PROPORTIONAL DISTRIBUTION AND MIGRATION CHARACTERISTICS OF CHINOOK SALMON IN THE CANADIAN PORTION OF THE YUKON RIVER WATERSHED AS DETERMINED BY REMOTE RADIO TELEMETRY TRACKING STATIONS – 2004

PROJECT CRE-78-04

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Prepared for

YUKON RIVER PANEL

RESTORATION AND ENHANCMENT FUND

2005

ABSTRACT

A project funded by the Yukon River Panel was conducted in 2004 to track radio-tagged adult Chinook salmon for a third consecutive year. Migrating tagged salmon were monitored throughout the upper Yukon River basin in Canada using 12 existing and 1 new remote telemetry stations *(RTS)* to determine proportional distribution, migration rates and migration timing.

A total of 958 Chinook salmon, tagged with radio transmitters were live released in June of 2004 at the tagging sites in Alaska as part of the basin-wide telemetry study. Of these, 283 (30%) fish were recorded by an *RTS* (Border) located upstream of the Alaska / Yukon border crossing of the upper Yukon River. Upstream of the Border *RTS*, 30 (11%) were reported caught in the mainstem Yukon River fisheries, 185 (65%) were tracked into tributaries monitored by *RTS's* and 68 (27%) remained in the mainstem Yukon River or entered tributaries not monitored by *RTS's*. Proportional distributions of radio-tagged fish ranged from highs of 19 percent in the Pelly and Teslin Rivers to lows of 5 percent in the Klondike, White and south Yukon Rivers. Stock-specific migration rates from the Alaska / Yukon border to the tributary *RTS's* were significantly different and ranged from a high of 54.9 kilometres per day for the Pelly River fish to a low of 43.6 kilometres per day for the south Yukon River fish. There was substantial overlap in run timing among the primary tributary stocks at the Alaska / Yukon border. The Klondike and White stocks may be considered early migrants; the Stewart, Pelly, and Big Salmon stocks may be considered mid-run migrants, and the Teslin and south Yukon stocks may be considered late migrants. Run timing at the respective tributary *RTS's* showed the earliest stock to complete their passage were the Klondike River fish, while the Teslin stock was the latest one to complete their passage.

This year's results are compared with those for 2003 and 2002. Spawning escapement to the upper Yukon River in Canada in 2004 was estimated to be approximately 17 percent lower than the 2003 estimate and 13 percent higher than the 2002 estimate. The proportions of radio-tagged fish resuming migration that reached the Yukon River crossing of the Alaska / Yukon border were 29% in 2002, 39% in 2003 and 30% in 2004. The difference in the proportional distribution of radio-tagged fish in tributaries monitored by *RTS's* among the years 2004 - 2002 was not statistically significant. Stock-specific mean migration rates among the years 2004 - 2002 were not significantly different and there was little apparent change in stock-specific run timing. The Big Salmon River stock showed the greatest fluctuation in proportional distribution, and the Pelly River stock showed the greatest fluctuation in run timing among the years.

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1.0 INTRODUCTION

Radio telemetry has been used extensively to track salmon in the rivers of northwestern Canada and Alaska in recent years. Both ground receiving stations and aerial tracking surveys have been used to establish the distribution, migration rates, run timing and relative abundance of salmon (Boyce 1999, Boyce and Eiler 2000, Eiler and Masters 2000, Evenson and Wuttig 2000, Mercer and Eiler 2004, Osborne 2004, Osborne *et al*. 2003, Palke 2003, Spencer *et al*. 2003).

The United States National Marine Fisheries Service (NMFS) and the Alaska Department of Fish and Game (ADF&G) conducted radio telemetry studies on Yukon River Chinook salmon (*Onchorhynchus tschawytscha*) from 2000 to 2004. Pilot studies were done in the first two years to refine tagging methods and to establish ground receiving stations prior to the start of a large scale, basin–wide study in 2002 (Eiler *et al.* 2004, Spencer *et al.* 2003). Up to 1100 returning adult Chinook salmon were to be captured throughout the run in the lower Yukon River near the Alaskan villages of Marshall and Russian Mission (Figure 1). Captured Chinook were to be fitted with radio transmitters (tags). A small subset of special tags known as 'archival' radio tags, which recorded temperature and depth data, was applied at the same location from 2002 to 2004 and was to be retrieved during the aerial tracking surveys. The radio-tagged fish were to be tracked throughout Alaska and Canada using remote tracking stations (*RTS*'s) (Eiler, 1995) and aerial tracking methods.

In 2004, ADF&G, NMFS and Haldane Environmental Services (HES) undertook year three of a project to track radio-tagged fish in the Canadian portions of the upper Yukon River watershed to complement the U.S. program in Alaska using 12 *RTS's* established in previous years. Also, aerial radio-tracking surveys were conducted throughout the upper Yukon River and Porcupine River drainages in the Yukon Territory by three other separate Yukon River Panel Restoration and Enhancement Fund (R&E) projects (CRE-02-04, CRE 17N-04, CRE 77-04). This report presents information on the distribution and migration characteristics of radio-tagged fish within the Canadian portion of the upper Yukon River watershed[1] in 2004 (excluding the Porcupine River

[1] A separate comprehensive report detailing the results of tracking radio – tagged Chinook salmon in both the Canadian and U.S. portions of the Yukon River basin from 2000 to 2002 was prepared by NMFS and ADF&G (Eiler et al. 2004). A second report covering the entire time span of the basin-wide study (2002 – 2004) is to be prepared by NMFS and ADF&G.

drainage), from data acquired by the *RTS's* and aerial tracking surveys, and makes comparisons with information collected in 2002 and 2003. The distribution and abundance of radio-tagged Chinook salmon in the upper Yukon River watershed (excluding the Porcupine River drainage) as determined by aerial telemetry surveys in 2004 are presented in a companion report (Mercer, 2005).

Remote tracking stations had been established in the Canadian portion of the upper Yukon River prior to 2004 at or near the mouths of five principle tributaries and at five locations on the mainstem Yukon River. They provided information on the proportional distribution of radio-tagged fish to the primary tributaries as well as specific sections of the mainstem Yukon River (Figure 1). Aerial tracking surveys of the entire upper Yukon River watershed complemented this project by identifying locations of spawning radio-tagged fish within selected tributaries.

1.1 Objectives

The principal objectives of the 2004 project year were to:

1. obtain precise information on the numbers of radio-tagged fish entering large first order tributaries of the upper Yukon River (tributaries entering directly into the mainstem Yukon River) to determine proportional distribution; and
2. determine stock-specific migration rates in the mainstem Yukon River within the Yukon Territory and stock-specific migration timing of tributary stocks based on the date and time when they passed the border *RTS* and tributary *RTS's*; and
3. examine carcasses of radio-tagged salmon that had entered the Teslin River (first order tributary of the Yukon River) for evidence of spawning success or failure.

In 2004, ADF&G, NMFS and HES received funding from the Yukon River Panel's R&E Fund[2] to conduct a third year of radio-tracking Chinook salmon in the Canadian portion of the upper Yukon River drainage. Five *RTS* towers and certain electronic components, contributed by DFO in 2002, continued to be used in the 2004 project year. *RTS's* and radio receivers for the mainstem Yukon River and Kluane River were supplied by the NMFS and the ADF&G as part of the basin-wide

[2] The R&E Fund was established pursuant to the Canada / U.S. Yukon River Salmon Agreement of the Pacific Salmon Treaty. The treaty was proclaimed in Dec. 2002; however the R&E fund has operated since 1996.

study. The *RTS* established on the Klondike River in 2004 was supported by an R&E project run by the Yukon River Commercial Fishers Association.

1.2 Study Area and Chinook Salmon Resource

The study area covered by this project is the upper Yukon River[3] and its principal tributaries. The entire Yukon River drainage is the 5th largest in North America in terms of land area drained and mean annual flows. Approximately 59% of the drainage is located in Alaska; the remaining 41% is located in the Yukon Territory and northern British Columbia (Todd 1970). The upper Yukon River drains an area of 245,200 km^2.

The ADF&G Pilot Station sonar estimates of the Yukon River Chinook salmon run for the period 1997 – 2004, ranged from 43,600 to 269,427, with an average of 139,873. The Canadian mark-recapture estimates of the mainstem Alaska / Yukon border escapement for the period 1984 – 2003 ranged from 16,995 to 58,802, with an average of 41,680. The Chinook salmon harvest from the Yukon River in Alaska, from all fisheries, averaged 138,874 pieces during the twenty-year period 1984 – 2003; while the Chinook salmon harvest from the Canadian portion of the Yukon River, from all fisheries, over the same time period, averaged 15,922 pieces (90% & 10% of the total combined U.S. and Canadian Yukon River Chinook salmon harvest, respectively) (Joint Technical Committee of the US/Canada Yukon River Panel, 2005, in prep.).

1.3 Previous Upper Yukon River Telemetry Studies

Previous to the basin-wide study that began in 2002, 4 telemetry studies had been conducted on upper Yukon River salmon in Canada: three involving Chinook salmon (Cleugh and Russell, 1980, Milligan *et al.*, 1985, Matthews, 1999); and one involving fall chum salmon (Milligan *et al.*, 1986). The NMFS began the Yukon River radio telemetry studies in 1998 with the installation of 12 *RTS's* in Alaska and 6 *RTS's* in the Yukon Territory in order to track fall Chum salmon. In 2000, ADF&G and NMFS began a Chinook salmon radio telemetry program in the lower Yukon River drainage. By the time the large-scale Chinook salmon radio-tagging program commenced in 2002, 37 *RTS's*

had been established in Alaska and the Yukon Territory. Six *RTS's* were added to the upper Yukon River in the Yukon Territory to track the distribution of fish in 2002; and 2 *RTS's* were added in 2003. The history of various components of the basin-wide Chinook salmon radio telemetry tracking studies in the Canadian portion of the upper Yukon River is described in detail in Eiler *et al*. 2004, Mercer and Eiler 2004, Osborne 2004 and Osborne *et al.* 2003.

2.0 MATERIALS AND METHODS

2.1 Radio Transmitter Application and Remote Tracking Station Installation

The capture of Chinook to apply the radio transmitters took place near the Alaskan villages of Russian Mission and Marshall, located approximately 250 kilometres upstream of the mouth of the Yukon River and followed methods very similar to those used in 2002 and 2003 (Eiler *et al*. 2004). The transmitters were pulse-coded, allowing many fish to be tracked on a single frequency. The tags, along with the R4500 receivers, were manufactured by Advanced Telemetry Systems (ATS, Isanti, Minnesota, U.S.A.). Eiler (1995) described the *RTS* structure and equipment in detail, and Osborne *et al.* (2003) updated the changes in the electronic components of the *RTS's* used throughout the Yukon River basin since 2003. There were two *RTS's* established part-way through the migration season in 2003 on the Yukon River; one at the mouth of the White River (Lower White) and one at Fraser Falls on the Stewart River, which were activated for the full season in 2004 (Osborne 2004). The Fraser Falls site was intended to establish the proportion of the Stewart River population of radio-tagged fish that ascend the falls. Fraser Falls is a significant partial barrier to fish movement to the upper Stewart River; it is a velocity barrier during periods of high flows, and side passage chute(s) around the falls disappear during periods of low flow.

One additional *RTS* site was established in the upper Yukon River in Canada on the Klondike River, approximately 2 kilometres upstream of its mouth in 2004 (Figure 1). The site location for the Klondike *RTS* was chosen to take advantage of an unused Water Survey of Canada tower instead of a tower designed and built for remote locations as used in all of the other sites.

[3] The upper Yukon River in this report refers to the Canadian portion of the Yukon River watershed, excluding the Porcupine River drainage

The narrow channel width and shallow depth of the Klondike River at this location was judged not to require substantive site elevation above the river. The Klondike station was installed and activated on July 3, 2004 (Figure 2).

2.2 Radio-Tagged Chinook Salmon Carcass Recovery on the Teslin River

A trip was made down the Teslin River during the first week of September to recover the dead and dying radio-tagged fish to check for evidence of spawning. The radio transmitters had the capability of transmitting mortality signals if they were stationary for a period longer than 24 hours (Eiler 1995, Mercer 2005 (in prep.). Only tags transmitting mortality signals were sought for recovery. Radio-tagged fish were located by ground tracking with an ATS R4500C receiver. Locations could be roughly determined by circling with the boat within the channel to determine which shore it was near, with final locations being made by walking the shore. The body cavities of recovered fish were opened to examine the gonads for degree of retention of gametes. Tissue samples of the heart muscle were also taken and preserved for testing for infection by the *Icthyophonus* parasite. Photographs were taken of each carcass examined.

2.2 Data Analysis

Radio-tagged fish were considered to have passed a given *RTS* when the recorded data indicated the following sequence of events: a) increasing signal strength recorded by the downstream antenna; b) maximum signal strength received by both antennae; and c) diminishing signal strength of the upstream directed antenna as the tagged fish proceeded upstream out of signal range. Tagged fish moving downstream past an *RTS* would result in a similar but opposite pattern in the data. The frequency / code combinations as registered by the tributary *RTS's* were matched with those recorded at the border *RTS* to generate data on stock-specific migration timing near the Alaska / Yukon border.

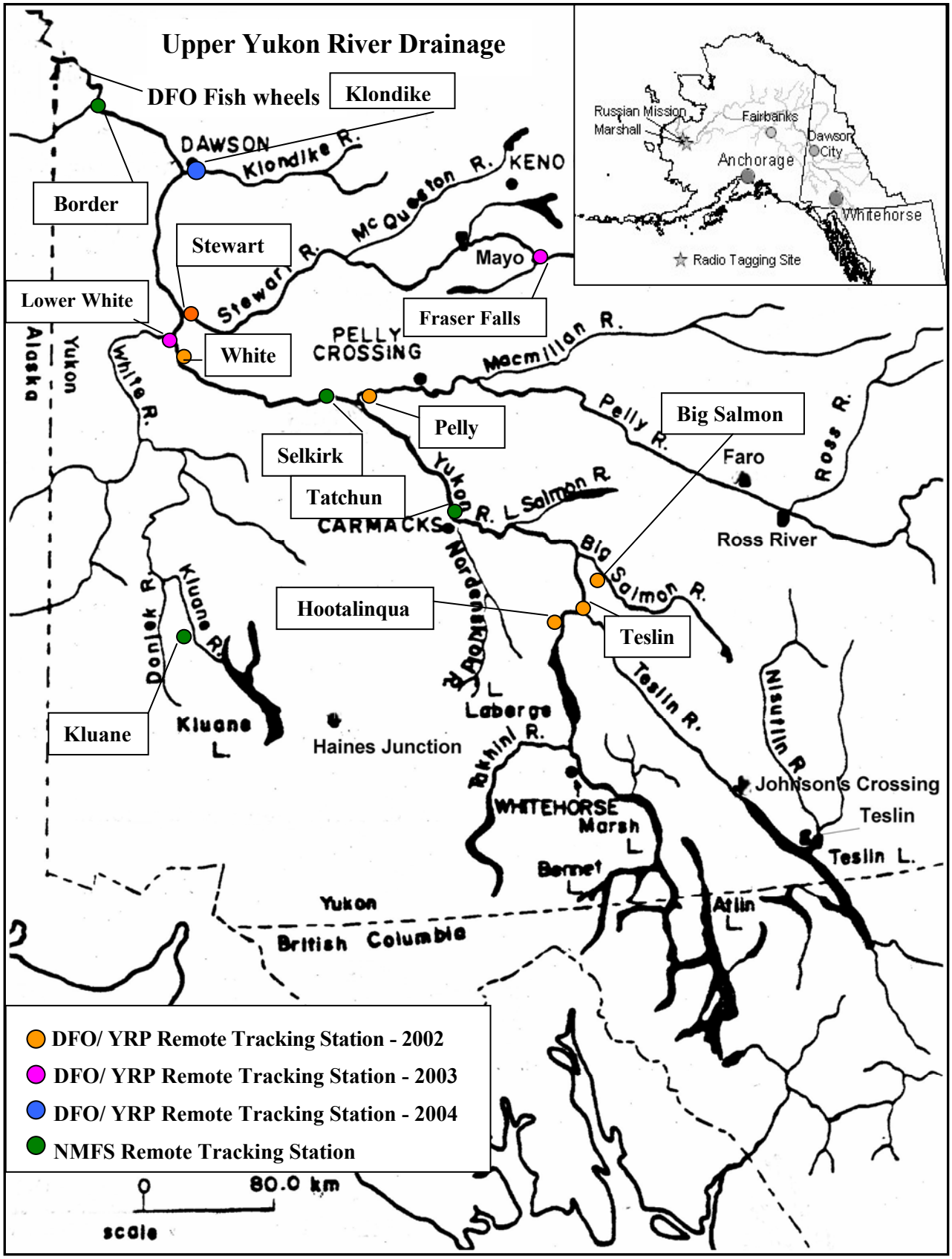

Figure 1. Locations of remote tracking stations in the Canadian portion of the upper Yukon River drainage, 2004.

Figure 2 Left: Water Survey Tower / *RTS* on the Klondike River; Right: View of Klondike River approximately 50 meters upstream of *RTS* (Klondike Highway Bridge in background). Photos courtesy of Jake Duncan, Dawson

Proportional distribution was compared among the years 2002 to 2004 using an arc-sin-square-root transform to convert percentages to degrees and conducting a *single-factor one-way ANOVA Test*. Migration rates for individual radio-tagged fish were calculated using time-taken / distance-travelled data from the Border *RTS* to the *RTS's* on primary tributaries.

3.0 RESULTS

3.1 Remote Tracking Station Results

The results presented in the following sections are for the radio-tagged population of fish only, without provision for weighting by any measures of fluctuations in abundance of the total population moving passed the radio tag application site. The results provided are intended as an indicator of probable migration characteristic trends of upper Yukon River Chinook populations in Canada with the assumption that the radio-tagged sample is representative of the untagged populations of fish. This assumption is predicated on the premise that sampling effort is reasonably proportional to fluctuations in unit measures of run abundance.

A total of 995 Chinook salmon were tagged with radio transmitters and live-released in June of 2004 at the tagging sites of Russian Mission and Marshall in Alaska. Seventy-seven (8%) of these transmitters were archival transmitters that were tracked for recovery during aerial tracking surveys (Mercer, 2005, in prep.). A total of 958 (96%) radio-tagged fish migrated past the first *RTS* upstream of the tagging sites, and of these, a total of 283 (30%) radio-tagged fish migrated upstream of the Alaska / Yukon border and passed the two Border *RTS's.* The remaining tagged fish migrated to terminal areas in Alaska, the Canadian portion of the Porcupine River, were caught in Alaskan fisheries, or dropped below the tagging sites. It is anticipated that a comprehensive report covering the radio-tracking of Chinook salmon throughout the entire Yukon River watershed upstream of the tagging sites during 2003 & 2004 will be released within the next two years by the US National Marine Fisheries Service. One highly suspect fish (#3035), that was last detected as being at large by the Ravens *RTS* in Alaska, was recovered at the Whitehorse Rapids Fish-Way. As this fish was not recorded by any *RTS's* in Canada and a number of *RTS's* located on the upper Yukon River in Alaska, this fish was excluded from analysis. Of radio-tagged fish entering Canada, 30 (11%) were reported as being caught in mainstem Yukon River fisheries, 185 (65%) were tracked into tributaries monitored by *RTS's,* and 68 (24%) remained in the mainstem Yukon River or entered tributaries not monitored by *RTS's* .

3.1.1 Radio-tagged Chinook Salmon Captured in Fisheries

Forty-two radio-tagged fish, which represented 15 percent of the 283 radio-tagged fish crossing the border, were reported as harvested in Canadian fisheries. Of these, 30 (11%) radio-tagged fish were caught in mainstem Yukon River fisheries near Dawson, Minto and Carmacks. These fish were excluded from the distribution analysis because their fates could not be determined (Table 1). The remaining 12 (4%) radio-tagged fish that passed tributary *RTS's*, were included in the distribution analysis. These proportions of the radio-tagged population compare with the two previous years when 42 [10% (5% mainstem and 5% tributary)] and 36 [17% (11% mainstem and 6% tributary)] were captured (in fisheries) in 2003 and 2002, respectively.

Table 1. Radio-tagged Chinook salmon recovered from fisheries in the Canadian portion of the upper Yukon River drainage, 2004.

Nearest Village to Capture Site	Number of Radio Transmitters Recovered	Inclusion in Distribution Analysis
Dawson City	24	No
Carmacks	5	No
Minto	1	No
Mayo	2	Yes
Pelly River	6	Yes
Teslin River	4	Yes
Total	42	

3.1.2 Distribution

The distribution of upper Yukon River radio-tagged Chinook salmon in the primary tributaries covered by *RTS's* is presented in Figure 3. The Pelly and Teslin drainages both received the largest portion of the total tagged fish entering the upper Yukon River drainage in Canada at 19%. The Big Salmon and Stewart drainages each accounted for 10% of the tags, while 5% of the tagged fish returned to the south Yukon River (upstream of the Teslin River confluence). The Fraser Falls station, which operated for the first full season in 2004, recorded the passage of 4 radio-tagged fish (15% of the radio-tagged fish recorded by the Stewart *RTS* on the Stewart River near its mouth).

The White and Klondike drainages were also monitored by their own *RTS's* for the first full season in 2004, and they each accounted for 5% of the total tagged fish coming across the border. The remaining 27% did not leave the mainstem Yukon River or entered other tributaries not monitored by *RTS's*. Most of these fish were located during aerial tracking surveys (B. Mercer, 2005, J. Duncan, 2005, in prep.). When the proportions for the Klondike and White Rivers are pooled with the 'Mainstem Yukon River and Other Tributaries' proportion, for 2004, there was no significant difference in the proportional distributions of radio-tagged fish among the years 2002 to 2004 *(single factor ANOVA, $F=0.005$, $df=2,15$, $\alpha=0.05$, $p=0.99$)* (Appendix 2).

Unlike the previous two years, there was no evidence of straying in 2004, where a radio-tagged fish was recorded by more than one tributary *RTS*.

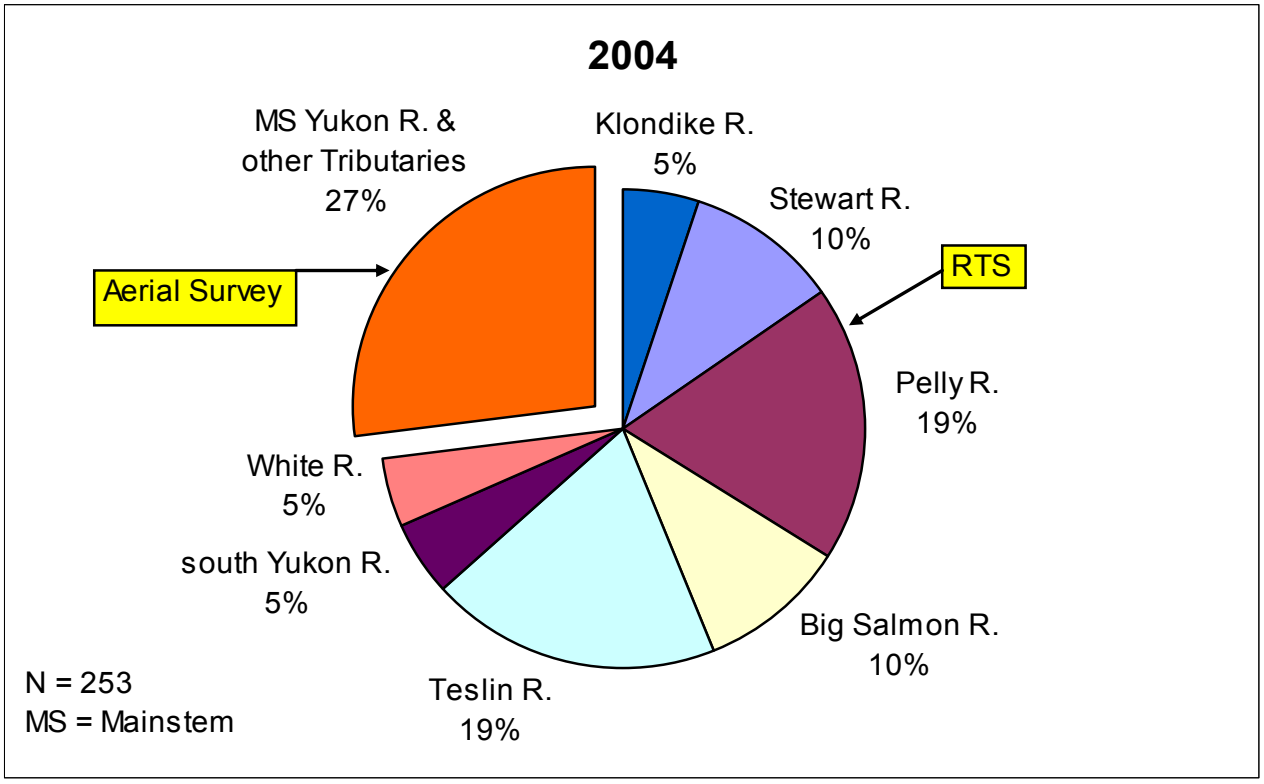

Figure 3. Proportional distribution of Chinook salmon in the Canadian portion of the upper Yukon River drainage, 2004

3.1.3 Migration Rates

Mean migration rates were calculated for travel in the mainstem Yukon River from the Border *RTS* to the nearest tributary *RTS* (i.e. Lower White *RTS* for White River fish, Stewart *RTS* for McQuesten River fish etc.). As in 2003, the Pelly River fish had the highest mean migration rate (54.9 km. / day) and the south Yukon River fish had the slowest mean migration rate (43.6 km / day) of all the tributary stocks monitored by *RTS's*. Mean migration rates were also calculated for tributary sub-stocks, where 10 or more radio-tagged fish were located by aerial tracking surveys (Table 2) (Mercer, 2005 in prep.). Mean migration rates among the tributary stocks monitored by *RTS's* were significantly different *(single factor ANOVA, $F=6.99$, $df=5,166$, $\alpha=0.05$, $p=5.93x\ 10^{-6}$)*. Similarly, mean migration rates among the tributary sub-stocks, where 10 or more radio-tagged fish were located by aerial tracking surveys, were significantly different *(single factor ANOVA, $F=14.19$, $df=6, 158$, $\alpha=0.05$, $p=6.69x\ 10^{-13}$)*. There appeared to be no relationship between distance travelled and mean migration rates for *RTS* monitored stocks *(OLS, $y= 57.49 -0.017x$, $t= -2.18$. $p=0.117$, $r^2=0.61$, $df=4$, $\alpha=0.05$)*. There was no significant difference in stock-specific migration rates for tributary stocks monitored by *RTS,* among years 2004 to 2002 *(single factor ANOVA, $F=0.14$, $df=2, 12$, $\alpha=0.05$, $p=0.87$)* (Appendix 3).

3.1.4 Migration Timing

The timing when radio-tagged fish stocks from tributaries monitored by *RTS's* passed the Border *RTS* is presented in Figure 4. Similar to the previous 2 years, stocks were thoroughly mixed as they entered the Yukon Territory. Nineteen days separated the dates when 90 percent of the first stock and 90 percent of the last stock had completed their passages by the Border *RTS,* 9 days longer than in the previous 2 years. However, the early Klondike and White Rivers stocks were not independently monitored by their own *RTS's* in 2003 and 2002. The Klondike River stock had essentially completed (90%) its passage by the Border *RTS* on July 16; the White River stock on July 21, early in the 19-day period of stocks' passage completion; the Stewart, Pelly, and Big Salmon Rivers stocks completed their passage mid-way in the period (July 26&27); the Teslin and south Yukon stocks completed their passage late in the period (August 1&5).

Table 2. Mean migration rates of radio-tagged salmon in the Canadian portion of the upper Yukon River drainage from tributary *RTS*'s and from aerial-surveyed streams where 10 or more radio-tagged fish were located, 2004.

Mean Migration Rate (km / day)				
Tributary Stock	**Upper Border *RTS* to Tributary *RTS****	**N**	**Standard Deviation**	**Distance from Upper Border *RTS* to Tributary *RTS* (Km.)**
RTS				
Stewart River drainage	51.9	26	9.9	198
White River drainage	51.9	12	3.6	194
Pelly River drainage	54.9	47	3.3	362
Big Salmon River drainage	48.1	25	5.4	618
Teslin River drainage	48.2	49	8.0	632
south Yukon River drainage	43.6	13	5.6	651
Aerial Surveys (≥10 tags)				
mainstem Yukon River**	40.3	43	9.7	
McQuesten River	54.0	12	8.4	
mainstem Pelly River	52.3	14	7.9	
lower mainstem Teslin River *	44.8	32	6.5	
Gender information was not available in 2004 due to the difficulty and the high error rate in determination at the tagging site (Eiler et al. 2004)				

- * That portion of the mainstem Teslin River downstream of Teslin Lake
- ** Fish harvested in fisheries excluded

The timing of the arrivals of the stocks at the primary spawning tributaries seems to reflect distance travelled (Figure 5). Ninety percent of the Klondike and White Rivers' stocks had passed their respective *RTS's* by the end of the second and third week of July, respectively; 90% of the Stewart and Pelly Rivers' stocks had passed their respective *RTS's* by early August; 90% of the Big Salmon stock had passed its *RTS* by the middle of August; and 90% of the Teslin and south Yukon Rivers' stocks had passed their respective *RTS's* by late August.

The timing of the passage by the Border *RTS* of stocks and sub-stocks having 10 or more radio-tagged fish as located by aerial surveys is presented in Figures 6 and 7. Their does not appear to be much difference in the timing of passage completion (90%) by the Border *RTS* between the McQuesten River sub-stock and the entire Stewart River drainage stock. However, radio-tagged fish, spawning elsewhere in the Stewart River drainage than the McQuesten River, tended to broaden the span of time for passage completion by the Stewart *RTS* of the entire Stewart River drainage stock. The mainstem Yukon River and the mainstem Teslin River radio-tagged fish

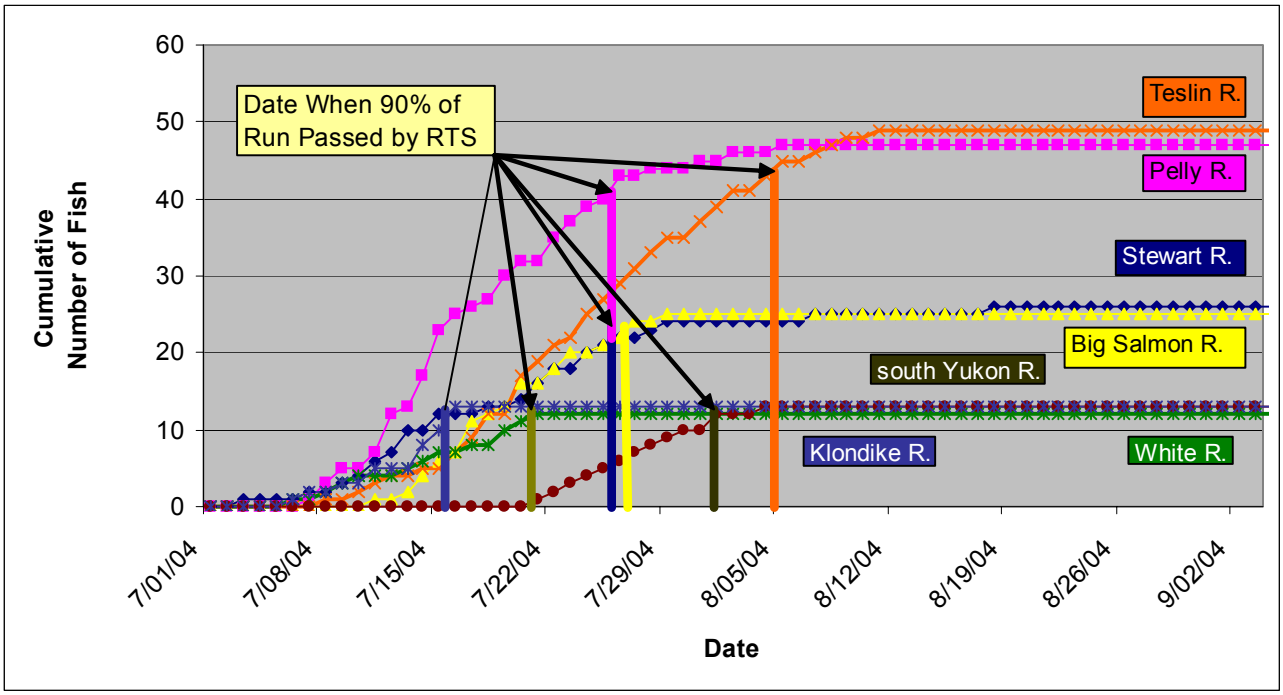

Figure 4. Migration timing of radio-tagged Chinook salmon stocks at the Border *RTS* on the Canadian portion of the upper Yukon River, 2004.

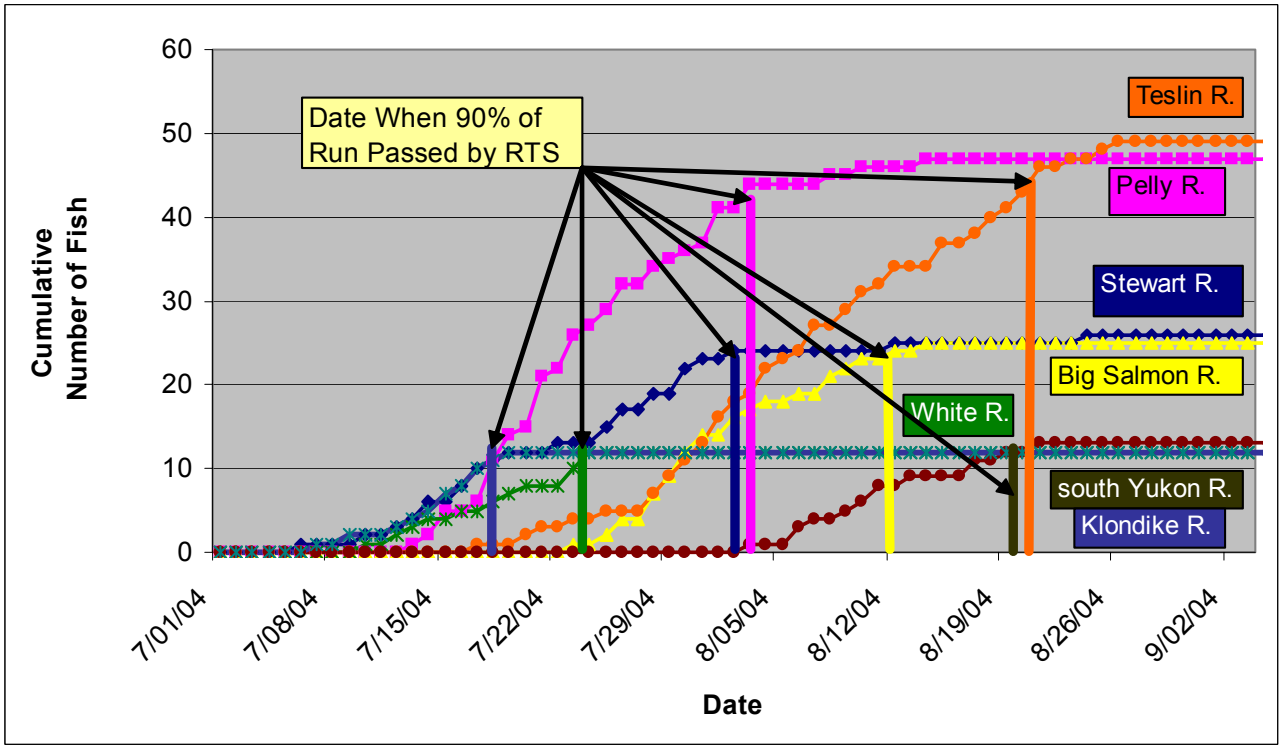

Figure 5. Migration timing of radio-tagged Chinook salmon stocks at their respective tributary *RTS's*, 2004.

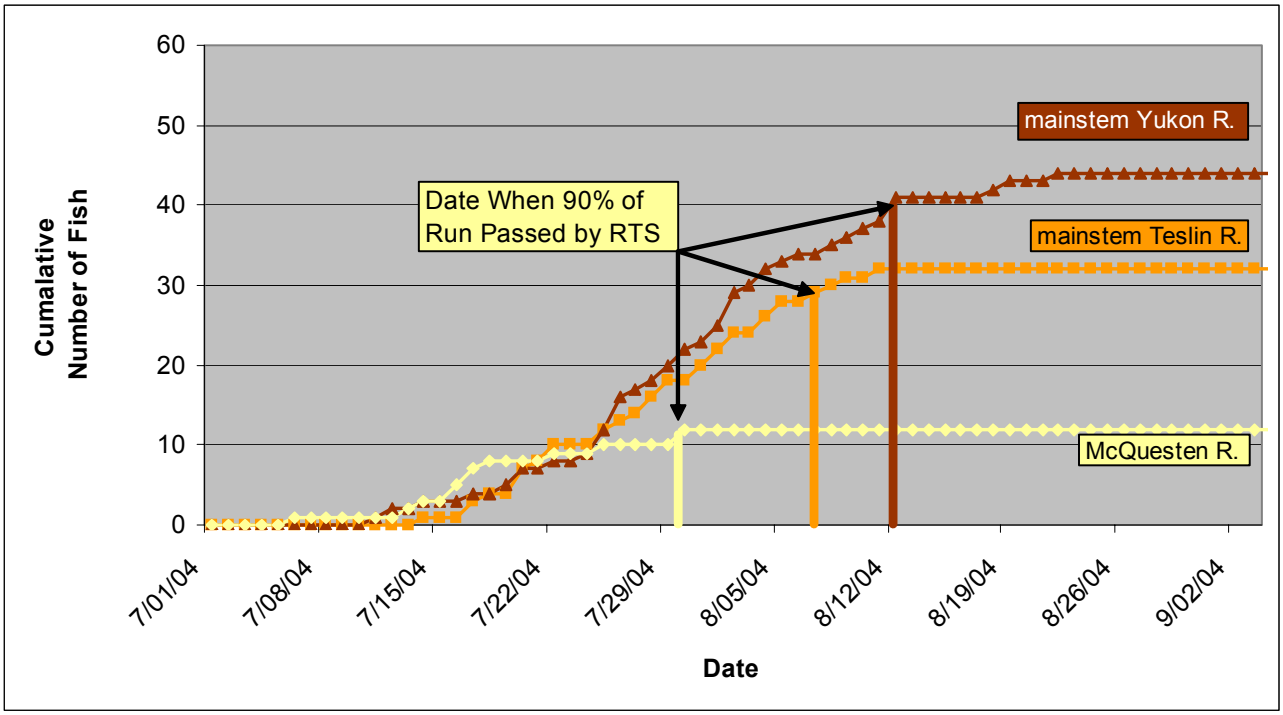

Figure 6. Migration timing of radio-tagged Chinook salmon stocks and sub-stocks, defined by aerial tracking surveys, at the Border *RTS* on the Canadian portion of the upper Yukon River, 2004.

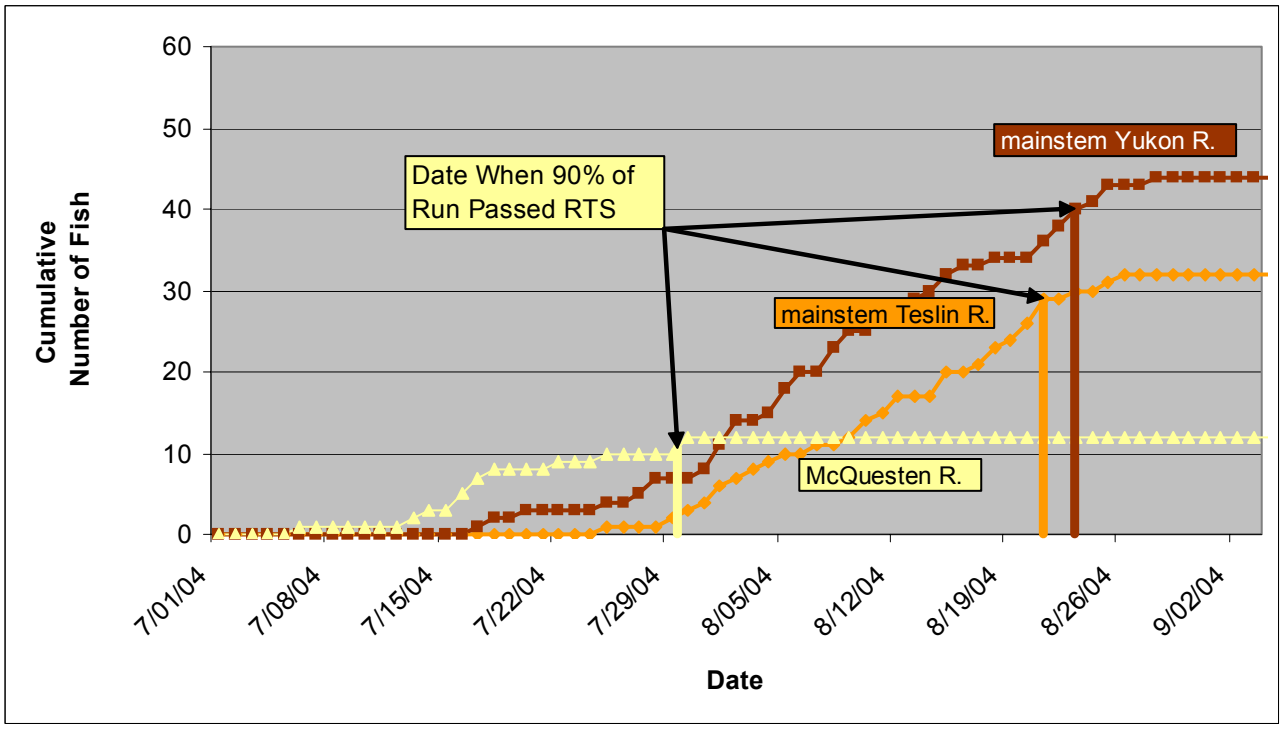

Figure 7. Migration timing of radio-tagged Chinook salmon stocks and sub-stocks, defined by aerial tracking surveys, at the nearest terminal RTS on the Canadian portion of the upper Yukon River, 2004.

completed their passage by the border *RTS* late in the period due to their larger stock sizes. It should be noted that the relatively small sample sizes of radio-tagged fish may influence the run timing of some stocks. Assuming a normal distribution, a higher number of tags would likely result in a greater span in passage timing.

3.2 Radio-Tagged Chinook Salmon Carcass Recovery on the Teslin River

Inclement weather and low water conditions made carcass recovery difficult. The receiver required protection from excessive moisture and could not be operated in the rain. Also, summer drought conditions resulted in very low water levels making several shallow areas of the river inaccessible to a propeller driven boat. The original plan was to survey the river from the outlet of Teslin Lake to its confluence with the Yukon River at Hootalinqua over the course of two trips. The first trip plan was to descend the river to its confluence with Boswell Creek and return upstream for a second pass. The second trip plan was to ascend the river from its mouth to Boswell Creek and return downstream for a second pass. However, two very shallow sections in the upper half of the river made upstream passage difficult with the available equipment, and the inclement weather prolonged the duration of the first trip. Due to the advanced stage of decomposition of many of radio-tagged carcasses and the difficulties of navigating in very low water conditions, the second trip to the lower half of the river was not undertaken.

A total of 22 radio-tags were detected in the upper half of the river; of these, 21 were transmitting mortality signals. The locations of 16 radio-tags allowed close approaches, but only 6 were recovered. The remaining tags were located in fast flowing deep water. Two of the recovered transmitters were from fish where more than 80% of the body had been scavenged. The sex ratio of the remaining fish was 2 males and 2 females. One of the males showed signs of having spawned with milt (sperm) running from the vent before necropsy and having flaccid testes and milt in the body cavity. The remaining male did not express milt when the body cavity was squeezed externally, and the testes were fully engorged (ripe). Both females had died recently before examination and showed signs of having spawned; one had its skein half full of eggs and many eggs loose in the body cavity, the other had an empty skein with approximately 10 eggs loose in the body cavity.

During the course of this investigation on the mainstem Teslin River, considerable spawning activity was observed at two sites. Numerous live fish were observed holding, rolling and splashing at the sites, and many carcasses were concentrated along the shores. These sites were located approximately 4.5 and 44 kilometres downstream of the Johnson's crossing bridge (Appendix 5, Figures 1&2). According to the traditional knowledge of a First Nations trapper, who lives at the lower site seasonally, both spawning sites are traditional and well-known to people who live on, and frequently travel, the river.

4.0 DISCUSSION

4.1 Remote Tracking

4.1.1 Distribution and Escapement Abundance

As in the previous two years, the *RTS's* located in the upper Yukon River in the Yukon Territory were effective in recording radio-tagged fish with functional transmitters as they passed because all fish that were recorded by terminal *RTS's* left an uninterrupted trail of recordings at downstream *RTS's*. The focus of this project for 2004 was on ground station (*RTS*) results. Estimates of abundance in the various drainages are generated using project and agency counts (i.e. weir, aerial index, fishery reports) to produce radio-tagged/untagged ratios. Radio-tagged fish numbers in terminal areas are determined by aerial surveys so estimates of abundance are addressed by Mercer, 2005.

The Pelly and Teslin Rivers drainages continued to dominate in terms of production, with remarkably little change from year to year. The Stewart River's productive capacity seems to be strongly influenced by the Fraser Falls partial barrier and by the hydro-electric dam complete barrier on the Mayo River. Radio-tagged fish ascending the falls to the upper Stewart River drainage (approximately 60% of the entire Stewart River drainage) have been consistently low during the three years of the study (2004-15%, 2002-25%) relative to its drainage area (the upper Stewart River drainage was not aerially surveyed in 2003). Of the major tributaries monitored by *RTS's* between 2002 and 2004, the Big Salmon River has shown the greatest fluctuations in annual returns. The Klondike and south Yukon Rivers made relatively small contributions to annual returns of the upper

Yukon River over the three years of the study at 3-5% each. Similarly, the White River's contribution was small at 3% and 5% for 2003 and 2004, respectively; the White River was not surveyed in 2002 (Osborne *et al.* 2003, Mercer and Eiler, 2004). This low productivity might be attributed to the Klondike River's relatively small drainage area, the White and Donjek Rivers' heavy sediment loading and the partial barrier to passage and smolt mortalities associated with the Whitehorse Rapids hydro-electric dam on the south Yukon River. Fish that remained in the mainstem Yukon River were presumed to have spawned there. Chinook spawning in the mainstem Yukon River has been documented in several areas (Milligan *et al*. 1985). The proportions of the entire run that were located in the 'Mainstem Yukon River and Other Tributaries' were remarkably similar among the three years of the tracking studies (36-37 %; the White and Klondike Rivers' proportions were pooled with the mainstem Yukon proportion for 2004 to allow comparison with previous years). Significant numbers of pre-spawning mortalities or unreported catches of in-transit fish would have probably resulted in a larger variation in these proportions. However, there was a noticeable increase in the number of radio-tagged fish that could not be located after they had passed the Tatchun *RTS* on the Yukon River, and the number of tags that were located in the town of Carmacks, by aerial surveys in 2004 over previous years (B. Mercer, pers. comm.).

The accuracy of the distribution and migration analyses generated from the telemetry data depends on the following assumptions: 1) the fates of radio-tagged fish are known; 2) tagging does not affect the migration behaviour and final destination of the fish; and 3) tagged fish are proportionately representative of the run and are not stock selective. The validity of assumption 1 was verified by the high efficiency of *RTS's* in detecting and recording fish and by the high success rate (94%) in re-locating fish by aerial tracking (Mercer, 2005). The consistency in proportional distribution, migration rates and run timing among the years 2002 to 2004 supports assumption 2 that fish are not being diverted from their natal primary tributaries. Though the sample size was too small to be conclusive, none of the female fish examined in the mainstem Teslin River showed clear evidence of pre-spawning mortality. Every sampling method has its inherent biases, and it is beyond the scope of this project to evaluate how well assumption 3 is met. Uncertainty as to how representative the radio-tagged sample is of the run composition has been a concern by all stakeholders from the outset of the basin-wide study. Efforts to adjust sampling effort and gear type to match run strength and fish size composition in order to reduce sampling bias were made during the tagging periods over the course of the basin-wide project (J. Eiler, pers.comm.). Various netting materials, mesh

sizes, hanging ratios and set depths were tested and assessed during 2000-2001 in preparation for the basin-wide study in 2002 (Spencer et al. 2003). While there is uncertainty as to the magnitude of size bias in the radio-tagged sample due to the use of a single gill net mesh size for capture, there is evidence that the number of fish tagged was proportional to relative run strength in 2002 and 2003 as determined by the catch per unit effort (set hour) (CPUE) at the tagging site at Russian Mission (Eiler *et al*. 2004, (Joint Technical Committee of the US/Canada Yukon River Panel, 2004).

4.1.2 Migration Rates and Timing

Migration rates are quite consistent throughout the three-year study for each stock. Differences in stock-specific mean migration rates of the radio-tagged Chinook salmon tracked to primary tributaries of the upper Yukon River that were monitored by *RTS's* were not significant among the years 2002 to 2004. The mean migration rate for the White River stock is quite similar to that of the Stewart River stock. If these stocks had similar numbers of returns, their patterns of migration timing would likely be similar given the close proximity of their mouths,

The first radio-tagged fish of the Klondike, White, Stewart, Pelly and Teslin Rivers' stocks arrived at the Border *RTS* during the first week of July, while the first radio-tagged fish of the Big Salmon and south Yukon Rivers' stocks arrived in the second and third weeks of July, respectively. As in 2003, there was little separation in run timing among the Stewart, Pelly and Big Salmon stocks at the Border *RTS*. The Klondike and White Rivers' stocks are well out in front of the other stocks when passing the Border *RTS,* but with only 1 year of data for these stocks and only representing 5% (each) of the run, it is uncertain if this pattern is consistent among years. Similar to 2003 and 2002, the Teslin and south Yukon Rivers' stocks completed (90%) their passages by the Border *RTS* later in the season (first week of August) than the other stocks.

The timing of the completion (90%) of the passage of stocks by their respective *RTS's* also shows a very similar pattern to 2002 and 2003 for all stocks. The Pelly River stock completed its passage by its *RTS* on a similar date (slightly earlier) to 2002, while the larger run in 2003 completed its passage (90%) about a week earlier. The Teslin River stock passage completion (90%) at the Teslin *RTS* falls a few days later than in 2002 and a few days earlier than in 2003, again, probably due to the larger run in 2003. The 13 south Yukon River radio–tagged fish completed (90%) their passage on

August 5th in 2004 compared to August 23rd for the 13 south Yukon River radio-tagged fish in 2003 and August 24th for the 7 south Yukon River radio-tagged fish in 2002, suggesting that this stock is the least predictable of the 5 stocks monitored by *RTS*'s over the three-year study period.

The Alaska / Yukon border escapement estimate numbers are 48,878 in 2004, 58,082 in 2003 and 43,359 in 2002 (Joint Technical Committee of the US/Canada Yukon River Panel, 2005, in prep.). The Pelly River stock seems to show the largest fluctuations in run timing as border escapement numbers changed among years. Given the size of the radio-tag sample, the low numbers of radio-tagged fish returning to second order tributaries make it difficult to establish trends in the timing of their passage.

The unique information generated by tracking Chinook salmon in the upper Yukon River drainage over the past three years will make a significant contribution to the management and conservation of these stocks. The substantial multi-year financial commitment by US government agencies, the Yukon River Panel and the Department of Fisheries and Oceans to establish the remote stations infrastructure and to tag an adequate number of fish each year has resulted in a fairly clear picture of the proportional distribution, chronology at various locations, and relative abundance of the Chinook salmon migration throughout the upper Yukon River drainage in Yukon. The consistency of the regional distributions, migration rates, migration timing and spawning locations will allow future resource allocation, habitat protection and stock-specific research to proceed with greater certainty and focus. While it would have been preferable for the full-scale study to have continued for a complete 5-6 year life cycle, the similarities in numbers among the three years of the study suggest that the trends are real.

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Acknowledgements

Several people contributed to the success of this year's project. John Eiler of the US National Marine Fisheries Service provided advice, support and encouragement. Mr. Eiler also provided in-season updates and summarized database files at season's end. Ted Spencer and Richard Driscoll of the Alaska Department of Fish and Game assisted in the activation and de-activation of Canadian stations at the season's beginning and end. Jake Duncan and Gerry Couture representing the Yukon River Fishers Association organized, and participated in, the installation of the Klondike station. Jake Duncan also assisted with in-season maintenance of the Stewart River station. Bruce Mitford of Mayo provided transport to, and help with maintenance of, the Fraser Falls station. Thanks go to helicopter pilots Delmar Washington and Karl Scholz. Pat Milligan of DFO Whitehorse provided technical advice throughout the project and he, Rick Ferguson and Helmut Grunberg reviewed various drafts of the report and provided editorial comment.

5.0 APPENDICES 1- 5

Appendix 1. Fates and migration rates of radio-tagged Chinook salmon tracked in the Canadian portion of the upper Yukon River basin, 2004.

Fish No.	Trans. Freq.	Trans. Code	Mid-Eye Fork Length	Date and Time Passing Upper Border *RTS*	Date and Time Passing Terminal *RTS*	Migration Rate (Km. / Day)	Fate (Primary Tributaries and Other Tributaries with ≥ 10 Radio Tag Locations	Terminal *RTS*
30	902	21	890	14-Jul-04 2:01	27-Jul-04 13:59	45.72	Big Salmon R. drainage	Big Salmon
87	942	16	945	16-Jul-04 21:20	29-Jul-04 13:50	48.65	Big Salmon R. drainage	Big Salmon
93	783	23	885	16-Jul-04 5:41	28-Jul-04 12:54	50.18	Big Salmon R. drainage	Big Salmon
129	922	8	615	12-Jul-04 18:02	24-Jul-04 11:47	52.57	Big Salmon R. drainage	Big Salmon
239	942	43	770	15-Jul-04 20:50	27-Jul-04 12:33	52.96	Big Salmon R. drainage	Big Salmon
244	742	38	920	14-Jul-04 11:21	28-Jul-04 8:02	44.53	Big Salmon R. drainage	Big Salmon
245	783	37	835	19-Jul-04 15:06	01-Aug-04 13:43	47.69	Big Salmon R. drainage	Big Salmon
298	742	69	835	22-Jul-04 5:06	07-Aug-04 10:24	38.05	Big Salmon R. drainage	Big Salmon
305	1843	70	945	13-Jul-04 21:32	25-Jul-04 8:43	53.83	Big Salmon R. drainage	Big Salmon
312	882	62	625	16-Jul-04 3:52	27-Jul-04 11:53	54.46	Big Salmon R. drainage	Big Salmon
352	723	67	850	13-Jul-04 13:17	25-Jul-04 16:13	50.91	Big Salmon R. drainage	Big Salmon
359	942	74	845	26-Jul-04 19:24	09-Aug-04 22:12	43.72	Big Salmon R. drainage	Big Salmon
371	1843	69	870	19-Jul-04 0:25	02-Aug-04 11:54	42.63	Big Salmon R. drainage	Big Salmon
401	902	67	625	17-Jul-04 20:50	29-Jul-04 14:30	52.59	Big Salmon R. drainage	Big Salmon
431	902	92	860	21-Jul-04 16:55	03-Aug-04 19:51	47.03	Big Salmon R. drainage	Big Salmon
440	843	97	830	19-Jul-04 5:35	30-Jul-04 16:58	53.79	Big Salmon R. drainage	Big Salmon
473	843	93	715	18-Jul-04 18:31	29-Jul-04 8:51	58.24	Big Salmon R. drainage	Big Salmon
496	882	98	970	22-Jul-04 22:51	05-Aug-04 17:51	44.75	Big Salmon R. drainage	Big Salmon
617	683	4	680	26-Jul-04 14:31	11-Aug-04 8:43	39.17	Big Salmon R. drainage	Big Salmon
638	702	5	860	21-Jul-04 2:55	01-Aug-04 11:20	54.38	Big Salmon R. drainage	Big Salmon
640	742	3	905	28-Jul-04 18:24	13-Aug-04 19:25	38.47	Big Salmon R. drainage	Big Salmon
652	843	2	890	25-Jul-04 13:54	08-Aug-04 0:59	45.85	Big Salmon R. drainage	Big Salmon
684	902	3	925	24-Jul-04 22:11	07-Aug-04 17:30	44.71	Big Salmon R. drainage	Big Salmon
3013	1033	45	850	10-Jul-04 4:50	22-Jul-04 11:02	50.35	Big Salmon R. drainage	Big Salmon
3041	1033	75	915	16-Jul-04 22:01	30-Jul-04 2:30	46.80	Big Salmon R. drainage	Big Salmon
20	922	18	870	6-Jul-04 23:56	06-Jul-04 23:56		Klondike R. drainage	Upper Border
64	922	13	985	10-Jul-04 20:45	10-Jul-04 20:45		Klondike R. drainage	Upper Border
85	902	18	850	14-Jul-04 2:14	14-Jul-04 2:14		Klondike R. drainage	Upper Border
109	942	20	915	5-Jul-04 15:55	05-Jul-04 15:55		Klondike R. drainage	Upper Border
114	742	15	930	10-Jul-04 2:30	10-Jul-04 2:30		Klondike R. drainage	Upper Border
137	882	16	1005	8-Jul-04 9:06	08-Jul-04 9:06		Klondike R. drainage	Upper Border
187	702	43	905	13-Jul-04 16:54	13-Jul-04 16:54		Klondike R. drainage	Upper Border
210	723	46	855	14-Jul-04 19:46	14-Jul-04 19:46		Klondike R. drainage	Upper Border
362	702	70	685	13-Jul-04 1:28	13-Jul-04 1:28		Klondike R. drainage	Upper Border

Fish No.	Trans. Freq.	Trans. Code	Mid-Eye Fork Length	Date and Time Passing Upper Border *RTS*	Date and Time Passing Terminal *RTS*	Migration Rate (Km. / Day)	Fate (Primary Tributaries and Other Tributaries with ≥ 10 Radio Tag Locations	Terminal *RTS*
467	1843	90	770	15-Jul-04 15:31	15-Jul-04 15:31		Klondike R. drainage	Upper Border
3034	1033	92	725	13-Jul-04 14:01	13-Jul-04 14:01		Klondike R. drainage	Upper Border
3046	1033	64	725	15-Jul-04 23:23	15-Jul-04 23:23		Klondike R. drainage	Upper Border
3055	1033	86	665	15-Jul-04 23:03	15-Jul-04 23:03		Klondike R. drainage	Upper Border
172	922	45	965	12-Jul-04 14:51	20-Jul-04 3:51	57.46	Little Salmon R.	Tatchun
258	882	37	860	19-Jul-04 14:41	28-Jul-04 23:13	46.32	Little Salmon R.	Tatchun
400	882	66	985	17-Jul-04 16:41	25-Jul-04 13:20	55.13	Little Salmon R.	Tatchun
564	942	87	750	7-Aug-04 3:12	16-Aug-04 5:11	47.71	Little Salmon R.	Tatchun
683	882	4	570	29-Jul-04 9:20	08-Aug-04 7:06	43.74	Little Salmon R.	Tatchun
233	742	48	820	1-Aug-04 23:24	17-Aug-04 6:40	41.27	mainstem Teslin R.	Teslin
246	843	48	900	19-Jul-04 3:21	30-Jul-04 21:23	53.75	mainstem Teslin R.	Teslin
263	683	45	920	21-Jul-04 14:50	03-Aug-04 16:51	48.27	mainstem Teslin R.	Teslin
337	942	70	735	13-Jul-04 7:44	24-Jul-04 7:41	57.43	mainstem Teslin R.	Teslin
339	683	63	840	17-Jul-04 19:18	29-Jul-04 12:29	53.91	mainstem Teslin R.	Teslin
340	702	64	800	16-Jul-04 15:59	28-Jul-04 13:11	53.15	mainstem Teslin R.	Teslin
381	942	66	630	19-Jul-04 13:56	31-Jul-04 12:11	52.96	mainstem Teslin R.	Teslin
428	783	95	920	20-Jul-04 8:08	01-Aug-04 20:26	50.48	mainstem Teslin R.	Teslin
491	702	90	840	21-Jul-04 16:41	04-Aug-04 21:26	44.49	mainstem Teslin R.	Teslin
493	742	88	700	24-Jul-04 13:51	06-Aug-04 5:17	49.96	mainstem Teslin R.	Teslin
507	882	88	970	24-Jul-04 18:23	10-Aug-04 6:22	38.28	mainstem Teslin R.	Teslin
544	1843	87	820	4-Aug-04 22:53	19-Aug-04 16:02	42.92	mainstem Teslin R.	Teslin
631	783	1	890	25-Jul-04 10:41	08-Aug-04 7:55	45.49	mainstem Teslin R.	Teslin
632	843	0	870	31-Jul-04 22:49	19-Aug-04 14:53	33.83	mainstem Teslin R.	Teslin
635	922	9	910	19-Jul-04 19:10	31-Jul-04 20:45	52.35	mainstem Teslin R.	Teslin
661	783	4	850	3-Aug-04 1:43	20-Aug-04 3:49	36.96	mainstem Teslin R.	Teslin
663	882	2	870	28-Jul-04 5:44	14-Aug-04 6:20	37.10	mainstem Teslin R.	Teslin
670	742	6	870	28-Jul-04 11:40	14-Aug-04 13:13	37.01	mainstem Teslin R.	Teslin
675	922	1	855	30-Jul-04 7:50	11-Aug-04 16:53	51.03	mainstem Teslin R.	Teslin
682	843	5	900	27-Jul-04 6:40	11-Aug-04 11:29	41.55	mainstem Teslin R.	Teslin
690	742	33	800	30-Jul-04 9:23	14-Aug-04 18:50	41.03	mainstem Teslin R.	Teslin
810	742	58	890	4-Aug-04 7:20	20-Aug-04 5:38	39.65	mainstem Teslin R.	Teslin
827	683	53	870	31-Jul-04 22:20	17-Aug-04 7:31	38.55	mainstem Teslin R.	Teslin
853	783	53	960	26-Jul-04 18:30	09-Aug-04 17:50	45.20	mainstem Teslin R.	Teslin
857	922	61	985	27-Jul-04 15:40	09-Aug-04 12:01	49.16	mainstem Teslin R.	Teslin
866	902	52	890	3-Aug-04 16:20	18-Aug-04 0:46	44.01	mainstem Teslin R.	Teslin
893	783	60	935	1-Aug-04 18:44	16-Aug-04 8:40	43.32	mainstem Teslin R.	Teslin
933	783	82	695	7-Aug-04 1:50	20-Aug-04 0:56	48.73	mainstem Teslin R.	Teslin

Fish No.	Trans. Freq.	Trans. Code	Mid-Eye Fork Length	Date and Time Passing Upper Border *RTS*	Date and Time Passing Terminal *RTS*	Migration Rate (Km. / Day)	Fate (Primary Tributaries and Other Tributaries with ≥ 10 Radio Tag Locations	Terminal *RTS*
941	702	10	760	8-Aug-04 20:00	22-Aug-04 3:31	47.44	mainstem Teslin R.	Teslin
977	882	76	990	10-Aug-04 12:06	24-Aug-04 13:11	44.97	mainstem Teslin R.	Teslin
1013	723	10	880	6-Aug-04 16:11	25-Aug-04 9:02	33.77	mainstem Teslin R.	Teslin
3039	1033	8	715	16-Jul-04 1:20	02-Aug-04 3:54	36.92	mainstem Teslin R.	Teslin
24	702	14	850	11-Jul-04 5:20	20-Jul-04 18:35	66.12	upper Teslin R. drainage	Teslin
29	882	22	825	10-Jul-04 16:30	22-Jul-04 13:54	53.11	upper Teslin R. drainage	Teslin
42	922	22	780	7-Jul-04 5:30	16-Jul-04 19:28	65.92	upper Teslin R. drainage	Teslin
75	922	15	845	15-Jul-04 17:40	27-Jul-04 2:30	55.56	upper Teslin R. drainage	Teslin
168	783	48	895	9-Jul-04 11:31	19-Jul-04 12:04	63.02	upper Teslin R. drainage	Teslin
254	723	41	815	15-Jul-04 5:23	28-Jul-04 9:05	48.02	upper Teslin R. drainage	Teslin
388	843	64	670	23-Jul-04 2:16	03-Aug-04 2:41	57.33	upper Teslin R. drainage	Teslin
407	742	65	910	19-Jul-04 13:19	01-Aug-04 2:01	50.41	upper Teslin R. drainage	Teslin
417	742	70	830	19-Jul-04 11:37	31-Jul-04 18:01	51.49	upper Teslin R. drainage	Teslin
457	683	95	655	17-Jul-04 1:25	27-Jul-04 22:00	58.17	upper Teslin R. drainage	Teslin
499	942	95	870	22-Jul-04 16:51	06-Aug-04 12:30	42.62	upper Teslin R. drainage	Teslin
633	882	11	860	23-Jul-04 18:31	05-Aug-04 8:00	50.28	upper Teslin R. drainage	Teslin
642	843	1	800	23-Jul-04 6:11	03-Aug-04 22:31	54.07	upper Teslin R. drainage	Teslin
656	942	75	675	20-Jul-04 8:22	30-Jul-04 20:06	60.22	upper Teslin R. drainage	Teslin
693	882	30	750	26-Jul-04 0:41	08-Aug-04 19:10	45.87	upper Teslin R. drainage	Teslin
826	942	54	800	25-Jul-04 7:11	06-Aug-04 13:31	51.50	upper Teslin R. drainage	Teslin
3037	1033	14	780	17-Jul-04 16:00	29-Jul-04 7:00	54.33	upper Teslin R. drainage	Teslin
22	1843	22	630	11-Jul-04 10:04	26-Jul-04 4:29	13.59	mainstem Yukon R.	White
192	882	38	1020	13-Jul-04 6:33	16-Jul-04 17:31	58.05	mainstem Yukon R.	White
252	683	43	830	24-Jul-04 10:40	31-Jul-04 15:30	45.12	mainstem Yukon R.	Selkirk
264	702	44	580	21-Jul-04 4:20	30-Jul-04 13:50	46.12	mainstem Yukon R.	Tatchun
318	702	72	825	10-Jul-04 1:47	17-Jul-04 14:50	57.44	mainstem Yukon R.	Tatchun
384	702	74	865	16-Jul-04 21:22	24-Jul-04 11:10	57.21	mainstem Yukon R.	Tatchun
399	843	65	935	25-Jul-04 10:42	01-Aug-04 0:20	49.47	mainstem Yukon R.	Selkirk
432	922	91	910	23-Jul-04 14:00	31-Jul-04 1:51	43.36	mainstem Yukon R.	Selkirk
438	742	99	835	11-Aug-04 8:50	24-Aug-04 2:34	25.51	mainstem Yukon R.	Selkirk
439	783	98	690	19-Jul-04 21:07	27-Jul-04 17:32	55.20	mainstem Yukon R.	Tatchun
441	882	96	775	30-Jul-04 2:42	05-Aug-04 8:25	52.09	mainstem Yukon R.	Selkirk
449	742	89	790	18-Jul-04 21:14	27-Jul-04 1:00	53.12	mainstem Yukon R.	Tatchun
465	922	87	910	29-Jul-04 3:18	07-Aug-04 10:02	35.01	mainstem Yukon R.	Selkirk
472	783	94	770	25-Jul-04 6:03	01-Aug-04 11:20	45.01	mainstem Yukon R.	Selkirk
475	902	91	790	25-Jul-04 20:04	04-Aug-04 18:23	43.64	mainstem Yukon R.	Tatchun
484	843	96	740	24-Jul-04 10:11	04-Aug-04 21:02	37.84	mainstem Yukon R.	Tatchun

Fish No.	Trans. Freq.	Trans. Code	Mid-Eye Fork Length	Date and Time Passing Upper Border *RTS*	Date and Time Passing Terminal *RTS*	Migration Rate (Km. / Day)	Fate (Primary Tributaries and Other Tributaries with ≥ 10 Radio Tag Locations	Terminal *RTS*
504	742	91	740	19-Jul-04 20:41	19-Jul-04 20:41		mainstem Yukon R.	Upper Border
528	843	95	715	1-Aug-04 11:22	12-Aug-04 2:14	40.81	mainstem Yukon R.	Tatchun
552	902	99	855	8-Aug-04 6:52	22-Aug-04 19:55	29.79	mainstem Yukon R.	Tatchun
554	942	97	945	17-Aug-04 8:22	22-Aug-04 23:24	35.66	mainstem Yukon R.	White
560	843	91	815	5-Aug-04 10:01	21-Aug-04 20:01	26.40	mainstem Yukon R.	Tatchun
565	683	11	895	7-Aug-04 8:00	14-Aug-04 21:51	42.89	mainstem Yukon R.	Selkirk
603	882	12	830	28-Jul-04 17:51	08-Aug-04 18:17	39.33	mainstem Yukon R.	Tatchun
615	922	26	745	24-Jul-04 19:51	31-Jul-04 7:22	55.79	mainstem Yukon R.	Pelly
634	902	75	930	26-Jul-04 7:56	03-Aug-04 0:05	42.35	mainstem Yukon R.	Selkirk
639	723	4	930	25-Jul-04 17:33	01-Aug-04 15:42	46.94	mainstem Yukon R.	Selkirk
649	723	5	925	2-Aug-04 7:50	13-Aug-04 22:00	37.39	mainstem Yukon R.	Tatchun
654	902	0	960	29-Jul-04 2:14	10-Aug-04 15:20	34.54	mainstem Yukon R.	Tatchun
662	843	3	940	31-Jul-04 23:12	05-Aug-04 19:20	41.47	mainstem Yukon R.	White
673	882	3	880	1-Aug-04 13:42	10-Aug-04 12:50	36.25	mainstem Yukon R.	Selkirk
678	702	9	710	28-Jul-04 20:21	07-Aug-04 0:41	47.20	mainstem Yukon R.	Tatchun
679	723	12	935	1-Aug-04 3:53	07-Aug-04 18:22	30.39	mainstem Yukon R.	White
680	742	26	865	1-Aug-04 3:03	10-Aug-04 21:21	33.29	mainstem Yukon R.	Selkirk
816	942	52	870	27-Jul-04 15:15	04-Aug-04 15:45	40.51	mainstem Yukon R.	Selkirk
854	843	52	585	3-Aug-04 3:30	15-Aug-04 17:06	34.48	mainstem Yukon R.	Tatchun
855	882	51	885	31-Jul-04 4:51	08-Aug-04 12:10	39.13	mainstem Yukon R.	Selkirk
899	683	54	800	18-Aug-04 22:12	24-Aug-04 17:12	34.65	mainstem Yukon R.	White
911	723	54	730	21-Aug-04 23:14	27-Aug-04 13:20	35.91	mainstem Yukon R.	White
920	702	57		4-Aug-04 19:48	20-Aug-04 15:27	20.54	mainstem Yukon R.	Selkirk
928	942	61	835	3-Aug-04 21:50	21-Aug-04 0:33	36.91	mainstem Yukon R.	Teslin
935	882	80	890	11-Aug-04 22:34	17-Aug-04 1:40	39.12	mainstem Yukon R.	White
949	942	79	1000	11-Aug-04 16:04	20-Aug-04 10:30	37.06	mainstem Yukon R.	Selkirk
958	902	83	810	10-Aug-04 21:56	23-Aug-04 9:32	34.71	mainstem Yukon R.	Tatchun
966	843	10	880	9-Aug-04 10:21	14-Aug-04 1:50	43.20	mainstem Yukon R.	White
33	1843	20	860	10-Jul-04 0:20	13-Jul-04 9:54	58.34	McQuesten R.	Stewart
61	843	16	820	14-Jul-04 4:31	17-Jul-04 16:18	56.80	McQuesten R.	Stewart
90	702	13	750	12-Jul-04 23:11	16-Jul-04 12:56	55.50	McQuesten R.	Stewart
95	882	21	820	12-Jul-04 13:41	16-Jul-04 0:59	57.13	McQuesten R.	Stewart
100	683	16	825	2-Jul-04 5:28	05-Jul-04 8:03	63.81	McQuesten R.	Stewart
121	683	20	855	9-Jul-04 3:04	12-Jul-04 21:12	52.80	McQuesten R.	Stewart
205	922	38	695	11-Jul-04 14:12	15-Jul-04 2:16	56.61	McQuesten R.	Stewart
242	702	40	710	12-Jul-04 1:20	15-Jul-04 6:10	61.94	McQuesten R.	Stewart
286	723	66	910	23-Jul-04 15:42	29-Jul-04 12:50	33.72	McQuesten R.	Stewart

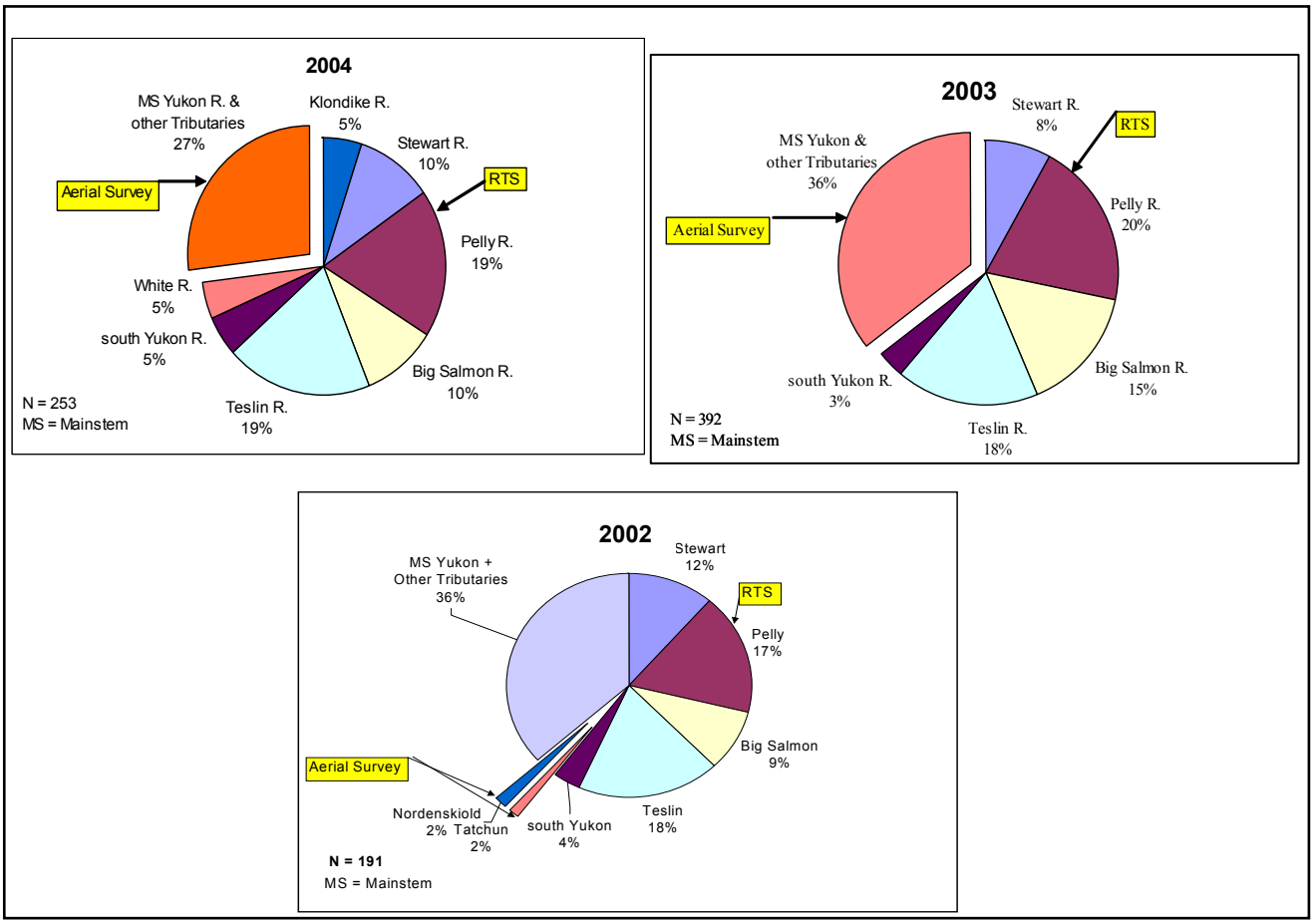
Fish No.	Trans. Freq.	Trans. Code	Mid-Eye Fork Length	Date and Time Passing Upper Border *RTS*	Date and Time Passing Terminal *RTS*	Migration Rate (Km. / Day)	Fate (Primary Tributaries and Other Tributaries with ≥ 10 Radio Tag Locations	Terminal *RTS*
345	882	69	910	17-Jul-04 11:11	21-Jul-04 7:36	51.49	McQuesten R.	Stewart
621	783	0	705	24-Jul-04 19:52	29-Jul-04 12:53	42.11	McQuesten R.	Stewart
624	902	9	750	20-Jul-04 14:20	24-Jul-04 1:03	57.53	McQuesten R.	Stewart
216	922	40	670	14-Jul-04 13:41	18-Jul-04 3:27	55.49	mainstem Stewart R.	Stewart
277	783	43	925	21-Jul-04 10:51	27-Jul-04 9:54	33.27	mainstem Stewart R.	Stewart
366	843	73	590	20-Jul-04 10:57	24-Jul-04 16:33	46.84	mainstem Stewart R.	Stewart
379	902	64	700	19-Jul-04 7:42	25-Jul-04 0:13	34.86	mainstem Stewart R.	Stewart
433	942	90		17-Aug-04 8:20	23-Aug-04 15:52	31.41	mainstem Stewart R.	Stewart
512	683	97	855	23-Jul-04 12:27	27-Jul-04 2:58	55.01	mainstem Stewart R.	Stewart
525	723	98	860	27-Jul-04 7:25	30-Jul-04 21:03	55.57	mainstem Stewart R.	Stewart
536	723	88	860	25-Jul-04 18:21	29-Jul-04 3:52	58.38	mainstem Stewart R.	Stewart
806	942	7	885	6-Aug-04 23:57	11-Aug-04 13:31	43.43	mainstem Stewart R.	Stewart
813	882	55	910	28-Jul-04 20:00	01-Aug-04 19:10	50.01	mainstem Stewart R.	Stewart
45	683	19	690	8-Jul-04 0:01	11-Jul-04 2:07	64.22	upper Stewart R. drainage	Fraser Falls
127	882	14	980	6-Jul-04 10:25	09-Jul-04 15:51	61.46	upper Stewart R. drainage	Fraser Falls
182	902	49	795	10-Jul-04 17:40	13-Jul-04 21:11	63.02	upper Stewart R. drainage	Fraser Falls
214	882	42	850	21-Jul-04 17:33	25-Jul-04 17:00	49.86	upper Stewart R. drainage	Fraser Falls
34	683	17	810	13-Jul-04 23:09	22-Jul-04 5:02	52.56	Nordenskiold R.	Tatchun
364	742	71	695	14-Jul-04 19:08	22-Jul-04 8:50	57.24	Nordenskiold R.	Tatchun
194	922	48	910	12-Jul-04 0:24	18-Jul-04 14:30	54.88	mainstem Pelly R.	Pelly
276	742	44	860	14-Jul-04 15:42	20-Jul-04 7:10	64.05	mainstem Pelly R.	Pelly
288	783	68	875	18-Jul-04 2:30	24-Jul-04 21:39	53.18	mainstem Pelly R.	Pelly
333	843	66	815	15-Jul-04 22:44	22-Jul-04 1:20	59.18	mainstem Pelly R.	Pelly
336	922	69	870	22-Jul-04 19:47	02-Aug-04 23:23	32.42	mainstem Pelly R.	Pelly
347	922	71	685	22-Jul-04 12:24	29-Jul-04 16:54	50.30	mainstem Pelly R.	Pelly
350	683	65	715	14-Jul-04 17:25	21-Jul-04 3:32	56.30	mainstem Pelly R.	Pelly
380	922	65	750	21-Jul-04 21:24	28-Jul-04 20:30	51.92	mainstem Pelly R.	Pelly
415	702	71	800	17-Jul-04 17:51	23-Jul-04 23:34	57.95	mainstem Pelly R.	Pelly
637	683	6	890	25-Jul-04 22:00	02-Aug-04 15:38	46.74	mainstem Pelly R.	Pelly
658	702	26	855	24-Jul-04 14:31	31-Jul-04 22:00	49.44	mainstem Pelly R.	Pelly
3010	1033	15	850	13-Jul-04 12:20	20-Jul-04 14:44	50.92	mainstem Pelly R.	Pelly
3019	1033	74	975	1-Aug-04 11:00	09-Aug-04 15:41	44.11	mainstem Pelly R.	Pelly
3058	1033	83	755	25-Jul-04 6:50	31-Jul-04 5:52	60.66	mainstem Pelly R.	Pelly
4	742	21	910	7-Jul-04 12:12	14-Jul-04 15:31	50.64	Pelly R. drainage	Pelly
5	783	20	850	7-Jul-04 9:31	13-Jul-04 23:13	55.02	Pelly R. drainage	Pelly
9	922	16	920	6-Jul-04 9:22	12-Jul-04 7:44	60.94	Pelly R. drainage	Pelly
13	702	8	875	8-Jul-04 15:34	14-Jul-04 18:53	58.89	Pelly R. drainage	Pelly

Fish No.	Trans. Freq.	Trans. Code	Mid-Eye Fork Length	Date and Time Passing Upper Border *RTS*	Date and Time Passing Terminal *RTS*	Migration Rate (Km. / Day)	Fate (Primary Tributaries and Other Tributaries with ≥ 10 Radio Tag Locations	Terminal *RTS*
48	742	16	840	13-Jul-04 7:34	19-Jul-04 11:55	58.48	Pelly R. drainage	Pelly
52	902	8	830	10-Jul-04 4:56	16-Jul-04 23:00	53.53	Pelly R. drainage	Pelly
57	702	20	920	14-Jul-04 18:32	22-Jul-04 6:31	48.20	Pelly R. drainage	Pelly
78	683	8	860	11-Jul-04 15:16	17-Jul-04 15:53	59.99	Pelly R. drainage	Pelly
80	723	23	895	11-Jul-04 14:34	17-Jul-04 19:43	58.17	Pelly R. drainage	Pelly
97	922	19	810	11-Jul-04 12:21	17-Jul-04 16:53	58.41	Pelly R. drainage	Pelly
103	742	13	875	11-Jul-04 4:40	17-Jul-04 16:57	55.51	Pelly R. drainage	Pelly
120	942	22	985	10-Jul-04 20:17	17-Jul-04 14:09	53.60	Pelly R. drainage	Pelly
147	843	44	570	13-Jul-04 12:13	20-Jul-04 2:52	54.69	Pelly R. drainage	Pelly
156	742	49	820	8-Jul-04 17:45	14-Jul-04 15:08	61.37	Pelly R. drainage	Pelly
174	1843	42	890	11-Jul-04 16:21	18-Jul-04 18:49	50.90	Pelly R. drainage	Pelly
213	843	43	810	16-Jul-04 7:50	22-Jul-04 6:12	60.94	Pelly R. drainage	Pelly
228	942	41	900	14-Jul-04 11:03	20-Jul-04 10:29	60.49	Pelly R. drainage	Pelly
265	723	43	665	14-Jul-04 19:08	20-Jul-04 9:34	64.54	Pelly R. drainage	Pelly
317	683	71	900	15-Jul-04 2:40	22-Jul-04 5:52	50.68	Pelly R. drainage	Pelly
327	1843	66	875	19-Jul-04 0:23	25-Jul-04 14:39	54.82	Pelly R. drainage	Pelly
357	902	73	590	14-Jul-04 11:44	20-Jul-04 8:30	61.63	Pelly R. drainage	Pelly
363	723	69	675	18-Jul-04 15:12	25-Jul-04 13:09	52.28	Pelly R. drainage	Pelly
389	882	65	860	18-Jul-04 20:42	24-Jul-04 19:07	60.92	Pelly R. drainage	Pelly
404	683	62	840	19-Jul-04 8:56	25-Jul-04 12:25	58.83	Pelly R. drainage	Pelly
480	702	87	840	23-Jul-04 20:30	31-Jul-04 6:59	48.61	Pelly R. drainage	Pelly
487	922	93	840	23-Jul-04 8:12	30-Jul-04 10:02	51.09	Pelly R. drainage	Pelly
495	843	99	830	21-Jul-04 4:03	27-Jul-04 17:21	55.16	Pelly R. drainage	Pelly
516	783	93	795	21-Jul-04 14:24	27-Jul-04 4:18	64.79	Pelly R. drainage	Pelly
655	922	11	870	27-Jul-04 2:45	02-Aug-04 23:50	52.56	Pelly R. drainage	Pelly
668	702	12	890	25-Jul-04 10:50	31-Jul-04 6:48	61.99	Pelly R. drainage	Pelly
829	723	51	830	30-Jul-04 18:02	07-Aug-04 21:13	44.45	Pelly R. drainage	Pelly
1024	742	76	690	4-Aug-04 17:20	13-Aug-04 5:35	42.48	Pelly R. drainage	Pelly
3008	1033	17	860	13-Jul-04 2:11	18-Jul-04 22:51	61.68	Pelly R. drainage	Pelly
220	702	48	830	21-Jul-04 10:56	21-Jul-04 10:56		Sixty Mile R.	Upper Border
219	683	37	885	23-Jul-04 13:23	10-Aug-04 9:12	36.53	south Yukon R.	Hootalinqua
456	1843	92	640	20-Jul-04 18:07	02-Aug-04 18:21	50.05	south Yukon R.	Hootalinqua
614	902	12	560	24-Jul-04 19:03	06-Aug-04 21:51	49.65	south Yukon R.	Hootalinqua
646	942	9	765	31-Jul-04 11:42	20-Aug-04 15:25	32.31	south Yukon R.	Hootalinqua
665	922	0	670	26-Jul-04 2:41	09-Aug-04 7:10	45.90	south Yukon R.	Hootalinqua
672	843	4	970	25-Jul-04 6:57	08-Aug-04 1:45	47.24	south Yukon R.	Hootalinqua
805	922	27	875	29-Jul-04 2:26	16-Aug-04 18:31	34.88	south Yukon R.	Hootalinqua

Fish No.	Trans. Freq.	Trans. Code	Mid-Eye Fork Length	Date and Time Passing Upper Border *RTS*	Date and Time Passing Terminal *RTS*	Migration Rate (Km. / Day)	Fate (Primary Tributaries and Other Tributaries with ≥ 10 Radio Tag Locations	Terminal *RTS*
871	723	58	935	27-Jul-04 7:02	10-Aug-04 9:20	46.20	south Yukon R.	Hootalinqua
355	843	70	950	21-Jul-04 21:51	05-Aug-04 0:40	46.13	Takhini R.	Hootalinqua
435	683	89	885	22-Jul-04 5:21	05-Aug-04 3:53	46.72	Takhini R.	Hootalinqua
834	902	58	870	28-Jul-04 8:58	12-Aug-04 9:26	43.36	Takhini R.	Hootalinqua
869	683	60	830	31-Jul-04 15:12	16-Aug-04 1:21	42.22	Takhini R.	Hootalinqua
873	783	56	910	3-Aug-04 16:44	18-Aug-04 4:01	45.00	Takhini R.	Hootalinqua
513	702	96	860	26-Jul-04 16:42	05-Aug-04 13:31	43.92	Tatchun Ck.	Tatchun
604	902	26	615	29-Jul-04 22:33	08-Aug-04 11:02	45.52	Tatchun Ck.	Tatchun
860	702	58	650	29-Jul-04 2:22	12-Aug-04 21:02	29.32	Tatchun Ck.	Tatchun
117	882	8	790	5-Jul-04 18:27	09-Jul-04 9:22	53.60	White R. drainage	Lower White
125	783	16	860	8-Jul-04 10:22	12-Jul-04 0:21	54.18	White R. drainage	Lower White
128	902	13	860	7-Jul-04 15:50	11-Jul-04 7:27	53.17	White R. drainage	Lower White
183	922	47	900	13-Jul-04 8:32	17-Jul-04 4:35	50.61	White R. drainage	Lower White
232	723	37	690	12-Jul-04 11:01	15-Jul-04 21:29	56.49	White R. drainage	Lower White
292	922	72	875	19-Jul-04 6:56	23-Jul-04 11:09	46.48	White R. drainage	Lower White
300	843	71	855	14-Jul-04 20:13	18-Jul-04 18:46	49.27	White R. drainage	Lower White
307	702	69	730	18-Jul-04 4:41	22-Jul-04 9:32	46.19	White R. drainage	Lower White
405	702	63	865	18-Jul-04 13:49	22-Jul-04 9:34	50.77	White R. drainage	Lower White
408	783	66	895	16-Jul-04 2:27	19-Jul-04 14:33	55.39	White R. drainage	Lower White
506	843	89	695	20-Jul-04 4:02	23-Jul-04 14:31	56.48	White R. drainage	Lower White
3001	1033	24	800	9-Jul-04 11:03	13-Jul-04 8:39	49.77	White R. drainage	Lower White
36	723	15	860	12-Jul-04 3:06	21-Jul-04 8:49	46.91	mainstem Yukon R. Fishery	Tatchun
39	843	8	700	21-Jul-04 14:56	21-Jul-04 14:56		mainstem Yukon R. Fishery	Upper Border
86	922	17	835	13-Jul-04 14:15	13-Jul-04 14:15		mainstem Yukon R. Fishery	Upper Border
123	723	18	915	9-Jul-04 6:00	09-Jul-04 6:00		mainstem Yukon R. Fishery	Upper Border
124	742	17	850	9-Jul-04 6:15	09-Jul-04 6:15		mainstem Yukon R. Fishery	Upper Border
148	882	43	650	7-Jul-04 20:21	07-Jul-04 20:21		mainstem Yukon R. Fishery	Upper Border
162	942	42	610	9-Jul-04 8:11	09-Jul-04 8:11		mainstem Yukon R. Fishery	Upper Border
165	702	39	835	8-Jul-04 11:52	08-Jul-04 11:52		mainstem Yukon R. Fishery	Upper Border
181	882	48	895	13-Jul-04 9:00	18-Jul-04 23:51	57.83	mainstem Yukon R. Fishery	Selkirk
203	882	40	880				mainstem Yukon R. Fishery	Upper Border
227	922	42	930	20-Jul-04 20:41	20-Jul-04 20:41		mainstem Yukon R. Fishery	Upper Border
291	902	71	860	21-Jul-04 13:17	21-Jul-04 13:17		mainstem Yukon R. Fishery	Upper Border
332	783	65	885	19-Jul-04 16:00	19-Jul-04 16:00		mainstem Yukon R. Fishery	Upper Border
360	1843	71	885	16-Jul-04 8:36	16-Jul-04 8:36		mainstem Yukon R. Fishery	Upper Border
445	1843	96	825	17-Jul-04 9:11	17-Jul-04 9:11		mainstem Yukon R. Fishery	Upper Border
485	882	95	840	20-Jul-04 4:03	20-Jul-04 4:03		mainstem Yukon R. Fishery	Upper Border

Fish No.	Trans. Freq.	Trans. Code	Mid-Eye Fork Length	Date and Time Passing Upper Border *RTS*	Date and Time Passing Terminal *RTS*	Migration Rate (Km. / Day)	Fate (Primary Tributaries and Other Tributaries with ≥ 10 Radio Tag Locations	Terminal *RTS*
508	902	87	950	24-Jul-04 19:50	24-Jul-04 19:50		mainstem Yukon R. Fishery	Upper Border
515	742	94	960	29-Jul-04 16:10	10-Aug-04 4:31	37.63	mainstem Yukon R. Fishery	Tatchun
531	922	92	865	27-Jul-04 11:52	27-Jul-04 11:52		mainstem Yukon R. Fishery	Upper Border
659	723	6	835	27-Jul-04 1:51	05-Aug-04 7:31	46.92	mainstem Yukon R. Fishery	Tatchun
676	942	0	715	27-Jul-04 16:54	09-Aug-04 19:24	33.07	mainstem Yukon R. Fishery	Tatchun
691	783	32	535	27-Jul-04 20:32	27-Jul-04 20:32		mainstem Yukon R. Fishery	Upper Border
817	683	51	870	3-Aug-04 18:24	03-Aug-04 18:24		mainstem Yukon R. Fishery	Upper Border
891	723	50	570	2-Aug-04 12:10	02-Aug-04 12:10		mainstem Yukon R. Fishery	Upper Border
898	942	55	875	8-Aug-04 9:25	08-Aug-04 9:25		mainstem Yukon R. Fishery	Upper Border
908	942	57	835	10-Aug-04 9:32	10-Aug-04 9:32		mainstem Yukon R. Fishery	Upper Border
922	742	55	910	14-Aug-04 10:22	29-Aug-04 11:33	28.79	mainstem Yukon R. Fishery	Tatchun
932	742	83	940				mainstem Yukon R. Fishery	
942	723	86	800	8-Aug-04 9:38	08-Aug-04 9:38		mainstem Yukon R. Fishery	Upper Border
3005	1033	20	825	7-Jul-04 23:34	07-Jul-04 23:34		mainstem Yukon R. Fishery	Upper Border
881	723	60	840	9-Aug-04 11:39	09-Aug-04 11:39		Not Found by Aerial Surveys	Upper Border
976	843	77	705	10-Aug-04 5:06	14-Aug-04 6:20	49.53	Not Found by Aerial Surveys	White
982	702	83	640	12-Aug-04 7:33	22-Aug-04 5:43	43.67	Not Found by Aerial Surveys	Tatchun
1001	683	10	955	1-Aug-04 21:12	12-Aug-04 19:21	39.67	Not Found by Aerial Surveys	Tatchun
1007	882	81	750	1-Aug-04 19:35	17-Aug-04 4:40	41.07	Not Found by Aerial Surveys	Teslin
1012	702	76	840	11-Aug-04 0:09	22-Aug-04 18:48	36.79	Not Found by Aerial Surveys	Tatchun
1018	902	82	940	31-Jul-04 10:46	10-Aug-04 13:50	42.79	Not Found by Aerial Surveys	Tatchun
1022	702	78	845	3-Aug-04 18:32	14-Aug-04 8:15	40.99	Not Found by Aerial Surveys	Tatchun
1033	723	79	820	1-Aug-04 23:06	09-Aug-04 23:04	40.63	Not Found by Aerial Surveys	Selkirk
1034	742	78	890	23-Aug-04 7:23	23-Aug-04 7:23		Not Found by Aerial Surveys	Upper Border
1038	902	86	890	15-Aug-04 4:14	21-Aug-04 19:31	30.23	Not Found by Aerial Surveys	White
3004	1033	21	820	11-Jul-04 0:01	17-Jul-04 17:40	64.34	Not Found by Aerial Surveys	Tatchun
3035	1033	91	720				Not Found by Aerial Surveys	

Appendix 2. Comparison of the proportional distribution of Chinook salmon stocks within the Canadian portion of the upper Yukon River drainage area among the years 2002 to 2004.



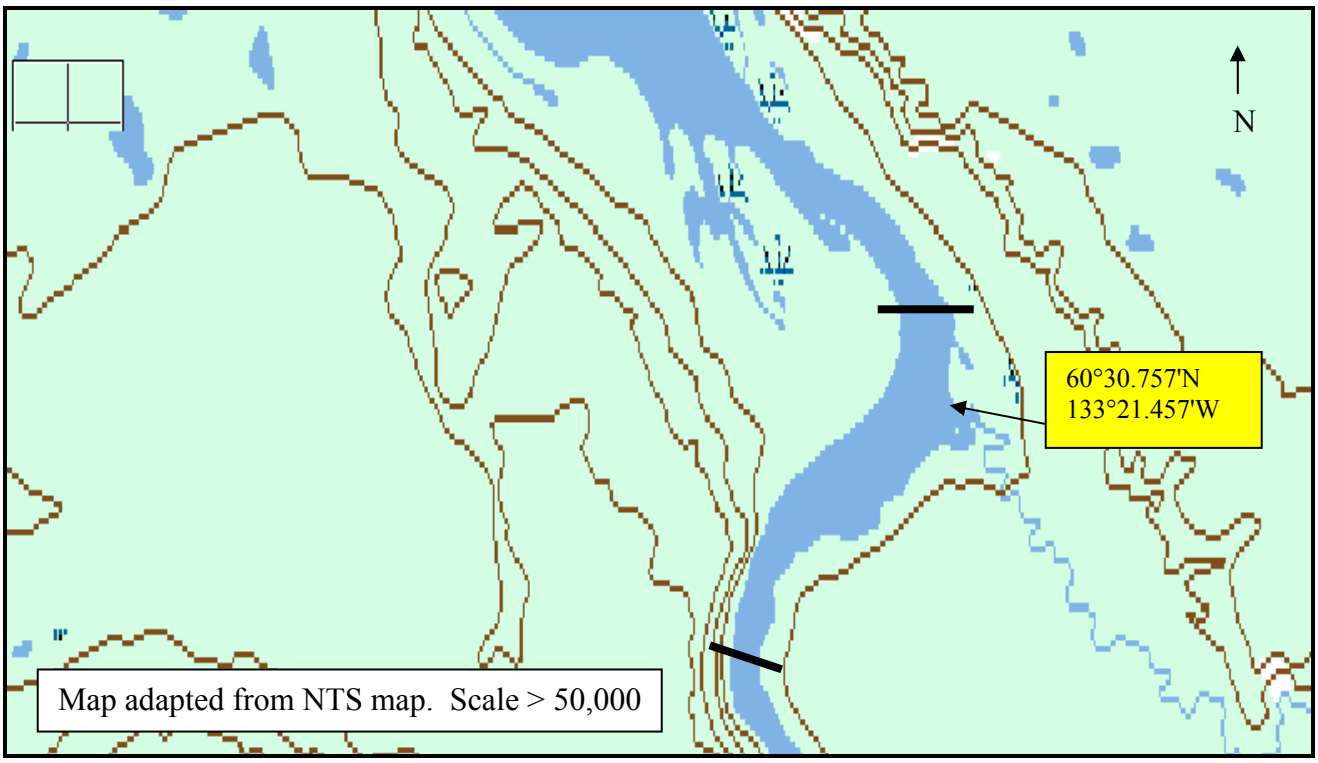
Appendix 3. Comparison of stock-specific Chinook salmon mean migration rates within the Canadian portion of the upper Yukon River drainage area among the years 2002 to 2004.

Drainage	2004		2003		2002	
	Mean Migration Rate (Km. / Day)	N	Mean Migration Rate (Km. / Day)	N	Mean Migration Rate (Km. / Day)	N
Stewart R.	51.94	26	51.16	31	52.66	23
Pelly R.	54.86	49	52.69	79	50.88	33
Big Salmon R.	48.08	25	46.99	59	46.11	17
Teslin R.	48.22	49	48.12	69	47.18	42
south Yukon R.	43..55	13	45.22	13	43.05	7

Appendix 4 Radio tags returned from fisheries and projects conducted in the Canadian portion of the upper Yukon River watershed, 2004

Fish Number	Radio Frequency	Radio Code	Defined Location Near Point of Recovery
4	742	21	Pelly Crossing
36	723	15	Carmacks
39	843	8	Dawson
75	922	15	Johnson's Crossing
78	683	8	Pelly Crossing
80	723	23	Pelly Crossing
86	922	17	Dawson
123	723	18	Dawson
124	742	17	Dawson
148	882	43	Dawson
156	742	49	Pelly Crossing
162	942	42	Dawson
165	702	39	Dawson
181	882	48	Minto
203	882	40	Dawson
216	922	40	Mayo
227	922	42	Dawson
265	723	43	Pelly Crossing
291	902	71	Dawson
332	783	65	Dawson
360	1843	71	Dawson
363	723	69	Pelly Crossing
417	742	70	Johnson's Crossing
445	1843	96	Dawson
485	882	95	Dawson
508	902	87	Dawson
515	742	94	Carmacks
525	723	98	Mayo
531	922	92	Dawson
642	843	1	Johnson's Crossing
659	723	6	Carmacks
676	942	0	Unknown
691	783	32	Dawson
693	882	30	Johnson's Crossing
817	683	51	Dawson
891	723	50	Dawson
898	942	55	Dawson
908	942	57	Dawson
922	742	55	Carmacks
932	742	83	Dawson
942	723	86	Dawson

Appendix 5, Figure 1. Observed spawning area on the Teslin River approximately 4.5 kilometres downstream of Johnson's Crossing Bridge



Appendix 5, Figure 2. Observed spawning area on the Teslin River approximately 44 kilometres downstream of Johnson's Crossing Bridge