

# **Migration timing of juvenile Fraser River sockeye in Johnstone Strait**

**Summary report September 20, 2016**

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Fisheries and Oceans Canada with support from the Pacific Salmon Commission undertook a three year study to examine the migration timing of juvenile Fraser River sockeye salmon passing through Johnstone Strait and their residence in the Strait of Georgia. Understanding and identifying this migration period was important in understanding potential interactions between the Aquaculture industry and the juvenile salmon and in understanding the location and levels of early marine mortality over their first months in the ocean.

This preliminary report provides the general catch information in the third year of study.

Fishing was conducted in the southern Johnstone Strait and Discovery Islands over a 10 week periods in 2016 (Figure 1). Fishing locations in this region were consistent with the first two years of study including sets in the ‘Primary area’ or region that all juvenile Sockeye had to pass if migrating north. Sets were conducted weekly (1-2 days/week) from the commercial salmon seine vessel ‘Nordic Queen’ (Table 1). In 2016, additional fishing (1 day/week) was conducted in the northern Strait of Georgia during the end of May and early June. This additional fishing followed the same protocol and was made possible with funding from ACRDP.

All fishing used a modified purse seine with small mesh bunt to retain the juvenile salmon. The bunt of net was partially dried along starboard side of the vessel. Prior to any detailed sampling, a sample of salmon for sea lice enumeration was obtained from the bunt. This sample ranged from 10-20 salmon depending on area and catch size. In small sets or when tide or wind could cause abrasion of fish on the net, the sea lice enumeration sample was not taken. For the sea lice enumeration sample, individual salmon, regardless of species, were removed from net and placed in individual plastic bags. Fish were identified through the bag for a general count per species, and placed immediately on dry ice. These fish are included in total counts by species. The remainder of the salmon in the bunt were then transferred by net and bucket to live tanks with flow through water on the deck of the vessel. Non salmon species were removed as possible from the bunt of net, counted and released directly back to the ocean.

All salmon were sorted to species and enumerated. Random samples of 30-50 fish of each species were euthanized and retained for subsequent sampling. During large sets, an additional 20-50 Sockeye salmon were retained to be available for additional DNA analysis as required. Other fish were released back to the ocean following enumeration. The random samples were measured and DNA clips of caudal fin were collected for stock identification. Sockeye, Chinook and Coho salmon were frozen individually on dry ice and subsequently in -80C storage for fish health analysis, diet analysis and otolith analysis. Pink and chum salmon were also retained but stored at -20C. All frozen fish currently remain at PBS and will be processed over the winter.

In addition to fishing, at each station information was collected on temperature, salinity and dissolved oxygen (portable CTD -50m casts) and zooplankton tows were collected to identify plankton in the water column. Information from these collections have been submitted for processing.

## 2016 Catch

Sockeye, Coho, Chinook, Pink, Chum Salmon and Steelhead Trout were all captured during the survey in 2016 (Table 2). Pacific herring, squid, ctenophores and jellyfish were also common in

the catches. Other species were observed but not in large numbers (Table 2). About 53% of the total catch during the survey was juvenile Sockeye salmon. Pink salmon and Chum salmon represented about 41% of the total catch with Pink salmon about 4 times more abundant than Chum salmon (Table 2). Coho and Chinook salmon were present in smaller numbers but were more common than in previous years. Pacific herring represented about 5% of the total fish catch.

#### A. Sockeye salmon

A single Sockeye salmon was captured in the first day of the survey (May 11, 2016). Catch of Sockeye salmon continued to increase through the fourth week of the survey and then rapidly declined. Over 85% of all Sockeye salmon captured in the Discovery Islands in 2016 occurred over a three week period. Sockeye salmon were captured in the northern Strait of Georgia during all four weeks of sampling but at levels lower than observed in the Discovery Islands.

The average size of the 2877 juvenile Sockeye salmon measured during the survey was  $10.3 \pm 1.3$ cm. The fish ranged from 7.5cm to 18.5cm in length. There was no significant difference in length of the Sockeye salmon captured in the Discovery Islands week 3-6 ( $10.1 \pm 1.4$ cm, n=1528) and in the northern Strait of Georgia ( $98.7 \pm 1.1$ cm, n=691). The fish 15.0cm and larger (n=18) were captured throughout the sampling period from the individual fish captured the first week of fishing (16.1cm) to two fish captured the last week of fishing (15.0cm each). Age of these larger fish has not yet been determined. In general there was an increase in the size of the juvenile Sockeye salmon over the study period (Figure 2) although the fish observed in the first two weeks were also larger than those observed during the peak migration period.

Stock ID is not yet available for these fish although it is anticipated that the dominant stocks will be Shuswap Complex and Chilko due to the year of ocean entry (juveniles from 2014 return year). The Sockeye salmon collected will be processed for diet, scales, otoliths, fish health and genomic studies. The Sockeye salmon collected as part of the sea lice enumeration samples will also be processed once enumeration of sea lice has been completed.

#### B. Other catch

After Sockeye salmon, Pink and Chum salmon were the most abundant salmon observed (Table 2). Few Chum salmon and no Pink salmon were observed the first week of sampling. The maximum catch of both species occurred during the sixth week of sampling (mid June). Similar to Sockeye salmon, Pink and Chum salmon were also captured in the northern Strait of Georgia sets. The average size of chum and pink salmon was slightly larger than the sockeye salmon ( $11.7 \pm 2.1$ cm and  $11.2 \pm 2.2$  cm respectively).

Coho and Chinook salmon were observed throughout the sampling period and in both the standard survey area and the northern Strait of Georgia. A total of 121 Chinook salmon were captured with catches increasing through the sampling period. Almost 300 Coho salmon were captured in the survey with about one third of these fish captured in the northern Strait of Georgia. Catch was variable by week with no trend apparent. The catch of Pacific herring was also variable. Few Pacific herring were captured in the northern Strait of Georgia. Catches in the Discovery Islands were present each week but ranged from an average of less than 1 per set in the last week to about 140 Pacific herring per set in late June. The majority of Pacific herring captured were age 1+ with very few young of year herring observed.

### Hydroacoustic monitoring

Hydroacoustic instruments were placed in Okisolla Inlet (n=2) and Knox Bay in 2016. Results in 2015 from Okisolla demonstrated that good readings could be obtained throughout the tidal cycle. Knox Bay was chosen as an alternate site as Sockeye salmon and other species consistently captured in this region. Instruments remain in place at this time but will be removed and data analyzed over the winter months.

### Discussion

In 2016, the outmigration of a dominant Fraser River Sockeye year class resulted in Sockeye salmon representing the largest catch in our sampling. Although the catch of Pink salmon was large, the ratio of Pink salmon to Sockeye salmon was not as close as would be expected based on results from an associated study in 2012. This discrepancy will be investigated further during the analysis.

As in previous years, fishing was successful with samples collected over the time period of interest. In addition, in combination with sampling of the juvenile Sockeye salmon at the Mission Rotary Screw trap, we will be able to look at any changes in health and condition between the regions and between years of varying density of both Sockeye salmon as well as other species.

Over the period of this study, three of the four run cycles of Fraser River Sockeye salmon including the largest and smallest groups were sampled during their migration period. Although the data analysis will be ongoing for the next months, initial interpretation suggests that although the migration timing through the Discovery Islands may broaden with larger numbers of outmigrating juveniles, it remains relatively condensed and will range from 2-4 weeks. It appears that the timing may shift slightly as well although further analysis is required to determine if the timing through the Discovery Islands is related to ocean entry timing, conditions of the fish at ocean entry, or conditions within the Strait of Georgia. This will be looked at in more detail during the analysis and reporting of this project.

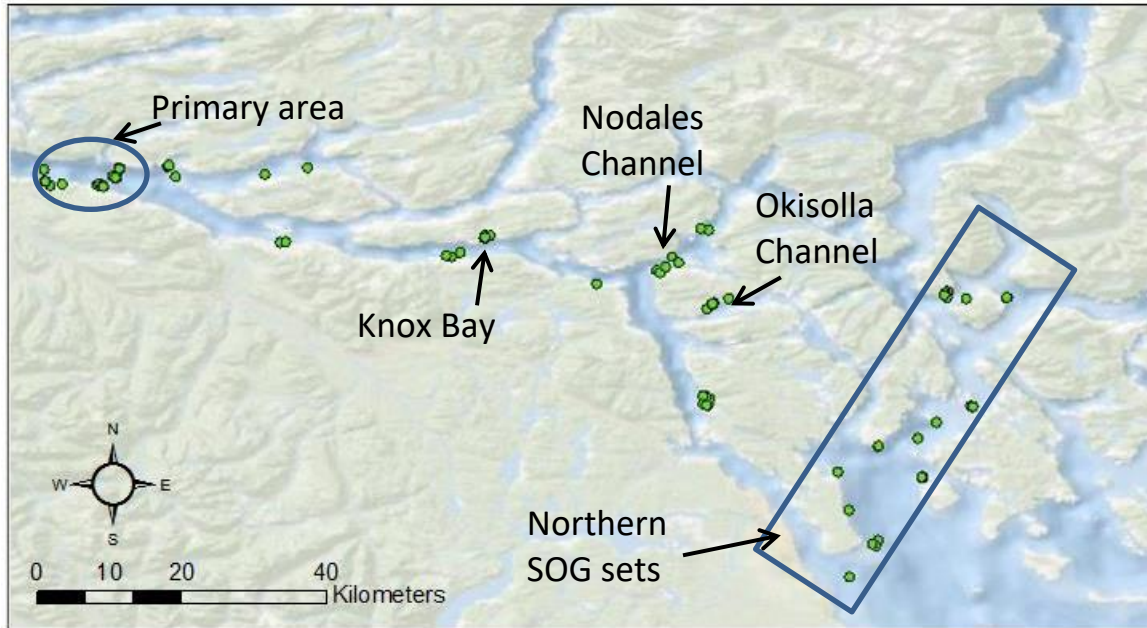


Figure 1. Location of purse seine sets conducted over 10 weeks (May 11-July 13) in 2016. A total of 141 sets were conducted over this time period.

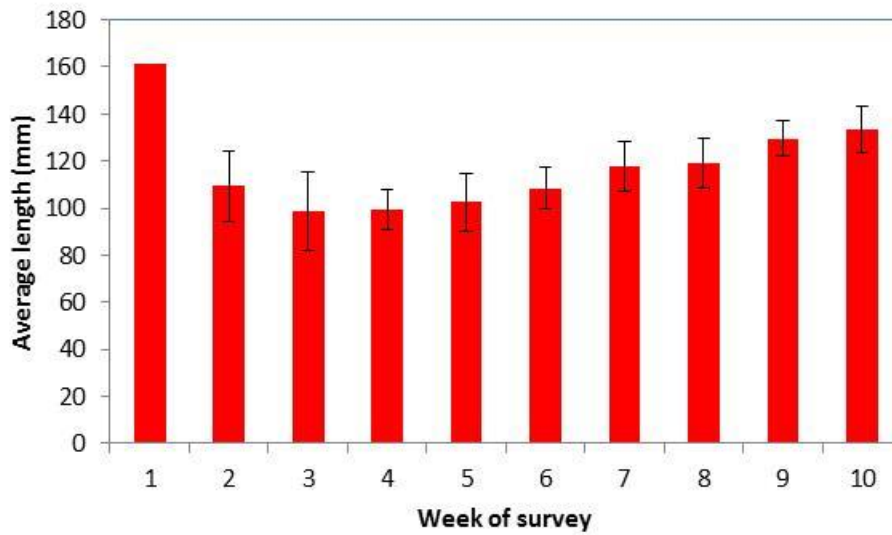


Figure 2. Average length of sockeye salmon over the 10 weeks of survey (refer to Table 1 for specific dates).

Table 1. Purse seine fishing dates and number of sets conducted in 2016 survey

<b>Week</b>	<b>Date</b>	<b>Number of Sets in Discovery/Johnstone St</b>	<b>Number of Sets in northern SOG</b>
1	May 11, 2016	6	
2	May 17-18, 2016	9	
3	May 24-26, 2016*	10	7
4	May 31-June 2, 2016*	13	6
5	June 7-9, 2016*	13	8
6	June 14-16, 2016*	13	8
7	June 21-22, 2016	13	
8	June 29-30, 2016	15	
9	July 6-7, 2016	13	
10	July 13, 2016	7	
<b>Total</b>	<b>May 11-July 13, 2016</b>	<b>141</b>	

\*Third day of fishing in Strait of Georgia

Table 2. Total catch by species in the purse seine survey. Number in parenthesis are sub adult or adult salmon that would have entered the ocean prior to 2016.

<b>Species</b>	<b>Total Catch</b>
Sockeye	32704 (1)
Coho	294 (2)
Chinook	121
Chum	5738 (2)
Pink	19752 (1)
Steelhead	21
Dolly varden	2
Pacific herring	2797
Threespine stickleback	101
Eulechon	18
Walleye pollock	4
Soft sculpin	7
Starry flounder	5
C-O sole	1
Staghorn sculpin	1
lingcod	1
Cabezon	1
Lemon sole	1
Bay pipefish	1
<i>Lampetra ayresii</i>	1
Rockfish (juvenile)	1
larval fish (unidentified)	6
Squid	302
Octopus (juvenile)	1
Ctenophores	~3,000L
Moon/white jellyfish	~43,000L
Cyanid jellyfish	69