



**WCVI Salmon Bulletin
June 20, 2019 Assessment Update
Area 23 Sockeye – Barkley Sound/Alberni Inlet**

Catch Estimates:

Total catch estimated to date is 29,987 adult sockeye:

Maa-nulth Treaty	874
Tsu-ma-uss	20,654
Commercial Gillnet (Area D)	6,700
Commercial Seine Net (Area B)	-
Recreational	877
Test Fishery	882
Stewardship	-
TOTAL	29,987

Escapement Estimates:

The total adult sockeye escapement to the Somass system is estimated at about 15,762 adults (12,371 Sproat, and 3,391 Great Central) through Wednesday, June 19 (the estimates are extrapolated for June 19). About 22% of the observed escapement to date is from the Great Central population. Future fisheries management of Somass sockeye as a combined stock requires similar productivity among the two populations.

Below, are a series of figures that express 2019 sockeye escapement observations relative to average escapement timing for the period from 2001 to 2018 and the target escapement for GCL and Sproat Lake based on the average stock composition of the aggregate forecasted run size in the sockeye management table. Although informative, in some years the observed escapement rate relative to average escapement timing may be a poor indication of final run abundance. In contrast to 'run timing', (i.e., the return of sockeye to Alberni Inlet) escapement timing tends to be more variable and is influenced by the impact of fisheries and environmental conditions, such as river temperature or flow.

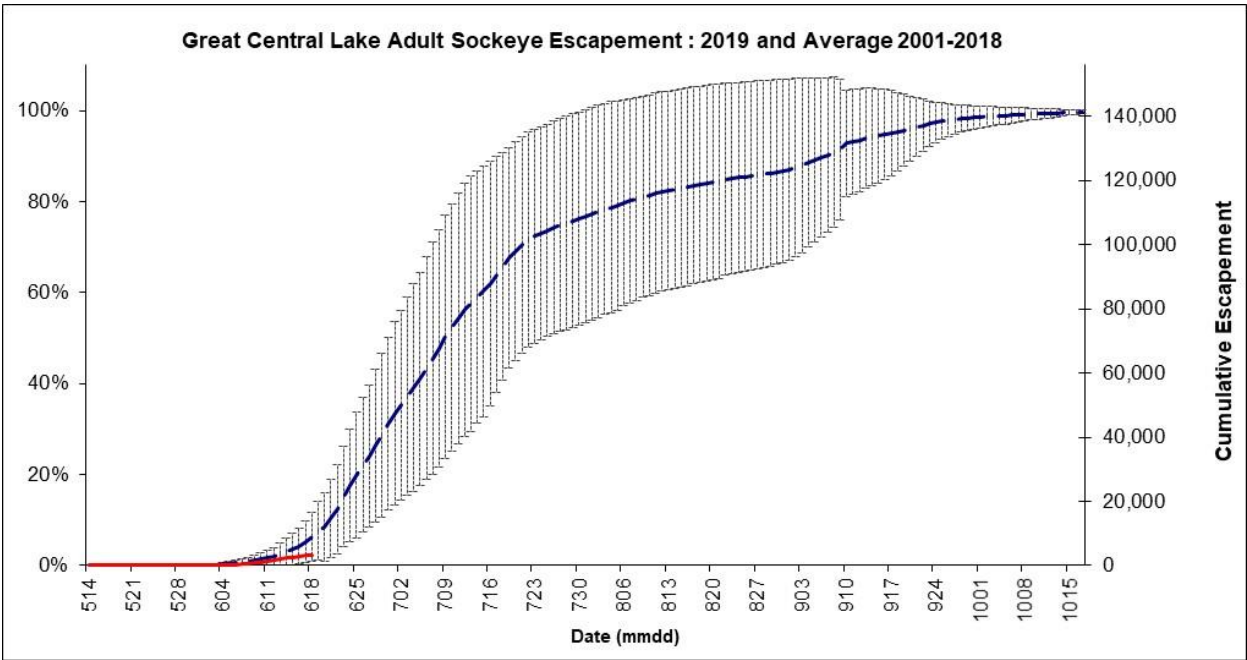


Figure 1. 2019 Great Central Lake sockeye escapement relative to average escapement timing. The total expected escapement is based on a target of 141,750 assuming Great Central Lake sockeye will comprise 54% of the Somass return.

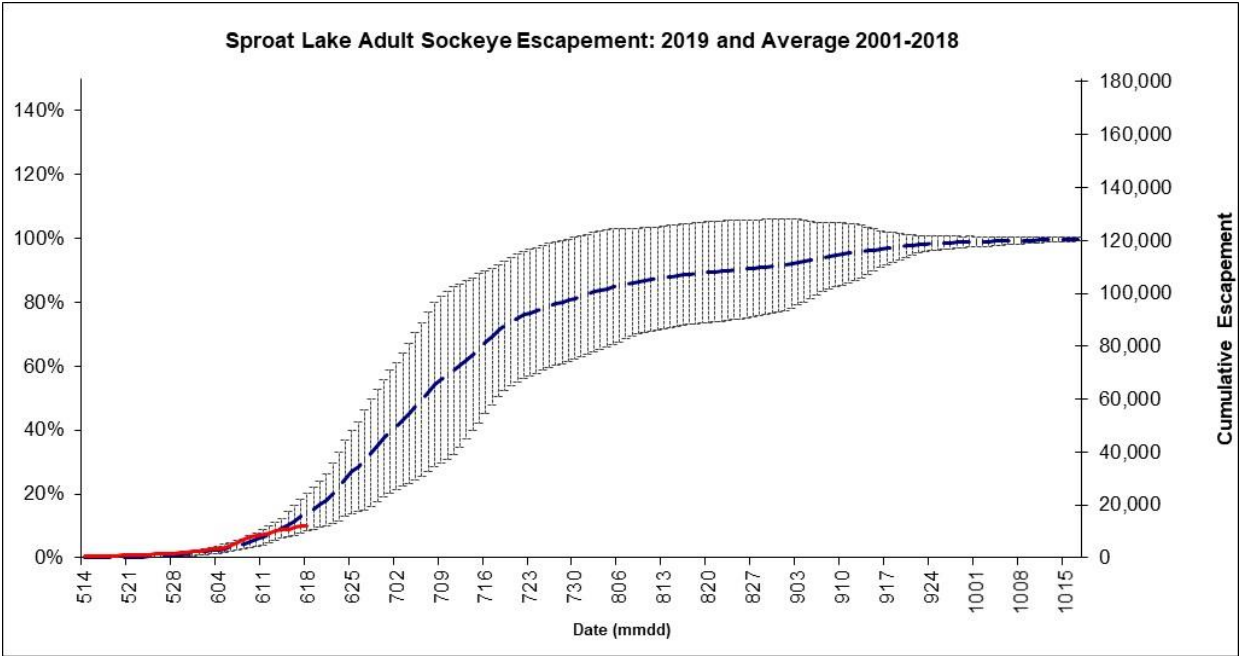


Figure 2. 2018 Sproat Lake sockeye escapement relative to average escapement timing. The total expected escapement is based on a target of 120,750 assuming Sproat Lake sockeye will comprise 46% of the Somass return.

Test Fishery Observations:

The test fishery operated on June 17 and 18. The estimates of abundance outside 10-Mile Point and inside 10-mile Point fish were 11,000 and 11,000, respectively. The average catch per set was 28 and 39 in the outside and inside areas, respectively.

There was no evidence of fish holding in this week's test fishery.

Biological Monitoring Results:

DNA samples are available from the test fishery, the Maa-nulth Domestic fishery from June 13 and the Tsu-ma-uss fishery from June 3 to 6. Results are tabulated below.

The portion of Henderson sockeye observed remains not significantly different than zero in all of the samples to date. The relative portions of Great Central Lake sockeye is lower than desired but higher than last week.

	2019 seine test BarkleySnd OUTSIDE 10-Jun 96(0)		2019 seine test BarkleySnd INSIDE 11-Jun 96(0)		2019 Gillnet BarkleySnd Tsu-ma-uss Jun 3-Jun 6 48(0)		2019 Gillnet BarkleySnd Maa-nulth 13-Jun 25(0)		2019 seine test BarkleySnd OUTSIDE 17-Jun 93(0)		2019 seine test BarkleySnd INSIDE 18-Jun 100(0)	
Stock	Est	SD	Est	SD	Est	SD	Est	SD	Est	SD	Est	SD
Great_Central	20.4	(4.6)	20.4	(4.7)	16.5	(6.0)	39.8	(9.9)	40.6	(5.3)	23.7	(4.6)
Henderson	0.0	(0.6)	0.1	(0.7)	0.1	(1.3)	0.0	(2.2)	0.2	(0.9)	0.0	(0.5)
Sproat	79.6	(4.6)	79.5	(4.8)	83.3	(6.0)	60.1	(10.0)	59.2	(5.3)	76.3	(4.6)

Weekly information from the test fishery in June appears to give a good indication of the relative proportions of Great Central and Sproat Lake in the final return. Analysis uses simple linear regression to relate proportions of GCL from the weekly test fishing samples to the final proportion in the Somass sockeye return. Additional models have been developed which use data combined for Inside and Outside fishing areas and weeks and appear to better represent the data. A summary of the predicted %GCL from Week 62 and 63 data presented below.

Model	Predicted	Upper 95%	Lower 95%	Regression r ²
Week 62 Average	26.2%	44.3%	8.1%	0.8514
Week 63 Average	35.3%	49.0%	21.7%	0.8481
Week 62 and 63 Average	30.4%	47.0%	13.8%	0.8632
Week 62, 63 and 64 Average	-	-	-	0.9020

Using the predicted value from the Week 62 and 63 Average model, the estimated proportion of GCL in the final return is approximately 30% (95% PI of 14% to 47%). Using this estimate and the current run size estimate of 350,000 implies that the total return to Great Central that could be expected in the absence of fishing is approximately 105,000 sockeye. This is slightly above the fishery reference point for Great Central of 100,000 sockeye, and above the upper and lower benchmarks of 92,000 and 30,000 respectively.

Continuing to plan harvesting the aggregate of the two stocks at a 25% harvest rate implies that the escapement to Great Central would be approximately 78,750 sockeye if the total run size remains at 350,000. This would result in escapement to Great Central that would be below the fishery reference point and the upper benchmark, but above the

lower benchmark and the 60,000 level that the Area 23 Round table agreed was the level not to go below.

Area D Gillnet Catch:

Weekly catch rates from the Area D gillnet fishery from the third and fourth weeks of June provide a good indication of the final Somass sockeye adult return. The figure below shows the relationship between the average catch per vessel hour and the final Somass run size.

Based on this relationship, the Somass sockeye adult return in 2019 is predicted at approximately 288,000 sockeye (95% prediction interval of 0 to 865,000).

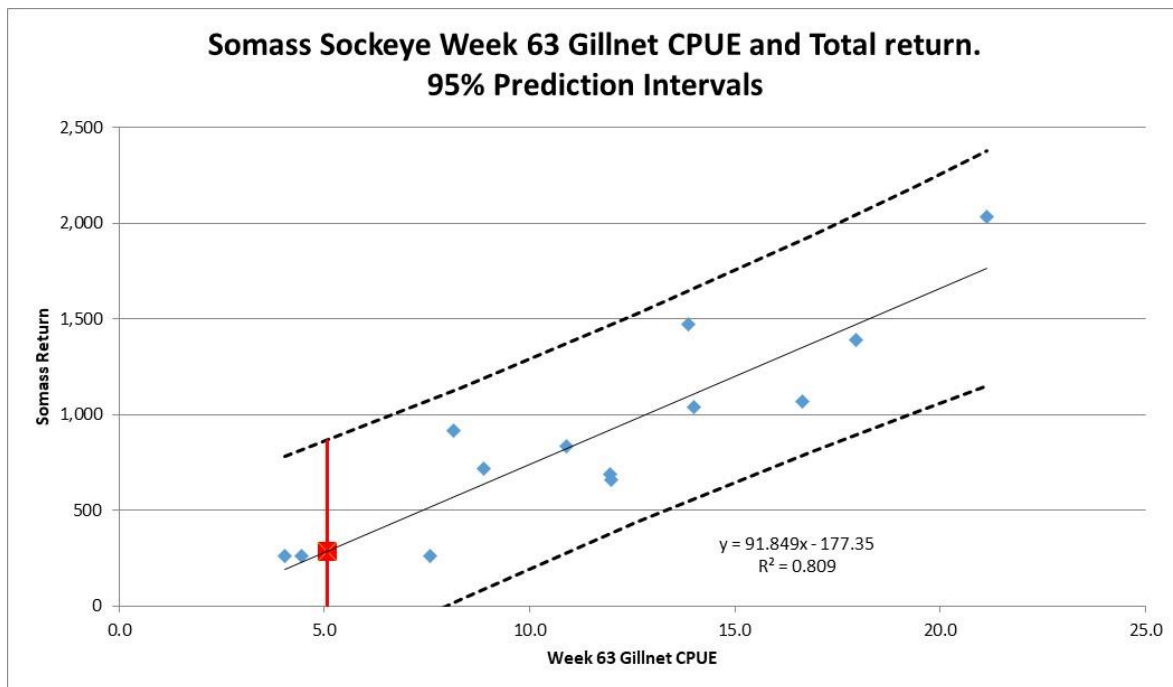


Figure 3: The relationship between standardized gillnet CPUE (sockeye/vessel hour) and total Somass adult return for week 63 gillnet fisheries in Area 23. Red point indicated 2019 value of 5.07 sockeye per vessel hour and the predicted Somass Return of 288,000 with a 95% prediction interval of 0 to 865,000.

Accounting to Date:

Parameter		Observed	Expected	Target
Escapement	Sproat	12,371 (78%)		120,750
	Great Central	3,391 (22%)		141,750
	TOTAL	15,762	39,938 (to June 20)	262,500
Catch	Sproat	21,727 (72%)		
	Great Central	8,240 (28%)		
	TOTAL	29,987	19,170 (to June 20)	
Somass Age Composition (Adults)	4 ₂	39%	13%	
	5 ₂	58%	76%	
	5 ₃	3%	10%	
	6 ₃	0%		
Stock Composition	Sproat	72%	81%	46%
	Great Central	28%	19%	54%
Harvest Rate		44%	20% (June)	25%
Somass Run Size Forecast		Pre-season management forecast: 350,000 (low)		

The following tables summarizes the accounting for Somass sockeye to June 20, 2019:

SOMASS (GCL + SPL)

TOTAL ADULT CATCH=	29,987	
TOTAL ADULT ESCAPEMENT=	15,762	
TOTAL CATCH PLUS ESCAPEMENT=	45,748	
Abundance Estimates:	Estimate	Lower CI
inner Alberni inlet estimate=	11,000	5,500
outer Alberni Inlet estimate=	11,000	5,500
	<hr/>	<hr/>
	22,000	11,000
<i>lower river abundance est</i>	736	368
TOTAL ACCOUNTING=	68,484	57,116
Harvest rate	44%	53%

Total Expected total Return Based on Run Timing and Week 63 Gillnet CPUE index:

	50% date	% of run to date	Predicted Somass Return
Average Timing	1-Jul	22.9%	298,759
Week 63 Gillnet CPUE Index			288,000

Stock Specific Accounting to Date:

Stock	Catch	Esc	Catch + Esc	Catch + Esc Stock comp (%)	Inner Alberni Inlet estimate	Outer Alberni Inlet estimate	In-river estimate	Total Accounting	Total accounting Stock comp (%)	Harvest rate
SPR	21,727	12,371	34,098	75%	8,392	6,511	465	49,466	72%	44%
GCL	8,240	3,391	11,631	25%	2,607	4,463	271	18,972	28%	43%
HED	20	-	20	-	0	0				
TOTAL	29,987	15,762	45,748	100%	10,999	10,975	736	68,438	100%	44%

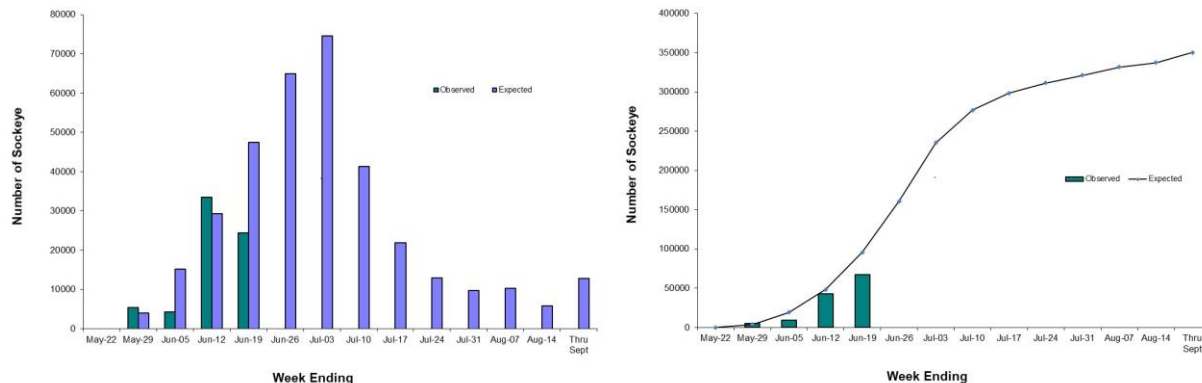


Figure 4: Observed and Expected accounting to date for a 350,000 run size with July 1 peak.

There is no change from the pre-season forecast of 350,000 for the stock aggregate. The first in-season re-forecast is expected June 27.

Environmental Monitoring Results:

Daily river temperatures over the past week ranged between 20.1 °C and 23.8°C (average 20.1°C) at the Sproat River fishway. These temperatures are very similar to last week.

Data is available for part of this week (June 14 to June 19) from the Stamp Falls fishway where river temperatures ranged between 17.9 °C and 21.5 °C (average 19.3 °C).

Alberni Inlet surface temperatures inside 10-Mile Point measured between 15 °C and 18 °C by the test boat on June 18. The sea surface temperatures measured outside 10-Mile Point were 15 °C at all locations on June 17. These temperatures are about a degree cooler than observed last week in both areas.

Harvest Planning Considerations:

- Total accounting to date is less than expected for a 350,000 aggregate return with recent average run timing. Unless run timing is later than observed in recent years, the total Somass return will be less than 350,000. This is supported by the Week 63 Gillnet CPUE index and the preliminary application of the run timing curves shown above. For an 350,000 return with average run timing, accounting to date would be expected to be approximately 90,000. Current accounting is approximately 68,000.
- The proportion of GCL in the return appears to be higher than expected pre-season but still lower than the long term average and the desired levels. Continuing to harvest the stocks as an aggregate will result in GCL escapements that are lower than the fishery reference levels. This may prolong differential returns between GCL and Sproat into the future.
- The harvest rate to date is over twice the desired level. Continued harvest at this rate will compromise future productivity by fishing into escapement targets.

Sources of Uncertainty:

There are several sources of uncertainty in the in-season assessment and management process:

One of the key sources of uncertainty is the test fishery assessment of the abundance of fish in Alberni Inlet, which is based on a subjective assessment by an experienced seine captain. Although this index has been reliable over the years, as source of uncertainty it becomes more of an issue when a large portion of the accounting is based on this number relative to more certain catch and escapement numbers. Both the overall accounting and harvest rate estimate rely on this assessment.

In addition to the overall accounting, another source of uncertainty with the in-season forecast is the presumed run timing. The in-season forecast expands the total accounting for the portion of the return that is normally accounted for by the date. However, run timing can vary significantly from year to year depending on factors such as environmental conditions and the age composition of the run. For this reason, the run size is not adjusted until the end of the June when about half the run has normally been accounted for.

Another source of uncertainty is the effect of adverse environmental conditions on spawners. The escapement is assessed at the Sproat and Stamp fishways prior to spawning. However, fish that hold in Alberni Inlet for prolonged periods and/or are subject to very high temperatures during their river migration may not spawn successfully.

BACKGROUND INFORMATION

RUN SIZE EXPECTATIONS:

Somass sockeye:

For 2019 fishery management purposes, the Area 23 round table agreed to begin fisheries in the “low” zone for early season harvest management, using a forecast for Somass Sockeye of 350,000 adult sockeye.

There is considerable uncertainty in the 2019 forecast. The forecasts vary between 196,000 based on Sibling models, to 1.3M based on coho survivals in the same ocean entry year. Model forecasts for the 2019 aggregate Somass sockeye return are 196,000 (Sibling); 312,000 (Sea Surface temperature); 379,000 (Sea Surface Salinity), 563,000 (SEP Biostandards), 1,340,000 (Coho Leading Indicator).

The forecast from the Sibling Model suggests a low proportion (19%) of Great Central Lake sockeye in the 2019 return which may result in the total return to Great Central Lake falling below the fishery reference point of 100,000, requiring a precautionary management approach to fishery management.

The first reforecast is expected June 27 but actions may be taken as early as June 20 to reduce fishery impact if stock composition indicate a very poor GCL return.

The age of return for sockeye to Sproat and Great Central lakes ranges from 3 to 6 years with age 4 and 5 fish predominant. Sockeye produced from brood years 2013 to 2016 will return in 2019, with 2014 and 2015 being the main contributing brood years. There are two key points to consider for these contributing brood years.

Point 1: Low returns from the 2013 brood year (age 3 and age 4 returns so far), results in expected low returns of 5 year olds in 2018.

Point 2: The returns so far from both the 2013 and 2014 brood years had a low proportion of Great Central Lake stock (23%, and 8%, respectively).

Henderson sockeye:

The recommended management outlook for Henderson sockeye is the “very low” zone for harvest management, corresponding to an expected return of less than 15,000. The key factors influencing this outlook are the low spawner abundances in the main contributing brood years (2014, 2015) for the 2019 return, as well as apparently low marine survival rates experienced by these two brood years. There were no surveys in Henderson Lake to estimate juvenile production from either of the main contributing brood years (2016 and 2017 sea-entry years). Based on the spawner abundances in 2014 and 2015, the smolt abundances in the 2016 and 2017 sea-entry years are estimated to be low (less than 1M).

IN-SEASON ASSESSMENT:

Test Fishery:

The purpose of the test fishery is to estimate abundance of sockeye in the Alberni Canal, to collect biological specimens for assessment (age and stock composition and parasite load) and to provide observations of fish behavior and condition. The test

fishery uses a combination of hydro-acoustic soundings and seine sets to determine the abundance of sockeye in Alberni Inlet. The boat follows a systematic route sounding throughout the canal by zigzagging in transects from one side to another. Choice of set location is dependent on either identifiable sockeye schools or typical holding areas. For both the area 'inside' 10-mile point and for the area 'outside' 10-mile point, an average catch per set is determined. These numbers are then expanded to total abundance for each area given scalars to account for the quality of sets/fishing conditions and also a scalar approximating the number of similar sets that are required to fish the entire area. There is considerable judgment and subjectivity involved in the determination of the abundance estimate; however over the years this information has been an important component of the in-season re-forecast method.

Catch Monitoring:

All harvesters in the Maanulth First Nation, Tsu-ma-uss Economic Opportunity, Area B Seine and Area D Gillnet fisheries are required to report catch and total catch is estimated from the sum of reports. Verification programs are in place for the Maanulth, Tsu-mas-uss Economic Opportunity and Area D fisheries. All Area B catch is validated. Validation and verification information may be used to revise catch estimates generated from individual harvester reports. The recreational catch is monitored and estimated through the WCVI Creel Survey program. Catch is estimated from the average catch-per-unit-effort (CPUE) and effort (boat-days).

Escapement Monitoring:

Video monitoring systems were installed at the Sproat fishway and Stamp Falls fishway in late April. Fish passing through both fishways are recorded 24 hours a day (i.e., tunnels are lit up at night) using a video monitoring system. Trained and experienced observers review a subsample of the video from both sites in order to generate estimates of escapement to each system. Biological samples of sockeye salmon are collected 2-3 times/week from fish at both counting sites to estimate the age and sex composition of escapement. The age results from biosampling are applied to total escapement numbers in order to estimate daily adult and jack escapement numbers. Escapement estimates reported here are preliminary as not all video has been sampled and reviewed.

Escapement for Henderson Lake sockeye will be estimated through a mark-resight program conducted on Clemens Creek spawning grounds in September and October. The Uchucklesaht First Nation is working on developing an in-season monitoring program at the outlet to Henderson Lake.

Biological Monitoring:

Fish are sampled for age composition from all fisheries and escapement. Fish are sampled for stock composition (estimated through DNA analysis) from the test fishery and commercial fisheries.

Environmental Monitoring:

Other information is considered such as river or Inlet conditions that may impact run and escapement timing. River temperature, discharge and barometric pressure are monitored remotely at Stamp Falls and the Sproat fishway. As river temperatures increase, the migration rate from Alberni Inlet to the Somass River system slows down

resulting in lower daily escapement rates and often higher “catchability” of fish in Alberni Inlet fisheries.

Fishery Indices:

In addition to information gathered through the test fishery and catch and escapement monitoring, there is a strong relationship between the commercial gillnet CPUE in *late* June and final run size. One objective of the “standardized early season fishing regime” developed in 2012 is to plan more consistent early-season fisheries to gain assessment information. Additional monitoring data (e.g. effort, average CPUE) gathered through verification programs will support this initiative.

Run Size Estimation:

In order to forecast the return of Somass sockeye in-season the two most pertinent questions are: What is the abundance accounted for to date? Is the run on-time, early or late? In the simplest form, the run reforecast is the total abundance accounted for divided by the portion expecting to return by the reforecast date. However, when considering these questions, uncertainty in the data must be accounted for. If most of the abundance is accounted for in either catch or escapement, then the data are fairly certain. On the other hand, if the bulk of the abundance is associated with test fishery estimates the data are more uncertain. In the latter case, a more precautionary approach is warranted before major upgrades or downgrades in the forecast. The observed age and stock composition of the return provides an indication of run timing and abundance; particularly when compared to pre-season expectations and long-term average observations. As well, environmental conditions that may affect “catchability” need to be considered. For example, extended holding of fish in Alberni Inlet due to inhospitable river conditions may create the impression of abundance when in fact new migration is insignificant.

Attachment 1. Somass management table.

Somass Run Size	Escapement Goal	Harvest Rate	Test Fish	Total TAC	Maanulth Treaty	Recreational (expected)	Commercial TAC	Comm Stewardship	Tsumass TAC	Area B Seine	Area D Gillnet
200,000	170,000	15%	5,000	25,000	5,000	4,000	16,000		12,800	-	3,200
250,000	200,000	20%	5,000	45,000	9,000	10,000	26,000		20,800	-	5,200
300,000	235,000	22%	5,000	60,000	11,000	15,000	34,000		27,200	-	6,800
350,000	262,500	25%	5,000	82,500	13,250	21,000	48,250		28,950	11,580	7,720
400,000	283,333	29%	8,000	108,667	14,179	28,000	66,487		33,244	19,946	13,297
450,000	304,167	32%	8,000	137,833	15,016	36,000	86,817		41,672	27,087	18,058
500,000	325,000	35%	8,000	167,000	15,853	45,000	106,147	5,000	45,516	33,378	22,252
550,000	331,250	40%	8,000	210,750	17,109	49,500	144,141	10,000	60,363	44,267	29,511
600,000	337,500	44%	8,000	254,500	18,365	54,000	182,135	10,000	65,411	64,034	42,690
650,000	343,750	47%	8,000	298,250	19,620	58,500	220,130	10,000	79,849	78,168	52,112
700,000	350,000	50%	8,000	342,000	20,876	63,000	258,124	10,000	81,881	99,746	66,497
750,000	358,333	52%	8,000	383,667	22,072	67,500	294,095	10,000	93,751	114,206	76,137
800,000	366,667	54%	8,000	425,333	22,886	72,000	330,447	10,000	105,748	128,820	85,880
850,000	375,000	56%	8,000	467,000	22,886	76,500	367,614	10,000	118,013	143,761	95,841
900,000	383,333	57%	8,000	508,667	22,886	81,000	404,781	10,000	130,278	158,702	105,801
950,000	391,667	59%	8,000	550,333	22,886	85,500	441,947	10,000	142,543	173,643	115,762
1,000,000	400,000	60%	8,000	592,000	22,886	90,000	479,114	10,000	145,425	194,213	129,475
1,050,000	400,833	62%	8,000	641,167	22,886	94,500	523,781	15,000	147,546	216,741	144,494
1,100,000	401,667	63%	8,000	690,333	22,886	99,000	568,447	15,000	149,431	242,410	161,607
1,150,000	402,500	65%	8,000	739,500	22,886	100,000	616,614	15,000	162,436	263,507	175,671
1,200,000	409,286	66%	8,000	782,714	22,886	100,000	659,828	15,000	174,104	282,435	188,290
1,250,000	416,071	67%	8,000	825,929	22,886	100,000	703,043	15,000	185,771	301,363	200,908
1,300,000	422,857	67%	8,000	869,143	22,886	100,000	746,257	15,000	197,439	320,291	213,527
1,350,000	429,643	68%	8,000	912,357	22,886	100,000	789,471	15,000	209,107	339,218	226,146
1,400,000	436,429	69%	8,000	955,571	22,886	100,000	832,685	15,000	220,775	358,146	238,764
1,450,000	443,214	69%	8,000	998,786	22,886	100,000	875,900	15,000	232,443	377,074	251,383
1,500,000	450,000	70%	8,000	1,042,000	22,886	100,000	919,114	15,000	244,111	396,002	264,001
1,550,000	465,000	70%	8,000	1,077,000	22,886	100,000	954,114	15,000	253,561	411,332	274,221
1,600,000	480,000	70%	8,000	1,112,000	22,886	100,000	989,114	15,000	263,011	426,662	284,441
1,650,000	495,000	70%	8,000	1,147,000	22,886	100,000	1,024,114	15,000	272,461	441,992	294,661
1,700,000	510,000	70%	8,000	1,182,000	22,886	100,000	1,059,114	15,000	281,911	457,322	304,881
1,750,000	525,000	70%	8,000	1,217,000	22,886	100,000	1,094,114	15,000	291,361	472,652	315,101
1,800,000	540,000	70%	8,000	1,252,000	22,886	100,000	1,129,114	15,000	300,811	487,982	325,321

Attachment 2. Henderson Management Table

Henderson Run Size	Escapement Goal	Harvest Rate	Total TAC	Maanulth Treaty	Remaining TAC	Other Fisheries	Maanulth Harvest Agreement
5,000	4,250	15%	750	201	549	439	110
10,000	8,500	15%	1,500	403	1,097	878	219
15,000	12,750	15%	2,250	604	1,646	1,317	329
20,000	16,375	18%	3,625	973	2,652	2,121	530
25,000	20,000	20%	5,000	1,343	3,658	2,926	732
35,000	25,750	26%	9,250	2,484	6,766	5,413	1,353
45,000	31,500	30%	13,500	3,625	9,875	7,900	1,975
52,500	33,750	36%	18,750	5,034	13,716	10,973	2,743
60,000	36,000	40%	24,000	6,444	17,556	14,045	3,511
67,500	36,750	46%	30,750	8,256	22,494	17,995	4,499
75,000	37,500	50%	37,500	10,069	27,431	21,945	5,486
90,000	45,000	50%	45,000	12,083	32,918	26,334	6,584
105,000	52,500	50%	52,500	14,096	38,404	30,723	7,681
120,000	60,000	50%	60,000	16,110	43,890	35,112	8,778
135,000	67,500	50%	67,500	18,124	49,376	39,501	9,875
150,000	75,000	50%	75,000	20,138	54,863	43,890	10,973

For more information contact:

Bryan Rusch
WCVI Salmon Stock Assessment
Telephone (250) 756-7294
Cell (250) 618-4066
E-mail: bryan.rusch@dfo-mpo.gc.ca