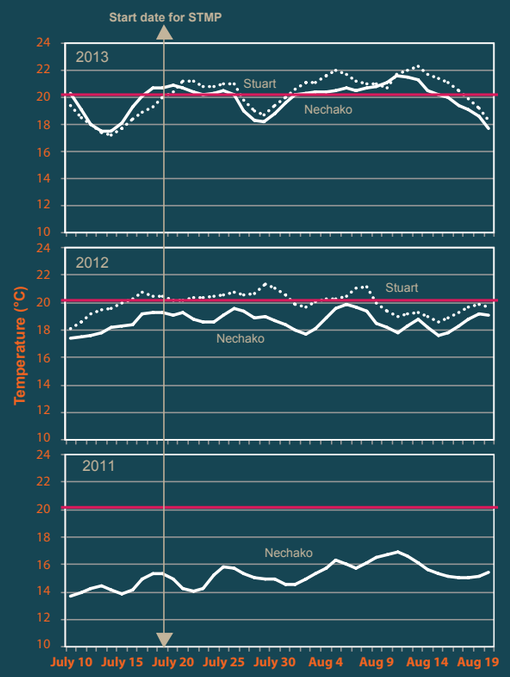
During the summer of 2013 water temperatures were the highest on record for some locations in the Fraser River, including the Nechako River. The adjacent thermograph indicates that the 20°C temperature threshold was exceeded for 22 days across the STMP period in 2013, reaching as high as 21.1°C on August 10. The temperature conditions in the Stuart River were even more elevated.



While temperatures in the Nechako exceeded 20°C, the amount by which it exceeded 20 degrees was less in the Nechako than in the Stuart River. This is consistent with previous documentation and conclusions (2005 NFCP Technical Data Review; McDonald et al. 2012[1]) which found that exceeding the temperature target of 20 degrees would have been more frequent and longer duration than in the absence of the STMP.

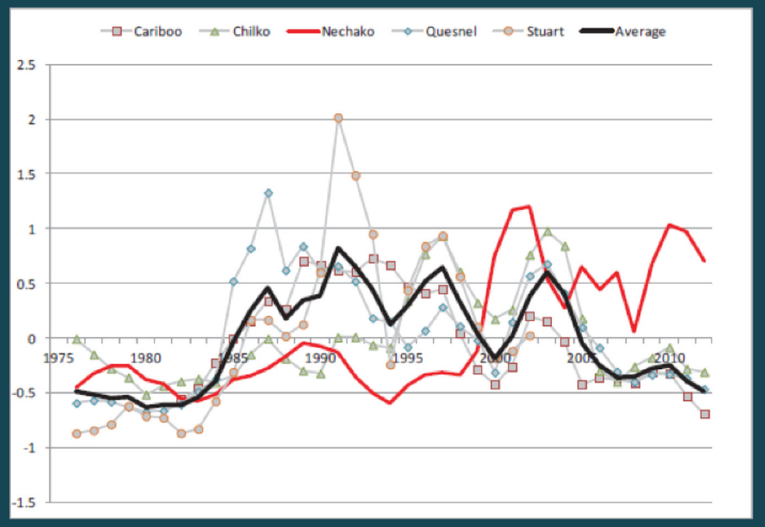
Remedial Measures

Remedial measures are actions that could be taken to enhance the salmon production capacity of the Nechako River in the event that flow management was determined to be limiting salmon production below the conservation goal. The NFCP established a comprehensive body of decision-making criteria for designing and implementing remedial measures. Various remedial measures that have been pilot-tested by the NFCP include inorganic fertilization, off-channel improvements and the installation of in situ habitat structures. Four years of NFCP research have shown that introducing fertilizer to the Upper Nechako River resulted in measured increases in nutrients, periphyton and insect abundance. Vegetative techniques have also been tested to control sediment inputs at failing banks and found to be suitable for application in smaller tributary streams. Many pilot in situ habitat structures performed well and demonstrated high utilization by juvenile Chinook. Taken together, the research and evaluation of remedial measures has provided a set of tools that could be adopted to mitigate any reductions in Chinook habitat capacity, should those be needed in the future.

Recent Productivity of Nechako Chinook

Chinook salmon in southern BC, including many Fraser River populations, have declined in abundance over a wide area and DFO and its partners have been working on a "Southern BC Chinook Strategic Planning Initiative". As part of this initiative, there was a Southern BC Chinook Science Workshop[2] that took place on May 22-23, 2013 that evaluated the status of most of the Chinook populations in southern BC including the Nechako population.

1 MacDonald, J.S., J. Morrison and D.A. Patterson. 2012. The efficacy of reservoir flow regulation for cooling migration temperature for sockeye salmon in the Nechako River Watershed of British Columbia. N. Am. J. Fish. Mgmt. 32: 415-427.
2 Source: https://dl.dropboxusercontent.com/u/66559302/SBC_Chinook_Panel_Report_FINAL_13Sept30.pdf



Trends in recent productivity of Chinook salmon in northern systems.

Under the DFO Wild Salmon Policy, Chinook and other salmon species are classified into Conservation Units (CUs). The Nechako Chinook population is part of the Mid-Fraser Summer Chinook CU which includes 17 streams. Five of these streams are shown in the diagram below, as presented at the Science Workshop. There is an increasing trend over time for the Nechako population (red line) which runs opposite to the declining trend shown by the average value of 4 other Mid-Fraser Chinook stocks (black line): Cariboo, Chilko, Quesnel and Stuart.

NFCP looks at trends in other Chinook populations to better understand the overall context of salmon stock dynamics, but continue to focus on ensuring Nechako specific data supports the conservation goal. Trends in the Nechako population are clearly different than those shown by other Mid-Fraser Summer Chinook however the reasons for the divergence in escapement trends is unknown. Nevertheless, the results confirm that the Nechako population continues to function effectively under present water flow management practices.

Conclusions

The NFCP has completed intensive sampling and monitoring of Nechako River Chinook salmon for almost four complete life cycles. In spite of uncertainties associated with the variability external to the Nechako River watershed (i.e., ocean conditions and harvest rates), the habitat capacity of the upper Nechako River as measured through various indices has been shown to support spawning and the production of juvenile Chinook salmon at numbers that result in returns of Chinook salmon at levels consistent with the 1987 Settlement Agreement. Consequently, it is the opinion of the NFCP Technical Committee that in-river conditions are sufficient to sustain a population of Chinook salmon that fluctuates generally within the target population range identified by the Conservation Goal. Current flow management helps to meet that conservation goal.

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Nechako Fisheries Conservation Program

Biological Data Summary 2014

Nechako Reservoir and Nechako River.

Reports for NFCP projects available at

WWW.NFCP.ORG

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Nechako Fisheries Conservation Program

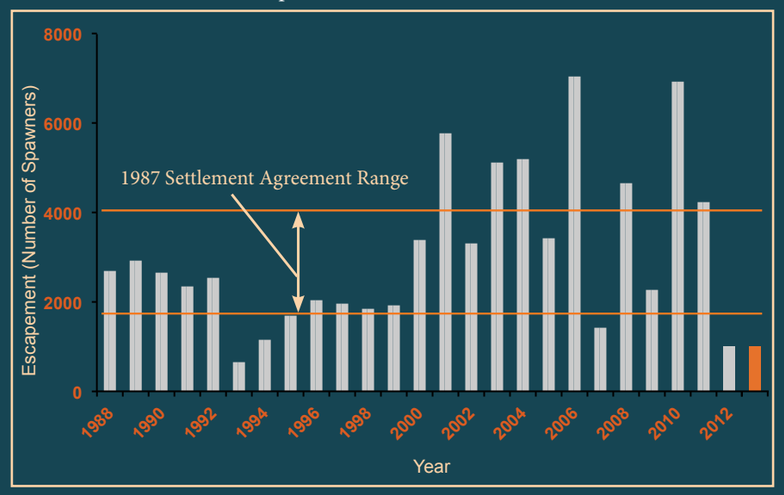
Nechako Fisheries Conservation Program

This report has been prepared to provide a brief summary of the purpose, structure, and technical findings of the Nechako Fisheries Conservation program (NFCP). The NFCP was formed to ensure the effective implementation of the 1987 Settlement Agreement between Rio Tinto Alcan, Fisheries and Oceans Canada and the BC Ministry of Environment. The objective of the NFCP is the conservation of salmon stocks in the Nechako River. Since 1987, the NFCP has monitored Nechako River Chinook salmon populations and their habitats, managed water flows from the Nechako Reservoir and evaluated different remedial measures. These activities are designed to avoid, and if necessary, to mitigate fisheries impacts from reservoir operations.

Chinook Monitoring

The 1987 Settlement Agreement set out a Conservation Goal of an average of 3100 adult Chinook in the Nechako River (range between 1,700 to 4,000 spawners). NFCP monitoring since 1987 has shown that Chinook returns to the Nechako have generally fallen within the target range. In 5 years when the escapement fell below 1,700 spawners (e.g., 2013) other Upper Fraser Chinook populations were also depressed, suggesting that periodic downturns in escapement are unrelated to habitat conditions within the Nechako River watershed.

Nechako River Chinook Escapement 1988-2013



Chinook spawn in the mainstem of the Nechako River between Vanderhoof and Cheslatta Falls typically between the end of August and early October. Chinook spawning locations are fairly evenly distributed, with highest numbers in the Upper Nechako about 20 km downstream of Kenney Dam. The eggs hatch in about December but the newly hatched alevin remain in the gravel until March of the following year. Juvenile Chinook emerge as free-swimming fry from March to May.

The procedure for estimating the annual Chinook population size is called "area-under-the-curve" and relies upon 5 helicopter counts at one-week intervals. This data, combined with estimates of average female residence times on the redds (gravel nests) is used to calculate the annual Chinook spawner population estimate. Helicopter surveys during spawning periods commence at Cheslatta Falls and finish at Vanderhoof. The helicopter flies at about 50 km/hour and between 30 and 35 m above the river. Two observers make independent observations, then the higher value of the two observations is used to represent the Chinook number in the river.

The residence time has been determined by observing how many days individual fish remain on their spawning redds. This is done from scaffolding towers installed at the rivers edge. Residence time has been assessed 16 times since 1989 and it was shown that mean female residence time on redds varied between 8.9 days and 12.5 days with a mean of 10.6 days. In view of the relative stability of the estimates, the NFCP has used the mean value of 10.6 days in most years to calculate the Chinook escapement. Every five years residence time is measured to ensure that the relationship remains stable over time.

- Sampling of Chinook carcasses has been conducted annually by NFCP to collect biological data on age, size, life history, sex and egg retention.
- Age data are used to interpret enumeration results as they indicate which brood years contributed to the spawning population.
- Over 99% of Nechako Chinooks spend their first summer and winter in freshwater before going to sea in their second year of life. During 11 years of sampling, 5-year olds were the dominant age class, followed by four-year olds. Small numbers of 3-year old, 6-year old and 7-year old fish also occur in the Nechako population.
- The sex ratio of Chinook (number of female carcasses to male carcasses) has averaged 1.37. The higher frequency of females is thought to be related to a number of possible causes including male:female variations in residence time and sex-based survival.
- Egg retention data can provide some insight into habitat conditions during migration, particularly high water temperature which can cause salmon to die before spawning.

Habitat Monitoring

To monitor physical habitat conditions, NFCP previously undertook a Sand Mapping Project to identify the location and riverbed particle size distribution for major sand beds upstream of the Nautley River. Major sand bed reaches covered a total of 17.1 km (19%) of the Upper Nechako River. This characterization provided a "snap shot" of previous physical habitat conditions that will be monitored by NFCP approximately every 10 years.

Indices of Habitat Productivity

The approach adopted by the NFCP to meet the "Conservation Goal" is that sufficient habitat quantity and quality is required to ensure that Chinook salmon can be sustained in the Nechako River. Useful indicators of Chinook habitat quantity and quality are the numbers of fry and juveniles produced in relation to the number of adult spawners. These relative numbers over time translate into an 'index' of habitat health. Indices have been developed by the NFCP for monitoring fry and older juveniles. Results have shown that there are stable relationships between the number of spawners and the subsequent fry and juvenile outmigrant production for Chinook escapements that fall within the limits of the Conservation Goal (between 1700 – 4000 spawners). At very high spawner densities above the Conservation Goal (i.e. 7000 spawners), results indicate that a higher proportion of juvenile Chinook outmigrate from the Upper Nechako River as fry, suggesting possible density dependence in habitat utilization. Based on the consistency of these relationships, the NFCP has concluded that the capacity of the available rearing habitat in the upper Nechako River is adequate for the number of spawners identified in the Conservation Goal.

Water Management

The NFCP monitors and manages the Nechako River water flow releases from the Skins Lake Spillway in accordance with the 1987 Settlement Agreement. The Annual Water Allocation (AWA) is a mean annual release of 36.8 m3/s of water at Skins Lake Spillway plus cooling flows in July and August. The amount of the release varies by season as directed by the NFCP Technical Committee but varies between 49 m^3/s in the spring and summer and 30 to 32 m^3/s in the fall and winter. The NFCP provides direction to Rio Tinto Alcan on how to release the AWA through the spillway during each year. Actual releases have exceeded the minimum required annual release in every year since 1987. In 2013/14, the average release was 36.85 m^3/s.

In late September of 2013, a flow anomaly was observed (where downstream water flows in the Nechako River below Cheslatta Falls were reported to be less that the reported release at the Spillway). RTA asked Triton Environmental Consultants investigate the anomaly and undertook measurements of the discharge immediately downstream from the Spillway. These measurements indicated that the Spillway release was less than was being reported. Based on this information, RTA increased the rate of release from the Spillway to ensure that the AWA was achieved by the end of March 2014, the end of the water year.

The Summer Temperature Management Program (STMP) uses flow and water temperature models to manage Nechako River water temperature. The STMP is specifically designed to benefit adult sockeye salmon during their upstream migration by moderating the effect of high water temperatures. The objective is to reduce the frequency of water temperatures >20°C at Finmore, located upstream of the confluence of the Nechako and Stuart Rivers. A temperature of 20°C is a temperature target for protecting migrating sockeye salmon from increased mortality. This is accomplished by releasing large quantities of water through the spillway to maintain daily river discharges in the Nechako River below Cheslatta Falls between 170 m^3/s and 283 m^3/s between July 20 and August 20 each year. The ability to achieve the STMP's objective is restricted by guidelines on the maximum flow permitted in the Nechako River to avoid flooding lands adjacent to the river. The graphs on the following page show the water temperature conditions in the Nechako at Finmore between 2011 - 2013 (solid lines). Corresponding temperatures during 2012 and 2013 in the Stuart River are shown as dotted lines. Stream cooling measures associated with the STMP were not required in 2011 as Skins Lake Spillway discharges exceeded STMP maximum cooling discharges due to abnormally elevated snowpacks and reservoir elevations.

Skins Lake Spillway.