



King Salmon Lake sockeye smolt survey - 2016 -



Final Report

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Prepared by:



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INTRODUCTION

Background:

The Taku River enhancement program started in 1989 and remains an important aspect within the Transboundary chapter of the Pacific Salmon Treaty (PST). An interest in diversifying or expanding the existing Taku enhancement program was reflected in the updated 2009 Transboundary PST arrangements. The impetus for conducting a new sockeye enhancement project at King Salmon Lake also came from previous recommendations within the following projects or processes: the Taku sockeye enhancement feasibility study (2008-2010), the Transboundary Panel Strategic Salmon Plan (2009), and the Taku Enhancement Production Plan (2009-2014).

This enhancement initiative was utilized within a relatively short-term to restore sockeye production to higher levels while taking advantage of underutilized rearing capacity in the lake. The first sockeye egg-take was implemented at King Salmon Lake in September of 2012 and the second in 2014. Eggs were incubated at the Port Snettisham Hatchery (in Alaska) and the enhanced fry were planted back into the lake of origin in spring of 2013 and 2015. With the majority of enhanced smolts from the 2014 brood year expected to be out-migrating during the spring of 2016, it was considered prudent that some monitoring of such be undertaken.

Objectives and scope:

The overall goal of this project was to capture out-migrating King Salmon Lake sockeye smolts for subsequent biological sampling.

The main objectives for the project included:

- To follow-up on related PST obligations, inform the Taku Enhancement Production Plan and further pursue recommendations of the Transboundary Panel Strategic Salmon Plan;
- The capture and biological sampling out-migrating sockeye smolts;
- Providing indicator information regarding sockeye smolt condition, lake productivity and enhanced / wild proportions;
- Prepare and submit a written report of project methods and results, inclusive of appropriate comparisons with previous data;
- To continue collaboration and communications with the TBR Enhancement Sub-Committee regarding this enhancement initiative.

Site description:

King Salmon Lake is located approximately 100km SSE from the community of Atlin, BC. (See the map in Figure 1 below.) The lake is situated at the headwaters of King Salmon Creek which flows into the main-stem Taku River. This remote location is only accessible by float

plane or helicopter. The lake supports a spawning / rearing sockeye salmon stock, the adults of which have been enumerated by TRT Fisheries since 2004.

Figure 1: General location of the project site



METHODS

On May 16, 2016 the TRT Fisheries Manager and a Technician proceeded to the site by helicopter. Out-migrating sockeye smolts were captured by fyke net at the outlet of the lake. The sampling target was 200 to 300. Smolts were sampled for: fork length (nearest mm); weight (nearest 0.1 g); age (scales); and otoliths. The crew returned from the site on 19, 2016. Smolt heads were preserved in ethanol and delivered to the DFO-Whitehorse Lab for otolith extraction and analysis.

RESULTS

General:

A total of 214 sockeye smolts were sampled during the project. Of these 212 were successfully aged and 210 of the otoliths were effectively read.

It should be noted that given the small sample size, detailed interpretation of results is limited. The project is only a reconnaissance level initiative where samples are obtained over a short period. However, the reduced cost and project duration does allow for the collection of useful indicator information and serves as some means of monitoring.

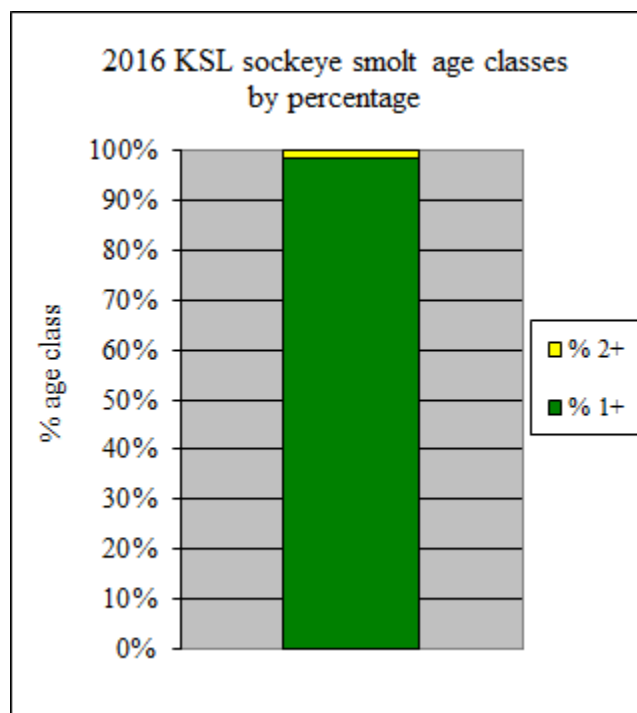
Ages:

Smolt age results are presented in Table 1 and Figure 2 below by number and percentage. Almost all of the smolts were age 1+ fish, with only 3 samples being age 2+.

Table 1: Summary of sampling results

Site	N	Age			
		# 1+	# 2+	% 1+	% 2+
King Salmon Lake	212	209	3	98.6	1.4

Figure 2: 2016 smolt age classes by percentage (n=212)



Lengths and weights:

Table 2 below provides a summary of lengths and weights by age class. Smolt fork lengths for age 1+ fish ranged from 64 - 111 mm with an average of 90 mm. The three age 2+ fish captured and sampled had lengths ranging from 84 - 103 mm with an average of 95 mm. The resulting length frequencies (for all samples) are depicted in Figure 3 below.

Smolt weights for age 1+ fish ranged from 3.0 – 14.2 g with an average of 7.6 g. The three age 2+ fish captured and sampled had weights ranging from 6.8 – 9.8 g with an average of 8.5 g. The resulting length/weight relationship (for all samples) is plotted in Figure 4.

Table 2: 2016 smolt length and weight summary by age class

		Age		
		1+	2+	*Combined
	N	209	3	212
Weight (grams)	Average	7.6	8.5	7.6
	Std. Dev.	2.0	4.8	2.0
	Min.	3.0	6.8	3.0
	Max.	14.2	9.8	14.2
Fork Length (mm)	Average	90.0	95.0	90.0
	Std. Dev.	8.8	9.8	8.8
	Min.	64.0	84.0	64.0
	Max.	111.0	103.0	111.0
* includes 2 additional non-aged specimens				

Results of otolith analysis for thermal marks are shown in Table 3 and Figure 5 below. Of the total sample, 15.2% displayed the hatchery thermal mark.

Table 3: 2016 smolt otolith / thermal marks

	#	%
Marked	32	15.2%
Not Marked	178	84.8%
Total	210	100.0%

The average weight (and length) of enhanced and wild age 1+ smolts are displayed in Table 4 and Figure 6 below. (Only samples which were effectively read for both age and otolith marks are included.)

Table 4: Average weight and length of enhanced vs. wild 1+ smolts

	# of samples	Ave. weight (g)	Ave. length (mm)
Enhanced	32	9.6	98
Wild	173	7.2	88

Figure 3: 2016 smolt length frequencies (n=214)

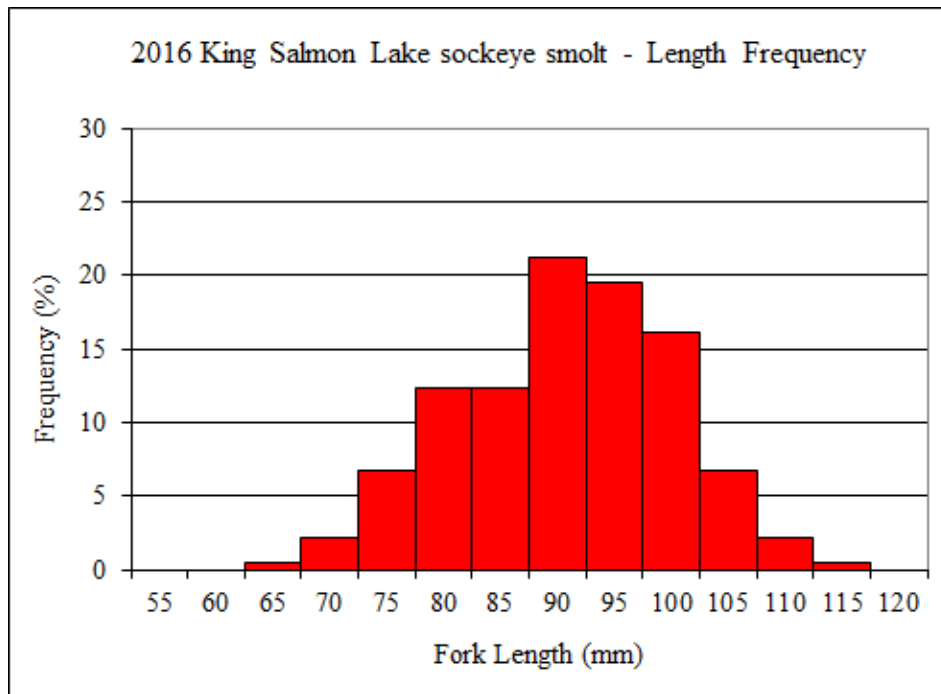


Figure 4: 2016 smolt length / weight relationship (n=214)

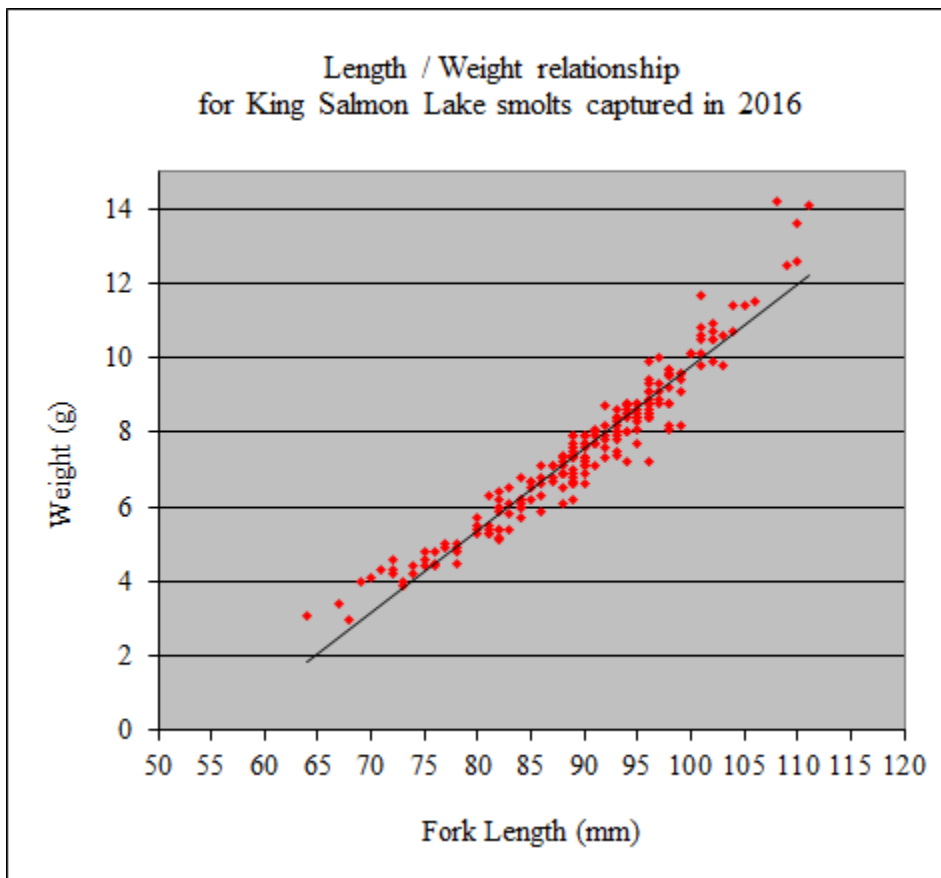


Figure 5: 2016 smolt thermal marks by percentage (n=210)

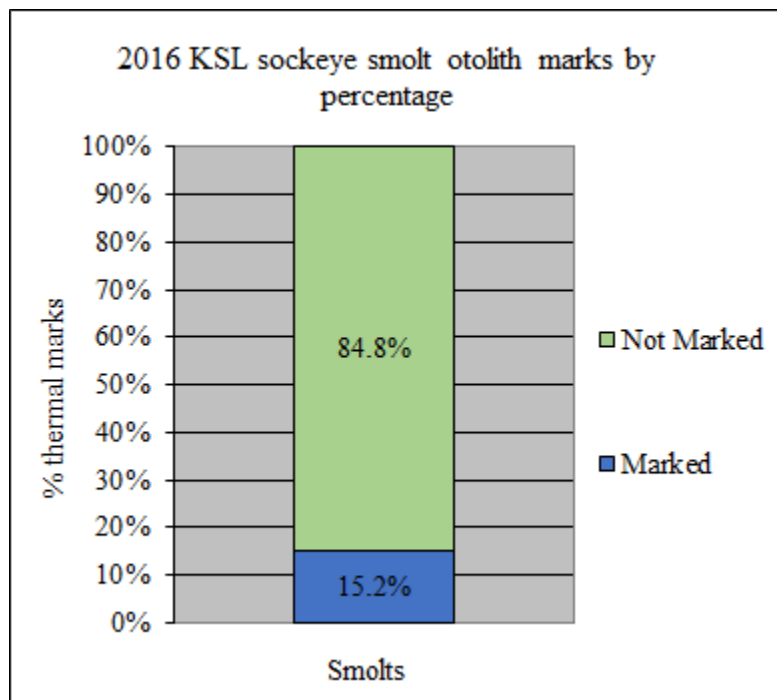
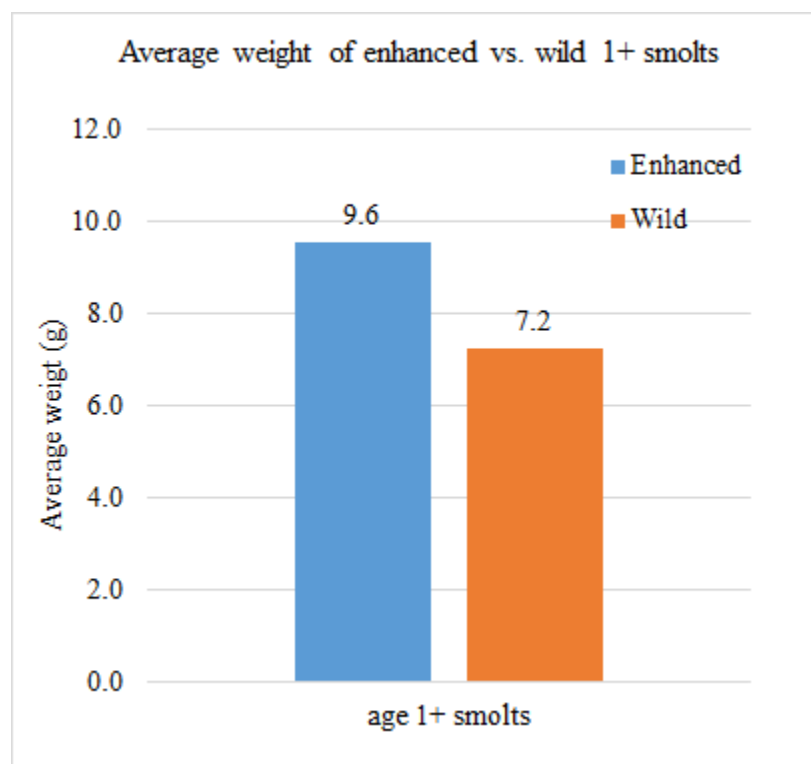


Figure 6: Average weights of enhanced vs. wild KSL 1+ smolts (n=205)



DISCUSSION

Data limitations:

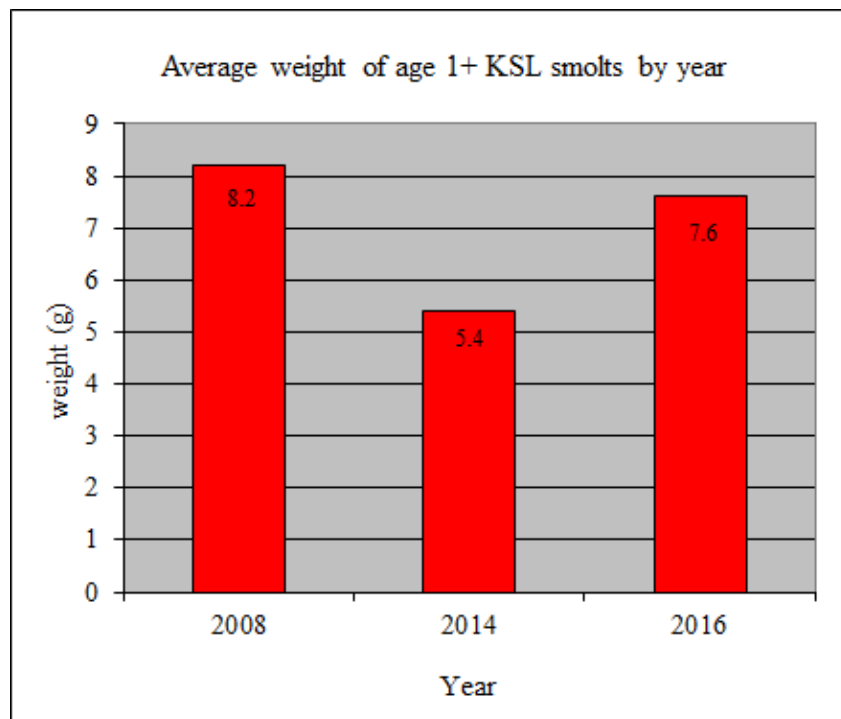
As noted previously, the relatively small sample size restricts the level at which data can be analysed. With merely a small fraction of the overall smolt population being sampled, only general interpretation of results can be made.

Average smolt weights:

A comparison of the yearly average weights of age 1+ smolts (wild and enhanced combined) from King Salmon Lake is portrayed in Figure 7 below. The average weights observed in 2008, 2014 and 2016 at King Salmon Lake was 8.2g, 5.4g and 7.6g, respectively..

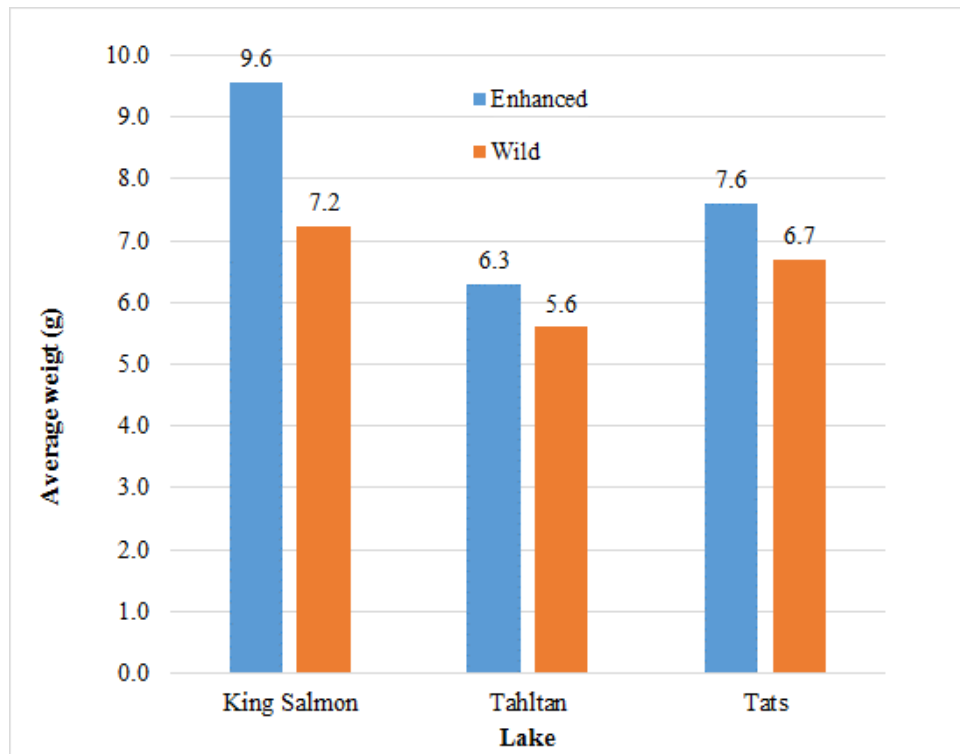
A comparison between 2016 average weights of age 1+ smolts (separated by wild and enhanced) from King Salmon, Tatsamenie, and Tahltan Lakes is portrayed in Figure 8 below. Enhanced smolts from King Salmon Lake show a larger degree of size difference.

Figure 7: Average weights of age 1+ smolts from KSL



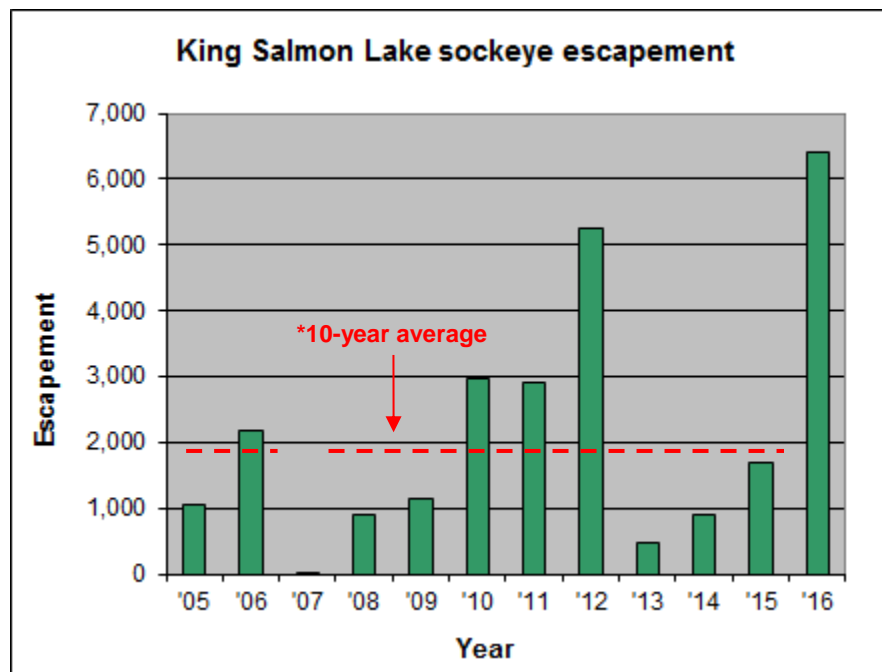
In general the 2016 smolt results were found to be quite favourable, in particular the relative ratio of enhanced smolts in the sample and the size difference between wild fish. A comparison of smolt weights with several other Transboundary lakes is shown in Figure 8 below.

Figure 8: 2016 comparison of average weights for age 1+ smolts from King Salmon, Tahltan, and Tatsamenie lakes



*For the Tatsamenie Lake age 1+ enhanced smolts the above weight is a composite of both fed and unfed. Separated, the age 1+ enhanced fed weight = 9.3 gms and direct release = 6.6 gms.

Figure 9: King Salmon Lake adult sockeye escapement 2005-2016



*The 10-year average excludes the 2007 weir count of 5 i.e. average is for 2005-06 and 2008-15. The average also uses 2009 and 2011 escapement estimates which are based upon aerial survey expansions.

Adult sockeye escapements into King Salmon Lake from 2005 – 2016 are portrayed in Figure 9 above. The total escapement in 2016 was 6,404 which is the highest on record and well above the 10 year average of 1,947. The 2016 lake escapement was not sampled for otoliths, therefore a reliable estimate of the enhanced contribution cannot be determined. However, enhanced King Salmon Lake sockeye were picked up during the otolith sampling of 2016 fisheries, providing some positive indication of a substantial enhanced component. In this regard, the enhanced portion of escapement has been very roughly approximated to be one third. To note, the associated brood year egg take (conducted in the fall of 2012) was relatively small. It resulted in approximately 238,000 eggs delivered to the hatchery, with 197,000 fry being planted back into the lake during the spring of 2013.

The second egg take at King Salmon Lake was conducted in the fall of 2014. It resulted in approximately 199,000 eggs delivered to the hatchery, with 169,000 fry being planted back into the lake during the spring of 2015. Most of the enhanced adults resulting from that project are therefore expected to return in 2018.

Recommendations:

Although this smolt sampling project remained limited in scope, it did provide some general indication of average smolt sizes and thermal mark presence/absence. This project is still considered experimental, therefore assessment results should help to steer any potential enhancement activities in the future.

Given some positive signs of enhanced production this year, there may be some interest to continue this project in the future. The original goal of this enhancement initiative was to use short term, small scale enhancement methods to restore the production of this stock to higher levels. TRT Fisheries still considers the original goal as valid, and would suggest that supplementing the production level of low brood years would be the best approach, in particular with the current limitation in detailed survival and production data. In any case, it is recommended that the existing information regarding this enhancement initiative be collated and summarized for further consideration.

With the expectation of returning enhanced sockeye in 2018, otolith samples could be taken at that time to determine the relative proportion of enhanced adults. In this regard, the preference would be to sample post-spawn sockeye, as opposed to sacrificing pre-spawn sockeye being enumerated thru the weir.

In the longer term, and in particular if this enhancement initiative is to continue, further monitoring and assessment is recommended. At this point it has been assumed that the lake is spawning limited, with underutilized rearing capacity. However, these assumptions are currently based on simple observation of spawning habitats, along with some preliminary limnology samples. In order to estimate egg to smolt survivals, a smolt enumeration project would need to be initiated. This would serve to provide better information regarding early stage wild and enhanced survivals, rearing capacity or potential, and wild spawning production limitations. Future consideration could also be given to the potential improvement or addition to spawning habitats.

PROJECT PERFORMANCE REVIEW

Below is a list of the measures for project success from the original proposal. After each is a brief review of post-project performance.

1. Achievement of the sampling target: The sampling target of 200-300 fish was achieved with a total sample of 214.
2. Effective reporting of results: Preliminary project results were provided to the TBR Technical Committee and Enhancement Sub-Committee during their post season meeting in November of 2016. This report will be made available to the TBR agencies and further discussion is expected at both the technical and political levels regarding the future of this enhancement initiative.
3. Not exceeding the original budget: Financial reporting is in progress, however it is anticipated that the project will be within the original budget.