SIZE, DISTRIBUTION AND ABUNDANCE OF JUVENILE CHINOOK SALMON OF THE NECHAKO RIVER, 1998

NECHAKO FISHERIES CONSERVATION PROGRAM
Technical Report No. M98-3

Prepared by:
Triton Environmental Consultants Ltd.

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EXECUTIVE SUMMARY

The size, distribution, and abundance of juvenile chinook salmon (*Oncorhynchus tshawytscha*) were measured in the upper 100 km of the Nechako River during 1998 as part of the tenth year of the Nechako Fisheries Conservation Program (NFCP).

Flows of the upper Nechako River in 1998 followed the same pattern seen in the years 1987 to 1995: stable flows (average = 53.0m^3/s) from January 1 to July 5, a spike of cooling flows (maximum = 298.0m^3/s) from July 6 to August 18, and a second period of stable flows (average = 28.6 m^3/s) from August 19 to December 31. Unlike 1996 and 1997, there were no forced spills from the Nechako Reservoir.

In contrast, water temperatures of the upper Nechako were unusually high in 1998 compared to 1987 to 1997. Temperatures rose from a minimum of 0.2°C on January 10 to a maximum of 19.7°C on July 6, and then decreased to a minimum of 0.4°C on December 28. Temperatures between January and April, and between August and December, were similar to those observed over the previous 10 years, but temperatures in May, June and early July were as much as 4.9°C greater than the 10-year average.

Timing of emergence of chinook fry in 1998 was similar to that of previous years-emergence began in April and ended by mid-May. However, the unusually high temperatures in spring and early summer of 1998 caused unusually fast growth in length and weight of 0+ chinook salmon in May, June and July compared to growth over the previous 10 years. Despite those relatively high growth rates, length, weight and condition of 0+ chinook measured in November, 1998, was unusually low compared to previous years. The best explanation for that apparent contradiction was that fast growth early in the growing season allowed a large proportion of the population of juvenile chinook to either smolt in their first year of life or to migrate out of the upper river in search of rearing habitat, thereby leaving only the smallest and poorest-conditioned juveniles to overwinter in the upper river.

Monthly electrofishing surveys along the length of the upper river in April, May, June, July and November captured 79,099 fish from 14 species or families. Juvenile chinook salmon were the most common species accounting for 27.6% of all captures. A total of 21,842 chinook were captured (21,507 0+ and 335 1+), of which 79% were captured at night.

Maximum catch-per-unit-effort (CPUE, number per 100 m^2 surveyed) of electrofished 0+ chinook occurred in April for both day and night catches. Thereafter until early November, CPUE decreased at a rate of 0.81 %/d for day catches and 1.2 %/d for night catches. Those CPUE and their rates of loss were similar to those of previous years, indicating that the relatively high water temperatures of late spring and early summer had little effect on population density along the river margins or on the rate of outmigration.

Spatial distribution of 0+ chinook along the length of the upper Nechako River, as indicated by electrofishing CPUE, was similar to that of previous years. Two peaks of CPUE were found in April: one 20 and 30 km downstream of Kenney Dam and a second one between 70 and 80 km from the Dam. The upstream peak moved even further upstream over the next 60 days and was within 10 km of Kenney Dam in June and July, while the downstream peak had disappeared. That indicated that some juvenile chinook moved upstream in spring and early summer to colonise rearing habitat in the uppermost reaches of the river, instead of simply migrating downstream after emergence. By early November, there were no clear peaks in CPUE, indicating that all remaining 0+ chinook had redistributed themselves evenly along the upper river in preparation for overwintering.

A total of 15,563 fish from 12 species or families were caught with three rotary screw traps at Diamond Island, 90 km downstream from Kenney Dam, between April 3 to July 18. Juvenile chinook salmon were the most common species, accounting for 54.5% of all captures. A total of 8,483 chinook were captured (7,282 0+ and 1,201 1+), of which 81% were taken at night.

The number of outmigrating 0+ chinook captured by rotary screw traps peaked between late April and late May. Day catches decreased at a rate of 6.0 %/d from May 16 to July 11, while night catches decreased at a rate of 1.9 %/d from May 16 to June 18. The numbers and the rates of loss were similar to those measured in previous years, thereby indicating that the relatively high temperatures in late spring and early summer had little effect on the rate of outmigration, at least over April to mid-July.

Expansion of the total numbers of captured 0+ and 1+ chinook salmon by the proportion of river volume sampled by the rotary screw traps provided an estimate of downstream migration of 133,709 0+ chinook and 22,436 1+ chinook between April 3 and July 18. That number of 0+ outmigrants was the third highest reported for the years 1992 to 1998. The number of 0+ outmigrants for the years 1992 to 1998 was positively and significantly correlated ($r = 0.8$, $P = 0.009$) with the number of parent spawners upstream of Diamond Island in the autumns of the years 1991 to 1997.

INTRODUCTION

This report describes juvenile chinook salmon (*Oncorhynchus tshawytscha*) size, distribution and abundance in the upper 100 km of the Nechako River in 1998.

This study was part of the tenth year (1998-1999) of the Nechako Fisheries Conservation Program (NFCP). The primary objectives of the 1998 juvenile chinook outmigration study were to describe growth and spatial distribution of juvenile chinook in the upper Nechako River, and to calculate an index of the number of juvenile chinook that migrated downstream of Diamond Island from March to July. The secondary objective was to compare the biological parameters measured in 1998 with those measured over the previous nine years.

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

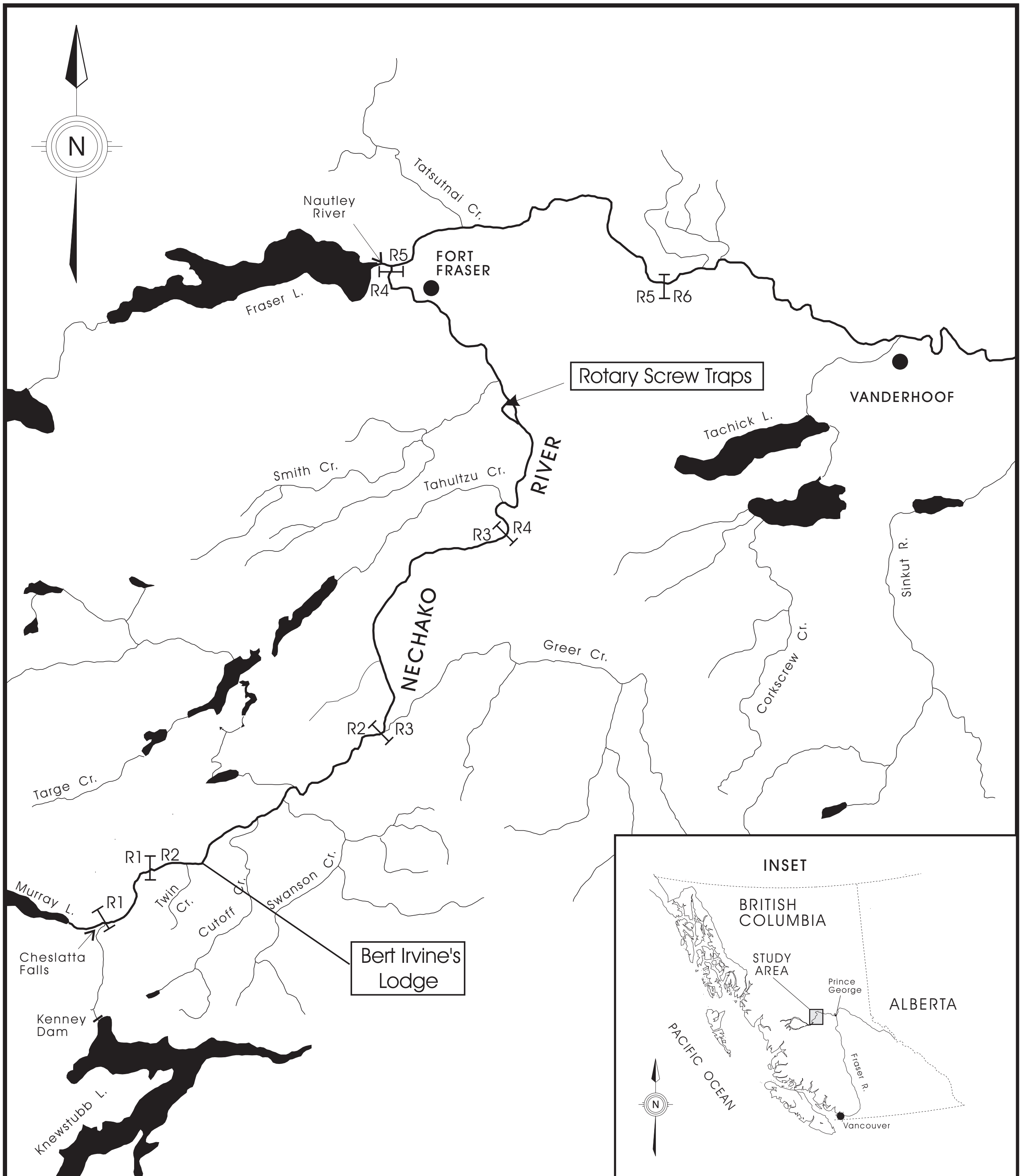
METHODS

Study Sites

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

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

In this report, all longitudinal distances are in kilometres from the foot of Kenney Dam. The first 9 km of the river are within the Nechako River Canyon, which was dewatered by the closing of Kenney Dam in October 1952. The majority of the flows in the upper river occur downstream of Cheslatta Falls.



Nechako Fisheries Conservation Program

Map # M98-3-1

0 25 KM

FIGURE 1. 1998 NECHAKO RIVER STUDY AREA AND TRAP LOCATIONS

Temperature and Flow

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

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

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

Electrofishing Surveys

Each year since 1990, NFCP has conducted electrofishing surveys of the upper Nechako River to measure the relative abundance and spatial distribution of juvenile chinook. The surveys began as a temporary replacement for inclined plane traps that were rendered inoperable in 1990 due to high river flows. Over the last 8 years they have become one of the most important components of the chinook monitoring program, mainly because they show spatial variation in juvenile density during spring and summer-something no fixed gear can do-and because electrofishing can be done at high flow levels that would render some fixed gear inoperable.

In 1998, as in previous years, an index of juvenile chinook salmon abundance was obtained from single-pass electrofishing surveys of each of the four reaches. Surveys began in April and continued through May, June and early July. They were discontinued during late July and August because summer cooling flows were too high to allow safe and effective electrofishing. Large flows are released into the upper river during July and August to cool the river and thereby reduce prespawning mortality of sockeye salmon (*Oncorhynchus nerka*) migrating through the lower Nechako River to spawning grounds in the Stuart, Stellako and Nadina River systems. The program of releases is called the Summer Temperature Management Program or STMP. A final electrofishing survey was conducted from November 2 to 7. Surveys of Reaches 1 through 4 were completed in each of the months sampled. Electrofishing surveys were carried out at night as well as during the day. Night was defined as the time period between sunset and sunrise.

Surveys were conducted on prime habitat for juvenile chinook salmon, defined as depth greater than 0.5 m, velocity greater than 0.3 m/s and a substrate of gravel and cobble (Envirocon Ltd. 1984). That habitat was found mainly along the margins of the river, so electrofishing surveys did not sample the portion of the population that may have resided in mid-channel. However, mid-channel residents are a minor component of the population of juvenile chinook. Electrofishing surveys conducted by the Department of Fisheries and Oceans (DFO) showed 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 juvenile chinook observed by snorkelling were found along river margins.

Fish were captured with a single pass of a Smith Root model 15A backpack electrofisher, identified to species, counted, and released live back into the river. Catch-per-unit-effort (CPUE) of juvenile chinook was the number of fish caught at a site divided by the area that was electrofished. Area was expressed in units of 100 m^2 to avoid fractional CPUE. Age of juvenile chinook was recorded as 0+ or 1+, based on fork length. Juvenile chinook less than 90 mm long were classified as 0+. Those over 90 mm in length in the spring and early summer were classified as 1+, but those over 90 mm long in late summer were classified as 0+ because by that time all 1+ chinook had migrated out of the upper Nechako River. Rainbow trout were classified as juveniles if their length was <200 mm and adults if their length was >200 mm.

Before release, 10 to 15 chinook were measured for body size. Fork length was measured to the nearest 1 mm with a measuring board, and wet weight was measured to the nearest 0.01 g with an electronic balance. Following the practice of previous years, Fulton's condition factor (Ricker 1975):

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

was used as an index of physical condition.

Mean daily length and weight of 0+ and 1+ chinook were calculated separately for day and night catches because fish could potentially avoid sampling gear more successfully during the day than during the night, and because the behaviour of juvenile chinook varies with time of day-resting near instream cover during the day and migrating during dusk and dawn.

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

That sampling strategy is called "semi-quantitative", to use a term coined by 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 impossible or impractical to enclose a survey area in blocking nets because the area is too large to be enclosed or flows through the area are too strong to allow nets to be installed. For example, almost all electrofishing conducted in lakes and reservoirs (DeVries et al. 1995; Van Den Ayle et al. 1995; Miranda et al. 1996), and in large rivers (R.L.&L. Environmental Services Ltd. 1994), is semi-quantitative. The upper Nechako River is too wide, deep and fast-moving to allow any part of the mainstem to be blocked off with nets.

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

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

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

Rotary Screw Traps

Rotary screw traps (RST) were used to estimate the number of juvenile chinook that migrated downstream past Diamond Island. RSTs were installed in early April and removed in mid-July to avoid potential damage caused by high cooling flows in July and August. The traps were not re-installed in September because too few chinook salmon had been caught in the autumn of previous years to justify re-installation of traps.

An RST consisted of a floating platform on top of which was a rotating cone. In front of the cone was an A-frame with a winch that was used to set the vertical position of the mouth of the cone, half of which was always submerged. In the back of the cone was a live box where captured fish were kept alive until the trap was emptied. The cone was 1.43 m long and was made of 3 mm thick aluminum sheet metal with multiple perforations to allow for draining of water. The diameter of the cone tapered from 1.55 m at the mouth to 0.3 m at the downstream end. Inside the cone was an auger or screw, the blades of which were painted black to reduce avoidance by fish. As the current of the river struck the blades of the screw, it forced the cone to rotate. Any fish that entered the cone were trapped in a temporary chamber formed by the screw blades. As the cone rotated, the chamber moved down the cone until its contents were deposited in the live box.

Three RSTs were installed off Diamond Island: RST 1 near the left bank, RST 2 in the middle of the river, and RST 3 near the right bank. RSTs were suspended from a cable strung across the river channel. The 1.5 m space between the right bank of the river and RST 3 was blocked with a wing made of wood beams with wire mesh. The 15 m long space between the left bank of the river and RST 1 was not blocked with a wing.

Each trap was emptied twice each day at about 0700 and 2000 hours. All fish were collected from the live trap, counted and identified to species. A subsample of 10 to 15 chinook salmon was kept for length and weight measurement using the same methods described above for the electrofishing surveys, after which all fish, including the subsampled fish, were released live back into the river.

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

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

where N_{ij} = number of juvenile salmon passing Diamond Island on the *jth* date as estimated by the catches of the *ith* trap, n_{ij} = number of chinook salmon caught in the *ith* trap on the *jth* date, v_{ij} = water flow (m^3/s) through the *ith* trap on the *jth* date, and V_j = total water flow (m^3/s) of the Nechako River past Diamond Island on the *jth* date. All analyses of rotary screw trap data were based on expanded numbers rather than on catches.

V_j was estimated from the height of the river surface at Diamond Island, as measured with a staff gauge, using a linear regression between flow and the height of the staff gauge ($n = 137$, $r^2 = 0.99$, $P<0.001$):

(3) $\log_e(\text{flow, } m^3/s) = -3.386 + 1.670\log_e(\text{staff height, cm})$,

The regression was calculated for steady flow conditions during April and May from the combined years of 1992 to 1998. Flows and staff gauge height were $\log_e$-transformed to linearize the exponential relationship between the two variables.

Water flow through a trap (v_{ij}) was the product of one half the cross-sectional area (1.61 m^2) of the mouth of the trap (the trap mouth was always half-submerged) and average water velocity in front of the trap. Average water velocity (m/s) was measured with a Swoffler (model 2100) flow meter at three different places in the front of the mouth of the RST. The one exception to this rule was RST 3, where 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 number each day. The best estimate of the total index number of chinook salmon was the mean of the three estimates weighted by the flow that passed through each trap.

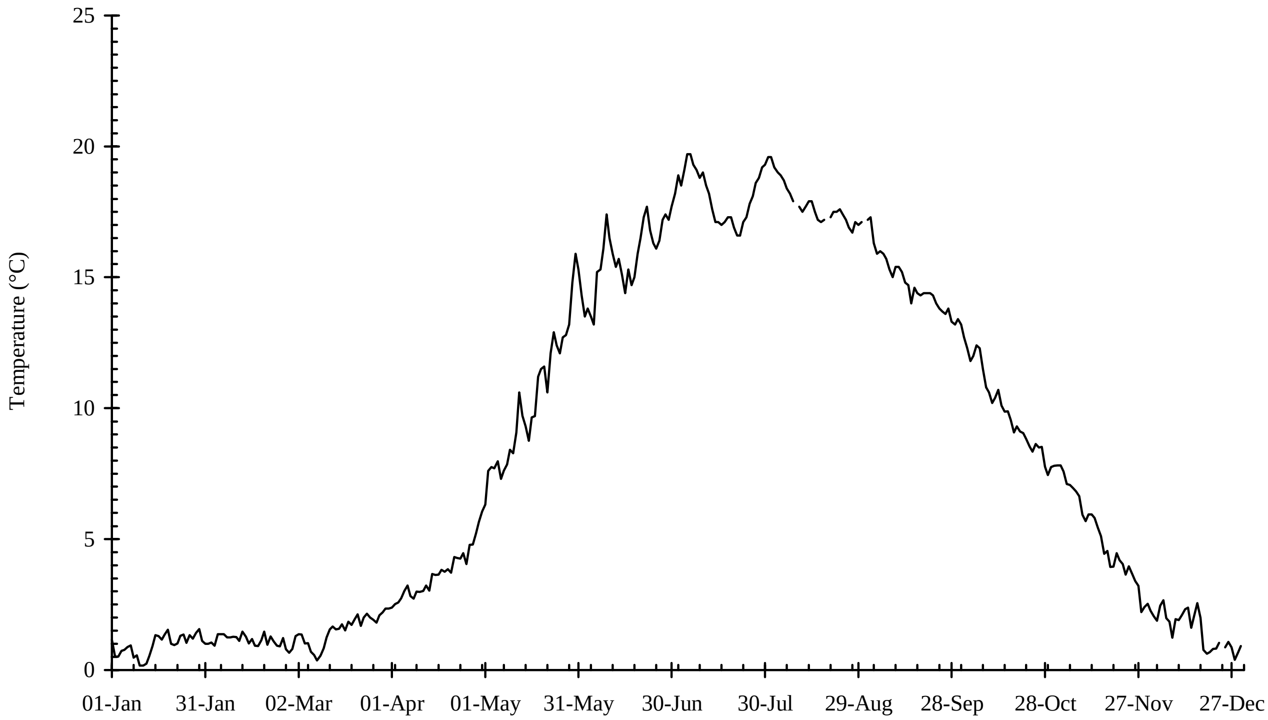
RESULTS AND DISCUSSION

Temperature

Mean daily water temperature of the upper Nechako River at Bert Irvine's Lodge rose from a minimum of 0.2°C on January 10 to a maximum of 19.7°C on July 6 and then decreased to a second minimum of 0.4°C on December 28 (Figure 2).

Spot temperatures measured during electrofishing surveys were higher than mean daily temperatures recorded at Bert Irvine's Lodge during April, May, June and July, but lower during November. That meant that the average daily temperatures at Bert Irvine's Lodge were only indices of seasonal changes

Figure 2
Mean Daily Temperatures of the Upper Nechako River Measured at Bert Irvine's Lodge, 1998



in the upper River. The temperatures that were actually experienced by juvenile chinook in the upper river may have been as much as ±3°C different from those at Bert Irvine's Lodge depending on their downstream distance and the time of day. Those differences tended to obscure relationships between temperature (as measured at Bert Irvine's) and growth of juvenile chinook salmon, making it difficult to use that data to develop models of temperature-dependent growth of juvenile chinook. The remainder of this section demonstrates that point by describing the direction and magnitude of the temperature differences.

The temperature differences were due primarily to seasonally varying longitudinal temperature gradients along the upper river and, secondarily, to differences in solar heating between day and night. To calculate the direction and magnitude of the longitudinal gradients, the differences between spot temperatures and mean daily temperature at Bert Irvine's were calculated for each day for which spot temperatures were measured. Those temperature differences were then plotted on the distance from Kenney Dam to the electrofishing sites for each month separately, and linear regressions of temperature difference on distance were calculated for each month (Figures 3 to 7). (The two very low spot temperatures measured in early April between 82 and 84 km from Kenney Dam were due to cold water entering the upper Nechako River from Smith Creek.) All five regressions were highly significant ($P<0.001$). Temperature gradients increased from +0.007°C/km in April to +0.020°C/km in May and +0.024°C/km in June, and then decreased to +0.019°C/km in July and to -0.020°C/km in November. The gradients were due to heating and cooling of water released into the upper river from Skins Lake Spillway. During spring and early summer, cool water was released that warmed as it passed down the upper Nechako River. By November, the situation was reversed with warm water spilling from the Reservoir and cooling as it passed down the river.

Spot temperatures taken during night-time electrofishing surveys in Reaches 1 to 4 were always lower than daytime spot temperatures. To demonstrate that effect, average day-night temperature differences were calculated by, first, calculating the residual temperature differences around each of the temperature-distance regressions of Figures 3 to 7.

Figure 3

Regression of the Difference Between Spot Temperatures at Electrofishing Sites in the Upper Nechako River and Mean Daily Temperature at Bert Irvine's Lodge on Distance From Kenney Dam, April 3-9, 1998

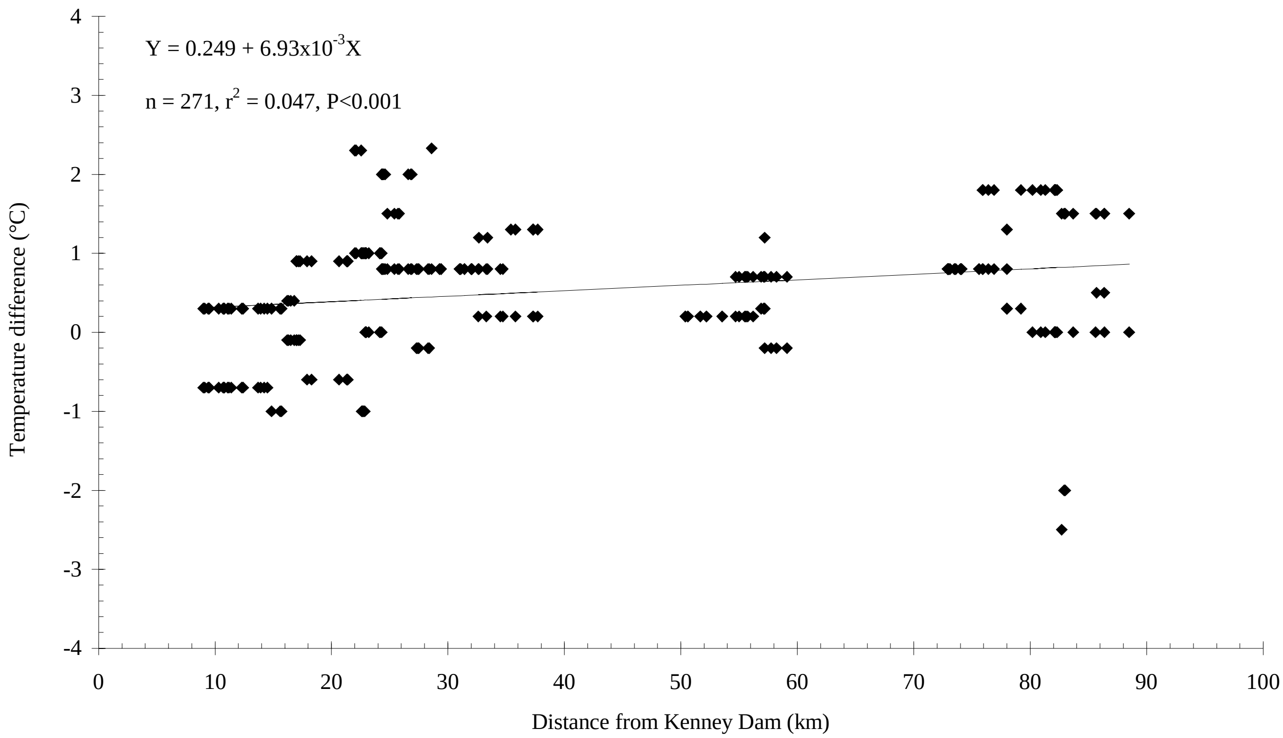


Figure 4

Regression of the Difference Between Spot Temperatures at Electrofishing Sites in the Upper Nechako River and Mean Daily Temperature at Bert Irvine's Lodge on Distance From Kenney Dam, May 17-23, 1998

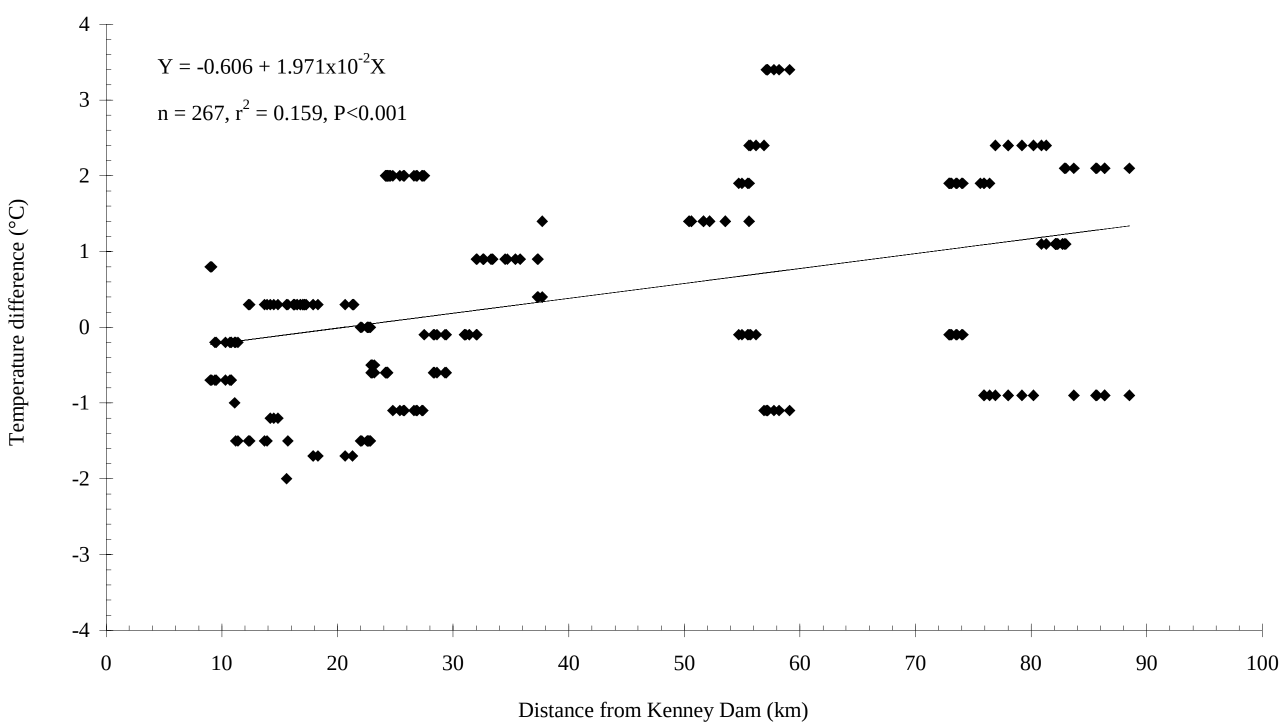


Figure 5
Regression of the Difference Between Spot Temperatures at Electrofishing Sites in the Upper Nechako River and Mean Daily Temperature at Bert Irvine's Lodge on Distance From Kenney Dam, June 15-22, 1998

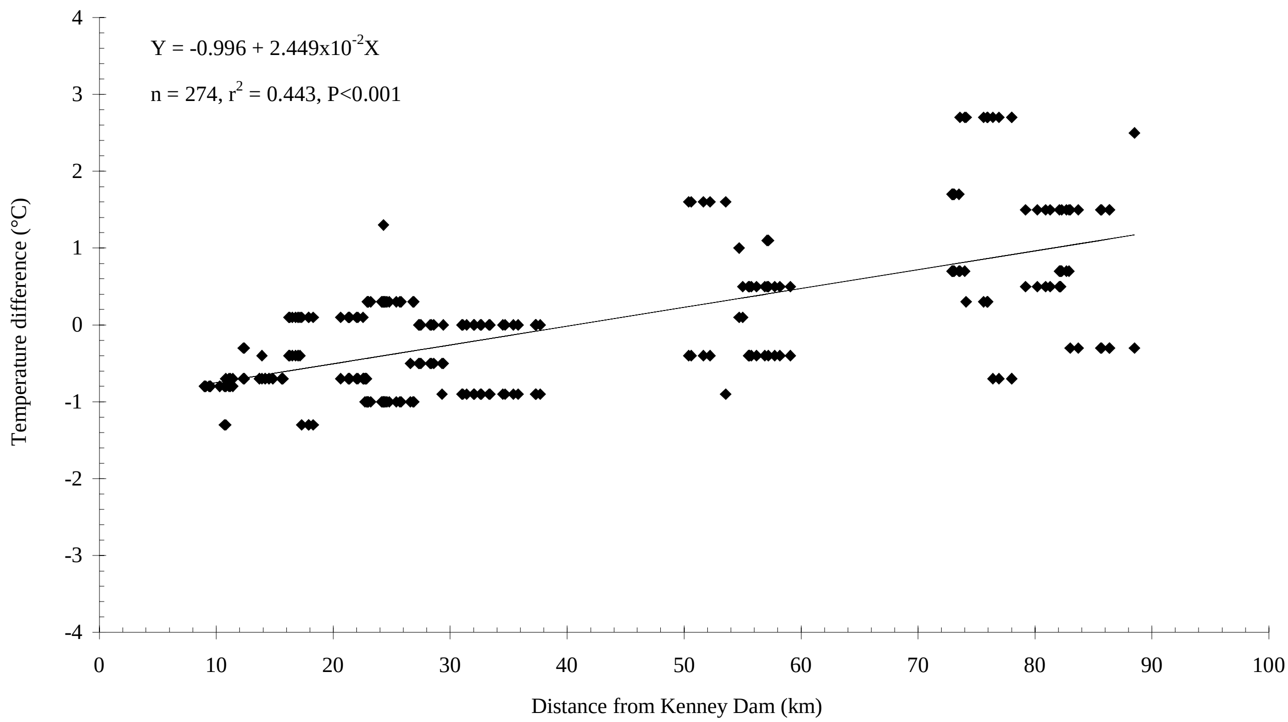


Figure 6
Regression of the Difference Between Spot Temperatures at Electrofishing Sites in the Upper Nechako River and Mean Daily Temperature at Bert Irvine's Lodge on Distance From Kenney Dam, July 3-10, 1998

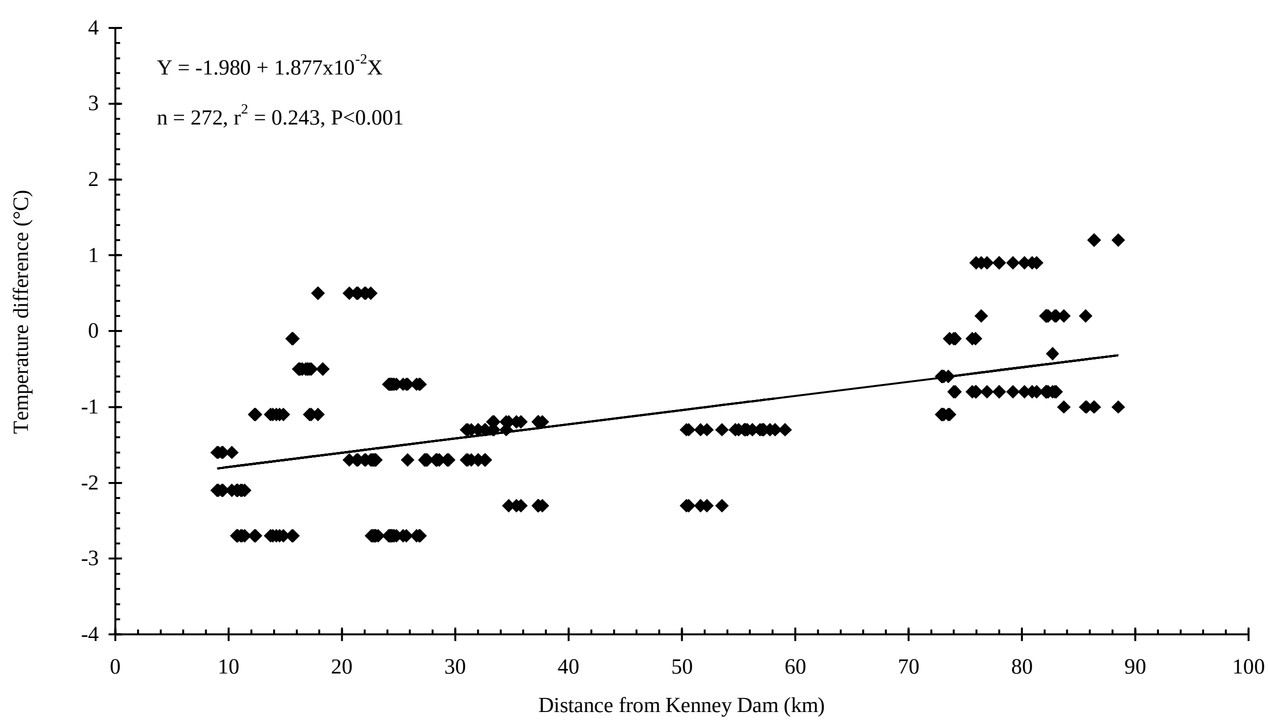
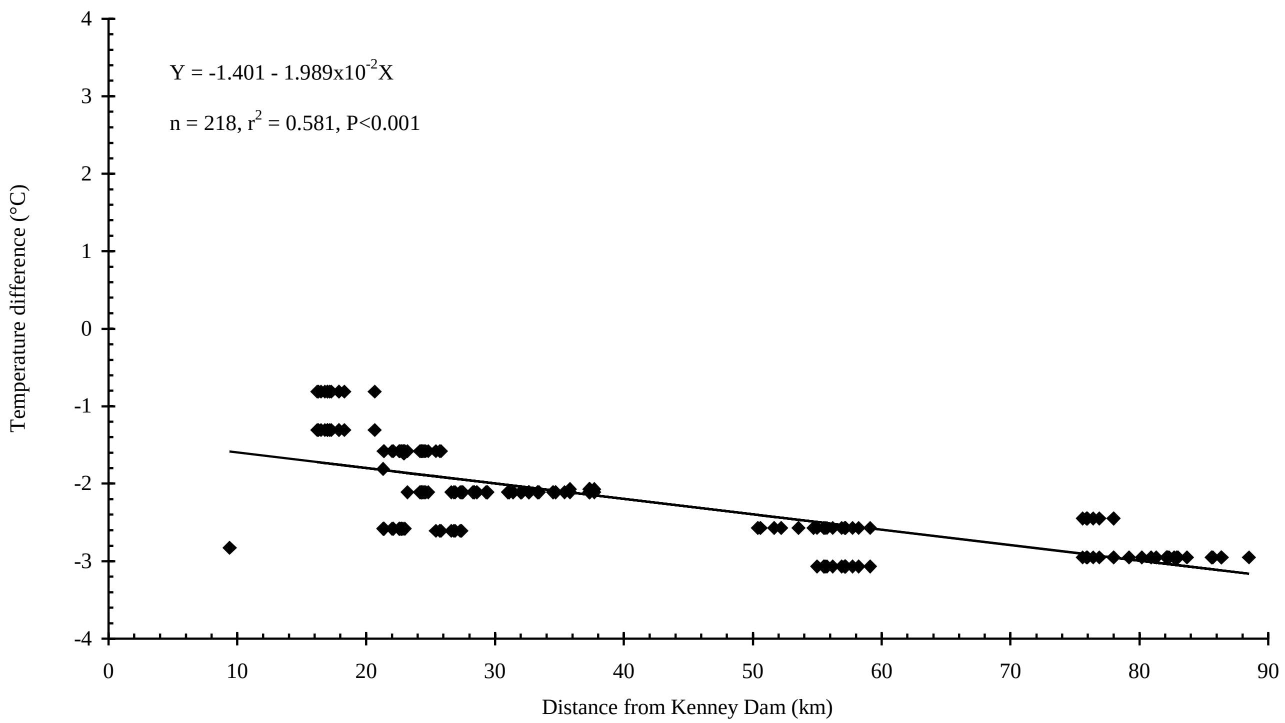


Figure 7
Regression of the Difference Between Spot Temperatures at Electrofishing Sites in the Upper Nechako River and Mean Daily Temperature at Bert Irvine's Lodge on Distance From Kenney Dam, November 2-7, 1998



Then, average residual temperature differences were calculated for day and night separately for each month (Figure 8). Day-night differences between mean residual temperature differences rose from 0.4°C in April to a maximum of 1.4°C in May, and then fell to 0.6°C in June, 0.7°C in July and 0.2°C in November. Those changes reflected the magnitude of daily solar heating of the Nechako River. For example, the temperature differences between day and night in November were low because the degree of daytime solar heating was low, but the temperature differences were greatest in May because the relative magnitude of daytime solar heating was greatest in that month.

Flow

From January 1 to July 5, a period of 185 days, releases from Skins Lake Spillway were roughly constant at 53.0 m^3/s (range: 49.4 to 55.8 m^3/s) (Figure 9). As a result, flows at Cheslatta Falls over the same period were roughly constant at 57.3 m^3/s (range: 52.0 to 68.6 m^3/s). The difference in average flows between Skins Lake Spillway and Cheslatta Falls was due to the addition of flows from the Murray Lake system.

From July 6 to August 18, a period of 45 days, cooling flows were released from Skins Lake Spillway as part of the STMP. During that period, flows ranged over an order of magnitude, sometimes from one day to the next, in response to the STMP protocol. For example, between July 6 and July 10, releases increased from 97.9 m^3/s to a maximum of 453.2 m^3/s. Then, on July 11 they fell to 14.2 m^3/s, and on July 12 they rose again to 309.9 m^3/s. Flows at Cheslatta Falls followed the release pattern at the spillway, but were much less variable from day to day because they were buffered by the several days of transit time through the Murray Lake system. Flows at Cheslatta Falls increased from 54.3 m^3/s on July 6 to a maximum of 298.0 m^3/s on August 6, and then fell to a minimum of 27.7 m | /s on September 19.

From August 18 to December 31, a period of 135 days, an average of 28.6 m^3/s (range: 14.6 to 56.7 m^3/s) was released from Skins Lake Spillway. Flows below Cheslatta Falls were equally stable with an average of 29.6 m^3/s (range: 28.5 to 31.2 m^3/s) from September 20 to December 31.

Figure 8
Mean (±1 SE) Residual Temperature Differences Between Day and Night Electrofishing Surveys, Upper Nechako River, 1998

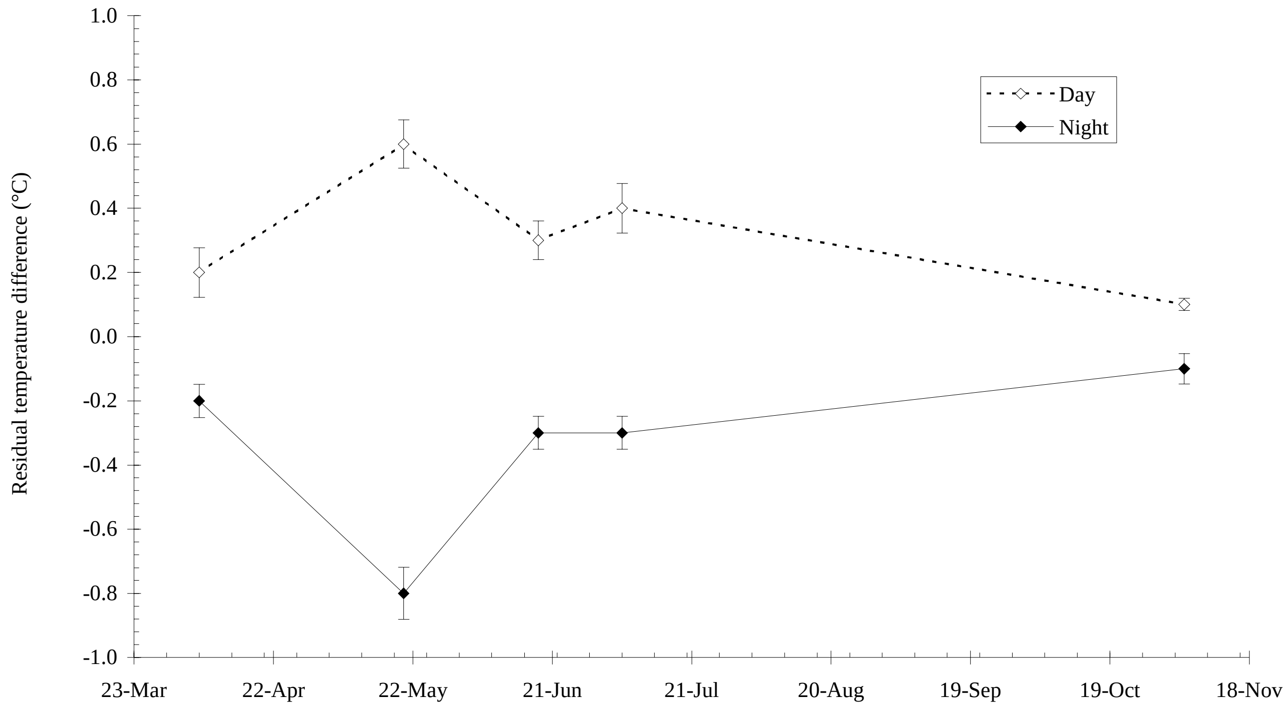
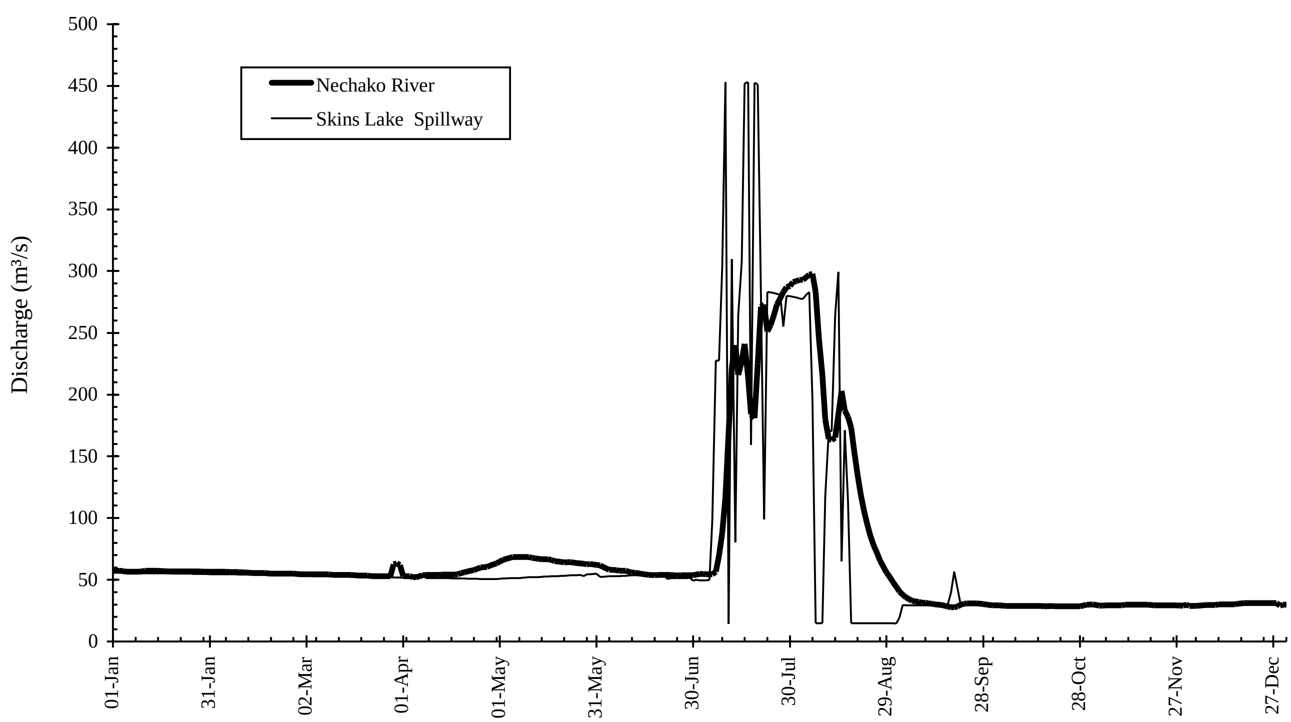


Figure 9
Daily Flows of the Nechako River Below Cheslatta Falls (WSC station 08JA017) and Releases from Skins Lake Spillway, 1998



In summary, the 1998 flow of the upper Nechako River at Cheslatta Falls was stable for 88% of the year. For the remaining 12% of the year, in July and August, the release of cooling flows caused a sudden five-fold increase and decrease in flow at Cheslatta Falls. That flow pattern was very different from the general flow pattern of unregulated rivers of the B.C. interior. In the latter, flows usually begin to increase in April due to snowmelt at higher elevations, reach a peak in June and then decline slowly to minima in October and November (Bradford 1994). Thus, regulation of the Nechako River has delayed the spring freshet for three months and compressed its duration from 7 months to 1.5 months.

Size and Growth of Chinook Salmon

Electrofishing

0+ Chinook Salmon: Sources of Variation

To determine the factors responsible for changes in the size of 0+ chinook salmon over time, standard two-factor analyses of variance (ANOVA) of length-at-date and weight-at-date were conducted with two factors: time of day (two classes: day and night) and date (five classes: April, May, June, July and November). In this case, and in all subsequent ANOVAs of this study, the date classes were chosen so that there was a roughly equal distribution of data in each class. The ANOVAs showed that:

(1) there was highly significant variation with date in mean length ($F_{4,5404}$ = 4662.4, P<0.001) and mean weight ($F_{4,5346}$ = 2024.0, P<0.001) of 0+ chinook salmon. Figures 10 and 11 (and Appendix 1) show that that variation was due to growth;

(2) mean length ($F_{1,5404}$ = 154.4, P<0.001) and mean weight ($F_{1,5346}$ = 57.5, P<0.001) of 0+ chinook salmon were highly significantly different between day and night catches. Figures 10 and 11 show that 0+ chinook tended to be smaller during the day than at night. The most likely reasons for the apparent day-night size differences are: (a) greater vulnerability of fish of all sizes to capture at night than during the day because fish cannot detect and avoid electrofishing gear as well at night as during the day; and (b) a wider size range of fish are active along the river margins at night than during the day because all juvenile chinook tend to migrate more at night than during the day to avoid predators; and

(3) the interaction of date and time of day was highly significant for both length ($F_{4,5404}$ = 53.1, P<0.001) and weight ($F_{4,5346}$ = 44.0, P<0.001). Figures 10 and 11 show that the interaction was due to seasonal variation in day-night size differences. That is, mean sizes at night were almost identical to mean sizes during the day for April and November, but they were greater than mean day sizes for May, June and July. The most likely reasons are: (a) seasonal changes in size-selection of electrofishing gear due to an increase in avoidance ability of juvenile chinook as they grow in size and swimming ability and (b) seasonal changes in the relative abundance and spatial distribution of fish of different sizes along the river margins.

0+ Chinook Salmon: Growth

Growth of 0+ chinook salmon electrofished along the river margins appeared to follow two separate growth stanzas (Ricker 1979). Growth was slow between April and May and then increased between May and November (Figures 10 and 11). The first stanza was due to continuous emergence of fry over a period of several weeks-the numbers of emergent fry were great enough to force 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 mean length-at-date and weight-at-date plots shown in Figures 10 and 11, emergence appeared to have ceased some time between early April and mid-May.

Growth of 0+ chinook salmon after emergence ceased was described with a one-cycle Gompertz growth curve (Zweifel and Lasker 1976), the standard growth model for the early life history stages of fish. A “cycle” is a period of constant growth pattern with the same meaning as a “growth stanza.” The Gompertz model for length was:

(4) $L = L_0 \exp[(A_0/\alpha)(1-\exp(-\alpha t))]$

Figure 10
Mean (±1 SD) Length-at-date of 0+ Chinook Salmon, Nechako River, 1998: Electrofishing

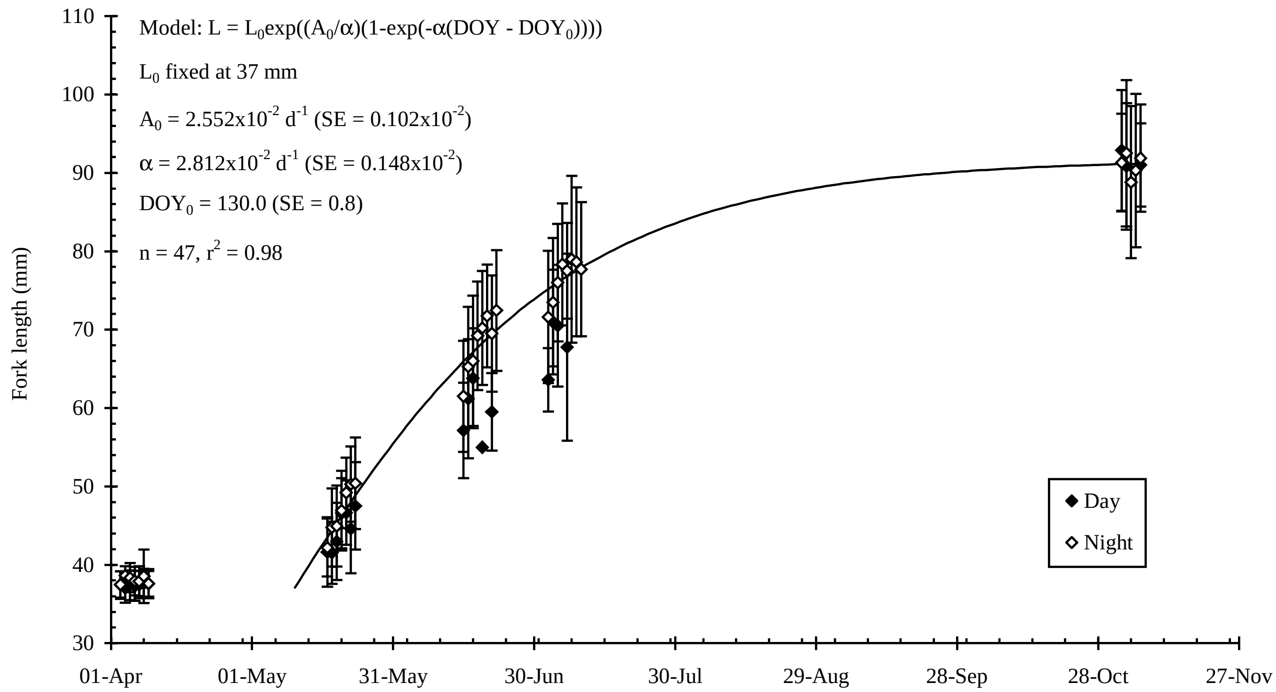
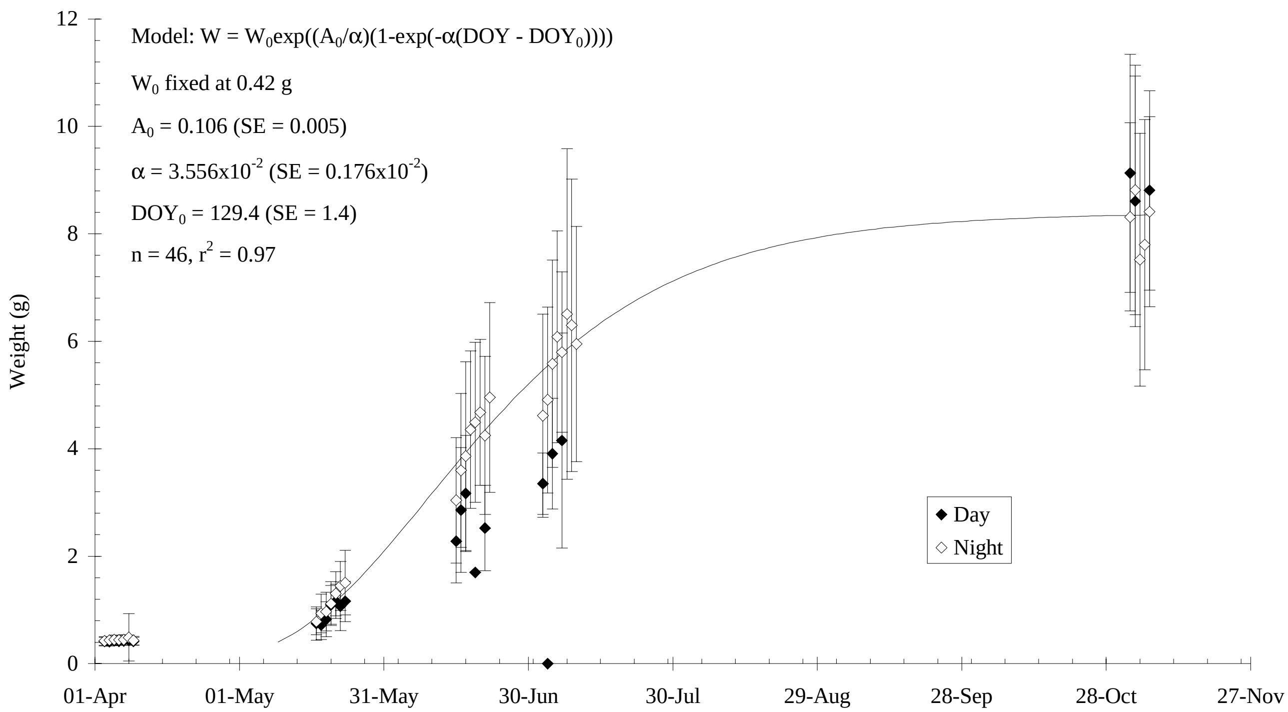


Figure 11
Mean (±1 SD) Weight-at-date of 0+ Chinook Salmon, Nechako River, 1998: Electrofishing



where L = length (mm) at age t (d), L_0 = length (mm) at emergence, A_0 = instantaneous growth rate (d^{-1}) at emergence, and α = instantaneous rate (d^{-1}) at which A_0 decayed with age. The one-cycle Gompertz model for weight was the same as equation (4) except that W_0, the weight (g) at emergence, was substituted for L_0.

The simplest way of estimating age from date was to modify equation (4) by inserting the parameter DOY_0, the mean day of the year (DOY) on which emergence ceased and the second growth stanza began. Therefore, t = DOY - DOY_0 and the modified Gompertz model for length was:

(5) $$L = L_0 \exp[(A_0/\alpha)(1-\exp(-\alpha(DOY - DOY_0)))].$$

L_0 was fixed at 37 mm and W_0 was fixed at 0.42 g, the mean length and weight of emergent chinook fry electrofished in April. Values of A_0, α and DOY_0 were estimated from mean daily lengths and weights with the non-linear regression program NLR of the SPSS statistical library (SPSS Inc. 1993). Each daily mean was weighted by its sample size. Day and night data were pooled to produce a single growth curve. (Although mean sizes were significantly different between day and night catches, the magnitude of the differences were small, there was only one population of juvenile chinook present in the Nechako River, and there is little practical value in calculating separate growth curves for day- and night-caught fish.) Mean length-at-date and weight-at-date collected in April were excluded because they belonged to the first growth stanza.

The modified Gompertz curves provided good fits to lengths-at-date and weights-at-date, explaining between 97 and 98% of the variation in mean size (Figures 10 and 11). The average date at which emergence ceased was estimated to be between May 9 (DOY = 129) and May 10 (DOY = 130).

The modified Gompertz curves showed rapid declines in growth rate over late summer and early fall. Those declines were due to three factors: (a) increasing body size, because growth rate always decreases with increasing body size (Ricker 1979; Jobling 1983); (b) decreasing water temperature; and (c) size-selective outmigration. That is, large chinook may have left the upper river earlier than smaller chinook, either to smolt or to search for downstream rearing habitat, leaving an overwintering population in November that was composed of smaller than average fish.

1+ Chinook Salmon: Growth

Growth of electrofished 1+ chinook was best described with linear regressions of mean length and weight on day of year, with mean size weighted by sample size (Figures 12 and 13). Both regressions were highly significant. Predicted mean length of 1+ chinook rose from 89 mm on April 3 (DOY = 93) to 113 mm on July 4 (DOY = 185) at a rate (±1 SE) of 0.27±0.06 mm/d. Predicted mean weight rose from 8.7 g on April 3 to 20.6 g on July 4 at a rate (±1 SE) of 0.13±0.02 g/d.

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

Following customary practice, a power function was used to model the relationship between weight and length of 0+ and 1+ chinook salmon:

(6a) $$W = aL^b$$

where a is a coefficient with units of g/mm and b is the length exponent. Equation (6a) was fit to individual weights and lengths after logarithmic transformation converted it to a linear regression:

(6b) $$\log_e(W) = \log_e(a) + b\log_e(L).$$

Equation (6b) explained 98.5% of the variance in $\log_e(W)$ (Figure 14). However, despite the good fit of the model, it overestimated the weight of the smallest and largest fish and underestimated the weight of fish in the middle of the length range. Clearly, the weight-length relationship for juvenile chinook was not linear over the entire juvenile stage.

0+ and 1+ Chinook Salmon: Condition

Average condition of 0+ chinook increased from 0.8 g/mm^3 in April to 1.2 g/mm^3 in July and then decreased to 1.1 g/mm^3 in November (Figure 15). Average condition of 1+ chinook salmon increased from 1.25 g/mm^3 in April to 1.4 g/mm^3 in May (Figure 16).

Diamond Island Traps

0+ Chinook Salmon: Sources of Variation

To determine the factors responsible for variation in size of 0+ chinook salmon caught by RSTs at Diamond Island, standard two-factor ANOVAs of length-at-date

Figure 12
Mean (±1 SD) Length-at-date of 1+ Chinook Salmon, Nechako River, 1998: Electrofishing

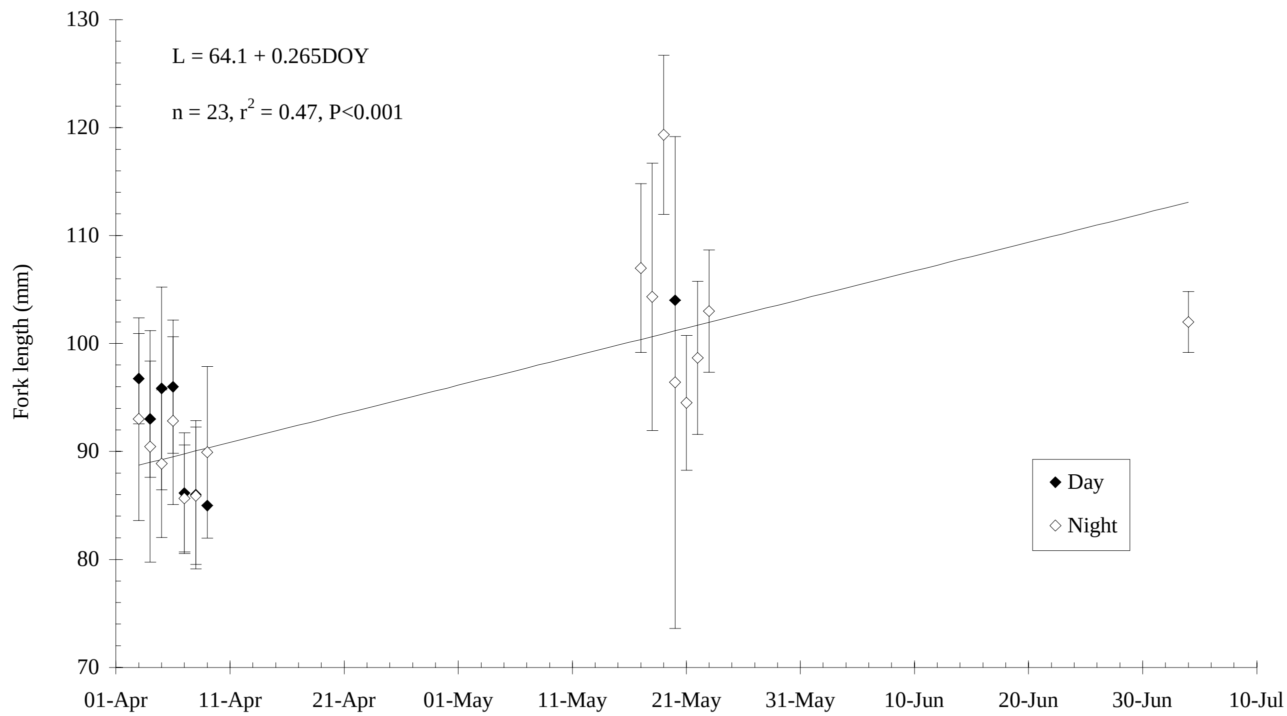


Figure 13
Mean (±1 SD) Weight-at-date of 1+ Chinook Salmon, Nechako River, 1998: Electrofishing

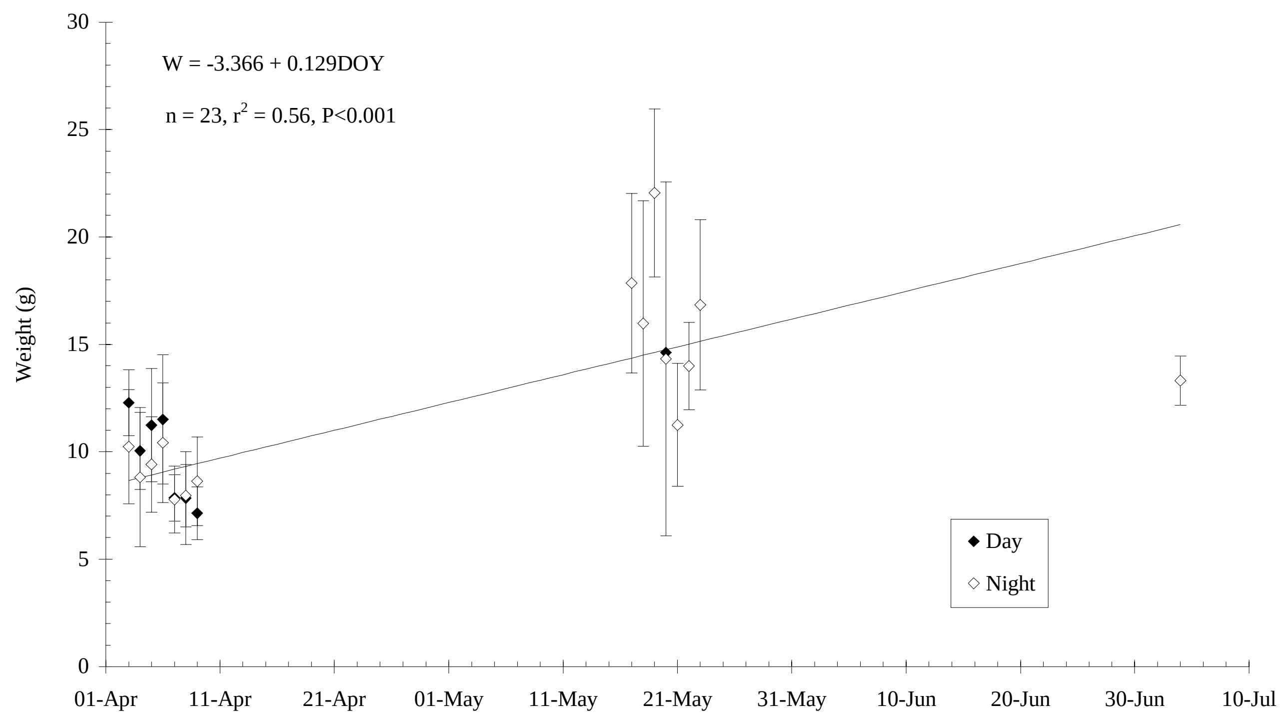


Figure 14
Regression of Weight on Length for Juvenile Chinook Salmon, Nechako River, 1998: Electrofishing

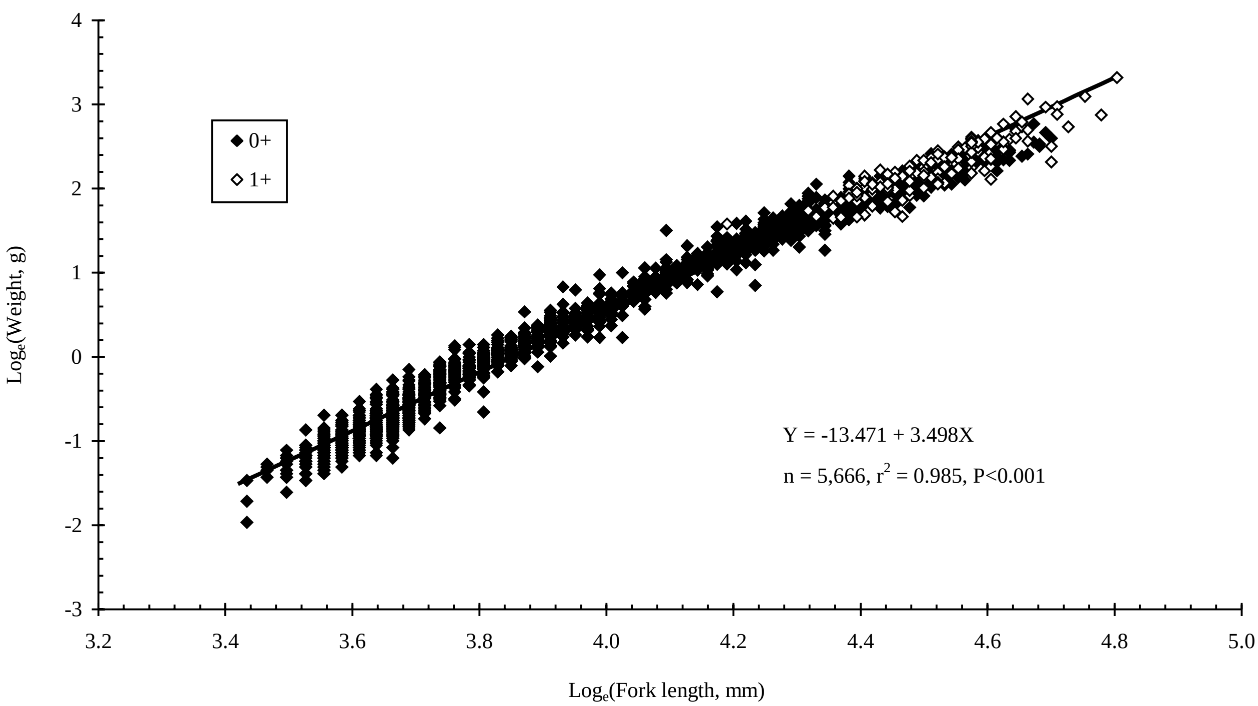


Figure 15
Mean (±1 SD) Condition-at-date of 0+ Chinook Salmon, Nechako River, 1998: Electrofishing

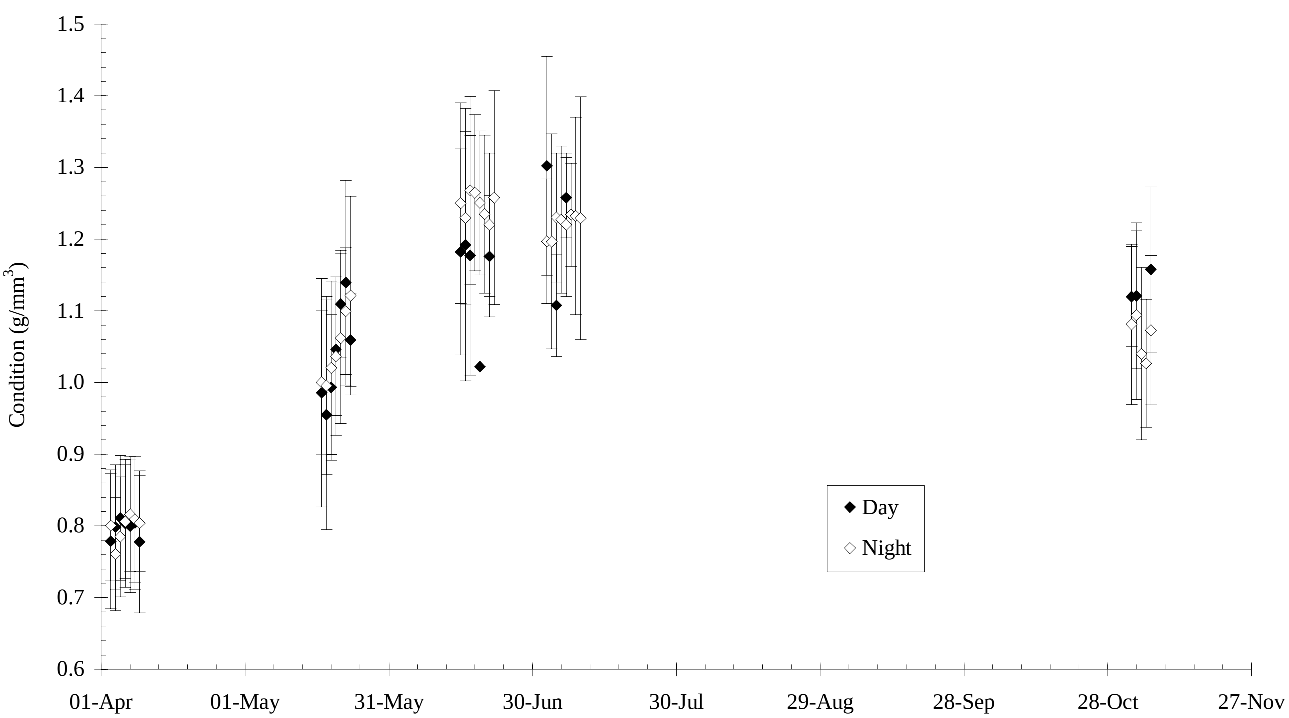
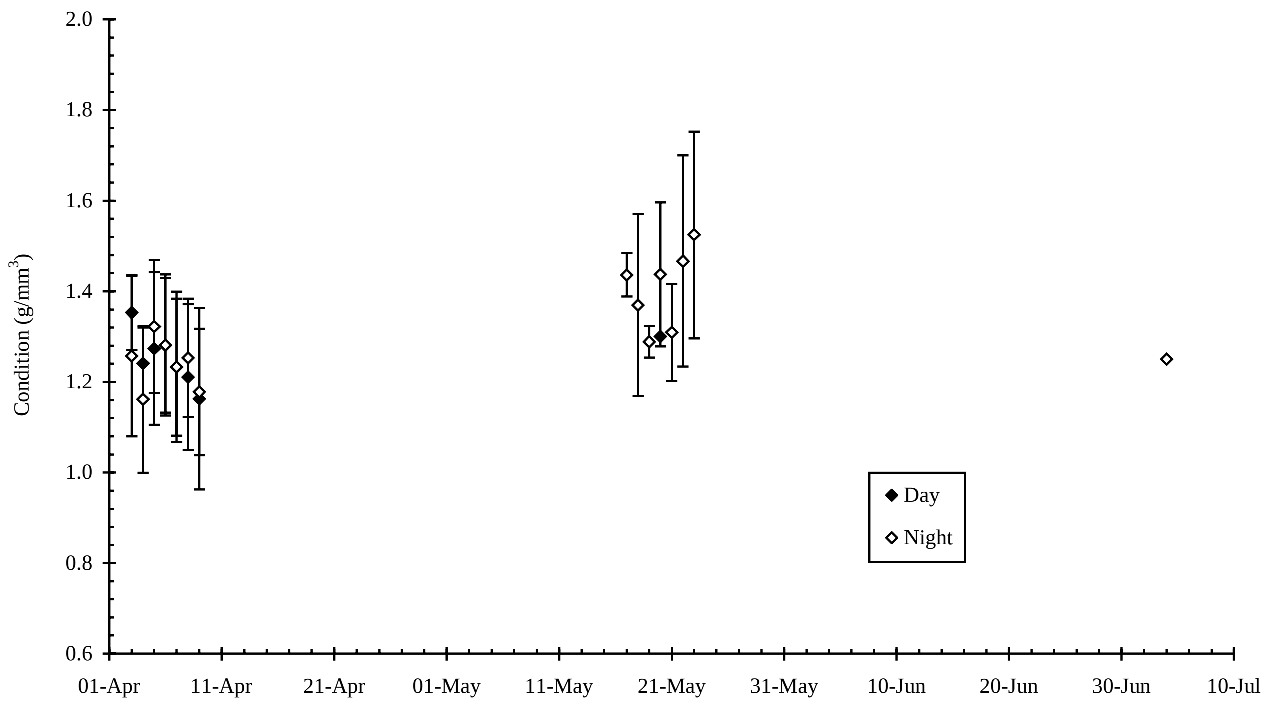


Figure 16
Mean (±1 SD) Condition-at-date of 1+ Chinook Salmon, Nechako River, 1998: Electrofishing



and weight-at-date were conducted. The ANOVAs were similar in structure to those described in the previous section on electrofishing and they showed similar results:

(1) there was highly significant variation with date for mean length ($F_{3,3397}$ = 1190.6, P<0.001) and for mean weight ($F_{3,3397}$ = 707.2, P<0.001) due to growth (Appendix 2 and Figures 17 and 18);

(2) mean length ($F_{1,3397}$ = 21.9, P<0.001) and mean weight ($F_{1,3397}$ = 28.1, P<0.001) varied significantly between day and night catches. Figures 17 and 18 showed that day-caught fish tended to be smaller than night-caught fish, most likely because of size-selectivity of RSTs and of day-night differences in the range of fish sizes; and

(3) the interaction of date and time of day was significant for both length ($F_{3,3397}$ = 33.0, P<0.001) and weight ($F_{3,3397}$ = 42.0, P<0.001). The length interaction was due to greater mean length at night than during the day for June and July but not for April and May.

0+ Chinook Salmon: Growth

Lengths and weights of 0+ chinook captured at Diamond Island followed trajectories with date that were similar to those of electrofished 0+ chinook (Figures 17 and 18). The first growth stanza ran from early April to mid-May, at which time the rate of fry emergence had dropped to a level that allowed the true population growth curve to become apparent. To fit Gompertz growth curves to the size-at-age data, the second stanza was defined as starting between April 15 (DOY = 105) and May 10 (DOY = 130), based on a visual assessment of the plots of size-at-date. Gompertz curves were then fit to mean size-at-date for each of the 24 possible starting dates and the regressions that explained the most variation in size, i.e. had the highest r^2, were chosen. Starting dates of April 19 (DOY = 109) and May 3 (DOY = 123) were found to provide the highest r^2 for length and weight, respectively (Figures 17 and 18).

Figure 17
Mean (±1 SD) Length-at-date of 0+ Chinook Salmon, Nechako River, 1998: Rotary Screw Traps

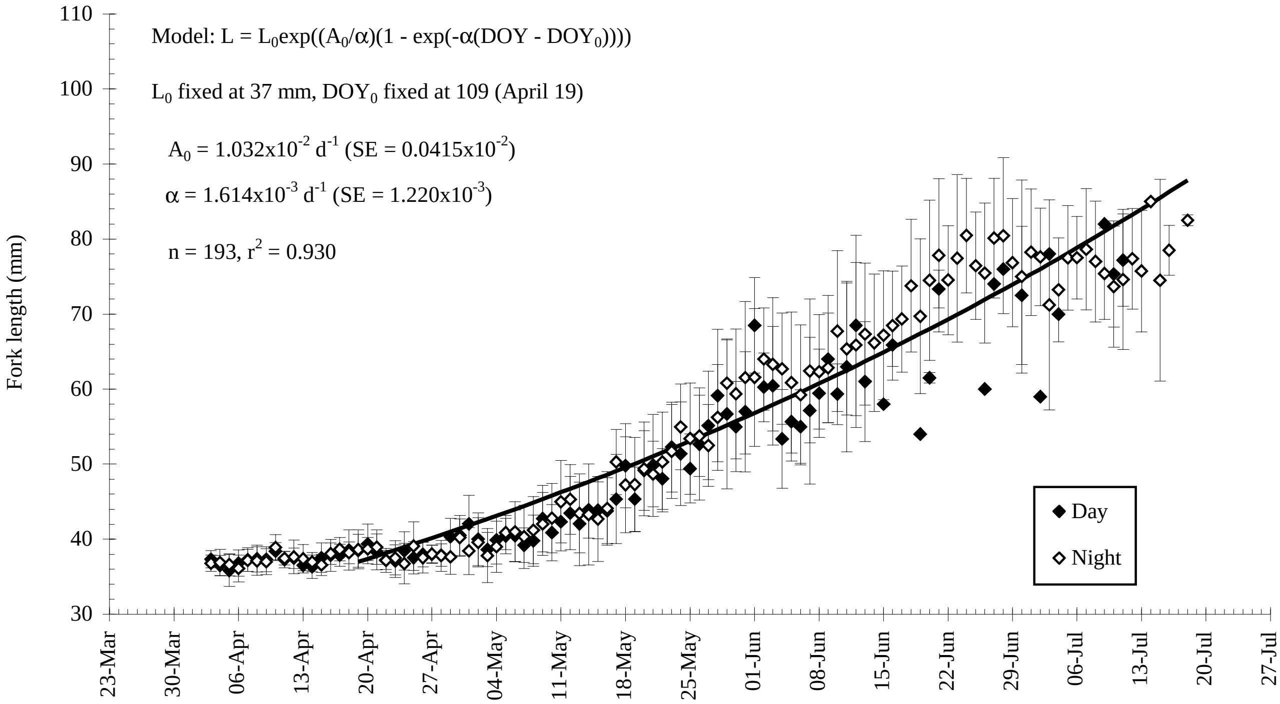
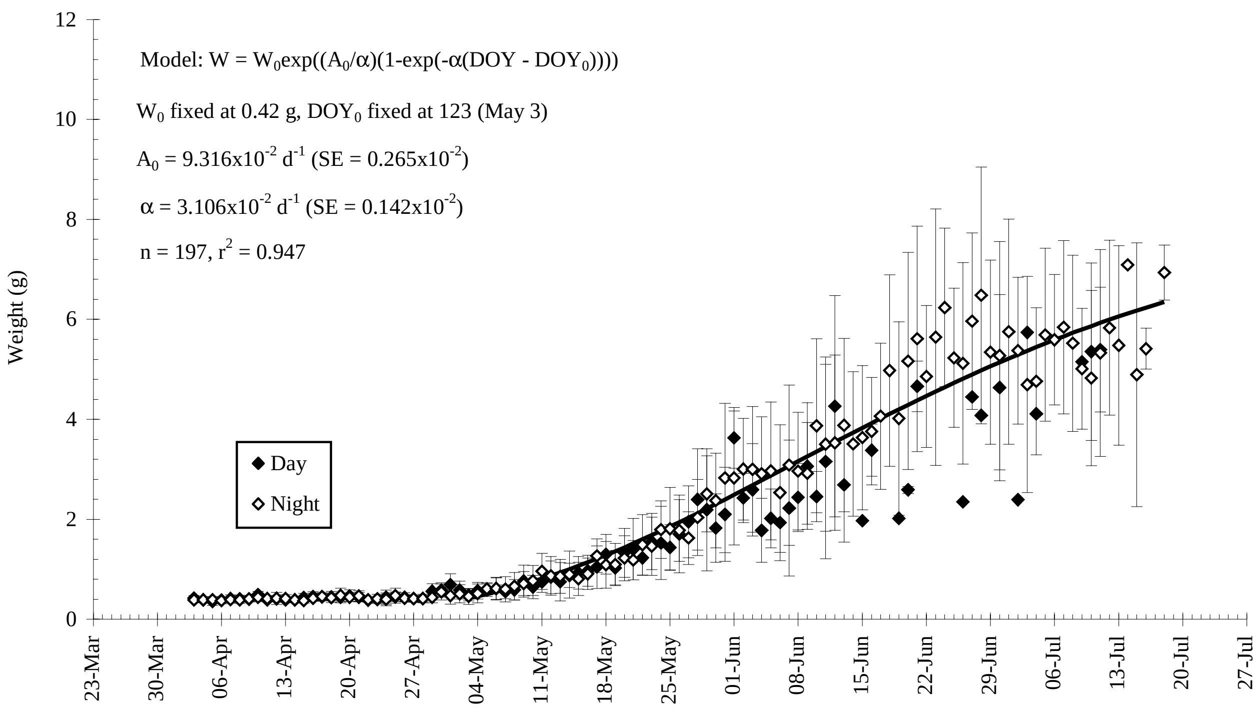


Figure 18
Mean (±1 SD) Weight-at-date of 0+ Chinook Salmon, Nechako River, 1998: Rotary Screw Traps



1+ Chinook Salmon: Growth

A total of 1,201 1+ chinook salmon were measured for size at Diamond Island in 1998 (Table 4 and Appendix 2). Two-way ANOVAs of size with time of day (i.e. day or night) and date showed that both mean length ($F_{1,930}$ = 11.2, P = 0.001) and mean weight ($F_{1,930}$ = 14.1, P<0.001) varied significantly with date over April and May (due to growth), but that there were no significant changes in mean length with time of day ($F_{1,930}$ = 1.7, P = 0.188) or in mean weight with time of day ($F_{1,930}$ = 2.4, P = 0.124), and no significant interactions of date and time of day for length ($F_{1,930}$ = 0.5, P = 0.481) or weight ($F_{1,930}$ = 0.7, P = 0.387). Therefore, linear regressions of mean length and weight on DOY were calculated (weighted by sample size) (Figures 19 and 20).

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

A regression of weight on length for trap-caught juvenile chinook salmon at Diamond Island (n = 4,350, r^2 = 0.990, P<0.001):

$$(7) \quad \log_e(W) = -12.727 + 3.296\log_e(L)$$

was similar to the regression for juvenile chinook salmon captured by electrofishing and so it was not shown as a figure in this report.

0+ and 1+ Chinook Salmon: Condition

The plot of mean condition-at-date of 0+ chinook salmon was similar to that shown for electrofished fish-condition increased over April and May to an asymptote of 1.2 g / mm^3 in late June and July (Figure 21). Condition of 1+ chinook also increased with date from 1.05 g / mm^3 in early April to 1.2 g / mm^3 in July (Figure 22).

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 1998. The curvature of the growth curves of 0+ chinook indicated that emergence ceased in early May and that growth was very rapid during late May, June and July. However, growth appeared to slow substantially later in the year. Part of that apparent slowdown may have been due to size-selective outmigration rather than to actual reduction in growth rate. That is, larger better-conditioned 0+ chinook may have left the river before November to smolt or to seek rearing habitat downstream, leaving smaller and poorly-conditioned fish to overwinter in the upper Nechako. That hypothesis is the simplest explanation of the substantially lower condition of electrofished chinook in November compared to July.

Catches of Chinook Salmon

Electrofishing/All Species

A total of 1,309 electrofishing sweeps were made along the margins of the upper Nechako River from April 3 to November 6: 659 during daylight and 670 at night. The average area covered by a sweep was 133 m^2 (SD = 120).

A total of 79,099 fish from 14 species or families were captured and then released (Table 1). Chinook salmon was the most common species (n = 21,842 or 27.61% of the total number), followed by redsided shiner (n = 17,408 or 22.01%) and largescale sucker (n = 12,518 or 15.83%). Bull trout was the least common species (n = 1 or 0.001%).

Electrofishing/0+ Chinook

A total of 21,507 0+ chinook were captured by electrofishing (Table 2), of which 4,526 or 21.04% were taken during daylight and the other 16,981 were taken at night. Catch-per-unit-effort (CPUE) of electrofishing catches of 0+ chinook ranged from 0 to 295 fish / 100 m^2. Variance of mean monthly CPUE increased directly with mean monthly CPUE, indicating that the $\log_e$(CPUE + 1) transformation was required to stabilise the variance (Sokal and Rohlf 1981).

Temporal Distribution of CPUE

Maximum density of 0+ chinook salmon occurred in early April for both day and night catches and then decreased with date through to November (Table 2 and Figure 23). To calculate the average rate of loss of 0+ chinook density with time, individual measurements of $\log_e$(CPUE + 1) were regressed on DOY for day and night catches separately. The predictive regressions were highly significant (P<0.001). The percent of variance explained by the regressions did not exceed 29% because of the large variation in $\log_e$(CPUE + 1) due to non-uniform distribution of chinook along the river.

Figure 19
Mean (±1 SD) Length-at-date of 1+ Chinook Salmon, Nechako River, 1998: Rotary Screw Traps

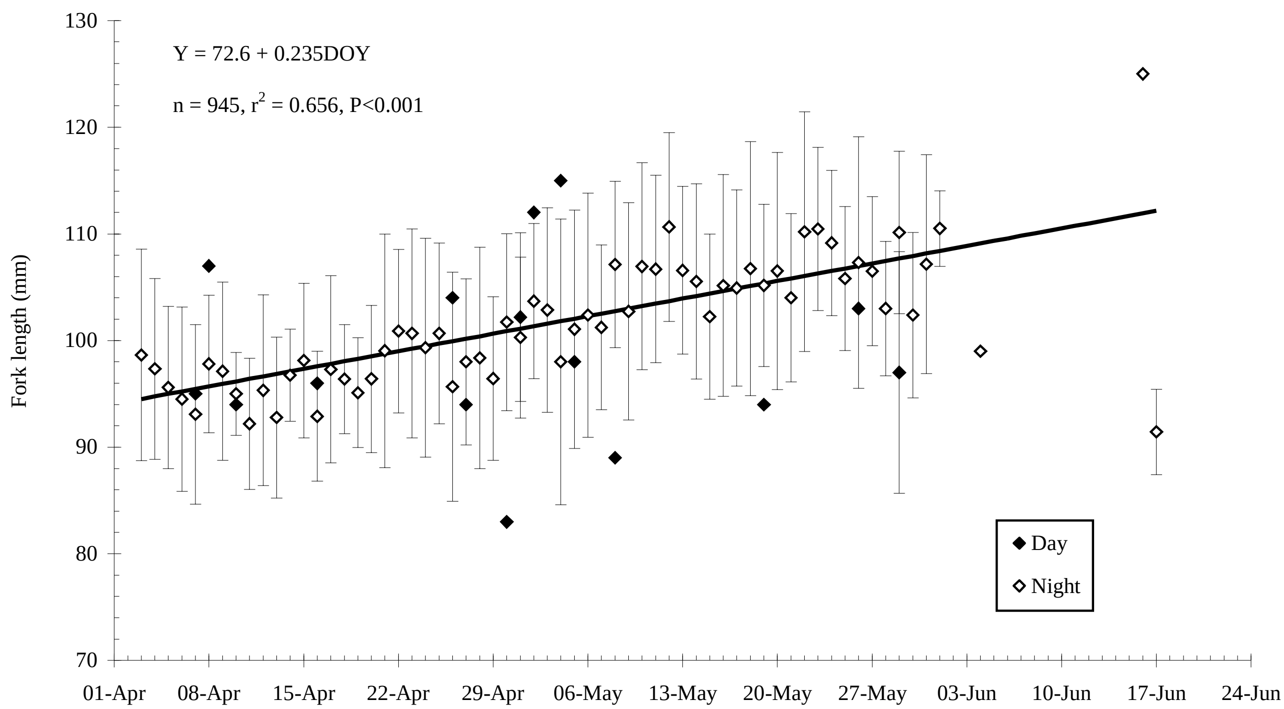


Figure 20
Mean (±1 SD) Weight-at-date of 1+ Chinook Salmon, Nechako River, 1998: Rotary Screw Traps

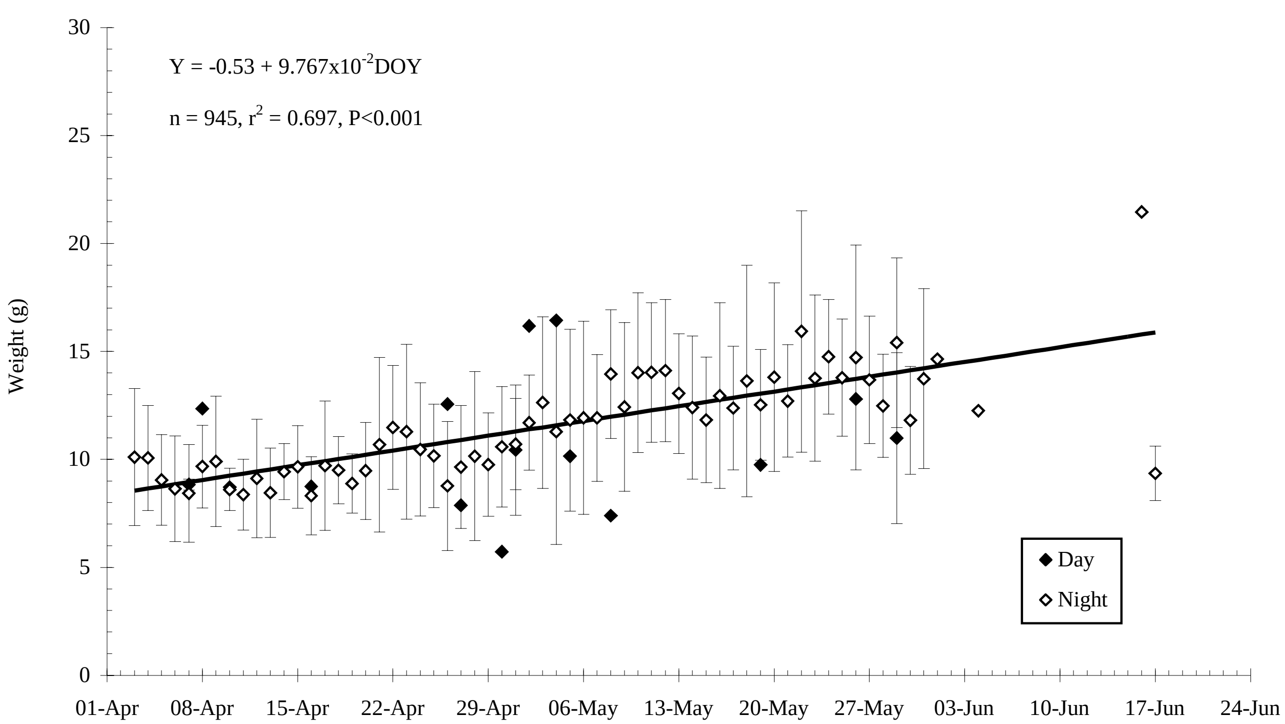


Figure 21
Mean (±1 SD) Condition-at-date of 0+ Chinook Salmon, Nechako River, 1998: Rotary Screw Traps

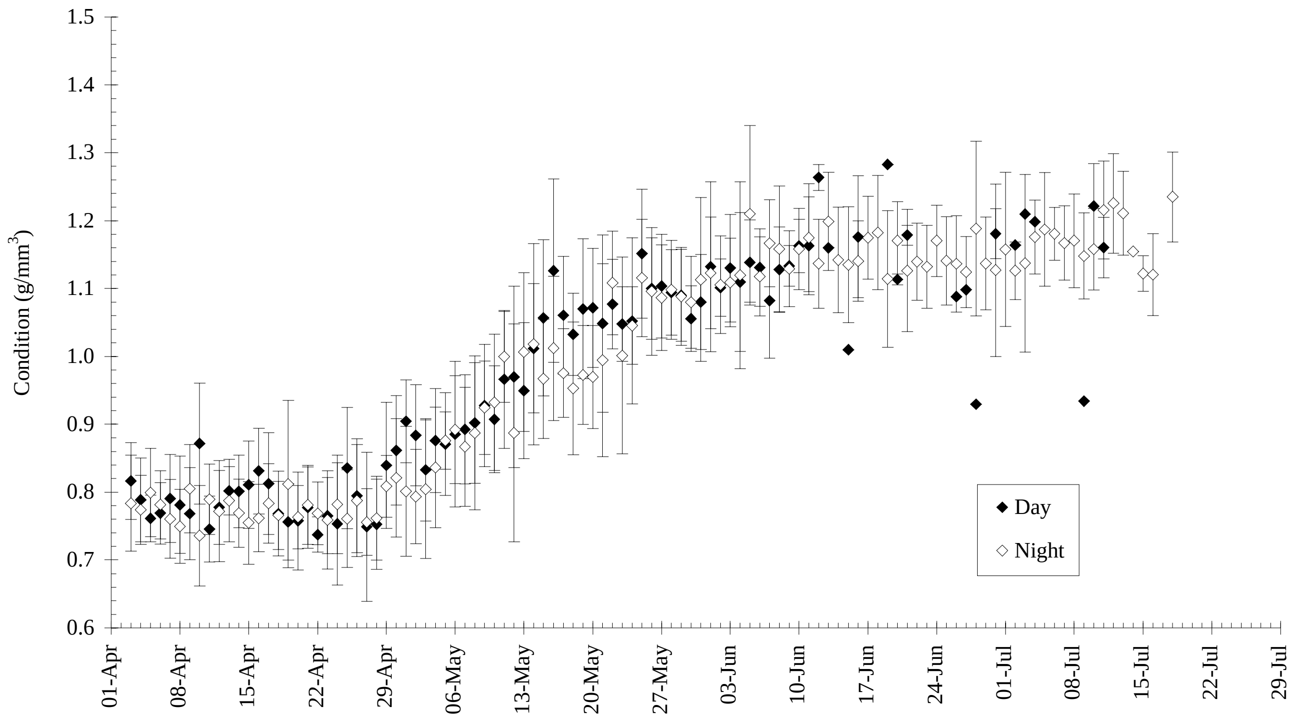


Figure 22
Mean (±1 SD) Condition-at-date of 1+ Chinook Salmon, Nechako River, 1998: Rotary Screw Traps

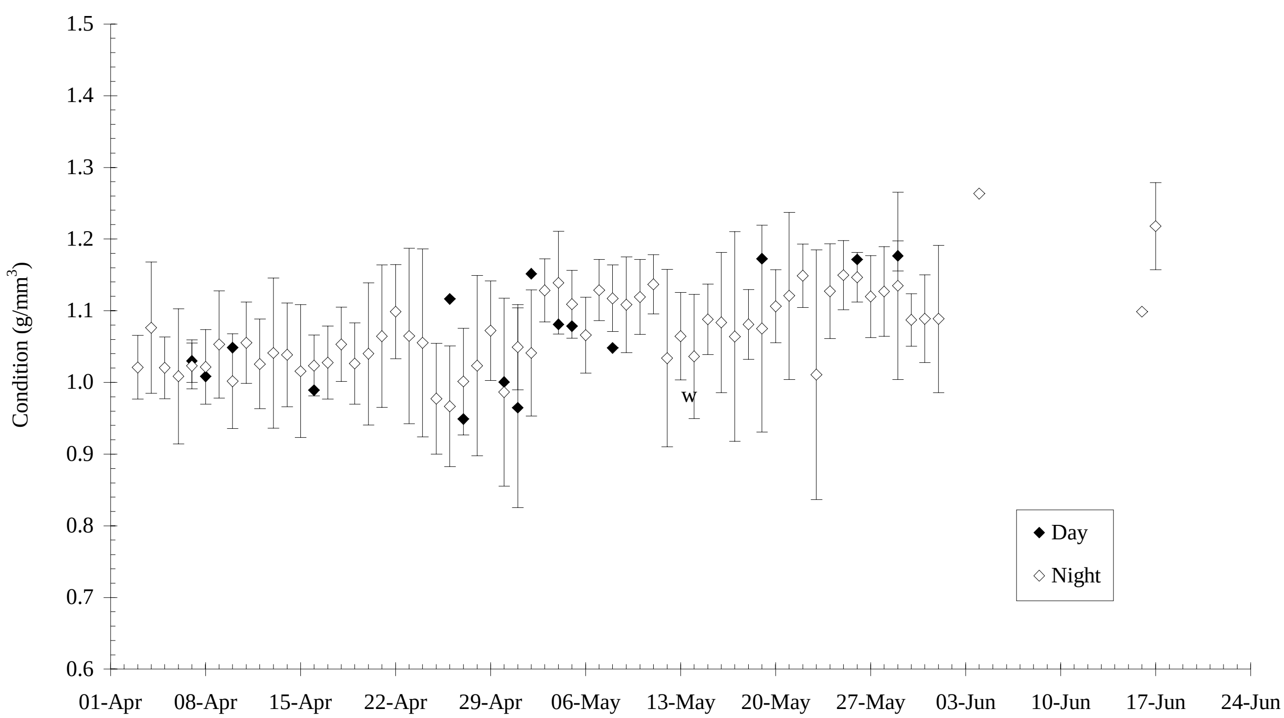


Table 1
Number of Fish Captured in the Upper Nechako River, 1998, by Electrofishing

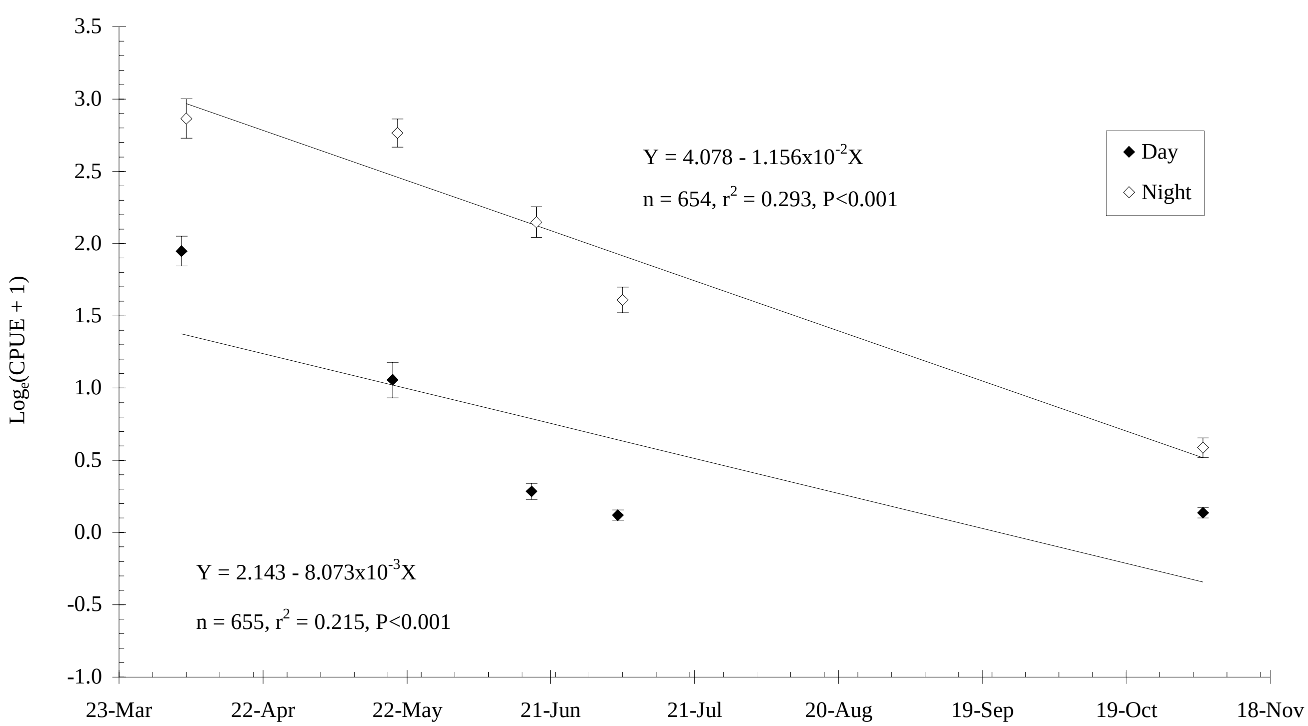
Common Name	Scientific Name	Adult				Juvenile				Total			
		Day	Night	Total	Percent	Day	Night	Total	Percent	Day	Night	Total	Percent
Chinook salmon	*Oncorhynchus tshawytscha*	0	0	0	0	4,587	17,255	21,842	28	4,587	17,255	21,842	27.61
Redsided shiner	*Richardsonius balteatus*	893	3,151	4,044	5	3,898	9,466	13,364	17	4,791	12,617	17,408	22.01
Largescale sucker	*Catostomus macrocheilus*	12	66	78	0	2,969	9,471	12,440	16	2,981	9,537	12,518	15.83
Northern pikeminnow[a]	*Ptychocheilus oregonensis*	11	306	317	0	2,344	5,779	8,123	10	2,355	6,085	8,440	10.67
Leopard dace	*Rhinichthys falcatus*	778	1,422	2,200	3	2,370	1,959	4,329	5	3,148	3,381	6,529	8.25
Sculpins (General)	*Cottidae*	811	995	1,806	2	1,523	1,530	3,053	4	2,334	2,525	4,859	6.14
Longnose dace	*Rhinichthys cataractae*	862	391	1,253	2	3,208	411	3,619	5	4,070	802	4,872	6.16
Rocky mountain whitefish	*Prosopium williamsoni*	0	123	123	0	745	1,114	1,859	2	745	1,237	1,982	2.51
Peamouth chub	*Mylocheilus caurinus*	0	4	4	0	100	170	270	0	100	174	274	0.35
Rainbow trout	*Oncorhynchus mykiss*	4	45	49	0	33	134	167	0	37	179	216	0.27
Lake trout	*Salvelinus namaycush*	0	0	0	0	132	4	136	0	132	4	136	0.17
Burbot	*Lota lota*	1	2	3	0	7	8	15	0	8	10	18	0.02
Sockeye salmon	*Oncorhynchus nerka*	0	0	0	0	2	2	4	0	2	2	4	0.01
Bull trout	*Salvelinus confluentes*	0	0	0	0	0	1	1	0	0	1	1	0.00
Total		3,372	6,505	9,877	12	21,918	47,304	69,222	88	25,290	53,809	79,099	100.00

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

Table 2
Mean Monthly Electrofishing Catch-per-unit-effort (CPUE, number / 100 m^2)
of Juvenile Chinook Salmon, Nechako River, 1998

	Number			0+ CPUE		1+ CPUE		0+ log_e(CPUE+1)		1+ log_e(CPUE+1)	
Date	0+	1+	n	mean	SD	mean	SD	mean	SD	mean	SD
Day											
05-Apr	2055	60	136	12.584	17.534	0.447	1.582	1.9475	1.2059	0.2115	0.4430
19-May	2076	1	137	11.053	31.137	0.006	0.071	1.0557	1.4329	0.0044	0.0518
17-Jun	230	0	137	0.990	3.772	0.000	0.000	0.2842	0.6532	0.0000	0.0000
05-Jul	127	0	135	0.398	2.756	0.000	0.000	0.1197	0.4073	0.0000	0.0000
04-Nov	38	0	110	0.286	0.962	0.000	0.000	0.1372	0.3886	0.0000	0.0000
sum	4526	61									
Night											
06-Apr	7427	236	135	45.191	61.316	1.622	3.408	2.8659	1.5735	0.5667	0.7778
20-May	4870	37	137	27.439	34.157	0.221	0.573	2.7652	1.1437	0.1376	0.3110
18-Jun	3015	0	137	17.178	25.341	0.000	0.000	2.1479	1.2505	0.0000	0.0000
06-Jul	1488	1	137	8.415	14.267	0.006	0.071	1.6102	1.0330	0.0044	0.0518
04-Nov	181	0	108	1.420	2.335	0.000	0.000	0.5876	0.7069	0.0000	0.0000
sum	16981	274									
Pooled											
sum	21507	335									

Figure 23
Mean (±1 SE) Monthly Electrofishing (CPUE, number / 100 m^2) of 0+ Chinook Salmon, Nechako River, 1998



The night-time rate of loss of $\log_e$(CPUE + 1) of 1.16% / d (SE = 0.07) was greater than the daytime rate of loss of 0.81 % / d (SE = 0.06) (Figure 23). However, the two rates were not statistically different from one another (t_{1307} = 0.038, P>0.9).

The intercept of the night regression of 4.078 (SE = 0.131) was 1.9 times greater than the intercept of the day regression of 2.143 (SE = 0.113), but the difference was not statistically significant either (t_{1307} = 0.030, P>0.9). The most likely reasons for the day-night difference in magnitude of $\log_e$(CPUE + 1) were: (1) juvenile chinook are more vulnerable to capture at night than during day because they are less able to detect and avoid the gear at night than during the day; and (2) greater numbers of juvenile chinook are active at night than during the day because of the need to avoid predators. That is, fry may have sought refuge during the day in habitat that was difficult to sample, but came out of refuge at night and were caught in greater numbers at that time.

The differences between the predicted $\log_e$(CPUE + 1) of day and night catches at the beginning and end of the regression period provide a range of estimates of the day-night difference in electrofishing catchability of 0+ chinook. In early April, the night-day difference was 1.592 (= 2.968 - 1.376), which means that night electrofishing caught an average of 4.9 times (= exp(1.592)) more 0+ chinook than day electrofishing. In early November, night electrofishing caught an average of 2.4 times (= exp(0.517 + 0.343)) more 0+ chinook than day electrofishing.

Spatial Distribution of CPUE

Figures 24 and 25 and Appendix 3 show the monthly distribution of mean $\log_e$(CPUE + 1) of 0+ chinook salmon over the upper 100 km of the Nechako River, aggregated into 10 km intervals.

In April, day sampling showed two peaks of 0+ chinook CPUE: an upstream one between 20 and 30 km from Kenney Dam, and the downstream one between 70 and 80 km. Few 0+ chinook were caught within the first 10 km from Kenney Dam. Night sampling in April showed a similar pattern.

In May, the distribution of CPUE shifted upstream in both day and night sampling. The upstream peak moved 10 km further upstream.

By mid-June, the upstream peak had moved within 10 km of Kenney Dam and the downstream peak had largely disappeared. A similar pattern was evident in July.

By early November, the 0+ chinook remaining in the river had redistributed themselves roughly evenly along the length of the river, and no clear peaks were visible.

In summary, the 1998 electrofishing surveys showed that newly-emergent 0+ chinook salmon were concentrated in two regions of the upper river. Over the next three months (April to June), the upstream concentration moved 20 km upstream to within 10 km of Kenney Dam, and the downstream concentration disappeared. That indicated active upstream migration of juveniles, presumably in search of rearing habitat. That pattern persisted through July. By early November, those juveniles remaining in the river had redistributed themselves evenly over the upper river, presumably in search of overwintering habitat.

To quantify those observations, the monthly x-centroid, x_m (km), or weighted center of distribution of 0+ chinook along the longitudinal (x-axis) of the river, was calculated as:

$$x_m = \sum^{i} (CPUE_i . x_i) / \sum^{i} CPUE_i \quad (8)$$

where $CPUE_i$ = CPUE at site i and x_i = longitudinal distance (km) from Kenney Dam to site i. The centroids confirmed the upstream migration of juvenile chinook towards Kenney Dam between April and June followed by downstream movement in fall as resident fish searched for overwintering habitat (Table 3).

Electrofishing/1+ Chinook

A total of 335 1+ chinook were captured by electrofishing (Table 2), of which 18% were taken during the day and the rest taken at night. CPUE of 1+ chinook ranged from 0.000 to 26.67 fish / 100 m^2, and decreased rapidly with date (Table 2 and Figure 26).

Figure 24
Mean (±1 SD) Monthly Catch-per-unit-effort (CPUE) of 0+ Chinook Salmon, Nechako River, 1998: Electrofishing (day)

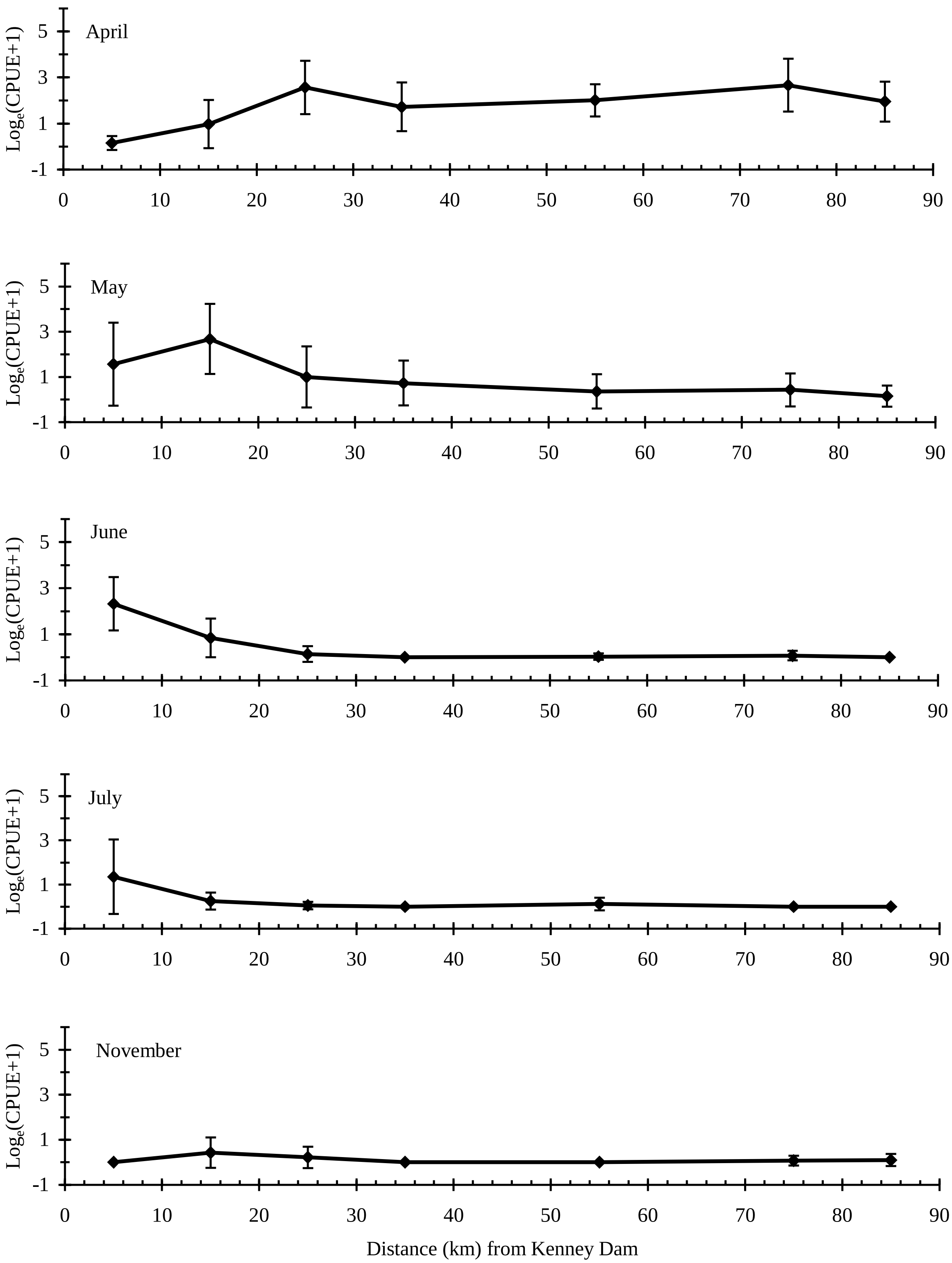


Figure 25
Mean (±1 SD) Monthly Catch-per-unit-effort (CPUE) of 0+ Chinook Salmon,
Nechako River, 1998: Electrofishing (night)

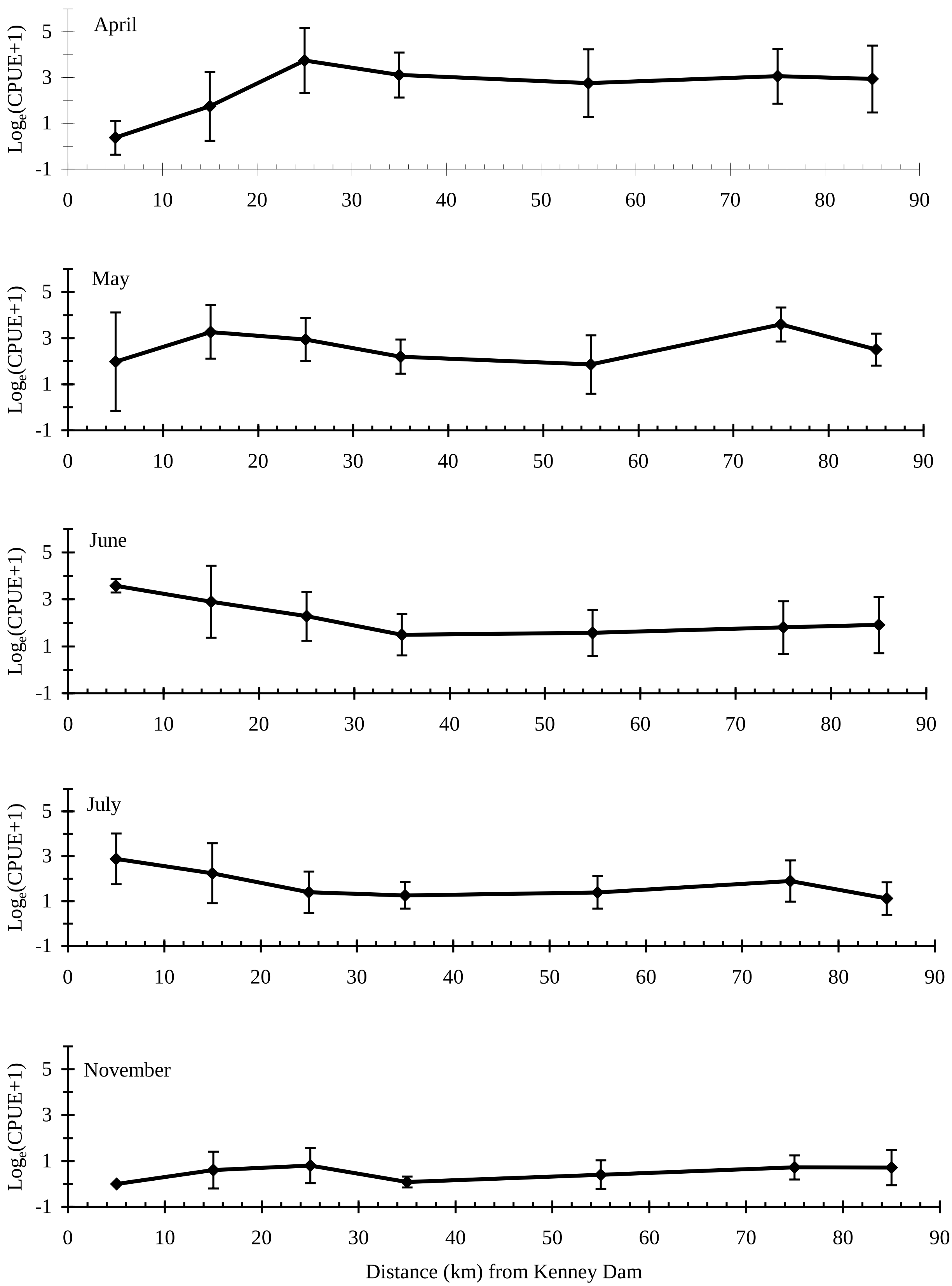


Table 3
Centroids of Juvenile Chinook Salmon Along the Longitudinal Axis of the Upper Nechako River, 1998

Date	Centroid (km) 0+	1+
Day		
05-Apr	51.7	50.3
19-May	23.9	35.0
17-Jun	20.9	-
05-Jul	31.2	-
04-Nov	40.7	-
Night		
06-Apr	47.0	52.8
20-May	45.9	39.3
18-Jun	24.9	-
06-Jul	29.5	15.0
04-Nov	45.7	-

Average rates of loss of 1+ chinook over April, May and June were calculated by regressing individual estimates of $\log_e$(CPUE + 1) on DOY. The day rate was 0.30%/d (SE = 0.04) and the night rate was 0.78%/d (SE = 0.08) (Figure 26).

Electrofishing CPUE for 1+ chinook showed that their abundance in April tended to increase with downstream distance, which was expected in fish that were migrating out of the river (Figure 27). By May, CPUE of 1+ chinook was roughly constant along the length of the upper river. By June, there were too few 1+ chinook in the river to allow for any generalisations about the distribution.

Diamond Island Rotary Screw Traps/0+ Chinook

A total of 8,483 juvenile chinook salmon were caught by rotary screw traps at Diamond Island in 1998 (Table 4 and Appendix 4): 7,282 0+ and 1,201 1+.

Methods of Analysis

All analyses of RST catches were based on numbers expanded by the ratio of river flow to trap flow according to equation (2).

The frequency distributions of expanded numbers of juvenile chinook salmon at Diamond Island required $\log_e$-transformation before analysis. However, the $\log_e$(number) transformation, rather than the $\log_e$(number + 1) transformation, was used for RST catches because the population expansion procedure

Figure 26
Mean (±1 SE) Monthly Electrofishing CPUE of 1+ Chinook Salmon, Nechako River, 1998

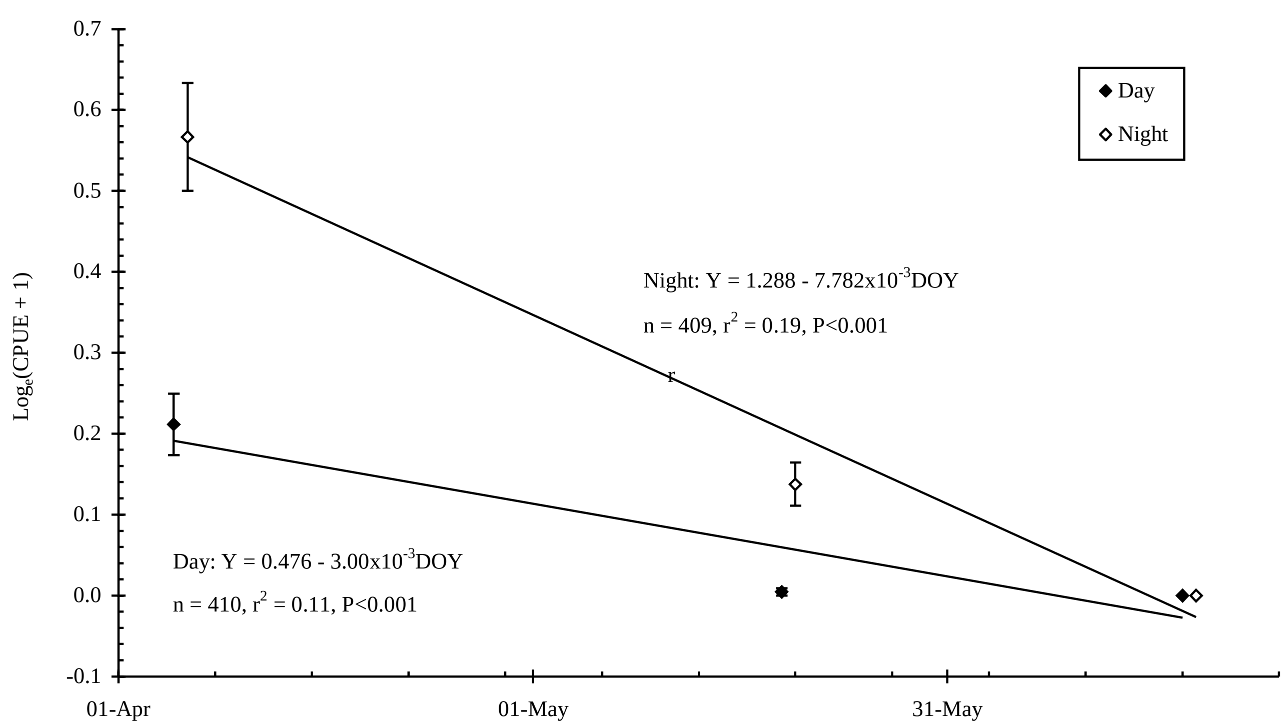


Figure 27
Spatial Distribution of 1+ Chinook Salmon of the Upper Nechako River, 1998: Electrofishing

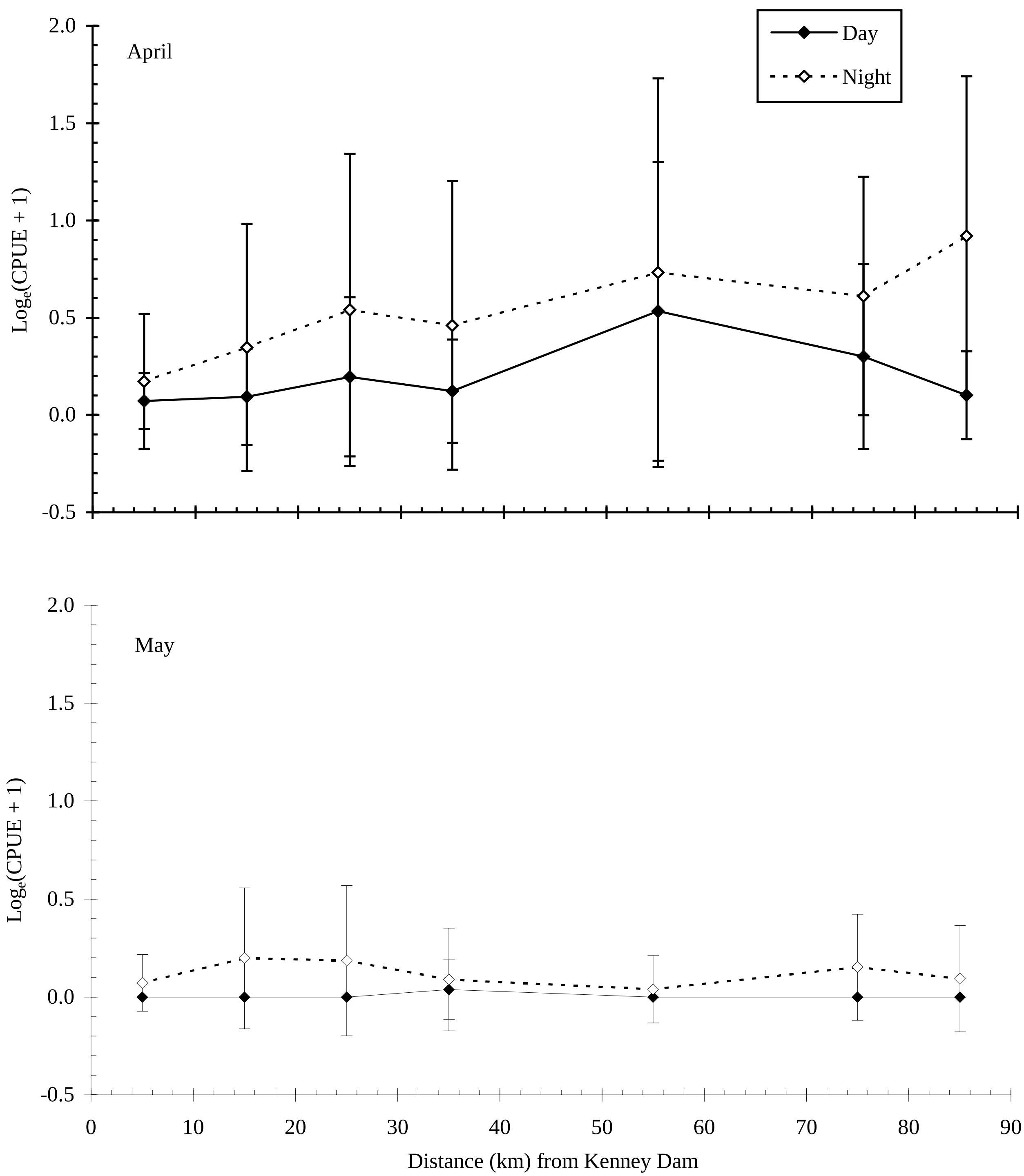


Table 4
Numbers of Juvenile Chinook Salmon Caught in Rotary Screw Traps, Diamond Island, Nechako River, 1998

Trap number	chinook 0+			chinook 1+		
	day	night	total	day	night	total
1	441	2,388	2,829	15	629	644
2	392	1,892	2,284	6	465	471
3	737	1,432	2,169	0	86	86
total	1,570	5,712	7,282	21	1,180	1,201

effectively divided catches into two clusters of data: zero catches and non-zero catches. Non-zero catches were expanded by a factor of about 100 because most RSTs sampled about 1% of the daily flow of the river past Diamond Island, but zero catches were expanded to population estimates of zero-in effect they were not expanded at all. To avoid the problem of combining two separate clusters of data, all zero catches of all Diamond Island traps were excluded from the analyses presented below.

Temporal Variance of Estimated Number

To determine which factors were responsible for changes in expanded numbers of 0+ chinook salmon caught in rotary screw traps, a standard three-way ANOVA of $\log_e$(number) on time of day (two classes: day and night), date (three classes: April, May and June-July), and RST (three classes corresponding to the three traps), was conducted. There were highly significant differences in $\log_e$(number) between day and night ($F_{1,475}$ = 184.4, P<0.001), among dates ($F_{2,475}$ = 38.6, P<0.001) and among traps ($F_{2,475}$ = 21.0, P<0.001). There were also highly significant interactions of date and time of day ($F_{2,475}$ = 27.0, P<0.001), date and RST ($F_{4,475}$ = 16.8, P<0.001), time of day and RST ($F_{2,475}$ = 14.1, P<0.001), and but not of date, time of day and trap ($F_{4,475}$ = 2.1, P = 0.081).

Figures 28 and 29 showed that catches tended to be greater at night than during the day during most months. Those differences were most likely due to: (1) greater avoidance of traps during the day than at night; and (2) greater numbers of juvenile chinook migrating at night than during the day.

The date effect was due to recruitment of juveniles to the traps over April and early May followed by loss of juveniles over late May, June and July due to a combination of downstream dispersal, natural mortality, and changes in the catchability of the traps as chinook fry grew in size and increased their ability to avoid capture.

The trap effect was due to greater catches in trap number 1 than in trap numbers 2 and 3 (Table 4 and Appendix 4), indicating that 0+ chinook salmon tended to pass closer to the left bank of the river at Diamond Island than to the right bank or the middle of the river.

The catch curves for the weighted average volume-expanded numbers measured during the day showed the typical three-part dome-shaped pattern observed in previous years (Figure 28). There was an initial period of increasing catches in April and May as juveniles recruited to Diamond Island from upstream emergence sites. Day catches reached a peak in late April and early May, and then decreased over late May, June and July due to a combination of downstream dispersal, natural mortality, and changes in the catchability of the traps due to growth of juvenile chinook.

It was more difficult to detect a dome-shaped pattern in the night RST catch curve (Figure 29). Instead, night numbers appeared to decrease continuously with time from early April, with substantial variation about that trend. It is not clear why there were such large differences between the two catch curves, but they may have been due to greater number of fry moving at night than during the day to avoid predators.

To estimate the time rates of loss of juvenile 0+ chinook from the RSTs, linear regressions of $\log_e$(number) on day of year (DOY) were fit to the declining right-hand limbs of both the day and night catch curves. Based on numbers alone, the dome of the day catches began on May 3, which was within the range of dates of the second growth stanza (April 19 to May 3) that were estimated from RST sizes-at-date. However, based on numbers alone, the dome of the night catches began 25 days later on May 28. Therefore, the midpoint of those two dates or May 16 was chosen as the beginning of the right-hand limb for both day and night catches.

Figure 28
Number of 0+ Chinook Salmon Passing Diamond Island, Nechako River, 1998, as Estimated by Rotary Screw Traps (day)

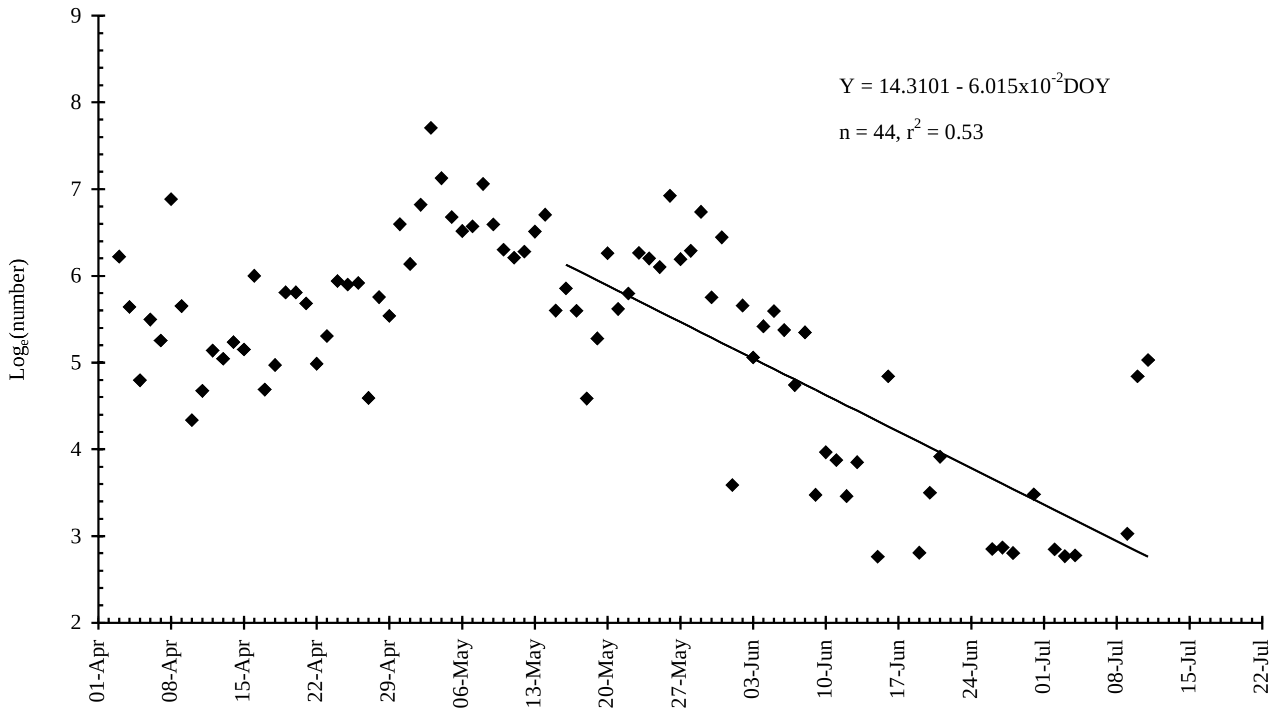
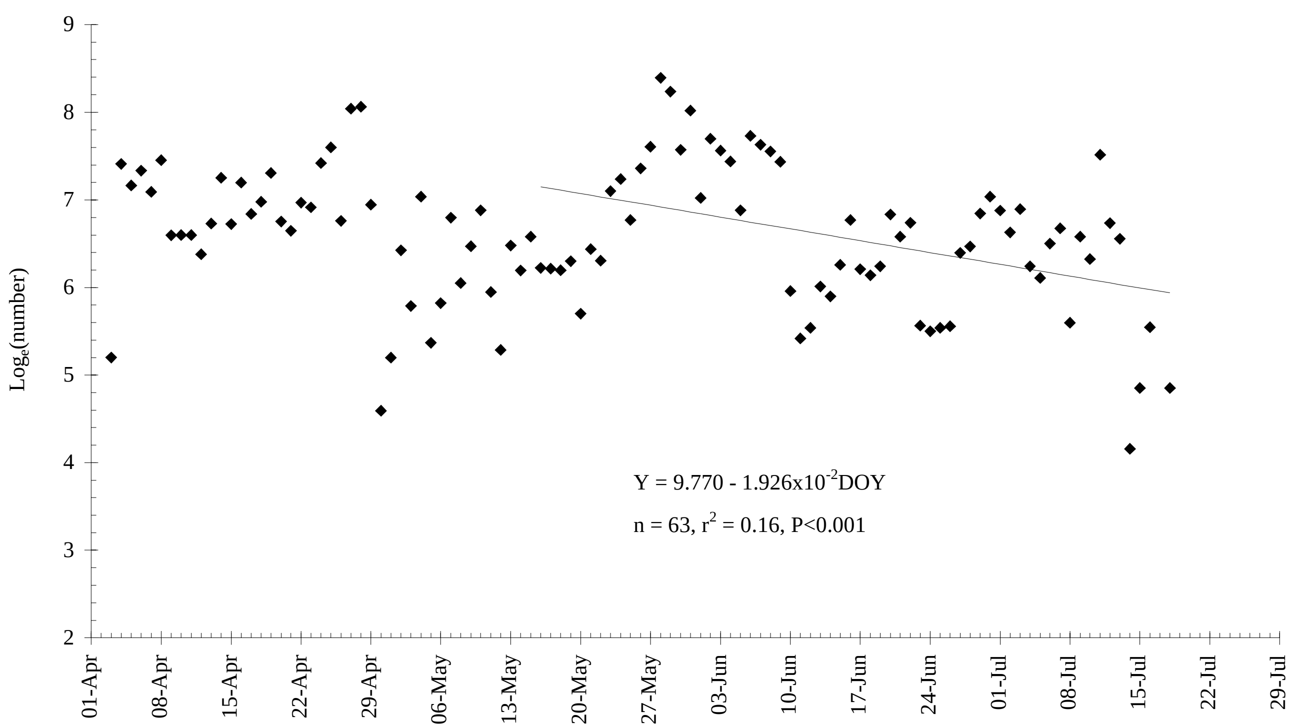


Figure 29
Number of 0+ Chinook Salmon Passing Diamond Island, Nechako River, 1998, as Estimated by Rotary Screw Traps (night)



Instantaneous rates of loss were 6.02%/d (SE = 0.85) for day catches (Figure 28), and 1.93%/d (SE = 0.54) for night catches (Figure 29). The three-fold difference between the two rates was probably due to greater avoidance of traps during the day, an avoidance that increased with increasing fish size, and to day-night differences in the number of fry that moved downstream.

A total of 7,282 0+ chinook salmon were caught at the rotary screw traps in 1998 (Table 4 and Appendix 4). Summing the volume-expanded number of 0+ chinook that were estimated to have passed Diamond Island between April 3 and July 18 produced totals ranging from 106,661 for trap 2 to 182,055 for trap 3. The total index number of 0+ chinook that passed Diamond Island, weighted by the average percent of river flow filtered by each trap, was 133,709.

Diamond Island Rotary Screw Traps/1+ Chinook

There were no clear domes or declining right-hand limbs for the catch curves of 1+ chinook (Figure 30). The average number of night catches (262) was more than 10 times greater than the average number of day catches (24).

A total of 1,201 1+ chinook were captured in the rotary screw traps between April 3 and June 17 which, when expanded by the percentage of river flow sampled by the traps, was equivalent to a total of 22,436 1+ chinook that passed Diamond Island in 1998 (Appendix 4).

Diamond Island Rotary Screw Traps/Other Fishes

A total of 15,563 fish from 12 species or families were captured by the rotary screw traps in 1998 (Table 5). Chinook salmon was the most common species, making up 54.51% of all fish. The three most common non-salmonid fishes were redsided shiner, leopard dace and largescale sucker. The least common fish was burbot-only three were caught in 1998. That distribution of number-by-species was similar to that reported for the electrofishing surveys.

Comparison with Previous Years

This section of the report compared the results of the 1998 investigations with results from the previous nine years of monitoring the upper Nechako River. The first step was to compare daily temperatures and flows among the years 1987 to 1998 to identify years of unusually high or low temperatures and flows. The next step was to determine if the biological features of 0+ chinook salmon population of the upper Nechako River reflected among-year differences in temperature and flow.

Temperature

Mean daily water temperatures at Bert Irvine's Lodge in 1998 were among the highest recorded since 1987 (Figures 31 and 32). Between January 1 and April 27, and between September 4 and December 31, temperatures were similar to the 10-year average. However, temperatures between April 28 and September 3 were consistently greater than the 10-year average by as much as 4.9°C. Relatively high air temperatures in May and June were responsible for the rapid increase in water temperature. Those temperatures had begun to decline by July 16 when cooling flows were first released from Skins Lake Spillway. The release of those flows from July 16 to August 14 further reduced temperatures to between 0 and 3°C above the 10-year average.

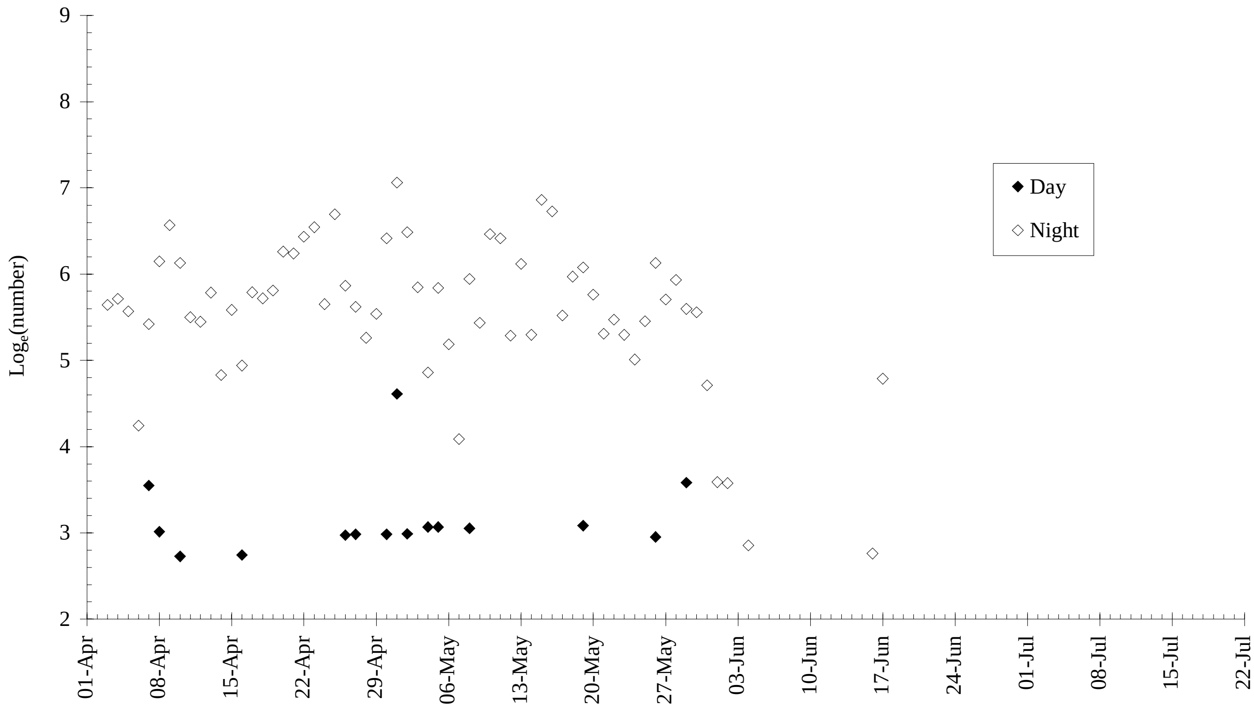
Flow

Unlike 1996 and 1997, daily flows of the upper Nechako River at Cheslatta Falls in 1998 were close to the 10-year average (Figure 33). Cumulative daily flows for 1998 fell within the range observed for 1987 to 1995 (Figure 34).

Growth of 0+ Chinook Salmon

Plots of mean length-at-date, weight-at-date and condition-at-date of 0+ chinook salmon electrofished over the last 10 years (Figure 35), and from rotary screw catches at Diamond Island conducted over the last nine years (Figure 36), and plots of length-at-age and weight-at-age predicted by the growth curves for electrofished fish for the last 8 years (Table 6 and Figure 37), showed the same growth pattern: (a) mean sizes-at-date in April 1998 were within the observed range for previous years; (b) mean sizes-at-date in May, June and July of 1998 were greater than any other observed over the previous nine years; and (c) mean sizes-at-date in November were below the observed range for previous years.

Figure 30
Number of 1+ Chinook Salmon Passing Diamond Island, Nechako River, 1998, as Estimated by Rotary Screw Traps



The most likely reason for the unusual growth pattern of juvenile chinook salmon in 1998 was the unusual temperature pattern of 1998, particularly the high water temperatures of May, June and July. Growth of fishes increases with increasing temperature, all other factors being equal, as long as the range of temperatures falls within the zone of physiological tolerance (Ricker 1979), as temperatures did in 1998. Flows were unlikely to be involved because the flow pattern of 1998 was similar to those of 1987 to 1995.

The unusually low size-at-date for November 1998 can also be explained by temperature, albeit indirectly, if unusually fast growth in spring and summer of 1998 allowed a large proportion of 0+ chinook to smolt within their first year of life instead of waiting until next spring, or to move downstream in search of rearing habitat. Those fish would have left the upper Nechako River before November, leaving only smaller fish to overwinter.

Spatial and Temporal Distribution of 0+ Chinook

Unlike growth data, the catch curves of monthly electrofishing CPUE in 1998 (Figure 38), and the seasonal pattern of change in the centroids of 0+ chinook in 1998 (Figure 39), did not show any unusual features compared to the previous seven to nine years. Daily indices of 0+ chinook outmigration measured at Diamond Island in 1997 also fell within the range observed in the previous seven years (Figure 40). Those findings are consistent with the average flow pattern of 1998. They also indicate that the high temperatures of the upper Nechako River in spring-summer 1998 had no obvious effects on the spatial and temporal distribution of 0+ chinook in 1998.

One possible reason for the lack of an obvious relationship between the distribution and abundance of juvenile chinook in the upper Nechako River in 1998 and flows and temperature was that flow-temperature "signals" may have been obscured by among-year variation in the number of emergent fry which, in turn, was due to among-year variation in the number of spawners. To remove the effect of this variation, both

Table 5
Number of Fish Captured at Diamond Island, Nechako River, 1998, by Rotary Screw Traps

		Adult				Juvenile				Total			
Common Name	Scientific Name	Day	Night	Total	Percent	Day	Night	Total	Percent	Day	Night	Total	Percent
Chinook salmon	*Oncorhynchus tshawytscha*	0	0	0	0.00	1591	6892	8483	54.51	1591	6892	8483	54.51
Redsided shiner	*Richardsonius balteatus*	10	710	720	4.63	143	912	1055	6.78	153	1622	1775	11.41
Leopard dace	*Rhinichthys falcatus*	30	1108	1138	7.31	11	269	280	1.80	41	1377	1418	9.11
Largescale sucker	*Catostomus macrocheilus*	1	105	106	0.68	114	1102	1216	7.81	115	1207	1322	8.49
Northern pikeminnow[a]	*Ptychocheilus oregonensis*	0	7	7	0.04	9	933	942	6.05	9	940	949	6.10
Sockeye salmon	*Oncorhynchus nerka*	0	0	0	0.00	40	610	650	4.18	40	610	650	4.18
Rocky mountain whitefish	*Prosopium williamsoni*	0	1	1	0.01	16	471	487	3.13	16	472	488	3.14
Longnose dace	*Rhinichthys cataractae*	1	125	126	0.81	2	45	47	0.30	3	170	173	1.11
Peamouth chub	*Mylocheilus caurinus*	0	0	0	0.00	18	153	171	1.10	18	153	171	1.10
Rainbow trout	*Oncorhynchus mykiss*	0	3	3	0.02	6	63	69	0.44	6	66	72	0.46
Sculpins (General)	*Cottidae*	4	24	28	0.18	7	24	31	0.20	11	48	59	0.38
Burbot	*Lota lota*	0	1	1	0.01	0	2	2	0.01	0	3	3	0.02
Total		46	2084	2130	13.69	1957	11476	13433	86.31	2003	13560	15563	100.00

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

Figure 31
Mean, Maximum and Minimum Daily Water Temperature of the Upper Nechako River at Bert Irvine's Lodge, 1987 to 1998

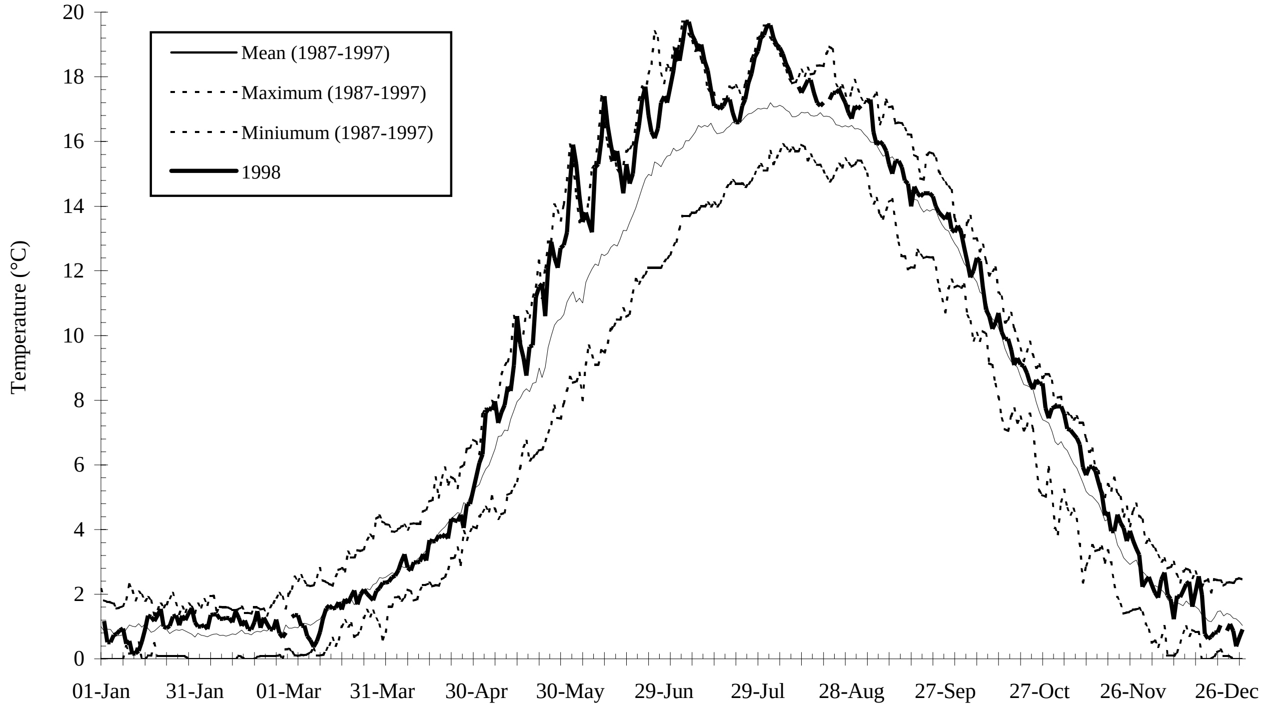


Figure 32
Difference Between Mean Daily Temperature of the Upper Nechako River at Bert Irvine's Lodge in 1998 and 1987 to 1997

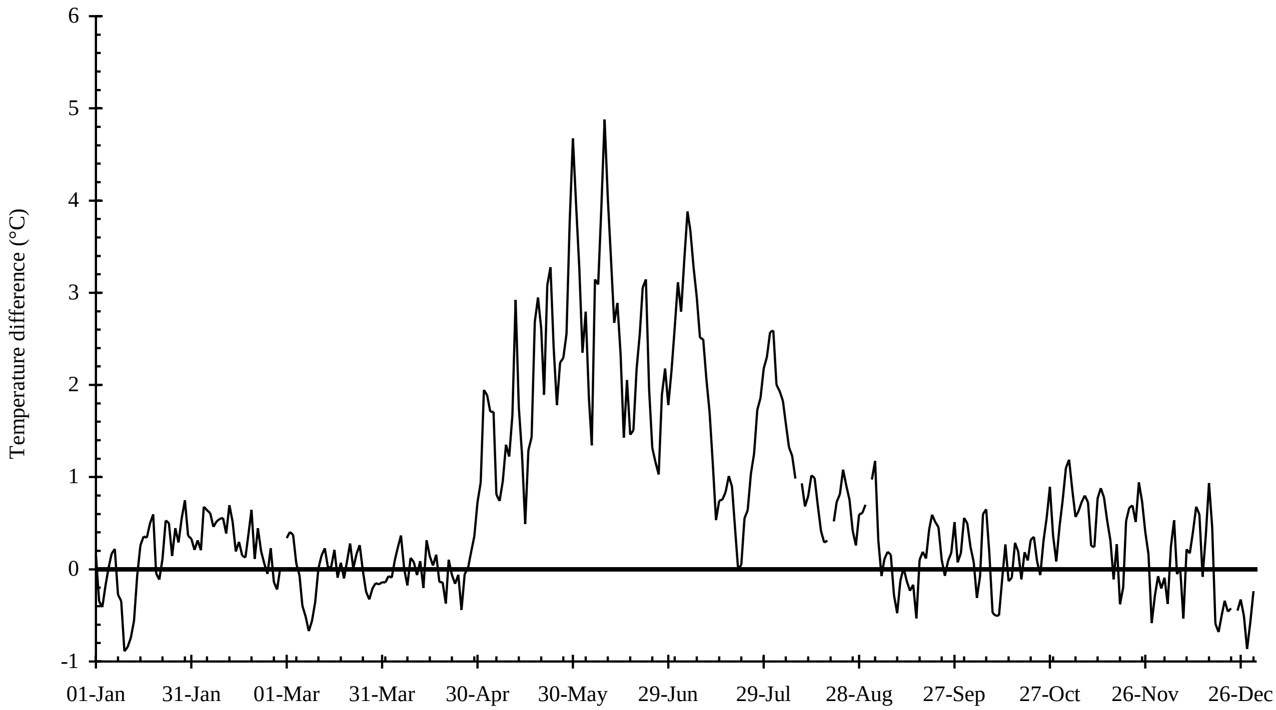


Figure 33
Mean, Maximum and Minimum Daily Flow of the Nechako River at Cheslatta Falls, 1987 to 1998

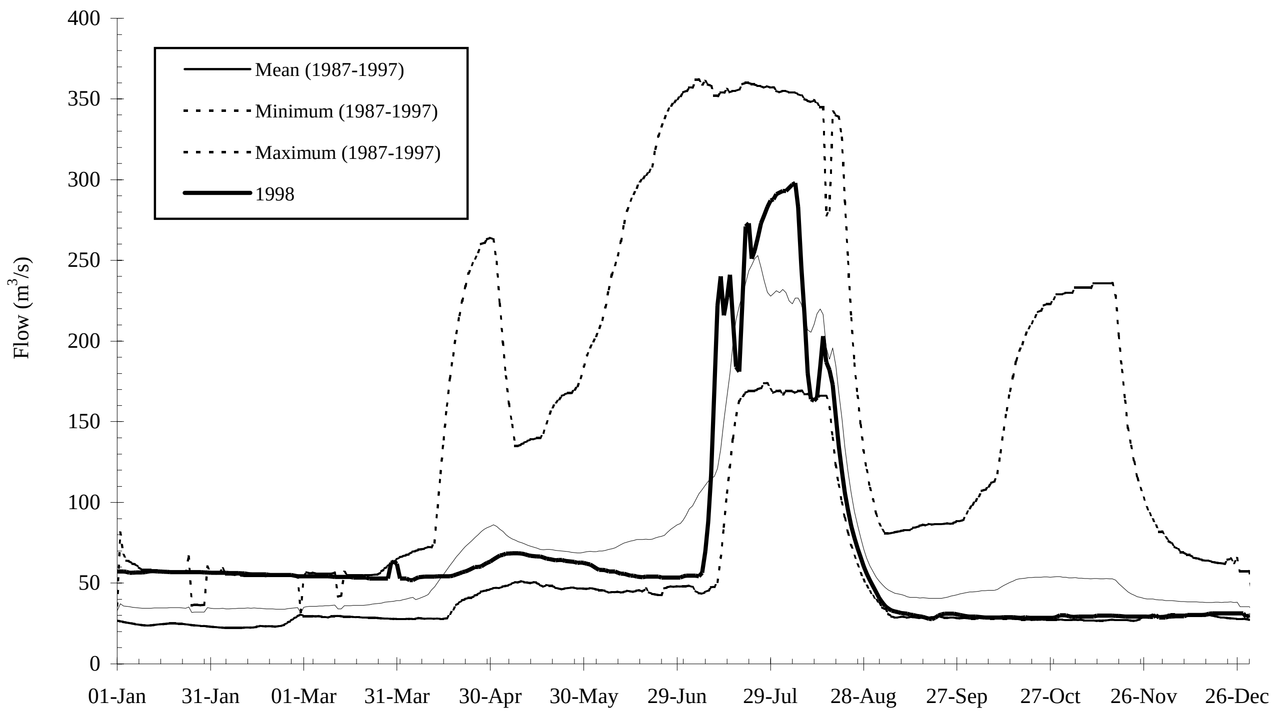


Figure 34
Cumulative Daily Flows of the Nechako River at Cheslatta Falls, 1987 to 1998

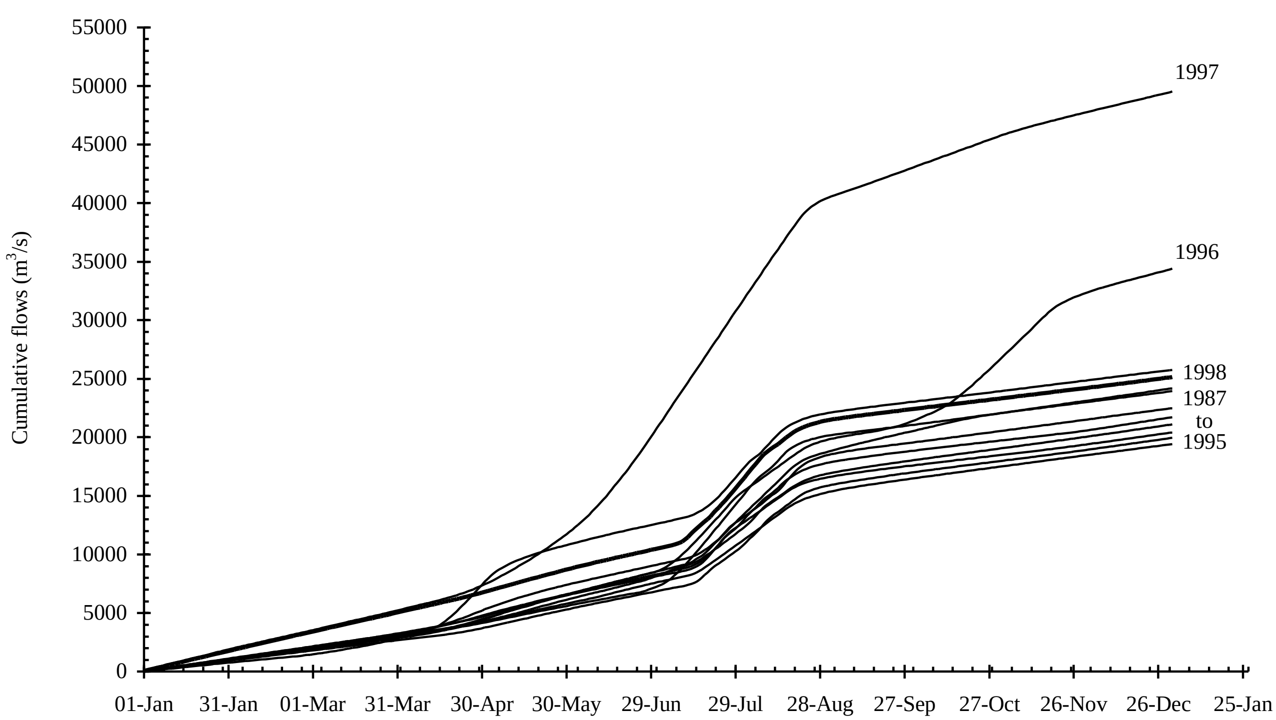


Figure 35
Mean Size-at-date of 0+ Chinook Salmon, Upper Nechako River, 1989 to 1998 (electrofishing)

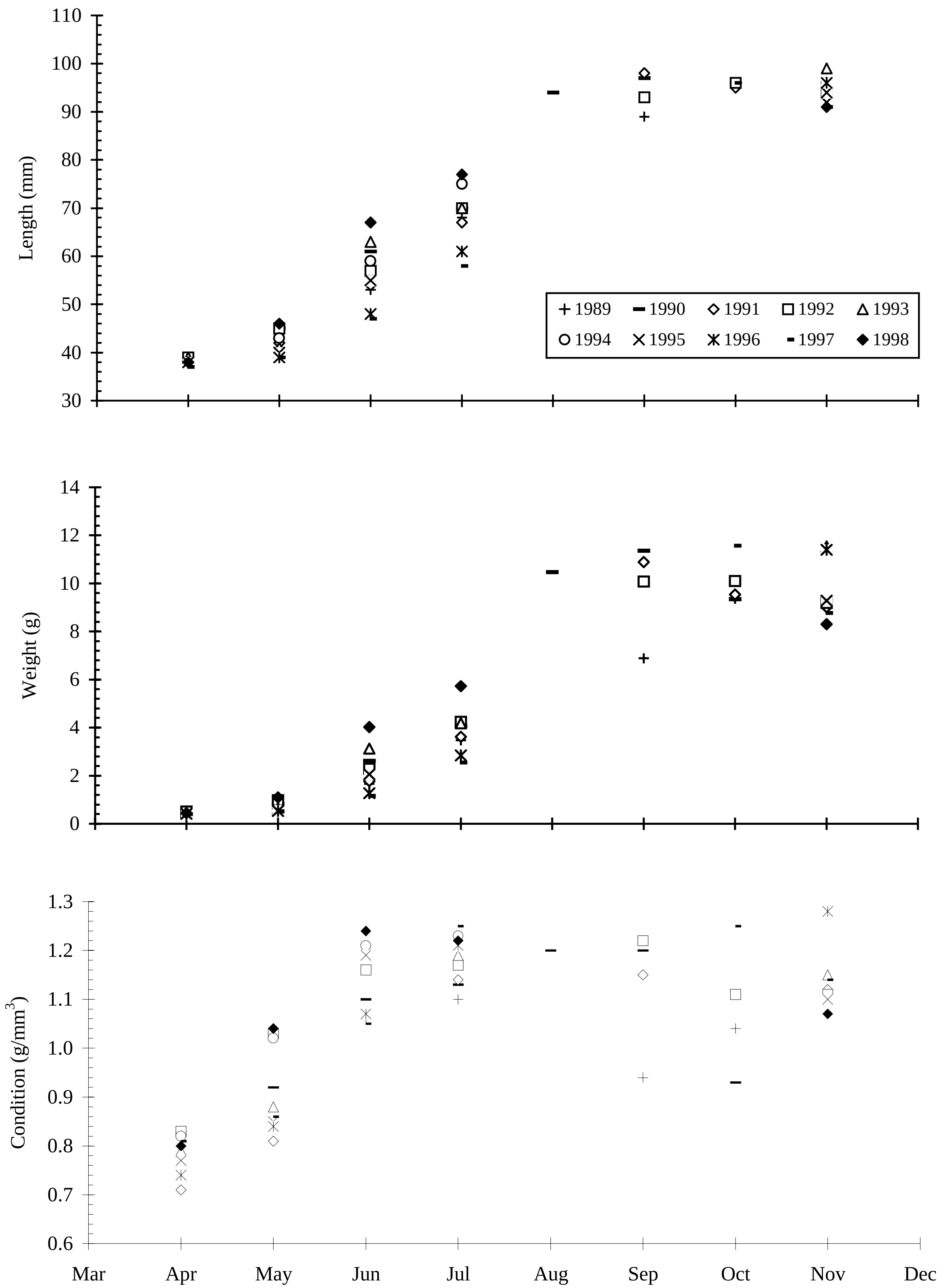


Figure 36
Mean Size-at-date of 0+ Chinook Salmon, Diamond Island, Nechako River, 1990 to 1998

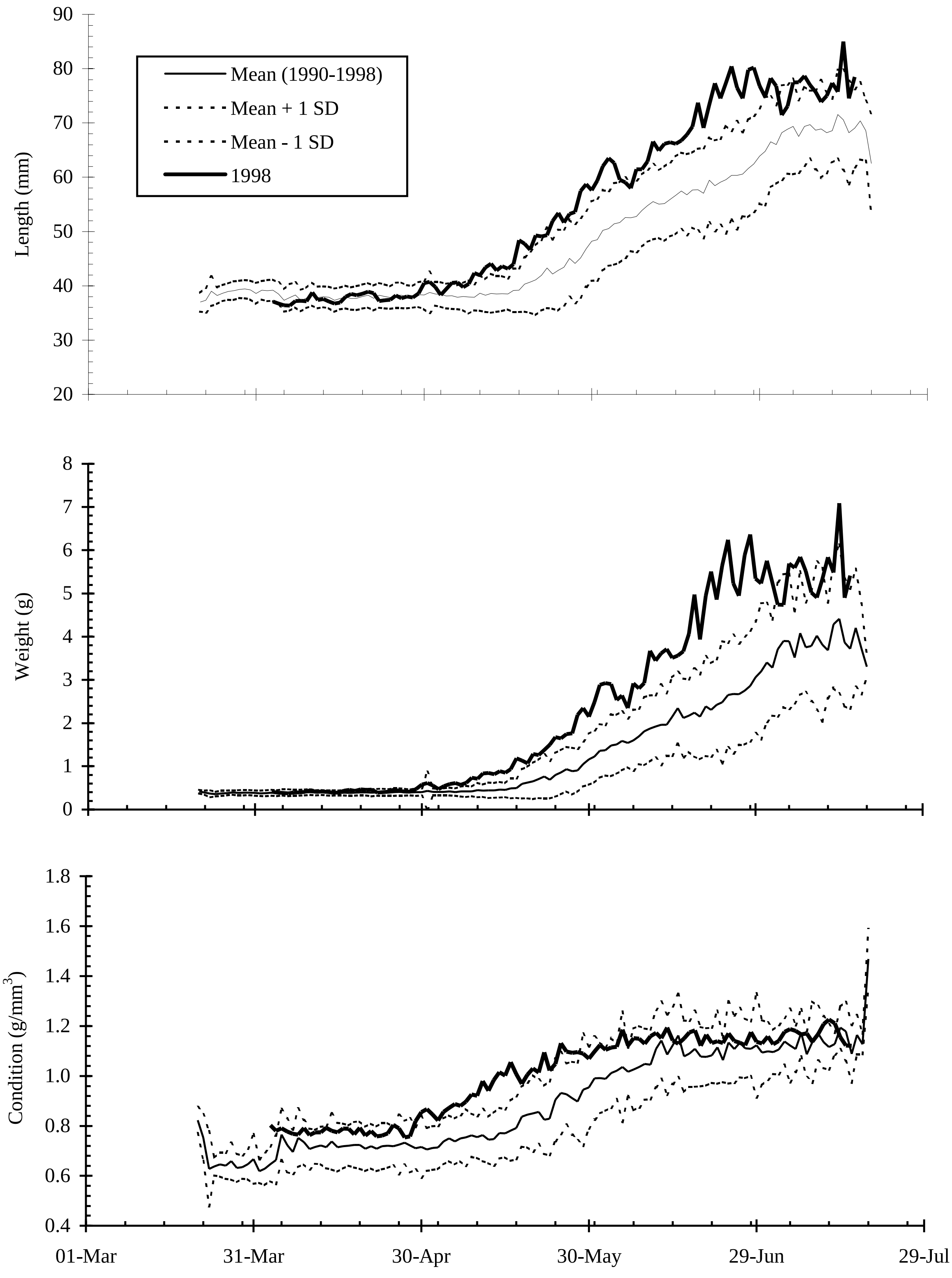


Table 6
Comparison of Growth of 0+ Chinook Salmon, Nechako River, 1991 to 1998

Year	Length (mm)				Weight (g)				Comments
	L_0	DOY_0	A_0	α	W_0	DOY_0	A_0	α	
Electrofishing									
1991	38.2	121.2	0.007677	0.005271	0.40	139.8	0.067570	0.020670	1
1991	38.2	121.6	0.010650	0.009778	0.40	135.9	0.072750	0.022430	2
1992	39.0	114.2	0.006313	0.003245	0.45	127.7	0.060320	0.019060	1
1992	39.0	112.8	0.009206	0.008405	0.45	126.4	0.066320	0.021250	2
1993	39.0	116.0	0.010600	0.009590	0.45	124.0	0.062600	0.018700	3
1994	38.5	111.1	0.011100	0.010300	0.41	128.2	0.081300	0.025200	3
1995	38.0	129.1	0.013710	0.013870	0.40	127.9	0.067060	0.020830	4
1996	38.0	139.6	0.011240	0.009557	0.38	140.5	0.061470	0.017020	4
1997	38.0	132.7	0.008400	0.006335	0.38	134.5	0.053110	0.015500	4
1998	37.0	130.0	0.025520	0.028120	0.42	129.4	0.106000	0.035560	4
Diamond Island traps									
1991	38.2	123.3	0.009134	0.006193	0.40	124.1	0.045530	0.012100	1
1991	38.2	121.3	0.008835	0.005634	0.40	124.7	0.047100	0.012400	2
1992	39.0	102.1	0.005937	0.002211	0.45	114.4	0.039290	0.012210	1
1992	39.0	102.3	0.007691	0.004576	0.45	114.6	0.043170	0.011780	2
1993	39.0	120.7	0.009540	0.005340	0.45	127.1	0.061000	0.017200	3
1994	38.5	114.0	0.007220	0.009280	0.41	119.2	0.056900	0.012600	3
1995	38.0	134.8	0.021760	0.028320	0.40	134.2	0.110300	0.066370	4
1996	38.0	144.9	0.017430	0.021070	0.38	142.5	0.085980	0.033410	4
1997	36.0	127.2	0.008219	-0.005405	0.38	126.5	0.036680	0.002020	4
1998	37.0	109.0	0.010320	0.001614	0.42	123.0	0.093160	0.031060	4

Comments: 1 = day, 1st and 2nd stanza pooled, 2 = night, 1st and 2nd stanza pooled,
3 = day and night pooled, 1st and 2nd stanza pooled, 4 = day and night pooled, 2nd stanza only.

Figure 37
Predicted Growth in Length and Weight of 0+ Chinook Sampled by Electrofishing in the Upper Nechako River, 1991 to 1998

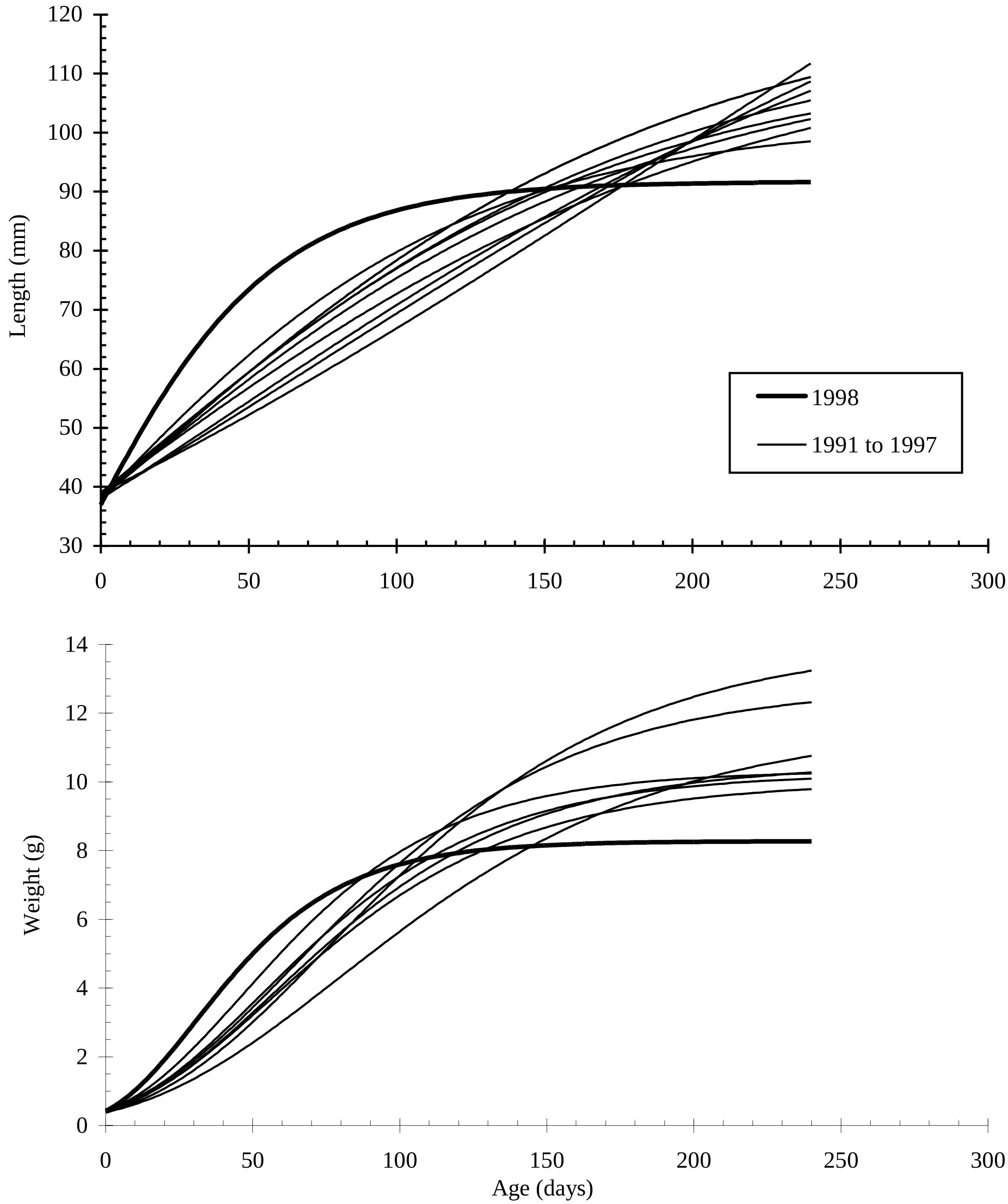


Figure 38
Mean Monthly CPUE of 0+ Chinook, Upper Nechako River, 1989 to 1998

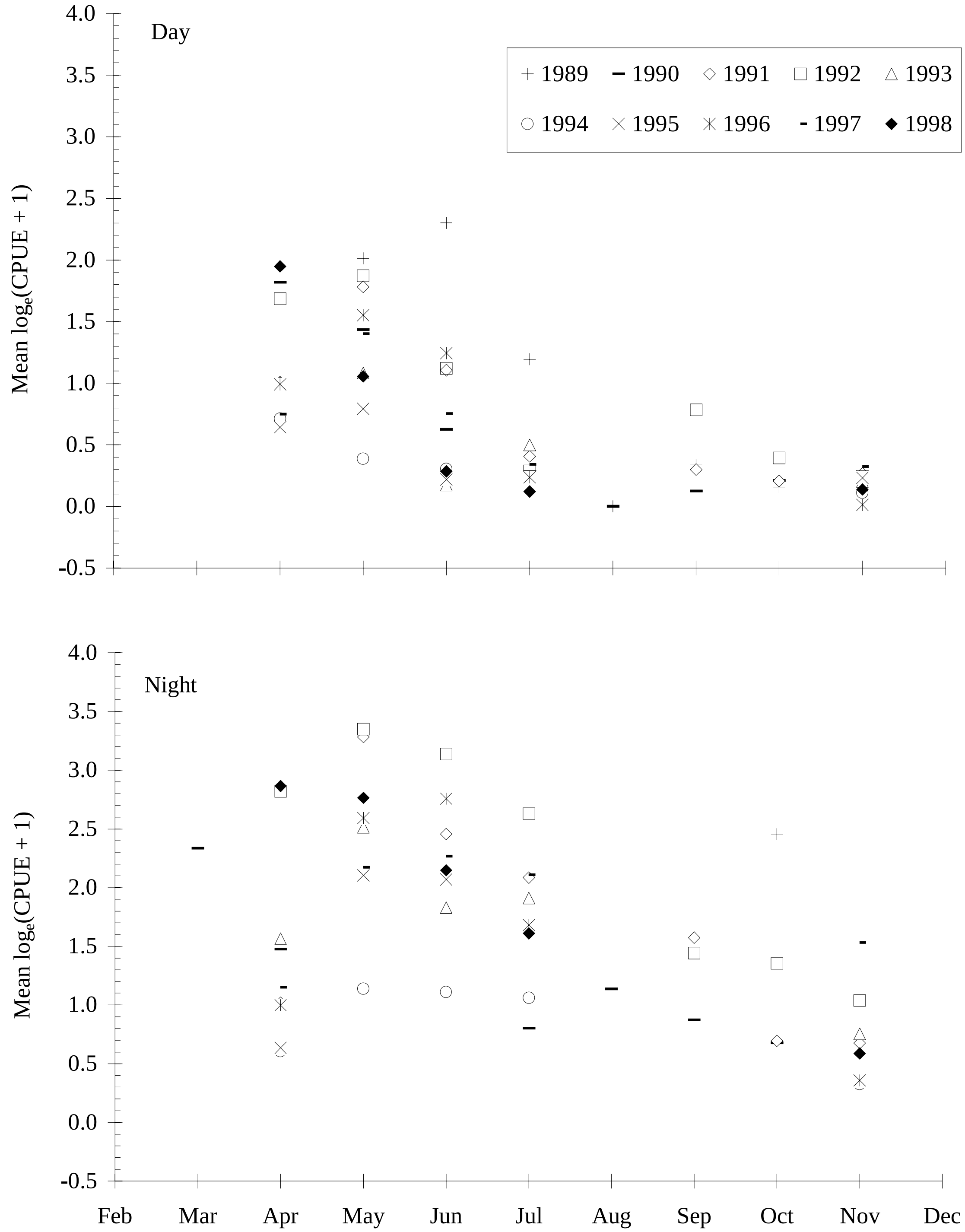


Figure 39
Monthly Centroids of 0+ Chinook, Upper Nechako River, 1991 to 1998

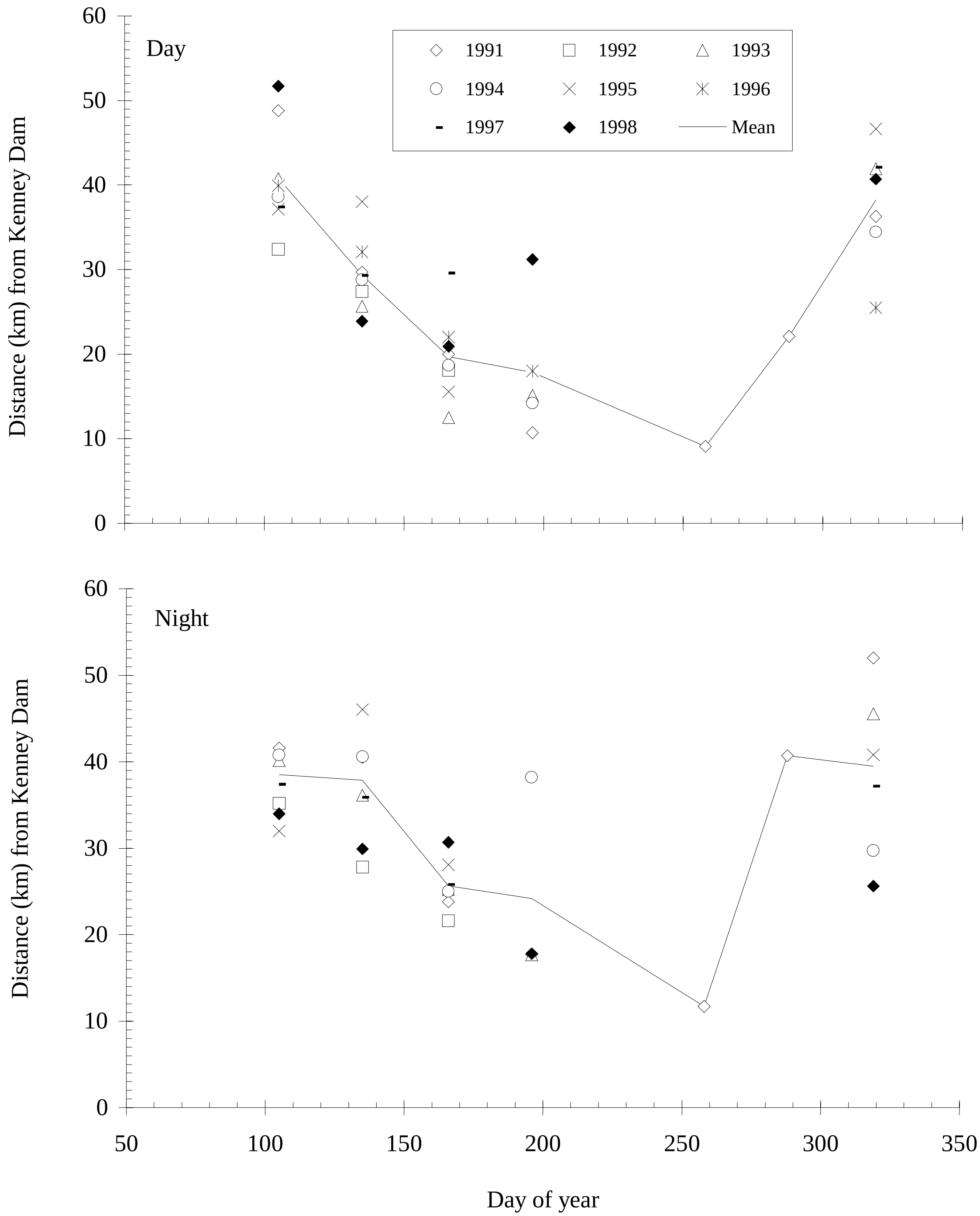
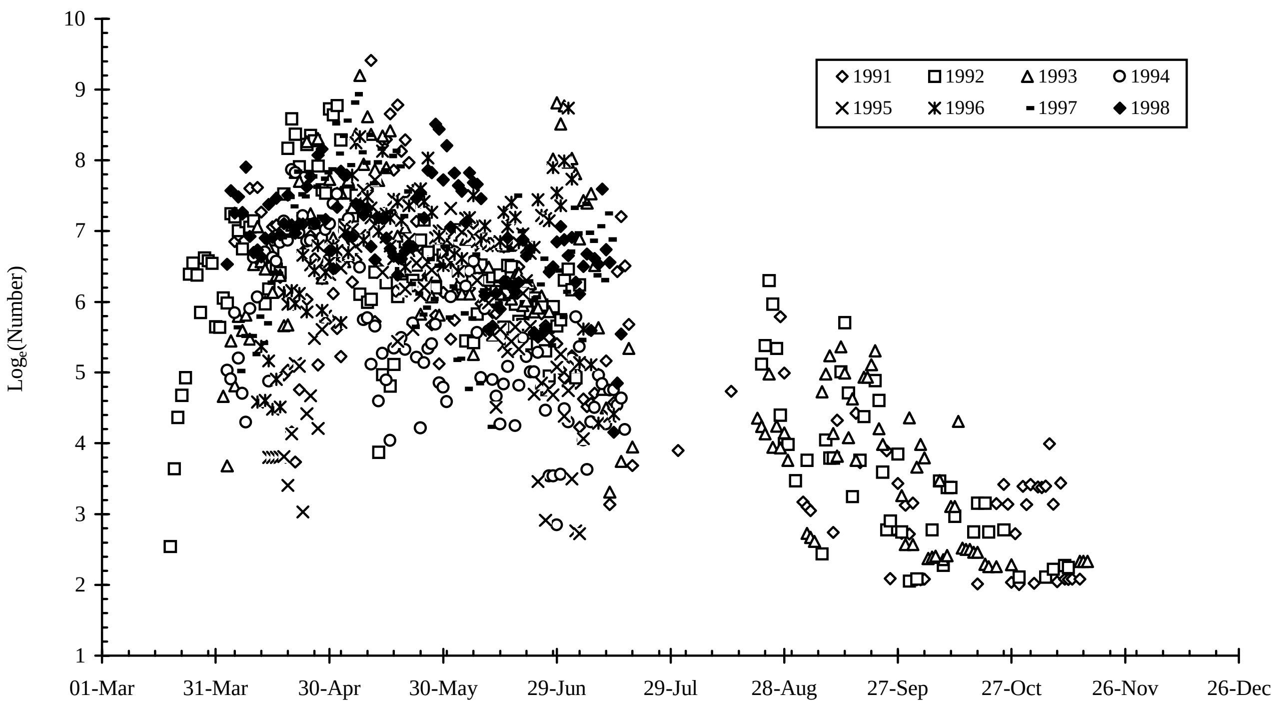


Figure 40
Daily Index of 0+ Chinook Outmigration, Diamond Island, Nechako River, 1991 to 1998



measures of fish number (number of 0+ outmigrants and electrofishing CPUE) were standardised by the number of adult chinook that spawned upstream of Diamond Island. The results are shown below.

Correlation of Outmigrant Number and Spawner Number

The total number of outmigrating 0+ chinook that passed Diamond Island between April and July of each year from 1992 to 1998 was significantly and positively correlated with the number of adults that spawned upstream of Diamond Island from 1991 to 1997 (Table 7 and Figure 41). A linear regression explained 70% of the variation in the total annual number of 0+ outmigrants. (Note that data for the year 1991 was not included in Figure 41 because it was not comparable with data from the years 1992 to 1998. See Table 7 for an explanation.)

The intercept of the regression was not statistically significant (P = 0.571) from zero, a result that was expected because zero spawners should produce zero juveniles.

In summary, the statistical significance of the outmigrant-spawner relationship confirmed that spawner number can be used as an index of the number of emergent fry.

Spawner-Standardised Number of Outmigrants

Each daily outmigrant estimate was divided by the total number of adults that had spawned upstream of Diamond Island in the previous fall. Comparison of Figures 40 and 42 showed that standardisation for spawner number reduced among-year variation in daily outmigration index, but considerable variation remained. It also showed that 1998 was comparable to the previous six years. There was no evidence for an effect of the relatively high temperatures in 1998 on the timing or magnitude of outmigration.

Table 7
Comparison of the Index Numbers of Juvenile Chinook Salmon Migrating Out of the Upper Nechako River With Numbers of the Parent Generation

Year	Total number of spawners	Number of spawners upstream of Diamond Island	Index number of outmigrating 0+ chinook the following year	Sampling period	Total index number of outmigrating 0+ chinook the following year	Total sampling period
1990	2642	1686	104182	Apr. 5 - July 31	105702	Apr. 5 - Nov. 15
1991	2360	1306	116538	Mar. 14 - July 17	119860	Mar. 14 - Nov. 17
1992	2498	1074	143000	Apr. 2 - July 19	146170	Apr. 2 - Nov. 16
1993	664	347	47589	Apr. 2 - July 17	47589	Apr. 2 - July 17
1994	1144	659	45025	Apr. 13 - July 13	45025	Apr. 13 - July 11
1995	1689	1143	105576	Apr. 12 - July 14	105576	Apr. 12- July 14
1996	2040	1455	133812	Apr. 5 - July 13	133812	Apr. 5 - July 13
1997	1954	1547	133709	Apr. 3 - July 17	133709	Apr. 3 - July 17

Note: the number of outmigrants estimated in 1991 (brood year 1990) is not comparable to the numbers of outmigrants estimated in subsequent years because one of the RSTs in 1991 had a wooden wing attached to one side that funneled additional fry into the RST, and which, therefore, required the assumption of greater flow into the trap.

Figure 41
Regression of the Number of 0+ Chinook Salmon Outmigrants on the Number of Parent Spawners Above Diamond Island, Nechako River

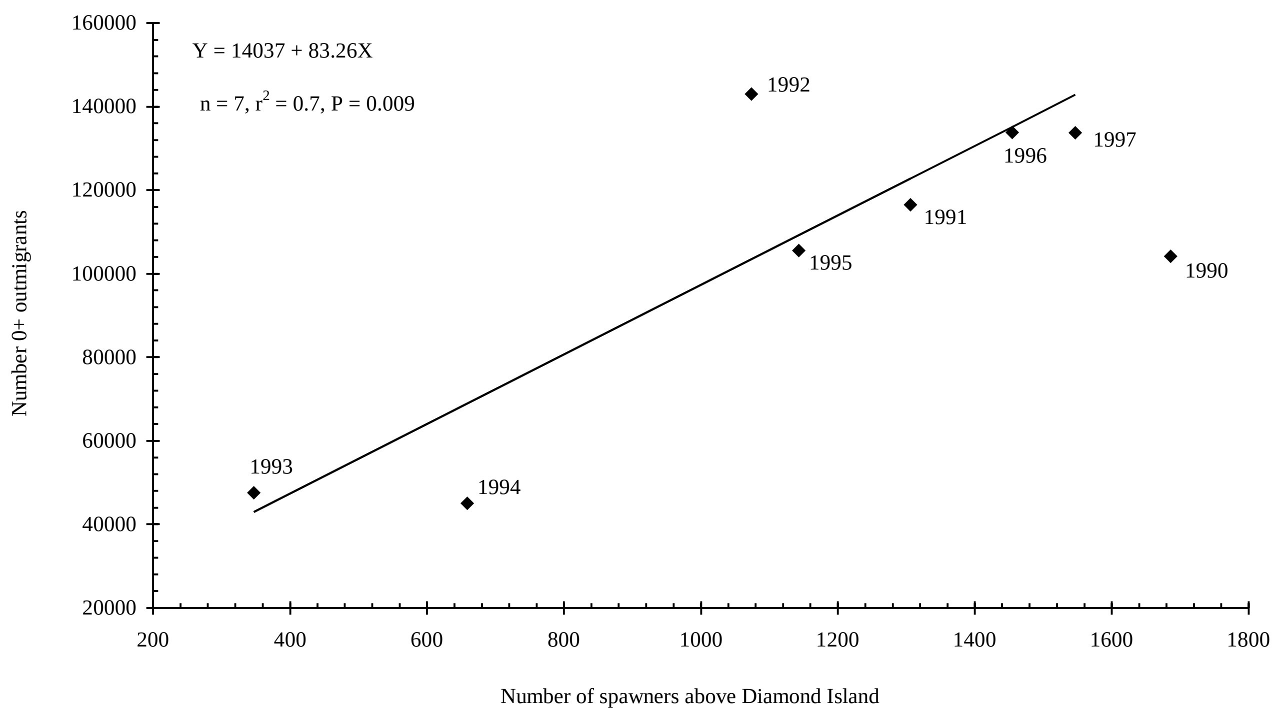
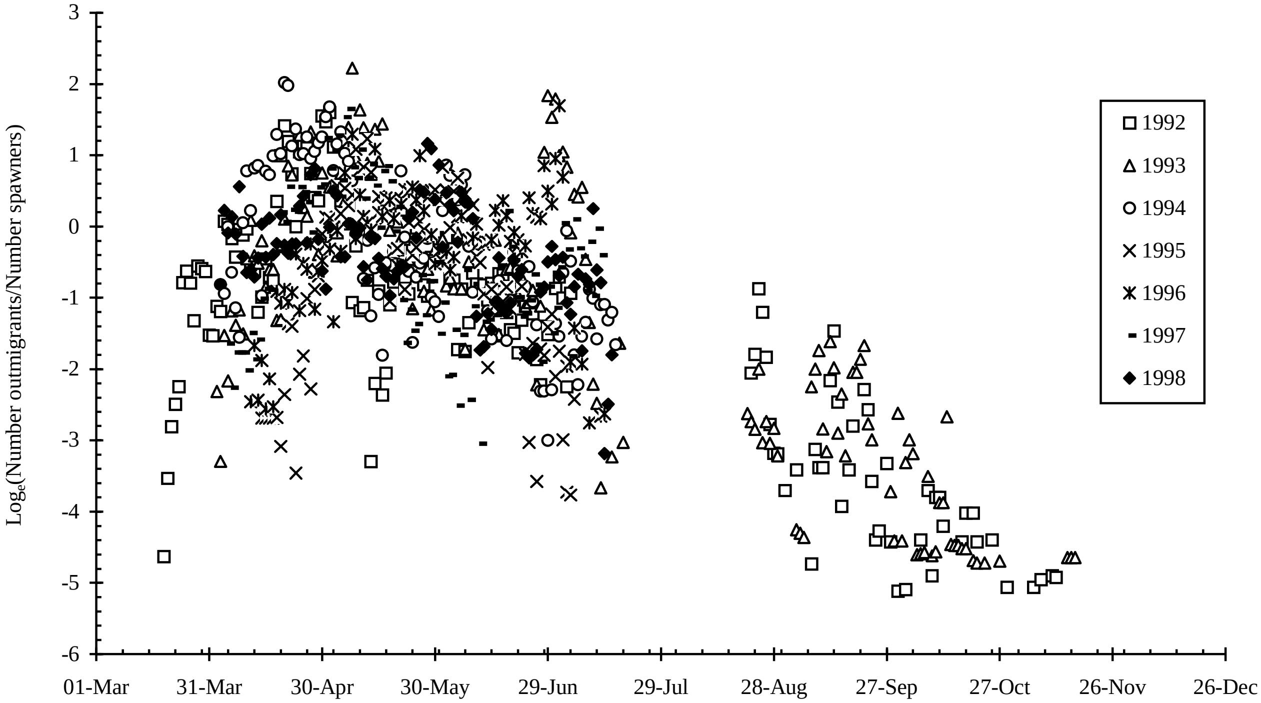


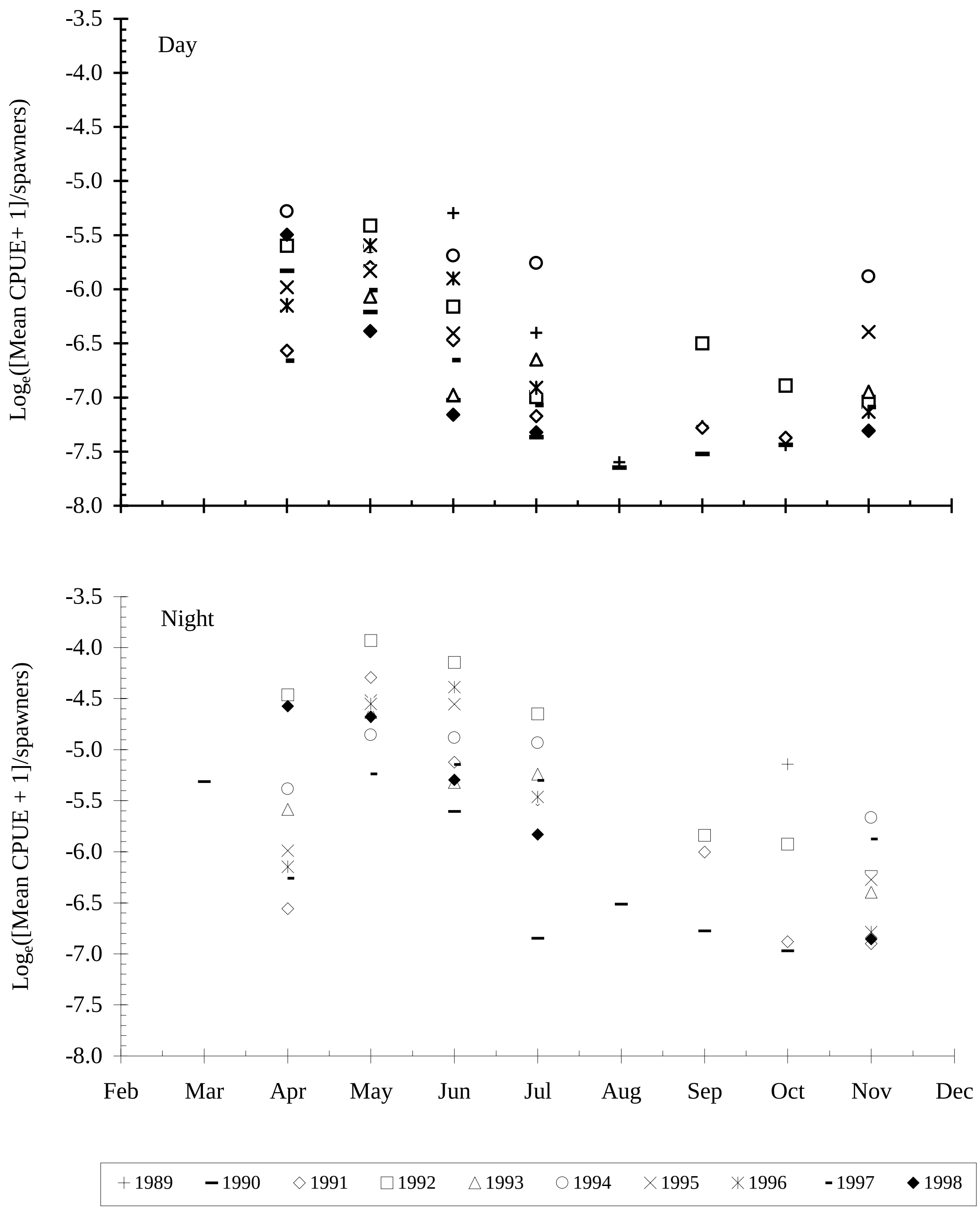
Figure 42
Daily Index of 0+ Chinook Outmigration at Diamond Island, Nechako River, 1992 to 1998, Standardised for the Number of Spawners Above Diamond Island in the Previous Autumn



Spawner-Standardised Electrofishing CPUE

A similar standardisation procedure was carried out for the monthly electrofishing CPUE data by dividing each monthly geometric mean CPUE + 1 by the number of spawners (1,706) counted in reaches 1 to 4 of the upper river in the previous autumn (Figure 43). That procedure assumed a significant correlation between total annual electrofishing CPUE and spawner number in the previous autumn. The existence of such a relationship was a reasonable assumption, but it has not yet been confirmed. Comparison of Figures 38 and 43 showed that spawner standardisation resulted in a decrease in among-year variation of monthly CPUE, particularly for the months of May and June, as well as changes in the relative ranking of years for each month.

Figure 43
Geometric Mean Monthly (CPUE + 1) of 0+ Chinook, Standardised for the Number of Spawners in Reaches 1-4 in the Previous Autumn, Nechako River, 1989 to 1998



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Appendix 1

Mean Daily Size of Fish Captured by Electrofishing in the Nechako River, 1998

Appendix 1
Mean Daily Size of Fish Captured by Electrofishing in the Nechako River, 1998

		Length (mm)			Weight (g)			Condition (g / mm³)		
Date	DOY	mean	SD	n	mean	SD	n	mean	SD	n
Chinook salmon, 0+ (day)										
03-Apr	93	37	2	99	0.41	0.08	99	0.78	0.09	99
04-Apr	94	37	2	46	0.41	0.08	46	0.80	0.09	46
05-Apr	95	37	2	171	0.43	0.09	171	0.81	0.09	171
06-Apr	96	37	2	161	0.42	0.08	161	0.80	0.09	161
07-Apr	97	37	2	120	0.42	0.08	120	0.80	0.09	120
08-Apr	98	38	2	181	0.44	0.09	181	0.80	0.09	181
09-Apr	99	38	2	65	0.42	0.08	65	0.78	0.10	65
17-May	137	42	4	104	0.75	0.31	104	0.99	0.16	104
18-May	138	42	4	147	0.72	0.27	147	0.96	0.16	147
19-May	139	43	5	92	0.83	0.32	92	0.99	0.10	92
20-May	140	47	4	35	1.10	0.36	35	1.05	0.09	35
21-May	141	47	4	18	1.16	0.32	18	1.11	0.07	18
22-May	142	45	6	22	1.07	0.45	22	1.14	0.14	22
23-May	143	48	6	4	1.16	0.38	4	1.06	0.06	4
15-Jun	166	57	6	29	2.28	0.77	29	1.18	0.14	29
16-Jun	167	61	8	59	2.86	1.16	59	1.19	0.19	59
17-Jun	168	64	6	19	3.17	1.08	19	1.18	0.17	19
19-Jun	170	55	0	1	1.70	0.00	1	1.02	0.00	1
21-Jun	172	60	5	2	2.53	0.80	2	1.18	0.08	2
03-Jul	184	64	4	5	3.35	0.57	5	1.30	0.15	5
04-Jul	185	71	7	28	-	0.00	0	-	0.00	0
05-Jul	186	71	8	2	3.91	1.03	2	1.11	0.07	2
07-Jul	188	68	12	4	4.16	2.00	4	1.26	0.06	4
02-Nov	306	93	8	16	9.13	2.22	16	1.12	0.07	16
03-Nov	307	91	8	17	8.61	2.33	17	1.12	0.10	17
06-Nov	310	91	5	4	8.81	1.85	4	1.16	0.11	4
Chinook salmon, 0+ (night)										
03-Apr	93	37	2	100	0.43	0.08	100	0.80	0.08	100
04-Apr	94	39	1	49	0.44	0.06	49	0.76	0.08	49
05-Apr	95	38	2	161	0.45	0.09	161	0.78	0.08	161
06-Apr	96	38	2	202	0.44	0.08	202	0.81	0.08	202
07-Apr	97	38	2	186	0.45	0.09	186	0.82	0.08	186
08-Apr	98	39	3	201	0.49	0.44	201	0.81	0.09	201
09-Apr	99	38	2	135	0.43	0.08	135	0.80	0.07	135
17-May	137	42	4	70	0.78	0.24	70	1.00	0.10	70
18-May	138	45	5	153	0.93	0.36	153	1.00	0.12	153
19-May	139	45	5	149	0.97	0.36	149	1.02	0.12	149
20-May	140	47	5	269	1.12	0.41	269	1.04	0.11	269
21-May	141	49	5	147	1.30	0.41	147	1.06	0.12	147
22-May	142	50	5	166	1.45	0.46	166	1.10	0.09	166
23-May	143	50	6	230	1.51	0.60	230	1.12	0.14	230
15-Jun	166	62	7	59	3.04	1.17	59	1.25	0.14	59
16-Jun	167	65	8	99	3.60	1.43	99	1.23	0.12	99
17-Jun	168	66	8	170	3.86	1.76	170	1.27	0.13	170

Appendix 1 (continued)
Mean Daily Size of Fish Captured by Electrofishing in the Nechako River, 1998

		Length (mm)			Weight (g)			Condition (g/mm³)		
Date	DOY	mean	SD	n	mean	SD	n	mean	SD	n
18-Jun	169	69	7	198	4.36	1.47	198	1.26	0.11	198
19-Jun	170	70	7	105	4.50	1.49	105	1.25	0.10	75
20-Jun	171	72	7	111	4.68	1.36	111	1.23	0.11	111
21-Jun	172	70	7	101	4.25	1.47	101	1.22	0.10	101
22-Jun	173	72	8	57	4.96	1.77	57	1.26	0.15	57
03-Jul	184	72	8	41	4.62	1.89	41	1.20	0.09	41
04-Jul	185	74	8	66	4.91	1.73	66	1.20	0.15	66
05-Jul	186	76	8	145	5.58	1.93	145	1.23	0.09	145
06-Jul	187	78	8	126	6.08	1.97	126	1.23	0.10	126
07-Jul	188	78	6	140	5.80	1.50	140	1.22	0.10	140
08-Jul	189	79	11	33	6.51	3.08	33	1.23	0.07	33
09-Jul	190	79	10	95	6.30	2.72	95	1.23	0.14	95
10-Jul	191	78	9	26	5.95	2.19	26	1.23	0.17	26
02-Nov	306	91	6	22	8.32	1.75	22	1.08	0.11	22
03-Nov	307	93	9	42	8.82	2.32	42	1.09	0.12	42
04-Nov	308	89	10	48	7.52	2.35	48	1.04	0.12	48
05-Nov	309	90	10	17	7.80	2.33	17	1.03	0.09	17
06-Nov	310	92	7	43	8.41	1.77	43	1.07	0.10	43
Chinook salmon, 1+ (day)										
03-Apr	93	97	4	4	12.28	1.54	4	1.35	0.08	4
04-Apr	94	93	5	5	10.04	1.80	5	1.24	0.08	5
05-Apr	95	96	9	13	11.24	2.64	13	1.27	0.17	13
06-Apr	96	96	6	4	11.51	3.01	4	1.28	0.15	4
07-Apr	97	86	6	21	7.85	1.08	21	1.23	0.15	21
08-Apr	98	86	7	11	7.84	2.16	11	1.21	0.16	11
09-Apr	99	85	0	2	7.14	1.23	2	1.16	0.20	2
20-May	140	104	0	1	14.62	0.00	1	1.30	0.00	1
Chinook salmon, 1+ (night)										
03-Apr	93	93	9	25	10.23	2.66	25	1.26	0.18	25
04-Apr	94	90	11	11	8.81	3.24	11	1.16	0.16	11
05-Apr	95	89	7	24	9.41	2.23	24	1.32	0.15	24
06-Apr	96	93	8	33	10.42	2.78	33	1.28	0.16	33
07-Apr	97	86	5	43	7.78	1.55	43	1.23	0.17	43
08-Apr	98	86	6	30	7.96	1.45	30	1.25	0.13	30
09-Apr	99	90	8	44	8.63	2.06	44	1.18	0.14	44
17-May	137	107	8	3	17.85	4.17	3	1.44	0.05	3
18-May	138	104	12	15	15.97	5.71	15	1.37	0.20	15
19-May	139	119	7	3	22.05	3.91	3	1.29	0.03	3
20-May	140	96	23	5	14.33	8.25	5	1.44	0.16	5
21-May	141	95	6	4	11.25	2.86	4	1.31	0.11	4
22-May	142	99	7	3	13.99	2.03	3	1.47	0.23	3
23-May	143	103	6	5	16.83	3.96	5	1.52	0.23	5
04-Jul	185	102	3	2	13.31	1.15	2	1.25	0.00	2

Appendix 1 (continued)
Mean Daily Size of Fish Captured by Electrofishing in the Nechako River, 1998

Date	DOY	Length (mm) mean	Length (mm) SD	Length (mm) n	Weight (g) mean	Weight (g) SD	Weight (g) n	Condition (g/mm³) mean	Condition (g/mm³) SD	Condition (g/mm³) n
Burbot, adult (day)										
03-Nov	307	320		1			1			0
Burbot, adult (night)										
06-Apr	96	300		1			1			0
Burbot, juvenile (day)										
04-Jul	185	200		1			1			0
05-Jul	186	300		1			1			0
08-Jul	189	135	13	3			3			0
09-Jul	190	161		1			1			0
Burbot, juvenile (night)										
05-Apr	95	98		1	7.77		1	0.83		1
08-Apr	98	125	5	2	13.83	3.14	2	0.71	0.08	2
04-Jul	185	237		1	77.27		1	0.58		1
09-Jul	190	124		1	13.09		1	0.69		1
10-Jul	191	151		1	23.79		1	0.69		1
Lake trout, 0+ (night)										
03-Apr	93	73	4	2	3.56	0.71	2	0.93	0.05	2
Lake trout, 1+ (day)										
04-Apr	94	72	8	2	2.81	1.16	2	0.74	0.07	2
Lake trout, 1+ (night)										
03-Apr	93	70		1	2.61		1	0.76		1
06-Apr	96	78		1	2.93		1	0.62		1
Rainbow trout, adult (day)										
07-Apr	97	200		1			0			0
03-Jul	184	200		1			0			0
Rainbow trout, adult (night)										
20-May	140	221		1			0			0
17-Jun	168	300		1			0			0
18-Jun	169	138	18	7	32.16	12.62	7	1.21	0.16	7
02-Nov	306	300		1			0			0
04-Nov	308	250		1			0			0
05-Nov	309	20		1			0			0
06-Nov	310	300		1			0			0
Rainbow trout, juvenile (day)										
03-Apr	93	162		1	52.70		1	1.24		1
07-Apr	97	134		1	29.94		1	1.24		1
17-May	137	93	6	4	8.96	2.26	4	1.09	0.08	4
18-May	138	173		1	58.94		1	1.14		1

Appendix 1 (continued)
Mean Daily Size of Fish Captured by Electrofishing in the Nechako River, 1998

Date	DOY	Length (mm)			Weight (g)			Condition (g/mm³)		
		mean	SD	n	mean	SD	n	mean	SD	n
15-Jun	166	90		1	7.90		1	1.08		1
16-Jun	167	107	41	6	18.41	9.82	6	1.13	0.10	6
18-Jun	169	118		1	17.46		1	1.06		1
04-Jul	185	98	55	7			0			0
05-Jul	186	113		1	16.05		1	1.11		1
07-Jul	188	94		1	9.13		1	1.10		1
02-Nov	306	118	43	4	24.25	21.17	4	1.19	0.10	4
03-Nov	307	197	14	2	94.84	1.25	2	1.26	0.25	2
05-Nov	309	127		1	22.30		1	1.09		1
Rainbow trout, juvenile (night)										
03-Apr	93	81	4	2	6.43	0.83	2	1.21	0.03	2
04-Apr	94	83	6	4	6.71	1.50	4	1.17	0.17	4
07-Apr	97	125	8	3	23.27	5.78	3	1.18	0.11	3
08-Apr	98	108		1	15.91		1	1.26		1
09-Apr	99	159		1	45.10		1	1.12		1
17-May	137	93		1	10.81		1	1.34		1
18-May	138	110	31	6	11.19	5.95	6	1.11	0.13	5
19-May	139	113	4	2	16.33	0.43	2	1.15	0.08	2
20-May	140	131	17	5	27.77	10.28	5	1.23	0.24	5
21-May	141	108	6	5	15.22	3.84	5	1.20	0.11	5
22-May	142	126	18	4	24.48	8.72	4	1.19	0.11	4
23-May	143	131	24	9	30.47	17.29	9	1.24	0.13	9
15-Jun	166	112		1	14.30		1	1.02		1
16-Jun	167	136	16	6	28.79	12.41	6	1.09	0.05	6
17-Jun	168	129	23	4	16.81	7.61	4	0.84	0.34	4
20-Jun	171	125	20	5	25.08	11.22	5	1.23	0.10	5
21-Jun	172	143	4	2	34.48	2.55	2	1.19	0.00	2
22-Jun	173	141	4	2	42.35	10.51	2	1.54	0.49	2
04-Jul	185	138	21	8	32.48	17.42	8	1.16	0.12	8
05-Jul	186	162	4	2	49.22	5.83	2	1.17	0.06	2
06-Jul	187	141	20	7	36.43	22.25	7	1.20	0.23	7
07-Jul	188	125	31	8	25.58	16.52	8	1.12	0.08	8
08-Jul	189	104		1	12.20		1	1.08		1
09-Jul	190	153	33	5	48.45	24.88	5	1.23	0.17	5
02-Nov	306	93	21	9	10.39	8.37	9	1.17	0.16	9
03-Nov	307	90	20	4	8.06	5.33	4	1.00	0.17	4
04-Nov	308	81		1	6.48		1	1.22		1
05-Nov	309	108	49	2	14.89	15.95	2	0.92	0.01	2
06-Nov	310	125		1	66.72		1	3.42		1
Sockeye salmon, 0+ (day)										
17-May	137	27		1	0.11		1	0.56		1
18-Jun	169	32		1	0.33		1	1.01		1
Sockeye salmon, 0+ (night)										
09-Apr	99	33	0	2	0.27	0.00	2	0.75	0.00	2

Appendix 2

Mean Size and Condition of Fish Captured by Rotary Screw Traps, Diamond Island, Nechako River, 1998

Appendix 2
Mean Size and Condition of Fish Captured by Rotary Screw Traps,
Diamond Island, Nechako River, 1998

	Length (mm)			Weight (g)			Condition (g/mm³)		
Date	mean	SD	n	mean	SD	n	mean	SD	n
Chinook salmon 0+ (day)									
03-Apr	37	1	12	0.43	0.05	12	0.82	0.06	12
04-Apr	37	1	14	0.39	0.06	14	0.79	0.06	14
05-Apr	36	2	6	0.36	0.08	6	0.76	0.03	6
06-Apr	37	2	11	0.39	0.05	11	0.77	0.05	11
07-Apr	37	2	10	0.41	0.07	10	0.79	0.06	10
08-Apr	37	2	20	0.41	0.07	20	0.78	0.07	20
09-Apr	37	2	12	0.40	0.06	12	0.77	0.07	12
10-Apr	38	1	5	0.49	0.06	5	0.87	0.09	5
11-Apr	37	1	7	0.39	0.04	7	0.75	0.05	7
12-Apr	37	1	11	0.41	0.06	11	0.78	0.05	11
13-Apr	37	1	10	0.39	0.02	10	0.80	0.04	10
14-Apr	36	2	12	0.39	0.06	12	0.80	0.05	12
15-Apr	38	2	11	0.43	0.08	11	0.81	0.06	11
16-Apr	38	2	20	0.46	0.09	20	0.83	0.06	20
17-Apr	38	1	7	0.44	0.07	7	0.81	0.07	7
18-Apr	39	3	9	0.45	0.11	9	0.77	0.06	9
19-Apr	38	2	15	0.44	0.09	15	0.76	0.06	15
20-Apr	39	3	13	0.47	0.12	13	0.76	0.07	13
21-Apr	38	2	16	0.44	0.10	16	0.78	0.06	16
22-Apr	37	1	8	0.38	0.04	8	0.74	0.03	8
23-Apr	37	2	11	0.39	0.05	11	0.77	0.06	11
24-Apr	38	3	18	0.44	0.14	18	0.75	0.09	18
25-Apr	38	2	19	0.45	0.10	19	0.84	0.09	19
26-Apr	38	2	19	0.44	0.09	19	0.79	0.08	19
27-Apr	38	1	5	0.41	0.07	5	0.75	0.11	5
28-Apr	38	1	17	0.41	0.07	17	0.75	0.07	17
29-Apr	40	2	13	0.56	0.15	13	0.84	0.09	13
30-Apr	41	3	27	0.58	0.15	27	0.86	0.08	27
01-May	42	4	16	0.69	0.21	16	0.90	0.06	16
02-May	40	4	30	0.58	0.18	30	0.88	0.07	30
03-May	39	2	30	0.49	0.12	30	0.83	0.08	30
04-May	40	3	30	0.57	0.17	30	0.88	0.08	30
05-May	40	2	25	0.58	0.13	25	0.87	0.08	25
06-May	40	3	29	0.61	0.22	29	0.89	0.11	29
07-May	39	2	29	0.55	0.14	29	0.89	0.08	29
08-May	40	3	30	0.59	0.21	30	0.90	0.09	30
09-May	43	4	24	0.76	0.32	24	0.93	0.09	24
10-May	41	4	24	0.64	0.24	24	0.91	0.08	24
11-May	42	4	20	0.75	0.20	20	0.97	0.10	20
12-May	43	5	19	0.84	0.33	19	0.97	0.13	19
13-May	42	6	22	0.75	0.38	22	0.95	0.10	22
14-May	44	4	23	0.88	0.24	23	1.01	0.10	23
15-May	44	4	15	0.93	0.33	15	1.06	0.11	15

Appendix 2 (continued)
Mean Size and Condition of Fish Captured by Rotary Screw Traps,
Diamond Island, Nechako River, 1998

	Length (mm)			Weight (g)			Condition (g/mm³)		
Date	mean	SD	n	mean	SD	n	mean	SD	n
16-May	44	4	15	0.97	0.31	15	1.13	0.13	15
17-May	45	6	14	1.04	0.43	14	1.06	0.09	14
18-May	50	6	5	1.30	0.40	5	1.03	0.06	5
19-May	45	4	9	1.03	0.34	9	1.07	0.10	9
20-May	49	5	24	1.33	0.49	24	1.07	0.09	24
21-May	50	7	14	1.40	0.62	14	1.05	0.13	14
22-May	48	4	18	1.23	0.35	18	1.08	0.07	18
23-May	52	6	23	1.55	0.56	23	1.05	0.05	23
24-May	51	7	23	1.53	0.73	23	1.05	0.12	23
25-May	49	5	19	1.44	0.45	19	1.15	0.10	19
26-May	53	7	30	1.71	0.78	30	1.10	0.07	30
27-May	55	7	21	1.95	0.72	21	1.10	0.08	21
28-May	59	9	22	2.40	1.01	22	1.09	0.06	22
29-May	57	10	23	2.19	1.23	23	1.09	0.07	23
30-May	55	6	17	1.82	0.69	17	1.06	0.05	17
31-May	57	8	22	2.10	0.94	22	1.08	0.07	22
01-Jun	69	6	2	3.63	0.61	2	1.13	0.13	2
02-Jun	60	5	4	2.43	0.49	4	1.10	0.04	4
03-Jun	60	8	9	2.59	0.92	9	1.13	0.08	9
04-Jun	53	7	14	1.78	0.64	14	1.11	0.10	14
05-Jun	56	5	15	2.02	0.59	15	1.14	0.06	15
06-Jun	55	5	13	1.93	0.59	13	1.13	0.06	13
07-Jun	57	10	7	2.22	1.36	7	1.08	0.08	7
08-Jun	59	6	13	2.44	0.68	13	1.13	0.06	13
09-Jun	64	8	2	3.07	1.27	2	1.13	0.03	2
10-Jun	59	4	3	2.45	0.50	3	1.16	0.04	3
11-Jun	63	11	3	3.16	1.94	3	1.16	0.07	3
12-Jun	69	12	2	4.27	2.21	2	1.26	0.02	2
13-Jun	61	8	3	2.69	1.15	3	1.16	0.00	3
15-Jun	58	0	1	1.97	0.00	1	1.01	0.00	1
16-Jun	66	3	8	3.39	0.52	8	1.18	0.09	8
19-Jun	54	0	1	2.02	0.00	1	1.28	0.00	1
20-Jun	62	1	2	2.59	0.07	2	1.11	0.01	2
21-Jun	73	3	3	4.66	0.50	3	1.18	0.01	3
26-Jun	60	0	1	2.35	0.00	1	1.09	0.00	1
27-Jun	74	0	1	4.45	0.00	1	1.10	0.00	1
28-Jun	76	0	1	4.08	0.00	1	0.93	0.00	1
30-Jun	73	9	2	4.64	1.86	2	1.18	0.04	2
02-Jul	59	0	1	2.39	0.00	1	1.16	0.00	1
03-Jul	78	0	1	5.74	0.00	1	1.21	0.00	1
04-Jul	70	0	1	4.11	0.00	1	1.20	0.00	1
09-Jul	82	0	1	5.15	0.00	1	0.93	0.00	1
10-Jul	75	7	3	5.35	1.77	3	1.22	0.06	3
11-Jul	77	6	5	5.40	1.25	5	1.16	0.04	5

Appendix 2 (continued)
Mean Size and Condition of Fish Captured by Rotary Screw Traps,
Diamond Island, Nechako River, 1998

	Length (mm)			Weight (g)			Condition (g/mm³)		
Date	mean	SD	n	mean	SD	n	mean	SD	n
Chinook salmon 0+ (night)									
03-Apr	37	1	9	0.39	0.04	9	0.78	0.07	9
04-Apr	37	2	20	0.39	0.05	20	0.77	0.05	20
05-Apr	37	1	20	0.39	0.06	20	0.80	0.07	20
06-Apr	36	2	20	0.37	0.06	20	0.78	0.05	20
07-Apr	37	1	30	0.39	0.06	30	0.76	0.06	30
08-Apr	37	2	20	0.39	0.07	20	0.75	0.05	20
09-Apr	37	2	20	0.41	0.06	20	0.81	0.06	20
10-Apr	39	2	20	0.44	0.09	20	0.74	0.07	20
11-Apr	37	1	13	0.42	0.05	13	0.79	0.05	13
12-Apr	38	2	20	0.42	0.12	20	0.77	0.07	20
13-Apr	37	2	20	0.42	0.08	20	0.79	0.06	20
14-Apr	37	1	23	0.39	0.04	23	0.77	0.05	23
15-Apr	37	1	21	0.37	0.05	21	0.75	0.06	21
16-Apr	38	1	30	0.42	0.06	30	0.76	0.05	30
17-Apr	39	2	29	0.46	0.08	29	0.78	0.06	29
18-Apr	38	1	32	0.43	0.05	32	0.77	0.05	32
19-Apr	39	3	28	0.48	0.15	28	0.81	0.12	28
20-Apr	39	2	29	0.44	0.04	29	0.76	0.05	29
21-Apr	39	2	20	0.47	0.10	20	0.78	0.06	20
22-Apr	37	2	17	0.40	0.04	17	0.77	0.05	17
23-Apr	38	2	18	0.41	0.09	18	0.76	0.07	18
24-Apr	37	3	26	0.40	0.12	26	0.78	0.07	26
25-Apr	39	3	14	0.47	0.15	14	0.76	0.07	14
26-Apr	38	2	25	0.42	0.07	25	0.79	0.08	25
27-Apr	38	1	30	0.42	0.03	30	0.76	0.05	30
28-Apr	38	2	30	0.42	0.09	30	0.76	0.06	30
29-Apr	38	2	23	0.44	0.11	23	0.81	0.05	23
30-Apr	40	2	5	0.55	0.16	5	0.82	0.09	5
01-May	38	3	9	0.47	0.17	9	0.80	0.10	9
02-May	40	3	22	0.51	0.18	22	0.79	0.07	22
03-May	38	4	17	0.45	0.15	17	0.80	0.10	17
04-May	39	3	30	0.52	0.19	30	0.84	0.09	30
05-May	41	2	10	0.61	0.12	10	0.88	0.04	10
06-May	41	4	17	0.62	0.22	17	0.89	0.08	17
07-May	40	4	29	0.60	0.25	29	0.87	0.09	29
08-May	41	4	19	0.66	0.28	19	0.89	0.11	19
09-May	42	4	29	0.71	0.24	29	0.92	0.07	29
10-May	43	5	30	0.77	0.30	30	0.93	0.10	30
11-May	45	5	13	0.96	0.36	13	1.00	0.07	13
12-May	45	5	10	0.87	0.39	10	0.89	0.16	10
13-May	43	5	31	0.86	0.34	31	1.01	0.12	31
14-May	43	7	24	0.90	0.47	24	1.02	0.15	24
15-May	43	6	23	0.81	0.33	23	0.97	0.09	23

Appendix 2 (continued)
Mean Size and Condition of Fish Captured by Rotary Screw Traps,
Diamond Island, Nechako River, 1998

Date	Length (mm)			Weight (g)			Condition (g/mm³)		
	mean	SD	n	mean	SD	n	mean	SD	n
16-May	44	5	25	0.91	0.31	25	1.01	0.11	25
17-May	50	4	23	1.27	0.33	23	0.98	0.07	23
18-May	47	6	20	1.09	0.47	20	0.95	0.10	20
19-May	47	6	18	1.09	0.42	18	0.97	0.07	18
20-May	49	6	16	1.22	0.45	16	0.97	0.08	16
21-May	49	4	25	1.18	0.40	25	0.99	0.14	25
22-May	50	7	24	1.49	0.60	24	1.11	0.08	24
23-May	52	6	30	1.46	0.58	30	1.00	0.14	30
24-May	55	6	30	1.79	0.58	30	1.05	0.06	30
25-May	53	7	25	1.81	0.83	25	1.12	0.09	25
26-May	54	5	30	1.78	0.62	30	1.10	0.09	30
27-May	53	5	30	1.62	0.53	30	1.09	0.08	30
28-May	56	7	30	2.04	0.76	30	1.10	0.07	30
29-May	61	6	23	2.51	0.76	23	1.09	0.07	23
30-May	59	9	25	2.38	0.95	25	1.08	0.07	25
31-May	62	10	25	2.83	1.50	25	1.11	0.12	25
01-Jun	62	9	27	2.83	1.34	27	1.12	0.08	27
02-Jun	64	7	26	3.00	1.02	26	1.11	0.07	26
03-Jun	63	9	30	3.00	1.26	30	1.11	0.07	30
04-Jun	63	7	28	2.91	1.13	28	1.12	0.14	28
05-Jun	61	9	28	2.97	1.38	28	1.21	0.13	28
06-Jun	59	9	30	2.53	1.36	30	1.12	0.06	30
07-Jun	62	10	30	3.08	1.60	30	1.17	0.06	30
08-Jun	62	8	30	2.96	1.18	30	1.16	0.09	30
09-Jun	63	7	26	2.92	1.02	26	1.13	0.06	26
10-Jun	68	11	19	3.87	1.74	19	1.16	0.06	19
11-Jun	65	9	14	3.50	1.74	14	1.17	0.08	14
12-Jun	66	11	16	3.53	1.75	16	1.14	0.07	16
13-Jun	67	9	18	3.88	1.73	18	1.20	0.07	18
14-Jun	66	9	17	3.51	1.44	17	1.14	0.08	17
15-Jun	67	9	21	3.64	1.44	21	1.13	0.09	21
16-Jun	68	7	23	3.76	1.07	23	1.14	0.06	23
17-Jun	69	7	23	4.06	1.46	23	1.17	0.06	23
18-Jun	74	9	22	4.98	1.91	22	1.18	0.08	22
19-Jun	70	10	24	4.02	1.93	24	1.11	0.10	24
20-Jun	75	11	22	5.16	2.17	22	1.17	0.06	22
21-Jun	78	10	24	5.61	2.25	24	1.13	0.09	24
22-Jun	75	7	19	4.86	1.42	19	1.14	0.06	19
23-Jun	77	11	16	5.64	2.56	16	1.13	0.06	16
24-Jun	80	8	15	6.24	1.59	15	1.17	0.05	15
25-Jun	76	7	15	5.23	1.39	15	1.14	0.06	15
26-Jun	75	9	15	5.12	2.01	15	1.14	0.07	15
27-Jun	80	8	18	5.96	1.77	18	1.12	0.05	18
28-Jun	80	10	20	6.48	2.57	20	1.19	0.13	20

Appendix 2 (continued)
Mean Size and Condition of Fish Captured by Rotary Screw Traps,
Diamond Island, Nechako River, 1998

Date	Length (mm)			Weight (g)			Condition (g/mm³)		
	mean	SD	n	mean	SD	n	mean	SD	n
29-Jun	77	9	20	5.35	1.84	20	1.14	0.07	20
30-Jun	75	13	27	5.28	2.28	27	1.13	0.13	27
01-Jul	78	8	24	5.76	2.25	24	1.16	0.11	24
02-Jul	78	6	21	5.38	1.47	21	1.13	0.04	21
03-Jul	71	14	23	4.70	2.16	23	1.14	0.13	23
04-Jul	73	7	21	4.76	1.47	21	1.18	0.05	21
05-Jul	77	7	21	5.69	1.73	21	1.19	0.08	21
06-Jul	78	6	20	5.59	1.30	20	1.18	0.04	20
07-Jul	79	8	20	5.84	1.74	20	1.17	0.05	20
08-Jul	77	8	16	5.52	1.76	16	1.17	0.07	16
09-Jul	75	6	20	5.01	1.21	20	1.15	0.06	20
10-Jul	74	8	17	4.83	1.75	17	1.16	0.06	17
11-Jul	75	9	29	5.33	2.07	29	1.22	0.07	29
12-Jul	77	7	19	5.83	1.75	19	1.23	0.07	19
13-Jul	76	8	11	5.48	2.00	11	1.21	0.06	11
14-Jul	85	0	1	7.09	0.00	1	1.15	0.00	1
15-Jul	75	13	2	4.90	2.64	2	1.12	0.03	2
16-Jul	79	3	4	5.42	0.41	4	1.12	0.06	4
18-Jul	83	1	2	6.94	0.55	2	1.23	0.07	2
Chinook salmon 1+ (day)									
07-Apr	95	0	2	8.83	0.25	2	1.03	0.03	2
08-Apr	107	0	1	12.35	0.00	1	1.01	0.00	1
10-Apr	94	0	1	8.71	0.00	1	1.05	0.00	1
16-Apr	96	0	1	8.75	0.00	1	0.99	0.00	1
26-Apr	104	0	1	12.56	0.00	1	1.12	0.00	1
27-Apr	94	0	1	7.88	0.00	1	0.95	0.00	1
30-Apr	83	0	1	5.72	0.00	1	1.00	0.00	1
01-May	102	8	5	10.43	3.02	5	0.96	0.14	5
02-May	112	0	1	16.18	0.00	1	1.15	0.00	1
04-May	115	0	1	16.44	0.00	1	1.08	0.00	1
05-May	98	0	1	10.15	0.00	1	1.08	0.00	1
08-May	89	0	1	7.39	0.00	1	1.05	0.00	1
19-May	94	0	1	9.74	0.00	1	1.17	0.00	1
26-May	103	0	1	12.80	0.00	1	1.17	0.00	1
29-May	97	11	2	10.99	3.96	2	1.18	0.02	2
Chinook salmon 1+ (night)									
03-Apr	99	10	14	10.10	3.18	14	1.02	0.04	14
04-Apr	97	8	15	10.06	2.43	15	1.08	0.09	15
05-Apr	96	8	17	9.05	2.10	17	1.02	0.04	17
06-Apr	95	9	4	8.64	2.45	4	1.01	0.09	4
07-Apr	93	8	13	8.43	2.27	13	1.02	0.03	13
08-Apr	98	6	20	9.67	1.92	20	1.02	0.05	20
09-Apr	97	8	24	9.91	3.01	24	1.05	0.08	24

Appendix 2 (continued)
Mean Size and Condition of Fish Captured by Rotary Screw Traps,
Diamond Island, Nechako River, 1998

	Length (mm)			Weight (g)			Condition (g/mm³)		
Date	mean	SD	n	mean	SD	n	mean	SD	n
10-Apr	95	4	24	8.61	0.98	24	1.00	0.07	24
11-Apr	92	6	16	8.37	1.64	16	1.06	0.06	16
12-Apr	95	9	15	9.12	2.74	15	1.03	0.06	15
13-Apr	93	8	18	8.46	2.06	18	1.04	0.10	18
14-Apr	97	4	8	9.43	1.30	8	1.04	0.07	8
15-Apr	98	7	17	9.66	1.91	17	1.02	0.09	17
16-Apr	93	6	9	8.32	1.81	9	1.02	0.04	9
17-Apr	97	9	20	9.71	3.00	20	1.03	0.05	20
18-Apr	96	5	16	9.50	1.56	16	1.05	0.05	16
19-Apr	95	5	18	8.89	1.38	18	1.03	0.06	18
20-Apr	96	7	25	9.47	2.24	25	1.04	0.10	25
21-Apr	99	11	25	10.67	4.05	25	1.06	0.10	25
22-Apr	101	8	24	11.48	2.87	24	1.10	0.07	24
23-Apr	101	10	21	11.29	4.05	21	1.06	0.12	21
24-Apr	99	10	15	10.46	3.08	15	1.06	0.13	15
25-Apr	101	8	24	10.16	2.39	24	0.98	0.08	24
26-Apr	96	11	18	8.77	2.99	18	0.97	0.08	18
27-Apr	98	8	14	9.65	2.85	14	1.00	0.07	14
28-Apr	98	10	11	10.15	3.91	11	1.02	0.13	11
29-Apr	96	8	14	9.76	2.39	14	1.07	0.07	14
30-Apr	102	8	21	10.59	2.79	21	0.99	0.13	21
01-May	100	8	21	10.70	2.12	21	1.05	0.06	21
02-May	104	7	20	11.70	2.20	20	1.04	0.09	20
03-May	103	10	14	12.63	3.98	14	1.13	0.04	14
04-May	98	13	5	11.28	5.21	5	1.14	0.07	5
05-May	101	11	16	11.82	4.22	16	1.11	0.05	16
06-May	102	11	8	11.92	4.47	8	1.07	0.05	8
07-May	101	8	9	11.92	2.93	9	1.13	0.04	9
08-May	107	8	14	13.95	2.97	14	1.12	0.05	14
09-May	103	10	11	12.43	3.92	11	1.11	0.07	11
10-May	107	10	20	14.02	3.71	20	1.12	0.05	20
11-May	107	9	10	14.03	3.24	10	1.14	0.04	10
12-May	111	9	17	14.12	3.30	17	1.03	0.12	17
13-May	107	8	19	13.05	2.77	19	1.06	0.06	19
14-May	106	9	11	12.40	3.31	11	1.04	0.09	11
15-May	102	8	21	11.83	2.90	21	1.09	0.05	21
16-May	105	10	20	12.95	4.30	20	1.08	0.10	20
17-May	105	9	13	12.38	2.87	13	1.06	0.15	13
18-May	107	12	19	13.63	5.36	19	1.08	0.05	19
19-May	105	8	17	12.52	2.56	17	1.08	0.14	17
20-May	107	11	17	13.81	4.37	17	1.11	0.05	17
21-May	104	8	11	12.70	2.60	11	1.12	0.12	11
22-May	110	11	10	15.93	5.60	10	1.15	0.04	10
23-May	110	8	11	13.76	3.84	11	1.01	0.17	11
24-May	109	7	7	14.76	2.66	7	1.13	0.07	7

Appendix 2 (continued)
Mean Size and Condition of Fish Captured by Rotary Screw Traps,
Diamond Island, Nechako River, 1998

	Length (mm)			Weight (g)			Condition (g/mm³)		
Date	mean	SD	n	mean	SD	n	mean	SD	n
25-May	106	7	11	13.79	2.71	11	1.15	0.05	11
26-May	107	12	16	14.72	5.20	16	1.15	0.03	16
27-May	107	7	14	13.68	2.95	14	1.12	0.06	14
28-May	103	6	18	12.48	2.39	18	1.13	0.06	18
29-May	110	8	14	15.41	3.92	14	1.13	0.13	14
30-May	102	8	13	11.81	2.51	13	1.09	0.04	13
31-May	107	10	6	13.74	4.17	6	1.09	0.06	6
01-Jun	111	4	2	14.65	0.02	2	1.09	0.10	2
04-Jun	99	0	1	12.26	0.00	1	1.26	0.00	1
16-Jun	125	0	1	21.46	0.00	1	1.10	0.00	1
17-Jun	91	4	7	9.35	1.26	7	1.22	0.06	7
Lake trout 0+ (night)									
23-Apr	85		1	4.30		1	0.70		1
Rainbow trout, adult (night)									
26-May	224		1	99.00		1	0.88		1
Rainbow trout, juvenile (day)									
05-May	124		1	19.46		1	1.02		1
20-May	121		1	17.69		1	1.00		1
01-Jun	144		1	30.60		1	1.02		1
02-Jun	131		1	24.82		1	1.10		1
05-Jul	177		1	54.89		1	0.99		1
12-Jul	278		1	68.18		1	0.32		1
Rainbow trout, juvenile (night)									
12-Apr	107		1	12.12		1	0.99		1
19-Apr	175		1	54.86		1	1.02		1
21-Apr	113	16	2	14.02	4.10	2	0.97	0.11	2
22-Apr	123		1	17.52		1	0.94		1
23-Apr	133		1	21.63		1	0.92		1
24-Apr	115		1	14.82		1	0.97		1
25-Apr	98		1	8.75		1	0.93		1
26-Apr	110	2	2	13.25	0.90	2	1.01	0.01	2
30-Apr	108	1	2	11.86	0.37	2	0.96	0.05	2
01-May	108	4	2	11.09	0.16	2	0.89	0.08	2
02-May	131	35	2	24.83	19.44	2	0.98	0.07	2
03-May	118	12	3	16.61	4.77	3	0.99	0.04	3
05-May	115	20	4	16.46	7.56	4	1.03	0.05	4
06-May	108	20	5	12.87	7.52	5	0.94	0.02	5
07-May	115		1	14.11		1	0.93		1
08-May	110	7	5	13.22	2.65	5	0.97	0.04	5
09-May	113	18	6	14.62	7.74	6	0.95	0.04	6
10-May	110		1	13.67		1	1.03		1
12-May	110	7	3	12.95	3.03	3	0.95	0.06	3

Appendix 2 (continued)
Mean Size and Condition of Fish Captured by Rotary Screw Traps,
Diamond Island, Nechako River, 1998

	Length (mm)			Weight (g)			Condition (g/mm³)		
Date	mean	SD	n	mean	SD	n	mean	SD	n
14-May	121	7	2	16.87	4.23	2	0.94	0.07	2
17-May	113	8	7	13.82	2.91	7	0.95	0.03	7
18-May	127		1	19.50		1	0.95		1
19-May	111		1	13.32		1	0.97		1
20-May	117		1	15.61		1	0.97		1
21-May	108		1	12.51		1	0.99		1
29-May	102		1	10.24		1	0.96		1
04-Jun	115		1	15.56		1	1.02		1
27-Jun	141		1	30.17		1	1.08		1
16-Jul	158		1	41.56		1	1.05		1
Sockeye salmon 0+ (day)									
22-Apr	26		1	0.13		1	0.74		1
03-May	27		1	0.11		1	0.56		1
07-May	29		1	0.14		1	0.57		1
10-May	28	1	2	0.11	0.01	2	0.53	0.03	2
12-May	35		1	0.31		1	0.72		1
23-May	35		1	0.35		1	0.82		1
28-May	32		1	0.24		1	0.73		1
29-May	41		1	0.62		1	0.90		1
31-May	32	3	2	0.28	0.08	2	0.83	0.02	2
03-Jun	42		1	0.61		1	0.82		1
04-Jun	32		1	0.21		1	0.64		1
05-Jun	29		1	0.18		1	0.74		1
07-Jun	31	1	5	0.25	0.03	5	0.81	0.06	5
12-Jun	24		1	0.32		1	2.31		1
15-Jun	33	4	2	0.29	0.09	2	0.82	0.00	2
19-Jun	36	6	3	0.41	0.28	3	0.78	0.14	3
20-Jun	35	2	6	0.36	0.10	6	0.81	0.09	6
21-Jun	35	4	2	0.37	0.22	2	0.83	0.27	2
25-Jun	40		1	0.55		1	0.86		1
26-Jun	50		1	0.96		1	0.77		1
07-Jul	46		1	0.73		1	0.75		1
10-Jul	45	1	2	0.72	0.03	2	0.82	0.07	2
11-Jul	45		1	0.68		1	0.75		1
Sockeye salmon 0+ (night)									
30-Apr	26		1	0.11		1	0.63		1
04-May	27		1	0.12		1	0.61		1
09-May	28		1	0.13		1	0.59		1
10-May	27		1	0.12		1	0.61		1
11-May	26		1	0.11		1	0.63		1
20-May	35		1	0.30		1	0.70		1
21-May	37	1	4	0.38	0.05	4	0.76	0.06	4
22-May	33	3	8	0.27	0.07	8	0.75	0.09	8

Appendix 2 (continued)
Mean Size and Condition of Fish Captured by Rotary Screw Traps,
Diamond Island, Nechako River, 1998

	Length (mm)			Weight (g)			Condition (g/mm³)		
Date	mean	SD	n	mean	SD	n	mean	SD	n
23-May	35	1	5	0.33	0.05	5	0.77	0.07	5
24-May	36	3	4	0.34	0.09	4	0.73	0.05	4
25-May	34	2	7	0.32	0.05	7	0.80	0.07	7
26-May	34	3	5	0.30	0.09	5	0.78	0.10	5
27-May	34	3	12	0.32	0.08	12	0.81	0.08	12
28-May	35	4	5	0.40	0.14	5	0.86	0.04	5
29-May	38	3	7	0.48	0.12	7	0.84	0.06	7
30-May	35	4	10	0.35	0.13	10	0.77	0.08	10
31-May	33	4	8	0.32	0.14	8	0.82	0.05	8
01-Jun	39	4	10	0.52	0.16	10	0.86	0.06	10
02-Jun	37	4	2	0.44	0.17	2	0.84	0.04	2
03-Jun	35	4	13	0.45	0.39	13	0.92	0.33	13
04-Jun	35	3	10	0.36	0.11	10	0.82	0.06	10
05-Jun	34	5	11	0.35	0.17	11	0.82	0.05	11
06-Jun	35	7	10	0.41	0.17	10	1.06	0.65	10
07-Jun	35	4	10	0.36	0.13	10	0.80	0.05	10
08-Jun	39	6	11	0.52	0.22	11	0.86	0.06	11
09-Jun	36	5	7	0.42	0.18	7	0.87	0.05	7
10-Jun	35	5	10	0.39	0.20	10	0.85	0.05	10
11-Jun	37	5	12	0.44	0.22	12	0.81	0.07	12
12-Jun	38	6	10	0.52	0.27	10	0.86	0.07	10
13-Jun	41	8	11	0.68	0.42	11	0.87	0.08	11
14-Jun	39	5	11	0.50	0.22	11	0.83	0.06	11
15-Jun	36	3	11	0.40	0.12	11	0.82	0.08	11
16-Jun	35	2	7	0.37	0.07	7	0.89	0.08	7
17-Jun	38	5	14	0.48	0.17	14	0.86	0.03	14
18-Jun	36	3	12	0.41	0.09	12	0.89	0.08	12
19-Jun	37	4	12	0.40	0.13	12	0.79	0.08	12
20-Jun	38	5	10	0.49	0.19	10	0.84	0.06	10
21-Jun	38	5	11	0.46	0.16	11	0.80	0.04	11
22-Jun	44	9	12	0.83	0.59	12	0.87	0.06	12
23-Jun	36	4	10	0.40	0.11	10	0.81	0.05	10
24-Jun	41	10	6	0.76	0.67	6	0.94	0.13	6
25-Jun	41	9	10	0.64	0.47	10	0.83	0.09	10
26-Jun	42	4	11	0.77	0.46	11	0.98	0.31	11
27-Jun	43	4	5	0.77	0.19	5	0.93	0.03	5
28-Jun	41	2	3	0.58	0.13	3	0.85	0.06	3
29-Jun	43	5	11	0.70	0.35	11	0.85	0.07	11
01-Jul	41	4	6	0.70	0.38	6	0.98	0.34	6
02-Jul	47		1	0.94		1	0.91		1
04-Jul	51	8	4	1.24	0.58	4	0.87	0.02	4
05-Jul	39		1	0.54		1	0.91		1
06-Jul	41		1	0.52		1	0.75		1
08-Jul	43		1	0.75		1	0.94		1
09-Jul	51	1	2	1.20	0.21	2	0.90	0.08	2

Appendix 2 (continued)
Mean Size and Condition of Fish Captured by Rotary Screw Traps,
Diamond Island, Nechako River, 1998

Date	Length (mm)			Weight (g)			Condition (g/mm³)		
	mean	SD	n	mean	SD	n	mean	SD	n
Sockeye salmon 1+ (night)									
08-Apr	91		1	6.47		1	0.86		1
17-Jun	53	3	2	1.26	0.18	2	0.84	0.01	2
18-Jun	56	1	2	1.21	0.06	2	0.69	0.08	2
19-Jun	52	4	3	1.14	0.30	3	0.79	0.04	3
27-Jun	74		1	3.49		1	0.86		1
28-Jun	64		1	2.45		1	0.93		1
Burbot, adult (night)									
24-Jun	44		1			1			1
Burbot, juvenile (night)									
23-Jun	130		1	13.62		1	0.62		1

Appendix 3

Mean Monthly Electrofishing Catch-per-unit-effort (CPUE) of Juvenile Chinook Salmon by 10 km Intervals of the Nechako River, 1998

Appendix 3
Mean Monthly Electrofishing Catch-per-unit-effort (CPUE) of Juvenile Chinook Salmon by 10 km Intervals of the Nechako River, 1998

Date	Distance (km) from Kenney Dam	0+ $\log_e$(CPUE+1)			1+ $\log_e$(CPUE+1)		
		mean	SD	n	mean	SD	n
Day							
Apr	0.0-9.9	0.1515	0.3031	4	0.0719	0.1438	4
	10.0-19.9	0.9700	1.0496	26	0.0929	0.2467	26
	20.0-29.9	2.5675	1.1601	38	0.1959	0.4084	38
	30.0-39.9	1.7217	1.0572	16	0.1225	0.2650	16
	50.0-59.9	2.0072	0.6984	19	0.5330	0.7677	19
	70.0-79.9	2.6638	1.1474	16	0.3001	0.4748	16
	80.0-89.9	1.9508	0.8654	17	0.1014	0.2265	17
May	0.0-9.9	1.5647	1.8301	4	0.0000	0.0000	4
	10.0-19.9	2.6765	1.5486	27	0.0000	0.0000	27
	20.0-29.9	0.9993	1.3512	38	0.0000	0.0000	38
	30.0-39.9	0.7333	0.9903	16	0.0379	0.1515	16
	50.0-59.9	0.3585	0.7587	19	0.0000	0.0000	19
	70.0-79.9	0.4320	0.7248	16	0.0000	0.0000	16
	80.0-89.9	0.1574	0.4618	17	0.0000	0.0000	17
Jun	0.0-9.9	2.3260	1.1613	4	0.0000	0.0000	4
	10.0-19.9	0.8334	0.8400	27	0.0000	0.0000	27
	20.0-29.9	0.1396	0.3473	38	0.0000	0.0000	38
	30.0-39.9	0.0000	0.0000	16	0.0000	0.0000	16
	50.0-59.9	0.0319	0.1391	19	0.0000	0.0000	19
	70.0-79.9	0.0758	0.2070	16	0.0000	0.0000	16
	80.0-89.9	0.0000	0.0000	17	0.0000	0.0000	17
Jul	0.0-9.9	1.3555	1.6853	4	0.0000	0.0000	4
	10.0-19.9	0.2489	0.3831	27	0.0000	0.0000	27
	20.0-29.9	0.0491	0.1677	37	0.0000	0.0000	37
	30.0-39.9	0.0000	0.0000	16	0.0000	0.0000	16
	50.0-59.9	0.1154	0.2832	19	0.0000	0.0000	19
	70.0-79.9	0.0000	0.0000	16	0.0000	0.0000	16
	80.0-89.9	0.0000	0.0000	16	0.0000	0.0000	16
Nov	0.0-9.9	0.0000	0.0000	1	0.0000	0.0000	1
	10.0-19.9	0.4237	0.6787	11	0.0000	0.0000	11
	20.0-29.9	0.2167	0.4784	38	0.0000	0.0000	38
	30.0-39.9	0.0000	0.0000	16	0.0000	0.0000	16
	50.0-59.9	0.0000	0.0000	19	0.0000	0.0000	19
	70.0-79.9	0.0758	0.2143	8	0.0000	0.0000	8
	80.0-89.9	0.0934	0.2717	17	0.0000	0.0000	17

Appendix 3 (continued)
Mean Monthly Electrofishing Catch-per-unit-effort (CPUE) of Juvenile Chinook Salmon
by 10 km Intervals of the Nechako River, 1998

Date	Distance (km) from Kenney Dam	0+ $\log_e$(CPUE+1) mean	0+ SD	0+ n	1+ $\log_e$(CPUE+1) mean	1+ SD	1+ n
Night							
Apr	0.0-9.9	0.3666	0.7332	4	0.1733	0.3466	4
	10.0-19.9	1.7415	1.5085	26	0.3478	0.6351	26
	20.0-29.9	3.7429	1.4251	38	0.5404	0.8020	38
	30.0-39.9	3.1116	0.9870	15	0.4606	0.7412	15
	50.0-59.9	2.7556	1.4839	19	0.7321	0.9989	19
	70.0-79.9	3.0589	1.2032	16	0.6106	0.6133	16
	80.0-89.9	2.9382	1.4626	17	0.9205	0.8215	17
May	0.0-9.9	1.9837	2.1406	4	0.0719	0.1438	4
	10.0-19.9	3.2691	1.1564	27	0.1976	0.3595	27
	20.0-29.9	2.9445	0.9429	38	0.1853	0.3830	38
	30.0-39.9	2.2024	0.7420	16	0.0889	0.2621	16
	50.0-59.9	1.8582	1.2655	19	0.0393	0.1714	19
	70.0-79.9	3.5980	0.7408	16	0.1515	0.2711	16
	80.0-89.9	2.5080	0.6946	17	0.0934	0.2717	17
Jun	0.0-9.9	3.5818	0.2943	4	0.0000	0.0000	4
	10.0-19.9	2.9018	1.5349	27	0.0000	0.0000	27
	20.0-29.9	2.2794	1.0429	38	0.0000	0.0000	38
	30.0-39.9	1.4968	0.8851	16	0.0000	0.0000	16
	50.0-59.9	1.5699	0.9735	19	0.0000	0.0000	19
	70.0-79.9	1.7993	1.1227	16	0.0000	0.0000	16
	80.0-89.9	1.9064	1.1961	17	0.0000	0.0000	17
Jul	0.0-9.9	2.8830	1.1334	4	0.0000	0.0000	4
	10.0-19.9	2.2418	1.3374	27	0.0224	0.1167	27
	20.0-29.9	1.3933	0.9190	38	0.0000	0.0000	38
	30.0-39.9	1.2530	0.5929	16	0.0000	0.0000	16
	50.0-59.9	1.3867	0.7270	19	0.0000	0.0000	19
	70.0-79.9	1.8917	0.9226	16	0.0000	0.0000	16
	80.0-89.9	1.1137	0.7276	17	0.0000	0.0000	17
Nov	0.0-9.9	0.0000	0.0000	1	0.0000	0.0000	1
	10.0-19.9	0.6060	0.8064	11	0.0000	0.0000	11
	20.0-29.9	0.8022	0.7642	38	0.0000	0.0000	38
	30.0-39.9	0.0902	0.2396	15	0.0000	0.0000	15
	50.0-59.9	0.4071	0.6239	19	0.0000	0.0000	19
	70.0-79.9	0.7263	0.5289	8	0.0000	0.0000	8
	80.0-89.9	0.7136	0.7641	16	0.0000	0.0000	16

Appendix 4

Daily Catch of Juvenile Chinook Salmon by Rotary Screw Traps and Index of Outmigrants, Diamond Island, Nechako River, 1998

Appendix 4. Daily catch of juvenile chinook salmon by rotary screw traps and index of outmigrants, Diamond Island, Nechako River, 1998.

Date	RST staff gage (cm)	River flow (m³/s)	RST No. 1: Trap flow (m³/s)	Percent flow sampled	Catch: 1+	Catch: 0+	Population estimate: 1+	Population estimate: 0+	RST No. 2: Trap flow (m³/s)	Percent flow sampled	Catch: 1+	Catch: 0+	Population estimate: 1+	Population estimate: 0+	RST No. 3: Trap flow (m³/s)	Percent flow sampled	Catch: 1+	Catch: 0+	Population estimate: 1+	Population estimate: 0+	Total Catch: 1+	Total Catch: 0+	Total Population estimate: 1+	Total Population estimate: 0+
Day																								
03-Apr	84.1	55.49	1.00	1.8	0	2	0	111	1.04	1.9	0	0	0	0	0.71	1.3	0	23	0	1802	0	25	0	505
04-Apr	84.1	55.49	1.00	1.8	0	0	0	0	1.04	1.9	0	9	0	480	0.71	1.3	0	5	0	392	0	14	0	283
05-Apr	84.1	55.49	1.00	1.8	0	0	0	0	1.04	1.9	0	3	0	160	0.71	1.3	0	3	0	235	0	6	0	121
06-Apr	84.1	55.49	1.28	2.3	0	0	0	0	1.18	2.1	0	1	0	47	0.72	1.3	0	13	0	1002	0	14	0	244
07-Apr	84.1	55.49	1.28	2.3	2	0	86	0	1.18	2.1	0	0	0	0	0.72	1.3	0	11	0	848	2	11	35	191
08-Apr	84.1	55.49	1.18	2.1	0	0	0	0	1.03	1.9	1	10	54	537	0.52	0.9	0	38	0	4062	1	48	20	976
09-Apr	84.1	55.49	1.18	2.1	0	1	0	47	1.03	1.9	0	1	0	54	0.52	0.9	0	12	0	1283	0	14	0	285
10-Apr	84.1	55.49	1.38	2.5	0	0	0	0	1.36	2.5	1	0	41	0	0.88	1.6	0	5	0	314	1	5	15	76
11-Apr	84.1	55.49	1.38	2.5	0	0	0	0	1.36	2.5	0	2	0	81	0.88	1.6	0	5	0	314	0	7	0	107
12-Apr	84.1	55.49	1.33	2.4	0	2	0	84	1.41	2.5	0	3	0	118	0.84	1.5	0	6	0	395	0	11	0	171
13-Apr	84.1	55.49	1.33	2.4	0	1	0	42	1.41	2.5	0	2	0	79	0.84	1.5	0	7	0	460	0	10	0	155
14-Apr	84.1	55.49	1.39	2.5	0	1	0	40	1.35	2.4	0	1	0	41	0.80	1.4	0	10	0	693	0	12	0	188
15-Apr	84.1	55.49	1.39	2.5	0	2	0	80	1.35	2.4	0	1	0	41	0.80	1.4	0	8	0	554	0	11	0	172
16-Apr	84.6	56.04	1.34	2.4	0	7	0	293	1.43	2.5	1	3	39	118	0.84	1.5	0	16	0	1073	1	26	16	404
17-Apr	84.6	56.04	1.34	2.4	0	1	0	42	1.43	2.5	0	0	0	0	0.84	1.5	0	6	0	402	0	7	0	109
18-Apr	86.1	57.71	1.34	2.3	0	0	0	0	1.43	2.5	0	3	0	121	0.84	1.4	0	6	0	414	0	9	0	144
19-Apr	87.6	59.40	1.30	2.2	0	2	0	91	1.32	2.2	0	3	0	135	1.12	1.9	0	16	0	848	0	21	0	333
20-Apr	87.6	59.40	1.30	2.2	0	2	0	91	1.32	2.2	0	1	0	45	1.12	1.9	0	18	0	954	0	21	0	333
21-Apr	88.6	60.54	1.37	2.3	0	4	0	177	1.25	2.1	0	2	0	97	0.68	1.1	0	10	0	884	0	16	0	293
22-Apr	88.6	60.54	1.37	2.3	0	1	0	44	1.25	2.1	0	0	0	0	0.68	1.1	0	7	0	619	0	8	0	147
23-Apr	88.6	60.54	1.36	2.2	0	5	0	222	1.26	2.1	0	2	0	96	0.69	1.1	0	4	0	353	0	11	0	201
24-Apr	90.6	62.84	1.36	2.2	0	3	0	139	1.26	2.0	0	5	0	249	0.69	1.1	0	12	0	1100	0	20	0	380
25-Apr	90.6	62.84	1.12	1.8	0	5	0	280	1.25	2.0	0	9	0	451	0.89	1.4	0	5	0	353	0	19	0	365
26-Apr	91.6	64.00	1.12	1.8	0	6	0	342	1.25	2.0	1	5	51	255	0.89	1.4	0	8	0	575	1	19	20	372
27-Apr	92.1	64.59	1.12	1.7	1	1	58	58	1.25	1.9	0	2	0	103	0.89	1.4	0	2	0	145	1	5	20	99
28-Apr	92.1	64.59	1.38	2.1	0	3	0	140	1.43	2.2	0	4	0	181	0.87	1.3	0	11	0	820	0	18	0	316
29-Apr	94.1	66.95	1.38	2.1	0	7	0	339	1.43	2.1	0	3	0	141	0.87	1.3	0	4	0	309	0	14	0	255
30-Apr	97.6	71.16	1.41	2.0	1	11	51	556	1.35	1.9	0	7	0	368	0.84	1.2	0	19	0	1606	1	37	20	731
01-May	98.6	72.38	1.41	1.9	5	6	257	308	1.35	1.9	0	0	0	0	0.84	1.2	0	17	0	1462	5	23	100	462
02-May	100.6	74.85	1.53	2.0	1	18	49	883	1.44	1.9	0	11	0	573	0.80	1.1	0	17	0	1591	1	46	20	915
03-May	102.1	76.72	1.53	2.0	0	44	0	2213	1.44	1.9	0	28	0	1495	0.80	1.0	0	37	0	3550	0	109	0	2223
04-May	102.1	76.72	1.43	1.9	1	17	54	915	1.39	1.8	0	13	0	717	0.75	1.0	0	28	0	2854	1	58	21	1247
05-May	102.1	76.72	1.43	1.9	1	6	54	323	1.39	1.8	0	9	0	497	0.75	1.0	0	22	0	2242	1	37	21	795
06-May	102.1	76.72	1.58	2.1	0	10	0	484	1.46	1.9	0	9	0	472	0.81	1.1	0	15	0	1415	0	34	0	675
07-May	102.1	76.72	1.58	2.1	0	10	0	484	1.46	1.9	0	9	0	472	0.81	1.1	0	17	0	1603	0	36	0	715
08-May	101.6	76.09	1.47	1.9	1	30	52	1553	1.25	1.6	0	10	0	609	0.87	1.1	0	15	0	1311	1	55	21	1166
09-May	100.6	74.85	1.47	2.0	0	6	0	306	1.25	1.7	0	8	0	479	0.87	1.2	0	21	0	1805	0	35	0	730
10-May	100.1	74.23	1.51	2.0	0	6	0	294	1.54	2.1	0	8	0	385	0.76	1.0	0	14	0	1372	0	28	0	545
11-May	99.1	72.99	1.51	2.1	0	6	0	289	1.54	2.1	0	4	0	189	0.76	1.0	0	16	0	1542	0	26	0	498
12-May	99.1	72.99	1.46	2.0	0	7	0	350	1.40	1.9	0	2	0	104	0.83	1.1	0	18	0	1580	0	27	0	533
13-May	99.1	72.99	1.46	2.0	0	4	0	200	1.40	1.9	0	22	0	1143	0.83	1.1	0	8	0	702	0	34	0	672
14-May	98.6	72.38	1.45	2.0	0	6	0	300	1.55	2.1	0	7	0	328	0.99	1.4	0	32	0	2341	0	45	0	817
15-May	98.1	71.77	1.45	2.0	0	2	0	99	1.55	2.2	0	3	0	139	0.99	1.4	0	10	0	725	0	15	0	270

Appendix 4. Daily catch of juvenile chinook salmon by rotary screw traps and index of outmigrants, Diamond Island, Nechako River, 1998.

	RST		RST No. 1:						RST No. 2:						RST No. 3:						Total			
	staff gage	River flow	Trap flow	Percent flow	Catch:		Population estimate:		Trap flow	Percent flow	Catch:		Population estimate:		Trap flow	Percent flow	Catch:		Population estimate:		Catch:		Population estimate:	
Date	(cm)	(m³/s)	(m³/s)	sampled	1+	0+	1+	0+	(m³/s)	sampled	1+	0+	1+	0+	(m³/s)	sampled	1+	0+	1+	0+	1+	0+	1+	0+
16-May	97.6	71.16	1.43	2.0	0	2	0	100	1.45	2.0	0	3	0	147	0.79	1.1	0	13	0	1173	0	18	0	349
17-May	97.1	70.55	1.43	2.0	0	3	0	148	1.45	2.1	0	3	0	146	0.79	1.1	0	8	0	716	0	14	0	269
18-May	97.1	70.55	1.47	2.1	0	0	0	0	1.35	1.9	0	0	0	0	0.77	1.1	0	5	0	459	0	5	0	98
19-May	96.6	69.94	1.37	2.0	0	2	0	102	1.42	2.0	1	1	49	49	0.42	0.6	0	6	0	998	1	9	22	196
20-May	96.1	69.34	1.49	2.1	0	6	0	279	1.47	2.1	0	14	0	659	0.74	1.1	0	8	0	746	0	28	0	524
21-May	95.1	68.14	1.49	2.2	0	2	0	91	1.47	2.2	0	4	0	185	0.74	1.1	0	9	0	825	0	15	0	276
22-May	94.6	67.54	1.45	2.1	0	3	0	140	1.43	2.1	0	5	0	237	0.82	1.2	0	10	0	828	0	18	0	329
23-May	94.1	66.95	1.45	2.2	0	4	0	184	1.43	2.1	0	9	0	423	0.82	1.2	0	16	0	1313	0	29	0	526
24-May	94.1	66.95	1.34	2.0	0	9	0	450	1.22	1.8	0	4	0	219	0.56	0.8	0	10	0	1190	0	23	0	493
25-May	93.6	66.35	1.34	2.0	0	5	0	248	1.22	1.8	0	4	0	217	0.56	0.8	0	12	0	1415	0	21	0	446
26-May	93.6	66.35	1.51	2.3	1	22	44	966	1.33	2.0	0	14	0	698	0.62	0.9	0	17	0	1815	1	53	19	1015
27-May	92.6	65.17	1.51	2.3	0	15	0	647	1.33	2.0	0	5	0	245	0.62	1.0	0	6	0	629	0	26	0	489
28-May	92.1	64.59	1.43	2.2	0	18	0	814	1.34	2.1	0	10	0	483	0.83	1.3	0	2	0	156	0	30	0	539
29-May	92.1	64.59	1.43	2.2	1	6	45	271	1.34	2.1	1	34	48	1642	0.83	1.3	0	7	0	547	2	47	36	845
30-May	92.1	64.59	1.40	2.2	0	10	0	463	1.37	2.1	0	3	0	141	0.72	1.1	0	4	0	358	0	17	0	315
31-May	92.1	64.59	1.40	2.2	0	22	0	1018	1.37	2.1	0	6	0	283	0.72	1.1	0	6	0	537	0	34	0	630
01-Jun	91.1	63.42	1.43	2.3	0	2	0	89	1.36	2.1	0	0	0	0	0.72	1.1	0	0	0	0	0	2	0	36
02-Jun	90.6	62.84	1.43	2.3	0	12	0	528	1.36	2.2	0	4	0	185	0.72	1.2	0	0	0	0	0	16	0	286
03-Jun	89.1	61.11	1.43	2.3	0	4	0	171	1.35	2.2	0	3	0	136	0.72	1.2	0	2	0	171	0	9	0	158
04-Jun	88.6	60.54	1.43	2.4	0	5	0	212	1.35	2.2	0	4	0	180	0.72	1.2	0	4	0	338	0	13	0	226
05-Jun	88.1	59.97	1.50	2.5	0	7	0	281	1.35	2.3	0	8	0	354	0.72	1.2	0	1	0	83	0	16	0	269
06-Jun	87.6	59.40	1.50	2.5	0	5	0	199	1.35	2.3	0	4	0	175	0.72	1.2	0	4	0	329	0	13	0	216
07-Jun	87.6	59.40	1.44	2.4	0	3	0	123	1.45	2.4	0	2	0	82	0.74	1.3	0	2	0	160	0	7	0	114
08-Jun	87.1	58.84	1.44	2.5	0	5	0	204	1.45	2.5	0	5	0	203	0.74	1.3	0	3	0	237	0	13	0	211
09-Jun	86.6	58.27	1.43	2.4	0	0	0	0	1.40	2.4	0	1	0	41	0.77	1.3	0	1	0	75	0	2	0	32
10-Jun	91.1	63.42	1.43	2.2	0	3	0	133	1.40	2.2	0	0	0	0	0.77	1.2	0	0	0	0	0	3	0	53
11-Jun	86.1	57.71	1.42	2.5	0	0	0	0	1.43	2.5	0	3	0	121	0.74	1.3	0	0	0	0	0	3	0	48
12-Jun	85.6	57.15	1.42	2.5	0	0	0	0	1.43	2.5	0	2	0	80	0.74	1.3	0	0	0	0	0	2	0	32
13-Jun	84.6	56.04	1.42	2.5	0	1	0	39	1.41	2.5	0	1	0	40	0.74	1.3	0	1	0	76	0	3	0	47
14-Jun	85.1	56.60	1.42	2.5	0	0	0	0	1.41	2.5	0	0	0	0	0.74	1.3	0	0	0	0	0	0	0	0
15-Jun	85.1	56.60	1.43	2.5	0	0	0	0	1.47	2.6	0	1	0	39	0.69	1.2	0	0	0	0	0	1	0	16
16-Jun	85.1	56.60	1.43	2.5	0	6	0	238	1.47	2.6	0	2	0	77	0.69	1.2	0	0	0	0	0	8	0	126
17-Jun	84.6	56.04	1.31	2.3	0	0	0	0	1.44	2.6	0	0	0	0	0.52	0.9	0	0	0	0	0	0	0	0
18-Jun	84.6	56.04	1.31	2.3	0	0	0	0	1.44	2.6	0	0	0	0	0.52	0.9	0	0	0	0	0	0	0	0
19-Jun	84.6	56.04	1.39	2.5	0	0	0	0	1.28	2.3	0	1	0	44	0.71	1.3	0	0	0	0	0	1	0	17
20-Jun	84.6	56.04	1.39	2.5	0	0	0	0	1.28	2.3	0	1	0	44	0.71	1.3	0	1	0	78	0	2	0	33
21-Jun	84.6	56.04	1.31	2.3	0	3	0	128	1.36	2.4	0	0	0	0	0.67	1.2	0	0	0	0	0	3	0	50
22-Jun	84.1	55.49	1.31	2.4	0	0	0	0	1.36	2.5	0	0	0	0	0.67	1.2	0	0	0	0	0	0	0	0
23-Jun	83.6	54.94	1.36	2.5	0	0	0	0	1.34	2.4	0	0	0	0	0.66	1.2	0	0	0	0	0	0	0	0
24-Jun	83.6	54.94	1.36	2.5	0	0	0	0	1.34	2.4	0	0	0	0	0.66	1.2	0	0	0	0	0	0	0	0
25-Jun	85.6	57.15	1.36	2.4	0	0	0	0	1.34	2.3	0	0	0	0	0.66	1.2	0	0	0	0	0	0	0	0
26-Jun	85.6	57.15	1.35	2.4	0	0	0	0	1.23	2.1	0	0	0	0	0.74	1.3	0	1	0	78	0	1	0	17
27-Jun	86.6	58.27	1.35	2.3	0	1	0	43	1.23	2.1	0	0	0	0	0.74	1.3	0	0	0	0	0	1	0	18
28-Jun	87.6	59.40	1.51	2.5	0	1	0	39	1.37	2.3	0	0	0	0	0.72	1.2	0	0	0	0	0	1	0	17
29-Jun	86.6	58.27	1.51	2.6	0	0	0	0	1.37	2.3	0	0	0	0	0.72	1.2	0	0	0	0	0	0	0	0

Appendix 4. Daily catch of juvenile chinook salmon by rotary screw traps and index of outmigrants, Diamond Island, Nechako River, 1998.

	RST		RST No. 1:						RST No. 2:						RST No. 3:						Total			
Date	staff gage (cm)	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+	Catch: 1+	Catch: 0+	Population estimate: 1+	Population estimate: 0+
30-Jun	85.1	56.60	1.38	2.4	0	2	0	82	1.38	2.4	0	0	0	0	0.72	1.3	0	0	0	0	0	2	0	33
01-Jul	86.6	58.27	1.38	2.4	0	0	0	0	1.38	2.4	0	0	0	0	0.72	1.2	0	0	0	0	0	0	0	0
02-Jul	88.1	59.97	1.38	2.3	0	1	0	43	1.38	2.3	0	0	0	0	0.72	1.2	0	0	0	0	0	1	0	17
03-Jul	87.6	59.40	1.52	2.6	0	1	0	39	1.44	2.4	0	0	0	0	0.77	1.3	0	0	0	0	0	1	0	16
04-Jul	88.1	59.97	1.52	2.5	0	0	0	0	1.44	2.4	0	1	0	42	0.77	1.3	0	0	0	0	0	1	0	16
05-Jul	88.1	59.97	1.48	2.5	0	0	0	0	1.47	2.5	0	0	0	0	0.78	1.3	0	0	0	0	0	0	0	0
06-Jul	88.6	60.54	1.48	2.4	0	0	0	0	1.47	2.4	0	0	0	0	0.78	1.3	0	0	0	0	0	0	0	0
07-Jul	88.1	59.97	1.54	2.6	0	0	0	0	1.48	2.5	0	0	0	0	0.91	1.5	0	0	0	0	0	0	0	0
08-Jul	93.6	66.35	1.54	2.3	0	0	0	0	1.48	2.2	0	0	0	0	0.91	1.4	0	0	0	0	0	0	0	0
09-Jul	105.6	81.16	1.54	1.9	0	0	0	0	1.48	1.8	0	1	0	55	0.91	1.1	0	0	0	0	0	1	0	21
10-Jul	118.6	98.53	1.47	1.5	0	5	0	335	1.43	1.4	0	0	0	0	0.99	1.0	0	0	0	0	0	5	0	127
11-Jul	132.6	118.72	1.47	1.2	0	0	0	0	1.43	1.2	0	4	0	333	0.99	0.8	0	1	0	120	0	5	0	153
12-Jul	160.6	163.48	1.47	0.9	0	0	0	0	1.43	0.9	0	0	0	0	0.99	0.6	0	0	0	0	0	0	0	0
13-Jul	160.6	163.48	1.71	1.0	0	0	0	0							0.85	0.5	0	0	0	0	0	0	0	0
14-Jul	160.6	163.48	1.71	1.0	0	0	0	0							0.85	0.5	0	0	0	0	0	0	0	0
15-Jul	160.6	163.48	1.71	1.0	0	0	0	0							0.85	0.5	0	0	0	0	0	0	0	0
16-Jul	160.6	163.48	1.71	1.0	0	0	0	0							0.85	0.5	0	0	0	0	0	0	0	0
17-Jul	160.6	163.48	1.71	1.0	0	0	0	0							0.85	0.5	0	0	0	0	0	0	0	0
Night																								
03-Apr	84.1	55.49	1.00	1.8	6	0	332	0	1.04	1.9	3	0	160	0	0.71	1.3	5	9	392	705	14	9	283	182
04-Apr	84.1	55.49	1.00	1.8	6	0	332	0	1.04	1.9	6	63	320	3363	0.71	1.3	3	19	235	1489	15	82	303	1655
05-Apr	84.1	55.49	1.00	1.8	0	6	0	332	1.04	1.9	12	18	640	961	0.71	1.3	1	40	78	3134	13	64	262	1292
06-Apr	84.1	55.49	1.28	2.3	3	0	130	0	1.18	2.1	1	37	47	1734	0.72	1.3	0	51	0	3930	4	88	70	1532
07-Apr	84.1	55.49	1.28	2.3	6	16	259	691	1.18	2.1	5	27	234	1265	0.72	1.3	2	26	154	2004	13	69	226	1201
08-Apr	84.1	55.49	1.18	2.1	13	0	614	0	1.03	1.9	5	45	268	2416	0.52	0.9	5	40	535	4276	23	85	468	1729
09-Apr	84.1	55.49	1.18	2.1	19	0	897	0	1.03	1.9	12	11	644	590	0.52	0.9	4	25	428	2673	35	36	712	732
10-Apr	84.1	55.49	1.38	2.5	8	0	321	0	1.36	2.5	16	31	651	1262	0.88	1.6	6	17	377	1067	30	48	459	734
11-Apr	84.1	55.49	1.38	2.5	8	0	321	0	1.36	2.5	5	45	203	1831	0.88	1.6	3	3	188	188	16	48	245	734
12-Apr	84.1	55.49	1.33	2.4	4	0	167	0	1.41	2.5	7	23	275	905	0.84	1.5	4	15	263	986	15	38	233	589
13-Apr	84.1	55.49	1.33	2.4	13	4	544	167	1.41	2.5	3	44	118	1731	0.84	1.5	5	6	329	395	21	54	326	837
14-Apr	84.1	55.49	1.39	2.5	5	3	200	120	1.35	2.4	2	44	82	1810	0.80	1.4	1	43	69	2979	8	90	125	1411
15-Apr	84.1	55.49	1.39	2.5	7	1	279	40	1.35	2.4	7	34	288	1399	0.80	1.4	3	18	208	1247	17	53	266	831
16-Apr	84.6	56.04	1.34	2.4	2	23	84	962	1.43	2.5	5	39	196	1530	0.84	1.5	2	24	134	1610	9	86	140	1337
17-Apr	84.6	56.04	1.34	2.4	10	9	418	376	1.43	2.5	7	34	275	1334	0.84	1.5	4	17	268	1140	21	60	327	933
18-Apr	86.1	57.71	1.34	2.3	13	24	560	1034	1.43	2.5	3	25	121	1010	0.84	1.4	3	18	207	1243	19	67	304	1073
19-Apr	87.6	59.40	1.30	2.2	13	8	592	364	1.32	2.2	6	27	271	1218	1.12	1.9	2	59	106	3127	21	94	333	1492
20-Apr	87.6	59.40	1.30	2.2	16	21	728	956	1.32	2.2	12	7	541	316	1.12	1.9	5	26	265	1378	33	54	524	857
21-Apr	88.6	60.54	1.37	2.3	10	0	442	0	1.25	2.1	13	17	630	824	0.68	1.1	5	25	442	2210	28	42	513	770
22-Apr	88.6	60.54	1.37	2.3	18	2	796	88	1.25	2.1	12	6	582	291	0.68	1.1	4	50	354	4419	34	58	623	1063
23-Apr	88.6	60.54	1.36	2.2	20	1	890	44	1.26	2.1	17	7	816	336	0.69	1.1	1	47	88	4149	38	55	696	1007
24-Apr	90.6	62.84	1.36	2.2	5	7	231	323	1.26	2.0	9	9	449	449	0.69	1.1	1	72	92	6597	15	88	285	1672
25-Apr	90.6	62.84	1.12	1.8	22	4	1232	224	1.25	2.0	16	0	801	0	0.89	1.4	4	100	282	7058	42	104	808	2000
26-Apr	91.6	64.00	1.12	1.8	7	5	399	285	1.25	2.0	6	22	306	1122	0.89	1.4	5	17	359	1222	18	44	353	862

Appendix 4. Daily catch of juvenile chinook salmon by rotary screw traps and index of outmigrants, Diamond Island, Nechako River, 1998.

Date	RST staff gage (cm)	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+	Total: Population estimate: 1+	Total: Population estimate: 0+
27-Apr	92.1	64.59	1.12	1.7	2	64	115	3684	1.25	1.9	10	15	515	772	0.89	1.4	2	78	145	5658	14	157	277	3104
28-Apr	92.1	64.59	1.38	2.1	2	29	93	1353	1.43	2.2	9	16	407	723	0.87	1.3	0	136	0	10137	11	181	193	3177
29-Apr	94.1	66.95	1.38	2.1	5	44	242	2128	1.43	2.1	9	4	422	187	0.87	1.3	0	9	0	695	14	57	255	1037
30-Apr	97.6	71.16	1.41	2.0	12	3	607	152	1.35	1.9	18	0	947	0	0.84	1.2	1	2	85	169	31	5	612	99
01-May	98.6	72.38	1.41	1.9	21	3	1080	154	1.35	1.9	36	0	1927	0	0.84	1.2	1	6	86	516	58	9	1166	181
02-May	100.6	74.85	1.53	2.0	21	3	1030	147	1.44	1.9	12	19	625	989	0.80	1.1	0	9	0	843	33	31	656	617
03-May	102.1	76.72	1.53	2.0	4	8	201	402	1.44	1.9	13	3	694	160	0.80	1.0	0	5	0	480	17	16	347	326
04-May	102.1	76.72	1.43	1.9	2	10	108	538	1.39	1.8	3	29	166	1600	0.75	1.0	1	14	102	1427	6	53	129	1139
05-May	102.1	76.72	1.43	1.9	7	4	377	215	1.39	1.8	9	3	497	166	0.75	1.0	0	3	0	306	16	10	344	215
06-May	102.1	76.72	1.58	2.1	5	6	242	291	1.46	1.9	4	3	210	157	0.81	1.1	0	8	0	755	9	17	179	338
07-May	102.1	76.72	1.58	2.1	3	10	145	484	1.46	1.9	0	26	0	1363	0.81	1.1	0	9	0	849	3	45	60	894
08-May	101.6	76.09	1.47	1.9	14	5	725	259	1.25	1.6	4	4	244	244	0.87	1.1	0	11	0	961	18	20	382	424
09-May	100.6	74.85	1.47	2.0	6	11	306	560	1.25	1.7	5	9	300	539	0.87	1.2	0	11	0	945	11	31	229	646
10-May	100.1	74.23	1.51	2.0	15	27	735	1324	1.54	2.1	18	13	866	625	0.76	1.0	0	10	0	980	33	50	642	973
11-May	99.1	72.99	1.51	2.1	17	7	820	338	1.54	2.1	15	5	709	236	0.76	1.0	0	8	0	771	32	20	612	383
12-May	99.1	72.99	1.46	2.0	10	0	501	0	1.40	1.9	0	6	0	312	0.83	1.1	0	4	0	351	10	10	198	198
13-May	99.1	72.99	1.46	2.0	14	22	701	1101	1.40	1.9	9	6	468	312	0.83	1.1	0	5	0	439	23	33	454	652
14-May	98.6	72.38	1.45	2.0	7	9	350	450	1.55	2.1	4	13	187	609	0.99	1.4	0	5	0	366	11	27	200	490
15-May	98.1	71.77	1.45	2.0	37	27	1832	1337	1.55	2.2	15	6	696	278	0.99	1.4	1	7	73	508	53	40	955	720
16-May	97.6	71.16	1.43	2.0	31	11	1547	549	1.45	2.0	12	5	588	245	0.79	1.1	0	10	0	902	43	26	835	505
17-May	97.1	70.55	1.43	2.0	8	13	396	643	1.45	2.1	5	10	243	486	0.79	1.1	0	3	0	268	13	26	250	500
18-May	97.1	70.55	1.47	2.1	11	5	527	240	1.35	1.9	9	15	470	783	0.77	1.1	0	5	0	459	20	25	393	491
19-May	96.6	69.94	1.37	2.0	13	17	665	870	1.42	2.0	5	8	246	394	0.42	0.6	2	0	333	0	20	25	436	545
20-May	96.1	69.34	1.49	2.1	10	6	465	279	1.47	2.1	7	5	330	235	0.74	1.1	0	5	0	466	17	16	318	299
21-May	95.1	68.14	1.49	2.2	8	15	366	686	1.47	2.2	3	14	139	648	0.74	1.1	0	5	0	458	11	34	202	625
22-May	94.6	67.54	1.45	2.1	13	16	605	744	1.43	2.1	0	8	0	379	0.82	1.2	0	6	0	497	13	30	238	549
23-May	94.1	66.95	1.45	2.2	7	29	323	1337	1.43	2.1	4	17	188	798	0.82	1.2	0	21	0	1723	11	67	199	1214
24-May	94.1	66.95	1.34	2.0	4	23	200	1149	1.22	1.8	3	17	164	931	0.56	0.8	0	25	0	2975	7	65	150	1392
25-May	93.6	66.35	1.34	2.0	9	23	446	1139	1.22	1.8	2	13	109	706	0.56	0.8	0	5	0	590	11	41	234	871
26-May	93.6	66.35	1.51	2.3	18	41	790	1801	1.33	2.0	6	29	299	1445	0.62	0.9	0	12	0	1281	24	82	460	1571
27-May	92.6	65.17	1.51	2.3	12	59	518	2545	1.33	2.0	4	33	196	1616	0.62	1.0	0	15	0	1573	16	107	301	2013
28-May	92.1	64.59	1.43	2.2	13	153	588	6918	1.34	2.1	8	76	386	3671	0.83	1.3	0	17	0	1328	21	246	378	4423
29-May	92.1	64.59	1.43	2.2	11	130	497	5878	1.34	2.1	4	77	193	3719	0.83	1.3	0	3	0	234	15	210	270	3775
30-May	92.1	64.59	1.40	2.2	11	60	509	2776	1.37	2.1	3	40	141	1886	0.72	1.1	0	5	0	447	14	105	259	1944
31-May	92.1	64.59	1.40	2.2	4	109	185	5043	1.37	2.1	2	50	94	2358	0.72	1.1	0	5	0	447	6	164	111	3037
01-Jun	91.1	63.42	1.43	2.3	0	36	0	1598	1.36	2.1	2	19	93	887	0.72	1.1	0	7	0	613	2	62	36	1120
02-Jun	90.6	62.84	1.43	2.3	2	81	88	3563	1.36	2.2	0	36	0	1666	0.72	1.2	0	6	0	521	2	123	36	2202
03-Jun	89.1	61.11	1.43	2.3	0	71	0	3044	1.35	2.2	0	29	0	1317	0.72	1.2	0	10	0	853	0	110	0	1927
04-Jun	88.6	60.54	1.43	2.4	0	57	0	2421	1.35	2.2	1	32	45	1439	0.72	1.2	0	9	0	761	1	98	17	1701
05-Jun	88.1	59.97	1.50	2.5	0	37	0	1483	1.35	2.3	0	12	0	531	0.72	1.2	0	9	0	747	0	58	0	973
06-Jun	87.6	59.40	1.50	2.5	0	76	0	3017	1.35	2.3	0	40	0	1754	0.72	1.2	0	21	0	1727	0	137	0	2277
07-Jun	87.6	59.40	1.44	2.4	0	82	0	3375	1.45	2.4	0	32	0	1314	0.74	1.3	0	12	0	958	0	126	0	2060
08-Jun	87.1	58.84	1.44	2.5	0	74	0	3017	1.45	2.5	0	33	0	1343	0.74	1.3	0	11	0	870	0	118	0	1911
09-Jun	86.6	58.27	1.43	2.4	0	60	0	2453	1.40	2.4	0	39	0	1618	0.77	1.3	0	6	0	452	0	105	0	1698
10-Jun	91.1	63.42	1.43	2.2	0	13	0	578	1.40	2.2	0	4	0	181	0.77	1.2	0	5	0	410	0	22	0	387

Appendix 4. Daily catch of juvenile chinook salmon by rotary screw traps and index of outmigrants, Diamond Island, Nechako River, 1998.

			RST No. 1:						RST No. 2:						RST No. 3:						Total			
Date	RST staff gage (cm)	River flow (m^3/s)	Trap flow (m^3/s)	Percent flow sampled	Catch: 1+	Catch: 0+	Population estimate: 1+	Population estimate: 0+	Trap flow (m^3/s)	Percent flow sampled	Catch: 1+	Catch: 0+	Population estimate: 1+	Population estimate: 0+	Trap flow (m^3/s)	Percent flow sampled	Catch: 1+	Catch: 0+	Population estimate: 1+	Population estimate: 0+	Catch: 1+	Catch: 0+	Population estimate: 1+	Population estimate: 0+
11-Jun	86.1	57.71	1.42	2.5	0	5	0	203	1.43	2.5	0	6	0	242	0.74	1.3	0	3	0	235	0	14	0	225
12-Jun	85.6	57.15	1.42	2.5	0	7	0	282	1.43	2.5	0	6	0	240	0.74	1.3	0	3	0	232	0	16	0	255
13-Jun	84.6	56.04	1.42	2.5	0	18	0	709	1.41	2.5	0	6	0	239	0.74	1.3	0	2	0	152	0	26	0	408
14-Jun	85.1	56.60	1.42	2.5	0	16	0	637	1.41	2.5	0	6	0	241	0.74	1.3	0	1	0	77	0	23	0	365
15-Jun	85.1	56.60	1.43	2.5	0	20	0	794	1.47	2.6	0	12	0	462	0.69	1.2	0	1	0	83	0	33	0	522
16-Jun	85.1	56.60	1.43	2.5	1	36	40	1429	1.47	2.6	0	16	0	616	0.69	1.2	0	3	0	248	1	55	16	869
17-Jun	84.6	56.04	1.31	2.3	5	10	214	429	1.44	2.6	2	16	78	623	0.52	0.9	0	3	0	324	7	29	120	498
18-Jun	84.6	56.04	1.31	2.3	0	15	0	643	1.44	2.6	0	10	0	389	0.52	0.9	0	2	0	216	0	27	0	463
19-Jun	84.6	56.04	1.39	2.5	0	17	0	684	1.28	2.3	0	8	0	352	0.71	1.3	0	6	0	470	0	31	0	514
20-Jun	84.6	56.04	1.39	2.5	0	27	0	1086	1.28	2.3	0	27	0	1187	0.71	1.3	0	2	0	157	0	56	0	928
21-Jun	84.6	56.04	1.31	2.3	0	22	0	941	1.36	2.4	0	17	0	699	0.67	1.2	0	4	0	333	0	43	0	720
22-Jun	84.1	55.49	1.31	2.4	0	24	0	1016	1.36	2.5	0	25	0	1017	0.67	1.2	0	2	0	165	0	51	0	845
23-Jun	83.6	54.94	1.36	2.5	0	8	0	324	1.34	2.4	0	7	0	286	0.66	1.2	0	1	0	83	0	16	0	261
24-Jun	83.6	54.94	1.36	2.5	0	6	0	243	1.34	2.4	0	9	0	368	0.66	1.2	0	0	0	0	0	15	0	245
25-Jun	85.6	57.15	1.36	2.4	0	8	0	337	1.34	2.3	0	7	0	298	0.66	1.2	0	0	0	0	0	15	0	255
26-Jun	85.6	57.15	1.35	2.4	0	9	0	382	1.23	2.1	0	6	0	280	0.74	1.3	0	0	0	0	0	15	0	259
27-Jun	86.6	58.27	1.35	2.3	0	26	0	1126	1.23	2.1	0	8	0	380	0.74	1.3	0	0	0	0	0	34	0	599
28-Jun	87.6	59.40	1.51	2.5	0	22	0	865	1.37	2.3	0	17	0	739	0.72	1.2	0	0	0	0	0	39	0	644
29-Jun	86.6	58.27	1.51	2.6	0	45	0	1736	1.37	2.3	0	13	0	554	0.72	1.2	0	0	0	0	0	58	0	940
30-Jun	85.1	56.60	1.38	2.4	0	40	0	1635	1.38	2.4	0	26	0	1068	0.72	1.3	0	4	0	315	0	70	0	1138
01-Jul	86.6	58.27	1.38	2.4	0	37	0	1558	1.38	2.4	0	17	0	719	0.72	1.2	0	4	0	324	0	58	0	971
02-Jul	88.1	59.97	1.38	2.3	0	26	0	1126	1.38	2.3	0	17	0	740	0.72	1.2	0	1	0	83	0	44	0	758
03-Jul	87.6	59.40	1.52	2.6	0	41	0	1606	1.44	2.4	0	21	0	868	0.77	1.3	0	0	0	0	0	62	0	988
04-Jul	88.1	59.97	1.52	2.5	0	20	0	791	1.44	2.4	0	11	0	459	0.77	1.3	0	1	0	77	0	32	0	515
05-Jul	88.1	59.97	1.48	2.5	0	17	0	690	1.47	2.5	0	9	0	367	0.78	1.3	0	2	0	154	0	28	0	450
06-Jul	88.6	60.54	1.48	2.4	0	21	0	860	1.47	2.4	0	20	0	824	0.78	1.3	0	0	0	0	0	41	0	666
07-Jul	88.1	59.97	1.54	2.6	0	33	0	1285	1.48	2.5	0	19	0	768	0.91	1.5	0	0	0	0	0	52	0	792
08-Jul	93.6	66.35	1.54	2.3	0	8	0	345	1.48	2.2	0	6	0	268	0.91	1.4	0	2	0	146	0	16	0	270
09-Jul	105.6	81.16	1.54	1.9	0	22	0	1159	1.48	1.8	0	12	0	656	0.91	1.1	0	1	0	89	0	35	0	722
10-Jul	118.6	98.53	1.47	1.5	0	2	0	134	1.43	1.4	0	15	0	1037	0.99	1.0	0	5	0	498	0	22	0	558
11-Jul	132.6	118.72	1.47	1.2	0	38	0	3063	1.43	1.2	0	9	0	750	0.99	0.8	0	13	0	1561	0	60	0	1833
12-Jul	160.6	163.48	1.47	0.9	0	9	0	999	1.43	0.9	0	0	0	0	0.99	0.6	0	11	0	1819	0	20	0	841
13-Jul	160.6	163.48	1.71	1.0	0	5	0	479							0.85	0.5	0	6	0	1152	0	11	0	703
14-Jul	160.6	163.48	1.71	1.0	0	1	0	96							0.85	0.5	0	0	0	0	0	1	0	64
15-Jul	160.6	163.48	1.71	1.0	0	0	0	0							0.85	0.5	0	2	0	384	0	2	0	128
16-Jul	160.6	163.48	1.71	1.0	0	2	0	192							0.85	0.5	0	2	0	384	0	4	0	256
17-Jul	160.6	163.48	1.71	1.0	0	0	0	0							0.85	0.5	0	0	0	0	0	0	0	0
18-Jul	160.6	163.48	1.71	1.0	0	2	0	192							0.85	0.5	0	0	0	0	0	2	0	128
SUM					644	2829	30697	129212			471	2284	23085	106661			86	2169	6676	182055	1201	7282	22436	133709