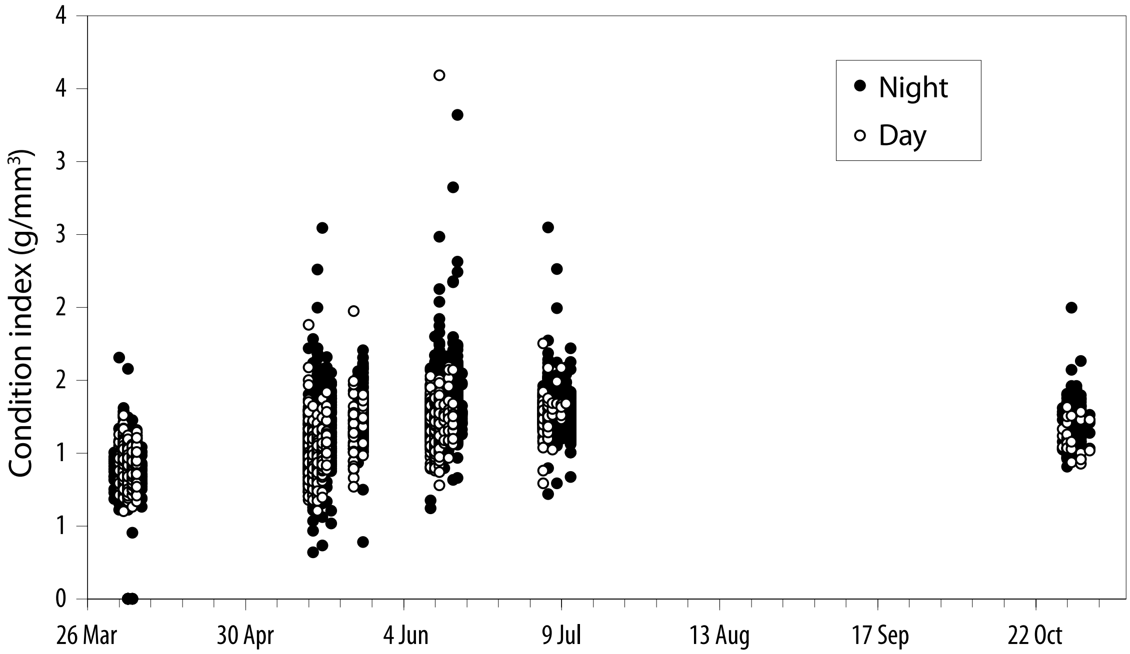


FIGURE 15 **Condition indices of juvenile chinook 1+ electrofished in the Nechako River, 2004. N = 120.**

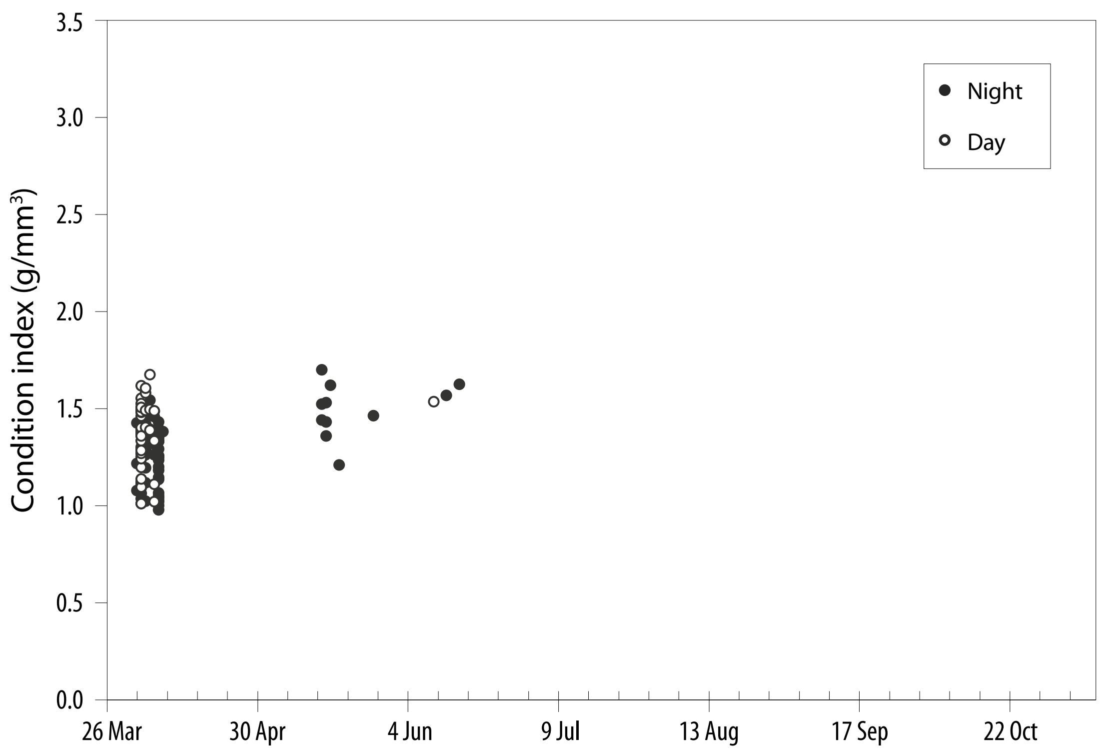


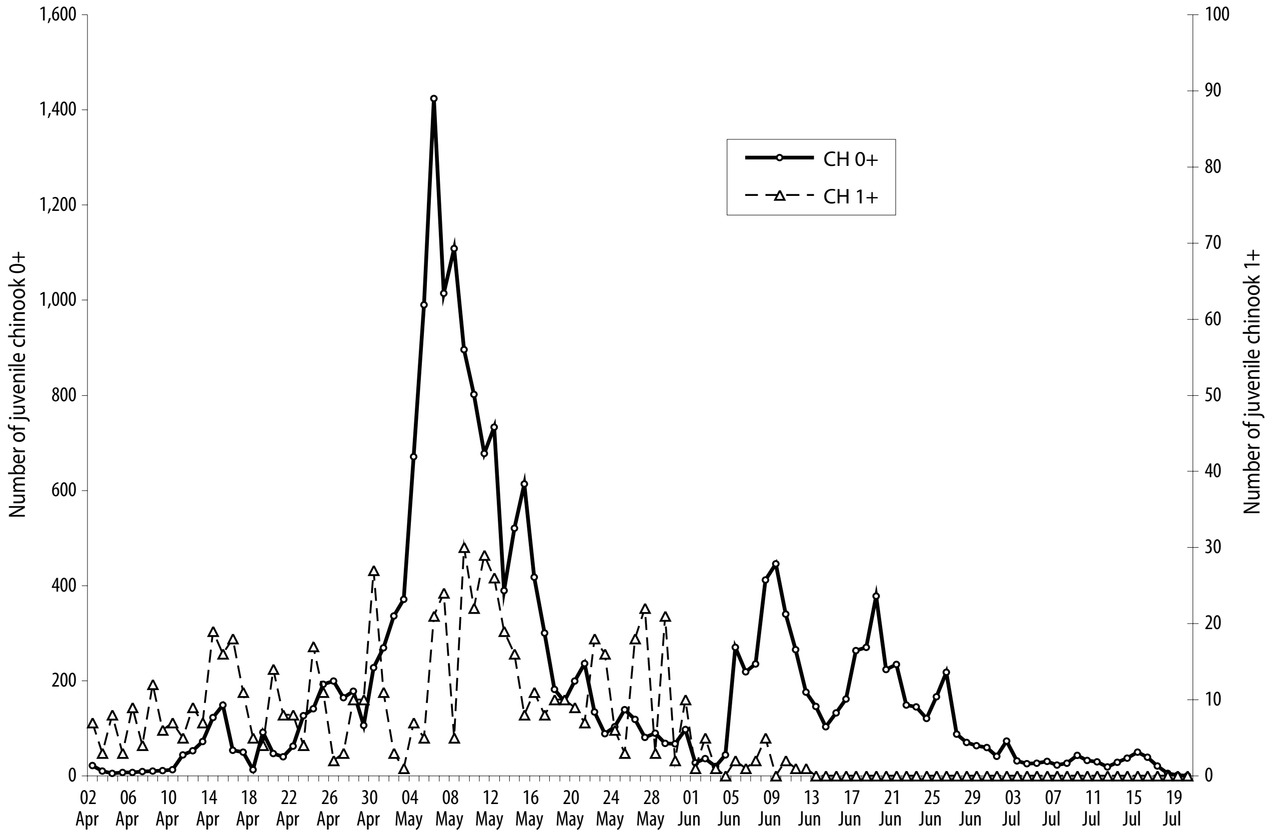
TABLE 3

Summary of rotary screw trap (RST) catches of chinook 0+ and 1+ at Diamond Is, Nechako River, April 2 to July 20, 2004

Trap number	Trap location	0+ chinook			1+ chinook		
		day	night	total	day	night	Total
1	Left margin	885	4,355	5,240	5	460	465
2	Mid Channel	649	9,952	10,601	9	177	186
3	Right margin	1,483	4,223	5,706	1	37	38
	Total	**3,017**	**18,530**	**21,547**	**15**	**674**	**689**

FIGURE 16

Juvenile chinook salmon 0+ and 1+ caught in rotary screw traps, Nechako River, 2004. Day and night catches included. Note different axes.



The numbers of 0+ chinook estimated to have passed Diamond Island between April 1 and July 20 ranged from 238,883 for trap 1 to 525,972 for trap 2 (**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 372,958. This is almost a 200% increase (189%) over the 2003 index (129,004 chinook 0+).

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 sub-sampled fish (not all fish caught were measured, Section 2.4).

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 mid- channel trap caught significantly more fish at night than the two other traps, and the right margin trap caught significantly more fish during the day (**Table 3, Figure 17**). This is different from previous years, when one of the margin traps usually caught fewer chinook 0+ than the two other traps at night, and when there were no significant differences among traps during the day. Overall, all traps caught more chinook 0+ at night (**Figure 17**). When water volume filtered by traps was taken into account (*i.e.,* standardized catches), the results were the same than those with absolute numbers: the right trap caught more fish than the other two during the day, and the mid-channel trap caught more fish during the night. Al traps also caught significantly more chinook 0+ at night.

The chinook 0+ morphological parameters (fork length, wet weight) also differed among traps (**Figures 18 A & B**): as in the previous year, the left

TABLE 4 **Factorial ANOVA on numbers of juvenile chinook 0+ captured by rotary screw traps standardized by volume sampled, Nechako, 2004. Ln - transformed values**

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Day/Night	1	883.35	136.737	412.50	<.0001
Trap location	2	95.75	47.88	7.41	0.0007
Day/Night * trap location	2	165.05	82.52	12.77	<.0001
Residual	651	4205.61	6.46		

FIGURE 17 **Mean numbers (± SE) of juvenile chinook 0+ caught in rotary screw traps, Nechako River, April 02 - July 20, 2004. Night and day catches are significantly different for all traps, PLSD test on Ln - transformed values.**

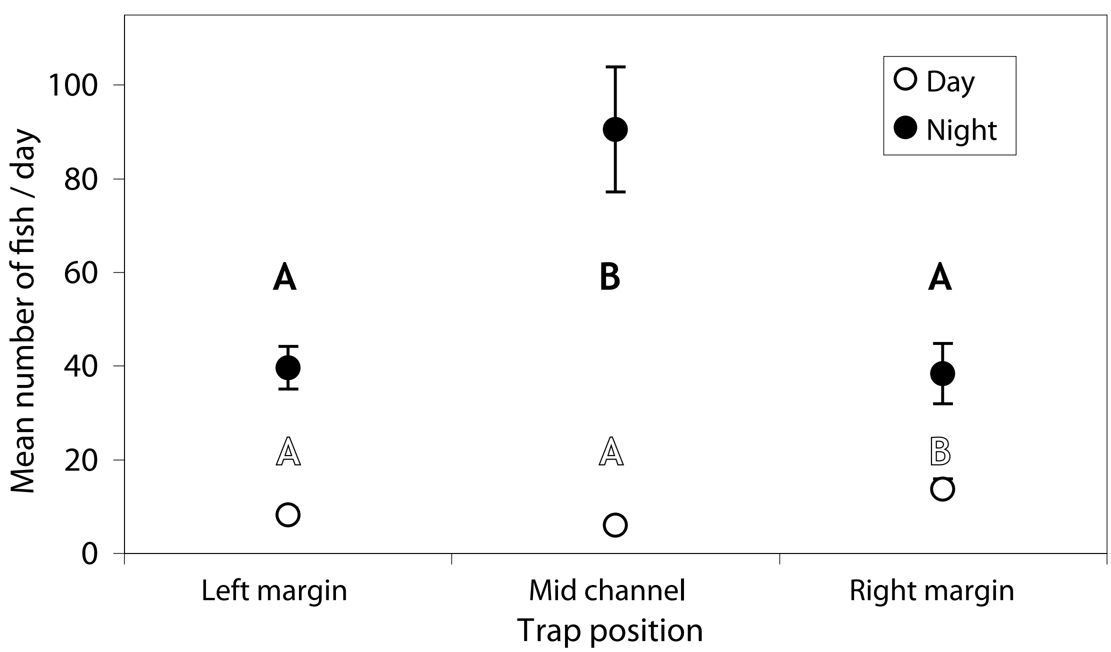
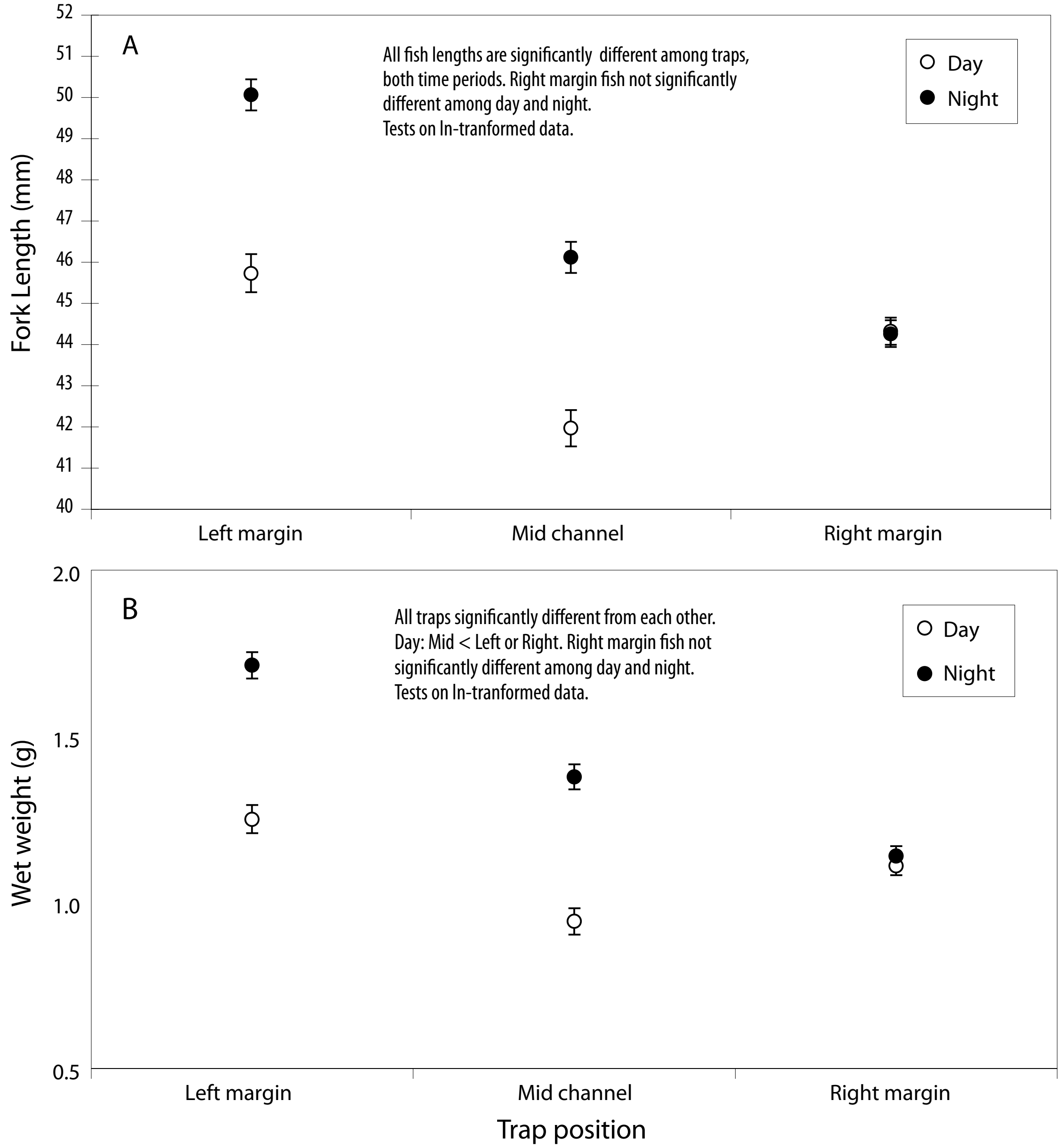


FIGURE 18 **Mean fork length and wet weight of juvenile chinook 0+ caught in rotary screw traps, Diamond Island, Nechako River, April - July, 2004. Error bars are SE.**



margin trap tended to catch significantly larger juvenile chinook than either of the two other traps (tests done on *l*n-transformed data) both at night and during the day. This is different from past years, when the traps which catch more fish (the two margin traps alternate in that regard) usually catch larger fish.

CHINOOK 1+

The numbers of 1+ chinook estimated to have passed Diamond Island between April 2 and July 20 ranged from 1,812 for trap 3 to 20,539 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 11,182. This is less than 50% of the number of chinook 1+ estimated at these same traps in 2003 (21,031) and reflects the drop in chinook 0+ recorded in 2003.

There was a significant interaction 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 average per session **(Table 3; Figure 19)**. Both juvenile 0+ and 1+ chinook thus tended use the middle of the river (where the left margin and mid-channel traps are located) more than the margins in 2004. This is the same trend than the one observed in 2003 and 2002, but different from 2001 when 0+ fish were caught in greater numbers along the right margin.

Chinook 1+ morphological parameters (fork length, wet weight) did not differ among traps (**Figure 20**; tests done on *l*n-transformed data). Only night catches were tested as there were only 15 fish caught during the day **(Table 3)**.

0+ Chinook Salmon Growth

Lengths and weights of 0+ chinook captured at Diamond Island followed trajectories similar to those of electrofished 0+ chinook (**Figures 21 and 22**; compare with **Figures 6 and 7**). The first growth stanza ran from early April to early to around May 17 - 21, at which time the rate of fry emergence had dropped to a level that allowed the true population growth curve to become apparent.

1+ Chinook Salmon Growth

The fork lengths and weights of 1+ chinook did not vary much with date, suggesting that the trigger for outmigration may be size dependent **(Figures 23 and 24)**.

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 between 0.90 and 1.0 g/mm^3 over April and May (emerging fish) and climbed to an asymptote of 1.2 g/mm^3 in June and July. The average condition index of chinook 0+ in 2004 was comparable to that in 2003 (0.83 - 1.4) and 2002 (0.80 - 1.1). Condition of 1+ chinook also increased slightly with date from 1.09 g/mm^3 in late April to 1.18 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 2004. The curvature of the growth curves of 0+ chinook indicated that emergence had ceased by late May (similar to 2003 but earlier than in 2002) and that growth was rapid over June and July.

3.4 Catches

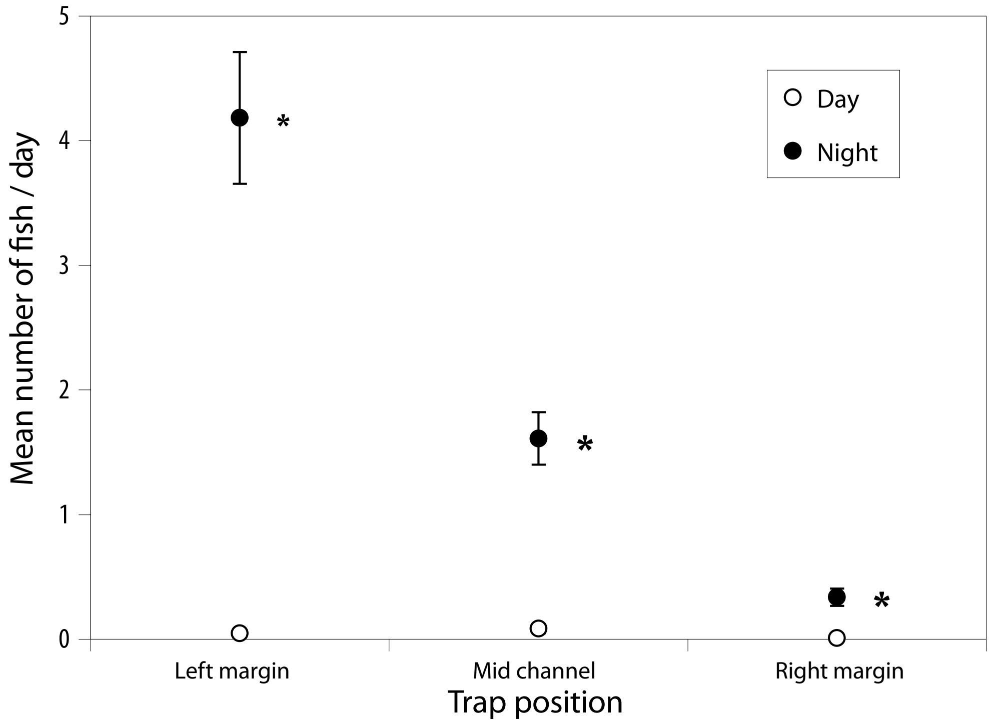
3.4.1 Electrofishing/All Species

In total, 1,248 electrofishing sweeps were made along the margins of the upper Nechako River from April 2 to November 3, 2004: 628 during daylight and 620 at night. The average area covered by a sweep was 132 m^2 (median of 120 m^2, range of 60 - 1,600 m^2). Most of the sweeps were less than 200 m2 in area. The greatest amount of effort directed to a single site was applied, as in previous years, to RM17.9, the 1,600 m^2 side channel site. Effort at individual sites ranged from 102 seconds (at site LM 80.2) to 1,583 seconds (at the 1,600 m^2 side channel site). The average effort per site was 255 seconds.

TABLE 5 **Factorial ANOVA on numbers of juvenile chinook 1+ captured by rotary screw traps standardized by volume sampled, Nechako, 2004. Ln - transformed values**

	DF	Sum of Squares	Mean Square	F-Value	P-Value
Day/Night	1	670.30	1121.2	217.78	<.0001
Trap location	2	146.96	73.48	23.87	<.0001
Day/Night x trap location	2	107.55	53.78	17.47	<.0001
Residual	651	2003.72	3.08		

FIGURE 19 **Mean numbers (± SE) of juvenile chinook 1+ caught in rotary screw traps, Nechako River, April 2 - July 20, 2004**



* significantly different from other traps during the same time period, PLSD test on L - transformed values

FIGURE 20 **Mean fork length and wet weight (± SE) of juvenile chinook 1+ caught in rotary screw traps at night, Nechako River, April 2 - July 20, 2004. There were no significant differences among traps, PLSD.**

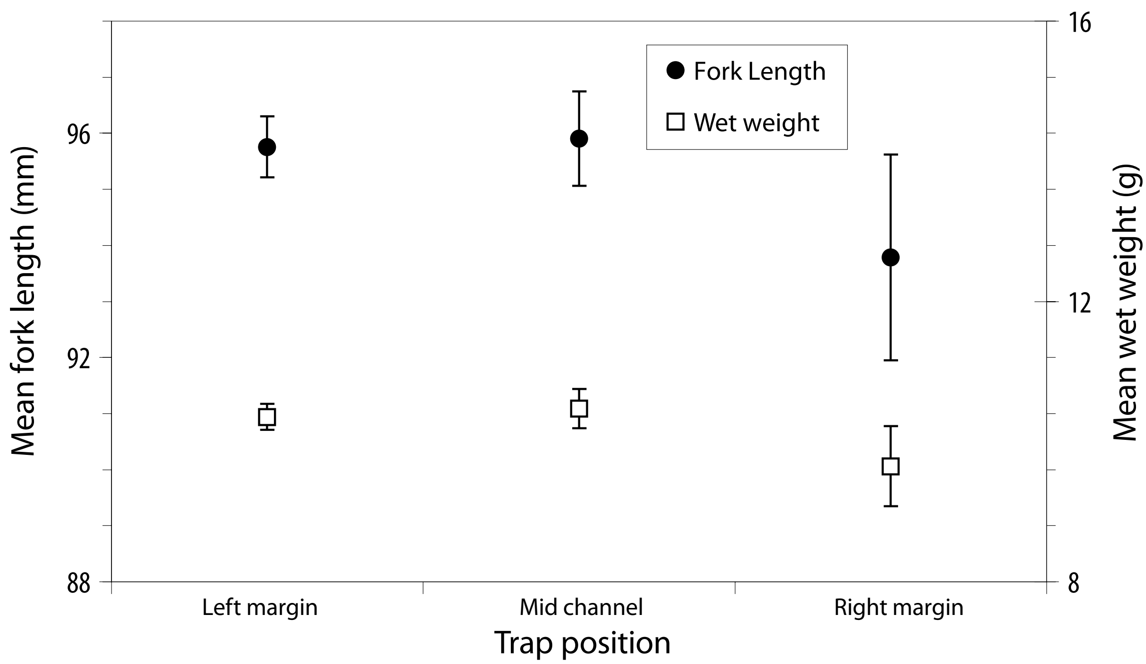


FIGURE 21 Mean length (±SE) of 0+ chinook salmon caught in rotary screw traps, Nechako River, 2004

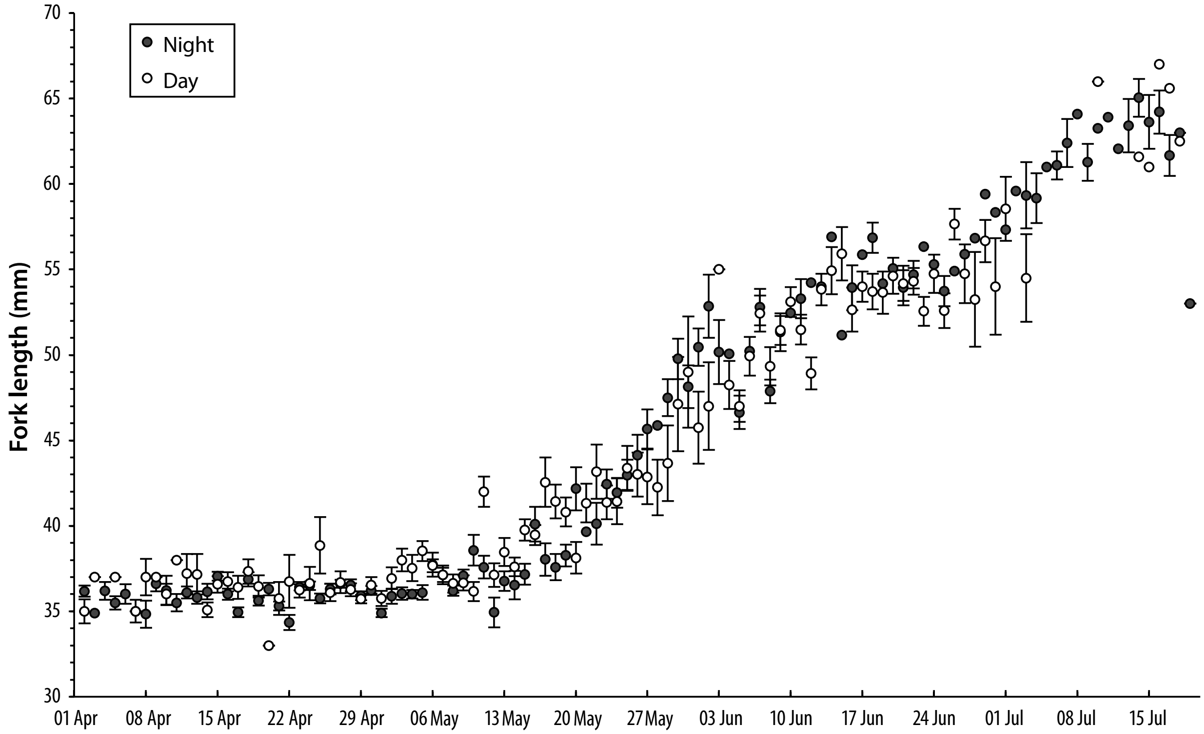


FIGURE 22 Mean weight (±SE) of 0+ chinook salmon caught in rotary screw traps, Nechako River, 2004

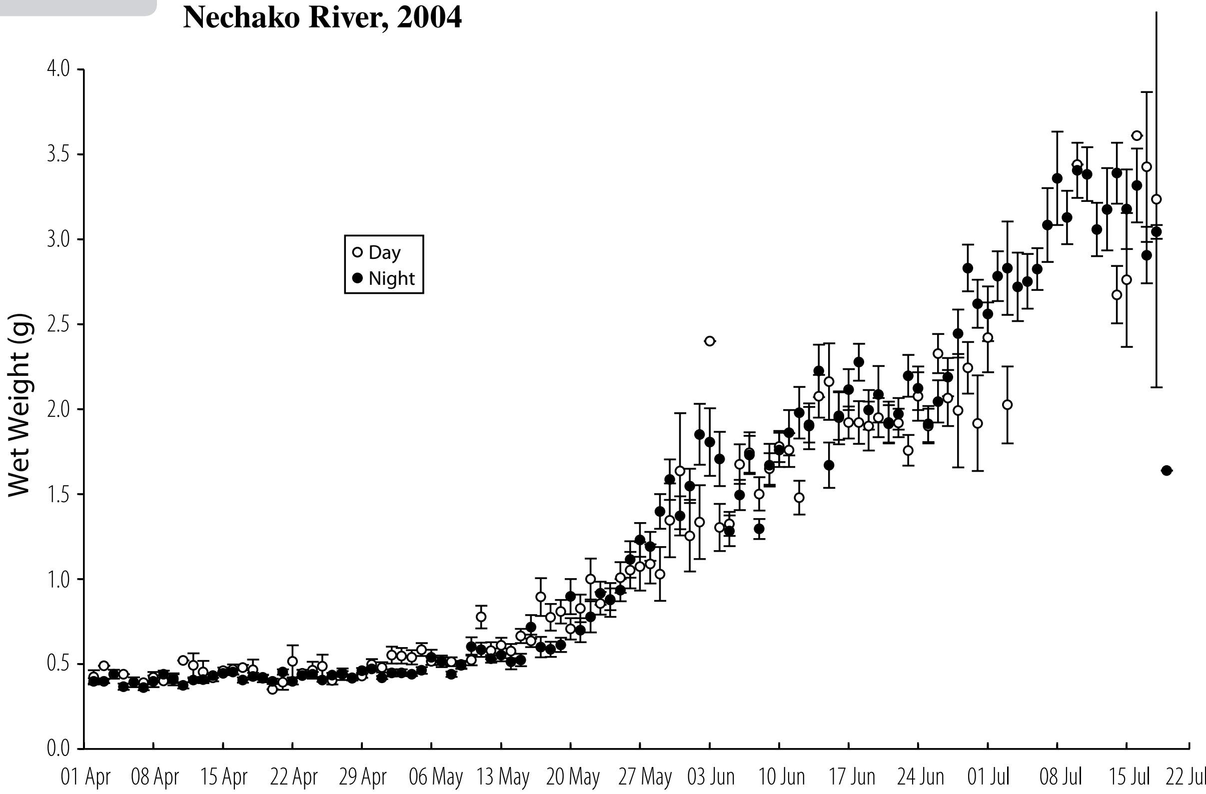


FIGURE 23 **Mean (±1 SE) length of 1+ chinook salmon, Nechako River, 2004, from rotary screw traps**

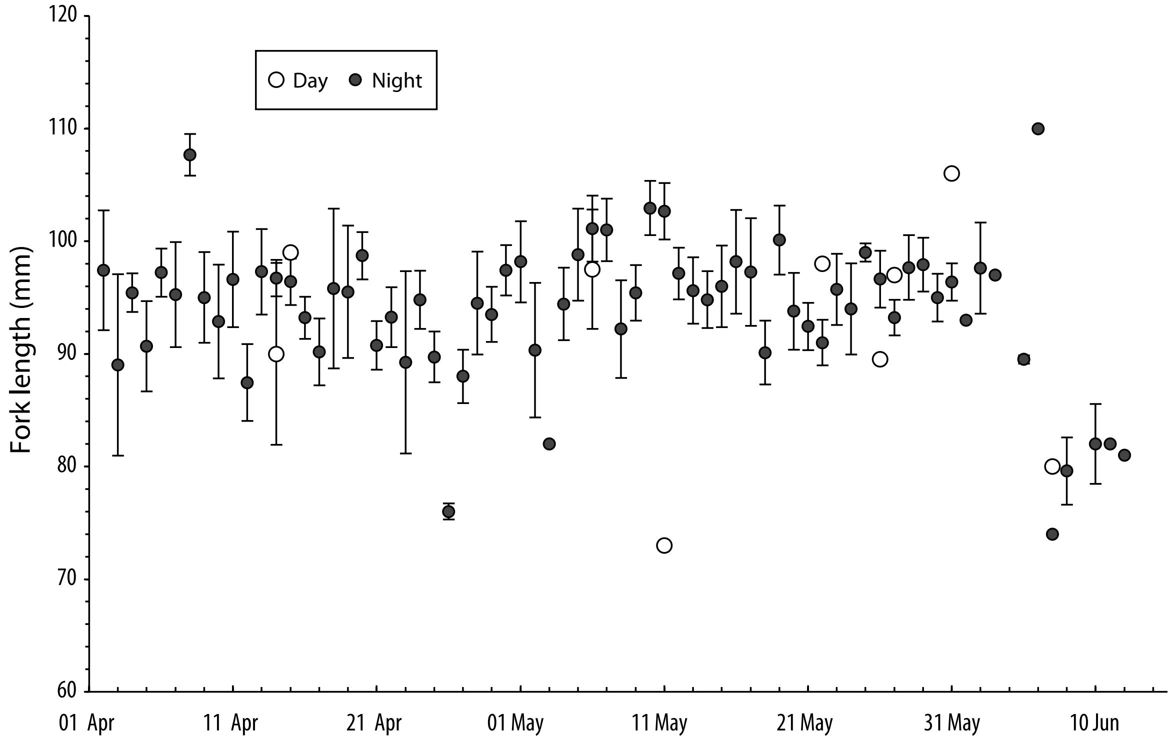
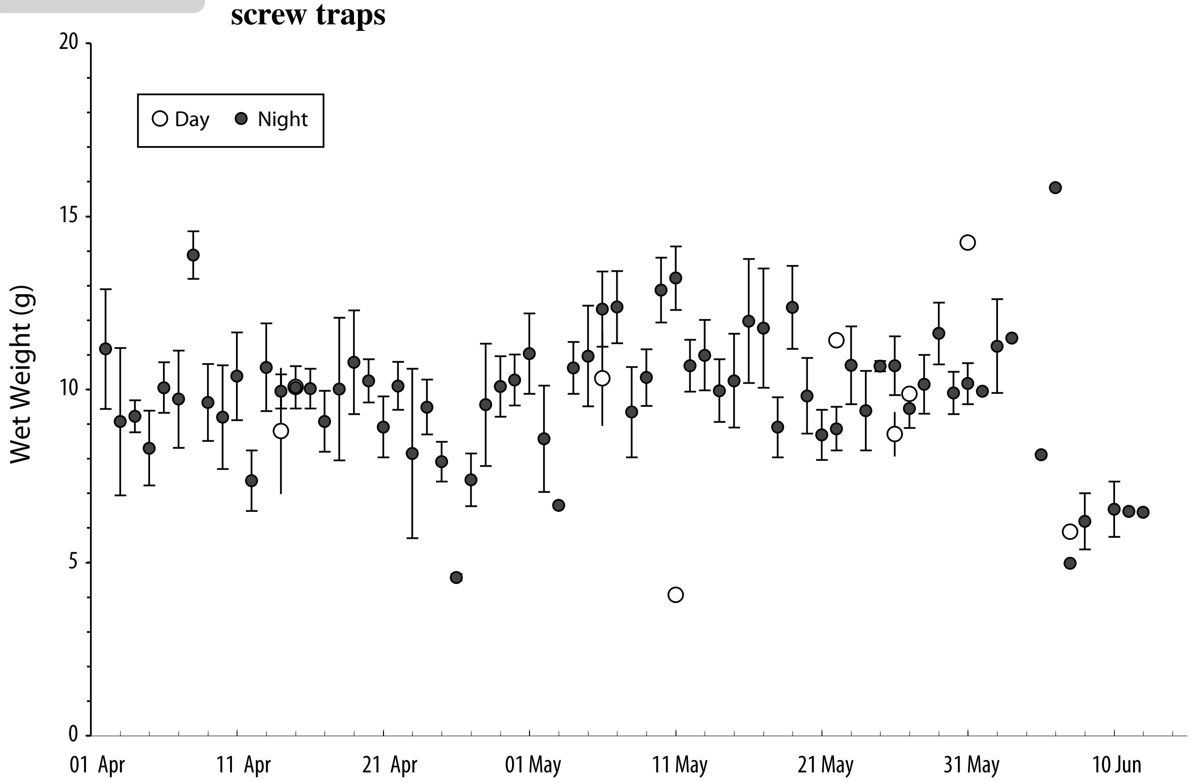


FIGURE 24 **Mean (±1 SE) weight of 1+ chinook salmon, Nechako River, 2004, from rotary screw traps**



Overall, 49,264 fish from 14 species or families were captured and then released (**Table 2**). This is an increase from last year, when 43,492 fish were caught from 13 species or families. Chinook salmon were, as usual, the most common species (N = 25,631) accounting for 52% of the total catch (compared to 65% in 2002 and 58% in 2003), followed by largescale sucker (N = 6,279 or 13%) and redside shiner (N = 5,110 or 10%). Bull trout and lamprey were the least common species (N = 1 and 1, respectively).

Lamprey

A single lamprey was captured at Diamond Island (site LM82.15) during index sampling in May of 2004. This is the first time that a lamprey has been captured during index sampling. Lamprey are not well documented in the Fraser River system above the confluence of the Thompson River. FISS records indicate that they are present in the Blackwater (West Road) River and Baezaeko River, although no species is given. Pacific lamprey *(Lampetra tridentata)* records are sparse, but records exist for the Chilko and Taseko rivers, and McPhail and Carveth (1994) note that they are present at least as far upstream as the Chilcotin River. McPhail (1999) indicates that they are present in the Nechako River, but no details or capture locations are provided, and there are no records for other lamprey species. River lamprey *(Lampetra ayresi)* and Western brook lamprey *(Lampetra richardsoni)* are thought to be confined to the lower Fraser River and its tributaries (McPhail and Carveth 1994, Scott and Crossman 1973).

Triton has previously captured juvenile lampreys (suspected to be Pacific lamprey) in the Nechako River near its confluence with the Fraser (Triton 2004), and in the Chilako River (a tributary to the Nechako; Triton 2003). Two adult Pacific lampreys were captured in the Nechako River at Vanderhoof, B.C. in June, 2004 (Triton, unpublished data), confirming the presence of this species in the Nechako River. The lamprey captured during index sampling is thought to be a Pacific lamprey based on the historical range of the species and the confirmed presence of Pacific lamprey in the Nechako River.

Pacific lampreys are anadromous, returning to freshwater to spawn. Sexually immature lampreys begin migrating to freshwater from July to September, and remain in fresh water until the following March (Scott and Crossman 1973). The lampreys do not feed during this time period, and are somewhat sedentary as their reproductive organs mature. Spawning occurs in the spring, generally from April to July, over sandy gravel substrates. Lampreys are able to migrate to the upper reaches of most streams due to their strong swimming ability and their ability to pull themselves through rapids by clinging to rocks with their suctorial disc (Scott and Crossman 1973). Lampreys do not migrate back downstream, as they die shortly after spawning.

Larval lampreys (called ammocoetes) burrow into muddy substrates downstream of the nest site after hatching, where they remain as filter feeders for up to six years (Scott and Crossman 1973). Transformation to the juvenile stage occurs in the summer to late fall, when the lampreys develop fin folds and an oral hood (precursors to fins and the sucking disc). The juveniles migrate downstream the following spring during high water. Lampreys spend 12 - 20 months at sea as parasitic adults before returning to spawn (Scott and Crossman 1973). Dwarf populations and non-anadromous populations have been documented. At least one non-anadromous population in Cowichan Lake, B.C., has now been identified as a separate species *(Lampetra macrostoma)*.

3.4.2 Electrofishing/0+ Chinook

Overall, 25,508 0+ chinook were captured by electrofishing (**Table 2**), of which 3,458 or 14% were taken during daylight. CPUE of electrofishing catches of 0+ chinook ranged from 0 to 281 fish/100 m2.

Temporal Distribution of CPUE

CPUEs of 0+ chinook salmon peaked in May for night catches, and then decreased through to November (**Table 6**). Day catches CPUE of 0+ chinook salmon gradually decreased from April through to November.

TABLE 6 **Mean electrofishing catch-per-unit-effort (CPUE, number/100 m^2) of juvenile chinook salmon, Nechako River, 2004. N = number of date/site combinations electrofished (same for both ages)**

	Number of fish			0+ CPUE		1+ CPUE	
Date	0+	1+	N	mean	SD	mean	SD
Day							
Apr	1,473	40	108	11.2	15.5	0.3	0.9
May	1,239	0	137	6.9	10.9	0.0	0.0
Jun	470	1	137	2.3	4.5	0.0	0.1
Jul	246	1	137	1.1	4.2	0.0	0.1
Nov	30	0	109	0.2	0.6	0.0	0.0
sum	3,458	42					
Night							
Apr	3,188	69	106	24.9	38.3	0.6	1.3
May	9,944	9	137	56.7	63.9	0.1	0.3
Jun	6,890	3	137	40.1	44.3	0.0	0.1
Jul	1,899	0	137	10.4	16.0	0.0	0.0
Nov	129	0	103	1.1	1.8	0.0	0.0
sum	22,050	81					
Total	**25,508**	**123**					

SPATIAL DISTRIBUTION OF CPUE

Based on the relative distributions of CPUE per month, newly emergent chinook salmon (April) were most abundant in the upper river from kms 10 to 40 (**Figure 25 and Appendix 2**), which is somewhat different from 2003 when they were more concentrated around kms 20 - 60. The May distribution was bimodal, with two main concentrations around kms 25 and 70 - 80, with overall higher CPUEs in all river sections. Relative increases in CPUE in Reach 1 for July were as in previous years, which may indicate active upstream migration of juveniles, presumably in search of rearing habitat. Also similar to previous years, there was a decrease in July of all CPUE values for all river sections as compared to June. Although river conditions in Reaches 1 and 4 precluded thorough sampling during November, CPUE values were as usual at their lowest for the rest of the river compared to other months. Overall, there was a general upstream movement of juvenile chinook 0+ from May to July and a large overall drop in abundance of fish residing in the river in October / November.

3.4.3 Electrofishing/1+ Chinook

Most of the 123 1+ chinook captured by electrofishing (66%; **Table 2**) were caught at night. CPUE of 1+ chinook ranged from 0.0 to 8 fish/100 m^2, and decreased rapidly with date (**Appendix 2**).

3.4.4 Diamond Island Rotary Screw Traps/Incidental Species

Overall, 29,361 fish from 12 species or families were captured by the rotary screw traps in 2004 (**Table 7**). Chinook salmon were the most common species, making up 76% of all fishes. The five most common non-salmonid fishes were largescale sucker, mountain whitefish, redside shiner, northern pikeminnow and leopard dace. The ranking of the species was different from that reported for the electrofishing surveys, but as in the latter, 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 more diverse habitats. This was

FIGURE 25 **Mean (+ 1 SD) monthly catch-per-unit-effort (CPUE, in fish caught per 100 m²) of 0+ chinook salmon, Nechako River, 2004: electrofishing. No sampling in the 40 - 49.9 km area. Note different axes between months.**

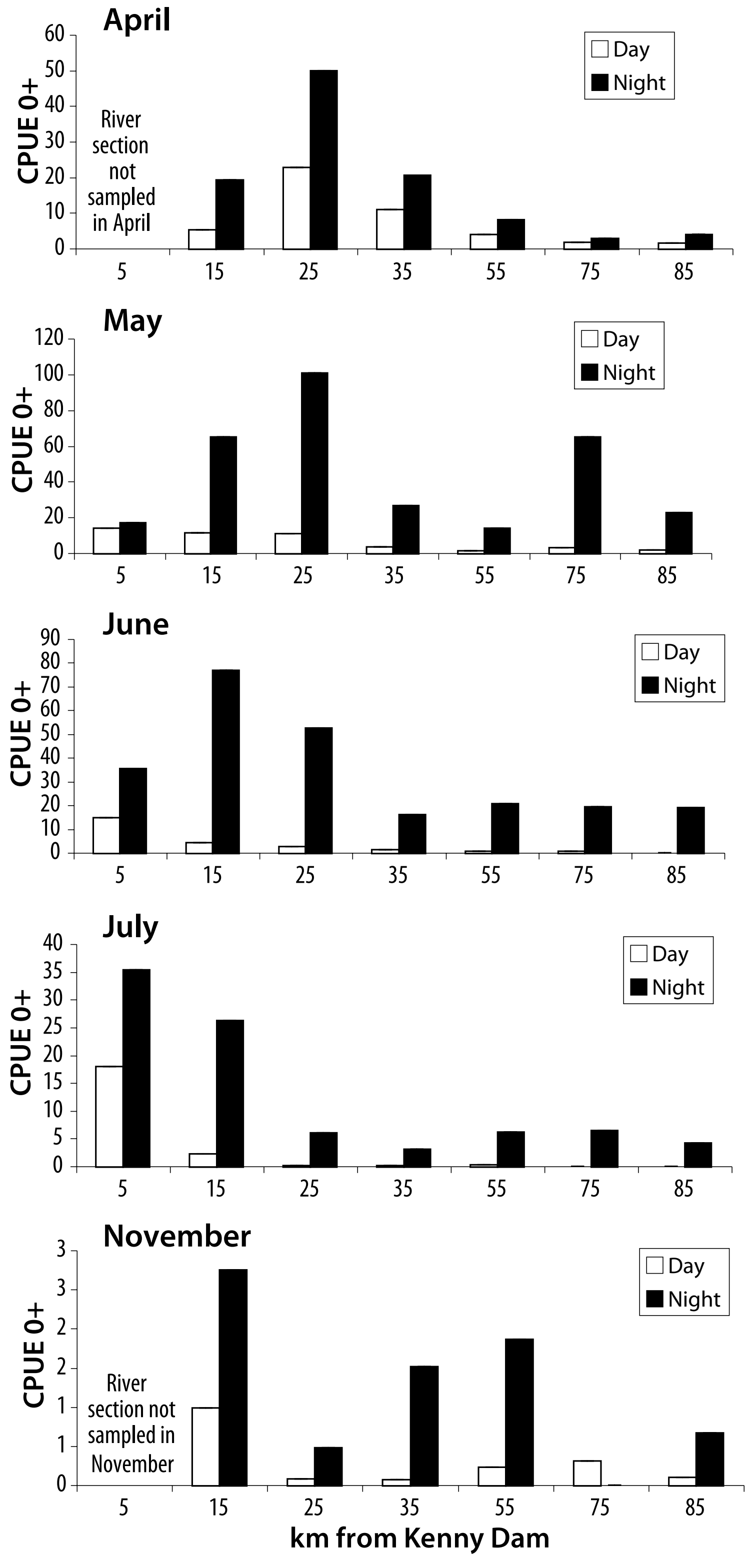


TABLE 7 Fish captured in the rotary screw traps in the upper Nechako River, 2004

Common Name	Scientific Name	Adult				Juvenile				Total			
		Day	Night	Total	Percent	Day	Night	Total	Percent	Day	Night	Total	Percent
Chinook salmon	*Oncorhynchus tshawytscha*[1]	15	674	689	2.7	3,017	18,530	21,547	83.9	3,032	19,204	22,236	86.6
Largescale sucker	*Catostomus macrocheilus*	1	10	11	0.0	223	2,575	2,798	10.9	224	2,585	2,809	10.9
Mountain whitefish	*Prosopium williamsoni*	3	3	6	0.0	66	995	1,061	4.1	69	998	1,067	4.2
Redside shiner	*Richardsonius balteatus*	7	281	288	1.1	75	605	680	2.6	82	886	968	3.8
Northern pikeminnow2	*Ptychocheilus oregonensis*	1	8	9	0.0	126	823	949	3.7	127	831	958	3.7
Leopard dace	*Rhinichthys falcatus*	9	303	312	1.2	13	294	307	1.2	22	597	619	2.4
Sockeye salmon	*Oncorhynchus nerka*[2]	0	1	1	0.0	13	180	193	0.8	13	181	194	0.8
Peamouth chub	*Mylocheilus caurinus*	0	0	0	0.0	75	104	179	0.7	75	104	179	0.7
Rainbow trout	*Oncorhynchus mykiss*	0	3	3	0.0	4	136	140	0.5	4	139	143	0.6
Longnose dace	*Rhinichthys cataractae*	5	32	37	0.1	11	82	93	0.4	16	114	130	0.5
Sculpins (General)	*Cottidae*	2	10	12	0.1	5	38	43	0.2	7	48	55	0.2
Burbot	*Lota lota*	0	0	0	0.0	0	3	3	0.0	0	3	3	0.0
Total		**43**	**1,325**	**1,368**	**5.3**	**3,628**	**24,365**	**27,993**	**109.0**	**3,671**	**25,690**	**29,361**	**114.3**

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

backed by the greater species evenness[1] of the electrofishing surveys: 0.14 for rotary screw traps sampling and 0.23 for electrofishing (Simpson's measure of evenness; Krebs 1999). Both measures were similar to that of the previous year (2003 - rotary screw traps: 0.17 and electrofishing: 0.23).

3.5 Comparisons with Previous Years

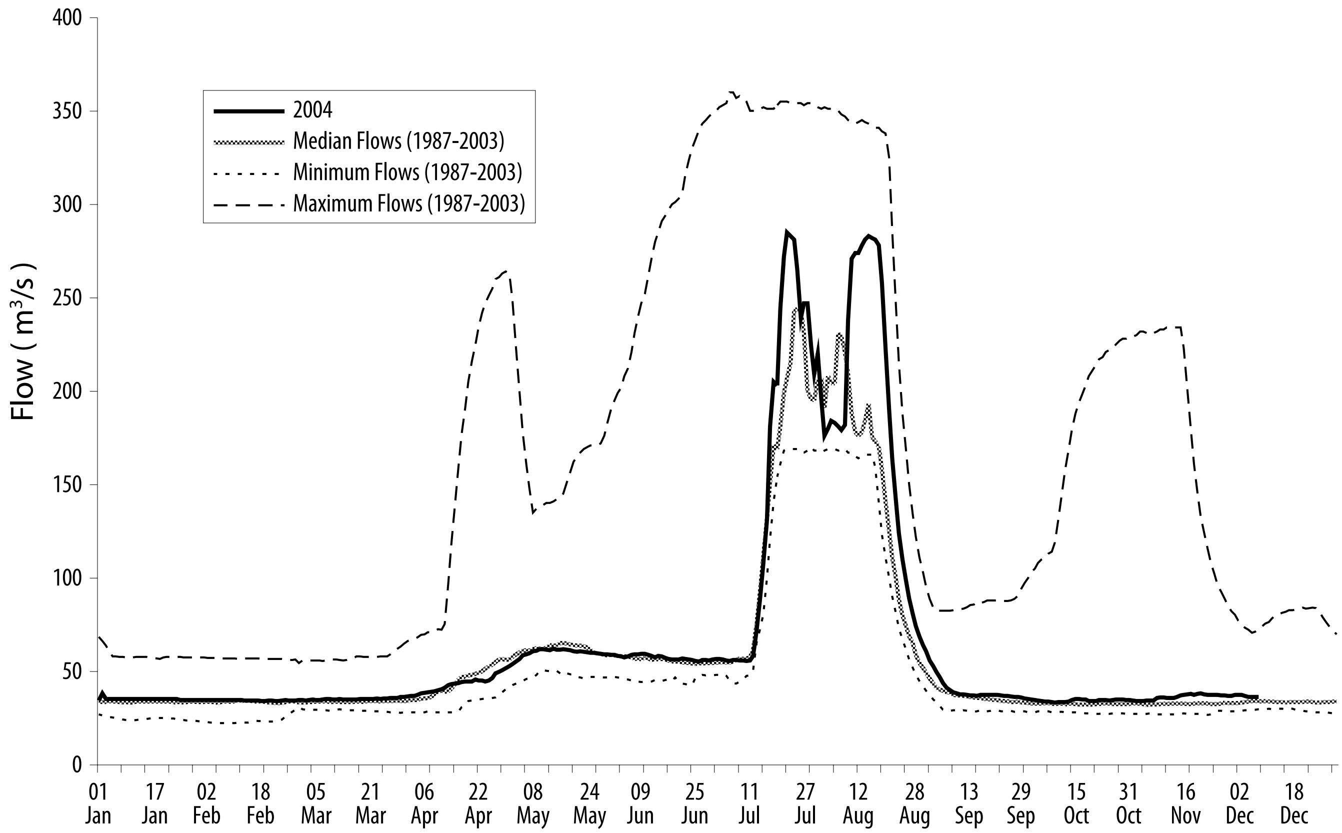
3.5.1 Temperature

Mean daily water temperatures below the Cheslatta Falls in 2004 were close to the average observed in the previous 13 years until mid - April, after which they remained close to the maximum until late August. River temperatures dropped rapidly through early September, and generally paralleled the minimum (1987 - 2003) for the remainder of the year (until November 28, 2004; **Figure 3**). It should also be noted that temperatures in the upper Nechako River in 2004 exceeded 19°C on two separate days (June 24 and August 20) and that spot temperatures taken during April and May index sampling were warmer than those of the past four years (see section 3.1).

3.5.2 Flows

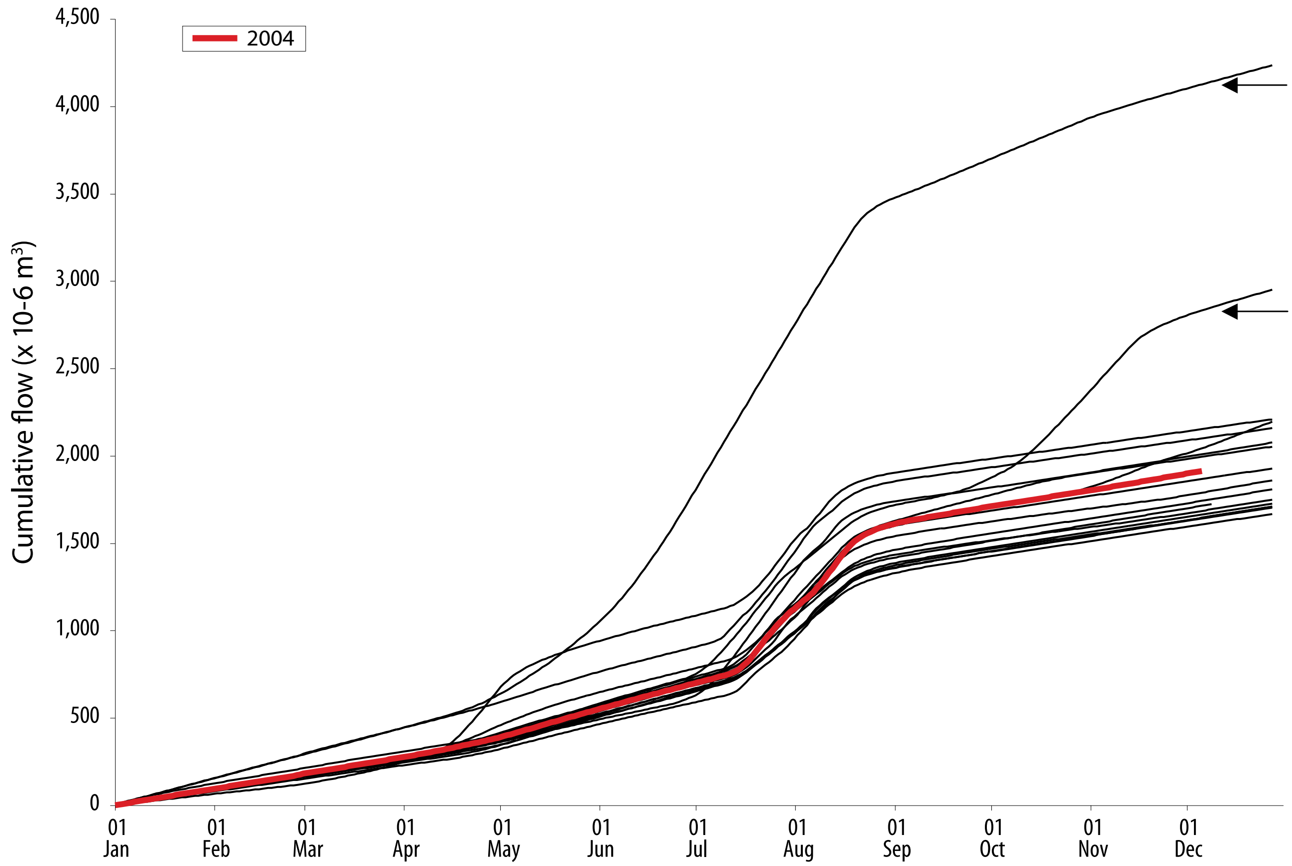
Daily flows of the upper Nechako River at Cheslatta Falls in 2004 paralleled the 17-year median (1987 - 2003) for most of the year, except for late July and mid August when they peaked above the 17-year median and early August when they dropped closer to the average minimum flow **(Figure 26)**. Cumulative daily flows for 2004 were similar to that of previous years **(Figure 27)**.

FIGURE 26 **Comparison of mean, maximum and minimum daily flow of the Nechako River at Cheslatta Falls in 2004 with flows for the years 1987 to 2003.**



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

FIGURE 27 **Cumulative daily flows of the Nechako River at Cheslatta Falls, 1987 to 2004.**



3.5.3 Growth of 0+ Chinook Salmon

Mean fork length of 0+ chinook salmon electrofished in 2004 ranged from 36 mm in April to 84 mm in November, while mean wet weight ranged from 0.42 g in April to 7.2 g in November. Both mean fork length and mean wet weight were almost identical to the 14-year average (1989 - 2003) in April, May, June and July, but for the second year in a row, below the 15-year average in November. The condition index for 0+ chinook salmon ranged from 0.91 in May to above 1.27 in both June and July. These are the highest values recorded since the inception of the program, and may indicate that chinook juveniles faced optimal rearing conditions in 2004. November condition index values were also above the 15-year average for this month (**Figure 28**). While the condition index is a function of fork length and wet weight (equation 1, Section 2.3.2), it should be noted that it does not vary linearly with these parameters and that the variation in the index is not reflected in **Figure 28** (cf. **Figure 14** for a visual estimate of the variation). This explains why average fork lengths and wet weights yield maximal condition indices.

Mean fork length of 0+ chinook salmon caught in rotary screw trap catches in 2004 ranged from 36 mm in April to 61 mm in July, while mean wet weight ranged from 0.4 g in April and May to 3.0 g in July. Both mean fork length and mean wet weight were almost identical to the average for the last 13 years (1991 - 2003) in May and June and slightly below the average in July (**Figure 29**). The condition index for chinook caught in rotary screw catches at Diamond Island ranged from 0.9 in April to 1.2 in July, values that are close to or above the maxima observed in the previous 13 years.

FIGURE 28 **Comparison of mean size of 0+ chinook in the upper Nechako River in 2004 with mean, minimum and maximum size for 1989 to 2003 (electrofishing)**

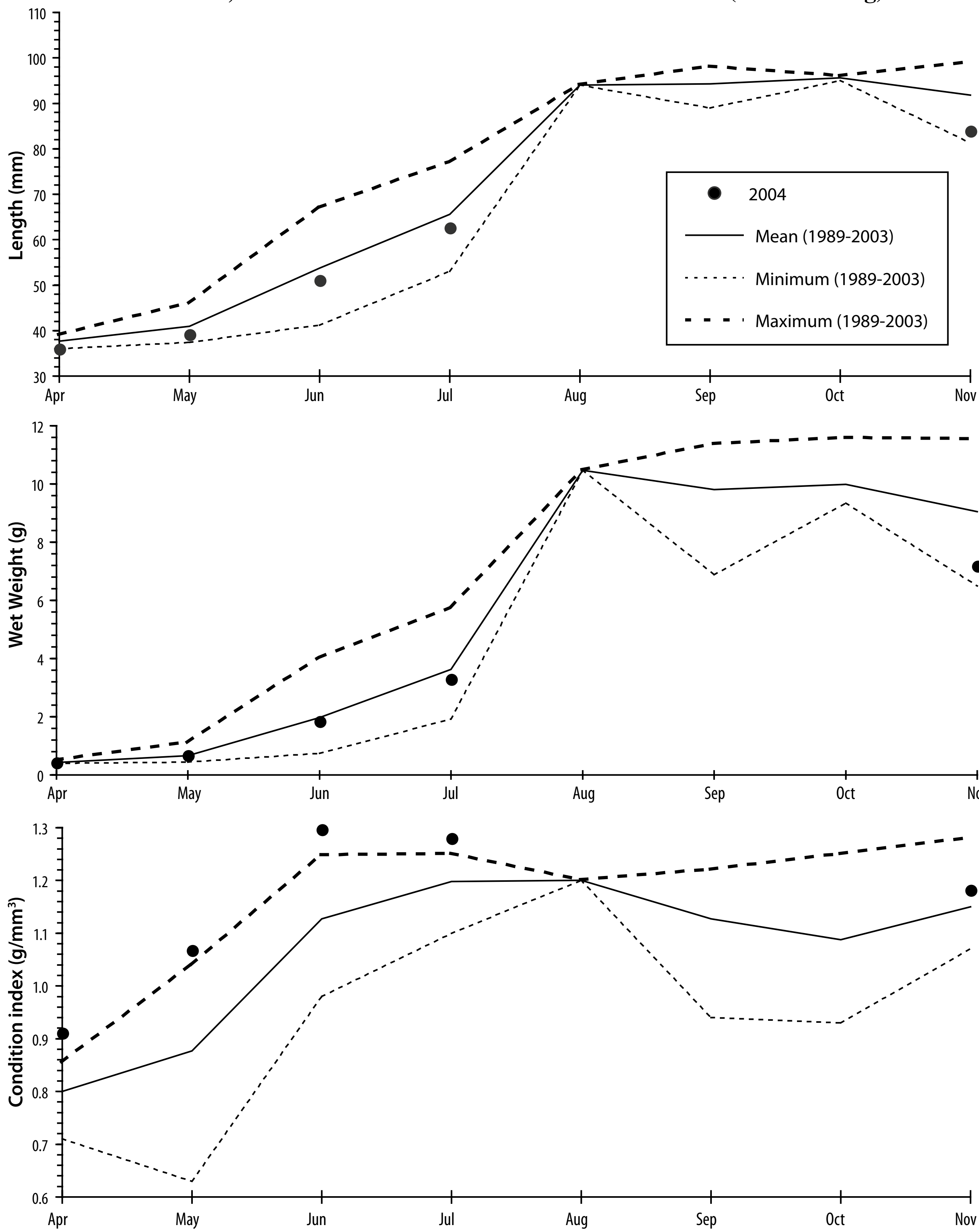
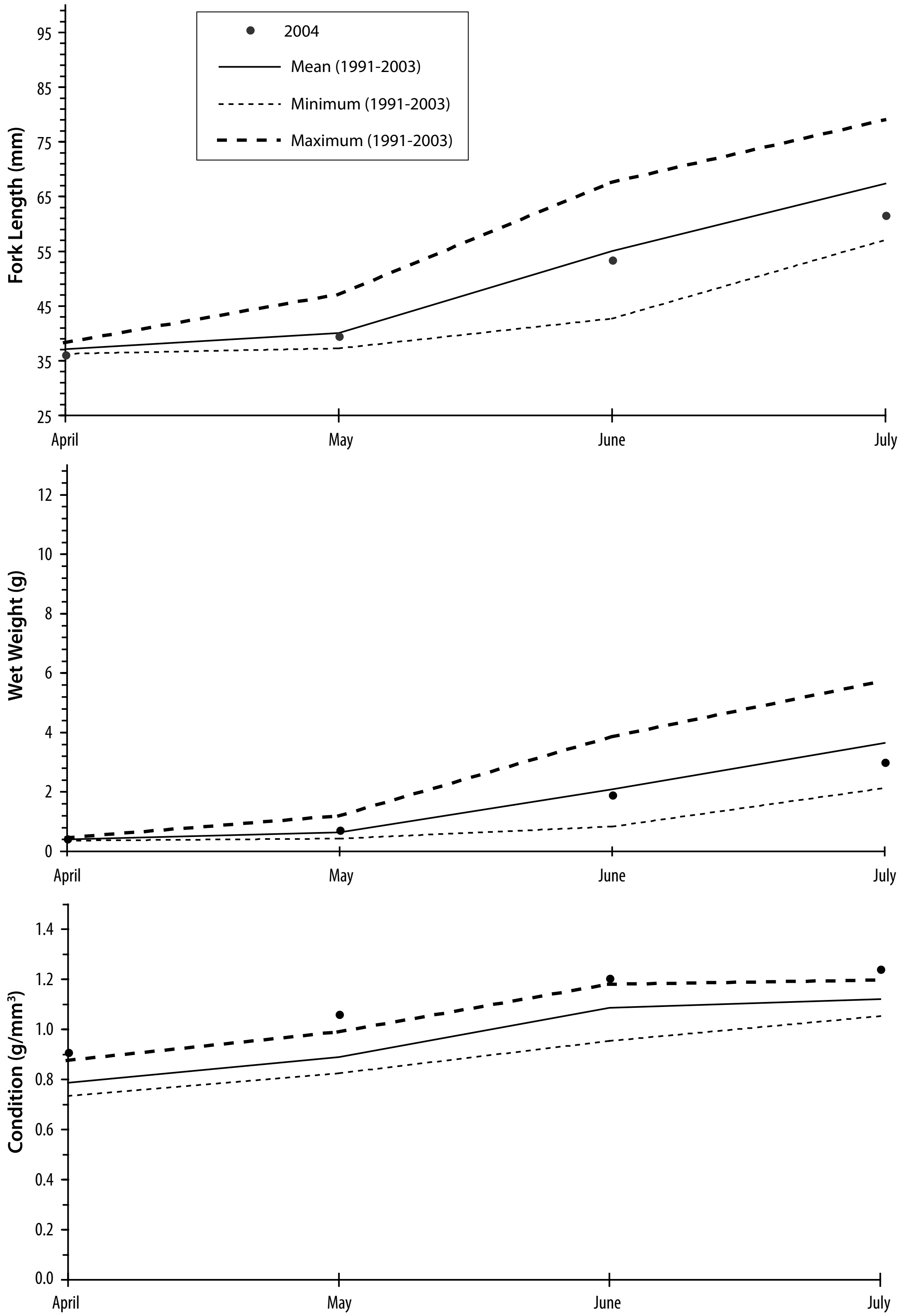


FIGURE 29 Comparison of mean size of 0+ chinook in the upper Nechako River in 2004 with mean, minimum and maximum size for 1991 to 2003 (Rotary Screw Traps)



3.5.4 Outmigration index

Daily indices (the sum of day and night catches for each day) of chinook outmigration measured at Diamond Island in 2004 were within the range observed in most of the previous thirteen years, except during the peak outmigration in May which had the highest daily indices ever observed for this time of year **(Figure 30)**. The 2004 index is the second highest index recorded since inception of the program, the year 2002 still representing the largest cohort of outmigrating juvenile chinook on record. In fact, the three highest indices for the program were recorded in the past four years **(Figure 31)**.

The index of outmigration of 0+ chinook that passed by Diamond Island between April and July of each year from 1992 to 2004 was significantly and positively correlated with the number of adults that spawned upstream of Diamond Island from 1991-2003 **(Figure 31)**. The similar number of spawners in the fall of 2000 and 2002 (2001 and 2003 data points of **Figure 31**) resulted in similar index values, confirming that the index of outmigration reflects real biological processes.

The data point for 2004 adds valuable information the general relationship as it falls in an area for which there were no previous records. The shape of the function of outmigrants in function of spawners the previous years appears for now to follow a power function, but this relation is strongly influenced by the results from 2002. One should therefore guard against making inferences about the exact shape of the function until more data are collected.

FIGURE 30 **Daily indices of chinook 0+ outmigrants, Diamond Island, Nechako River, 1991 to 2004. Dark line is 2004.**

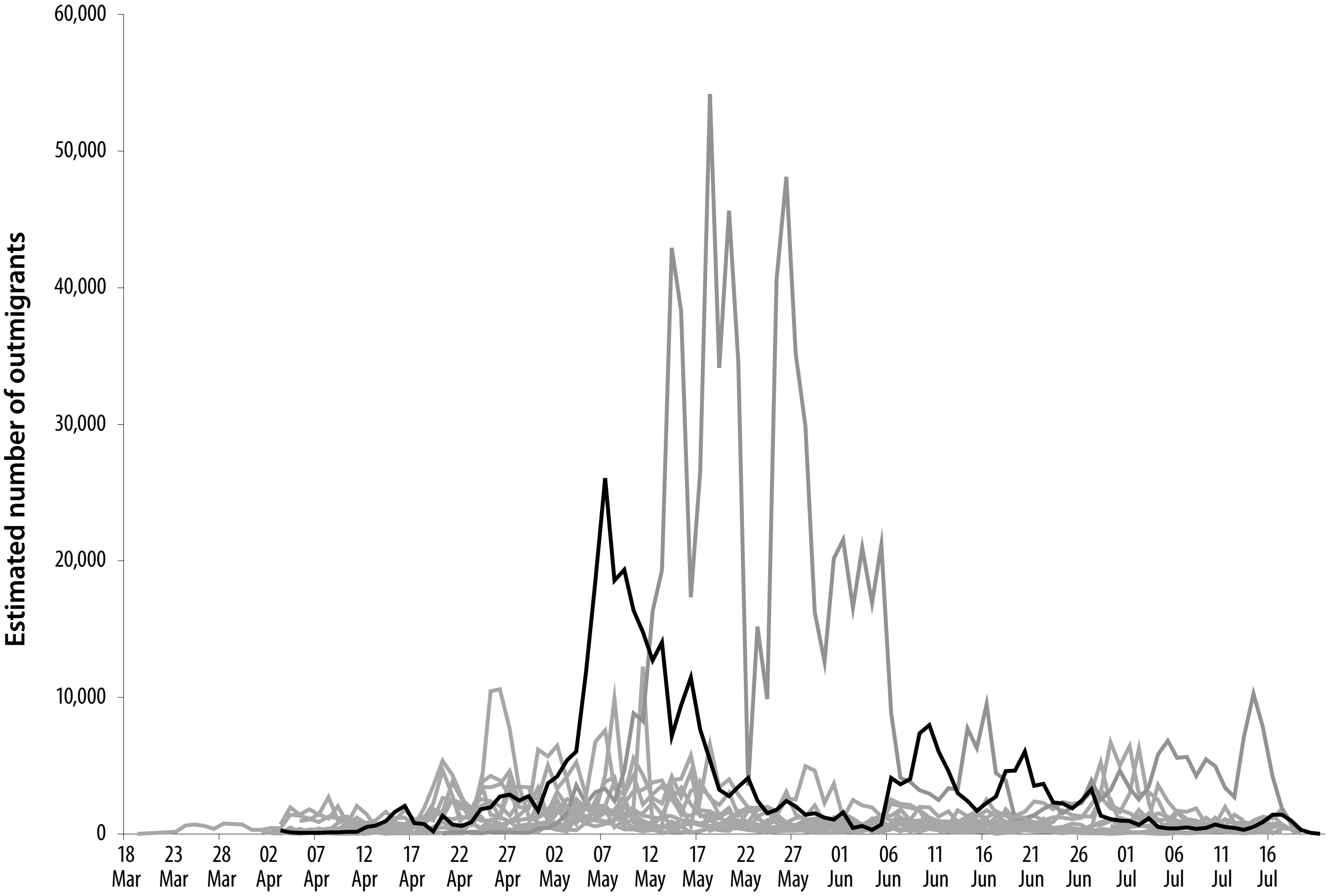
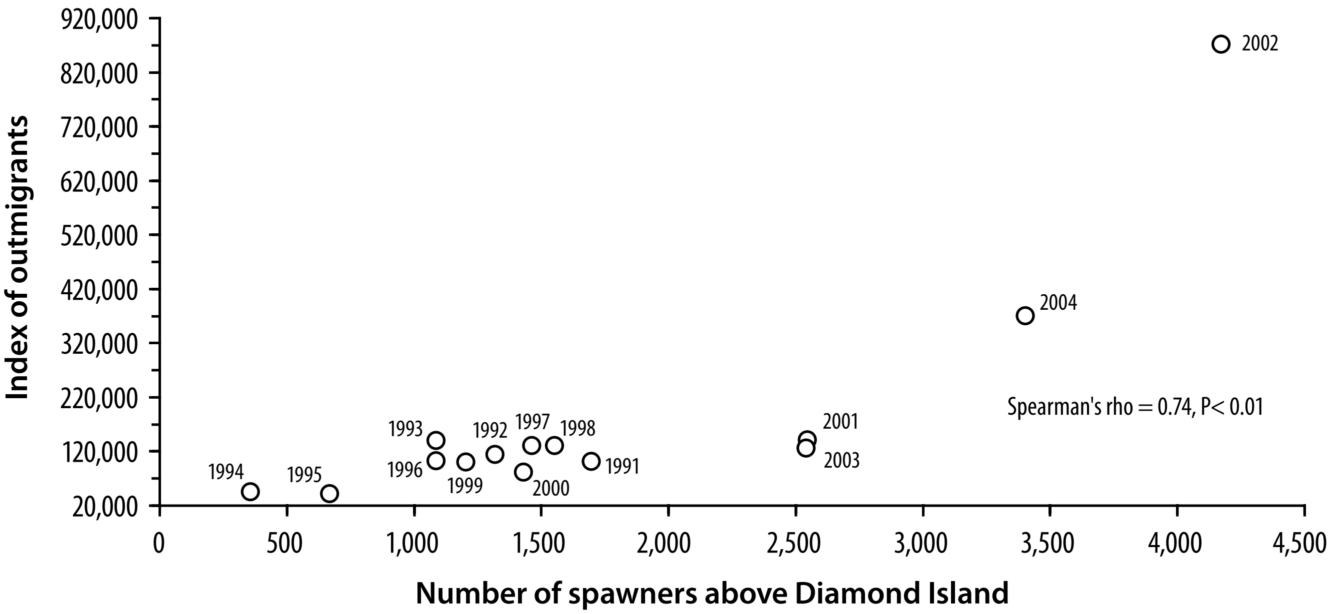


FIGURE 31 **Index of chinook salmon 0+ outmigrants calculated from rotary screw traps vs. the number of spawners above Diamond Island the previous year, Nechako River 1991-2004**



3.5.5 Conclusions

The calculated index of juvenile outmigration for chinook in the upper Nechako River appeared to reflect the biological processes as evidenced by the continued strong relationship between spawners returning to the system and juveniles leaving the system. 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 the population of juveniles resulting from a spawner returns that do not exceed the upper range defining the Conservation Goal. It should be noted that these results do not rule out density dependent effects for juveniles that may occur as a result of spawner returns that exceed the upper range of the Conservation Goal.

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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, 2004

APPENDIX 1

Daily catch of juvenile chinook salmon by rotary screw traps, and index of outmigrants at Diamond Island, Nechako River, 2004

				RST No. 1						RST No. 2						RST No. 3						Total Catch		Weighted Average	
Date	RST staff (cm)	Corrected Staff (m)	River flow m³/s	Trap flow m³/s	Percent flow sampled	Catch 1+	Catch 0+	Population estimate 1+	Population estimate 0+	Trap flow m³/s	Percent flow sampled	Catch 1+	Catch 0+	Population estimate 1+	Population estimate 0+	Trap flow m³/s	Percent flow sampled	Catch 1+	Catch 0+	Population estimate 1+	Population estimate 0+	1+	0+	1+	0+
Day																									
2-Apr	10.0	0.69	33.6	1.00	2.99	0	0	0.0	0.0	0.96	2.86	0	0	0.0	0.0	0.93	2.77	0	2	0.0	72.3	0	2	0	23
3-Apr	11.0	0.70	34.6	1.00	2.91	0	0	0.0	0.0	0.96	2.78	0	0	0.0	0.0	0.93	2.69	0	1	0.0	37.2	0	1	0	12
4-Apr	11.5	0.71	35.0	1.18	3.37	0	0	0.0	0.0	1.01	2.87	1	0	34.8	0.0	1.02	2.91	0	0	0.0	0.0	1	0	11	0
5-Apr	12.0	0.71	35.5	1.18	3.32	0	0	0.0	0.0	1.01	2.84	0	0	0.0	0.0	1.02	2.87	0	1	0.0	34.8	0	1	0	11
6-Apr	12.5	0.72	36.0	1.21	3.35	0	0	0.0	0.0	1.13	3.12	0	0	0.0	0.0	0.95	2.64	0	0	0.0	0.0	0	0	0	0
7-Apr	13.5	0.73	37.0	1.17	3.15	0	0	0.0	0.0	1.15	3.11	0	0	0.0	0.0	0.96	2.61	0	1	0.0	38.3	0	1	0	11
8-Apr	13.5	0.73	37.0	1.19	3.22	0	0	0.0	0.0	1.14	3.07	0	0	0.0	0.0	0.92	2.48	0	4	0.0	161.2	0	4	0	46
9-Apr	14.5	0.74	38.0	1.19	3.13	0	0	0.0	0.0	1.14	2.99	0	1	0.0	33.4	0.92	2.42	0	0	0.0	0.0	0	1	0	12
10-Apr	15.0	0.74	38.5	1.25	3.24	0	0	0.0	0.0	1.10	2.86	0	1	0.0	34.9	1.02	2.65	0	3	0.0	113.1	0	4	0	46
11-Apr	16.5	0.76	40.0	1.25	3.11	0	1	0.0	32.1	1.10	2.75	0	0	0.0	0.0	1.02	2.55	0	0	0.0	0.0	0	1	0	12
12-Apr	18.0	0.77	41.5	1.20	2.89	0	0	0.0	0.0	1.18	2.84	0	1	0.0	35.3	1.02	2.45	0	4	0.0	163.2	0	5	0	61
13-Apr	20.5	0.80	44.2	1.20	2.71	0	0	0.0	0.0	1.18	2.67	0	2	0.0	75.0	1.02	2.30	0	4	0.0	173.6	0	6	0	78
14-Apr	23.0	0.82	46.9	1.20	2.57	0	0	0.0	0.0	1.21	2.58	3	3	116.3	116.3	1.06	2.25	0	10	0.0	444.7	3	13	41	176
15-Apr	24.0	0.83	48.0	1.20	2.51	0	1	0.0	39.9	1.21	2.52	0	3	0.0	119.0	1.06	2.20	1	12	45.5	546.2	1	16	14	221
16-Apr	24.5	0.84	48.6	1.28	2.62	0	2	0.0	76.2	1.20	2.46	0	8	0.0	325.1	0.78	1.61	0	9	0.0	559.1	0	19	0	284
17-Apr	24.0	0.83	48.0	1.28	2.66	0	1	0.0	37.7	1.20	2.49	0	2	0.0	80.3	0.78	1.63	0	2	0.0	122.8	0	5	0	74
18-Apr	24.0	0.83	48.0	1.10	2.30	0	0	0.0	0.0	1.21	2.51	0	1	0.0	39.8	0.88	1.83	0	2	0.0	109.2	0	3	0	45
19-Apr	23.5	0.83	47.5	1.10	2.33	0	0	0.0	0.0	1.21	2.54	0	5	0.0	196.6	0.88	1.85	0	4	0.0	215.8	0	9	0	134
20-Apr	23.0	0.82	46.9	1.30	2.77	0	0	0.0	0.0	1.19	2.54	0	0	0.0	0.0	0.78	1.66	0	1	0.0	60.4	0	1	0	14
21-Apr	23.5	0.83	47.5	1.30	2.74	0	2	0.0	73.1	1.19	2.51	0	1	0.0	39.8	0.78	1.64	0	1	0.0	61.1	0	4	0	58
22-Apr	23.0	0.82	46.9	1.26	2.69	0	1	0.0	37.2	1.21	2.57	0	0	0.0	0.0	0.85	1.82	0	3	0.0	165.1	0	4	0	57
23-Apr	23.0	0.82	46.9	1.26	2.69	0	4	0.0	148.9	1.21	2.57	0	5	0.0	194.3	0.85	1.82	0	7	0.0	385.2	0	16	0	226
24-Apr	23.0	0.82	46.9	1.29	2.76	0	2	0.0	72.6	1.23	2.63	0	3	0.0	114.1	0.91	1.93	0	3	0.0	155.3	0	8	0	109
25-Apr	22.5	0.82	46.4	1.24	2.67	0	1	0.0	37.4	1.20	2.60	0	3	0.0	115.5	0.82	1.77	0	3	0.0	169.5	0	7	0	99
26-Apr	23.5	0.83	47.5	1.24	2.61	0	0	0.0	0.0	1.20	2.54	0	6	0.0	236.4	0.82	1.73	0	4	0.0	231.4	0	10	0	145
27-Apr	24.5	0.84	48.6	1.26	2.59	0	1	0.0	38.5	1.18	2.42	0	5	0.0	206.2	0.84	1.72	0	4	0.0	232.6	0	10	0	148
28-Apr	27.5	0.87	52.0	1.26	2.42	0	1	0.0	41.3	1.18	2.26	0	11	0.0	485.7	0.84	1.61	0	4	0.0	249.0	0	16	0	254
29-Apr	28.5	0.88	53.2	1.24	2.34	0	7	0.0	299.5	1.14	2.14	0	19	0.0	888.8	0.92	1.72	0	4	0.0	232.4	0	30	0	484
30-Apr	29.0	0.88	53.8	1.24	2.31	0	5	0.0	216.3	1.14	2.11	0	22	0.0	1,040.5	0.92	1.70	0	8	0.0	470.0	0	35	0	571
1-May	29.5	0.89	54.4	1.25	2.29	0	9	0.0	392.7	1.24	2.29	0	13	0.0	568.6	0.96	1.76	0	5	0.0	283.5	0	27	0	426
2-May	30.5	0.90	55.6	1.23	2.22	0	16	0.0	722.0	1.25	2.26	0	17	0.0	752.7	0.98	1.76	0	37	0.0	2,104.9	0	70	0	1,123
3-May	32.0	0.91	57.4	1.23	2.15	0	19	0.0	885.3	1.25	2.19	0	25	0.0	1,143.0	0.98	1.70	0	18	0.0	1,057.4	0	62	0	1,027
4-May	34.0	0.93	59.8	1.31	2.20	0	71	0.0	3,233.6	1.21	2.02	0	66	0.0	3,269.8	0.85	1.43	0	109	0.0	7,630.3	0	246	0	4,360
5-May	37.0	0.96	63.6	1.31	2.07	0	50	0.0	2,421.2	1.21	1.90	0	34	0.0	1,791.0	0.85	1.34	0	35	0.0	2,605.0	0	119	0	2,242
6-May	38.0	0.97	64.9	1.28	1.97	0	95	0.0	4,811.9	1.22	1.88	2	58	106.4	3,086.8	1.05	1.61	0	143	0.0	8,870.4	2	296	37	5,416
7-May	38.0	0.97	64.9	1.28	1.97	0	41	0.0	2,076.7	1.22	1.88	0	39	0.0	2,075.6	1.05	1.61	0	81	0.0	5,024.5	0	161	0	2,946
8-May	37.5	0.97	64.2	1.39	2.16	0	70	0.0	3,242.1	1.28	1.98	0	24	0.0	1,209.1	1.02	1.59	0	66	0.0	4,158.2	0	160	0	2,792

APPENDIX 1 (cont.) Daily catch of juvenile chinook salmon by rotary screw traps, and index of outmigrants at Diamond Island, Nechako River, 2004

Date	RST staff (cm)	Corrected Staff (m)	River flow m³/s	RST No. 1 Trap flow m³/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 m³/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 m³/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	37.5	0.97	64.2	1.35	2.09	0	35	0.0	1,670.7	1.21	1.89	0	17	0.0	900.1	0.96	1.49	0	122	0.0	8,170.9	0	174	0	3,177
10-May	38.5	0.98	65.5	1.35	2.05	0	24	0.0	1,168.7	1.21	1.85	0	20	0.0	1,080.3	0.96	1.46	0	40	0.0	2,732.9	0	84	0	1,565
11-May	39.0	0.98	66.2	1.28	1.94	1	23	51.5	1,185.6	1.25	1.88	0	15	0.0	797.0	1.00	1.51	0	44	0.0	2,913.0	1	82	19	1,538
12-May	39.5	0.99	66.8	1.28	1.92	0	26	0.0	1,353.4	1.25	1.86	0	22	0.0	1,180.4	1.00	1.50	0	16	0.0	1,069.7	0	64	0	1,212
13-May	39.0	0.98	66.2	1.41	2.13	0	18	0.0	846.3	1.24	1.87	0	12	0.0	640.6	1.00	1.51	0	27	0.0	1,790.6	0	57	0	1,035
14-May	38.0	0.97	64.9	1.41	2.17	0	21	0.0	968.0	1.24	1.91	0	12	0.0	628.0	1.00	1.54	0	50	0.0	3,250.8	0	83	0	1,477
15-May	37.5	0.97	64.2	1.33	2.06	0	21	0.0	1,018.0	1.21	1.88	0	12	0.0	638.5	0.98	1.52	0	31	0.0	2,038.9	0	64	0	1,172
16-May	37.0	0.96	63.6	1.33	2.08	0	15	0.0	719.9	1.21	1.90	0	8	0.0	421.4	0.98	1.54	0	25	0.0	1,627.9	0	48	0	870
17-May	36.5	0.96	63.0	1.31	2.09	0	5	0.0	239.7	1.23	1.95	0	5	0.0	257.0	1.00	1.59	0	16	0.0	1,006.9	0	26	0	463
18-May	36.0	0.95	62.3	1.31	2.11	0	6	0.0	284.7	1.23	1.97	0	5	0.0	254.4	1.00	1.61	0	8	0.0	498.4	0	19	0	335
19-May	35.0	0.94	61.1	1.29	2.11	0	9	0.0	426.1	1.25	2.05	0	2	0.0	97.4	0.98	1.61	0	11	0.0	682.9	0	22	0	381
20-May	34.5	0.94	60.4	1.29	2.13	0	14	0.0	656.0	1.25	2.08	0	1	0.0	48.2	0.98	1.63	0	5	0.0	307.2	0	20	0	343
21-May	35.0	0.94	61.1	1.29	2.11	0	5	0.0	236.7	1.25	2.05	0	2	0.0	97.4	0.98	1.61	0	5	0.0	310.4	0	12	0	208
22-May	34.0	0.93	59.8	1.23	2.06	1	1	48.6	48.6	1.18	1.97	0	1	0.0	50.8	0.89	1.49	0	12	0.0	807.4	1	14	18	254
23-May	33.0	0.92	58.6	1.21	2.07	0	0	0.0	0.0	1.26	2.15	0	1	0.0	46.6	0.99	1.69	0	13	0.0	771.0	0	14	0	237
24-May	32.5	0.92	58.0	1.21	2.09	0	2	0.0	95.6	1.26	2.17	0	4	0.0	184.4	0.99	1.70	0	18	0.0	1,056.3	0	24	0	402
25-May	32.5	0.92	58.0	1.33	2.30	0	6	0.0	261.3	1.18	2.03	0	2	0.0	98.7	0.85	1.47	0	26	0.0	1,770.4	0	34	0	587
26-May	32.0	0.91	57.4	1.33	2.32	1	5	43.1	215.5	1.18	2.05	1	4	48.8	195.3	0.85	1.48	0	14	0.0	943.3	2	23	34	393
27-May	32.5	0.92	58.0	1.33	2.30	1	5	43.5	217.7	1.18	2.03	0	1	0.0	49.3	0.85	1.47	0	9	0.0	612.8	1	15	17	259
28-May	32.5	0.92	58.0	1.33	2.30	0	2	0.0	87.1	1.18	2.03	0	0	0.0	0.0	0.85	1.47	0	12	0.0	817.1	0	14	0	242
29-May	32.0	0.91	57.4	1.33	2.32	0	2	0.0	86.2	1.18	2.05	0	0	0.0	0.0	0.85	1.48	0	4	0.0	269.5	0	6	0	103
30-May	32.0	0.91	57.4	1.37	2.38	0	2	0.0	84.0	1.22	2.13	0	0	0.0	0.0	1.08	1.88	0	6	0.0	318.6	0	8	0	125
31-May	31.5	0.91	56.8	1.30	2.28	1	1	43.8	43.8	1.20	2.12	1	0	47.2	0.0	1.03	1.82	0	4	0.0	219.9	2	5	32	80
1-Jun	31.5	0.91	56.8	1.30	2.28	0	2	0.0	87.6	1.20	2.12	0	0	0.0	0.0	1.03	1.82	0	2	0.0	110.0	0	4	0	64
2-Jun	30.5	0.90	55.6	1.31	2.36	0	0	0.0	0.0	1.19	2.14	0	3	0.0	140.1	0.97	1.75	0	2	0.0	114.3	0	5	0	80
3-Jun	30.0	0.89	55.0	1.31	2.39	0	0	0.0	0.0	1.19	2.17	0	0	0.0	0.0	0.97	1.77	0	1	0.0	56.5	0	1	0	16
4-Jun	30.0	0.89	55.0	1.32	2.41	0	1	0.0	41.6	1.20	2.19	0	2	0.0	91.5	1.05	1.91	0	5	0.0	261.3	0	8	0	123
5-Jun	29.5	0.89	54.4	1.32	2.43	0	2	0.0	82.2	1.20	2.21	0	1	0.0	45.2	1.05	1.93	0	19	0.0	982.3	0	22	0	335
6-Jun	31.0	0.90	56.2	1.28	2.28	0	2	0.0	87.7	1.15	2.06	0	1	0.0	48.6	0.95	1.68	0	10	0.0	593.9	0	13	0	216
7-Jun	32.5	0.92	58.0	1.28	2.21	0	4	0.0	181.0	1.15	1.99	1	0	50.2	0.0	0.95	1.63	0	16	0.0	981.1	1	20	17	343
8-Jun	34.5	0.94	60.4	1.28	2.12	0	13	0.0	613.4	1.15	1.91	0	12	0.0	628.3	0.95	1.56	0	23	0.0	1,470.5	0	48	0	858
9-Jun	34.5	0.94	60.4	1.28	2.12	0	13	0.0	613.4	1.15	1.91	0	14	0.0	733.0	0.95	1.56	0	39	0.0	2,493.5	0	66	0	1,180
10-Jun	33.5	0.93	59.2	1.28	2.16	0	12	0.0	554.5	1.15	1.95	0	8	0.0	410.2	0.95	1.60	0	25	0.0	1,565.5	0	45	0	788
11-Jun	32.5	0.92	58.0	1.25	2.16	0	8	0.0	369.7	1.19	2.05	0	7	0.0	341.1	0.93	1.61	0	39	0.0	2,427.1	0	54	0	927
12-Jun	32.5	0.92	58.0	1.25	2.16	0	0	0.0	0.0	1.19	2.05	0	2	0.0	97.4	0.93	1.61	0	11	0.0	684.6	0	13	0	223
13-Jun	32.0	0.91	57.4	1.30	2.26	0	1	0.0	44.3	1.18	2.05	0	1	0.0	48.7	0.96	1.68	0	15	0.0	891.9	0	17	0	284
14-Jun	31.0	0.90	56.2	1.30	2.31	0	3	0.0	130.0	1.18	2.01	0	0	0.0	0.0	0.96	1.72	0	11	0.0	640.3	0	14	0	229
15-Jun	31.5	0.91	56.8	1.22	2.14	0	1	0.0	46.7	1.17	2.06	0	1	0.0	48.5	0.92	1.62	0	16	0.0	987.0	0	18	0	309

APPENDIX 1 (cont.) Daily catch of juvenile chinook salmon by rotary screw traps, and index of outmigrants at Diamond Island, Nechako River, 2004

				RST No. 1						RST No. 2						RST No. 3						Total Catch		Weighted Average	
	RST staff	Corrected Staff	River flow	Trap flow	Percent flow	Catch		Population estimate		Trap flow	Percent flow	Catch		Population estimate		Trap flow	Percent flow	Catch		Population estimate					
Date	(cm)	(m)	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+
16-Jun	30.0	0.89	55.0	1.22	2.21	0	7	0.0	316.3	1.17	2.13	0	3	0.0	141.0	0.92	1.67	0	13	0.0	776.5	0	23	0	382
17-Jun	29.5	0.89	54.4	1.25	2.30	0	8	0.0	348.2	1.14	2.01	0	10	0.0	476.9	0.77	1.42	0	12	0.0	842.8	0	30	0	516
18-Jun	28.5	0.88	53.2	1.25	2.35	0	11	0.0	468.4	1.14	2.14	0	4	0.0	186.6	0.77	1.46	0	15	0.0	1,030.6	0	30	0	505
19-Jun	28.5	0.88	53.2	1.28	2.41	0	29	0.0	1,203.8	1.17	2.20	0	6	0.0	272.2	0.92	1.72	0	11	0.0	639.2	0	46	0	726
20-Jun	28.0	0.87	52.6	1.28	2.43	0	32	0.0	1,316.7	1.15	2.18	0	5	0.0	229.5	0.95	1.81	0	12	0.0	662.3	0	49	0	763
21-Jun	28.0	0.87	52.6	1.28	2.43	0	15	0.0	617.2	1.15	2.18	0	15	0.0	688.6	0.95	1.81	0	7	0.0	386.4	0	37	0	576
22-Jun	28.0	0.87	52.6	1.28	2.42	0	10	0.0	412.4	1.16	2.21	0	7	0.0	316.5	1.01	1.91	0	6	0.0	313.7	0	23	0	351
23-Jun	27.5	0.87	52.0	1.28	2.45	0	6	0.0	244.7	1.16	2.24	0	2	0.0	89.4	1.01	1.93	0	12	0.0	620.4	0	20	0	302
24-Jun	27.5	0.87	52.0	1.19	2.28	0	12	0.0	525.9	1.15	2.21	0	5	0.0	225.8	1.02	1.96	0	5	0.0	255.6	0	22	0	341
25-Jun	26.5	0.86	50.9	1.19	2.33	0	6	0.0	257.1	1.15	2.26	0	3	0.0	132.5	1.02	2.00	0	8	0.0	399.8	0	17	0	258
26-Jun	26.5	0.86	50.9	1.29	2.53	0	14	0.0	553.2	1.15	2.26	0	5	0.0	221.4	0.94	1.85	0	9	0.0	486.6	0	28	0	422
27-Jun	27.5	0.87	52.0	1.29	2.47	0	2	0.0	80.8	1.15	2.21	0	0	0.0	0.0	0.94	1.81	0	2	0.0	110.6	0	4	0	62
28-Jun	27.0	0.86	51.4	1.20	2.34	0	1	0.0	42.7	1.15	2.24	0	1	0.0	44.5	1.02	1.98	0	6	0.0	302.3	0	8	0	122
29-Jun	27.0	0.86	51.4	1.24	2.41	0	0	0.0	0.0	1.15	2.23	0	1	0.0	44.8	0.94	1.82	0	5	0.0	274.1	0	6	0	93
30-Jun	28.0	0.87	52.6	1.24	2.36	0	1	0.0	42.4	1.15	2.18	0	0	0.0	0.0	0.94	1.78	0	3	0.0	168.2	0	4	0	63
1-Jul	27.5	0.87	52.0	1.23	2.37	0	5	0.0	210.7	1.13	2.18	0	1	0.0	45.9	0.99	1.90	0	5	0.0	263.7	0	11	0	171
2-Jul	28.0	0.87	52.6	1.23	2.35	0	0	0.0	0.0	1.13	2.16	0	0	0.0	0.0	0.99	1.88	0	0	0.0	0.0	0	0	0	0
3-Jul	27.5	0.87	52.0	1.24	2.38	0	2	0.0	83.9	1.09	2.01	0	0	0.0	0.0	0.99	1.90	0	2	0.0	105.4	0	4	0	63
4-Jul	27.5	0.87	52.0	1.24	2.38	0	0	0.0	0.0	1.09	2.01	0	0	0.0	0.0	0.99	1.90	0	0	0.0	0.0	0	0	0	0
5-Jul	27.0	0.86	51.4	1.25	2.43	0	0	0.0	0.0	1.19	2.31	0	0	0.0	0.0	1.00	1.95	0	0	0.0	0.0	0	0	0	0
6-Jul	27.0	0.86	51.4	1.25	2.43	0	0	0.0	0.0	1.19	2.31	0	0	0.0	0.0	1.00	1.95	0	0	0.0	0.0	0	0	0	0
7-Jul	27.0	0.86	51.4	1.25	2.43	0	0	0.0	0.0	1.00	1.95	0	0	0.0	0.0	0.85	1.65	0	0	0.0	0.0	0	0	0	0
8-Jul	26.5	0.86	50.9	1.25	2.46	0	0	0.0	0.0	1.00	1.97	0	0	0.0	0.0	0.85	1.67	0	0	0.0	0.0	0	0	0	0
9-Jul	27.5	0.87	52.0	1.28	2.46	0	0	0.0	0.0	1.06	2.04	0	0	0.0	0.0	1.00	1.92	0	0	0.0	0.0	0	0	0	0
10-Jul	27.5	0.87	52.0	1.28	2.46	0	0	0.0	0.0	1.06	2.04	0	0	0.0	0.0	1.00	1.92	0	1	0.0	52.1	0	1	0	16
11-Jul	28.5	0.88	53.2	1.35	2.54	0	0	0.0	0.0	1.20	2.27	0	0	0.0	0.0	1.02	1.91	0	0	0.0	0.0	0	0	0	0
12-Jul	29.0	0.88	53.8	1.35	2.51	0	0	0.0	0.0	1.20	2.24	0	0	0.0	0.0	1.02	1.89	0	0	0.0	0.0	0	0	0	0
13-Jul	37.0	0.96	63.6	1.31	2.06	0	0	0.0	0.0	1.21	1.90	0	0	0.0	0.0	0.57	0.89	0	0	0.0	0.0	0	0	0	0
14-Jul	49.0	1.08	79.9	1.37	1.72	0	5	0.0	291.5	1.23	1.54	0	0	0.0	0.0	0.62	0.78	0	0	0.0	0.0	0	5	0	124
15-Jul	59.5	1.19	95.5	1.40	1.46	0	5	0.0	342.1	1.23	1.29	0	3	0.0	232.5	0.54	0.56	0	0	0.0	0.0	0	8	0	241
16-Jul	70.0	1.29	112.6	1.23	1.09	0	1	0.0	91.6	1.16	1.03	0	0	0.0	0.0	0.55	0.49	0	0	0.0	0.0	0	1	0	38
17-Jul	96.5	1.56	161.5	1.27	0.79	0	2	0.0	253.8	1.24	0.77	0	2	0.0	259.8	0.48	0.30	0	1	0.0	338.4	0	5	0	270
18-Jul	113.0	1.72	196.2	1.32	0.67	0	1	0.0	148.4	1.13	0.57	0	0	0.0	0.0	0.77	0.39	0	1	0.0	254.3	0	2	0	122
19-Jul	109.0	1.68	187.5	1.32	0.71	0	0	0.0	0.0	1.13	0.60	0	0	0.0	0.0	0.77	0.41	0	0	0.0	0.0	0	0	0	0
Day Totals						**5**	**885**	**231**	**41,554**			**9**	**649**	**404**	**32,180**			**1**	**1,483**	**46**	**93,467**	**15**	**3,017**	**240**	**52,699**

APPENDIX 1 (cont.) Daily catch of juvenile chinook salmon by rotary screw traps, and index of outmigrants at Diamond Island, Nechako River, 2004

				RST No. 1						RST No. 2						RST No. 3						Total Catch		Weighted Average	
	RST staff	Corrected Staff	River flow	Trap flow	Percent flow	Catch		Population estimate		Trap flow	Percent flow	Catch		Population estimate		Trap flow	Percent flow	Catch		Population estimate					
Date	(cm)	(m)	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																									
2-Apr	10.0	0.69	33.6	1.00	2.99	2	12	66.9	401.7	0.96	2.86	1	3	35.0	105.0	0.93	2.77	4	4	144.6	144.6	7	19	81	221
3-Apr	10.5	0.70	34.1	1.00	2.95	0	4	0.0	135.8	0.96	2.82	2	4	71.0	142.0	0.93	2.73	1	1	36.7	36.7	3	9	35	106
4-Apr	11.0	0.70	34.6	1.18	3.42	0	0	0.0	0.0	1.01	2.91	5	5	171.6	171.6	1.02	2.95	2	0	67.8	0.0	7	5	75	54
5-Apr	11.5	0.71	35.0	1.18	3.37	0	0	0.0	0.0	1.01	2.87	1	2	34.8	69.6	1.02	2.91	2	4	68.7	137.4	3	6	33	66
6-Apr	12.5	0.72	36.0	1.21	3.35	4	0	119.3	0.0	1.13	3.12	3	6	96.0	192.0	0.95	2.64	2	1	75.9	37.9	9	7	99	77
7-Apr	13.0	0.72	36.5	1.17	3.20	3	0	93.9	0.0	1.15	3.16	0	8	0.0	253.5	0.96	2.64	1	0	37.8	0.0	4	8	45	89
8-Apr	13.5	0.73	37.0	1.19	3.22	5	1	155.4	31.1	1.14	3.07	3	5	97.6	162.7	0.92	2.48	4	0	161.2	0.0	12	6	137	68
9-Apr	14.5	0.74	38.0	1.19	3.13	1	0	31.9	0.0	1.14	2.99	5	6	167.0	200.4	0.92	2.42	0	4	0.0	165.5	6	10	70	117
10-Apr	15.0	0.74	38.5	1.25	3.24	4	0	123.5	0.0	1.10	2.86	2	7	69.9	244.5	1.02	2.65	1	2	37.7	75.4	7	9	80	103
11-Apr	16.0	0.75	39.5	1.25	3.15	2	0	63.4	0.0	1.10	2.79	1	43	35.9	1,541.6	1.02	2.58	2	0	77.4	0.0	5	43	59	504
12-Apr	17.0	0.76	40.5	1.20	2.96	7	0	236.6	0.0	1.18	2.91	2	27	68.8	928.5	1.02	2.51	0	20	0.0	795.8	9	47	107	561
13-Apr	19.5	0.79	43.1	1.20	2.78	5	0	179.9	0.0	1.18	2.73	2	32	73.2	1,171.4	1.02	2.36	0	34	0.0	1,440.1	7	66	89	838
14-Apr	22.0	0.81	45.8	1.20	2.63	11	0	418.4	0.0	1.21	2.64	4	44	151.4	1,665.4	1.06	2.30	1	65	43.4	2,822.6	16	109	211	1,439
15-Apr	24.0	0.83	48.0	1.20	2.51	10	0	398.7	0.0	1.21	2.52	3	100	119.0	3,967.5	1.06	2.20	2	32	91.0	1,456.6	15	132	208	1,827
16-Apr	24.0	0.83	48.0	1.28	2.66	13	0	489.6	0.0	1.20	2.49	4	29	160.7	1,164.7	0.78	1.63	1	5	61.4	307.0	18	34	266	502
17-Apr	24.0	0.83	48.0	1.28	2.66	7	0	263.6	0.0	1.20	2.49	4	20	160.7	803.3	0.78	1.63	0	24	0.0	1,473.7	11	44	162	650
18-Apr	24.0	0.83	48.0	1.10	2.30	3	0	130.5	0.0	1.21	2.51	2	3	79.5	119.3	0.88	1.83	0	7	0.0	382.1	5	10	75	151
19-Apr	23.0	0.82	46.9	1.10	2.35	2	1	85.0	42.5	1.21	2.57	2	56	77.7	2,175.7	0.88	1.88	0	25	0.0	1,333.0	4	82	59	1,205
20-Apr	23.0	0.82	46.9	1.30	2.77	9	0	325.1	0.0	1.19	2.54	5	34	196.7	1,337.3	0.78	1.66	0	12	0.0	724.8	14	46	201	660
21-Apr	23.0	0.82	46.9	1.30	2.77	6	2	216.7	72.2	1.19	2.54	2	23	78.7	904.6	0.78	1.66	0	11	0.0	664.4	8	36	115	517
22-Apr	23.0	0.82	46.9	1.26	2.69	6	0	223.3	0.0	1.21	2.57	1	51	38.9	1,981.4	0.85	1.82	1	7	55.0	385.2	8	58	113	819
23-Apr	23.0	0.82	46.9	1.26	2.69	2	11	74.4	409.4	1.21	2.57	2	83	77.7	3,224.7	0.85	1.82	0	16	0.0	880.3	4	110	57	1,554
24-Apr	23.0	0.82	46.9	1.29	2.76	11	12	399.1	435.4	1.23	2.63	5	103	190.1	3,915.7	0.91	1.93	1	18	51.8	931.8	17	133	232	1,817
25-Apr	22.5	0.82	46.4	1.24	2.67	10	0	373.9	0.0	1.20	2.60	1	157	38.5	6,042.8	0.82	1.77	0	28	0.0	1,582.4	11	185	156	2,627
26-Apr	23.0	0.82	46.9	1.24	2.64	2	0	75.7	0.0	1.20	2.57	0	111	0.0	4,323.1	0.82	1.75	0	78	0.0	4,460.5	2	189	29	2,716
27-Apr	24.5	0.84	48.6	1.26	2.59	1	11	38.5	424.0	1.18	2.42	1	103	41.2	4,247.9	0.84	1.72	1	40	58.1	2,325.7	3	154	45	2,285
28-Apr	26.5	0.86	50.9	1.26	2.48	7	1	282.4	40.3	1.18	2.32	3	88	129.5	3,799.0	0.84	1.64	0	73	0.0	4,442.8	10	162	155	2,516
29-Apr	28.0	0.87	52.6	1.24	2.36	7	1	296.2	42.3	1.14	2.16	3	53	138.8	2,452.0	0.92	1.74	0	22	0.0	1,264.3	10	76	160	1,213
30-Apr	29.0	0.88	53.8	1.24	2.31	18	50	778.7	2,163.1	1.14	2.11	8	135	378.4	6,385.0	0.92	1.70	1	7	58.8	411.3	27	192	441	3,133
1-May	29.0	0.88	53.8	1.25	2.32	7	103	302.1	4,445.4	1.24	2.31	4	127	173.1	5,494.2	0.96	1.78	0	12	0.0	672.9	11	242	172	3,774
2-May	30.5	0.90	55.6	1.23	2.22	3	6	135.4	270.7	1.25	2.26	0	234	0.0	10,360.8	0.98	1.76	0	26	0.0	1,479.1	3	266	48	4,268
3-May	31.0	0.90	56.2	1.23	2.19	1	27	45.6	1,231.5	1.25	2.23	0	236	0.0	10,562.4	0.98	1.74	0	46	0.0	2,645.2	1	309	16	5,012
4-May	34.0	0.93	59.8	1.31	2.20	4	41	182.2	1,867.3	1.21	2.02	2	307	99.1	15,209.5	0.85	1.43	1	76	70.0	5,320.2	7	424	124	7,514
5-May	36.5	0.96	63.0	1.31	2.09	3	31	143.8	1,486.1	1.21	1.92	2	638	104.3	33,269.6	0.85	1.36	0	202	0.0	14,883.8	5	871	93	16,247
6-May	38.0	0.97	64.9	1.28	1.97	12	79	607.8	4,001.5	1.22	1.88	7	641	372.5	34,114.6	1.05	1.61	0	407	0.0	25,246.5	19	1127	348	20,621
7-May	38.0	0.97	64.9	1.28	1.97	19	116	962.4	5,875.6	1.22	1.88	5	487	266.1	25,918.6	1.05	1.61	0	250	0.0	15,507.7	24	853	439	15,607
8-May	37.5	0.97	64.2	1.39	2.16	4	92	185.3	4,261.0	1.28	1.98	1	568	50.4	28,615.9	1.02	1.59	0	288	0.0	18,145.1	5	948	87	16,541

APPENDIX 1 (cont.) Daily catch of juvenile chinook salmon by rotary screw traps, and index of outmigrants at Diamond Island, Nechako River, 2004

				RST No. 1						RST No. 2						RST No. 3						Total Catch		Weighted Average	
Date	RST staff (cm)	Corrected Staff (m)	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+
9-May	37.5	0.97	64.2	1.35	2.09	21	62	1,002.4	2,959.5	1.21	1.89	8	593	423.6	31,398.2	0.96	1.49	1	67	67.0	4,487.3	30	722	548	13,183
10-May	38.0	0.97	64.9	1.35	2.07	15	12	723.2	578.6	1.21	1.87	7	389	374.4	20,803.4	0.96	1.48	0	316	0.0	21,376.3	22	717	406	13,223
11-May	39.0	0.98	66.2	1.28	1.94	23	12	1,185.6	618.6	1.25	1.88	5	334	265.7	17,745.6	1.00	1.51	0	249	0.0	16,484.8	28	595	525	11,158
12-May	40.0	0.99	67.5	1.28	1.90	15	124	788.5	6,518.3	1.25	1.85	10	336	541.8	18,205.4	1.00	1.48	1	209	67.5	14,110.6	26	669	497	12,794
13-May	39.5	0.99	66.8	1.41	2.11	11	18	522.3	854.7	1.24	1.85	8	251	431.3	13,531.5	1.00	1.49	0	63	0.0	4,219.2	19	332	348	6,087
14-May	38.8	0.98	65.9	1.41	2.14	10	60	468.3	2,809.9	1.24	1.88	6	316	319.0	16,802.6	1.00	1.51	0	61	0.0	4,029.4	16	437	289	7,903
15-May	38.5	0.98	65.5	1.33	2.02	7	66	346.2	3,263.8	1.21	1.84	1	364	54.3	19,756.6	0.98	1.49	0	119	0.0	7,984.2	8	549	149	10,252
16-May	37.5	0.97	64.2	1.33	2.06	10	21	484.8	1,018.0	1.21	1.88	1	289	53.2	15,376.6	0.98	1.52	0	59	0.0	3,880.5	11	369	201	6,755
17-May	37.0	0.96	63.6	1.31	2.07	6	18	290.5	871.6	1.23	1.93	1	186	51.9	9,656.3	1.00	1.57	1	70	63.6	4,449.8	8	274	144	4,924
18-May	36.5	0.96	63.0	1.31	2.09	8	14	383.5	671.1	1.23	1.95	2	139	102.8	7,143.8	1.00	1.59	0	9	0.0	566.4	10	162	178	2,882
19-May	36.0	0.95	62.3	1.29	2.07	8	21	386.6	1,014.7	1.25	2.01	2	78	99.4	3,875.2	0.98	1.58	0	35	0.0	2,217.8	10	134	177	2,367
20-May	35.0	0.94	61.1	1.29	2.11	7	20	331.4	946.9	1.25	2.05	1	107	48.7	5,208.4	0.98	1.61	1	52	62.1	3,228.4	9	179	156	3,098
21-May	35.0	0.94	61.1	1.29	2.11	7	90	331.4	4,260.9	1.25	2.05	0	91	0.0	4,429.6	0.98	1.61	0	43	0.0	2,669.6	7	224	121	3,877
22-May	34.0	0.93	59.8	1.23	2.06	14	4	680.3	194.4	1.18	1.97	3	85	152.3	4,316.4	0.89	1.49	0	31	0.0	2,085.7	17	120	308	2,177
23-May	34.0	0.93	59.8	1.21	2.03	12	30	591.6	1,479.1	1.26	2.10	3	22	142.7	1,046.5	0.99	1.65	1	22	60.6	1,332.2	16	74	277	1,280
24-May	33.0	0.92	58.6	1.21	2.07	5	22	241.4	1,062.2	1.26	2.15	1	29	46.6	1,351.0	0.99	1.69	0	28	0.0	1,660.5	6	79	102	1,338
25-May	32.5	0.92	58.0	1.33	2.30	1	41	43.5	1,785.5	1.18	2.03	1	32	49.3	1,578.7	0.85	1.47	1	32	68.1	2,179.0	3	105	52	1,813
26-May	32.0	0.91	57.4	1.33	2.32	12	26	517.1	1,120.4	1.18	2.05	4	35	195.3	1,708.5	0.85	1.48	0	34	0.0	2,290.8	16	95	273	1,623
27-May	32.0	0.91	57.4	1.33	2.32	17	23	732.6	991.1	1.18	2.05	4	25	195.3	1,220.4	0.85	1.48	0	18	0.0	1,212.8	21	66	359	1,128
28-May	32.0	0.91	57.4	1.33	2.32	3	32	129.3	1,378.9	1.18	2.05	0	20	0.0	976.3	0.85	1.48	0	23	0.0	1,549.7	3	75	51	1,281
29-May	32.5	0.92	58.0	1.33	2.30	18	33	783.9	1,437.1	1.18	2.03	3	17	148.0	838.7	0.85	1.47	0	12	0.0	817.1	21	62	363	1,071
30-May	32.0	0.91	57.4	1.37	2.38	2	25	84.0	1,049.4	1.22	2.13	0	22	0.0	1,032.5	1.08	1.88	0	12	0.0	637.1	2	59	31	922
31-May	32.0	0.91	57.4	1.30	2.26	8	54	354.1	2,390.4	1.20	2.09	0	27	0.0	1,288.9	1.03	1.80	0	11	0.0	611.3	8	92	130	1,495
1-Jun	31.5	0.91	56.8	1.30	2.28	0	13	0.0	569.4	1.20	2.12	1	6	47.2	283.4	1.03	1.82	0	4	0.0	219.9	1	23	16	370
2-Jun	31.0	0.90	56.2	1.31	2.34	3	21	128.2	897.7	1.19	2.12	1	8	47.2	377.5	0.97	1.73	1	2	57.8	115.5	5	31	81	501
3-Jun	30.0	0.89	55.0	1.31	2.39	0	9	0.0	376.5	1.19	2.17	1	4	46.2	184.7	0.97	1.77	0	5	0.0	282.7	1	18	16	285
4-Jun	30.0	0.89	55.0	1.32	2.41	0	28	0.0	1,163.6	1.20	2.19	0	3	0.0	137.2	1.05	1.91	0	5	0.0	261.3	0	36	0	553
5-Jun	29.5	0.89	54.4	1.32	2.43	1	137	41.1	5,631.7	1.20	2.21	1	76	45.2	3,438.1	1.05	1.93	0	35	0.0	1,809.5	2	248	30	3,771
6-Jun	31.0	0.90	56.2	1.28	2.28	1	101	43.8	4,426.8	1.15	2.06	0	87	0.0	4,231.5	0.95	1.68	0	17	0.0	1,009.7	1	205	17	3,405
7-Jun	32.5	0.92	58.0	1.28	2.21	0	102	0.0	4,615.7	1.15	1.99	0	67	0.0	3,364.4	0.95	1.63	1	46	61.3	2,820.7	1	215	17	3,687
8-Jun	34.5	0.94	60.4	1.28	2.12	1	210	47.2	9,908.1	1.15	1.91	4	84	209.4	4,398.0	0.95	1.56	0	69	0.0	4,411.5	5	363	89	6,490
9-Jun	34.5	0.94	60.4	1.28	2.12	0	210	0.0	9,908.1	1.15	1.91	0	110	0.0	5,759.2	0.95	1.56	0	59	0.0	3,772.2	0	379	0	6,776
10-Jun	34.0	0.93	59.8	1.28	2.14	2	181	93.4	8,451.8	1.15	1.93	0	75	0.0	3,886.3	0.95	1.58	0	39	0.0	2,467.8	2	295	35	5,220
11-Jun	33.0	0.92	58.6	1.25	2.14	1	100	46.7	4,669.7	1.19	2.03	0	76	0.0	3,742.2	0.93	1.59	0	35	0.0	2,201.2	1	211	17	3,662
12-Jun	32.0	0.91	57.4	1.25	2.19	0	100	0.0	4,572.1	1.19	2.07	0	40	0.0	1,928.4	0.93	1.62	1	23	61.6	1,416.3	1	163	17	2,770
13-Jun	31.0	0.90	56.2	1.30	2.31	0	88	0.0	3,813.2	1.18	2.01	0	34	0.0	1,620.6	0.96	1.72	0	7	0.0	407.4	0	129	0	2,107
14-Jun	31.5	0.91	56.8	1.30	2.28	0	57	0.0	2,496.5	1.18	2.08	0	27	0.0	1,300.8	0.96	1.70	0	5	0.0	294.2	0	89	0	1,469
15-Jun	31.0	0.90	56.2	1.22	2.17	0	71	0.0	3,277.7	1.17	2.08	0	28	0.0	1,344.7	0.92	1.64	0	15	0.0	915.5	0	114	0	1,937

APPENDIX 1 (cont.) Daily catch of juvenile chinook salmon by rotary screw traps, and index of outmigrants at Diamond Island, Nechako River, 2004

				RST No. 1						RST No. 2						RST No. 3						Total Catch		Weighted Average	
Date	RST staff (cm)	Corrected Staff (m)	River flow m³/s	Trap flow m³/s	Percent flow sampled	Catch 1+	Catch 0+	Population estimate 1+	Population estimate 0+	Trap flow m³/s	Percent flow sampled	Catch 1+	Catch 0+	Population estimate 1+	Population estimate 0+	Trap flow m³/s	Percent flow sampled	Catch 1+	Catch 0+	Population estimate 1+	Population estimate 0+	1+	0+	1+	0+
16-Jun	31.0	0.90	56.2	1.22	2.17	0	88	0.0	4,062.5	1.17	2.08	0	33	0.0	1,584.8	0.92	1.64	0	17	0.0	1,037.5	0	138	0	2,344
17-Jun	30.5	0.90	55.6	1.25	2.25	0	145	0.0	6,450.5	1.14	2.05	0	60	0.0	2,924.3	0.77	1.39	0	28	0.0	2,009.6	0	233	0	4,093
18-Jun	29.5	0.89	54.4	1.25	2.30	0	152	0.0	6,616.7	1.14	2.01	0	68	0.0	3,243.1	0.77	1.42	0	20	0.0	1,404.6	0	240	0	4,125
19-Jun	29.0	0.88	53.8	1.28	2.38	0	133	0.0	5,581.8	1.17	2.18	0	176	0.0	8,073.1	0.92	1.70	0	22	0.0	1,292.5	0	331	0	5,283
20-Jun	28.5	0.88	53.2	1.28	2.40	0	54	0.0	2,246.7	1.15	2.15	0	76	0.0	3,527.8	0.95	1.79	0	44	0.0	2,455.5	0	174	0	2,740
21-Jun	28.0	0.87	52.6	1.28	2.43	0	123	0.0	5,061.1	1.15	2.18	0	47	0.0	2,157.6	0.95	1.81	0	27	0.0	1,490.2	0	197	0	3,068
22-Jun	28.5	0.88	53.2	1.28	2.40	0	80	0.0	3,336.1	1.16	2.19	0	35	0.0	1,599.9	1.01	1.89	0	10	0.0	528.6	0	125	0	1,930
23-Jun	28.0	0.87	52.6	1.28	2.42	0	56	0.0	2,309.6	1.16	2.21	0	41	0.0	1,853.6	1.01	1.91	0	28	0.0	1,463.9	0	125	0	1,909
24-Jun	28.0	0.87	52.6	1.19	2.26	0	43	0.0	1,905.4	1.15	2.19	0	33	0.0	1,507.2	1.02	1.93	0	22	0.0	1,137.1	0	98	0	1,536
25-Jun	25.2	0.84	49.4	1.19	2.40	0	88	0.0	3,660.8	1.15	2.33	0	30	0.0	1,286.3	1.02	2.06	0	31	0.0	1,504.2	0	149	0	2,192
26-Jun	26.5	0.86	50.9	1.29	2.53	0	113	0.0	4,465.2	1.15	2.26	0	27	0.0	1,195.5	0.94	1.85	0	49	0.0	2,649.5	0	189	0	2,847
27-Jun	26.5	0.86	50.9	1.29	2.53	0	43	0.0	1,699.1	1.15	2.26	0	22	0.0	974.1	0.94	1.85	0	18	0.0	973.3	0	83	0	1,250
28-Jun	27.0	0.86	51.4	1.20	2.34	0	33	0.0	1,409.0	1.15	2.24	0	14	0.0	623.7	1.02	1.98	0	15	0.0	755.8	0	62	0	944
29-Jun	27.0	0.86	51.4	1.24	2.41	0	24	0.0	995.5	1.15	2.23	0	16	0.0	716.5	0.94	1.82	0	17	0.0	931.9	0	57	0	881
30-Jun	27.5	0.87	52.0	1.24	2.38	0	29	0.0	1,216.5	1.15	2.21	0	12	0.0	543.4	0.94	1.80	0	14	0.0	776.1	0	55	0	860
1-Jul	28.0	0.87	52.6	1.23	2.35	0	13	0.0	554.1	1.13	2.16	0	10	0.0	463.8	0.99	1.88	0	7	0.0	373.3	0	30	0	470
2-Jul	27.5	0.87	52.0	1.23	2.37	0	41	0.0	1,728.1	1.13	2.18	0	19	0.0	871.5	0.99	1.90	0	13	0.0	685.6	0	73	0	1,132
3-Jul	28.0	0.87	52.6	1.24	2.36	0	9	0.0	381.8	1.09	2.07	0	10	0.0	482.6	0.99	1.88	0	8	0.0	426.4	0	27	0	428
4-Jul	27.5	0.87	52.0	1.24	2.38	0	12	0.0	503.4	1.09	2.01	0	7	0.0	334.1	0.99	1.90	0	6	0.0	316.3	0	25	0	392
5-Jul	27.0	0.86	51.4	1.25	2.43	0	19	0.0	780.7	1.19	2.31	0	4	0.0	173.3	1.00	1.95	0	3	0.0	153.8	0	26	0	389
6-Jul	27.5	0.87	52.0	1.25	2.41	0	17	0.0	706.4	1.19	2.28	0	6	0.0	262.9	1.00	1.93	0	7	0.0	363.0	0	30	0	453
7-Jul	27.5	0.87	52.0	1.25	2.41	0	12	0.0	498.6	1.00	1.93	0	9	0.0	467.5	0.85	1.63	0	1	0.0	61.2	0	22	0	369
8-Jul	27.0	0.86	51.4	1.25	2.43	0	16	0.0	657.5	1.00	1.95	0	8	0.0	410.9	0.85	1.65	0	2	0.0	121.1	0	26	0	431
9-Jul	27.5	0.87	52.0	1.28	2.46	0	17	0.0	690.2	1.06	2.04	0	21	0.0	1,027.3	1.00	1.92	0	5	0.0	260.4	0	43	0	669
10-Jul	27.5	0.87	52.0	1.28	2.46	0	22	0.0	893.2	1.06	2.04	0	8	0.0	391.4	1.00	1.92	0	1	0.0	52.1	0	31	0	482
11-Jul	28.0	0.87	52.6	1.35	2.57	0	18	0.0	700.3	1.20	2.29	0	9	0.0	393.0	1.02	1.93	0	2	0.0	103.6	0	29	0	427
12-Jul	29.0	0.88	53.8	1.35	2.51	0	10	0.0	397.7	1.20	2.24	0	8	0.0	357.1	1.02	1.89	0	0	0.0	0.0	0	18	0	271
13-Jul	31.5	0.91	56.8	1.31	2.30	0	14	0.0	607.6	1.21	2.13	0	10	0.0	468.9	0.57	1.00	0	4	0.0	399.4	0	28	0	515
14-Jul	44.5	1.04	73.6	1.37	1.86	0	20	0.0	1,074.1	1.23	1.67	0	12	0.0	717.0	0.62	0.84	0	0	0.0	0.0	0	32	0	731
15-Jul	56.0	1.15	90.2	1.40	1.55	0	24	0.0	1,549.9	1.23	1.37	0	15	0.0	1,097.1	0.54	0.60	0	2	0.0	335.5	0	41	0	1,168
16-Jul	66.0	1.25	105.9	1.23	1.16	0	18	0.0	1,552.2	1.16	1.09	0	12	0.0	1,098.0	0.55	0.52	0	8	0.0	1,538.4	0	38	0	1,371
17-Jul	83.0	1.42	135.5	1.27	0.94	0	10	0.0	1,064.9	1.24	0.92	0	1	0.0	109.0	0.48	0.35	0	4	0.0	1,135.9	0	15	0	679
18-Jul	108.0	1.67	185.4	1.32	0.71	0	1	0.0	140.2	1.13	0.61	0	2	0.0	329.5	0.77	0.42	0	0	0.0	0.0	0	3	0	173
19-Jul	109.0	1.68	187.5	1.32	0.71	0	1	0.0	141.8	1.13	0.60	0	0	0.0	0.0	0.77	0.41	0	0	0.0	0.0	0	1	0	58
20-Jul	116.0	1.75	202.9	1.32	0.65	0	0	0.0	0.0	1.13	0.55	0	0	0.0	0.0	0.77	0.38	0	0	0.0	0.0	0	0	0	0
Night Totals						**460**	**4355**	**20,308**	**197,330**			**177**	**9,952**	**8,134**	**493,792**			**37**	**4,223**	**1,767**	**265,805**	**674**	**18,530**	**10,942**	**320,259**
OVERALL TOTALS						**465**	**5,240**	**20,539**	**238,884**			**186**	**10,601**	**8,538**	**525,972**			**38**	**5,706**	**1,813**	**359,272**	**689**	**21,547**	**11,182**	**372,958**

APPENDIX 2

Mean monthly catch-per-unit-effort (CPUE, fish caught per m^2) of juvenile chinook salmon by 10 km intervals of the upper Nechako River, 2004

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Mean monthly catch-per-unit-effort (CPUE, fish caught per m^2) of juvenile chinook salmon by 10 km intervals of the upper Nechako River, 2004

Date	Time of day	Distance from Kenney Dam	Midpoint (km)	0+ CPUE		1+ CPUE	
				mean	SD	mean	SD
April	Day	10.0-19.9	15	5.3	4.5	1.3	1.8
		20.0-29.9	25	22.9	19.7	0.4	1.0
		30.0-39.9	35	11.0	11.0	0.2	0.6
		50.0-59.9	55	3.9	4.3	0.2	0.5
		70.0-79.9	75	1.8	1.2	0.0	0.0
		80.0-89.9	85	1.6	2.9	0.0	0.0
April	Night	10.0-19.9	15	19.2	24.1	0.8	1.9
		20.0-29.9	25	50.0	52.4	0.4	1.1
		30.0-39.9	35	20.6	18.1	0.1	0.3
		50.0-59.9	55	8.1	9.3	1.4	2.1
		70.0-79.9	75	2.9	2.5	0.3	0.6
		80.0-89.9	85	3.9	6.2	0.6	0.8
May	Day	0.0-9.9	5	14.2	17.7	0.0	0.0
		10.0-19.9	15	11.5	12.4	0.0	0.0
		20.0-29.9	25	11.0	14.4	0.0	0.0
		30.0-39.9	35	3.5	3.9	0.0	0.0
		50.0-59.9	55	1.4	2.1	0.0	0.0
		70.0-79.9	75	3.2	4.4	0.0	0.0
		80.0-89.9	85	1.6	3.3	0.0	0.0
May	Night	0.0-9.9	5	17.1	29.9	0.0	0.0
		10.0-19.9	15	64.9	49.4	0.2	0.5
		20.0-29.9	25	100.7	86.2	0.0	0.1
		30.0-39.9	35	26.7	22.1	0.0	0.0
		50.0-59.9	55	13.9	17.9	0.1	0.3
		70.0-79.9	75	64.9	52.8	0.1	0.2
		80.0-89.9	85	22.7	22.1	0.0	0.0
June	Day	0.0-9.9	5	14.9	16.6	0.0	0.0
		10.0-19.9	15	4.2	4.7	0.0	0.2
		20.0-29.9	25	2.6	3.3	0.0	0.0
		30.0-39.9	35	1.2	1.6	0.0	0.0
		50.0-59.9	55	0.7	1.2	0.0	0.0
		70.0-79.9	75	0.6	0.9	0.0	0.0
		80.0-89.9	85	0.1	0.3	0.0	0.0

APPENDIX 2 (cont.)

Mean monthly catch-per-unit-effort (CPUE, fish caught per m^2) of juvenile chinook salmon by 10 km intervals of the upper Nechako River, 2004

Date	Time of day	Distance from Kenney Dam	Midpoint (km)	0+ CPUE mean	0+ CPUE SD	1+ CPUE mean	1+ CPUE SD
June	Night	0.0-9.9	5	35.5	23.4	0.0	0.0
		10.0-19.9	15	76.7	58.4	0.0	0.0
		20.0-29.9	25	52.5	49.3	0.0	0.1
		30.0-39.9	35	16.0	10.2	0.0	0.0
		50.0-59.9	55	20.5	15.5	0.1	0.3
		70.0-79.9	75	19.5	12.0	0.1	0.2
		80.0-89.9	85	19.0	19.2	0.0	0.0
		0.0-9.9	5	17.9	17.7	0.0	0.0
		10.0-19.9	15	2.3	2.6	0.0	0.2
		20.0-29.9	25	0.2	0.5	0.0	0.0
July	Day	30.0-39.9	35	0.1	0.3	0.0	0.0
		50.0-59.9	55	0.2	0.7	0.0	0.0
		70.0-79.9	75	0.1	0.2	0.0	0.0
		80.0-89.9	85	0.0	0.0	0.0	0.0
		0.0-9.9	5	35.4	33.8	0.0	0.0
		10.0-19.9	15	26.2	22.3	0.0	0.0
		20.0-29.9	25	6.0	9.6	0.0	0.0
July	Night	30.0-39.9	35	3.1	5.0	0.0	0.0
		50.0-59.9	55	6.1	9.2	0.0	0.0
		70.0-79.9	75	6.4	5.8	0.0	0.0
		80.0-89.9	85	4.2	3.8	0.0	0.0
		10.0-19.9	15	1.0	1.5	0.0	0.0
		20.0-29.9	25	0.1	0.3	0.0	0.0
November	Day	30.0-39.9	35	0.1	0.3	0.0	0.0
		50.0-59.9	55	0.2	0.5	0.0	0.0
		70.0-79.9	75	0.3	0.4	0.0	0.0
		80.0-89.9	85	0.1	0.4	0.0	0.0
		10.0-19.9	15	2.8	2.8	0.0	0.0
		20.0-29.9	25	0.5	0.8	0.0	0.0
November	Night	30.0-39.9	35	1.5	1.9	0.0	0.0
		50.0-59.9	55	1.9	2.5	0.0	0.0
		70.0-79.9	75	0.0	0.0	0.0	0.0
		80.0-89.9	85	0.7	1.3	0.0	0.0