

2010 SUMMER RUN SOCKEYE SALMON

Near Final Escapement Estimates

Background

The Summer Run consists of several populations distributed among four geographic areas within the Fraser River watershed: the Chilcotin, Quesnel, upper Nechako and Stuart river systems. Populations within this timing group enter the lower Fraser River from mid-July through mid-September and migrate immediately upstream to terminal spawning areas. Spawners begin arriving on spawning grounds in mid-August, with the peak of spawning occurring from mid-September to early October. Die-off is generally complete by late October.

The total 2006 brood year Summer Run spawning ground escapement was not enumerated due to funding shortfalls (a small number of populations in the Quesnel system were not assessed in 2006). Escapement to the enumerated populations totalled 815,934 spawners with an average spawning success of 97.2%. The largest assessed spawning populations in 2006 were observed in the Chilko River/Lake aggregate (469,504), Stellako River (147,194) and Horsefly River (106,714).

Escapement Estimation

The 2010 Summer Run escapement estimation plan was based on a pre-season escapement goal of 1,045,000 spawners (at the 50% probability forecast) using standard enumeration methodology based on the number of spawners expected to return by population (Andrew and Webb, 1987). Low precision visual surveys are used to enumerate populations with expected escapements of <75,000 spawners. Enumeration fences, mark-recapture studies or DIDSON (Dual Frequency Identification Sonar) studies are used for populations with expected escapements >75,000 spawners, where high precision estimates are required (the actual technique is based on local characteristics). The escapement estimation plan in 2010 had four components:

Visual Surveys

Most Summer Run populations had expected escapements of less than 75,000 spawners; consequently, they were assessed visually on foot, by boat or by helicopter. Survey frequency ranged from weekly coverage on most systems, to single surveys for remote or difficult to access systems. Where single surveys were used, the survey was timed to coincide with expected peak abundance using temporal patterns in nearby populations to schedule coverage.

On each visual survey the entire spawning area is assessed with counts of live and dead sockeye collected. The sex and spawning success (females only) is recorded for all carcasses recovered. After enumeration, all recovered carcasses are chopped in half with a machete to avoid re-counting on subsequent surveys.

For each stream the total escapement is the sum of the maximum count of live spawners and the cumulative count of recovered carcasses through the date of the peak live count multiplied by an index expansion factor. The total escapement for a stream is reported by males, females and jacks in three steps:

- The total jack recovery is adjusted by applying an expansion factor of 1.26 (Andrew and Webb MS, 1987). The adjusted carcass recovery totals are then used to calculate the proportion of adult males, females and jacks for each stream;
- If the adult carcass recovery sample (excluding unsexed carcasses and jacks) is both temporally and spatially representative throughout the die-off period, then the estimate is

- stratified by adult males, females and jacks on the basis of the proportions calculated above;
- If the total adult carcass recovery is not considered both temporally and spatially representative throughout the die-off period, then the adult sex ratio, jack composition and female spawning success is estimated from a nearby population or population aggregate. Jacks are excluded from this calculation if none were observed during surveys of the stream in question.

The 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. The effective female escapement is the product of the total female escapement and the average female spawning success (excluding sockeye killed for biological samples).

Enumeration Fences

Escapements to the Stellako River and the Horsefly River spawning channel were assessed using counting fences. The Stellako River fence was operated jointly by DFO (Fraser River Stock Assessment) and Stellat'en First Nations. The Horsefly River spawning channel is managed by DFO (Habitat and Enhancement Branch).

The total escapement in fenced streams is estimated from the daily fence counts. The sex specific escapement (including jacks) and female spawning success are estimated from carcasses recovered during foot surveys using the methods as described for visual surveys.

DIDSON (Dual Frequency Identification Sonar)

Escapements to the Chilko River/Lake system and the Horsefly River were assessed using hydroacoustic imaging systems (DIDSON). The Chilko River DIDSON study was conducted jointly by DFO (Fraser River Stock Assessment) and the Tsilhqot'in National Government. The Horsefly River DIDSON study was conducted jointly by DFO (Fraser River Stock Assessment) and the Northern Shuswap Tribal Council.

The procedures used to analyse the DIDSON data to estimate total escapement are similar to those described in Cronkite et. al (2006). The sex specific escapement (including jacks) and female spawning success are estimated from carcasses recovered during foot surveys using the methods as described for visual surveys.

Mark-Recapture

Escapement to the Mitchell River was assessed using mark-recapture methods. This project was conducted as part of ongoing work to calibrate assessment methods for Fraser Sockeye populations between 25,000 and 75,000 spawners and was funded by the Pacific Salmon Commission, Southern Boundary Enhancement and Restoration Fund.

The procedures used to analyse the Mitchell River mark-recapture data and to estimate sex specific escapement (including jacks) and female spawning success are similar to those described in Schubert 2007.

Escapements

The near final Summer Run sockeye escapement estimate totals 2,992,074 of which 1,322,676 are adult males, 1,666,280 are adult females and 3,118 are jacks. This is the largest assessed Summer Run escapement on record for this cycle year (components of the 2002 and 2006 Summer Runs were not assessed on the spawning grounds). It is well above the in-season spawning escapement target (2,080,000) and exceeds the PSC in-season estimate of potential spawning escapement of 2,805,200 by 7% based on Mission hydroacoustic estimates (accounting for in-river harvests above Mission).

The largest Summer Run escapements in 2010 were observed in the Chilko River/Lake aggregate (2,462,975), Stellako River (202,803) and Horsefly River (124,074). Relative to the brood year, sockeye escapements increased in all areas of the watershed. Comparisons of total escapement by area for 2006 and 2010 are: Chilcotin from 459,504 to 2,462,975; Quesnel from 169,768 to 249,376; Nechako from 149,147 to 204,434; and, Stuart from 27,515 to 75,289.

Physical conditions (water levels and temperatures) on the spawning grounds were conducive for spawning in most areas of the watershed during the 2010 Summer Run spawning period. Water levels were lower than average in areas of the Stuart and Quesnel systems but they were not reported to be limiting or restricting fish access (with the exception of some of the smaller West Arm tributaries of Quesnel Lake). Sockeye arrival to the spawning grounds and spawning timing was within normal ranges. Similar to most Early Summer Run Sockeye populations, elevated levels of pre-spawn mortality were observed in the earliest arrivals in most of areas of the watershed for Summer Run Sockeye populations, most notably in the Chilcotin system. Spawning success for the Summer Run aggregate is 88.1% in 2010, below the long term average of 90.4%.

Individual estimates of escapement and spawning success by population are included below in Table 1.

- **Chilcotin** – The Chilcotin system supports several Sockeye populations which are enumerated as an aggregate. The 2010 escapement to this area (2,462,975) is the largest on record, more than double the previous record of 1,039,624 set in 1991. It is 5 times the 2006 brood year escapement (469,504) and 4 times the 1990-2006 cycle year average (604,208). This system experienced elevated levels of pre-spawn mortality in the earliest arrivals, but spawning success gradually improved towards the end of the spawning. Spawning success in the Chilcotin system is the lowest in the watershed at 86.4%, below the long term average of 91.8%.
- **Quesnel** – This system has historically supported ~44 populations on this historically subdominant cycle year. The 2010 escapement to this area (249,376) represents the first increase relative to the brood year for this system since 2004. It is 69% greater than the 2009 (historically the dominant cycle year) escapement of 149,467 and is 48% higher than the 2006 brood of 169,768 (note that a small component of the 2006 escapement was not assessed). Relative to the brood year, escapement to the Horsefly River system (152,169) increased 18% from 129,320 while escapement to the Mitchell River system (75,029) more than tripled the brood (22,446). Spawning success for the Quesnel system in 2010 is 95.4%, well above the long term system average of 84.4%.
- **Upper Nechako** – Although this watershed has historically supported 5 Summer Run sockeye stocks on this cycle year (Table 1), only the Stellako River is consistently productive. However, in 2010 sockeye were reported spawning in two streams where they are not consistently observed (Nithi and Ormonde creeks). The 2010 system escapement is 204,434 almost all of which spawned in the Stellako River. This escapement is 37% higher than the 2006 brood year escapement of 149,147 and 15% higher than the 1990-2006 cycle year average (178,006). Spawning success in the Stellako River is 96.7%, above the long term average of 91.5%.
- **Stuart** – This watershed supports 7 Summer Run populations (Table 1). The total Late Stuart system escapement in 2010 is estimated at 75,289 spawners, the majority (77%) of which spawned in the Tachie River. The 2010 Late Stuart escapement is 3 times higher than the 2006 brood (27,515), but only 80% of the 1990-2006 cycle year average (93,646). Spawning success in the system is 98.0%, well above the long term system average of 92.0%.

References

Andrew, J.H., and T.M. Webb. MS 1987. Review and assessment of adult sockeye salmon enumeration programs on the Fraser River. Prepared by Environmental and Social Systems Analysis Ltd. For the Department of Fisheries and Oceans.

Cronkite, G.M.W., Enzenhofer, H.J., Ridley, T., Holmes, J., Lilija, J., and Benner, K, 2006. Use of high-frequency imaging sonar to estimate adult sockeye salmon escapement in the Horsefly River, British Columbia. Can. Tech. Rep. Fish. Aquat. Sci. 2647: vi + 47 p.

Schubert, N.D. 2007. Estimating the 1995 Fraser River sockeye salmon (*Oncorhynchus nerka*) escapement. Can. Tech. Rep. Fish. Aquat. Sci. 2737: ix + 71 p.

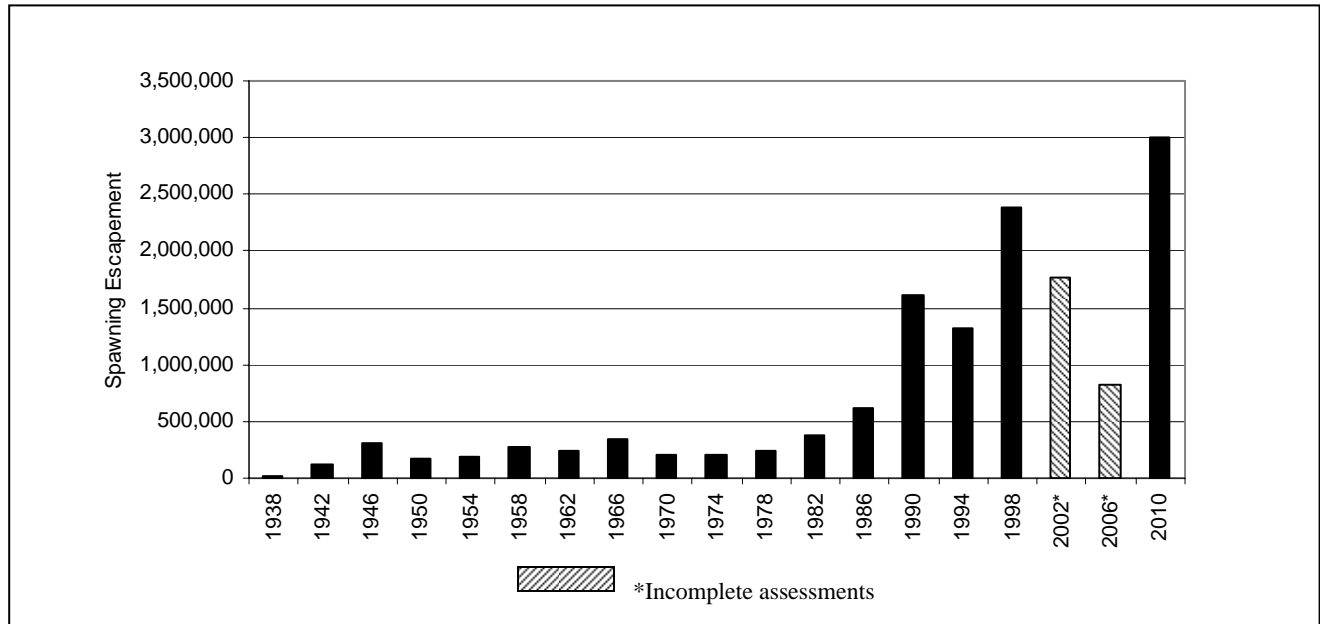


Figure 1. Total spawning escapement for Summer Run sockeye (1938-2010 cycle line)

TABLE 1. 2010 NEAR FINAL SUMMER RUN SOCKEYE SALMON ESCAPEMENT SUMMARY

WATERSHED AREA	PEAK SPAWNING	TOTAL POPULATION	ADULTS	JACKS	MALES	FEMALES	% SPAWN	EFFECTIVE FEMALES ^a	REMARKS
<u>CHILCOTIN SYSTEM</u>									
Chilko River (incl. Lake)	Sep. 27-Oct. 7, 2010.	2,462,975	2,459,946	3,029	1,091,664	1,368,282	86.4%	1,181,540	
AREA TOTAL:		2,462,975	2,459,946	3,029	1,091,664	1,368,282	86.4%	1,181,540	
<u>QUESNEL SYSTEM</u>									
Cariboo River, lower		162	162	0	70	92	93.6%	86	Horsefly R. adult sex ratio and % spawn used.
Cariboo River, upper		1,620	1,620	0	705	915	93.6%	856	Horsefly R. adult sex ratio and % spawn used.
Quesnel River		1,008	1,008	0	439	569	93.6%	532	Horsefly R. adult sex ratio and % spawn used.
Sub-total:		2,790	2,790	0	1,214	1,576	93.6%	1,475	
<u>Horsefly River</u>									
Horsefly Channel		22,493	22,493	0	11,617	10,876	93.6%	10,176	Data provided by HEB channel operator; Horsefly R. % spawn used.
Horsefly River	Sep. 13-17, 2010.	124,074	124,053	21	53,992	70,061	93.6%	65,550	
Little Horsefly River	Sep. 17-24, 2010.	4,068	4,068	0	1,986	2,082	87.6%	1,823	
McKinley Creek, lower	Sep. 15-22, 2010.	1,289	1,289	0	512	777	82.1%	638	
McKinley Creek, upper	Sep. 10-17, 2010.	245	245	0	97	148	82.1%	122	L. McKinley Cr. sex ratio and % spawn used.
Moffat Creek		0	0	0	0	0	0.0%	0	
Tisdall Creek ²		0	0	0	0	0	0.0%	0	
Sub-total:		152,169	152,148	21	68,204	83,944	93.3%	78,309	
<u>Mitchell River</u>									
Cameron Creek	Sep. 26-Oct. 2, 2010.	243	243	0	104	139	99.3%	138	Mitchell R. sex ratio and % spawn used.
Mitchell River	Sep. 18-24, 2010.	74,320	74,320	0	31,879	42,441	99.3%	42,107	
Penfold Creek	Sep. 20-26, 2010.	466	466	0	200	266	99.3%	264	Mitchell R. sex ratio and % spawn used.
Sub-total:		75,029	75,029	0	32,183	42,846	99.3%	42,509	
<u>Quesnel Lake - East Arm</u>									
Big Slide - Shore	Sep. 22-29, 2010.	311	311	0	135	176	93.6%	165	Horsefly R. adult sex ratio and % spawn used.
Bill Miner Creek	Sep. 29-Oct. 5, 2010.	22	22	0	10	12	93.6%	11	Horsefly R. adult sex ratio and % spawn used.
Bill Miner Creek - Shore	Sep. 18-25, 2010.	166	166	0	72	94	93.6%	88	Horsefly R. adult sex ratio and % spawn used.
Blue Lead Creek	Sep. 18-25, 2010.	423	423	0	184	239	93.6%	224	Horsefly R. adult sex ratio and % spawn used.
Blue Lead Creek - Shore	Sep. 27-Oct. 4, 2010.	1,067	1,067	0	464	603	93.6%	564	Horsefly R. adult sex ratio and % spawn used.
Bouldery Creek		0	0	0	0	0	0.0%	0	
Bouldery Creek - Shore ³	Sep. 27-Oct 2, 2010.	382	382	0	166	216	93.6%	202	Horsefly R. adult sex ratio and % spawn used.
Elysia - Shore ²		0	0	0	0	0	0.0%	0	
Junction Shore		0	0	0	0	0	0.0%	0	
Killdog Creek ²		0	0	0	0	0	0.0%	0	
Killdog Creek - Shore ²		0	0	0	0	0	0.0%	0	
Lynx Creek	Sep. 27-Oct. 1, 2010.	76	76	0	33	43	93.6%	40	Horsefly R. adult sex ratio and % spawn used.
Lynx Creek - Shore	Sep. 27-Oct. 3, 2010.	72	72	0	31	41	93.6%	38	Horsefly R. adult sex ratio and % spawn used.
Slate Bay ²		0	0	0	0	0	0.0%	0	
Summit Creek	Sep. 27-Oct. 4, 2010.	214	214	0	93	121	93.6%	113	Horsefly R. adult sex ratio and % spawn used.
Unnamed Point		0	0	0	0	0	0.0%	0	
Sub-total:		2,733	2,733	0	1,188	1,545	93.5%	1,445	

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<u>Quesnel Lake - North Arm</u>									
Bear Beach - Shore	Sep. 30-Oct. 6, 2010.	122	122	0	52	70	99.3%	69	Mitchell R. sex ratio and % spawn used.
Betty Frank's - Shore ²	Sep. 28-Oct 5, 2010.	124	124	0	53	71	99.3%	70	Mitchell R. sex ratio and % spawn used.
Bowling Point	Sep. 17-24, 2010.	473	473	0	203	270	99.3%	268	Mitchell R. sex ratio and % spawn used.
Deception Point	Sep. 17-24, 2010.	6,349	6,349	0	2,614	3,735	97.9%	3,656	
Devoe Creek - Shore	Sep. 14-21, 2010.	36	36	0	16	20	93.6%	19	Horsefly R. adult sex ratio and % spawn used.
Goose Point - Shore	Sep. 21-28, 2010.	648	648	0	278	370	99.3%	367	Mitchell R. sex ratio and % spawn used.
Grain Creek	Sep. 17-21, 2009.	459	459	0	200	259	93.6%	242	Horsefly R. adult sex ratio and % spawn used.
Grain Creek - Shore	Sep. 14-21, 2010.	556	556	0	242	314	93.6%	294	Horsefly R. adult sex ratio and % spawn used.
Isaiah Creek ²	Sep. 20-30, 2010.	97	97	0	42	55	93.6%	51	Horsefly R. adult sex ratio and % spawn used.
Junction Creek	Sep. 21-25, 2010.	22	22	0	9	13	95.2%	12	Wasko Cr. sex ratio and % spawn used.
Limestone Point - Shore ²		0	0	0	0	0	0.0%	0	
Long Creek ²		0	0	0	0	0	0.0%	0	
Long Creek - Shore	Sep. 14-24, 2010.	842	842	0	366	476	93.6%	445	Horsefly R. adult sex ratio and % spawn used.
Marten Creek - Shore ²		0	0	0	0	0	0.0%	0	
Roaring River	Sep. 14-21, 2010	887	887	0	380	507	99.3%	503	Mitchell R. sex ratio and % spawn used.
Roaring River - Shore	Sep. 21-27, 2010.	491	491	0	211	280	99.3%	278	Mitchell R. sex ratio and % spawn used.
Unnamed Cove	Sep. 21-28, 2010.	403	403	0	175	228	93.6%	213	Horsefly R. adult sex ratio and % spawn used.
Wasko Creek, lower	Sep. 19-23, 2010.	4,829	4,829	0	2,080	2,749	95.2%	2,617	
Wasko Creek, upper ²		0	0	0	0	0	0.0%	0	
Watt Creek	Sep. 21-28, 2010.	151	151	0	65	86	99.3%	85	Mitchell R. sex ratio and % spawn used.
Watt Creek - Shore ²	Sep. 21-28, 2010.	166	166	0	71	95	99.3%	94	Mitchell R. sex ratio and % spawn used.
Sub-total:		16,655	16,655	0	7,057	9,598	96.7%	9,283	
<u>Quesnel Lake - West Arm</u>									
Abbot Creek ²		0	0	0	0	0	0.0%	0	No access due to beaver dam.
Hazeltine Creek ²		0	0	0	0	0	0.0%	0	Limited access due to low water.
Spusks Creek ²		0	0	0	0	0	0.0%	0	Limited access due to low water.
Tasse Creek ²		0	0	0	0	0	0.0%	0	Limited access due to low water.
Tasse Creek - Shore ²		0	0	0	0	0	0.0%	0	
Whiffle Creek ²		0	0	0	0	0	0.0%	0	Limited access due to low water.
Sub-total:		0	0	0	0	0	0.0%	0	
AREA TOTAL:		249,376	249,355	21	109,846	139,509	95.4%	133,021	
<u>NECHAKO</u>									
Francois Lake		0	0	0	0	0	0.0%	0	
Nechako River		1,332	1,332	0	588	744	96.7%	719	Stellako R. adult sex ratio and % spawn used.
Nithi River		22	22	0	10	12	96.7%	12	Stellako R. adult sex ratio and % spawn used.
Ormonde Creek	Oct. 7-10, 2010.	277	277	0	122	155	96.7%	150	Stellako R. adult sex ratio and % spawn used.
Stellako River	Sep. 28-Oct. 1, 2010.	202,803	202,783	20	89,572	113,211	96.7%	109,383	
AREA TOTAL:		204,434	204,414	20	90,292	114,122	96.7%	110,264	

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<u>LATE STUART</u>									
Kazchek Creek	Sep. 14-19, 2010.	32	32	0	13	19	98.0%	19	Tachie R. adult sex ratio and % spawn used.
Kuzkwa Creek	Sep. 14-21, 2010.	3,610	3,610	0	1,481	2,129	98.0%	2,086	Tachie R. adult sex ratio and % spawn used.
Middle River	Sep. 21-28, 2010.	13,340	13,340	0	5,474	7,866	98.0%	7,708	Tachie R. adult sex ratio and % spawn used.
Pinchi Creek	Sep. 21-29, 2010.	365	365	0	150	215	98.0%	211	Tachie R. adult sex ratio and % spawn used.
Sakeniche Creek		0	0	0	0	0	0.0%	0	
Sowchea Creek		7	7	0	3	4	98.0%	4	Tachie R. adult sex ratio and % spawn used.
Tachie River	Sep. 21-28, 2010.	57,935	57,887	48	23,753	34,134	98.0%	33,448	
AREA TOTAL:		75,289	75,241	48	30,874	44,367	98.0%	43,476	
TOTALS:									
		2,992,074	2,988,956	3,118	1,322,676	1,666,280	88.1%	1,468,301	

^a Effective female totals do not include fish killed for samples.¹ No historical sockeye spawning population on record.² No historical sockeye spawning population on record for this cycle year.³ Estimate includes area previously reported seperately as Bouldery Shore, 2 km east.