Abstracts - Other NFCP Reports

Nechako River Chinook Residence Time, 1989 (M89-8)
Prepared by Gail Faulkner, DFO April 1993

Under the auspices of the NFCP, a study of the residence time of spawning chinook salmon, (Oncorhynchus tshawytscha), was undertaken on the Nechako River. Residence times were determined for both an upper (19.2 km) and lower (152.7 km) river site. The female residence times for early and late spawners of the upper river site were 9.6 + 3.1 and 7.2 + 3.4 days, respectively. The residence time for females in the lower river site was 10.9 + 3.9 days. The overall female residence time of 9.1 + 3.6 days was 39% lower than that recorded for 1980. This difference may have been due to the poor water visibility encountered in the first week of 1989 or the warmer water temperatures.

Pre-Fertilization Assessment: Baseline Fisheries Studies of Reach 1 of the Upper Nechako River, 1991 (RM91-5)
Prepared by Triton Environmental Consultants Ltd. April 1993

Change in flows from the short term to the long term flow regime, as a result of the Kemano Completion Project, could present a risk to the achievement of the conservation of the conservation goal for chinook salmon of the Nechako River because of cooler water in mid summer and potential changes in water chemistry. One of the remedial measures recommended by the Strangway Working Group (1987) was the fertilization of the upper Nechako River to compensate for potential reduction in growth of juvenile chinook. Baseline data on juvenile size and abundance was collected before implementation of Kemano Completion Project and this report summarizes data collected for the second year within Reach 1 of the upper Nechako River. The relative abundance of juvenile chinook was quantified by snorkel surveys and electrofishing from April to October, 1991, sub-samples were measured and weighed, and condition indices were calculated. Peak abundance of chinook (0+) was evident to June. Catch Per Unit Effort (CPUE) was greater during the night than the day from June to October, and juveniles were on average larger in the night than during the day. Mean lengths and weights of chinook (0+) increased from 40 mm and 0.46 g in May to 52 mm and 1.48 g in June, 67 mm and 3.67 g in July, and reached 98 mm and 11.00 g by September to October.

Comparisons to a salmonid growth model (Iwama and Tautz 1981) indicated that chinook fry were growing at near maximum rates until mid summer and were about 50% of maximum by early fall. At reduced temperatures (10ºC in Reach 1) in the upper portion of the river there is scope to compensate for potential growth reduction by augmenting the available food supply in summer.

Pre-Fertilization Assessment: Baseline Fisheries Studies of Reach 1 of the Upper Nechako River, 1990 (RM90-5)
Prepared by Triton Environmental Consultants Ltd. April 1993

The Strangway Working Group (Anon 1987) recognized that the change in flows from the short term to the long term regime, as a result of the Kemano Completion Project, required a set of remedial measures to ensure the conservation of the Nechako River chinook (Oncorhynchus tshawytscha Walbaum). The cooler water required for the summer thermal control period may potentially reduce chinook growth and abundance in the upper Nechako River. One of the remedial measures recommended by the Strangway Working Group to address this risk was the fertilization of the upper Nechako River. The objective of the 1990/91 fertilization assessment project was to collect baseline data on the biology of chinook within Reach 1 during a non-treatment year. However, a series of forced spills of up to 255 m3/s released from Skins Lake Spillway, at the request of the British Columbia Ministry of the Environment, caused this year to be atypical, and therefore, not necessarily a representative baseline year. Although the 1990/91 year was atypical, information concerning chinook behavioural patterns, size and condition were determined. Snorkel observations indicated that peak abundance occurred in June with 85% of chinook (0+) associated with cover habitat on the margins and declined in October to where no chinook were observed in the day during snorkelling floats. There appeared to be a shift in the behaviour during the fall. Although chinook were not observed on the river margins during day snorkel floats in October, they were reported in October from night electroshocking. In addition, a length/weight regression and monthly chinook sizes and condition factors were determined. The weight/length regression equation was: $\log(w) = 3.31 \log(l) - 2.53$.

The April mean values of the parameters; length, weight and condition factor for chinook (1+) were 90.7 mm, 9.8 g and 1.31 (K), respectively. The May and October mean values of the parameters; length, weight and condition factor for chinook (0+) were 41.1 mm and 105.0 mm, 0.81 g and 14.19 g, and 0.92 (K) and 1.33 (K).

Assessment of Fertilization (RM92-5)
Prepared by Triton Environmental Consultants Ltd

One of the principal components of the Kemano Completion Project is the construction of a two-level-release facility at the Kenney Dam to deliver 10°C water during the summer cooling water period (July 15 to August 15). While this will coincide with the upstream migration of sockeye salmon (Oncorhynchus nerka), and should thus be beneficial to this species, the reduction in temperature in the upper reaches of the Nechako may also result in changes in growth rates of juvenile chinook salmon (Oncorhynchus tshawytscha). In recognition of this fact the Strangway Working Group suggested that nutrients be added to the upper Nechako to provide additional food resources to offset any change in chinook growth. In order to accurately assess the effects of fertilizer addition to the Nechako, however, baseline data need to be collected before any implementation takes place. This report summarizes baseline data gathered for the third consecutive year about juvenile chinook abundance and growth rate in Reach 1 of the upper Nechako River. The abundance of these fish was quantified through snorkel surveys and electrofishing sampling from April to October 1992. Snorkel surveys encompassed the whole length of the upper section of the Nechako in May, June and July, and were limited to specific electrofishing sites the other months. Subsamples of fish caught during electrofishing were measured and weighed, and condition indices were calculated. Both types of sampling concurred in ascribing the peak abundance of chinook (0+) to June, a result also recorded during the previous year. Juveniles preferentially frequented the left margin of the stream. They were also more abundant in km 13-14, where the abundance of large woody debris (LWD) may provide them with more cover. The catches of electrofished juvenile chinook (catch per unit effort (CPUE)) were greater at night than in the day, and juveniles were on average smaller in the day than during the night. Chinook (0+) measured on average 38 mm fork length (FL) and weighed 0.44 g in April. These measurements increased to 41 mm and 0.67 g in May, 54 mm and 1.85 g in June, 70 mm and 4.24 g in July, 93 mm and 10.08 g in September, and to 96 mm and 10.10 g in October.

The fishes' instantaneous growth rate for 1992 was very similar to those obtained in the same area in 1991 and 1986, a result which should facilitate the future task of assessing the impacts of in-stream fertilization. The relation between temperature and salmonid growth was modelled for two temperature regimes using Iwama and Tautz's (1981) growth model. A comparison between observed values for chinook (0+) and the model's values indicate that there is scope for growth after the planned cold water release, and that average chinook weight could potentially be increased by as much as 150% in October.

Numerical Model of Nechako River (RM90-8)
Prepared by Hay and Company Consultants Inc.

An HEC-2 water surface model for the Nechako River between Cheslatta Falls and the Nautley River confluence has been developed by the Nechako Fisheries Conservation Program (NFCP) Technical Committee. The model is to be used as a planning tool in the formulation of appropriate mitigation and /or compensation strategies for the Nechako River fisheries resources. The model is based on the Nechako River water surface profile and cross-sectional surveys conducted on July 9 and 10, 1990, at a discharge which varied from approximately 52m3/s to 63m3/s as measured at the Water Survey for Canada (WSC) gauging station, 08JA017, Nechako River below Cheslatta Falls. This report provides details of the Nechako River survey, the HEC-2 model development, model calibration and limitations, and computed output for the calibrated model and associated sensitivity tests. Modelled results provide water levels and associated hydraulic information for approximately 300 river cross sections, selected to depict distinct changes in river hydraulic characteristics including slope, cross-sectional area, channel roughness, locations of principal tributaries, and locations with actively eroding banks. The average distance between cross-sections used in the model was approximately 317 m.

Cattle Ranching Activities in Riparian Zones (RM90-3.2)
Prepared by Triton Environmental Consultants Ltd. March 1998

A study to review ranching activities in riparian zones of the Nechako River and tributaries was undertaken to identify areas where cattle could be affecting streambanks and to investigate the applicability of fencing areas to protect streambanks.

The study area included the upper Nechako River upstream of the Nautley River to Cheslatta Falls as well as six major tributaries; Greer Creek, Targe Creek, Swanson Creek, Smith Creek, Tahultzu Creek and Cutoff Creek. All six of the tributaries flow through rangeland and private pasture. In addition, these creeks either contribute directly to the production of Nechako juvenile chinook (Onchoryncus tshawytscha) or could contribute sediment to the Nechako River resulting in indirect affects on chinook production.

Vehicle, foot and helicopter surveys were conducted in June 1990 to gather information on local cattle operations and the state of streambanks within the study area. David Booth, Provincial Range Officer, Ministry of Forests in Vanderhoof provided information on cattle activity including areas of use and numbers of cattle being produced. Regional Provincial Agency Staff provided information on agricultural and regulatory considerations. Site specific information on cattle ranging activities, and watering sites was collected through interviews with ranchers in the study area. In addition, ranchers were asked if they had any concerns with fencing off riparian areas and any suggestions that they might have as alternatives to fencing.

There are 13 ranchers with grazing permits on land close to the Nechako River and/or tributaries. Most cattle range freely from May 20 to October 1 and are overwintered in private pastures. These private pastures are fenced and cattle are generally kept away from riparian areas by use of alternative water sources (such as wells in the winter, and small lakes and dugouts as temperatures rise) and placement of salt licks away from stream margins.

The information collected during the study indicates that cattle access only a few banks along the upper Nechako River. In general, in this area cattle activity did not appear to be affecting stream bank stability. However, some areas of concern were identified in tributary systems including the lower reaches of Swanson Creek and sections of Greer Creek. Possible remedial strategies include fencing as a means of protecting riparian areas or possibly alternate range management programs and/or stock management.

Investigation into the Use of Instream Cover Structures by Juvenile Chinook Salmon (RM88-2)
Prepared by Triton Environmental Consultants Ltd. April 1998

This study was initiated during the early stages of the NFCP to compile existing information on the use of cover by juvenile chinook salmon. The project did not include the collection of any new data. The analysis provided guidance for the first stage of the remedial measures program and indicated that targeted field studies would provide the knowledge of specific cover habitat utilization in the Nechako River, which will be used in the design of the individual complexes to be implemented as remedial measures.

Size Distribution and Abundance of Juvenile Chinook Salmon of the Nechako River, 1994 (M94-3)

In 1994, the size, distribution, and abundance of juvenile chinook salmon (Oncorhynchus tshawytscha) was measured in the upper 100 km of the Nechako River as part of the sixth year of the Nechako Fisheries Conservation Program (NFCP). The average date of 50% emergence of the juveniles, as estimated from their growth in length and weight, ranged from April 21 to May 8. Electroshocking surveys showed that the centre of distribution of resident 0+ chinook moved upstream from April to July as the fish searched for rearing habitats. In the fall, resident 0+ chinook redistributed themselves evenly along the length of the upper river in preparation for overwintering. Maximum density of electroshocked 0+ chinook occurred in mid-April and then decreased from April to November at a rate of 0.23%•d-1 for night catches. Maximum numbers of outmigrating 0+ chinook sampled by rotary screw traps at Diamond Island also occurred in April. Trap catches of juvenile chinook decreased with time at a rate of 5.1•d-1 for day catches and 2.6•d-1 for night catches. A total of 2,282 0+ chinook and 320 1+ chinook were sampled by the rotary screw traps. Expansion of these numbers by the proportion of river volume sampled by the traps provided an index of downstream migration of 47,589 0+ chinook and 6,361 1+ chinook.

Nechako River Sand Mapping (RM90-8.1)
Prepared by Ken Rood, Ken Rood & Associates, August 1998

The Nechako Fisheries Conservation Program (NFCP) Technical Committee is responsible for monitoring gravel quality along the Nechako River. Mapping and monitoring of sand beds is one aspect of this program. Sand bed reaches are interspersed along the typically gravel and cobble bed of the upper Nechako River and the monitoring program is intended to examine both the extent of existing sand bed reaches and the development of any new sand accumulation areas along the river. Covering gravel and cobble substrate with sand alters gravel quality and may affect spawning and rearing habitat.

The main objective of this report is to provide baseline information for the monitoring program by identifying and mapping sand bed reaches along the upper Nechako River. This is accomplished through the following specific objectives:

Identify major areas of sand accumulation in the Nechako River upstream of the Nautley River;

Delineate the upstream and downstream limits of the sand accumulations and mark these onto 1:7,500 Air Photo Mosaic Sheets;

Identify, in the field, any cross sections required to adequately characterize the sand bed reaches in addition to those cross sections surveyed for the river gradient and HEC-II modelling; and

Collect samples of river bed material and characterize the grain size distribution in each major sand accumulation reach.

This report addresses Objectives 1, 2 and 4. Objective 3 was reported under separate cover (letter to Mr. W.O. Rublee; June 11, 1990).

Incubation Environment: Testing of Redd Capping (M88-9)
Prepared by Triton Environmental Consultants Ltd. April 1993

The Strangway Working Group recognized that the change in flows from the short term to the long term regime requires the conservation of the Nechako River chinook (Oncorhynchus tshawytscha) population. One of the Nechako Fisheries Conservation Program projects to monitor the state of the chinook stock is the indexing of the numbers and quality of emergent fry. Should the fry emergence index indicate a negative trend in stock health, it may be necessary to intensify the monitoring project to gain further insight on processes within the incubation environment. Redd Capping was identified as one technique which could be used. This technique was investigated at two sites along the Nechako River. Traditionally, this technique has been used in smaller systems and modifications were developed to improve the viability in the larger Nechako River system. Although the modifications proved successful, it was concluded that due to the prohibitive costs associated with an extensive monitoring program of Redd Capping, it is unacceptable as a part of the Nechako Fisheries Early Warning Monitoring Program.

This report should be read in conjunction with the Nechako Fisheries Conservation Program 10-Year Review Background Report (Triton in prep.) as it answers some of the questions raised at the workshop. Readers who did not attend the workshop should also review the presentation materials that were provided at the workshop (Appendix F). The format of the workshop was an open brainstorming of questions, comments and ideas, structured to address the workshop's objectives and focus questions. These comments were based on the information provided in the 10-Year Review Background Report and the workshop presentations. Neither of these sources of information provided conclusions related to the NFCP's individual projects. The statements made at the workshop reflect the opinions and judgements of the individual participants. As is always the case in large group settings, the level of participation by each individual varied.

The report contains our best effort to accurately summarize the workshop discussions. We have not attempted to verify the scientific credibility of each statement. Also, the workshop did not seek to reach consensus on each proposed suggestion, or to poll participants on their level of support for specific points. We have applied our best judgement as to whether a given statement had general consensus, was felt by several participants, or was merely the opinion of an individual participant.

A draft version of this report was distributed to the workshop participants for feedback. Further thoughts and clarifications developed after the workshop are included in this report either directly in the text, as footnotes, or as endnotes. Errors in describing the methods used in the monitoring programs were corrected in the body of the text. If a post-workshop comment provided definitive clarification on an uncertain point, it was italicised and inserted directly into the text. We used footnotes to identify comments that were parenthetic in nature, or that provided an explanation that gave helpful clarification. Endnotes were used to identify post-workshop comments that expanded on a particular topic. All endnotes are preceded by a brief summary statement so that readers can obtain the main thrust of the comment without having to read the comment in full. A "pointing hand" symbol is used for both footnotes and endnotes to indicate that the comment was made after the workshop.

1992 Bank Stabilization Monitoring Program (RM92-7)
Prepared by Triton Environmental Consultants Ltd. July 1999

Two sites in the Upper Nechako River watershed selected in 1991 for a pilot project using bio-engineering techniques were re-visited during May and November of 1992 as part of an ongoing monitoring program. Vegetative growth was superior for both herbaceous and woody species at the Greer Creek site compared to that observed at the Nechako River site. Willow shoots from the spiling at Greer Creek demonstrated the most vigorous growth, whereas unrooted and rooted cuttings at the Nechako River site demonstrated the least vigorous growth. Only 9% of the rooted cuttings and 13% of the unrooted cuttings planted at the

Nechako River site exhibited signs of growth in May of 1992. Of the rooted cuttings observed growing in 1991, 80% survived to 1992, whereas only 35% of the unrooted cuttings observed growing in 1991 survived into the second year. The observed difference in growth and survival between bio-engineering techniques employed at each site was likely a response to better growing conditions at the Greer Creek site than at the Nechako River site. Preliminary observations indicate lateral erosion at the Greer Creek treated area is reduced compared to the control area. Erosion at the Nechako River site appears to be reduced only at revegetated areas where the toe of the bank was protected, whereas revegetated areas with no protection at the toe of the bank had similar and in some instances, increased lateral erosion when compared to control areas. Structural bio-engineering techniques located at the Nechako River site experienced no obvious overwinter damage. The spiling located at the Greer Creek site experienced some damage resulting from spring freshet but this damage has had little effect upon the spiling structural integrity. Spiling is considered the most robust of the techniques employed during this pilot project.

Nechako River Secondary Channel Geomorphology Studies Phase II (RM88-1)
Prepared by Ken Rood and Associates June 1998

In 1986, many of the Nechako River's secondary channels were visited, surveyed or measured from air photographs (Reid Crowther 1987). Sutek (1988) used the data collected for the Reid Crowther report to describe individual secondary channels along Reaches 2 and 4 and parts of Reach 6. Within these three reaches, which comprise 35% of the main channel length between Kenney Dam and Vanderhoof, are found approximately 70% of the secondary channels.

The Nechako Fisheries Conservation Program (NFCP) contracted with K. Rood & Associates, through Triton Environmental Consultants Ltd, to identify secondary channels where rearing habitat may be most effectively created or improved. This main objective is to be achieved through three sub-objectives:

1. Complete the existing inventory of secondary channels by describing secondary channels in Reach 1 (km 9 to 14.7), Reach 3 (km 43.0 to 66.6), Reach 5 (km 100.6 to 131.5) and the upper part of Reach 6 (km 131.5 to 152.0), using aerial photographs (NFCP 1988);

2. Extend the description of the secondary channels in all reaches by observing substrate, flow character, and the elevation difference between the secondary channel invert and the water surface at fall and spring discharges; and,

3. Rank the secondary channels for potential habitat creation or improvement.

The secondary channels are described in Appendix A to this report and ranked in Appendix B. More detail on each channel is provided on the inventory tables prepared for the 1:7,500 Air Photo Mosaics (NFCP 1988).

Identification and Ranking of Sources Contributing Sediment to the Upper Nechako River (RM89-7)
Prepared by Ken Rood and Associates September 1999

Sediments are contributed to the upper Nechako River by bank and valley wall erosion along the river and by its tributaries. It appears that, over the last 30 years, the tributaries have contributed roughly the same annual volume of sediment as bank and valley wall erosion.

Measurement of suspended sediment concentration indicates that the largest tributaries, such as Greer, Swanson, Smith and Targe Creeks typically have loads ranging from 100 to 1000 times as large as small undisturbed watersheds. Sediment loads are often intercepted by swamps and lakes along the tributaries and erosion along the lower reaches of the tributaries, as in Greer Creek, is most likely to affect the Nechako River. Overall, measured Nechako River sediment loads are similar to those of other regulated or lake controlled systems.

Some small watersheds with large, discrete sediment sources may have annual loads comparable to the larger basins. Erosion often occurs along the steep reaches where tributaries flow from the Nechako Plateau into the incised Nechako Valley. Failures and erosion of glacio-lacustrine or glacio-fluvial sediments elevates sediment loads in these reaches. Because most sediment results from individual failures, there may be an opportunity to control sediment supply in these small watersheds.

Active erosion occurs at approximately 38 sites along the upper Nechako River; however, a few sites contribute much of the annual supply. Sites where bank or valley wall retreat is sufficiently great that it may be measured from aerial photographs include km 30.5 to 30.8 (opposite Targe Creek), km 81.0 to 81.3 (at the downstream end of Diamond Island) and at the apices of bends, in contact with the left valley wall, in the reach from km 29.8 to 38.7. Erosion rates vary but the failures within the reach from km 29.8 to 38.7 are the most important sources of fine sand and silt to the upper Nechako River. The most active failures along the upper Nechako River annually contribute from 100 to 1000 times more sediment than smaller, less-active failures.

Ranking of the tributaries and the bank and valley wall failures was based on the relative contribution of the sediment source, the position of the sediment source relative to spawning reaches along the upper Nechako River and, in the case of the bank and valley wall failures, the size of the material contributed by the failure.

Tributaries and bank and valley wall erosion sites that contribute sediment directly to those reaches with major and moderate spawning populations potentially have the greatest effect on the fish habitat of the Nechako River. Sediment sources that contribute directly to the reach with the major spawning population, as well as sediment sources that contribute large quantities of sediment to reaches with moderate spawning populations are listed based on the rankings for the spawning reaches and the magnitude of the sediment sources discussed.

Nechako River Substrate Quality and Composition Project Comparison of 1992 and 2000 Freeze-Core Sample Results (R00-7)

Baseline gravel quality (substrate) samples were first collected in 1992 at three sites between Cheslatta Falls and Fort Fraser; the program was repeated in 2000. Roughly 36 sampls were collected at each site in each sampling year, using a modified freeze-core sampler, thought sufficient to detect a 10% change in mean fine-sediment content. Each sample was broken into a top (surface layer) and bottom (sub-surface layer) that were analyzed separately. a two-tailed t-test (=0.10) was used to assess the significance of the observed changes in mean percent fines at each site, treating the surface and lower layer samples separately.

Fine sediment content increased by less than 10% in the surface layer at all three sites. However, the fine and medium sand content - a sonstituent of fine sediment - increased by around 30% and was significant at two sites. Changes in the more abundant constituent, coarse sand, were variable and less pronounced. Silt and clay content was consistently low, in the range of sample error.

Fine sediment content increased by 5% or less in the sub-surface layer at two sites (Sites 1 and 2). Again, the increase in fine and medium sand was dominant, while the changes in coarse sand content were variable, and silt and clay content were negligible. Deposition of coarse sediment over the previous substrate at Site 3 resulted in a decrease in fine sediment content there.

Future sampling will be required to determine whether the observed trends are truly occurring as described. We recommend collecting another set of samplesa