

# 2011 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 Summer Run consists of several populations distributed among four geographic areas within the Fraser River watershed: the Chilcotin, Quesnel, 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 2007 brood year escapement for the Summer Run totalled 432,274 spawners with an average spawning success of 96.7%. The largest spawning escapements in 2007 were observed in the Chilko River/Lake aggregate (306,707), Horsefly River (55,181) and Stellako River (41,481).

### Escapement Estimation

The 2011 escapement estimation plan was based on a pre-season spawning escapement goal of 600,000 (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 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).

Visual surveys were conducted jointly by DFO (Fraser River Stock Assessment), Stellat'en First Nations (Nechako system) and T'lazt'en First Nations (Stuart system).

### ***Enumeration Fences***

Escapement to the Horsefly River spawning channel was assessed by counting fence. The spawning channel is operated and managed by DFO, Ecosystems Management Branch.

The total escapement in fenced streams is estimated from the sum of 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)***

Escapement to the Chilko River/Lake system was assessed using hydroacoustic imaging systems (DIDSON). The Chilko River DIDSON project was conducted jointly by DFO (Fraser River Stock Assessment) and the Tsilhqot'in National Government.

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 Stellako River was assessed using mark-recapture methods. The Stellako River mark-recapture study was conducted jointly by DFO (Fraser River Stock Assessment) and Stellat'en First Nations.

The procedures used to analyse the Stellako 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 Summer Run Sockeye spawning escapement estimate totals 1,052,670 of which 420,934 are adult males, 628,318 are adult females and 3,418 are jacks (Table 1). This is the fourth largest Summer Run spawning escapement on record for this cycle year (Figure 1). It is almost 2.5 times the 2007 brood year (432,274) and is 7% higher than the recent (1991-2007) cycle average of 980,436 (Figure 1). It is well above both the in-season spawning escapement target and the Pacific Salmon Commission in-season estimate of potential spawning escapement (accounting for in-river harvest above Mission) of 622,400 and 770,840, respectively.

The largest Summer Run escapements in 2011 were observed in the Chilko River/Lake system (918,537) and Stellako River (84,318). Notable differences in escapement relative to the brood year were observed in all watershed areas, with escapements increasing in the Chilcotin and

Nechako systems and decreasing in the Quesnel and Stuart systems. Comparisons of total escapement by area for 2007 and 2011 are: Chilcotin from 306,707 to 918,537; Quesnel from 75,100 to 45,475; Nechako from 41,760 to 84,628; and Stuart from 8,707 to 4,030.

Although water levels were higher than average in most areas of the watershed, physical conditions (water levels and temperatures) on the spawning grounds were favourable throughout the Summer Run spawning period in all areas. Sockeye arrival to the spawning grounds was slightly later than normal (~1 week) in most watershed areas in 2011; however, spawning timing was within normal ranges at all populations.

The elevated pre-spawn mortality levels observed in the Early Stuart and Early Summer Run timing groups in 2011 continued through the Summer Run spawning period. Although weighted towards the earliest arrivals, elevated pre-spawn mortality was observed throughout the duration of the Summer Run spawning period in all areas of the watershed. Spawning success for the Summer Run aggregate is an estimated 79.6% in 2011, well below the long term average of 90.3%.

Estimates of escapement and spawning success by watershed area and spawning site are provided in Table 1.

- **Chilcotin** – The Chilcotin system supports several Sockeye spawning sites which are enumerated as an aggregate. The 2011 escapement to this area (918,537) is the third largest on record for this cycle year (Figure 2a). It is 3 times the 2007 brood year escapement (306,707) and 35% higher than the 1991-2007 cycle year average (679,649). Spawning success in the Chilcotin system is an estimated 81.6%, well below the long term average of 91.8%.
- **Quesnel** – This system supports ~30 spawning sites on this cycle year. The 2011 escapement to this area (45,475) is 61% of the brood year escapement (75,100) and 28% of the 1991-2007 cycle year average (161,200) (Figure 2b). Relative to the brood year, escapement to the Horsefly River system (32,386) decreased 47% from 60,792 while escapement to the Mitchell River system (11,558) increased 17% over brood (9,880). Spawning success for the Quesnel system in 2011 is an estimated 69.0%, well below the long term system average of 84.6%.
- **Nechako** – This system typically supports 2 Summer Run sockeye spawning sites on this cycle year; however in 2011 Sockeye were observed spawning in a tributary of Francois Lake (Nithi Creek) where they are not consistently observed (Table 1). Due to abnormally high water levels in the system, the Stellako River enumeration fence was replaced by a mark-recapture study in 2011. The total escapement to this area is 84,628, almost all of which spawned in the Stellako River. This escapement is double the 2007 brood year escapement of 41,760, but falls short of the 1991-2007 cycle year average (95,390) (Figure 2c). Spawning success in the Stellako River is an estimated 60.1% in 2011, well below the long term average of 91.7%.
- **Stuart** – This watershed typically supports 5 Summer Run spawning sites on this cycle year. The total system escapement in 2011 (4,030) is 46% of the 2007 brood (8,707) and only 9% of the 1991-2007 cycle year average (44,197) (Figure 2d). Spawning success in the system is 53.8%, well below the long term system average of 91.9%.

## 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 + 71p.

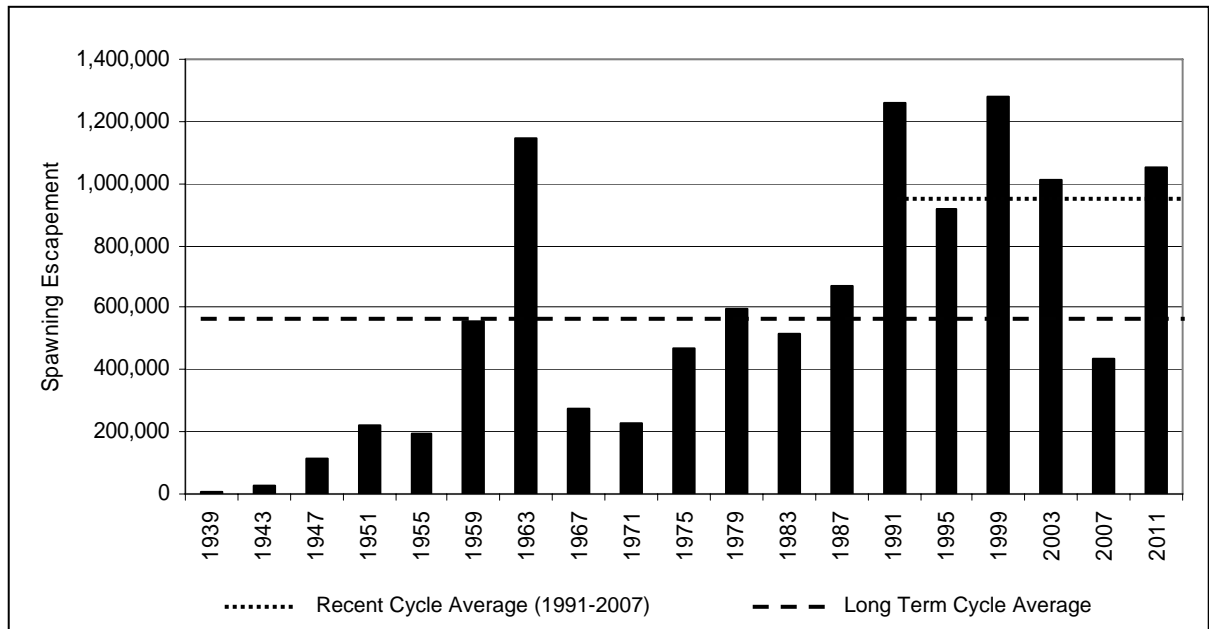
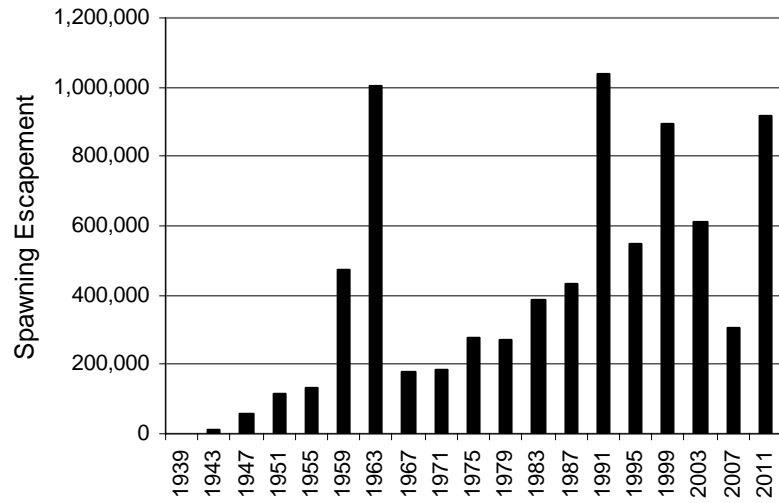
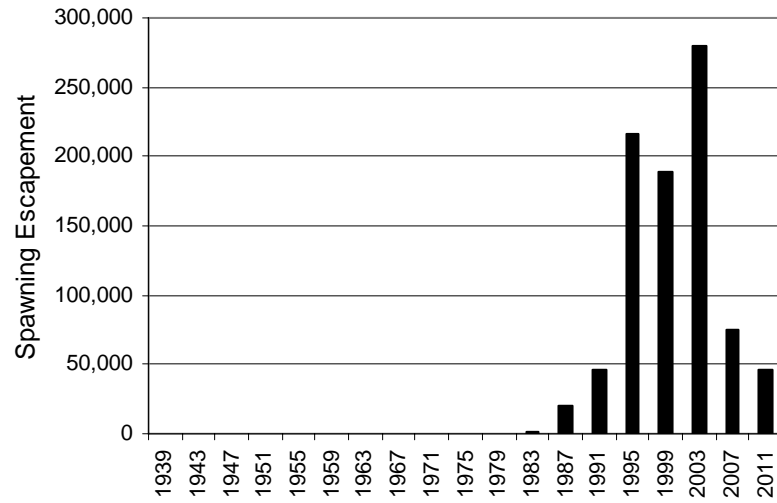


Figure 1. Total Summer Run Sockeye spawning escapement on the 1939-2011 cycle line.

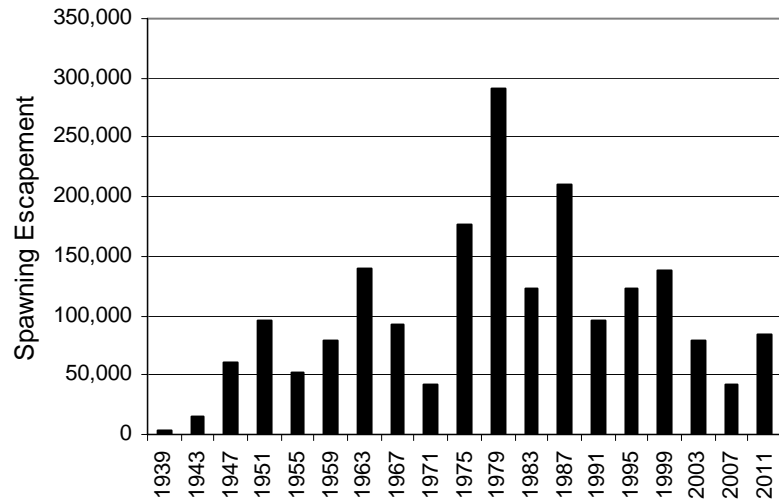
a. Chilcotin



b. Quesnel



c. Nechako



d. Stuart

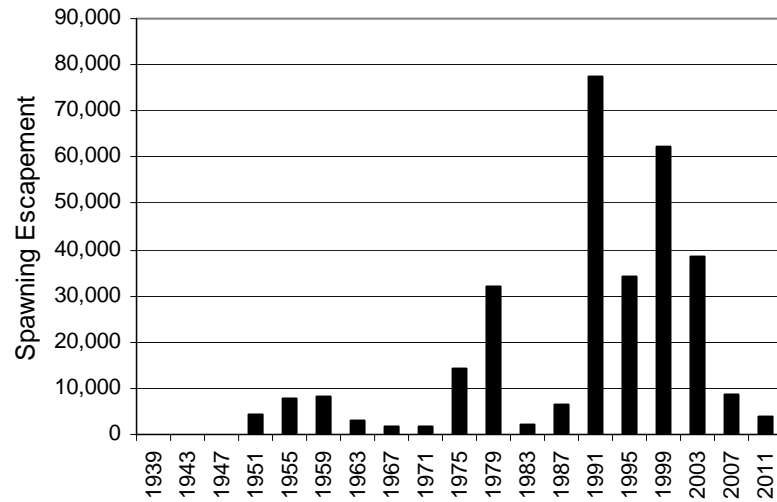


Figure 2 (a-d). Total Summer Run Sockeye spawning escapement for the Chilcotin (a), Quesnel (b), Nechako (c) and Stuart (d) systems on the 1939-2011 cycle line.

TABLE 1. 2011 PRELIMINARY SUMMER RUN SOCKEYE SALMON ESCAPEMENT SUMMARY

WATERSHED AREA	PEAK SPAWNING	TOTAL	ADULTS	JACKS	MALES	FEMALES	% SPAWN	EFFECTIVE FEMALES <sup>a</sup>	REMARKS
<u>CHILCOTIN SYSTEM</u>									
Chilko River (incl. Lake)	Sep. 24-Oct.5, 2011.	918,537	915,892	2,645	355,189	560,703	81.6%	457,537	
AREA TOTAL:		918,537	915,892	2,645	355,189	560,703	81.6%	457,537	
<u>QUESNEL SYSTEM</u>									
Cariboo River, lower		0	0	0	0	0	0.0%	0	
Quesnel River		38	38	0	17	21	67.6%	14	Horsefly R. sex ratio and % spawn used.
Sub-total:		38	38	0	17	21	67.6%	14	
<u>Horsefly River</u>									
Horsefly Channel		2,362	2,362	0	1,257	1,105	67.6%	747	Horsefly R. % spawn used.
Horsefly River	Sep. 6-16, 2011.	29,666	29,666	0	13,219	16,447	67.6%	11,116	
Little Horsefly River	Sep. 17-23, 2011.	286	286	0	127	159	67.6%	107	Horsefly R. sex ratio and % spawn used.
McKinley Creek, lower	Sep. 17-23, 2011.	72	72	0	32	40	67.6%	27	Horsefly R. sex ratio and % spawn used.
McKinley Creek, upper		0	0	0	0	0	0.0%	0	
Moffat Creek		0	0	0	0	0	0.0%	0	
Tisdall Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Sub-total:		32,386	32,386	0	14,635	17,751	67.6%	11,997	
<u>Mitchell River</u>									
Cameron Creek		0	0	0	0	0	0.0%	0	
Mitchell River	Sep. 16-22, 2011.	11,542	11,542	0	5,533	6,009	72.8%	4,372	
Penfold Creek		16	16	0	8	8	72.8%	6	Mitchell R. sex ratio and % spawn used.
Sub-total:		11,558	11,558	0	5,541	6,017	72.8%	4,378	
<u>Quesnel Lake - East Arm</u>									
Big Slide - Shore <sup>1</sup>	Oct. 1-6, 2011.	14	14	0	6	8	67.6%	5	Horsefly R. sex ratio and % spawn used.
Bill Miner Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Bill Miner Creek - Shore		0	0	0	0	0	0.0%	0	
Blue Lead Creek		25	25	0	11	14	67.6%	9	Horsefly R. sex ratio and % spawn used.
Blue Lead Creek - Shore	Oct. 1-6, 2011.	164	164	0	73	91	67.6%	62	Horsefly R. sex ratio and % spawn used.
Bouldery Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Bouldery Creek - Shore	Oct. 1-6, 2011.	31	31	0	14	17	67.6%	11	Horsefly R. sex ratio and % spawn used.
Elysia - Shore <sup>2</sup>		0	0	0	0	0	0.0%	0	
Junction Shore <sup>1</sup>		0	0	0	0	0	0.0%	0	
Lynx Creek	Sep. 25-Oct. 5, 2011	22	22	0	10	12	67.6%	8	Horsefly R. sex ratio and % spawn used.
Lynx Creek - Shore		4	4	0	2	2	67.6%	1	Horsefly R. sex ratio and % spawn used.
Slate Bay <sup>1,3</sup>		0	0	0	0	0	0.0%	0	
Summit Creek	Oct. 6-12, 2011.	146	146	0	65	81	67.6%	55	Horsefly R. sex ratio and % spawn used.
Sub-total:		406	406	0	181	225	67.6%	152	
<u>Quesnel Lake - North Arm</u>									
Bear Beach - Shore		0	0	0	0	0	0.0%	0	
Betty Frank's - Shore		0	0	0	0	0	0.0%	0	
Bowling Point		11	11	0	5	6	72.8%	4	Mitchell R. sex ratio and % spawn used.

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WATERSHED AREA	PEAK SPAWNING	TOTAL	ADULTS	JACKS	MALES	FEMALES	% SPAWN	EFFECTIVE FEMALES <sup>a</sup>	REMARKS
Deception Point	Sep. 26-Oct. 2, 2011.	497	497	0	238	259	72.8%	188	Mitchell R. sex ratio and % spawn used.
Goose Point - Shore	Sep. 17-23, 2011.	63	63	0	30	33	72.8%	24	Mitchell R. sex ratio and % spawn used.
Grain Creek		0	0	0	0	0	0.0%	0	
Grain Creek - Shore		0	0	0	0	0	0.0%	0	
Isaiah Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Junction Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Long Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Long Creek - Shore <sup>1</sup>		0	0	0	0	0	0.0%	0	
Roaring River	Sep. 15-21, 2011.	113	113	0	54	59	72.8%	43	Mitchell R. sex ratio and % spawn used.
Roaring River - Shore		11	11	0	5	6	72.8%	4	Mitchell R. sex ratio and % spawn used.
Unnamed Cove <sup>1</sup>		0	0	0	0	0	0.0%	0	
Wasko Creek, lower	Sep. 15-21, 2011.	248	248	0	119	129	72.8%	94	Mitchell R. sex ratio and % spawn used.
Wasko Creek, upper <sup>1</sup>		0	0	0	0	0	0.0%	0	
Watt Creek	Sep. 12-18, 2011.	18	18	0	9	9	72.8%	7	Mitchell R. sex ratio and % spawn used.
Watt Creek - Shore		43	43	0	21	22	72.8%	16	Mitchell R. sex ratio and % spawn used.
Sub-total:		1,004	1,004	0	481	523	72.8%	381	
<u>Quesnel Lake - West Arm</u>									
Abbot Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Hazeltine Creek <sup>1</sup>		83	83	0	37	46	67.6%	31	Horsefly R. sex ratio and % spawn used.
Spusks Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Tasse Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Whiffle Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	
Sub-total:		83	83	0	37	46	67.6%	31	
AREA TOTAL:		45,475	45,475	0	20,892	24,583	69.0%	16,953	
<u>NECHAKO</u>									
Francois Lake <sup>1</sup>		0	0	0	0	0	0.0%	0	
Nechako River	Sep. 21-28, 2011	245	245	0	124	121	60.1%	73	Stellako R. adult sex ratio and % spawn used.
Nithi River	Oct. 1-10, 2011	65	65	0	33	32	60.1%	19	Stellako R. adult sex ratio and % spawn used.
Ormonde Creek		0	0	0	0	0	0.0%	0	
Stellako River	Sep. 25-Oct. 4, 2011	84,318	83,816	502	42,367	41,449	60.1%	24,896	
AREA TOTAL:		84,628	84,126	502	42,524	41,602	60.1%	24,988	
<u>STUART</u>									
Kazchek Creek		16	16	0	10	6	52.8%	3	Tachie R. adult sex ratio and % spawn used.
Kuzkwa Creek	Sep. 21-35, 2011.	616	569	47	358	211	59.7%	126	
Middle River	Sep. 23-27, 2011.	603	563	40	348	215	52.8%	113	Tachie R. sex ratio and % spawn used.
Pinchi Creek	Sep. 24-28, 2011.	338	316	22	195	121	52.8%	64	Tachie R. sex ratio and % spawn used.
Sakeniche Creek <sup>1</sup>		0	0	0	0	0	0.0%	0	

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Sowchea Creek		0	0	0	0	0	0.0%	0	
Tachie River	Sep. 22-26, 2011.	2,457	2,295	162	1,418	877	52.8%	463	
AREA TOTAL:		4,030	3,759	271	2,329	1,430	53.8%	769	
TOTALS:		1,052,670	1,049,252	3,418	420,934	628,318	79.6%	500,247	

<sup>a</sup> Effective female totals do not include fish killed for samples.

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

<sup>2</sup> Estimate includes area previously reported separately as Elysia Shore, 1 km west.

<sup>3</sup> Estimate includes area previously reported separately as Slate Bay, 1 km east.