2019 EARLY STUART SOCKEYE

Preliminary Escapement Estimates

Preliminary escapement estimates are based on in-season data that have not been fully verified. Changes in preliminary estimates are likely.

Background

The Early Run, commonly referred to as the Early Stuart Run, consists of more than 40 populations that spawn exclusively in the Stuart River system and which comprise one of the 24 validated Conservation Units (CU) that have been identified for Fraser Sockeye (Grant et al. 2011). Populations within this timing group enter the lower Fraser River from late June to mid-July and migrate immediately upstream to terminal spawning areas. Spawners begin arriving on the spawning grounds in late July, with peak of spawning from early to mid-August. Die-off is generally complete by late August.

The Early Stuart CU (Takla-Trembleur-EStu) was designated RED status in the 2017 Wild Salmon Policy biological status evaluations (DFO 2018) and was recently recommended for listing as Endangered by COSEWIC (Committee on the Status of Endangered Wildlife in Canada) (COSEWIC 2017).

The 2015 brood year escapement for the Early Stuart Run totaled 10,096 spawners with an average spawning success of 75.1%. The largest populations in 2015 were observed in O'Ne-Ell Creek (1,693), Sidney Creek (1,355), Van Decar Creek (1,151) and Gluske Creek (754).

The 2019 Early Stuart assessment project was conducted jointly by DFO Fraser River Stock Assessment and T'lazt'en Nation.

Big Bar Landslide on the Fraser River

According to satellite data, the Big Bar landslide occurred sometime during late October - early November, 2018. Enormous pieces of rock and debris sheared off a 125-metre cliff and crashed into a remote and rugged portion of the Fraser River, 64 kms north of the town of Lillooet, BC. An estimated 120,000 m^3 of material was deposited into a narrow canyon section of the river creating a large rapid with a vertical drop of about 5 m. The area is inaccessible by public roads, and in the absence of creel survey and patrol flights by DFO personnel, which occur only during the fishing season, the slide went unnoticed until it was reported to DFO on June 23, 2019.

The Department evaluated the severity and multi-jurisdictional implications of the slide on June 25, and on June 29, a Unified Command Incident Management Team was established in Lillooet, BC, with personnel representing the governments of Canada, British Columbia and First Nations. Phase 1 of the project, which ran from late June to late September, was conducted under an emergency response situation, and included hydroacoustic and radio telemetry assessments of natural salmon passage as well as a trap and transport operation.

Extensive radio telemetry and hydroacoustic data indicated that natural migration of Sockeye salmon was totally impeded from early July until near the end of August, coinciding with the period when the majority of Early Stuart Sockeye were expected to migrate through that section of the Fraser River. The first evidence of radio-tagged Sockeye migrating past the slide was on August 26th. From late July to early September, a total of 60,346 Pacific Salmon, including 51,449 Sockeye, were trapped and transported via helicopter over the slide. The transported Sockeye would have represented Early Stuart along with other populations from the Early Summer and Summer management groups. Due to their early migration timing, very few Early Stuart Sockeye

would likely have migrated past the slide in late August as river discharge decreased below 1900 m^3/s and natural passage was restored for Sockeye.

Escapement Estimation

The 2019 Early Stuart escapement was assessed using a combination of ground and aerial visual surveys.

As in previous years, in 2019 the majority of Early Stuart streams were visually surveyed on foot over a 4-day cycle with the entire accessible spawning area assessed. Remote streams or those with accessible lengths too long to survey on foot (e.g., Driftwood River and its tributaries) as well as streams where typically only Late Stuart Sockeye spawn were surveyed by helicopter on a single occasion during the expected peak spawning period. Counts of live spawners and carcasses were recorded on each survey. For ground surveys, carcass counts were recorded by sex and spawning success (females only). After enumeration, carcasses were chopped in half with a machete to avoid re-counting on subsequent surveys. For each stream the total escapement is the sum of the peak count of live spawners and the cumulative count of carcasses through the date of the peak live count multiplied by an expansion factor. Stream specific expansion factors were applied on Gluske, Forfar and O'Ne-Ell (Kynoch) creeks based on the average stream specific calibration indices from 1990-2009 (1.59, 1.69 and 1.71, respectively). For the remaining populations, either the 1990-2009 average expansion factor for Early Stuart streams (1.65), or the standard expansion factor (1.8) for small (less than 25,000) Fraser River Sockeye populations was applied, depending on survey frequency (4 or 7 day cycle, respectively) (see Welch et al. 2017 for a summary of the calibration data used to develop escapement estimates from visual counts for Fraser Sockeye populations).

The total Sockeye escapement to an individual stream is parsed into male, female and jack totals in three steps based on carcass recovery data:

1. The proportions of adult males and females and jacks is calculated based on recovery totals, with the jack recovery total first expanded by a factor of 1.26 to account for lower recovery probability due to smaller body size (Andrew and Webb MS, 1987).

2. Recovery data is assessed to determine, qualitatively, whether the recovery sample (excluding unsexed carcasses) is temporally representative throughout the die-off period and spatially representative throughout the recovery area. If so, then the estimate of total escapement is parsed into adult males, adult female and jack totals, based on the proportions calculated above. Adult sex ratio is then calculated based on male and female totals.

3. If the recovery sample is considered not temporally or spatially representative, then adult sex ratio, and jack proportion are approximated based on average values for the appropriate population aggregate (e.g., values for Fleming Creek would be approximated based on average values for all Trembleur Lake tributaries aggregated), with the exception that the proportion of jacks would be assumed to be zero if no jacks were observed during surveys of the stream in question.

Average female spawning success is calculated from the weighted daily estimates of female egg retention (0%, 50% or 100%) in the female carcass recovery sample. Effective female escapement is estimated as the product of total female escapement and average percent female spawning success (excluding Sockeye sacrificed for biological samples). If the recovery sample is considered not temporally and spatially representative, then female spawning success is approximated based on the average value for the appropriate population aggregate.

Escapements

The preliminary total spawner escapement estimate for 2019 for Early Stuart Sockeye is 89 fish of which 43 are adult males, 46 are adult females and 0 are jacks (Table 1). The 2019 escapement is 1% of the 2015 brood year (10,096) and less than 1% of the long-term cycle average of 42,694 (Figure 1). Additionally, the 2019 escapement is less than 1% of the Pacific Salmon Commission (PSC) in-season estimate of potential spawning escapement[1] of 25,820. An adopted projected spawning escapement[2] was not provided by the Fraser Panel for Early Stuart Sockeye in 2019.

The 2019 escapement is the lowest on record for this cycle year and for all cycle years since comprehensive surveys began in 1938. Early Stuart Sockeye were observed in only 10 of the 33 streams assessed in 2019 (compared to Sockeye being observed in 19 streams of the same 33 streams in the 2015 brood year) The largest escapements in 2019 were observed in Forfar (29), O'Ne-Ell (14) and Van Decar creeks (14) (Table 1).

Due to a low June snowpack (<50% of normal; BC MOECCS 2019) and early snowmelt (1-3 weeks ahead of normal), on the whole, Early Stuart Sockeye experienced lower than average flows during the majority of their migration in the Fraser River, with discharge levels at Hope ranging between 3,830-4,840 m^3/s for the month of July, which was 13%-42% below average, (Environment Canada 2019). However, as a result of a greater than 1 in 100 year flood event in the Chilcotin River watershed in early July, Early Stuart Sockeye experienced much greater than normal turbidity conditions during their migration in the Fraser River in the first half of July. SONAR data collected at the Mission, Qualark and Big Bar sites indicated a virtual halt to salmon migration in the Fraser mainstem for several days coinciding with the peak in the sediment pulse from the Chilcotin watershed. During July, Fraser River water temperatures at Hope were as much as 2°C above average, ranging between 16°C and 19°C (DFO Fraser River Environmental Watch 2019.

Timing of Sockeye arrival at the spawning grounds was well outside the normal range in 2019, with the first Sockeye (carcass) observed in the terminal area on August 11th, approximately 2-3 weeks later than normal. This was presumably a result of delays encountered by migrating fish at the Big Bar landslide. Spawning timing was delayed approximately the same number of weeks. Except for Kazchek Creek and Middle River, water temperatures at all surveyed creeks remained within a suitable range for Sockeye spawning (between 7°C and 16°C) throughout the duration of the spawning period. Discharge in spawning streams were characterized as being average throughout the spawning period, and was not reported to be limiting or hampering Sockeye access in most cases. Beaver dams were identified as potentially limiting access in a few streams (e.g., Gluske, O'Ne-Ell, and Sowchea), and in at least one case, completely obstructed fish passage into a spawning stream (Sandpoint Creek).

Due to very low spawner abundance in 2019, too few carcasses were recovered to provide reliable estimates of sex ratio and spawning success; total recovery for the system amounting to only 14 carcasses. Therefore, for 2019 sex ratio and spawning success estimates are based on assumed values (i.e., 50% males, 50% females, 0% jacks, 100% female spawning success).

Enhancement Response To The Big Bar Slide

As a mitigation measure to address the impact of the slide, 88 spawning pairs of Early Stuart Sockeye (stock identification based on Genetic Stock Identification samples) were collected below the slide and taken to the Cultus Lake Laboratory. Seventeen females and 30 males matured and

[1] The potential spawning escapement is the number of Sockeye estimated past the PSC hydroacoustic site in the Lower Fraser River at Mission minus estimates of catch above Mission.

[2] The projected spawning escapement is the potential spawning escapement adjusted to account for historic differences between the Mission hydroacoustic estimates of fish passage and the spawning grounds estimates.

were spawned, resulting in ~19,500 eggs hatching to the alevin stage (Mary Beth Fagan, Salmonid Enhancement Program, pers. comm.).

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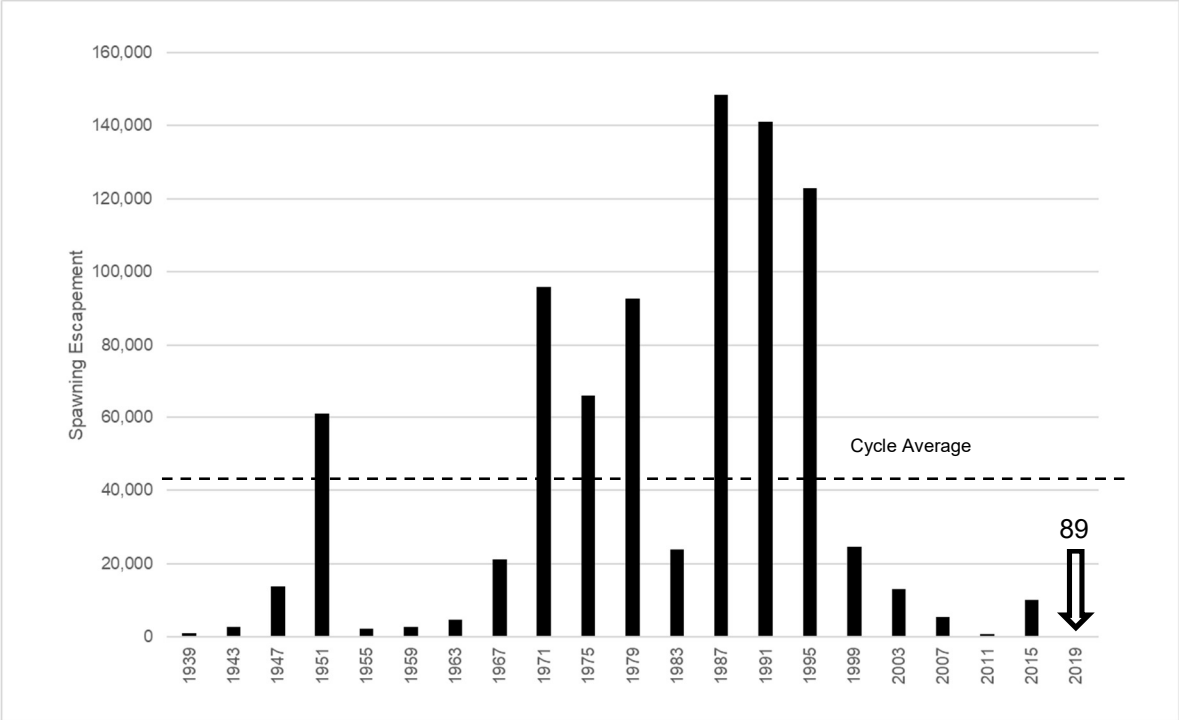

Figure 1. Total Early Stuart Sockeye spawning escapement (1939-2019 cycle line).

TABLE 1. 2019 PRELIMINARY EARLY STUART SOCKEYE SALMON ESCAPEMENT SUMMARY

WATERSHED AREA	PEAK SPAWNING	TOTAL POPULATION	ADULTS	JACKS	MALES	FEMALES	% SPAWN	EFFECTIVE FEMALES*	REMARKS
Takla-Trembleur-Estu									
Driftwood River									
Blackwater Creek		0	0	0	0	0	0.0%	0	
Driftwood River		0	0	0	0	0	0.0%	0	
Kastberg Creek		0	0	0	0	0	0.0%	0	
Kotsine River		0	0	0	0	0	0.0%	0	
Porter Creek		0	0	0	0	0	0.0%	0	
Sub-total:		0	0	0	0	0	0.0%	0	
Takla Lake - Northwest Arm									
Crow Creek		0	0	0	0	0	0.0%	0	
Dust Creek	Aug. 14-23, 2019.	12	12	0	6	6	100.0%	6	Sex ratio and spawning success assumed.
Hooker Creek		0	0	0	0	0	0.0%	0	
Point Creek		0	0	0	0	0	0.0%	0	
Sinta Creek		0	0	0	0	0	0.0%	0	
Sub-total:		12	12	0	6	6	100.0%	6	
Takla Lake - Northeast Arm									
Ankwill Creek		2	2	0	1	1	100.0%	1	Sex ratio and spawning success assumed.
Blanchet Creek		0	0	0	0	0	0.0%	0	
Blanchet North Creek		0	0	0	0	0	0.0%	0	
Frypan Creek		0	0	0	0	0	0.0%	0	
Hudson's Bay Creek		0	0	0	0	0	0.0%	0	
Lovell Creek (Forsythe Creek)		0	0	0	0	0	0.0%	0	
Maclaing Creek (5 Mile Creek)		0	0	0	0	0	0.0%	0	
Shale Creek		2	2	0	1	1	100.0%	1	Sex ratio and spawning success assumed.
15 Mile Creek		2	2	0	1	1	100.0%	1	Sex ratio and spawning success assumed.
25 Mile Creek		0	0	0	0	0	0.0%	0	
Sub-total:		6	6	0	3	3	100.0%	3	
Takla Lake - Main Arm									
Gluske Creek		0	0	0	0	0	0.0%	0	
Narrows Creek	Aug. 14-20, 2019.	10	10	0	5	5	100.0%	5	Sex ratio and spawning success assumed.
Sakeniche River		0	0	0	0	0	0.0%	0	
Sub-total:		10	10	0	5	5	100.0%	5	
Middle River									
Baptiste Creek		0	0	0	0	0	0.0%	0	
Forfar Creek	Aug. 15-28, 2019.	29	29	0	14	15	100.0%	15	Sex ratio and spawning success assumed.
Kazchek Creek		0	0	0	0	0	0.0%	0	
Middle River		0	0	0	0	0	0.0%	0	
O'Ne-Ell Creek (Kynoch Creek)	Aug. 15-20, 2019.	14	14	0	7	7	100.0%	7	Sex ratio and spawning success assumed.
Van Decar Creek (Rossette Creek)	Aug. 22-27, 2019.	10	10	0	5	5	100.0%	5	Sex ratio and spawning success assumed.
Sub-total:		53	53	0	26	27	100.0%	27	

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WATERSHED AREA	PEAK SPAWNING	TOTAL POPULATION	ADULTS	JACKS	MALES	FEMALES	% SPAWN	EFFECTIVE FEMALES*	REMARKS
Trembleur Lake									
Fleming Creek		0	0	0	0	0	0.0%	0	
Paula Creek		3	3	0	1	2	100.0%	2	Sex ratio and spawning success assumed.
Sidney Creek (Felix Creek)		5	5	0	2	3	100.0%	3	Sex ratio and spawning success assumed.
Tildesley Creek		0	0	0	0	0	0.0%	0	
Sub-total:		8	8	0	3	5	100.0%	5	
Stuart Lake									
Sowchea Creek		0	0	0	0	0	0.0%	0	
Sub-total:		0	0	0	0	0	0.0%	0	
TOTALS:		89	89	0	43	46	100.0%	46	

* Effective female totals do not include fish killed for biological samples.