

# 2011 EARLY SUMMER RUN SOCKEYE

## Preliminary Escapement Estimates

Preliminary escapement estimates are based on daily data summaries that have been entered into the computer database at the completion of the field projects. The individual data have not been finally verified, sampling data have not been applied and bias tests have not been performed on the mark-recapture data. Changes in preliminary estimates are likely.

### Background

The Early Summer Run consists of several populations that spawn predominantly in small streams and lakes in seven geographic areas within the Fraser River watershed: Lower Fraser, Seton-Anderson, South Thompson, North Thompson, Chilcotin, Nechako and Upper Fraser watersheds. Populations within this timing group enter the lower Fraser River from mid July to mid August and migrate immediately upstream to terminal spawning areas. Spawners begin arriving on spawning grounds in early August, with peak of spawning from late August to mid September. Die-off is generally complete by late September.

The 2007 brood year escapement for the Early Summer Run totalled 123,461 spawners with an average spawning success of 97.4%. The largest spawning escapements in 2007 were observed in Upper Pitt River system (41,838), North Thompson River (16,940) and Raft River (14,357).

### Escapement Estimation

The 2011 escapement estimation plan was based on a pre-season spawning escapement goal of 181,200 (at the 50% probability forecast) using standard enumeration methodology for 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 less than 75,000 spawners. DIDSON (Dual Frequency Identification Sonar), enumeration fences or mark-recapture studies are used for populations with expected escapements of greater than 75,000 spawners where high precision estimates are required (the actual technique is based on local characteristics). The 2011 escapement estimation plan had four components:

#### *Visual Surveys*

Most Early 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 stream 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).

### ***Carcass Surveys***

Escapements to three lake spawning populations (Chilliwack, Nahatlatch and Taseko lakes) were estimated by expanding carcass recoveries by recovery effort following standard practices (Andrew and Webb, 1987).

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.

### ***Enumeration Fences / Counters***

Escapements to the Nadina River spawning channel and Scotch Creek were assessed using manual counting fences. Escapement to Gates Creek and the Gates Creek spawning channel were assessed using electronic counters. The Nadina River spawning channel and Gates Creek system counters are managed by DFO (Oceans, Habitat and Enhancement Branch). The Scotch Creek fence is operated by the Little Shuswap Indian Band.

The total escapement is estimated from the sum of the daily upstream counts (fence or electronic counter). 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 Upper Pitt River system was assessed using mark-recapture methods.

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

## **Escapements**

The preliminary 2011 Early Summer Run Sockeye spawning escapement estimate totals 231,043 of which 101,487 are adult males, 127,970 are adult females and 1,586 are jacks (Table 1). This is the second largest Early Summer Sockeye spawning escapement on record for this cycle year. It is almost double the 2007 brood year (123,461) and is 32% higher than the recent (1991-2007) cycle average of 174,480 (Figure 1). It slightly exceeds the in-season spawning escapement target of 228,400 and is 61% of the PSC in-season estimate of potential spawning escapement of 375,960 based on Mission hydroacoustic estimates (accounting for in-river harvest above Mission).

The largest Early Summer Run escapements in 2011 were observed in the Gates Creek system (57,437), Upper Pitt River system (56,531) and Scotch Creek (33,814). Notable differences in escapement relative to the brood year were observed in all areas of the watershed with escapements increasing in all areas except the North Thompson. Comparisons of total

escapement by area for 2007 and 2011 are: Lower Fraser from 47,678 to 67,993; Seton-Anderson from 2,898 to 57,437; South Thompson from 24,798 to 66,330; North Thompson from 43,908 to 24,160; Chilcotin from 233 to 964; Nechako from 1,773 to 10,058; and, Upper Fraser from 2,173 to 4,101.

Although water levels were notably higher than average in most areas, physical conditions on the spawning grounds were favourable for the majority of the Early Summer Run spawning period in all areas of the watershed. High water events were noted near the tail end of the spawning period in the Chilliwack Lake system, Upper Pitt River, Nahatlatch River and Nadina River. Sockeye arrival to the spawning grounds and spawning timing was within normal ranges at all populations. With the exception of the North Thompson River, counting conditions were noted to be better than normal through the peak spawning periods at all glacially influenced systems including the Upper Adams, Eagle and Nahatlatch rivers.

Despite favourable conditions on the spawning grounds, elevated levels of pre-spawn mortality were observed in a number of areas in the watershed in 2011, including the Nahatlatch River/Lake, Nadina River system and South Thompson systems. Spawning success for the Early Summer Run aggregate is an estimated 82.2% in 2011, below the long term average of 88.9%.

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

- **Lower Fraser** – This region includes several Early Summer run spawning populations in three unique watersheds (Chilliwack Lake, Upper Pitt River and Nahatlatch Lake systems). The 2011 spawning escapement to this group totals 67,993, the majority of which spawned in Upper Pitt River system (56,531). Escapements increased relative to the brood and recent (1991-2007) cycle year averages in all three systems. As most Lower Fraser Early Summer Run populations typically have large 5 year old components, it is expected that, like the 4 year old returns in 2010, the 5 year old returns in 2011 experienced much higher than average marine survival rates. Results from samples collected on the spawning grounds are not yet available to confirm age composition. As noted above, visibility on all glacially influenced streams in the Lower Fraser area was exceptional for the second consecutive year in 2011, providing for excellent counting conditions as well as an opportunity to observe and document Sockeye spawning behaviour and distribution in these systems. Comparisons of total escapement by system for 2007 and 2011 are: Upper Pitt River system from 41,838 to 56,531; Chilliwack Lake system from 1,987 to 4,493; and the Nahatlatch Lake system from 3,853 to 6,969. Spawning success in the Upper Pitt system (98.8%) and Chilliwack system (99.6%) is above the long term system averages of 89.1% and 91.2%, respectively. Spawning success in the Nahatlatch system (85.6%) is below the long term average of 93.6%.
- **Seton-Anderson** – This area has two Early Summer Run Sockeye spawning sites; Gates Creek and Gates Creek Spawning Channel. The 2011 escapement to the system (57,437) is the largest on record for this cycle year. It is almost 20 times higher than the brood (2,898) and 5 times higher than the 1991-2007 cycle average (10,661). Although spawning success in the system is the second lowest observed in the watershed (74.1%), it is consistent with the long term system average. Spawning success in both the channel (52.5%) and creek (82.2%) are above the long term averages for the individual sites (43.9% and 72.3%, respectively). High water in the system in mid-August delayed channel operations until after Sockeye arrival to the system. Once operational (August 15<sup>th</sup>) channel loading was weighted towards the front end of the run (loaded to capacity by August 26<sup>th</sup>). As pre-spawn mortality is weighted towards the earliest arrivals, spawning success in the channel was notably lower than the creek population.
- **South Thompson** – This watershed has ~ twelve Early Summer Run spawning sites on this cycle year, typically dominated by the Seymour River. The 2011 spawning escapement to

this system (66,330) is almost 3 times the brood year (24,798) and slightly higher than the 1991-2007 cycle average (62,878). Record cycle year escapements were observed in six streams in 2011, including Scotch Creek (33,814), Eagle River (10,676) and Upper Adams River (538). Notable increases relative to brood were observed at Scotch Creek (8,274 to 33,814), Seymour River (9,911 to 16,110) and Eagle River (4,729 to 10,676). Visibility was reported to be good to excellent on glacially influenced streams such as Upper Adams, Eagle and Perry rivers in 2011. Physical conditions (water levels and temperatures) were reported as good at all Early Summer Sockeye spawning streams in the South Thompson. Despite the favourable conditions, most populations experienced elevated pre-spawn mortality levels on the earliest arrivals. Spawning success for the system is estimated at 75.8% (ranging from 62.5% to 94.3%), well below the long-term system average of 94.1%.

- **North Thompson** – This watershed has historically supported eight Early Summer spawning sites on this cycle year, one of which had no observed spawners in 2011 (Finn Creek). Decreases relative to the 2007 brood year were observed at all major system populations, the largest of which was observed in the North Thompson River mainstem. The reported 2011 escapement to the North Thompson River mainstem (4,205) is only 25% of the 2007 brood escapement (16,940); however high water and glacial turbidity in the North Thompson River mainstem resulted in extremely poor counting conditions during the peak spawning period. As a result, the reported estimate for the North Thompson River should be considered a minimum estimate. The Raft River escapement (9,243) is 64% of the brood (14,357), but is 40% higher than the recent (1991-2007) cycle average (6,588). Escapement to Fennell Creek (9,884) is 88% of the brood (11,218) and 85% of the recent cycle year average (11,593). Spawning success in the system is an estimated 86.0%, below the long-term system average of 88.4%.
- **Chilcotin** – The Taseko Lake system supports the Early Summer Run Sockeye in this area. Historically, one spawning site was documented (Taseko Lake shore spawners); however Sockeye were observed spawning in Yohetta Creek (tributary of the Tchaikazan River) for the second consecutive year in 2011. Escapement to this system (964) is 4 times the brood year (233) but similar to the recent (1995-2007) cycle year average (903). Spawning success for the system is an estimated 91.1%, below the long term average of 95.9%.
- **Nechako** – This area has two Early Summer Run Sockeye spawning sites on this cycle year; Nadina River and Nadina River Spawning Channel. The 2011 escapement (10,058) is over 5 times the brood (1,773) but only 50% of the recent (1991-2007) cycle average (20,092). The 2011 escapement represents the first increase relative to the brood on this cycle year since the record cycle escapement in 1991 (61,174). Despite relatively good conditions on the spawning grounds, elevated levels of pre-spawn mortality were observed in the system throughout the duration of the run. The estimated spawning success in system is the lowest in the watershed at 43.4%, well below the long term system average of 89.6%. Due to a high water event at the tail of the spawning period combined with extremely heavy predator activity in the system, carcass recoveries in the river were limited; therefore channel estimates of sex ratio and spawning success have been applied to the river. In season reports of a relatively high proportion of males in the system were confirmed in the channel carcass recovery sample (72% males).
- **Upper Fraser** – The Bowron River and its tributaries support the only persistent Early Summer run populations in the Upper Fraser watershed. The 2011 system escapement (4,101) is almost double the brood year (2,173) but only 36% of the recent (1991-2007) cycle average of 11,307. Spawning success for this system is an estimated 97.3%, above the long-term system average of 91.2%.

## 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.

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

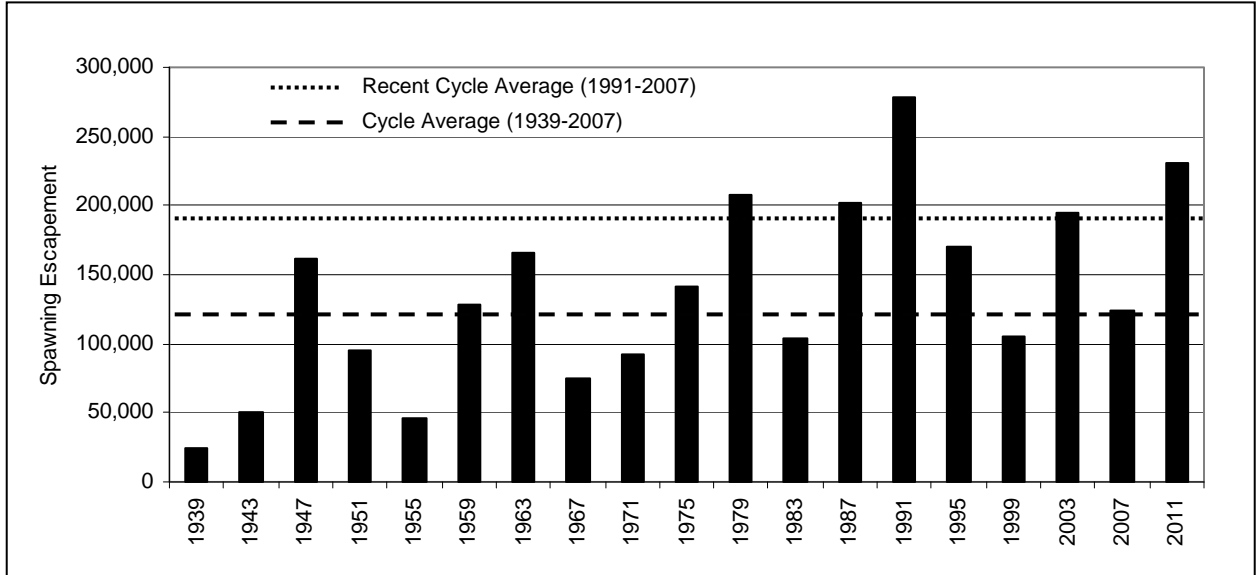


Figure 1. Total spawning escapement for Early Summer Run sockeye (1939-2011 cycle line)

TABLE 1. 2011 PRELIMINARY EARLY SUMMER RUN SOCKEYE SALMON ESCAPEMENT SUMMARY

WATERSHED AREA	PEAK SPAWNING	TOTAL POPULATION	ADULTS	JACKS	MALES	FEMALES	% SPAWN	EFFECTIVE FEMALES*	REMARKS
<u>LOWER FRASER RIVER</u>									
<u>Chilliwack Lake</u>									
Chilliwack Lake		3,836	3,824	12	1,711	2,113	99.6%	2,105	
Dolly Varden Creek	Aug. 23-30, 2011.	657	655	2	293	362	99.6%	361	Chilliwack Lake sex ratio and % spawn used.
Sub Total:		4,493	4,479	14	2,004	2,475	99.6%	2,466	
<u>Nahatlatch Lake</u>									
Nahatlatch Lake		1,781	1,777	4	746	1,031	81.4%	839	Nahatlatch comp. sex ratio used.
Nahatlatch River	Sep. 2-9, 2011.	5,188	5,178	10	2,174	3,004	87.1%	2,616	Nahatlatch comp. sex ratio used.
Sub Total:		6,969	6,955	14	2,920	4,035	85.6%	3,455	
<u>Pitt River, upper</u>									
Blue Creek <sup>2</sup>		0	0	0	0	0	0.0%	0	
Corbold Creek <sup>2</sup>	Sep. 3-10, 2011.	13,756	13,756	0	6,332	7,424	98.8%	7,332	U.Pitt R. system adult sex ratio and % spawn used.
Cypress Creek <sup>2</sup>		0	0	0	0	0	0.0%	0	
Fish Hatchery Creek <sup>2</sup>	Sep. 7-10, 2011.	1,319	1,319	0	607	712	98.8%	703	U.Pitt R. system adult sex ratio and % spawn used.
North Boise Creek <sup>2</sup>		0	0	0	0	0	0.0%	0	
Pitt River, upper	Sep. 6-16, 2011.	40,031	40,018	13	18,475	21,543	98.8%	20,646	Estimate includes 648 males and 641 females killed for hatchery egg take.
Slough Creek <sup>2</sup>	Sep. 10-16, 2011.	90	90	0	41	49	98.8%	48	U.Pitt R. system adult sex ratio and % spawn used.
South Boise Creek <sup>2</sup>	Sep. 12-18, 2011.	502	502	0	231	271	98.8%	268	U.Pitt R. system adult sex ratio and % spawn used.
Upper Pitt Channel <sup>2</sup>	Sep. 7-13, 2011.	833	833	0	383	450	98.8%	444	U.Pitt R. system adult sex ratio and % spawn used.
Sub Total:		56,531	56,518	13	26,069	30,449	98.8%	29,441	
AREA TOTAL:		67,993	67,952	41	30,993	36,959	97.4%	35,362	
<u>SETON-ANDERSON</u>									
Gates Channel		18,330	17,677	653	7,898	9,779	52.5%	5,136	
Gates Creek	Sep. 1-8, 2011.	39,107	38,219	888	12,255	25,964	82.2%	21,344	
AREA TOTAL:		57,437	55,896	1,541	20,153	35,743	74.1%	26,480	
<u>EARLY SOUTH THOMPSON</u>									
Adams River	Aug. 30, 2011.	29	29	0	14	15	73.2%	11	Scotch Cr. sex ratio and % spawn used.
Anstey River		2,495	2,495	0	1,040	1,455	94.3%	1,372	
Burton Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Cayenne Creek	Aug. 30, 2011.	14	14	0	7	7	73.2%	5	Scotch Cr. sex ratio and % spawn used.
Celista Creek		0	0	0	0	0	0.0%	0	
Crazy Creek		0	0	0	0	0	0.0%	0	
Eagle River	Aug. 31-Sep. 7, 2011.	10,676	10,676	0	4,157	6,519	72.7%	4,739	
Four Mile Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	

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Gorge Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Huihill Creek		86	86	0	43	43	73.2%	31	Scotch Cr. sex ratio and % spawn used.
Hunakwa Creek		0	0	0	0	0	0.0%	0	
Loftus Creek	Aug. 29-Sep. 1, 2011.	40	40	0	16	24	72.7%	17	Eagle R. sex ratio and % spawn used.
McNomee Creek	Sep. 1-3, 2011.	346	346	0	189	157	62.5%	98	
Momich River		0	0	0	0	0	0.0%	0	
Nikwikwaia Creek <sup>1</sup>		29	29	0	14	15	73.2%	11	Scotch Cr. sex ratio and % spawn used.
Pass Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Perry River	Aug. 31-Sep. 7, 2011.	1,237	1,237	0	482	755	72.7%	549	Eagle R. sex ratio and % spawn used.
Scotch Creek	Aug. 28-Sep. 3, 2011.	33,814	33,814	0	16,782	17,032	73.2%	12,464	Fence operated by SNFC.
Seymour River	Aug. 27-Sep. 3, 2011.	16,110	16,110	0	6,226	9,884	79.9%	7,896	
Upper Adams River	Sep. 1-8, 2011.	538	538	0	267	271	73.2%	198	Scotch Cr. sex ratio and % spawn used.
Upper Momich River <sup>1</sup>		0	0	0	0	0	0.0%	0	
Yard Creek	Aug. 31-Sep. 7, 2011.	916	916	0	381	535	83.8%	448	
AREA TOTAL:		66,330	66,330	0	29,618	36,712	75.8%	27,839	
<u>NORTH THOMPSON</u>									
Barriere River		103	103	0	48	55	84.2%	46	Fennel Cr. sex ratio and % spawn used.
Clearwater River	Sep. 9-12, 2011.	419	419	0	189	230	87.2%	200	Raft R. sex ratio and % spawn used.
Fennell Creek	Aug. 24-28, 2011.	9,884	9,884	0	4,572	5,312	84.2%	4,475	
Finn Creek		0	0	0	0	0	0.0%	0	
Grouse Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Harper Creek	Aug. 24-29, 2011.	104	104	0	48	56	84.2%	47	Fennel Cr. sex ratio and % spawn used.
Hemp Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Lemieux Creek	Sep. 2-5, 2011.	202	202	0	95	107	96.4%	103	
Lion Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Mann Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
North Thompson River	Sep. 20-25, 2011.	4,205	4,205	0	1,893	2,312	87.2%	2,015	Raft R. adult sex ratio and % spawn used.
Raft River	Sep. 2-6, 2011.	9,243	9,241	2	4,159	5,082	87.2%	4,430	
AREA TOTAL:		24,160	24,158	2	11,004	13,154	86.0%	11,316	
<u>CHILCOTIN SYSTEM</u>									
Taseko Lake		960	960	0	469	491	91.1%	447	
Yohetta Creek, upper <sup>4</sup>		4	4	0	2	2	91.1%	2	Taseko Lake sex ratio and % spawn used.
AREA TOTAL:		964	964	0	471	493	91.1%	449	
<u>NECHAKO</u>									
Glacier Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Nadina Channel		6,523	6,521	2	4,695	1,826	43.4%	792	

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Nadina River	Sep. 13-20, 2011.	3,535	3,535	0	2,545	990	43.4%	430	Nadina Channel sex ratio and % spawn used.
AREA TOTAL:		10,058	10,056	2	7,240	2,816	43.4%	1,222	
<u>UPPER FRASER</u>									
Bowron River, upper	Sep. 4-12, 2011.	4,004	4,004	0	1,961	2,043	97.3%	1,988	
Bowron River, lower <sup>4</sup>		0	0	0	0	0	0.0%	0	
Huckey Creek <sup>3</sup>	Sep. 4-12, 2011.	97	97	0	47	50	97.3%	49	Bowron River sex ratio and % spawn used.
Indianpoint Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Pomerov Creek <sup>3</sup>		0	0	0	0	0	0.0%	0	
Sus Creek <sup>3</sup>		0	0	0	0	0	0.0%	0	
AREA TOTAL:		4,101	4,101	0	2,008	2,093	97.3%	2,037	
<b>TOTALS:</b>		<b>231,043</b>	<b>229,457</b>	<b>1,586</b>	<b>101,487</b>	<b>127,970</b>	<b>82.2%</b>	<b>104,704</b>	

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

<sup>1</sup> No historical sockeye spawning population on record for this cycle year.

<sup>2</sup> Historical escapements previously included as part of the Upper Pitt River escapement.

<sup>3</sup> Historical escapements previously included as part of the Bowron River escapement.

<sup>4</sup> Not previously surveyed on this cycle year.