Champagne & Aishihik First Nations' Nordenskiold River

Upper Nordenskiold River Salmon Restoration 2001 – Final Report - August, 2001

Yukon River Panel - Restoration and Enhancement Fund

RE-17-01

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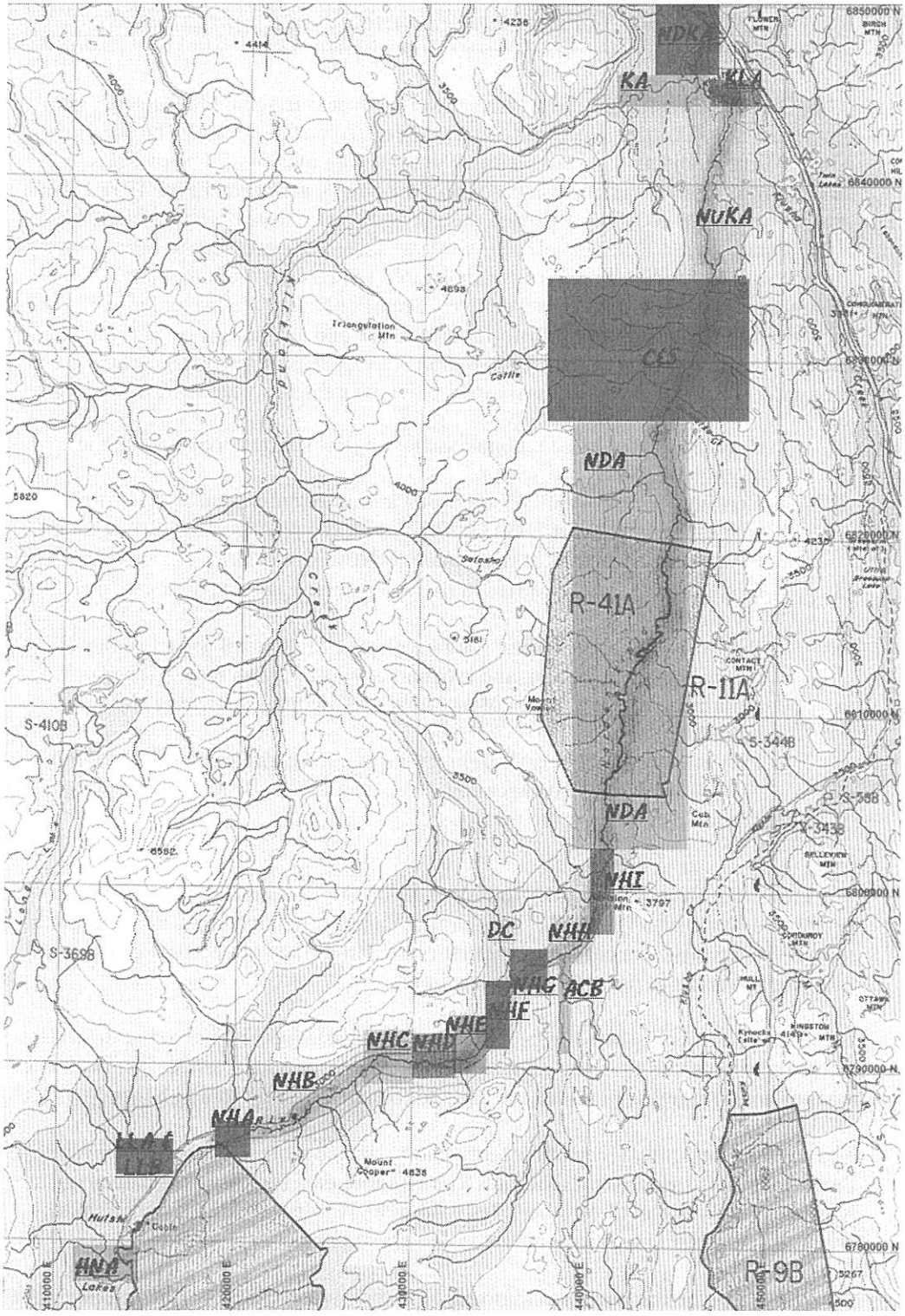
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Executive Summary

CAFN's overall objective on the Nordenskiold River is to facilitate the successful rebuilding of salmon populations to their fullest sustainable levels. The summer of 2001 project's objective was to continue with the removal of all obstructions to salmon migration on the upper Nordenskiold River as identified in the 1998 CAFN inventory and the 2000 Beaver management and Dam removal project funded by HRSEP and Yukon River Panel. This work was deemed necessary to help ensure that the successful distribution of Nordenskiold wild stocks were realized throughout the upper reaches of the River. Traditional Knowledge and in-situ surveys of past years revealed historic salmon use and an abundance of prime habitat but the numbers of returning salmon were at critical low limits. The following is a summary of the individual objectives for this year's R&E funding.

1. Perform a fixed wing reconnaissance flight over the study area at the beginning of the field season.
2. Continue to remove all obstructions to salmon migration at the critical migration time as per DFO Guidelines for the management of Beaver in Fish Bearing Streams in the Yukon & NBC Division;
3. Obtain temperature profiles in known historic spawning areas by installing data loggers;
4. Perform a helicopter aerial spawning survey in the fall to record the abundance, distribution, and location of adult salmon (live & dead) including GPS references of any new obstructions, spawning sites, and habitat features.
5. Perform Winter Beaver Trapping program in accordance with the DFO Guidelines for the Management of Beaver in Fish Bearing Streams; and
6. Write up and report the results.

The crew of 2, through a total of 16 field days on the Nordenskiold, successfully performed objectives 1, 2, and 3. In addition, the crew obtained new and additional stream survey bio-physical data and performed a multitude of gee-type minnow trapping in-search of juvenile chinook salmon.

No juvenile chinook salmon were captured. This was expected due to the dismal spawning forecasts and observations of 2000. A total of 50 traps were set. Each trap was set on average for 17.84 hrs for a grand total of 909.82 trapping hours.

The crew successfully placed four temperature data loggers at strategic sites along the river and its associated tributaries. Temperature data loggers were placed in Kirkland Creek and at three other sites within the Nordenskiold. All the loggers were programmed to record temperatures every six hours.

One very large beaver dam was removed from below the outlet of Hutchi Lake with staggering results. This dam was not present during the 1998 summer field survey.

However, during the 1998 fall helicopter survey, this dam was observed. The surveyors falsely surmised that the following year's freshet would remove the dam. This did not occur. The dam grew, increased the volume of the lake, and created a settlement area upstream which affected the whole benthic morphology of the upstream habitat including a well documented and important chinook-spawning dune.

This historic spawning dune, located above the beaver dam, received silt deposits to its interstitial spaces as a result of the backwater effect of the dam. Once the crew breached the dam the lake level and upper portion of the river dropped over 18 inches within the first 36 hours and opened up this upstream habitat to potential spawners.

No other beaver dams were observed throughout the study area; however a number of beavers and their lodges were observed and noted. The successful dam removals, performed during the summer of 2000, remained open and navigatable by salmon. The reason why the beavers did not or could not rebuild the dams was probably due to the continuance of the hydrological recharging of the area which has been occurring since the summer of 2000.

A helicopter survey performed on Monday, August 20, and shared between CAFN and DFO's Habitat Section yielded exciting results. The area surveyed encompassed the whole river from Hutchi down to Carmacks including portions of Kirkland Creek, Klusha Creek, Rawlinson Creek and, its tributary, Incised Creek. Originally set for the first week of August, the timing of the survey was delayed due to the lack of visibility from the extreme turbidity of the Nordenskiold. Due to the actual timing of the helicopter survey, the end of the spawning window was capsulated. Five spawners were observed on the historic dune above the removed beaver dam, just below the outlet of Hutchi Lake on the Nordenskiold. The spawning activity cleaned the gravels of the dune. Two eagles were also observed at this upper reach. Downstream of the aforementioned beaver dam, the Nordenskiold became turbid with effluent from a small tributary entering it on river right and remained turbid to its outlet.

One white tailed salmon carcass was observed about 5 miles upstream on Kirkland creek, suggesting successful spawning activity having occurred on that creek as well. Three live spawners, three carcasses, and three bald eagles were observed just below the Kirkland Creek confluence where, historically, major spawning has occurred.

On Klusha Creek, just below the Twin Lakes road crossing, two spawning salmon were observed on a bed of washed gravel. Hats off to the crew from Little Salmon Camacks First Nations whom successfully removed the maze of Beaver Dams within Klusha Creek's lower reaches. This was the first visual observation of salmon on this river in recent years.

Acknowledgments

It is with great appreciation, I would like to thank:

- Champagne and Aishihik First Nations' Chief and staff for initially identifying the need for this project and providing the necessary resources and continuing support; Especially, Michael Jim & Linaya Workman, Renewable Resource Officers for CAFN, for providing input, advice, and direction throughout the projects development and completion; And Lawrence Joe, Director of lands & resources for CAFN, for his continual support.

- Department of Fisheries and Oceans Canada staff, for providing technical support and arranging a coordinated effort from similar projects within the greater watershed.

- This project would not have been possible without the financial contributions obtained from The Yukon River Panel Restoration & Enhancement (R&E) Program. The Yukon River Panel provided the financial resources to make this project a reality and I would like to thank the Panel's Secretary, Hugh J. Monaghan, for his efficient administration of the fund for this project.

- I would not have been able to complete this project without the professional assistance of Gordon Joe, CAFN member, whom assisted in every aspect collecting field data and with the removal of obstructions to migration.

Thank you,

Ian C. Pumphrey

March, 2002

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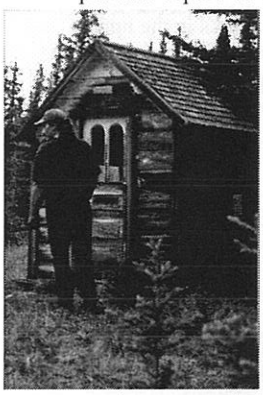
1 Introduction

1.1 General Study Area

The Nordenskiold River drainage basin lies within the Central Yukon Plateau Eco-region (Ecological Stratification Working Group 1995). The region is characterized by rolling hills and plateaus separated by broad, deeply cut valleys. The most common forest types are white and black spruce. Black spruce is dominant in colder, poorly drained areas. As naturally recurring fires are frequent, several vegetation communities are prevalent. Lodge-pole pine and trembling aspen most commonly colonize burnt-over areas. Shrub birch and willow, with occasional paper birch and alpine fir, dominate the sub-alpine vegetation. Extensive grasslands occur on lower south-facing slopes. These grassland slopes form a significant vegetation feature in the Nordenskiold River Valley. The cold, semiarid climate of the region has a mean annual temperature of approximately -3.5^{0}C, with a summer mean of 12.0^{0}C and a winter mean of -19.0^{0}C.



The Nordenskiold River drains an area of approximately 6370 square kilometers (Water Survey of Canada unpublished data). The headwaters of the Nordenskiold River are made up of Moraine Lake on the Kluane Plateau (elevation 910 meters) and Long Lake (elevation 1200 meters) both flowing north-east to a chain of three lakes known as Hutchi (Hutshi) Lakes (elevation 750 meters). The Nordenskiold River's (traditional - *Chu` ena Chù*) north-south trending out-wash valley flows from Hutchi Lakes (traditional - *Chu`ena Mān)* to its confluence with the Yukon River at Carmacks (elevation 525 meters). The major tributaries of the Nordenskiold River include Long Lake Tributary, Moraine Lake Tributary (marked as *Nordenskiold* on maps), Klusha Creek, and Kirkland Creek, which lays within the study area, and Rowlinson Creek which enters north downstream of the current study area (figure 1 – appendix j).

Approximately 22 km over the height of land to the west of Hutchi Lakes lay the waters of Aishihik and Canyon Lakes, which drain south into the Alsek River drainage. Just a few kilometers to the south lay the divide of the Takhini Basin of the upper Yukon drainage.

The Upper Nordenskiold River drainage is included on National Topographic Series map sheets 105 E, 115 A, 115 H and 115 I. The complete upper Nordenskiold study area was broken down into 19 reaches in the 1998 Inventory, each with its own homogeneous ecological representation. The upper Nordenskiold River from about 23 km below Hutchi Lake to just below Kirkland Creek confluence was the extent of this projects area. Reaches NDA, C&S, NUKA, KA, and NUKA were the primary areas of concern and the object of the Removal of Barriers to Salmon Migration project (See Figure 1 – Map at the front of report or appendix J).

The study area falls within Champagne & Aishihik First Nations' (CAFN) traditional territory and with a section of the area overlapping within Little Salmon / Carmacks First Nation's Traditional Territory. Champagne and Aishihik First Nations are one of 14 First Nation Governments of the Yukon Territory and many CAFN members lived at or are descendants of citizens from the historic Hutchi Village (traditional - Chu` ena Keyi) located on the southeast banks of Northern Hutchi Lake.

The present land use with-in this study area is not as active compared to that of yester-year. Within the study area on the Nordenskiold River there is small scale trapping concessions and a couple CAFN member cabins, a small agriculture lease, some mining claims and only one intermittently

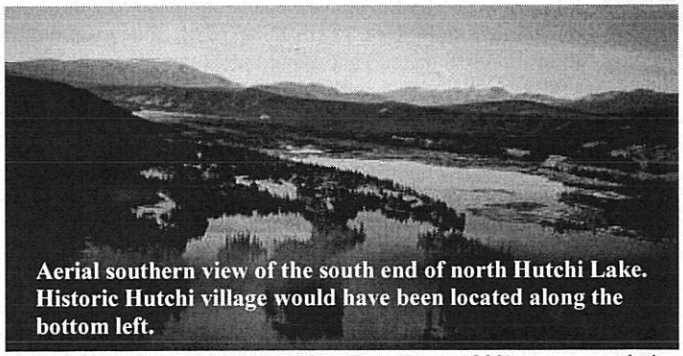
active coal exploration site at Division Mountain. A potential coal mine has been proposed at this site over the last decade.

Klusha Creek has had the most significant land use activities over the years due to its location running along side the Klondike Highway. There are a number of residential and agricultural properties as well as quartz and placer claims. The Yukon Quest trail momentarily passes by Klusha Creek as well.

1.2 Background

CAFN has recognized the need for the restoration of dwindling chinook stocks in the upper Nordenskiold River for many years. *Champagne & Aishihik First Nations' Fisheries Research,* prepared for the **Greater Kluane Land Use Plan,** suggested that the upper Nordenskiold River was no longer being utilized by salmon as it has in the past. The report stated that *restoration and reintroduction of these salmon populations would greatly increase the harvesting opportunities for all user groups* (p. 15). The report recommends:

> *The potential for enhancement in these areas should be investigated. Proposals to rebuild or reintroduce salmon or their habitat should be encouraged and supported (p.15).*



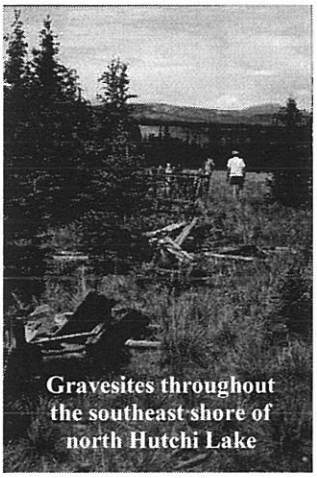
Aerial southern view of the south end of north Hutchi Lake. Historic Hutchi village would have been located along the bottom left.

The Greater Kluane Regional Land Use Plan (Rev. June, 1992) recommendation states:

> *Government should investigate the potential for enhancement of formerly important salmon fisheries on the Little Klukshu,* ***Upper Nordenskiold****, and Dezadeash Rivers. This work, which could include rebuilding or reintroduction of salmon populations to their habitat, should be carried out in close consultation with local residents with knowledge of the fishery. The enhancement and rehabilitation of existing salmon fisheries should be a priority for management within the region (P.64, Rec.#4).*

The Department of Fisheries and Oceans (DFO) stream files indicated evidence of historical spawning sites upstream of the Kirkland Creek confluence on the Nordenskiold. Al von Finster, DFO's Senior Habitat Biologist, reported that evidence suggested that no chinook spawning took place on the Nordenskiold upstream of the confluence with Kirkland Creek in 1994. However, in 1995, he observed pairs of spawning Chinook salmon all the way upstream at the outlet of the northern Hutchi Lake.

A high percentage of the modern-day CAFN membership has genealogical links to the historical settlement of Hutchi Village (traditional - Chu`ena Keyi) located on the eastern banks of northern Hutchi Lake. Two hundred years ago, the community of Hutchi was one of the largest communities in the Yukon with an estimated population of as many as 225 people (Chief Jim Boss, Chu`ena Keyi). Hutchi was one of the largest traditional settlements of the Champagne and Aishihik First Nations (CAFN) people. Around 1918-19, an influenza outbreak occurred which caused families to shift their place of residency along the banks. Reminisce of the once traditionally active village remains visible today. There are a large number of marked and unmarked gravesites throughout the area echoing the population of yesteryear.


Gravesites throughout the southeast shore of north Hutchi Lake

Families have not been based here since the 1940s since the building of the Alaska Highway. The village has since been, for the most part, used as a seasonal trapping, hunting, and fishing camp.

Traditional Knowledge research revealed net-set locations and sites where salmon were known to occupy. Three salmon sites in particular were of interest with regards to historic chinook spawning distributions (Pumphrey, 1998).

King Salmon use to spawn in Chu Yäna Män (the Northern Hutchi Lake), but in recent years have not been able to reach the lake because of beaver dams in the Nordenskiold below the lake outlet ('Chu'ena Keyi - Hutchi History Research).

Moose Jackson, a respected elder of CAFN, said he remembers hearing about small numbers of King Salmon (adults) making it to Moraine Lake, but he has never seen them himself. Moraine Lake forms the headwaters of the Upper Nordenskiold which drains into Hutchi Lake (HNA-2 of Fig. 1). This would suggest that salmon were spawning southwest of Hutchi Lake in this upper most tributary (southwest of reach HNA[2] of Fig.1). All of the data collected during the 1998 summer field survey show a high impossibility of salmon making it through HNA reach today due to the high number of beaver dams and their impact on habitat. However, when Hutchi was an active First Nation village the surrounding habitat would have been different with active trapping close to the village. During the 1998 fall helicopter survey the habitat southwest of reach HNA looked very favorable for salmon.

Stella Boss, another respected elder of CAFN, revealed that 'Si Män (Sakata Lake) was known for the ochre (red dirt), big fish, and at one time salmon used the lake'. This lake is one of two headwater lakes of Kirkland Creek and this knowledge suggests that salmon once utilized and spawned though-out Kirkland Creek (Pumphrey, 1998)

Lawrence Joe, CAFN member and CAFN Director of Renewable Resources, stated that his grandmother has seen salmon regularly spawn below Braeburn Lake on Klusha Creek (Interview, 1998). DFO's Al von Finster stated that the historic dunes below Braeburn Lake are still visible (Interview, 1998). No adult salmon fry or adults have been reported caught or observed in this creek until this year during the Fall Helicopter Survey.

In a literature review of Dominique Legros' *Structure Socio-culturelle et rapports de domination chez les Tutchone Septentrionaux du Yukon au Dix Neuvieme Siecle*, the following was reported

> ** The principal salmon weir of the Hutshi Lake people was on the Nordenskiold River about 30 km from Carmacks. Hutshi Lake itself was their 'meeting' place. [p.195]*
>
> ** Three traditional sites for salmon fishing were located about 2 and 18 km from the mouth (2 chinook spawning areas), and one for chum salmon that was 45 km from the mouth of the Nordenskiold River. [p. 592]*

> ** Legros also discussed the variability in numbers salmon spawning at the different sites.*
>
> **J.W. Ellington, an Anglican minister, observed in 1888 that the downriver area produced only 10 fish a day by trap and, according to the Tutchone, the traps at the Little Salmon produced 40 to 60 according to the same criteria. [p.593]*

(Cox, 1999, p. 159).

Between the years 1910 to 1917, RCMP fishery harvest reports estimated that on average the people at Hutchi harvested 10,000 lbs. of salmon per year (Seigel & McEwen 1984; Cox, 1999).

It appears obvious that salmon distribution and numbers were substantially higher during the First Nation occupation within the study area. First Nations of the area were stewards to their environment actively trapping beavers, bears, and generally protecting and enhancing the resources that their existence totally depended upon. Moose Jackson stated that 'there was always lots of bears in the area' as he pointed to the west side of the north Hutchi Lake. 'Hutchi Joe wouldn't pass up a chance to hunt bear.' Moose figures it was Hutchi Joe's way of keeping the population down (Pumphrey, 1998).

Within the last 6 years the Department of Fisheries and Oceans and industry have performed 4 cursory fishery surveys which denoted 3 years with limited chinook adult and fry utilization above Kirkland Creek confluence on the Nordenskiold River. The Department of Fisheries and Oceans (DFO) stream files indicated evidence of historical spawning sites upstream of the mouth of Kirkland Creek on the Nordenskiold. DFO's Senior Habitat Biologist reported evidence which suggested that no chinook spawning took place upstream of the Kirkland Creek confluence in 1994 due to the 0 results obtained from limited minnow trapping in August of 1995. However this theory was questioned when White Mountain Consulting in the spring of 1995 reported capturing chinook fry within this same area. DFO observed pairs of spawning chinook salmon all the way upstream at the outlet of the northern Hutchi Lake during their 1995 survey.

During the summer of 1995 and the fall of 1997, White Mountain Environmental performed fisheries investigations on the Nordenskiold to collect baseline information for the environmental review process required for the potential licensing of the proposed Division Mountain coal mine (Fig. 1). Adult chinook salmon was first observed on July 27 of 1995 near the outlet of Kirkland creek. 'A partial aerial survey was conducted on this date and 46 adult salmon were observed in a 5 km stretch of river immediately downstream of Kirkland Creek and a further 8 salmon were observed immediately upstream of the mouth Kirkland Creek. A single adult salmon was observed approximately 5 km upstream of Kirkland Creek. Ground observations noted that the salmon were actively building redds about 100 meters downstream of Kirkland Creek. On august 3, adult salmon were observed building redds 8 km downstream of Kirkland Creek' *(4). (Appendix J - NDKA , NUKA, and KA).*

White Mountain performed an aerial survey again on August 18, 1997. The water was turbid 'likely due to a fire that burned along a 9 km stretch in upper Kirkland Creek'. Only six chinook were observed below the Rowlinson Creek confluence on the Nordenskiold and only two were observed between Rowlinson Creek confluence and Kirkland Creek confluence. The other observed chinook were found between Hutchi Lake and Klusha Creek confluence with a total of 75 live and dead chinook being observed in pockets right up to within 1km of Hutchi Lake.

White Mountain's 1995 spring and summer investigations stated the chinook fry most heavily utilized the Nordenskiold River below Kirkland creek extending down past this projects study area to the Yukon River confluence. Their primary concentration was in the lower reaches and at the mouths of clear water creeks. The extent of their range was as far south as 300 meters of the outlet from Hutchi Lake. No salmon fry were captured at the tributaries to Hutchi Lake or anywhere in Klusha Creek.

To this end, in 1998/99 CAFN in conjunction with Environmental and Administrative Services Yukon (E.A.S.Y.) were successful in proposing to the Yukon River Panel's Restoration and Enhancement Fund to provide the financial resources to complete the first stage of a restoration and enhancement (R&E) plan, a *Salmon & Salmon Habitat Inventory*. This inventory and subsequent restoration recommendations acted as a user-friendly guide for prioritizing and developing a restoration implementation plan for the upper Nordenskiold River. A number of initiatives under the 1998/99 plan were used to apply for further funding. The *Removal of Barriers to Migration* sections of the 1998 Inventory were successful for partial funding under the Yukon River Panel's Restoration & Enhancement (R&E) Program and the Department of Fisheries & Oceans Habitat Restoration and Salmon Enhancement Program (HRSEP) in 2000 – 2001 and again in 2001-2002. This report describes the outcome of the third seasons, 2001-2002, restoration activities on the upper Nordenskiold River.

Even though the stream morphology, water quality, and resulting salmon habitat proved favourable over the three years of this study, the juvenile fishery surveys were disappointing. The 1998 report, *Salmon & Salmon Habitat Inventory*, project's biophysical survey portrayed ideal salmon spawning and rearing habitat but utilization was desperately low for chinook fry and critically low for adults. The 2000-2001 *Removal of Barriers to Migration* utilization study showed an even more desperate result. This years project showed even more dismal results in fry utilization; none were caught. However, adult utilization appeared to be hopeful, with spawning pairs of King salmon observed at the outlet of Hutshi Lake on the historic dune above the removed beaver dam that was obstructing migration; carcasses observed on Kirkland Creek; and pairs of spawning salmon observed on Klusha Creek below Twin Lakes outlet.

It is evident that restoration activities are not only necessary but may be critical to the long-term viability of chinook salmon on the upper Nordenskiold River. The cummulative upper Nordenskiold salmon surveys' numbers were disappointing but the biophysical surveys and historic distribution revealed potential short and long-term restoration opportunities that could maximize chinook abundance and distribution .

The removal of barriers to migration and the implementation of stock-specific management practices made up the bulk of the short and long term potential restoration activities identified and recommended in the past studies. The continuation of the removal of barriers to migration was a recognized measure to greatly increase access to potential habitat of both chinook fry and returning adult.

Conducting Nordenskiold chinook enumeration, timing, and stock-specific monitoring studies, a recommendation in the 1998 - 1990 studies, provides a long term monitoring venue in the maintenance of stock diversity and abundance. Accurate run-time data could direct stock-specific management practices of Yukon River Fisheries. If the Yukon River's sub-stocks are in danger and the timing of the run at fishery zones is known, then management practices, such as a fishery closures at peak run times, could be issued. Accurate run-timing data will also aid managers in timing cost efficient and effective aerial surveys. An enumeration strategy would also provide a tool to monitor the health, strength, and the effectiveness of any restoration project. All this data may be beneficial in indicating point specific problems or overall trends.

The final recommendation of the previous reports was the placement of artificial propagated Chinook salmon , such as the strategic placement of incubation boxes, with brood obtained from the resident sub-stocks. This was deemed necessary due to the desperate state of present upper Nordenskiold stock status. It may also speed up the natural recovery and distribution rates while maintaining and protecting sub-stock genetic makeup. Before considering this option, it was recommended that site locations be identified; restoration activities continue with the scope focused on specific biological data gaps to be filled in; and ambient temperature regimes be recorded. Restoration activities should not occur until proposed methods have been successfully proven in more prolific spawning areas to increase the success rate on declining Nordenskiold sub-

stocks. Artificial propagation procedures should be sensitive to First Nation values while protecting the genetic makeup of the Nordenskiold sub-stocks (Pumphrey, 2001).

1.3 Objectives

1.3.1 Long-term Objective

CAFN wishes to facilitate the rebuilding of salmon populations to their fullest sustainable levels. As a result, increased harvest opportunities for all user groups may be realized.

As a follow-up to the 1998 *Salmon and Salmon Habitat Inventory* and the 2000 *Removal of Barriers to Migration* , CAFN realized that continuing the *Removal of Barriers to Migration* and the collection of baseline data was the necessary next step to obtaining the long-term objective.

1.3.2 Report Objectives

The report objective is to document the obstruction removals performed and add to the essential baseline biophysical data collected in 1998 and 2000. Also, to insert temperature data loggers at strategic sites in order to profile the ambient temperature days. This will enable managers to calculate emergence-timing estimates for wild Chinook salmon and enhanced salmon. Enhanced eggs could possibly be placed in incubation boxes, sometime in the future, as per prescribed recommendations of the previous studies.

1.4 Report Layout

This report follows the same layout used in the 1998 and 2000 reports. The overview map, located at the beginning of this report, highlights the locations of all reaches within the study area and notes those reaches that were concentrated on during the *Removal of Barriers to Salmon Migration* in 2000. This report is designed to be used with the 1998 restoration and enhancement (R&E) plan, a *Salmon & Salmon Habitat Inventory,* and the report on *Removal of Barriers to Salmon Migration* of 2000. By utilizing both reports, the reader will get an eco-system holistic view of the study area and managers can track changes of the baseline data obtained during all projects over time. Copy of the previous reports can be obtained from the DFO - Whitehorse Office, The Yukon River Panel, or Champagne & Aishihik First Nations offices.

To effectively use this report, the appendices and previous reports from 1998 and 2000 have to be referenced in whole to obtain and appreciate all of the elements which make up or influence any particular parameter of interest. For example, if one was interested in the water levels or quality at the time of this 2001 study at the site just below Hutchi Lake outlet (NHA), they merely need to go to appendix F and G of this report. However, without the complete picture of the # of fry caught here in previous years, the # of spawners observed, the water quality, quantity, and geo-physical and biological features of the reach before the Beaver Dam was placed, all these parameters found in the previous years' reports, then the data will be viewed in isolation and erroneous assumptions may be made.

For a comparative view of background data acquisitions of all specific survey sites, see the 1998 and the 2000 reports along with this report. Both layouts are similar to this report and designed to make comparative analysis easy.

For site-specific detailed results of the data parameters collected in the field this study year, see the appendices at the back of this report.

The table of contents of the report provides easy access to all sections and Appendices.

The proceeding sections will describe the *Data Collection Methods* followed by the *Summary and Discussion of Results*.

2 Methods

Four activities were performed during the *Removal of Barriers to Salmon Migration, 2001,* project: Beaver Dam removal (July-August, 2001); In-situ habitat data collection (July-August, 2001); Helicopter Survey (August 2001); and Beaver Trapping (March -April 2002).

The summer *Removal of Barriers to Salmon Migration* was broken up into two stages. During both stages boats were used to access the sites. Snow machines will be used to gain access to the sites during the winter beaver removal.

The methods used to conduct each survey are described in detail below.

2.1 Removal of Barriers to Migration Methodology

The summer *Removal of Barriers to Salmon Migration* started with a fly-in to Hutchi Lake with the intentions of canoeing down to Division Mountain removing obstructions along the way while collecting baseline geo-physical and fisheries data. Once the Beaver Dam, just below Hutchi, was removed, the increased speed and force of the river denied the crew the opportunity to continue their decent down the river. The fixed wing fly over of the area allowed the crew to surmise that there were no more barriers to migration present within this upper most section of the river which in turn allowed the crew the opportunity to focus on the lower sections where more beaver activities were observed in previous years.

The crew accessed the Division Mountain site by truck and boated to the areas of interest to collect data and place a temperature data logger.

The crew then accessed the Nordenskiold again just past twin lakes down a long trail and started their descent down the section of river noted for the higher concentration of beaver dams. This portion of the trip lasted 5 days and would entail the removal of all obstructions (beaver dams) that potentially inhibited salmon migration during the season.

Removals were performed by hand with the aid of walking sticks, ropes, and a chain saw. The water level was extremely high all over the Yukon this year and the Nordenskiold was no exception. Places where one could easily stand during the summer of 1998 were now in places over ones head. This was exactly what the crew experienced in 2000 as well. The increased velocities made removals very dangerous.

2.2 Summer geo-physical habitat Stream Survey

During the summer survey of 2001, four temperature data loggers were placed in the stream at various locations to obtain temperature profiles of the stream in known or potential spawning areas. The Venco Minilog-T miniature temperature data loggers were set to record temperatures every 6 hours. Technically, these units could remain placed in the stream for five years and are capable of retaining data for up to twenty years.

During the 1998 inventory, field data-forms were designed to meet British Columbia's Resource Inventory Councils (RIC) standards while maintaining the Yukon standards and approaches to maximize quality assurance and field time efficiency. After consultations during the inventory data collection in 1998 with DFO's Habitat section, the forms were finalized and tailored to meet the

Yukon's needs using standardized parameters. Completed forms may be viewed in previous reports and a collective view of data obtained this year can be viewed in the appendices.

The methodology used in collecting data for each section of the data form is discussed below:

2.2.1 Reach Description

This first section on the form lists the date, representative reach site location identifier, surveyor's initials, map sheet # (1:50K), air photo #, and the date of survey. A Magellan Colour Track GPS was used to record the UTM coordinates using NAV 87 for the representative reference sites. A micro-tape recorder aided in the documentation of general site descriptions at each site.

2.2.2 Photography methodology

A 35mm instant disposable Kodak camera was used to take all pictures. For each photo the roll and frame numbers were catalogued. Photos of the cross-sectional reference point, upstream, and downstream of the reference points were taken and recorded at each representative site and data-logger placement sites. In addition, habitat feature photos were taken and documented for some sites.

2.2.3 Stream Bed Material Classification Methodology

Visual observations of the compaction and composition of streambed material were recorded as per RIC standards. The percent of composition of fines, gravel, and larges were observed and documented. The intermediate diameter of a representative bed material that is larger than 90% of the total substrate was recorded under the heading, D_{90}. All other streambed material composition and compaction were noted.

2.2.4 Banks Classification Methodology

Bank descriptions also followed RIC standards. A metric measuring tape was used for all measurements. Bank full depth and flood heights were calculated from the waters level at the time of the survey. Confinement classification describes the channel in relation to the reach valley walls.

2.2.5 Vegetation and Cover Classification Methodology

Cover estimates are visual assessments of the type and amount of in-channel cover available for fish. Total cover was calculated as the percent of the total channel covered and then broken down to specific percentage of cover type.

Crown closure is the percentage of the channel area covered by streamside riparian vegetation that projects over the stream channel looking down from overhead.

The vegetation notes section lists all dominant riparian vegetation followed by the minor and incidental species observed.

2.2.6 Channel Characteristics Classification Methodology

Channel characteristics section is self-explanatory. This section is to be used with the photographs provided within the *Reach Results and Discussion*. Between pictures and in-field visual observations and measurements that were recorded, the channel is accurately portrayed. The only equipment used here was a graduated measuring stick to measure depths and an Inco® clinometer to measure slope.

2.2.7 In-situ Water Quality Classification Methodology

In-situ water quality data was collected at some representative reach sites using a Horiba U-10 water quality meter. The following outlines the meter's parameters and accuracy:

Parameter	Range	Accuracy
pH	0 - 14	0.1 pH
Conductivity	0-100 us/cm	1 us/cm
Turbidity	0 - 800 NTU	1 NTU
Dissolved O_2 - DO	0 - 19.9 mg/l	0.1 mg/l
Temperature	0 - 50 °C	0.1 °C

2.2.8 Summer Water Quantity Survey Classification Methodology

All flow velocities were calculated using the streamkeeper's orange float method , the same method used in 2000. Please note that flows calculated during the 1998 inventory used a Top Setting Wading Rod with a Price Flow Meter calibrated by Environment Canada's National Calibration Unit.

Discharge was calculated using the *velocity area* method

For a historic overview of water quantity, refer to the 1998 Inventory in appendix Water Survey Canada's mean monthly and extremes of discharge for 1982-95 for the Nordenskiold River below Rowlinson Creek - station # 09AH004 were analyzed as per the 1998 inventory report. Environment Canada's total monthly precipitation for Carmacks from 1963 - 1997 was also examined in 1998.

2.3 Winter Beaver Removal

Winter Beaver Removal is scheduled to be performed during March/April of 2002. All trapping will be performed in accordance to the territorial regulations. An assistant trapper and a proprietor of a Nordenskiold trap line will perform all trapping within the study area.

2.4 JCS primary relative indexing and health monitoring Methodology

The Protocol for the Baiting of Gee - Type Minnow traps for the Capture of Juvenile Chinook Salmon in the Yukon River Drainage Basin was used for all JCS collections. The consultant and 1 CAFN trainee/crew member performed these functions during the months identified at each representative site in the drainage. .

A minimum of five Gee - type minnow traps were set at each site for a minimum of twelve hours for each trap. All procedures strictly abided to the *Protocol for the Baiting of Gee - Type Minnow traps for the Capture of Juvenile Chinook Salmon in the Yukon River Drainage Basin*. A walnut-sized portion of unpreserved Yukon River salmon roe was placed in a perforated "Alligator" brand sandwich bag. The bag was then tied and suspended inside the trap and secured with a "twist-tie". The traps were placed, not in the main flow, but in areas where there was adequate flow and cover and secured to the bank with a cord.

All juvenile fish captured were to be anaesthetized with Alka-Seltzer® and held in a bucket until sufficient time passed for the anesthetic to take effect. Species were then to be accurately identified using the Field Key to the Freshwater Fishes of British Columbia, RIC (1996) and Freshwater Fishes of Canada. Metalarva (not fully formed as a fry) fish, not field identifiable, will be preserved in 10% formalin solution and properly identified later using the *Identification of Larval Fishes of Alaskan Freshwaters* manual.

For each trap, the date, location, number of JCS caught, number of hours set and the combined catch per unit effort was calculated and recorded.

Each fish was weighed with an Acculab® pocket pro portable electronic scale and weighed to $1/10^{th}$ of a gram. Each fish was measured to the nearest millimeter. All data was recorded on prepared reach data forms. All JCS were examined for adipose fin removals to identify hatchery-reared fry. A condition factor (k) defined as k = Weight (grams) * $[100/\text{Length (cm)}]^3$ were calculated for each juvenile chinook salmon. This factor is widely used in assessing the overall condition or general health of salmonids and is increasingly being used on the Yukon River.

All other fish observations were recorded along with the reach and habitat they were observed within.

2.5 Helicopter Survey

On Monday, August 20, 2001, a local helicopter company was hired to pilot the fall adult salmon distribution and abundance survey. The area surveyed encompassed the whole river from Hutchi down to Carmacks including portions of Kirkland Creek, Klusha Creek, Rawlinson Creek and, its tributary, Incised Creek. Three surveyors and pilot recorded GPS references of any new obstructions or habitat features missed during the summer's ground survey. The abundance, distribution, and location of adult salmon were also recorded.

3 Summary and Discussion of Results

To help summarize and discuss the results of the project's data collection initiatives, this section is broken down into five noted subsections – *Removal of Obstructions to Migration*, *Summer Geo-physical Habitat Stream Survey, JCS primary relative indexing and health monitoring Methodology, Helicopter Survey*, and *Recommendations*.

To effectively use this report, the appendices and previous reports from 1998 and 2000 have to be referenced in whole to obtain and appreciate all of the elements which make up or influence any particular parameter of interest. Without the complete picture, the data may be viewed in isolation and erroneous assumptions may be made.

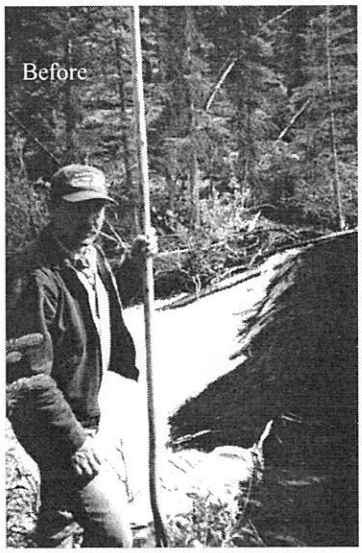
The scope of this project was not to analyze the data in depth, but to collect and report on the data and house the data in a user friendly fashion. Therefore the summary of results is more of a users guide to the appendices attached and the user can then make his/her own inferences on the topic at hand. That being said, the author has performed some summaries upon the data collected in the field which is discussed within this section.

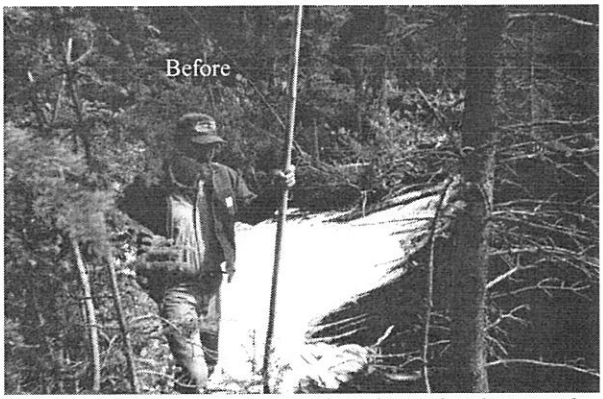
For site-specific detailed results of the data parameters collected in the field, see the appendicies.

For a comparative view of background data acquisitions of all specific survey sites, see the 1998 and the 2000 reports along with this report. Both layouts are similar to this report and designed to make comparative analysis easy.

3.1 Beaver Dam Removal Summary of Results

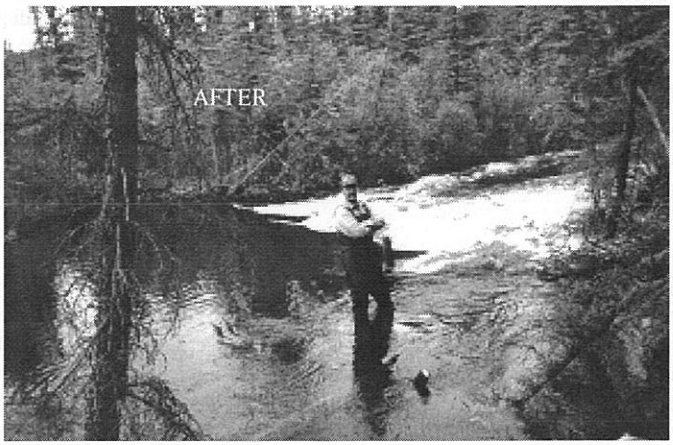
In the year 2000, twelve beaver dams were partially removed or breached from the entire project area. However, due to the unusually high water levels in that year and the persistent rainfall during the project dates, all the dams were partially or totally under water allowing migration of salmon possible.





This year, 2001, the only beaver dams located and removed was in an area not visited in 2000. One very large beaver dam was removed just below the outlet of Hutchi Lake with staggering results. This dam was not present during the 1998 summer field survey. However, during the 1998 fall helicopter survey, this dam was observed. The surveyors of 1998 believed that the following year's freshet would remove the dam. This did not occur. The dam grew, increased the volume of the lake, and created a settlement area upstream which affected the whole benthic

morphology of the upstream habitat including the well documented and important chinook-spawning dune.



This historic spawning dune, located above the beaver dam, received silt deposits to its interstitial spaces as a result of the backwater effect of the dam. Once the crew breached the dam the lake level and upper portion of the river dropped over 18 inches within the first 36 hours and opened up this upstream habitat to potential spawners.

No other beaver dams were observed throughout the study area; however a number of beavers and their lodges were observed and noted. Eight beavers were observed from the Twin Lake access put-in down to the Kirkland Creek confluence. The waterway, from the successful dam removals performed during the summer of 2000, remained open and navigatable by salmon. The reason why the beavers did not or could not rebuild the dams was probably due to the continuance of the hydrological recharging of the area which has been occurring since the summer of 2000.

The photos are before and after pictures of the beaver dam breached just below Hutshi Lake outlet. Both ends of the dam were breached.

During the helicopter survey, performed later in the fall, pairs of chinook spawners were observed utilizing the dune located just above the removed dam. One may venture to presume that this important habitat may not have been attainable if the dam was not removed.

Lodges were located at 445389E 6838039N and at 445472E 6839534N just downstream about 1km from the twin Lakes access put-in site.. There were continuous evidence of beaver activity and use throughout the main-stem of the Nordenskiold during the 2001 season as was the case in the 2000 season. It is this author's opinion that the beavers are using the Nordenskiold main-stem as a transportation route for food collection and storage but utilize the oxbow and pothole lakes scattered within most of the lower river valley as their stable lodging environment.

3.2 Summer geo-physical habitat Stream Survey - Summary of Results

Investigations were carried out at representative reference sites for reaches surveyed. For site-specific results and discussions see appendices. For a comparative view of all survey specific results from year to year, see previous reports in collaboration with the attached appendices.

3.2.1 Stream Survey - Habitat summary Results

During the 2001 survey, the sites in Appendix A were re-assessed including some new ones investigated and background data collected. This data was collected and recorded in the same format as during the 1998 and 2000 inventories. Please review both reports when requiring data specific information.

3.2.2 Summary of Water Quality and Quantity

The summer of 2001, as was the summer of 2000, was extremely wet with water levels and discharges amongst the highest recorded in years and a total reverse from 1998. Overall in-situ flow and discharge measurements overall fell within acceptable parameters as outlined in RIC's publication - A Review of Habitat Capacity for Salmon Spawning and Rearing (1993) but the quantity values were many times the values recorded in 1998.

The Water Survey Canada's monthly mean historic discharge of the Nordenskiold River downstream of Rowlinson Creek - station # 09AH004 during the period 1982 to 1996 ranged from a low of 3.5 m^3/sec in March to a high of 46.2 m^3/sec in May. The minimum daily discharge (1.7 m^3/sec) was recorded on April 4, 1995, and the maximum daily discharge (199.0 m^3/sec) was recorded on May 28, 1992. The data can be viewed in the '98 report.

Environment Canada's total monthly precipitation for Carmacks during 1963 - 1997 was also examined. The lowest precipitation in Carmacks, during the period from 1963 to 1997, occurs in April, with an annual monthly mean of 6.7 mm, and the highest occurs in July, with an annual monthly mean 54.8 mm. The data can be viewed in the '98 report.

Based on the abundance and diversity values of the benthic fauna found during the 1998 Survey within the study area, the first reach of the Nordenskiold River downstream of north Hutchi Lake (NHA) appeared to be the most productive site. Historic spawning dunes were observed at this site as well as pike, grayling and long-nose suckers. Due to the beaver dam, this year's survey showed a very different habitat. The benthos were more lake like and the dune received silt deposits to its interstitial spaces as a result of the backwater effect of the dam. Since the Dam removal, the parameters from an aerial view appeared to resemble that of the '98 description once again.

3.3 JCS primary relative indexing and health monitoring Results

This year's survey produced no JCS (*Oncorhynchus tshawytscha*), four slimy sculpins, and one burbot during 892 hours of minnow trapping of which 50 traps were set for an average of 17.84 hours.

During 1998 gee-type minnow trapping, 2023 hours of tapping took place with nine JCS (*Oncorhynchus tshawytscha*) captured, eight slimy sculpins, three long nose suckers, two arctic grayling, and two northern pike.

Due to the limited fund resources in 2000, no Minnow traps were set.

During the 2001 study, adult kings were observed breaking the surface and holding up just upstream of the Kirkland Creek confluence on the Nordenskiold (NUKA). In half an hour, the surface water was breached five times. The water was too turbid to see anything under the surface.

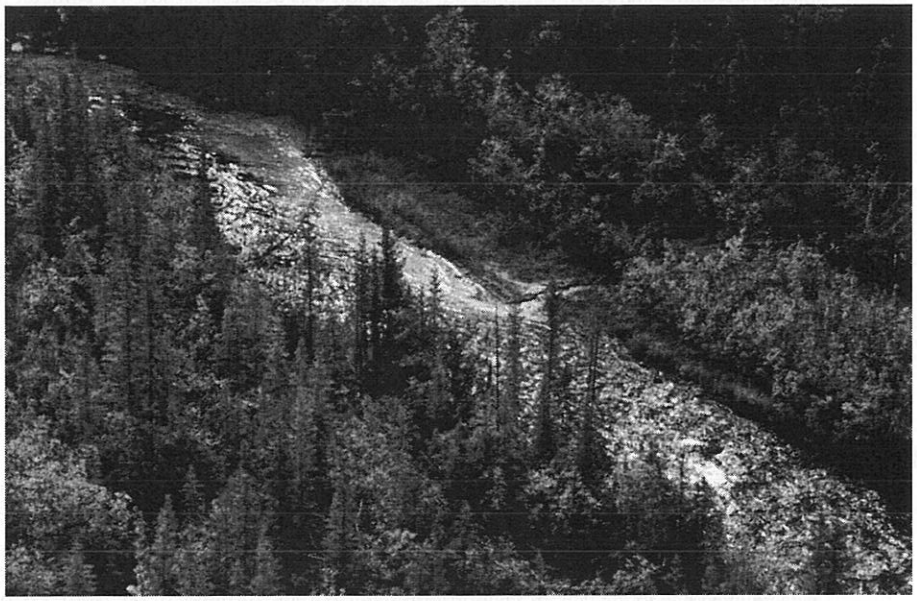
Even though the stream morphology, water quality, and resulting salmon habitat proved favorable over the three years of this study, the juvenile fishery surveys were disappointing. The 1998 report, *Salmon & Salmon Habitat Inventory*, biophysical surveys portrayed ideal salmon spawning and rearing habitat but utilization was desperately low for chinook fry and critically low for adults. The 2000-2001 *Removal of Barriers to Migration* utilization study showed even more desperate results. This year's project showed results that are even more dismal in fry utilization; there were none caught. However, adult utilization appeared to be hopeful, with spawning pairs of King salmon observed at the outlet of Hutshi Lake on the historic dune above the removed beaver dam that was obstructing migration; carcasses observed on Kirkland Creek; and pairs of spawning salmon observed on Klusha Creek below Twin Lakes outlet.

It is evident that restoration activities are not only necessary but may be critical to the long-term viability of chinook salmon on the upper Nordenskiold River. The upper Nordenskiold salmon survey numbers were disappointing but the biophysical survey and historic distribution revealed potential short and long-term restoration opportunities that could maximize chinook abundance and distribution. The 2000 and 2001 surveys reiterated this point.

3.4 Helicopter Survey

On Monday, August 20, a helicopter survey shared between CAFN and DFO's Habitat Section, yielded exciting results. The area surveyed encompassed the whole river from Hutchi down to Carmacks including portions of Kirkland, Klusha, Rawlinson and, its tributary, Incised Creeks. Originally set for the first week of August, the timing of the survey was delayed due to the lack of visibility from the extreme turbidity of the Nordenskiold. The actual timing of the helicopter survey is believed to have capsulated the end of the spawning window. Five spawners were observed on the historic dune above the removed beaver dam, just below the outlet of Hutchi Lake, on the Nordenskiold. The spawning activity cleaned the gravels of the dune. Two eagles were also observed at this upper reach. There were two mudslide fans, which we saw during the Helicopter survey this last summer, which really affected water quality in the Nordenskiold. The first photo depicts the big new one encountered at the confluence of a tributary entering the Nordenskiold down by Jensen's Farm. The second is the one just below Hutshi outlet that we documented in 1998 and is obviously still occurring. These slides appeared to be caused by ground water discharges which melted permafrost in the banks, gave way, and subsequently released sediments and

till into the stream.



One white tailed salmon carcass was observed about 5 miles upstream on Kirkland creek, suggesting successful spawning activity having occurred on that creek as well. Three live spawners, three carcasses, and three bald eagles were observed just below the Kirkland Creek confluence where, historically, major spawning has occurred.

On Klusha Creek, just below Twin Lakes road crossing, two spawning salmon were observed on a bed of washed gravel. Hats off to the crew from Little Salmon Camacks First Nations whom successfully removed the maze of Beaver Dams within the lower reaches of Klusha Creek. This was the first visual observation on this river in recent years. In recent times, only traditional knowledge suggested that salmon utilized this river. A detailed write-up from Al von Finster of the helicopter survey can be located in the appendices of this report.

3.5 Recommendations

It is evident that restoration activities are not only necessary but may be critical to the long-term viability of chinook salmon on the upper Nordenskiold River. The Nordenskiold salmon survey numbers were disappointing but the biophysical survey and historic distribution revealed potential short and long-term restoration opportunities that could maximize chinook abundance and distribution. This year's survey reiterated this point.

The removal of barriers to migration and the implementation of stock-specific management practices make up the bulk of the short and long term potential restoration activities identified and recommended.

The continuation of the removal of barriers to migration will greatly increase access to potential habitat for both chinook fry and returning adults. The barrier to migration removal strategy should continue on the upper and lower Nordenskiold River.

Conducting Nordenskiold chinook enumeration, timing, and stock-specific monitoring studies will aid in the maintenance of stock diversity and abundance in the long term. Accurate run-time

data could direct stock-specific management practices of Yukon River Fisheries. If the Yukon River's sub-stocks are in danger and the timing of the run at fishery zones is known, then management practices, such as a fishery closures at peak run times, could be issued. Accurate run-timing data will also aid managers in timing cost efficient and effective aerial surveys.

An enumeration strategy would also provide a tool to monitor the health, strength, and the effectiveness of any restoration projects. Tag return data from the proposed monitoring site (NDKA) and data obtained from post spawn mortality assessments could provide distribution, timing, and restoration monitoring data at a site-specific level. If another monitoring site was proposed and placed at the mouth of the Nordenskiold River, then in-river timing and distribution data could be obtained for the entire river.

Sub-stock data obtained will aid managers in assessing the health of the run. Age, sex, length, and weight ratios can be obtained in a minimal stress setting. This data can be used over time and area to indicate the health of the run. This data will be beneficial in indicating point specific problems or overall trends.

Artificial propagation of Nordenskiold chinook, such as the strategic placement of incubation boxes, with brood obtained from the resident sub-stocks. This was deemed necessary due to the desperate state of present upper Nordenskiold stock status. It may also speed up the natural recovery and distribution rates while maintaining and protecting sub-stock genetic makeup. Before considering this option, it is recommended that site locations be identified; restoration activities continue with the scope focused on specific biological data gaps to be filled in; and ambient temperature regimes be recorded. Restoration activities should not occur until proposed methods have been successfully proven in more prolific spawning areas to increase the success rate on declining Nordenskiold sub-stocks. Artificial propagation procedures should be sensitive to First Nation values while protecting the genetic makeup of the Nordenskiold sub-stocks

Local and First Nation Governments should be consulted on all enumeration and monitoring methods proposed during all stages.

It is recommended that a similar project and resulting plan, such as was performed in 1998 on the upper Nordenskiold River, be performed and initiated by the Little Salmon / Carmacks First Nation for the lower portion of the Nordenskiold River drainage. Such a project would mutually benefit each section of the Nordenskiold including the traditional, commercial, and sport fisheries along the American and Canadian portions of the Yukon River.

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