2008 FALL CHUM SALMON TAG RECOVERY PROJECT YUKON RIVER *(MINTO TO FORT SELKIRK)* CRE-29-08

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with

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2008 Fall Chum Salmon Tag Recovery Project
Yukon River (Minto to Fort Selkirk)

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ABSTRACT

The Department of Fisheries and Oceans Canada has conducted tagging programs on migratory Pacific salmon populations in the upper Yukon River drainage since 1982. Fall chum salmon are marked with spaghetti tags at two fish wheels located near the Yukon-Alaska border. The purpose of the tagging and subsequent tag recovery is to estimate the size of the fall chum spawning migration into Canada using marked to unmarked ratios. Yearly spawning migration estimates are used to monitor the relative long term run size of the fall chum salmon population in the Yukon River in Canada.

During October of 2008, the project recovered spaghetti tags from post-spawning fall chum salmon in the Minto index area of the Yukon River near Pelly Crossing, Yukon Territory. Spaghetti tags were recovered through foot and boat surveys at several known fall chum spawning locations. The survey observed and recovered a total of 21 spaghetti tags, all of which were Canadian origin. The fall chum salmon tagged to untagged ratio for Canadian tagged fall chum salmon for 2008 was 43.2 fish for the Minto index area. Using the Lincoln-Peterson mark and recapture method an estimate of fall chum border escapement was estimated to be 258,854 ± 102,606 for 2008.

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INTRODUCTION

A fall chum salmon spawning ground tag recovery program has been conducted annually on the Yukon River between Minto and Fort Selkirk, Yukon since the late 1990s. It is one of several assessment programs for fall chum salmon that are conducted each year within Canadian portion of the Upper Yukon River. Funding for the project was provided by the Yukon River Panel which funds programs in both Canada and the United States that focus on the restoration, and enhancement of Canadian-origin salmon within the Yukon River Basin. In addition, the program provides funding for projects conducted within the Canadian portion of the Yukon River drainage that foster stewardship of salmon habitat and resources and maintaining viable fisheries. Through various projects in both countries, there is hope that sustainable salmon fisheries can continue along the Yukon River over the long-term and that salmon returns can once again approach historic levels of abundance. A stock rebuilding program for Canadian origin fall chum was implemented in the late 1990s when run projections were low (Milligan, pers. com., 2007). Since this time stocks have recovered with fall chum salmon border escapements averaging over 100,000 fish and ranging from approximately 92,000 to slightly over 450,000 for the period from 2002 to 2007. The means of measuring success or failure of this program continues to involve a mark-recapture program that is used to determine annual border and spawning escapement estimates and establish temporal trends.

The project was administered by the Selkirk District Renewable Resource Council (SRRC) with field assistance provided by members of the Selkirk First Nation (SFN) from the community of Pelly Crossing in south central Yukon. The involvement of the SRRC and SFN members in local fisheries management projects has recently expanded as a result of the finalization of the SFN Final Agreement and the Canada-US Yukon River Salmon Agreement. Combined, these agreements have been influential in increasing awareness of local issues while building the capacity to initiate and participate in various fisheries management projects throughout the SFN Traditional Territory. In addition to providing local jobs and benefits to the community of Pelly Crossing, this project identifies important fall chum spawning habitat for consideration in ongoing land

use planning initiatives in the region. The Minto area is especially rife with activity with the development of the Minto Mine that is currently in production.

Fall chum salmon runs have been weak within the 1998-2001 period, however run strength improved within the 2002-2006 period. As part of the management of the Upper Yukon fall chum salmon run in Canada, a mark-recapture tagging program is conducted each year as the primary tool for estimating border escapement, the number of fish entering Canada. In years past, when the commercial fishery was closed for conservation purposes, management biologists found that abundance estimates without the fishery were difficult to determine since there was no catch or tag recovery information available (Milligan, pers. com., 2007). In response, an alternate method to estimate fall chum abundance was explored in the late 1990s that involved the enumeration and recovery of spaghetti tags at known fall chum spawning sites.

In summary, the primary objective of this project is to develop the Minto index area as a proxy to estimate border escapement and relative year to year abundance. Tag ratios used to derive a border escapement estimate are developed through the enumeration of spawning fish and recovery or observation of spaghetti tags at known spawning sites in the Yukon River between Minto Landing and Fort Selkirk, Yukon (Figure 1 and Appendix I).

METHODS

Spaghetti tags applied by DFO to fall chum salmon at fish wheels near the Yukon-Alaska border were recovered through a combination of foot surveys or observed on live fish by drifting over known spawning locations on the Yukon River between Minto and the confluence of the Yukon and Pelly rivers at Fort Selkirk (Figure 1). Tag recovery work was conducted between October 22 and 26 in 2008, during a period that was well after the peak spawn. Spawning locations were found using previously referenced coordinates using a hand held Garmin 76CS GPS. Any additional sites that were thought to contain spawning chum were investigated. All sites were accessed using a boat and outboard motor. Loose tags along the shoreline were collected and carcasses enumerated by surveying the perimeter of the spawning area by foot. For the carcass tally, only heads were enumerated to avoid duplication. The sex, spawning condition,

visual inspection for mark (adipose clip, adipose and caudal punch) and a measurement of both mid-eye fork and postorbital hypural length (± 5 mm) were recorded on only those carcasses that were whole. At locations where significant numbers of schooling fall chum were observed in the water, enumeration was performed using a boat and tally counter by simply drifting over spawning aggregations. At these sites a minimum of three drifts were made by a single observer at the bow of the boat. A second observer surveyed the stream bed for loose tags during each drift which were eventually recovered using a gaff or wading in the water. All live fish and carcasses on the slough bottom were counted during each drift. The maximum number of observed tagged and untagged fish enumerated at each spawning site were used in the calculation of the overall tag to untagged ratio for the project.

A border escapement estimate in 2008 was estimated using the Lincoln-Peterson mark and recapture method. This method used the used the total number of tagged fish ($n1$), tags observed or recovered (m) and fish enumerated in the Minto index area ($n2$) to determine an estimate of border escapement (N). The formula used was $N = (n1n2)/m$ and a 95% confidence interval was calculated using the variance of mark recapture estimates for individual sites.

RESULTSAND DISCUSSION

Environmental Conditions

Ground accumulations of snow and the extremely high water level of the river during the fall of 2008 made nearly all aspects of the field work more difficult. Snow hampered tag recovery along the shoreline by covering loose tags that were well away from the margins of the sloughs. Snow and ice can dramatically reduce shoreline tag recoveries and can skew ratios of tagged to untagged fish. As in 2007, the unusually high water level of the Yukon River in 2008 reduced visibility in the deeper regions of the sloughs but did allow boat access to each index site. The reduced visibility was a factor at all sites that limited the enumeration of spawning fish at many of the sites. The higher water levels also made wading difficult and boating down some of the channels dangerous and difficult. The higher water levels however did provide access to all of the inspected spawning sites.

The air temperatures were seasonally below normal and well below freezing during the morning and staying cool throughout the day. High winds and snow squalls were experienced during the week of the survey. The Pelly River began to flow ice on October 25 preventing access to a spawning site just downstream of its confluence near Fort Selkirk (Figure 3). Ice cover in the sloughs hampered survey efforts near the end of the project.

Fall Chum Salmon Tag Recoveries

Ten sites were inspected for spaghetti tags (Figure 1 and Appendix I) between October 22 and 26, 2008. In addition several other areas were investigated for groups of spawning fish, carcasses or redds. Over the course of the survey a total of 864 fall chum salmon in varied post spawning condition were enumerated. A total of 717 spawning fish were enumerated by boat during drifts over spawning aggregations; the balance (147 fish) were carcasses enumerated along the shoreline during foot surveys at each of the spawning sites. Many of those carcasses were not whole fish, having been scavenged by wildlife such as eagles, ravens and bears. Fall chum salmon heads and jawbones were often the only remains observed along the shoreline. Carcass retention on the gravel bars was especially low in 2008 due to the high water levels in the river.

A total of 21 orange spaghetti tags were recovered or observed all of which were of Canadian origin. Of the 21 Canadian tags, 20 were determined to be from the current tagging year and used to calculate tagged to untagged ratios (Table 1). All tag recoveries were either found along the shoreline, attached to carcasses, or lying submerged on the bottom of sloughs (Appendix II). Un-recovered tags represented those observed and enumerated on live fish during drifts with the boat over spawning sites.

A slightly greater number of loose tags were found than were counted on live fish. Loose tags are typically those recovered along the shoreline or found on the bottom of sloughs (Table 1). The timing of the tag recovery program was timed to coincide with the post-spawning period of the fall chum run in the upper Yukon River. Due to the high water levels of the Yukon River in 2008 the spawning run was later than usual and the project was conducted much later than in previous years. Overall, tag recoveries along the shoreline, in the water and visually observations of live-tagged fish were much

reduced in 2008. Accumulations of snow hampered the collection of loose tags along the shoreline. In addition, the high water levels obscured visibility of tagged chum salmon in the sloughs and prevented the field crew from wading many of the spawning sites. Using sites where spawning fall chum salmon could be enumerated a tag ratio of tagged and untagged live fish was determined to be 79.7 fish per tag. Unattached tags collected from the bottom of sloughs and along the shoreline while counting carcasses resulted in a tag ratio of 13.4 carcasses per tag. Combining all tag recoveries for 2008 resulted in a tagged to untagged ratio of 43.2 fish per tag for the Minto index area. This value approximates those values determined in 2006 and 2007 of 40.1 and 43.7, respectfully (Table 2).

Table 1 Summary of enumeration and tag recovery statistics of fall chum salmon in the Minto Index area, October 2008.

Enumeration Method	Count	Canadian 2008 Spaghetti Tags Recovered or Observed	Tag Ratio
Fall Chum Carcasses on Shore	147	11**	13.4 fish per tag
Live Fall Chum in Slough*	717	9	79.7 fish per tag
Total	864	20	43.2 fish per tag

* Orange tags observed of Canadian origin.
** Consists of 6 tags found unattached in sloughs, 4 unattached on shoreline and 1 attached to a carcass.

Using recovered tags the Lincoln-Peterson method estimated a fall chum salmon border escapement of 258,854 ± 102,606 (95% confidence interval). This estimate used the number of tagged fish at the border and both recovered loose tags and those observed on live fish at each of the spawning locations in the Minto index area. Considering that several key assumptions using this method may not have been achieved it is likely an over estimation of escapement. As in 2007, the 2008 Canadian spaghetti tagging program ended before the run was completed (Milligan, pers. com., 2008). With a portion of the run being untagged, the potential for over estimating the run size through a skewing of the tag ratio appears to be a constraint on the accuracy of this estimate.

The 2008 border escapement estimate of 258,854 fall chum using recovered tags in the Minto area is about 67,500 fish or 35 percent higher than the estimate from the US sonar program of 191,375 fish. Both estimates are well above the Canadian Yukon River fall chum spawning escapement goal of greater than 80,000 fish. At the time of writing a border estimate using mark recapture information from the Canadian commercial fishery was not available for comparison (Milligan, pers. com., 2008). It should also be noted that the confidence intervals for the estimate were much larger in 2008 compared to estimates for other survey years. This is thought to be the result of the lower number of sites examined in 2008, the low number of fish examined, and the low number of tags observed.

Table 2 Comparison between DFO fall chum border escapement estimates from DFO mark recapture programs and tag ratios determined for the Minto index area, 2002-2007.

Year	Canada-US border escapement estimate	Determined tag ratios Minto index area (fish per tag)
2002	104,853	24.2
2003	153,656	31.1
2004	163,625	33.3
2005	451,477	137.4
2006	217,810	40.1
2007	235,956	43.7

The poor carcass retention from high water levels in 2008 made for almost no biological sampling of carcasses for sexual determination and visual inspection for tag loss or markings. The few carcasses that were on the shoreline were heavily predated upon and largely in pieces preventing any morphometric measurements or sexual determination. With the exception of one tagged carcass found in the water several of the loose tags had the appearance of being forcibly removed.

Tag Recovery Timing

The survey in 2008 was completed during roughly the same statutory weeks as 2005 and 2006, and about a week later than previous survey year. Spawning activity appeared to be just past the peak as evidenced by the many live fish that were observed in good condition. Many of the females were observed holding over constructed redds and

no digging behavior in the gravel was observed. The run was considered to be late by ~6 days in 2008. It is believed that the higher water level and flow of the Yukon River may have contributed to the late spawning activity (Figure 2).

Nearly all of carcasses that were enumerated in 2008 were partial remains composed of only heads, tissue or skeletal fragments scattered along the shoreline. This was unlike the situation in 2005 where the large run and lower water levels resulted in many whole carcasses scattered along the shorelines as predators were simply high-grading select parts of the fish, particularly the eyes. As in 2007, predators were once again having a much more difficult time of accessing fish as both the high flows and increased water depth in many of the sloughs appeared to make harvesting difficult even for bears (Figure 4).

Fall Chum Salmon Spawning Sites

The mainstem sloughs of the Yukon River between Minto and Fort Selkirk have long been known as an important fall chum spawning areas by Selkirk First Nation people as well as local residents. While the earlier run of Chinook salmon is generally a more popular fishery for the residents of Pelly Crossing, a small aboriginal fishery for fall chum salmon continues around the Minto Landing area. Local interest in harvesting fall chum salmon was again modest in 2008 with several individuals from the community participating. Catches of chum salmon in the Minto area were reported to be excellent in 2008 (Alfred, pers. com., 2008). Other fishing locations were not observed during the survey.

With the even higher water levels of the Yukon River in 2008 some notable changes occurred in habitat utilization at the spawning sites in comparison to 2007. Very high utilization of spawning habitat was observed at sites W50-1, W52, W55 and W58. Combined, these sites represented all but one of the tags recovered or observed during the project. As in 2007, site W58-1 had very few redds and carcasses in relation to the size of the spawning run. The poor utilization of this site can likely be attributed to greater water depths and higher water velocities that resulted in fish not selecting this spawning site. This site represents the upper reaches of an important and consistently utilized spawning location known as Big Creek Slough or W58. Both sites W58 and W58-1 were

heavily used by spawning fall chum in 2005. Two new spawning sites where identified at SP1 and SP2. It was estimated that at SP1 there were about 100 spawning fish and associated redds although enumeration at the site was not possible due to water depth and poor visibility. SP2 was only a spawning location with very few redds, live fish and carcasses.

Water levels of the Yukon River in 2008 were extremely high. Yukon River flow data at a water survey station just downstream of the Minto Index area show higher discharge than the previous six years for the time considered to be the peak fall chum salmon spawning period of late September through to the middle of October (Figure 2). It is believed the increased water velocities and substrate depths had profound impacts on both carcass retention and the specific location of redds at each of the spawning sites. This was especially evident at site W58 where fall chum salmon were now using an area that was previously exposed along the right cutbank of the main channel that runs through the slough. Sites that continue to be heavily utilized are generally those that have the most diverse and extensive habitats available and are less prone to flooding or desiccation at various flows.

REFERENCES

SRRC. 2007. *2007 Fall Chum Salmon Tag Recovery Project, Yukon River (Minto to Fort Selkirk).* Prepared for the Yukon River Panel under the Yukon Restoration and Enhancement Fund by the Selkirk Renewable Resource Council.

PERSONAL COMMUNICATION

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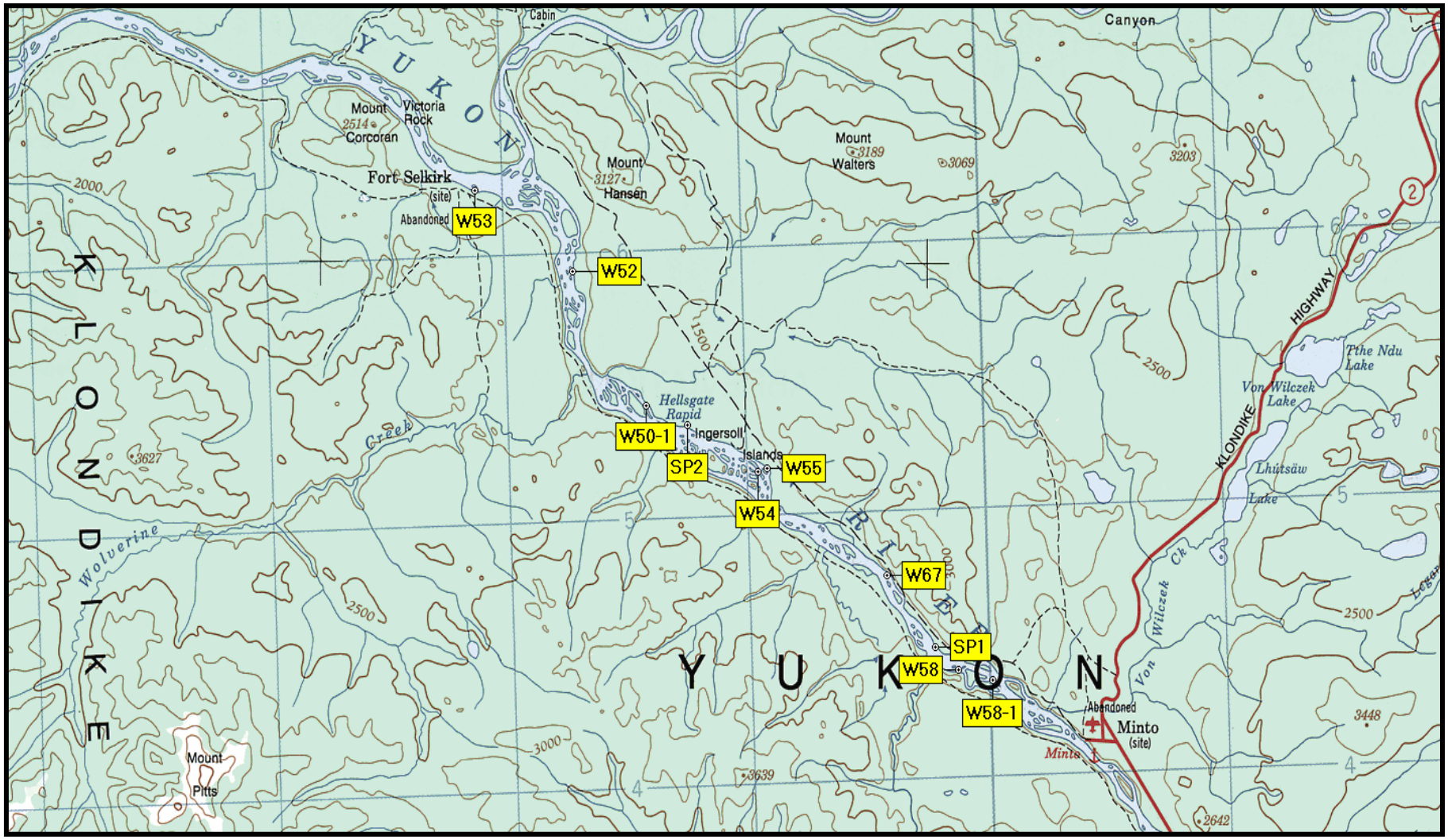

FIGURE 1: YUKON RIVER (MINTO INDEX AREA) FALL CHUM SALMON TAG RECOVERY INSPECTION SITES

5 0 5 10 15 km

SCALE 1 : 250,000

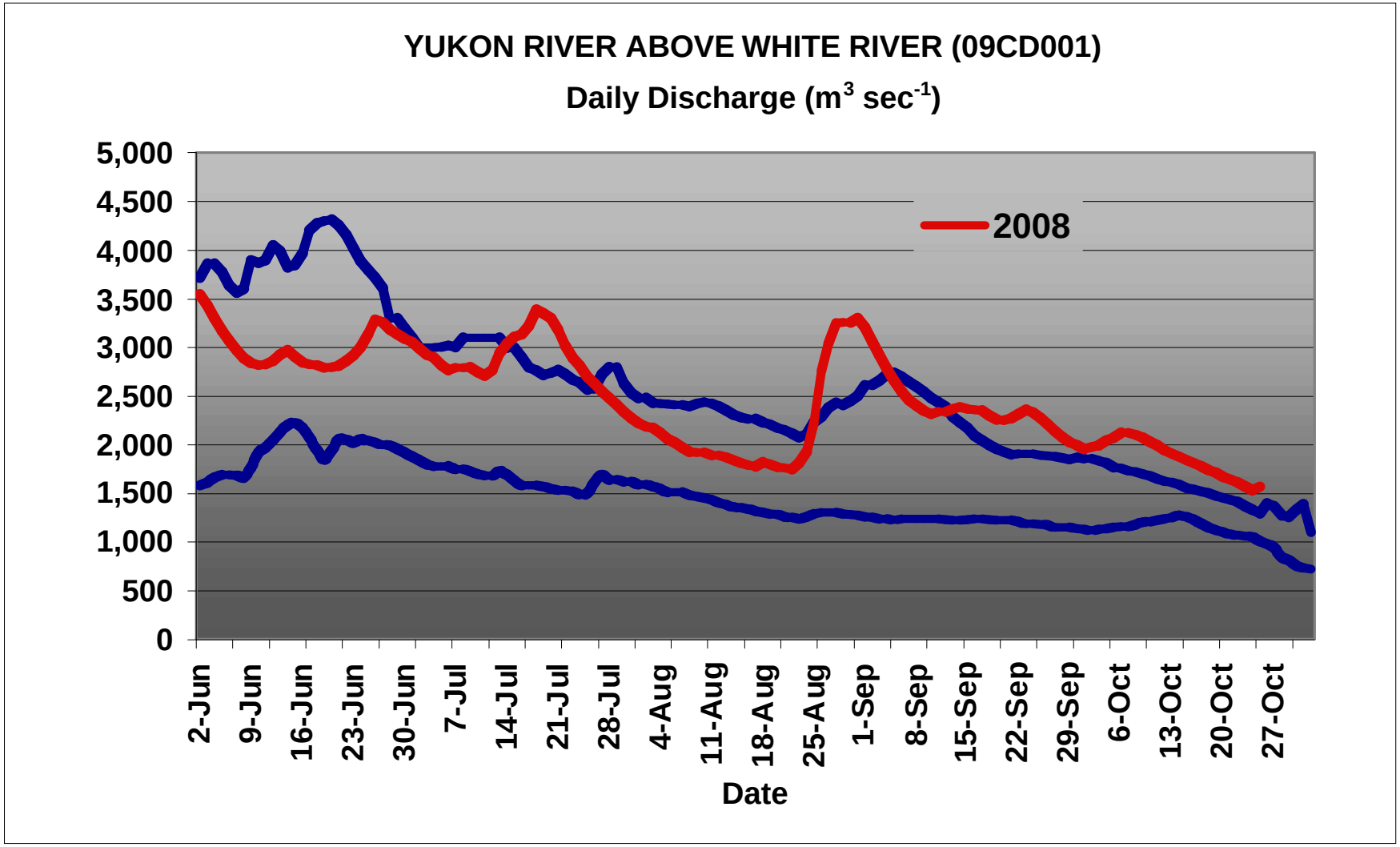

Figure 2 Comparison of daily mean discharge for Yukon River at gauging station # 09CD001 above the confluence with the White River from June through October 2001 to 2008. The minimum and maximum daily mean discharge from a 2001 to 2007 data set is compared to daily mean discharge for 2008. Data supplied by Water Survey of Canada.

Figure 3 Flowing ice in the Yukon River at Fort Selkirk from contributions of the Pelly River on October 26, 2008.

Figure 4 Small exposed gravel bar where predators were feeding on one of the few carcasses observed along the shoreline at this location.

APPENDIX I

2008 SURVEY WAYPOINTS

APPENDIX I 2008 SURVEY WAYPOINTS

Waypoints	Updated Map Reference*	Description
SP1	N 62° 42' 08.6" W 137° 13' 55.4"	River right at inlet to a large slough
SP2	N 62° 41' 44.3" W 137° 11' 54.3"	Just downstream of Ingersoll Islands at inlet to a small slough
W50-1	N 62° 42' 08.6" W 137° 13' 55.4"	At inlet to Rock Face Slough
W52	N 62° 44' 48.8" W 137° 17' 35.3"	Warm-springs above confluence of Pelly River on right bank of Yukon River
W53	N 62° 46' 25.0" W 137° 22' 27.5"	Slough in front of Fort Selkirk also known as Steamboat Slough
W54	N 62° 40' 48.7" W 137° 8' 24.4"	Ingersoll Islands – amongst islands
W55	N 62° 40' 53.6" W 137° 07' 58.9"	Ingersoll Islands – river right side channel
W58	N 62° 36' 50.8" W 136° 58' 32.5"	Big Creek Slough – primary spawning area
W58-1	N 62° 36' 38.6" W 136° 56' 51.0"	Big Creek Slough - upstream inlet
W67	N 62° 38' 45.0" W 137° 2' 2.2"	Downstream of Big Creek river right at slough downstream outlet

***Position Format: hddd° mm' ss.s" (NAD 27 Alaska)**

APPENDIX II

2008 FALL CHUM SALMON TAG RECOVERY DATA

APPENDIX II 2008 FALL CHUM SALMON TAG RECOVERY DATA

Sample	Site	Date	Tag Color	Tag Origin	Tag Number	Location
1	W58	23-Oct-08	Orange	Canada	B01799	found attached to shore carcass
2	W58	23-Oct-08	Orange	Canada	A04500	found on shore
3	W58	23-Oct-08	Orange	Canada	A02094	found on shore
4	W58	23-Oct-08	Orange	Canada	A03645	found in slough
5	W58	23-Oct-08	Orange	Canada	B00117	found in slough
6	W58	23-Oct-08	Orange	Canada	B01858	found in slough
7	W58	23-Oct-08	Orange	Canada	B00078	found in slough
8	W58	23-Oct-08	Orange	Canada	B01738	found in slough
9	W55	24-Oct-08	Orange	Canada	Z003387	found in slough
10	W55	24-Oct-08	Orange	Canada	A04373	found on shore
11	W67	24-Oct-08	Orange	Canada	B01230	found on shore
12	W55	24-Oct-08	Orange	Canada	A06311	found in slough

APPENDIX III

2008 FALL CHUM SALMON BIOLOGICAL DATA

APPENDIX III 2008 FALL CHUM SALMON BIOLOGICAL DATA

Sample	Site	Date	Sex	Tag Number or Fin Markings	Condition*	POHL (mm)	MEF (mm)
1	W58-1	23-Oct-08	M	no tag or markings	SC	505	645
2	W58	23-Oct-08	F	tagged with no markings	SC	515	640
3	W67	24-Oct-08	M	no tag or markings	SC	545	685

R = ripe live fish
S = spent live fish
SC = spent carcass